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953 Mapleview Drive E – Block 192 Site Plan

Mapleview South (Innisfil) Ltd.

Detailed Stormwater Management Report

June 2024

The Jones Consulting Group Ltd.
229 Mapleview Drive East, Barrie ON L4N 0W5

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Detailed Stormwater Management Report

Mapleview South (Innisfil) Ltd. – Block 192 Site Plan

953 Mapleview Drive East, City of Barrie

1. Introduction

1.1. Appointment

The Jones Consulting Group Ltd. (TJCG) was retained by Mapleview South (Innisfil) LTD. (Client) to provide engineering services for a proposed residential subdivision development located in the Hewitt's Secondary Plan Area (HSPA) southeast of Mapleview Drive and Prince William Way in the City of Barrie (City). The subdivision is to be known as the Mapleview South Subdivision. This Report pertains to the Block 192 Site Plan located in the northeast corner of the overall subdivision, east of Dallaire Street.

This *Detailed Stormwater Management Report* (DSWMR) has been prepared in support of the *953 Mapleview Drive – Block-192 Site Plan* prepared by S&C Architects Inc., dated June 14th, 2024, and demonstrates how the lands will be serviced in regard to stormwater management. Block 192 is part of the overall *Mapleview South Draft Plan of Subdivision* prepared by TJCG, dated December 22, 2022.

1.2. Property Description

Block 192 is irregular in shape and is comprised of approximately 0.74 hectares (ha) of land. The subject property is legally described as Part of Lot 19, Concession 11, Geographic Township of Innisfil, in the City of Barrie, County of Simcoe. A copy of the *953 Mapleview Drive – Block-192 Site Plan* prepared by S&C Architects Inc. and the proposed *Draft Plan of Subdivision* prepared by The Jones Consulting Group for the overall subdivision lands have been attached in **Appendix D**.

The site is situated southeast of the intersection of Mapleview Drive East and Prince William Way. It is bound to the north, south and west by a Future Residential Subdivision (Mapleview South Subdivision), and to the east by a stormwater management facility (SWMF12) on future residential lands (Sandy Creek Estates). The location of the subject property is shown in **Figure 1**.

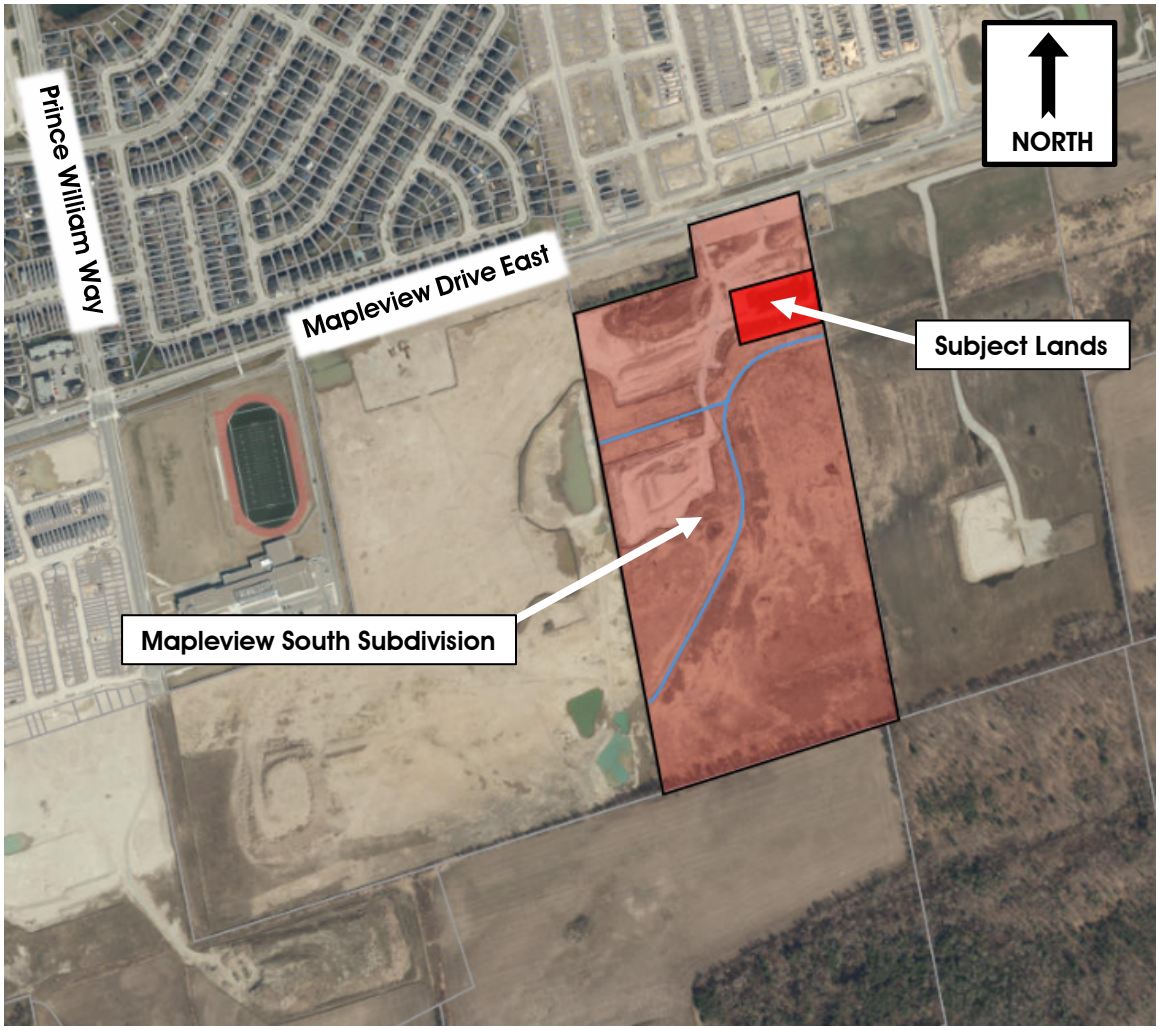


Figure 1 - Site Location

The existing site topography ranges in elevation from a maximum elevation of 252.5 meters at the northwest corner of the site adjacent to a minimum elevation of 259 meters near the southern boundary of the block. Sandy Cove Creek generally drains from southwest to northeast, with the subject lands draining from the north and south towards the creek. Existing slopes range from 1% to 7%.

1.3. Existing and Proposed Land Use

The lands were previously used for agricultural practices comprised of mainly pasture and seasonal crops. The branch of Sandy Cove Creek/Redfern Channel traverses the Mapleview South

Subdivision from southwest to northeast. Drainage of the subject lands in its previous condition was directed southerly to these watercourses.

The site is designated as residential per the City of Barrie Official Plan 2051, Council adopted Version February 15, 2022. The Block 192 Site Plan proposes the development of a 120-unit, 5 storey apartment building with, above and below ground surface parking, an outdoor amenity area, and internal roadway/fire route.

1.4. Supporting Documents

The following documents have been referenced in the preparation of this report:

- Mapleview South (Innisfil) Ltd. Functional Servicing Report, The Jones Consulting Group, June 2023;
- Mapleview South (Innisfil) Ltd. Detailed Stormwater Management Report, The Jones Consulting Group, June 2023;
- 969, 979 & 989 Mapleview Drive East Stormwater Management Report, Tatham Engineering, November 2023;
- Hewitt's Secondary Plan Area Subwatershed Impact Study, Lover's, Hewitt's and Sandy Cove Creeks, R.J. Burnside & Associates Ltd., September 2016;
- Mapleview South (Innisfil) Ltd. 953 Mapleview Drive, Barrie, Ontario, Proposed Draft Plan of Subdivision, The Jones Consulting Group, Dec. 22, 2022;
- 953 Mapleview Drive – Block-192 Site Plan, S&C Architects Inc., June 14, 2024;
- City of Barrie, Stormwater Infrastructure Design Standard, D700 June 2023;
- City of Barrie, Hewitt's Secondary Plan Transportation Improvements Municipal Class Environmental Assessment, Phases 3 & 4, adopted by council June 19, 2017;
- City of Barrie, Secondary Plan, Background Studies & Infrastructure Master Plan, Intensification and Annexed Lands, AMEC, October 2013;
- Lake Simcoe Region Conservation Authority, Watershed Development Guidelines, April 2015;
- Lake Simcoe Region Conservation Authority, Barrie Creeks, Lovers Creek and Hewitt's Creek Subwatershed Plan, 2012;

- Lake Simcoe Region Conservation Authority, Technical Guidelines for Stormwater Management Submissions, April 2022;
- Lake Simcoe Region Conservation Authority Phosphorus Offsetting Policy, July 2021;
- Credit Valley Conservation Authority & Toronto Region Conservation Authority, Low Impact Development Stormwater Management Planning and Design Guide, 2010;
- Sustainable Technologies Evaluation Program (Step), Evaluation of Residential Lot Level Stormwater Management Practices, 2013;
- Ministry of the Environment, Lake Simcoe Protection Plan, July 2009;
- Ministry of the Environment, Stormwater Management Planning and Design Manual, March 2003;
- Ministry of Transportation, Drainage Management Manual, February 2008;
- Geotechnical Investigation Report, Mapleview South Development, Cambium Inc., December 2018;
- Hydrogeological Assessment, Mapleview South (Innisfil) Ltd., R.J. Burnside & Associates Limited; May 2023;
- Geotechnical Investigation Report – Mapleview South Development Block B (192), Barrie, Ontario, Cambium Inc., June 2024;
- Hydrogeological Brief – Block 192 953 Mapleview Drive, R.J. Burnside & Associates Limited, June 2024;
- Functional Servicing & Stormwater Management Report, 969, 979 & 989 Mapleview Drive East Phase 1, Tatham Engineering Ltd, February 2022;
- Stormwater Management Report, 883 Mapleview Drive East Proposed Residential Subdivision, Schaeffers Consulting Engineers, April 2022.

2. Approval Agencies & Design Criteria

The proposed development is subject to the policies and requirements of the City of Barrie (City), the Lake Simcoe Region Conservation Authority (LSRCA), and the Ministry of the Environment Conservation and Parks (MOE) with respect to drainage and stormwater management.

2.1. City of Barrie

The stormwater drainage recommendations for the proposed development have been designed to adhere to the City of Barrie's *Storm Drainage and Stormwater Management Policies and Design Guidelines* (March 2023).

The City's document was prepared to reflect current accepted design practices and is intended as a guide to provide a solid engineering basis for storm drainage and stormwater management design, to establish uniform guidelines of minimum standards, and to improve the processing of site plan and plan of subdivision applications for approval in the City. The document provides legal and technical requirements specific to stormwater drainage systems, stormwater management systems, site grading, minimum requirements for erosion & sediment control, guidelines for hydrologic and hydraulic analysis, and stormwater quantity & quality control techniques, among other topics.

2.2. Lake Simcoe Region Conservation Authority (LSRCA)

The subject site is located within the Hewitt's Creek Subwatershed, which is part of the larger Lake Simcoe Watershed, located within the Lake Simcoe Region Conservation Authority's (LSRCA) jurisdiction. Parts of the site are located within Regulated Areas Pursuant to *Ontario Regulations 179/06*. As such, it is expected that the LSRCA will require the stormwater management plan to adhere to the LSRCA *Technical Guidelines for Stormwater Mangement Submissions* (September 2016) as well as conform to the recommendations of the MOE *Stormwater Management Planning and Design Manual* (March 2003).

The goal of Stormwater Management is to mitigate the effects of urbanization on the hydrologic cycle including increased runoff and decreased infiltration, of rain and snowmelt. The LSRCA *Watershed Development Policies* and *Stormwater Management Technical Guidelines* provide a framework for the planning and design of major development projects adjacent to naturalized

areas as well as the design of stormwater management infrastructure to address flooding, water quality, erosion, water balance, and natural heritage.

The LSRCA Technical Guidelines no longer follow a traditional approach to the development of stormwater management infrastructure. The Technical Guidelines provide guidance in developing an effective approach to stormwater management which follows Better Site Design Techniques developed by the Minnesota Pollution Control Agency's *Minnesota Stormwater Manual* (2016). Better Site Design involves techniques applied early in the planning and design process to preserve natural areas, reduce impervious cover, redistribute runoff and use pervious areas to more effectively treat stormwater runoff. A major difference between the traditional development process and Better Site Design process is the implementation of Low Impact Development (LID) measures. The focus of design has shifted to treating and utilizing rainfall as soon as it hits the ground, reducing and controlling runoff volume and mimicking natural hydrology rather than simply conveying runoff.

2.3. Ministry of the Environment, Conservation and Parks (MOE)

Stormwater management proposals for developments are to be consistent with the guidelines of the MOE's *Stormwater Management Planning and Design Manual* (March 2003), in an effort to mitigate against any negative effects on the receiving waters of Sandy Cove Creek resulting from increased urbanization.

2.4. Ministry of Natural Resources & Forestry (MNRF)

The Ministry of Natural Resources and Forestry (MNRF) is the authority having jurisdiction on a provincial level with regards to development adjacent to and within floodplains. Through a series of provincial policy statements and Technical Guideline publications on Natural Hazards, Flooding, and Official Plan Flood Limit Policies, the MNRF through its water management program aims to support development applications which are sustainable and do not create an additional public threat.

According to the provincial policy statement on public health and safety issued under the *Planning Act*, the "province's long-term economic prosperity, environmental health, and social well-being depend on reducing the potential for public costs and risk to Ontario's residents by directing development away from areas where there is a risk to public health and safety or a risk

of property damage". The policy generally states that development will be diverted to areas outside of hazardous lands adjacent to river and stream systems which are impacted by flooding and/or erosion hazards.

2.5. Ministry of Transportation (MTO)

The Ministry of Transportation (MTO) provides design guidance through a series of publications including the *Drainage Management Manual* and the Ministry's *Drainage Directives.* These documents provide users with tools and guidance for the hydrologic and hydraulic analysis of systems to analyze the potential hazards to the travelling public and ensure the longevity of critical infrastructure such as bridges and culverts.

2.6. Stormwater Management, Flood & Erosion Protection Design Criteria

The Flood & Erosion Protection and the Drainage & Conveyance design criteria within the City of Barrie are established by the Lake Simcoe Region Conservation Authority (LSRCA), Ministry of Transportation (MTO), Ministry of Environment Conservation and Parks (MECP), Ministry of Natural Resources & Forestry (MNRF) and the City of Barrie (City) engineering design standards. This section outlines the key design criteria as follows:

- City of Barrie *Storm Drainage & Stormwater Management Policies & Design Guidelines* (March 2023) as follows:
    - *Water Quality & Erosion Control* including;
        - Developments ≥ 5 Ha shall implement measures to detain and store the runoff from the 25mm event and release it over a minimum of 24 hours, and;
        - Phosphorus loadings projected under post-development conditions shall be minimized to limit the impacts on receiving watercourses and Lake Simcoe;
    - *Quantity Control (Flood Protection)* requires the control of post-development peak flow rates to pre-development levels;
    - *Water Balance* is required for all new developments ≥ 5 Ha where infiltration and recharge is promoted on-site to match pre-development annual infiltration volumes in the post-development condition;

- *Receiving Watercourses* are required in general to be maintained in their natural state, keeping with pre-development base flows and velocities;
- *Stormwater Management Facilities* cannot be constructed within the 100 year floodplain, and may only be constructed within the Regional floodplain if permitted by the City and Conservation Authority;
- *Erosion & Sediment Control* measures shall be implemented to minimize the impact of erosion and sediments leaving disturbed sites to receiving systems.

- LSRCA *Technical Guidelines for Stormwater Management Submissions (April 2022) – Sections 3, 4 & 5* as follows:
  - *Stormwater Quantity Control* including;
    - Peak Flow Control – post-development peak flow rates are not to exceed the corresponding pre-development peak flow rate for the 2, 5, 10, 25, 50 and 100 year storm events;
    - Runoff Volume Control – New developments that create more than 0.5 Ha of new impervious surface shall capture, treat and retain the runoff volume generated from the 25mm storm event from the total impervious area to be developed. Note *'Sites with Restrictions' – – Section 3.2.6.;*
    - Major-Minor System Conveyance – The minor system is designed to convey more frequent events (1:5 Year Storm) while the major system conveys runoff from infrequent events (1:100 Year Storm) when the minor system's capacity is exceeded, and;
    - Regulatory Storm Conveyance – Where there is an external drainage area flowing through a site, the developer must demonstrate safe conveyance of the Regulatory Storm (Hurricane Hazel or 100-year storm, which ever produces a greater peak flow)) to a sufficient outlet.
  - *Stormwater Quality Control* including;
    - MOE Enhanced Level of Protection corresponding to an 80% long term average removal of Total Suspended Solids (TSS);
    - An 80% reduction of Total Phosphorus load anticipated on an annual basis under Post-Development conditions;
    - Protection of fresh water sources (surface and ground-based) from Winter Salts;
    - Thermal mitigation where required to provide cooling of SWM Facility discharge to limit the impacts to receiving streams, and;

        - A screening against any additional contaminants which may be generated from proposed land uses beyond what has been described earlier.
    - *Stream Erosion Control* typically requires the detention of the runoff produced from the 25mm storm event and release over a period of at least 24 hours. In general, *Stream Erosion Control* is achieved by meeting the SWM Quality Control design criteria for the drawdown time from the end-of-pipe SWMF.
    - *Water Balance / Groundwater Recharge* is to be maintained to the maximum extent possible where post-development annual infiltration volumes should meet pre-development levels.
    - *Erosion & Sediment Control* measures should be instituted prior to site disturbance and should remain in place and in good working order until the subject lands have been re-stabilized.
- MTO Drainage Management Manual (1997)
- MTO Drainage Design Standards (2008)
- MOE Stormwater Management Planning and Design Manual (2003)

3. Site Physiography & Background Studies

3.1. Subwatershed Impact Study

The *Hewitt's Secondary Plan Area Subwatershed Impact Study* (September 2016, Rev. 2017) prepared by RJ Burnside & Associates Ltd. detailed the preliminary approach to stormwater management for each of the subwatersheds and subcatchments within the *Hewitt's Secondary Plan*. The subject lands are identified under the *SIS* as part of *Post Development Catchment 12.* The following is a summary of the recommended approach established in the SIS for Catchment 12:

> *SWMF#12 is proposed to be located in the Phase 3 lands of the Finger Lake Development between the south side of Mapleview Drive and Sandy Cove Creek in an area of relatively steep grades sloping away from Mapleview Drive. The intent of the facility is to provide treatment for Phase 1 portions of the non-participating landowner to the west of Finger Lakes property and for the Phase 1 and Phase 3 lands (north of Sandy Cove Creek) Finger Lakes property.*
>
> *The entirety of the catchment area consists of residential development and there may be an opportunity to collect drainage from Mapleview Drive ROW and direct the flow into the SWMF, however additional P removal and infiltration to meet LSRCA guideline should be provided within the ROW. We have not included any part of the external ROW runoff in the digital model to SWMF#12 at this time as the majority of this area receives quality control treatment from the existing OGS at Hewitt's Creek.*
>
> *The preliminary design for this facility is provided by the Finger Lakes consultant and is currently proposed to be oriented in a east-west direction, and meets all the requirements for the length to width ratio's recommended by the MOECC. The SWMF is proposed to have a wet forebay at the west end, with a main cell extending to either side of the north south collector road proposed. The two portions of the main cell are to be connected with an equalization pipe.*
>
> *The SWMF and block are adequately sized for the drainage area but there is currently not a significant opportunity to reduce the facility size within the block or to reconfigure the shape to allow for more development lots due to the selected location and grading.*
>
> *As the portion of Sandy Cove Creek which sits immediately south of the proposed SWMF location is currently part of the Redfern Municipal Drain, there is an opportunity to*

relocate the watercourse channel to a location which may provide a more advantageous development configuration. The current SWMF location results in some grading and servicing challenges which could be avoided by relocating the Creek. A portion of the Creek on the adjacent Dorsay Lands is to be relocated south, and coordination will be required to ensure a proper transition is provided.

Furthermore, based on preliminary investigations and background data, the *SIS* identifies the following opportunities and constraints for implementing LID's within Catchment 12:

Although the catchment is dominated by sandy loam soils, the area also contains high groundwater levels on the southern, lower half of the site. The entire catchment is within the SGRA and there are no park or school blocks to utilize for LID. As such, the following are the LID recommendations for the catchment:

- *5 mm target should be pursued at detailed design for the implementation of infiltration LID measures.*
- *The remainder of the target is to be achieved through filtration and attenuation measures.*
- *Due to the presence of the SGRA, infiltration LIDs within ROW must consider water quality issues including the potential for pre-treatment. Use of CB inserts and deepened sumps where ROW infiltration measures are to be implemented.*
- *Use of shallow LID options (located all or partially above the frost line) to increase opportunities.*
- *Placement of LID measures where feasible within Sandy Cove Creek stream corridor.*
- *Consider the use of a 3rd pipe roof drainage clean water exfiltration in SGRA areas where pre-treatment is not feasible or cost prohibitive.*
- *LIDs are to be provided to achieve groundwater balance volumes as outlined in Section 4.6.3. to the extent possible.*
- *Additional topsoil depths of 300mm, as outlined in Section 5.5.2.1., on all of the proposed lots within this area could provide some level of infiltration and peak flow reduction, however there is currently no credit for this method.*

The *SIS* final recommendations for Catchment 12:

a) *Provide an end-of-pipe SWMF within Catchment 12 to provide quality and quantity controls as per the LSRCA and City Standards. Specific SWMF characteristics and precise location to be determined at Draft Plan and detailed design stage.*

b) *A 5 mm infiltration target should be pursued at detailed design with an additional 20 mm filtration target.*

c) *Infiltration/Filtration LID to be provided within the ROW, NHS buffer and on pervious areas of private lots where possible.*

d) *The assumed Sandy Cove Creek road crossing location to be confirmed by the non-group participating landowner and detailed design of the crossing including confirmation of the potential impact on the floodplain to be completed.*

The SIS recommendations have been confirmed through the completion of further geotechnical & hydrogeological investigations, as well as a groundwater monitoring program and a detailed review of available background studies.

3.2. Site Soils and Geotechnical Considerations

3.2.1. Soil Survey of Simcoe County

The Soil Map of Simcoe County, South Sheet, Report No. 29 prepared by the Canada Department of Agriculture shows the site being comprised of Bondhead Sandy Loam (Bs) Soil. This soil type is noted to have good to imperfect drainage characteristics and belongs to Group B of the SCS Hydrological Soils Group Classification System. A copy of the Soil Map of Simcoe County, South Sheet, Report No. 29 has been attached in **Appendix D.**

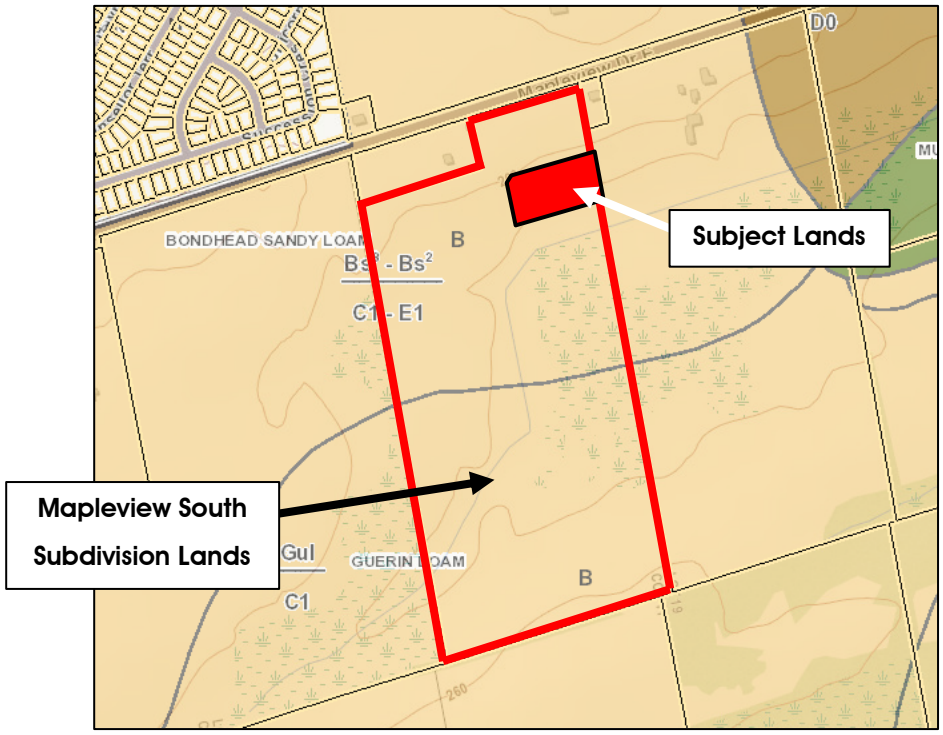


Figure 2 - Site Soils Identification

Table 1 - Soil Type Distribution

Soil Type	Soil Name	HSG Group	Total Area (ha)	Percentage Area (%)
Bs	Bondhead Sandy Loam	Group B	0.74	100.00

3.2.2. Geotechnical Investigation

An initial analysis of the site's subsurface soils and groundwater conditions for the overall Mapleview South Subdivision Lands was completed by Cambium Inc. (Cambium) in May 2018 to provide geotechnical recommendations for the site's construction requirements based on observed borehole (BH) and groundwater monitoring data. The investigation included the advancement of sixteen (16) boreholes (BH No. 101 to 115) to a depth ranging from approx. 5 to 8 meters below the existing ground surface and each outfitted with a monitoring well.

The borehole logs show that the site is covered in a layer of topsoil (300-900 mm thick, average depth of 600 mm) over layers of clay, till, sand and silty sand. Over the course of the investigation

and monitoring, evidence of groundwater in all of the sixteen (16) boreholes was observed. Based on water level recordings, the stabilized ground water table appears to reflect a subdued expression of the ground profile, with downward gradient from west to east in the general direction of Sandy Cove Creek. The presence of a confined aquifer has also been identified in locations where groundwater level readings were recorded at or above the existing surface. The site's observed and predicted groundwater elevations have been utilized to establish the proposed grading design, for the Mapleview South Subdivision's future buried infrastructure, road bedding and dwellings. Refer to the *Geotechnical Investigation Report - Mapleview South Development, Mapleview Drive East*, prepared by Cambium Inc., dated December 2018, under separate cover.

A block specific geotechnical investigation was conducted by Cambium in May of 2024 for Block 192 which advanced four (4) boreholes to depths ranging from 6.5m to 6.7m below the existing ground surface. Groundwater and caving conditions were noted in the open boreholes during and upon completion of drilling. The subsurface investigation generally produced findings of a surficial layer of engineered fill followed by non-cohesive silty sand to sand soils. Bedrock was not encountered. Groundwater was observed in all boreholes at depths ranging from 5.5m to 5.6m below ground surface. For further information regarding subsurface soil characteristics and groundwater levels, refer to the *Geotechnical Investigation Report – Mapleview South Development Block B (192), Barrie, Ontario*, prepared by Cambium Inc. dated June 2024, under separate cover.

3.3. Existing Drainage Conditions

The subject lands consist of approximately 0.74 hectares of land which has historically been used for agricultural purposes. The land's topography contains slopes ranging from 1 – 7%, generally draining from north to south toward the Sandy Cove Creek/Redfern Municipal Drain. The property is part of pre-development drainage area 128, as described in the SIS.

There are no existing stormwater management facilities on the subject lands and all flows are released uncontrolled to the Sandy Cove Creek/Redfern Municipal Drain.

3.4. Proposed Drainage Conditions

Development of the subject lands will consist of a 120-unit, 5 storey apartment building complete with above and below ground surface parking, an outdoor amenity area, landscaped areas, and internal roadway/fire route. The site is part of post-development drainage area 12, as described

in the SIS, and is designated as catchments 111 & part of 12-B on **Drawing STM-1** of the *Mapleview South Subdivision – Phase 1 Registration Drawings* dated June 2023.

The grading of the subject lands will direct stormwater runoff to the internal road network, which will contain a proposed storm sewer system to convey minor flow (up to the 5 Year event) to an underground infiltration gallery. Major event flow (> 5 year event) and minor flows that are not infiltrated within the underground facility will be conveyed to the downstream Stormwater Management Facility #12 (SWMF12) located within the adjacent Sandy Creek Estates lands (previously Finger Lakes), east of the Block 192 Site Plan. A portion of drainage which could not be directed to SWMF-12 will drain uncontrolled to the re-aligned municipal drain located southeast of the development. The post-development condition of this uncontrolled area will consist of lawn surfaces in its entirety, which is considered to produce clean runoff. The internal roads of Block 192 and the overall Mapleview South Subdivision have been designed to convey the major overland flow within the right-of-way and prevent flooding of adjacent properties.

The end-of-pipe SWMF12 located on the Sandy Creek Estates lands is understood to be proposed as a wet pond complete with a forebay and filtration cell, aiming to provide extended detention and flood control, along with quantity and quality control functions. Details on that facility would be submitted by others (Tatham Engineering) in support of the Sandy Creek Estates development design approvals. Design coordination has been undertaken in accordance with the *Mapleview South Subdivision – Phase 1 Registration Drawings* to ensure adequate sizing of the downstream SWMF12 to provide the required quantity and quality control. At the time of this writing, SWMF12 and the Sandy Creek Estates development are in the Detailed Design phase.

The storm sewer subcatchment plans **Drawings STM-**1 for Block 192 and the overall Mapleview South Subdivision have been included in **Appendix A** and **Appendix D** respectively. Furthermore, the Post-Development Stormwater Management Plan, **Drawing SWM-1** for Block 192 has been included in **Appendix A**.

The proposed drainage system will also include a Low Impact Development (LID) infiltration gallery with the aim to deliver upstream treatment for contaminants, promote groundwater recharge and assist in maintaining water balance to pre-development levels as per regulatory stormwater management design criteria. The *SIS* had identified a preliminary list of LID measures deemed suitable for implementation within the subject lands, which has been further refined through consultations with the City of Barrie and LSRCA during the *Design Charrette* process for the Mapleview South Subdivision. The LID measures proposed within Block 192 include an

underground infiltration gallery complete with an upstream Oil Grit Separator (OGS) unit to achieve the LSRCA and City of Barrie targets for infiltration, filtration, water balance and total phosphorus removal. The proposed LID location and footprint is shown on **Drawing SWM-1** in **Appendix A**. Further design details regarding LID measures are provided in **Section 5.2.2.**

The proposed works require an Erosion and Sediment Control Plan in order to provide the appropriate protection of downstream receiving systems during construction. The proposed ESC works are outlined within **Section 5.7** of this Report and outline the construction and staging requirements at various phases of the development. The proposed erosion and sediment control techniques are illustrated on **Drawings ESC-1** and **ESC-2**.

4. Hydrology

4.1. OTTHYMO Modeling Overview

4.1.1. Discrete Event Modeling – LID Model

The development was hydrologically modeled using the latest version of Visual OTTHYMO modeling software (version 6.2). Discrete event modeling was completed for the 25mm 4-hour Chicago (Water Quality) rainfall event, in accordance with the City of Barrie's *Storm Drainage and Stormwater Management Policies and Design Guidelines* (March 2023). LID sizing was determined based on the results of the 25mm Event modeling to ensure total volumetric capture on a discrete event basis and confirm adequate drawdown time (minimum 24hr period) of the facility.

