Appendix G:

Stormwater Management Report

West 5th Street from Stone Church Road West to Rymal Road West Municipal Class Environmental Assessment – Preliminary Stormwater Management Assessment

October 10, 2025

Prepared for:

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Project No.: 165001381

WEST 5TH STREET FROM STONE CHURCH ROAD WEST TO RYMAL ROAD WEST MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT – PRELIMINARY STORMWATER MANAGEMENT ASSESSMENT

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1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) has been retained by the City of Hamilton (City) to undertake the Municipal Class Environmental Assessment (MCEA) Study for West 5th Street from Stone Church Road West to Rymal Road West (study area).

This Stormwater Management (SWM) assessment has been prepared in support of the MCEA. The purpose of this report is to provide a summary of the existing drainage conditions through the study area as well as outline design considerations for future improvements. This includes defining SWM criteria, guiding the development of a proposed storm sewer, and evaluating alternative SWM strategies.

Presented below are the existing drainage patterns and stormwater infrastructure within the study area, a description of the SWM criteria and ultimate conditions based off the assumptions listed in the SWM reports of the surrounding lands, a description of the proposed storm sewer network, and a list of alternative SWM strategies.

2.0 BACKGROUND INFORMATION

The following documents were reviewed as part of this study:

- *Sheldon's Gate Phase 1 (No: D0171-P01-17; City Files: 25T-2013-05) As-Builts Final Submission*, prepared by Urbex Engineering Limited, April 2025
- *Mewburn Neighbourhood SWM Facility (Contract No: C15-26-19) As-Builts Final Submission*, prepared by S. Llewellyn & Associates Limited, June 2019
- *Highway Drainage Design Standards*, Ministry of Transportation Ontario (MTO), 2023.
- *1021 West 5th Street – Functional Servicing Report*, prepared by S.Llewellyn & Associates Limited, July 2022.
- *Comprehensive Development Guidelines and Financial Policies Manual*, City of Hamilton, 2019.
- *Mewburn Neighbourhood SWM Facility (SWM2) – West 5th Street*, prepared by S. Llewellyn & Associates Limited, October 2017.
- *William Connell City Wide Park – Stormwater Management Facility (SWM1) Design Report*, prepared by IBI Group, February 2016.
- *West Central Mountain Drainage Assessment Supplemental Capacity Analysis and SWM Sizing – Mewburn and Sheldon Neighbourhoods*, prepared by AMEC Environmental & Infrastructure, October 2011.
- *City of Hamilton Criteria and Guidelines for Stormwater Infrastructure Design,* Philips Engineering Ltd., September 2007.

- *Mewburn and Sheldon Neighbourhoods Master Servicing Plan – Class EA Study*, prepared by SNC Lavalin, December 2004.
- *AgMaps,* Ontario Ministry of Agriculture, Food and Rural Affairs.

In addition, the City of Hamilton's Water and Wastewater GIS Services Web Map was consulted.

In reviewing the above documents, three proposed stormwater management facilities were identified in the vicinity of the study area. These facilities along with relevance to West 5th Street are listed in Table 1 below and can be located on Drawing DR1 from the *William Connell City Wide Park – Stormwater Management Facility (SWM1) Design Report* in Appendix A.

Table 1: Surrounding Stormwater Management Facilities

Name	Alternate Names	Relevance to West 5th Street
SWM1	William Connell Park Pond, Pond 220	• Constructed. • Most of the southern half of the study area drains to this facility. • The Sheldon neighbourhood development will drain to this facility. • This facility outlets underneath West 5th Street through the sewer crossing at STN-7+15, towards SWM2.
SWM2	Mewburn Pond, Pond 222	• Constructed. • Most of the northern half of the study area drains to this facility. • This pond is part of the Mewburn development to the east of West 5th Street. SWM1 drains into SWM2.
SWM3	Pond 221	• Status unknown (does not appear to be constructed). • No relevance; no lands from the study area drain to this pond. It will no longer be mentioned in this report.

3.0 EXISTING CONDITIONS

Within the study area, West 5th Street generally consists of 1 north- and 1 south-bound lane, with a rural cross-section complete with gravel shoulders and roadside ditches. The land use surrounding the subject lands is mixed-use, including low and medium density residential, commercial, and parkland. These lands are in various stages of development, but all are anticipated to be completed and/or intensified in the future. Two significant subdivisions surround the study area: the Sheldon subdivision to the south-west which drains to SWM1, and the Mewburn subdivision to the east, which contains SWM2.

As part of the study, the existing drainage conditions were examined and documented. The 1 km section of road in the study area has multiple high points, resulting in 5 outlets from the West 5th Street right-of-way (ROW).

These outlets and their drainage catchments are identified in Figure 1 and described in Table 2. The drainage boundaries generally follow the ultimate subcatchment boundaries laid out in drawing DR1 from

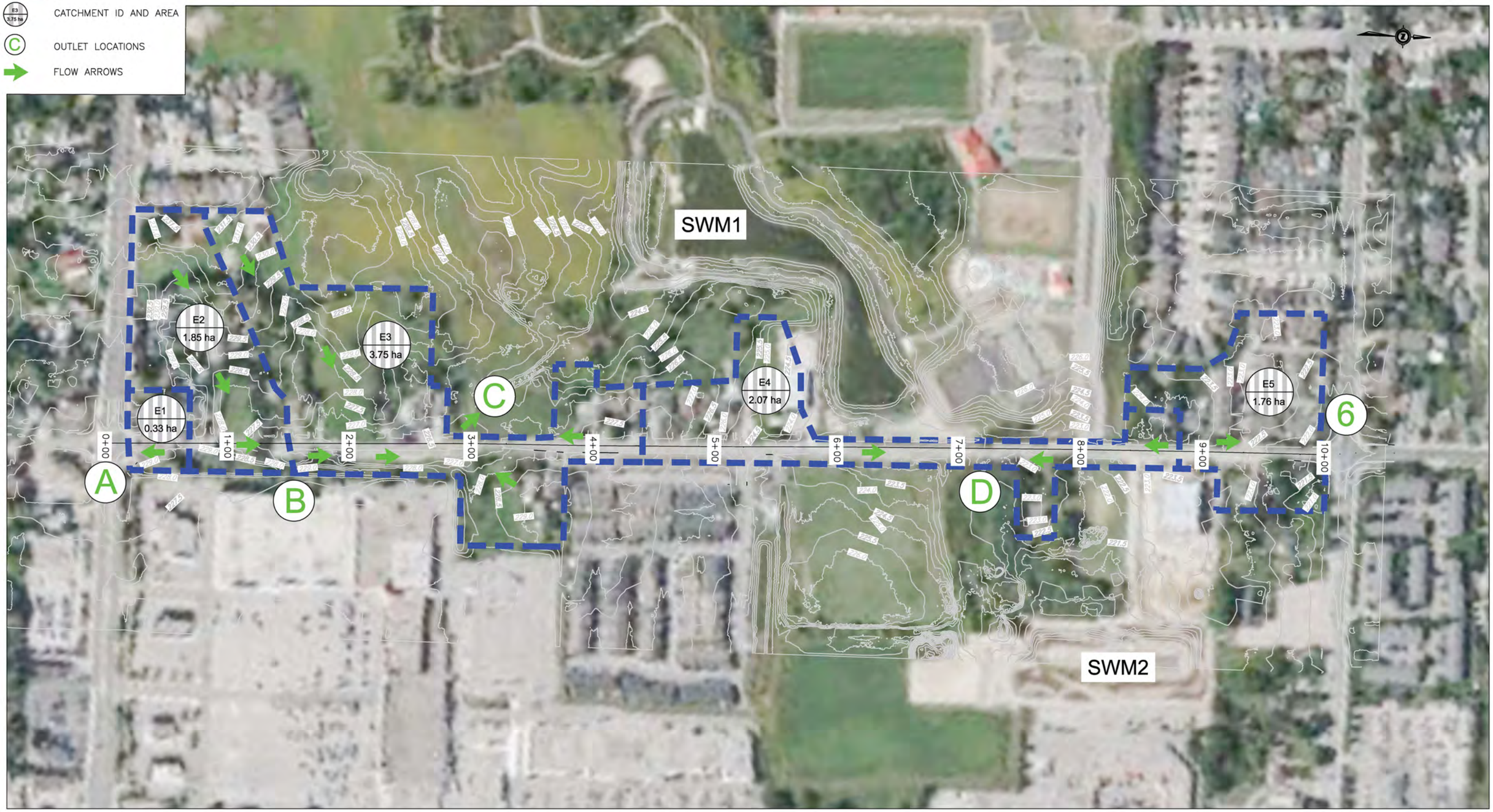
the *William Connell City Wide Park – Stormwater Management Facility (SWM1) Design Report* (Appendix A) but were adjusted based on the existing topography of the surrounding properties and existing high points in the West 5th Street ROW. Associated ultimate conditions catchments from DR1 are also listed in Table 2.

Table 2: Existing Catchments and Outlets

Outlet	Catchment & Area Figure 1	Description	DR1 Catchment
A	E1 0.33 ha	The existing storm sewer in Rymal Road West. Under existing conditions, there is a highpoint at STN-0+67 on West 5th Street, resulting in a small drainage area flowing overland towards Rymal Road West, where it is collected in the Rymal Road West storm sewer.	Part of C-68F. This outlet is eliminated in ultimate conditions.
B	E2 1.85 ha	A ditch inlet catch basin draining east to the South Hamilton Square shopping mall. This outlet collects drainage from the highpoint at STN-0+67 to the existing West 5th Street centreline culvert crossing at STN-1+53, including some external drainage west of West 5th Street consisting of single-family residential properties and open space.	Part of C-68F and C-92F. This outlet is eliminated in ultimate conditions.
C	E3 3.75 ha	The existing storm sewer within the Sheldon neighbourhood development, flowing to SWM1. This outlet collects drainage from the culvert at STN-1+53 to the high point at STN-4+41. This includes some external drainage west of West 5th Street consisting of single-family residential properties and open space.	Part of C-68F, C-92F and C-67F
D	E4 2.07 ha	The large sewer crossing West 5th Street at STN-7+12, ultimately flowing through the Mewburn subdivision to SWM2. This outlet collects drainage between highpoints at STN-4+41 and STN-8+80, and associated external drainage. This crossing is also the outlet for SWM1.	C-69F C-70F Part of C-37.
6	E5 1.76 ha	The existing storm sewer system at Stone Church Road West. This outlet drains the northern most section of West 5th Street, starting at the highpoint at STN-8+80 and north to Stone Church Road West. This outlet is analysed in the *West Central Mountain Drainage Assessment Supplemental Capacity Analysis and SWM Sizing – Mewburn and Sheldon Neighbourhoods*, and also labelled outlet 6 in that report.	Part of C-37.

SUPPLEMENTAL LEGEND:

- CATCHMENT AREA
- CATCHMENT ID AND AREA (E3 3.75 ha)
- OUTLET LOCATIONS (C)
- FLOW ARROWS



EXISTING SERVICES	DRAWING #, SOURCE	DATE	CONSTRUCTED SERVICES	COMPLETION

DETAILS	
DESIGN	BR
DRAWN BY	MK
CHECKED	
APPROVED	
DATE	AUGUST 2025

No.	REVISIONS	DATE	CONSULTANT

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TITLE: WEST 5TH STREET EA

WEST 5TH STREET
SWM ASSESSMENT FIGURE 1

PROJECT No. 165001381

SHEET No. 01

PLAN FILE No.

Throughout the study area, there are several existing centreline and entrance culverts. No site inspection was completed for these culverts as they are either new crossings or are assumed to be replaced/abandoned as part of the West 5th Street urbanization/improvements. Table 3 describes the centreline culvert and sewer crossings within the study area. See Figure 1 for stationing only; culvert locations are not shown in this figure. Entrance culverts have not been documented.

Table 3: Existing Centreline Culvert and Sewer Crossings

Location	Infrastructure	Direction	Outlet
STN-1+53	400mm CSP culverts	East	Outlet B: Drains towards existing ditch inlet catch basin, and towards South Hamilton Square shopping mall to the east.
STN-6+86	550mm CSP culvert	West	Drains through a sewer pipe to the large sewer crossing which outlets SWM1.
STN-7+12	1800mm x 1200mm concrete box Sewer	East	Outlet D: Drains towards the Mewburn neighbourhood. Contains stubs for future storm sewer within West 5th Street ROW.

Within the study area, there are multiple sections of existing storm sewer.

- South of the study area is an 825 mm storm sewer in the Rymal Road West ROW which collects the drainage from existing catchment E1.
- At STN 2+95 there is a storm sewer which drains to the proposed Sheldon neighbourhood. It replaces the previously existing culvert at STN 2+83. This sewer consists of 3 manholes and 3 lengths of pipe (600 mm, 750 mm, and 730 x 1150 mm elliptical pipe) leading into the Sheldon neighbourhood from the West 5th Street ROW.
- There is a single length of 300 mm storm sewer at the intersection of Carmel Dr and West 5th Street (STN 5+26). As designed for the 1155 West 5th Street development, the sewer flows towards West 5th Street (Carmel Drive Plan and Profile, 2015, Appendix A). The status of this length of storm sewer should be confirmed during the West 5th Street storm sewer final design to determine whether the flows from this area need to be accommodated. Regardless, this area has been accommodated in SWM2.
- There is an existing 1800 mm x 1200 mm length of pipe that crosses the West 5th Street ROW at STN 7+10, which extends from the SWM1 outlet to the SWM2 inlet. This length of sewer discharges SWM1 to the Mewburn subdivision.
- At the north end of the study area is two lengths of pipe (375 mm flowing to 450 mm) and two manholes which discharge to the 1200 mm storm sewer in the middle of the West 5th Street & Stone Church Road West intersection. This system captures the flows from existing drainage area E5.

Under existing and ultimate conditions, every catchment is within the Upper Ottawa Creek subwatershed, itself part of the Red Hill Creek watershed. These catchments ultimately discharge to the Mount Albion pond.

4.0 STORMWATER MANAGEMENT OBJECTIVES

The preliminary SWM Plan for West 5th Street upgrades should be completed in accordance with the background documents and guidelines noted in Section 2.0. The criteria listed inside those documents is summarized below. Site specific targets are listed in Section 7.1.

4.1 CONVEYANCE

4.1.1 Minor Events - Storm Sewer System

Based on the *Comprehensive Development Guidelines and Financial Policies Manual*, the minor drainage system is to be sized to convey runoff from a 5-year design storm event. Any proposed storm sewer should either be the 5-year design storm event or be designed to allow any existing downstream storm sewer to remain unsurcharged.

4.1.2 Major Events – Overland

Any flows in excess of the storm sewer capacity (>5-year design storm) shall be conveyed overland via the West 5th Street ROW to an appropriate outlet location. According to the Hamilton Official Plan-Functional Road Classification, West 5th Street is defined as a minor arterial road. For roads classified as arterial or emergency routes, the major drainage system is to be sized to convey the 100-year design storm event within the ROW with a maximum depth of 0 mm above the crown of the road, as per the *Comprehensive Development Guidelines and Financial Policies Manual*.

4.1.3 Crossings

None of the centreline culvert crossings are anticipated to remain in place, however, should the final design include culverts under West 5th Street, the *Comprehensive Development Guidelines and Financial Policies Manual* states that new roadway culverts should have sufficient conveyance for the Regulatory flow in order to avoid adverse backwater effects. This document also states that MTO design criteria is to be used in the evaluation of existing and proposed culverts for freeboard and clearance. Proposed culverts should meet design criteria outlined in *Highway Drainage Design Standards* (2023).

The sewer crossing carrying flow from SWM1 under West 5th Street towards SWM2 is designed to convey the Regional storm event without spilling to the surface, with the upstream SWM1 providing necessary water quantity control, as described in the *Mewburn Neighbourhood SWM Facility (SWM2) – West 5th Street*.

4.2 WATER QUALITY CONTROL

As part of the Red Hill Creek watershed, Enhanced Water Quality Treatment per the MECP's *Stormwater Management Planning and Design Manual* is required through removal of 80% Total Suspended Solids (TSS). This requirement is listed in the *West Central Mountain Drainage Assessment Supplemental Capacity Analysis and SWM Sizing – Mewburn and Sheldon Neighbourhoods* report.

4.3 WATER QUANTITY CONTROL

Post-development peak flows for the 2-year to 100-year storm events must be controlled to pre-development levels.

5.0 ULTIMATE DRAINAGE CONDITIONS

The *William Connell City Wide Park – Stormwater Management Facility (SWM1) Design Report* provides the most updated ultimate conditions drainage plan for the study area (DR1 in Appendix A). This drawing states the imperviousness values assumed during the design of SWM1, which are used to determine whether additional SWM infrastructure is required to complete the works on West 5th Street while meeting the criteria outlined in the previous section. Further, the *Mewburn Neighbourhood SWM Facility (SWM2)* provides more detailed catchment areas and assumptions for the sections of West 5th Street draining to SWM2 (Drawing DA2 in Appendix A). Information from these two reports has been compiled in Table 4.

Table 4: Ultimate Drainage Conditions

Outlet	Existing Catchment ID	Assumed Drainage Area (ha)	Assumed Impervious	Notes
A	E1	0.33	Existing Conditions	• Under ultimate conditions, it was assumed that this outlet will be eliminated and this area directed to SWM1, which has been sized to accommodate these lands. A small section of West 5th Street will likely still contribute to Outlet A but will need to be determined based on the proposed West 5th Street road profile. • If flow is still directed to Outlet A (Rymal Road West), water quality and quantity controls may be required based on a comparison to the existing conditions catchment (E1).
B	E2	1.85	Existing Conditions	• This outlet is assumed to be eliminated in ultimate conditions and directed towards Outlet C / SWM1.
C	E1, E2 and E3	5.93	65%	• Ultimately, SWM1 has been sized to accommodate flows from these lands for both water quantity and quality control.

Outlet	Existing Catchment ID	Assumed Drainage Area (ha)	Assumed Impervious	Notes
D	E4	2.07	65% for all of E4 and 70% for West 5th ROW	• Ultimately, SWM2 has been sized to accommodate flows from these lands for both water quantity and quality control. • In the Mewburn report, the West 5th ROW has been separated into its own catchment with an assumed impervious coverage of 70%. See drawing DA2 in Appendix A.
6	E6	1.76	Existing Conditions (41.90% per DR1)	• It is recommended in the *West Central Mountain Drainage Assessment Supplemental Capacity Analysis and SWM Sizing – Mewburn and Sheldon Neighbourhoods* (2011) that "no additional drainage area contribution (beyond existing) is recommended for Outlet 6". • This is the only existing outlet that was ultimately assumed to not drain to SWM1 nor SWM2. • This section of West 5th Street will ultimately drain the site plan application at 1021 West 5th Street. There is 0.07 ha of this site draining uncontrolled to West 5th Street and Stone Church Road West. The remainder of the site will also drain to West 5th Street, but a proposed storage tank will control up to the 100-yr storm to the 5-yr flow. The proposed drainage plan for this site is illustrated in Figure 2.0 from *1021 West 5th Street* (2022) provided in Appendix A. • Water quantity and quality controls are likely to be required for this area, but will need to be confirmed based on the proposed road layout / impervious coverage. Water quantity control will be required to meet existing conditions and water quality control will be required to treat any additional impervious coverage.

With the urbanization of the study area, it is assumed that under ultimate conditions, the culvert crossings will be removed, and the ditches and culverts replaced with an underground storm sewer system.

6.0 PROPOSED CONDITIONS

The proposed West 5th Street widening will increase net impervious area from existing conditions. The proposed West 5th Street widening includes two traffic lanes, a turning lane, and boulevards with sidewalks and cycle lanes. See West 5th Street - Preferred Alternative in Appendix B for the proposed typical cross-section and plan view.

The minor event flows will drain via a storm sewer (minor system), while the major flows will drain by overland flow along the roadway (major system). See Figure 2 for the proposed catchments.

6.1 MINOR SYSTEM- STORM SEWER

6.1.1 Design Criteria

The storm sewer network was developed in accordance with the City of Hamilton's *Comprehensive Development Guidelines and Financial Policies Manual*. Key design criteria include a maximum manhole spacing of 120 meters, minimum horizontal separations of 2.5 meters from watermains and 1.5 meters from sanitary sewers, and invert drops of at least 0.03 meters at manholes where direction changes. The system was designed to convey runoff up to the 5-year event at a maximum 85% capacity. Rainfall intensities were based on the Mount Hope IDF curves for a 5-year storm, assuming an initial time of concentration of 10 minutes. Rational Method and Manning's equation was used to calculate storm sewer capacities.

6.1.2 Storm Sewer Design

Existing storm sewer data, including elevations and pipe diameters, were obtained from the City of Hamilton's Water and Wastewater GIS Services Web Map and verified using relevant as-built drawings included in Appendix A. Although the City recommends a minimum cover depth of 2.75 meters for storm sewers, the existing storm sewer does not meet this standard so this standard could not be met for new pipes. A minimum cover depth of 1.2 meters was targeted for new pipes to ensure protection against frost penetration (OPSD 3090.101).

Runoff coefficients for each sewer length were determined using Table F.1 from the City of Hamilton's guidelines. The proposed storm sewer layout is shown in Figure 2, with the associated storm sewer design sheet (5-year event) also provided in Appendix C.

6.1.3 Design Considerations and Capacity Issues

The proposed storm sewer network connects to two existing systems at manholes 6 and 17. Manhole 6 is located upstream of the SWM1 inlet, while manhole 17 is upstream of the SWM2 inlet. No new storm sewer infrastructure is proposed at the north end of the site; however the existing storm sewer was modelled to check there is capacity for the road improvements.

SUPPLEMENTAL LEGEND:

- CATCHMENT AREA
- CATCHMENT ID AND AREA (e.g. 100 / 3.75 ha)
- OUTLET LOCATIONS (C)
- FLOW ARROWS

SWM1

SWM2

100	0.13 ha
101	0.21 ha
102	0.20 ha
103	0.20 ha
104	0.16 ha
105	0.19 ha
110	0.16 ha
111	1.56 ha
112	2.00 ha
113	0.04 ha
114	0.08 ha
115	0.07 ha
116	0.07 ha
117	0.58 ha
118	0.34 ha
200	0.22 ha
201	0.18 ha
202	0.31 ha
203	0.31 ha
204	0.12 ha
210	0.81 ha
211	0.23 ha
212	0.18 ha
213	0.10 ha
600	0.17 ha
601	0.14 ha
610	1.16 ha
611	0.79 ha

PROPOSED SUBSURFACE STORAGE LOCATION

PROPOSED LID LOCATION

C

D

6

0+00 1+00 2+00 3+00 4+00 5+00 6+00 7+00 8+00 9+00 10+00

660mm ORIFICE PLATE ON MH 6 OUTLET

EXISTING SERVICES	DRAWING #, SOURCE	DATE	CONSTRUCTED SERVICES	COMPLETION

DETAILS	
DESIGN	BR
DRAWN BY	MK
CHECKED	
APPROVED	
DATE	OCTOBER 2025

No.	REVISIONS	DATE	CONSULTANT

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WEST 5TH STREET
SWM ASSESSMENT FIGURE 2

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6.1.3.1 Connection to Manhole 6 (Outlet C)

This outlet consists of storm sewers along Dunlop Road that were designed for an interim and ultimate condition where they do not convey the entirety of proposed catchments 111 and 112 (see Figure 2). For drainage plans associated with these conditions, see Sheets 13 and 14 from the Sheldon's Gate Phase 1 Drawing set in Appendix A. As observed on this storm sewer drawing, a large external drainage area (catchment 111 on Figure 2, and south of EXT STM1 on Sheldon's Gate catchments) and the south end of West 5th Street are conveyed to the existing outlet draining east through the adjacent commercial property (outlet B on Figure 1). Under ultimate conditions in the Sheldon's Gate subdivision design, the extension of Alexsia Street would redirect most of this external area directly to the Alexsia Street storm sewer, bypassing the Dunlop Road sewers. Under the updated interim conditions (reflecting the current West 5th Road design), this external area (catchment 111) will now be directed north (and away from existing outlet B), resulting in more flow to the existing Dunlop Road storm sewers than assumed in the original interim and ultimate design. This results in these storm sewers being over capacity. This issue is resolved in the ultimate build out of Sheldon's Gate subdivision; however, as the Alexsia Street extension is not completed and the timing of it is unknown, a solution has been presented herein to implement in the West 5th Street design.

The overcapacity pipes as described above are existing pipes between manholes 6–8, 8–9, and 9–10. A summary of these overcapacity pipes in the proposed conditions for West 5th Street without any additional measures is provided in Table 5.

Table 5: Summary of Overcapacity Pipes on Dunlop Road

Pipe length		Capacity (% Full)	City of Hamilton Guidelines (% Full)
U/S MH	D/S MH		
6	8	102.7	85
8	9	101.6	85
9	10	90.1	85

An existing 600 mm diameter pipe between existing manholes 5 and 6 (Plan and Profile drawings) has also been found to be undersized due to the above mentioned increase in drainage area. However, as it is within the West 5th ROW, the pipe is proposed to be removed and replaced with a 750 mm diameter pipe and manhole 5 removed and replaced with proposed manhole 4 installed further south. This will allow the pipe to meet the 85% capacity requirement in the City of Hamilton guidelines.

To ensure the 3 segments of overcapacity pipes meet the City capacity guidelines, 3 alternatives were explored. These alternatives are listed below along with notes on potential challenges, constraints, and a high-level cost comparison.

1. **Upsize existing pipes between manholes 6 and 10 to meet capacity requirement**

    a. Cover is already an issue, and elliptical pipes have already been installed, which would only be made worse with larger pipes.

    b. Is the most expensive option due to removal of existing pipes.

    c. May require replacement of the following two downstream pipes to ensure a larger pipe does not flow into a smaller pipe.

    d. Replaces new pipes installed within the last 2 years.

2. **Provide storage within supersized pipes in West 5th Street and restrict flows from manhole 6 using an orifice plate**

    a. Cover is already an issue between proposed manholes 4 and 6, which would be made worse by increasing the pipes south of manhole 6.

    b. If the pipes to the north are supersized, the existing pipe between manholes 6 and 7 will need to be replaced, increasing the cost.

    c. Supersized pipes will require the pipes to be full, as they are providing the storage. Therefore, they will not meet the 85% capacity guideline, unless all pipes are upsized significantly (which is not possible due to cover).

    d. Will cost less than option #1, but more expensive than option #3 due to large pipes and upsized manholes.

3. **Provide storage in subsurface system within West 5th Street ROW with orifice plate restricting flows from MH 6**

    a. Storage can be provided while not surcharging other sewers (maintain 85% capacity).

    b. No obvious conflicts with sanitary sewer, watermain, or gas.

    c. Shallow systems can work in current low cover areas.

    d. Subsurface storage provided by ADS is the cheapest option explored.

The subsurface storage option (#3) was chosen as it reduces the need to rip up and replace the new sewers on Dunlop Road, is the most cost-effective option, and results in the proposed West 5th Street pipes meeting capacity requirements.

The modified rational method was used to calculate the approximate storage volume required within the West 5th ROW, with the outflow rate set to the 85% capacity of the downstream sewer. To restrict flows, a 660 mm orifice is proposed for the 750 mm outlet pipe on MH 6, directing a portion of the flows into the subsurface storage. See Appendix C for calculations. A Stormtech SC-310 system is proposed to be

used due to limited cover in the area, with details in Table 6 and System Specifications provided by ADS in Appendix C. The storage will be located south of MH 6, between the storm sewer and watermain, as noted in the Plan and Profile drawings provided in Appendix D.

