Stormwater Management Report for The Drummond Subdivision

City of Ottawa
May 2022
Updated June 2023

Prepared for: David Schaeffer Engineering Ltd.

Prepared by:

JFSA Water Resources and Environmental Consultants

JFSA Ref. No.: 2226-21

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in the City of Ottawa

June 2023

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Background: Rational for Report Update

This report is an update of the approved May 2022 "Stormwater Management Report for The Drummond Subdivision". The updates reflect the addition of Glaciation Lane along the western edge of the park block and a corresponding reduction in the park block area. The park block near the Ridge SWM pond has also been slightly reduced and replaced with residential units. Slight refinements have been made to the alignment of roads and the storm sewer network within this phase of development, and have been incorporated into the model accordingly, but these minor adjustments have negligible impacts on the storm sewer operations previously assessed.

Stormwater Management Report for The Drummond Subdivision

in the City of Ottawa
October 2021
Updated May 2022

1 INTRODUCTION AND OBJECTIVES

J.F. Sabourin and Associates Inc. (JFSA) was retained by David Schaeffer Engineering Ltd. (DSEL) to prepare a Stormwater Management (SWM) Plan for the Drummond Subdivision, located in Barrhaven within the City of Ottawa. As shown by the image provided on the cover page, the future development is located east of Borrisokane Road and Highway 416, south of Cambrian Road and north of the Ridge Development. The site has a total drainage area of approximately 19.06 ha, with 13.19 ha of the proposed development being serviced by a dry SWM pond that is implemented in the northwest corner of the development which services both the Ridge and Drummond sites and will discharge to the Jock River via an existing ditch on the west side of Borrisokane Road. This portion of the proposed development will meet water quality requirements via Etobicoke Exfiltration Trenches, CB Infiltration trenches, and two oil-and-grit separators that discharge to the SWM pond, which have been sized to ensure 80% Total Suspended Solids (TSS) removal, for more details regarding the OGS units within the development please refer to JFSA's July 2020, Pond Design Brief for the Ridge (Brazeau) Subdivision. The remaining 5.87 ha of the Drummond site will discharge to the east to the Halfmoon Bay SWM facility, refer to JFSA August 2021 *"Stormwater Management Report for Phase 3 of the Half Moon Bay West Subdivision"* for full details on this SWM facility.

As documented in the Barrhaven South Urban Expansion Area Master Servicing Study, by J. L Richards 2018, the development will also have Etobicoke Exfiltration Systems (EES) implemented within this subdivision. These EES will be installed within local roadways of the subdivision, to exfiltrate runoff from the development for the more frequent events. To ensure some conservatism within the SWM design, the benefits of these EES have not been included in this detailed SWM analysis. Full details of these EES units and the respective post-development water budget have been documented in the JFSA June 2023 memo titled "*The Drummond (The Ridge Phase 3/4): Low Impact Development (LID) Design*"

The Drummond development has a total drainage area of approximately 19.06 ha and consists primarily of single and townhomes, making up 17.33 ha, with the remaining 1.73 ha consisting of park blocks. Figure 1 provides an overview of the location of these respective blocks within the subdivision.