4.1.2. Continuous Simulation Modeling – LID Model

In addition to discrete event modeling, a continuous modeling simulation was developed to assess the drawdown characteristics of the LID, as well as assess Runoff Volume Capture, SWM Quality Control, and Post-Development Water Balance for the proposed site on an annual basis. The continuous modeling simulation uses a data set of hourly precipitation obtained in the City of Barrie for a 12-month period from June 1st, 2005 to May 31st, 2006, representing a typical year. To further the continuous model simulation, the corresponding set of climatic data consisting of maximum and minimum daily temperatures for the annual period was coded into the OTTHYMO model to simulate evapotranspiration processes. Inputs to the continuous modeling simulation mimic the model setup for the proposed condition continuous modeling completed as part of the *SIS*.

4.1.3. Modeling Approach & Rationale

As described above, the hydrologic modeling pertaining to this Report includes two scenarios under post-development conditions. Pre-to-post development peak flow event modeling for the 2 to 100-year, 25mm Event, and Regional Event storms were completed as part of the detailed design of the Sandy Creek Estates lands and includes the proposed condition of the Mapleview South Subdivision Lands. Refer to the *969, 979 & 989 Mapleview Drive East Stormwater Management Report* prepared by Tatham Engineering, dated November 3rd 2023. To ensure proper functionality of the receiving SWMF12 in relation to quantity and quality control, an

allowable runoff coefficient for Block 192 has been imposed as part of design coordination. Quantity and quality control target achievements for Block 192 are further described in **Section 5.3** and **Section 5.4** of this Report, respectively.

The post-development models evaluated are listed below:

- *Post-Dev-LID*: Post Development LID Model 25mm 4hr Chicago Event
- *Post-Dev-LID*: Post Development LID Model Continuous Event

The 25mm water quality event and continuous event simulations were completed to assess a number of LID facility characteristics, including:

- the drawdown time during a typical 25mm event;
- the drawdown time between storm events producing runoff;
- sufficient redundant volume available if inter-event window is short (<48 hours);
- overflow of the LID;
- total infiltration volume on a single event and annual basis; and
- total capture volume on a single event and annual basis.

After running the models, with respect to the area draining to the LID (catchment 301), the proposed infiltration gallery captured and infiltrated 100% of the total runoff water volume during the 25mm Event and **90.2%** of the annual runoff water on the continuous event. For more details and reference, the *detailed OTTHYMO outputs* can be found in **Appendix C**.

4.2. Post-Development Modeling

The post-development condition of the development lands has been broken down into three (3) catchments. The post-development catchments are outlined on **Drawing SWM-1** provided in **Appendix A.**

Catchment 301 encompasses the majority of Block 192 and includes the proposed building, a portion of landscaped area, parking space, part of the internal roadway, and the LID feature. Runoff generated by this catchment during minor events (< 5-year storm) will be conveyed via the proposed subsurface storm sewer network to the LID feature before discharging off site to the downstream SWMF12. Site grading has been designed to direct runoff generated by this catchment during major events (> 5-year storm) to the proposed internal roadway network within the Mapleview South Subdivision lands, which drain overland through Block 199 to SWMF12.

Catchment 302 represents a large portion of lawn covered sloping around the perimeter of the block, landscaped areas, and a portion of the internal roadway. Due to grading constraints, drainage generated by this catchment is not able to be directed to the proposed LID. Minor event runoff (< 5-year storm) is captured by the subsurface storm sewer system at Dallaire Street and directed to SWMF12. Major event runoff (> 5-year storm) is conveyed overland to SWMF12.

Catchment 303 represents a portion of retaining wall and mostly lawn area located along the southern boundary of the development. Due to grading constraints, drainage generated by this catchment is not able to be directed to the proposed LID, however, due to the nature of land coverage proposed within this catchment, runoff is not expected to produce pollutants. All runoff generated by this catchment is conveyed overland in a southeast direction to the existing municipal drain.

The following **Table 2** illustrates the parameters coded into the post-development OTTHYMO models for Block 192. The post-development catchment properties are illustrated on **Drawing SWM-1** in **Appendix A** of this Report.

Table 2: Post-Development OTTHYMO Model Parameters

NASHYD Catchments	Area (ha)	L (m)	S (%)	RC	CN	Ia (mm)	Tp (hr)	DT (min)
303	0.10	20	10	0.14	51	4.85	0.07	1
STANDHYD Catchments	**Area (ha)**	**XIMP (%)**	**TIMP (%)**	**SLPP (%)**	**LGP (m)**	**SLPI (%)**	**LGI (m)**	**DT (min)**
*301	0.42	91	91	2.00	10	2.00	52.6	1
302	0.20	19	37	25.00	10	2.00	36.51	1
Storage Chamber	**Manufacturer**	**Model**	**Number of Chambers**	**Depth of Stone Above Chamber (mm)**	**Depth of Stone Below Chamber (mm)**	**System Footprint (m^2)**	**Voids in Stone (Porosity)**	**Max Storage Volume (m^3)**
1	StormTech	SC-740	39	305	305	149.9	0.4	112.67

**Runoff from this catchment is conveyed to the Site's proposed LID*

5. Stormwater Management Plan

5.1. Introduction

The stormwater management plan is intended to provide an environmentally sound approach to stormwater issues. The issues can be divided into four main categories: stormwater quality control, stormwater quantity control, water balance, and erosion and sediment control.

In accordance with the *SIS,* the subject lands do not include any end-of-pipe stormwater management facilities. Primarily all quality and quantity control is provided off-site. All flows are directed to SWMF12 located on the Sandy Creek Estates Lands to the east of the subject lands. Any development adjacent to the re-aligned Sandy Cove Creek/Redfern Municipal Drain will drain uncontrolled to the 60m wide Natural Heritage System corridor which crosses the Mapleview South subdivision from southwest to northeast.

A Low Impact Development (LID) infiltration gallery has been proposed to provide additional stormwater quality control and water balance mitigation on site. In addition, the proposed infiltration gallery has been sized to accommodate the required erosion control volume for the development.

5.2. Low Impact Development & Pre-Treatment Devices

As per the recommendations of the *SIS*, the City of Barrie, LSRCA and MOE, a suite of Low Impact Development measures is being proposed throughout the subject lands in an effort to reduce the reliance on end-of-pipe facilities and better mimic the natural hydrologic cycle. The Mapleview South Subdivision will include both inline and offline practices associated with the stormwater management plan, all designed in accordance with the *Credit Valley Conservation Authority & Toronto and Region Conservation Authority – Low Impact Development Stormwater Management Planning and Design Guide (2010)*.

Infiltration rates used throughout the design and modeling utilize a factor of safety of 2.5 as per recommendations of the Geotechnical Consultant and Hydrogeologist.

Further description of the LID proposed for the site is provided in the subsections below. Plan, sections and detail drawings have been provided for the infiltration gallery. Refer to **Drawings LID-1** and **LID-2** in **Appendix A**.

5.2.1. Lot Level Controls

In accordance with the *SIS,* it is recommended that all catchments should incorporate an increased depth of absorbent topsoil of at least 300mm thick to promote at-source infiltration of pervious surfaces on lots. It is further recommended that any absorbent topsoil be amended with organic content (compost) as recommended in the *CVC Design Guidelines* while scarifying subsoils and remaining as unconsolidated as reasonably possible to maintain void spaces. A study conducted in BC has asserted reductions in runoff volume and peak flows up to 50% from the placement of 300mm of absorbent landscaping (British Columbia Ministry of Land, Water and Air Protection, May 2002). Another study conducted in Ontario through the *Sustainable Technologies Evaluation Program (STEP)* has confirmed similar findings with a reduction in runoff of up to 27% (STEP, Residential Lot Level SWM Practices, 2013).

Other recommendations include downspout disconnection, where roof leaders are directed away from impervious surfaces. Though not explicitly quantified, sub-area routing can be applied throughout all hydrologic modelling to capture the benefit of re-routing runoff produced from rooftops to pervious surfaces. Additionally, it is recommended to incorporate rain barrels at the lot level where possible, to further reduce runoff volumes to downstream systems.

Although the above lot level controls are recommended, they are not specifically quantified in the detailed design calculations as the provision of these controls cannot be enforced at the lot level.

5.2.2. Infiltration Gallery

An infiltration gallery is proposed in series with the storm sewer network where stormwater runoff is collected from the site's internal roadway, parking and landscaped areas, and building rooftop. The facility has been designed to have a maximized footprint to capture and infiltrate as much stormwater runoff as possible before overflowing into the next downstream segment of storm pipe. Runoff generated from the upstream catchment area will be collected by a conventional storm sewer network and directed to a proposed oil grit separator (OGS) unit for pre-treatment before entering the infiltration gallery.

The infiltration gallery is located within the parking lot of Block 192 and will be comprised of Stormtech SC-740 chambers surrounded by a clear stone media (void ratio of 0.4) and wrapped in a non-woven filter fabric. This LID will feature an ETV verified isolator row at the first run of chambers to provide additional removal of pollutants upon entry to the facility. The infiltration

gallery will have an open bottom to allow the entire footprint area to be utilized for infiltration and has been designed to provide greater than 1m of separation to the recorded high-groundwater level. Inlet and outlet pipes to the system have been configured to allow for the maximum amount of storage to be achieved in the facility, which was determined to be 112.7m^3. This exceeds the volume of rainfall produced by the 25mm Water Quality Event within the LID's upstream drainage area; 105m^3 (0.42ha x 25mm x 10). In addition, discrete event modelling of the LID determined a 47.7hr drawdown period over the course of this simulation, falling within the desired 24-48hr period. For further details, a detailed cross section of the LID is displayed on **Drawings LID-1** and **LID-2** in **Appendix A**, and ADS design drawings have been included in **Appendix B**.

5.2.3. Oil Grit Separator Unit

An oil grit separator (OGS) unit has been proposed immediately upstream of the LID to act as a pre-treatment device for flows entering the facility. An ADS FD-4HC unit has been sized to accept minor event runoff generated by 0.22ha of the development block. ADS detailed sizing reports have been provided in **Appendix B** of this Report. Equivalent OGS units may also be explored.

5.3. Stormwater Quantity Control

5.3.1. Peak Flow Control

The SWMF12 designed by others will provide necessary stormwater quantity control for the development. This facility will be designed to attenuate post development peak runoff generated by the north portion of the Mapleview South Subdivision lands for storm events up to and including the 100-year event.

The design of the Mapleview South Subdivision (and corresponding downstream SWMF12 by Tatham) developed allowable runoff coefficients and imperviousness values for medium density blocks within the Mapleview South Lands. Block 192 is located within catchment area 12-A of the overall Mapleview South subdivision lands. It is further defined as part of Catchment 1202 on Drawing SWM-3 of the *Mapleview South Subdivision, Phase 1 Registration Drawings*, which has been included in **Appendix D** of this Report. Area 1202 of this drawing generates drainage from both Block 192 and an additional medium density Site Plan Block known as Block 193 to the north of the proposed lands. In the proposed grading condition, 1.23ha of drainage area is directed to

SWMF12 from these Blocks combined. Refer to the *953 Mapleview Dr E – Block 193 Site Plan, Detailed Stormwater Management Report*, prepared by TJCG under separate cover.

The allowable and proposed runoff coefficients for Catchment 1202 have been illustrated in **Table 3** below.

Table 3 – Allowable vs Proposed Hydrologic Characteristics

Catchment 1202 Hydrologic Properties		
	Allowable	Proposed
Drainage Area to SWMF12 (ha)	1.30 ha	1.23 ha
Runoff Coefficient	0.75	0.73
Total Imperviousness (TIMP %)	75%	74%

Given the proposed condition of the combined site plan blocks are within the allowable limits for the hydrologic properties outlined in **Table 3** (above), it is not anticipated that the development of the Block 192 Site Plan per the *953 Mapleview Drive – Block 192 Site Plan* prepared by S&C Architects Inc. dated June 14, 2024 will have negative hydraulic impacts on the quantity control function of the downstream SWMF12. Refer to the *969, 979, & 989 Mapleview Drive East Stormwater Management Report* prepared by Tatham Engineering, dated November 3rd 2023, and the *Mapleview South Subdivision (953 Mapleview Dr. E) Detailed Stormwater Management Report* prepared by TJCG, dated June 2023 under separate cover for further information regarding how the overall development plan achieves the required quantity control targets.

5.3.2. Runoff Volume Control

The LSRCA's *Technical Guidelines for Stormwater Management* offers guidance in determining the appropriate volumetric control targets for subject sites as a function of the site characteristics. The overall Mapleview South Subdivision lands are deemed to be a *Major Development* under the *Lake Simcoe Protection Plan* and are required to provide runoff volume control. Several constraints have been identified within the Mapleview South Subdivision lands which limit the implementation of LID measures, therefore the targets for the development were established under *Section 3.2.6. Flexible Treatment Alternative for Sites with Restrictions*. The *SIS* as well as various background investigations and studies, identified the following constraints:

Table 4 – Runoff Volume Control Target Factors & Constraints

Factor	Site Specific Constraint
v. Areas with high chloride concentrations	• Infiltration of surface water from Mixed Use & High Density Residential, Collector and Arterial roadways discouraged (permitted with conditions) per City of Barrie *Infiltration Low Impact Development Screening Process.*
vi. Zoning, Setbacks, Land Use Requirements	• Limited land use (Parks, Open Space, Institutional Blocks) given drainage area size available for centralized infiltration-based LID practices. • No dedicated SWMF facilities on the subject lands
vii. Property/Infrastructure Restrictions	• Blocks available for centralized facility are located at upstream portions of catchment or in locations where limited flow can be routed to. • Limited opportunities within ROW due to servicing constraints (depth vs. groundwater)

The factors identified above limit the location and effectiveness of infiltration-based LID practices throughout the subject lands applicable to this report. Therefore, Alternative #2 was selected as the target for the overall subdivision as this is the maximum practical amount achievable (best efforts for 5mm infiltration) given the constraints.

Although Alternative #2 was established for the overall subdivision lands due to the above noted constraints, the proposed LID for Block 192 is able to exceed this target by providing a means of capturing and retaining / treating direct runoff volume from 25mm of rainfall from all impervious surfaces on site. **Therefore, meeting initial runoff volume control requirements per the LSRCA without the need for a flexible treatment alternative**. The following is a summary of calculations used to determine the LID performance outlined herein.

LID Storage Capacity: **112.67m^3**

Block Impervious Area: 0.45m^2

25mm of Rainfall Across Impervious Surfaces: 0.45m^2 x 25mm x 10 = **112.5m^3**

It should be noted that there is additional provided volume within the downstream SWMF12 that is not accounted for in this design.

5.3.3. Minor-Major System Conveyance

The Storm Sewer system (minor system) is designed for the 5-year event, with rainfall intensities calculated using the A, B, C parameters listed in Table 3.1 of the *City of Barrie Storm Drainage and Stormwater Management Policies and Design Guidelines.*

All storm sewers throughout the subject lands have been designed to maintain a minimum depth of cover of 1.5m.

There are no crossing conflicts anticipated with the Sanitary Sewers, Watermain, or Utility Ducts. The *Storm Drainage Area Plan*, referenced as **Drawing STM-1** in **Appendix A**, is to be reviewed in conjunction with the *Storm Sewer Design Sheet* in **Appendix B**.

Major System flows (flow > 5-year event) will be conveyed through Dallaire Street, which directs runoff to SWMF12 through a proposed overland spillway in accordance with City of Barrie Standards. For right-of-way conveyance calculations, refer to Section 5.3.3. of the *Mapleview South (Innisfil) Ltd. Detailed Stormwater Management Report*, prepared by The Jones Consulting Group, dated June 2023.

5.4. Stormwater Quality Control

As per the City, LSRCA and MOE requirements, Enhanced (Level 1) stormwater quality control for Total Suspended Solids (TSS) is required for the subject lands. Thus, an integrated treatment train approach is proposed, comprised of an oil grit separator, LID infiltration gallery and external SWM wet pond facility.

The incorporation of LID measures will also provide phosphorus removal benefits to ensure that best efforts are taken to reduce post-development phosphorus loadings to pre-development levels (or a minimum 80% removal of TP from post-development). Phosphorus Loading calculations are detailed within **Section 5.4.2**.

A summary of the proposed LID practices and their corresponding removal efficiencies is provided below in **Table 5**. Concentration-based removal efficiency values are taken from the Low Impact Development Treatment Train Tool (LIDTTT), Version 1.2.1., April 2018.

Table 5 – LID Practice for TSS and TP removal efficiency

LID BMP Concentration Based Removal Efficiencies		
LID Practice	**TSS Removal Efficiency (%)**	**TP Removal Efficiency (%)**
Oil Grit Separator	60%	20%
Infiltration Gallery	75%	60%
Wet Retention Pond	80%	63%

The total removal efficiency of a series of BMP devices in a treatment train can be expressed as follows:

$$R = 1 - (1 - A_1) * (1 - A_2) * \cdots * (1 - A_n)$$

Where: R = Total Treatment Train Removal Efficiency

A_1 = Removal Efficiency of 1st (Upstream) BMP

A_2 = Removal Efficiency of 2nd (Upstream) BMP

A_n = Removal Efficiency of nth (Last downstream) BMP

An overview of the treatment trains and catchment-based performance on TSS and TP removal efficiency are provided in **Sections 5.4.1. and 5.4.2.** below.

5.4.1. TSS Removal

In terms of the quality control requirements for stormwater runoff, the "Enhanced" level of protection as stipulated by the Ministry of Environment is to be provided. i.e. 80% removal of Total Suspended Solids (TSS) on an annual basis. These requirements are to be achieved through a combination of LID practices on site and the proposed off-site stormwater management facility on the Sandy Creek Estates lands (SWMF12).

As demonstrated in **Section 5.3.1.,** there is no anticipated increase in peak flow or runoff volume to the SWMF beyond its intended design and as such, no impact is expected to the facility's ability to achieve the water quality criteria it is designed for.

There are four (4) distinct treatment trains established within the site in relation to TSS removal, as described below:

Table 6 - TSS Concentration Removal Efficiency

Treatment Train	Catchment Areas	Area (ha)	TSS Removal
OGS > Infiltration Gallery > Wet Pond (SWMF12)	202, 203	0.22	98.0 %
Infiltration Gallery > Wet Pond (SWMF12)	*201	0.20	95.0 %
Wet Pond (SWMF12)	204, 205	0.30	80.0 %
Sanitary Collection System	N/A	0.02	100 %
Total		**0.74**	**89.9 %**

Note: *Runoff from this catchment consists of rooftop drainage and does not produce pollutants. Catchment Areas 201-206 are illustrated on **Drawing STM-1**.

As the results show, a **net reduction in total suspended solids of 89.9%** is achieved when implementing BMPs in the post-development condition for the Mapleview South Block 192 lands.

5.4.2. Phosphorus Budget

Similar to the Total Suspended Solids calculation, LID BMP on site and SWM facilities off-site are utilized to reduce the total phosphorus amount leaving the property. A series of treatment train approaches, their removal efficiency rate, respective subcatchment description and area are summarized below.

There are four (4) distinct treatment trains established within the site in relation to TP removal, as described below:

Table 7 - TP Concentration Removal Efficiency

Treatment Train	Catchment Areas	Area (ha)	TP Removal
OGS > Infiltration Gallery > Wet Pond (SWMF12)	202, 203	0.22	88.2%
Infiltration Gallery > Wet Pond (SWMF12)	*201	0.20	85.0 %
Wet Pond (SWMF12)	204, 205	0.30	63.0 %
Sanitary Collection System	N/A	0.02	100 %
Total		**0.74**	**77.4 %**

Note: *Runoff from this catchment consists of rooftop drainage and does not produce pollutants. Catchment Areas 201-206 are illustrated on **Drawing STM-1**.

As the results show, the overall TP removal rate achieved in the post-development condition when implementing BMPs is **77.4%**. The remaining phosphorus amount not managed within the property will be addressed by the Phosphorus Offsetting Policy as described below.

Under the Lake Simcoe Protection Plan (LSPP), a stormwater management plan must demonstrate how phosphorus loadings are minimized between the existing and proposed development scenarios. Thus, a Phosphorus Budget Tool spreadsheet was prepared to reflect all parameters and calculations presented in the MECP P-Budget tool, and to determine the increase and mitigation of phosphorus load after the development and BMP adoption.

Further, the pre-development and post-development total phosphorous loading was estimated using a mass balance approach, utilizing land use breakdown statistics provided in **Appendix C**. The *MECP Pre- and Post-Development Phosphorous Loading* calculations have been provided in **Appendix B**.

Supporting calculations are provided below:

Pre-Development Annual TP Estimate

Drainage Area:	0.74ha
Annual Load:	0.14kg/yr – *from MECP Pre-Development Phosphorous Load*

Post-Development Annual TP Estimate (without mitigation)

Drainage Area:	0.74 ha
Annual Load:	0.98 kg/yr – *from MECP Post-Development Phosphorous Load*

Post-Development Annual TP Estimate (with mitigation)

Drainage Area:	0.74 ha
Annual Load:	0.22 kg/yr – *from MECP Post-Development Phosphorous Load*

Pre- and post-development annual loading of **0.14 kg/yr** and **0.98 kg/yr** were respectively estimated, indicating the site has **increased** the annual total phosphorous load in the post-development condition by **0.84 kg/yr** without the implementation of BMPs. The addition of BMPs will reduce the post-development annual total phosphorous load to **0.22 kg/yr.** A net **increase** of **0.08 kg/yr** has been estimated between pre- and post-development conditions.

This development will be subject to the *Lake Simcoe Phosphorous Offsetting Policy* and as such, will pay a phosphorous offsetting fee to the LSRCA. The Phosphorous offsetting Fee, including a 15% administration fee, is calculated as follows:

Offsetting Calculation = 1.15 x (2.5 x TP deficit in kg/yr x $35,770)

The developer is required to pay an estimated **$8,227.10** in offsetting costs.

5.5. Stream Erosion Control

In terms of the erosion control requirements for stormwater runoff, the Ministry of Environment has stipulated that in the absence of an erosion assessment of the receiver, the 25mm post-development peak flow is to be released over a 24-hour period. These requirements are intended to be achieved through the proposed off-site stormwater management facilitiy on the Sandy Creek Estates lands.

As demonstrated in **Section 5.3.1.,** there is no anticipated increase in peak flow or runoff volume to the end-of-pipe SWMF beyond its intended design and as such, no impact is expected to the facility's ability to achieve the erosion control criteria it is required to be designed for.

5.6. Water Balance

The primary objective of the LSRCA's water balance target is to capture and manage annual rainfall on the development site to preserve the pre-development hydrology (water balance) through a combination of infiltration, evapotranspiration, absorbent landscaping, rainwater reuse and/or other LID practices. Various site-specific characteristics contribute to the ability to achieve water balance. They include, but are not limited to: soil permeability, the ability to collect and direct drainage into the ground, groundwater table elevations and seasonal fluctuations. Best efforts will be made via the SWM Plan to maintain groundwater recharge while considering site specific characteristics.

A site-specific water balance in accordance with the SIS recommendations has been completed for Site Plan Block 192 by R.J. Burnside & Associates Ltd. and is included in **Appendix D** of this Report. RJB completed a pre- to post-development water balance to estimate the infiltration volume deficit that would need to be mitigated via the proposed SWM Plan. The infiltration and runoff volume as calculated in the RJB Water Balance Assessment are presented in **Table 8** below.

Table 8 - Summary of Water Balance Calculations by RJB

Water Balance Runoff & Infiltration Volumes – RJB Table G-3			
	Pre-Development	**Post-Development**	**Difference**
Impervious Area Runoff Volume (m^3/a)	18	3,965	3,946
Pervious Area Runoff Volume (m^3/a)	1,002	318	-684
Total Runoff Volume (m^3/a)	1,021	4,282	3,261
Total Infiltration Volume from Pervious Surfaces (m^3/a)	1,504	590	**-914**

The results summarized in the table above indicate that there is an increase in total runoff volume and a deficit in infiltration volume from pre- to post-development without accounting for LID's. The SWM Plan herein is intended to mitigate or reduce the water balance deficit as outlined above. Runoff generated from this development is directed to the proposed Low Impact Development (LID) infiltration gallery. The infiltration gallery and its contributing drainage area is shown on **Drawing LID-1** in **Appendix A.**

Upon review of the *Environment Canada Daily Climate Normals* for the *Barrie WPCC* from the years 1979 to 2008, a statistical analysis of rainfall data was completed and it is noted that on an annual average over that time period, this gauge has received **928.1mm** of total precipitation, comparable to the mean average annual precipitation of 939 mm for Hewitts Creek, published in the *LSRCA Climate Data Set, April 2017* and comparable to average annual precipitation of 933 mm used by RJB in their water balance calculations.

A continuous data set of precipitation and temperature for a one-year period (June 2005-May 2006) was used for the continuous model simulation in the PCSWMM hydrologic model to estimate the annual infiltration capability of the proposed LID's. The continuous data set has a total annual precipitation of **984.3mm**, comparable to the average annual precipitations noted above.

Reviewing the results of the Post-Dev-LID (Continuous) model simulation, it is estimated that approximately **71.0%** of the annual runoff generated from the site is captured and retained by the proposed infiltration gallery. This annual capture efficiency is applied to the post-development annual runoff volume calculated by RJB (4,282m^3), in addition to the post-development infiltration volume occurring naturally (590m^3), increasing the site's post-development infiltration from 294 m^3/a to 3,630 m^3/a ((4,282m^3 x 71%) + 590 m^3). The revised annual infiltration volume results in eliminating the infiltration deficit of 914 m^3/a to a surplus of **2,126 m^3/a**.

In summary, the proposed stormwater management plan achieves the water balance criteria for the subject lands by fully mitigating the infiltration deficit established in RJB's pre-to-post-development water balance calculations.

5.7. Erosion & Sediment Control

The proposed works will require an *Erosion and Sediment Control (ESC) Plan* in order to provide adequate protection of downstream receiver systems throughout construction. During construction, the majority of the development's natural features will be removed, and the topsoil stripped within the development area. The exposed surface will be susceptible to erosion, increasing the potential for sediment runoff. To minimize local and downstream impacts from erosion and sedimentation during construction, the following measures have been recommended:

- Excess earth and topsoil is to be stockpiled away from the creek limits and/or removed from site. Stockpiles shall be seeded or covered with erosion control if left for periods of greater than 30 days.
- Temporary sediment control fencing should be erected around the perimeter of all grading activities, including double silt fence along the south and east boundaries.
- Temporary sediment fabric and stone filters should be installed on catch basins until surface cover has been stabilized.
- Temporary rock flow check dams should be installed within drainage cut-off swales.
- A temporary construction access mud mat should be installed at the construction accesses to reduce the amount of material that may be transported off site.
- A Temporary erosion and sediment control trap is to be constructed, complete with a rip-rap lined overflow weir functioning as the trap outlet. The sediment trap's purpose is to detain runoff long enough to allow most soil particles to settle out of suspension.
- Construction during dryer months should be monitored for wind-borne transport of sediments. At the direction of the engineer, the contractor may be directed to water down exposed earth areas with an aqueous solution of calcium chloride.
- All disturbed areas not under immediate construction for 30 days, or not intended for building activities within a 3-month time period, should be stabilized with seeding.

- Phased removal of temporary sediment trap, drainage swales, rock check dams, etc. during building phase of the development to coincide with upstream stabilization (established vegetation) of catchment areas.
- A weekly monitoring program to ensure all ESC measures are in place and not damaged by vandalism or a significant weather event.

The measures described above are shown on the Erosion and Sediment Control Plan and Notes & Details, **Drawings ESC-1** and **ESC-2**, respectively, included in **Appendix A.** Through proper implementation of the detailed erosion and sediment control measures, off-site impacts are expected to be minimized during the construction phase of the project.

6. Conclusions

This Detailed Stormwater Management Report identifies the recommended servicing design for the proposed Mapleview South Subdivision. This Report outlines the proposed infrastructure required to service the site with regards to stormwater management quality control, quantity control, water balance and erosion and sediment control.

In particular, this report has recommended the following:

- Low Impact Development measures are recommended to be implemented throughout the subject lands in a variety of forms to meet additional quantity control and annual water balance targets, promote groundwater recharge and mitigate the impacts of increased runoff and stormwater pollution (including Phosphorus loadings) on end-of-pipe SWM facilities by managing runoff as close to its source as possible, as described in **Section 3.4.**
- Construct a Minor and Major Drainage system comprised of pipes and roadways to safely convey minor and major (Regional) storm events to a suitable outlet, as detailed in **Section 5.3.3.**
- Prior to construction, the erosion and sediment control measures outlined in **Section 5.7.** and detailed on the engineering plans should be implemented. These controls are to be maintained throughout the construction period and only removed once exposed areas have been stabilized with vegetative cover.
- The Designs in this report are consistent with the *Hewitt's Secondary Plan Area Subwatershed Impact Study* prepared by R.J. Burnside & Associates Ltd., City of Barrie *Storm Drainage and Stormwater Management Policies & Guidelines*, LSRCA *Technical Guidelines for Stormwater Management Submissions*, the CVC/TRCA *Low Impact Development Stormwater Management Planning and Design Guidelines*, the MOE *Stormwater Management Planning and Design Manual* and industry best-practices at the time of report preparation.

It is recommended that this report be accepted as fulfilling the civil engineering and stormwater management requirements in support of the Site Plan Application.

All of which is respectfully submitted,
THE JONES CONSULTING GROUP LTD.

Appendix A

Engineering Drawings

The Jones Consulting Group Ltd. – *Mapleview South (Innisfil) Ltd. 953 Mapleview Drive East, Block 192 Drawings,* Stamped June 21, 2024:

ESC-1	Erosion and Sediment Control Plan
ESC-2	Erosion and Sediment Control Plan – Notes and Details
STM-1	Storm Sewer Subcatchment Plan
DS-1	Design Sheets
SWM-1	Post-Development Stormwater Drainage Area Plan
LID-1	LID Plan View, Infiltration Gallery
LID-2	LID Sections & Details, Infiltration Gallery

BLOCK 193 8 DALLAIRE STREET

STORM WATER MANAGEMENT
& PEDESTRIAN ACCESS
BLOCK 199

2.0m S/W

2.0m S/W

PROP. SINGLE ROW SEDIMENT CONTROL FENCE AS PER D711

BLOCK 192
24 DALLAIRE STREET

1
0.74

Block 191
Medium Density
(1.83 ha.)

DALLAIRE ST

1.5m S/W

1.5m S/W

1.5m S/W

1:160

1:120

30.00m

8.00m

PROP. CONSTRUCTION ENTRANCE PER D710

PROP. DOUBLE SILTATION CONTROL FENCING PER LSRCA ESC-2

PROP. 12m x 6m x 1.6m DEEP SEDIMENT TRAP WITH 0.5H:1V SIDESLOPES TOP ELEV. 252.60 BOTTOM ELEV. 251.00 (AS PER OPSD 219.220)

LOT 61

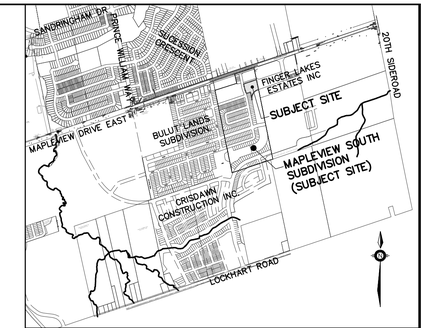
PROP. 5m WIDE WEIR AT ELEV. 252.50 C/W 300mm THICK 150mmø RIPRAP SPILLWAY

Block 196
Environmental
Protection
(1.34 ha.)

3:1 MAX.