Table 6. ADS Subsurface Storage Details

Length	170 m
Width	2.50 m
Height (including stone layers)	0.71 m
Invert elevation	224.830 m
Maximum ponding elevation	225.540 m

Once the Sheldon Gate subdivision is developed, a significant portion of the flow will be redirected to manhole 27 (Figure 2) on Alexsia Street, reducing flows to the proposed pipes between manholes 2–3, 3–4, and 4–6. In ultimate conditions, the alternatives listed above to alleviate the capacity issues on Dunlop Road may not be required. Timing of this development should be reviewed during detailed design to re-assess the capacity constraints on these pipes. If West 5th Street will be constructed ahead of the Alexsia Street extension, the proposed alternatives listed above should be re-evaluated at detailed design to determine the most cost effective and efficient design at the time.

6.1.3.2 Connection to Manhole 17 (Outlet D)

To complete the connection from the existing pipe extending from manhole 14 to 13 at the intersection of Carmel Drive and West 5th Street, a pipe extension is proposed.

To assess the capacity of the existing storm sewer system downstream of SWM1, the 100-year outflow from the pond was used as the design flow for the pipe segment between manholes 18 and 17. As shown in the storm sewer design sheet (5-year Event) in Appendix C, the pipes conveying flow from the SWM1 have adequate capacity to handle the additional flow from the proposed storm sewer.

6.1.3.3 Existing North Sewer (Outlet 6)

To include the flows from the storage tank in catchment 611, the 100-year outflow was used as the design flow from that catchment. As shown in the storm sewer design sheet (5-year Event) in Appendix C, the existing pipes have adequate capacity to handle the additional flow to the storm sewer.

6.1.4 Cover Considerations

Depth of cover for all proposed sewer segments can be identified in the Plan and Profile drawings showing invert elevations, in Appendix D. Two segments (from manholes 3 - 4, and manholes 4 - 6) do not meet the minimum cover requirement of 1.2 meters. To mitigate the risk of frost penetration, several alternatives should be considered during the final design phase. As previously mentioned, under ultimate conditions a significant amount of flow will be redirected to manhole 27, resulting in these pipes being oversized.

One alternative is to install 600mm pipes with additional SWM control to limit flow until ultimate conditions have been established. Other alternatives include installing elliptical pipes with equivalent hydraulic capacity or insulating the pipes. The preferred approach will be finalized during detailed design.

All remaining pipes in the system are within the maximum design capacity and meet the minimum cover requirements.

6.2 MAJOR SYSTEM

The overland flow for the ROW was designed in accordance with the City of Hamilton standards, which require that 100-year storm events be conveyed without flooding the roadway. Arterial roads must remain fully passable, with a maximum allowable flood depth of 0 mm above the road crown, while local and collector roads may accommodate up to 150 mm of flood depth. Within the study area, West 5th Street is classified as a minor arterial roadway, while the connecting roads are designated as collector roads, in accordance with the City of Hamilton Official Plan.

Overland flow from major storm events was assessed by calculating 100-year design flows using the Rational Method and Manning's Equation, with rainfall intensities based on the Mount Hope IDF curves and an assumed initial time of concentration of 10 minutes. See storm sewer design sheet (100-year Event) in Appendix C for calculations. The 5-year event flows were then subtracted from the 100-year event flows to account for the capacity of the storm sewer. These flows were used to determine the capacity of the roadway.

FlowMaster, a hydraulic modeling tool for steady flow conditions, was used to evaluate the overland flow capacity of the proposed West 5th Street cross-section. The analysis was conducted at five locations, presented in Table 7: three along West 5th Street and two at intersections where the overland flow route is directed offsite towards adjacent roads. These locations were selected for analysis because they either receive the highest amount of flow or are situated along segments with shallow slopes. The FlowMaster cross sections are shown in Appendix E, while flood depths are shown in Table 7. The resulting flood depths do not exceed the maximum allowable depths specified in the *City of Hamilton Comprehensive Development Guidelines and Financial Policies Manual*.

Table 7: Overland Flow Assessment

Station	Overland Flow [m^3/s]	Flood Depth [m]	Road Classification	Maximum Allowable Flood Depth [m]
3+00	0.45	-0.005	Minor Arterial	0
Outside of ROW (Future Street 'A' from Mewburn Subdivision)	0.50	0.015	Collector	0.15
Outside of ROW (Dunlop Drive)	0.57	0.020	Collector	0.15
7+10	0.23	-0.040	Minor Arterial	0
10+00	0.21	-0.025	Minor Arterial	0

7.0 STORMWATER MANAGEMENT

A Stormwater Management (SWM) Strategy was considered as a method to minimize/mitigate environmental impacts due to the proposed West 5th Street Road improvements. A range of SWM controls are available on any given site and an evaluation of site conditions and physical constraints is required to determine which options are most appropriate. Physical constraints include topography, soils, bedrock elevation, groundwater elevation, and drainage area. Various design alternatives were considered for the overall SWM strategy including:

- **Distributed or Lot Level Controls**: Lot level controls include most Low Impact Development (LID) measures such as bio-retention areas (bio-swales), tree pits, vegetated conveyance systems such as grassed swales, vegetated buffer strips, and filter strips which provide passive water quality treatment for adjacent roads, primarily filtering sediments and heavy metals prior to out-letting. Additional treatment can also be provided with the use of enhanced grass swales which utilize permanent rock check dams used to reduce in-channel flow velocities to allow finer sediment to settle. Distributed infiltration measures such as infiltration trenches, porous pavements, and sand filters provide water quantity benefits while also contributing to groundwater recharge. Oil and Grit Separators (OGSs) and other Manufactured Treatment Devices (MTD) can also provide water quality treatment where space is limited.

- **End-of-Pipe Controls**: End-of-Pipe storage facilities such as wet ponds, dry ponds, constructed wetlands, and infiltration basins can be effective control measures, providing both water quality and quantity control measures. Underground storage can be effective at providing quantity controls where available property is limited. If the updated West 5th Street design remains below the assumed impervious values used in the design of the SWM facilities, no additional SWM control will be required. If the proposed West 5th Street design results in more area and/or impervious area being directed to the outlet than assumed, water quantity and/or quality controls will be required.

7.1 STORM WATER MANAGEMENT ASSESSMENT

To assess whether additional stormwater management is required at each outlet, the updated imperviousness for the proposed right-of-way was compared to the areas and imperviousness used in the design of each stormwater management facility. A summary of this comparison is provided in **Error! Reference source not found.**, which outlines the proposed drainage areas resulting from the West 5th Street road improvements, compared to the original assumed values used in the design of each existing pond. Due to space constraints, any water quality control will be through LID measures or OGS units, while water quantity control will be through LIDs or subsurface storage (supersized pipes or detention chambers).

Table 8: Imperviousness Comparison

Outlet	Proposed Road Widening (See Figure 2)			
C	**Catchment**	**Total Area (ha)**	**Impervious Area (ha)**	**% Impervious**
	100	0.13	0.10	75.0
	101	0.21	0.16	75.0
	102	0.20	0.15	75.0
	103	0.20	0.15	75.0
	104	0.16	0.12	75.0
	105	0.19	0.14	75.0
	110	0.16	0.10	65.0
	111	1.56	1.01	65.0
	112	2.00	1.30	65.0
	113	0.04	0.00	0.0
	114	0.08	0.00	0.0
	115	0.14	0.00	0.0
	117	0.58	0.38	65.0
	118	0.34	0.22	65.0
	Total	**5.99**	**3.83**	**64.0**
	Assumed in Pond Design (See Figure DR1 in Appendix A)			
	Catchment	**Total Area (ha)**	**Impervious Area (ha)**	**% Impervious**
	67F	0.68	0.44	65.0
	68F	2.57	1.67	65.0
	92F	2.84	1.85	65.0
	Total	**6.09**	**3.96**	**65.0**

Outlet	Proposed Road Widening (See Figure 2)			
D	Proposed Road Widening (See Figure DA2 in Appendix A)			
	Catchment	**Total Area (ha)**	**Impervious Area (ha)**	**% Impervious**
	69F	2.84	1.95	68.5*
	74F	0.93	0.65	70.0
	75F	1.41	0.71	50.0
	83F	2.46	1.72	70.0
	84F	2.93	2.05	70.0
	85F	3.48	2.44	70.0
	Total	**14.05**	**9.51**	**67.7**
	Assumed in Pond Design (See Figure DA2 in Appendix A)			
	Catchment	**Total Area (ha)**	**Impervious Area (ha)**	**% Impervious**
	69F	2.84	1.89	66.4
	74F	0.93	0.65	70.0
	75F	1.41	0.71	50.0
	83F	2.46	1.72	70.0
	84F	2.93	2.05	70.0
	85F	3.48	2.44	70.0
	Total	**14.05**	**9.45**	**67.3**
6	**Proposed Road Widening (See Figure 2)**			
	Catchment	**Total Area (ha)**	**Impervious Area (ha)**	**% Impervious**
	600	0.32	0.24	75.0
	Total	**0.32**	**0.24**	**75.0**
	Existing Conditions (See Figure 2)			
	Catchment	**Total Area (ha)**	**Impervious Area (ha)**	**% Impervious**
	600	0.32	0.16	50.0
	Total	**0.32**	**0.16**	**50.0**

*See Table 9 for imperviousness calculation.

Table 9: Imperviousness Calculation for Catchment 69F

Sub catchment Area (ha)		Impervious Area (ha)	% Impervious
0.33		0.18	55.0
0.48		0.34	70.0
0.11		0.06	55.0
0.23		0.13	55.0
0.52		0.36	70.0
1.16		0.87	75.0
Total	**2.84**	**1.94**	**68.5**

7.1.1 Outlet C- SWM1

Under ultimate conditions assumed by the SWM1 pond design there is an assumed drainage area of 6.09 ha, with 65.0% imperviousness, resulting in 3.96 ha of impervious area. The proposed West 5th Street improvements result in a total drainage area of 5.99 ha, with 64.0% imperviousness resulting in 3.83 ha of impervious area. The reduced drainage area is the result of catchment C-68F being smaller than assumed in the pond design. In the pond design an additional 0.1 ha of pervious area adjacent to West 5th Street is assumed to drain towards the ROW, however site topography suggests this area drains to the parking lot to the east of West 5th Street (South Hamilton Square Plaza).

Since the total drainage area and assumed impervious area used in the design of the pond are higher than the values resulting from the proposed road improvements, no additional storm water management is proposed for this outlet.

7.1.2 Outlet D- SWM2

To assess outlet D, the same catchments used in the pond design were used to compare to proposed conditions since the majority of the drainage area is external to the ROW. The imperviousness for the ROW was updated from the assumed 70.0% to 75.0%. The updated imperviousness calculations for catchment 69F is shown in Table 9. Under Ultimate conditions assumed by the SWM2 pond design there is an assumed drainage area of 14.05 ha, with 67.3% imperviousness, resulting in 9.45 ha of impervious area. The proposed West 5th Street improvements has the same drainage area, with 67.7% imperviousness, resulting in an impervious area of 9.51 ha. In the report titled *Mewburn Neighbourhood SWM Facility (SWM2) – West 5th Street*, the imperviousness used for the pond design was rounded up to 68%. The proposed road improvements have an imperviousness below 68% therefore, no additional SWM controls are required.

7.1.3 Outlet 6- Stone Church Road

Under existing conditions, a total of 0.32 ha along the ROW drains to Outlet 6, with 0.16 ha of impervious area, resulting in an imperviousness of 50%. With the proposed road widening, the drainage area

remains the same, but the impervious area increases to 0.22 hectares, raising the imperviousness to 70%. As noted in Table 4, it is recommended that no additional drainage be directed to Outlet 6. Since the imperviousness increases under the proposed conditions, stormwater management will be required at this outlet to match existing flows.

7.2 STORMWATER MANAGEMENT/LID EVALUATION

The SWM strategy was designed to meet SWM design guidelines and policies outlined above. Water quality, water quantity, and erosion controls are required for any proposed road improvements. A treatment train approach using source, conveyance, and end-of-pipe facilities, in combination with LID practices, should be considered to enhance the water quantity, water quality, water balance, and erosion mitigation potential. **Error! Reference source not found.** provides an evaluation of SWM and LID measures considered to meet the design objectives for the proposed West 5th Street road improvements.

Due to the lack of geotechnical data available for the site, soil data from AgMaps was referenced to get a general idea of the soil conditions adjacent to the site. The soil surrounding the site is silty loam, classified into Hydrologic soil groups Group C and D. This indicates the soils have low infiltration capacity and a high runoff potential.

Table 10: SWM/LID Evaluation

SWM/ LID Feature	Comments	Recommendations
Exfiltration Galleries	Soils within the area range between type C and D[1]. These soil types are known to be poorer for infiltration and may limit function of exfiltration galleries.	Site specific hydrogeological and geotechnical investigations are recommended to be completed.
Underground Chambers/ Soakaways	Space constraints and potential utilities conflicts within the ROW are a concern. Spacing from groundwater table should be considered when site specific hydrogeological/geotechnical information is available.	Not recommended due to potential utility conflicts. To be confirmed during detailed design.
Superpipes	Requires significant excavation and coordination with existing infrastructure.	Not recommended due to depth requirements and potential conflicts with existing infrastructure.
Bioretention Cells/ Rain Gardens	Space constraints and potential utilities conflicts within the ROW are a concern.	Potentially feasible. To be confirmed during detailed design.
Permeable Pavement	Potential maintenance concerns and long-term performance issues. The City of Hamilton prefers permeable pavement only in low traffic areas[2].	Not recommended due to high traffic and potential maintenance requirements.

SWM/ LID Feature	Comments	Recommendations
Enhanced Grass Swales	Space constraints and potential utilities conflicts within the ROW are a concern.	Not recommended due to spatial constraints. To be confirmed during detailed design.
Soil Cells / Tree Trenches (S	Space constraints and potential utilities conflicts within the ROW are a concern. Spacing from groundwater table should be considered when site specific hydrogeological/geotechnical information is available.	Potentially feasible. Site specific hydrogeological and geotechnical investigations are recommended to be completed.
Underground Storage Tank	Provides high volume storage with minimal surface impact. Utility conflicts are a concern.	May be feasible where deep excavation is viable. To be confirmed during detailed design.
Notes: *1. Ontario Ministry of Agriculture, Food and Rural Affairs. (n.d.). AgMaps [Interactive map]. https://www.ontario.ca/page/agmaps* 2. *Comprehensive Development Guidelines and Financial Policies Manual*, City of Hamilton, 2019.		

The feasibility of each option was screened based on the following criteria:

- Ability to meet stormwater management water quantity, quality and erosion control criteria.
- Spatial constraints within the road ROW and downstream watercourses.
- Integration with the proposed road cross-section.
- Suitable connection with the minor conveyance infrastructure and outlet.
- Cost-effectiveness including operation and maintenance.

7.2.1 Storage Requirements

As mentioned in Section 7.1, the only outlet requiring additional stormwater management is Outlet 6 (other than the storm sewer capacity issues as discussed in Section 6.1.3.1). It is recommended in the *West Central Mountain Drainage Assessment Supplemental Capacity Analysis and SWM Sizing – Mewburn and Sheldon Neighbourhoods* (2011) that “no additional drainage area contribution (beyond existing) is recommended for Outlet 6”.

To determine the required storage volume, the Modified Rational Method was used, and the 5-year event was overcontrolled to reduce the overland flows during the 100-year event to match existing flows. This approach was taken because runoff from the 100-year event is expected to bypass the storage unit and flow overland. Peak flow increases from existing to proposed conditions were calculated for both the 5-year and 100-year events. The peak flow increases by 0.015 m^3/s for the 5-year event and 0.027 m^3/s for

the 100-year event. The amount of overcontrol was determined by the incremental increase from the 5-year event to 100-year event, 0.012 m^3/s.

To find the allowable release rate from the proposed storage unit, runoff from catchments 600, 601, and 610 were considered since runoff from catchment 611 is already controlled by an underground storage unit. The allowable release rate was then calculated by subtracting the level of overcontrol (0.012 m^3/s) from the existing 5-year runoff from catchments 600, 601, and 610. Therefore the allowable release rate from the proposed storage unit is 0.257 m^3/s.

Using a time of concentration of 10 minutes, the difference between inflow (5-year event runoff) and allowable outflow was calculated over time, resulting in the volume that must be stored. The minimum required storage volume, occurring when this difference is greatest, is 31.0 m^3. Flow rates are summarized in Table 11, while detailed Modified Rational Method calculations are shown in Appendix F.

Table 11: Flow Rates used for Modified Rational Method

Event	5-year	100-Year
Existing Peak Flow Rate [m^3/s]	0.304	0.535
Proposed Uncontrolled Peak Flow rate [m^3/s]	0.319	0.561
Increase in Peak Flow [m^3/s]	0.015	0.027
Allowable Release Rate from catchments 600, 601 and 610 [m^3/s]	0.257	
Release Rate from 1021 West 5th Storage Tank [m^3/s]	0.036	0.062
Proposed Controlled Peak Flow Rate [m^3/s]	0.293	0.535
Storage Volume Required [m^3]	31.9	

7.2.2 Possible Alternatives and Locations

As mentioned in **Error! Reference source not found.**, several alternatives should be considered at the current design phase. These include bioretention cells, soil cells/tree trenches, and an underground storage tank. Due to limited space within the ROW, the only potentially feasible location for an LID/SWM facility is at at the southwest corner of the Stone Church Road and West 5th Street intersection. A recommendation cannot be provided at this time due to the lack of site specific geotechnical/hydrogeological data. The final SWM approach will be determined during the detailed design phase.

8.0 CONCLUSIONS AND RECOMMENDATIONS

This report presents an assessment of existing drainage conditions, outlines the proposed storm sewer network, and details the stormwater management strategy throughout the study area. Based on the findings, the following conclusions have been drawn

- Future storm sewers will be designed to accommodate minor flows within the West 5th Street ROW to the appropriate outlet location. All existing culverts are assumed to be removed/abandoned.
- The future West 5th Street ROW will be designed to convey the major flows to the appropriate outlet location.
- Several existing pipe segments on Dunlop Road exceed the maximum design guideline of 85% full flow. A subsurface storage system is proposed to alleviate this issue; however, this will need to be re-evaluated at detailed design based on up to date information.
- Several legs of the proposed storm sewer have inadequate cover and will require either insulation or installation as elliptical pipes with an equivalent hydraulic capacity. Adequate cover could also be achieved with downsizing pipes and additional SWM.
- For water quantity and quality control, the majority of the West 5th Street ROW through the study area is accounted for in the design of external SWM facilities (SWM1 or SWM2).
- Site-specific hydrogeological and geotechnical investigations are recommended to support final design and construction planning.
- Additional SWM will be required to match existing peak flow rates at outlet 6. Options include soil cells, bioretention cells, or an underground storage tank.
- Several components of this report are subject to confirmation and refinement during the final design phase.

APPENDIX A:
Relevant Figures from Background Documents

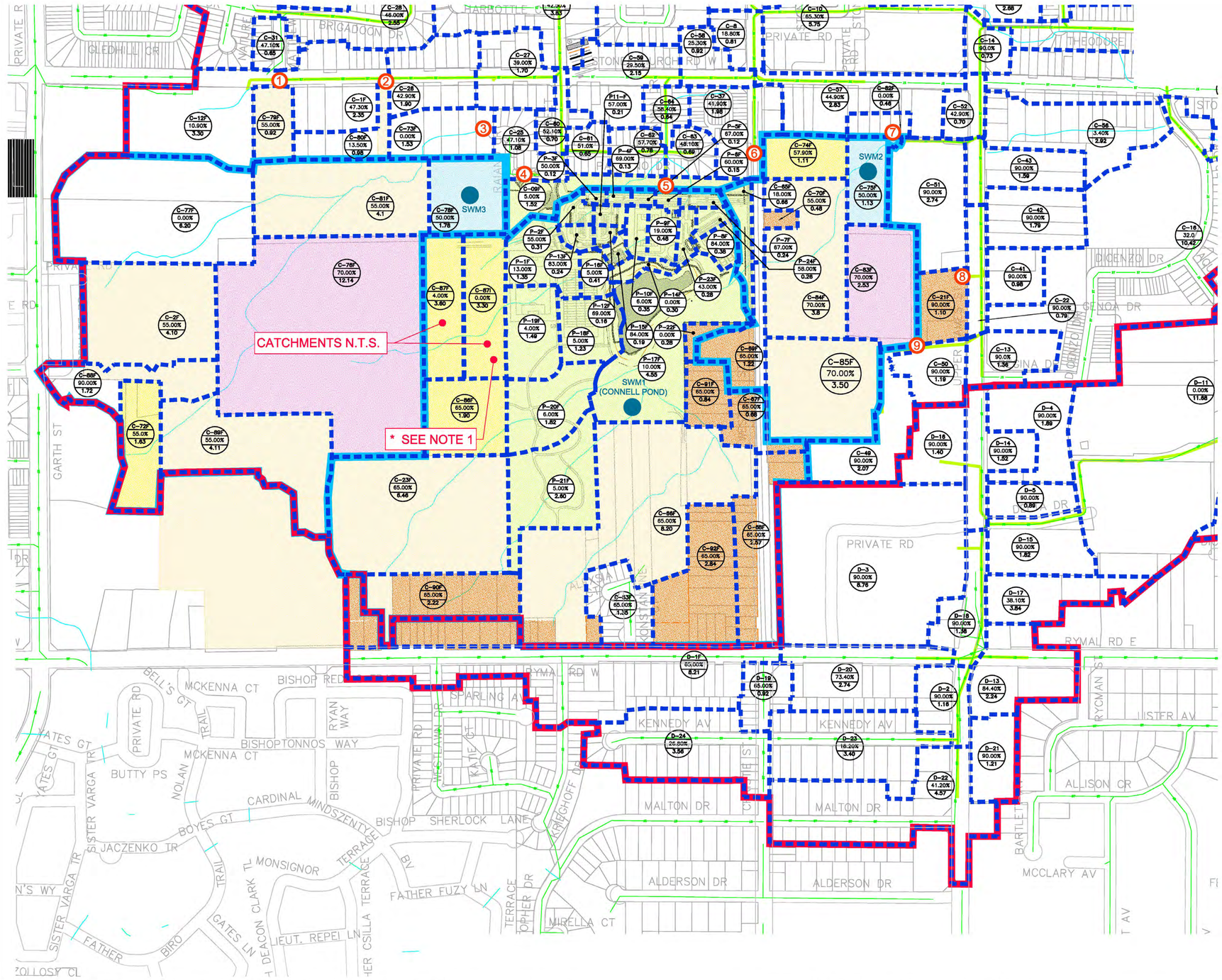
WILLIAM CONNELL CITY WIDE PARK

UPDATED FUTURE ULTIMATE CONDITIONS SUBCATCHMENT BOUNDARY PLAN

14-P-22 (DR1)

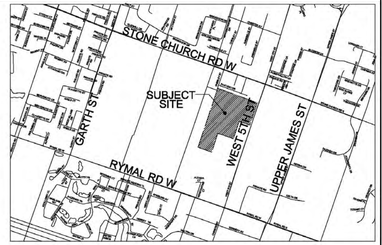
FILE No.	CONTRACT No. DRAWING No. 14-P-22 (DR1)	SHEET No. 28 of 29

DIMENSIONS SHOWN ON THIS PLAN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED



NOTES:

1. C-87I – REPRESENTS INTERIM EXISTING CONDITION DRAINAGE TO PARK UNTIL FUTURE DEVELOPMENT OF C-87F AND SWM3 POND.



LEGEND:

- CATCHMENT BOUNDARY
- SUBCATCHMENT BOUNDARY
- SWM FACILITY DRAINAGE BOUNDARY
- PROPERTY BOUNDARY
- STORM SEWERS
- EXISTING OPEN WATERCOURSE
- MODELED TRUNK STORM SEWERS
- ⑤ OUTLET NUMBER
- PROPOSED SWM FACILITY LOCATION
- SUBCATCHMENT NUMBER / TOTAL FUTURE ULTIMATE IMPERVIOUSNESS / SUBCATCHMENT AREA (ha)
- CURRENTLY PROPOSED RESIDENTIAL
- CURRENTLY PROPOSED PARKLANDS
- POTENTIAL FUTURE SWM BLOCK
- FUTURE INSTITUTIONAL
- POTENTIAL FUTURE RESIDENTIAL
- POTENTIAL FUTURE INFILL / INTENSIFICATION AREAS

DRAWING BACKGROUND INFORMATION SUPPLIED BY THE CITY FROM THE WEST CENTRAL MOUNTAIN DRAINAGE ASSESSMENT SUPPLEMENTAL CAPACITY ANALYSIS AND SWM SIZING, MEWBURN AND SHELDON NEIGHBOURHOODS, DATED OCTOBER 2011, BY AMEC ENVIRONMENT & INFRASTRUCTURE.

No.	REVISIONS	INITIAL	DATE
7.	MOE/HCA APPLICATION SUBMISSION	DF	2016/02/18
6	MOE/HCA SUBMISSION - CITY/HCA REVIEW	DF	2015/12/18
5.	50% DETAILED DESIGN SUBMISSION	DF	2015/08/17
4.	100% FUNCTIONAL PLAN - HCA SUBMISSION	DF	2015/06/26
3.	100% FUNCTIONAL DESIGN RESUBMISSION	DF	2015/03/24
2.	100% FUNCTIONAL DESIGN SUBMISSION	DF	2014/11/25
1.	50% FUNCTIONAL DESIGN SUBMISSION	DF	2014/10/01

DRAWN BY: D.F. DATE: SEPTEMBER 29, 2014

REFERENCE MATERIAL:
Surveyed By :
Sewer Plans :
Water Plans :
Survey Plan :
Regional Surveyor: City of Hamilton Public Works Department

Geodetic Bench Mark IndNo. 07720020068 Elevation= 229.005
Borehole Report -

SCALES
0 50 100 150 m
HOR – 1:3500

IBI GROUP
7th Floor - 55 St. Clair Avenue West
Toronto ON M4V 2Y7 Canada
tel 416 596 1930 fax 416 596 0644
ibigroup.com

LICENSED PROFESSIONAL ENGINEER M. GIULIANO FEB 18/16 PROVINCE OF ONTARIO

Project Manager (Design)
Monir Moniruzzaman, P. Eng.
Manager of Design
Sally Yong-Lee, P. Eng.

