FUNCTIONAL SERVICING REPORT

SAINT ELIZABETH VILLAGE

(Village Square)

MARCH 20, 2024 (REV.1)

City of Hamilton

LandSmith
ENGINEERING & CONSULTING LTD.

TABLE OF CONTENTS

1. Introduction

1.1. Background

LandSmith Engineering & Consulting Ltd. have been retained by Zest Communities Inc. for the completion of a *Functional Servicing Report* in support of the development of the north-east area of the Saint Elizabeth Village lands which are located at 393 Rymal Road West in the City of Hamilton. The parcel which is being analyzed is in the process of being severed from the balance of the lands of Saint Elizabeth Village and is to be developed as described below.

The purpose of this report is to illustrate how the development of this property from primarily vacant land to apartment buildings and bungalow townhomes totaling 430 units, together with 21,000 square feet of commercial areas can be accommodated by the available private and municipal services adjacent to the site in accordance with the requirements of the City of Hamilton. The current applications with the City of Hamilton are for the re-zoning of the lands to accommodate the proposed development which is further described within Section 1.3. Site plan processes including detailed engineering will proceed at a later stage.

1.2. Site Location & Topography

The site is located on the Saint Elizabeth Village grounds to the south of Rymal Road at municipal address 393 Rymal Road West which proceeds from the corner of Garth Street and Rymal Road West ~700m to the west. The specific area of the property that is proposed to be developed is located immediately at the north-east corner of the current property. Figure 1 on the following page illustrates the exact location of the site.

A topographic survey illustrating the existing conditions of the lands can be found within Appendix 'A' of this report for reference purposes. As can be seen through review of the survey, the site slopes very significant from north to south with elevations of ~236m along Rymal Road, but only ~226m along the existing private road at the site's southern limit.

Currently stormwater for the area of the site proposed for re-development is captured by several inlets and conveyed to an existing chain of internal ponds which cross the Saint Elizabeth Village property. These ponds are part of the headwaters of Twenty Mile Creek and ultimately discharge from the Saint Elizabeth Village site to the west across Christopher Drive and then proceed southerly across the adjacent Hydro corridor.

1.3. Proposed Development

The current development proposal is described on the site plan prepared by SRM Architects which is contained within Appendix 'A' for reference purposes. As can be seen, the development will entail the construction of five multi-storey buildings with 374 apartment units within, together with 56 townhomes and a two-storey building dedicated to office and retail, totaling 21,786 sf. Surface and underground parking areas are provided and incorporated into the design as seen on the Site Plan. The Site Plan contained in Appendix 'A' was the basis of the following engineering analysis.

Figure 1: Site Location Plan

2. Servicing Analysis

2.1. Water Servicing

There is an existing 400mm diameter watermain located within Rymal Road at the frontage of the proposed development area. This watermain is illustrated on Plan 17-H-17_4R1 which is contained within Appendix 'D' for reference purposes. During the recent reconstruction of Rymal Road a 200mm water service connection was extended to the subject lands at the north-east corner. This water connection can be extended into the site to service the proposed internal units as illustrated on the functional Site Servicing Plan contained within Appendix 'A' for reference.

In addition – there are 150mm diameter internal watermains adjacent to the site along Bishop Ryan Way and Cardinal Mindszenty Boulevard. No connection will be made to the watermains on Bishop Ryan Way, however the units fronting Cardinal Mindszenty Boulevard will be required to be serviced from the existing 150mm watermain on that street with individual water service connections.

Based on the proposal for the construction of 374 residential apartments, 42 bungalow townhouses, and 14 3-storey townhouses the expected domestic water demands have been calculated to be approximately 3598 fixture units – this is equivalent to 20.7 L/s peak domestic water usage.

It should be noted that no floor plans for each specific unit / building type were available at the time of the writing of this report, and as such assumptions for the expected fixtures for each unit type were utilized in the completion of this calculation. More detailed calculations can be provided at Site Plan stage in order to clear the expected conditions of Site Plan approval.

Fire-flow demands for the proposed development were also calculated based on the City of Hamilton criteria and the use of the Ontario Fire Marshall's guidelines (OBC Method). Fire-flows were calculated for the 'worst-case' scenario at Building C which has the tallest protrusion from the adjacent ground elevation and is nearest to other surrounding buildings. Peak fire demands were determined to be 150 L/s.

Calculation sheets for both domestic flows and fire-flows are contained within Appendix 'B' for reference purposes.

Hydrant flow testing data for the six nearest available hydrants on Rymal Road were obtained from the City of Hamilton flow test database. The results of the flow tests completed on the adjacent watermain are found in the table on the following page.

Hydrant ID	Address	Pres. Zone	Test Date	Static Pressure (psi)	Residual Pressure (psi)	Test Flow (IGPM)	Theoretical FF IGPM @ 20 psi	Theoretical FF L/S @ 20 psi
HC70H001	393 RYMAL RD W	6	2014-05-30	71	68	1,050	4849	305.92
HC70H002	RYMAL RD W	6	2014-05-30	70	68	1,010	5744	362.39
HC70H004	RYMAL RD W	6	2014-05-30	62	60	960	4969	313.50
HC70H011	RYMAL RD W	6	2014-05-30	66	62	1,000	3739	235.89

Table 1: City of Hamilton Hydrant Testing Data

In addition to these hydrant flow tests from the City of Hamilton database, additional flow tests were completed by Saint Elizabeth Village ownership team during recent works within the site which were completed in 2019. These flow tests were completed by Jackson Water Works and the actual flow test results are contained within Appendix 'B' for reference purposes. Table 2 below summarizes these additional hydrant flow tests:

Hydrant Location	Pres. Zone	Test Date	Static Pressure (psi)	Residual Pressure (psi)	Test Flow (USGPM)	Theoretical FF USGPM @ 20 psi	Theoretical FF L/S @ 20 psi
Garth Street, 2nd south of Rymal	6	2016-07-19	78	71	2068	6171	389.33
Rymal Road, 2nd east of Garth	6	2016-07-19	67	62	2226	7029	443.46
Rymal Road, 3rd east of Garth	6	2016-07-19	70	64	2276	7267	458.48

Table 2: Jackson Water Works Hydrant Testing Data

As can be seen, the adjacent watermain on Rymal Road can supply between 235.9 and 458.48 L/s of flow at 20psi. Based on this information it can be concluded that the adjacent watermains are capable of providing the necessary domestic and fire-flows for the development.

It should be noted that Saint Elizabeth Village ownership completed a Watermain Hydraulic Analysis (WHA) in 2019 through consultants WSP Canada Inc. This work was completed in support of upgrades to the site including a new building known as the Upper Mill Pond building. This WHA identified that fire-flows between 380 L/s – 400 L/s were available within the Saint Elizabeth Village site within the smaller diameter private watermain network. Pages from the WHA completed by WSP are contained within Appendix 'B' for reference. Based on the performance of the internal watermain network as identified within this report there is no reason to believe that the required fire-flow of 150 L/s could not be met.

As noted, a preliminary site servicing plan has been provided within Appendix 'A' for reference purposes and provides illustrative locations for expected watermain connections to the buildings an internal watermain network layout. The final layout and watermain diameters can be determined at Site Plan stage.

2.2. Sanitary Servicing

There is an existing private sanitary sewer network currently within the Saint Elizabeth Village site, including 250mm PVC sanitary sewers on both Bishop Ryan Way and Cardinal Mindszenty Boulevard.

A preliminary Site Servicing Plan is contained within Appendix 'A' and provides a proposed / illustrated servicing scheme based on the available connection points.

The expected sanitary generation rate has been estimated based on the residential population, together with sanitary generation from the commercial area as estimated via the Ontario Building Code Section 8.2.1.3. Population densities for each unit type were based on comments from the City of Hamilton received on the previous FSR version. It was assumed that half of the apartments will be one-bedroom and half will be two-bedroom.

Unit Type	Density	Persons / Unit	Units	Pop.	L / Cap. / Day	Avg. Flow (L/s)	Peak Factor	Peak Flow (L/s)
1-BR Apt.	High	2	187	374	360	1.558	5	7.79
2-BR Apt.	High	2.7	187	505	360	2.104	5	10.52
3-Sty TH	Med	3.5	14	49	360	0.204	5	1.02
Bung. TH	Med	3.5	42	147	360	0.613	5	3.06

Table 3: Domestic Sanitary Flows

Based on the OBC Section 8, commercial area will generate 5 liters per day per 1.0 square meter of floor area. Given the commercial floor area of 2024 sq.m, the daily flow 10,120 Liters of sanitary effluent equates to an average flow of 0.117 L/s and a peak instantaneous flow rate of 0.585 L/s.

Office area will generate 75 L for each 9.3 sq.m of floor space. Based on the 2024 square meters of floor area the office area will generate 16,323 L/day of sanitary effluent, which equates to an average flow rate of 0.19 L/s and a peak instantaneous flow rate of 0.944 L/s.

Considering both domestic and commercial / office flows the average expected sanitary flow rate from the development will be 4.79 L/s with a peak instantaneous flow rate of 23.92 L/s.

The existing adjacent 250mm PVC sanitary sewers will have capacity to convey this peak instantaneous flow rate to the adjacent sanitary sewer downstream system. AECOM has studied the internal sanitary sewer network of the Saint Elizabeth Village site and a draft version of their completed study was provided to LandSmith in January 2023. The connection point for the proposed development will be the 250mm sanitary sewer within the catchment identified by AECOM as CA4.

Figures 4.1 and 4.2 from the AECOM report are included within Appendix 'B' for reference purposes the sanitary sewer to which connection from the development area will be made terminates at the node identified as Ex. MH92A. As can be seen, the upstream sewer is 250mm in diameter and has a slope of 2.96%. As such the capacity of the pipe is 88.67 L/s which based on the current design flow of 1.74 L/s leaves ample capacity for the flows from the development site.

The receiver of flows from the local private Saint Elizabeth Village sanitary sewers is an existing 750mm sanitary trunk main which crosses Saint Elizabeth Village property, and proceeds easterly, past Christopher Drive, through the hydro corridor and proceeds southerly to the Upper James Street pumping station located at Twenty Road West and Upper James Street.

In order to determine actual sanitary flows being generated, AECOM prepared a report: *St. Elizabeth Village – Sanitary Wastewater Flow Monitoring and Infiltration/Inflow (I/I) Analysis Program*, dated August 2023 (DRAFT). This flow monitoring occurred from June 2022 to June 2023, and included one flow monitor on the City's trunk sanitary sewer after the last contributing catchment for the Saint Elizabeth Village collection system. The downstream flow monitor location was identified within the AECOM report as MH15A. The trunk sanitary sewer at this location has a 750mm diameter, a slope of 0.54%, and a contributing drainage area of approximately 189 hectares, which includes all of Saint Elizabeth Village.

Flow monitoring on this sanitary sewer pipe indicated that the average wet-weather flow experienced at this node was 32.09 L/s. The capacity of a 750mm pipe with slope of 0.54%, flowing at 100% full is 818 L/s. Based on the available capacity within the pipe the expected flow rates from the development if 23.9 L/s can be accommodated within the existing system. The ongoing work by AECOM will provide additional detail to this analysis once their reports are finalized and through ongoing flow monitoring.

Connection of flows to the sanitary pumping station would be subject to the Airport Employment Growth District policies as the local sanitary pumping station is a part of the sanitary sewer network which services the AEGD lands. Application will be made at Site Plan stage for sanitary capacity allocation for the development proposal. We understand that the City of Hamilton have recently upgraded the Twenty Road Sewage Pumping Station (SPS), with updated ECA approved in 2021 giving the Twenty Road SPS capacity to pump up to 1000 L/s. A copy of the approved ECA for this upgrade is attached to this report in Appendix 'B' for reference. The work was carried out in 2021 and as such the downstream SPS should have ample capacity to service the proposed development.

2.3. Stormwater Management

2.3.1. Existing Conditions

The topography of the existing site has been described above in Section 1.2 and the topographic survey for the site is contained within Appendix 'A' for reference purposes. Based on the topographic information drawing *STMDA1: Pre-Development Storm Drainage Area Plan* was created which described the existing drainage pattern of the site. This figure is contained within Appendix 'C' for reference purposes.

Under existing conditions stormwater runoff from the site is connected to the existing Saint Elizabeth Village infrastructure in several locations.

Firstly, there are catch-basins at Bishop Reding Way which convey stormwater from the grassed area north of that street to the existing storm sewers on Bishop Ryan Way. The area contributing to these storm sewers is identified as Area 1 on the Pre-Development Drainage Area Plan.

Secondly, there is an existing storm sewer along Bishop Tonnos Way to which catch-basins within the existing parking area surrounding Bishop Tonnos Square are connected. This storm sewer discharges westerly to the existing storm sewer within Bishop Ryan Way. The contributing area to these storm sewers is identified as Area 2 on the Pre-Development Drainage Area Plan.

Thirdly, the grassed area between Cardinal Mindszenty Boulevard and Bishop Tonnos Way drains towards an existing catch basin north of Cardinal Mindszenty Boulevard near the intersection of Bishop Ryan Way and connects to the adjacent storm sewer. The contributing area to these storm sewers is identified as Area 3 on the Pre-Development Drainage Area Plan.

The Bishop Ryan Way storm sewer which accepts runoff from these three main areas for the development lands discharges to the existing ponds via an outfall located south of Cardinal Mindszenty Way just west of Bishop Ryan Way. This connection location to the existing internal pond network is identified as Outfall 1 on the Pre-Development Drainage Area Plan.

Finally, the roads and parking areas for Bishop Tonnos Square which run along the easterly portion of the site drain southerly along Msgr Henke Terrance and are collected into storm sewers which pass down to Cardinal Mindszenty Boulevard and discharge to the existing internal pond system. Specifically there is a 600mm diameter storm sewer which passes down to the internal ponds – this storm sewer is identified on the pre-development drainage area plan and proceeds to the Outfall 2 location which is to the east of Messenger Henkey Terrace.

The major overland flow route for all of these drainage areas is north to south and under extreme rainfall events any runoff not entering the internal storm system will drain southerly to the internal ponds which are part of the headwaters of Twenty Mile Creek.

Under existing conditions, the majority of the site areas – Area 1, 2, and 3 are contributing drainage to the storm sewers on Bishop Ryan Way. The storm sewers on that street range in size from 450mm at the upstream end to 600mm at the downstream end.

Area 4 contributes flows to the 600mm storm sewer which crosses Messenger Henkey Terrace and Cardinal Mindszenty Boulevard and enters the internal pond system at Outfall 2. In addition to Area 4 some additional flows from Bishop Sherlock Lane and the townhomes to the east also enter the 600mm storm sewer, this will be discussed further in the following sections.

2.3.2. Existing Conditions Hydrology

The hydrology for the existing catchments noted above and as described on *STMDA1: Pre-Development Storm Drainage Area Plan* was analyzed using MIDUSS v2 stormwater software. The percentage impervious for each catchment was calculated based on review of the topographic information.

Mount Hope IDF parameters were utilized together with the Chicago 6-hour storm hyteograph which usually represents a worst-case for urban peak runoff due to the peaked rainfall distribution. In addition to analysis with the Chicago 6-hour storm the 12-Hour SCS storm event distribution was also analyzed, with Mount Hope IDF parameters in order to review a worst case for existing runoff and ensure that the stormwater management design can be considered conservative.

Based on the analysis described above the peak runoff rates for each of the noted catchments are summarized in the table below – while the MIDUSS v2 output files outlining the details of the runoff calculations are contained within Appendix 'C' for reference purposes.

Catchment	Area (ha)	% Impervious	Peak Runoff (m^3/s) by Return Period		
			5-Year	25-Year	100-Year
1	0.936	21.1	0.055	0.087	0.118
2	1.497	43.7	0.186	0.28	0.366
3	0.862	24.4	0.065	0.106	0.152
4	1.243	27.3	0.092	0.141	0.187
Total Peak Runoff (m^3/s)			**0.398**	**0.614**	**0.823**

Table 4: Existing Conditions Hydrologic Analysis Summary – Chicago 6-Hour Storm

Catchment	Area (ha)	% Impervious	Peak Runoff (m^3/s) by Return Period		
			5-Year	25-Year	100-Year
1	0.936	21.1	0.044	0.074	0.105
2	1.497	43.7	0.139	0.222	0.298
3	0.862	24.4	0.054	0.098	0.144
4	1.243	27.3	0.072	0.116	0.157
Total Peak Runoff (m^3/s)			**0.309**	**0.510**	**0.704**

Table 5: Existing Conditions Hydrologic Analysis Summary – 12-Hour SCS

As can be seen, the Chicago 6-hour storm results in higher peak flow rates from the various catchments. Based on this analysis the design of site stormwater management features will be completed using the Chicago 6-hour storm which represents a conservative analysis as compared with the 12-hour SCS distribution.

2.3.3. Stormwater Criteria

Quantity Controls:

Based on the existing functionality of the SEV internal ponds system it was determined that no additional runoff should be discharged to the ponds. Runoff from the proposed development area is to be self-contained and controlled to match pre-to-post for each return period event. In addition – based on the design of the site the flows should be limited to the capacity of the receiving sewers, whether the sewers on Bishop Ryan Way, or the 600mm diameter storm sewer at the site's south-east corner.

Given the design of the site grading, as will be discussed in the following sections, the majority of flows from the site under the developed condition will be directed to the south-east corner. As such further analysis of the receiving 600mm storm sewer was completed. Drainage Figure 1 contained within Appendix 'C' illustrates the extent of flows outside the development area contributing to the 600mm diameter storm sewer. Based on the contributing areas it was determined that under the 100-year storm event the available capacity within the 600mm storm sewer is 0.280 m^3/s.

Given the fact that most of the flows currently attributed to the Bishop Ryan Way sewers are being diverted from that street to the south-east corner of the site, a similar analysis was not completed for those storm sewers.

In summary, the criteria for quantity controls is first – to ensure no additional flows to the existing internal pond system within Saint Elizabeth Village, and second – to limit flows from the development area to the capacity of the downstream receiving system.

Quality Controls:

Considering the ultimate receiver or runoff from the site is Twenty Mile Creek, within the jurisdiction of the Niagara Peninsula Conservation Authority, and given the ultimate receiver of drainage from the site is Lake Ontario it was determined that stormwater quality control to MECP Normal level protection with 70% long-term suspended solids removal should be provided.

The following sections will illustrate how the noted stormwater criteria will be met through the proposed engineering servicing design.

2.3.4. Stormwater Management Design

SWM Quantity Controls:

A preliminary site grading plan has been prepared for the development and as noted above is contained within Appendix 'A' for reference purposes. Based on this grading plan it was proposed that a CULTEC Recharger 902HD system should be installed at the south-east area of the site where there is available landscaped surface under which the system can be placed.

Based on the grading for the site the areas which will flow uncontrolled have been limited to the degree possible, based on grading constraints. Drawing *STMDA2: Post Development Storm Drainage Area Plan* has been included in Appendix 'C' for reference purposes and illustrates all the proposed drainage areas and their outlets.

Area 3, which consists of Bishop Ryan Way and Cardinal Mindszenty Boulevard – existing asphalt areas which are either being replaced (in the case of Bishop Ryan Way) or remaining in their existing condition will continue to drain uncontrolled to the existing internal pond system. In addition, Area 2 which represents the new townhomes fronting Cardinal Mindszenty Boulevard will also be uncontrolled, draining directly to the adjacent street.

Based on the proposed grading the balance of the site can be routed through the proposed CULTEC system. In order to match the existing peak runoff from the development area in the proposed condition the uncontrolled flows are subtracted from the existing peak runoff rates. This gives the maximum allowable discharge from the CULTEC system as summarized in the table below. Note that once again the Chicago 6-hour storm was utilized together with the Mount Hope IDF parameters for a conservative design and for consistency with the existing conditions analysis.

Return Period (Year)	Existing Total Peak Runoff (m^3/s)	Area 2 Uncontrolled Peak Flow (m^3/s)	Area 3 Uncontrolled Peak Flow (m^3/s)	CULTEC Peak Allowable Discharge Rate (m^3/s)
5	0.398	0.053	0.138	0.207
25	0.614	0.082	0.199	0.333
100	0.823	0.110	0.252	0.461

Table 6: Uncontrolled Flow Discharge and Allowable CULTEC Discharge Summary

Based on the table above, the allowable peak discharge rate from the CULTEC system is superseded by the criteria to limit flows to the capacity of the receiving sewers. Given that the 600mm storm sewer has available capacity of 0.28 m^3/s the discharge from the CULTEC system must be further limited than were the pre-to-post criteria to be used.

MIDUSS v2 Hydrologic analysis was carried out for the routing of the storage system and it was determined that 1332 cubic meters of storage would be required within the system in order to limit discharge to the allowable rates. A bed layout sized 15.85m x 74.68m was designed using software provided by CULTEC and the rating curve for the storage was determined based on the CULTEC sizing software. The base of the CULTEC bed is to be set at 223.37m in elevation as described on the Preliminary *Site Servicing Plan*. It was determined that a three-orifice design would be required in order to meet the discharge targets for each of the return period events as follows:

- Orifice 1 – Size 220mm Inv. Elevation 223.37m
- Orifice 2 – Size 200mm Inv. Elevation 223.52m
- Orifice 3 – Size 200mm Inv. Elevation 224.64m

These sizes and elevations of each of the orifices were utilized the MIDUSS v2 analysis as can be seen through review of the output files contained in Appendix 'C'. Based on the routing of the system the discharge from the system is summarized via the table below.

Return Period (Year)	Storage Required (m^3)	Peak Outflow (m^3/s)	Water Depth (m)	WSEL (m)	Flow Target (m^3/s)	% of Flow Target
5	620.6	0.142	0.750	224.12	0.280	51%
25	1026.7	0.191	1.184	224.55	0.280	68%
100	1331.8	0.280	1.680	225.05	0.280	100%

Table 7: CULTEC Discharge Summary

Based on the foregoing analysis the total storage of 1330 cubic meters provided by the CULTEC 902HD system is sufficient to ensure that the sum of the peak uncontrolled and controlled flows does not exceed the existing conditions for each of the noted return periods. Table 8 below summarizes the total flows from the site under the proposed design and compares them to the existing conditions. As can be seen the discharge from the development area to the internal pond system is significantly reduced by virtue of the proposed stormwater management design.

Return Period (Year)	Existing Total Peak Runoff (m^3/s)	Area 2 Uncontrolled Peak Flow (m^3/s)	Area 3 Uncontrolled Peak Flow (m^3/s)	CULTEC Actual Discharge Rate (m^3/s)	Proposed Total Peak Runoff (m^3/s)	% Increase / Decrease (+ / -)
5	0.398	0.053	0.138	0.142	0.333	-16%
25	0.614	0.082	0.199	0.191	0.472	-23%
100	0.823	0.110	0.252	0.280	0.642	-22%

Table 8: Overall Site Stormwater Discharge Summary

Discussions with the site architect completed prior to the finalization of this report indicated that it may be possible to utilize storage within some of the rooftop areas to limit flows to the proposed CULTEC system and thereby reduce its size. This can be further analyzed at the Site Plan stage to see whether the proposed underground storage system can be reduced in size and footprint.

It should be noted that a preliminary geotechnical report was provided to LandSmith prior to the finalization of this Stormwater Management Report. Within the report it was noted that the ground-water table throughout the site is typically above 3m below the existing ground elevations. However, in the area where the CULTEC system is proposed, a higher groundwater table of only 1.6m below surface was encountered. There is a monitoring well installed at that location and ongoing readings will be obtained by the geotechnical consultant through the course of 2024. If this high ground water table is determined to be a permanent condition than alternate storage means may be considered, including the use of a liner beneath the CULTEC system in order to ensure that the function of the system is not impacted by groundwater.

Opportunities for groundwater recharge, including the incorporation of low-impact-development (LID) groundwater infiltration features in various areas of the site can be considered further at the Site Plan stage once the required zoning for the site is achieved and detailed development design commences.

SWM Quality Controls:

In addition to the stormwater quality controls identified in the previous section stormwater quality controls will also be required. Based on the downstream receiver, MECP Level '2' Quality control will be required - this will entail a design which accounts for the long-term removal of 70% of total suspended solids (TSS).

The proposed stormwater design for the site provides three areas in which the reduction of TSS from existing the site are achieved as follows:

1. Inclusion of a separator row within the CULTEC System which forces stormwater entering the chambers to pass through a filter cloth with 0.300mm openings. The separator row is an ETV verified technology that is capable of providing 80% long term TSS removal as a standalone feature. Further conversation with the manufacturer can be completed at the Site Plan stage and a separator row can be incorporated in the final design of the system.

2. Direction of the first 36 cubic meters of runoff to ground water. Given the base of the CULTEC Recharger 902HD is set on 3050mm of dead storage before the outlet, this initial runoff will be directed to groundwater. Note that this will be subject to ongoing groundwater monitoring and an open bottom system may not be possible to be implemented subject to further analysis,

3. Inclusion of an oil-grit-separator unit – in this case a Stormceptor EF12 (or equivalent) which can provide 60% long-term TSS removal based on the ETV particle size distribution as a stand-alone feature.

The combination of these three areas of the SWM design will lead to the long-term removal of over 70% of the total suspended solids from the stormwater leaving the site. Sizing reports for the Stormceptor EF model are contained within Appendix 'C' for reference, together with associated detail drawings. The final selection of the oil-grit-separator unit will be completed at the site-plan stage and an equivalent unit may be considered provided it will give the sufficient level of quality control. The addition of such features as CB Shield and or other LID features as part of an extended treatment train approach can be discussed at site plan stage, however the design as it stands meets the 70% long term TSS removal requirement.

3. Conclusions

In conclusion, based on the foregoing analysis we recommend that the development can be serviced in accordance with the requirements of the City of Hamilton as follows:

1. Water servicing can be provided through extension of the previously provided 200mm water service connection which extends from the 400mm diameter Rymal Road trunk watermain. There is ample water available for domestic usage and fire-flows based on the City's completed hydrant flow-tests.

2. There are available sanitary sewers within the Saint Elizabeth Village development which can convey sanitary effluent to the local trunk sanitary sewer. Monitoring of the trunk sanitary sewer at the downstream end of the site indicates that the existing 750mm trunk sewer can accommodate flows from the site. The trunk sanitary sewer connects to the Twenty Road Sanitary Pumping Station which has recently been upgraded. Capacity for sanitary discharge within this area is subject to AEGD policies and must be applied for at Site Plan stage.

3. Stormwater runoff from the site can be captured and attenuated using a CULTEC Recharger 902HD system in order to attenuate water quantity to pre-development levels and/or the allowable capacity within the receiving system. In addition, stormwater quality control can be provided through the combination of the CULTEC system in a treatment train which will include a Stormceptor EF12 (or equivalent) oil-grit separation chamber.

Thank you for your consideration of the above Functional Servicing Report. Should you have any questions or require clarification with respect to any part of the above please do not hesitate to contact the undersigned.

Respectfully submitted,

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2024-03-20
PROVINCE OF ONTARIO

Attachments:

Appendix 'A' – Background Information

Site Plan – SRM Architects

Topographic Survey – A.T. McLaren

Preliminary Site Servicing Layout Plan

Preliminary Site Grading Plan

Preliminary Sediment and Erosion Control Plan

Appendix 'B' – Water/Wastewater Servicing Calculations

Domestic Water Usage Calculations

Required Fire-Flow Calculations

Fire Separation Distances – Figure W1

Jackson Waterworks – Hydrant Testing Results

Saint Elizabeth Village WHA (2019) – Select Pages

AECOM – Wastewater Capacity Analysis (DRAFT) – Select Pages

Rymal Road Trunk Sanitary Sewer, Contributing Areas

Twenty Road SPS Upgrades – Approved ECA

Appendix 'C' – SWM Analysis

Pre-Development Storm Drainage Area Plan – Figure STMDA1

Post-Development Storm Drainage Area Plan – Figure STMDA2

Drainage Figure 1 – Existing 600mm storm sewer capacity

MIDUSS V2 Output Files

CULTEC Recharger 902HD Sizing Report & Details

Stormceptor EF12, Sizing Report & Details

Appendix 'D' – City of Hamilton Existing Infrastructure Drawings

17-H-17_4R1

17-H-17_5R1

17-H-17_18R

APPENDIX 'A' – Background Information

Site Plan – SRM Architects

Topographic Survey – A.T. McLaren

Preliminary Site Servicing Layout Plan

Preliminary Site Grading Plan

Preliminary Sediment and Erosion Control Plan

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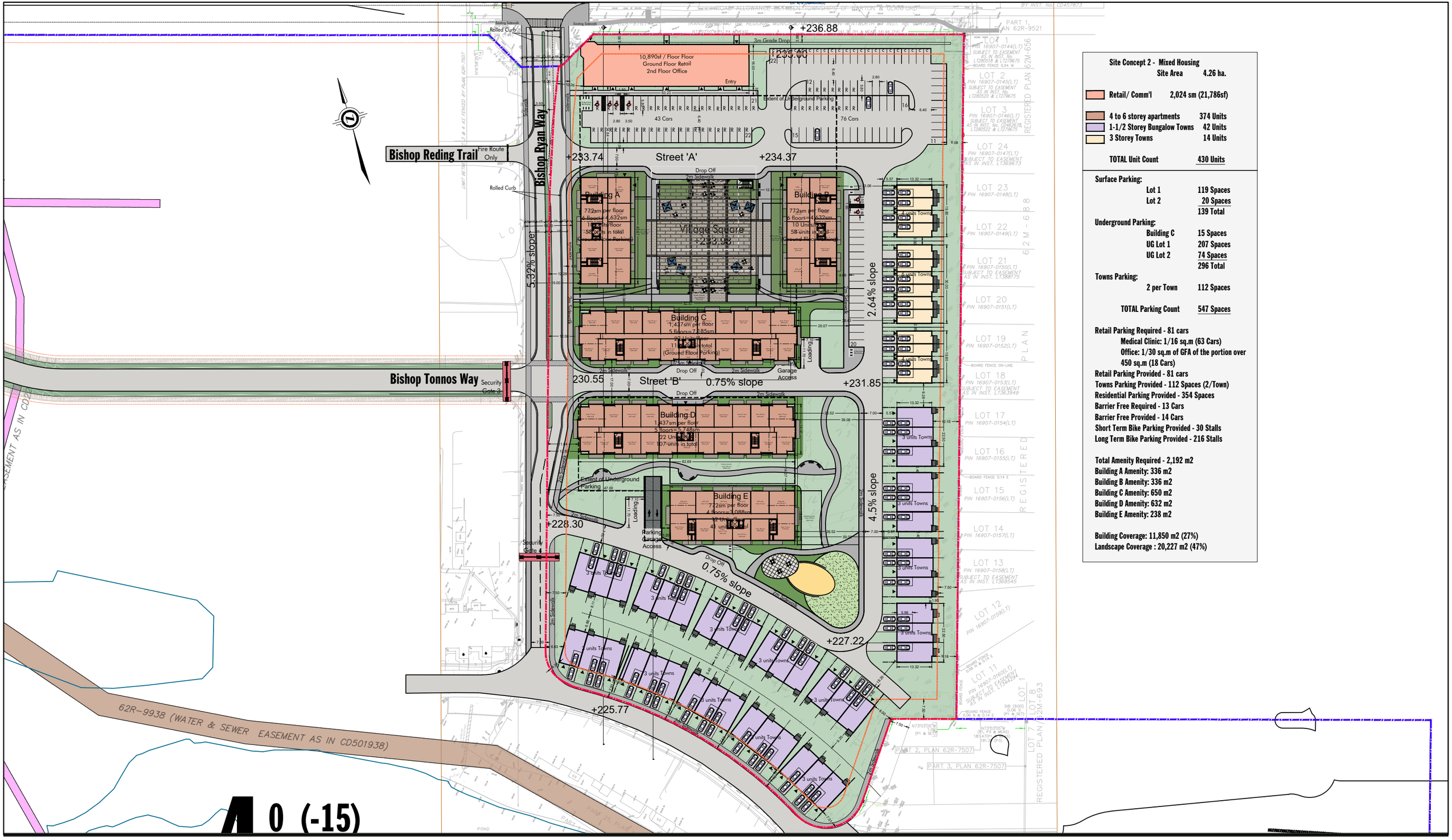


Site Concept 2 - Mixed Housing

Site Area	4.26 ha.
Retail/ Comm'l	2,024 sm (21,786sf)
4 to 6 storey apartments	374 Units
1-1/2 Storey Bungalow Towns	42 Units
3 Storey Towns	14 Units
TOTAL Unit Count	430 Units

Surface Parking:

Lot 1	119 Spaces
Lot 2	20 Spaces
	139 Total

Underground Parking:

Building C	15 Spaces
UG Lot 1	207 Spaces
UG Lot 2	74 Spaces
	296 Total

Towns Parking:

2 per Town	112 Spaces
TOTAL Parking Count	547 Spaces

Retail Parking Required - 81 cars
Medical Clinic: 1/16 sq.m (63 Cars)
Office: 1/30 sq.m of GFA of the portion over 450 sq.m (18 Cars)
Retail Parking Provided - 81 cars
Towns Parking Provided - 112 Spaces (2/Town)
Residential Parking Provided - 354 Spaces
Barrier Free Required - 13 Cars
Barrier Free Provided - 14 Cars
Short Term Bike Parking Provided - 30 Stalls
Long Term Bike Parking Provided - 216 Stalls

Total Amenity Required - 2,192 m2
Building A Amenity: 336 m2
Building B Amenity: 336 m2
Building C Amenity: 650 m2
Building D Amenity: 632 m2
Building E Amenity: 238 m2

Building Coverage: 11,850 m2 (27%)
Landscape Coverage : 20,227 m2 (47%)

St. Elizabeth Village Development Concept

Rymal Road West at Garth St

Hamilton, On

Site Plan

NOTE: Property line, buildings, drive access and street setbacks are all shown as approximate. A detailed site survey must be provided prior to finalizing all conditions. Dimensions used are all based on reference plans and are not intended as legally binding. Architect is not responsible for any changes that may occur due to verification of zoning, boundary conditions, OP, or other regulations. The enclosed drawing is for reference and information purposes only.

C8054
March 08, 2024

SRM↗
architects+
urban⋆designers

PHASE 4

TOPOGRAPHIC SURVEY
OF PART OF
LOT 3
CONCESSION 1
GEOGRAPHIC
TOWNSHIP OF GLANFORD
IN THE
CITY OF HAMILTON

SCALE 1: 300 METRIC

6 3 0 6 12 18 metres

S.D. McLAREN, O.L.S. – 2017

PHASE 4

BENCH MARK NOTE:

MONUMENT No 07720020068

RIB WITH BRASS CAP

LOCATED IN GLANBROOK, 10m EAST OF CENTRELINE OF WEST 5TH STREET. 25m NORTH OF CENTRELINE OF RYMAL ROAD, 3m EAST OF SIDEWALK, 8m NORTHWEST OF TRAFFIC SWITCHBOX.

ELEVATION – 229.005 metres CGVD 28

LEGEND:

□	DENOTES	MONUMENT SET
■	=	MONUMENT FOUND
IB	=	IRON BAR
SIB	=	STANDARD IRON BAR
SSIB	=	SHORT STANDARD IRON BAR
824	=	A.T. McLAREN, O.L.S.
Mea	=	MEASURED
MH	=	MANHOLE
CB	=	CATCH BASIN
DICB	=	DITCH INLET CATCH BASIN
CC	=	CUT CROSS
LP	=	LIGHT POLE
BH	=	BOREHOLE
CSTAR	=	CUT STAR
FH	=	CUT STAR
WV	=	WATER VALVE
ADD	=	ADDITION
WCRB	=	WOOD CURB
WRW	=	WOOD RETAINING WALL
SRW	=	STONE RETAINING WALL
LSA	=	LANDSCAPED AREA
ILS	=	INTER-LOCKING STONE
PS	=	PATIO STONE
AC	=	AIR CONDITIONER
UBOX	=	UTILITY BOX
BBOX	=	BELL BOX
GM	=	GAS METER
GV	=	GAS VALVE
HM	=	HYDRO METER
CLF	=	CHAIN LINK FENCE
BF	=	BOARD FENCE
WIF	=	WROUGHT IRON FENCE
TB	=	TOP OF BANK
BB	=	BOTTOM OF BANK
CONC	=	CONCRETE
SW	=	SIDEWALK
DS	=	DOOR SILL
GF	=	GARAGE FLOOR
COL	=	COLUMN
PIL	=	PILLAR
EN POR	=	ENCLOSED PORCH
MB	=	MAIL BOX
U	=	OVERHEAD UTILITIES
EVG	=	EVERGREEN
ø	=	DIAMETER
CONCF	=	CONCRETE FENCE
BOLF	=	BOLLARD FENCE
BOL	=	BOLLARD
FIREC	=	FIRE CONNECTION
BLK	=	BLOCK
TCB	=	TRAFFIC CONTROL BOX
EOA	=	EDGE OF ASPHALT
EOG	=	EDGE OF GRAVEL
CL	=	CENTRELINE
HWALL	=	HEAD WALL
CCRB	=	CONCRETE CURB
OH	=	OVERHANG
GTANK	=	GAS TANK
APP	=	APPROACH

BEARING NOTE:

BEARINGS ARE UTM GRID, DERIVED FROM OBSERVED REFERENCE POINTS A AND B, BY REAL TIME NETWORK OBSERVATIONS, UTM ZONE 17, NAD83 (CSRS) (1997.0)

NOTE:

DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID DISTANCES BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.999666529

INTEGRATION DATA

OBSERVED REFERENCE POINTS (ORP's): UTM ZONE 17, NAD83 (CSRS) (1997.0). COORDINATES TO URBAN ACCURACY PER SEC. 14(2) OF O.REG. 216/10

POINT ID	NORTHING	EASTING
ORP Ⓐ	4783868.794	588308.034
ORP Ⓑ	4784188.198	588600.972

COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN.