SANDY CREEK
ESTATES SUBDIVISION

BLOCK 6
STORMWATER
MANAGEMENT FACILITY
(BY OTHERS)



KEY PLAN
NTS

LEGEND

- EXISTING CONTOUR
- EX. SIGN
- EX. HYDRANT & VALVE
- EX. VALVE
- EX. SANITARY MANHOLE
- EX. STORM MANHOLE
- EX. CATCHBASIN
- EX. DOUBLE CATCHBASIN
- EX. BORE HOLE
- TEMPORARY SWALE
- EX. DIRECTION OF OVERLAND FLOW
- DIRECTION OF EXTERNAL STORM DRAINAGE
- PROP. SILTATION CONTROL FENCE AS PER P1233
- TEMP. ROCK CHECK DAM AS PER D786
- PROPOSED CEDAR POST
- DRAINAGE BOUNDARY
- LSRCA REGULATED LIMIT
- EROSION CATCHMENT AREA NUMBER
- PRE-GRADE CATCHMENT AREA (ha.)
- CATCHBASIN SEDIMENT TRAP
- CLEAR AND GRUB AREA
- TOP SOIL STOCK PILE

NOTE:
I HAVE REVIEWED THE PLANS FOR THE CONSTRUCTION OF THE MAPLEVIEW SOUTH DEVELOPMENT LOCATED EAST OF PRINCE WILLIAM WAY AND SOUTH OF MAPLEVIEW DRIVE EAST AND HAVE PREPARED THIS PLAN TO INDICATE THE COMPATIBILITY OF THE PROPOSAL TO EXISTING ADJACENT PROPERTIES AND MUNICIPAL SERVICES. IT IS MY BELIEF THAT ADHERENCE TO THE PROPOSED GRADES AS SHOWN WILL PRODUCE ADEQUATE DRAINAGE AND PROPER FACILITY OF MUNICIPAL SERVICES WITHOUT ANY DETRIMENTAL EFFECT TO THE EXISTING DRAINAGE PATTERNS OR ADJACENT PROPERTIES.

REFERENCES:

1. CITY OF BARRIE LATEST MANUALS AND GUIDELINES
2. OPSD AND OPSS
3. CRYSTAL HOMES SUBDIVISION DEVELOPMENT BY TATHAM ENGINEERING LIMITED
4. SANDY COVE CREEK REALIGNMENT BY TATHAM ENGINEERING LIMITED
5. BULUT LANDS SUBDIVISION DEVELOPMENT BY SCHAEFFERS CONSULTING ENGINEERING
6. DRAFT PLAN OF MAPLEVIEW SOUTH SUBDIVISION BY JONES CONSULTING GROUP LTD.
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13. HEWITT'S SECONDARY PLAN AREA SIS BY R.J. BURNSIDE & ASSOCIATES LIMITED
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BENCHMARK:

BENCHMARK NO. 03120080055 LOCATED APPROXIMATELY 1.9km EAST OF YONGE STREET, APPROXIMATELY 6m NORTH OF CENTERLINE OF MAPLEVIEW DRIVE EAST AND 35m WEST OF CITY BOUNDARY LINE. N4912122.851 E611241.154 ELEV 223.039

BENCHMARK NO. 03120110020 LOCATED ON MAPLEVIEW DRIVE EAST ON THE SOUTH SIDE OF THE BOULEVARD, APPROXIMATELY 790m WEST OF THE MAPLEVIEW DRIVE EAST AND 20TH SIDE ROAD INTERSECTION. N4912264.547 E611717.298 ELEV 225.546

BENCHMARK NO. 03120080008. LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE EAST (12TH CONCESSION ROAD), APROXIMATELY 0.8km EAST OF YONGE STREET (HWY #11) AND APPROXIMATELY 10.0m NORTH OF MAPLEVIEW DRIVE EAST CENTERLINE. N4911763.816 E610187.698 ELEV 211.834

BENCHMARK NO: 03120080054 LOCATED ON THE SOUTH LIMIT OF MAPLEVIEW DRIVE WEST APPROXIMATELY 1km EAST OF HURONIA ROAD. N4910878.122 E607601.062 ELEV 248.996

NO.	REVISIONS	DATE	INITIAL
2.	FIRST SUBMISSION	JUNE 2024	MF
1.	ISSUED FOR PRE-CONSULTATION	JULY 2023	DR

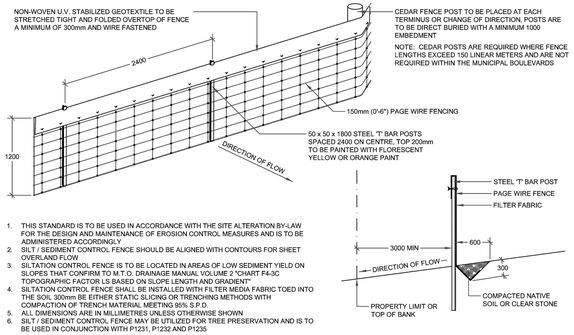
LICENSED PROFESSIONAL ENGINEER
M. G. FUS
100149153
06-21-2024
PROVINCE OF ONTARIO

MAPLEVIEW SOUTH (INNISFIL) LTD
953 MAPLEVIEW DRIVE EAST
CITY OF BARRIE

BLOCK 192
EROSION AND SEDIMENT
CONTROL PLAN

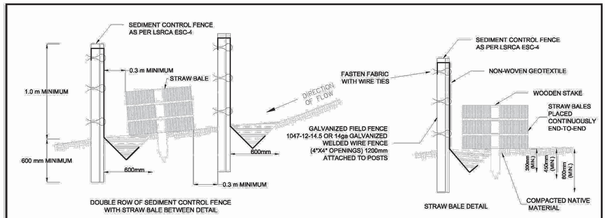
JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN JJH	SCALE: 1:250	DATE MAY 2023
DRAWN JJH	PROJECT REI-17055	DWG. Nº ESC-1
CHECKED RC/DR		



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 P1231, P1232 AND P1235

Barrie	FENCE SILTATION CONTROL	REV No. 3	DATE: APR 2023
			SCALE: N.T.S.
			P1233



NOTES:

1. SEDIMENT CONTROL FENCE SHOULD BE ALIGNED WITH CONTOURS FOR SHEET OVERLAND FLOW.
2. SEDIMENT CONTROL FENCE IS TO BE LOCATED IN AREAS OF LOW SEDIMENT YIELD ON SLOPES THAT CONFORM TO MTO DRAINAGE MANUAL VOLUME 2 CHART F4-3C TOPOGRAPHIC FACTOR LS BASED ON SLOPE LENGTH AND GRADIENT.
3. SEDIMENT CONTROL FENCE SHALL BE INSTALLED WITH FILTER MEDIA FABRIC TIED INTO THE SOIL A MINIMUM OF 300 mm BY EITHER STATIC SLICING OR TRENCH METHODS WITH COMPACTION OF TRENCH MATERIAL MEETING 95% STANDARD PROCTOR MAXIMUM DRY DENSITY.
4. STEEL 'T' BAR POSTS ARE TO BE SPACED A MAXIMUM DISTANCE OF 2000 mm ON CENTER.
5. STRAW BALES TO BE PLACED END-TO-END CONTINUOUSLY BETWEEN SEDIMENT CONTROL FENCES.
6. FROZEN GROUND CONDITIONS REQUIRE FILTER FABRIC TO BE BACKFILLED IN TRENCH WITH CLEAR STONE.
7. GEOTEXTILE FABRIC TO BE COMPRISED OF NON-WOVEN U.V. STABILIZED MATERIAL FABRIC TO BE FOLDED OVER TOP OF FENCE A MINIMUM OF 300 mm AND WIRE FASTENED.
8. CONSTRUCTION OPERATIONS SHALL BE CARRIED OUT IN SUCH A MANNER THAT EROSION AND WATER POLLUTION IS MINIMIZED.
9. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE SHOWN.

NO.	REVISION	DATE
1	SWM GUIDELINES UPDATE	06.2016

DOUBLE ROW SEDIMENT CONTROL FENCE	DATE: 06.2016
	SCALE: NTS
LSRCA ESC-5	

EROSION CONTROL NOTES

1. THE ACCOMPANYING PLANS SET OUT THE MEASURES THAT WILL BE TAKEN BY THE DEVELOPER AND ITS CONTRACTORS TO CONTROL DOWNSTREAM SEDIMENT TO THE LOWEST LEVEL PRACTICALLY ACHIEVABLE. THE CONDITIONS AND TECHNIQUES SET OUT ARE TO BE FOLLOWED UNLESS APPROVED OTHERWISE BY THE CONTRACT ADMINISTRATOR, CONSERVATION AUTHORITY AND/OR MUNICIPALITY.
2. ALL TEMPORARY SILT CONTROL AND EROSION PROTECTION DEVICES (I.E. SILT FENCING, DRAINAGE SWALES, ROCK CHECK DAMS, SEDIMENT BASIN, GRAVEL ACCESS PAD, ETC.) SHALL BE CONSTRUCTED PRIOR TO COMMENCEMENT OF SITE WORKS AND SHALL REMAIN IN PLACE AND BE MAINTAINED BY THE CONTRACTOR UNTIL CONSTRUCTION IS COMPLETE AND THE GRASS HAS ESTABLISHED GROWTH, SUBJECT TO APPROVAL BY THE CITY OF BARRIE APPROVALS BRANCH.
3. ALL SEDIMENTATION CONTROL MEASURES ARE TO BE INSPECTED REGULARLY (MINIMUM WEEKLY), AS WELL AS AFTER EVERY RAINFALL EVENT AND ANY DAMAGED SILT CONTROL AND EROSION PROTECTION DEVICES SHALL BE PROMPTLY REPAIRED OR REPLACED BY THE CONTRACTOR.
4. THE CONTRACTOR MUST USE MATERIALS, CONSTRUCTION PRACTICES, AND MITIGATION TECHNIQUES IN ORDER TO PREVENT THE UNAUTHORIZED HARMFUL ALTERATION, DISRUPTION OR DESTRUCTION OF VEGETATION OR THE IMPAIRMENT OF WATER QUALITY.
5. THE CONTRACTOR SHALL BE PREPARED FOR UNEXPECTED CONDITIONS AND ACCORDINGLY HAVE STOCKPILED MATERIALS ON SITE FOR NECESSARY REPAIRS AS A RESULT OF FAILED OR INADEQUATE CONTROL MEASURES.
6. AREAS WITHOUT STABLE GROUND COVER SHALL BE PROTECTED WITH SILTATION CONTROL FENCING, STRAW MULCH, ETC, AND MAINTAINED BY THE CONTRACTOR UNTIL VEGETATION HAS BECOME ESTABLISHED IN THE SUBSEQUENT GROWING SEASON.
7. ALL EXPOSED SOIL MUST BE GRADED TO A STABLE SLOPE AND TREATED AS QUICKLY AS POSSIBLE TO PREVENT EROSION AND SEDIMENT FROM LEAVING THE SITE. ALL AREA STRIPPED OF VEGETATIVE COVER FOR LONGER THAN 30 DAYS SHALL BE TOPSOILED AND SEEDED AT THE DIRECTION OF THE ENGINEER.
8. ALL SITE DRAINAGE TO BE DIRECTED TO THE TEMPORARY SEDIMENT BASINS AND OTHER CHECK DAMS VIA SHEET DRAINAGE, BERMS OR SWALES (AS NECESSARY) TO FACILITATE THE COMPLETION OF GRADING WORKS. THE CONTRACTOR SHALL CONSTRUCT ANY ADDITIONAL SWALES OR BERMS THAT MAY BE NECESSARY TO DIRECT RUN-OFF IN A CONTROLLED MANNER OF SUITABLE QUALITY.
9. ALL CONSTRUCTION VEHICLES SHALL ENTER AND EXIT THE SITE FROM THE PROPOSED CONSTRUCTION ACCESS VIA THE GRAVEL ACCESS PAD.
10. ANY DEWATERING WASTE SHALL BE DISCHARGED TO A VEGETATED AREA AT LEAST 30m FROM ANY WATERCOURSE AND FILTERED. FILTERING METHOD SHALL INCLUDE APPROPRIATELY SIZED DEWATERING BAG (FILTER BAG) ON TOP OF A 300mm THICK CLEARSTONE PAD TO BE APPROVED BY SITE INSPECTOR AND LSRCA. DEWATERING BAG AND CLEARSTONE PAD SHALL BE MAINTAINED IN GOOD WORKING ORDER AND REPLACED AS DEEMED NECESSARY.
11. TECHNIQUES FOR EROSION AND SEDIMENT CONTROLS ARE TO ADHERE TO ACCEPTED ENGINEERING PRACTICE AND MUNICIPAL, CONSERVATION AUTHORITY AND ONTARIO PROVINCIAL STANDARD SPECIFICATIONS AND DRAWINGS. THE CONTRACTOR SHALL OBTAIN A CURRENT COPY AND BECOME FAMILIAR WITH OPSS 805; CONSTRUCTION SPECIFICATION FOR TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES, AS WELL AS APPLICABLE MUNICIPAL STANDARDS AND/OR APPROVAL AGENCY STANDARDS.
12. THE CONTRACTOR MAY CONSIDER ALTERNATIVE SEDIMENT AND EROSION CONTROL MEASURES, SUCH MEASURES MUST BE PRESENTED IN WRITING FOR APPROVAL BY THE CONTRACT ADMINISTRATOR AND MUST BE APPROVED IN WRITING BY THE APPLICABLE APPROVAL AGENCIES.

CONSTRUCTION SEQUENCE

THE FOLLOWING CONSTRUCTION SEQUENCE IS PROVIDED FOR CONTRACTOR GUIDANCE:

1. CONSTRUCT ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES INCLUDING SILT FENCE, TREE PRESERVATION FENCE, MUD MATS, CHECK DAMS, SEDIMENT BASINS, SWALES/BERMS, ETC.
2. HYDRO SEED ALL EROSION CONTROL WORKS I.E. TEMPORARY DRAINAGE SWALES/BERMS.
3. STRIPPING AND REMOVAL OF TOPSOIL. A VOLUME OF TOPSOIL TO BE STORED ON-SITE AS REQUIRED TO FACILITATE RESTORATION OF SITE.
4. PROCEED WITH EARTH EXCAVATION, CUT TO FILL AND PRE-GRADING OPERATIONS. ALL AREAS STRIPPED OF VEGETATIVE COVER FOR A PERIOD GREATER THAN 30 DAYS SHALL BE HYDRO SEEDED AS DIRECTED BY THE ENGINEER.
5. PROCEED WITH SITE WORKS I.E. SITE SERVICING AND SURFACE WORKS INSTALLATIONS.
6. RESTORATION OF DISTURBED AREAS.
7. REMOVAL OF SEDIMENT AND EROSION CONTROLS.

NOTE SILTATION AND EROSION CONTROL MEASURES ARE TO BE MONITORED AND MAINTAINED THROUGHOUT CONSTRUCTION AND NECESSARY REPAIRS TO BE PROMPTLY COMPLETED AS REQUIRED.

CONTINGENCY PLAN

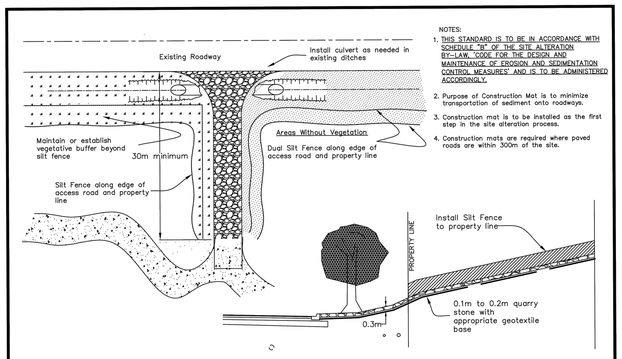
IF UNFORESEEN EVENTS CAUSE THE STRATEGIES SET OUT IN THIS PLAN TO BE INSUFFICIENT OR INAPPROPRIATE TO MEET THE OBJECTIVE, THE CONTRACTOR IS EXPECTED TO RESPOND IN A TIMELY MANNER WITH ALL REASONABLE MEASURES CONSISTENT WITH SAFETY, TO PREVENT, COUNTERACT OR REMEDY DOWNSTREAM SEDIMENTATION AND EROSION.

IF A SPILL OCCURS IT SHALL BE REPORTED TO THE MINISTRY OF ENVIRONMENT, CONSERVATION AND PARKS SPILLS ACTION CENTRE AT 1-800-268-6060 AND THE ON CALL CITY OF BARRIE ENVIRONMENTAL OFFICER SHOULD ALSO BE NOTIFIED VIA CELL PHONE AT (705) 725-3374.

IF APPROVAL AGENCIES DETERMINE THAT LONG TERM DAMAGE TO THE NATURAL ENVIRONMENT HAS OCCURRED DUE TO FAILURE OF THIS PLAN TO CONTROL SEDIMENTS, A RESTORATION PLAN WILL BE DEVELOPED BY THE CONTRACTOR IN CONSULTATION WITH AND APPROVAL FROM THE APPROPRIATE AGENCIES FOR IMPLEMENTATION BY THE CONTRACTOR.

HYDRO SEEDING

1. ALL TEMPORARY EROSION AND SEDIMENT CONTROL SWALES AND BERMS TO BE HYDRO SEEDED IMMEDIATELY FOLLOWING CONSTRUCTION.
2. ALL AREAS STRIPPED OF VEGETATIVE COVER FOR LONGER THAN 30 DAYS SHALL BE HYDRO SEEDED AS DIRECTED BY THE ENGINEER.
3. HYDRO SEED MIX TO BE 48% ANNUAL RYE GRASS, 48% FALL RYE AND 4% RED CLOVER (100 kg/Ha) WITH FIBRATAC TACTIFIER OR APPROVED EQUIVALENT.



NOTES:

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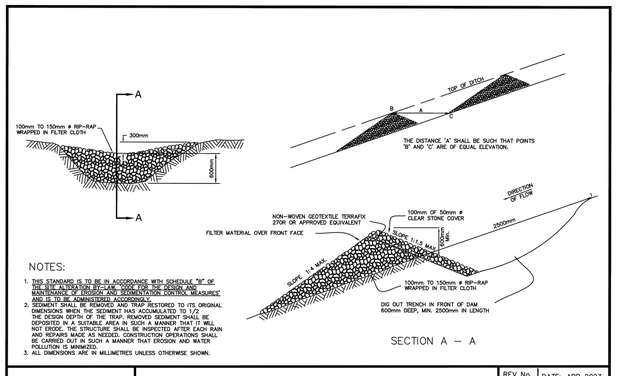
2. Purpose of Construction Mat is to minimize transportation of sediment onto roadways.
3. Construction mat is to be installed as the first step in the site alteration process.
4. Construction mats are required where paved roads are within 300m of the site.

Barrie	Construction Entrance	REV No. 2	DATE: APR 2023
			SCALE: N.T.S
			D710



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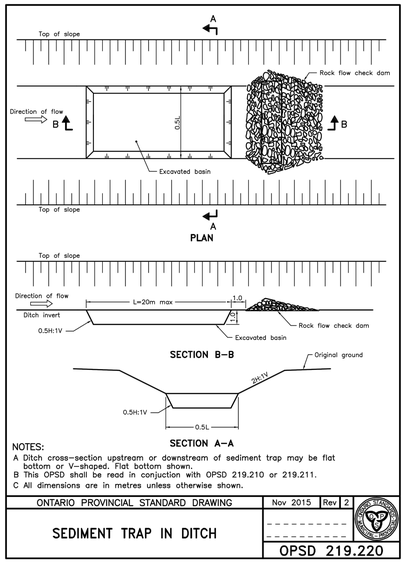
2. SEDIMENT SHALL BE REMOVED AND TRAP RESTORED TO ITS ORIGINAL DIMENSIONS WHEN THE SEDIMENT HAS ACCUMULATED TO 1/2 THE DESIGN DEPTH OF THE TRAP. REMOVED SEDIMENT SHALL BE DISPOSED OF IN A MANNER THAT WILL NOT CAUSE FURTHER SILTATION.
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.

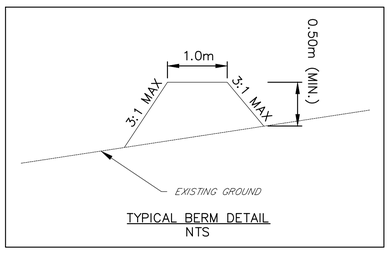
Barrie	Granular Erosion Control Device	REV No. 3	DATE: APR 2023
			SCALE: N.T.S.
			D786



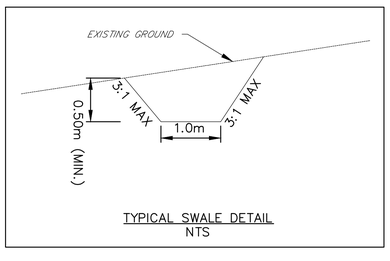
NOTES:

A Ditch cross-section upstream or downstream of sediment trap may be flat bottom or V-shaped. Flat bottom shown.
B This OPSD shall be read in conjuction with OPSD 219.210 or 219.211.
C All dimensions are in metres unless otherwise shown.

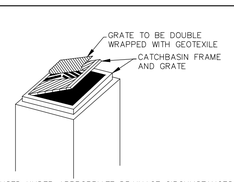
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev 2
SEDIMENT TRAP IN DITCH		
		OPSD 219.220



TYPICAL BERM DETAIL
NTS



TYPICAL SWALE DETAIL
NTS



NOTES:
1. TO BE USED UNDER APPROPRIATE DRAINAGE CIRCUMSTANCES. BETWEEN APRIL AND DECEMBER.
2. WOVEN GEOTEXTILE TO HAVE A MINIMUM EQUIVALENT OPENING SIZE OF 0.15mm AND A MAXIMUM EQUIVALENT OPENING SIZE OF 0.25mm OR A NON WOVEN GEOTEXTILE TO BE CONSIDERED BASED ON SOIL PARAMETERS AND SITE CONDITIONS.
3. GEOTEXTILE TO BE REPLACED PERIODICALLY WHEN ACCUMULATED SEDIMENTS INTERFERES WITH DRAINAGE, OR AS DIRECTED BY THE ENGINEER..

CATCHBASIN SEDIMENT TRAP
N.T.S.

SITE DATA	
OVERALL SITE AREA TO BE DISTURBED	0.74Ha
EXISTING LAND USE	(VACANT) AGRICULTURAL FIELD
PREDOMINANT SOIL TYPE	BONDHEAD SANDY LOAM
SEDIMENT TRAP SIZING	
BOTTOM ELEVATION	251.00
TOP ELEVATION	252.60
OVERFLOW WEIR ELEVATION	252.50
DIMENSIONS (LxWxD)	12x6x1.6
STORAGE VOLUME	115.2m3
CATCHMENT AREA	0.74 Ha
REQUIRED ACTIVE STORAGE VOLUME BASED ON 125cu.m/Ha OF DRAINAGE AREA TO POND	92.50m3

NOTE:
I HAVE REVIEWED THE PLANS FOR THE CONSTRUCTION OF THE MAPLEVIEW SOUTH DEVELOPMENT LOCATED EAST OF PRINCE WILLIAM WAY AND SOUTH OF MAPLEVIEW DRIVE EAST AND HAVE PREPARED THIS PLAN TO INDICATE THE COMPATIBILITY OF THE PROPOSAL TO EXISTING ADJACENT PROPERTIES AND MUNICIPAL SERVICES. IT IS MY BELIEF THAT ADHERENCE TO THE PROPOSED GRADES AS SHOWN WILL PRODUCE ADEQUATE DRAINAGE AND PROPER FACILITY OF MUNICIPAL SERVICES WITHOUT ANY DETRIMENTAL EFFECT TO THE EXISTING DRAINAGE PATTERNS OR ADJACENT PROPERTIES.

REFERENCES:

1. CITY OF BARRIE LATEST MANUALS AND GUIDELINES
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3. CRYSTAL HOMES SUBDIVISION DEVELOPMENT BY TATHAM ENGINEERING LIMITED
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LICENSED PROFESSIONAL ENGINEERS — M. G. FUJS — 100149153 — 06-21-2024 — PROVINCE OF ONTARIO

MAPLEVIEW SOUTH (INNISFIL) LTD
953 MAPLEVIEW DRIVE EAST
CITY OF BARRIE

BLOCK 192
EROSION AND SEDIMENT
NOTES AND DETAILS

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
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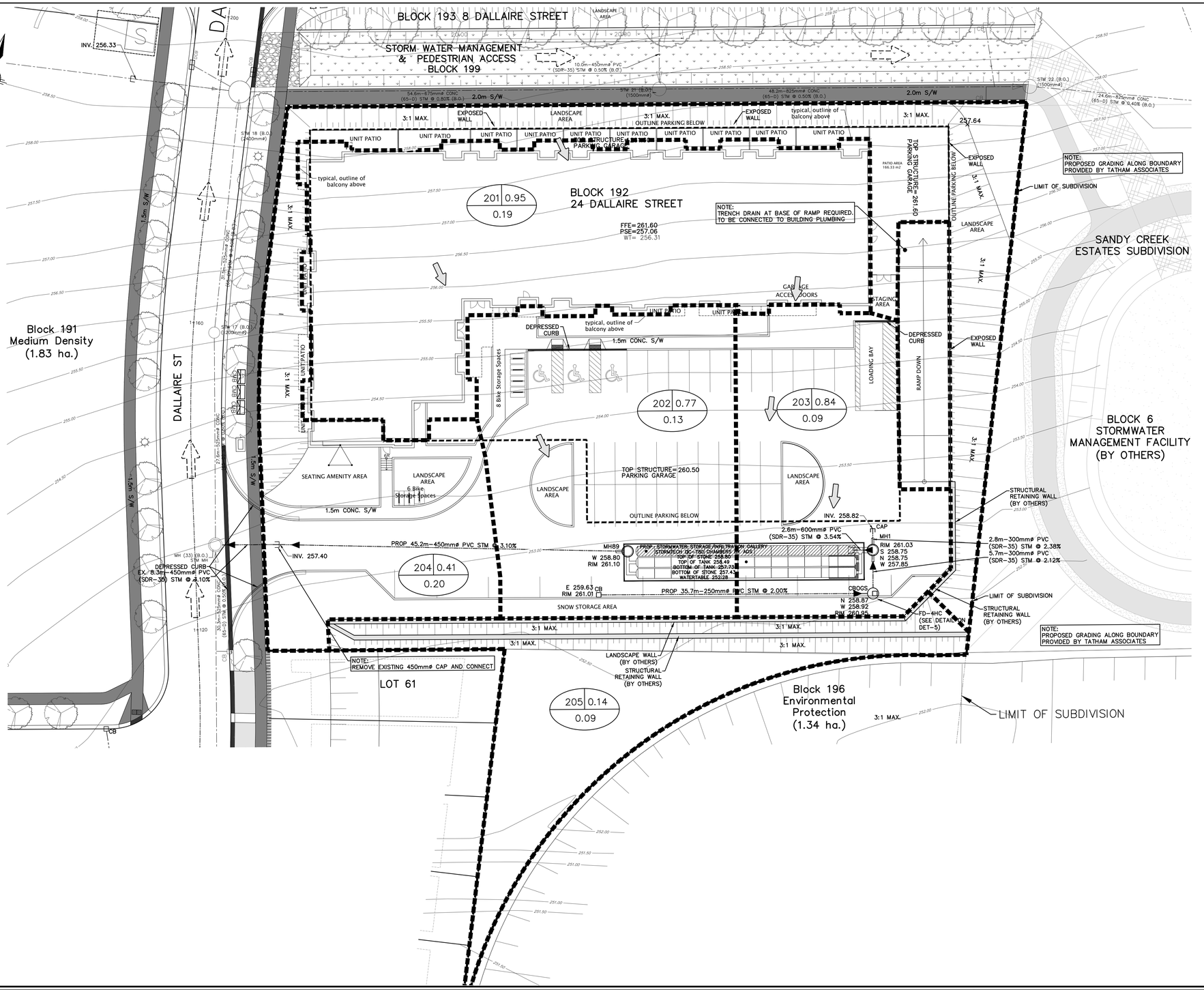
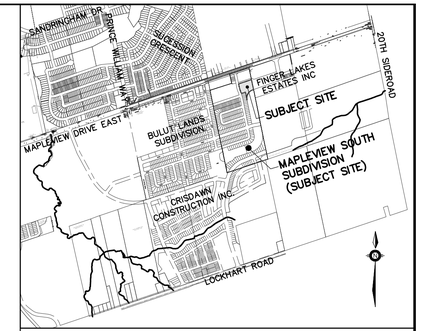
DESIGN JT	SCALE: N/A	DATE MAY 2023
DRAWN JT	PROJECT REI-17055	DWG. № ESC-2
CHECKED DR		





KEY PLAN
NTS

LEGEND

- PROPOSED STORM DRAINAGE BOUNDARY
- PROPOSED OVERLAND DRAINAGE FLOW DIRECTION
- DIRECTION OF EXTERNAL STORM DRAINAGE
- INTERNAL CATCHMENT AREA NUMBER — 401 | 0.15 / 0.27 — RUNOFF COEFFICIENT / AREA (ha)
- EXTERNAL CATCHMENT AREA NUMBER — 502 | 0.32 / 0.07 — RUNOFF COEFFICIENT / AREA (ha)
- STM1 — PROPOSED STORM MAINTENANCE HOLE
- STM12 — PROPOSED CATCHBASIN MAINTENANCE HOLE
- DCB1 — PROPOSED DOUBLE CATCHBASIN
- CB2 — PROPOSED CATCHBASIN

NOTE:
REFER TO DESIGN SHEET ON DRAWING DS-1

REFERENCES:

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2.	FIRST SUBMISSION	JUNE 2024	MF
1.	ISSUED FOR PRE-CONSULTATION	JULY 2023	DR

LICENSED PROFESSIONAL ENGINEER M. G. FUS 100149153 06-21-2024 PROVINCE OF ONTARIO

MAPLEVIEW SOUTH (INNISFIL) LTD
953 MAPLEVIEW DRIVE EAST
CITY OF BARRIE

BLOCK 192
STORM SEWER
SUBCATCHMENT PLAN

JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

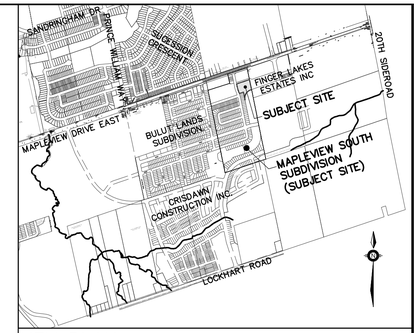
DESIGN	JJH	SCALE: 1:250	DATE MAY 2023
DRAWN	JJH	PROJECT REI-17055	DWG. Nº STM-1
CHECKED	RC/DR		

BLK 192 STORM SEWER DESIGN - MINOR SYSTEM

Barrie

Design flow in (m^3/s)	Q= C·I·A / 360	Pipe capacity (m^3/s)	Q	Client:	Anthony Reino
Site specific runoff coefficient	C	Manning roughness value	n=0.013	Project:	Mapleview South (Innisfil) LTD
Rainfall intensity (mm/hr)	I = A/(T.C. + B)^C	Cross sectional area of pipe (m^2)	A	Address:	953 Mapleview Drive East - BLK 192
function of the local intensity-duration data	A= 843.019	Hydraulic Radius (m)	R_h	File:	REI-17055
function of the local intensity-duration data	B= 4.582	Sewer pipe slope (m/m)	S	Design:	KR
function of the local intensity-duration data	C= 0.763	Velocity of flow (m/s)	V	Check:	MF
Max. time of concentration (min)	T.C.= 10			Date:	June 19 2024
Drainage area (ha)	A			Design sheet:	DS-1

AREAS	Street	MANHOLE FROM	MANHOLE TO	LENGTH (m)	INCREMENT C	INCREMENT A	INCREMENT CA	TOTAL CA	FLOW TIME (min) TO	FLOW TIME (min) IN	I (mm/h)	TOTAL Q (cms)	S (%)	D (mm)	Q FULL (cms)	V FULL (m/s)	% FULL
201	BLK 192	STUB	MH1	2.8	0.95	0.19	0.18	0.18	10.00	0.02	109	0.055	2.40	300	0.150	2.1	***36.7***
202	BLK 192	CB1	OGS	35.7	0.77	0.13	0.10	0.10	10.00	0.35	109	0.030	2.00	250	0.084	1.7	***36.2***
203	BLK 192	OGS	MH1	5.7	0.84	0.09	0.08	0.18	10.35	0.05	107	0.053	2.10	300	0.140	2.0	***38.0***
	BLK 192	MH1	LID	2.6				0.36	10.40	0.01	107	0.107	3.50	600	1.149	4.1	***9.3***
	BLK 192	LID	MH33 (B.O)	45.2				0.36	10.41	0.24	107	0.107	3.10	450	0.502	3.2	***21.3***



KEY PLAN
NTS

MAPLEVIEW SOUTH SUBDIVISION SANITARY DESIGN SHEET
(DETAILED DESIGN 1ST SUBMISSION, JUNE 2023)

SANITARY SEWER DESIGN - LOCAL SEWER
Development Details Basis

Barrie

DESIGN SHEET 1 of 1
FILE NO REI-17055
CONTRACT / PROJECT MAPLEVIEW SOUTH (INNISFIL) LTD.

n ≥ 0.013
M = 5/P^0.2 Babbit
M=1+[14/(4+P^0.5)] Harmon
Q_p = P*q*M/86.4
Q_I = I*A
$Q_{tot} = Q_p + Q_I$
$Q_{Commercial}$

Numbers in blue or text in red are equations
(Harmon or Babbitt peaking factor where; M ≥ 2), the greater of the two is used in the spreadsheet. Please refer to Section 3.3.1.1 of the Barrie Sanitary Design Guidelines for additional guidance on which peaking factor to use.