CITY OF HAMILTON
Public Works Department

WILLIAM CONNELL CITY WIDE PARK
UPDATED FUTURE ULTIMATE CONDITIONS SUBCATCHMENT BOUNDARY PLAN
DR1

FILE:J:\36886_WCCW_Park\5.9 Drawings\05civil\layout\d09_DR1.dwg, LAYOUT:DR-1
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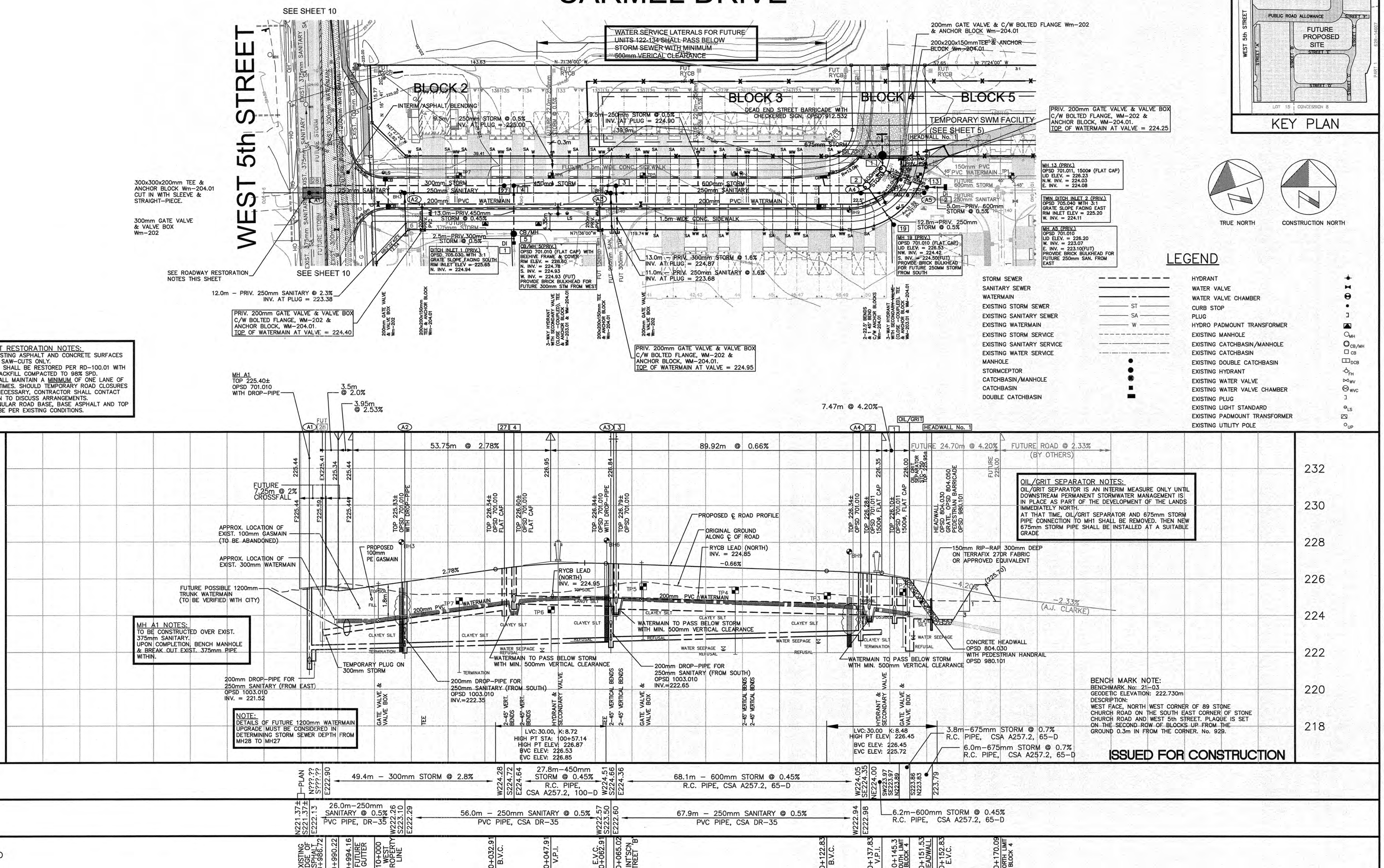
CARMEL DRIVE



WEST 5th STREET RESTORATION NOTES:

1. ALL CUTS TO EXISTING ASPHALT AND CONCRETE SURFACES SHALL BE CLEAN SAW-CUTS ONLY.
2. DISTURBED ROAD SHALL BE RESTORED PER RD-100.01 WITH SELECT NATIVE BACKFILL COMPACTED TO 98% SPD.
3. CONTRACTOR SHALL MAINTAIN A MINIMUM OF ONE LANE OF TRAFFIC AT ALL TIMES. SHOULD TEMPORARY ROAD CLOSURES BE DESIRED OR NECESSARY, CONTRACTOR SHALL CONTACT CITY OF HAMILTON TO DISCUSS ARRANGEMENTS.
4. DEPTHS OF GRANULAR ROAD BASE, BASE ASPHALT AND TOP ASPHALT SHALL BE PER EXISTING CONDITIONS.

LEGEND

STORM SEWER · SANITARY SEWER · WATERMAIN · EXISTING STORM SEWER (ST) · EXISTING SANITARY SEWER (SA) · EXISTING WATERMAIN (W) · EXISTING STORM SERVICE · EXISTING SANITARY SERVICE · EXISTING WATER SERVICE · MANHOLE · STORMCEPTOR · CATCHBASIN/MANHOLE · CATCHBASIN · DOUBLE CATCHBASIN

HYDRANT · WATER VALVE · WATER VALVE CHAMBER · CURB STOP · PLUG · HYDRO PADMOUNT TRANSFORMER · EXISTING MANHOLE · EXISTING CATCHBASIN/MANHOLE · EXISTING CATCHBASIN · EXISTING DOUBLE CATCHBASIN · EXISTING HYDRANT · EXISTING WATER VALVE · EXISTING WATER VALVE CHAMBER · EXISTING PLUG · EXISTING LIGHT STANDARD · EXISTING PADMOUNT TRANSFORMER · EXISTING UTILITY POLE

BENCH MARK NOTE:
BENCHMARK No: 21-03
GEODETIC ELEVATION: 222.730m
DESCRIPTION:
WEST FACE, NORTH WEST CORNER OF 89 STONE CHURCH ROAD ON THE SOUTH EAST CORNER OF STONE CHURCH ROAD AND WEST 5th STREET. PLAQUE IS SET ON THE SECOND ROW OF BLOCKS UP FROM THE GROUND 0.3m IN FROM THE CORNER. No. 929.

ISSUED FOR CONSTRUCTION

No	Date	Drawn	Appr'd	Revisions
6	SEP 30/15	M.L.	J.W.E.	ISSUED FOR CONSTRUCTION
5	AUG 20/15	M.L.	J.W.E.	ISSUED FOR APPROVAL
4	JULY 20/15	M.L.	J.W.E.	300mm GATE VALVE ADDED ON WEST 5th
3	MAY 26/15	M.L.	J.W.E.	ISSUED FOR REVIEW
2	APR. 21/15	M.L.	J.W.E.	ISSUED FOR REVIEW
1	NOV. 25/14	M.L.	J.W.E.	2nd SUBMISSION

APPROVALS

Design	J.W.E.	Checked	A.J.C.
Drawn	M.L.	Checked	J.W.E.

Scale Horiz. 1:500 Vert. 1:100

Date OCTOBER 2014

LICENSED PROFESSIONAL ENGINEER – PROVINCE OF ONTARIO

1155 WEST 5th STREET
HAMILTON, ON
SONOMA HOMES

CARMEL DRIVE
PLAN AND PROFILE

amec foster wheeler

Contract No.
Consultant File No. TP110111
Drawing No. SHEET 4 OF 15

Path: P:\Work\110111\land\dwg\subdivision\contract\IFC 15-09-30\4-public Road Prof(IFC).dwg
Plotted: 2015-09-30 Plotted By: mike.loncar
Last Saved: 2015-09-30 Last Saved By: mike.loncar

DWG No.: 16070 -DA2

STORM CATCHMENT PLAN

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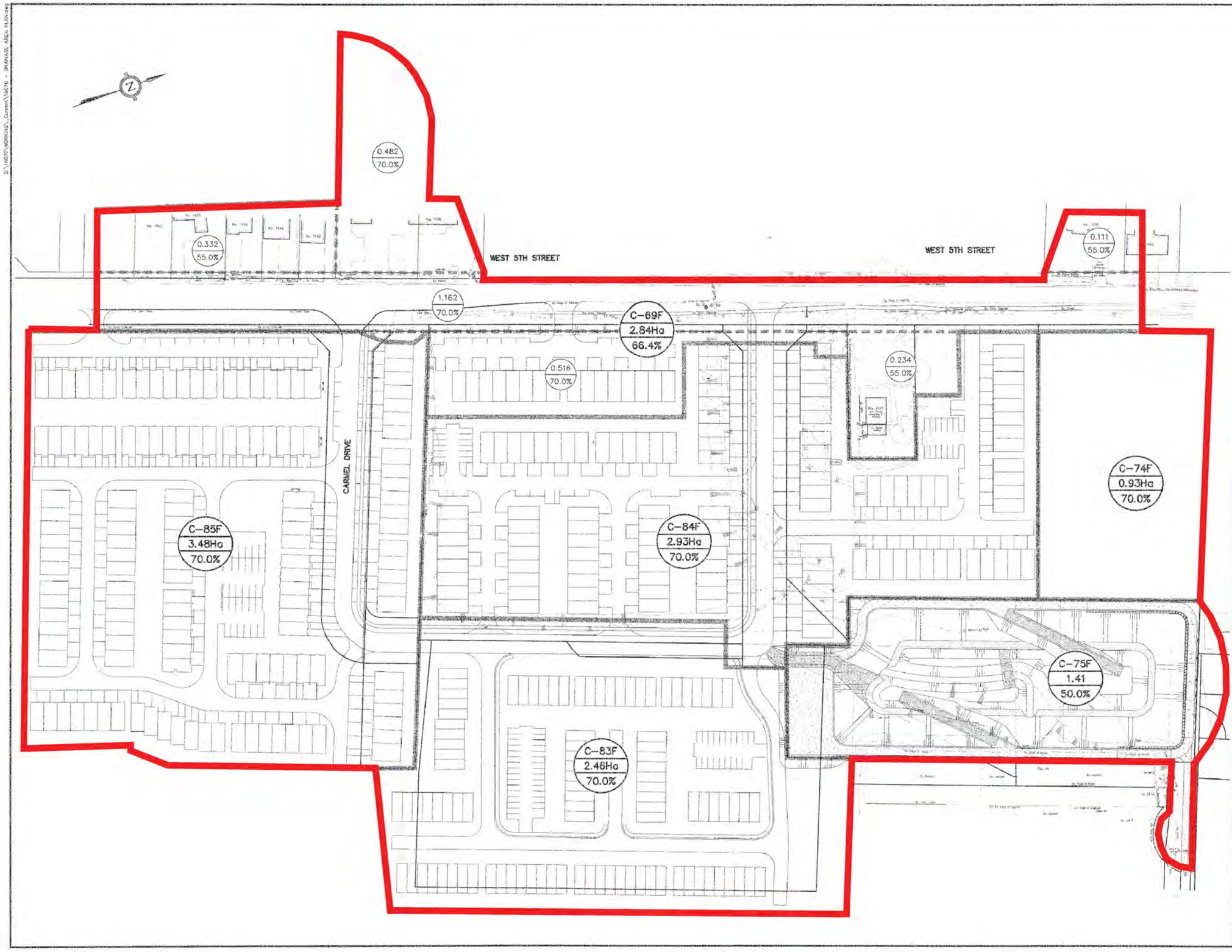
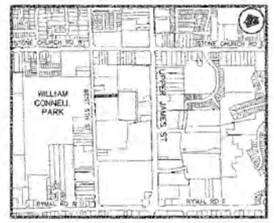




LEGEND

C-74F — CATCHMENT ID
0.93Ha — CATCHMENT AREA
70.0% — CATCHMENT IMPERVIOUSNESS

0.234 — SUB-CATCHMENT AREA
55.0% — SUB-CATCHMENT IMPERVIOUSNESS

CATCHMENT BOUNDARY

SUB-CATCHMENT BOUNDARY

BENCH MARK NOTE:

ELEVATIONS ARE TAKEN FROM PLANS PREPARED BY A.T. McLAREN, DATED JULY 22, 2016. ELEVATIONS SHOWN ON THIS PLAN ARE GEODETIC AND ARE REFERRED TO CITY OF HAMILTON BENCH MARK No 21-03.

DESCRIPTION: West face, north west corner of 89 Stone Church Road on the south east corner of Stone Church Rd and West 5th St. Plaque is set on the second row of blocks up from the ground 0.3 m in from the corner. No. 929.

ELEVATION = 222.730 metres

NO.	DATE	BY	REVISIONS
1.	NOV./16	SF	ISSUED FOR CITY REVIEW

DESIGN	JO	CHK'D	
DRAWN	RB	CHK'D	
DATE	Sep. 13, 16		
SCALE	1:750		

APPROVALS

STAMP

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS
Tel. (905) 631-6978
Fax (905) 631-8927
email: info@sllea.on.ca
3228 South Service Road, Suite #105 East Bldg, Burlington, Ont. L7N 3H8

CLIENT

CITY OF HAMILTON
DEPARTMENT OF
INFRASTRUCTURE PLANNING

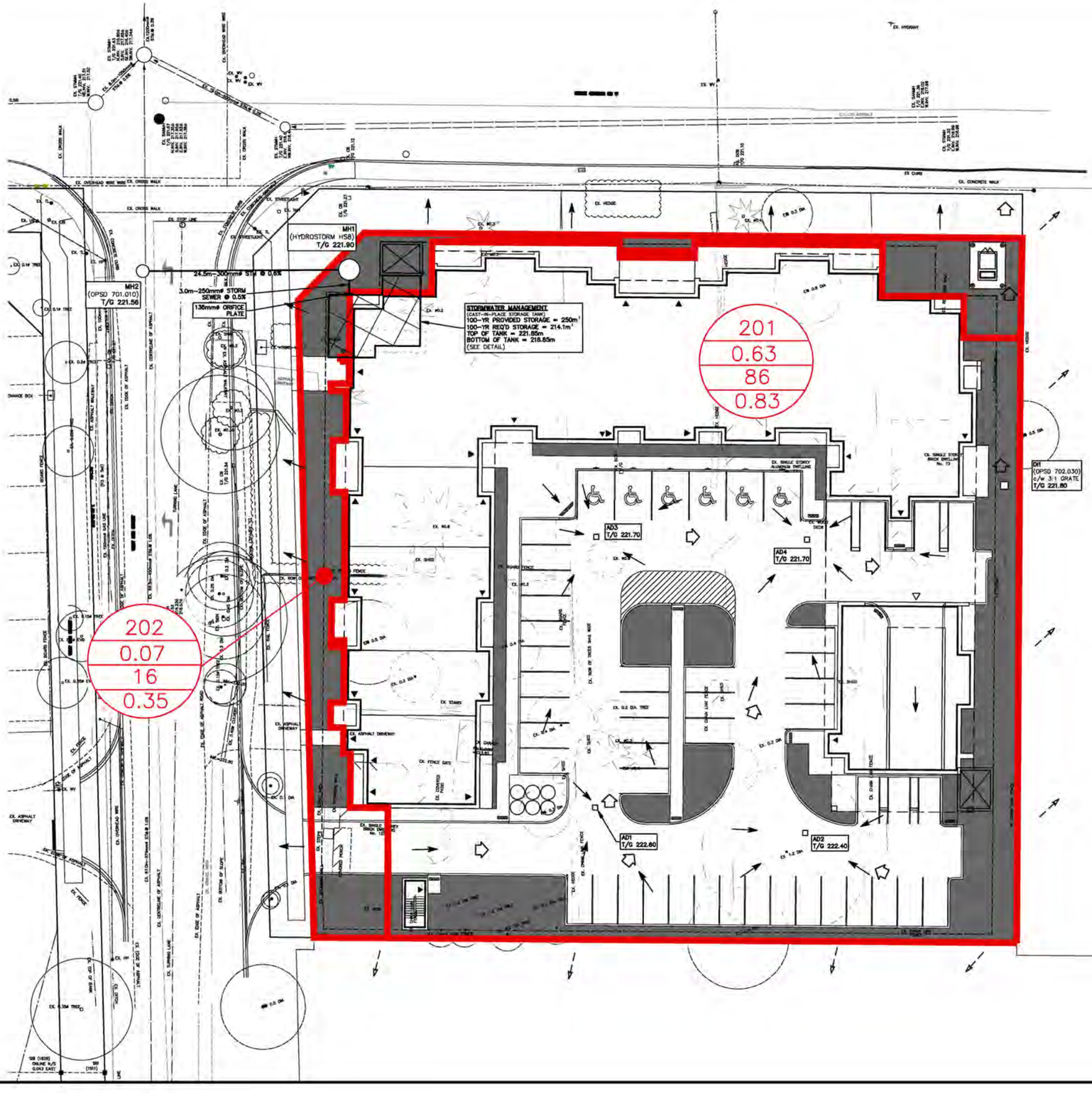
PROJECT NAME

MEWBURN NEIGHBOURHOOD
SWM FACILITY
WEST 5TH STREET, HAMILTON, ONTARIO

TITLE

STORM CATCHMENT
PLAN

PROJECT No.	DRAWING No.
16070	DA2



LEGEND:

- CATCHMENT AREA BOUNDARY
- PERVIOUS AREA
- 101 / 0.04 / 25 / 0.41 — DRAINAGE AREA ID; DRAINAGE AREA (ha); PERCENT IMPERVIOUS; RUNOFF COEFFICIENT
- PROPOSED OVERLAND FLOW ROUTE
- EXISTING DIRECTION OF DRAINAGE

FIGURE 2.0
POST-DEVELOPMENT STORM DRAINAGE AREA PLAN

SCALE: 1:500

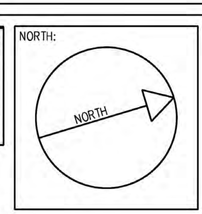
PROJECT: 1021 WEST 5TH ST
PROJECT No.: 22018

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS
Tel. (905) 631-6978
Fax (905) 631-8927
email: info@sla.on.ca
3228 South Service Road, Suite #105 East Wing, Burlington, Ont., L7N 3H8

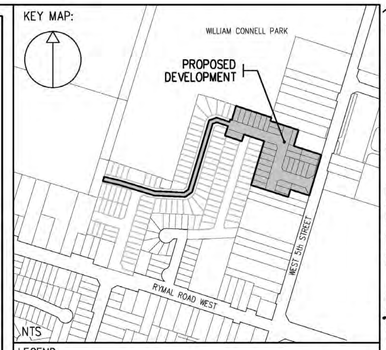
THIS CERTIFIES THAT THE WORK SHOWN ON THIS DRAWING RELATED TO UNDERGROUND WORKS HAS BEEN COMPLETED IN THE FIELD AS REQUIRED BY THE CITY OF HAMILTON SUBDIVISION AGREEMENT. ALL UNDERGROUND SERVICES SHOWN ARE AS-CONSTRUCTED.

C. J. RIDD, P.Eng. — APRIL 1/2025 DATE

NORTH:



KEY MAP:



LEGEND:

- TRIBUTARY ID — STMXX
- TRIBUTARY AREA — ha
- COEFFICIENT OF IMPERVIOUSNESS — C=XX
- SUB-TRIBUTARY ID (IF REQUIRED) — STMXXa
- SUB-TRIBUTARY AREA — ha
- COEFFICIENT OF IMPERVIOUSNESS — C=XX
- DRAINAGE AREA NUMBER BY OTHERS — 1
- AREA (HECTARES, TOTAL) BY OTHERS — 0.286
- COEFFICIENT OF IMPERVIOUSNESS, AVE BY OTHERS — 0.45
- DENOTES LIMIT OF STORM TRIBUTARY AREA
- DENOTES LIMIT OF EXISTING STORM TRIBUTARY AREA
- DENOTES LIMIT OF STORM SUB-TRIBUTARY AREA
- OVERLAND FLOW ROUTE

APPROVED DRAWINGS (I.F.C.)

No.	DATE	BY	REVISION
9	APR 01, 2025	CC	AS-BUILTS, FINAL SUBMISSION
8	FEB 12, 2025.	CC	AS-BUILTS, 2nd RE-SUBMISSION
7	NOV 18, 2024	CC	AS-BUILTS, 1st SUBMISSION
–	JULY 16, 2024	CC	COMPOSITE UTILITY PLAN COMPLETED
–	FEB 29, 2024	CC	REVISED SILT FENCE
–	FEB 22, 2024	CC	APPROVED DRAWINGS
–	FEB 15, 2024	CC	UTILITY UPDATE
6	JAN 09, 2024	CC	6th SUBMISSION
5	NOV 27, 2023	CC	5th SUBMISSION

BENCHMARKS:
ELEVATIONS SHOWN ON THIS PLAN ARE GEODETIC AND ARE REFERRED TO CITY OF HAMILTON BENCH MARK No.21-03. WEST FACE, NORTHWEST CORNER OF 89 STONE CHURCH ROAD ON THE SOUTHEAST CORNER OF STONE CHURCH ROAD AND WEST 5TH STREET. PLAQUE IS SET ON THE SECOND ROW OF BLOCKS UP FROM THE GROUND 0.3m IN FROM THE CORNER No.929. ELEVATION – 222.730m

STAMP:

LICENSED PROFESSIONAL ENGINEER — 04/04/25 — C. J. RIDD — 100550142 — PROVINCE OF ONTARIO

CONSULTANT:
URBEX ENGINEERING LIMITED
161 REBECCA STREET
HAMILTON, ON. L8R 1B9
TEL 905-522-3328
FAX 905-522-0452
EMAIL info@urbex.biz

MUNICIPALITY:
THE CITY OF HAMILTON

SHELDON'S GATE PHASE 1
HAMILTON, ONTARIO

INTERIM STORM DRAINAGE AREA PLAN

FILE NAME:	CITY FILES:
13-SG01-STM(interim)-abuilts.dwg	25T-2013-05

SCALE : 1 : 1000 (20 10 5 0 10 20 30 40 50)

LAST SAVED BY: CHRIS CORSINI

SHEET No.: 13

D0171-P01-17 (SHELDON'S GATE PHASE 1)

NOTE#1
EXISTING SWM FACILITY TO REMAIN OPERATIONAL.
EXISTING Q5 & Q100 FLOW RATES OBTAINED FROM MOE No. 3-0610-097-006, DATED JULY 1997

ENGINEERING LIMITED URBEX

161 Rebecca Street, Hamilton, ON. L8R 1B9

DESIGNED BY	C. Corsini
DATE	November 2019
REVISED BY	C. Corsini
DATE	April 2025.

CITY OF HAMILTON

STORM SEWER DESIGN (5 YEAR DESIGN)

Sheldon's Gate Phase 1

APPROVED SET (I.F.C.) - INTERIM DEVELOPMENT

URBEX FILE No. : **D0171-P01-17**

CITY OF HAMILTON FILE No. : **25T-201305**

PIPE ROUGHNESS (n)			DESIGN STORM PARAMETERS
< 600	=	0.013	i5=1049.5/(td+8)^0.803
≥ 600	=	0.013	
DESIGN VELOCITIES			DESIGN STORM PARAMETERS
MIN =	0.80	m/s	Q=0.0028(I5)(AC)
MAX =	3.65	m/s	
MINIMUM PIPE SIZE			MAXIMUM PIPE CAPACITY
	300	mm	85%
TIME OF CONCENTRATION			STORM YEAR EVENT
	10	minutes	5

AREA	STREET NAME	MANHOLE		TIME IN MINUTES			STORM WATER STUDY							PROPOSED SEWER DESIGN				CAPACITY (m^3/s)	VELOCITY (m/s)	PERCENT FULL (%)
		FROM	TO	ELAPSED UPPER END	FLOW IN SECTION	ELAPSED LOWER END	AREA (ha)	C	CUMULATIVE AREA	A X C	CUMULATIVE A X C	i (mm/hr)	Q (m^3/s)	LENGTH (m)	DIAMETER	TYPE	GRADE (%)			
EXT STM2	WEST 5th STREET	MH#111	MH#110	10.00	0.29	10.29	0.560	0.556	0.560	0.311	0.311	103.038	0.090	**23.4**	600	REIN. CONCRETE	**0.38**	0.395	1.353	22.7%
EXT STM3.1	WEST 5th STREET	TEMP DICB#1	MH#112	10.00	0.09	10.09	0.062	0.650	0.062	0.040	0.040	103.038	0.012	**6.5**	250(pvc)	SMOOTH PVC	**0.92**	0.058	1.167	20.1%
EXT STM3.1	WEST 5th STREET - 100yr	TEMP DICB#1	MH#112	10.00	0.09	10.09	0.062	0.650	0.062	0.040	0.040	181.813	0.021	**6.5**	250(pvc)	SMOOTH PVC	**0.92**	0.058	1.167	35.4%
													0.009	***Additional Flow Captured (100 YR)***						
EXT STM3.2	WEST 5th STREET	MH#112	MH#110	10.09	0.87	10.96	0.725	0.507	0.787	0.368	0.408	102.613	0.126	**62.5**	600	REIN. CONCRETE	**0.30**	0.351	1.202	35.9%
STM1	DUNLOP ROAD	MH#110	MH#109	10.96	0.25	11.21	0.116	0.65	1.463	0.075	0.795	98.830	0.229	**22.6**	750	REIN. CONCRETE	**0.35**	0.687	1.507	33.3%
EXT STM1	WEST 5th STREET	TEMP DICB#2	MH#109	25.07	0.15	25.22	2.647	0.373	2.647	0.987	0.987	63.223	0.175	**17.6**	525(pvc)	SMOOTH PVC	**0.91**	0.417	1.902	42.0%
EXT STM1	WEST 5th STREET - 100yr	TEMP DICB#2	MH#109	25.07	0.15	25.22	2.647	0.373	2.647	0.987	0.987	115.672	0.320	**17.6**	525(pvc)	SMOOTH PVC	**0.91**	0.417	1.902	76.8%
													0.145	***Additional Flow Captured (100 YR)***						
STM2	DUNLOP ROAD	MH#109	MH#108	25.22	0.89	26.12	0.232	0.65	4.342	0.151	1.933	62.988	0.495	**59.8**	900(ellipt)	ELLIPT CONCRETE	**0.15**	0.735	1.115	67.3%
	DOGLEG	MH#108	MH#106	26.12	0.15	26.27	0.000	0.00	4.342	0.000	1.933	61.659	0.488	**11.1**	900(ellipt)	ELLIPT CONCRETE	**0.18**	0.805	1.222	60.6%
STM3	ALEXSIA STREET	MH#107	MH#106	10.00	0.51	10.51	0.220	0.65	0.220	0.143	0.143	103.038	0.041	**45.8**	675	REIN. CONCRETE	**0.39**	0.547	1.482	7.5%
STM4	ALEXSIA STREET	MH#106	MH#105	26.27	0.47	26.74	0.397	0.65	4.959	0.258	2.334	61.440	0.555	**50.5**	900(ellipt)	ELLIPT CONCRETE	**0.38**	1.170	1.775	47.5%
	DOGLEG	MH#105	MH#102	26.74	0.06	26.80	0.000	0.00	4.959	0.000	2.334	60.766	0.551	**12.0**	900(ellipt)	ELLIPT CONCRETE	**1.50**	2.324	3.526	23.7%

ENGINEERING LIMITED URBEX

161 Rebecca Street, Hamilton, ON. L8R 1B9

DESIGNED BY	C. Corsini
DATE	November 2019
REVISED BY	C. Corsini
DATE	April 2025.