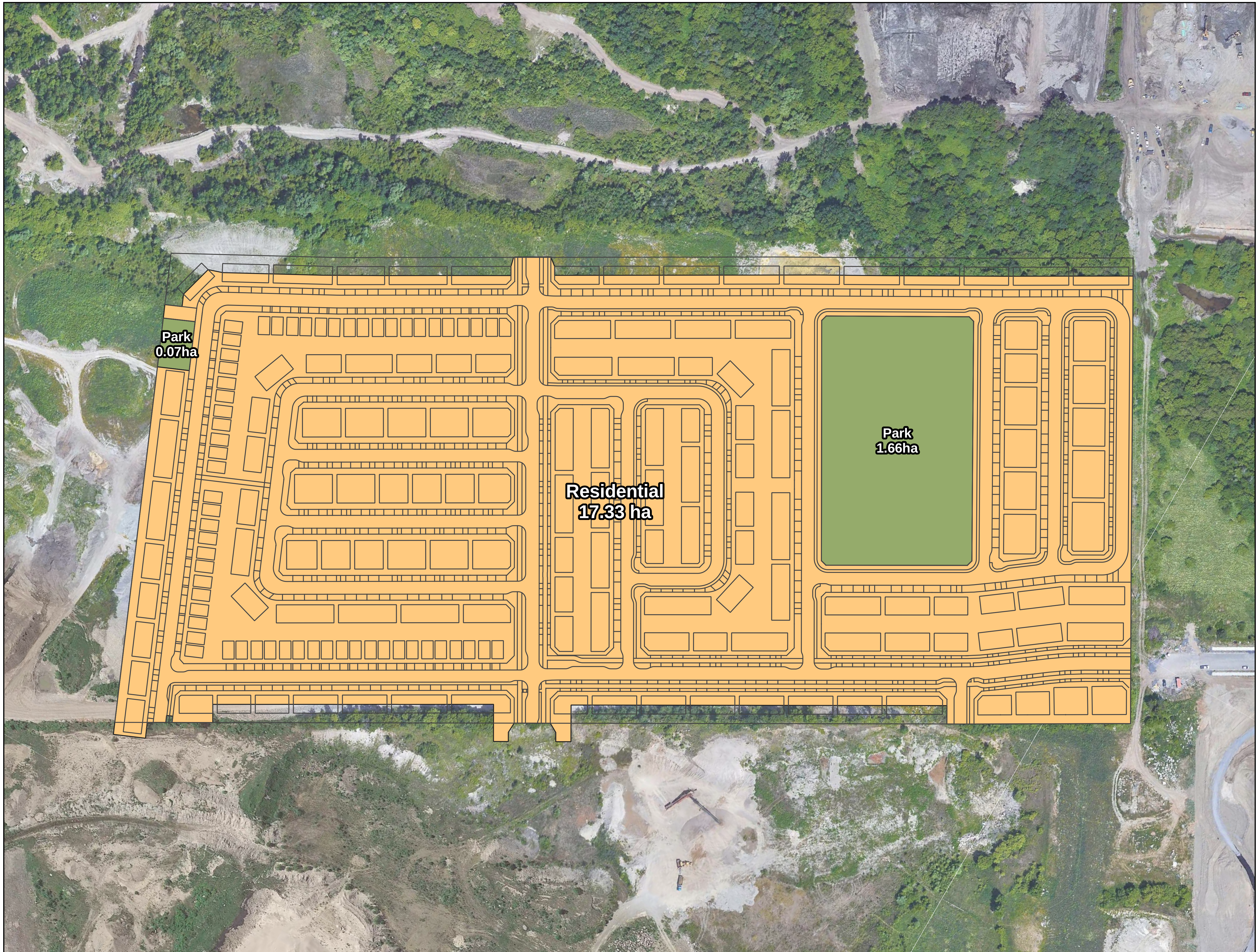
The purpose of this report is to evaluate the major and minor system flows of the proposed development with respect to the City of Ottawa stormwater management guidelines and to check the adequacy of the proposed pipe sizes to convey the 2-year (5-year on collector and 10-year on arterial roads) and the 100-year storm flows from within the development and from external areas. As well as assess the site's quality control targets, SWM pond operations and flow contributions to Greenbank Road.

The following background documents were reviewed in preparing this report:

- *Stormwater Management Planning and Design Manual,* Ministry of the Environment, March 2003.
- *Jock River Flood Risk Mapping (within the City of Ottawa) Hydraulics Report*, PSR Group Ltd. and J.F. Sabourin and Associates Inc., November 2004.
- *Erosion and Sediment Control Guidelines for Urban Construction,* Conservation Halton et al., December 2006.
- *Draft City of Ottawa Stormwater Management Facility Design Guidelines,* IBI Group, April 2012.
- *City of Ottawa Sewer Design Guidelines,* City of Ottawa, October 2012.
- *Technical Bulletin ISDTB-2014-01, Revisions to Ottawa Design Guidelines – Sewer,* City of Ottawa, February 2014.
- *The City of Ottawa Technical Bulletin PIEDTB-2016-01*, City of Ottawa, September 2016.
- *The City of Ottawa Technical Bulletin ISTB-2018-04*, City of Ottawa, June 2018.
- *Functional Servicing Report for Caivan Communities, Brazeau Lands, 3809 Borrisokane Road*, David Schaeffer Engineering Limited, September 2019.
- *Design Brief for the Stormwater Management Pond for the Ridge (Brazeau) Subdivision,* David Schaeffer Engineering Limited and J.F. Sabourin and Associates Inc., July 2020.
- *Stormwater Management Report Pond for the Ridge (Brazeau) Subdivision,* David Schaeffer Engineering Limited and J.F. Sabourin and Associates Inc., July 2020.
- *The Ridge (Brazeau): Low Impact Development (LID) Design,* J.F. Sabourin and Associates Inc., July 2020.
- *Brazeau / Drummond Oil-Grit Separator Design Details,* David Schaeffer Engineering Limited, July 2020.
- *Stormwater Management Report for Phase 3 of the Half Moon Bay West Subdivision for full details on this SWM facility, JFSA August 2021*

As per the September 2016 *City of Ottawa Technical Bulletin PIEDTB-2016-01*, the proposed subdivision has been designed with a 2-year minor system level of service on local roads and a 5-year level of service on collector roads (Dundonald Drive & Elevation Road). Where possible with grading and minor system capture limitations, road ponding areas up to 35 cm deep were used to contain the 100-year major system flows.