(Peak population flow where; q = 225 L/day/person; P = population in thousands) 225 litres/person/day
(Peak extraneous flow: I= 0.1L/s/ha over development area)
(Total peak flow as the sum of peak population flow and peak extraneous flow)
See Note 1.

AREA - STREET	MAINTENANCE HOLE FROM	MAINTENANCE HOLE TO	DWELL UNITS	DWELL (ACC) UNITS	DENSITY P.P.U.	POP. (P)	POP. (ACC)	M PEAKING FACTOR BABBIT	M PEAKING FACTOR HARMON	Max PEAKING FACTOR	Q_p (l/s)	AREA (ha)	AREA (ACC) (ha)	Q_I (l/s)	Q_{tot} (l/s)	L (m)	D (mm)	S (%)	Qf FULL (l/s)	d/D[2]	d/D[3] >0.5 or >0.7	Velocity FULL (m/s)	Velocity Partial[1] (m/s)	Velocity[4] > 0.6 (m/s)
1A - Colosimo Cres			8		3.25	26																		
1B - Colosimo Cres	SAN 01A	SAN 02A	8	16	2.57	21	47	9.234	4.321	9.234	1.120	0.49	0.49	0.049	1.169	52.2	200	2.00	46.384	0.109	Ok	1.476	0.618	Ok
2A - Colosimo Cres			10		3.25	33																		
2B - Colosimo Cres	SAN 02A	SAN 03A	16	42	2.57	41	120	7.638	4.221	7.638	2.391	0.76	1.25	0.125	2.516	108.7	200	1.10	34.399	0.183	Ok	1.095	0.628	Ok
3 - Dallaire St	SAN 03A	SAN 04A	6	48	3.25	20	140	7.412	4.201	7.412	2.696	0.32	1.57	0.157	2.853	74.6	200	1.00	32.798	0.199	Ok	1.044	0.629	Ok
4 - Colosimo Cres	SAN 05A	SAN 06A	8	8	3.25	26	26	10.375	4.364	10.375	0.702	0.39	0.39	0.039	0.741	58.5	200	2.00	46.384	0.088	Ok	1.476	0.534	Check
5 - Colosimo Cres	SAN 06A	SAN 07A	3	11	3.25	10	36	9.735	4.342	9.735	0.906	0.19	0.58	0.058	0.964	14.7	200	2.00	46.384	0.099	Ok	1.476	0.577	Check
6 - Colosimo Cres	SAN 07A	SAN 08A	18	29	3.25	59	94	8.019	4.251	8.019	1.968	0.64	1.22	0.122	2.090	80.7	200	1.20	35.929	0.163	Ok	1.144	0.610	Ok
7 - Colosimo Cres	SAN 08A	SAN 04A	13	42	3.25	42	137	7.446	4.204	7.446	2.647	0.53	1.75	0.175	2.822	76.4	200	1.00	32.798	0.198	Ok	1.044	0.627	Ok
8 - Dallaire St	SAN 04A	SAN 09A	5	95	3.25	16	292	6.394	4.083	6.394	4.869	0.33	3.65	0.365	5.234	77.6	200	0.60	25.406	0.307	Ok	0.809	0.623	Ok
9 - Dallaire St	SAN 10A	SAN 11A	2	2	3.25	7	7	13.689	4.431	13.689	0.232	0.13	0.13	0.013	0.245	18.8	200	2.00	46.384	0.052	Ok	1.476	0.379	Check
10 - Dallaire St	SAN 11A	SAN 09A	5	7	3.25	16	23	10.655	4.373	10.655	0.631	0.29	0.42	0.042	0.673	64.1	200	2.00	46.384	0.064	Ok	1.476	0.518	Check
11 - McAush St	SAN 09A	SAN 12A	16	118	3.25	52	367	6.109	4.040	6.109	5.842	0.77	4.84	0.484	6.326	105.8	200	0.50	23.192	0.356	Ok	0.738	0.615	Ok
12 - McAush St	SAN 12A	SAH 34063 (B.O.)	18	136	3.25	59	426	5.931	4.009	5.931	6.575	0.83	5.67	0.567	7.142	102.8	200	0.50	23.192	0.380	Ok	0.738	0.635	Ok
EXT - McAush St	SAH 34063 (B.O.)	SAH 34066 (B.O.)		136			426	5.931	4.009	5.931	6.575		5.67	0.567	7.142	40.4	200	0.50	23.192	0.380	Ok	0.738	0.635	Ok
13 - Dallaire St	SAN 10A	SAN 13A	17	17	3.25	55	55	8.923	4.306	8.923	1.284	0.79	0.79	0.079	1.363	101.2	200	1.70	42.764	0.122	Ok	1.361	0.606	Ok
14 - Dallaire St	SAN 13A	SAH 34067 (B.O.)	12	29	3.25	39	94	8.019	4.251	8.019	1.968	0.59	1.38	0.138	2.106	95.6	200	1.20	35.929	0.164	Ok	1.144	0.610	Ok
EXT - Dallaire St	SAH 34067 (B.O.)	SAH 34068 (B.O.)		29			94	8.019	4.251	8.019	1.968		1.38	0.138	2.106	40.1	250	1.20	65.143	0.123	Ok	1.327	0.594	Check
15 - MD BLK 191	STUB	SAN 14A	300	300	2.57	771	771	5.267	3.870	5.267	10.575	1.83	1.83	0.183	10.758	11.0	200	0.50	23.192	0.478	Ok	0.738	0.721	Ok
16 - Lotus Rd	SAN 14A	SAN 15A	14	314	2.57	36	807	5.219	3.858	5.219	10.968	0.42	2.25	0.225	11.193	85.4	200	0.60	25.406	0.464	Ok	0.809	0.779	Ok
17 - Lotus Rd	SAN 15A	SAN 16A	10	324	2.57	26	833	5.186	3.850	5.186	11.247	0.33	2.58	0.258	11.505	77.4	200	0.60	25.406	0.471	Ok	0.809	0.783	Ok
18 - Dallaire St	SAN 03A	SAN 16A	7	7	3.25	23	23	10.655	4.373	10.655	0.631	0.33	0.33	0.033	0.664	77.5	200	2.00	46.384	0.063	Ok	1.476	0.518	Check
19 - Dallaire St	SAN 16A	SAN 17A	2	333	3.25	7	862	5.151	3.841	5.151	11.562	0.16	3.07	0.307	11.869	58.7	200	0.50	23.192	0.506	Check	0.738	0.738	Ok
20 - MD BLK 192	STUB	SAN 17A	~~100~~120	~~100~~120	2.57	~~257~~309	~~257~~309	~~5.661~~ 6.324	~~4.196~~ 4.073	~~5.661~~ 6.324	~~4.991~~ 5.089	0.74	0.74	0.074	~~4.165~~ 5.163	11.0	200	0.90	31.115	0.279	0.285	Ok	0.990	0.699	0.729
21 - Dallaire St	SAN 17A	SAN 18A	2	~~135~~459	2.57	~~5~~ 6	~~1324~~1177	~~4.864~~ 4.840	~~3.767~~ 3.753	~~4.864~~ 4.840	~~14.293~~14.833	0.22	4.03	0.403	~~14.261~~ 15.236	70.3	200	0.50	23.192	0.591	0.577	Check	0.738	0.776	0.783
Landuse					Q m³/d/ha	Q m3/d/ha																		
22 - MD BLK 193*	Commercial				28	~~25~~ 79*	79*	8.307	4.270	~~2.608~~8.307	~~0.830~~ 1.709	~~0.05~~0.63	0.63		~~0.830~~1.709										
22 - MD BLK 193	STUB	SAN 18A	~~80~~100	~~80~~100	2.57	~~205~~257	~~205~~336	~~5.981~~ 6.219	~~4.144~~4.057	~~5.981~~ 6.219	~~3.873~~5.441	~~0.07~~0.63	~~0.07~~0.63	0.063	~~0.700~~0.763	~~7.213~~ 11.0	200	1.00	32.798	0.33	0.326	Ok	1.044	0.665	0.772
23 - Dallaire St	SAN 18A	SAH 33887 (B.O.)	4	~~549~~559	2.57	~~10~~ 11	~~1340~~1524	~~4.715~~ 4.596	~~3.744~~3.678	~~4.715~~4.596	~~16.455~~18.239	0.14	~~4.79~~4.80	0.479	~~0.480~~12.985	~~20.420~~ 20.420	37.5	250	0.80	53.189	0.439	0.385	Ok	1.084	0.951	0.981
24 - Lotus Rd	SAN 14A	SAH 34087 (B.O.)	7	7	2.57	18	18	11.168	4.386	11.168	0.523	0.21	0.21	0.021	0.544	45.8	200	4.50	69.576	0.062	Ok	2.215	0.647	Ok
EXT - Lotus Rd	SAH 34087 (B.O.)	SAH 34088 (B.O.)		7			18	11.168	4.386	11.168	0.523		0.21	0.021	0.544	39.5	250	2.00	84.100	0.057	Ok	1.713	0.474	Check
25 - Terry Fox Dr	SAN 20A	SAN 21A	13	13	3.25	42	42	9.415	4.329	9.415	1.036	0.66	0.66	0.066	1.102	80.6	200	2.00	46.384	0.106	Ok	1.476	0.603	Ok
26 - Terry Fox Dr	SAN 21A	SAN 22A	16	29	3.25	52	94	8.019	4.251	8.019	1.968	0.91	1.57	0.157	2.125	109.9	200	1.20	35.929	0.165	Ok	1.144	0.610	Ok
27 - Giovanni Cres	SAN 23A	SAN 22A	2	2	3.25	7	7	13.689	4.431	13.689	0.232	0.22	0.22	0.022	0.254	38.3	200	2.00	46.384	0.053	Ok	1.476	0.379	Check
28 - Terry Fox Dr	SAN 22A	SAN 24A	8	39	3.25	26	127	7.558	4.214	7.558	2.495	0.70	2.49	0.249	2.744	99.4	200	1.00	32.798	0.195	Ok	1.044	0.615	Ok

Date: ~~June 2023~~ June 2024 CALCULATED BY: ~~VBS~~ MG CHECKED BY: ~~BC~~ MF

(1) without extraneous flow
(2) with extraneous flow
(3) d/D>0.5 for pipes 375 and less, d/D>0.7 for pipes greater than 375
(4) Velocity check based on the lesser of full flow or partial velocity

Numbers in Blue are cell formulas

* Note: An equivalent population of 79 people was calculated for the Commercial Landuse within Block 193 by multiplying the anticipated flowrate per hectare (28 m^3/d/ha) by the area (0.63 ha) and dividing it by the peak population flow converted to m^3/person/day (0.225 m^3/person/day). The equivalent population has been rounded up to the next person.

REFERENCES:
1. CITY OF BARRIE LATEST MANUALS AND GUIDELINES
2. SPSD AND OPSS
3. CRYSTAL HOMES SUBDIVISION DEVELOPMENT BY TATHAM ENGINEERING LIMITED
4. SANDY COVE CREEK REALIGNMENT BY TATHAM ENGINEERING LIMITED
5. BULUT LANDS SUBDIVISION DEVELOPMENT BY SCHAEFFERS CONSULTING ENGINEERING
6. DRAFT PLAN OF MAPLEVIEW SOUTH SUBDIVISION BY JONES CONSULTING GROUP LTD.
7. MAPLEVIEW DRIVE EAST WIDENING BY R.J. BURNSIDE & ASSOCIATES LIMITED
8. OLS PLAN BY RUDY MAK SURVEYING LTD.
9. AWAN GROUP RESIDENTIAL DEVELOPMENT BY PEARSON ENGINEERING LTD.
10. HEWITT'S CENTRAL SUBDIVISION (BRADLEY HOMES) BY JONES CONSULTING GROUP LTD.
11. GEOTECHNICAL INVESTIGATION REPORT BY CAMBIUM INC.
12. HYDROGEOLOGICAL ASSESSMENT BY R.J. BURNSIDE & ASSOCIATES LIMITED
13. HEWITT'S SECONDARY PLAN AREA SIS BY R.J. BURNSIDE & ASSOCIATES LIMITED
14. LSRCA LATEST MANUALS AND GUIDELINES

BENCHMARK:
BENCHMARK NO. 03120080055 LOCATED APPROXIMATELY 1.9km EAST OF YONGE STREET, APPROXIMATELY 6m NORTH OF CENTERLINE OF MAPLEVIEW DRIVE EAST AND 30m WEST OF CITY BOUNDARY LINE. N4912122.851 E611241.154 ELEV 223.039
BENCHMARK NO. 03120110020 LOCATED ON MAPLEVIEW DRIVE EAST ON THE SOUTH SIDE OF THE BOULEVARD, APPROXIMATELY 790m WEST OF THE MAPLEVIEW DRIVE EAST AND 20TH SIDE ROAD INTERSECTION. N4912284.547 E611717.298 ELEV 225.549
BENCHMARK NO. 03120080008. LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE EAST (12TH CONCESSION ROAD), APROXIMATELY 0.8km EAST OF YONGE STREET (HWY #11) AND APPROXIMATELY 10.0m NORTH OF MAPLEVIEW DRIVE EAST CENTERLINE. N4911763.816 E610187.698 ELEV 211.834
BENCHMARK NO: 03120080054 LOCATED ON THE SOUTH LIMIT OF MAPLEVIEW DRIVE WEST APPROXIMATELY 1km EAST OF HURONIA ROAD. N4910878.122 E607601.062 ELEV 248.996

NO.	REVISIONS	DATE	INITIAL
1.	FIRST DETAILED SUBMISSION	JUNE 2024	MF

LICENSED PROFESSIONAL ENGINEER M. G. FUS 100149153 06-21-2024 PROVINCE OF ONTARIO

MAPLEVIEW SOUTH (INNISFIL) LTD
953 MAPLEVIEW DRIVE EAST
CITY OF BARRIE

BLOCK 192
STORM AND SANITARY
DESIGN SHEETS

JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN KR	SCALE: N/A	DATE MAY 2024
DRAWN KR	PROJECT REI-17055	DWG. Nº DS-1
CHECKED MF		

BLOCK 193 8 DALLAIRE STREET

LANDSCAPE AREA

STORM WATER MANAGEMENT & PEDESTRIAN ACCESS BLOCK 199

10.0m–450mmø PVC (SDR–35) STM @ 0.50% (B.G.)

STM 21 (B.O.) (1500mmø)

54.6m–675mmø CONC (65–D) STM @ 0.80% (B.G.)

2.0m S/W

48.2m–825mmø CONC (65–D) STM @ 0.50% (B.G.)

STM 22 (B.O.) (1500mmø)

24.6m–825mmø CONC (65–D) STM @ 0.40% (B.G.)

INV. 256.33

DALLAIRE ST

1.5m S/W

STM 18 (B.O.) (2400mmø)

31.9m–525mmø CONC (65–D) STM @ 0.40% (B.G.)

STM 17 (B.O.) (2400mmø)

27.6m–525mmø CONC (65–D) STM @ 0.40% (B.G.)

Block 191
Medium Density
(1.83 ha.)

BLOCK 192
24 DALLAIRE STREET

FFE=261.60
PSE=257.06
WT= 256.31

NOTE:
TRENCH DRAIN AT BASE OF RAMP REQUIRED. TO BE CONNECTED TO BUILDING PLUMBING

TOP STRUCTURE= 261.60 PARKING GARAGE

OUTLINE PARKING BELOW

3:1 MAX.

EXPOSED WALL

typical, outline of balcony above

UNIT PATIO

LANDSCAPE AREA

GARBAGE ACCESS DOORS

STAGING AREA

DEPRESSED CURB

1.5m CONC. S/W

8 Bike Storage Spaces

LOADING BAY

RAMP DOWN

301
0.42 | 90.6%

302
0.20 | 37.0%

303
0.10 | 5.0%

PATIO AREA 166.33 m2

257.64

NOTE:
PROPOSED GRADING ALONG BOUNDARY PROVIDED BY TATHAM ASSOCIATES

LIMIT OF SUBDIVISION

SANDY CREEK ESTATES SUBDIVISION

BLOCK 6
STORMWATER
MANAGEMENT FACILITY
(BY OTHERS)

STRUCTURAL RETAINING WALL (BY OTHERS)

SEATING AMENITY AREA

6 Bike Storage Spaces

TOP STRUCTURE= 260.50 PARKING GARAGE

INV. 258.82

INV. 257.76

CAP

MH1

RIM 261.03
S 258.75
N 258.75
W 257.85

2.8m–300mmø PVC (SDR–35) STM @ 2.38%
5.7m–300mmø PVC (SDR–35) STM @ 2.12%

EX. 8.3m–450mmø PVC (SDR–35) STM @ 3.10%

INV. 257.40

PROP 45.2m–450mmø PVC STM @ 3.10%

MH89

PROP. STORMWATER STORAGE/INFILTRATION GALLERY STORMTECH SC-740 CHAMBERS BY ADS

W 258.80
RIM 261.10

TOP OF STONE 258.80
TOP OF TANK 258.49
BOTTOM OF TANK 257.73
BOTTOM OF STONE 257.43
WATERTABLE 252.28

2.6m–600mmø PVC (SDR–35) STM @ 3.54%

CB
E 259.63
RIM 261.01

PROP 35.7m–250mmø PVC STM @ 2.00%

CBOGS
N 258.87
W 258.92
RIM 260.85

SNOW STORAGE AREA

FD–4HC (SEE DETAIL ON DET–5)

LIMIT OF SUBDIVISION

STRUCTURAL RETAINING WALL (BY OTHERS)

NOTE:
PROPOSED GRADING ALONG BOUNDARY PROVIDED BY TATHAM ASSOCIATES

DEPRESSED CURB

NOTE:
REMOVE EXISTING 450mmø CAP AND CONNECT

LOT 61

LANDSCAPE WALL (BY OTHERS)

STRUCTURAL RETAINING WALL (BY OTHERS)

Block 196
Environmental
Protection
(1.34 ha.)

LIMIT OF SUBDIVISION

KEY PLAN
NTS

LEGEND

- PROPOSED INTERNAL LOCAL STORM SEWER, FLOW DIRECTION AND MAINTENANCE HOLE
- CB — PROPOSED CATCH BASIN
- DCB — PROPOSED DOUBLE CATCH BASIN
- PROPOSED SWALE/DITCH
- STORM SUB–CATCHMENT AREA
- PROPOSED OVERLAND DRAINAGE FLOW DIRECTION
- DIRECTION OF EXTERNAL STORM DRAINAGE
- 301 — CATCHMENT ID#; AREA (ha) 0.420 | 94.4% — IMPERVIOUS PERCENTAGE

REFERENCES:

1. CITY OF BARRIE LATEST MANUALS AND GUIDELINES
2. OPSD AND OPSS
3. CRYSTAL HOMES SUBDIVISION DEVELOPMENT BY TATHAM ENGINEERING LIMITED
4. SANDY COVE CREEK REALIGNMENT BY TATHAM ENGINEERING LIMITED
5. BULUT LANDS SUBDIVISION DEVELOPMENT BY SCHAEFFERS CONSULTING ENGINEERING
6. DRAFT PLAN OF MAPLEVIEW SOUTH SUBDIVISION BY JONES CONSULTING GROUP LTD.
7. MAPLEVIEW DRIVE EAST WIDENING BY R.J. BURNSIDE & ASSOCIATES LIMITED
8. OLS PLAN BY RUDY MAK SURVEYING LTD.
9. AWAN GROUP RESIDENTIAL DEVELOPMENT BY PEARSON ENGINEERING LTD.
10. HEWITT'S CENTRAL SUBDIVISION (BRADLEY HOMES) BY JONES CONSULTING GROUP LTD.
11. GEOTECHNICAL INVESTIGATION REPORT BY CAMBIUM INC.
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13. HEWITT'S SECONDARY PLAN AREA SIS BY R.J. BURNSIDE & ASSOCIATES LIMITED
14. LSRCA LATEST MANUALS AND GUIDELINES

BENCHMARK:

BENCHMARK NO. 03120080055 LOCATED APPROXIMATELY 1.8km EAST OF YONGE STREET, APPROXIMATELY 6m NORTH OF CENTERLINE OF MAPLEVIEW DRIVE EAST AND 35m WEST OF CITY BOUNDARY LINE. N4912122.851 E611241.154
ELEV 223.039

BENCHMARK NO. 03120110020 LOCATED ON MAPLEVIEW DRIVE EAST ON THE SOUTH SIDE OF THE BOULEVARD, APPROXIMATELY 790m WEST OF THE MAPLEVIEW DRIVE EAST AND 20TH SIDE ROAD INTERSECTION. N4912264.547 E611717.298
ELEV 225.549

BENCHMARK NO. 03120080008. LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE EAST (12TH CONCESSION ROAD), APROXIMATELY 0.8km EAST OF YONGE STREET (HWY #11) AND APPROXIMATELY 10.0m NORTH OF MAPLEVIEW DRIVE EAST CENTERLINE. N4911763.816 E610187.698
ELEV 211.834

BENCHMARK NO: 03120080054 LOCATED ON THE SOUTH LIMIT OF MAPLEVIEW DRIVE WEST APPROXIMATELY 1km EAST OF HURONIA ROAD. N4910878.122 E607601.062 ELEV 248.996

NO.	REVISIONS	DATE	INITIAL
1.	FIRST SUBMISSION	JUNE 2024	MF

LICENSED PROFESSIONAL ENGINEER
M. G. RUS
100149153
06-21-2024
PROVINCE OF ONTARIO

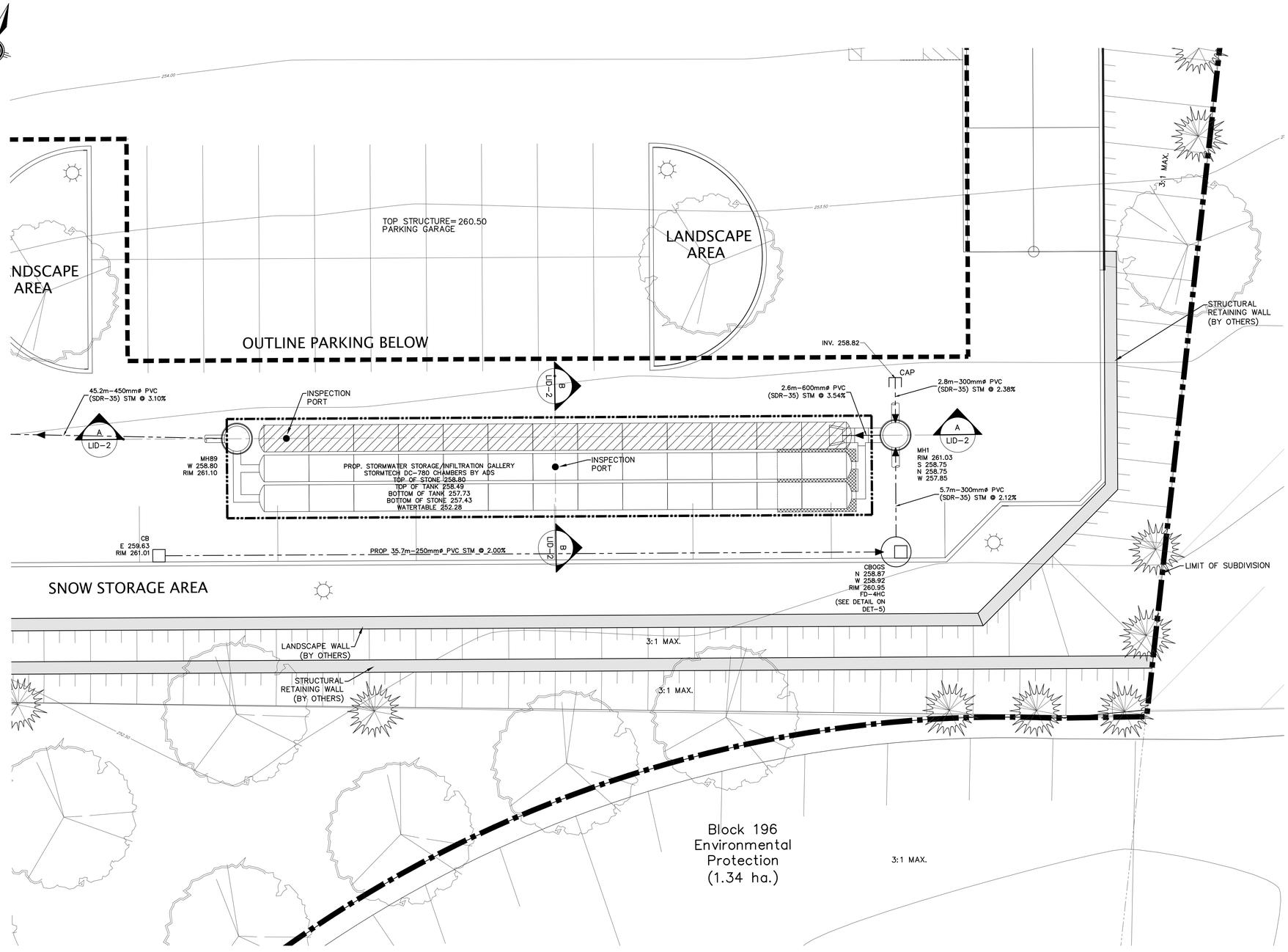
MAPLEVIEW SOUTH (INNISFIL) LTD
953 MAPLEVIEW DRIVE EAST
CITY OF BARRIE

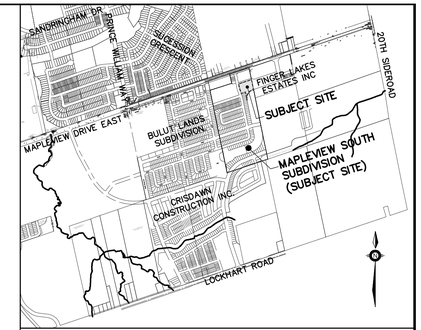
BLOCK 192
POST–DEVELOPMENT
STORMWATER DRAINAGE AREA PLAN

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	KR	SCALE: 1:250	DATE MAY 2023
DRAWN	KR	PROJECT REI–17055	DWG. Nº SWM–1
CHECKED	MF		

G:\Eng. 3D\REI–17055\Production DWGS\REI–17055–Block 192 SWM–1.dwg Layout:Blk 192 SWM–1 Plotted: Jun 20, 2024 @ 3:32pm by kschulz The Jones Consulting Group Ltd





KEY PLAN
NTS

REFERENCES:

1. CITY OF BARRIE LATEST MANUALS AND GUIDELINES
2. OPSD AND OPSS
3. CRYSTAL HOMES SUBDIVISION DEVELOPMENT BY TATHAM ENGINEERING LIMITED
4. SANDY COVE CREEK REALIGNMENT BY TATHAM ENGINEERING LIMITED
5. BULUT LANDS SUBDIVISION DEVELOPMENT BY SCHAEFFERS CONSULTING ENGINEERING
6. DRAFT PLAN OF MAPLEVIEW SOUTH SUBDIVISION BY JONES CONSULTING GROUP LTD.
7. MAPLEVIEW DRIVE EAST WIDENING BY R.J. BURNSIDE & ASSOCIATES LIMITED
8. OLS PLAN BY RUDY MAK SURVEYING LTD.
9. AWAN GROUP RESIDENTIAL DEVELOPMENT BY PEARSON ENGINEERING LTD.
10. HEWITT'S CENTRAL SUBDIVISION (BRADLEY HOMES) BY JONES CONSULTING GROUP LTD.
11. GEOTECHNICAL INVESTIGATION REPORT BY CAMBIUM INC.
12. HYDROGEOLOGICAL ASSESSMENT BY R.J. BURNSIDE & ASSOCIATES LIMITED
13. HEWITT'S SECONDARY PLAN AREA 'SIS BY R.J. BURNSIDE & ASSOCIATES LIMITED
14. LSRCA LATEST MANUALS AND GUIDELINES

BENCHMARK:

BENCHMARK NO. 03120080055 LOCATED APPROXIMATELY 1.9km EAST OF YONGE STREET, APPROXIMATELY 6m NORTH OF CENTERLINE OF MAPLEVIEW DRIVE EAST AND 35m WEST OF CITY BOUNDARY LINE. N4912122.851 E611241.154 ELEV 223.039
BENCHMARK NO. 03120110020 LOCATED ON MAPLEVIEW DRIVE EAST ON THE SOUTH SIDE OF THE BOULEVARD, APPROXIMATELY 790m WEST OF THE MAPLEVIEW DRIVE EAST AND 20TH SIDE ROAD INTERSECTION. N4912264.547 E611717.298 ELEV 225.548
BENCHMARK NO. 03120080008, LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE EAST (12TH CONCESSION ROAD), APPROXIMATELY 0.8km EAST OF YONGE STREET (HWY #11) AND APPROXIMATELY 10.0m NORTH OF MAPLEVIEW DRIVE EAST CENTERLINE. N4911763.816 E610187.698 ELEV 211.834
BENCHMARK NO. 03120080054 LOCATED ON THE SOUTH LIMIT OF MAPLEVIEW DRIVE WEST APPROXIMATELY 1km EAST OF HURONIA ROAD. N4910878.122 E607601.062 ELEV 248.996

NO.	REVISIONS	DATE	INITIAL
1.	FIRST SUBMISSION	JUNE 2024	MF

LICENSED PROFESSIONAL ENGINEER
M. G. FLIS
100149153
06-21-2024
PROVINCE OF ONTARIO

MAPLEVIEW SOUTH (INNISFIL) LTD
953 MAPLEVIEW DRIVE EAST
CITY OF BARRIE

BLOCK 192
LID PLAN VIEW
INFILTRATION GALLERY

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
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DESIGN MF/KS	SCALE: 1:100	DATE MAY 2024
DRAWN KS	PROJECT REI–17055	DWG. № LID–1
CHECKED DR		