METRIC NOTE

DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

SURVEYOR'S CERTIFICATE:

I CERTIFY THAT:
1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE REGULATIONS MADE UNDER THEM
2. THE SURVEY WAS COMPLETED ON THE 23rd DAY OF MAY, 2017

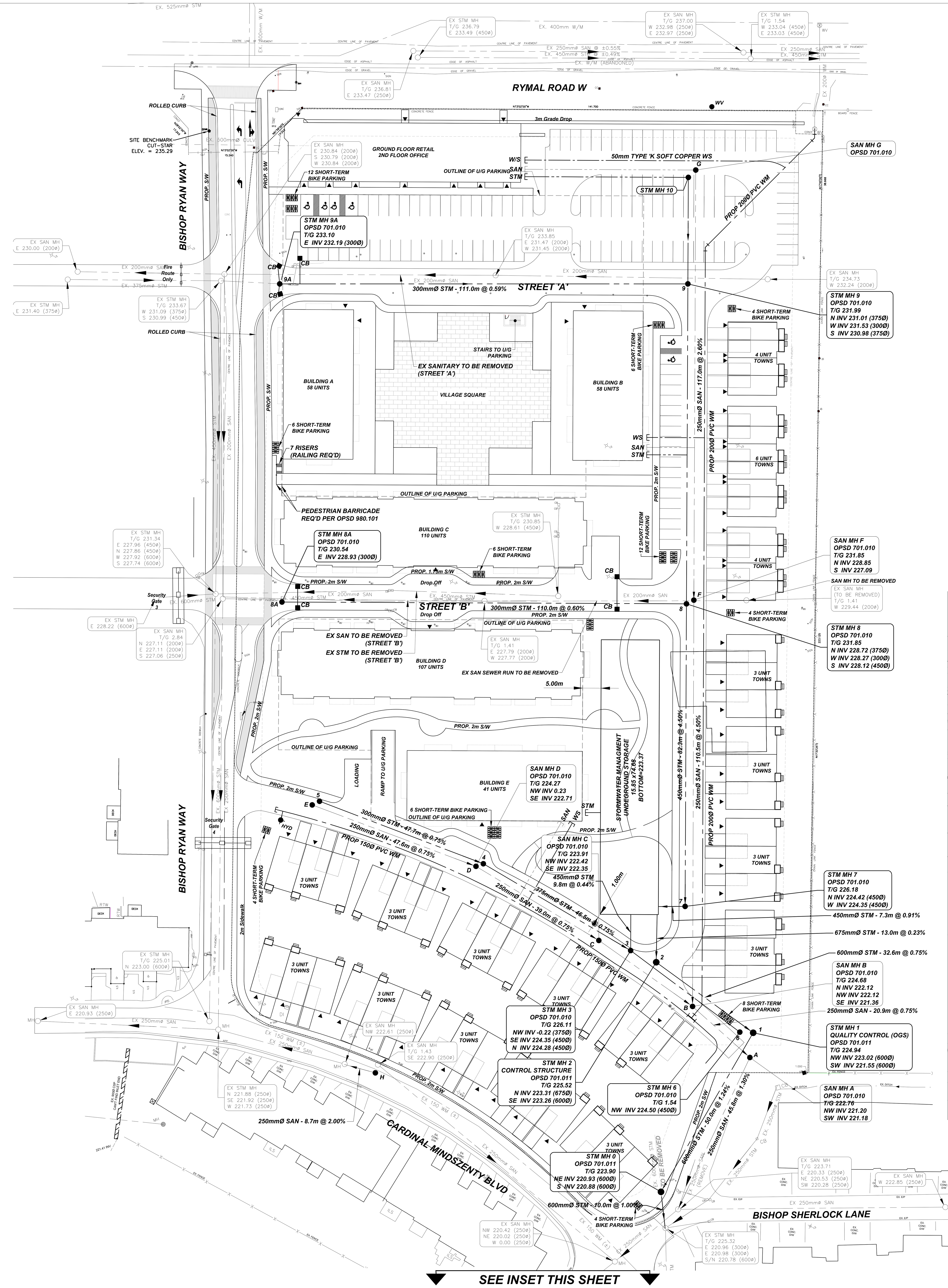
JUNE 8, 2017
DATE

S. DAN McLAREN, O.L.S.

A.T. McLaren Limited
LEGAL AND ENGINEERING SURVEYS
69 JOHN STREET SOUTH, SUITE 230
HAMILTON, ONTARIO, L8N 2B9
PHONE (905) 527-8559 FAX (905) 527-0032

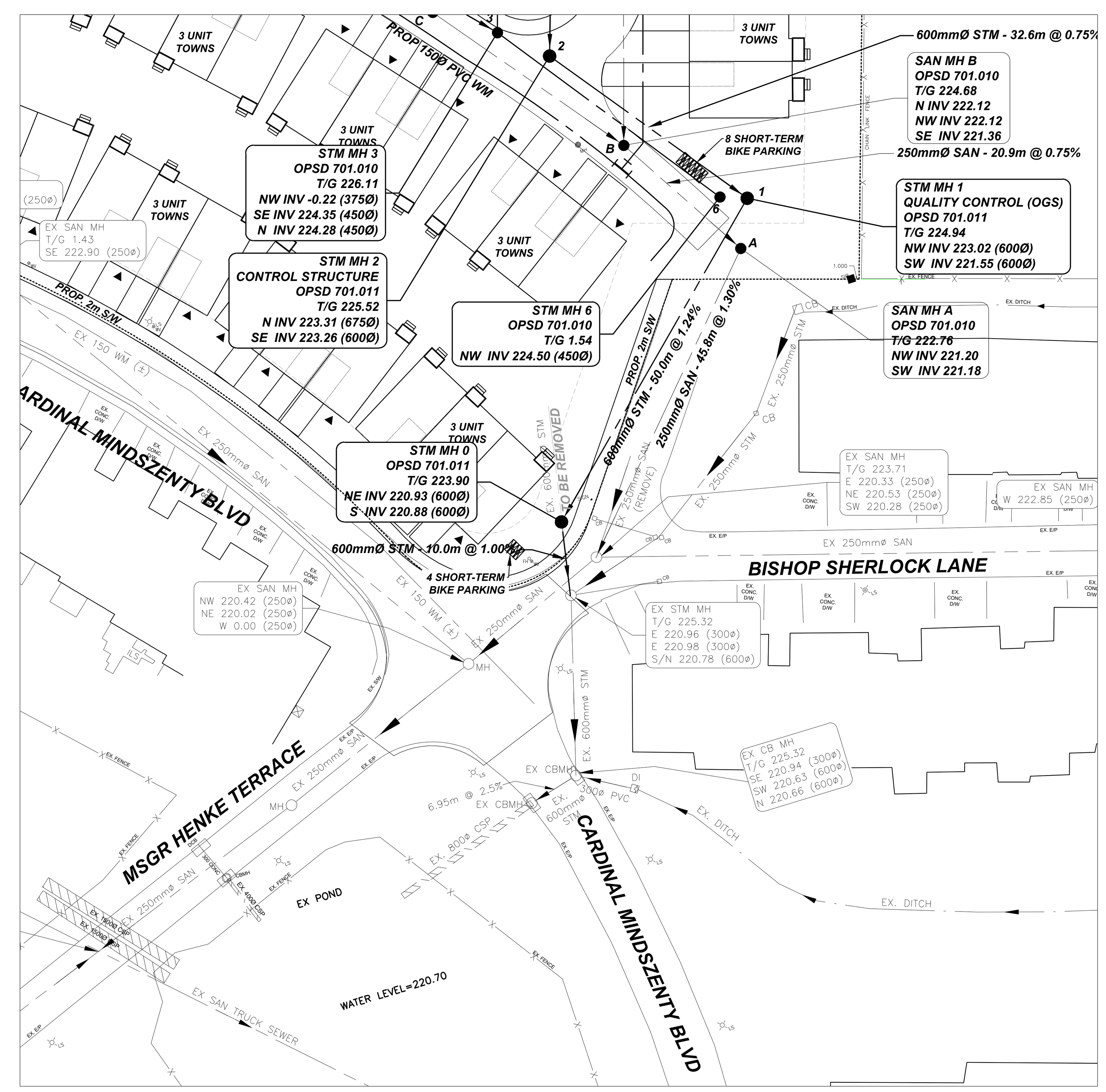
Drawn	Checked	Crew Chief	Scale	Dwg.No.
JB	DD	SM	1:300	35282-PH4

FILE NAME: 35282 Sister Elizabeth Topo.dwg LAYOUT: E-Size-PH4
LAST SAVED BY: David Gunsteman DATE: June 8, 2017



LEGEND

SAN	EXISTING SANITARY MAINTENANCE HOLE
SAN	PROPOSED SANITARY MAINTENANCE HOLE
PLUG	EXISTING PLUG
PLUG	PROPOSED PLUG
STM MH	EXISTING STORM MAINTENANCE HOLE
STM MH	PROPOSED STORM MAINTENANCE HOLE
CB	EXISTING CATCH BASIN
CB	PROPOSED CATCH BASIN/AREA DRAIN
DCB	EXISTING DOUBLE CATCH BASIN
DCB	PROPOSED DOUBLE CATCH BASIN
DICB	EXISTING DITCH INLET CATCH BASIN
DICB	PROPOSED DITCH INLET CATCH BASIN
CBMH	EXISTING CATCH BASIN MAINTENANCE HOLE
CBMH	PROPOSED CATCH BASIN MAINTENANCE HOLE
11.25° BEND	PROPOSED 11.25° WATERMAIN BEND
22.5° BEND	PROPOSED 22.5° WATERMAIN BEND
45° BEND	PROPOSED 45° WATERMAIN BEND
90° BEND	PROPOSED 90° WATERMAIN BEND
CROSS	EXISTING WATERMAIN CROSS
CROSS	PROPOSED WATERMAIN CROSS
REDUCER	EXISTING WATERMAIN REDUCER
REDUCER	PROPOSED WATERMAIN REDUCER
TEE	EXISTING WATERMAIN TEE
TEE	PROPOSED WATERMAIN TEE
WV	EXISTING WATER VALVE
WV	PROPOSED WATER VALVE



INSET
SCALE: 1:600

KEY PLAN N.T.S.

BENCHMARK NOTE:

ELEVATION = 229.005 (CGVD–1928)
MONUMENT: 07720020068

RIB WITH BRASS CAP

LOCATED IN GLANBROOK, 10m EAST OF CENTRELINE OF WEST 5TH STREET, 25m NORTH OF CENTRELINE OF RYMAL ROAD, 3m EAST OF SIDEWALK, 8m NORTHWEST OF TRAFFIC SWITCHBOX.

SITE BENCHMARK:

ELEVATION = 235.29

CUT–STAR LOCATED IN SIDEWALK, SOUTH–WEST OF THE INTERSECTION OF RYMAL ROAD WEST AND BISHOP RYAN WAY AS INDICATED ON PLAN.

GENERAL NOTES:

1. TENDERE'R SHALL SATISFY THEMSELVES AS TO THE NATURE OF THE GROUND AND BID ACCORDINGLY.
2. ALL ROCK LINE INDICATIONS SHOWN ON THE PLAN MUST BE VERIFIED BY THE CONTRACTOR.
3. CONTRACTOR SHALL VERIFY LOCATIONS AND INVERTS OF ALL EXISTING SANITARY AND STORM SEWERS AND WATERMAINS, PRIVATE DRAINS AND WATER SERVICES, GAS MAINS, CABLE TV, HYDRO AND TELEPHONE DUCTS ETC AT START OF CONSTRUCTION.

NO:	DATE:	DESCRIPTION:
1	2024-03-26	REVISED PER FSR COMMENTS
0	2023-05-10	FSR SUBMISSION

REVISIONS

SEAL

LandSmith ENGINEERING & CONSULTING LTD.
LANDSMITH ENGINEERING & CONSULTING LTD.
1059 UPPER JAMES STREET, SUITE 207
HAMILTON, ON L9C 3A6
ANDREW@LANDSMITHEC.COM
289-309-3632

CLIENT: ZEST COMMUNITIES

MUNICIPALITY: CITY OF HAMILTON

PROJECT NAME: ST. ELIZABETH VILLAGE

TITLE: PRELIMINARY SERVICING PLAN

SCALE:	1:600	DATE:	2023-05-10
CHECKED BY:	AS	DESIGNED BY:	BC
DWG No:	23008SEV	SHEET No:	S1

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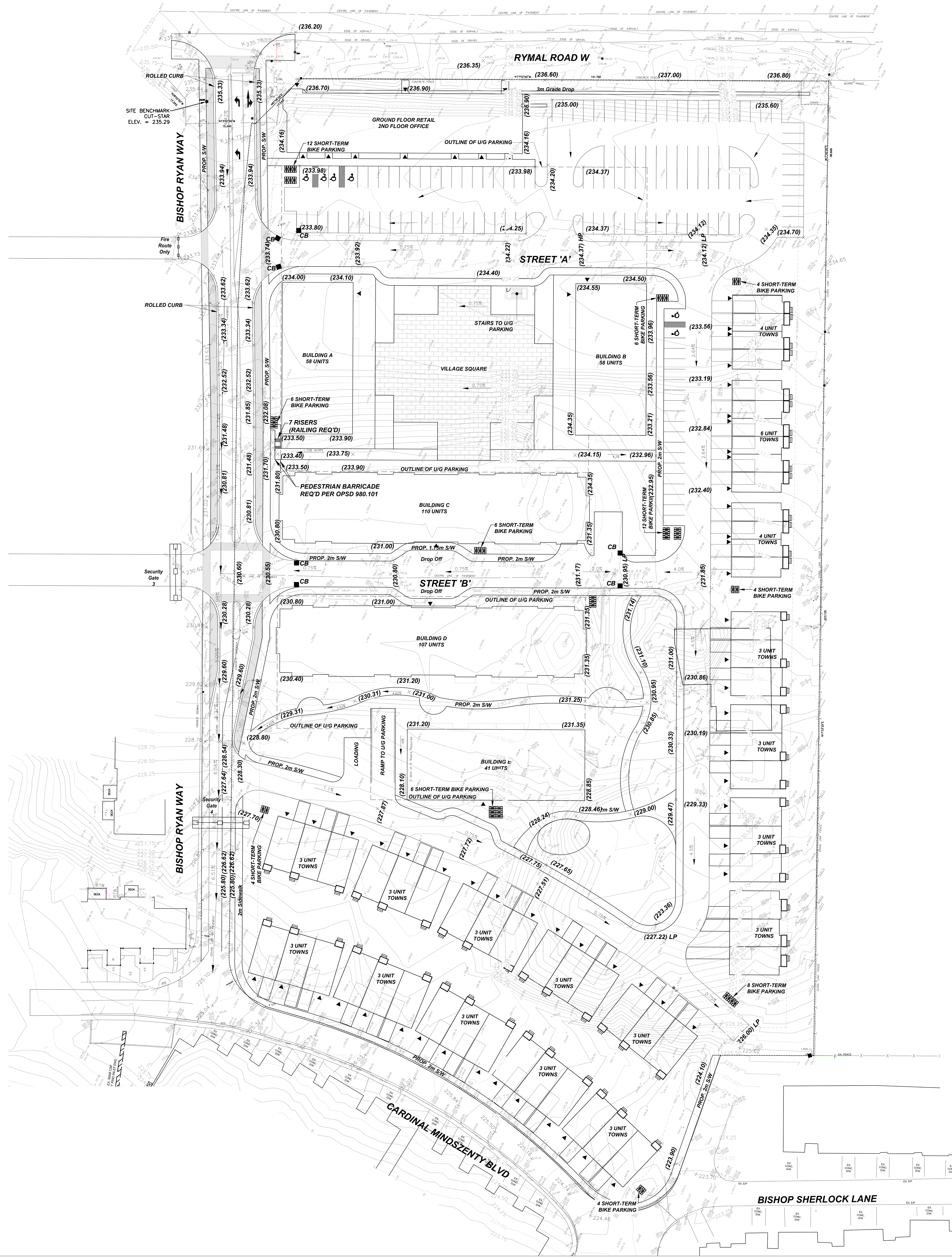

LEGEND

100.50	EXISTING ELEVATION
100.50	EXISTING ELEVATION (CALCULATED)
(100.00)	PROPOSED ELEVATION
(100.00)	PROPOSED APRON ELEVATION
S(100.00)	PROPOSED SWALE ELEVATION
	PROPOSED DOWNSPOUT
	PROPOSED SWALE
	PROPOSED SILT FENCE
▲	PROPOSED ENTRANCE LOCATION

KEY PLAN N.T.S.

BENCHMARK NOTE:

ELEVATION = 229.005 (CGVD-1928)
MONUMENT: 07720020068

RIB WITH BRASS CAP

LOCATED IN GLANBROOK, 10m EAST OF CENTRELINE OF WEST 5TH STREET. 25m NORTH OF CENTRELINE OF RYMAL ROAD, 3m EAST OF SIDEWALK, 8m NORTHWEST OF TRAFFIC SWITCHBOX.

SITE BENCHMARK:

ELEVATION = 235.29

CUT-STAR LOCATED IN SIDEWALK, SOUTH-WEST OF THE INTERSECTION OF RYMAL ROAD WEST AND BISHOP RYAN WAY AS INDICATED ON PLAN.

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2. ALL ROCK LINE INDICATIONS SHOWN ON THE PLAN MUST BE VERIFIED BY THE CONTRACTOR.
3. CONTRACTOR SHALL VERIFY LOCATIONS AND INVERTS OF ALL EXISTING SANITARY AND STORM SEWERS AND WATERMAINS, PRIVATE DRAINS AND WATER SERVICES, GAS MAINS, CABLE TV, HYDRO AND TELEPHONE DUCTS ETC AT START OF CONSTRUCTION.

NO:	DATE:	DESCRIPTION:
1	2024-03-26	REVISED PER FSR COMMENTS
0	2023-05-10	FSR SUBMISSION

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HAMILTON, ON L9C 3A6
ANDREW@LANDSMITHEC.COM
289-309-3632

CLIENT: ZEST COMMUNITIES

MUNICIPALITY: CITY OF HAMILTON

PROJECT NAME: ST. ELIZABETH VILLAGE

TITLE: PRELIMINARY GRADING PLAN

SCALE: 1:600	DATE: 2023-05-10
CHECKED BY: AS	DESIGNED BY: AS
DWG No: 23008SEV	SHEET No: G1

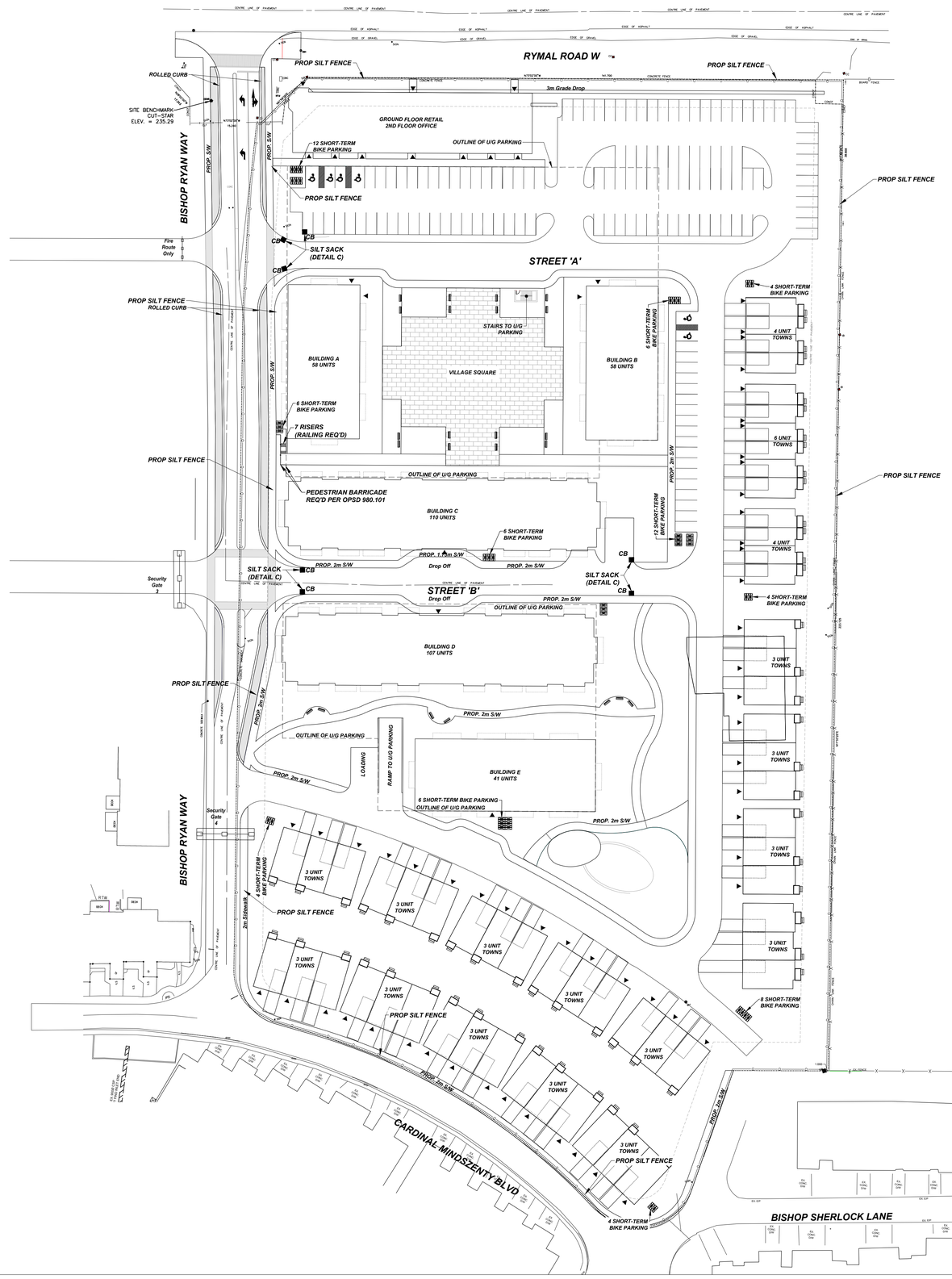
DRAWING FILE: Z:\Project Files\PROJECTS_Hamilton\Saint Elizabeth Village\CAD\BASE_ST.ELIZABETH VILLAGE CP2.dwg PLOTTED: Mar 26, 2024 - 12:48pm PLOTTED BY: BrandonCole

SILTATION AND EROSION CONTROL NOTES:

1. SILTATION CONTROL BARRIERS SHALL BE PLACED AS DETAILED ON THE PLAN ACCORDING TO OPSD 219.130 (SEE DETAIL ON THIS SHEET).
2. ALL SILTATION CONTROL MEASURES SHALL BE CLEANED AND MAINTAINED AFTER EACH RAINFALL EVENT TO THE SATISFACTION OF THE CITY OF HAMILTON.
3. CATCH BASIN SEDIMENT CONTROL DEVICES SHALL BE SILTSACK BY ACF ENVIRONMENTAL OR APPROVED EQUIVALENT, TO BE PLACED AS PER THE MANUFACTURER'S RECOMMENDATIONS (IF APPLICABLE).
4. ADDITIONAL SILTATION CONTROL MEASURES MAY BE REQUIRED AS PER FIELD CONDITIONS AS DETERMINED BY THE CITY.
5. SILTATION CONTROL BARRIERS SHALL BE PACED AS DETAILED
6. ALL SILTATION CONTROL MEASURES SHALL BE CLEANED AND MAINTAINED AFTER EACH RAINFALL AS DIRECTED TO THE SATISFACTION OF THE CITY OF HAMILTON.
7. SILTATION AND EROSION CONTROL DEVICES SHALL BE INSTALLED PRIOR TO WORKS COMMENCING ON SITE AND SHALL BE MAINTAINED FOR THE DURATION OF CONSTRUCTION UNTIL GROUND COVER IS ESTABLISHED AND THE SITE IS FULLY DEVELOPED.
8. EROSION & SEDIMENT CONTROLS MUST BE INSPECTED ON A REGULAR BASIS AFTER EVERY RAINFALL EVENT, AND MUST BE MAINTAINED AND REPAIRED IN A TIMELY MANNER TO PREVENT SEDIMENT FROM LEAVING THE SITE.
9. EXISTING AND PROPOSED CATCHBASININS ARE TO BE PROTECTED WITH A SILTSAC FOR THE DURATION OF CONSTRUCTION.
10. IT IS REQUIRED TO STABILIZE ALL AREAS THAT WILL REMAIN DISTRUSTED FOR MORE THAN 30 DAYS.
11. SILT FENCE AND CATCH BASIN PROTECTION ARE NOT TO BE REMOVED UNTIL COMPLETION OF CONSTRUCTION.
12. THE SILTATION AND EROSION CONTROL MEASURES ILLUSTRATED ON THIS PLAN ARE CONSIDERED MINIMUM REQUIREMENT, CONDITIONS MAY REQUIRE ADDITIONAL MEASURES WHICH WILL BE IDENTIFIED BY THE ENGINEER DURING CONSTRUCTION.
13. ALL EROSION AND SEDIMENT CONTROL DEVICES SHOULD BE AS PER THE "GREATER GOLDEN HORSESHOE AREA CONSERVATION AUTHORITIES", "EROSION AND SEDIMENT CONTROL GUIDELINE FOR URBAN CONSTRUCTION".
14. THE OWNER IS RESPONSIBLE FOR THE REMOVAL OF ALL MUD AND DEBRIS THAT ARE TRACKED ONTO THE ROADWAYS FROM VEHICLES ENTER AND LEAVING THE CONSTRUCTION SITE. THE OWNER SHALL, UPON VERBAL AND/OR REQUEST B[Y THE CITY, IMMEDIATELY PROCEED WITH THE CLEANUP OPERATION AT THEIR EXPENSE. SHOULD THE OWNER FAIL TO MAINTAIN THE ROAD AS DIRECTED, THE CITY WILL HAVE THE CLEANING CARRIED OUT, AND DRAW ON THE SECURITY FOR COST AND/OR LAY CHARGES.

LEGEND

×100.50	EXISTING ELEVATION
×±100.50	EXISTING ELEVATION (CALCULATED)
×(100.00)	PROPOSED ELEVATION
(100.00)	PROPOSED APRON ELEVATION
×S(100.00)	PROPOSED SWALE ELEVATION
	PROPOSED DOWNSPOUT
	PROPOSED ENTRANCE LOCATION
	PROPOSED SWALE
	PROPOSED SWALE WITH SUBDRAIN
	PROPOSED SILT FENCE OPSD 219.130 (SEE DETAIL 'B')
CB	PROPOSED SILT SACK (SEE DETAIL 'C')



KEY PLAN N.T.S.

BENCHMARK NOTE:

ELEVATION = 229.005 (CGVD-1928)

MONUMENT: 07720020068

RIB WITH BRASS CAP

LOCATED IN GLANBROOK, 10m EAST OF CENTRELINE OF WEST 5TH STREET. 25m NORTH OF CENTRELINE OF RYMAL ROAD, 3m EAST OF SIDEWALK, 8m NORTHWEST OF TRAFFIC SWITCHBOX.

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CUT-STAR LOCATED IN SIDEWALK, SOUTH-WEST OF THE INTERSECTION OF RYMAL ROAD WEST AND BISHOP RYAN WAY AS INDICATED ON PLAN.

GENERAL NOTES:

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NO:	DATE:	DESCRIPTION:
1	2024-03-26	REVISED PER FSR COMMENTS
0	2023-05-10	FSR SUBMISSION

REVISIONS

SEAL

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1059 UPPER JAMES STREET, SUITE 207
HAMILTON, ON L9C 3A6
ANDREW@LANDSMITHEC.COM
289-309-3632

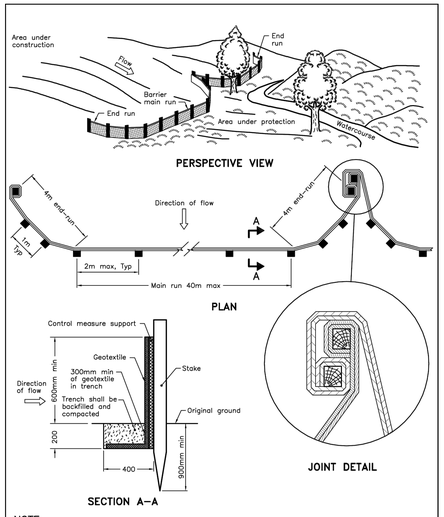
CLIENT: ZEST COMMUNITIES

MUNICIPALITY: CITY OF HAMILTON

PROJECT NAME: ST. ELIZABETH VILLAGE

TITLE: SEDIMENT AND EROSION CONTROL PLAN

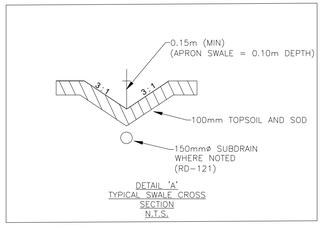
SCALE: 1:600	DATE: 2023-05-10
CHECKED BY: AS	DESIGNED BY: AS/BC
DWG No: 23008SEV	SHEET No: G1



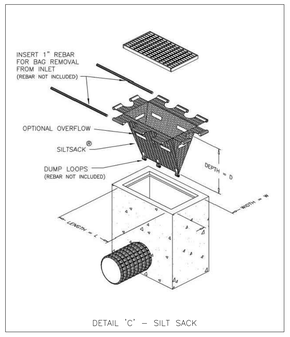
NOTE:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev 2
HEAVY-DUTY SILT FENCE BARRIER		
	OPSD 219.130	

DETAIL 'B'



DETAIL 'A'
TYPICAL SWALE CROSS SECTION
N.T.S.



DETAIL 'C' - SILT SACK

NOTES:
1. LOCATIONS UNDERGROUND SERVICES ARE APPROXIMATE AND MUST BE FIELD VERIFIED PRIOR TO CONSTRUCTION.
2. ANY DISCREPANCIES BETWEEN SERVICE LOCATIONS AND THESE ENGINEERING DRAWINGS MUST BE BROUGHT TO THE ATTENTION OF THE PROJECT ENGINEER.

DRAWING FILE: Z:\Project Files\PROJECTS_Hamilton\Saint Elizabeth Village\CAD\BASE_ST.ELIZABETH VILLAGE CP2.dwg PLOTTED: Mar 26, 2024 - 12:49pm PLOTTED BY: BrandonCole

APPENDIX 'B' – Water/Wastewater Servicing Calculations

Domestic Water Usage Calculations

Required Fire-Flow Calculations

Fire Separation Distances – Figure W1

Jackson Waterworks – Hydrant Testing Results

Saint Elizabeth Village WHA (2019) – Select Pages

AECOM – Wastewater Capacity Analysis (DRAFT) – Select Pages

Rymal Road Trunk Sanitary Sewer, Contributing Areas

Twenty Road SPS Upgrades – Approved ECA

LandSmith
ENGINEERING & CONSULTING LTD.

Date: ***2023-04-29***

DOMESTIC WATER USEAGE REQUIREMENTS

Project: Saint Elizabeth Village
Method: Fixture Unit Method, Per OBC Table 7.6.3.2.A

Fixtures: The number of fixtures was calculated based on the assumed fixtures by unit type as per the Site plan provided by SRM Architects

Amount	***Fixture Type***	***Fixture Units Per***	***Total***
Residential Apartment			
374	Watercloset	3	1122
374	Private Bathroom Group	3.6	1346.4
374	Kitchen Sink	1.4	523.6
	Total:		***2992***
3-Storey Townhouse			
14	Watercloset	3	42
14	Private Bathroom Group	3.6	50.4
14	Dishwasher	1.4	19.6
14	Kitchen Sink	1.4	19.6
14	Clothes Washer	1.4	19.6
14	Hose Bib	2.5	35
	Total:		***151.2***
Bungalow Townhouse			
42	Watercloset	3	126
42	Private Bathroom Group	3.6	151.2
42	Dishwasher	1.4	58.8
42	Kitchen Sink	1.4	58.8
42	Clothes Washer	1.4	58.8
42	Hose Bib	2.5	105
	Total:		***453.6***
		Overall Total:	***3596.8***

	Col. 1	Col. 1 × 10	Col. 1 × 100
100	53	174	900
90	51	164	835
80	49	153	750
70	47	140	680
60	44	128	600
50	41	115	520
40	38	102	435
30	33	88	350
20	27	72	262
10	21	53	174

Maximum hydraulic load is estimated to be 358.2 Imperial Gallons / Minute

3596.8 Fixture Units = 358.2 Ipgm = 20.7 L/s

The estimated maximum hydraulic load for the proposed development is 20.7 L/s

LandSmith
ENGINEERING & CONSULTING LTD.

Date: 2023-04-29

FIRE FLOW DEMAND REQUIREMENTS

Project: Saint Elizabeth Village
Method: OFM-TG-03-1999
FIRE PROTECTION WATER SUPPLY GUIDELINE FOR PART 3 IN THE ONTARIO BUILDING CODE
http://www.mcscs.jus.gov.on.ca/english/FireMarshal/Legislation/TechnicalGuidelinesandReports/TG-1999-03.html

Formula:

$$Q = K \times V \times S_{Tot}$$

Where:
Q = minimum supply of water in litres
K = water supply coefficient (Table 1)
V = total building volume in cubic meters
S_{Tot} = total of spacial coefficient tables

Volume (V)

6 Storeys Above Ground

Ground Floor Area:	1467	(sq.m)
Height:	18	(m)
Volume 1 (Building):	26406	(cu.m)

Total Volume (V) = 26406.0 (cu.m)

Water Supply Coefficient (K)

K: 18

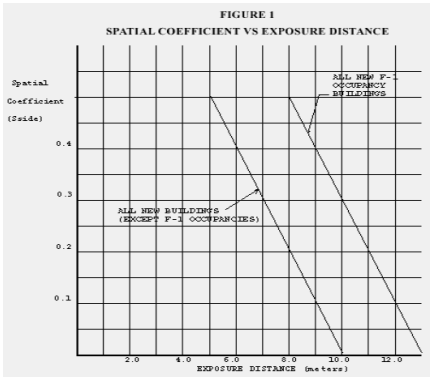
OBC Part: C (Residential)

Construction Type: *Building is of combustible construction with fire separations and fire-resistance ratings provided in accordance with Subsection 3.2.2. of the OBC, including loadbearing walls, columns and arches. Noncombustible construction may be used in lieu of fire-resistance rating where permitted in Subsection 3.2.2. of the OBC.*

Spacial Coefficients (S)

	Distance		
S_1	0.3	10	(North)
S_2	0	38	(East)
S_3	0	17	(South)
S_4	0	24	(West)

S_{Tot} = 1.0 + S_1 + S_2 + S_3 + S_4 = **1.3**



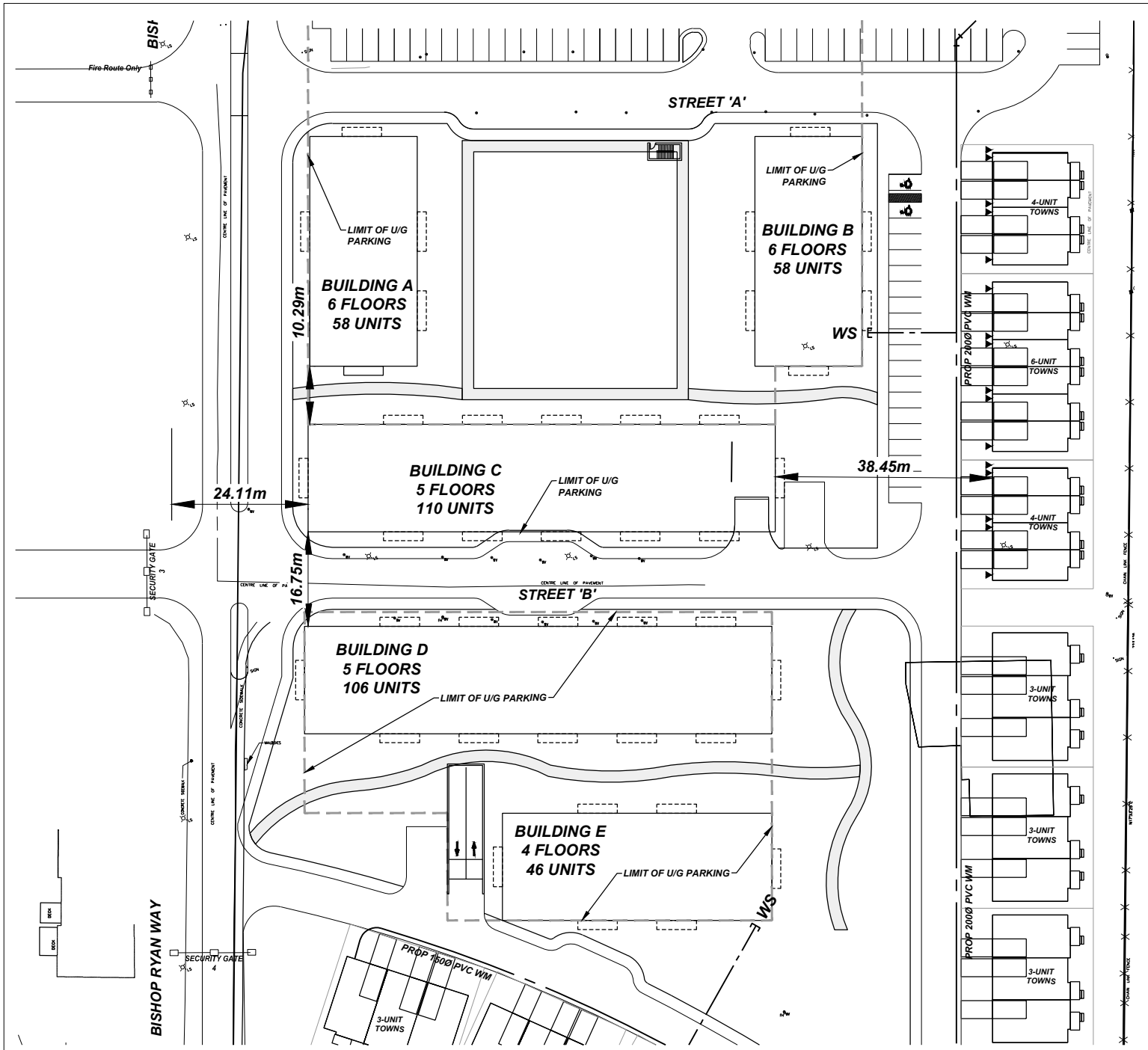
Q = *617,900*

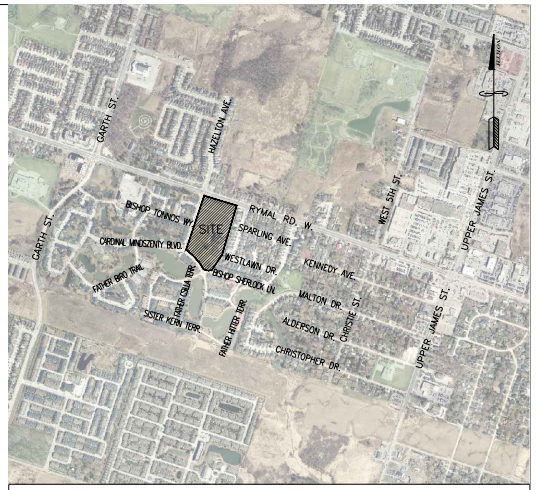
Required Flow Rate (OBC) = *9,000* L / Min
= *150* L / Sec

City of Hamilton Target Flow for residential units (greater than 3 units) = 150 L/s <---Governs

Table 2:
Minimum Water Supply Flow Rates

Building Code, Part 3 Buildings	Required Minimum Water Supply Flow Rate (L/min.)
One-storey building with building area not exceeding 600m² (excluding F-1 occupancies)	1800
All other buildings	2700 (If **Q** ≤ 108,000L)(1) 3600 (If **Q** > 108,000L **and** ≤ 135,000L)(1) 4500 (If **Q** > 135,000L **and** ≤ 162,000L)(1) 5400 (If **Q** > 162,000L **and** ≤ 190,000L)(1) 6300 (If **Q** > 190,000L **and** ≤ 270,000L)(1) 9000 (If **Q** > 270,000L)(1)





KEY PLAN N.T.S.