CITY OF HAMILTON

STORM SEWER DESIGN (5 YEAR DESIGN)

Sheldon's Gate Phase 1

APPROVED SET (I.F.C.) - INTERIM DEVELOPMENT

URBEX FILE No. : **D0171-P01-17**

CITY OF HAMILTON FILE No. : **25T-201305**

PIPE ROUGHNESS (n)			DESIGN STORM PARAMETERS
< 600	=	0.013	i5=1049.5/(td+8)^0.803
≥ 600	=	0.013	
DESIGN VELOCITIES			DESIGN STORM PARAMETERS
MIN =	0.80	m/s	Q=0.0028(I5)(AC)
MAX =	3.65	m/s	
MINIMUM PIPE SIZE			MAXIMUM PIPE CAPACITY
	300	mm	85%
TIME OF CONCENTRATION			STORM YEAR EVENT
	10	minutes	5

AREA	STREET NAME	MANHOLE		TIME IN MINUTES			STORM WATER STUDY							PROPOSED SEWER DESIGN				CAPACITY (m^3/s)	VELOCITY (m/s)	PERCENT FULL (%)
		FROM	TO	ELAPSED UPPER END	FLOW IN SECTION	ELAPSED LOWER END	AREA (ha)	C	CUMULATIVE AREA	A X C	CUMULATIVE A X C	i (mm/hr)	Q (m^3/s)	LENGTH (m)	DIAMETER	TYPE	GRADE (%)			
	ALEXSIA STREET	MH#103	MH#104	10.00	0.20	10.20	0.000	0.00	0.000	0.000	0.000	103.038	0.000	**14.1**	525	REIN. CONCRETE	**0.35**	0.265	1.188	0.0%
STM5	DOGLEG	MH#104	MH#102	10.20	0.12	10.31	0.061	0.65	0.061	0.040	0.040	102.138	0.011	**11.6**	525	REIN. CONCRETE	**0.69**	0.373	1.668	3.0%
STM6	SHADY OAKS BLVD	MH#102	MH#101	26.80	0.21	27.01	0.083	0.65	5.103	0.054	2.427	60.686	0.566	**23.3**	1050	REIN. CONCRETE	**0.34**	1.661	1.858	34.1%
STM7	DOGLEG	MH#101	MH#100	27.01	0.14	27.15	0.457	0.478	5.560	0.218	2.646	60.395	0.601	**15.6**	1050	REIN. CONCRETE	**0.32**	1.612	1.803	37.3%
EXT STM5	FUT SHADY OAKS BLVD	TEMP DICB#5	MH#118	37.88	0.09	37.97	3.370	0.282	3.370	0.950	0.950	48.607	0.129	**15.1**	525	REIN. CONCRETE	**1.79**	0.600	2.686	21.5%
EXT STM5	FUT SHADY OADS BLVD - 100yr	TEMP DICB#5	MH#118	37.88	0.09	37.97	3.370	0.282	3.370	0.950	0.950	89.720	0.239	**15.1**	525	REIN. CONCRETE	**1.79**	0.600	2.686	39.8%
													0.109	***Additional Flow Captured (100 YR)***						
STM21	SHADY OAKS BLVD	MH#118	MH#115	37.97	0.41	38.39	0.191	0.65	3.561	0.124	1.074	48.527	0.255	**50.7**	750	REIN. CONCRETE	**0.65**	0.936	2.053	27.3%
EXT STM4	FUT BERING BLVD	TEMP DICB#4	MH#117	15.74	0.11	15.84	1.082	0.25	1.082	0.271	0.271	82.509	0.202	**9.9**	525	REIN. CONCRETE	**0.61**	0.350	1.568	57.8%
EXT STM4	FUT BERING BLVD - 100yr	TEMP DICB#4	MH#117	15.74	0.11	15.84	1.082	0.25	1.082	0.271	0.271	148.567	0.253	**9.9**	525	REIN. CONCRETE	**0.61**	0.350	1.568	72.1%
													0.190	***Additional Flow Captured (100 YR) including 0.140cu.m./s***						
	FUT BERING BLVD	MH#117	MH#116	15.84	0.15	16.00	0.000	0.00	1.082	0.000	0.271	82.216	0.252	**21.0**	750	REIN. CONCRETE	**0.81**	1.045	2.292	24.1%
	DOGLEG	MH#116	MH#115	16.00	0.08	16.08	0.000	0.00	1.082	0.000	0.271	81.796	0.252	**10.1**	750	REIN. CONCRETE	**0.69**	0.965	2.115	26.1%

ENGINEERING LIMITED URBEX
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DATE	November 2019
REVISED BY	C. Corsini
DATE	April 2025.

CITY OF HAMILTON

STORM SEWER DESIGN (5 YEAR DESIGN)

Sheldon's Gate Phase 1

APPROVED SET (I.F.C.) - INTERIM DEVELOPMENT

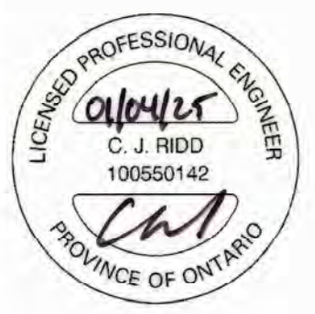
URBEX FILE No. : **D0171-P01-17**

CITY OF HAMILTON FILE No. : **25T-201305**

PIPE ROUGHNESS (n)			DESIGN STORM PARAMETERS
< 600	=	0.013	i5=1049.5/(td+8)^0.803
≥ 600	=	0.013	
DESIGN VELOCITIES			DESIGN STORM PARAMETERS
MIN =	0.80	m/s	Q=0.0028(I5)(AC)
MAX =	3.65	m/s	
MINIMUM PIPE SIZE			MAXIMUM PIPE CAPACITY
	300	mm	85%
TIME OF CONCENTRATION			STORM YEAR EVENT
	10	minutes	5

AREA	STREET NAME	MANHOLE		TIME IN MINUTES			STORM WATER STUDY							PROPOSED SEWER DESIGN				CAPACITY (m^3/s)	VELOCITY (m/s)	PERCENT FULL (%)
		FROM	TO	ELAPSED UPPER END	FLOW IN SECTION	ELAPSED LOWER END	AREA (ha)	C	CUMULATIVE AREA	A X C	CUMULATIVE A X C	i (mm/hr)	Q (m^3/s)	LENGTH (m)	DIAMETER	TYPE	GRADE (%)			
	SHADY OAKS BLVD	MH#115	MH#114	38.39	0.18	38.57	0.000	0.00	4.643	0.000	1.345	48.181	0.481	**19.5**	1050	REIN. CONCRETE	**0.31**	1.586	1.775	30.3%
	DOGLEG	MH#114	MH#100	38.57	0.10	38.67	0.000	0.00	4.643	0.000	1.345	48.029	0.480	**15.0**	1050	REIN. CONCRETE	**0.60**	2.207	2.469	21.8%
STM22	EASEMENT	MH#100	EX MH#HG21B042	38.67	0.19	38.86	0.104	0.65	10.307	0.068	4.058	47.945	0.998	**29.5**	1350	REIN. CONCRETE	**0.47**	3.817	2.584	26.1%
	SWM POND	EX MH#HG21B042	EX MH#HG21B066	38.86	0.23	39.09	0.000	0.00	10.307	0.000	4.058	47.789	0.996	32.8	1350	REIN. CONCRETE	0.40	3.522	2.383	28.3%

NOTES: 1) REINFORCED CONCRETE PIPE AS PER OPSS 1820, CSA A257.1-M92 100-D (ASTM C-76, CLASS IV)
2) SMOOTH PVC PIPE AS PER OPSS 1841, SDR 35



ENGINEERING LIMITED URBEX

161 Rebecca Street, Hamilton, ON. L8R 1B9

DESIGNED BY	C. Corsini
DATE	November 2019
REVISED BY	C. Corsini
DATE	April 2025.

CITY OF HAMILTON

STORM SEWER DESIGN (100 YEAR DESIGN)

Sheldon's Gate Phase 1

APPROVED SET (I.F.C.) - INTERIM DEVELOPMENT

URBEX FILE No. : **D0171-P01-17**

CITY OF HAMILTON FILE No. : **25T-201305**

PIPE ROUGHNESS (n)			DESIGN STORM PARAMETERS
< 600	=	0.013	i100=2317.4/(td+11)^0.836
≥ 600	=	0.013	
DESIGN VELOCITIES			**DESIGN STORM PARAMETERS**
MIN =	0.80	m/s	Q=0.0028(I100)(AC)
MAX =	3.65	m/s	
MINIMUM PIPE SIZE			**MAXIMUM PIPE CAPACITY**
	300	mm	85%
TIME OF CONCENTRATION			**STORM YEAR EVENT**
	10	minutes	100

AREA	STREET NAME	MANHOLE		TIME IN MINUTES			STORM WATER STUDY							PROPOSED SEWER DESIGN				CAPACITY (m^3/s)	VELOCITY (m/s)	PERCENT FULL (%)
		FROM	TO	ELAPSED UPPER END	FLOW IN SECTION	ELAPSED LOWER END	AREA (ha)	C	CUMULATIVE AREA	A X C	CUMULATIVE A X C	i (mm/hr)	Q (m^3/s)	LENGTH (m)	DIAMETER	TYPE	GRADE (%)			
EXT STM2	WEST 5th STREET	MH#111	MH#110	10.00	0.29	10.29	0.560	0.556	0.560	0.311	0.311	181.813	0.159	**23.4**	600	REIN. CONCRETE	**0.38**	0.395	1.353	40.1%
EXT STM3.1	WEST 5th STREET	TEMP DICB#1	MH#112	10.00	0.09	10.09	0.062	0.650	0.062	0.040	0.040	181.813	0.021	**6.5**	250(pvc)	SMOOTH PVC	**0.92**	0.058	1.167	35.4%
EXT STM3.1	WEST 5th STREET - 100yr	TEMP DICB#1	MH#112	10.00	0.09	10.09	0.062	0.650	0.062	0.040	0.040	181.813	0.021	**6.5**	250(pvc)	SMOOTH PVC	**0.92**	0.058	1.167	35.4%
													0.000	***Additional Flow Captured (100 YR)***						
EXT STM3.2	WEST 5th STREET	MH#112	MH#110	10.09	0.87	10.96	0.725	0.507	0.787	0.368	0.408	181.144	0.207	**62.5**	600	REIN. CONCRETE	**0.30**	0.351	1.202	59.0%
STM1	DUNLOP ROAD	MH#110	MH#109	10.96	0.25	11.21	0.116	0.65	1.463	0.075	0.795	175.148	0.390	**22.6**	750	REIN. CONCRETE	**0.35**	0.687	1.507	56.7%
EXT STM1	WEST 5th STREET	TEMP DICB#2	MH#109	25.07	0.15	25.22	2.647	0.373	2.647	0.987	0.987	115.672	0.320	**17.6**	525(pvc)	SMOOTH PVC	**0.91**	0.417	1.902	76.8%
EXT STM1	WEST 5th STREET - 100yr	TEMP DICB#2	MH#109	25.07	0.15	25.22	2.647	0.373	2.647	0.987	0.987	115.672	0.320	**17.6**	525(pvc)	SMOOTH PVC	**0.91**	0.417	1.902	76.8%
													0.000	***Additional Flow Captured (100 YR)***						
STM2	DUNLOP ROAD	MH#109	MH#108	25.22	0.89	26.12	0.232	0.65	4.342	0.151	1.933	115.260	0.624	**59.8**	900(ellipt)	ELLIPT CONCRETE	**0.15**	0.735	1.115	84.9%
	DOGLEG	MH#108	MH#106	26.12	0.15	26.27	0.000	0.00	4.342	0.000	1.933	112.935	0.611	**11.1**	900(ellipt)	ELLIPT CONCRETE	**0.18**	0.805	1.222	75.9%
STM3	ALEXSIA STREET	MH#107	MH#106	10.00	0.51	10.51	0.220	0.65	0.220	0.143	0.143	181.813	0.073	**45.8**	675	REIN. CONCRETE	**0.39**	0.547	1.482	13.3%
STM4	ALEXSIA STREET	MH#106	MH#105	26.27	0.47	26.74	0.397	0.65	4.959	0.258	2.334	112.551	0.735	**50.5**	900(ellipt)	ELLIPT CONCRETE	**0.38**	1.170	1.775	62.9%
	DOGLEG	MH#105	MH#102	26.74	0.06	26.80	0.000	0.00	4.959	0.000	2.334	111.368	0.728	**12.0**	900(ellipt)	ELLIPT CONCRETE	**1.50**	2.324	3.526	31.3%

ENGINEERING LIMITED URBEX

161 Rebecca Street, Hamilton, ON. L8R 1B9

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CITY OF HAMILTON

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Sheldon's Gate Phase 1

APPROVED SET (I.F.C.) - INTERIM DEVELOPMENT

URBEX FILE No. : D0171-P01-17

CITY OF HAMILTON FILE No. : 25T-201305

PIPE ROUGHNESS (n)			DESIGN STORM PARAMETERS
< 600	=	0.013	i100=2317.4/(td+11)^0.836
≥ 600	=	0.013	
DESIGN VELOCITIES			DESIGN STORM PARAMETERS
MIN =	0.80	m/s	Q=0.0028(I100)(AC)
MAX =	3.65	m/s	
MINIMUM PIPE SIZE			MAXIMUM PIPE CAPACITY
	300	mm	85%
TIME OF CONCENTRATION			STORM YEAR EVENT
	10	minutes	100

AREA	STREET NAME	MANHOLE		TIME IN MINUTES			STORM WATER STUDY							PROPOSED SEWER DESIGN				CAPACITY (m^3/s)	VELOCITY (m/s)	PERCENT FULL (%)
		FROM	TO	ELAPSED UPPER END	FLOW IN SECTION	ELAPSED LOWER END	AREA (ha)	C	CUMULATIVE AREA	A X C	CUMULATIVE A X C	i (mm/hr)	Q (m^3/s)	LENGTH (m)	DIAMETER	TYPE	GRADE (%)			
	ALEXSIA STREET	MH#103	MH#104	10.00	0.20	10.20	0.000	0.00	0.000	0.000	0.000	181.813	0.000	**14.1**	525	REIN. CONCRETE	**0.35**	0.265	1.188	0.0%
STM5	DOGLEG	MH#104	MH#102	10.20	0.12	10.31	0.061	0.65	0.061	0.040	0.040	180.394	0.020	**11.6**	525	REIN. CONCRETE	**0.69**	0.373	1.668	5.4%
STM6	SHADY OAKS BLVD	MH#102	MH#101	26.80	0.21	27.01	0.083	0.65	5.103	0.054	2.427	111.228	0.756	**23.3**	1050	REIN. CONCRETE	**0.34**	1.661	1.858	45.5%
STM7	DOGLEG	MH#101	MH#100	27.01	0.14	27.15	0.457	0.478	5.560	0.218	2.646	110.717	0.820	**15.6**	1050	REIN. CONCRETE	**0.32**	1.612	1.803	50.9%
EXT STM5	FUT SHADY OAKS BLVD	TEMP DICB#5	MH#118	37.88	0.09	37.97	3.370	0.282	3.370	0.950	0.950	89.720	0.239	**15.1**	525	REIN. CONCRETE	**1.79**	0.600	2.686	39.8%
EXT STM5	FUT SHADY OADS BLVD - 100yr	TEMP DICB#5	MH#118	37.88	0.09	37.97	3.370	0.282	3.370	0.950	0.950	89.720	0.239	**15.1**	525	REIN. CONCRETE	**1.79**	0.600	2.686	39.8%
													0.000	***Additional Flow Captured (100 YR)***						
STM21	SHADY OAKS BLVD	MH#118	MH#115	37.97	0.41	38.39	0.191	0.65	3.561	0.124	1.074	89.576	0.269	**50.7**	750	REIN. CONCRETE	**0.65**	0.936	2.053	28.8%
EXT STM4	FUT BERING BLVD	TEMP DICB#4	MH#117	15.74	0.11	15.84	1.082	0.25	1.082	0.271	0.271	148.567	0.253	**9.9**	525	REIN. CONCRETE	**0.61**	0.350	1.568	72.1%
EXT STM4	FUT BERING BLVD - 100yr	TEMP DICB#4	MH#117	15.74	0.11	15.84	1.082	0.25	1.082	0.271	0.271	148.567	0.253	**9.9**	525	REIN. CONCRETE	**0.61**	0.350	1.568	72.1%
													0.140	***Additional Flow Captured (100 YR) including 0.140cu.m./s***						
	FUT BERING BLVD	MH#117	MH#116	15.84	0.15	16.00	0.000	0.00	1.082	0.000	0.271	148.080	0.252	**21.0**	750	REIN. CONCRETE	**0.81**	1.045	2.292	24.1%
	DOGLEG	MH#116	MH#115	16.00	0.08	16.08	0.000	0.00	1.082	0.000	0.271	147.379	0.252	**10.1**	750	REIN. CONCRETE	**0.69**	0.965	2.115	26.1%

ENGINEERING LIMITED URBEX
161 Rebecca Street, Hamilton, ON. L8R 1B9

DESIGNED BY	C. Corsini
DATE	November 2019
REVISED BY	C. Corsini
DATE	April 2025.

CITY OF HAMILTON

STORM SEWER DESIGN (100 YEAR DESIGN)

Sheldon's Gate Phase 1

APPROVED SET (I.F.C.) - INTERIM DEVELOPMENT

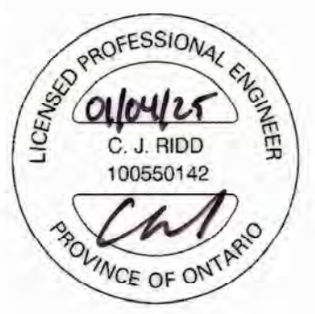
URBEX FILE No. : **D0171-P01-17**

CITY OF HAMILTON FILE No. : **25T-201305**

PIPE ROUGHNESS (n)			DESIGN STORM PARAMETERS
< 600	=	0.013	i100=2317.4/(td+11)^0.836
≥ 600	=	0.013	
DESIGN VELOCITIES			DESIGN STORM PARAMETERS
MIN =	0.80	m/s	Q=0.0028(I100)(AC)
MAX =	3.65	m/s	
MINIMUM PIPE SIZE			MAXIMUM PIPE CAPACITY
	300	mm	85%
TIME OF CONCENTRATION			STORM YEAR EVENT
	10	minutes	100

AREA	STREET NAME	MANHOLE		TIME IN MINUTES			STORM WATER STUDY							PROPOSED SEWER DESIGN				CAPACITY (m^3/s)	VELOCITY (m/s)	PERCENT FULL (%)
		FROM	TO	ELAPSED UPPER END	FLOW IN SECTION	ELAPSED LOWER END	AREA (ha)	C	CUMULATIVE AREA	A X C	CUMULATIVE A X C	i (mm/hr)	Q (m^3/s)	LENGTH (m)	DIAMETER	TYPE	GRADE (%)			
	SHADY OAKS BLVD	MH#115	MH#114	38.39	0.18	38.57	0.000	0.00	4.643	0.000	1.345	88.952	0.475	**19.5**	1050	REIN. CONCRETE	**0.31**	1.586	1.775	29.9%
	DOGLEG	MH#114	MH#100	38.57	0.10	38.67	0.000	0.00	4.643	0.000	1.345	88.677	0.474	**15.0**	1050	REIN. CONCRETE	**0.60**	2.207	2.469	21.5%
STM22	EASEMENT	MH#100	EX MH#HG21B042	38.67	0.19	38.86	0.104	0.65	10.307	0.068	4.058	88.526	1.146	**29.5**	1350	REIN. CONCRETE	**0.47**	3.817	2.584	30.0%
	SWM POND	EX MH#HG21B042	EX MH#HG21B066	38.86	0.23	39.09	0.000	0.00	10.307	0.000	4.058	88.243	1.143	32.8	1350	REIN. CONCRETE	0.40	3.522	2.383	32.4%

NOTES: 1) REINFORCED CONCRETE PIPE AS PER OPSS 1820, CSA A257.1-M92 100-D (ASTM C-76, CLASS IV)
2) SMOOTH PVC PIPE AS PER OPSS 1841, SDR 35

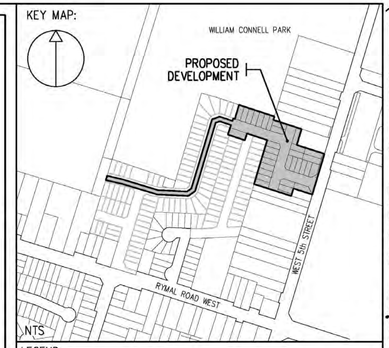


THIS CERTIFIES THAT THE WORK SHOWN ON THIS DRAWING RELATED TO UNDERGROUND WORKS HAS BEEN COMPLETED IN THE FIELD AS REQUIRED BY THE CITY OF HAMILTON SUBDIVISION AGREEMENT. ALL UNDERGROUND SERVICES SHOWN ARE AS-CONSTRUCTED.

C. J. RIDD, P.Eng. — APRIL 1/2025 DATE

NORTH:

KEY MAP:



LEGEND:

- TRIBUTARY ID — STMXX
- TRIBUTARY AREA — ha
- COEFFICIENT OF IMPERVIOUSNESS — C=XX
- SUB-TRIBUTARY ID (IF REQUIRED) — STMXXa
- SUB-TRIBUTARY AREA — ha
- COEFFICIENT OF IMPERVIOUSNESS — C=XX
- DRAINAGE AREA NUMBER BY OTHERS — 1
- AREA (HECTARES, TOTAL) BY OTHERS — 0.286
- COEFFICIENT OF IMPERVIOUSNESS, AVE BY OTHERS — 0.45
- DENOTES LIMIT OF STORM TRIBUTARY AREA
- DENOTES LIMIT OF EXISTING STORM TRIBUTARY AREA
- DENOTES LIMIT OF STORM SUB-TRIBUTARY AREA
- OVERLAND FLOW ROUTE

APPROVED DRAWINGS (I.F.C.)

No.	DATE	BY	REVISION
9	APR 01, 2025	CC	AS-BUILTS, FINAL SUBMISSION
8	FEB 12, 2025.	CC	AS-BUILTS, 2nd RE-SUBMISSION
7	NOV 18, 2024	CC	AS-BUILTS, 1st SUBMISSION
–	JULY 16, 2024	CC	COMPOSITE UTILITY PLAN COMPLETED
–	FEB 29, 2024	CC	REVISED SILT FENCE
–	FEB 22, 2024	CC	APPROVED DRAWINGS
–	FEB 15, 2024	CC	UTILITY UPDATE
6	JAN 09, 2024	CC	6th SUBMISSION
5	NOV 27, 2023	CC	5th SUBMISSION

BENCHMARKS:
ELEVATIONS SHOWN ON THIS PLAN ARE GEODETIC AND ARE REFERRED TO CITY OF HAMILTON BENCH MARK No.21-03. WEST FACE, NORTHWEST CORNER OF 89 STONE CHURCH ROAD ON THE SOUTHEAST CORNER OF STONE CHURCH ROAD AND WEST 5TH STREET. PLAQUE IS SET ON THE SECOND ROW OF BLOCKS UP FROM THE GROUND 0.3m IN FROM THE CORNER No.929.
ELEVATION – 222.730m

STAMP:

LICENSED PROFESSIONAL ENGINEER — 04/04/25 — C. J. RIDD — 100550142 — PROVINCE OF ONTARIO

CONSULTANT:
URBEX ENGINEERING LIMITED
161 REBECCA STREET
HAMILTON, ON. L8R 1B9
TEL 905-522-3328
FAX 905-522-0452
EMAIL info@urbex.biz

MUNICIPALITY: THE CITY OF HAMILTON

SHELDON'S GATE PHASE 1
HAMILTON, ONTARIO

ULTIMATE STORM DRAINAGE AREA PLAN

FILE NAME:	CITY FILES:
14-SG01-STM(ultimate)-abuilts.dwg	25T-2013-05

SCALE : 1 : 1000 (20 10 5 0 10 20 30 40 50)

LAST SAVED BY: CHRIS CORSINI

SHEET No.: 14

SWM POND SERVICING ALEXSIA COURT COURT TO BE REMOVED AS PART OF SHELDON'S GATE PHASE#2 DEVELOPMENT

D0171-P01-17 (SHELDON'S GATE PHASE 1)

ENGINEERING LIMITED
URBEX

161 Rebecca Street, Hamilton, ON. L8R 1B9

DESIGNED BY	C. Corsini
DATE	November 2019
REVISED BY	C. Corsini
DATE	April 2025.