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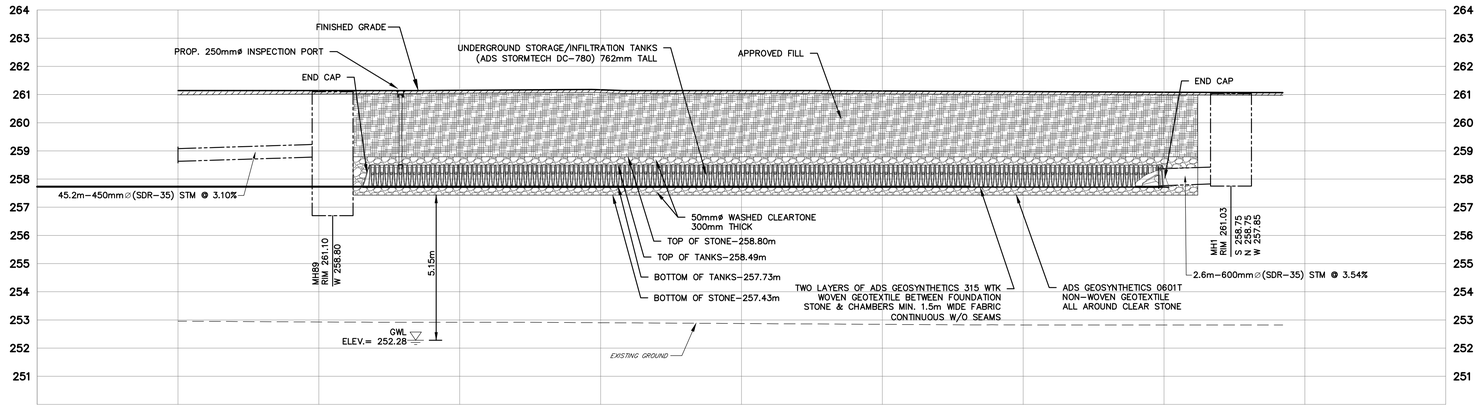

SECTION A-A

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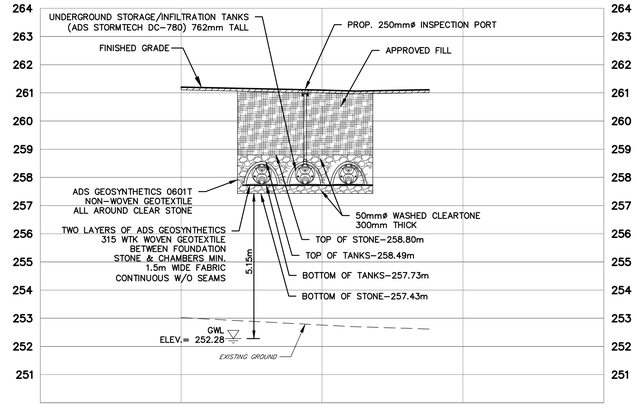

SECTION B-B

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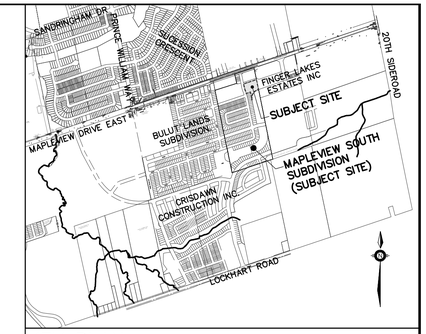

KEY PLAN

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BENCHMARK NO. 03120110020 LOCATED ON MAPLEVIEW DRIVE EAST ON THE SOUTH SIDE OF THE BOULEVARD, APPROXIMATELY 790m WEST OF THE MAPLEVIEW DRIVE EAST AND 20TH SIDE ROAD INTERSECTION. N4912264.547 E611717.298
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1.	FIRST SUBMISSION	JUNE 2024	MF

LICENSED PROFESSIONAL ENGINEER
M. G. FUS
100149153
06-21-2024
PROVINCE OF ONTARIO

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953 MAPLEVIEW DRIVE EAST
CITY OF BARRIE

BLOCK 192
LID SECTIONS & DETAILS
INFILTRATION GALLERY

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DESIGN	MF/KS	SCALE: AS NOTED	DATE MAY 2024
DRAWN	KS	PROJECT REI-17055	DWG. Nº LID-2
CHECKED	DR		

Appendix B

Supporting Calculations

- Storm Sewer Design Sheet
- ADS SC-740 Stormtech Chambers Design Drawings
- ADS FD-4HC OGS Sizing Summary
- ADS FD-4HC OG Detail Drawing
- Pre- to Post-Development Phosphorous Loading Project Development Summary
- LID Design Notes

BLK 192 STORM SEWER DESIGN - MINOR SYSTEM

Design flow in (m^3/s)	Q= C·I·A / 360	Pipe capacity (m^3/s)	Q	Client:	Anthony Reino
Site specific runoff coefficient	C	Manning roughness value	n=0.013	Project:	Mapleview South (Innisfil) LTD
Rainfall intensity (mm/hr)	I = A/(T.C. + B)^C	Cross sectional area of pipe (m^2)	A	Address:	953 Mapleview Drive East - BLK 192
function of the local intensity-duration data	A= 843.019	Hydraulic Radius (m)	R_h	File:	REI-17055
function of the local intensity-duration data	B= 4.582	Sewer pipe slope (m/m)	S	Design:	KR
function of the local intensity-duration data	C= 0.763	Velocity of flow (m/s)	V	Check:	MF
Max. time of concentration (min)	T.C.= 10			Date:	June 19 2024
Drainage area (ha)	A			Design sheet:	DS-1

AREAS	Street	MANHOLE		LENGTH	INCREMENT			TOTAL	FLOW TIME (min)		I	TOTAL Q	S	D	Q FULL	V FULL	% FULL
		FROM	TO	(m)	C	A	CA	CA	TO	IN	(mm/h)	(cms)	(%)	(mm)	(cms)	(m/s)	
201	BLK 192	STUB	MH1	2.8	0.95	0.19	0.18	0.18	10.00	0.02	109	0.055	2.40	300	0.150	2.1	***36.7***
202	BLK 192	CB1	OGS	35.7	0.77	0.13	0.10	0.10	10.00	0.35	109	0.030	2.00	250	0.084	1.7	***36.2***
203	BLK 192	OGS	MH1	5.7	0.84	0.09	0.08	0.18	10.35	0.05	107	0.053	2.10	300	0.140	2.0	***38.0***
	BLK 192	MH1	LID	2.6				0.36	10.40	0.01	107	0.107	3.50	600	1.149	4.1	***9.3***
	BLK 193	LID	MH33 (B.O)	45.2				0.36	10.41	0.24	107	0.107	3.10	450	0.502	3.2	***21.3***

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER:	CODY NEATH 519-465-9958 CODY.NEATH@ADSPIPE.COM
ADS SALES REP:	RYAN MARTIN 705-207-3059 RYAN.MARTIN@ADSPIPE.COM
PROJECT NO:	S407366
ONTARIO SITE COORDINATOR:	RYAN RUBENSTEIN 519-710-3687 RYAN.RUBENSTEIN@ADSPIPE.COM

Advanced Drainage Systems, Inc.

SiteAssist™
FOR STORMTECH
INSTALLATION INSTRUCTIONS
VISIT OUR WEBSITE

953 MAPLEVIEW DRIVE BLOCK 192

BARRIE, ON.

DC-780 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH DC-780.
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, "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 THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE CSA S6 CL-625 TRUCK AND THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 50 mm (2").
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 550 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 23° C / 73° F), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF THE DC-780 CHAMBER SYSTEM

1. STORMTECH DC-780 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH DC-780 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/SC-800/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.
6. MAINTAIN MINIMUM - 150 mm (6") SPACING BETWEEN THE CHAMBER ROWS.
7. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE WELL GRADED BETWEEN ¾" AND 2" (20-50 mm)..
8. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
9. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH DC-780 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/SC-800/DC-780 CONSTRUCTION GUIDE".
2. THE USE OF CONSTRUCTION EQUIPMENT OVER DC-780 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADERS, DUMP TRUCKS, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/SC-800/DC-780 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH SC-310/SC-740/SC-800/DC-780 CONSTRUCTION GUIDE".
3. FULL 900 mm (36") OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO THE CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

PROPOSED LAYOUT

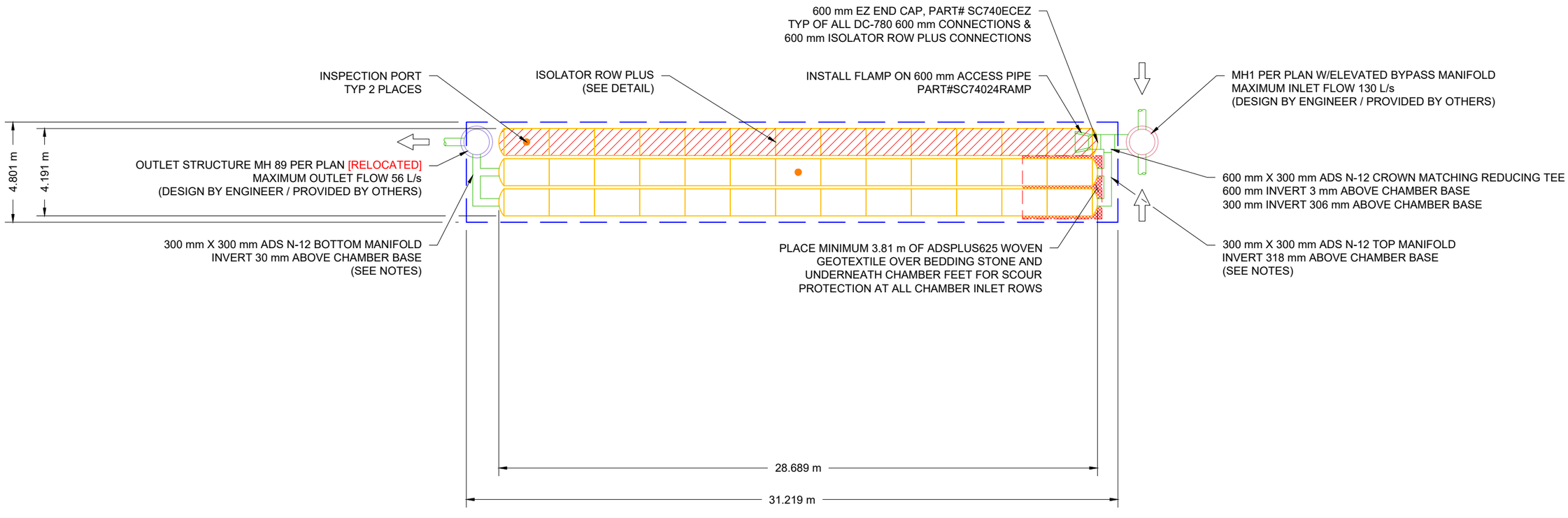
39	STORMTECH DC-780 CHAMBERS
6	STORMTECH DC-780 END CAPS
305	STONE ABOVE (mm)
305	STONE BELOW (mm)
40	% STONE VOID
112.9	**INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED)**
149.9	SYSTEM AREA (m²)
72.0	SYSTEM PERIMETER (m)

PROPOSED ELEVATIONS

262.155	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):
259.107	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):
258.954	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):
258.954	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):
258.954	MINIMUM ALLOWABLE GRADE (TOP OF RIGID PAVEMENT):
258.802	TOP OF STONE:
258.497	TOP OF DC-780 CHAMBER:
258.053	300 mm TOP MANIFOLD INVERT:
257.765	300 mm BOTTOM MANIFOLD INVERT:
257.738	600 mm ISOLATOR ROW PLUS INVERT:
257.735	BOTTOM OF DC-780 CHAMBER:
257.430	BOTTOM OF STONE:

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECHNICAL NOTE 6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- THE SITE DESIGN ENGINEER MUST REVIEW THE PROXIMITY OF THE CHAMBERS TO THE BUILDING/STRUCTURE. NO FOUNDATION LOADS SHALL BE TRANSMITTED TO THE CHAMBERS. THE SITE DESIGN ENGINEER MUST CONSIDER EFFECTS OF POSSIBLE SATURATED SOILS ON BEARING CAPACITY OF SOILS AND SEEPAGE INTO BASEMENTS.
- **ATTENTION**: THIS DRAWING IS NOT INTENDED FOR USE IN BIDDING OR CONSTRUCTION WITHOUT THE PRIOR APPROVAL OF THE PROJECT'S ENGINEER OF RECORD (EOR). AS WITH ALL PROPOSED ADS LAYOUTS, THE EOR SHOULD REVIEW AND APPROVE THIS DRAWING PRIOR TO USE IN BIDDING AND/OR CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE EOR TO ENSURE THAT THE PRODUCT(S) DEPICTED AND THE ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.



953 MAPLEVIEW DRIVE
BLOCK 192
BARRIE, ON.

DATE: 04-11-24 | DRAWN: JR | CHECKED: JR
PROJECT #: S407366

DATE	DRWN	CHKD	DESCRIPTION
6/11/24	RCT	RCT	REVISED PER COMMENTS
5/7/24	RCT	RCT	REVISED PER NEW PLAN

StormTech® Chamber System
888-892-2694 | WWW.STORMTECH.COM

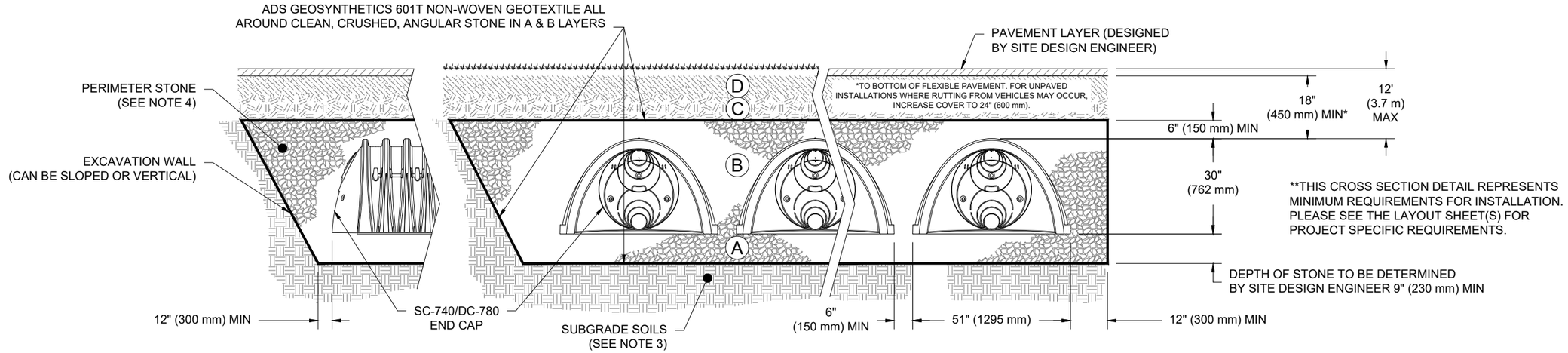
4640 TRUEMAN BLVD
HILLIARD, OH 43026

SCALE = 1 : 200

ACCEPTABLE FILL MATERIALS: STORMTECH DC-780 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 18" (450 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE[5]	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE[5]	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.
5. WHERE RECYCLED CONCRETE AGGREGATE IS USED IN LAYERS 'A' OR 'B' THE MATERIAL SHOULD ALSO MEET THE ACCEPTABILITY CRITERIA OUTLINED IN TECHNICAL NOTE 6.20 "RECYCLED CONCRETE STRUCTURAL BACKFILL".



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. DC-780 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 2".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 550 LBS/FT/%. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

953 MAPLEVIEW DRIVE
BLOCK 192
BARRIE, ON.

DATE: 04-11-24 | DRAWN: JR | CHECKED: JR
PROJECT #: S407366

DATE	DRWN	CHKD	DESCRIPTION
6/11/24	RCT	RCT	REVISED PER COMMENTS
5/7/24	RCT	RCT	REVISED PER NEW PLAN

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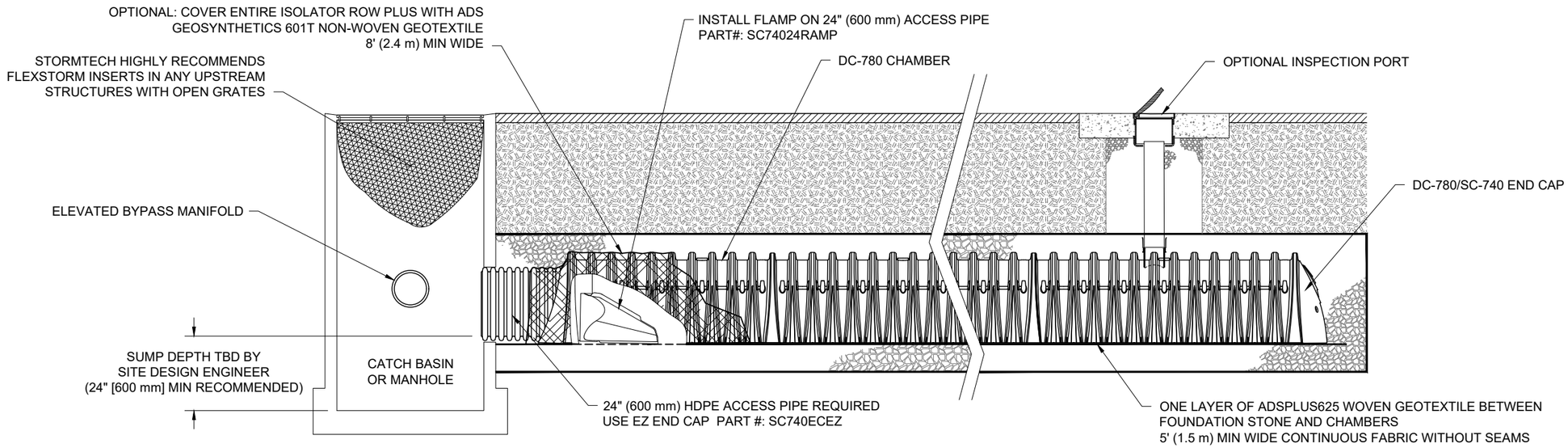


DC-780 ISOLATOR ROW PLUS DETAIL
NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

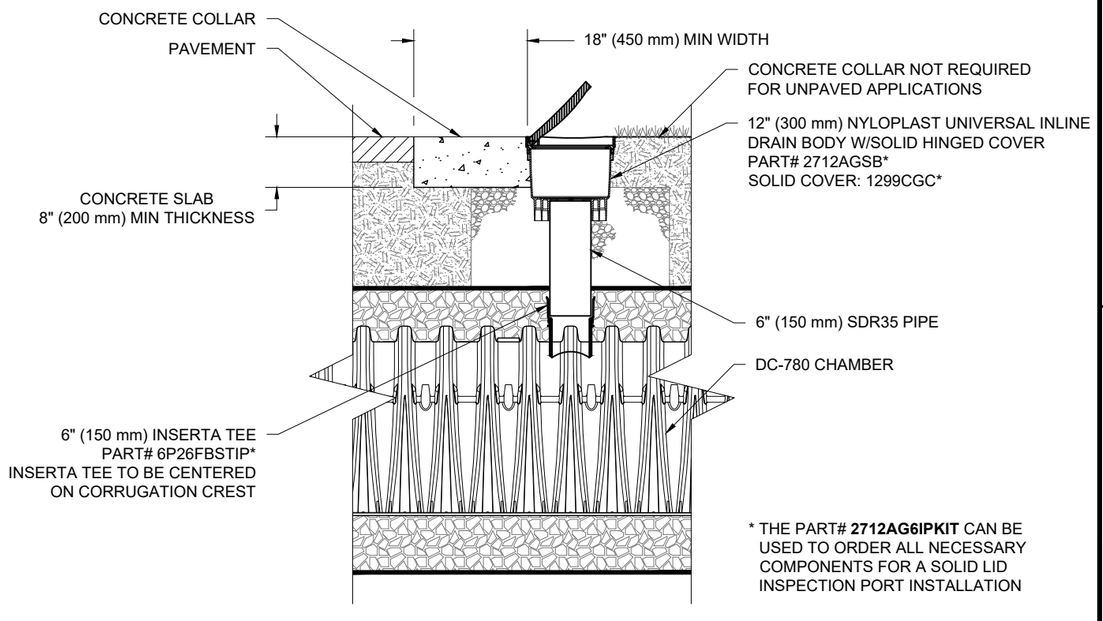
STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.



* THE PART# **2712AG6IPKIT** CAN BE USED TO ORDER ALL NECESSARY COMPONENTS FOR A SOLID LID INSPECTION PORT INSTALLATION

DC-780 6" (150 mm) INSPECTION PORT DETAIL
NTS

953 MAPLEVIEW DRIVE
BLOCK 192
BARRIE, ON.

DATE: 04-11-24 | DRAWN: JR
PROJECT #: S407366 | CHECKED: JR

DATE	DRWN	CHKD	DESCRIPTION
6/11/24	RCT	RCT	REVISED PER COMMENTS
5/7/24	RCT	RCT	REVISED PER NEW PLAN

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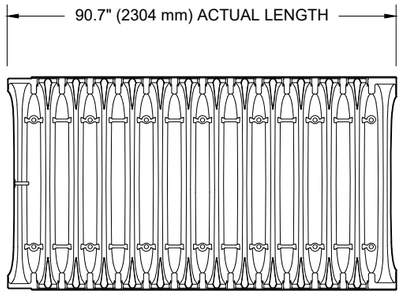
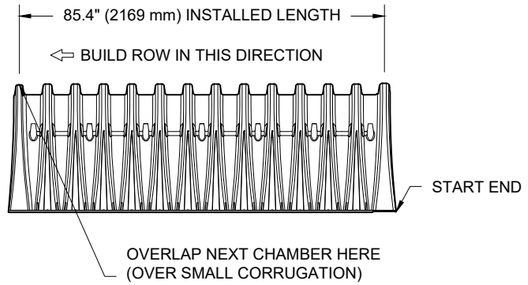
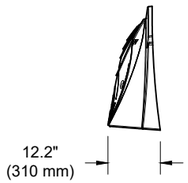
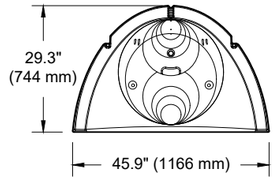
DC-780 TECHNICAL SPECIFICATION

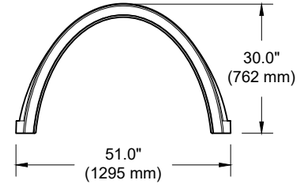
NTS







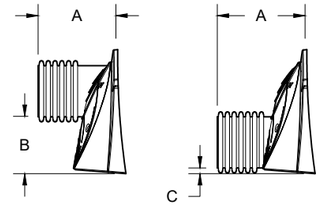




NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	51.0" X 30.0" X 85.4"	(1295 mm X 762 mm X 2169 mm)
CHAMBER STORAGE	46.2 CUBIC FEET	(1.30 m³)
MINIMUM INSTALLED STORAGE*	78.4 CUBIC FEET	(2.20 m³)
WEIGHT	75.0 lbs.	(33.6 kg)

*ASSUMES 6" (152 mm) STONE ABOVE, 9" (229 mm) BELOW,
AND 6" (152 mm) BETWEEN CHAMBERS



PRE-FAB STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PRE-FAB STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
PRE-CORED END CAPS END WITH "PC"

PART #	STUB	A	B	C
SC740EPE06T / SC740EPE06TPC	6" (150 mm)	10.9" (277 mm)	18.5" (470 mm)	---
SC740EPE06B / SC740EPE06BPC			---	0.5" (13 mm)
SC740EPE08T / SC740EPE08TPC	8" (200 mm)	12.2" (310 mm)	16.5" (419 mm)	---
SC740EPE08B / SC740EPE08BPC			---	0.6" (15 mm)
SC740EPE10T / SC740EPE10TPC	10" (250 mm)	13.4" (340 mm)	14.5" (368 mm)	---
SC740EPE10B / SC740EPE10BPC			---	0.7" (18 mm)
SC740EPE12T / SC740EPE12TPC	12" (300 mm)	14.7" (373 mm)	12.5" (318 mm)	---
SC740EPE12B / SC740EPE12BPC			---	1.2" (30 mm)
SC740EPE15T / SC740EPE15TPC	15" (375 mm)	18.4" (467 mm)	9.0" (229 mm)	---
SC740EPE15B / SC740EPE15BPC			---	1.3" (33 mm)
SC740EPE18T/ SC740EPE18TPC	18" (450 mm)	19.7" (500 mm)	5.0" (127 mm)	---
SC740EPE18B / SC740EPE18BPC			---	1.6" (41 mm)
SC740ECEZ*	24" (600 mm)	18.5" (470 mm)	---	0.1" (3 mm)

ALL STUBS, EXCEPT FOR THE SC740ECEZ ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694.

* FOR THE SC740ECEZ THE 24" (600 mm) STUB LIES BELOW THE BOTTOM OF THE END CAP APPROXIMATELY 1.75" (44 mm). BACKFILL MATERIAL SHOULD BE REMOVED FROM BELOW THE N-12 STUB SO THAT THE FITTING SITS LEVEL.

NOTE: ALL DIMENSIONS ARE NOMINAL

953 MAPLEVIEW DRIVE
BLOCK 192
BARRIE, ON.

DATE: 04-11-24 | DRAWN: JR
PROJECT #: S407366 | CHECKED: JR

DATE	DRWN	CHKD	DESCRIPTION
6/11/24	RCT	RCT	REVISED PER COMMENTS
5/7/24	RCT	RCT	REVISED PER NEW PLAN

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ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

ADS OGS Sizing Summary

Project Name: 953 Mapleview - Block 192

Consulting Engineer: Jones Consulting Group

Location: Barrie, ON

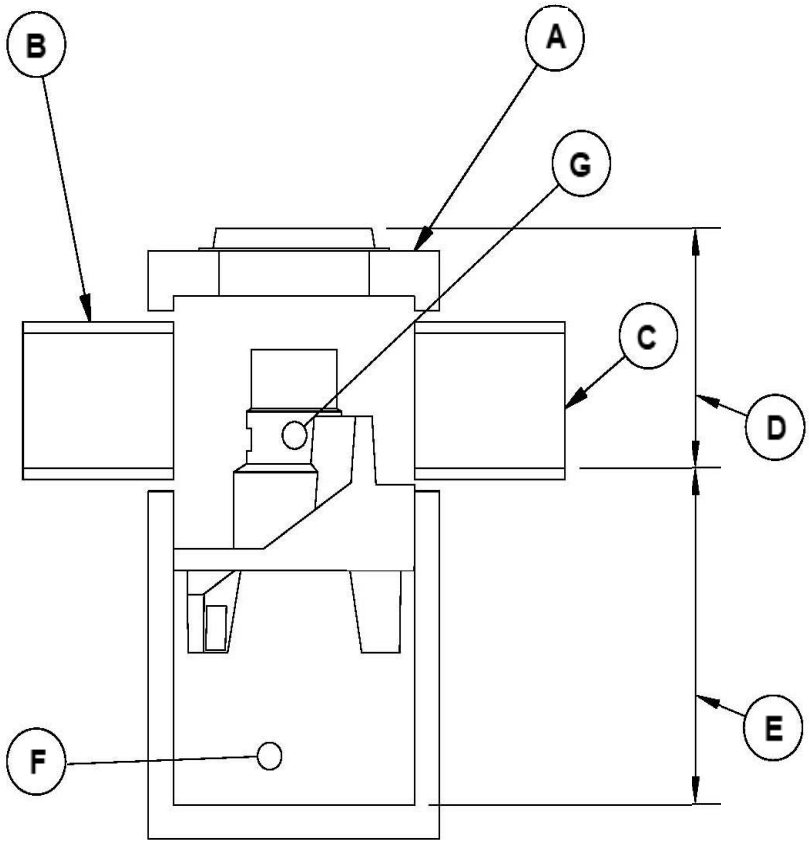
Sizing Completed By: C. Neath **Email:** cody.neath@ads-pipe.com

Treatment Requirements		
Treatment Goal:	Enhanced (MOE)	
Selected Parameters:	80% TSS	90% Volume
Selected Unit:	**FD-4HC**	

Site Details	
Site Area:	0.22 ha
% Impervious:	83%
Rational C:	0.80
Rainfall Station:	Barrie, ONT
Particle Size Distribution:	Fine
Peak Flowrate:	53 L/s

Summary of Results		
Model	**TSS Removal**	**Volume Treated**
FD-4HC	96.0%	>90%
FD-5HC	98.0%	>90%
FD-6HC	98.0%	>90%
FD-8HC	99.0%	>90%
FD-10HC	100.0%	>90%

FD-4HC Specification	
Unit Diameter (A):	1,200 mm
Inlet Pipe Diameter (B):	250 mm
Outlet Pipe Diameter (C):	300 mm
Height, T/G to Outlet Invert (D):	2080 mm
Height, Outlet Invert to Sump (E):	1515 mm
Sediment Storage Capacity (F):	0.78 m³
Oil Storage Capacity (G):	723 L
Recommended Sediment Depth for Maintenance:	440 mm
Max. Pipe Diameter:	600 mm
Peak Flow Capacity:	510 L/s



Site Elevations:	
Rim Elevation:	260.95
Inlet Pipe Elevation:	258.92
Outlet Pipe Elevation:	258.87

Notes:

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

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.