SCALE:

0 10 20 30 40 50 60 70 80

1:1000

LandSmith ENGINEERING & CONSULTING LTD.

PROJECT: ST. ELIZABETH VILLAGE

FIRE SEPARATION DISTANCES

FIGURE W1

JACKSON WATERWORKS

Telephone: (905) 547-6770
Toll Free: (800)-734-5732
E-mail: jww@bellnet.ca
Website: www.jacksonwaterworks.ca

Mr. John Oreskovic
S. Llewellyn & Associates
3228 South Service Road, East Wing, Suite 105
Burlington Ontario **L7N 3H8**

20 July 2016

Jackson Waterworks has recently completed fire hydrant flow testing at 393 Rymal Road West in Hamilton (St. Elizabeth Village).

We define the Test Hydrant as the hydrant being flowed and the Base Hydrant as the hydrant where static and residual pressures are recorded. Where possible, we inspect the secondary valve for the Test Hydrant to make sure it is in the fully open position.

Test Hydrant Location: Rymal Road, 2nd East of Garth Street & 3rd East of Garth Street
Hydrant Make & Model: McAvity M67
Hydrant Operation: Normal
Secondary Valve: Not Accessible
Valve Gate Position: Unknown

Test Hydrant Location: Garth Street, 2nd South of Rymal Road
Hydrant Make & Model: Canada Valve B50B-18
Hydrant Operation: Normal
Secondary Valve: Not Accessible
Valve Gate Position: Unknown

There were no irregularities to report.

Trusting this meets with your approval, we are...

Yours truly,

Mark Schmidt
Jackson Waterworks

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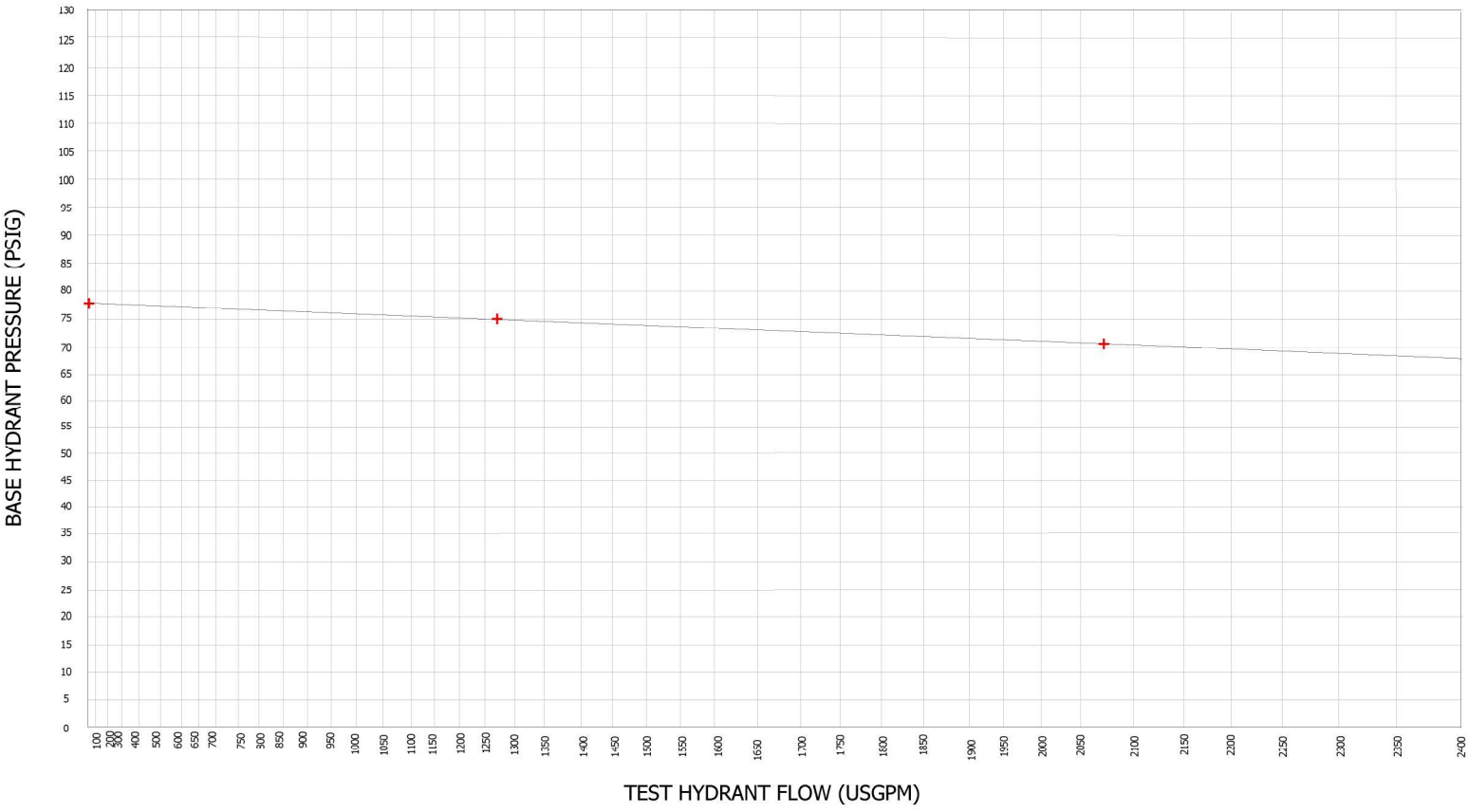
FIRE HYDRANT FLOW TEST RESULTS



No. of Ports Open	Port Dia. (in)	Pitot Reading (psig)	Pitot Conversion (usgpm)	Residual Pressure (psig)
1	2.50	57	1267	75
2	2.50	38/38	2068	71
THEORETICAL FLOW @ 20psi			6271	

Test Date	19 July 2016
Test Time	10:30am
Pipe Diameter (in)	8
Static Pressure (psig)	78

SITE INFORMATION	
Site/Developer Name	St. Elizabeth Village
Site Address/Municipality	393 Rymal Road West, Hamilton
Location of Test Hydrant	Garth Street, 2nd South of Rymal Road
Location of Base Hydrant	Garth Street, 1st South of Rymal Road
Technicians Comments	Testing has been completed in accordance with NFPA-291 guidelines wherever and whenever possible and practical. Conversion factors for pitot tube readings have been used depending on hose nozzle internal design and installation profile. Refer to attached cover letter for any further comments. Verified By: Mark Schmidt

221 Sherman Avenue North, Hamilton, Ontario L8L 6N2

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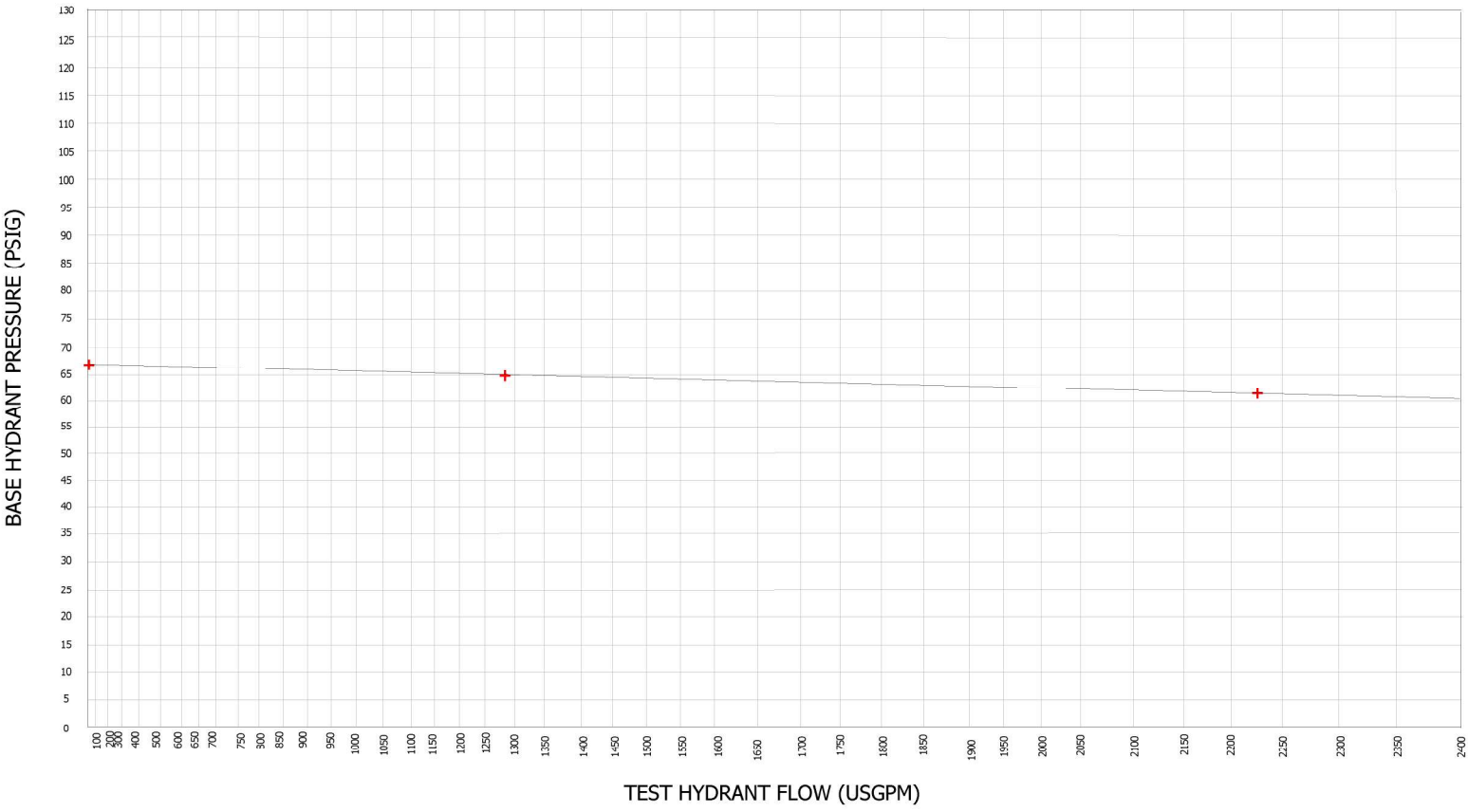
FIRE HYDRANT FLOW TEST RESULTS



No. of Ports Open	Port Dia. (in)	Pitot Reading (psig)	Pitot Conversion (usgpm)	Residual Pressure (psig)
1	2.50	58	1278	65
2	2.50	44/44	2226	62
THEORETICAL FLOW @ 20psi			7029	

Test Date	19 July 2016
Test Time	10:00am
Pipe Diameter (in)	16
Static Pressure (psig)	67

SITE INFORMATION	
Site/Developer Name	St. Elizabeth Village
Site Address/Municipality	393 Rymal Road West, Hamilton
Location of Test Hydrant	Rymal Road, 2nd East of Garth Street
Location of Base Hydrant	Rymal Road, 3rd East of Garth Street
Technicians Comments	Testing has been completed in accordance with NFPA-291 guidelines wherever and whenever possible and practical. Conversion factors for pitot tube readings have been used depending on hose nozzle internal design and installation profile. Refer to attached cover letter for any further comments. Verified By: Mark Schmidt

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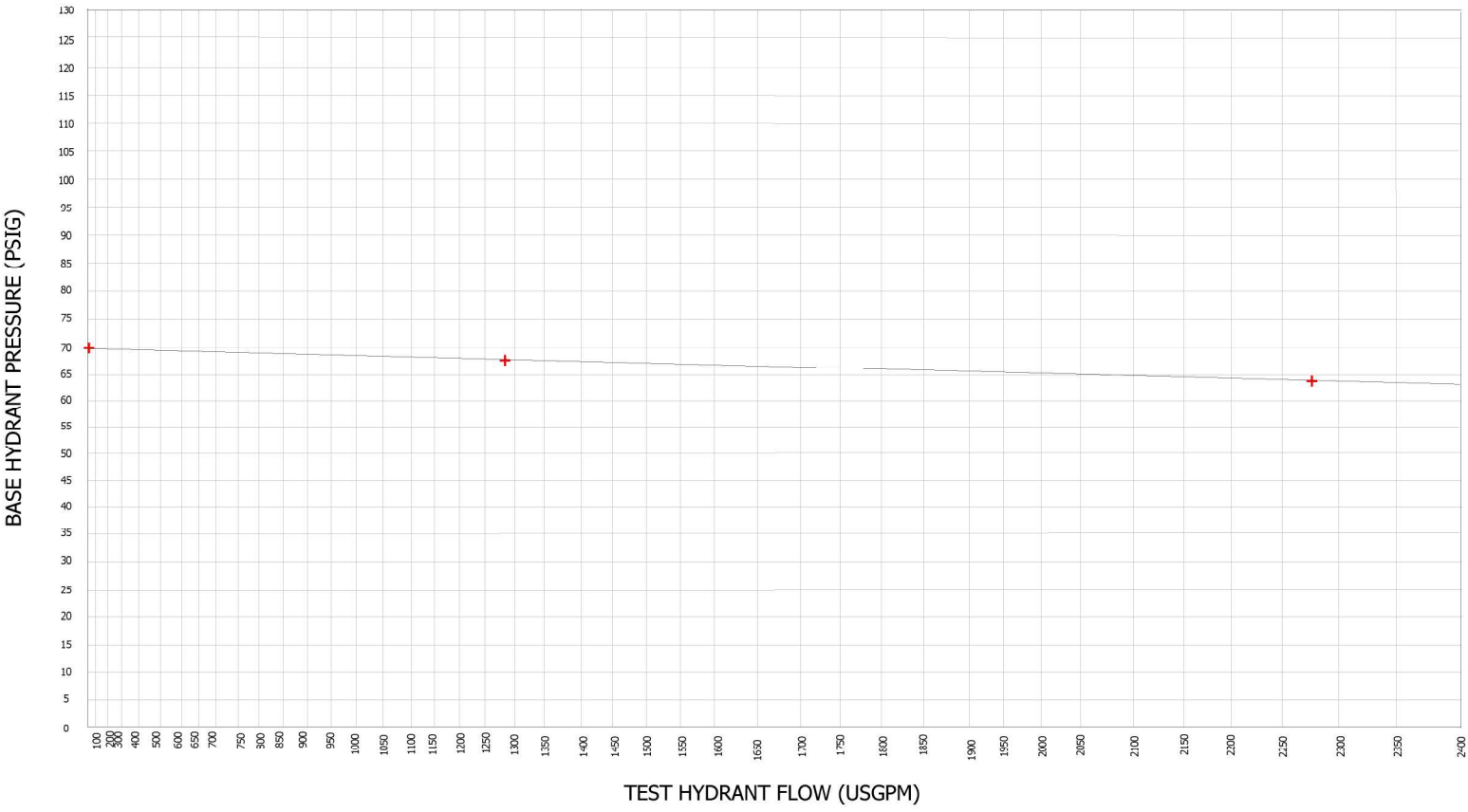
FIRE HYDRANT FLOW TEST RESULTS



No. of Ports Open	Port Dia. (in)	Pitot Reading (psig)	Pitot Conversion (usgpm)	Residual Pressure (psig)
1	2.50	58	1278	68
2	2.50	46/46	2276	64
THEORETICAL FLOW @ 20psi			7267	

Test Date	19 July 2016
Test Time	10:15am
Pipe Diameter (in)	16
Static Pressure (psig)	70

SITE INFORMATION	
Site/Developer Name	St. Elizabeth Village
Site Address/Municipality	393 Rymal Road West, Hamilton
Location of Test Hydrant	Rymal Road, 3rd East of Garth Street
Location of Base Hydrant	Rymal Road, 2nd East of Garth Street
Technicians Comments	Testing has been completed in accordance with NFPA-291 guidelines wherever and whenever possible and practical. Conversion factors for pitot tube readings have been used depending on hose nozzle internal design and installation profile. Refer to attached cover letter for any further comments. Verified By: Mark Schmidt

221 Sherman Avenue North, Hamilton, Ontario L8L 6N2

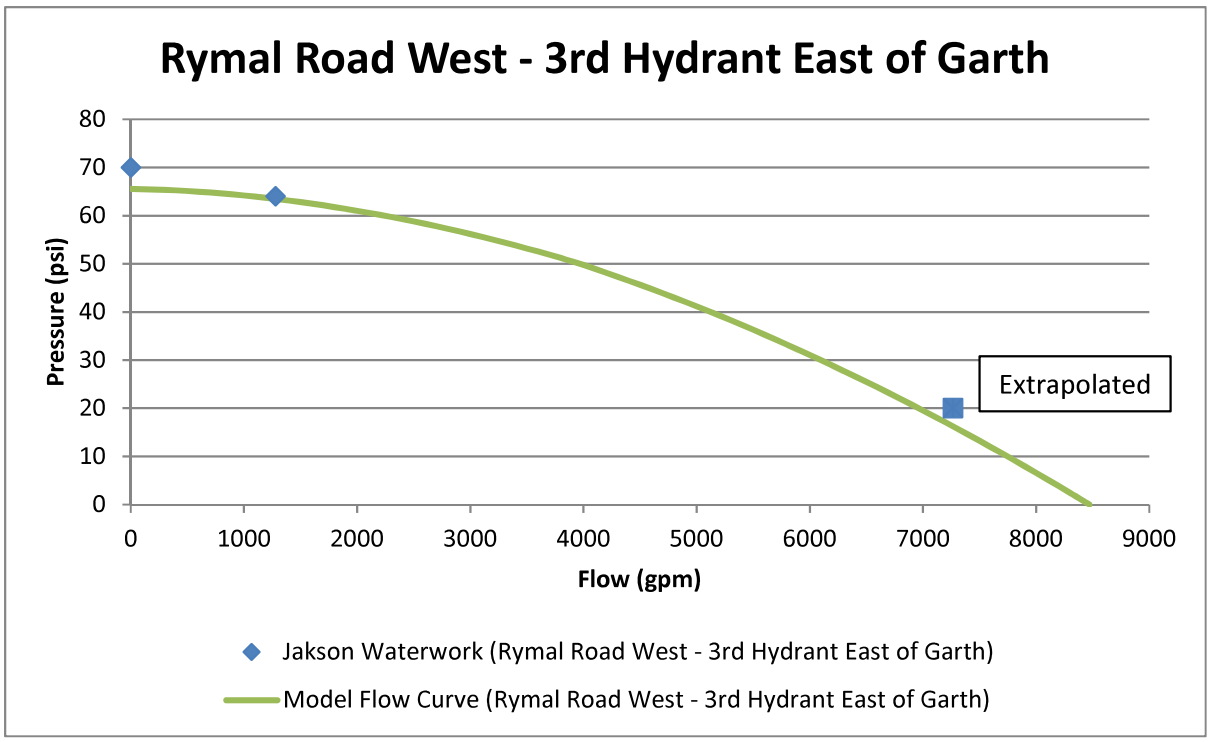


Figure E1 - Model Calibration Curve for Rymal Road West (3rd Hydrant east of Garth) - Hydrant Flow Test Curve vs. Model Result Curve

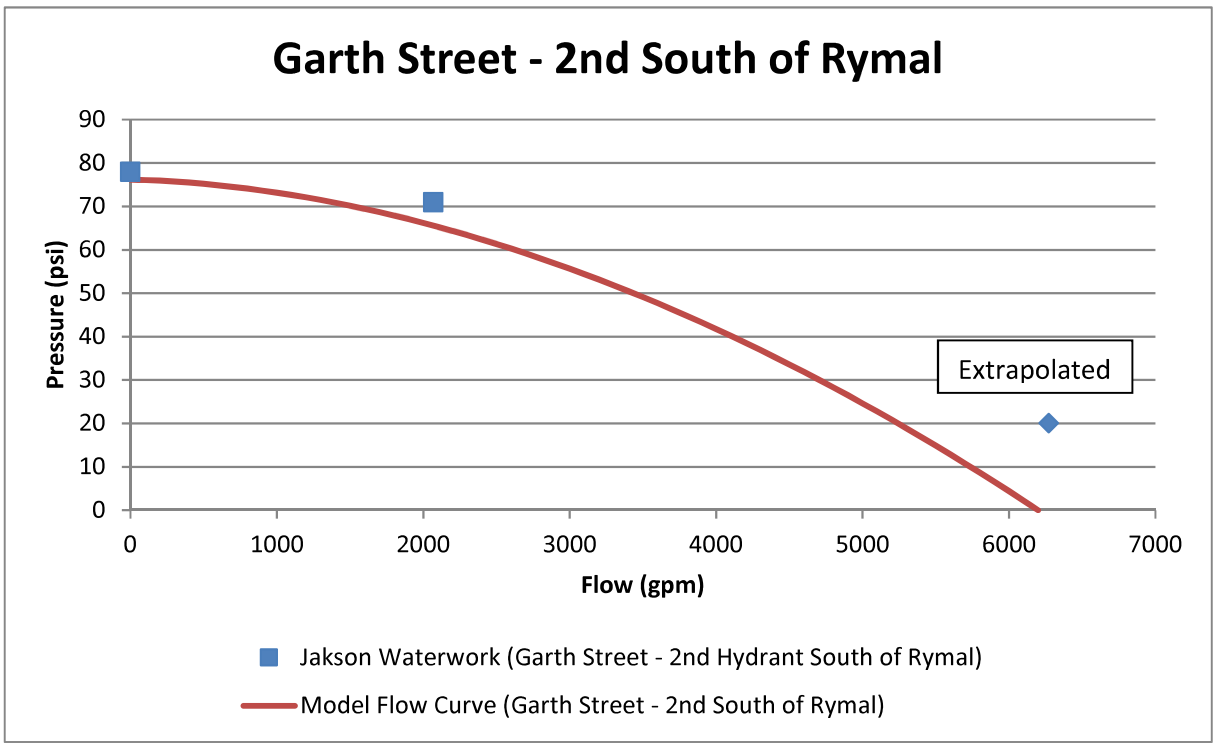


Figure E2 - Model Calibration Curve for Garth Street (2nd Hydrant south of Rymal Road) - Hydrant Flow Test Curve vs. Model Result Curve

Table E1- Hydrant Flow Test Results compared to Modeled Hydrant Flow Curve for Rymal Road West (3rd Hydrant east of Garth)

Rymal Road West - 3rd Hydrant East of Garth				
Source	**Static Pressure (psi)**	**Residual Pressure (psi)**	**Test Flow (GPM)**	**Theoretical Flowavailable at 20 psi residual (GPM)**
Hydrant Test	70	64	1,278	7,267
Model Curve	66	64	1,200	7,000

Table E2 - Hydrant Flow Test Results compared to Modeled Hydrant Flow Curve for Garth Street (2nd Hydrant south of Rymal Road)

Garth Street - 2nd Hydrant South of Rymal				
Source	**Static Pressure (psi)**	**Residual Pressure (psi)**	**Test Flow (GPM)**	**Theoretical Flowavailable at 20 psi residual (GPM)**
Hydrant Test	78	71	2,068	6,271
Model Curve	76	65	2,100	5,200

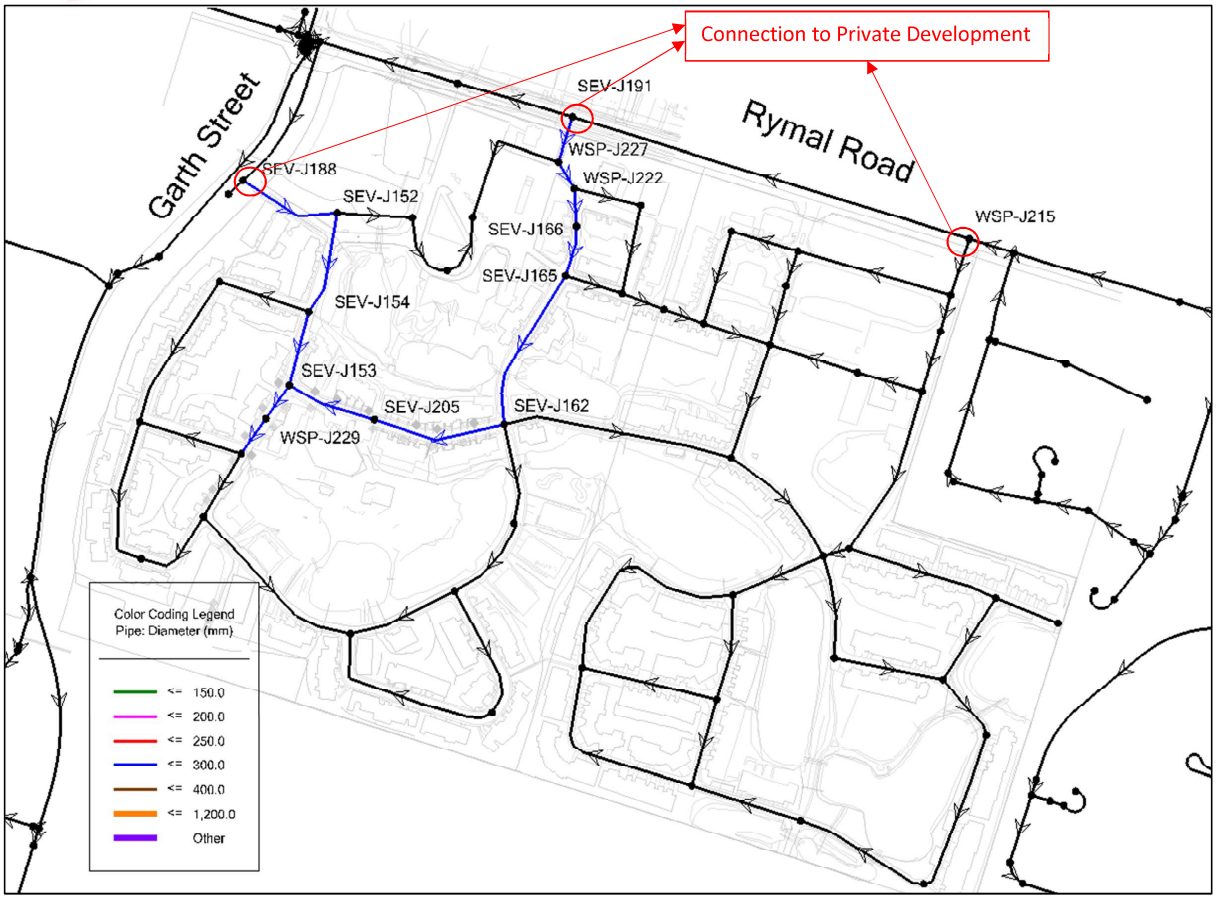


Figure A1 – Zest Communities Watermain Sizes and Junction IDs (Proposed watermains to be upsized shown in color)
***Watermains identified by color coding were included in this analysis and upsized for the purpose of the Upper Mill Pond Building.**

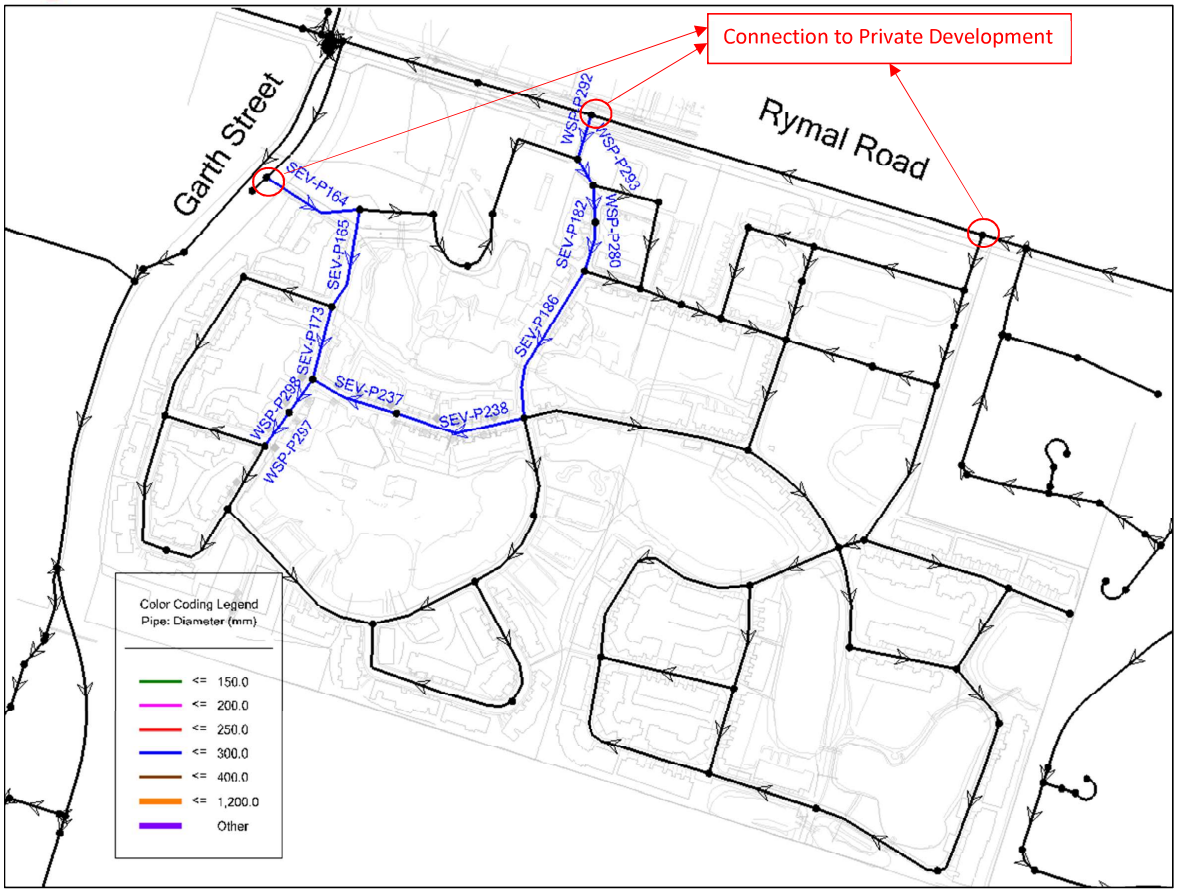


Figure A2 – Zest Communities Watermain Sizes and Pipe IDs (Proposed watermains to be upsized shown in color)
***Watermains identified by color coding were included in this analysis and upsized for the purpose of the Upper Mill Pond Building.**

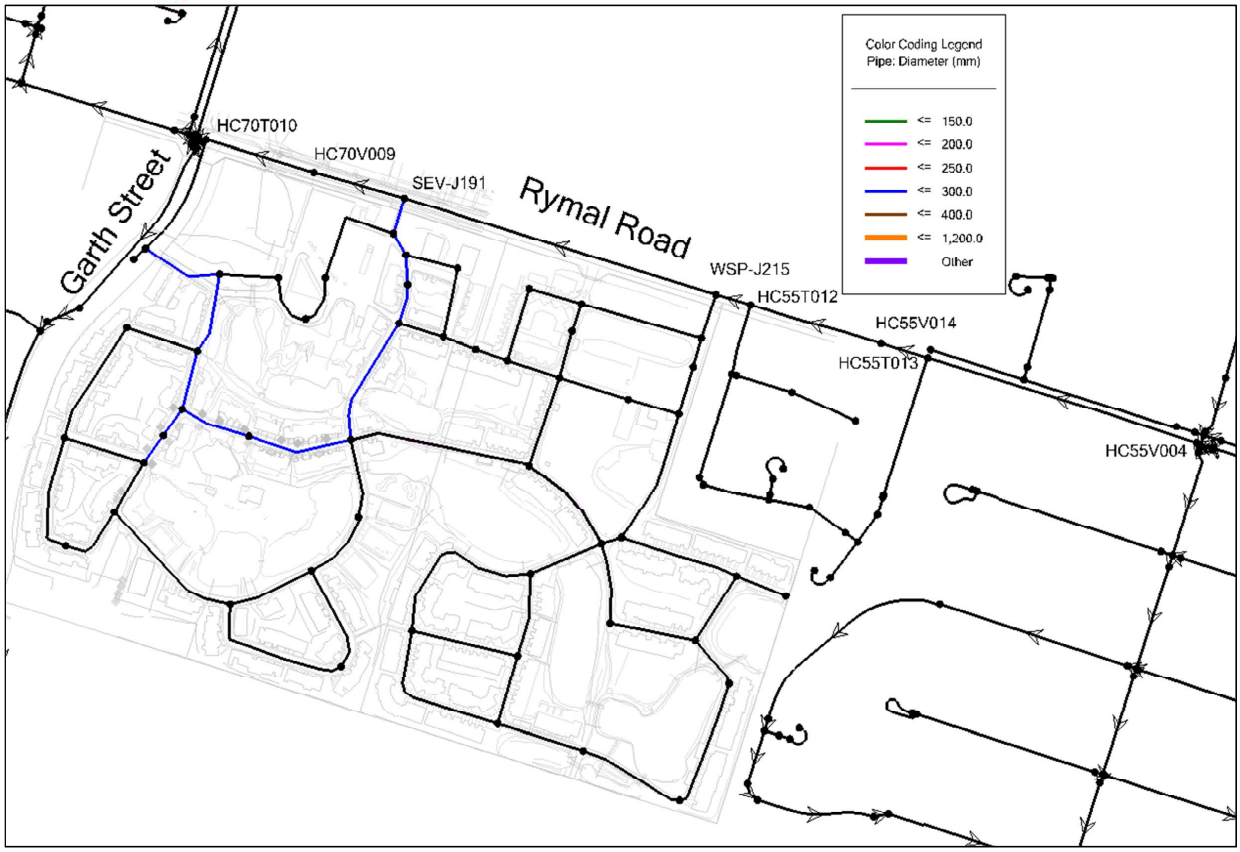


Figure B1 – Junction IDs along Rymal Road

Results: Zest Communities Water Distribution Analysis

City of Hamilton

Revision Date: July 2019

2011 MDD+FF (HDR05 at 50%)								
ID	Pressure District	Elevation	Static Pressure (kPa)	Fire-Flow Demand (Req) (L/s)	Available Flow at Hydrant (L/s)	Satisfies Fire Flow Constraints?	Residual Pressure (kPa)	Junction w/ Minimum Pressure (System)
SEV-J188	6	224.8	488.0	350.0	426	TRUE	140.00	HC51RSH5
SEV-J191	6	228.1	456.0	350.0	999	N/A	166.00	HC51RSH5
WSP-J215	6	235.7	382.0	350.0	766	N/A	140.00	HC51RSH5
WSP-J229	6	224.0	496.0	350.0	441	TRUE	140.00	HC51RSH5

*Note: SEV_J188 and WSP_J229 represent the connection point between the Municipal and private watermain networks

*Note: SEV_J191 and WSP_J215 are junctions within the private watermain network

Results: Zest Communities Water Distribution Analysis

City of Hamilton

Revision Date: July 2019

2021 MDD+FF (HDR05 at 50%)								
ID	Pressure District	Elevation	Static Pressure (kPa)	Fire-Flow Demand (Req) (L/s)	Available Flow at Hydrant (L/s)	Satisfies Fire Flow Constraints?	Residual Pressure (kPa)	Junction w/ Minimum Pressure (System)
SEV-J188	6	224.8	446.0	350.0	387	TRUE	140.00	HC51RSH5
SEV-J191	6	228.1	414.0	350.0	808	N/A	184.00	HC51RSH5
WSP-J215	6	235.7	340.0	350.0	636	N/A	143.00	HC51RSH5
WSP-J229	6	224.0	454.0	350.0	400	TRUE	140.00	HC51RSH5

*Note: SEV_J188 and WSP_J229 represent the connection point between the Municipal and private watermain networks

*Note: SEV_J191 and WSP_J215 are junctions within the private watermain network

Results: Zest Communities Water Distribution Analysis

City of Hamilton

Revision Date: July 2019

2031 MDD+FF (HDR05 at 50%)								
ID	Pressure District	Elevation	Static Pressure (kPa)	Fire-Flow Demand (Req) (L/s)	Available Flow at Hydrant (L/s)	Satisfies Fire Flow Constraints?	Residual Pressure (kPa)	Junction w/ Minimum Pressure (System)
SEV-J188	6	224.8	423	350.0	367	TRUE	140.00	HC51RSH5
SEV-J191	6	228.1	391	350.0	623	N/A	227.00	HC51RSH5
WSP-J215	6	235.7	317	350.0	567	N/A	144.00	HC51RSH5
WSP-J229	6	224.0	431	350.0	380	TRUE	140.00	HC51RSH5

*Note: SEV_J188 and WSP_J229 represent the connection point between the Municipal and private watermain networks

*Note: SEV_J191 and WSP_J215 are junctions within the private watermain network

Results: Zest Communities Water Distribution Analysis

City of Hamilton

Revision Date: July 2019

2011 MDD+FF (HDR05 at 70%)								
ID	Pressure District	Elevation	Static Pressure (kPa)	Fire-Flow Demand (Req) (L/s)	Available Flow at Hydrant (L/s)	Satisfies Fire Flow Constraints?	Residual Pressure (kPa)	Junction w/ Minimum Pressure (System)
SEV-J188	6	224.8	505	350.0	439	TRUE	140.00	HC51RSH5
SEV-J191	6	228.1	473	350.0	1000	N/A	183.00	HC51RSH5
WSP-J215	6	235.7	399	350.0	802	N/A	140.00	HC51RSH5
WSP-J229	6	224.0	513	350.0	453	TRUE	140.00	HC51RSH5

*Note: SEV_J188 and WSP_J229 represent the connection point between the Municipal and private watermain networks