CITY OF HAMILTON

STORM SEWER DESIGN (5 YEAR DESIGN)

Sheldon's Gate Phase 1

APPROVED SET (I.F.C.) - ULTIMATE DEVELOPMENT

URBEX FILE No. : **D0171-P01-17**

CITY OF HAMILTON FILE No. : **25T-201305**

PIPE ROUGHNESS (n)			DESIGN STORM PARAMETERS
< 600	=	0.013	i5=1049.5/(td+8)^0.803
≥ 600	=	0.013	
DESIGN VELOCITIES			**DESIGN STORM PARAMETERS**
MIN =	0.80	m/s	Q=0.0028(I5)(AC)
MAX =	3.65	m/s	
MINIMUM PIPE SIZE			**MAXIMUM PIPE CAPACITY**
	300	mm	85%
TIME OF CONCENTRATION			**STORM YEAR EVENT**
	10	minutes	5

AREA	STREET NAME	MANHOLE		TIME IN MINUTES			STORM WATER STUDY							PROPOSED SEWER DESIGN				CAPACITY (m^3/s)	VELOCITY (m/s)	PERCENT FULL (%)
		FROM	TO	ELAPSED UPPER END	FLOW IN SECTION	ELAPSED LOWER END	AREA (ha)	C	CUMULATIVE AREA	A X C	CUMULATIVE A X C	i (mm/hr)	Q (m^3/s)	LENGTH (m)	DIAMETER	TYPE	GRADE (%)			
PATHWAY 1																				
C-68F(a)	WEST 5th STREET	FUT MH#125	FUT MH#124	10.00	0.51	10.51	0.255	0.65	0.255	0.166	0.166	103.038	0.048	30.5	375	SMOOTH PVC	0.40	0.104	0.989	45.9%
C-68F(b)	WEST 5th STREET	FUT MH#124	FUT MH#123	10.51	1.56	12.08	0.800	0.65	1.055	0.520	0.686	100.734	0.193	103.2	525	REIN. CONCRETE	0.30	0.246	1.100	78.7%
C-68F(c)	WEST 5th STREET	FUT MH#123	FUT MH#122	12.08	1.26	13.34	0.756	0.65	1.811	0.491	1.177	94.383	0.311	104.7	600(conc)	REIN. CONCRETE	0.40	0.402	1.385	77.4%
C-68F(d)	WEST 5th STREET	FUT MH#122	MH#111	13.34	0.28	13.62	0.244	0.65	2.055	0.159	1.336	89.882	0.336	23.4	600(conc)	REIN. CONCRETE	0.40	0.402	1.385	83.7%
	WEST 5th STREET	MH#111	MH#110	13.62	0.29	13.91	0.000	0.00	2.055	0.000	1.336	88.941	0.333	**23.4**	600(conc)	REIN. CONCRETE	**0.38**	0.392	1.350	84.9%
C-68F(g)	WEST 5th STREET	FUT MH#121	MH#112	10.00	0.41	10.41	0.178	0.65	0.178	0.116	0.116	103.038	0.033	23.5	300	SMOOTH PVC	0.50	0.068	0.966	49.1%
C-68F(i)	MUN No.1177-1183	FUT	MH#112	10.00	0.50	10.50	0.268	0.65	0.268	0.174	0.174	103.038	0.050	30.0	450	REIN. CONCRETE	0.30	0.163	0.992	30.8%
C-68F(i)	MUN No.1177-1183 - 100YR	FUT	MH#112	10.00	0.50	10.50	0.268	0.65	0.268	0.174	0.174	181.813	0.089	30.0	450	REIN. CONCRETE	0.30	0.163	0.992	54.4%
													0.038	***Additional Flow Captured (100 YR)***						
C-68F(h)	MUN No.1187	FUT	MH#112	10.00	0.50	10.50	0.257	0.75	0.257	0.193	0.193	103.038	0.056	30.0	450	REIN. CONCRETE	0.30	0.163	0.992	34.1%
C-68F(h)	MUN No.1187 - 100YR	FUT	MH#112	10.00	0.50	10.50	0.257	0.75	0.257	0.193	0.193	181.813	0.098	30.0	450	REIN. CONCRETE	0.30	0.163	0.992	60.2%
													0.043	***Additional Flow Captured (100 YR)***						
C-68F(f)	WEST 5th STREET	MH#112	MH#110	10.50	0.87	11.37	0.200	0.65	0.903	0.130	0.613	100.779	0.254	**62.5**	600(conc)	REIN. CONCRETE	**0.30**	0.348	1.200	72.9%
STM1	DUNLOP ROAD	MH#110	MH#109	13.91	0.25	14.16	0.150	0.65	3.108	0.098	2.046	87.998	0.585	**22.6**	750	REIN. CONCRETE	**0.35**	0.687	1.507	85.1%
STM2	DUNLOP ROAD	MH#109	MH#108	14.16	0.89	15.05	0.232	0.20	3.340	0.046	2.092	87.200	0.592	**59.8**	900(ellipt)	ELLIPT CONCRETE	**0.15**	0.735	1.115	80.5%
	DOGLEG	MH#108	MH#106	15.05	0.15	15.20	0.000	0.00	3.340	0.000	2.092	84.474	0.576	**11.1**	900(ellipt)	ELLIPT CONCRETE	**0.18**	0.805	1.222	71.5%
C-92F(b)	FUT ALEXIA STREET	FUT MH#119	MH#107	10.00	2.77	12.77	1.969	0.65	1.969	1.280	1.280	103.038	0.369	215.9	675	REIN. CONCRETE	0.30	0.480	1.300	76.9%
STM3	ALEXIA STREET	MH#107	MH#106	12.77	0.51	13.28	0.227	0.65	2.196	0.148	1.427	91.858	0.367	**45.8**	675	REIN. CONCRETE	**0.39**	0.547	1.482	67.1%
STM4	ALEXIA STREET	MH#106	MH#105	15.20	0.47	15.68	0.397	0.65	5.933	0.258	3.778	84.031	0.970	**50.5**	900(ellipt)	ELLIPT CONCRETE	**0.38**	1.170	1.775	82.9%
	ALEXIA STREET	MH#105	MH#102	15.68	0.06	15.73	0.000	0.00	5.933	0.000	3.778	82.677	0.955	**12.0**	900(ellipt)	ELLIPT CONCRETE	**1.50**	2.324	3.526	41.1%

ENGINEERING LIMITED URBEX
161 Rebecca Street, Hamilton, ON. L8R 1B9

CITY OF HAMILTON

STORM SEWER DESIGN (5 YEAR DESIGN)

Sheldon's Gate Phase 1

APPROVED SET (I.F.C.) - ULTIMATE DEVELOPMENT

URBEX FILE No. : **D0171-P01-17**

CITY OF HAMILTON FILE No. : **25T-201305**

DESIGNED BY	C. Corsini
DATE	November 2019
REVISED BY	C. Corsini
DATE	April 2025.

PIPE ROUGHNESS (n)			DESIGN STORM PARAMETERS
< 600	=	0.013	i5=1049.5/(td+8)^0.803
≥ 600	=	0.013	
DESIGN VELOCITIES			**DESIGN STORM PARAMETERS**
MIN =	0.80	m/s	Q=0.0028(I5)(AC)
MAX =	3.65	m/s	
MINIMUM PIPE SIZE			**MAXIMUM PIPE CAPACITY**
	300	mm	85%
TIME OF CONCENTRATION			**STORM YEAR EVENT**
	10	minutes	5

AREA	STREET NAME	MANHOLE		TIME IN MINUTES			STORM WATER STUDY							PROPOSED SEWER DESIGN				CAPACITY (m^3/s)	VELOCITY (m/s)	PERCENT FULL (%)
		FROM	TO	ELAPSED UPPER END	FLOW IN SECTION	ELAPSED LOWER END	AREA (ha)	C	CUMULATIVE AREA	A X C	CUMULATIVE A X C	i (mm/hr)	Q (m^3/s)	LENGTH (m)	DIAMETER	TYPE	GRADE (%)			
FUT STM5b	FUT ALEXIA STREET	FUT MH#120	MH#103	10.00	1.41	11.41	0.913	0.65	0.913	0.593	0.593	103.038	0.171	120.0	525	REIN. CONCRETE	0.50	0.317	1.420	54.0%
STM5b	ALEXIA STREET	MH#103	MH#104	11.41	0.20	11.61	0.167	0.65	1.080	0.109	0.702	96.989	0.191	**14.1**	525	REIN. CONCRETE	**0.35**	0.265	1.188	71.8%
STM5a	ALEXIA STREET	MH#104	MH#102	11.61	0.12	11.72	0.068	0.65	1.148	0.044	0.746	96.202	0.201	**11.6**	525	REIN. CONCRETE	**0.69**	0.373	1.668	53.9%
STM6	SHADYOAKS TRAIL	MH#102	MH#101	15.73	0.21	15.94	0.097	0.65	7.178	0.063	4.587	82.519	1.141	**23.3**	1050	REIN. CONCRETE	**0.34**	1.661	1.858	68.7%
STM7	SHADYOAKS TRAIL	MH#101	MH#100	15.94	0.14	16.09	0.341	0.65	7.519	0.222	4.809	81.940	1.184	**15.6**	1050	REIN. CONCRETE	**0.32**	1.612	1.803	73.5%
PATHWAY 2																				
C-53F(a)	KONSTANTINE COURT	EX MH#HG21B007	EX MH#HG21B003	10.00	0.92	10.92	0.582	0.65	0.582	0.378	0.378	103.038	0.109	90.0	375	SMOOTH PVC	1.09	0.172	1.632	63.4%
C-53F(b)	ALEXSIA COURT	EX MH#HG21B001	EX MH#HG21B003	10.00	0.52	10.52	0.572	0.65	0.572	0.372	0.372	103.038	0.107	41.8	375	SMOOTH PVC	0.74	0.142	1.345	75.6%
STM8	FUT ALEXIA STREET	EX MH#HG21B003	EX MH#HG21B005	10.92	0.05	10.96	0.224	0.65	1.378	0.146	0.896	98.999	0.248	7.5	450	REIN. CONCRETE	2.27	0.448	2.730	55.4%
	ALEXIA STREET	EX MH#HG21B005	FUT MH#201	10.96	0.53	11.49	0.000	0.00	1.378	0.000	0.896	98.807	0.248	57.4	450	REIN. CONCRETE	1.00	0.297	1.812	83.3%
C-92F(a)	FUT DEVELOPMENT	UPSTREAM	FUT MH#201	10.00	0.16	10.16	0.750	0.65	0.750	0.488	0.488	103.038	0.141	12.0	450	REIN. CONCRETE	0.50	0.210	1.281	66.9%
STM9	FUT BERING BLVD	FUT MH#201	FUT MH#200	11.49	0.75	12.25	0.985	0.65	3.113	0.640	2.023	96.652	0.548	107.1	675	REIN. CONCRETE	1.00	0.876	2.374	62.5%
STM10	FUT BERING BLVD	FUT MH#200	MH#116	12.25	0.78	13.03	0.574	0.65	3.687	0.373	2.397	93.758	0.629	107.9	750	REIN. CONCRETE	**0.81**	1.045	2.292	60.2%
	FUT BERING BLVD	MH#116	MH#115	13.03	0.08	13.11	0.000	0.00	3.687	0.000	2.397	90.939	0.610	**10.1**	750	REIN. CONCRETE	**0.69**	0.965	2.115	63.3%
STM11	FUT CLIPPER DRIVE	FUT MH#308	FUT MH#307	10.00	0.86	10.86	0.558	0.65	0.558	0.363	0.363	103.038	0.105	80.5	375	SMOOTH PVC	1.00	0.165	1.563	63.5%
STM12	FUT SPRING MEADOW GROVE	FUT MH#309	FUT MH#307	10.00	0.75	10.75	0.297	0.65	0.297	0.193	0.193	103.038	0.056	70.0	375	SMOOTH PVC	1.00	0.165	1.563	33.8%
STM13	FUT CLIPPER DRIVE	FUT MH#307	FUT MH#306	10.86	0.63	11.49	0.371	0.65	1.226	0.241	0.797	99.255	0.221	84.1	450	REIN. CONCRETE	1.50	0.364	2.219	60.8%
STM14	FUT SHADYOAKS TRAIL	FUT MH#311	FUT MH#310	10.00	0.32	10.32	0.114	0.65	0.114	0.074	0.074	103.038	0.021	32.0	300	SMOOTH PVC	1.50	0.118	1.673	18.2%
STM15	FUT SHADYOAKS TRAIL	FUT MH#310	FUT MH#306	10.32	0.34	10.65	0.477	0.65	0.591	0.310	0.384	101.596	0.109	38.5	375	SMOOTH PVC	1.50	0.202	1.914	54.1%

ENGINEERING LIMITED URBEX

161 Rebecca Street, Hamilton, ON. L8R 1B9

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DATE	November 2019
REVISED BY	C. Corsini
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CITY OF HAMILTON

STORM SEWER DESIGN (5 YEAR DESIGN)

Sheldon's Gate Phase 1

APPROVED SET (I.F.C.) - ULTIMATE DEVELOPMENT

URBEX FILE No. : **D0171-P01-17**

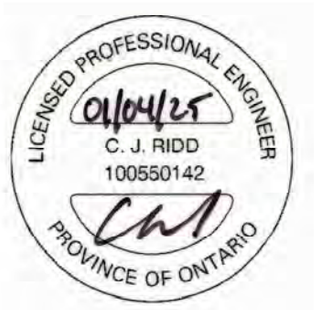
CITY OF HAMILTON FILE No. : **25T-201305**

PIPE ROUGHNESS (n)			DESIGN STORM PARAMETERS
< 600	=	0.013	i5=1049.5/(td+8)^0.803
≥ 600	=	0.013	
DESIGN VELOCITIES			**DESIGN STORM PARAMETERS**
MIN =	0.80	m/s	Q=0.0028(I5)(AC)
MAX =	3.65	m/s	
MINIMUM PIPE SIZE			**MAXIMUM PIPE CAPACITY**
	300	mm	85%
TIME OF CONCENTRATION			**STORM YEAR EVENT**
	10	minutes	5

AREA	STREET NAME	MANHOLE		TIME IN MINUTES			STORM WATER STUDY							PROPOSED SEWER DESIGN				CAPACITY (m^3/s)	VELOCITY (m/s)	PERCENT FULL (%)
		FROM	TO	ELAPSED UPPER END	FLOW IN SECTION	ELAPSED LOWER END	AREA (ha)	C	CUMULATIVE AREA	A X C	CUMULATIVE A X C	i (mm/hr)	Q (m^3/s)	LENGTH (m)	DIAMETER	TYPE	GRADE (%)			
	FUT SHADYOAKS TRAIL	FUT MH#306	FUT MH#305	11.49	0.27	11.76	0.000	0.00	1.817	0.000	1.181	96.664	0.320	36.2	600	REIN. CONCRETE	1.00	0.641	2.195	49.9%
STM16	FUT SHADYOAKS TRAIL	FUT MH#305	FUT MH#304	11.76	0.46	12.23	0.626	0.65	2.443	0.407	1.588	95.583	0.425	61.0	600	REIN. CONCRETE	1.00	0.641	2.195	66.3%
STM17	FUT SHADYOAKS TRAIL	FUT MH#304	FUT MH#303	12.23	0.09	12.32	0.117	0.65	2.560	0.076	1.664	93.821	0.437	12.9	675	REIN. CONCRETE	1.00	0.876	2.374	49.9%
STM18	FUT SHADYOAKS TRAIL	FUT MH#303	FUT MH#302	12.32	0.54	12.86	0.620	0.65	3.180	0.403	2.067	93.485	0.541	77.4	675	REIN. CONCRETE	1.00	0.876	2.374	61.7%
STM19	FUT SHADYOAKS TRAIL	FUT MH#302	FUT MH#301	12.86	0.51	13.37	0.714	0.65	3.894	0.464	2.531	91.524	0.649	67.6	750	REIN. CONCRETE	0.75	1.006	2.206	64.5%
STM20	FUT SHADYOAKS TRAIL	FUT MH#301	FUT MH#300	13.37	0.12	13.49	0.125	0.65	4.019	0.081	2.612	89.763	0.657	16.1	750	REIN. CONCRETE	0.75	1.006	2.206	65.3%
STM21	SHADYOAKS TRAIL	FUT MH#300	MH#115	13.49	0.58	14.08	0.459	0.65	**4.478**	0.298	2.911	89.355	0.728	71.9	750	REIN. CONCRETE	**0.65**	0.936	2.053	77.8%
																	.			
	SHADYOAKS TRAIL	MH#115	MH#114	14.08	0.18	14.26	0.000	0.00	8.165	0.000	5.307	87.454	1.300	**19.5**	1050	REIN. CONCRETE	**0.31**	1.586	1.775	81.9%
	SHADYOAKS TRAIL	MH#114	MH#100	14.26	0.10	14.36	0.000	0.00	8.165	0.000	5.307	86.875	1.291	**15.0**	1050	REIN. CONCRETE	**0.60**	2.207	2.469	58.5%
STM22	EASEMENT	MH#100	EX MH#HG21B042	16.09	0.19	16.28	0.129	0.65	15.813	0.084	10.200	81.546	2.410	**29.5**	1350	REIN. CONCRETE	**0.47**	3.817	2.584	63.1%
	SWM POND	EX MH#HG21B042	EX MH#HG20B066	16.28	0.23	16.51	0.000	0.00	15.813	0.000	10.200	81.032	2.395	32.8	1350	REIN. CONCRETE	0.40	3.522	2.383	68.0%

NOTES: 1) REINFORCED CONCRETE PIPE AS PER OPSS 1820, CSA A257.1-M92 100-D (ASTM C-76, CLASS IV)

2) SMOOTH PVC PIPE AS PER OPSS 1841, SDR 35



ENGINEERING LIMITED
URBEX

161 Rebecca Street, Hamilton, ON. L8R 1B9

DESIGNED BY	C. Corsini
DATE	November 2019
REVISED BY	C. Corsini
DATE	April 2025.

CITY OF HAMILTON

STORM SEWER DESIGN (100 YEAR DESIGN)

Sheldon's Gate Phase 1

APPROVED SET (I.F.C.) - ULTIMATE DEVELOPMENT

URBEX FILE No. : **D0171-P01-17**

CITY OF HAMILTON FILE No. : **25T-201305**

PIPE ROUGHNESS (n)			DESIGN STORM PARAMETERS
< 600	=	0.013	i100=2317.4/(td+11)^0.836
≥ 600	=	0.013	
DESIGN VELOCITIES			**DESIGN STORM PARAMETERS**
MIN =	0.80	m/s	Q=0.0028(I100)(AC)
MAX =	3.65	m/s	
MINIMUM PIPE SIZE			**MAXIMUM PIPE CAPACITY**
	300	mm	85%
TIME OF CONCENTRATION			**STORM YEAR EVENT**
	10	minutes	100

AREA	STREET NAME	MANHOLE		TIME IN MINUTES			STORM WATER STUDY							PROPOSED SEWER DESIGN				CAPACITY (m^3/s)	VELOCITY (m/s)	PERCENT FULL (%)
		FROM	TO	ELAPSED UPPER END	FLOW IN SECTION	ELAPSED LOWER END	AREA (ha)	C	CUMULATIVE AREA	A X C	CUMULATIVE A X C	i (mm/hr)	Q (m^3/s)	LENGTH (m)	DIAMETER	TYPE	GRADE (%)			
PATHWAY 1																				
C-68F(a)	WEST 5th STREET	FUT MH#125	FUT MH#124	10.00	0.51	10.51	0.255	0.65	0.255	0.166	0.166	181.813	0.084	30.5	375	SMOOTH PVC	0.40	0.104	0.989	80.9%
C-68F(b)	WEST 5th STREET	FUT MH#124	FUT MH#123	10.51	1.56	12.08	0.800	0.65	1.055	0.520	0.686	178.173	0.342	103.2	525	REIN. CONCRETE	0.30	0.246	1.100	139.2%
C-68F(c)	WEST 5th STREET	FUT MH#123	FUT MH#122	12.08	1.26	13.34	0.756	0.65	1.811	0.491	1.177	168.021	0.554	104.7	600(conc)	REIN. CONCRETE	0.40	0.402	1.385	137.8%
C-68F(d)	WEST 5th STREET	FUT MH#122	MH#111	13.34	0.28	13.62	0.244	0.65	2.055	0.159	1.336	160.719	0.601	23.4	600(conc)	REIN. CONCRETE	0.40	0.402	1.385	149.6%
	WEST 5th STREET	MH#111	MH#110	13.62	0.29	13.91	0.000	0.00	2.055	0.000	1.336	159.181	0.595	**23.4**	600(conc)	REIN. CONCRETE	**0.38**	0.392	1.350	152.0%
C-68F(g)	WEST 5th STREET	FUT MH#121	MH#112	10.00	0.41	10.41	0.178	0.65	0.178	0.116	0.116	181.813	0.059	23.5	300	SMOOTH PVC	0.50	0.068	0.966	86.6%
C-68F(i)	MUN No.1177-1183	FUT	MH#112	10.00	0.50	10.50	0.268	0.65	0.268	0.174	0.174	181.813	0.089	30.0	450	REIN. CONCRETE	0.30	0.163	0.992	54.4%
C-68F(i)	MUN No.1177-1183 - 100YR	FUT	MH#112	10.00	0.50	10.50	0.268	0.65	0.268	0.174	0.174	181.813	0.089	30.0	450	REIN. CONCRETE	0.30	0.163	0.992	54.4%
													0.000	***Additional Flow Captured (100 YR)***						
C-68F(h)	MUN No.1187	FUT	MH#112	10.00	0.50	10.50	0.257	0.75	0.257	0.193	0.193	181.813	0.098	30.0	450	REIN. CONCRETE	0.30	0.163	0.992	60.2%
C-68F(h)	MUN No.1187 - 100YR	FUT	MH#112	10.00	0.50	10.50	0.257	0.75	0.257	0.193	0.193	181.813	0.098	30.0	450	REIN. CONCRETE	0.30	0.163	0.992	60.2%
													0.000	***Additional Flow Captured (100 YR)***						
C-68F(f)	WEST 5th STREET	MH#112	MH#110	10.50	0.87	11.37	0.200	0.65	0.903	0.130	0.613	178.245	0.306	**62.5**	600(conc)	REIN. CONCRETE	**0.30**	0.348	1.200	87.9%
STM1	DUNLOP ROAD	MH#110	MH#109	13.91	0.25	14.16	0.150	0.65	3.108	0.098	2.046	157.636	0.903	**22.6**	750	REIN. CONCRETE	**0.35**	0.687	1.507	131.4%
STM2	DUNLOP ROAD	MH#109	MH#108	14.16	0.89	15.05	0.232	0.20	3.340	0.046	2.092	156.326	0.916	**59.8**	900(ellipt)	ELLIPT CONCRETE	**0.15**	0.735	1.115	124.6%
	DOGLEG	MH#108	MH#106	15.05	0.15	15.20	0.000	0.00	3.340	0.000	2.092	151.829	0.889	**11.1**	900(ellipt)	ELLIPT CONCRETE	**0.18**	0.805	1.222	110.5%
C-92F(b)	FUT ALEXIA STREET	FUT MH#119	MH#107	10.00	2.77	12.77	1.969	0.65	1.969	1.280	1.280	181.813	0.652	215.9	675	REIN. CONCRETE	0.30	0.480	1.300	135.8%
STM3	ALEXIA STREET	MH#107	MH#106	12.77	0.51	13.28	0.227	0.65	2.196	0.148	1.427	163.936	0.655	**45.8**	675	REIN. CONCRETE	**0.39**	0.547	1.482	119.7%
STM4	ALEXIA STREET	MH#106	MH#105	15.20	0.47	15.68	0.397	0.65	5.933	0.258	3.778	151.095	1.598	**50.5**	900(ellipt)	ELLIPT CONCRETE	**0.38**	1.170	1.775	136.6%
	ALEXIA STREET	MH#105	MH#102	15.68	0.06	15.73	0.000	0.00	5.933	0.000	3.778	148.847	1.574	**12.0**	900(ellipt)	ELLIPT CONCRETE	**1.50**	2.324	3.526	67.8%

ENGINEERING LIMITED URBEX

161 Rebecca Street, Hamilton, ON. L8R 1B9

DESIGNED BY	C. Corsini
DATE	November 2019
REVISED BY	C. Corsini
DATE	April 2025.

CITY OF HAMILTON

STORM SEWER DESIGN (100 YEAR DESIGN)

Sheldon's Gate Phase 1

APPROVED SET (I.F.C.) - ULTIMATE DEVELOPMENT

URBEX FILE No. : **D0171-P01-17**

CITY OF HAMILTON FILE No. : **25T-201305**

PIPE ROUGHNESS (n)			DESIGN STORM PARAMETERS
< 600	=	0.013	i100=2317.4/(td+11)^0.836
≥ 600	=	0.013	
DESIGN VELOCITIES			**DESIGN STORM PARAMETERS**
MIN =	0.80	m/s	Q=0.0028(I100)(AC)
MAX =	3.65	m/s	
MINIMUM PIPE SIZE			**MAXIMUM PIPE CAPACITY**
	300	mm	85%
TIME OF CONCENTRATION			**STORM YEAR EVENT**
	10	minutes	100

AREA	STREET NAME	MANHOLE		TIME IN MINUTES			STORM WATER STUDY							PROPOSED SEWER DESIGN				CAPACITY (m^3/s)	VELOCITY (m/s)	PERCENT FULL (%)
		FROM	TO	ELAPSED UPPER END	FLOW IN SECTION	ELAPSED LOWER END	AREA (ha)	C	CUMULATIVE AREA	A X C	CUMULATIVE A X C	i (mm/hr)	Q (m^3/s)	LENGTH (m)	DIAMETER	TYPE	GRADE (%)			
FUT STM5b	FUT ALEXIA STREET	FUT MH#120	MH#103	10.00	1.41	11.41	0.913	0.65	0.913	0.593	0.593	181.813	0.302	120.0	525	REIN. CONCRETE	0.50	0.317	1.420	95.2%
STM5b	ALEXIA STREET	MH#103	MH#104	11.41	0.20	11.61	0.167	0.65	1.080	0.109	0.702	172.208	0.338	**14.1**	525	REIN. CONCRETE	**0.35**	0.265	1.188	127.5%
STM5a	ALEXIA STREET	MH#104	MH#102	11.61	0.12	11.72	0.068	0.65	1.148	0.044	0.746	170.947	0.357	**11.6**	525	REIN. CONCRETE	**0.69**	0.373	1.668	95.8%
STM6	SHADYOAKS TRAIL	MH#102	MH#101	15.73	0.21	15.94	0.097	0.65	7.178	0.063	4.587	148.583	1.908	**23.3**	1050	REIN. CONCRETE	**0.34**	1.661	1.858	114.9%
STM7	SHADYOAKS TRAIL	MH#101	MH#100	15.94	0.14	16.09	0.341	0.65	7.519	0.222	4.809	147.619	1.988	**15.6**	1050	REIN. CONCRETE	**0.32**	1.612	1.803	123.3%
PATHWAY 2																				
C-53F(a)	KONSTANTINE COURT	EX MH#HG21B007	EX MH#HG21B003	10.00	0.92	10.92	0.582	0.65	0.582	0.378	0.378	181.813	0.193	90.0	375	SMOOTH PVC	1.09	0.172	1.632	111.9%
C-53F(b)	ALEXSIA COURT	EX MH#HG21B001	EX MH#HG21B003	10.00	0.52	10.52	0.572	0.65	0.572	0.372	0.372	181.813	0.189	41.8	375	SMOOTH PVC	0.74	0.142	1.345	133.5%
STM8	FUT ALEXIA STREET	EX MH#HG21B003	EX MH#HG21B005	10.92	0.05	10.96	0.224	0.65	1.378	0.146	0.896	175.417	0.440	7.5	450	REIN. CONCRETE	2.27	0.448	2.730	98.2%
	ALEXIA STREET	EX MH#HG21B005	FUT MH#201	10.96	0.53	11.49	0.000	0.00	1.378	0.000	0.896	175.112	0.439	57.4	450	REIN. CONCRETE	1.00	0.297	1.812	147.7%
C-92F(a)	FUT DEVELOPMENT	UPSTREAM	FUT MH#201	10.00	0.16	10.16	0.750	0.65	0.750	0.488	0.488	181.813	0.248	12.0	450	REIN. CONCRETE	0.50	0.210	1.281	118.0%
STM9	FUT BERING BLVD	FUT MH#201	FUT MH#200	11.49	0.75	12.25	0.985	0.65	3.113	0.640	2.023	171.668	0.973	107.1	675	REIN. CONCRETE	1.00	0.876	2.374	111.0%
STM10	FUT BERING BLVD	FUT MH#200	MH#116	12.25	0.78	13.03	0.574	0.65	3.687	0.373	2.397	167.013	1.121	107.9	750	REIN. CONCRETE	**0.81**	1.045	2.292	107.2%
	FUT BERING BLVD	MH#116	MH#115	13.03	0.08	13.11	0.000	0.00	3.687	0.000	2.397	162.441	1.090	**10.1**	750	REIN. CONCRETE	**0.69**	0.965	2.115	113.0%
STM11	FUT CLIPPER DRIVE	FUT MH#308	FUT MH#307	10.00	0.86	10.86	0.558	0.65	0.558	0.363	0.363	181.813	0.185	80.5	375	SMOOTH PVC	1.00	0.165	1.563	112.0%
STM12	FUT SPRING MEADOW GROVE	FUT MH#309	FUT MH#307	10.00	0.75	10.75	0.297	0.65	0.297	0.193	0.193	181.813	0.098	70.0	375	SMOOTH PVC	1.00	0.165	1.563	59.6%
STM13	FUT CLIPPER DRIVE	FUT MH#307	FUT MH#306	10.86	0.63	11.49	0.371	0.65	1.226	0.241	0.797	175.825	0.392	84.1	450	REIN. CONCRETE	1.50	0.364	2.219	107.7%
STM14	FUT SHADYOAKS TRAIL	FUT MH#311	FUT MH#310	10.00	0.32	10.32	0.114	0.65	0.114	0.074	0.074	181.813	0.038	32.0	300	SMOOTH PVC	1.50	0.118	1.673	32.0%
STM15	FUT SHADYOAKS TRAIL	FUT MH#310	FUT MH#306	10.32	0.34	10.65	0.477	0.65	0.591	0.310	0.384	179.538	0.193	38.5	375	SMOOTH PVC	1.50	0.202	1.914	95.7%

ENGINEERING LIMITED URBEX
161 Rebecca Street, Hamilton, ON. L8R 1B9

CITY OF HAMILTON

STORM SEWER DESIGN (100 YEAR DESIGN)

Sheldon's Gate Phase 1

APPROVED SET (I.F.C.) - ULTIMATE DEVELOPMENT

URBEX FILE No. : **D0171-P01-17**

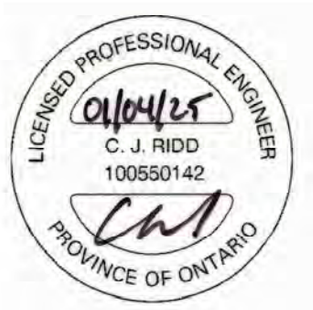
CITY OF HAMILTON FILE No. : **25T-201305**

DESIGNED BY	C. Corsini
DATE	November 2019
REVISED BY	C. Corsini
DATE	April 2025.