Project Name:	953 Mapleview - Block 192
Consulting Engineer:	Jones Consulting Group
Location:	Barrie, ON

Net Annual Removal Efficiency Summary: FD-4HC

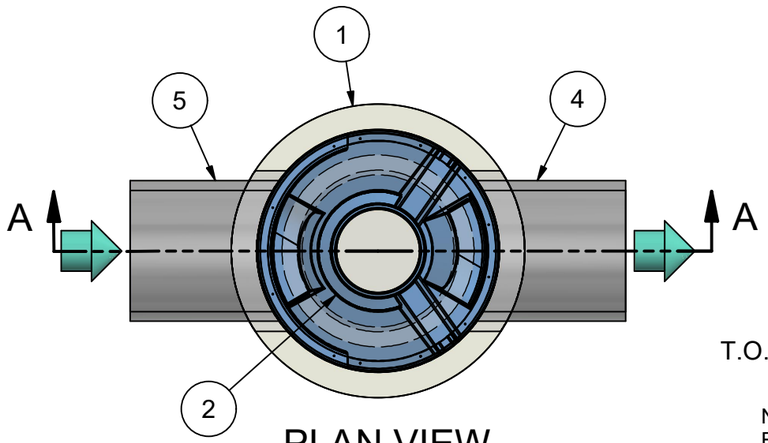
Rainfall Intensity[1]	Fraction of Rainfall[1]	FD-4HC Removal Efficiency[2]	Weighted Net-Annual Removal Efficiency
mm/hr	%	%	%
0.50	0.3%	100.0%	0.3%
1.00	25.7%	100.0%	25.7%
1.50	5.3%	100.0%	5.3%
2.00	13.4%	100.0%	13.4%
2.50	5.5%	100.0%	5.5%
3.00	3.7%	100.0%	3.7%
3.50	7.2%	98.9%	7.1%
4.00	3.4%	97.7%	3.3%
4.50	2.4%	96.7%	2.4%
5.00	4.3%	95.7%	4.2%
6.00	3.6%	94.1%	3.4%
7.00	4.3%	92.8%	4.0%
8.00	3.4%	91.6%	3.1%
9.00	1.6%	90.6%	1.5%
10.00	2.1%	89.7%	1.9%
20.00	8.9%	84.1%	7.5%
30.00	2.3%	81.0%	1.8%
40.00	1.0%	78.9%	0.8%
50.00	0.5%	77.3%	0.4%
100.00	0.7%	72.4%	0.5%
150.00	0.1%	69.8%	0.0%
200.00	0.0%	67.9%	0.0%
		Total Net Annual Removal Efficiency:	96.0%
		Total Runoff Volume Treated:	>90%

Notes:

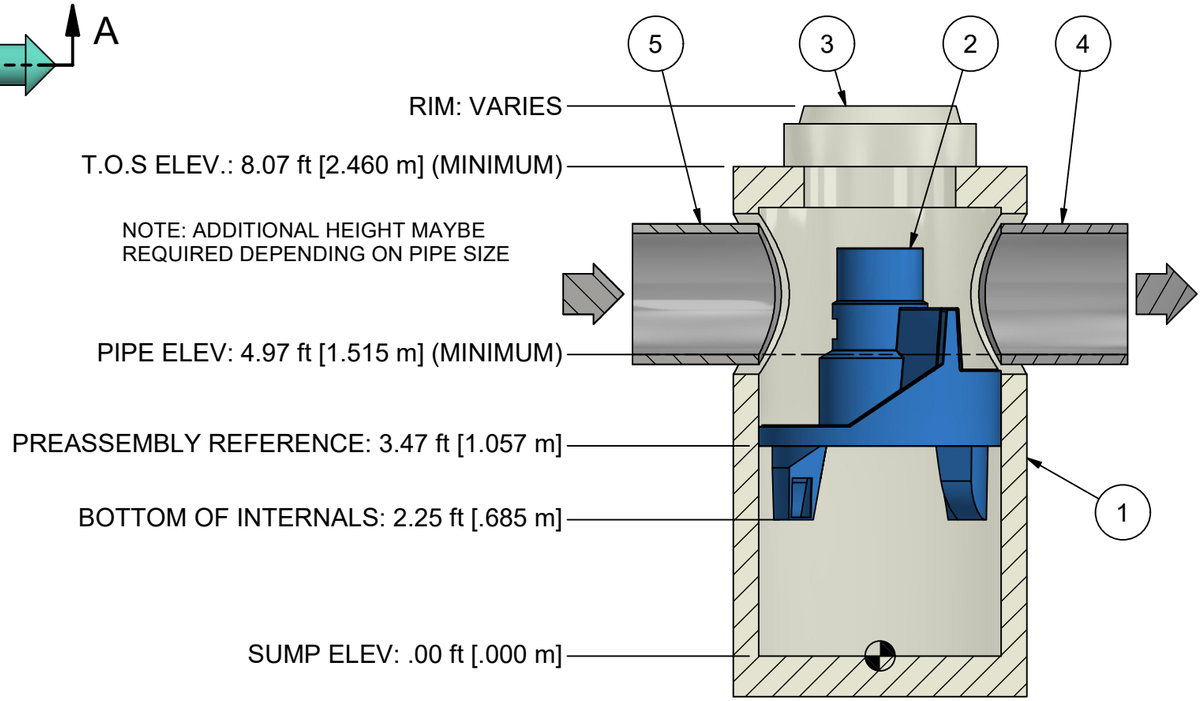
(1) Rainfall Data: 1978:2007, HLY03, Barrie, ONT, 6110557.

(2) Based on third party verified data and appoximating the removal of a PSD similar to the STC Fine distribution

(3) Rainfall adjusted to 5 min peak intensity based on hourly average.



PLAN VIEW



SECTION A-A

HYDRO FRAME AND COVER (INCLUDED)

GRADE RINGS BY OTHERS AS REQUIRED

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

2. CONTACT HYDRO INTERNATIONAL FOR A BOTTOM OF STRUCTURE ELEVATION PRIOR TO SETTING FIRST DEFENSE MANHOLE.

3. CONTRACTOR TO CONFIRM RIM, PIPE INVERTS, PIPE DIA. AND PIPE ORIENTATION PRIOR TO RELEASE OF UNIT TO FABRICATION.

PRODUCT SPECIFICATION:

1. Peak Hydraulic Flow: 18.0 cfs (510 l/s)
2. Min Sediment Storage Capacity: 0.7 cu. yd. (0.5 cu. m.)
3. Maximum Inlet/Outlet Pipe Diameters: 24 in. (600 mm)
4. The Treatment System Shall Use An Induced Vortex To Separate Pollutants From Stormwater Runoff.
5. For More Product Information Including Regulatory Acceptances, Please Visit https://hydro-int.com/en/products/first-defense

GENERAL NOTES:
1. General Arrangement drawings only. Contact Hydro International for site specific drawings.
2. The diameter of the inlet and outlet pipes may be no more than 24".
3. Multiple inlet pipes possible (refer to project plan).
4. Inlet/outlet pipe angle can vary to align with drainage network (refer to project plan.s)
5. Peak flow rate and minimum height limited by available cover and pipe diameter.
6. Larger sediment storage capacity may be provided with a deeper sump depth.

PARTS LIST

ITEM	QTY	SIZE (in)	SIZE (mm)	DESCRIPTION
1	1	48	1200	I.D. PRECAST MANHOLE
2	1			INTERNAL COMPONENTS (PRE-INSTALLED)
3	1	30	750	FRAME AND COVER (ROUND)
4	1	24 (MAX)	600 (MAX)	OUTLET PIPE (BY OTHERS)
5	1	24 (MAX)	600 (MAX)	INLET PIPE (BY OTHERS)

PROJECTION

IF IN DOUBT ASK

DATE:	SCALE:
10/7/2019	1:30

DRAWN BY:	CHECKED BY:	APPROVED BY
ER	MRJ	

Title
4-ft DIAMETER
FIRST DEFENSE

GENERAL ARRANGEMENT

Hydro International®
hydro-int.com
HYDRO INTERNATIONAL

WEIGHT:	MATERIAL:
19448 lbmass	

STOCK NUMBER:

DRAWING NO.: FD GA-4

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

Ontario

MINISTRY OF THE ENVIRONMENT

Database Version: V 2.0 Release Update
Update Date: 30-Mar-12

Project DEVELOPMENT Summary

DEVELOPMENT: REI-17022 Block 192
Subwatershed: Hewitts Creek

Total Pre-Development Area (ha):	0.7400	Total Pre-Development Phosphorus Load (kg/yr):	0.14

Pre-Development Land Use	Area (ha)	P coeff. (kg/ha)	P Load (kg/yr)
Cropland	0.74	0.19	0.14

POST-DEVELOPMENT LOAD

Post-Development Land Use	Area (ha)	P coeff. (kg/ha)	Best Management Practice applied with P Removal Efficiency		P Load (kg/yr)
High Intensity - Residential	0.74	1.32	Treatment Train Approach	77%	0.22

See Section 5.4.2 of the Detailed SWMR for 953 Mapleview Dr E - Block 192 Site Plan, prepared by TJCG

Post-Development Area Altered:	**0.74**
Total Pre-Development Area:	**0.74**
Unaffected Area:	**0**

	P Load (kg/yr)
Pre-Development:	**0.14**
Post-Development:	**0.98**
Change (Pre - Post):	**-0.84**
595% Net Increase in Load	
Post-Development (with BMPs):	**0.22**
Change (Pre - Post):	**-0.08**
57.01% Net Increase in Load	

DEVELOPMENT: **REI-17022 Block 192**
Subwatershed: **Hewitts Creek**

CONSTRUCTION PHASE LOAD

SUMMARY WITH IMPLEMENTATION OF BMPs	P Load (kg/yr)
Pre-Development:	**0.14**
Construction Phase Amortized Over 8 Years :	to be determined
Post-Development:	**0.22**
Post-Development + Amortized Construction:	**to be determined**
Pre-Development Load - Post-Development Load:	**-0.08**
Conclusion:	**57% Increase in Load**
Pre-Development Load - (Post-Development + Amortized Construction Load):	**to be determined**
Conclusion:	**to be determined**

Based on a comparison of Pre-Development and Post-Development loads, and in consideration of Construction Phase loads, the Ministry would encourage the Municipality to:

Not approve development as site specific appropriate

	Project:	Block 192 Site Plan - Mapleview South Subdivision	Date:	Jun-24
	File No.:	REI-17055	Designed:	KR
	Subject:	BLK 192 Infiltration Gallery per TRCA/CVC LID Manual	Checked:	MF
	Revisions:			

BMP Type **LOT LEVEL / CONVEYANCE CONTROL**

Infiltration Galleries, designed per *CVC Section 4.4 - Soakaways, Infiltration Trenches & Chambers,* generally involve the collection of runoff to a stone filled reservoir providing storage for a particular return period event. Water then infiltrates into the ground over a period of 24 - 48 hours typically, recharging the groundwater sources. Infiltration Galleries are of three general types of facilities: Soakaway Pits (Typical to a Sinlge Lot), Infiltration Trenches (Typical to Multiple Lots, located in an easement), or Infiltration Chambers (Typically centralized modular storage units below ground). These facilities promote groundwater recharge through infiltration which aids in meeting Water Balance, provide Water Quality benefits through a treatment train approach and can assist in Stream Erosion Control

Common Concerns

1 Risk of Groundwater Contamination
2 Risk of Soil Contamination
3 Location on Private Property / Enforcement
4 Standing Water and Mosquitos
5 Proximity to Foundations & Seepage
6 Winter Operation

Physical Suitability and Constraints

1 Proximity to Drinking Water Sources i.e. WHPA's, not within 2yr Travel Time
2 Site Topography, locate on slopes <15%
3 Water Table, minimum 1.0m separation from Bottom of Facility to SHGWT
4 Site Soils & Infiltration Capacity, min 15 mm/hr
5 Drainage Area, 5:1 to 20:1 Impervious Drainage Area to BMP Area (10:1 Max for Roads)
6 Pollution Hot Spot Runoff
7 Setback from Buildings, minimum of 5m from foundations
8 Proximity to Underground Utilities

Table 4.4.1 Ability of soakaways, infiltration trenches and chambers to meet SWM objectives

BMP	Water Balance Benefit	Water Quality Improvement	Stream Channel Erosion Control Benefit
Soakaways, Infiltration Trenches and Chambers	Yes	Yes	Partial - depends on soil infiltration rate

Table 4.4.2 Volumetric runoff reduction[1] achieved by infiltration trenches and perforated pipe systems

LID Practice	Location	Runoff Reduction[1]	Reference
Infiltration trench with underdrain	Virginia	60%	Schueler (1983)
Grass swale/ Perforated pipe system	Ontario	73%	J.F. Sabourin and Associates (2008a)
Grass swale/ Perforated pipe system	Ontario	86%	J.F. Sabourin and Associates (2008a)
Perforated pipe system	Ontario	95%	SWAMP (2005)
Perforated pipe system	Ontario	89%	SWAMP (2005)
Runoff Reduction Estimate[2]		**85%**	

Notes:
1. Runoff reduction estimates are based on differences in runoff volume between the practice and a conventional impervious surface over the period of monitoring.
2. This estimate is provided only for the purpose of initial screening of LID practices suitable for achieving stormwater management objectives and targets. Performance of individual facilities will vary depending on site specific contexts and facility design parameters and should be estimated as part of the design process and submitted with other documentation for review by the approval authority.

BMP Sizing Guidelines

1 Geometry & Layout, typically linear or rectangular, modular units afford flexibility to suit nearly any system orientation
2 Pretreatment should be provided to ensure system longevity, by way of leaf screens, vegetated filter strips/grass swales or filter devices (OGS Units)
3 Conveyance by Direct Inlet, 3rd Pipe System, or Storm Sewer, an Overflow should be provided outletting to grade or a nearby Storm Sewer
4 The infiltration rate of the soil in the pervious area should be at least 15 mm/hr
5 Filter Media will vary depending on type of system to be constructed. Typically includes a layer of clear stone (50mm dia.), which fills the reservoir. Systems can also be complimented with an underlying sand filter layer for improved Water Quality benefits. A geotextile is commonly used as a separator between adjacent native soils and stone reservoir, as well as between filter mediums. Check AOS (non-woven) or POA (woven) for piping, clogging, etc.

	Project:	Block 192 Site Plan - Mapleview South Subdivision	Date:	13-Jun-24
	File No.:	REI-17055	Designed:	KR
	Subject:	BLK 192 Infiltration Gallery per TRCA/CVC LID Manual	Checked:	MF
	Revisions:	0		
		0		

BMP Sizing Calculations (Infiltration Galleries)

Note: If sizing a chamber system, use the manufacturers design spreadsheet / sizing tools

1) Depth of a facility is a function of native soil infiltration rate, porosity of storage media, and targeted drawdown time:

Eq. 1.2 $d_{R\,MAX} = i * t_S / V_R$ Where:

- $d_{R\,MAX}$ = Maximum Depth of Stone Reservoir (mm), Limit to 2000mm MAX.
- i = Infiltration Rate for Native Soils (mm/hr) - Use FS Rate, not actual
- t_S = Drawdown Time (Design for 24 - 48 Hours)
- V_R = Void Ratio of Stone Reservoir (Typically 0.4 for 50mm Clear Stone)

2) Facility footprint is then determined based on the Water Quality Volume (WQV) to be captured, as well as the available storage volume in the reservoir:

Eq. 2 $A_F = WQV / (d_R * V_R)$ Where:

- A_F = Footprint Area of Facility (m^2)
- WQV = Water Quality Volume (m^3), Depth of Runoff (mm) * Catchment (m^2) OR Runoff Vol. (m^3)
- $d_{R\,MAX}$ = Design Stone Reservoir Depth (m)
- V_R = Void Ratio of Stone Reservoir (Typically 0.4 for 50mm Clear Stone)

Infiltration Gallery Sizer: = *user input* = *calculated / constant* = *design parameter*

1) $d_{R\,MAX} = i * t_S / V_R$

$d_{R\,MAX}$ = **1368 mm**

Where:

f' =	11.4	mm/hr
t_S =	48	hrs
V_R =	0.4	

Note: CHECK DEPTH TO SHGWT FOR MINIMUM 1.0m SEPARATION

2) $A_F = WQV / (d_R * V_R)$

A_F = **159.3 m^2**

A_P = **149.9 m^2**

Where:

WQV =	87.15	m^3
$d_{R\,MAX}$ =	1.368	m
V_R =	0.4	

Depth of Runoff:	21.00	mm
Catchment Area:	4150	m^2
XIMP:	91%	
Imp. Area	3777	m^2

Recommended Area Check (5:1 - 20:1 Ratio): CAUTION! Consider additional protection against sedimentation

301 OTTHYMO Catchment ID

A_P based on I/P Ratio:

$A_{F\,MIN}$ = **251.767 m^2**

$A_{F\,MAX}$ = **755.3 m^2**

I/P_{PROV} : 25 :1

ADDITIONAL NOTES: Contributing Area Land Use is comprised of Medium Density Residential and Rooftop Drainage. Upstream pre-treatment is provide by an OGS unit prior to flows entering the facility

Rerefences: **STEP Low Impact Development Stormwater Management Planning & Design Guide:** *https://wiki.sustainabletechnologies.ca/wiki/Main_Page*

Item	Page	Link
Eq.'s 1.1, 1.2, 2, 3	*Bioretention: Sizing*	*https://wiki.sustainabletechnologies.ca/wiki/Bioretention:_Sizing*
Eq. 4	*Curb Cuts*	*https://wiki.sustainabletechnologies.ca/wiki/Curb_cuts*
Eq. 5	*Flow Through Media*	*https://wiki.sustainabletechnologies.ca/wiki/Flow_through_media*
Eq. 6	*Flow Through Perforated Pipe*	*https://wiki.sustainabletechnologies.ca/wiki/Flow_through_perforated_pipe*

Appendix C

OTTHYMO Modeling

- Post-Development OTTHYMO Inputs
- Discrete Event Modelling: 25mm Storm, Detailed Output
- Continuous Event Modelling: Water Balance Summary
- OTTHYMO Digital Modeling Files

Weighted Curve Number Calculator

Input:

Catchment ID	301		
Hydrologic Soil Group	AB	Weighted Curve Number	Weighted Runoff 'C'
Soil Texture	Bondhead Sandy Loam		
Wetland(ha)/CN	0.000	N/A	N/A
Woods(ha)/CN	0.000	N/A	N/A
Pasture/Lawn Area(ha)/CN	0.039	49.0	0.10
Cultivated(ha)/CN	0.000	N/A	N/A
Impervious Area(ha)/CN	0.376	98.0	0.95

Calculated:

Area	0.415	ha
Average CN	93	
Average Pervious CN	49	
Average Runoff 'C'	0.87	

Initial Abstraction Calculator

Input:

Wetland	16	mm
Woods	10	mm
Pasture/Lawns	5	mm
Cultivated	7	mm
Impervious Areas	2	mm

Calculated:

Total Average IA	2.28	mm
Average Pervious IA	5.00	mm

*Weighted Curve Numbers and Weighted Rational Coefficients are determined from the weighted average of the area and Curve Number or Rational Coefficient in a given soil type, i.e. Type A, B, C or D.

Time of Concentration Calculator

Input:

Fow Length Max El.		m
Flow Length Min. El.		m
Catchment Flow Length	30	m

Calculated:

Catchment Ave. Slope	2.00	%
Imperviousness	90.63%	
Directly Connected Imperviousness	90.63%	

Calculated: RATIONAL COEFFICIENT

5YR Rational 'C'	0.87	

Calculated: MTO DRAINAGE MANUAL

25YR Rational 'C'	0.96	
50YR Rational 'C'	1.00	
100YR Rational 'C'	1.00	

Calculated: AIRPORT METHOD (Runoff Coef <0.4)

Time of Concentration	3.26	min
Time of Concentration	0.05	hr
Time to Peak	0.04	hr

$Tc=3.26*(1.1-C)*L^{0.5}*S^{-0.33}$

Calculated: BRANSBY-WILLIAMS METHOD (Runoff Coef >=0.4)

Time of Concentration	1.63	min
Time of Concentration	0.03	hr
Time to Peak	0.02	hr

$Tc=0.057*L*S^{-0.2}*A^{-0.1}$

Use:

Time of Concentration	**0.03**	**hr**
Time to Peak	**0.02**	**hr**

Catchment Area Summary (301)

	Area (ha)	CN	CN*A	Rational "C"	C*A
Wetlands "A"	0.0000	50	0.00	0.05	0.0000
Woods "A"	0.0000	36	0.00	0.08	0.0000
Pasture/Lawn "A"	0.0000	49	0.00	0.10	0.0000
Cultivated "A"	0.0000	66	0.00	0.22	0.0000
Impervious "A" (Connected)	0.0000	98	0.00	0.95	0.0000
Impervious "A" (Dis-Connected)	0.0000	98	0.00	0.95	0.0000
Total Area "A"	0.0000				
Weighted CN "A"			0.00		0.0000
Wetlands "AB"	0.0000	50	0.00	0.05	0.0000
Woods "AB"	0.0000	36	0.00	0.08	0.0000
Pasture/Lawn "AB"	0.0389	49	1.91	0.10	0.0039
Cultivated "AB"	0.0000	66	0.00	0.22	0.0000
Impervious "AB" (Connected)	0.3760	98	36.85	0.95	0.3572
Impervious "AB" (Dis-Connected	0.0000	98	0.00	0.95	0.0000
Total Area "AB"	0.4149				
Weighted CN "AB"			93.41		0.8703
Wetlands "B"	0.0000	50	0.00	0.05	0.0000
Woods "B"	0.0000	60	0.00	0.25	0.0000
Pasture/Lawn "B"	0.0000	69	0.00	0.28	0.0000
Cultivated "B"	0.0000	74	0.00	0.35	0.0000
Impervious "B" (Connected)	0.0000	98	0.00	0.95	0.0000
Impervious "B" (Dis-Connected)	0.0000	98	0.00	0.95	0.0000
Total Area "B"	0.0000				
Weighted CN "B"			0.00		0.0000
Wetlands "BC"	0.0000	50	0.00	0.05	0.0000
Woods "BC"	0.0000	60	0.00	0.25	0.0000
Pasture/Lawn "BC"	0.0000	69	0.00	0.28	0.0000
Cultivated "BC"	0.0000	74	0.00	0.35	0.0000
Impervious "BC" (Connected)	0.0000	98	0.00	0.95	0.0000
Impervious "BC" (Dis-Connected	0.0000	98	0.00	0.95	0.0000
Total Area "BC"	0.0000				
Weighted CN "BC"			0.00		0.0000
Totals:	0.4149	Weighted CN	93.41	Weighted "C"	0.87

Weighted Curve Number Calculator

Input:

Catchment ID	302		
Hydrologic Soil Group	AB	Weighted Curve Number	Weighted Runoff 'C'
Soil Texture	Bondhead Sandy Loam		
Wetland(ha)/CN	0.000	N/A	N/A
Woods(ha)/CN	0.000	N/A	N/A
Pasture/Lawn Area(ha)/CN	0.126	49.0	0.10
Cultivated(ha)/CN	0.000	N/A	N/A
Impervious Area(ha)/CN	0.074	98.0	0.95

Calculated:

Area	0.200	ha
Average CN	67	
Average Pervious CN	49	
Average Runoff 'C'	0.41	

Initial Abstraction Calculator

Input:

Wetland	16	mm
Woods	10	mm
Pasture/Lawns	5	mm
Cultivated	7	mm
Impervious Areas	2	mm

Calculated:

Total Average IA	3.89	mm
Average Pervious IA	5.00	mm

*Weighted Curve Numbers and Weighted Rational Coefficients are determined from the weighted average of the area and Curve Number or Rational Coefficient in a given soil type, i.e. Type A, B, C or D.

Time of Concentration Calculator

Input:

Fow Length Max El.		m
Flow Length Min. El.		m
Catchment Flow Length	18	m

Calculated:

Catchment Ave. Slope	25.00	%
Imperviousness	37.00%	
Directly Connected Imperviousness	18.50%	

Calculated: RATIONAL COEFFICIENT

5YR Rational 'C'	0.41

Calculated: MTO DRAINAGE MANUAL

25YR Rational 'C'	0.46
50YR Rational 'C'	0.50
100YR Rational 'C'	0.52

Calculated: AIRPORT METHOD (Runoff Coef <0.4)

Time of Concentration	3.28	min
Time of Concentration	0.05	hr
Time to Peak	0.04	hr

$Tc=3.26*(1.1-C)*L^{0.5}*S^{-0.33}$

Calculated: BRANSBY-WILLIAMS METHOD (Runoff Coef >=0.4)

Time of Concentration	0.63	min
Time of Concentration	0.01	hr
Time to Peak	0.01	hr

$Tc=0.057*L*S^{-0.2}*A^{-0.1}$

Use:

Time of Concentration	**0.01**	**hr**
Time to Peak	**0.01**	**hr**

Catchment Area Summary (302)

	Area (ha)	CN	CN*A	Rational "C"	C*A
Wetlands "A"	0.0000	50	0.00	0.05	0.0000
Woods "A"	0.0000	36	0.00	0.08	0.0000
Pasture/Lawn "A"	0.0000	49	0.00	0.10	0.0000
Cultivated "A"	0.0000	66	0.00	0.22	0.0000
Impervious "A" (Connected)	0.0000	98	0.00	0.95	0.0000
Impervious "A" (Dis-Connected)	0.0000	98	0.00	0.95	0.0000
Total Area "A"	0.0000				
Weighted CN "A"			0.00		0.0000
Wetlands "AB"	0.0000	50	0.00	0.05	0.0000
Woods "AB"	0.0000	36	0.00	0.08	0.0000
Pasture/Lawn "AB"	0.1257	49	6.16	0.10	0.0126
Cultivated "AB"	0.0000	66	0.00	0.22	0.0000
Impervious "AB" (Connected)	0.0369	98	3.62	0.95	0.0351
Impervious "AB" (Dis-Connected	0.0369	98	3.62	0.95	0.0351
Total Area "AB"	0.1996				
Weighted CN "AB"			67.13		0.4145
Wetlands "B"	0.0000	50	0.00	0.05	0.0000
Woods "B"	0.0000	60	0.00	0.25	0.0000
Pasture/Lawn "B"	0.0000	69	0.00	0.28	0.0000
Cultivated "B"	0.0000	74	0.00	0.35	0.0000
Impervious "B" (Connected)	0.0000	98	0.00	0.95	0.0000
Impervious "B" (Dis-Connected)	0.0000	98	0.00	0.95	0.0000
Total Area "B"	0.0000				
Weighted CN "B"			0.00		0.0000
Wetlands "BC"	0.0000	50	0.00	0.05	0.0000
Woods "BC"	0.0000	60	0.00	0.25	0.0000
Pasture/Lawn "BC"	0.0000	69	0.00	0.28	0.0000
Cultivated "BC"	0.0000	74	0.00	0.35	0.0000
Impervious "BC" (Connected)	0.0000	98	0.00	0.95	0.0000
Impervious "BC" (Dis-Connected	0.0000	98	0.00	0.95	0.0000
Total Area "BC"	0.0000				
Weighted CN "BC"			0.00		0.0000
Totals:	0.1996	Weighted CN	67.13	Weighted "C"	0.41

Weighted Curve Number Calculator

Input:

Catchment ID	303		
Hydrologic Soil Group	AB	Weighted Curve Number	Weighted Runoff 'C'
Soil Texture	Bondhead Sandy Loam		
Wetland(ha)/CN	0.000	N/A	N/A
Woods(ha)/CN	0.000	N/A	N/A
Pasture/Lawn Area(ha)/CN	0.093	49.0	0.10
Cultivated(ha)/CN	0.000	N/A	N/A
Impervious Area(ha)/CN	0.005	98.0	0.95

Calculated:

Area	0.098	ha
Average CN	51	
Average Pervious CN	49	
Average Runoff 'C'	0.14	

Initial Abstraction Calculator

Input:

Wetland	16	mm
Woods	10	mm
Pasture/Lawns	5	mm
Cultivated	7	mm
Impervious Areas	2	mm

Calculated:

Total Average IA	4.85	mm
Average Pervious IA	5.00	mm

*Weighted Curve Numbers and Weighted Rational Coefficients are determined from the weighted average of the area and Curve Number or Rational Coefficient in a given soil type, i.e. Type A, B, C or D.

Time of Concentration Calculator

Input:

Fow Length Max El.		m
Flow Length Min. El.		m
Catchment Flow Length	20	m

Calculated:

Catchment Ave. Slope	10.00	%
Imperviousness	5.00%	
Directly Connected Imperviousness	0.00%	

Calculated: RATIONAL COEFFICIENT

5YR Rational 'C'	0.14	

Calculated: MTO DRAINAGE MANUAL

25YR Rational 'C'	0.16	
50YR Rational 'C'	0.17	
100YR Rational 'C'	0.18	

Calculated: AIRPORT METHOD (Runoff Coef <0.4)

Time of Concentration	6.53	min
Time of Concentration	0.11	hr
Time to Peak	0.07	hr

$Tc=3.26*(1.1-C)*L^{0.5}*S^{-0.33}$

Calculated: BRANSBY-WILLIAMS METHOD (Runoff Coef >=0.4)

Time of Concentration	0.91	min
Time of Concentration	0.02	hr
Time to Peak	0.01	hr

$Tc=0.057*L*S^{-0.2}*A^{-0.1}$

Use:

Time of Concentration	**0.11**	**hr**
Time to Peak	**0.07**	**hr**

Catchment Area Summary (303)