*Note: SEV_J191 and WSP_J215 are junctions within the private watermain network

Results: Zest Communities Water Distribution Analysis

City of Hamilton

Revision Date: July 2019

2021 MDD+FF (HDR05 at 70%)								
ID	Pressure District	Elevation	Static Pressure (kPa)	Fire-Flow Demand (Req) (L/s)	Available Flow at Hydrant (L/s)	Satisfies Fire Flow Constraints?	Residual Pressure (kPa)	Junction w/ Minimum Pressure (System)
SEV-J188	6	224.8	466	350.0	402	TRUE	140.00	HC51RSH5
SEV-J191	6	228.1	434	350.0	869	N/A	178.00	HC51RSH5
WSP-J215	6	235.7	361	350.0	681	N/A	142.00	HC51RSH5
WSP-J229	6	224.0	474	350.0	416	TRUE	140.00	HC51RSH5

*Note: SEV_J188 and WSP_J229 represent the connection point between the Municipal and private watermain networks

*Note: SEV_J191 and WSP_J215 are junctions within the private watermain network

Results: Zest Communities Water Distribution Analysis

City of Hamilton

Revision Date: May 2019

2031 MDD+FF (HDR05 at 70%)								
ID	Pressure District	Elevation	Static Pressure (kPa)	Fire-Flow Demand (Req) (L/s)	Available Flow at Hydrant (L/s)	Satisfies Fire Flow Constraints?	Residual Pressure (kPa)	Junction w/ Minimum Pressure (System)
SEV-J188	6	224.8	443	350.0	382	TRUE	140.00	HC51RSH5
SEV-J191	6	228.1	411	350.0	737	N/A	202.00	HC51RSH5
WSP-J215	6	235.7	337	350.0	615	N/A	143.00	HC51RSH5
WSP-J229	6	224.0	451	350.0	395	TRUE	140.00	HC51RSH5

*Note: SEV_J188 and WSP_J229 represent the connection point between the Municipal and private watermain networks

*Note: SEV_J191 and WSP_J215 are junctions within the private watermain network

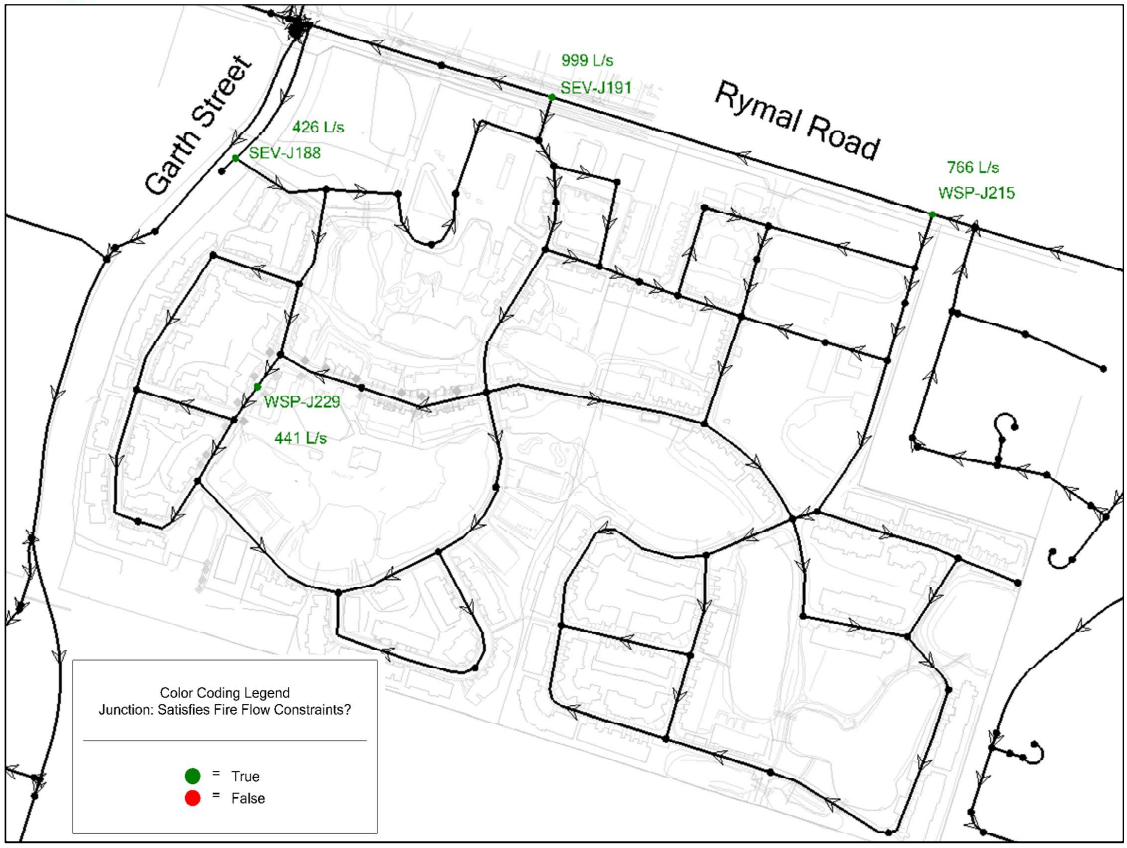


Figure C1 – Available Fire Flows under 2011 MDD+FF Scenario at 50% WL (HDR05)

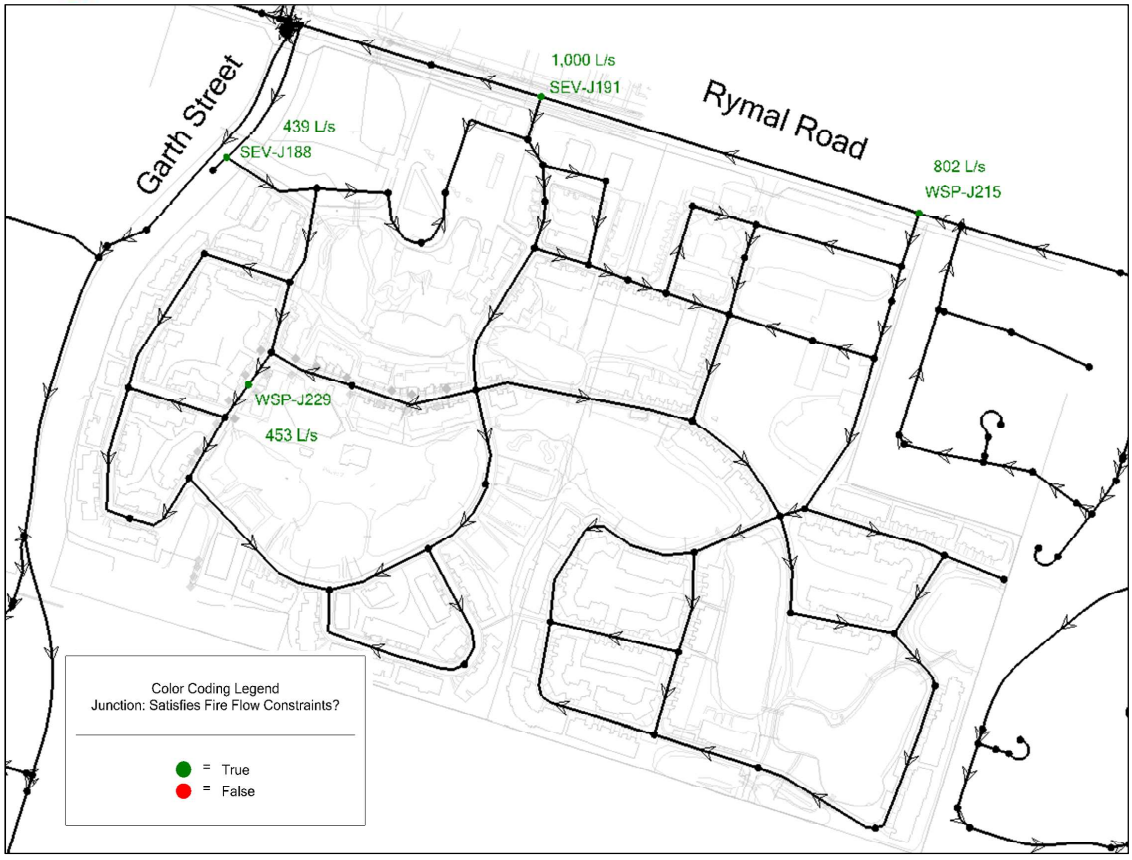


Figure C2 – Available Fire Flows under 2011 MDD+FF Scenario at 70% WL (HDR05)

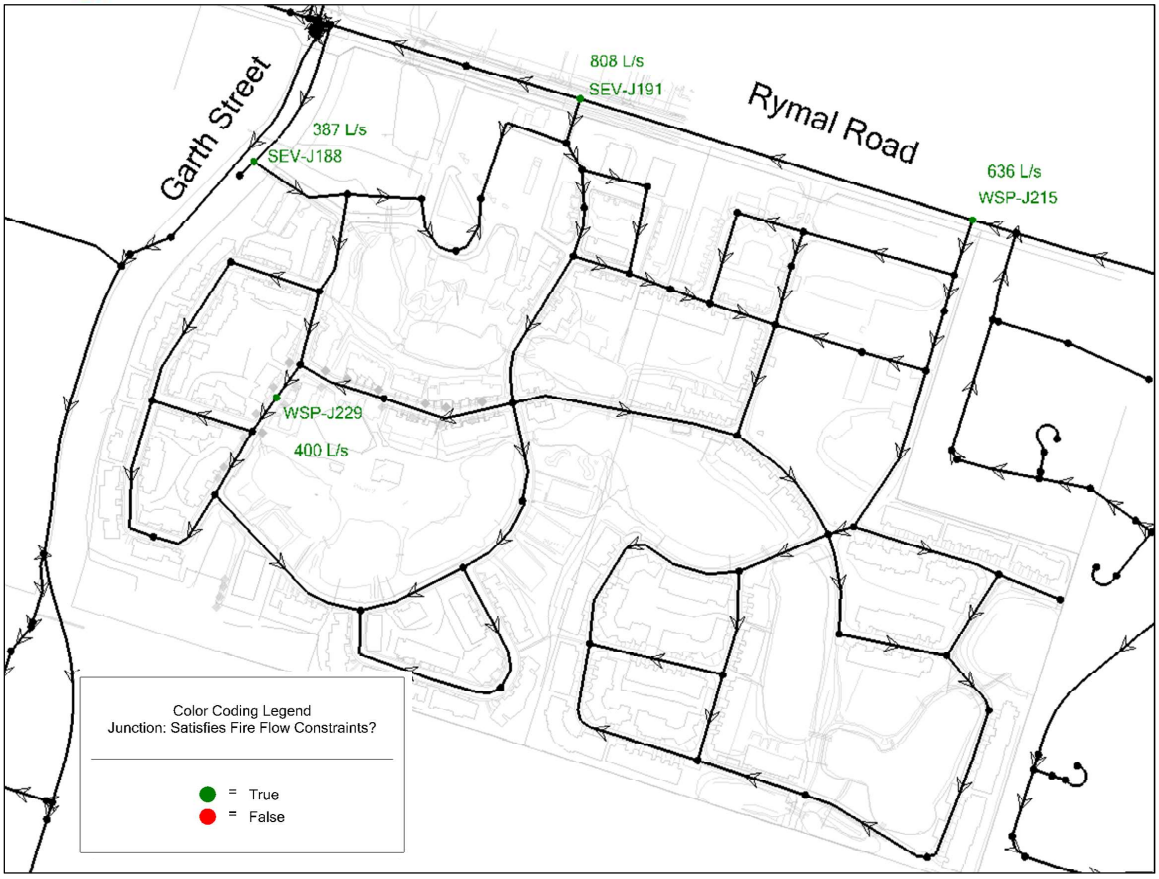


Figure C3 – Available Fire Flows under 2021 MDD+FF Scenario at 50% WL (HDR05)

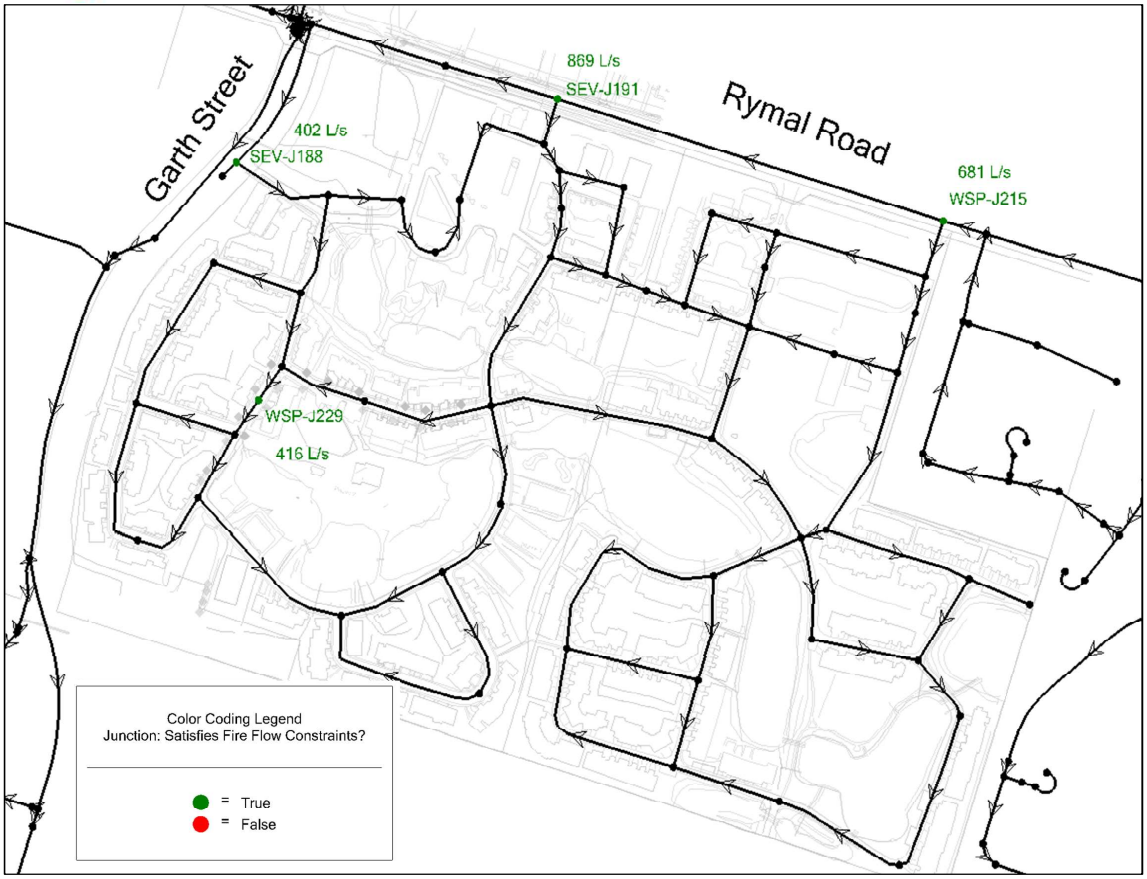


Figure C4 – Available Fire Flows under 2021 MDD+FF Scenario at 70% WL (HDR05)

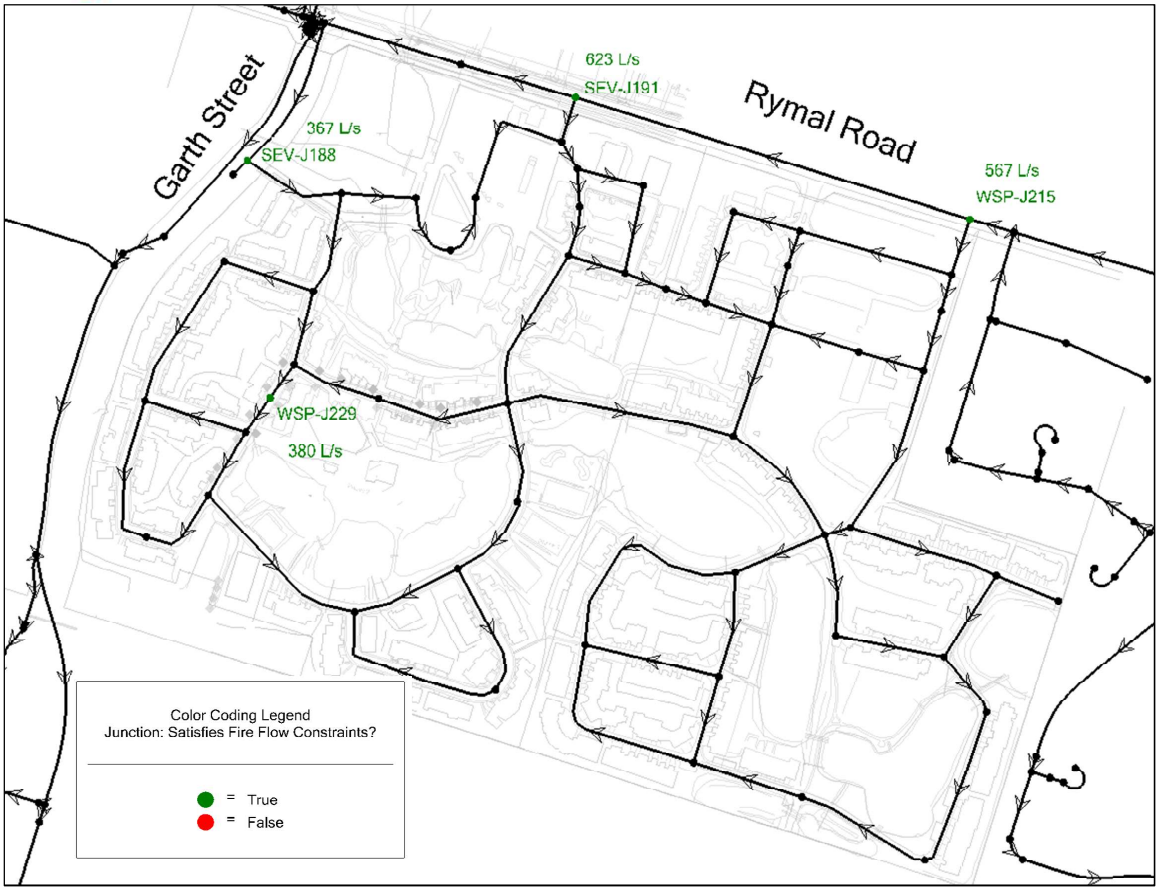


Figure C5 – Available Fire Flows under 2031 MDD+FF Scenario at 50% WL (HDR05)

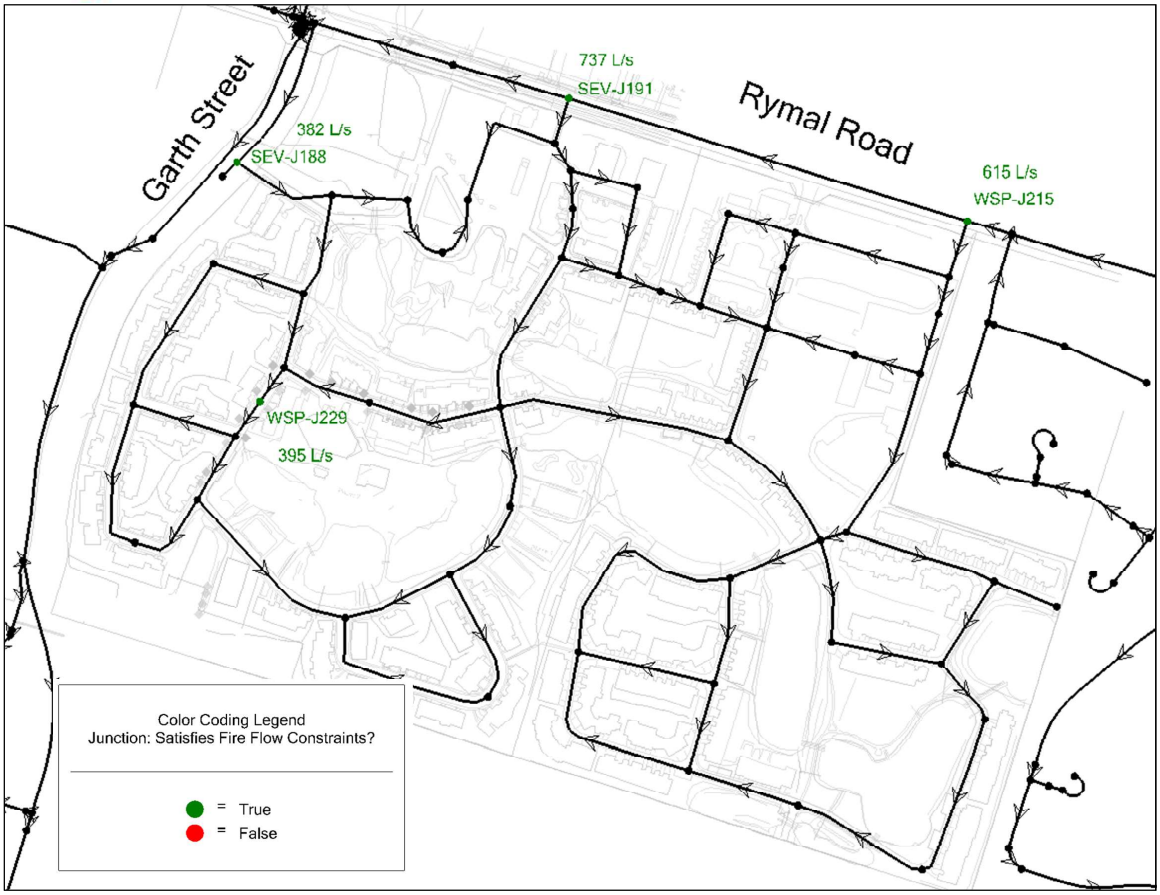
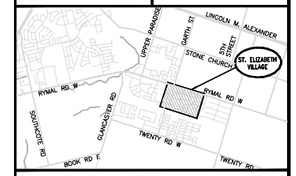


Figure C6 – Available Fire Flows under 2031 MDD+FF Scenario at 70% WL (HDR05)

CONSTRUCTION NORTH

TRUE NORTH



LEGEND

- CATCHMENT AREA BOUNDARIES
- EXISTING SANITARY TRUNK SEWER
- EXISTING PROPERTY LINE
- EXISTING EASEMENT
- EXISTING FENCE
- EXISTING DITCH/ SWALE

ALL AREAS ZONING BYLAW "DE"

MARK	DESCRIPTION	APP	DATE
6.			
5.			
4.			
3.			
2.			
1.	MASTER SERVICING REPORT	SM	2020-04-01

AECOM CANADA LTD.
50 SPORTSWORLD CROSSING ROAD, SUITE 290
KITCHENER, ON, N2P 0A4
TEL: 519-650-5313
FAX: 519-650-3424

LANDx DEVELOPMENTS

ST. ELIZABETH'S VILLAGE

EXISTING SANITARY CATCHMENT AREAS

DRN: KM	DSN: KM	PROJECT NUMBER: 60579660	
CHK: SM	APP: SM	Do not scale this document. All measurements must be obtained from stated dimensions.	
SCALE: 1:1250	DRAWING NUMBER: FIGURE 4.1		

0 20 mm

FILE NAME: C:\USERS\MCTAVISHK\DESKTOP\DESKTOP\PROJECTS\ST.: ELIZ\SHEETS\60579660 - SEV - EXISTING SANITARY DRAINAGE AREAS.DWG LAST SAVED BY: MCTAVISHK PLOT DATE: 4/9/2020 5:14:08 PM

EXISTING SANITARY SEWER CAPACITY SHEET

AECOM

Project: **ST. ELIZABETHS VILLAGE**
Client: LANDx Developments
Project Number: 60579660
Date: March 16, 2020
Design By: RW
Checked By: KM/SM

DESIGN PARAMETERS

Average Daily Flow

Residential	0.00417	L/s/c			Manning's "n"	0.015	Maximum Pipe Full 75%
Commercial	0.95	L/s/ha	> Peak Factor	2.5	Minimum Velocity	0.75 m/s	Babbit Formula M = 5
Industrial	0.40	L/s/ha	> Peak Factor	1.0	Maximum Velocity	2.75 m/s	$P^{0.2}$
School / Institutional	0.25	L/s/ha	> Peak Factor	1.0	Infiltration Rate	0.6 L/s/ha	

ASSUMPTION

LOCATION				EXTERNAL		RESIDENTIAL												COMMERCIAL			INFILTRATION			PIPE DESIGN						
STREET	AREA NUMBER	MANHOLE LOCATION		External Flows	External Area (ha)	HECTARES OF EACH DENSITY								R.O.W. Infiltration	POPUL.	ACCUM. POPUL.	PEAK FACTOR	PEAK RES. FLOW	AREA	ACCUM. AREA	PEAK FLOW	AREA	ACCUM. AREA	INFIL. FLOW	DESIGN FLOW	LENGTH	SLOPE	PIPE		CAPACITY	VELOCITY	% FULL
		FROM MH	TO MH			DE	R2	R3	R4/R5	R6	R7	R8	R9														SIZE	MATERIAL			
				l/s	75	110	36	72	143	196	312	387	775		"P"		"F"	l/s	ha	ha	l/s	ha	ha	l/s	l/s	m	%	mm		l/s	m/s	
Catchment Area 1																															
Szollosy Circle	*1*	EX.MH27A	EX.MH26A			0.314									16	16	4.39	0.29		0.000	0.00	0.314	0.314	0.19	0.48	21.8	1.88	250	CLAY	70.67	1.44	1%
Szollosy Circle	*2*	EX.MH26A	EX.MH25A			0.388									20	36	4.34	0.65		0.000	0.00	0.388	0.702	0.42	1.07	54.7	1.74	250	CLAY	67.98	1.38	2%
Sister Varga Terrace	*3*	EX.MH25A	EX.MH24A			0.268									8	44	4.33	0.79		0.000	0.00	0.268	0.970	0.58	1.37	59.0	1.58	250	CLAY	64.78	1.32	2%
Sister Varga Terrace	*4*	EX.MH24A	EX.MH23A			0.219									8	52	4.31	0.93		0.000	0.00	0.219	1.189	0.71	1.64	70.9	1.48	250	CLAY	62.70	1.28	3%
Szollosy Circle	*5*	EX.MH29A	EX.MH28A			0.472									24	24	4.37	0.44		0.000	0.00	0.472	0.472	0.28	0.72	42.2	2.91	250	CLAY	87.92	1.79	1%
Szollosy Circle	*6*	EX.MH30A	EX.MH28A			0.710									38	38	4.34	0.69		0.000	0.00	0.710	0.710	0.43	1.12	51.5	2.68	250	CLAY	84.37	1.72	1%
Whelan's Way	*7*	EX.MH28A	EX.MH23A			0.506									32	94	4.25	1.67		0.000	0.00	0.506	1.688	1.01	2.68	103.2	0.52	250	CLAY	37.16	0.76	7%
Sister Varga Terrace	*8*	**EX.MH23A**	EX.MH22A			0.441									20	166	4.18	2.89		0.000	0.00	0.441	3.318	1.99	4.88	75.4	0.48	250	CLAY	35.71	0.73	14%
Jaczenk Terrace	*9*	EX.MH36A	EX.MH35A			1.796									354	354	4.05	5.97		0.000	0.00	1.796	1.796	1.08	7.05	91.5	1.36	250	CLAY	60.10	1.22	12%
Jaczenk Terrace	*10*	EX.MH35A	EX.MH22A			0.038									0	354	4.05	5.97		0.000	0.00	0.038	1.834	1.10	7.07	35.9	0.92	250	CLAY	49.43	1.01	14%
Sister Varga Terrace	*11*	**EX.MH22A**	EX.MH21A			0.484									20	540	3.96	8.91		0.000	0.00	0.484	5.636	3.38	12.29	72.1	0.42	250	CLAY	33.40	0.68	37%
Szollosy Circle	*12*	EX.MH38A	EX.MH37A			0.641									28	28	4.36	0.51		0.000	0.00	0.641	0.641	0.38	0.89	24.3	3.66	250	CLAY	98.60	2.01	1%
Szollosy Circle	*13*	EX.MH37A	EX.MH21A			0.378									28	56	4.30	1.01		0.000	0.00	0.378	1.019	0.61	1.62	90.0	2.50	250	CLAY	81.49	1.66	2%
Sister Varga Terrace	*14*	**EX.MH21A**	EX.MH20A			0.290									14	610	3.93	9.99		0.000	0.00	0.290	6.945	4.17	14.16	73.8	0.41	250	CLAY	33.00	0.67	43%
Butty Pass	*15*	EX.MH39A	EX.MH20A			0.524									10	10	4.41	0.18		0.000	0.00	0.524	0.524	0.31	0.49	46.3	0.97	200	CLAY	28.00	0.89	2%
Gibbon's Square	*16*		EX.MH40A			1.051									208	208	4.14	3.59		0.000	0.00	1.051	1.051	0.63	4.22	1.0	0.50	250	CLAY	36.44	0.74	12%
Butty Pass	*17*	EX.MH40A	EX.MH20A			0.101									0	208	4.14	3.59		0.000	0.00	0.101	1.152	0.69	4.28	76.1	0.37	250	CLAY	31.35	0.64	14%
Connection to Trunk		**EX.MH20A**	**EX.MH4A**												**0**	**828**	**3.85**	**13.30**		**0.000**	**0.00**	**0.000**	**8.621**	**5.17**	**18.47**	**26.2**	**3.54**	**250**	**CLAY**	**96.97**	**1.98**	**19%**
Catchment Area 2																															
Father Biro Trail	*18*	EX.MH61A	EX.MH60A			0.600									10	10	4.41	0.18		0.000	0.00	0.600	0.600	0.36	0.54	58.2	0.81	250	PVC	46.38	0.94	1%
Father Biro Trail	*19*	EX.MH60A	EX.MH59A			0.326									12	22	4.37	0.40		0.000	0.00	0.326	0.926	0.56	0.96	49.8	0.56	250	PVC	38.57	0.79	2%
Gate Lane	*21*	EX.MH64A	EX.MH63A			0.489									20	20	4.38	0.37		0.000	0.00	0.489	0.489	0.29	0.66	56.1	0.98	250	PVC	51.02	1.04	1%
Gate Lane	*22*	EX.MH63A	EX.MH62A			0.536									30	50	4.31	0.90		0.000	0.00	0.536	1.025	0.62	1.52	62.8	1.40	250	PVC	60.98	1.24	2%
Gate Lane	*23*	EX.MH62A	EX.MH59A			0.389									24	74	4.28	1.32		0.000	0.00	0.389	1.414	0.85	2.17	45.6	1.56	250	PVC	64.37	1.31	3%
Father Biro Trail	*24*	**EX.MH59A**	EX.MH58A			0.061									0	96	4.25	1.70		0.000	0.00	0.061	2.401	1.44	3.14	29.0	0.55	250	PVC	38.22	0.78	8%
Father Biro Trail	*25*	EX.MH58A	EX.MH57A			0.393									6	102	4.24	1.80		0.000	0.00	0.393	2.794	1.68	3.48	78.0	0.41	250	PVC	33.00	0.67	11%
Gate Lane	*27*	EX.MH66A	EX.MH57A			0.842									38	38	4.34	0.69		0.000	0.00	0.842	0.842	0.51	1.20	96.8	2.54	250	PVC	82.14	1.67	1%
Father Biro Trail	*28*	**EX.MH57A**	EX.MH56A			0.331									16	156	4.19	2.72		0.000	0.00	0.331	3.967	2.38	5.10	43.5	0.53	250	PVC	37.52	0.76	14%
Father Biro Trail	*29*	EX.MH56A	EX.MH55A			0.304									16	172	4.17	2.99		0.000	0.00	0.304	4.271	2.56	5.55	35.8	0.20	250	PVC	23.05	0.47	24%
Father Biro Trail	*30*	EX.MH55A	EX.MH54A			0.309									16	188	4.16	3.26		0.000	0.00	0.309	4.580	2.75	6.01	37.6	0.58	250	PVC	39.25	0.80	15%
Father Biro Trail	*31*	EX.MH54A	EX.MH53A			0.261									0	188	4.16	3.26		0.000	0.00	0.261	4.841	2.90	6.16	64.7	0.40	250	PVC	32.60	0.66	19%
Jaczenk Terrace	*32*	EX.MH68A	EX.MH53A			0.566									32	32	4.35	0.58		0.000	0.00	0.566	0.566	0.34	0.92	45.5	4.24	250	CLAY	106.12	2.16	1%
Bells Gate	*33*	EX.MH46A	EX.MH47A			1.143									8	8	4.42	0.15		0.000	0.00	1.143	1.143	0.69	0.84	37.5	4.66	200	CONC	61.36	1.95	1%
Nolan Trail	*34*	EX.MH48A	EX.MH47A			0.857									36	36	4.34	0.65		0.000	0.00	0.857	0.857	0.51	1.16	54.8	2.61	200	CONC	45.92	1.46	3%
Nolan Trail	*35*	**EX.MH47A**	EX.MH50A			0.254									12	56	4.30	1.01		0.000	0.00	0.254	2.254	1.35	2.36	73.1	1.14	200	PVC	30.35	0.97	8%
Bishop Reding Way	*36*	EX.MH78A	EX.MH76A			0.396									16	16	4.39	0.29		0.000	0.00	0.396	0.396	0.24	0.53	76.3	4.40	200	PVC	59.63	1.90	1%
Bishop Tonnos Way	*37*	EX.MH77A	EX.MH76A			0.262									12	12	4.41	0.22		0.000	0.00	0.262	0.262	0.16	0.38	53.4	3.24	200	CONC	51.17	1.63	1%

EXISTING SANITARY SEWER CAPACITY SHEET

AECOM

Project:	**ST. ELIZABETHS VILLAGE**
Client:	LANDx Developments
Project Number:	60579660
Date:	March 16, 2020
Design By:	RW
Checked By:	KM/SM

DESIGN PARAMETERS

Average Daily Flow

Residential	0.00417 L/s/c			Manning's "n"	0.015	Maximum Pipe Full	75%
Commercial	0.95 L/s/ha	> Peak Factor	2.5	Minimum Velocity	0.75 m/s	Babbit Formula	M = 5
Industrial	0.40 L/s/ha	> Peak Factor	1.0	Maximum Velocity	2.75 m/s		$P^{0.2}$
School / Institutional	0.25 L/s/ha	> Peak Factor	1.0	Infiltration Rate	0.6 L/s/ha		

ASSUMPTION

LOCATION				EXTERNAL		RESIDENTIAL												COMMERCIAL			INFILTRATION			PIPE DESIGN							
STREET	AREA NUMBER	MANHOLE LOCATION		External Flows	External Area (ha)	HECTARES OF EACH DENSITY								R.O.W. Infiltration	POPUL.	ACCUM. POPUL.	PEAK FACTOR	PEAK RES. FLOW	AREA	ACCUM. AREA	PEAK FLOW	AREA	ACCUM. AREA	INFIL. FLOW	DESIGN FLOW	LENGTH	SLOPE	PIPE		CAPACITY	VELOCITY	% FULL
		FROM MH	TO MH			DE	R2	R3	R4/R5	R6	R7	R8	R9														SIZE	MATERIAL			
				l/s	75	110	36	72	143	196	312	387	775		"P"		"F"	l/s	ha	ha	l/s	ha	ha	l/s	l/s	m	%	mm		l/s	m/s	
Bishop Tonnos Way	*38*	**EX.MH76A**	EX.MH75A			0.584									20	48	4.32	0.86		0.000	0.00	0.584	1.242	0.75	1.61	39.4	2.99	200	CONC	49.15	1.56	3%
Bishop Tonnos Way	*39*	EX.MH75A	EX.MH74A			0.297									12	60	4.30	1.08		0.000	0.00	0.297	1.539	0.92	2.00	47.7	1.13	200	CONC	30.22	0.96	7%
Bishop Tonnos Way/ Mckennan Court	*40*	EX.MH74A	EX.MH50A			0.562									14	74	4.28	1.32		0.000	0.00	0.562	2.101	1.26	2.58	45.0	2.00	200	CONC	40.20	1.28	6%
Nolan Trail	*41*	**EX.MH50A**	EX.MH51A			0.572									24	154	4.19	2.69		0.000	0.00	0.572	4.927	2.96	5.65	91.4	2.88	250	CONC	87.46	1.78	6%
Nolan Trail	*42*	EX.MH51A	EX.MH52A			0.032									0	154	4.19	2.69		0.000	0.00	0.032	4.959	2.98	5.67	37.6	0.32	250	CLAY	29.15	0.59	19%
Nolan Trail	*43*	EX.MH52A	EX.MH53A			0.033									0	154	4.19	2.69		0.000	0.00	0.033	4.992	3.00	5.69	26.1	0.92	250	CLAY	49.43	1.01	12%
Boyes Gate	*44*	**EX.MH53A**	EX.MH80A			0.230									14	388	4.03	6.52		0.000	0.00	0.230	10.629	6.38	12.90	42.9	0.79	250	CLAY	45.81	0.93	28%
Boyes Gate	*45*	**EX.MH80A**	**EX.MH10A**			**0.051**									**0**	**388**	**4.03**	**6.52**		**0.000**	**0.00**	**0.051**	**10.680**	**6.41**	**12.93**	**14.9**	**9.25**	**200**	**PVC**	**86.45**	**2.75**	**15%**
Catchment Area 3																															
Bishop Reding Way	*46*	EX.MH91A	EX.MH90A			0.745									0	0	4.50	0.00		0.000	0.00	0.745	0.745	0.45	0.45	73.7	1.04	200	CONC	28.99	0.92	2%
Bishop Reding Way	*47*	EX.MH90A	EX.MH86A			0.559									0	0	4.50	0.00		0.000	0.00	0.559	1.304	0.78	0.78	73.8	0.83	200	CONC	25.90	0.82	3%
Bishop Reding Way	*48*	EX.MH89A	EX.MH86A			0.665									26	26	4.36	0.47		0.000	0.00	0.665	0.665	0.40	0.87	39.9	0.40	200	CONC	17.98	0.57	5%
Bishop Ryan Way	*49*	**EX.MH86A**	EX.MH85A			0.163									0	26	4.36	0.47		0.000	0.00	0.163	2.132	1.28	1.75	88.3	4.17	200	CONC	58.05	1.85	3%
Bishop Tonnos Way	*50*	EX.MH88A	EX.MH87A			1.053									0	0	4.50	0.00	1.053	1.053	2.50	2.106	2.106	1.26	3.76	71.1	2.32	200	CONC	43.30	1.38	9%
Bishop Tonnos Way	*51*	EX.MH87A	EX.MH85A			0.669									0	0	4.50	0.00		1.053	2.50	0.669	2.775	1.67	4.17	71.2	0.93	200	CONC	27.41	0.87	15%
Bishop Ryan Way	*52*	**EX.MH85A**	EX.MH83A			0.568									14	40	4.33	0.72		1.053	2.50	0.568	5.475	3.29	6.51	117.0	4.43	250	PVC	108.48	2.21	6%
Cardinal Mindszenty BLVD	*53*	EX.MH84A	EX.MH83A			0.372									14	14	4.40	0.26		1.053	2.50	0.372	0.372	0.22	2.98	35.7	1.93	250	PVC	71.60	1.46	4%
Cardinal Mindszenty BLVD	*54*	**EX.MH83A**	EX.MH82A			0.345									12	66	4.29	1.18		1.053	2.50	0.345	6.192	3.72	7.40	48.9	1.63	250	PVC	65.80	1.34	11%
Cardinal Mindszenty BLVD	*55*	EX.MH82A	EX.MH81A			0.464									10	76	4.27	1.35		1.053	2.50	0.464	6.656	3.99	7.84	61.1	1.82	250	PVC	69.53	1.42	11%
Connection to Trunk Sewer		**EX.MH81A**	**EX.MH11A**												**0**	**76**	**4.27**	**1.35**		**1.053**	**2.50**	**0.000**	**6.656**	**3.99**	**7.84**	**11.7**	**3.84**	**250**	**PVC**	**100.99**	**2.06**	**8%**
Catchment Area 4																															
Bishop Sherlock Lane	*56*	EX.MH94A	EX.MH93A			0.677									22	22	4.37	0.40		0.000	0.00	0.677	0.677	0.41	0.81	72.8	3.46	250	PVC	95.87	1.95	1%
Bishop Reding Way	*57*		EX.MH93A			0.424									0	0	4.50	0.00		0.000	0.00	0.424	0.424	0.25	0.25	1.0	0.50	250	PVC	36.44	0.74	1%
MSGR Henke Terrace	*58*	**EX.MH93A**	EX.MH92A			0.140									0	22	4.37	0.40		0.000	0.00	0.140	1.241	0.74	1.14	22.3	1.17	250	PVC	55.75	1.14	2%
Cardinal Mindszenty BLVD	*59*	EX.MH95A	EX.MH92A			0.695									10	10	4.41	0.18		0.000	0.00	0.695	0.695	0.42	0.60	83.8	2.96	250	PVC	88.67	1.81	1%
																32	**4.35**	**0.58**		**0.000**	**0.00**	**0.000**	**1.936**	**1.16**	**1.74**	**83.8**	**2.96**	**250**	**PVC**	**88.67**	**1.81**	**2%**

Table 4-1 Dry Weather Flow Characteristics

Flow Monitor	Area (ha)	Average WWF (L/s)	Average DWF (L/s)	Average DWF Volume (L/d)	Daily Min. DWF (L/s)	Daily Peak DWF (L/s)	Peaking Factor (Peak Hour)	GWI (80% min DWF) (L/s)	Average DWF Volume - GWI (L/d)
~~MH4A~~	**155.45**	~~N/A~~	~~N/A~~	~~N/A~~	~~N/A~~	~~N/A~~	~~N/A~~	~~N/A~~	~~N/A~~
MH2A_N	**121.27**	12.44	9.38	810,000	8.31	10.23	1.09	7.50	648,000
MH2A_S	**34.18**	5.02	4.51	390,000	4.12	4.79	1.06	3.61	312,000
MH20A	**8.62**	4.85	4.82	416,000	4.39	5.02	1.04	3.86	333,000
MH80A	**10.7**	2.12	1.79	155,000	1.65	2.03	1.13	1.43	124,000
MH81A	**4.86**	0.64	0.69	60,000	0.67	0.70	1.01	0.55	48,000
MH92A	**1.94**	0.63	0.31	27,000	0.26	0.36	1.16	0.25	21,000
MH96A	**4.54**	1.45	1.11	96,000	1.00	1.19	1.07	0.89	77,000
MH109A	**0.53**	0.06	0.01	1,000	0.01	0.01	1.00	0.01	1,000
MH111A	**1.09**	0.61	0.65	56,000	0.57	0.70	1.08	0.52	45,000
MH114A	**1.09**	0.12	0.04	3,000	0.04	0.05	1.25	0.03	3,000
MH15A	**188.82**	32.09	23.94	2,068,000	23.11	25.87	1.08	19.15	1,655,000

Note: All catchment areas were determined using the information provided in the 2020 AECOM report and drawn using the land parcels for the catchment areas upstream of the St. Elizabeth Study area.