PIPE ROUGHNESS (n)			DESIGN STORM PARAMETERS
< 600	=	0.013	i100=2317.4/(td+11)^0.836
≥ 600	=	0.013	
DESIGN VELOCITIES			**DESIGN STORM PARAMETERS**
MIN =	0.80	m/s	Q=0.0028(I100)(AC)
MAX =	3.65	m/s	
MINIMUM PIPE SIZE			**MAXIMUM PIPE CAPACITY**
	300	mm	85%
TIME OF CONCENTRATION			**STORM YEAR EVENT**
	10	minutes	100

AREA	STREET NAME	MANHOLE		TIME IN MINUTES			STORM WATER STUDY							PROPOSED SEWER DESIGN				CAPACITY (m^3/s)	VELOCITY (m/s)	PERCENT FULL (%)
		FROM	TO	ELAPSED UPPER END	FLOW IN SECTION	ELAPSED LOWER END	AREA (ha)	C	CUMULATIVE AREA	A X C	CUMULATIVE A X C	i (mm/hr)	Q (m^3/s)	LENGTH (m)	DIAMETER	TYPE	GRADE (%)			
	FUT SHADYOAKS TRAIL	FUT MH#306	FUT MH#305	11.49	0.27	11.76	0.000	0.00	1.817	0.000	1.181	171.687	0.568	36.2	600	REIN. CONCRETE	1.00	0.641	2.195	88.6%
STM16	FUT SHADYOAKS TRAIL	FUT MH#305	FUT MH#304	11.76	0.46	12.23	0.626	0.65	2.443	0.407	1.588	169.952	0.756	61.0	600	REIN. CONCRETE	1.00	0.641	2.195	118.0%
STM17	FUT SHADYOAKS TRAIL	FUT MH#304	FUT MH#303	12.23	0.09	12.32	0.117	0.65	2.560	0.076	1.664	167.114	0.779	12.9	675	REIN. CONCRETE	1.00	0.876	2.374	88.9%
STM18	FUT SHADYOAKS TRAIL	FUT MH#303	FUT MH#302	12.32	0.54	12.86	0.620	0.65	3.180	0.403	2.067	166.571	0.964	77.4	675	REIN. CONCRETE	1.00	0.876	2.374	110.0%
STM19	FUT SHADYOAKS TRAIL	FUT MH#302	FUT MH#301	12.86	0.51	13.37	0.714	0.65	3.894	0.464	2.531	163.394	1.158	67.6	750	REIN. CONCRETE	0.75	1.006	2.206	115.1%
STM20	FUT SHADYOAKS TRAIL	FUT MH#301	FUT MH#300	13.37	0.12	13.49	0.125	0.65	4.019	0.081	2.612	160.526	1.174	16.1	750	REIN. CONCRETE	0.75	1.006	2.206	116.7%
STM21	SHADYOAKS TRAIL	FUT MH#300	MH#115	13.49	0.58	14.08	0.459	0.65	**4.478**	0.298	2.911	159.859	1.303	71.9	750	REIN. CONCRETE	**0.65**	0.936	2.053	139.1%
																	.			
	SHADYOAKS TRAIL	MH#115	MH#114	14.08	0.18	14.26	0.000	0.00	8.165	0.000	5.307	156.743	2.329	**19.5**	1050	REIN. CONCRETE	**0.31**	1.586	1.775	146.8%
	SHADYOAKS TRAIL	MH#114	MH#100	14.26	0.10	14.36	0.000	0.00	8.165	0.000	5.307	155.792	2.315	**15.0**	1050	REIN. CONCRETE	**0.60**	2.207	2.469	104.9%
STM22	EASEMENT	MH#100	EX MH#HG21B042	16.09	0.19	16.28	0.129	0.65	15.813	0.084	10.200	146.961	4.197	**29.5**	1350	REIN. CONCRETE	**0.47**	3.817	2.584	109.9%
	SWM POND	EX MH#HG21B042	EX MH#HG20B066	16.28	0.23	16.51	0.000	0.00	15.813	0.000	10.200	146.104	4.173	32.8	1350	REIN. CONCRETE	0.40	3.522	2.383	118.5%

NOTES: 1) REINFORCED CONCRETE PIPE AS PER OPSS 1820, CSA A257.1-M92 100-D (ASTM C-76, CLASS IV)
2) SMOOTH PVC PIPE AS PER OPSS 1841, SDR 35



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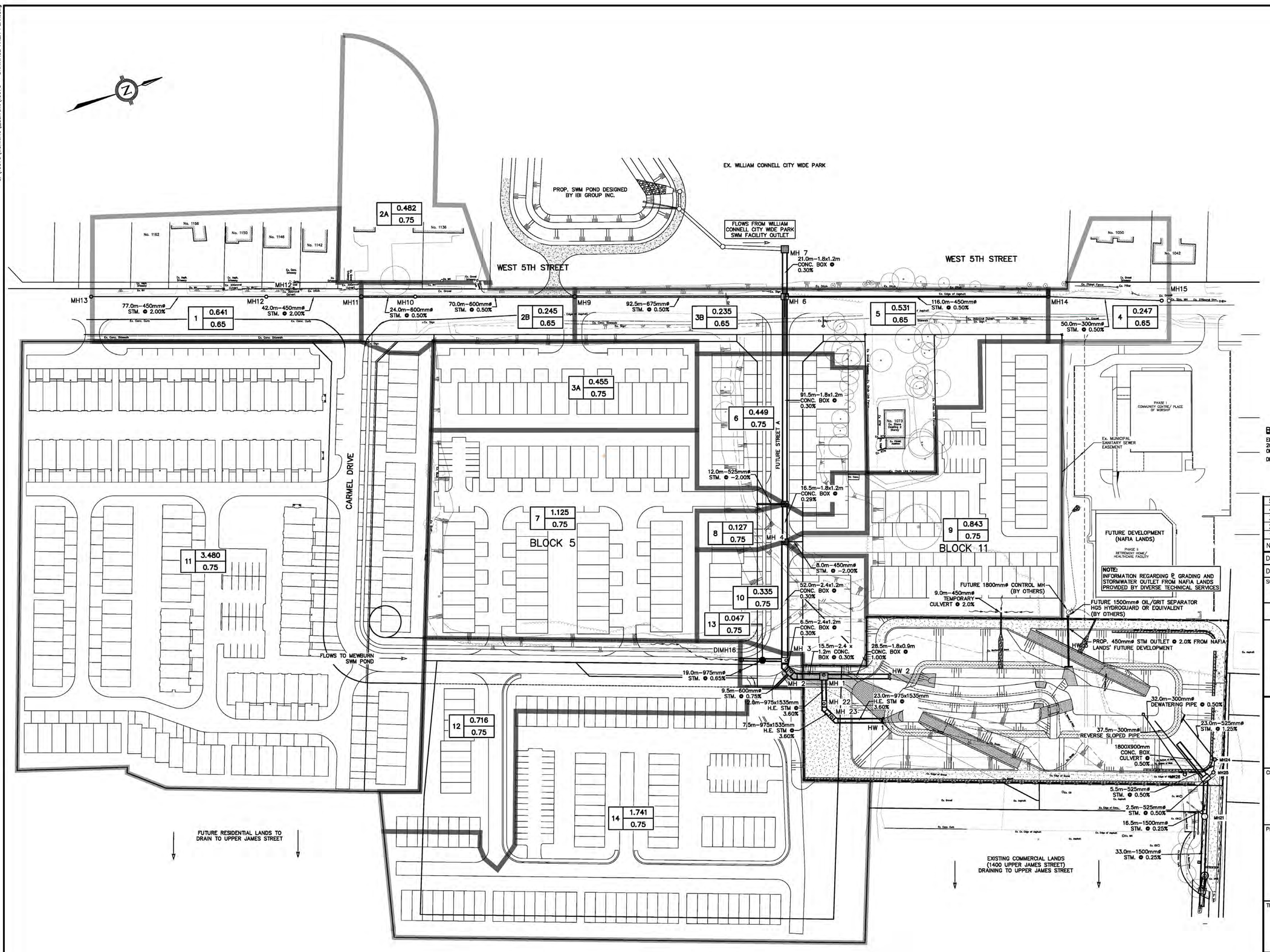
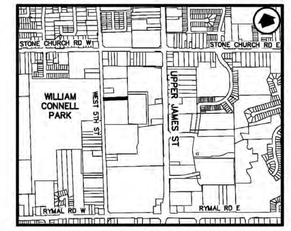




KEY MAP
N.T.S.

LEGEND

9 | 0.843 | 0.75 — DRAINAGE AREA ID / AREA (Ha) / RUNOFF COEFFICIENT

DRAINAGE AREA BOUNDARY

BENCH MARK NOTE:

ELEVATIONS ARE TAKEN FROM PLANS PREPARED BY A.T. McLAREN, DATED JULY 22, 2016. ELEVATIONS SHOWN ON THIS PLAN ARE GEODETIC AND ARE REFERRED TO CITY OF HAMILTON BENCH MARK No 21-03.

DECRIPTION: West face, north west corner of 89 Stone Church Road on the south east corner of Stone Church Rd and West 5th St. Plaque is set on the second row of blocks up from the ground 0.3 m in from the corner. No. 929.

ELEVATION – 222.730 metres

NO.	DATE	BY	REVISIONS
5.	JUN./19	SF	ISSUED FOR TENDER
4.	MAR./19	SF	REVISED AS PER CITY COMMENTS
3.	OCT./17	SF	REVISED AS PER CITY COMMENTS
2.	MAY./17	SF	REVISED AS PER CITY COMMENTS
1.	NOV./16	SF	ISSUED FOR CITY REVIEW

DESIGN	RB	CHK'D	SF	DATE
DRAWN	RB	CHK'D	SF	Sep. 13, 16

SCALE 1:750 (0, 5, 15, 25, 50, 75)

APPROVALS

STAMP: LICENSED PROFESSIONAL ENGINEER — S.V. FRANKOWICH — 6/21/19 — PROVINCE OF ONTARIO

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS
Tel. (905) 631-5978
Fax (905) 631-8927
email: info@sla.on.ca
3228 South Service Road, Suite #105 East Wing, Burlington, Ont., L7N 3H8

CLIENT

CITY OF HAMILTON
GROWTH MANAGEMENT

PROJECT NAME

MEWBURN NEIGHBOURHOOD SWM FACILITY
WEST 5TH STREET, HAMILTON, ONTARIO

TITLE

STORM DRAINAGE AREA PLAN

CONTRACT No.	DRAWING No.	SHEET No.
C15-26-19 (PED)	18-S-34	10

SLA PROJECT No.: 16070
SLA SHEET No.: DA1

APPENDIX B:
Proposed West 5th Street Cross Section

WEST 5TH STREET

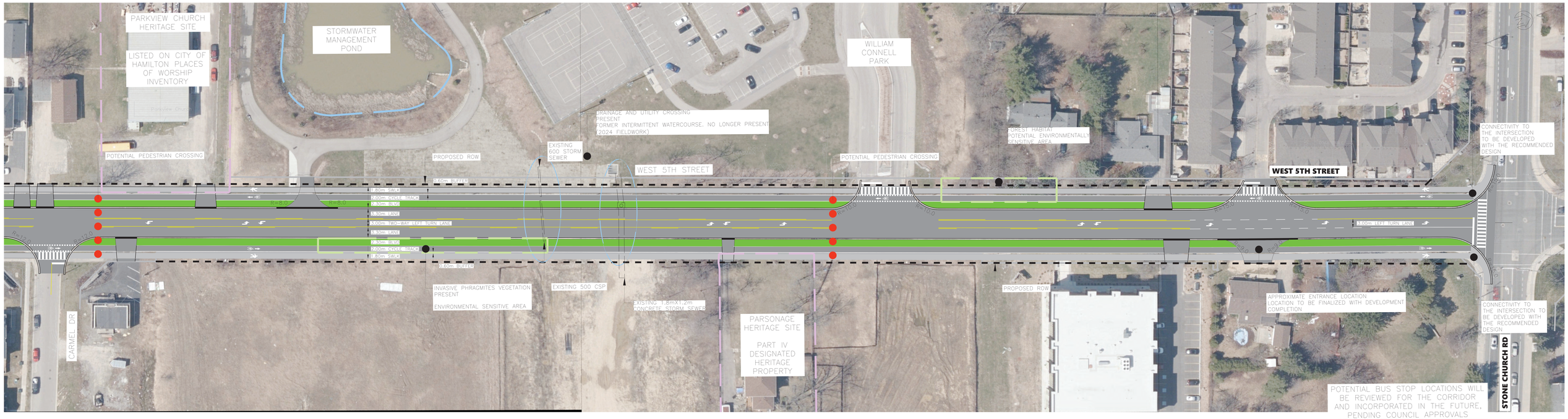
STUDY AREA

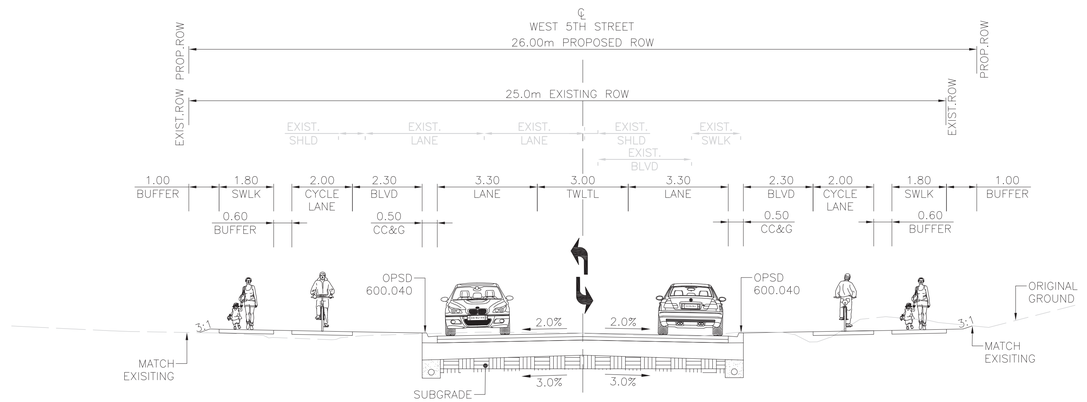
LEGEND:

- POTENTIAL ENVIRONMENTAL SENSITIVE AREA
- HERITAGE AREA
- WATER FEATURE
- POTENTIAL PEDESTRIAN CROSSING

WEST 5TH STREET

STUDY AREA





WEST 5TH STREET – PREFERRED ALTERNATIVE

CARMEL DR TO STONE CHURCH RD W

EXISTING SERVICES	DRAWING #: SOURCE	DATE	CONSTRUCTED SERVICES	COMPLETION

DETAILS	
DESIGN	MK
DRAWN BY	MK
CHECKED	
APPROVED	
DATE	MAY 2025
165001381	

No.	REVISIONS	DATE	CONSULTANT

CONSULTANT OR DIVISION

Stantec

600 - 171 Queens Avenue
London, ON, N6A 5J7
www.stantec.com

ENGINEER'S STAMP

Hamilton

SCALE

TITLE

WEST 5TH STREET

TYPICALS

PROJECT No. ***_**

SHEET No. 01

PLAN FILE No.

APPENDIX C:
Storm Sewer Design

Manholes (U/S-D/S)	Catchment	Contributing Area (ha)	Land Use	Runoff Coefficient
1 - 2	100	0.13	ROW*	0.69
	110	0.16	ROW*	0.69
	113	0.04	Parks (Grassed Area)	0.25
	Total	**0.33**	**-**	**0.64**
2 - 3	101	0.21	ROW*	0.69
	111	1.56	Single Family Residential	0.50
	114	0.08	Parks (Grassed Area)	0.25
	Total	**1.85**	-	**0.51**
3 - 4	102	0.20	ROW*	0.69
	112	2.00	Parks (Grassed Area)	0.25
	115	0.14	Parks (Grassed Area)	0.25
	Total	**2.34**	-	**0.29**
4 - 6	103	0.20	ROW*	0.69
	117	0.58	Single Family Residential/ Parks	0.38
	Total	**0.78**	-	**0.46**
7 - 6	104	0.16	ROW*	0.69
	105	0.19	ROW*	0.69
	118	0.34	Single Family Residential	0.50
	Total	**0.69**	-	**0.60**
8 - 9	External Catchment (Sheet 14 in Appendix A)	**0.45**	Semi- Detached Residential	**0.65**
14 - 13	200	0.22	ROW*	0.69
	211	0.23	Semi- Detached Residential	0.65
	Total	**0.45**	-	**0.67**
13-15	201	0.18	ROW*	0.69
	210	0.81	Single family Residential	0.50
	Total	**0.99**	-	**0.53**
15 - 17	202	**0.31**	ROW*	**0.69**
20 - 17	203	0.31	ROW*	0.69
	204	0.12	ROW*	0.69

Manholes (U/S-D/S)	Catchment	Contributing Area (ha)	Land Use	Runoff Coefficient
	212	0.18	Single Family Residential	0.50
	213	0.10	Single Family Residential	0.50
	Total	**0.71**	-	**0.62**
17 - 21	External Catchment (Drawing No. 10 in Appendix A)	**0.58**	Townhouses	**0.75**
21 - 22	External Catchment (Drawing No. 10 in Appendix A)	**0.34**	Townhouses	**0.75**
23 - 24	600	0.09	ROW*	0.69
	601	0.09	ROW*	0.69
	Total	**0.18**	-	**0.69**
24 - 25	602	0.07	ROW*	0.69
	603	0.07	ROW*	0.69
	610	1.16	Semi- Detached Residential	0.65
	611	0.00**	Apartments	0.65
	Total	**1.30**	-	**0.65**

Notes:

* Right of way runoff coefficient calculated from a 75% impervious area, using RC = (Imp%*0.9/100) + 0.05 (Schueler, 1987)

** Contributing area of this catchment was replaced by the 100 year peak flow from the underground storage tank located at 1021 West 5th Street (0.062 m^3/s)

West 5th Street- Storm Sewer Design Sheet (5-year Event) without additional measures

Manhole				Contributing Area						5 Year Calculation							Pipe Data				Flow Data					100-year Event	
Outlet	U/S	D/S	Area ID	Override Area	5-Year Area Design	Runoff Coeff. Design	A x R	Totaled A x R	Accum. A x R	Override T_c	U/S T_c	D/S T_c	Rainfall Intensity	Flow	External Flow	Total Flow	Length Design	Slope Design	Design Size	Nominal Size	Full Capacity	Full Velocity	Actual Velocity	Time of Flow	5-Year Q_d/Q_c	Total Flow	Overland Flow
				(ha)	(ha)					(min)	(min)	(min)	(mm/hr)	(m^3/s)	(m^3/s)	(m^3/s)	(m)	(%)	(mm)	(mm)	(m^3/s)	(m/s)	(m/s)	(min)	(%)	(m^3/s)	(m^3/s)
C	1	2	-	0.330	0.33	0.56	0.18	0.00	0.18	10.000	10.000	10.688	103.04	0.053	0.000	**0.053**	**44.0**	**0.50**	**375**	375	0.124	1.123	1.066	0.688	**42.5%**	0.093	0.04
	2	3	-	1.850	1.85	0.51	0.95		1.14		10.688	11.493	99.98	0.316	0.000	**0.316**	**81.6**	**0.50**	**600**	600	0.434	1.536	1.689	0.805	**72.7%**	0.562	0.25
	3	4	-	2.340	2.34	0.29	0.68		1.82		11.493	12.259	96.65	0.488	0.000	**0.488**	**76.3**	**0.50**	**675**	675	0.594	1.661	1.869	0.766	**82.0%**	0.872	0.38
	4	6	-	0.850	0.85	0.45	0.38		2.20		12.259	13.090	93.71	0.572	0.000	**0.572**	**76.5**	**0.37**	**750**	750	0.677	1.533	1.732	0.832	**84.5%**	1.027	0.45
	6		-				0.00		2.20		13.090																
C	7	6	-	0.690	0.69	0.61	0.42	0.00	0.42	10.000	10.000	10.962	103.04	0.121	0.000	**0.121**	**62.5**	**0.30**	**600**	600	0.336	1.189	1.082	0.962	**36.1%**	0.214	0.09
	6		-				0.00		0.42		10.962																
C	6	8	-	0.116	0.12	0.65	0.08	2.62	2.70	13.090	13.090	13.306	90.73	0.680	0.000	**0.680**	**22.6**	**0.35**	**750**	750	0.662	1.499	1.747	0.216	**102.7%**	1.221	0.54
	8	9	-	0.232	0.23	0.65	0.15		2.85		13.306	14.082	89.99	0.712	0.000	**0.712**	**59.8**	**0.15**	**900**	900	0.701	1.102	1.284	0.776	**101.6%**	1.279	0.57
	9	10	-	0.000			0.00		2.85		14.082	14.216	87.44	0.692	0.000	**0.692**	**11.1**	**0.18**	**900**	900	0.768	1.207	1.382	0.134	90.1%	1.245	0.55
	10		-				0.00		2.85		14.216																
D	14	13	-	0.450	0.45	0.69	0.31	0.00	0.31	10.000	10.000	10.397	103.04	0.088	0.000	**0.088**	**55.6**	**2.80**	**300**	300	0.162	2.289	2.335	0.397	**54.7%**	0.156	0.07
	13		-				0.00		0.31		10.397																
D	13	15	-	0.990	0.99	0.54	0.54	0.31	0.84	10.397	10.397	10.890	101.25	0.238	0.000	**0.238**	**69.8**	**1.47**	**450**	450	0.346	2.173	2.358	0.493	**68.7%**	0.421	0.18
	15	17	-	0.310	0.31	0.73	0.22		1.07		10.890	11.835	99.12	0.294	0.000	**0.294**	**118.4**	**0.93**	**525**	525	0.415	1.916	2.088	0.945	**71.0%**	0.523	0.23
	17		-				0.00		1.07		11.835																
D	20	17	-	0.710	0.71	0.64	0.45	0.00	0.45	10.000	10.000	11.474	103.04	0.129	0.000	**0.129**	**119.9**	**0.50**	**450**	450	0.202	1.268	1.356	1.474	**64.1%**	0.228	0.10
	17		-	0.000	0.00	0.00	0.00		0.45		11.474																
D	18	17	-	0.000	0.00	0.00	0.00	0.00	0.00	10.000	10.000	10.010	103.04	0.000	2.180	**2.180**	**21.0**	**0.30**	**1400**	1400	3.221	2.092	2.249	0.010	**67.7%**	2.180	0.00
	17		-	0.000			0.00		0.00		10.010																
D	17	21	-	0.580	0.58	0.75	0.44	1.52	1.96	11.835	11.835	12.600	95.31	0.518	2.180	**2.698**	**108.0**	**0.30**	**1400**	1400	3.221	2.092	2.354	0.765	**83.8%**	3.105	0.41
	21	22	-	0.340	0.65	0.75	0.49		2.44		12.600	12.960	92.46	0.628	2.180	**2.808**	**52.0**	**0.30**	**1600**	1600	4.599	2.287	2.402	0.361	**61.0%**	3.305	0.50
	22		-				0.00		2.44		12.960																
6	23	24	-	0.170	0.17	0.73	0.12	0.00	0.12	10.000	10.000	10.926	103.04	0.035	0.000	**0.035**	**67.0**	**1.00**	**375**	375	0.175	1.587	1.206	0.926	**20.1%**	0.062	0.03
	24	25	-	1.300	1.30	0.66	0.86		0.98		10.926	11.237	98.97	0.269	0.062	**0.331**	**69.5**	**4.07**	**450**	450	0.575	3.617	3.725	0.311	**57.6%**	0.541	0.21
	25		-				0.00		0.98		11.237																

West 5th Street- Storm Sewer Design Sheet (100-year Event) without additional measures

Manhole				Contributing Area						100 Year Calculation							Pipe Data				Flow Data				
Outlet	U/S	D/S	Area ID	Override Area (ha)	5-Year Area Design (ha)	Runoff Coeff. Design	A x R	Totaled A x R	Accum. A x R	Override T_c (min)	U/S T_C (min)	D/S T_C (min)	Rainfall Intensity (mm/hr)	Flow (m^3/s)	External Flow (m^3/s)	Total Flow (m^3/s)	Length Design (m)	Slope Design (%)	Design Size (mm)	Nominal Size (mm)	Full Capacity (m^3/s)	Full Velocity (m/s)	Actual Velocity (m/s)	Time of Flow (min)	100-Year Q_A/Q_C (%)
C	1	2	-	0.330	0.33	0.56	0.18	0.00	0.18	10.000	10.000	10.535	181.81	0.093	0.000	**0.093**	**39.9**	0.50	375	375	0.124	1.123	1.240	0.535	75.1%
	2	3	-	1.850	1.85	0.51	0.95		1.14		10.535	11.314	178.03	0.562	0.000	**0.562**	**81.7**	0.50	600	600	0.434	1.536	1.751	0.778	129.4%
	3	4	-	2.340	2.34	0.29	0.68		1.82		11.314	12.074	172.82	0.872	0.000	**0.872**	**75.8**	0.50	675	675	0.594	1.661	1.894	0.761	146.7%
	4	6	-	0.850	0.85	0.45	0.38		2.20		12.074	12.951	168.05	1.027	0.000	**1.027**	**80.7**	0.37	750	750	0.677	1.533	1.747	0.877	151.6%
	6		-				0.00		2.20		12.951														
C	7	6	-	0.690	0.69	0.61	0.42	0.00	0.42	10.000	10.000	10.826	181.81	0.214	0.000	**0.214**	**62.5**	0.30	600	600	0.336	1.189	1.261	0.826	63.6%
	6		-				0.00		0.42		10.826														
C	6	8	-	0.116	0.12	0.65	0.08	2.62	2.70	12.951	12.951	13.172	162.89	1.221	0.000	**1.221**	**22.6**	0.35	750	750	0.662	1.499	1.709	0.220	184.3%
	8	9	-	0.232	0.23	0.65	0.15		2.85		13.172	13.965	161.64	1.279	0.000	**1.279**	**59.8**	0.15	900	900	0.701	1.102	1.256	0.793	182.5%
	9	10	-	0.000			0.00		2.85		13.965	14.099	157.34	1.245	0.000	**1.245**	**11.1**	0.18	900	900	0.768	1.207	1.376	0.134	162.1%
	10		-				0.00		2.85		14.099														
D	14	13	-	0.450	0.45	0.69	0.31	0.00	0.31	10.000	10.000	10.354	181.81	0.156	0.000	**0.156**	**56.4**	2.80	300	300	0.162	2.289	2.655	0.354	96.4%
	13		-				0.00		0.31		10.354														
D	13	15	-	0.990	0.99	0.54	0.54	0.31	0.84	10.354	10.354	10.815	179.29	0.421	0.000	**0.421**	**68.5**	1.47	450	450	0.346	2.173	2.478	0.461	121.7%
	15	17	-	0.310	0.31	0.73	0.22		1.07		10.815	11.725	176.12	0.523	0.000	**0.523**	**119.3**	0.93	525	525	0.415	1.916	2.184	0.910	126.1%
	17		-				0.00		1.07		11.725														
D	20	17	-	0.710	0.71	0.64	0.45	0.00	0.45	10.000	10.000	11.384	181.81	0.228	0.000	**0.228**	**120.0**	0.50	450	450	0.202	1.268	1.445	1.384	113.2%
	17		-	0.000	0.00	0.00	0.00		0.45		11.384														
D	18	17	-	0.000	0.00	0.00	0.00	0.00	0.00	10.000	10.000	10.010	181.81	0.000	2.180	**2.180**	**21.0**	0.30	1400	1400	3.221	2.092	2.249	0.010	67.7%
	17		-	0.000			0.00		0.00		10.010														
D	17	21	-	0.580	0.58	0.75	0.44	1.52	1.96	11.725	11.725	12.467	170.20	0.925	2.180	**3.105**	**108.0**	0.30	1400	1400	3.221	2.092	2.427	0.742	96.4%
	21	22	-	0.340	0.65	0.75	0.49		2.44		12.467	12.814	165.69	1.125	2.180	**3.305**	**52.0**	0.30	1600	1600	4.599	2.287	2.493	0.348	71.9%
	22		-				0.00		2.44		12.814														
6	23	24	-	0.170	0.17	0.73	0.12	0.00	0.12	10.000	10.000	10.782	181.81	0.062	0.000	**0.062**	**67.0**	1.00	375	375	0.175	1.587	1.429	0.782	35.5%
	24	25	-	1.300	1.30	0.66	0.86		0.98		10.782	11.059	176.34	0.479	0.062	**0.541**	**69.5**	4.07	450	450	0.575	3.617	4.177	0.277	94.1%
	25		-				0.00		0.98		11.059														