	Area (ha)	CN	CN*A	Rational "C"	C*A
Wetlands "A"	0.0000	50	0.00	0.05	0.0000
Woods "A"	0.0000	36	0.00	0.08	0.0000
Pasture/Lawn "A"	0.0000	49	0.00	0.10	0.0000
Cultivated "A"	0.0000	66	0.00	0.22	0.0000
Impervious "A" (Connected)	0.0000	98	0.00	0.95	0.0000
Impervious "A" (Dis-Connected)	0.0000	98	0.00	0.95	0.0000
Total Area "A"	0.0000				
Weighted CN "A"			0.00		0.0000
Wetlands "AB"	0.0000	50	0.00	0.05	0.0000
Woods "AB"	0.0000	36	0.00	0.08	0.0000
Pasture/Lawn "AB"	0.0929	49	4.55	0.10	0.0093
Cultivated "AB"	0.0000	66	0.00	0.22	0.0000
Impervious "AB" (Connected)	0.0000	98	0.00	0.95	0.0000
Impervious "AB" (Dis-Connected	0.0049	98	0.48	0.95	0.0046
Total Area "AB"	0.0978				
Weighted CN "AB"			51.45		0.1425
Wetlands "B"	0.0000	50	0.00	0.05	0.0000
Woods "B"	0.0000	60	0.00	0.25	0.0000
Pasture/Lawn "B"	0.0000	69	0.00	0.28	0.0000
Cultivated "B"	0.0000	74	0.00	0.35	0.0000
Impervious "B" (Connected)	0.0000	98	0.00	0.95	0.0000
Impervious "B" (Dis-Connected)	0.0000	98	0.00	0.95	0.0000
Total Area "B"	0.0000				
Weighted CN "B"			0.00		0.0000
Wetlands "BC"	0.0000	50	0.00	0.05	0.0000
Woods "BC"	0.0000	60	0.00	0.25	0.0000
Pasture/Lawn "BC"	0.0000	69	0.00	0.28	0.0000
Cultivated "BC"	0.0000	74	0.00	0.35	0.0000
Impervious "BC" (Connected)	0.0000	98	0.00	0.95	0.0000
Impervious "BC" (Dis-Connected	0.0000	98	0.00	0.95	0.0000
Total Area "BC"	0.0000				
Weighted CN "BC"			0.00		0.0000
Totals:	0.0978	Weighted CN	51.45	Weighted "C"	0.14

```
       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```


***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\kransom.JONES\AppData\Local\Civica\VH5\0e32c285-5856-4fe8-af0e-3a4eb0307df2\52
Summary filename: C:\Users\kransom.JONES\AppData\Local\Civica\VH5\0e32c285-5856-4fe8-af0e-3a4eb0307df2\52

DATE: 05-31-2024 TIME: 12:15:15

USER:

COMMENTS: _____

****
** SIMULATION : WQE 25mm 4hr CHI **
****

| CHICAGO STORM |
| Ptotal= 25.00 mm |

IDF curve parameters: A= 458.560
B= 4.699
C= 0.781
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	1.56	1.00	6.77	2.00	4.31	3.00	2.07
0.08	1.65	1.08	10.39	2.08	3.92	3.08	1.99
0.17	1.76	1.17	24.03	2.17	3.61	3.17	1.92
0.25	1.88	1.25	77.76	2.25	3.34	3.25	1.85
0.33	2.03	1.33	31.02	2.33	3.12	3.33	1.79
0.42	2.20	1.42	17.08	2.42	2.92	3.42	1.73
0.50	2.41	1.50	11.77	2.50	2.76	3.50	1.68
0.58	2.68	1.58	9.02	2.58	2.61	3.58	1.63
0.67	3.02	1.67	7.34	2.67	2.48	3.67	1.58
0.75	3.47	1.75	6.21	2.75	2.36	3.75	1.54
0.83	4.11	1.83	5.40	2.83	2.25	3.83	1.50
0.92	5.09	1.92	4.79	2.92	2.16	3.92	1.46

| CALIB |
| STANDHYD (0301) |
|ID= 1 DT= 1.0 min |

Area (ha)= 0.42
Total Imp(%)= 90.63 Dir. Conn.(%)= 90.63

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.38	0.04
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	52.60	10.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr

0.017	1.56	1.017	6.77	2.017	4.31	3.02	2.07
0.033	1.56	1.033	6.77	2.033	4.31	3.03	2.07
0.050	1.56	1.050	6.77	2.050	4.31	3.05	2.07
0.067	1.56	1.067	6.77	2.067	4.31	3.07	2.07
0.083	1.56	1.083	6.77	2.083	4.31	3.08	2.07
0.100	1.65	1.100	10.39	2.100	3.92	3.10	1.99
0.117	1.65	1.117	10.39	2.117	3.92	3.12	1.99
0.133	1.65	1.133	10.39	2.133	3.92	3.13	1.99
0.150	1.65	1.150	10.39	2.150	3.92	3.15	1.99
0.167	1.65	1.167	10.39	2.167	3.92	3.17	1.99
0.183	1.76	1.183	24.03	2.183	3.61	3.18	1.92
0.200	1.76	1.200	24.03	2.200	3.61	3.20	1.92
0.217	1.76	1.217	24.03	2.217	3.61	3.22	1.92
0.233	1.76	1.233	24.03	2.233	3.61	3.23	1.92
0.250	1.76	1.250	24.03	2.250	3.61	3.25	1.92
0.267	1.88	1.267	77.76	2.267	3.34	3.27	1.85
0.283	1.88	1.283	77.76	2.283	3.34	3.28	1.85
0.300	1.88	1.300	77.76	2.300	3.34	3.30	1.85
0.317	1.88	1.317	77.76	2.317	3.34	3.32	1.85
0.333	1.88	1.333	77.76	2.333	3.34	3.33	1.85
0.350	2.03	1.350	31.02	2.350	3.12	3.35	1.79
0.367	2.03	1.367	31.02	2.367	3.12	3.37	1.79
0.383	2.03	1.383	31.02	2.383	3.12	3.38	1.79
0.400	2.03	1.400	31.02	2.400	3.12	3.40	1.79
0.417	2.03	1.417	31.02	2.417	3.12	3.42	1.79
0.433	2.20	1.433	17.08	2.433	2.92	3.43	1.73
0.450	2.20	1.450	17.08	2.450	2.92	3.45	1.73
0.467	2.20	1.467	17.08	2.467	2.92	3.47	1.73
0.483	2.20	1.483	17.08	2.483	2.92	3.48	1.73
0.500	2.20	1.500	17.08	2.500	2.92	3.50	1.73
0.517	2.41	1.517	11.78	2.517	2.76	3.52	1.68
0.533	2.41	1.533	11.77	2.533	2.76	3.53	1.68
0.550	2.41	1.550	11.77	2.550	2.76	3.55	1.68
0.567	2.41	1.567	11.77	2.567	2.76	3.57	1.68
0.583	2.41	1.583	11.77	2.583	2.76	3.58	1.68
0.600	2.68	1.600	9.02	2.600	2.61	3.60	1.63
0.617	2.68	1.617	9.02	2.617	2.61	3.62	1.63
0.633	2.68	1.633	9.02	2.633	2.61	3.63	1.63
0.650	2.68	1.650	9.02	2.650	2.61	3.65	1.63
0.667	2.68	1.667	9.02	2.667	2.61	3.67	1.63
0.683	3.02	1.683	7.34	2.683	2.48	3.68	1.58
0.700	3.02	1.700	7.34	2.700	2.48	3.70	1.58
0.717	3.02	1.717	7.34	2.717	2.48	3.72	1.58
0.733	3.02	1.733	7.34	2.733	2.48	3.73	1.58
0.750	3.02	1.750	7.34	2.750	2.48	3.75	1.58
0.767	3.47	1.767	6.21	2.767	2.36	3.77	1.54
0.783	3.47	1.783	6.21	2.783	2.36	3.78	1.54
0.800	3.47	1.800	6.21	2.800	2.36	3.80	1.54
0.817	3.47	1.817	6.21	2.817	2.36	3.82	1.54
0.833	3.47	1.833	6.21	2.833	2.36	3.83	1.54
0.850	4.11	1.850	5.40	2.850	2.25	3.85	1.50
0.867	4.11	1.867	5.40	2.867	2.25	3.87	1.50
0.883	4.11	1.883	5.40	2.883	2.25	3.88	1.50
0.900	4.11	1.900	5.40	2.900	2.25	3.90	1.50
0.917	4.11	1.917	5.40	2.917	2.25	3.92	1.50
0.933	5.09	1.933	4.79	2.933	2.16	3.93	1.46
0.950	5.09	1.950	4.79	2.950	2.16	3.95	1.46
0.967	5.09	1.967	4.79	2.967	2.16	3.97	1.46
0.983	5.09	1.983	4.79	2.983	2.16	3.98	1.46
1.000	5.09	2.000	4.79	3.000	2.16	4.00	1.46

Max.Eff.Inten.(mm/hr)=	77.76	2.25	
over (min)	5.00	3.00	
Storage Coeff. (min)=	1.56 (ii)	2.93 (ii)	
Unit Hyd. Tpeak (min)=	5.00	3.00	
Unit Hyd. peak (cms)=	0.41	0.38	
			TOTALS
PEAK FLOW (cms)=	0.07	0.00	0.071 (iii)
TIME TO PEAK (hrs)=	1.35	1.37	1.35
RUNOFF VOLUME (mm)=	23.00	1.41	20.97
TOTAL RAINFALL (mm)=	25.00	25.00	25.00
RUNOFF COEFFICIENT =	0.92	0.06	0.84

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| CHAMBER(0004)| OUTFLOW: OFF, UNDERDRAIN: OFF, INFIL: ON
|IN= 2--> OUT= 3 | CHAMBER:

| DT= 1.0 min | MAX STO VOL (cu.m.)= 112.67 Bottom Area(m2) = 149.90

DEPTH (mm)	STORAGE (cu.m.)	DEPTH (mm)	STORAGE (cu.m.)
0.00	0.00	711.00	63.85
25.00	1.52	737.00	66.46
51.00	3.05	762.00	69.03
76.00	4.57	787.00	71.57
102.00	6.09	813.00	74.05
127.00	7.61	838.00	76.47
152.00	9.14	864.00	78.83
178.00	10.66	889.00	81.14
203.00	12.18	914.00	83.37
229.00	13.70	940.00	85.53
254.00	15.23	965.00	87.58
279.00	16.75	991.00	89.50
305.00	18.27	1016.00	91.21
330.00	21.26	1041.00	92.84
356.00	24.24	1067.00	94.40
381.00	27.20	1092.00	95.92
406.00	30.15	1118.00	97.45
432.00	33.09	1143.00	98.97
457.00	36.00	1168.00	100.49
483.00	38.90	1194.00	102.02
508.00	41.78	1219.00	103.54
533.00	44.63	1245.00	105.06
559.00	47.47	1270.00	106.58
584.00	50.27	1295.00	108.11
610.00	53.05	1321.00	109.63
635.00	55.80	1346.00	111.15
660.00	58.52	1372.00	112.67
686.00	61.20	0.00	0.00

NATIVE SOIL LAYER:
Infiltration (m/hr) = 0.0114

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW:ID= 2	0.42	0.071	1.35	20.97
OVERFLOW:ID= 3	0.00	0.000	0.00	0.00

Volume Reduction Rate[(RVin-RVout)/RVin](%)= 100.00
Time to reach Max storage (Hr)= 4.07
Volume of water for drawdown in LID (cu.m.)= 81.46
Volume of maximum water storage (cu.m.)= 81.53
Calculated Drawdown Time (Hr)= 47.68

| Junction Command(0005) |

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 3(0004)	0.00	0.00	0.00	0.00
OUTFLOW: ID= 2(0005)	0.00	0.00	0.00	0.00

| CALIB STANDHYD (0302) ID= 1 DT= 1.0 min | Area (ha)= 0.20 Total Imp(%)= 37.00 Dir. Conn.(%)= 18.50

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.07	0.13
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	2.00	25.00
Length	(m)=	36.51	18.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	1.56	1.017	6.77	2.017	4.31	3.02	2.07
0.033	1.56	1.033	6.77	2.033	4.31	3.03	2.07
0.050	1.56	1.050	6.77	2.050	4.31	3.05	2.07
0.067	1.56	1.067	6.77	2.067	4.31	3.07	2.07
0.083	1.56	1.083	6.77	2.083	4.31	3.08	2.07
0.100	1.65	1.100	10.39	2.100	3.92	3.10	1.99
0.117	1.65	1.117	10.39	2.117	3.92	3.12	1.99
0.133	1.65	1.133	10.39	2.133	3.92	3.13	1.99
0.150	1.65	1.150	10.39	2.150	3.92	3.15	1.99

0.167	1.65	1.167	10.39	2.167	3.92	3.17	1.99
0.183	1.76	1.183	24.03	2.183	3.61	3.18	1.92
0.200	1.76	1.200	24.03	2.200	3.61	3.20	1.92
0.217	1.76	1.217	24.03	2.217	3.61	3.22	1.92
0.233	1.76	1.233	24.03	2.233	3.61	3.23	1.92
0.250	1.76	1.250	24.03	2.250	3.61	3.25	1.92
0.267	1.88	1.267	77.76	2.267	3.34	3.27	1.85
0.283	1.88	1.283	77.76	2.283	3.34	3.28	1.85
0.300	1.88	1.300	77.76	2.300	3.34	3.30	1.85
0.317	1.88	1.317	77.76	2.317	3.34	3.32	1.85
0.333	1.88	1.333	77.76	2.333	3.34	3.33	1.85
0.350	2.03	1.350	31.02	2.350	3.12	3.35	1.79
0.367	2.03	1.367	31.02	2.367	3.12	3.37	1.79
0.383	2.03	1.383	31.02	2.383	3.12	3.38	1.79
0.400	2.03	1.400	31.02	2.400	3.12	3.40	1.79
0.417	2.03	1.417	31.02	2.417	3.12	3.42	1.79
0.433	2.20	1.433	17.08	2.433	2.92	3.43	1.73
0.450	2.20	1.450	17.08	2.450	2.92	3.45	1.73
0.467	2.20	1.467	17.08	2.467	2.92	3.47	1.73
0.483	2.20	1.483	17.08	2.483	2.92	3.48	1.73
0.500	2.20	1.500	17.08	2.500	2.92	3.50	1.73
0.517	2.41	1.517	11.78	2.517	2.76	3.52	1.68
0.533	2.41	1.533	11.77	2.533	2.76	3.53	1.68
0.550	2.41	1.550	11.77	2.550	2.76	3.55	1.68
0.567	2.41	1.567	11.77	2.567	2.76	3.57	1.68
0.583	2.41	1.583	11.77	2.583	2.76	3.58	1.68
0.600	2.68	1.600	9.02	2.600	2.61	3.60	1.63
0.617	2.68	1.617	9.02	2.617	2.61	3.62	1.63
0.633	2.68	1.633	9.02	2.633	2.61	3.63	1.63
0.650	2.68	1.650	9.02	2.650	2.61	3.65	1.63
0.667	2.68	1.667	9.02	2.667	2.61	3.67	1.63
0.683	3.02	1.683	7.34	2.683	2.48	3.68	1.58
0.700	3.02	1.700	7.34	2.700	2.48	3.70	1.58
0.717	3.02	1.717	7.34	2.717	2.48	3.72	1.58
0.733	3.02	1.733	7.34	2.733	2.48	3.73	1.58
0.750	3.02	1.750	7.34	2.750	2.48	3.75	1.58
0.767	3.47	1.767	6.21	2.767	2.36	3.77	1.54
0.783	3.47	1.783	6.21	2.783	2.36	3.78	1.54
0.800	3.47	1.800	6.21	2.800	2.36	3.80	1.54
0.817	3.47	1.817	6.21	2.817	2.36	3.82	1.54
0.833	3.47	1.833	6.21	2.833	2.36	3.83	1.54
0.850	4.11	1.850	5.40	2.850	2.25	3.85	1.50
0.867	4.11	1.867	5.40	2.867	2.25	3.87	1.50
0.883	4.11	1.883	5.40	2.883	2.25	3.88	1.50
0.900	4.11	1.900	5.40	2.900	2.25	3.90	1.50
0.917	4.11	1.917	5.40	2.917	2.25	3.92	1.50
0.933	5.09	1.933	4.79	2.933	2.16	3.93	1.46
0.950	5.09	1.950	4.79	2.950	2.16	3.95	1.46
0.967	5.09	1.967	4.79	2.967	2.16	3.97	1.46
0.983	5.09	1.983	4.79	2.983	2.16	3.98	1.46
1.000	5.09	2.000	4.79	3.000	2.16	4.00	1.46

Max.Eff.Inten.(mm/hr)=	77.76	4.40		
over (min)	5.00	5.00		
Storage Coeff. (min)=	1.25 (ii)	4.95 (ii)		
Unit Hyd. Tpeak (min)=	5.00	5.00		
Unit Hyd. peak (cms)=	0.44	0.23		
			TOTALS	
PEAK FLOW (cms)=	0.01	0.00	0.008 (iii)	
TIME TO PEAK (hrs)=	1.35	1.40	1.35	
RUNOFF VOLUME (mm)=	24.00	1.98	6.04	
TOTAL RAINFALL (mm)=	25.00	25.00	25.00	
RUNOFF COEFFICIENT =	0.96	0.08	0.24	

***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB			
NASHYD (0303)	Area (ha)=	0.10	Curve Number (CN)= 51.0
ID= 1 DT= 1.0 min	Ia (mm)=	4.85	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)=	0.07	

NOTE: RAINFALL WAS TRANSFORMED TO 1.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.017	1.56	1.017	6.77	2.017	4.31	3.02	2.07
0.033	1.56	1.033	6.77	2.033	4.31	3.03	2.07
0.050	1.56	1.050	6.77	2.050	4.31	3.05	2.07
0.067	1.56	1.067	6.77	2.067	4.31	3.07	2.07
0.083	1.56	1.083	6.77	2.083	4.31	3.08	2.07
0.100	1.65	1.100	10.39	2.100	3.92	3.10	1.99
0.117	1.65	1.117	10.39	2.117	3.92	3.12	1.99
0.133	1.65	1.133	10.39	2.133	3.92	3.13	1.99
0.150	1.65	1.150	10.39	2.150	3.92	3.15	1.99
0.167	1.65	1.167	10.39	2.167	3.92	3.17	1.99
0.183	1.76	1.183	24.03	2.183	3.61	3.18	1.92
0.200	1.76	1.200	24.03	2.200	3.61	3.20	1.92
0.217	1.76	1.217	24.03	2.217	3.61	3.22	1.92
0.233	1.76	1.233	24.03	2.233	3.61	3.23	1.92
0.250	1.76	1.250	24.03	2.250	3.61	3.25	1.92
0.267	1.88	1.267	77.76	2.267	3.34	3.27	1.85
0.283	1.88	1.283	77.76	2.283	3.34	3.28	1.85
0.300	1.88	1.300	77.76	2.300	3.34	3.30	1.85
0.317	1.88	1.317	77.76	2.317	3.34	3.32	1.85
0.333	1.88	1.333	77.76	2.333	3.34	3.33	1.85
0.350	2.03	1.350	31.02	2.350	3.12	3.35	1.79
0.367	2.03	1.367	31.02	2.367	3.12	3.37	1.79
0.383	2.03	1.383	31.02	2.383	3.12	3.38	1.79
0.400	2.03	1.400	31.02	2.400	3.12	3.40	1.79
0.417	2.03	1.417	31.02	2.417	3.12	3.42	1.79
0.433	2.20	1.433	17.08	2.433	2.92	3.43	1.73
0.450	2.20	1.450	17.08	2.450	2.92	3.45	1.73
0.467	2.20	1.467	17.08	2.467	2.92	3.47	1.73
0.483	2.20	1.483	17.08	2.483	2.92	3.48	1.73
0.500	2.20	1.500	17.08	2.500	2.92	3.50	1.73
0.517	2.41	1.517	11.78	2.517	2.76	3.52	1.68
0.533	2.41	1.533	11.77	2.533	2.76	3.53	1.68
0.550	2.41	1.550	11.77	2.550	2.76	3.55	1.68
0.567	2.41	1.567	11.77	2.567	2.76	3.57	1.68
0.583	2.41	1.583	11.77	2.583	2.76	3.58	1.68
0.600	2.68	1.600	9.02	2.600	2.61	3.60	1.63
0.617	2.68	1.617	9.02	2.617	2.61	3.62	1.63
0.633	2.68	1.633	9.02	2.633	2.61	3.63	1.63
0.650	2.68	1.650	9.02	2.650	2.61	3.65	1.63
0.667	2.68	1.667	9.02	2.667	2.61	3.67	1.63
0.683	3.02	1.683	7.34	2.683	2.48	3.68	1.58
0.700	3.02	1.700	7.34	2.700	2.48	3.70	1.58
0.717	3.02	1.717	7.34	2.717	2.48	3.72	1.58
0.733	3.02	1.733	7.34	2.733	2.48	3.73	1.58
0.750	3.02	1.750	7.34	2.750	2.48	3.75	1.58
0.767	3.47	1.767	6.21	2.767	2.36	3.77	1.54
0.783	3.47	1.783	6.21	2.783	2.36	3.78	1.54
0.800	3.47	1.800	6.21	2.800	2.36	3.80	1.54
0.817	3.47	1.817	6.21	2.817	2.36	3.82	1.54
0.833	3.47	1.833	6.21	2.833	2.36	3.83	1.54
0.850	4.11	1.850	5.40	2.850	2.25	3.85	1.50
0.867	4.11	1.867	5.40	2.867	2.25	3.87	1.50
0.883	4.11	1.883	5.40	2.883	2.25	3.88	1.50
0.900	4.11	1.900	5.40	2.900	2.25	3.90	1.50
0.917	4.11	1.917	5.40	2.917	2.25	3.92	1.50
0.933	5.09	1.933	4.79	2.933	2.16	3.93	1.46
0.950	5.09	1.950	4.79	2.950	2.16	3.95	1.46
0.967	5.09	1.967	4.79	2.967	2.16	3.97	1.46
0.983	5.09	1.983	4.79	2.983	2.16	3.98	1.46
1.000	5.09	2.000	4.79	3.000	2.16	4.00	1.46

Unit Hyd Qpeak (cms)= 0.053

PEAK FLOW (cms)= 0.001 (i)
TIME TO PEAK (hrs)= 1.433
RUNOFF VOLUME (mm)= 1.534
TOTAL RAINFALL (mm)= 24.998
RUNOFF COEFFICIENT = 0.061

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0008)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0302):		0.20	0.008	1.35	6.04
+ ID2= 2 (0303):		0.10	0.001	1.43	1.53
ID = 3 (0008):		0.30	0.009	1.37	4.56

```
     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0009)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH   0005 <ID= 1> IS DRY.
*** W A R N I N G :  HYDROGRAPH   0009 = HYDROGRAPH 0008
        ID1= 1 (  0005):     0.00   0.000     0.00     0.00
      + ID2= 2 (  0008):     0.30   0.009     1.37     4.56
        ==========================================================
        ID = 3 (  0009):     0.30   0.009     1.37     4.56

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

 FINISH
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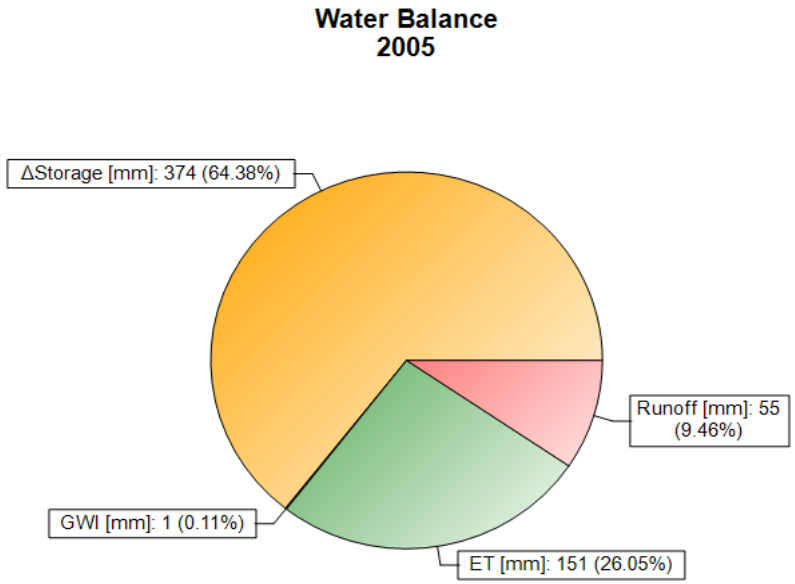
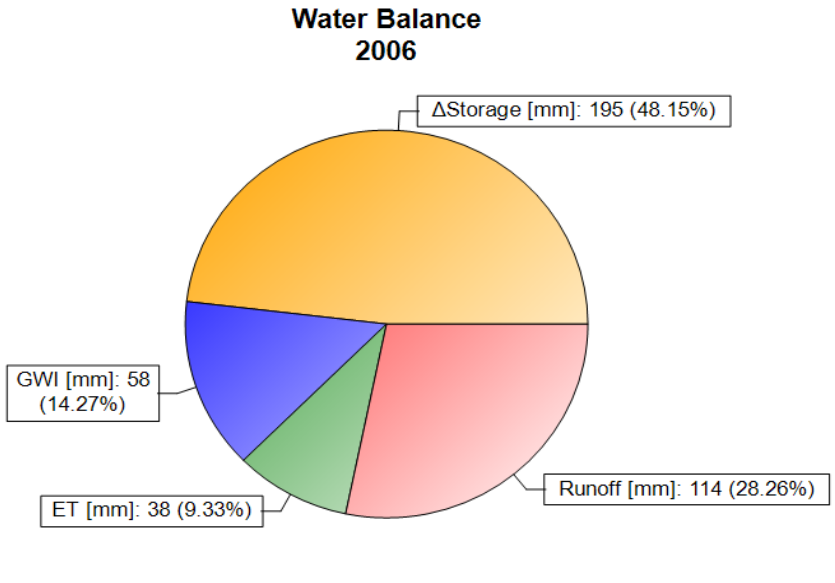
OTTHYMO Continuous Simulation Modelling - Block 192

Addhyd 7 - Water Balance Output

Period	Precipitation (mm)	Rain (mm)	Snow (mm)	Snowmelt (mm)	ET (mm)	INFIL (mm)	GWI (mm)	Runoff (mm)	Δ Storage	Runoff Coef
2005	580.2	489.5	90.7	51.3	151.2	389.7	0.6	54.9	373.5	0.1
2006	404.1	242.4	161.7	366.8	37.7	308.7	57.7	114.2	194.6	0.3
Avg	492.2	365.9	126.2	209.0	94.4	349.2	29.1	84.5	284.0	0.2
Total	984.3	731.9	252.4	418.1	188.8	698.4	58.3	169.1	568.1	-

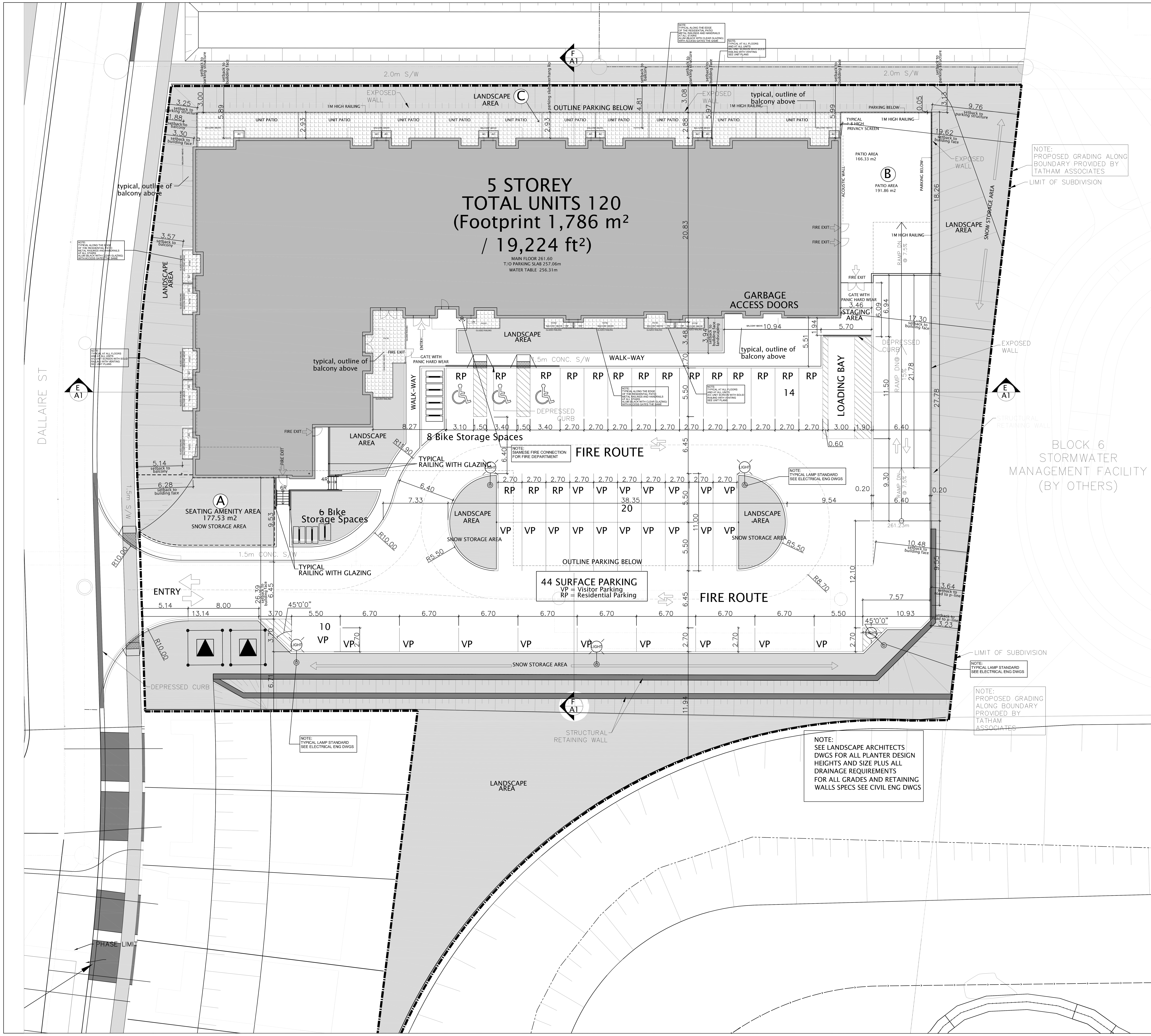


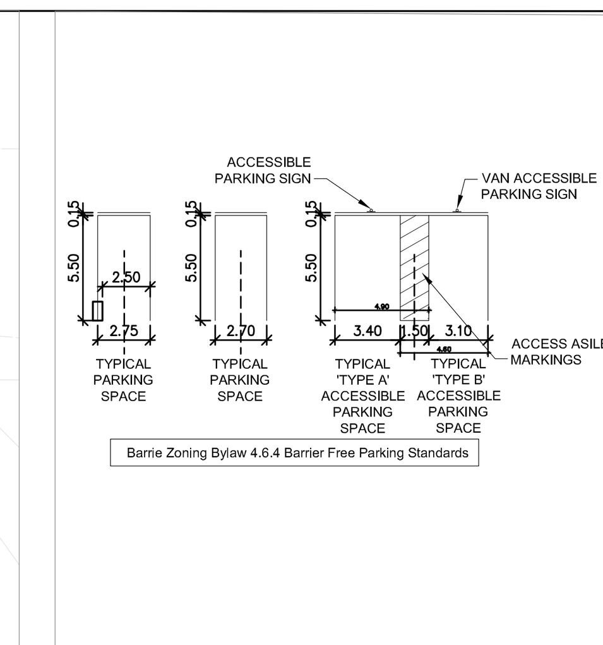


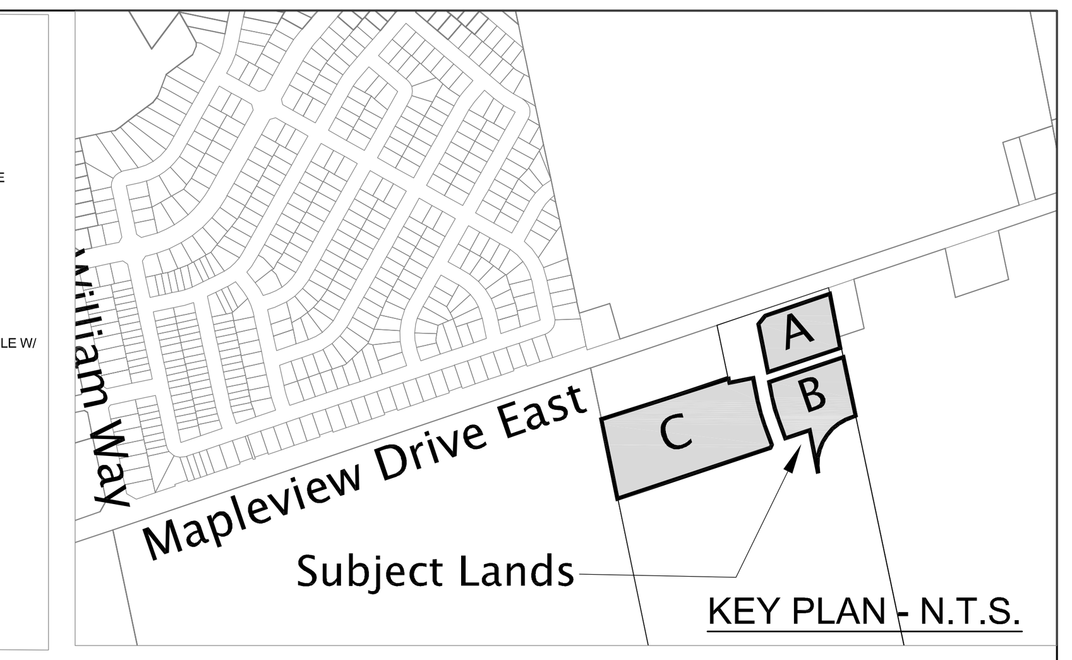
Appendix D

Supporting Documents

- 953 Mapleview Drive – Block-192 Site Plan, S&C Architects Inc., June 14, 2024
- 953 Mapleview Drive – Proposed Draft Plan of Subdivision, TJCG, Dec 2019
- Simcoe County Soils Map Excerpt, Report No. 29
- Drawing No. SWM-3, Mapleview South Subdivision Phase 1 Registration Drawings, TJCG, May 2021
- Drawing No. STM-1, Mapleview South Subdivision Phase 1 Registration Drawings, TJCG, May 2021
- Water Balance for Pre- and Post-Development Land Use Conditions – Site Plan Block 192, prepared by RJB







Block 'B' Details

B BUILDING FOOT PRINT
(3.2.2.43A GROUP C)

ALLOWABLE	1,800 m2
PROPOSED	1,792 m2

Unit Count:

BLOCK 'B' Apartment Building (5 Storey)	120 units
Total	120 units

	REQUIRED	PROPOSED
Site Plan Area	-	0.74 ha.(7,363.63m2)
Lot Frontage	24.0 m	70.9 m
Front Yard	3.0 m	3.28 m
Interior Side Yard	5.0 m	5.89 m
Exterior Side Yard	1.8 m	26.39 m
Rear Yard	5.0 m	17.32 m
Lot Coverage	max 50 % (0.36 ha.)	24 % (0.18 ha.)
Accessory Structures	max 10 % (0.07 ha.)	0 % (0.00 ha.)
Landscape Open Space	min. 25 % (0.18 ha.)	48 % (0.34 ha.)
Paved Area	max 35 %	28 % (0.21 ha.)
Density Index	min 120 max 300	162.16
Floor Space Index	min 0.5 max 2.5	1.22