Peaking Factor = Peak DWF/Average DWF

N/A – Not Applicable

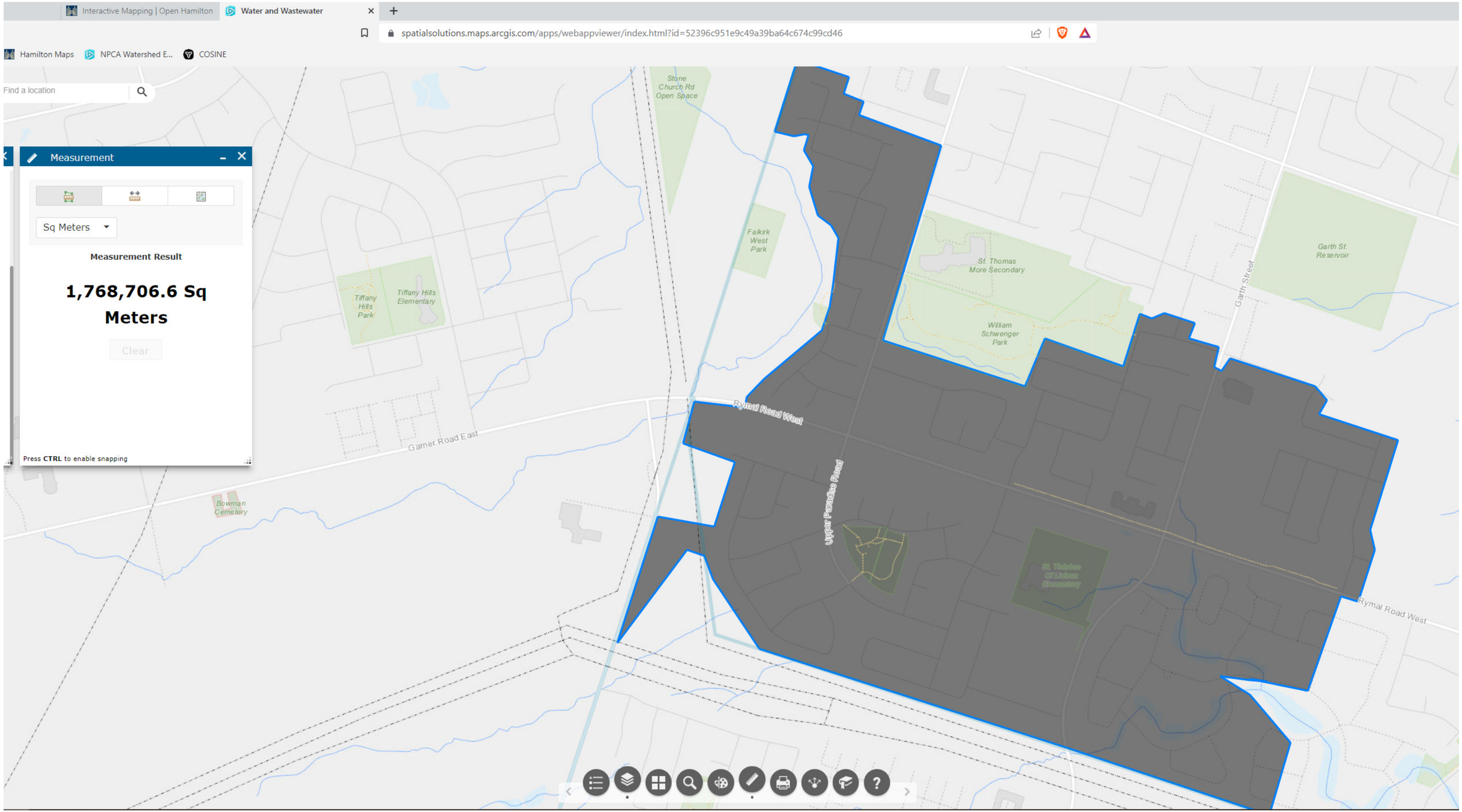
4.2 Wet Weather Flow Analysis

The flow monitoring data was further reviewed for wet weather flow characteristics. The wet weather response parameters for the sanitary system were calculated as follows:

- **Volumetric I/I Coefficient (Cv, %)** = Total RDII Volume / (Total Rainfall Depth X Drainage Area)
- **Peak RDII Rate (l/s/ha)** = Maximum flow in the RDII Hydrograph/Drainage Area

Table 4-2 to Table 4-5 summarizes the I/I rate, and volumetric runoff coefficient measured at each local sanitary monitoring location for the eleven (11) selected rain events. It is important to note that the I/I factor was not calculated for all monitoring locations during the selected storm events because the data was erroneous or missing during the selected events, rain data was unreliable due to below freezing temperatures, and/or the intensity of the events was not significant enough to warrant a reaction from the local sewers.

The peak I/I rate of the monitoring stations ranged from **0.01 l/s/ha to 4.8 l/s/ha**, for the eleven (11) significant rain events selected for this analysis. In comparison, the City of Toronto's infiltration allowance in sanitary sewer design criteria is 0.26 L/s/ha, Etobicoke Development Guidelines is 0.28 L/s/ha, York Region is 0.29 L/s/ha, and the City of Hamilton infiltration allowance rate was 0.6 l/s/ha (City of Hamilton Engineering Guidelines for Servicing Land Under



RYMAL ROAD TRUNK SEWER, CONTRIBUTING DRAINAGE AREA

AMENDED ENVIRONMENTAL COMPLIANCE APPROVAL
NUMBER 6048-BS9KV5
Issue Date: March 23, 2021

City of Hamilton
77 James Street North, No. 400
Hamilton, Ontario
L8R 2K3

Site Location: Twenty Road Sewage Pumping Station (HC018)
1980 Upper James Street North, Part 1 of Reference Plan 62R-6629, Lot 5, Concession 1
City of Hamilton

You have applied under section 20.2 of Part II.1 of the Environmental Protection Act , R.S.O. 1990, c. E. 19 (Environmental Protection Act) for approval of:

establishment, replacement and alteration, usage and operation of new and existing municipal sewage works, for the transmission of sanitary sewage via pumping station discharging to the City of Hamilton sewage collection system which ultimately discharges to the Woodward Avenue Wastewater Treatment Plant for treatment and disposal as follows:

Classification of Collection System: Separate Sewer Systems

Sanitary Sewage Pumping Stations

Twenty Road Sewage Pumping Station (HC018)

- designed for an initial period peak flow of 590 litres per second, having a design 10 year period peak flow of 1000 litres per second and reduced after the 10 year period to an ultimate period peak flow of 590 litres per second, consisting of an existing dry well/wet well type sewage pumping station (Station A) and a proposed prefabricated wet well pumping station (Station B) designed to function in parallel as part of an overall system, as follows;

  Station A - existing dry well/wet well

  - equipped with two (2) dry well submersible pumps and one (1) standby pump with variable frequency drives, each rated at 295 litres per second at a Total Dynamic Head (TDH) of 25.4 metres;
  - one (1) 600 millimetres diameter overflow pipe;

- 600 millimetres diameter forcemain from pumping station to north of Twenty Road and sanitary sewers on Upper James Street;
- one (1) flowmeter;

Station B - proposed prefabricated wet well

- equipped with two (2) submersible constant speed pumps with approximate impeller diameter size of 410 millimetres each rated at typical operating point of 380 litres per second at a Total Dynamic Head (TDH) of 19.0 metres (with low and high wet well levels of approximately 360 litres per second and 410 litres per second);
- 450 millimetres diameter yard piping discharge from the flowmetering chamber to a new swab launch chamber and eventual discharge to a new 750 millimetres diameter forcemain describe below;
- 750 millimetres diameter 900 metres long forcemain, to run parallel to the existing 600 millimetres diameter forcemain, and outletting to the same outlet maintenance hole as the existing 600 millimetres diameter forcemain on Upper James Street just east of Alderson Drive;
- one (1) flowmeter;

- The proposed 750 millimetres diameter forcemain is to operate with Station B under normal conditions. The overall system will have a manual interconnection valve with the existing 600 millimetres diameter forcemain that is normally closed. In the event that the existing 600 millimetres diameter forcemain is taken out of service (e.g. inspection), then Station A will pump through the 750 millimetres diameter by manually opening the interconnection valve. The opposite scenario will also occur with Station B pumping through the existing 600 millimetres.

including all other mechanical system, electrical system, instrumentation and control system, standby power system, piping, pumps, valves and appurtenances essential for the proper, safe and reliable operation of the Works in accordance with this Approval, in the context of process performance and general principles of wastewater engineering only;

all in accordance with the submitted supporting documents listed in Schedule A.

For the purpose of this environmental compliance approval, the following definitions apply:

1. "Approval" means this environmental compliance approval and any schedules attached to it, and the application;

APPENDIX 'C' – SWM Analysis

Pre-Development Storm Drainage Area Plan – Figure STMDA1

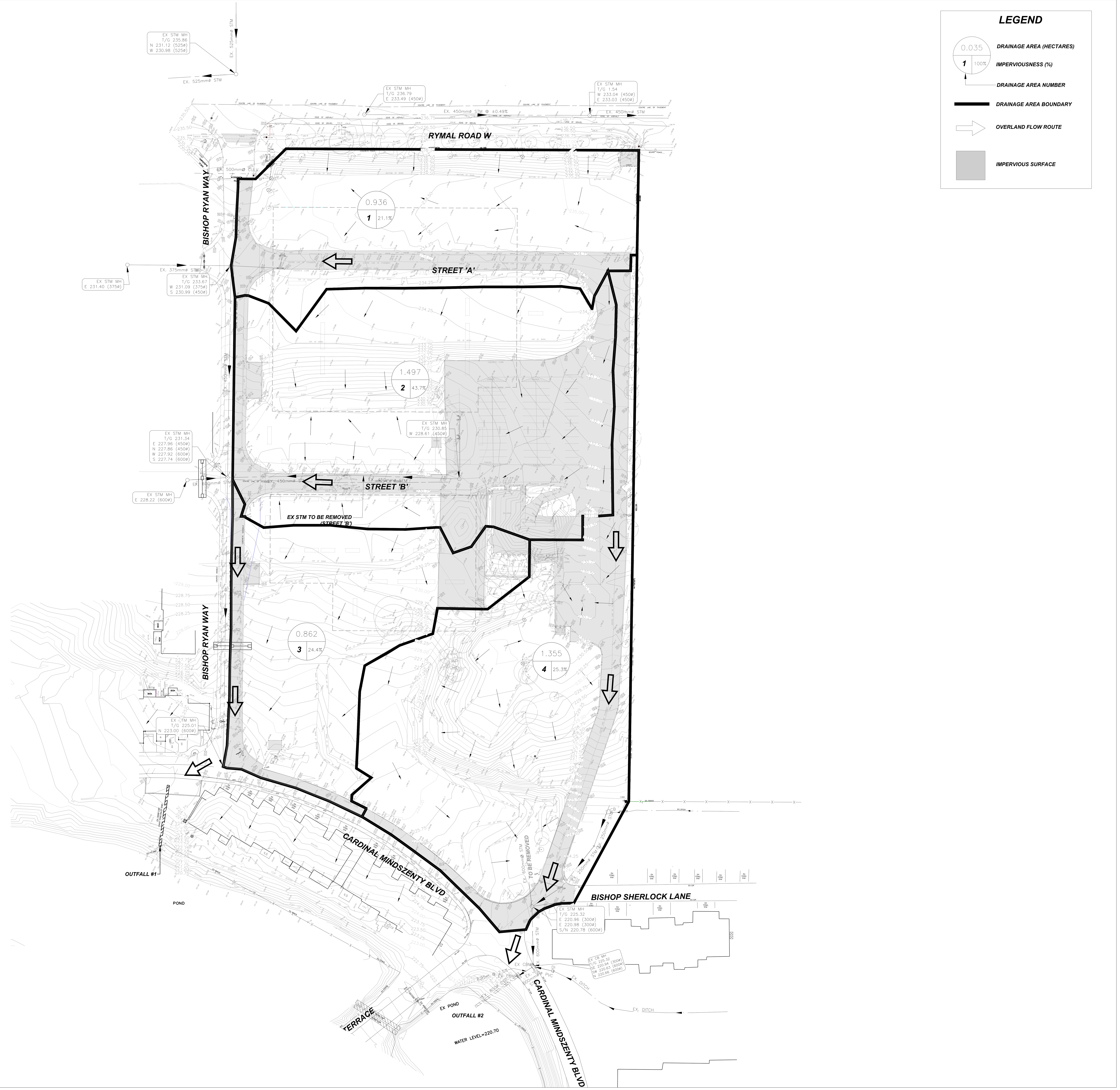
Post-Development Storm Drainage Area Plan – Figure STMDA2

Drainage Figure 1 – Existing 600mm storm sewer capacity

MIDUSS V2 Output Files

CULTEC Recharger 902HD Sizing Report & Details

Stormceptor EF12, Sizing Report & Details



KEY PLAN N.T.S.

BENCHMARK NOTE:

ELEVATION = 229.005 (CGVD-1928)

MONUMENT: 07720020068

RIB WITH BRASS CAP

LOCATED IN GLANBROOK, 10m EAST OF CENTRELINE OF WEST 5TH STREET. 25m NORTH OF CENTRELINE OF RYMAL ROAD, 3m EAST OF SIDEWALK, 8m NORTHWEST OF TRAFFIC SWITCHBOX.

SITE BENCHMARK:

ELEVATION = 235.29

CUT-STAR LOCATED IN SIDEWALK, SOUTH-WEST OF THE INTERSECTION OF RYMAL ROAD WEST AND BISHOP RYAN WAY AS INDICATED ON PLAN.

GENERAL NOTES:

1. TENDERE'R SHALL SATISFY THEMSELVES AS TO THE NATURE OF THE GROUND AND BID ACCORDINGLY.
2. ALL ROCK LINE INDICATIONS SHOWN ON THE PLAN MUST BE VERIFIED BY THE CONTRACTOR.
3. CONTRACTOR SHALL VERIFY LOCATIONS AND INVERTS OF ALL EXISTING SANITARY AND STORM SEWERS AND WATERMAINS, PRIVATE DRAINS AND WATER SERVICES, GAS MAINS, CABLE TV, HYDRO AND TELEPHONE DUCTS ETC AT START OF CONSTRUCTION.

NO:	DATE:	DESCRIPTION:
0	2023-05-10	FSR SUBMISSION

REVISIONS

SEAL

LandSmith ENGINEERING & CONSULTING LTD.
LANDSMITH ENGINEERING & CONSULTING LTD.
1059 UPPER JAMES STREET, SUITE 207
HAMILTON, ON L9C 3A6
ANDREW@LANDSMITHEC.COM
289-309-3632

CLIENT: ZEST COMMUNITIES

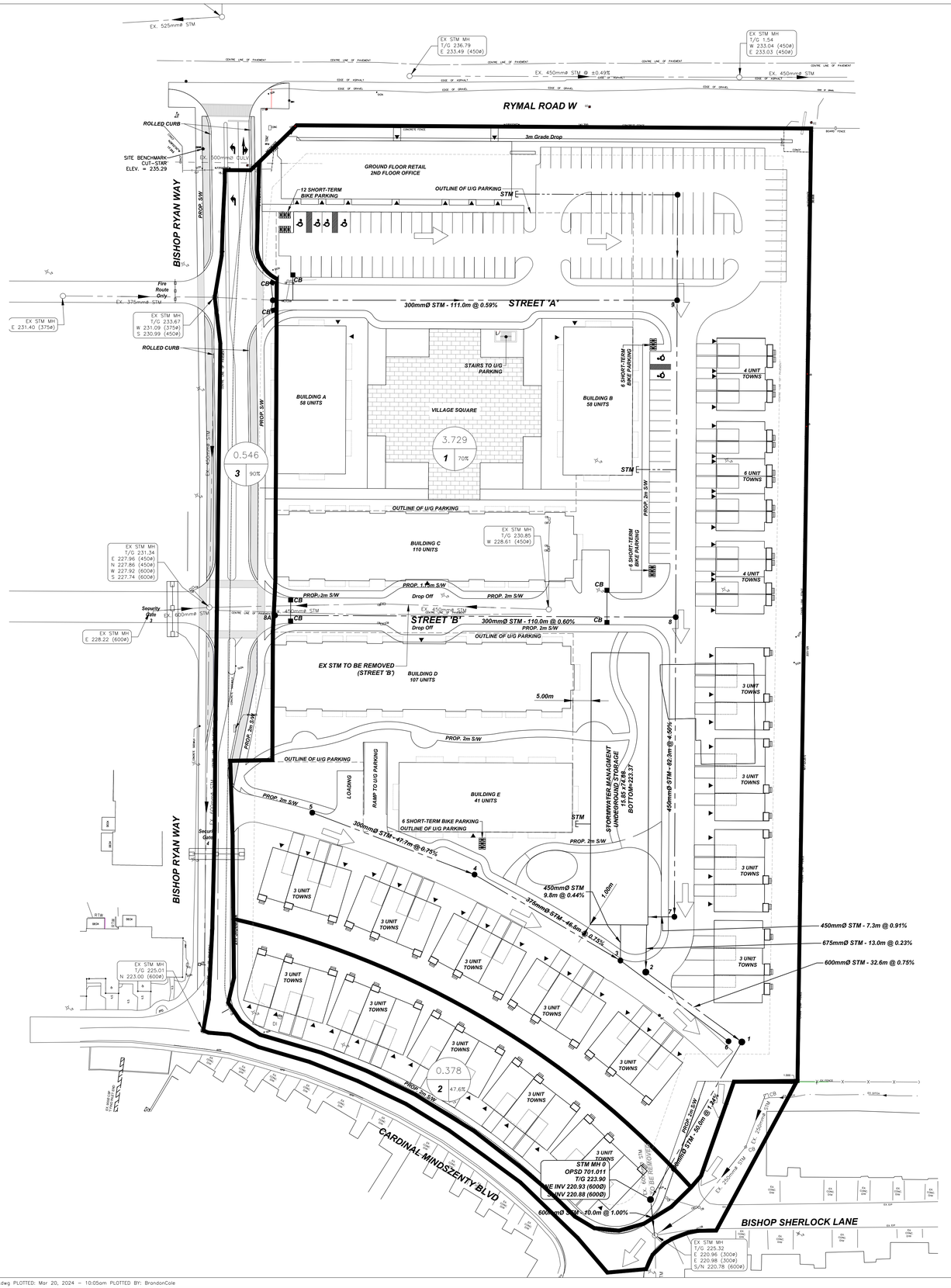
MUNICIPALITY: CITY OF HAMILTON

PROJECT NAME: ST. ELIZABETH VILLAGE

TITLE: PRE-DEVELOPMENT STORM DRAINAGE AREA PLAN

SCALE: 1:750	DATE: 2023-05-10
CHECKED BY: AS	DESIGNED BY: DH/BC
DWG No: 23008SEV	SHEET No: STMDA1

DRAWING FILE: Z:\Project Files\PROJECTS_Hamilton\Saint Elizabeth Village\CAD\BASE_ST.ELIZABETH VILLAGE CP.dwg PLOTTED: Mar 20, 2024 - 9:58am PLOTTED BY: BrandonCole



LEGEND

- 0.035 / 1 / 100% — DRAINAGE AREA (HECTARES); IMPERVIOUSNESS (%); DRAINAGE AREA NUMBER
- DRAINAGE AREA BOUNDARY
- OVERLAND FLOW ROUTE

KEY PLAN N.T.S.

BENCHMARK NOTE:

ELEVATION = 229.005 (CGVD-1928)

MONUMENT: 07720020068

RIB WITH BRASS CAP

LOCATED IN GLANBROOK, 10m EAST OF CENTRELINE OF WEST 5TH STREET. 25m NORTH OF CENTRELINE OF RYMAL ROAD, 3m EAST OF SIDEWALK, 8m NORTHWEST OF TRAFFIC SWITCHBOX.

SITE BENCHMARK:

ELEVATION = 235.29

CUT-STAR LOCATED IN SIDEWALK, SOUTH-WEST OF THE INTERSECTION OF RYMAL ROAD WEST AND BISHOP RYAN WAY AS INDICATED ON PLAN.

GENERAL NOTES:

1. TENDERER SHALL SATISFY THEMSELVES AS TO THE NATURE OF THE GROUND AND BID ACCORDINGLY.
2. ALL ROCK LINE INDICATIONS SHOWN ON THE PLAN MUST BE VERIFIED BY THE CONTRACTOR.
3. CONTRACTOR SHALL VERIFY LOCATIONS AND INVERTS OF ALL EXISTING SANITARY AND STORM SEWERS AND WATERMAINS, PRIVATE DRAINS AND WATER SERVICES, GAS MAINS, CABLE TV, HYDRO AND TELEPHONE DUCTS ETC AT START OF CONSTRUCTION.

NO:	DATE:	DESCRIPTION:
1	2024-03-19	REVISED PER FSR COMMENTS
0	2023-05-10	FSR SUBMISSION

REVISIONS

SEAL

LandSmith ENGINEERING & CONSULTING LTD.
LANDSMITH ENGINEERING & CONSULTING LTD.
1059 UPPER JAMES STREET, SUITE 207
HAMILTON, ON L9C 3A6
ANDREW@LANDSMITHEC.COM
289-309-3632

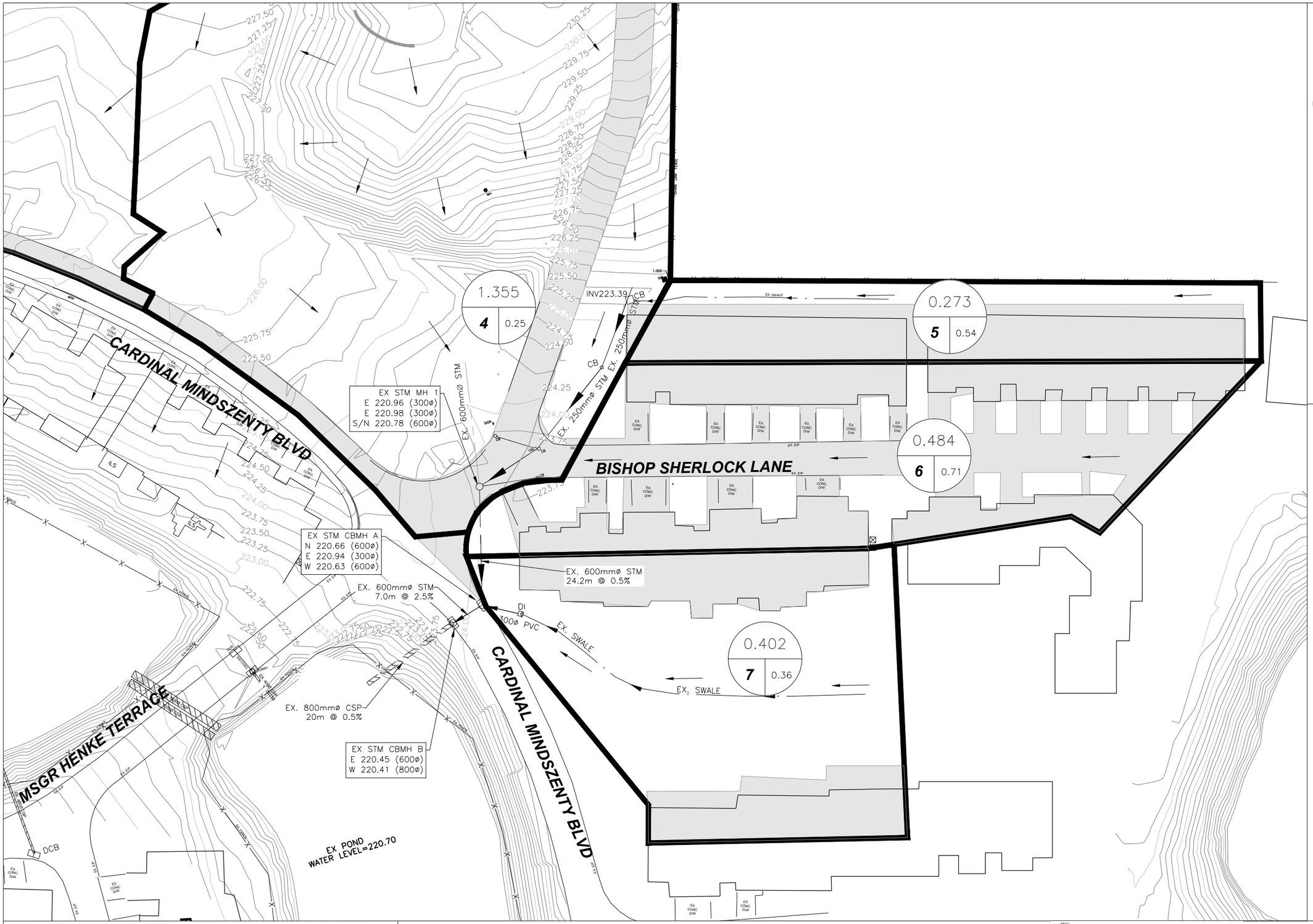
CLIENT:
ZEST COMMUNITIES

MUNICIPALITY:
CITY OF HAMILTON

PROJECT NAME:
ST. ELIZABETH VILLAGE

TITLE:
POST-DEVELOPMENT
STORM DRAINAGE AREA PLAN

SCALE: 1:600	DATE: 2023-05-10
CHECKED BY: AS	DESIGNED BY: AF/BC
DWG No: 23008SEV	SHEET No: STMDA2



LEGEND

- 0.035 / 1 / 0.25 — DRAINAGE AREA (HECTARES) / RUNOFF COEFFICIENT "C"
- DRAINAGE AREA NUMBER
- DRAINAGE AREA BOUNDARY
- OVERLAND FLOW ROUTE
- IMPERVIOUS SURFACE
- SHEET FLOW DIRECTION

SCALE:

0 10 20 30 40 50 60

1:750

LandSmith ENGINEERING & CONSULTING LTD.

PROJECT: ST. ELIZABETH VILLAGE

EXISTING 600mm STORM SEWER CAPACITY

DRAINAGE FIGURE 1

CITY OF HAMILTON

DOWNSTREAM STORM SEWER CAPACITY CALCULATIONS

100-Year Storm

LandSmith ENGINEERING & CONSULTING LTD.

Design By: A.Smith
Date: Mar. 19, 2024

Location: Saint Elizabeth Village

DESIGN INFORMATION

Design Storm Parameters				Pipe Roughness
Tci =	10 mins	A=	2317.40	n = 0.013
Hamilton		B=	11.00	min. v = 0.9 m/s
100-Year		C=	0.836	max v = 3.65m/s

Catchment No.	Manhole Number U/S	Manhole Number D/S	Area "Aa" (ha)	Runoff Coeff "Ca"	Aa x Ca	Cumulative Area A = ΣAa (ha)	Cumulative A x C = ΣAa x Ca	Time in Section "tcf" (min)	Initial Time of Conc. "tci" (min)	Time of Conc. tc = tcf + tci (min)	Rainfall Intensity "i" (mm/hr)	Quantity of Flow "Q" (m^3/s)	Type of Pipe	Manning's Roughness Coefficient "n"	Slope "S" (%)	Pipe Diameter "D" (mm)	Pipe Length "L" (m)	Pipe Velocity "V" (m/s)	Q_{FULL} (m^3/s)	% Full
	Existing Conditions - 600mm PIPE																			
4,5,6	STM MH1	CBMH A	2.000	0.43	0.858	2.000	0.858	0.26	21.97	22.23	123.88	0.295	conc	0.013	0.50	600	24.2	1.55	0.45	65%
7	CBMH A	CBMH B	0.402	0.36	0.143	2.402	1.001	0.03	22.23	22.26	123.78	0.344	conc	0.013	2.50	600	7.0	3.47	1.01	34%
-	CBMH B	Pond	-	-	-	-	-					0.344	PVC	0.023	0.50	800	20.0	1.06	0.55	62%
									Tc. Via Airport formula											
	600mm PIPE, No Site Flows																			
5,6	STM MH1	CBMH A	0.757	0.65	0.492	0.757	0.492	0.26	21.97	22.23	123.88	0.169	conc	0.013	0.50	600	24.2	1.55	0.45	37%
7	CBMH A	CBMH B	0.402	0.36	0.143	1.159	0.635	0.03	22.23	22.26	123.78	0.218	conc	0.013	2.50	600	7.0	3.47	1.01	22%
-	CBMH B	Pond	-	-	-	-	-					0.344	CSP	0.023	0.50	800	20.0	1.06	0.55	62%
									Tc. Via Airport formula											
								Maximum Capacity 600mm pipe at lowest slope (0.50%)				0.450	conc	0.013	0.50	600	24.2	1.55	0.45	99%
							Residual Capacity for Site Flows = 0.450 - 0.169 = 0.281 cms													

	Area	% IMP	C
Area 4	1.355	25.3	0.25
Area 5	0.273	54.1	0.54
Area 6	0.484	73.6	0.71
Area 7	0.402	33.9	0.36

PRE-DEVELOPMENT - 5-YEAR STORM (6-HR CHICAGO):

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                    February 7, 2010"
"           10   Units used:                                            ie METRIC"
"                Job folder:               Z:\Project Files\PROJECTS\_Hamilton\"
"                                  Saint Elizabeth Village\SWM\Existing Conditions"
"                Output filename:                                         EX_5.out"
"                Licensee name:                           andrew@landsmithec.com"
"                Company               LandSmith Engineering & Consulting Ltd."
"                Date & Time last used:                2024-03-18 at 2:44:02 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      360.000   Max. Storm length"
"     3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1049.500   Coefficient A"
"        8.000   Constant B"
"        0.803   Exponent C"
"        0.500   Fraction R"
"      360.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           103.038    mm/hr"
"             Total depth                  54.797    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   Catchment 1"
"       21.100   % Impervious"
"        0.936   Total Area"
"      135.000   Flow length"
"        1.600   Overland Slope"
"        0.739   Pervious Area"
"      135.000   Pervious length"
"        1.600   Pervious slope"
"        0.197   Impervious Area"
"      135.000   Impervious length"
"        1.600   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.299   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.900   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.055     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.739      0.197      0.936      hectare"
"             Time of concentration  45.874     5.827      28.010     minutes"
"             Time to Centroid       282.197    201.013    245.983    minutes"
"             Rainfall depth         54.797     54.797     54.797     mm"
"             Rainfall volume        404.68     108.22     512.90     c.m"
"             Rainfall losses        38.412     5.457      31.459     mm"
"             Runoff depth           16.385     49.340     23.338     mm"
"             Runoff volume          121.00     97.44      218.45     c.m"
"             Runoff coefficient     0.299      0.900      0.426      "
"             Maximum flow           0.021      0.052      0.055      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.055     0.055     0.000     0.000"
```

```
" 33          CATCHMENT 102"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"           102   Catchment 2"
"        43.700   % Impervious"
"         1.497   Total Area"
"       130.000   Flow length"
"         3.500   Overland Slope"
"         0.843   Pervious Area"
"       130.000   Pervious length"
"         3.500   Pervious slope"
"         0.654   Impervious Area"
"       130.000   Impervious length"
"         3.500   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        75.000   Pervious SCS Curve No."
"         0.299   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.467   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.896   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      0.186     0.055     0.000     0.000 c.m/sec"
"              Catchment 102          Pervious   Impervious Total Area "
"              Surface Area           0.843      0.654      1.497      hectare"
"              Time of concentration  35.461     4.504      13.807     minutes"
"              Time to Centroid       266.815    198.975    219.362    minutes"
"              Rainfall depth         54.797     54.797     54.797     mm"
"              Rainfall volume        461.84     358.48     820.31     c.m"
"              Rainfall losses        38.419     5.684      24.114     mm"
"              Runoff depth           16.378     49.113     30.683     mm"
"              Runoff volume          138.04     321.29     459.33     c.m"
"              Runoff coefficient     0.299      0.896      0.560      "
"              Maximum flow           0.029      0.181      0.186      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      0.186     0.240     0.000     0.000"
" 33          CATCHMENT 103"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"           103   Catchment 3"
"        24.400   % Impervious"
"         0.862   Total Area"
"       105.000   Flow length"
"         5.300   Overland Slope"
"         0.652   Pervious Area"
"       105.000   Pervious length"
"         5.300   Pervious slope"
"         0.210   Impervious Area"
"       105.000   Impervious length"
"         5.300   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        75.000   Pervious SCS Curve No."
"         0.299   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.467   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.884   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      0.065     0.240     0.000     0.000 c.m/sec"
```

```
"             Catchment 103          Pervious   Impervious Total Area "
"             Surface Area           0.652      0.210      0.862      hectare"
"             Time of concentration  27.545     3.499      15.802     minutes"
"             Time to Centroid       255.110    197.407    226.931    minutes"
"             Rainfall depth         54.797     54.797     54.797     mm"
"             Rainfall volume        357.10     115.25     472.35     c.m"
"             Rainfall losses        38.423     6.376      30.603     mm"
"             Runoff depth           16.374     48.421     24.194     mm"
"             Runoff volume          106.71     101.84     208.55     c.m"
"             Runoff coefficient     0.299      0.884      0.442      "
"             Maximum flow           0.027      0.059      0.065      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.065     0.305     0.000     0.000"
" 33          CATCHMENT 104"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          104   Catchment 4"
"       27.300   % Impervious"
"        1.243   Total Area"
"      260.000   Flow length"
"        4.200   Overland Slope"
"        0.904   Pervious Area"
"      260.000   Pervious length"
"        4.200   Pervious slope"
"        0.339   Impervious Area"
"      260.000   Impervious length"
"        4.200   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.299   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.895   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.092     0.305     0.000     0.000 c.m/sec"
"             Catchment 104          Pervious   Impervious Total Area "
"             Surface Area           0.904      0.339      1.243      hectare"
"             Time of concentration  50.888     6.464      27.379     minutes"
"             Time to Centroid       289.607    202.070    243.282    minutes"
"             Rainfall depth         54.797     54.797     54.797     mm"
"             Rainfall volume        495.18     185.95     681.13     c.m"
"             Rainfall losses        38.415     5.760      29.500     mm"
"             Runoff depth           16.382     49.037     25.297     mm"
"             Runoff volume          148.04     166.40     314.44     c.m"
"             Runoff coefficient     0.299      0.895      0.462      "
"             Maximum flow           0.023      0.087      0.092      c.m/sec"
```

PRE-DEVELOPMENT - 25-YEAR STORM (6-HR CHICAGO):