Subject: Orifice Sizing to re-direct flow to Subsurface Storage
Project: West 5th EA
Project No.: 165001381
Client: City of Hamilton
Date: 2025-10-10

Vertical Orifice on Manhole 6 outlet			
Elevation (m)	Orifice #1 (m^3/s)	Parameters	
225.54	0.560	Orifice #1	
		Orifice #1 Elev. (m)	Orifice Coeff.
		224.830	0.600
		Orifice Mid Elev. (m)	Perimeter (m)
		225.160	2.073
		Orifice #1Diam.(mm)	Area (m^2)
		660	0.342

Vertical Orifice Plate in Pipe

Max. ponding elev =	**225.540**	m
Orifice invert elev. =	**224.830**	m
Ponding Depth	**0.71**	m

Notes:

1 Orifice flow rate calculated using
Orifice Area * Orifice Coefficient * sqrt (2 * 9.81 * Elevation Difference between orifice mid-point and water surface)

2 Friction factor assumes turbulent flow at 20 °C

3 Target flow for orifice sizing calculated as 85% of full flow capacity of 750 mm pipe leaving manhole 6
(0.662 m3/s * 85% = 0.5627 m^3/s)

Subject: Modified Rational Method Calculation
Project: West 5th EA
Project No.: 165001381
Client: City of Hamilton
Date: 2025-10-10

Modified Rational Method- Outlet 6

Total Drainage Area: 6.060 ha
Composite Runoff Coefficient: 0.45

Rainfall Intensity

Use Mount Hope 5-Year Design Storm

Storage Calculation

Release Rate: 0.56000 cms

Time (min.)	Rainfall Intensity (mm/hr)	Peak Runoff Rate (cms)	Incremental Runoff Volume (cu. m)	Incremental Outflow Volume (cu. m)	Storage Volume (cu. m)	
1	179.9	1.364	82	34	48.2	
2	165.3	1.253	150	67	83.1	
3	153.1	1.161	209	101	108.1	
4	142.8	1.082	260	134	125.3	
5	133.9	1.015	304	168	136.5	
6	126.1	0.956	344	202	142.7	
7	**119.3**	**0.905**	**380**	**235**	**144.8**	<= Max. Storage
8	113.3	0.859	412	269	143.5	
9	107.9	0.818	442	302	139.4	
10	103.1	0.782	469	336	132.9	
11	98.7	0.748	494	370	124.3	

West 5th Street- Storm Sewer Design Sheet (5-year Event) with subsurface storage

Manhole				Contributing Area						5 Year Calculation							Pipe Data				Flow Data					100-year Event	
Outlet	U/S	D/S	Area ID	Override Area	5-Year Area Design	Runoff Coeff. Design	A x R	Totaled A x R	Accum. A x R	Override T_c	U/S T_c	D/S T_c	Rainfall Intensity	Flow	External Flow	Total Flow	Length Design	Slope Design	Design Size	Nominal Size	Full Capacity	Full Velocity	Actual Velocity	Time of Flow	5-Year Q_A/Q_C	Total Flow	Overland Flow
				(ha)	(ha)					(min)	(min)	(min)	(mm/hr)	(m^3/s)	(m^3/s)	(m^3/s)	(m)	(%)	(mm)	(mm)	(m^3/s)	(m/s)	(m/s)	(min)	(%)	(m^3/s)	(m^3/s)
C	1	2	-	0.330	0.33	0.56	0.18	0.00	0.18	10.000	10.000	10.688	103.04	0.053	0.000	**0.053**	**44.0**	**0.50**	**375**	375	0.124	1.123	1.066	0.688	**42.5%**	0.093	0.04
	2	3	-	1.850	1.85	0.51	0.95		1.14		10.688	11.493	99.98	0.316	0.000	**0.316**	**81.6**	**0.50**	**600**	600	0.434	1.536	1.689	0.805	**72.7%**	0.562	0.25
	3	4	-	2.340	2.34	0.29	0.68		1.82		11.493	12.259	96.65	0.488	0.000	**0.488**	**76.3**	**0.50**	**675**	675	0.594	1.661	1.869	0.766	**82.0%**	0.872	0.38
	4	6	-	0.850	0.85	0.45	0.38		2.20		12.259	13.090	93.71	0.572	0.000	**0.572**	**76.5**	**0.37**	**750**	750	0.677	1.533	1.732	0.832	**84.5%**	1.027	0.45
	6		-				0.00		2.20		13.090																
C	7	6	-	0.690	0.69	0.61	0.42	0.00	0.42	10.000	10.000	10.962	103.04	0.121	0.000	**0.121**	**62.5**	**0.30**	**600**	600	0.336	1.189	1.082	0.962	**36.1%**	0.214	0.09
	6		-				0.00		0.42		10.962																
C	6	8	-	0.116	0.12	0.65	0.08	2.62	2.70	13.090	13.090	13.313	90.73	0.680	-0.120	**0.560**	**22.6**	**0.35**	**750**	750	0.662	1.499	1.694	0.222	**84.6%**	1.220	0.66
	8	9	-	0.232	0.23	0.65	0.15		2.85		13.313	14.113	89.97	0.712	-0.120	**0.592**	**59.8**	**0.15**	**900**	900	0.701	1.102	1.245	0.800	**84.4%**	1.278	0.69
	9	10	-	0.000			0.00		2.85		14.113	14.252	87.34	0.691	-0.120	**0.571**	**11.1**	**0.18**	**900**	900	0.768	1.207	1.334	0.139	**74.4%**	1.244	0.67
	10		-				0.00		2.85		14.252																
D	14	13	-	0.450	0.45	0.69	0.31	0.00	0.31	10.000	10.000	10.397	103.04	0.088	0.000	**0.088**	**55.6**	**2.80**	**300**	300	0.162	2.289	2.335	0.397	**54.7%**	0.156	0.07
	13		-				0.00		0.31		10.397																
D	13	15	-	0.990	0.99	0.54	0.54	0.31	0.84	10.397	10.397	10.890	101.25	0.238	0.000	**0.238**	**69.8**	**1.47**	**450**	450	0.346	2.173	2.358	0.493	**68.7%**	0.421	0.18
	15	17	-	0.310	0.31	0.73	0.22		1.07		10.890	11.835	99.12	0.294	0.000	**0.294**	**118.4**	**0.93**	**525**	525	0.415	1.916	2.088	0.945	**71.0%**	0.523	0.23
	17		-				0.00		1.07		11.835																
D	20	17	-	0.710	0.71	0.64	0.45	0.00	0.45	10.000	10.000	11.474	103.04	0.129	0.000	**0.129**	**119.9**	**0.50**	**450**	450	0.202	1.268	1.356	1.474	**64.1%**	0.228	0.10
	17		-	0.000	0.00	0.00	0.00		0.45		11.474																
D	18	17	-	0.000	0.00	0.00	0.00	0.00	0.00	10.000	10.000	10.010	103.04	0.000	2.180	**2.180**	**21.0**	**0.30**	**1400**	1400	3.221	2.092	2.249	0.010	**67.7%**	2.180	0.00
	17		-	0.000			0.00		0.00		10.010																
D	17	21	-	0.580	0.58	0.75	0.44	1.52	1.96	11.835	11.835	12.600	95.31	0.518	2.180	**2.698**	**108.0**	**0.30**	**1400**	1400	3.221	2.092	2.354	0.765	**83.8%**	3.105	0.41
	21	22	-	0.340	0.65	0.75	0.49		2.44		12.600	12.960	92.46	0.628	2.180	**2.808**	**52.0**	**0.30**	**1600**	1600	4.599	2.287	2.402	0.361	**61.0%**	3.305	0.50
	22		-				0.00		2.44		12.960																
6	23	24	-	0.170	0.17	0.73	0.12	0.00	0.12	10.000	10.000	10.926	103.04	0.035	0.000	**0.035**	**67.0**	**1.00**	**375**	375	0.175	1.587	1.206	0.926	**20.1%**	0.062	0.03
	24	25	-	1.300	1.30	0.66	0.86		0.98		10.926	11.237	98.97	0.269	0.062	**0.331**	**69.5**	**4.07**	**450**	450	0.575	3.617	3.725	0.311	**57.6%**	0.541	0.21
	25		-				0.00		0.98		11.237																

Negative "External Flow" included to simulate flow reduction due to 660 mm Orifice and subsurface storage. Note "Total Flow" in 750mm manhole 6 outlet is equal to maximum flow in orifice design

User Inputs

Chamber Model:	SC-310
Outlet Control Structure:	No
Project Name:	
Engineer:	N/A
Project Location:	
Measurement Type:	Metric
Required Storage Volume:	75.01 cubic meters.
Stone Porosity:	40%
Stone Foundation Depth:	153 mm.
Stone Above Chambers:	153 mm.
Design Constraint Dimensions:	(3.00 m. x 90.01 m.)

Note: ADS sizing tool only allows a length to 152 m. A storage unit was sized to 75 cubic meters, and the length doubled to represent 150 cubic meters.

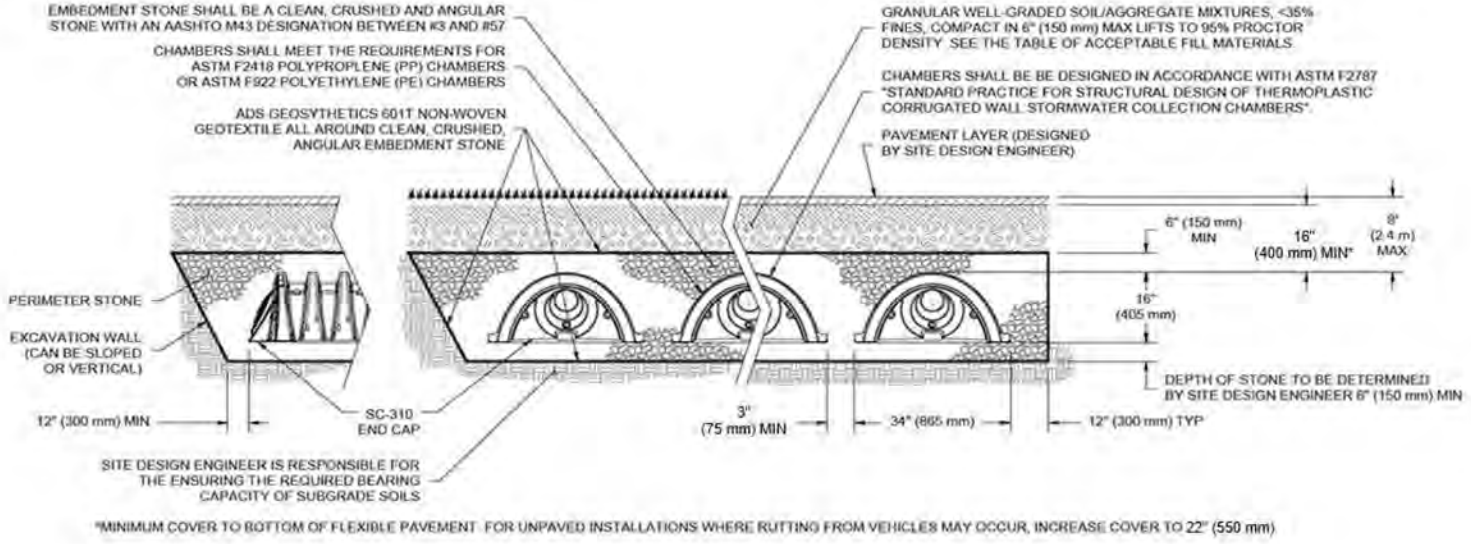
Results

System Volume and Bed Size

Installed Storage Volume:	76.18 cubic meters.
Storage Volume Per Chamber:	0.42 cubic meters.
Number Of Chambers Required:	75
Number Of End Caps Required:	4
Chamber Rows:	2
Maximum Length:	84.42 m.
Maximum Width:	2.42 m.
Approx. Bed Size Required:	201.66 square meters.
Average Cover Over Chambers:	N/A .

System Components

Amount Of Stone Required:	113 cubic meters
Volume Of Excavation (Not Including Fill):	144 cubic meters
Total Non-woven Geotextile Required:	633 square meters
Woven Geotextile Required (excluding Isolator Row):	9 square meters
Woven Geotextile Required (Isolator Row):	122 square meters
Total Woven Geotextile Required:	130 square meters
Impervious Liner Required:	0 square meters



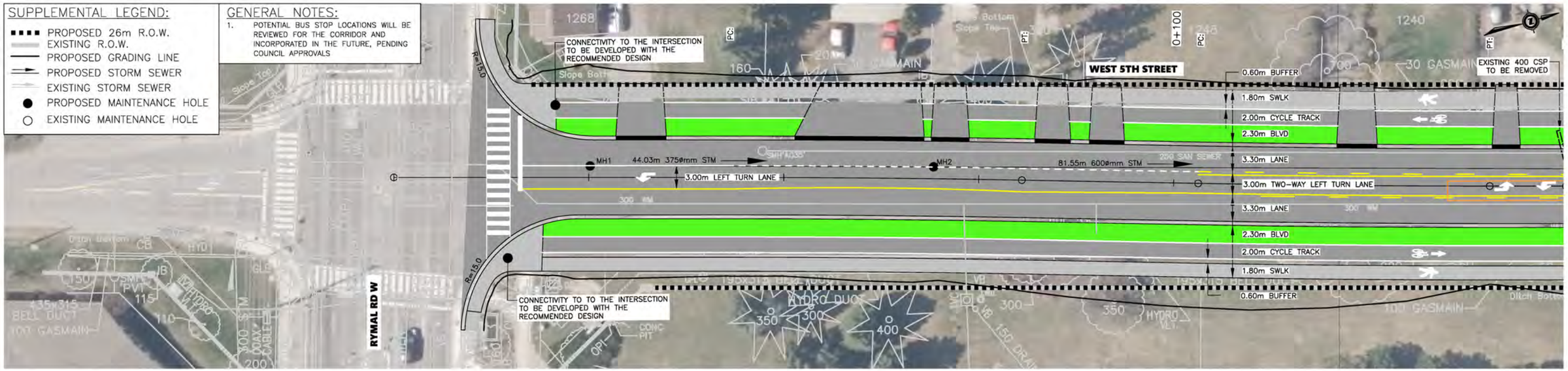
APPENDIX D:
Plan and Profile Drawings

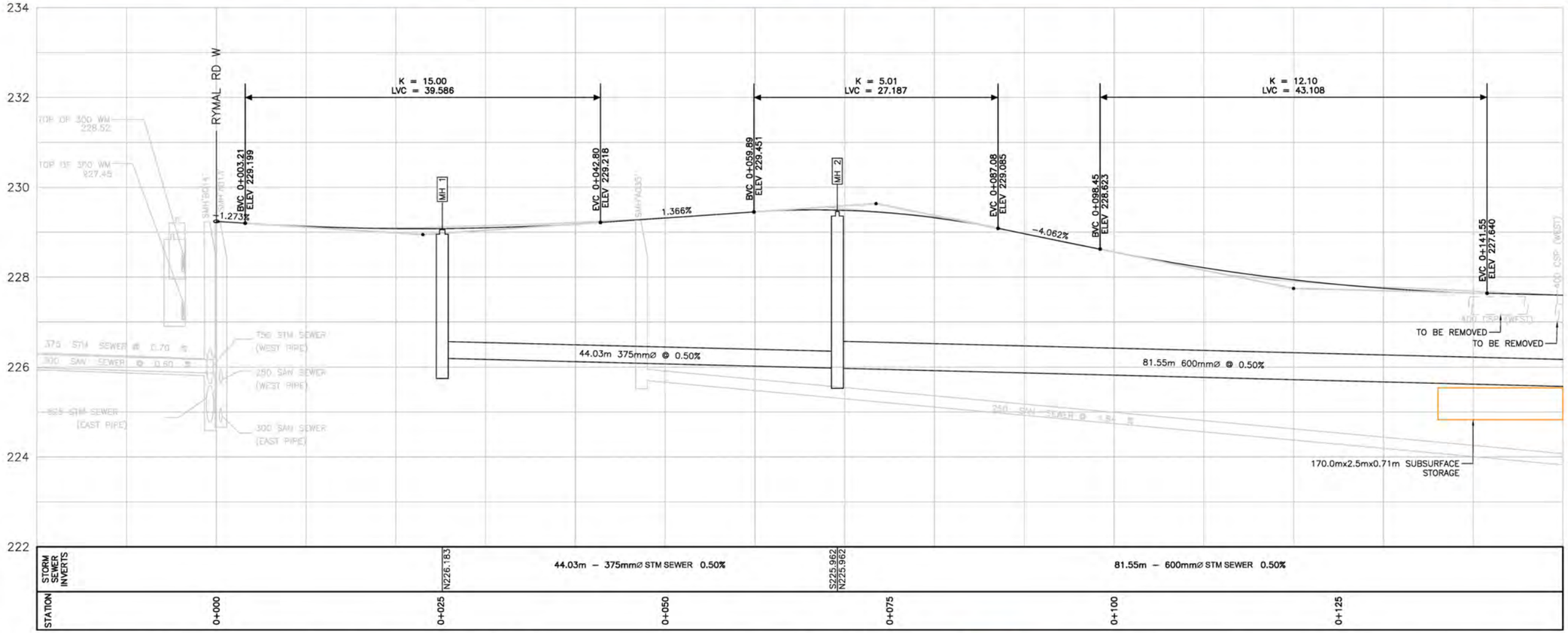
SUPPLEMENTAL LEGEND:

- PROPOSED 26m R.O.W.
- EXISTING R.O.W.
- PROPOSED GRADING LINE
- PROPOSED STORM SEWER
- EXISTING STORM SEWER
- PROPOSED MAINTENANCE HOLE
- EXISTING MAINTENANCE HOLE

GENERAL NOTES:

1. POTENTIAL BUS STOP LOCATIONS WILL BE REVIEWED FOR THE CORRIDOR AND INCORPORATED IN THE FUTURE, PENDING COUNCIL APPROVALS





EXISTING SERVICES	DRAWING #, SOURCE	DATE	CONSTRUCTED SERVICES	COMPLETION

DETAILS	
DESIGN	MK
DRAWN BY	MK
CHECKED	SB
APPROVED	SB
DATE	OCTOBER 2025
	165001381

No.	REVISIONS	DATE	CONSULTANT

CONSULTANT OR DIVISION

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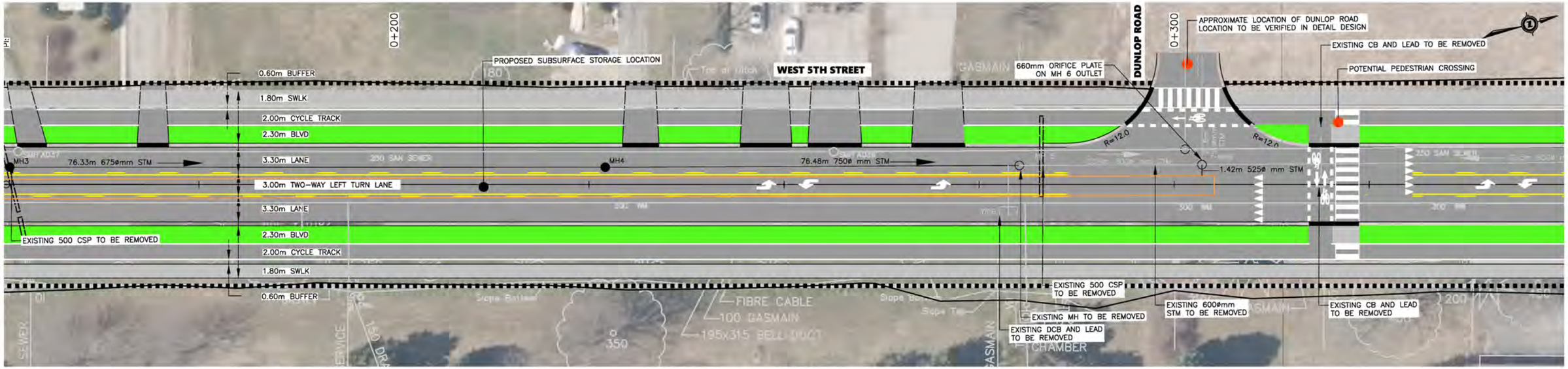
WEST 5TH STREET EA

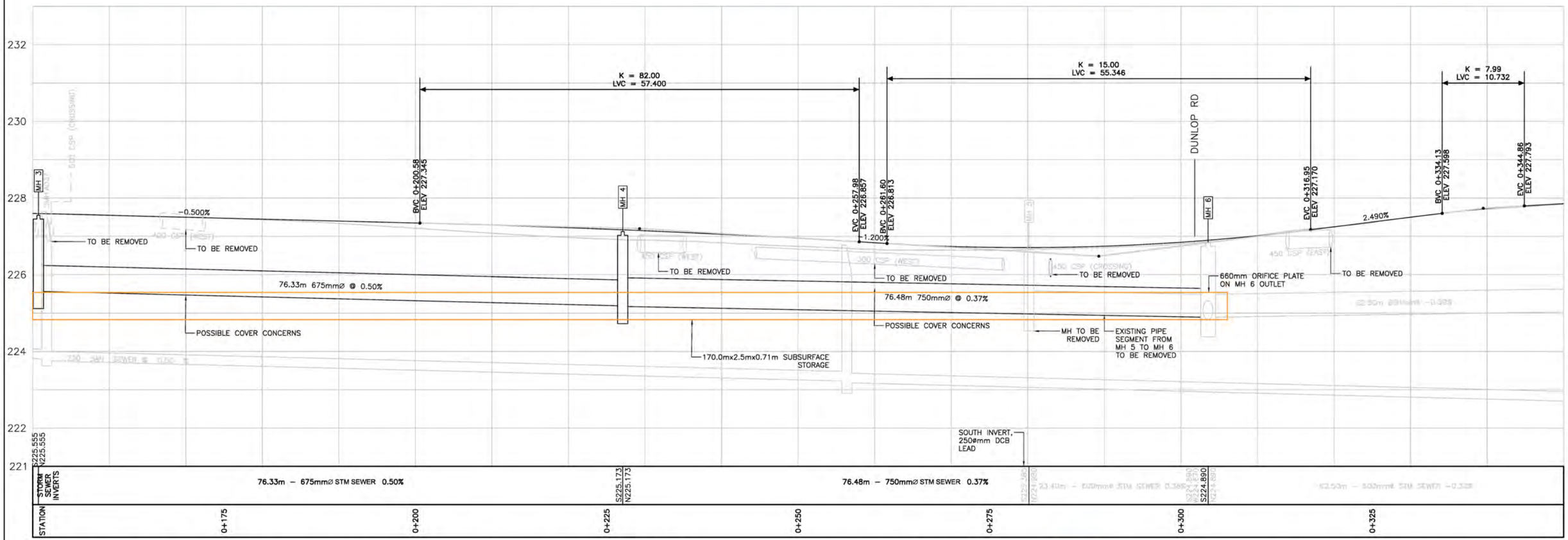
WEST 5TH STREET
PREFERRED ALTERNATIVE

PROJECT No.

SHEET No.
01

PLAN FILE No.