Building Block B

. GFA	8,930 m2
. Height in Stories	5
Units	120

Parking Calculations	Required	Provided
Required Parking (120 x 1.0)	120 spaces	120 spaces
Required Visitor Parking (120 x 0.5=60)	60 spaces	
Proposed Visitor Parking (120 x 0.2=24)		27 spaces
Total Required	180 spaces	147 spaces

Parking Breakdown	
Typical Surface Spaces	41 spaces
Surface Barrier Free Spaces	3 spaces
Underground Barrier Free Spaces	3 spaces
Typical Underground Spaces	100 spaces
Total Provided	147 spaces

Barrie Zoning Bylaw 4.6.4 Barrier Free Parking
Barrier Free spaces calculated using Accessibility Parking for Barrie Ont.
Required over 100 spaces 1 space plus 3% of the required parking spaces
3% of 147 =4.41 (5) plus 1 = 6 (6 required, provided 6)
(Type A - 3.4 x 1.5 - 3 spaces)
(Type B - 3.1 x 1.5 - 3 spaces)

Bicycle Rack Storage (.2 x 120)	24 Required	22 Secure Storage Provided 14 Surface Bike Racks Provided
Total		36 Bikes

Required Outdoor Amenity Area (10m²/unit-10x120) 1200 m²

Provided Amenity Breakdown For Condo Building

Provided Outdoor Amenity

Garden Amenity At Entry, A	177.53 m²
Patio area on east side , B	191.86 m²
Patio area over parking structure at North side, C	232.70 m²
Patio area at ground floor Units at East and South	87.00 m²
Balcony area at typical floors (157.68 X 4 floors)	630.72 m²
Total Outdoor Amenity	1319.81 m²

Provided Shared Indoor Amenity

lounge/meeting rooms Amenity Plus public Washrooms	158.52 m²
Total In door Amenity	158.52 m²

Fire Route - - - - - - - - - - - - - - -

Unit type and area per floor AFFORDABLE UNIT *

Unit	Area	Unit Type	Main floor	2nd floor	3rd floor	4th floor	5th floor	
A	55m	1 bed 1 bath	7	7	7	7	7	35
B *	34m	Bachelor	2	2	2	2	2	10
C *	49m	1 bed/1 bath	1	1	1	1	1	5
D	55m	1 bed/1 bath/den	1	1	1	1	1	5
E	50m	1 bed/1 bath	3	4	4	4	4	19
E+	52m	1 bed/1 bath	1	1	1	1	1	5
F	58m	1 bed/1 bath	1	1	1	1	1	5
G	63m	1 bed/1 bath/den		2	2	2	2	8
H	86m	2 bed/2 bath	2	2	2	2	2	10
I	98m	2 bed/2 bath/den		1	1	1	1	4
J	70m	2 bed/2 bath		1	1	1	1	4
K	106m	3 bed/2 bath	1	1	1	1	1	5
L	80m	2 bed/2 bath	1	1	1	1	1	5
			20	25	25	25	25	120

Total Units	120
Affordable Units *	15

No.	Description	Date	Rev.
15	ISSUED FOR PRE-CONSULTATION MEETING	JUN 14, 2024	
14	ISSUED FOR PRE-CONSULTATION MEETING	May 06, 2024	
13	ISSUED FOR PRE-CONSULTATION MEETING	April 15, 2024	
12	ISSUED FOR PRE-CONSULTATION MEETING	April 12, 2024	
11	ISSUED FOR PRE-CONSULTATION MEETING	April 11, 2024	
12	ISSUED FOR PRE-CONSULTATION MEETING	April 05, 2024	
11	ISSUED FOR PRE-CONSULTATION MEETING	Mar 28, 2024	
10	ISSUED FOR PRE-CONSULTATION MEETING	Mar 19, 2024	
9	ISSUED FOR PRE-CONSULTATION MEETING	Feb 26, 2024	
8	ISSUED FOR PRE-CONSULTATION MEETING	Feb 07, 2024	
7	ISSUED FOR PRE-CONSULTATION MEETING	Nov 27, 2023	
6	ISSUED FOR PRE-CONSULTATION MEETING	Nov 16, 2023	
5	ISSUED FOR PRE-CONSULTATION MEETING	Oct 24, 2023	
4	ISSUED FOR PRE-CONSULTATION MEETING	July 18, 2023	
3	ISSUED FOR CLIENT AND CONSULTANT REVIEW	May 24, 2023	
2	ISSUED FOR CLIENT AND CONSULTANT REVIEW	Aril 20, 2023	
1	ISSUED FOR CLIENT AND CONSULTANT REVIEW	March 30, 2023	SA

CLIENT: MAPLEVIEW SOUTH (INNISFIL) LTD.

953 MAPLEVIEW DRIVE-BLOCK-192
SITE PLAN 120 UNITS

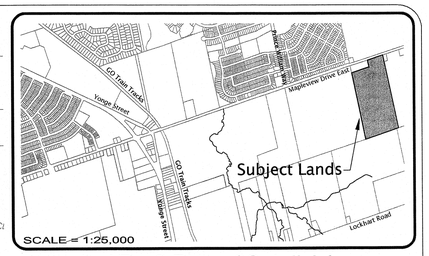
ELEVATION:
Drawing No. A-101

TOTAL AREA:

DATE ISSUED: March 30,2023

PROJECT #: 2023-05
MARKETING NAME: -
SCALE: 1:200
MUNICIPALITY: City of Barrie

S&C ARCHITECTS INC.
T:(416)848-0991 F:(416)860-6101
INFO@SCARCHITECTS.CA
60 RANDALL DRIVE SUITE 10
AJAX, ONTARIO L1S 6L3



Proposed Draft Plan of Subdivision

Part of Lot 19, Concession 11
Geographic Township of Innisfil,
Now in the
City of Barrie 2021

OWNER'S CERTIFICATE

I, THE UNDERSIGNED, BEING THE REGISTERED OWNER OF THE SUBJECT LANDS, HEREBY AUTHORIZE THE JONES CONSULTING GROUP LTD., TO PREPARE THIS DRAFT PLAN OF SUBDIVISION AND TO SUBMIT SAME TO THE CITY OF BARRIE FOR APPROVAL.

April 12, 2021 — DATE

MAPLEVIEW SOUTH (INNISFIL) LTD.
ANTHONY REINO, A.S.O.

SURVEYOR'S CERTIFICATE

I CERTIFY THAT THE BOUNDARIES OF THE LANDS TO BE SUBDIVIDED AND THEIR RELATIONSHIP TO ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.

April 7, 2021 — DATE

RUDY MAK, O.L.S.

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51(17) OF THE PLANNING ACT

a) SHOWN ON DRAFT PLAN
b) SHOWN ON DRAFT PLAN
c) SHOWN ON KEY PLAN
d) RESIDENTIAL, OPEN SPACE, STORMWATER MANAGEMENT, & ENVIRONMENTAL PROTECTION
e) SHOWN ON DRAFT PLAN
f) SHOWN ON DRAFT PLAN
g) SHOWN ON DRAFT PLAN
h) MUNICIPAL PIPED WATER TO BE PROVIDED
i) SANDY/CLAY LOAM
j) SHOWN ON DRAFT PLAN
k) ALL MUNICIPAL SERVICES TO BE PROVIDED
l) SHOWN ON DRAFT PLAN

STATISTICS	Area (ha.)	Units
★ 13.7 m Singles		48 units
■ 11.5 m Singles		66 units
○ 10.4 m Singles		30 units
▾ 9.0 m Singles (LOTS 1 - 183)		39 units
SUB TOTAL	6.34 ha.	183 units
Street Townhomes (6.0m) (BLOCKS 184 - 193)	1.45 ha.	74 units
Medium Density Residential (BLOCKS 194 - 196 @ 70 uph)	2.93 ha.	205 units
Future Lots & Blocks (BLOCKS 197 - 204)	0.14 ha.	4 units
Open Space (BLOCK 205)	0.01 ha.	
Environmental Protection (BLOCKS 206 - 208)	2.78 ha.	
Stormwater Management & Drainage (BLOCKS 209 - 211)	1.41 ha.	
Widening & Reserve (BLOCKS 212 - 218)	0.14 ha.	
Roads (MINOR COLLECTOR, STREET 'A') (MAJOR COLLECTOR, STEET 'B') (LOCAL STREETS 'C' - 'F')	3.83 ha.	
TOTAL	19.03 ha.	466 units

0 10 50 100M
SCALE 1 : 1500 (A1)

MAPLEVIEW SOUTH (INNSIFIL) LTD.
953 MAPLEVIEW DRIVE, BARRIE, ONTARIO

PROPOSED DRAFT PLAN OF SUBDIVISION

Raymond J. Dumanski REGISTERED PROFESSIONAL PLANNER R.P.P.

Date Issued:	DEC. 13, 2019
Checked By:	RD
Project No.:	REI-17055
Drawn By:	m.c.r.
Drawing Name:	REI-17055-DP-4B.dwg

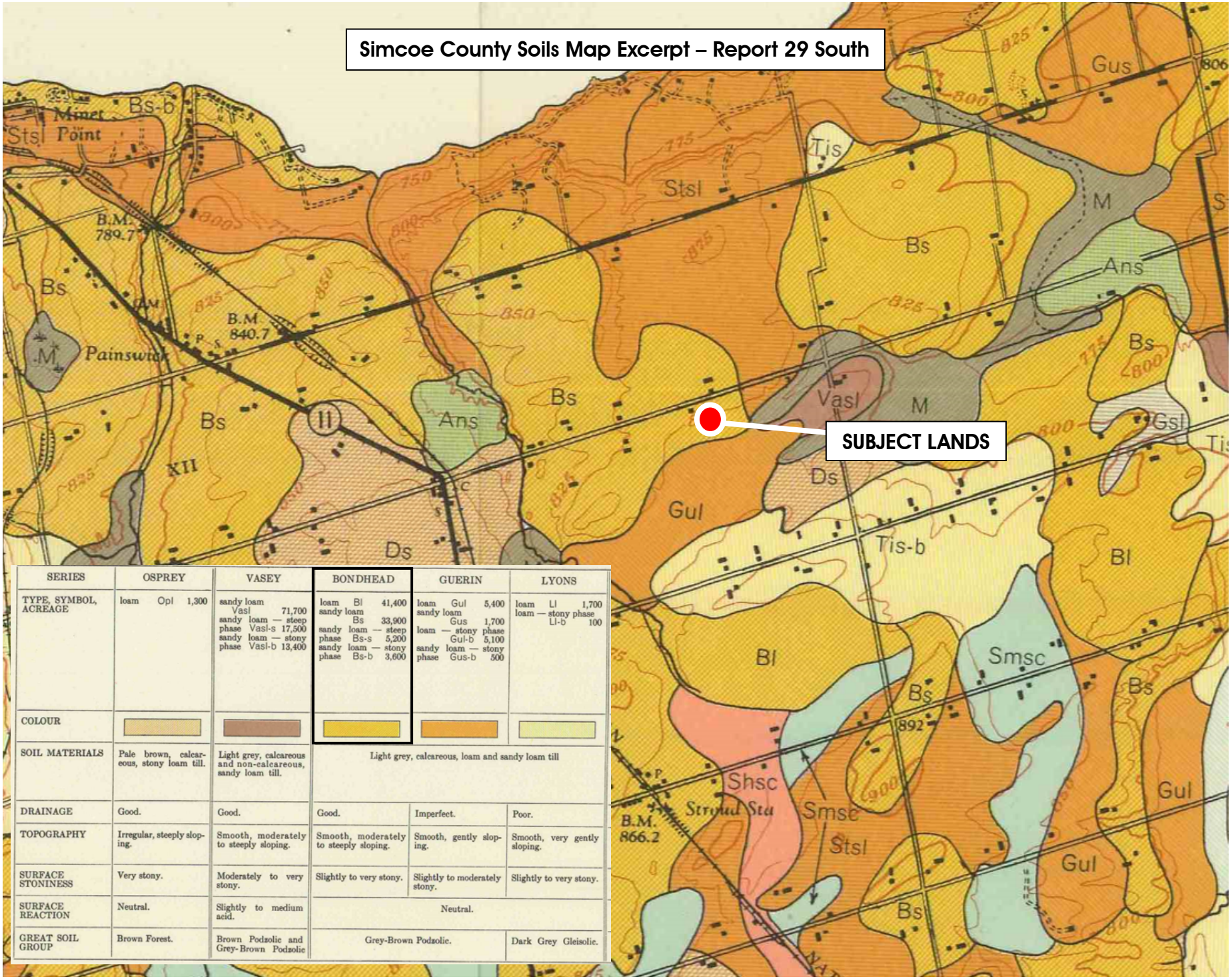
JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS

229 Mapleview Drive East, Unit 1, Barrie, Ontario, L4N 0W5
Phone: 705-734-2538 Fax: 705-734-1056
www.jonesconsulting.com

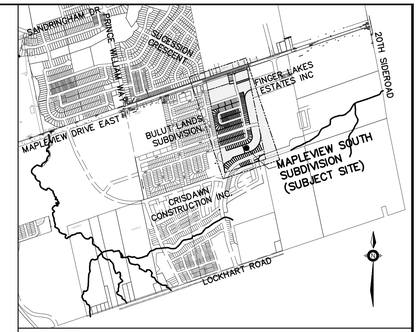
SCHEDULE OF REVISIONS		
DATE	DESCRIPTION	DRAWN
FEB. 25, 2021	CHANGES AS PER ENG COMMENTS/SWM POND REVISION	m.c.r.
MARCH 5, 2021	REVISION TO LOTS 172 & 173	m.c.r.
APRIL 1, 2021	MINOR CHANGES TO TITLE BLOCK ONLY	m.c.r.

MAPLEVIEW SOUTH (INNSIFIL) LTD.
953 MAPLEVIEW DRIVE BARRIE, ONTARIO

Simcoe County Soils Map Excerpt – Report 29 South



SERIES	OSPREY	VASEY	BONDHEAD	GUERIN	LYONS
TYPE, SYMBOL, ACREAGE	loam Opl 1,300	sandy loam Vasl 71,700 sandy loam — steep phase Vasl-s 17,500 sandy loam — stony phase Vasl-b 13,400	loam Bl 41,400 sandy loam Bs 33,900 sandy loam — steep phase Bs-s 5,200 sandy loam — stony phase Bs-b 3,600	loam Gul 5,400 sandy loam Gus 1,700 loam — stony phase Gul-b 5,100 sandy loam — stony phase Gus-b 500	loam Ll 1,700 loam — stony phase Ll-b 100
COLOUR					
SOIL MATERIALS	Pale brown, calcareous, stony loam till.	Light grey, calcareous and non-calcareous, sandy loam till.	Light grey, calcareous, loam and sandy loam till		
DRAINAGE	Good.	Good.	Good.	Imperfect.	Poor.
TOPOGRAPHY	Irregular, steeply sloping.	Smooth, moderately to steeply sloping.	Smooth, moderately to steeply sloping.	Smooth, gently sloping.	Smooth, very gently sloping.
SURFACE STONINESS	Very stony.	Moderately to very stony.	Slightly to very stony.	Slightly to moderately stony.	Slightly to very stony.
SURFACE REACTION	Neutral.	Slightly to medium acid.	Neutral.		
GREAT SOIL GROUP	Brown Forest.	Brown Podzolic and Grey-Brown Podzolic	Grey-Brown Podzolic.		Dark Grey Gleisolic.



KEY PLAN
NTS

LEGEND

*B.O. – BY OTHERS

- LIMIT OF SUBDIVISION
- PHASE LIMIT
- STM 01 (B.O.) — STORM MAINTENANCE HOLE (B.O.)
- CB (B.O.) — SINGLE CATCHBASIN (B.O.)
- DCB (B.O.) — DOUBLE CATCHBASIN (B.O.)
- STORM SEWER & DIRECTION OF FLOW (B.O.)
- STM 25 — PROP. STORM MAINTENANCE HOLE
- CB — PROP. CATCH BASIN
- DCB — PROP. DOUBLE CATCH BASIN
- PROP. STORM SEWER & DIRECTION OF FLOW
- 173 — LOT NUMBER
- POOLS AND RIFFLES (BY TATHAM)
- PROP. CREEK CENTERLINE (BY TATHAM)
- STORM SEWER, EXFILTRATION TRENCH & DIRECTION OF FLOW
- LID SUBCATCHMENT BOUNDARY
- CATCHMENT BOUNDARY

12–A (OVERALL / LID CATCHMENT AREA ID NUMBER)
1.03 65% (AREA (ha.), IMPERVIOUSNESS)

- DIRECTION OF POST DEVELOPMENT 100 YEAR STORM EVENT OVERLAND FLOW
- 253.00 — EX. CONTOUR AND ELEVATION

ALL CB'S AND DCB'S TO BE EQUIPPED WITH CB SHIELDS. REFER TO DETAIL ON DRAWING DET–2

REFER TO DRAWING DET–1 FOR EXFILTRATION TRENCH DETAIL

REFERENCES:

1. CITY OF BARRIE LATEST MANUALS AND GUIDELINES
2. OPSD AND OPSS
3. CRYSTAL HOMES SUBDIVISION DEVELOPMENT BY TATHAM ENGINEERING LIMITED
4. SANDY CLOVE CREEK REALIGNMENT BY TATHAM ENGINEERING LIMITED
5. BULUT LANDS SUBDIVISION DEVELOPMENT BY SCHAEFFERS CONSULTING ENGINEERING
6. DRAFT PLAN OF MAPLEVIEW SOUTH SUBDIVISION BY JONES CONSULTING GROUP LTD.
7. MAPLEVIEW DRIVE EAST WIDENING BY R.J. BURNSIDE & ASSOCIATES LIMITED
8. OLS PLAN BY RUDY MAK SURVEYING LTD.
9. AMAN GROUP RESIDENTIAL DEVELOPMENT BY PEARSON ENGINEERING LTD.
10. HEWITT'S GATE EAST PHASE 3 BRADLEY HOMES BY JONES CONSULTING GROUP LTD.
11. GEOTECHNICAL INVESTIGATION REPORT BY CAMBIUM INCORPORATION
12. HYDROGEOLOGICAL ASSESSMENT BY R.J. BURNSIDE & ASSOCIATES LIMITED
13. HEWITT'S SECONDARY PLAN AREA SIS BY R.J. BURNSIDE & ASSOCIATES LIMITED
14. LSRCA LATEST MANUALS AND GUIDELINES

BENCHMARK:

BENCHMARK NO. 03120080055 LOCATED APPROXIMATELY 1.9km EAST OF YONGE STREET, APPROXIMATELY 6m NORTH OF CENTERLINE OF MAPLEVIEW DRIVE EAST AND 30m WEST OF CITY BOUNDARY LINE. N4912122.851 E611241.154 ELEV 223.039
BENCHMARK NO. 03120110020 LOCATED ON MAPLEVIEW DRIVE EAST ON THE SOUTH SIDE OF THE BOULEVARD, APPROXIMATELY 790m WEST OF THE MAPLEVIEW DRIVE EAST AND 20TH SIDE ROAD INTERSECTION. N4912264.547 E611717.298 ELEV 225.549
BENCHMARK NO. 03120080008, LOCATED ON THE NORTH SIDE OF MAPLEVIEW DRIVE EAST (12TH CONCESSION ROAD), APPROXIMATELY 0.8km EAST OF YONGE STREET (HWY #11) AND APPROXIMATELY 10.0m NORTH OF MAPLEVIEW DRIVE EAST CENTERLINE. N4911763.816 E610187.698 ELEV 211.834
BENCHMARK NO: 03120080054 LOCATED ON THE SOUTH LIMIT OF MAPLEVIEW DRIVE WEST APPROXIMATELY 1km EAST OF HURONIA ROAD. N4910878.122 E607601.062 ELEV 248.996

NO.	REVISIONS	DATE	INITIAL
3.	DETAILED DESIGN SUBMISSION	JUN 2023	RC
2.	FSR SUBMISSION – UPDATED	JUN 2022	MF
1.	FSR SUBMISSION FOR DRAFT PLAN	JUN 2021	DR

LICENSED PROFESSIONAL ENGINEER — M. CHATTOPADHYAY — 100128869 — June 16/2023 — PROVINCE OF ONTARIO

Barrie
70 COLLIER STREET
BARRIE, ONTARIO, L4M 4T5
TEL: (705)726-4242
EMAIL: SERVICE.BARRIE@BARRIE.CA

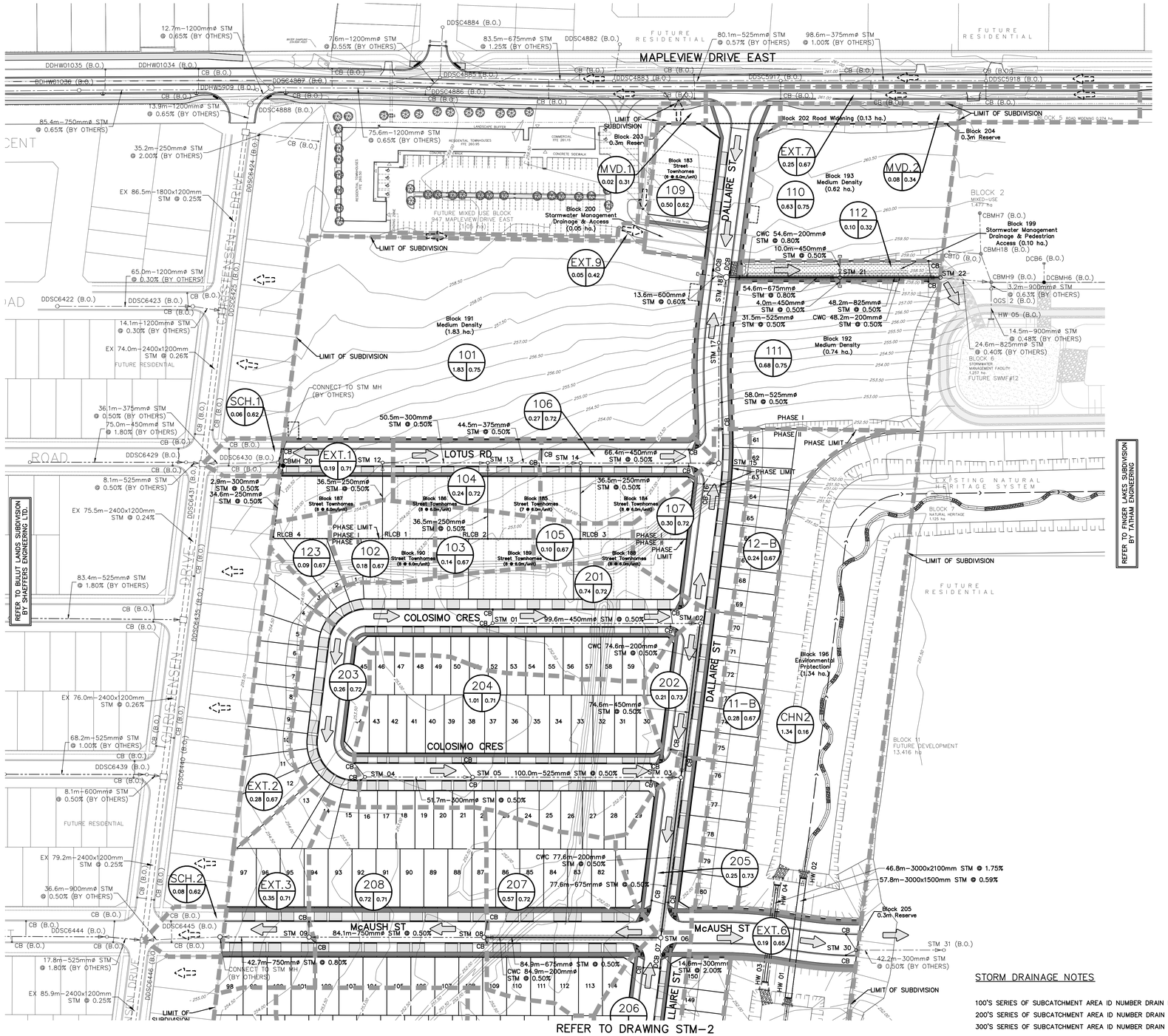
Lake Simcoe Region conservation authority
120 BAYVIEW PARKWAY
NEWMARKET, ONTARIO, L3Y 3W3
TEL: (905)895-1281
TOLL FREE: 1-800-465-0437

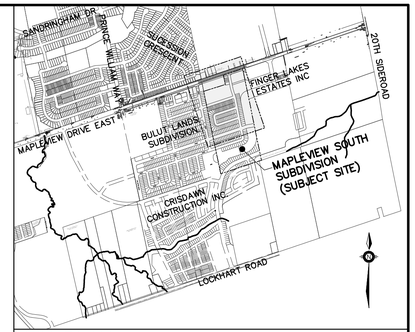
MAPLEVIEW SOUTH (INNISFIL) LTD
953 MAPLEVIEW DRIVE EAST
CITY OF BARRIE

LID – EXFILTRATION SYSTEM DRAINAGE AREA PLAN

JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	VBS	SCALE: 1:1500	DATE MAR 2023
DRAWN	VBS	PROJECT REI–17055	DWG. Nº SWM–3
CHECKED	RC/DR		





KEY PLAN
NTS

LEGEND
*B.O. – BY OTHERS

- PROP. SANITARY SERVICE
- PHASE LIMIT
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- DCB (B.O.) — DOUBLE CATCHBASIN (B.O.)
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- CB — PROP. CATCH BASIN
- DCB — PROP. DOUBLE CATCH BASIN
- PROP. STORM SEWER & DIRECTION OF FLOW
- STORM SEWER, EXFILTRATION TRENCH & DIRECTION OF FLOW
- 105 / 1.03 / 0.65 — CATCHMENT AREA ID NUMBER; RUN-OFF COEFFICIENT; AREA (ha.)
- DIRECTION OF POST DEVELOPMENT 100 YEAR STORM EVENT OVERLAND FLOW
- 253.00 — EX. CONTOUR AND ELEVATION
- DIRECTION OF EXISTING EXTERNAL OVERLAND FLOW
- 50 — MUNICIPAL ADDRESS
- 173 — LOT NUMBER
- POOLS AND RIFFLES (BY TATHAM)
- PROP. CREEK CENTERLINE (BY TATHAM)

STORM DRAINAGE NOTES

100'S SERIES OF SUBCATCHMENT AREA ID NUMBER DRAIN INTO SWMF#12
200'S SERIES OF SUBCATCHMENT AREA ID NUMBER DRAIN INTO SWMF#11
300'S SERIES OF SUBCATCHMENT AREA ID NUMBER DRAIN INTO SWMF#17

REFERENCES:
1. CITY OF BARRIE LATEST MANUALS AND GUIDELINES
2. OPSD AND OPSS
3. CRYSTAL HOMES SUBDIVISION DEVELOPMENT BY TATHAM ENGINEERING LIMITED
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7. MAPLEVIEW DRIVE EAST WIDENING BY R.J. BURNSIDE & ASSOCIATES LIMITED
8. OLD PLAN BY RUDY MAK SURVEYING LTD.
9. AWAN GROUP RESIDENTIAL DEVELOPMENT BY PEARSON ENGINEERING LTD.
10. HEWITT'S GATE EAST PHASE 3 BRADLEY HOMES BY JONES CONSULTING GROUP LTD.
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1.	FSR SUBMISSION FOR DRAFT PLAN	JUN 2021	DR

LICENSED PROFESSIONAL ENGINEER — M. CHATTOPADHYAY — 100128685 — PROVINCE OF ONTARIO — June 16, 2023

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70 COLLIER STREET
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Lake Simcoe Region conservation authority
120 BAYVIEW PARKWAY
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TEL: (905)895-1281
TOLL FREE: 1-800-465-0437

MAPLEVIEW SOUTH (INNISFIL) LTD
953 MAPLEVIEW DRIVE EAST
CITY OF BARRIE

STORM SEWER SUBCATCHMENT PLAN

JONES CONSULTING GROUP LTD. PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	VBS	SCALE: 1:1000	DATE FEB 2023
DRAWN	VBS	PROJECT REI-17055	DWG. Nº STM-1
CHECKED	RC/DR		

WATER BALANCE CALCULATIONS
Mapleview South - Block 192
Mapleview South (Innisfil) Ltd.
Barrie, ON
PROJECT No.300042309

BURNSIDE

TABLE F-3

Water Balance for Pre- and Post-Development Land Use Conditions (with no SWM/LID measures in place)
Site Plan Block 192

Land Use Description	Approx. Land Area* (m^2)	Estimated Impervious Fraction for Land Use*	Estimated Impervious Area (m^2)	Runoff from Impervious Area** (m/a)	Runoff Volume from Impervious Area (m^3/a)	Estimated Pervious Area (m^2)	Runoff from Pervious Area** (m/a)	Runoff Volume from Pervious Area (m^3/a)	Infiltration from Pervious Area** (m/a)	Infiltration Volume from Pervious Area (m^3/a)	Total Runoff Volume (m^3/a)	Total Infiltration Volume (m^3/a)
Pre-Development Land Use												
Natural Heritage System / Wetland	185	0.00	0	0.793	0	185	0.136	25	0.204	38	25	38
Open Space /Agricultural	7,122	0.00	0	0.793	0	7,122	0.136	968	0.204	1,452	968	1,452
Rural Residential	93	0.25	23	0.793	18	70	0.132	9	0.204	14	28	14
TOTAL PRE-DEVELOPMENT	**7,400**		**23**		**18**	**7,377**		**1,002**		**1,504**	**1,021**	**1,504**
Post-Development Land Use (with no LID measures in place)												
Buildings	1,800	1.00	1,800	0.793	1,427	0	0.132	0	0.246	0	1,427	0
Pavement	3,000	1.00	3,000	0.793	2,379	0	0.132	0	0.246	0	2,379	0
Landscaped	2,400	0.00	0	0.793	0	2,400	0.132	318	0.246	590	318	590
Landscaped with Underground Parking	200	1.00	200	0.793	159	0	0.132	0	0.246	0	159	0
TOTAL POST-DEVELOPMENT	**7,400**		**5,000**		**3,965**	**2,400**		**318**		**590**	**4,282**	**590**
									% Change from Pre to Post		420	61
									Effect of development (with no mitigation)		4.2 times increase in runoff	61% reduction of infiltration

* data provided by Jones Consulting Group Ltd.

** figures from Tables F-1 and F-2

To balance pre- to post-,
the infiltration target (m^3/a)= **914**

WATER BALANCE CALCULATIONS
Mapleview South - Block 192
Mapleview South (Innisfil) Ltd.
Barrie, ON
PROJECT No.300042309

TABLE F-4

Water Balance Mitigation Strategy Direct Runoff to Infiltration Facility					
Total Area (m^2)	**Total Annual Precipitation (m)***	**Runoff Volume from Impervious Area (m^3/a)*****	**Runoff Volume from Pervious Area (m^3/a)*****	**Total Runoff Volume (m^3/a)**	**Potential Infiltration (m^3/a) in Facility (assumes 71% capture of total annual runoff volume)****
7,400	0.933	3,965	318	4,282	3,040

* values from Barrie WPCC climate station

** based on data provided by Jones Consulting

*** figures from Table F-3