```
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"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                                February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:              Z:\Project Files\PROJECTS\_Hamilton\"
"                                Saint Elizabeth Village\SWM\Existing Conditions"
"                Output filename:                                     EX_25.out"
"                Licensee name:                          andrew@landsmithec.com"
"                Company               LandSmith Engineering & Consulting Ltd."
"                Date & Time last used:                2024-03-18 at 2:50:27 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      360.000   Max. Storm length"
"     3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1719.500   Coefficient A"
"       10.000   Constant B"
"        0.823   Exponent C"
"        0.500   Fraction R"
"      360.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          146.101    mm/hr"
"             Total depth                 79.419    mm"
"            6   025hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   Catchment 1"
"       21.100   % Impervious"
"        0.936   Total Area"
"      135.000   Flow length"
"        1.600   Overland Slope"
"        0.739   Pervious Area"
"      135.000   Pervious length"
"        1.600   Pervious slope"
"        0.197   Impervious Area"
"      135.000   Impervious length"
"        1.600   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.407   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.927   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.087     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.739      0.197      0.936      hectare"
"             Time of concentration  35.386     5.047      23.901     minutes"
"             Time to Centroid       261.818    197.721    237.553    minutes"
"             Rainfall depth         79.419     79.419     79.419     mm"
"             Rainfall volume        586.51     156.85     743.36     c.m"
"             Rainfall losses        47.084     5.762      38.365     mm"
"             Runoff depth           32.335     73.657     41.054     mm"
"             Runoff volume          238.79     145.47     384.26     c.m"
"             Runoff coefficient     0.407      0.927      0.517      "
"             Maximum flow           0.053      0.077      0.087      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.087     0.087     0.000     0.000"
" 33          CATCHMENT 102"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          102   Catchment 2"
"       43.700   % Impervious"
```

```
"        1.497   Total Area"
"      130.000   Flow length"
"        3.500   Overland Slope"
"        0.843   Pervious Area"
"      130.000   Pervious length"
"        3.500   Pervious slope"
"        0.654   Impervious Area"
"      130.000   Impervious length"
"        3.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.407   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.915   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.280     0.087     0.000     0.000 c.m/sec"
"             Catchment 102          Pervious   Impervious Total Area "
"             Surface Area           0.843      0.654      1.497      hectare"
"             Time of concentration  27.354     3.901      12.447     minutes"
"             Time to Centroid       249.967    195.961    215.640    minutes"
"             Rainfall depth         79.419     79.419     79.419     mm"
"             Rainfall volume        669.35     519.55     1188.90    c.m"
"             Rainfall losses        47.076     6.732      29.445     mm"
"             Runoff depth           32.343     72.687     49.974     mm"
"             Runoff volume          272.59     475.51     748.10     c.m"
"             Runoff coefficient     0.407      0.915      0.629      "
"             Maximum flow           0.073      0.262      0.280      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                     0.280     0.367     0.000     0.000"
" 33          CATCHMENT 103"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         103   Catchment 3"
"       24.400   % Impervious"
"        0.862   Total Area"
"      105.000   Flow length"
"        5.300   Overland Slope"
"        0.652   Pervious Area"
"      105.000   Pervious length"
"        5.300   Pervious slope"
"        0.210   Impervious Area"
"      105.000   Impervious length"
"        5.300   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.407   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.917   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.106     0.367     0.000     0.000 c.m/sec"
"             Catchment 103          Pervious   Impervious Total Area "
"             Surface Area           0.652      0.210      0.862      hectare"
"             Time of concentration  21.247     3.030      13.576     minutes"
"             Time to Centroid       240.969    194.562    221.428    minutes"
"             Rainfall depth         79.419     79.419     79.419     mm"
"             Rainfall volume        517.55     167.04     684.59     c.m"
"             Rainfall losses        47.087     6.555      37.197     mm"
"             Runoff depth           32.332     72.864     42.222     mm"
"             Runoff volume          210.70     153.25     363.95     c.m"
"             Runoff coefficient     0.407      0.917      0.532      "
"             Maximum flow           0.069      0.085      0.106      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                    0.106     0.473     0.000     0.000"
" 33          CATCHMENT 104"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          104   Catchment 4"
"       27.300   % Impervious"
"        1.243   Total Area"
"      260.000   Flow length"
"        4.200   Overland Slope"
"        0.904   Pervious Area"
"      260.000   Pervious length"
"        4.200   Pervious slope"
"        0.339   Impervious Area"
"      260.000   Impervious length"
"        4.200   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.407   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.929   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.141     0.473     0.000     0.000 c.m/sec"
"             Catchment 104          Pervious   Impervious Total Area "
"             Surface Area           0.904      0.339      1.243      hectare"
"             Time of concentration  39.254     5.599      23.727     minutes"
"             Time to Centroid       267.518    198.604    235.724    minutes"
"             Rainfall depth         79.419     79.419     79.419     mm"
"             Rainfall volume        717.68     269.50     987.18     c.m"
"             Rainfall losses        47.075     5.645      35.764     mm"
"             Runoff depth           32.344     73.774     43.655     mm"
"             Runoff volume          292.28     250.34     542.63     c.m"
"             Runoff coefficient     0.407      0.929      0.550      "
"             Maximum flow           0.060      0.131      0.141      c.m/sec"
```

PRE-DEVELOPMENT - 100-YEAR STORM (6-HR CHICAGO):

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                                February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:             Z:\Project Files\PROJECTS\_Hamilton\"
"                                Saint Elizabeth Village\SWM\Existing Conditions"
"                Output filename:                                    EX_100.out"
"                Licensee name:                          andrew@landsmithec.com"
"                Company               LandSmith Engineering & Consulting Ltd."
"                Date & Time last used:                2024-03-18 at 2:51:56 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      360.000   Max. Storm length"
"     3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     2317.400   Coefficient A"
"       11.000   Constant B"
"        0.836   Exponent C"
"        0.500   Fraction R"
"      360.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          181.813    mm/hr"
"             Total depth                 98.891    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   Catchment 1"
"       21.100   % Impervious"
"        0.936   Total Area"
"      135.000   Flow length"
"        1.600   Overland Slope"
"        0.739   Pervious Area"
"      135.000   Pervious length"
"        1.600   Pervious slope"
"        0.197   Impervious Area"
"      135.000   Impervious length"
"        1.600   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.472   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.938   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.118     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.739      0.197      0.936      hectare"
"             Time of concentration  30.658     4.618      21.623     minutes"
"             Time to Centroid       252.213    196.018    232.714    minutes"
"             Rainfall depth         98.891     98.891     98.891     mm"
"             Rainfall volume        730.31     195.31     925.62     c.m"
"             Rainfall losses        52.205     6.138      42.485     mm"
"             Runoff depth           46.686     92.753     56.406     mm"
"             Runoff volume          344.78     183.18     527.96     c.m"
"             Runoff coefficient     0.472      0.938      0.570      "
"             Maximum flow           0.090      0.098      0.118      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.118     0.118     0.000     0.000"
" 33          CATCHMENT 102"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          102   Catchment 2"
"       43.700   % Impervious"
```

```
"        1.497   Total Area"
"      130.000   Flow length"
"        3.500   Overland Slope"
"        0.843   Pervious Area"
"      130.000   Pervious length"
"        3.500   Pervious slope"
"        0.654   Impervious Area"
"      130.000   Impervious length"
"        3.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.472   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.923   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.366     0.118     0.000     0.000 c.m/sec"
"             Catchment 102          Pervious   Impervious Total Area "
"             Surface Area           0.843      0.654      1.497      hectare"
"             Time of concentration  23.699     3.570      11.563     minutes"
"             Time to Centroid       241.953    194.395    213.281    minutes"
"             Rainfall depth         98.891     98.891     98.891     mm"
"             Rainfall volume        833.46     646.93     1480.39    c.m"
"             Rainfall losses        52.236     7.629      32.743     mm"
"             Runoff depth           46.655     91.261     66.148     mm"
"             Runoff volume          393.21     597.02     990.23     c.m"
"             Runoff coefficient     0.472      0.923      0.669      "
"             Maximum flow           0.126      0.331      0.366      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.366     0.485     0.000     0.000"
" 33          CATCHMENT 103"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         103   Catchment 3"
"       24.400   % Impervious"
"        0.862   Total Area"
"      105.000   Flow length"
"        5.300   Overland Slope"
"        0.652   Pervious Area"
"      105.000   Pervious length"
"        5.300   Pervious slope"
"        0.210   Impervious Area"
"      105.000   Impervious length"
"        5.300   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.472   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.930   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.152     0.485     0.000     0.000 c.m/sec"
"             Catchment 103          Pervious   Impervious Total Area "
"             Surface Area           0.652      0.210      0.862      hectare"
"             Time of concentration  18.408     2.773      12.329     minutes"
"             Time to Centroid       234.144    193.089    218.180    minutes"
"             Rainfall depth         98.891     98.891     98.891     mm"
"             Rainfall volume        644.44     207.99     852.44     c.m"
"             Rainfall losses        52.233     6.914      41.175     mm"
"             Runoff depth           46.658     91.977     57.716     mm"
"             Runoff volume          304.06     193.45     497.51     c.m"
"             Runoff coefficient     0.472      0.930      0.584      "
"             Maximum flow           0.113      0.105      0.152      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                    0.152     0.632     0.000     0.000"
" 33          CATCHMENT 104"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          104   Catchment 4"
"       27.300   % Impervious"
"        1.243   Total Area"
"      260.000   Flow length"
"        4.200   Overland Slope"
"        0.904   Pervious Area"
"      260.000   Pervious length"
"        4.200   Pervious slope"
"        0.339   Impervious Area"
"      260.000   Impervious length"
"        4.200   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.472   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.940   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.187     0.632     0.000     0.000 c.m/sec"
"             Catchment 104          Pervious   Impervious Total Area "
"             Surface Area           0.904      0.339      1.243      hectare"
"             Time of concentration  34.009     5.122      21.649     minutes"
"             Time to Centroid       257.148    196.787    231.320    minutes"
"             Rainfall depth         98.891     98.891     98.891     mm"
"             Rainfall volume        893.64     335.57     1229.21    c.m"
"             Rainfall losses        52.205     5.907      39.566     mm"
"             Runoff depth           46.686     92.984     59.325     mm"
"             Runoff volume          421.88     315.53     737.41     c.m"
"             Runoff coefficient     0.472      0.940      0.600      "
"             Maximum flow           0.100      0.166      0.187      c.m/sec"
```

PRE-DEVELOPMENT - 5-YEAR STORM (12-HR SCS):

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                    February 7, 2010"
"           10   Units used:                                           ie METRIC"
"                Job folder:              Z:\Project Files\PROJECTS\_Hamilton\"
"                                  Saint Elizabeth Village\SWM\Existing Conditions"
"                Output filename:                                  EX_5_12SCS.out"
"                Licensee name:                              andrew@landsmithec.com"
"                Company               LandSmith Engineering & Consulting Ltd."
"                Date & Time last used:                 2024-03-19 at 2:26:39 PM"
" 31          TIME PARAMETERS"
"       10.000   Time Step"
"      720.000   Max. Storm length"
"    10000.000   Max. Hydrograph"
" 32          STORM Historic"
"            5   Historic"
"      720.000   Duration"
"       72.000   Rainfall intensity values"
"                  1.570     1.570     1.570     1.570     1.570"
"                  1.570     1.570     1.570     1.570     1.570"
"                  1.570     1.880     1.880     1.880     1.880"
"                  1.880     1.880     2.500     2.500     2.500"
"                  2.500     2.500     2.500     2.500     3.760"
"                  3.760     3.760     5.010     5.010     5.010"
"                  7.510     7.510     7.510    30.050    56.340"
"                 82.630    11.270    11.270    11.270     5.010"
"                  5.010     5.010     3.760     3.760     3.760"
"                  3.760     3.760     3.760     2.190     2.190"
"                  2.190     2.190     2.190     2.190     2.190"
"                  2.190     2.190     2.190     2.190     2.190"
"                  1.250     1.250     1.250     1.250     1.250"
"                  1.250     1.250     1.250     1.250     1.250"
"                  1.250     1.250"
"             Maximum intensity            82.630    mm/hr"
"             Total depth                  62.765    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   Catchment 1"
"       21.100   % Impervious"
"        0.936   Total Area"
"      135.000   Flow length"
"        1.600   Overland Slope"
"        0.739   Pervious Area"
"      135.000   Pervious length"
"        1.600   Pervious slope"
"        0.197   Impervious Area"
"      135.000   Impervious length"
"        1.600   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.338   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.896   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.044     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.739      0.197      0.936      hectare"
"             Time of concentration  47.436     6.353      30.393     minutes"
```

```
"             Time to Centroid       499.045    385.083    451.770    minutes"
"             Rainfall depth         62.765     62.765     62.765     mm"
"             Rainfall volume        463.52     123.96     587.48     c.m"
"             Rainfall losses        41.558     6.548      34.171     mm"
"             Runoff depth           21.207     56.217     28.594     mm"
"             Runoff volume          156.61     111.03     267.64     c.m"
"             Runoff coefficient     0.338      0.896      0.456      "
"             Maximum flow           0.025      0.039      0.044      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.044     0.044     0.000     0.000"
" 33          CATCHMENT 102"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          102   Catchment 2"
"       43.700   % Impervious"
"        1.497   Total Area"
"      130.000   Flow length"
"        3.500   Overland Slope"
"        0.843   Pervious Area"
"      130.000   Pervious length"
"        3.500   Pervious slope"
"        0.654   Impervious Area"
"      130.000   Impervious length"
"        3.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.338   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.904   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.139     0.044     0.000     0.000 c.m/sec"
"             Catchment 102          Pervious   Impervious Total Area "
"             Surface Area           0.843      0.654      1.497      hectare"
"             Time of concentration  36.668     4.911      15.229     minutes"
"             Time to Centroid       480.801    382.449    414.405    minutes"
"             Rainfall depth         62.765     62.765     62.765     mm"
"             Rainfall volume        528.99     410.60     939.59     c.m"
"             Rainfall losses        41.569     6.028      26.038     mm"
"             Runoff depth           21.196     56.737     36.727     mm"
"             Runoff volume          178.64     371.17     549.81     c.m"
"             Runoff coefficient     0.338      0.904      0.585      "
"             Maximum flow           0.033      0.130      0.139      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.139     0.184     0.000     0.000"
" 33          CATCHMENT 103"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          103   Catchment 3"
"       24.400   % Impervious"
"        0.862   Total Area"
"      105.000   Flow length"
"        5.300   Overland Slope"
"        0.652   Pervious Area"
"      105.000   Pervious length"
"        5.300   Pervious slope"
"        0.210   Impervious Area"
"      105.000   Impervious length"
"        5.300   Impervious slope"
```

```
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.338   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.908   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.054     0.184     0.000     0.000 c.m/sec"
"             Catchment 103          Pervious   Impervious Total Area "
"             Surface Area           0.652      0.210      0.862      hectare"
"             Time of concentration  28.482     3.814      17.019     minutes"
"             Time to Centroid       466.980    380.343    426.718    minutes"
"             Rainfall depth         62.765     62.765     62.765     mm"
"             Rainfall volume        409.02     132.01     541.03     c.m"
"             Rainfall losses        41.581     5.780      32.845     mm"
"             Runoff depth           21.184     56.985     29.920     mm"
"             Runoff volume          138.05     119.86     257.91     c.m"
"             Runoff coefficient     0.338      0.908      0.477      "
"             Maximum flow           0.031      0.043      0.054      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.054     0.238     0.000     0.000"
" 33          CATCHMENT 104"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          104   Catchment 4"
"       27.300   % Impervious"
"        1.243   Total Area"
"      260.000   Flow length"
"        4.200   Overland Slope"
"        0.904   Pervious Area"
"      260.000   Pervious length"
"        4.200   Pervious slope"
"        0.339   Impervious Area"
"      260.000   Impervious length"
"        4.200   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.338   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.898   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.072     0.238     0.000     0.000 c.m/sec"
"             Catchment 104          Pervious   Impervious Total Area "
"             Surface Area           0.904      0.339      1.243      hectare"
"             Time of concentration  52.620     7.047      29.860     minutes"
"             Time to Centroid       507.786    386.528    447.229    minutes"
"             Rainfall depth         62.765     62.765     62.765     mm"
"             Rainfall volume        567.18     212.99     780.17     c.m"
"             Rainfall losses        41.561     6.431      31.970     mm"
"             Runoff depth           21.204     56.334     30.795     mm"
"             Runoff volume          191.61     191.16     382.78     c.m"
"             Runoff coefficient     0.338      0.898      0.491      "
"             Maximum flow           0.026      0.066      0.072      c.m/sec"
```

PRE-DEVELOPMENT - 25-YEAR STORM (12-HR SCS):

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                    February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:              Z:\Project Files\PROJECTS\_Hamilton\"
"                                  Saint Elizabeth Village\SWM\Existing Conditions"
"                Output filename:                                  EX_25_12SCS.out"
"                Licensee name:                             andrew@landsmithec.com"
"                Company               LandSmith Engineering & Consulting Ltd."
"                Date & Time last used:                 2024-03-19 at 2:32:24 PM"
" 31          TIME PARAMETERS"
"       10.000   Time Step"
"      720.000   Max. Storm length"
"    10000.000   Max. Hydrograph"
" 32          STORM Historic"
"            5   Historic"
"      720.000   Duration"
"       72.000   Rainfall intensity values"
"                  2.240     2.240     2.240     2.240     2.240"
"                  2.240     2.240     2.240     2.240     2.240"
"                  2.240     2.240     2.690     2.690     2.690"
"                  2.690     2.690     2.690     3.590     3.590"
"                  3.590     3.590     3.590     5.590     5.380"
"                  5.380     5.380     7.180     7.180     7.180"
"                 10.760    10.760    10.760    43.060    80.730"
"                118.400    16.150    16.150    16.150     7.180"
"                  7.180     7.180     5.380     5.380     5.380"
"                  5.380     5.380     5.380     3.140     3.140"
"                  3.140     3.140     3.140     3.140     3.140"
"                  3.140     3.140     3.140     3.140     3.140"
"                  1.790     1.790     1.790     1.790     1.790"
"                  1.790     1.790     1.790     1.790     1.790"
"                  1.790     1.790"
"             Maximum intensity           118.400    mm/hr"
"             Total depth                  90.023    mm"
"            6   025hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   Catchment 1"
"       21.100   % Impervious"
"        0.936   Total Area"
"      135.000   Flow length"
"        1.600   Overland Slope"
"        0.739   Pervious Area"
"      135.000   Pervious length"
"        1.600   Pervious slope"
"        0.197   Impervious Area"
"      135.000   Impervious length"
"        1.600   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.444   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.926   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.074     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.739      0.197      0.936      hectare"
"             Time of concentration  37.028     5.484      25.737     minutes"
"             Time to Centroid       474.480    380.208    440.736    minutes"
"             Rainfall depth         90.023     90.023     90.023     mm"
"             Rainfall volume        664.83     177.79     842.62     c.m"
"             Rainfall losses        50.041     6.672      40.891     mm"
"             Runoff depth           39.982     83.351     49.133     mm"
"             Runoff volume          295.27     164.61     459.88     c.m"
```

```
"             Runoff coefficient     0.444      0.926      0.546      "
"             Maximum flow           0.057      0.057      0.074      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.074     0.074     0.000     0.000"
" 33          CATCHMENT 102"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          102   Catchment 2"
"       43.700   % Impervious"
"        1.497   Total Area"
"      130.000   Flow length"
"        3.500   Overland Slope"
"        0.843   Pervious Area"
"      130.000   Pervious length"
"        3.500   Pervious slope"
"        0.654   Impervious Area"
"      130.000   Impervious length"
"        3.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.444   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.932   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.222     0.074     0.000     0.000 c.m/sec"
"             Catchment 102          Pervious   Impervious Total Area "
"             Surface Area           0.843      0.654      1.497      hectare"
"             Time of concentration  28.623     4.239      13.518     minutes"
"             Time to Centroid       460.098    377.884    409.167    minutes"
"             Rainfall depth         90.023     90.023     90.023     mm"
"             Rainfall volume        758.73     588.92     1347.65    c.m"
"             Rainfall losses        50.033     6.145      30.854     mm"
"             Runoff depth           39.991     83.879     59.170     mm"
"             Runoff volume          337.04     548.73     885.77     c.m"
"             Runoff coefficient     0.444      0.932      0.657      "
"             Maximum flow           0.078      0.191      0.222      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.222     0.296     0.000     0.000"
" 33          CATCHMENT 103"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          103   Catchment 3"
"       24.400   % Impervious"
"        0.862   Total Area"
"      105.000   Flow length"
"        5.300   Overland Slope"
"        0.652   Pervious Area"
"      105.000   Pervious length"
"        5.300   Pervious slope"
"        0.210   Impervious Area"
"      105.000   Impervious length"
"        5.300   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.444   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.928   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.098     0.296     0.000     0.000 c.m/sec"
"             Catchment 103          Pervious   Impervious Total Area "
```

```
"             Surface Area           0.652      0.210      0.862      hectare"
"             Time of concentration  22.233     3.293      14.606     minutes"
"             Time to Centroid       449.120    375.884    419.627    minutes"
"             Rainfall depth         90.023     90.023     90.023     mm"
"             Rainfall volume        586.66     189.34     776.00     c.m"
"             Rainfall losses        50.038     6.497      39.414     mm"
"             Runoff depth           39.985     83.527     50.609     mm"
"             Runoff volume          260.57     175.68     436.25     c.m"
"             Runoff coefficient     0.444      0.928      0.562      "
"             Maximum flow           0.069      0.063      0.098      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.098     0.393     0.000     0.000"
" 33          CATCHMENT 104"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          104   Catchment 4"
"       27.300   % Impervious"
"        1.243   Total Area"
"      260.000   Flow length"
"        4.200   Overland Slope"
"        0.904   Pervious Area"
"      260.000   Pervious length"
"        4.200   Pervious slope"
"        0.339   Impervious Area"
"      260.000   Impervious length"
"        4.200   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.444   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.919   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.116     0.393     0.000     0.000 c.m/sec"
"             Catchment 104          Pervious   Impervious Total Area "
"             Surface Area           0.904      0.339      1.243      hectare"
"             Time of concentration  41.075     6.084      25.784     minutes"
"             Time to Centroid       481.390    380.964    437.503    minutes"
"             Rainfall depth         90.023     90.023     90.023     mm"
"             Rainfall volume        813.51     305.48     1118.99    c.m"
"             Rainfall losses        50.016     7.323      38.361     mm"
"             Runoff depth           40.008     82.700     51.663     mm"
"             Runoff volume          361.53     280.63     642.17     c.m"
"             Runoff coefficient     0.444      0.919      0.574      "
"             Maximum flow           0.063      0.098      0.116      c.m/sec"
```

PRE-DEVELOPMENT - 100-YEAR STORM (12-HR SCS):

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                    February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:              Z:\Project Files\PROJECTS\_Hamilton\"
"                                  Saint Elizabeth Village\SWM\Existing Conditions"
"                Output filename:                                  EX_100_12SCS.out"
"                Licensee name:                              andrew@landsmithec.com"
"                Company               LandSmith Engineering & Consulting Ltd."
"                Date & Time last used:                 2024-03-19 at 2:35:27 PM"
" 31          TIME PARAMETERS"
"       10.000   Time Step"
"      720.000   Max. Storm length"
"    10000.000   Max. Hydrograph"
" 32          STORM Historic"
"            5   Historic"
"      720.000   Duration"
"       72.000   Rainfall intensity values"
"                  2.800     2.800     2.800     2.800     2.800"
"                  2.800     2.800     2.800     2.800     2.800"
"                  2.800     2.800     3.360     3.360     3.360"
"                  3.360     3.360     3.360     4.480     4.480"
"                  4.480     4.480     4.480     4.480     6.730"
"                  6.730     6.750     8.970     8.970     8.970"
"                 13.450    13.450    13.450    53.810   100.890"
"                147.970    20.180    20.180    20.180     8.970"
"                  8.970     8.970     6.730     6.730     6.730"
"                  6.730     6.730     6.730     3.920     3.920"
"                  3.920     3.920     3.920     3.920     3.920"
"                  3.920     3.920     3.920     3.920     3.920"
"                  2.240     2.240     2.240     2.240     2.240"
"                  2.240     2.240     2.240     2.240     2.240"
"                  2.240     2.240"
"             Maximum intensity           147.970    mm/hr"
"             Total depth                 112.088    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   Catchment 1"
"       21.100   % Impervious"
"        0.936   Total Area"
"      135.000   Flow length"
"        1.600   Overland Slope"
"        0.739   Pervious Area"
"      135.000   Pervious length"
"        1.600   Pervious slope"
"        0.197   Impervious Area"
"      135.000   Impervious length"
"        1.600   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.507   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.939   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.105     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.739      0.197      0.936      hectare"
"             Time of concentration  32.260     5.011      23.236     minutes"
"             Time to Centroid       462.882    377.929    434.750    minutes"
"             Rainfall depth         112.088    112.088    112.088    mm"
"             Rainfall volume        827.78     221.37     1049.15    c.m"
"             Rainfall losses        55.224     6.814      45.009     mm"
"             Runoff depth           56.864     105.274    67.079     mm"
"             Runoff volume          419.94     207.91     627.86     c.m"
```

```
"             Runoff coefficient     0.507      0.939      0.598      "
"             Maximum flow           0.096      0.071      0.105      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.105     0.105     0.000     0.000"
" 33          CATCHMENT 102"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          102   Catchment 2"
"       43.700   % Impervious"
"        1.497   Total Area"
"      130.000   Flow length"
"        3.500   Overland Slope"
"        0.843   Pervious Area"
"      130.000   Pervious length"
"        3.500   Pervious slope"
"        0.654   Impervious Area"
"      130.000   Impervious length"
"        3.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.507   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.943   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.298     0.105     0.000     0.000 c.m/sec"
"             Catchment 102          Pervious   Impervious Total Area "
"             Surface Area           0.843      0.654      1.497      hectare"
"             Time of concentration  24.937     3.874      12.493     minutes"
"             Time to Centroid       450.266    375.723    406.228    minutes"
"             Rainfall depth         112.088    112.088    112.088    mm"
"             Rainfall volume        944.69     733.27     1677.96    c.m"
"             Rainfall losses        55.236     6.354      33.875     mm"
"             Runoff depth           56.852     105.734    78.214     mm"
"             Runoff volume          479.16     691.70     1170.86    c.m"
"             Runoff coefficient     0.507      0.943      0.698      "
"             Maximum flow           0.117      0.242      0.298      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.298     0.402     0.000     0.000"
" 33          CATCHMENT 103"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          103   Catchment 3"
"       24.400   % Impervious"
"        0.862   Total Area"
"      105.000   Flow length"
"        5.300   Overland Slope"
"        0.652   Pervious Area"
"      105.000   Pervious length"
"        5.300   Pervious slope"
"        0.210   Impervious Area"
"      105.000   Impervious length"
"        5.300   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.506   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.938   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.144     0.402     0.000     0.000 c.m/sec"
"             Catchment 103          Pervious   Impervious Total Area "
```

```
"             Surface Area           0.652      0.210      0.862      hectare"
"             Time of concentration  19.370     3.009      13.247     minutes"
"             Time to Centroid       440.661    374.166    415.777    minutes"
"             Rainfall depth         112.088    112.088    112.088    mm"
"             Rainfall volume        730.45     235.75     966.20     c.m"
"             Rainfall losses        55.371     7.002      43.569     mm"
"             Runoff depth           56.717     105.086    68.519     mm"
"             Runoff volume          369.61     221.02     590.63     c.m"
"             Runoff coefficient     0.506      0.938      0.611      "
"             Maximum flow           0.110      0.079      0.144      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.144     0.545     0.000     0.000"
" 33          CATCHMENT 104"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          104   Catchment 4"
"       27.300   % Impervious"
"        1.243   Total Area"
"      260.000   Flow length"
"        4.200   Overland Slope"
"        0.904   Pervious Area"
"      260.000   Pervious length"
"        4.200   Pervious slope"
"        0.339   Impervious Area"
"      260.000   Impervious length"
"        4.200   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.508   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.936   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.157     0.545     0.000     0.000 c.m/sec"
"             Catchment 104          Pervious   Impervious Total Area "
"             Surface Area           0.904      0.339      1.243      hectare"
"             Time of concentration  35.785     5.559      23.427     minutes"
"             Time to Centroid       468.804    378.917    432.051    minutes"
"             Rainfall depth         112.088    112.088    112.088    mm"
"             Rainfall volume        1012.90    380.36     1393.26    c.m"
"             Rainfall losses        55.105     7.127      42.007     mm"
"             Runoff depth           56.984     104.961    70.081     mm"
"             Runoff volume          514.94     356.17     871.11     c.m"
"             Runoff coefficient     0.508      0.936      0.625      "
"             Maximum flow           0.104      0.123      0.157      c.m/sec"
```

POST-DEVELOPMENT – UNCONTROLLED AREA 2 - 5-YEAR STORM (6-HR CHICAGO):

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                    February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:               Z:\Project Files\PROJECTS\_Hamilton\"
"                                  Saint Elizabeth Village\SWM\Proposed Conditions"
"                Output filename:                         Prop_A2_uncontrolled_5.out"
"                Licensee name:                            andrew@landsmithec.com"
"                Company               LandSmith Engineering & Consulting Ltd."
"                Date & Time last used:                2024-03-20 at 8:51:00 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      360.000   Max. Storm length"
"     3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1049.500   Coefficient A"
"        8.000   Constant B"
"        0.803   Exponent C"
"        0.500   Fraction R"
"      360.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           103.038    mm/hr"
"             Total depth                  54.797    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   Post-Dev A2 Uncontrolled"
"       47.600   % Impervious"
"        0.378   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.198   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.180   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.299   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.891   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.053     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.198      0.180      0.378      hectare"
"             Time of concentration  20.679     2.627      7.494      minutes"
"             Time to Centroid       244.959    195.944    209.160    minutes"
"             Rainfall depth         54.797     54.797     54.797     mm"
"             Rainfall volume        108.54     98.60      207.13     c.m"
"             Rainfall losses        38.419     5.961      22.969     mm"
"             Runoff depth           16.379     48.836     31.828     mm"
"             Runoff volume          32.44      87.87      120.31     c.m"
"             Runoff coefficient     0.299      0.891      0.581      "
"             Maximum flow           0.010      0.050      0.053      c.m/sec"
```

POST-DEVELOPMENT – UNCONTROLLED AREA 2 - 25-YEAR STORM (6-HR CHICAGO):

```
"                MIDUSS Output ------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                                February 7, 2010"
"           10   Units used:                                        ie METRIC"
"                Job folder:              Z:\Project Files\PROJECTS\_Hamilton\"
"                                  Saint Elizabeth Village\SWM\Proposed Conditions"
"                Output filename:                  Prop_A2_uncontrolled_25.out"
"                Licensee name:                        andrew@landsmithec.com"
"                Company               LandSmith Engineering & Consulting Ltd."
"                Date & Time last used:               2024-03-19 at 2:56:27 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      360.000   Max. Storm length"
"     3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1719.500   Coefficient A"
"       10.000   Constant B"
"        0.823   Exponent C"
"        0.500   Fraction R"
"      360.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          146.101    mm/hr"
"             Total depth                 79.419    mm"
"            6   025hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   Post-Dev A2 Uncontrolled"
"       47.600   % Impervious"
"        0.378   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.198   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.180   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.406   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.920   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.082     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.198      0.180      0.378      hectare"
"             Time of concentration  15.951     2.275      6.750      minutes"
"             Time to Centroid       233.185    193.321    206.363    minutes"
"             Rainfall depth         79.419     79.419     79.419     mm"
"             Rainfall volume        157.31     142.90     300.20     c.m"
"             Rainfall losses        47.139     6.345      27.721     mm"
"             Runoff depth           32.280     73.074     51.698     mm"
"             Runoff volume          63.94      131.48     195.42     c.m"
"             Runoff coefficient     0.406      0.920      0.651      "
"             Maximum flow           0.026      0.072      0.082      c.m/sec"
```

POST-DEVELOPMENT – UNCONTROLLED AREA 2 - 100-YEAR STORM (6-HR CHICAGO):

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                    February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:               Z:\Project Files\PROJECTS\_Hamilton\"
"                                  Saint Elizabeth Village\SWM\Proposed Conditions"
"                Output filename:                      Prop_A2_uncontrolled_100.out"
"                Licensee name:                           andrew@landsmithec.com"
"                Company               LandSmith Engineering & Consulting Ltd."
"                Date & Time last used:                 2024-03-20 at 8:48:44 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      360.000   Max. Storm length"
"     3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     2317.400   Coefficient A"
"       11.000   Constant B"
"        0.836   Exponent C"
"        0.500   Fraction R"
"      360.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           181.813    mm/hr"
"             Total depth                  98.891    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   Post-Dev A2 Uncontrolled"
"       47.600   % Impervious"
"        0.378   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.198   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.180   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.472   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.933   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.110     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.198      0.180      0.378      hectare"
"             Time of concentration  13.820     2.082      6.279      minutes"
"             Time to Centroid       227.383    191.968    204.632    minutes"
"             Rainfall depth         98.891     98.891     98.891     mm"
"             Rainfall volume        195.87     177.93     373.81     c.m"
"             Rainfall losses        52.263     6.666      30.559     mm"
"             Runoff depth           46.627     92.225     68.332     mm"
"             Runoff volume          92.36      165.94     258.29     c.m"
"             Runoff coefficient     0.472      0.933      0.691      "
"             Maximum flow           0.040      0.090      0.110      c.m/sec"
```

POST-DEVELOPMENT – UNCONTROLLED AREA 3 - 5-YEAR STORM (6-HR CHICAGO):

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                    February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:               Z:\Project Files\PROJECTS\_Hamilton\"
"                                  Saint Elizabeth Village\SWM\Proposed Conditions"
"                Output filename:                    Prop_A3_uncontrolled_5.out"
"                Licensee name:                         andrew@landsmithec.com"
"                Company               LandSmith Engineering & Consulting Ltd."
"                Date & Time last used:                2024-03-20 at 9:52:25 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      360.000   Max. Storm length"
"     3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1049.500   Coefficient A"
"        8.000   Constant B"
"        0.803   Exponent C"
"        0.500   Fraction R"
"      360.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           103.038    mm/hr"
"             Total depth                  54.797    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   Post-Dev A3 Uncontrolled"
"       90.000   % Impervious"
"        0.546   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.055   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.491   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.299   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.891   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.138     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.055      0.491      0.546      hectare"
"             Time of concentration  20.679     2.627      3.275      minutes"
"             Time to Centroid       244.959    195.944    197.705    minutes"
"             Rainfall depth         54.797     54.797     54.797     mm"
"             Rainfall volume        29.92      269.27     299.19     c.m"
"             Rainfall losses        38.419     5.961      9.207      mm"
"             Runoff depth           16.379     48.836     45.590     mm"
"             Runoff volume          8.94       239.98     248.92     c.m"
"             Runoff coefficient     0.299      0.891      0.832      "
"             Maximum flow           0.003      0.137      0.138      c.m/sec"
```

POST-DEVELOPMENT – UNCONTROLLED AREA 3 - 25-YEAR STORM (6-HR CHICAGO):

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                    February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:               Z:\Project Files\PROJECTS\_Hamilton\"
"                                  Saint Elizabeth Village\SWM\Proposed Conditions"
"                Output filename:                    Prop_A3_uncontrolled_25.out"
"                Licensee name:                          andrew@landsmithec.com"
"                Company               LandSmith Engineering & Consulting Ltd."
"                Date & Time last used:                 2024-03-20 at 9:54:29 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      360.000   Max. Storm length"
"     3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1719.500   Coefficient A"
"       10.000   Constant B"
"        0.823   Exponent C"
"        0.500   Fraction R"
"      360.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           146.101    mm/hr"
"             Total depth                  79.419    mm"
"            6   025hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   Post-Dev A3 Uncontrolled"
"       90.000   % Impervious"
"        0.546   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.055   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.491   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.406   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.920   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.199     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.055      0.491      0.546      hectare"
"             Time of concentration  15.951     2.275      2.915      minutes"
"             Time to Centroid       233.185    193.321    195.186    minutes"
"             Rainfall depth         79.419     79.419     79.419     mm"
"             Rainfall volume        43.36      390.26     433.63     c.m"
"             Rainfall losses        47.139     6.345      10.425     mm"
"             Runoff depth           32.280     73.074     68.994     mm"
"             Runoff volume          17.62      359.08     376.71     c.m"
"             Runoff coefficient     0.406      0.920      0.869      "
"             Maximum flow           0.007      0.196      0.199      c.m/sec"
```

POST-DEVELOPMENT – UNCONTROLLED AREA 3 - 100-YEAR STORM (6-HR CHICAGO):

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                    February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:               Z:\Project Files\PROJECTS\_Hamilton\"
"                                  Saint Elizabeth Village\SWM\Proposed Conditions"
"                Output filename:                  Prop_A3_uncontrolled_100.out"
"                Licensee name:                          andrew@landsmithec.com"
"                Company               LandSmith Engineering & Consulting Ltd."
"                Date & Time last used:                2024-03-20 at 9:55:57 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      360.000   Max. Storm length"
"     3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     2317.400   Coefficient A"
"       11.000   Constant B"
"        0.836   Exponent C"
"        0.500   Fraction R"
"      360.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           181.813    mm/hr"
"             Total depth                  98.891    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   Post-Dev A3 Uncontrolled"
"       90.000   % Impervious"
"        0.546   Total Area"
"       40.000   Flow length"
"        2.000   Overland Slope"
"        0.055   Pervious Area"
"       40.000   Pervious length"
"        2.000   Pervious slope"
"        0.491   Impervious Area"
"       40.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.472   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.933   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.252     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.055      0.491      0.546      hectare"
"             Time of concentration  13.820     2.082      2.706      minutes"
"             Time to Centroid       227.384    191.968    193.852    minutes"
"             Rainfall depth         98.891     98.891     98.891     mm"
"             Rainfall volume        53.99      485.95     539.94     c.m"
"             Rainfall losses        52.263     6.666      11.225     mm"
"             Runoff depth           46.627     92.225     87.665     mm"
"             Runoff volume          25.46      453.19     478.65     c.m"
"             Runoff coefficient     0.472      0.933      0.886      "
"             Maximum flow           0.011      0.246      0.252      c.m/sec"
```