EXISTING SERVICES	DRAWING #, SOURCE	DATE	CONSTRUCTED SERVICES	COMPLETION	DETAILS	No.	REVISIONS	DATE	CONSULTANT
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					DRAWN BY MK				
					CHECKED RB				
					APPROVED RB				
					DATE OCTOBER 2025				
					165001381				

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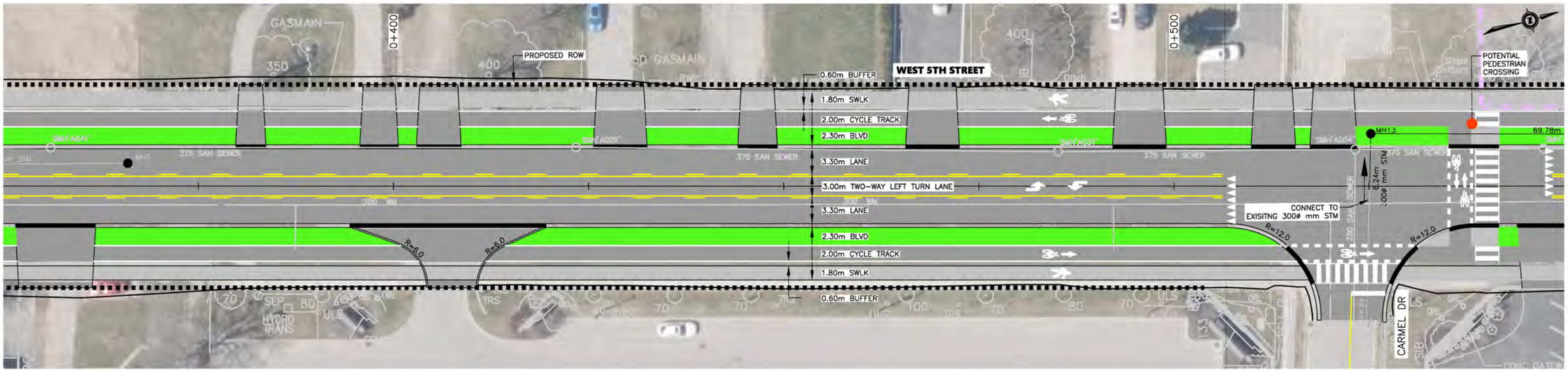
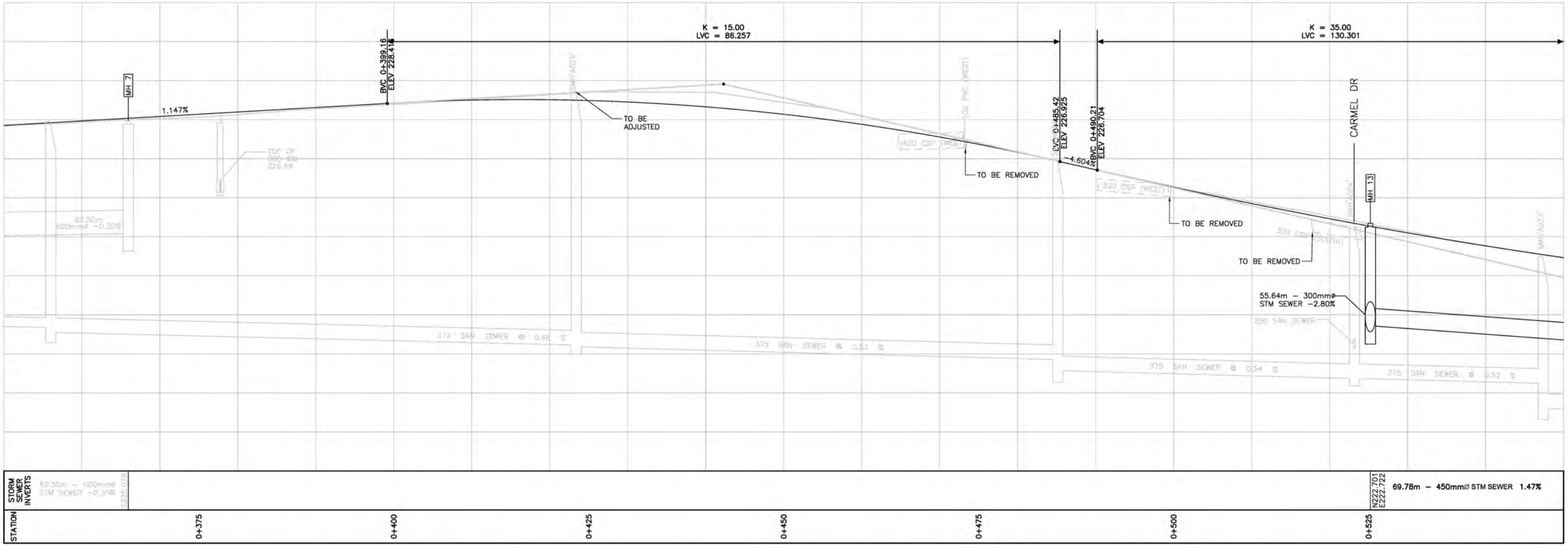
WEST 5TH STREET
PREFERRED ALTERNATIVE

PROJECT No.

SHEET No.
02

PLAN FILE No.





STORM SEWER INVERTS	62.50m – 600mmø STM SEWER –0.30%										N222.701 E222.722	69.78m – 450mmØ STM SEWER 1.47%
STATION	0+375		0+400		0+425		0+450		0+475		0+500	0+525

EXISTING SERVICES	DRAWING #, SOURCE	DATE	CONSTRUCTED SERVICES	COMPLETION

DETAILS	
DESIGN	MK
DRAWN BY	MK
CHECKED	IB
APPROVED	IB
DATE	OCTOBER 2023
	165001381

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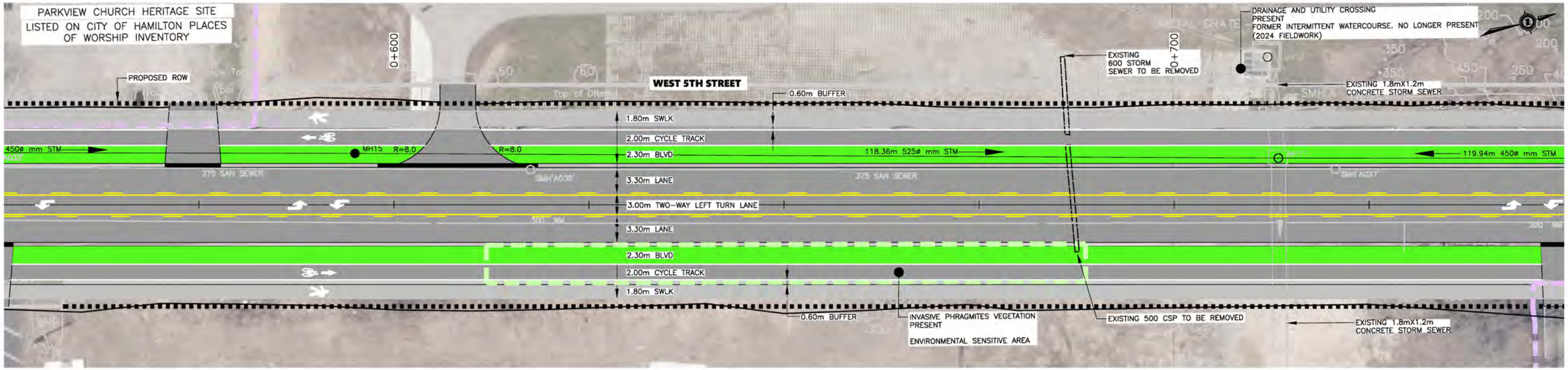
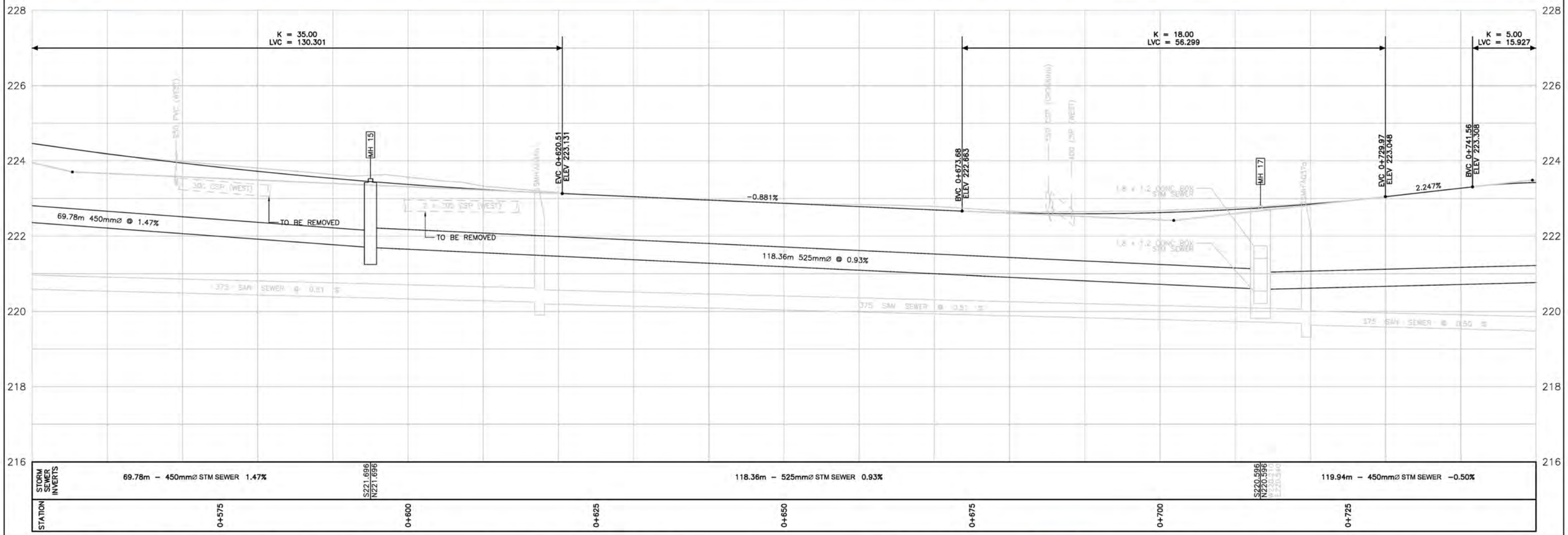
PROJECT No.

SHEET No.
03

PLAN FILE No.





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DETAILS	
DESIGN	MK
DRAWN BY	MK
CHECKED	RB
APPROVED	RB
DATE	OCTOBER 2025
	165001381

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TITLE

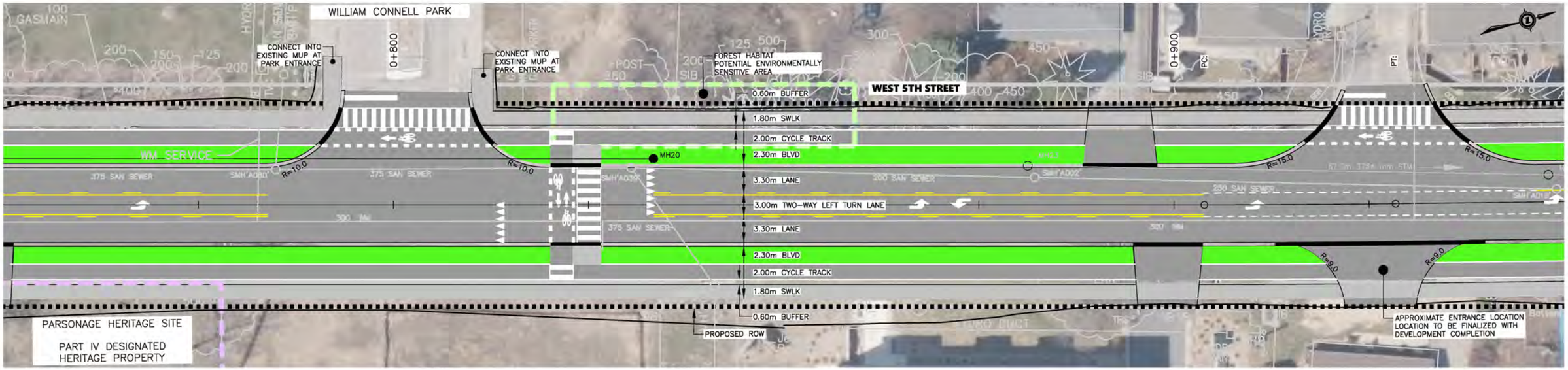
WEST 5TH STREET EA

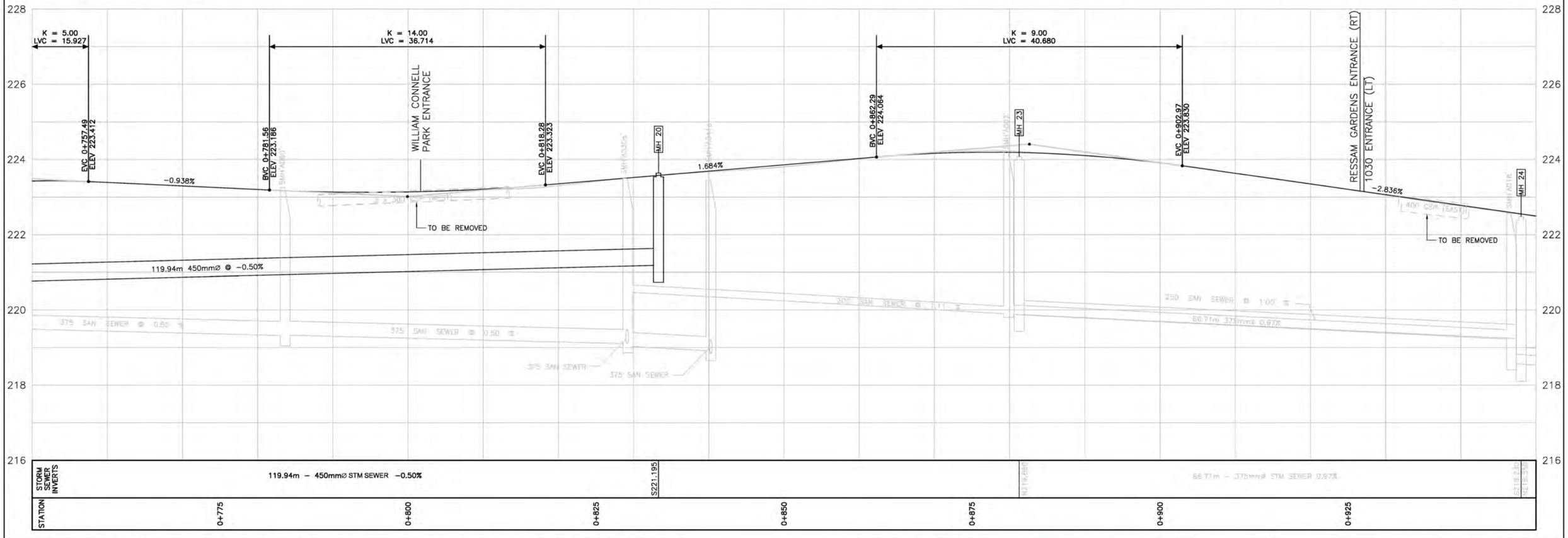
WEST 5TH STREET
PREFERRED ALTERNATIVE

PROJECT No.

SHEET No.
04

PLAN FILE No.





EXISTING SERVICES	DRAWING #, SOURCE	DATE	CONSTRUCTED SERVICES	COMPLETION

DETAILS	
DESIGN	MK
DRAWN BY	MK
CHECKED	RD
APPROVED	RD
DATE	OCTOBER 2025
	165001381

No.	REVISIONS	DATE	CONSULTANT

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TITLE

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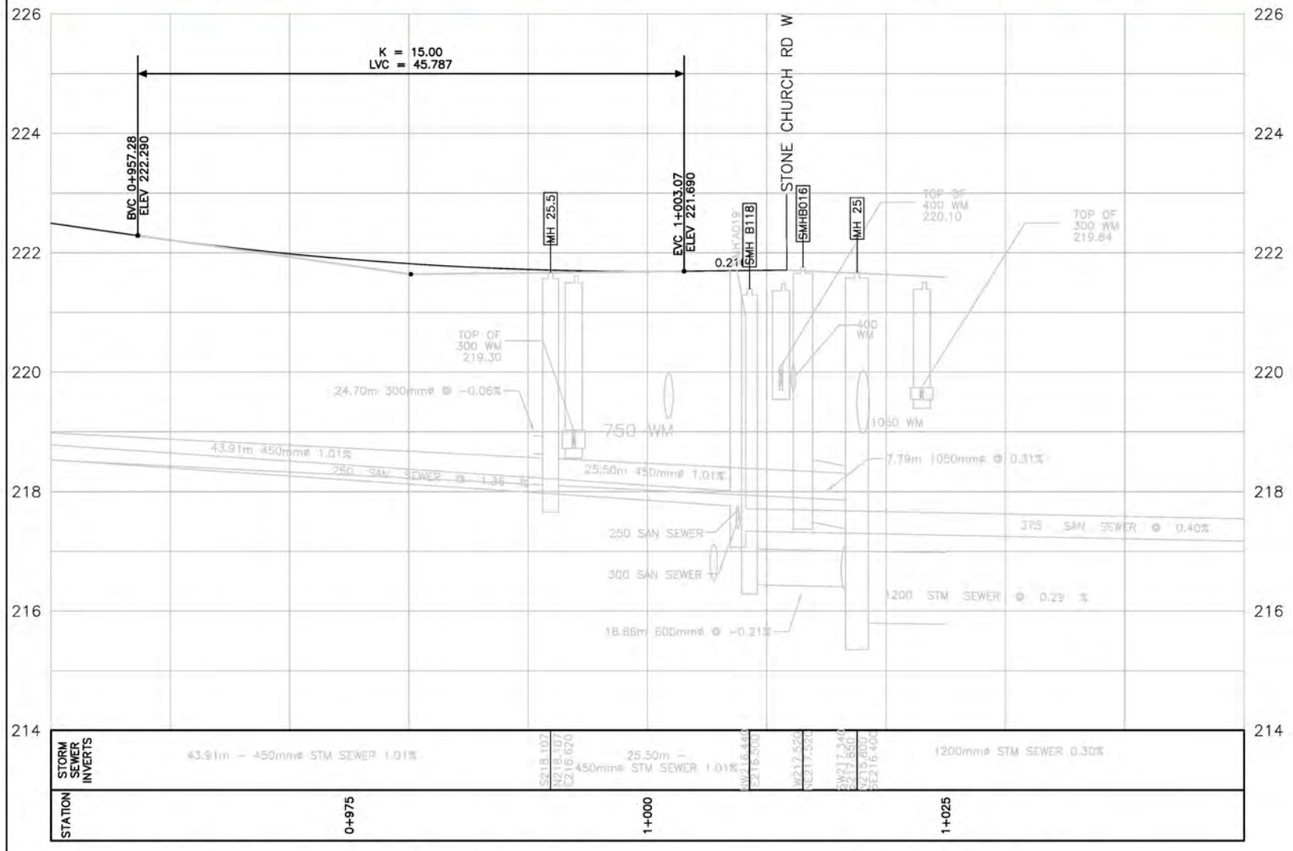
WEST 5TH STREET
PREFERRED ALTERNATIVE

PROJECT No.

SHEET No.
05

PLAN FILE No.



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DESIGN	MK
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APPROVED	IB
DATE	OCTOBER 2025
	165001381

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WEST 5TH STREET
PREFERRED ALTERNATIVE

PROJECT No.

SHEET No.
06

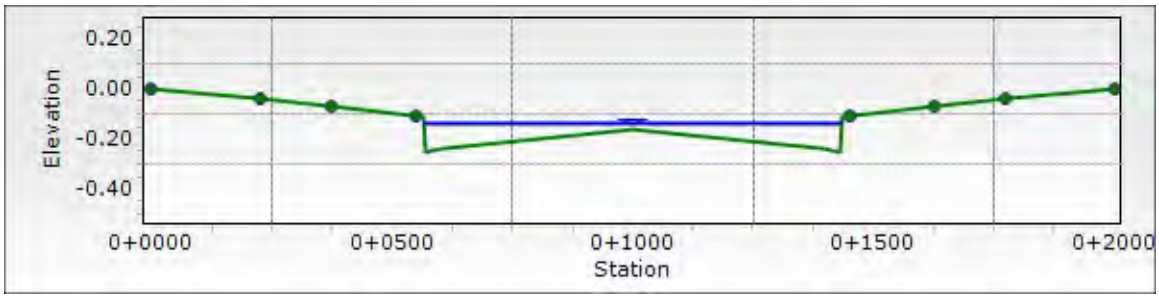
PLAN FILE No.

APPENDIX E:
FlowMaster Results

Cross Section for Dunlop Drive (MH8-9)

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

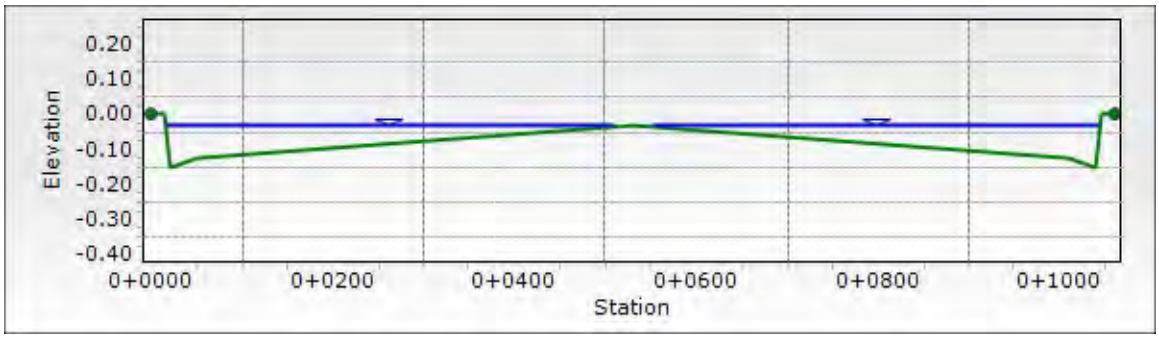
Input Data	
Channel Slope	0.750 %
Normal Depth	114.8 mm
Discharge	0.57 m³/s



Cross Section for STN 3+00 (MH4-6)

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

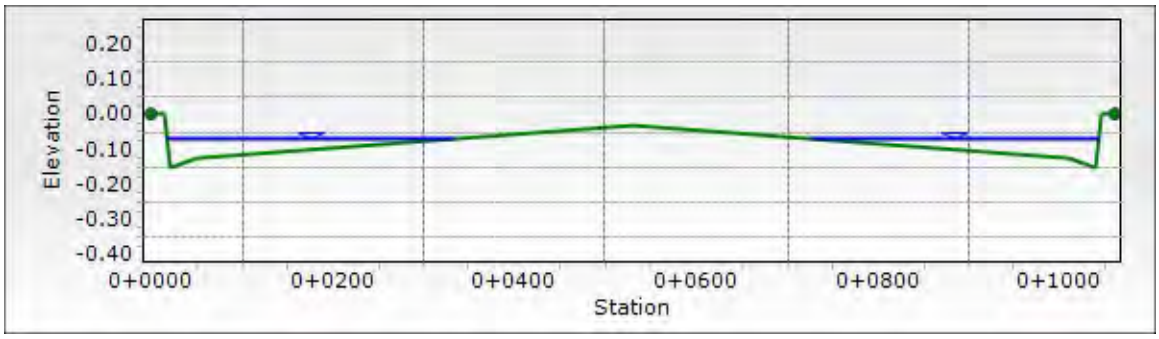
Input Data	
Channel Slope	0.800 %
Normal Depth	116.6 mm
Discharge	0.45 m³/s



Cross Section for STN 7+10(MH15-17)

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

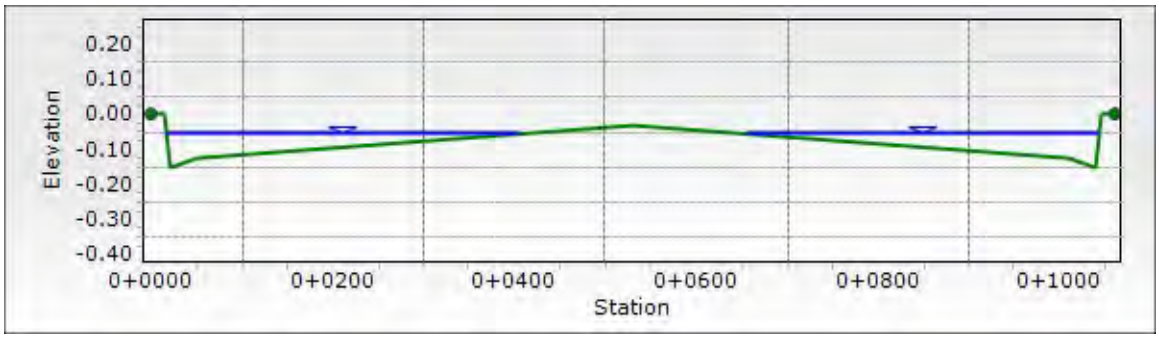
Input Data	
Channel Slope	2.100 %
Normal Depth	81.9 mm
Discharge	0.23 m³/s



Cross Section for STN 10+00 (MH23-25)

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

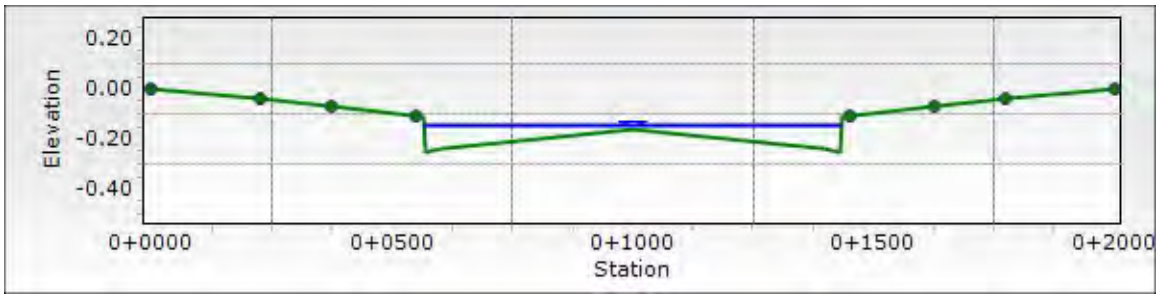
Input Data	
Channel Slope	0.610 %
Normal Depth	96.1 mm
Discharge	0.21 m³/s



Cross Section for Street A (MH17-21)

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.750 %
Normal Depth	110.0 mm
Discharge	0.50 m³/s



APPENDIX F:
Modified Rational Method Calculations

Subject: Existing Condition Peak Discharges North to Stone Church Rd
Project: West 5th EA
Project No.: 165001381
Client: City of Hamilton
Date: 8/19/2025

Exisiting Flow to Outlet 6

Area		RC	Weighted RC
ROW	0.320	0.566	0.632
Catchment 610	1.160	0.65	
Total	1.480		

Time of Concentration (Minimum per City of Hamilton)	10	min
Runoff Coefficient	0.63	
Area	1.480	ha

Event	a	b	c	Rainfall Intensity (mm/hr)	Composite RC	Peak Discharge (cms)
2-year	646	6	0.71	90.2	0.63	0.235
5-year	1050	8	0.803	103.1	0.63	0.268
100-year	2317.4	11	0.836	181.8	0.63	0.473

Subject: Proposed Condition Peak Discharges North to Stone Church Rd
Project: West 5th EA
Project No.: 165001381
Client: City of Hamilton
Date: 8/19/2025

Proposed Flow to Outlet 6

Area		RC	Weighted RC
ROW	0.320	0.73	0.667
Catchment 610	1.160	0.65	
Total	1.480		

Time of Concentration (Minimum per City of Hamilton)	10	min
Runoff Coefficient	0.67	
Area	1.480	ha

Event	a	b	c	Rainfall Intensity (mm/hr)	Composite RC	Peak Discharge (cms)
2-year	646	6	0.71	90.2	0.67	0.248
5-year	1050	8	0.803	103.1	0.67	0.283
100-year	2317.4	11	0.836	181.8	0.67	0.499

Subject: Modified Rational Method Calculation
Project: West 5th EA
Project No.: 165001381
Client: City of Hamilton
Date: 8/19/2025

Modified Rational Method- Outlet 6

Total Drainage Area: 1.480 ha
% Impervious: 22%

Area		RC	Weighted RC
ROW	0.320	0.69	0.659
Catchment 610	1.160	0.65	
Total	1.480		

Composite Runoff Coefficient: 0.66

Mount Hope IDF Parameters - 5 year		
a	b	c
1050	8	0.803

Rainfall Intensity

Use Mount Hope 5-Year Design Storm

Storage Calculation

Release Rate: 0.25650 cms

Time (min.)	Rainfall Intensity (mm/hr)	Peak Runoff Rate (cms)	Incremental Runoff Volume (cu. m)	Incremental Outflow Volume (cu. m)	Storage Volume (cu. m)	
1	179.9	0.487	29	15	13.9	
2	165.3	0.448	54	31	23.0	
3	153.1	0.415	75	46	28.5	
4	142.8	0.387	93	62	31.3	
5	133.9	0.363	109	77	31.9	<= Max. Storage
6	126.1	0.342	123	92	30.7	
7	119.3	0.323	136	108	28.1	
8	113.3	0.307	147	123	24.3	
9	107.9	0.292	158	139	19.4	
10	103.1	0.279	168	154	13.7	
11	98.7	0.267	177	169	7.3	