POST-DEVELOPMENT – CULTEC SYSTEM ROUTING - 5-YEAR STORM (6-HR CHICAGO):

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                    February 7, 2010"
"           10   Units used:                                              ie METRIC"
"                Job folder:              Z:\Project Files\PROJECTS\_Hamilton\"
"                   Saint Elizabeth Village\SWM\600 STM Analysis\MIDUSS\STORAGE"
"                Output filename:                                      cultec_5.out"
"                Licensee name:                              andrew@landsmithec.com"
"                Company               LandSmith Engineering & Consulting Ltd."
"                Date & Time last used:                 2024-03-19 at 1:20:14 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      360.000   Max. Storm length"
"     3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1049.500   Coefficient A"
"        8.000   Constant B"
"        0.803   Exponent C"
"        0.500   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          103.038    mm/hr"
"             Total depth                 46.985    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   No description"
"       70.000   % Impervious"
"        3.729   Total Area"
"      225.000   Flow length"
"        3.000   Overland Slope"
"        1.119   Pervious Area"
"      225.000   Pervious length"
"        3.000   Pervious slope"
"        2.610   Impervious Area"
"      225.000   Impervious length"
"        3.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.256   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.877   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.668     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           1.119      2.610      3.729      hectare"
"             Time of concentration  54.407     6.571      11.893     minutes"
"             Time to Centroid       179.523    106.820    114.909    minutes"
"             Rainfall depth         46.985     46.985     46.985     mm"
"             Rainfall volume        525.62     1226.44    1752.05    c.m"
"             Rainfall losses        34.943     5.759      14.514     mm"
"             Runoff depth           12.041     41.226     32.471     mm"
"             Runoff volume          134.70     1076.12    1210.83    c.m"
"             Runoff coefficient     0.256      0.877      0.691      "
"             Maximum flow           0.023      0.664      0.668      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.668     0.668     0.000     0.000"
" 54          POND DESIGN"
"        0.668   Current peak flow    c.m/sec"
"        0.280   Target outflow    c.m/sec"
"       1210.8   Hydrograph volume    c.m"
"          37.   Number of stages"
"      223.370   Minimum water level    metre"
```

```
"      225.120   Maximum water level    metre"
"      223.370   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                223.370     0.000     0.000"
"                223.419   0.00125    24.050"
"                223.467   0.00493    48.100"
"                223.516   0.01017    72.150"
"                223.564   0.01744    96.200"
"                223.613   0.03720   120.250"
"                223.662   0.04944   144.300"
"                223.710   0.06136   196.030"
"                223.759   0.08072   247.760"
"                223.807   0.09153   298.910"
"                223.856    0.1013   349.490"
"                223.905    0.1101   400.060"
"                223.953    0.1181   450.050"
"                224.002    0.1257   500.030"
"                224.051    0.1328   549.430"
"                224.099    0.1395   598.260"
"                224.148    0.1459   646.520"
"                224.196    0.1520   694.490"
"                224.245    0.1580   742.170"
"                224.294    0.1637   789.270"
"                224.342    0.1691   835.790"
"                224.391    0.1745   881.460"
"                224.439    0.1796   925.970"
"                224.488    0.1846   969.900"
"                224.537    0.1896  1012.400"
"                224.585    0.1943  1053.450"
"                224.634    0.1989  1093.070"
"                224.682    0.2043  1130.380"
"                224.731    0.2120  1164.810"
"                224.780    0.2211  1194.350"
"                224.828    0.2309  1220.430"
"                224.877    0.2489  1244.480"
"                224.926    0.2591  1268.530"
"                224.974    0.2681  1292.580"
"                225.023    0.2766  1316.630"
"                225.071    0.2845  1340.680"
"                225.120    0.2921  1364.730"
"            3.   ORIFICES"
"                 Orifice   Orifice   Orifice Number of"
"                  invert coefficie  diameter  orifices"
"                223.370     0.630    0.2200     1.000"
"                223.520     0.630    0.2000     1.000"
"                224.640     0.630    0.2000     1.000"
"              Peak outflow                  0.142    c.m/sec"
"              Maximum level               224.122    metre"
"              Maximum storage             620.573    c.m"
"              Centroidal lag                3.160   hours"
"                   0.668     0.668     0.142     0.000 c.m/sec"
```

POST-DEVELOPMENT – CULTEC SYSTEM ROUTING - 25-YEAR STORM (6-HR CHICAGO):

```
"                MIDUSS Output ------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                                February 7, 2010"
"           10   Units used:                                        ie METRIC"
"                Job folder:              Z:\Project Files\PROJECTS\_Hamilton\"
"                   Saint Elizabeth Village\SWM\600 STM Analysis\MIDUSS\STORAGE"
"                Output filename:                                  cultec_25.out"
"                Licensee name:                          andrew@landsmithec.com"
"                Company               LandSmith Engineering & Consulting Ltd."
"                Date & Time last used:               2024-03-19 at 1:18:49 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      360.000   Max. Storm length"
"     3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1719.500   Coefficient A"
"       10.000   Constant B"
"        0.823   Exponent C"
"        0.500   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          146.101    mm/hr"
"             Total depth                 68.724    mm"
"            6   025hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   No description"
"       70.000   % Impervious"
"        3.729   Total Area"
"      225.000   Flow length"
"        3.000   Overland Slope"
"        1.119   Pervious Area"
"      225.000   Pervious length"
"        3.000   Pervious slope"
"        2.610   Impervious Area"
"      225.000   Impervious length"
"        3.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.364   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.918   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    1.005     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           1.119      2.610      3.729      hectare"
"             Time of concentration  41.305     5.685      10.862     minutes"
"             Time to Centroid       160.531    104.474    112.621    minutes"
"             Rainfall depth         68.724     68.724     68.724     mm"
"             Rainfall volume        768.82     1793.91    2562.72    c.m"
"             Rainfall losses        43.685     5.619      17.039     mm"
"             Runoff depth           25.039     63.105     51.685     mm"
"             Runoff volume          280.11     1647.23    1927.34    c.m"
"             Runoff coefficient     0.364      0.918      0.752      "
"             Maximum flow           0.062      0.997      1.005      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    1.005     1.005     0.000     0.000"
```

```
" 54          POND DESIGN"
"        1.005   Current peak flow    c.m/sec"
"        0.280   Target outflow    c.m/sec"
"       1927.3   Hydrograph volume    c.m"
"          37.   Number of stages"
"      223.370   Minimum water level    metre"
"      225.120   Maximum water level    metre"
"      223.370   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                223.370     0.000     0.000"
"                223.419   0.00125    24.050"
"                223.467   0.00493    48.100"
"                223.516   0.01017    72.150"
"                223.564   0.01744    96.200"
"                223.613   0.03720   120.250"
"                223.662   0.04944   144.300"
"                223.710   0.06136   196.030"
"                223.759   0.08072   247.760"
"                223.807   0.09153   298.910"
"                223.856    0.1013   349.490"
"                223.905    0.1101   400.060"
"                223.953    0.1181   450.050"
"                224.002    0.1257   500.030"
"                224.051    0.1328   549.430"
"                224.099    0.1395   598.260"
"                224.148    0.1459   646.520"
"                224.196    0.1520   694.490"
"                224.245    0.1580   742.170"
"                224.294    0.1637   789.270"
"                224.342    0.1691   835.790"
"                224.391    0.1745   881.460"
"                224.439    0.1796   925.970"
"                224.488    0.1846   969.900"
"                224.537    0.1896  1012.400"
"                224.585    0.1943  1053.450"
"                224.634    0.1989  1093.070"
"                224.682    0.2043  1130.380"
"                224.731    0.2120  1164.810"
"                224.780    0.2211  1194.350"
"                224.828    0.2309  1220.430"
"                224.877    0.2489  1244.480"
"                224.926    0.2591  1268.530"
"                224.974    0.2681  1292.580"
"                225.023    0.2766  1316.630"
"                225.071    0.2845  1340.680"
"                225.120    0.2921  1364.730"
"           3.   ORIFICES"
"                Orifice   Orifice   Orifice Number of"
"                 invert coefficie  diameter  orifices"
"                223.370     0.630    0.2200     1.000"
"                223.520     0.630    0.2000     1.000"
"                224.640     0.630    0.2000     1.000"
"             Peak outflow                  0.191    c.m/sec"
"             Maximum level               224.554    metre"
"             Maximum storage            1026.687    c.m"
"             Centroidal lag                3.233   hours"
"                  1.005     1.005     0.191     0.000 c.m/sec"
```

POST-DEVELOPMENT – CULTEC SYSTEM ROUTING - 100-YEAR STORM (6-HR CHICAGO):

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                    February 7, 2010"
"           10   Units used:                                            ie METRIC"
"                Job folder:               Z:\Project Files\PROJECTS\_Hamilton\"
"                   Saint Elizabeth Village\SWM\600 STM Analysis\MIDUSS\STORAGE"
"                Output filename:                                   cultec_100.out"
"                Licensee name:                            andrew@landsmithec.com"
"                Company               LandSmith Engineering & Consulting Ltd."
"                Date & Time last used:                 2024-03-19 at 1:04:33 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      360.000   Max. Storm length"
"     3600.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     2317.400   Coefficient A"
"       11.000   Constant B"
"        0.836   Exponent C"
"        0.500   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           181.813    mm/hr"
"             Total depth                  86.135    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   No description"
"       70.000   % Impervious"
"        3.729   Total Area"
"      225.000   Flow length"
"        3.000   Overland Slope"
"        1.119   Pervious Area"
"      225.000   Pervious length"
"        3.000   Pervious slope"
"        2.610   Impervious Area"
"      225.000   Impervious length"
"        3.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.431   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.933   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    1.292     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           1.119      2.610      3.729      hectare"
"             Time of concentration  35.519     5.199      10.213     minutes"
"             Time to Centroid       151.917    103.199    111.255    minutes"
"             Rainfall depth         86.135     86.135     86.135     mm"
"             Rainfall volume        963.59     2248.37    3211.96    c.m"
"             Rainfall losses        48.989     5.775      18.739     mm"
"             Runoff depth           37.146     80.360     67.396     mm"
"             Runoff volume          415.55     2097.64    2513.17    c.m"
"             Runoff coefficient     0.431      0.933      0.782      "
"             Maximum flow           0.105      1.274      1.292      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    1.292     1.292     0.000     0.000"
```

```
" 54          POND DESIGN"
"        1.292   Current peak flow    c.m/sec"
"        0.280   Target outflow    c.m/sec"
"       2513.2   Hydrograph volume    c.m"
"          37.   Number of stages"
"      223.370   Minimum water level    metre"
"      225.120   Maximum water level    metre"
"      223.370   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                223.370     0.000     0.000"
"                223.419   0.00125    24.050"
"                223.467   0.00493    48.100"
"                223.516   0.01017    72.150"
"                223.564   0.01744    96.200"
"                223.613   0.03720   120.250"
"                223.662   0.04944   144.300"
"                223.710   0.06136   196.030"
"                223.759   0.08072   247.760"
"                223.807   0.09153   298.910"
"                223.856    0.1013   349.490"
"                223.905    0.1101   400.060"
"                223.953    0.1181   450.050"
"                224.002    0.1257   500.030"
"                224.051    0.1328   549.430"
"                224.099    0.1395   598.260"
"                224.148    0.1459   646.520"
"                224.196    0.1520   694.490"
"                224.245    0.1580   742.170"
"                224.294    0.1637   789.270"
"                224.342    0.1691   835.790"
"                224.391    0.1745   881.460"
"                224.439    0.1796   925.970"
"                224.488    0.1846   969.900"
"                224.537    0.1896  1012.400"
"                224.585    0.1943  1053.450"
"                224.634    0.1989  1093.070"
"                224.682    0.2043  1130.380"
"                224.731    0.2120  1164.810"
"                224.780    0.2211  1194.350"
"                224.828    0.2309  1220.430"
"                224.877    0.2489  1244.480"
"                224.926    0.2591  1268.530"
"                224.974    0.2681  1292.580"
"                225.023    0.2766  1316.630"
"                225.071    0.2845  1340.680"
"                225.120    0.2921  1364.730"
"           3.   ORIFICES"
"                Orifice   Orifice   Orifice Number of"
"                 invert coefficie  diameter  orifices"
"                223.370     0.630    0.2200     1.000"
"                223.520     0.630    0.2000     1.000"
"                224.640     0.630    0.2000     1.000"
"             Peak outflow                  0.280    c.m/sec"
"             Maximum level               225.053    metre"
"             Maximum storage            1331.771    c.m"
"             Centroidal lag                3.215   hours"
"                  1.292     1.292     0.280     0.000 c.m/sec"
```

CULTEC Stormwater Design Calculator

Please Fill in the Shaded Cells

Project Information:

Project Name	Saint Elizabeth Village
Address	393 Rymal Road West
City	Hamilton
State/Province	ON
ZIP/Postal Code	
Country	

Calculations Performed By:

Name	Andrew Smith
Company Name	LandSmith
Address	1059 Upper James St, Suite 207
City	Hamilton
State/Province	Ontario
ZIP/Postal Code	L9C 3A6
Country	Canada
Phone	289-309-3632
Email	andrew@landsmithec.com

Date: March 20, 2024

Project Number: 23008SEV

Input Project Requirements

Unit of Measure	**Metric**	
Select Model	Recharger 902HD	
Stone Porosity	40%	
Number of HVLV Internal Manifolds	1 Internal Manifold	
Stone Depth **Above** Chamber	305	mm
Stone Depth **Below** Chamber	305	mm
Stone **Between** Chamber rows	229	mm
☑ Include Separator Row		
Workable Bed Depth	2.06	meters
Max. Bed Width	18.00	meters
Storage Volume Required	1350.00	cu. meters
Stone Base Elevation	223.37	meters

Additional Information:

Other models are available if products above do not meet your requirements. Contact CULTEC for further design assistance.
Call CULTEC at 203-775-4416 for pricing information.

Hyperlinks to product specific webpages:

Please visit our website for more information such as CAD details, spec information, brochures, installation instructions, and other design tools on certain models.

Contactor Field Drain C-4HD
Contactor 100HD
Recharger 150XLHD
Recharger 180HD
Recharger 280HD
Recharger 330XLHD
Recharger 360HD
Recharger 902HD
HVLV SFCx2 Feed Connector
HVLV FC-24 Feed Connector
HVLV FC-48 Feed Connector
CULTEC No. 4800 Woven Geotextile
CULTEC No. 410 Non-Woven Geotextile

For design assistance, drawings and pricing send these calculations to:
mailto:tech@cultec.com

Website:
www.cultec.com

CULTEC Stormwater Design Calculator

Date:	March 20, 2024

Project Number:	23008SEV

Project Information:

Saint Elizabeth Village
393 Rymal Road West
Hamilton
ON

Calculations Performed By:

Andrew Smith
LandSmith
1059 Upper James St, Suite 207
Hamilton Ontario
L9C 3A6
Canada
289-309-3632
andrew@landsmithec.com

RECHARGER 902HD

Recharger 902HD Chamber Specifications

Height	**1219**	mm
Width	**1981**	mm
Length	**1.25**	meters
Installed Length	**1.12**	meters
Bare Chamber Volume	**1.80**	cu. meters
Installed Chamber Volume	**2.89**	cu. meters

Breakdown of Storage Provided by Recharger 902HD Stormwater System

Within Chambers	**831.43**	cu. meters
Within Feed Connectors	**0.12**	cu. meters
Within Stone	**533.20**	cu. meters
Total Storage Provided	**1,364.8**	**cu. meters**
Total Storage Required	1350.00	cu. meters

Materials List

Recharger 902HD

Total Number of Chambers Required	**462**	**pieces**
Separator Row Chambers	**66**	pieces
Chamber Units	**462**	pieces
End Caps	**14**	pieces
HVLV FC-48 Feed Connectors	**6**	pieces
CULTEC No. 410 Non-Woven Geotextile	**3373**	sq. meters
CULTEC No. 4800 Woven Geotextile	**94**	meters
Stone	**1333**	cu. meters

Separator Row Qty Included in Total

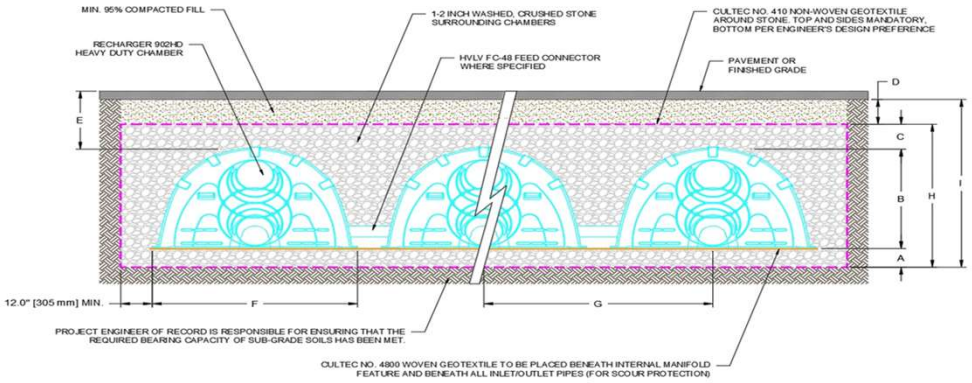
Based on 1 Internal Manifold

Bed Detail

Bed Layout Information

Number of Rows Wide	**7**	pieces
Number of Chambers Long	**66**	pieces
Chamber Row Width	**15.24**	meters
Chamber Row Length	**74.07**	meters
Bed Width	**15.85**	meters
Bed Length	**74.68**	meters
Bed Area Required	**1183.59**	sq. meters
Length of Separator Row	**74.07**	meters

Bed detail for reference only. Not project specific. Not to scale.



Conceptual graphic only. Not job specific.

Cross Section Table Reference

A	Depth of Stone Base	**305**	mm
B	Chamber Height	**1219**	mm
C	Depth of Stone Above Units	**305**	mm
D	Depth of 95% Compacted Fill	**305**	mm
E	Max. Depth Allowed Above the Chamber	**2.54**	meters
F	Chamber Width	**1981**	mm
G	Center to Center Spacing	**2.21**	meters
H	Effective Depth	**1.83**	meters
I	Bed Depth	**2.13**	meters

CULTEC Stage-Storage Calculations

Date:	March 20, 2024

Project Information:

Saint Elizabeth Village
393 Rymal Road West
Hamilton
ON

Project Number: 23008SEV

Chamber Model -	**Recharger 902HD**	
Number of Rows-	7	units
Total Number of Chambers -	462	units
HVLV FC-48 Feed Connectors-	6	units
Stone Void -	40	%
Stone Base -	305	mm
Stone Above Units -	305	mm
Area -	1183.59	m2
Base of Stone Elevation -	223.37	

Recharger 902HD Incremental Storage Volumes

Height of System		Chamber Volume		HVLV Feed Connector Volume		Stone Volume		Cumulative Storage Volume		Total Cumulative Storage Volume		Elevation		
in	mm	ft³	m³	ft3	m3	ft³	m³	ft³	m³	ft³	m³	ft	m	
72.0	1829	0.0	0.0	0.0	0.0	424.7	12.0	424.670	12.0	48195.07	1364.73	229.37	225.20	Top of Stone Elevation
71.0	1803	0.0	0.0	0.0	0.0	424.7	12.0	424.670	12.0	47770.40	1352.70	229.29	225.17	
70.0	1778	0.0	0.0	0.0	0.0	424.7	12.0	424.670	12.0	47345.72	1340.68	229.20	225.15	
69.0	1753	0.0	0.0	0.0	0.0	424.7	12.0	424.670	12.0	46921.05	1328.65	229.12	225.12	
68.0	1727	0.0	0.0	0.0	0.0	424.7	12.0	424.670	12.0	46496.38	1316.63	229.04	225.10	
67.0	1702	0.0	0.0	0.0	0.0	424.7	12.0	424.670	12.0	46071.71	1304.60	228.95	225.07	
66.0	1676	0.0	0.0	0.0	0.0	424.7	12.0	424.670	12.0	45647.04	1292.58	228.87	225.05	
65.0	1651	0.0	0.0	0.0	0.0	424.7	12.0	424.670	12.0	45222.37	1280.55	228.79	225.02	
64.0	1626	0.0	0.0	0.0	0.0	424.7	12.0	424.670	12.0	44797.70	1268.53	228.70	225.00	
63.0	1600	0.0	0.0	0.0	0.0	424.7	12.0	424.670	12.0	44373.03	1256.50	228.62	224.97	
62.0	1575	0.0	0.0	0.0	0.0	424.7	12.0	424.670	12.0	43948.36	1244.48	228.54	224.94	
61.0	1549	0.0	0.0	0.0	0.0	424.7	12.0	424.670	12.0	43523.69	1232.45	228.45	224.92	
60.0	1524	34.2	1.0	0.0	0.0	411.0	11.6	445.161	12.6	43099.02	1220.43	228.37	224.89	Top of Chamber Elevation
59.0	1499	85.1	2.4	0.0	0.0	390.6	11.1	475.734	13.5	42653.86	1207.82	228.29	224.87	
58.0	1473	119.0	3.4	0.0	0.0	377.1	10.7	496.062	14.0	42178.13	1194.35	228.20	224.84	
57.0	1448	203.8	5.8	0.0	0.0	343.1	9.7	546.964	15.5	41682.07	1180.30	228.12	224.82	
56.0	1422	271.7	7.7	0.0	0.0	316.0	8.9	587.701	16.6	41135.10	1164.81	228.04	224.79	
55.0	1397	339.3	9.6	0.0	0.0	288.9	8.2	628.276	17.8	40547.40	1148.17	227.95	224.77	
54.0	1372	373.4	10.6	0.0	0.0	275.3	7.8	648.685	18.4	39919.13	1130.38	227.87	224.74	
53.0	1346	407.2	11.5	0.0	0.0	261.8	7.4	669.013	18.9	39270.44	1112.01	227.79	224.72	
52.0	1321	458.1	13.0	0.0	0.0	241.4	6.8	699.505	19.8	38601.43	1093.07	227.70	224.69	
51.0	1295	458.1	13.0	0.0	0.0	241.4	6.8	699.505	19.8	37901.92	1073.26	227.62	224.67	
50.0	1270	491.9	13.9	0.0	0.0	227.9	6.5	719.833	20.4	37202.42	1053.45	227.54	224.64	
49.0	1245	509.0	14.4	0.0	0.0	221.1	6.3	730.079	20.7	36482.58	1033.07	227.45	224.61	
48.0	1219	525.8	14.9	0.0	0.0	214.3	6.1	740.161	21.0	35752.51	1012.40	227.37	224.59	
47.0	1194	559.7	15.8	0.0	0.0	200.8	5.7	760.489	21.5	35012.34	991.44	227.29	224.56	
46.0	1168	576.8	16.3	0.0	0.0	194.0	5.5	770.735	21.8	34251.85	969.90	227.20	224.54	
45.0	1143	593.6	16.8	0.0	0.0	187.2	5.3	780.817	22.1	33481.12	948.08	227.12	224.51	
44.0	1118	593.6	16.8	0.0	0.0	187.2	5.3	780.817	22.1	32700.30	925.97	227.04	224.49	
43.0	1092	610.7	17.3	0.0	0.0	180.4	5.1	791.063	22.4	31919.49	903.86	226.95	224.46	
42.0	1067	627.5	17.8	0.0	0.0	173.7	4.9	801.145	22.7	31128.42	881.46	226.87	224.44	
41.0	1041	644.7	18.3	0.0	0.0	166.8	4.7	811.472	23.0	30327.28	858.77	226.79	224.41	
40.0	1016	661.3	18.7	0.0	0.0	160.1	4.5	821.473	23.3	29515.81	835.79	226.70	224.39	
39.0	991	661.5	18.7	0.0	0.0	160.1	4.5	821.555	23.3	28694.33	812.53	226.62	224.36	
38.0	965	678.4	19.2	0.0	0.0	153.3	4.3	831.719	23.6	27872.78	789.27	226.54	224.34	
37.0	940	678.3	19.2	0.0	0.0	153.4	4.3	831.637	23.5	27041.06	765.72	226.45	224.31	
36.0	914	695.4	19.7	0.0	0.0	146.5	4.1	841.883	23.8	26209.42	742.17	226.37	224.28	
35.0	889	695.4	19.7	0.0	0.0	146.5	4.1	841.883	23.8	25367.54	718.33	226.29	224.26	
34.0	864	695.5	19.7	0.0	0.0	146.5	4.1	841.964	23.8	24525.66	694.49	226.20	224.23	
33.0	838	712.3	20.2	0.0	0.0	139.8	4.0	852.047	24.1	23683.69	670.65	226.12	224.21	
32.0	813	712.3	20.2	0.0	0.0	139.8	4.0	852.047	24.1	22831.65	646.52	226.04	224.18	
31.0	787	712.3	20.2	0.0	0.0	139.8	4.0	852.047	24.1	21979.60	622.39	225.95	224.16	
30.0	762	729.2	20.6	0.0	0.0	133.0	3.8	862.211	24.4	21127.55	598.26	225.87	224.13	
29.0	737	729.2	20.6	0.0	0.0	133.0	3.8	862.211	24.4	20265.34	573.85	225.79	224.11	
28.0	711	746.3	21.1	0.0	0.0	126.1	3.6	872.456	24.7	19403.13	549.43	225.70	224.08	
27.0	686	746.2	21.1	0.0	0.0	126.2	3.6	872.375	24.7	18530.68	524.73	225.62	224.06	
26.0	660	763.1	21.6	0.0	0.0	119.4	3.4	882.539	25.0	17658.30	500.03	225.54	224.03	
25.0	635	763.1	21.6	0.0	0.0	119.4	3.4	882.539	25.0	16775.76	475.04	225.45	224.01	
24.0	610	763.2	21.6	0.0	0.0	119.4	3.4	882.631	25.0	15893.23	450.05	225.37	223.98	
23.0	584	763.1	21.6	0.1	0.0	119.4	3.4	882.622	25.0	15010.60	425.05	225.29	223.95	
22.0	559	780.2	22.1	0.3	0.0	112.5	3.2	892.946	25.3	14127.97	400.06	225.20	223.93	
21.0	533	780.2	22.1	0.3	0.0	112.5	3.2	892.981	25.3	13235.03	374.77	225.12	223.90	
20.0	508	780.2	22.1	0.4	0.0	112.4	3.2	893.003	25.3	12342.05	349.49	225.04	223.88	
19.0	483	780.2	22.1	0.4	0.0	112.4	3.2	893.013	25.3	11449.04	324.20	224.95	223.85	
18.0	457	797.0	22.6	0.4	0.0	105.7	3.0	903.107	25.6	10556.03	298.91	224.87	223.83	
17.0	432	797.1	22.6	0.4	0.0	105.7	3.0	903.199	25.6	9652.92	273.34	224.79	223.80	
16.0	406	814.1	23.1	0.4	0.0	98.9	2.8	913.368	25.9	8749.72	247.76	224.70	223.78	
15.0	381	814.2	23.1	0.4	0.0	98.8	2.8	913.455	25.9	7836.36	221.90	224.62	223.75	
14.0	356	814.1	23.1	0.4	0.0	98.9	2.8	913.379	25.9	6922.90	196.03	224.54	223.73	
13.0	330	814.2	23.1	0.5	0.0	98.8	2.8	913.480	25.9	6009.52	170.17	224.45	223.70	
12.0	305	0.0	0.0	0.0	0.0	424.7	12.0	424.670	12.0	5096.04	144.30	224.37	223.67	Bottom of Chamber Elevation
11.0	279	0.0	0.0	0.0	0.0	424.7	12.0	424.670	12.0	4671.37	132.28	224.29	223.65	
10.0	254	0.0	0.0	0.0	0.0	424.7	12.0	424.670	12.0	4246.70	120.25	224.20	223.62	
9.0	229	0.0	0.0	0.0	0.0	424.7	12.0	424.670	12.0	3822.03	108.23	224.12	223.60	
8.0	203	0.0	0.0	0.0	0.0	424.7	12.0	424.670	12.0	3397.36	96.20	224.04	223.57	
7.0	178	0.0	0.0	0.0	0.0	424.7	12.0	424.670	12.0	2972.69	84.18	223.95	223.55	
6.0	152	0.0	0.0	0.0	0.0	424.7	12.0	424.670	12.0	2548.02	72.15	223.87	223.52	
5.0	127	0.0	0.0	0.0	0.0	424.7	12.0	424.670	12.0	2123.35	60.13	223.79	223.50	
4.0	102	0.0	0.0	0.0	0.0	424.7	12.0	424.670	12.0	1698.68	48.10	223.70	223.47	
3.0	76	0.0	0.0	0.0	0.0	424.7	12.0	424.670	12.0	1274.01	36.08	223.62	223.45	
2.0	51	0.0	0.0	0.0	0.0	424.7	12.0	424.670	12.0	849.34	24.05	223.54	223.42	
1.0	25	0.0	0.0	0.0	0.0	424.7	12.0	424.670	12.0	424.67	12.03	223.45	223.40	
0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.000	0.0	0.00	0.00	223.37	223.37	Bottom of Stone Elevation
-1.0														
-2.0														
-3.0														
-4.0														
-5.0														
-6.0														
-7.0														
-8.0														

CULTEC, Inc.
P.O. Box 280
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tech@cultec.com

Stormceptor®

FORTERRA

Stormceptor® EF Sizing Report

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

05/02/2023

Province:	Ontario
City:	Hamilton
Nearest Rainfall Station:	HAMILTON RBG CS
Climate Station Id:	6153301
Years of Rainfall Data:	20

Site Name:	

Drainage Area (ha):	3.70
% Imperviousness:	70.00

Runoff Coefficient 'c': 0.72

Particle Size Distribution:	CA ETV
Target TSS Removal (%):	60.0

Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	83.40
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	Yes
Upstream Orifice Control Flow Rate to Stormceptor (L/s):	610.00
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	480.00
Estimated Average Annual Sediment Load (kg/yr):	1278.72

Project Name:	SEV Phase 4 Lands
Project Number:	23008Sev
Designer Name:	Andrew Smith
Designer Company:	LandSmith Engineering & Consulting Ltd.
Designer Email:	andrew@landsmithec.com
Designer Phone:	289-775-9374
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	34
EFO6	44
EFO8	51
EFO10	56
EFO12	60

Recommended Stormceptor EFO Model: EFO12

Estimated Net Annual Sediment (TSS) Load Reduction (%): 60

Water Quality Runoff Volume Capture (%): > 90

imbrium

THIRD-PARTY TESTING AND VERIFICATION

►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterwavs.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

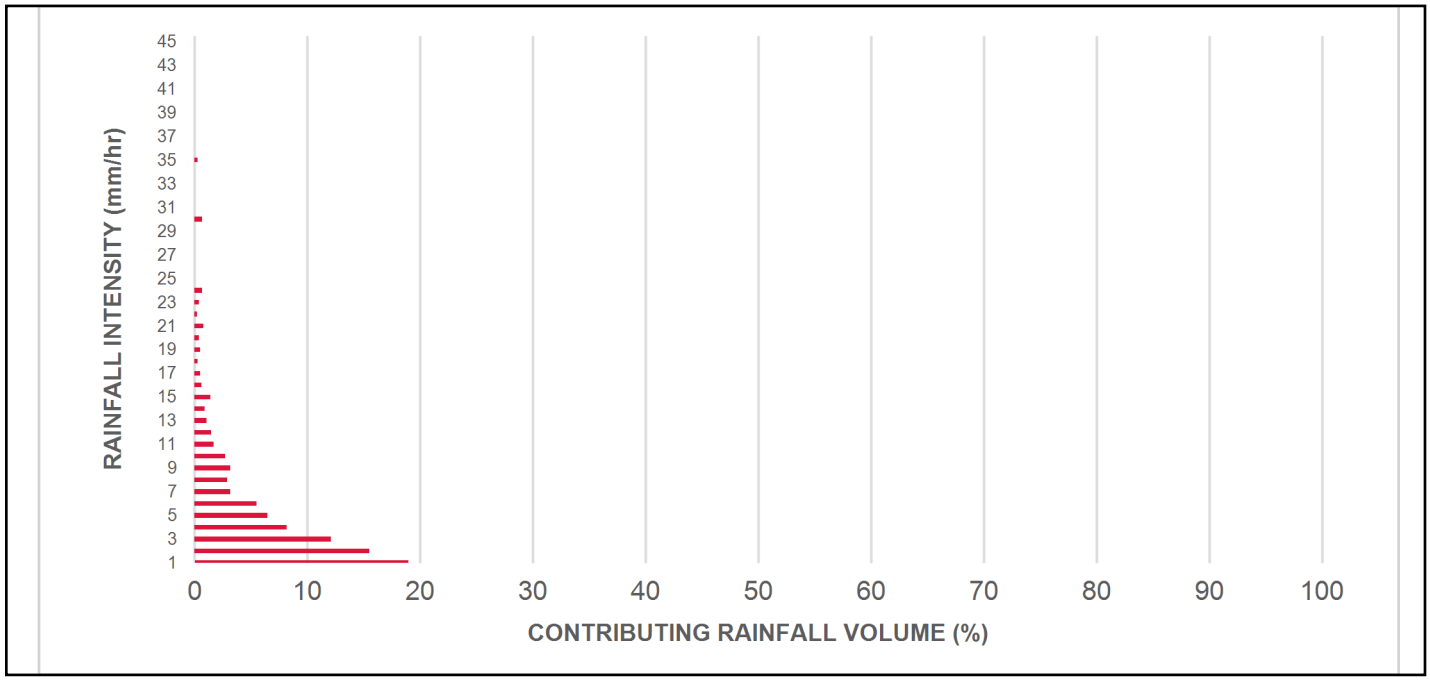
imbrium

Upstream Flow Controlled Results

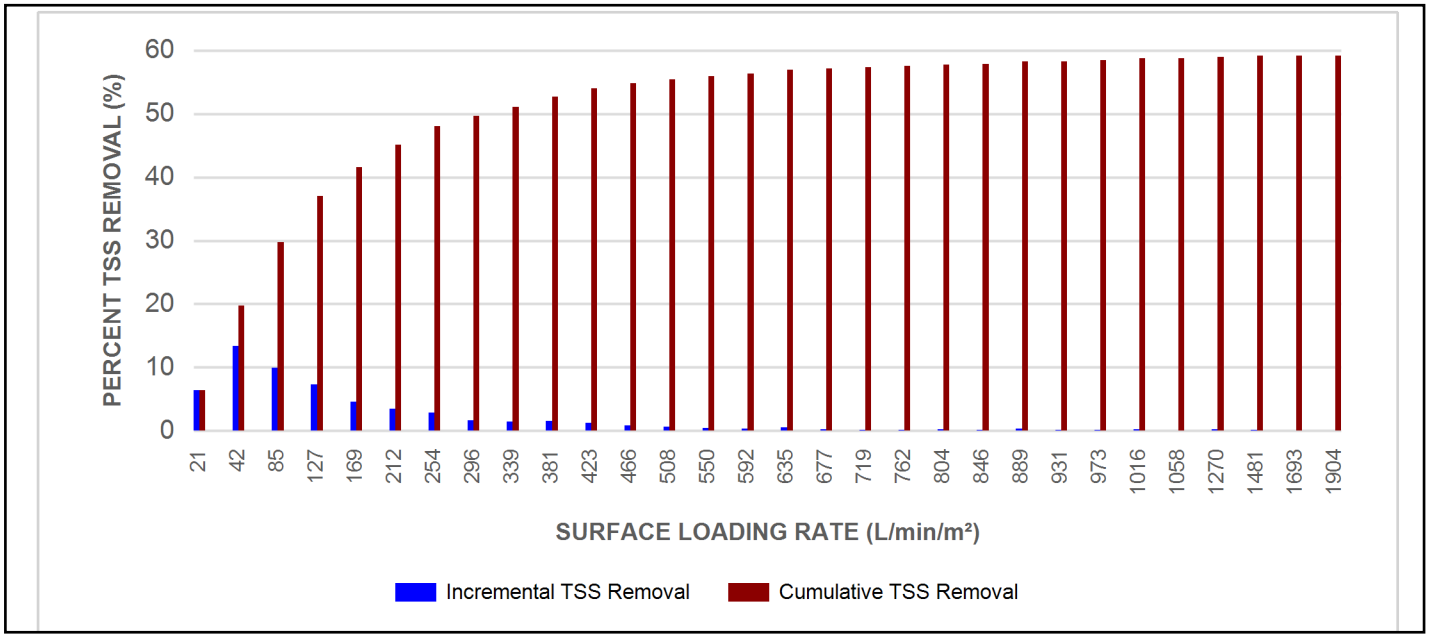
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.5	9.1	9.1	3.70	222.0	18.0	70	6.4	6.4
1	19.0	28.0	7.41	444.0	36.0	70	13.4	19.7
2	15.5	43.5	14.81	889.0	71.0	66	10.2	29.9
3	12.1	55.6	22.22	1333.0	107.0	62	7.5	37.5
4	8.2	63.8	29.62	1777.0	142.0	59	4.8	42.3
5	6.5	70.4	37.03	2222.0	178.0	57	3.7	46.0
6	5.5	75.9	44.44	2666.0	213.0	54	2.9	48.9
7	3.2	79.0	51.84	3110.0	249.0	53	1.7	50.6
8	2.9	81.9	59.25	3555.0	284.0	52	1.5	52.1
9	3.2	85.2	66.65	3999.0	320.0	50	1.6	53.7
10	2.7	87.9	74.06	4444.0	355.0	50	1.3	55.1
11	1.7	89.6	81.47	4888.0	391.0	48	0.8	55.9
12	1.5	91.1	88.87	5332.0	427.0	47	0.7	56.6
13	1.1	92.2	96.28	5777.0	462.0	46	0.5	57.1
14	0.9	93.1	103.68	6221.0	498.0	45	0.4	57.5
15	1.4	94.5	111.09	6665.0	533.0	44	0.6	58.1
16	0.6	95.1	118.49	7110.0	569.0	43	0.3	58.4
17	0.5	95.6	125.90	7554.0	604.0	42	0.2	58.6
18	0.3	95.9	133.31	7998.0	640.0	42	0.1	58.7
19	0.5	96.4	140.71	8443.0	675.0	42	0.2	59.0
20	0.4	96.8	148.12	8887.0	711.0	41	0.2	59.1
21	0.8	97.6	155.52	9331.0	747.0	41	0.3	59.4
22	0.2	97.8	162.93	9776.0	782.0	41	0.1	59.5
23	0.4	98.2	170.34	10220.0	818.0	41	0.2	59.7
24	0.7	98.9	177.74	10665.0	853.0	41	0.3	60.0
25	1.1	100.0	185.15	11109.0	889.0	41	0.4	60.4
30	0.7	100.7	222.18	13331.0	1066.0	39	0.3	60.7
35	0.3	101.1	259.21	15552.0	1244.0	36	0.1	60.8
40	-1.1	100.0	296.24	17774.0	1422.0	34	N/A	60.5
45	0.0	100.0	333.27	19996.0	1600.0	30	0.0	60.5
							Estimated Net Annual Sediment (TSS) Load Reduction =	**60 %**

Climate Station ID: 6153301 *Years of Rainfall Data*: 20

RAINFALL DATA FROM HAMILTON RBG CS RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



imbrium

Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

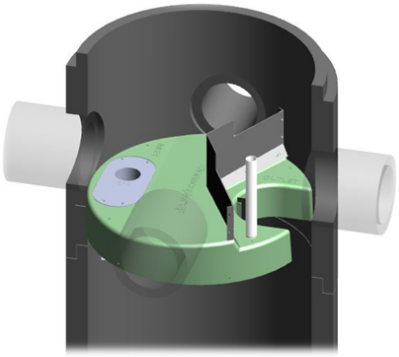
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

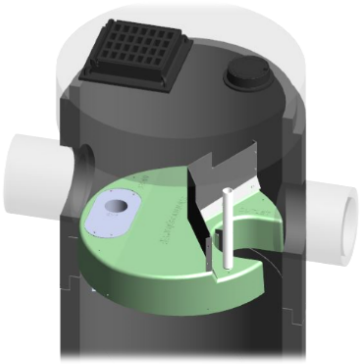
DESIGN FLEXIBILITY

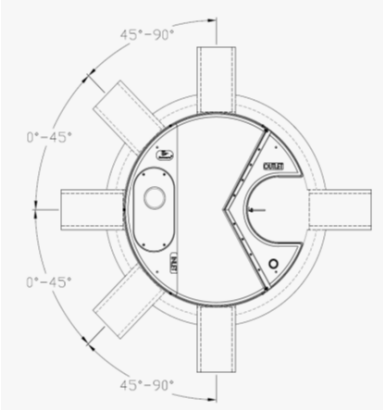
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft^3)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft^3)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

Table of TSS Removal vs Surface Loading Rate Based on Third-Party Test Results
Stormceptor® EFO

SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL
1	70	660	42	1320	35	1980	24
30	70	690	42	1350	35	2010	24
60	67	720	41	1380	34	2040	23
90	63	750	41	1410	34	2070	23
120	61	780	41	1440	33	2100	23
150	58	810	41	1470	32	2130	22
180	56	840	41	1500	32	2160	22
210	54	870	41	1530	31	2190	22
240	53	900	41	1560	31	2220	21
270	52	930	40	1590	30	2250	21
300	51	960	40	1620	29	2280	21
330	50	990	40	1650	29	2310	21
360	49	1020	40	1680	28	2340	20
390	48	1050	39	1710	28	2370	20
420	47	1080	39	1740	27	2400	20
450	47	1110	38	1770	27	2430	20
480	46	1140	38	1800	26	2460	19
510	45	1170	37	1830	26	2490	19
540	44	1200	37	1860	26	2520	19
570	43	1230	37	1890	25	2550	19
600	42	1260	36	1920	25	2580	18
630	42	1290	36	1950	24		

STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall

remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

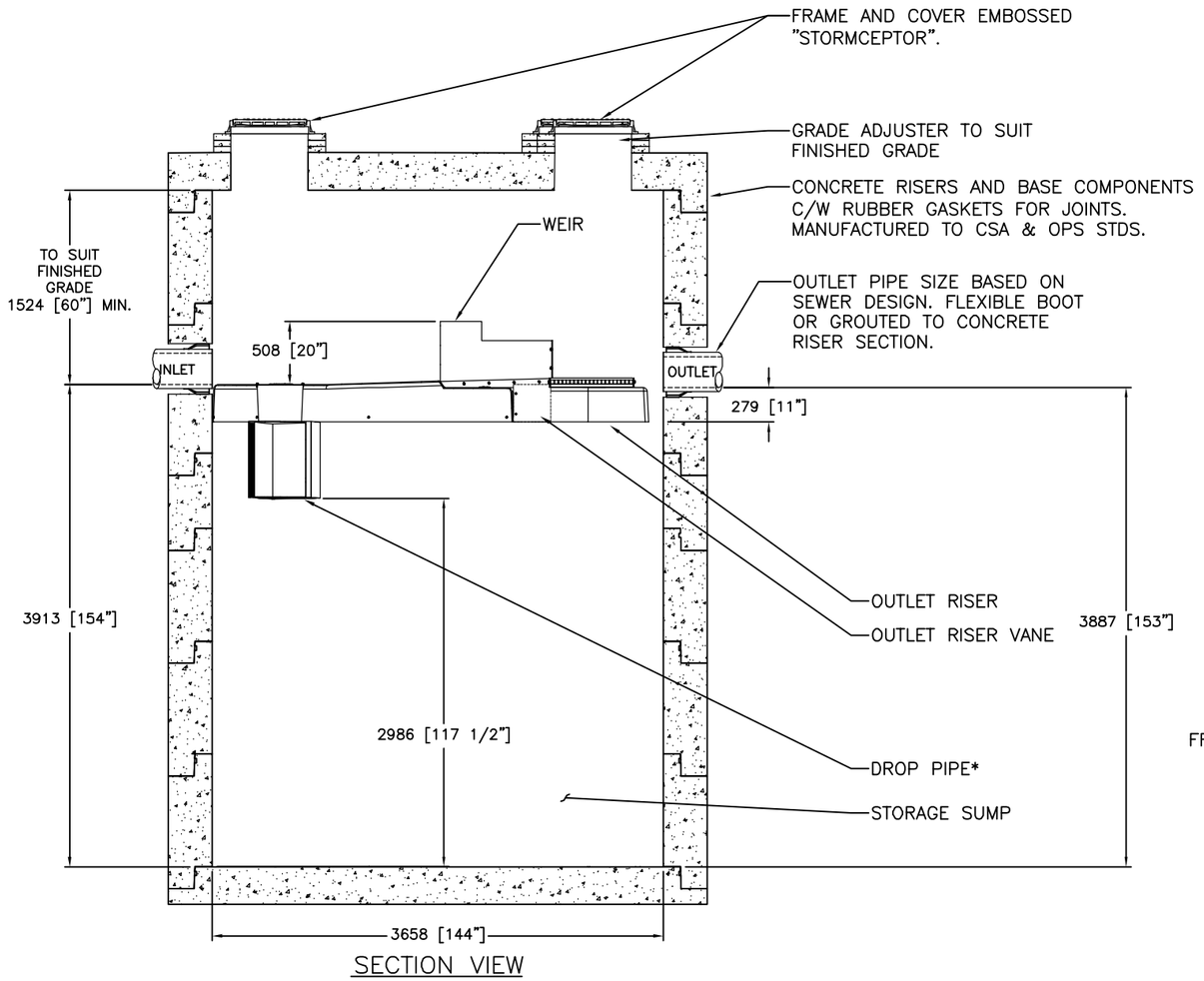
3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to

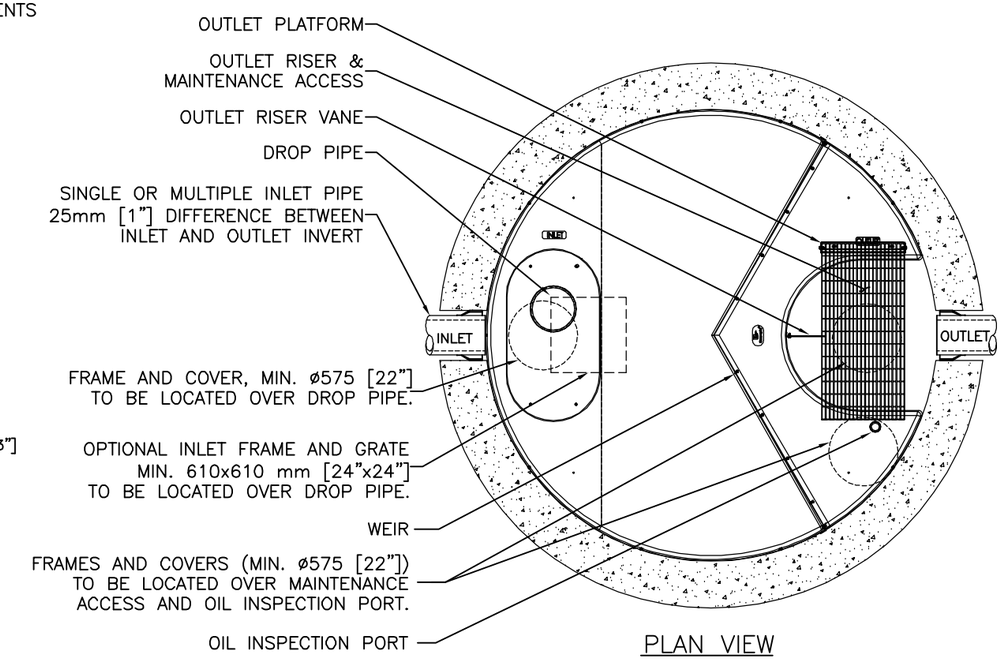
assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m^2 to 2600 L/min/m^2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

DRAWING NOT TO BE USED FOR CONSTRUCTION



SECTION VIEW



PLAN VIEW

GENERAL NOTES:

* MAXIMUM SURFACE LOADING RATE (SLR) INTO LOWER CHAMBER THROUGH DROP PIPE IS 1135 L/min/m^2 (27.9 gpm/ft^2) FOR STORMCEPTOR EF12 AND 535 L/min/m^2 (13.1 gpm/ft^2) FOR STORMCEPTOR EFO12 (OIL CAPTURE CONFIGURATION).

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

INSTALLATION NOTES

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

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

STANDARD DETAIL
NOT FOR CONSTRUCTION

SITE SPECIFIC DATA REQUIREMENTS

STORMCEPTOR MODEL	EFO12				
STRUCTURE ID					*
HYDROCARBON STORAGE REQ'D (L)					*
WATER QUALITY FLOW RATE (L/s)					*
PEAK FLOW RATE (L/s)					*
RETURN PERIOD OF PEAK FLOW (yrs)					*
DRAINAGE AREA (HA)					*
DRAINAGE AREA IMPERVIOUSNESS (%)					*
PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

MARK	DATE	REVISION DESCRIPTION	BY
1	6/8/18	OUTLET PLATFORM	JSK
0	5/26/17	INITIAL RELEASE	JSK

Stormceptor® EF

SCALE = NTS

imbrium®
407 FAIRVIEW DRIVE, WHITBY, ON L1N 9A9
TF 800-565-4801 CA 416-665-8600 INTL +1-416-665-8600

DATE:	10/24/2017
DESIGNED:	JSK
DRAWN:	JSK
CHECKED:	BSF
APPROVED:	SP
PROJECT No.:	EFO12
SEQUENCE No.:	*
SHEET:	1 OF 1

APPENDIX 'D' – City Infrastructure Drawings

17-H-17_4R1 – Rymal Road Reconstruction, Plan & Profile

17-H-17_5R1 - Rymal Road Reconstruction, Plan & Profile

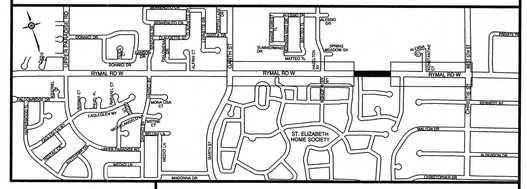
17-H-17_18R – Rymal Road Reconstruction, Cross-Sections

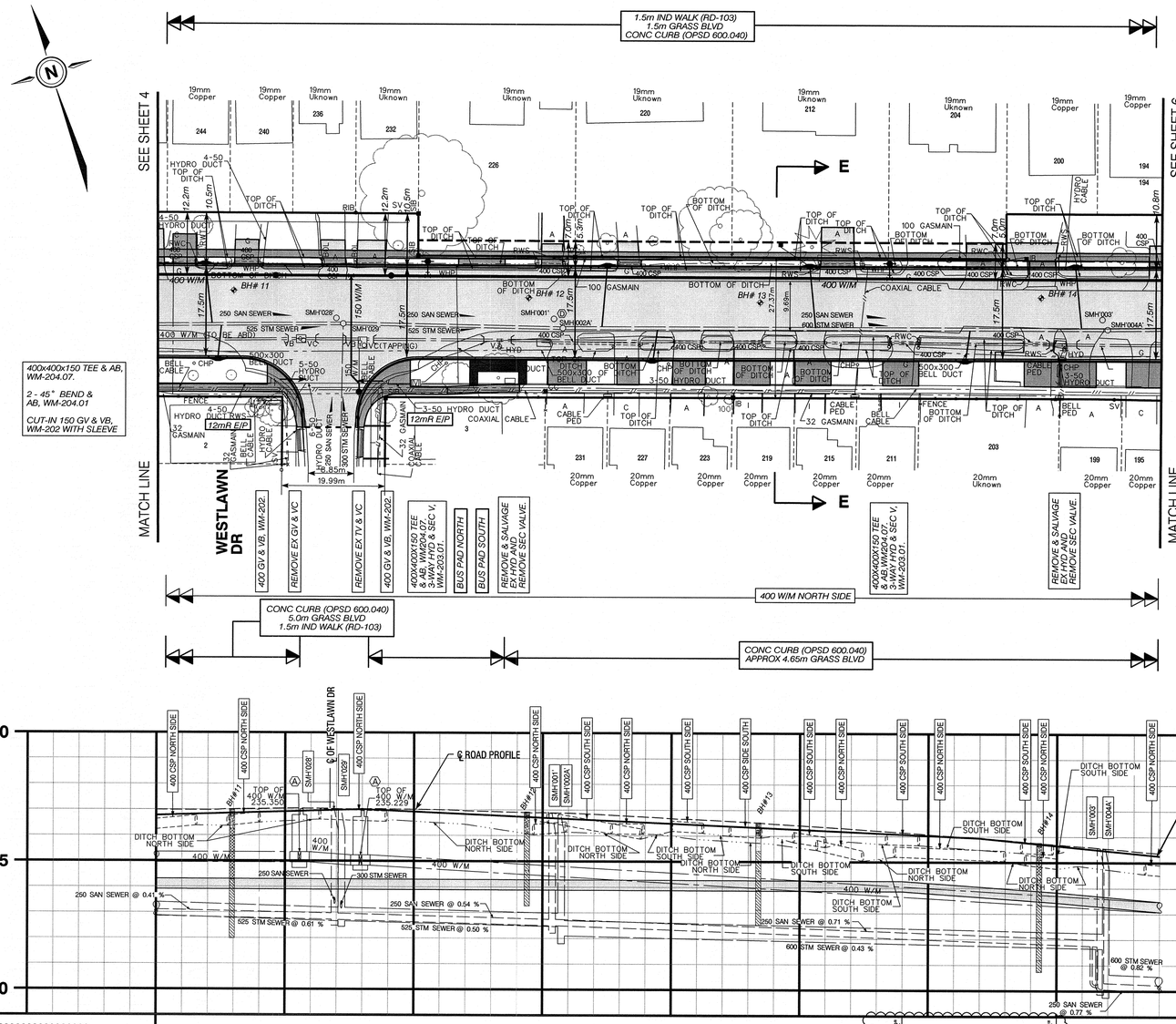
RYMAL ROAD WEST

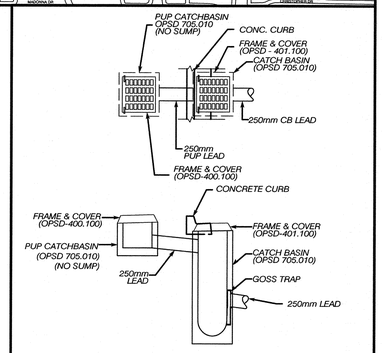
RYMAL ROAD WEST

CONTRACT No. C15-54-17 (HW)
DRAWING No. 17-H-17
SHEET No. 5R1 OF 24

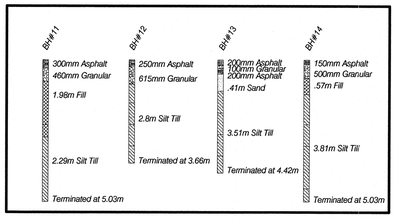
DIMENSIONS SHOWN ON THIS PLAN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED







OFFSET CATCH BASIN & PUP DETAIL
NTS



FOR TYPICAL CROSS SECTIONS, REFER TO DWG No. 17-H-17 (6)
FOR EROSION AND SEDIMENT CONTROL, REFER TO DWG No. 17-H-17 (9)
FOR CULVERT EXTENSION, REFER TO DWG No. 17-H-17 (10-11)
FOR ROAD LAYOUT, REFER TO DWG No. 17-H-17 (12-13)
FOR JACK AND BORE, REFER TO DWG. No. 17-H-17 (14)
FOR ROAD CROSS SECTIONS @ 20M , REFER TO DWG No. 17-H-17 (15-24)
FOR TREE REMOVALS, REFER TO DWG No. 17-H-17 (T1-T3)
FOR STREET LIGHTING, REFER TO DWG No. 17-H-17 (E1-E4)
FOR WATERMAIN LOWERING DETAIL, REFER TO DWG No. 17-H-17 (2)

C.B. REMOVALS/REPLACEMENTS

6+69.0 north, 6+71.0 south,
7+47.0 north, 7+56.0 south,
7+85.0 north, 8+16.0 south,
8+38.0 north
CONSTRUCT CATCHBASIN (OPSD 705.010) & 250 CB LEAD

7+81.0 north
PUP CATCH BASIN (NO SUMP)
(OPSD 400.100, OPSD 705.010)

EXISTING SEWER MANHOLES

A	SMH'028'	HF21A028
	E-INV=232.710	CHAINAGE=6+94.624
	W-INV=232.729	TOP OF GRATE=237.006
	S-INV=233.330	
A	SMH'029'	HF21B029
	E-INV=232.660	CHAINAGE=6+95.980
	W-INV=232.660	TOP OF GRATE=236.972
	S-INV=233.150	
A	SMH'001'	HG21A001
	W-INV=232.490	CHAINAGE=7+36.874
	E-INV=232.490	TOP OF GRATE=236.874
D	SMH'002A'	HG21B002
	W-INV=232.453	CHAINAGE=7+38.615
	E-INV=232.090	TOP OF GRATE=236.814
A	SMH'003'	HG21A003
	E-INV=230.060	CHAINAGE=8+43.493
	W-INV=231.740	TOP OF GRATE=235.559
	W-INV=230.16 (LOWER)	
A	SMH'004A'	HG21B004
	E-INV=230.040	CHAINAGE=8+44.545
	W-INV=231.640	TOP OF GRATE=235.529
	W-INV=230.00 (LOWER)	

PROPOSED WATERMAIN INVERT ELEVATIONS		293.91m W/M @ - 0.03%					8+56.00 VERT DEFLECT 233.86	30.0m W/M @ -1.43%	8+86.00 VERT DEFLECT 233.45	45.0m W/M @ -1.78%					PROPOSED WATERMAIN INVERT ELEVATIONS
PROPOSED ℄ OF ROAD PROFILE ELEVATIONS		75.0m @ 0.60%	PVI 7+00.00 237.01	120.0m @ -0.89%					PVI 8+30.00 235.94	60.0m @ -1.95%		8+80.00 234.77			PROPOSED ℄ OF ROAD PROFILE ELEVATIONS
EXISTING ℄ OF ROAD PROFILE ELEVATIONS	237.02	237.01	237.06	237.04	236.99	236.92	236.82	236.65	236.49	236.31	236.10	235.89	235.62	235.38	EXISTING ℄ OF ROAD PROFILE ELEVATIONS
EXISTING ℄ OF ROAD ALLOWANCE CHAINAGE	6+60	6+75	6+90	7+05	7+20	7+35	7+50	7+65	7+80	7+95	8+10	8+25	8+40	8+55	EXISTING ℄ OF ROAD ALLOWANCE CHAINAGE

No.	REVISIONS	INITIAL	DATE
1	Watermain elevations and slopes updated	SV	08/02/18

Borehole Report - GTR 1818

DRAWN BY: MB, MK, NZ DATE: November, 2017

REFERENCE MATERIAL:

Surveyed By : J. Hough
Sewer Plans : 02-S-15, 05-S-52, 08-S-37, 11-S-11, 90-S-42, 90-S-72, 91-S-45, 91-S-46, 91-S-9, 97-S-60, 90-S-9
Road Plans: 01-H-15, 05-H-67, 05-H-92, 09-H-38, 00-H-37, 98-H-52
Water Plans: 06-W-46, 07-W-16, 74-W-494, 93-W-20, 96-W-47, R-87_W2AB, 79-W-10, 79-W-9
Large Service Plans: LSP_1659, LSP, 2973
Misc. Plans: MC2006-267

Geodetic Bench Mark Index No. 07720020097 Elevation=226.246m

SCALES

HORIZONTAL 1:500 (0, 5m, 10m, 20m)

VERTICAL 1:100 (0, 1m, 2m, 4m)

Project Manager (Design)
Sarath, Vala P.Eng.

Manager of Design
Susan Jacob, P. Eng.

CITY OF HAMILTON
Public Works Department

RYMAL ROAD WEST
Proposed Road Reconstruction, Watermain Installation & Associated Works
From : Garth Street
To : West 5th Street

17-H-17 (5R1)

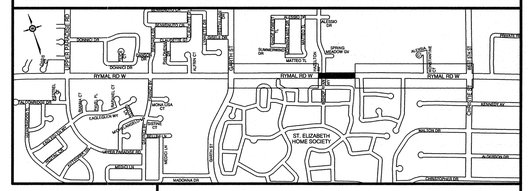
RYMAL ROAD WEST

RYMAL ROAD WEST

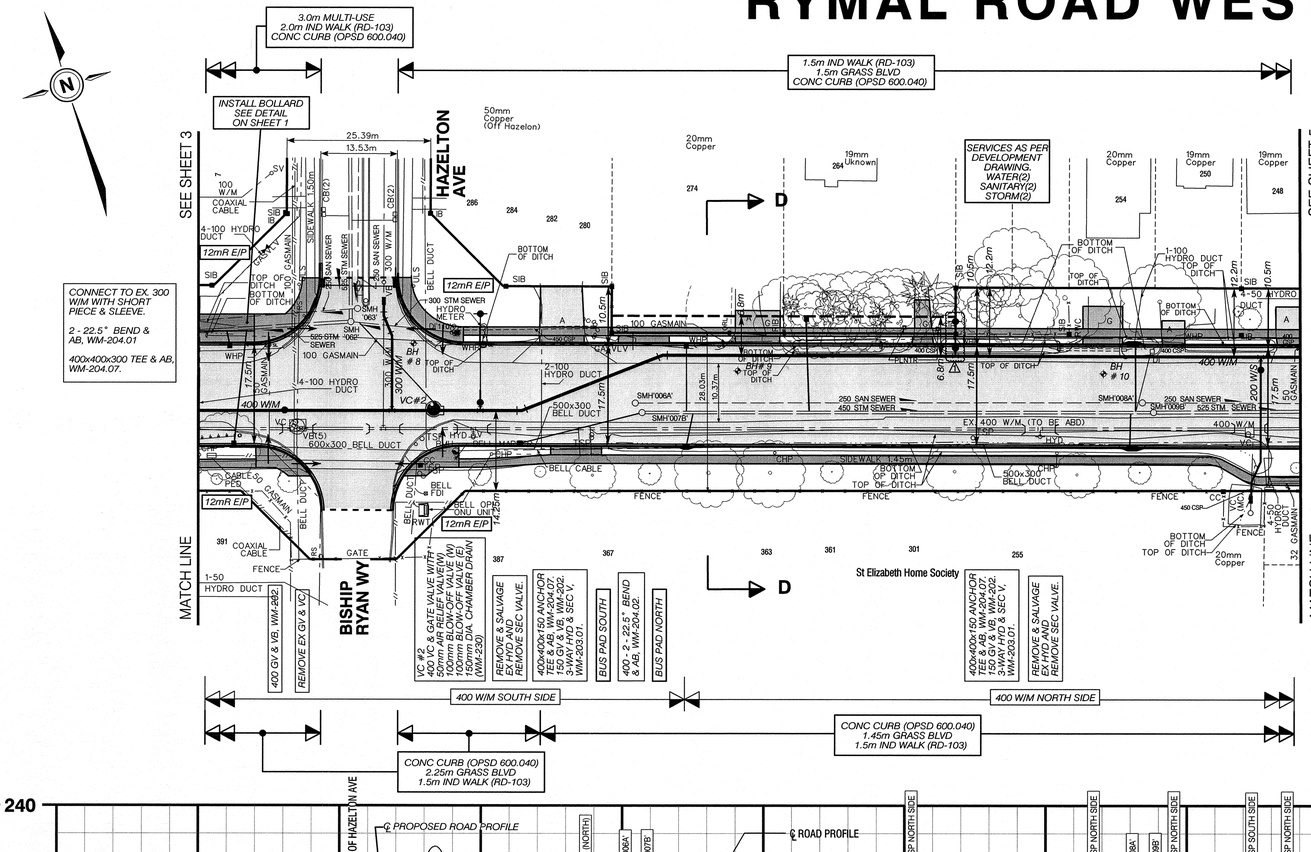
CONTRACT No. C15-54-17 (HW)
DRAWING No. 17-H-17

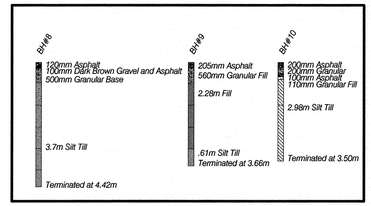
SHEET No. 4R1 OF 24

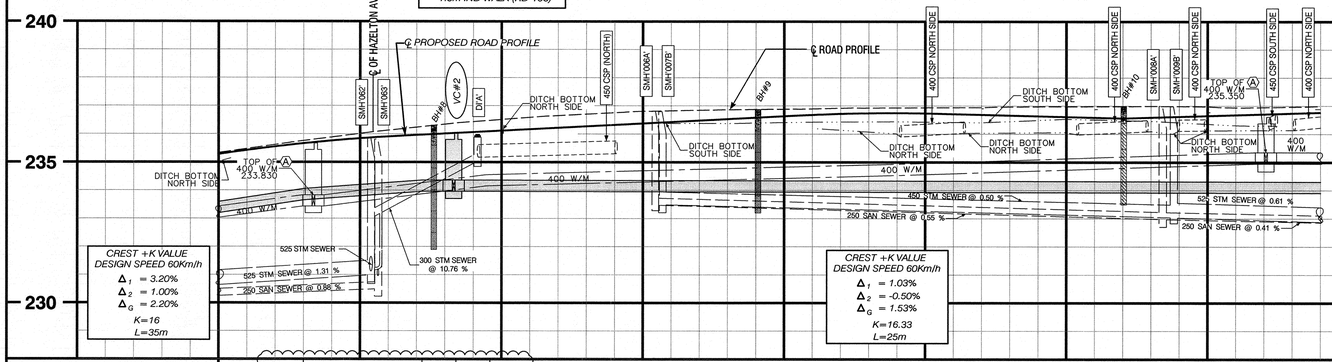
DIMENSIONS SHOWN ON THIS PLAN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED

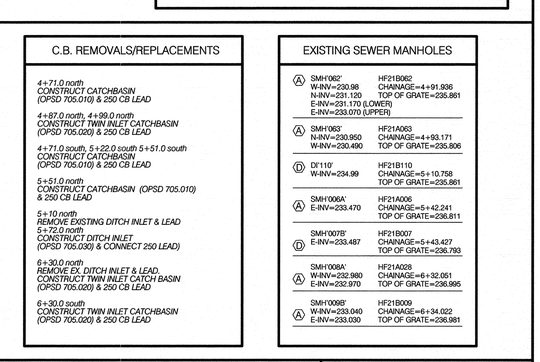


FOR TYPICAL CROSS SECTIONS, REFER TO DWG No. 17-H-17 (8)
FOR EROSION AND SEDIMENT CONTROL, REFER TO DWG No. 17-H-17 (9)
FOR CULVERT EXTENSION, REFER TO DWG No. 17-H-17 (10-11)
FOR ROAD LAYOUT, REFER TO DWG No. 17-H-17 (12-13)
FOR JACK AND BORE, REFER TO DWG. No. 17-H-17 (14)
FOR ROAD CROSS SECTIONS @ 20M , REFER TO DWG No. 17-H-17 (15-24)
FOR TREE REMOVALS, REFER TO DWG No. 17-H-17 (T1-T3)
FOR STREET LIGHTING, REFER TO DWG No. 17-H-17 (E1-E4)
FOR WATERMIAN LOWERING DETAIL, REFER TO DWG No. 17-H-17 (2)









C.B. REMOVALS/REPLACEMENTS

4+71.0 north
CONSTRUCT CATCHBASIN (OPSD 705.010) & 250 CB LEAD

4+87.0 north, 4+99.0 north
CONSTRUCT TWIN INLET CATCHBASIN (OPSD 705.020) & 250 CB LEAD

4+71.0 south, 5+22.0 south 5+51.0 south
CONSTRUCT CATCHBASIN (OPSD 705.030) & 250 CB LEAD

5+51.0 north
CONSTRUCT CATCHBASIN (OPSD 705.010) & 250 CB LEAD

5+10 north
REMOVE EXISTING DITCH INLET & LEAD
5+72.0 north
CONSTRUCT DITCH INLET (OPSD 705.030) & CONNECT 250 LEAD)

6+30.0 north
REMOVE EX. DITCH INLET & LEAD.
CONSTRUCT TWIN INLET CATCH BASIN (OPSD 705.020) & 250 CB LEAD

6+30.0 south
CONSTRUCT TWIN INLET CATCHBASIN (OPSD 705.020) & 250 CB LEAD

EXISTING SEWER MANHOLES

A	SMH'062' W-INV=230.98 N-INV=231.120 E-INV=231.170 (LOWER) E-INV=233.070 (UPPER)	HF21B062	CHAINAGE=4+91.936 TOP OF GRATE=235.861
A	SMH'063' N-INV=230.950 W-INV=230.490	HF21A063	CHAINAGE=4+93.171 TOP OF GRATE=235.806
D	DF'110' W-INV=234.99	HF21B110	CHAINAGE=5+10.758 TOP OF GRATE=235.861
A	SMH'006A' E-INV=233.470	HF21A006	CHAINAGE=5+42.241 TOP OF GRATE=236.811
D	SMH'007B' E-INV=233.487	HF21B007	CHAINAGE=5+43.427 TOP OF GRATE=236.793
A	SMH'008A' W-INV=232.980 E-INV=232.970	HF21A028	CHAINAGE=6+32.051 TOP OF GRATE=236.995
A	SMH'009B' W-INV=233.040 E-INV=233.030	HF21B009	CHAINAGE=6+34.022 TOP OF GRATE=236.981

PROPOSED WATERMAIN INVERT ELEVATIONS	4+80.00 VERT DEFLECT 0° 45.8' 233.65	20.97M W/M @ 1.48%
	5+00.97 VERT DEFLECT 50° 45.8' 233.96	5+00.97 HORIZ DEFLECT 0° 10.2' 233.96
	5+18.97 VERT DEFLECT 0° 10.2' 233.96	293.91m W/M @ - 0.03%
PROPOSED ℄ OF ROAD PROFILE ELEVATIONS	PVC 4+62.50 235.20	PVI 4+80.00 235.76
	PVT 4+97.50 235.94	70.0m @ 1.03%
	PVC 5+82.50 236.66	PVI 5+90.00 236.79
	PVT 5+98.50 236.72	32.5m @ - 0.50%
	PVI 6+25.00 236.56	75.0m @ 0.60%
	7+00.00 237.01	
EXISTING ℄ OF ROAD PROFILE ELEVATIONS	235.34	235.77 / 236.14 / 236.44 / 236.66 / 236.80 / 236.86 / 236.90 / 236.95 / 236.97 / 236.99 / 236.99 / 236.98 / 237.02
EXISTING ℄ OF ROAD ALLOWANCE CHAINAGE	4+65	4+80 / 4+95 / 5+10 / 5+25 / 5+40 / 5+55 / 5+70 / 5+85 / 6+00 / 6+15 / 6+30 / 6+45 / 6+60

No.	REVISIONS	INITIAL	DATE
1	Watermain elevations updated and hydrant location revised	SV	08/02/18

Borehole Report - GTR_1818

DRAWN BY: MB, MK, NZ, SV DATE: November, 2017

REFERENCE MATERIAL:
Surveyed By : J. Hough
Sewer Plans : 02-S-15, 05-S-52, 08-S-37, 11-S-11, 90-S-42, 90-S-72, 91-S-45, 91-S-46, 91-S-8, 97-S-60, 90-S-9
Road Plans: 01-H-15, 05-H-67, 05-H-92, 09-H-36, 00-H-37, 98-H-52
Water Plans: 06-W-46, 07-W-16, 74-W-494, 93-W-20, 96-W-47, R-87_W2AB, 79-W-10, 79-W-9
Large Service Plans: LSP_1659, LSP, 2973
Misc. Plans: MC2006-261

Geodetic Bench Mark Index No. 07720020097 Elevation=226.246m

SCALES
HORIZONTAL 1:500 (0, 5m, 10m, 20m)
VERTICAL 1:100 (0, 1m, 2m, 4m)

Project Manager (Design)
Sarath Vala, P.Eng.

Manager of Design
Susan Jacob, P. Eng.

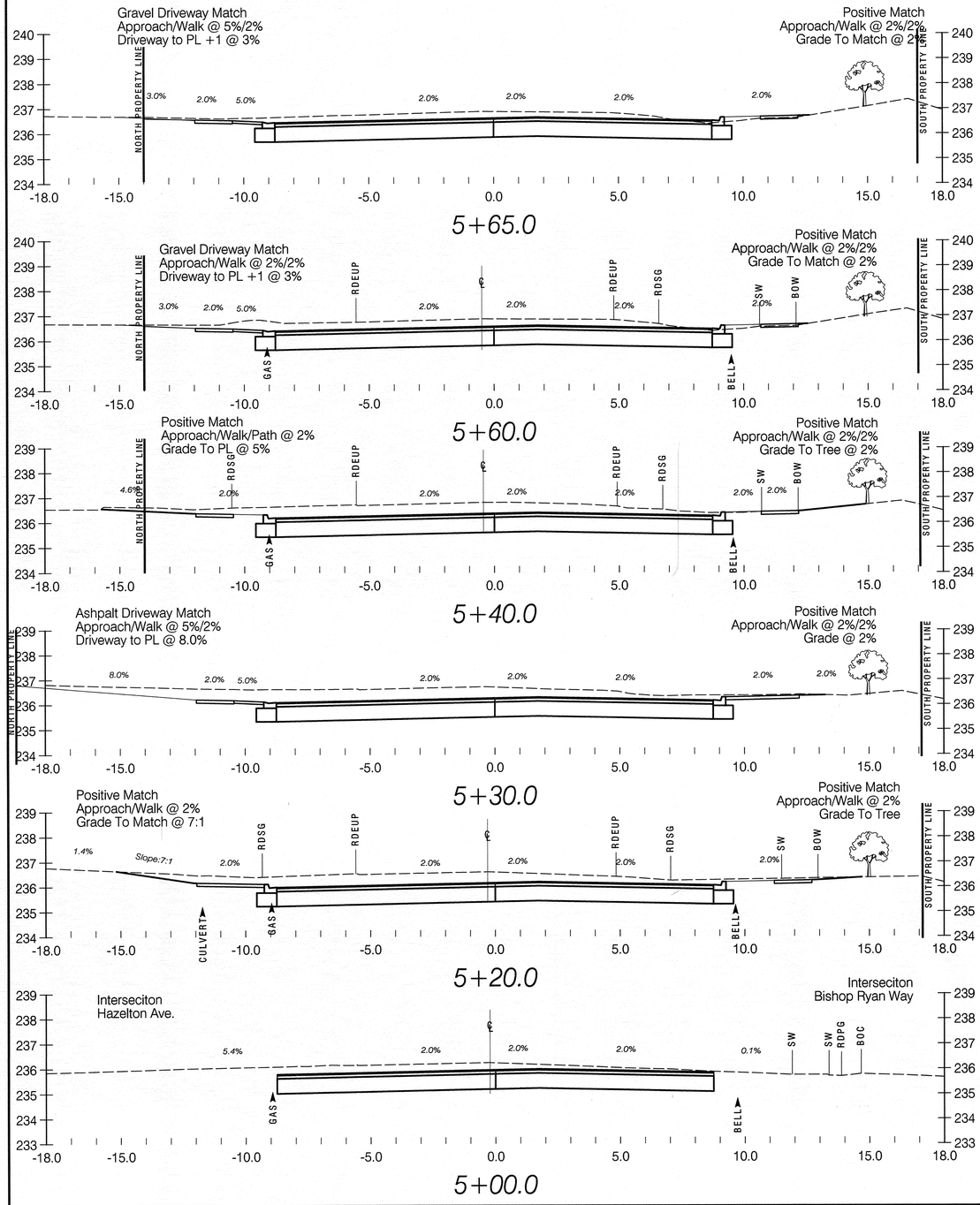
CITY OF HAMILTON
Public Works Department

RYMAL ROAD WEST
Proposed Road Reconstruction, Watermain Installation & Associated Works
From : Garth Street
To : West 5th Street

17-H-17 (4R1)

RYMAL ROAD WEST

CONTRACT No. C15-54-17 (HW)	SHEET No.
DRAWING No. 17-H-17	18 OF 24



No.	REVISIONS	INITIAL	DATE
1	CROSS SECTIONS REVISED TO CORRECT THE DEPTH OF PROPOSED ROAD STRUCTURE	NZ	01/03/18

DRAWN BY: MDK,NZ DATE: November, 2017

REFERENCE MATERIAL:

Geodetic Bench Mark Index No. 13-07 Elevation=202.710m

Borehole Report -

SCALES

1:100

Project Manager (Design)

Sarath Vala, P.Eng.

Manager of Design

Susan Jacob, P. Eng.

CITY OF HAMILTON
Public Works Department

RYMAL ROAD WEST

Road Cross Section @ 20m

STA. 5+00.0 TO STA. 6+25.0

17-H-17 (18)