PCSWMM was used to model the major and minor systems, to ensure that all stormwater management requirements are satisfied. The general SWM design criteria and guidelines that are to be met are described in Section 2. The existing Ridge detailed PCSWMM model (developed by JFSA in 2020) has been updated to include the detailed design of the Drummond site, which was previously represented in the Ridge model as lumped subcatchments. Small refinements have also been made to the drainage areas within the Ridge development which have also been incorporated in this updated analysis, refer to JFSA's February 2022 memo titled: "*The Ridge – Updated HGL Analysis*" for full details regarding changes to the Ridge development.



Legend

- Park
- Residential
- Development Plan

SCALE: 1:2500

0 50 100 m

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DSEL
david schaeffer engineering ltd

Drummond SWM Report

Figure 1: Site Overview

PROJECT	2226-21
DRAWN	ON
DATE	JUNE 2023

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2 DESIGN CRITERIA AND GUIDELINES

The design criteria and guidelines used for the stormwater management of the subject subdivision are those that were developed in the background documents, as well as those provided in the October 2012 *City of Ottawa Sewer Design Guidelines* and subsequent technical memorandums, and generally accepted stormwater management design guidelines.

The detailed design of the proposed development determined that the 19.06 ha subdivision has an average imperviousness of 64%. The total 71 ha drainage area to the dry pond has an average imperviousness of 64%. A detailed analysis of the proposed dual drainage system was required to confirm that the following general design criteria and guidelines for the minor and major systems would be met.

2.1 Minor System

a) Storm sewers are to be designed to provide a minimum 2-year level of service, plus 5-year inflows on collector roads (Dundonald Drive & Elevation Road) and 10-year inflows on arterial roads.

b) The 100-year hydraulic grade line (HGL) within the development minor systems must be maintained at least 0.3 m below the underside of footing elevation where gravity house connections are installed.

c) For less frequent storms (i.e. larger than 1:2 year or 1:5 year on collector / 1:10 year on arterial roads), the minor system shall, if required, will be limited with the use of inlet control devices to prevent excessive hydraulic surcharges and to maximize the use of surface storage on the road where desired.

d) Catchbasins on the road are to be equipped with City standard type S19 (fish) grates or City standard type S22 side inlets, and grates for catch basins in rear yards, parks and open spaces with pedestrian traffic are to be City standard type S19, S30 and S31.

e) Both Single and double catch basins are to be equipped with 200 mm minimum lead pipes.

f) Rearyard catchbasins are to be equipped with 250 mm minimum lead pipes. Catchbasins installed on the street, where rearyard catchbasins connect to the main storm sewer through the catchbasin, are to be equipped with 250 mm minimum lead pipes for both single and double catch basins.

g) Under full flow conditions, the allowable velocity in storm sewers is to be no less than 0.80 m/s and no greater than 3.0 m/s. Where velocities over 3.0 m/s are proposed, provisions shall be made to protect against displacement of sewers by sudden jarring or movement. Velocities greater than 6 m/s are not permitted.

2.2 Major System

a) The major system shall be designed with enough road surface storage to allow the excess runoff of a 100-year storm to be retained within road ponding areas where desired.

b) Inlet control devices should be sized such that they do not create surface ponding on the road during the 2-year design storm on local roads (5-year design storm on collector and 10-year design storm on arterial roads); it should be noted that surface ponding over grates is present during rainfall under any design, as an appropriate depth of water is required for runoff to enter the grate (refer to Tables D-6 of Appendix D).

c) Roof leaders shall be installed to direct the runoff to splash pads and onto grassed areas.

d) For the 100-year storm, the maximum total depth of water (static + dynamic) on all roads shall not exceed 35 cm at the gutter.

e) During the 100-year + 20% stress test, the maximum extent of surface water on streets, rearyards, public space and parking areas shall not touch the building envelope.

f) When catchbasins are installed in rear yards, safe overland flow routes are to be provided to allow the release of excess flows from such areas.

g) The product of the maximum flow depths on streets and maximum flow velocity must be less than 0.60 m^2/s on all roads.

h) The excess major system flows up to the 100-year return period are to be retained on-site in development blocks such as parks, schools, commercial, etc.

i) There must be at least 15 cm of vertical clearance between the spill elevation on the street and the ground elevation at the nearest building envelope that is in the proximity of the flow route or ponding area.

j) There must be at least 30 cm of vertical clearance between the rearyard spill elevation and the ground elevation at the adjacent building envelope.

3 ASSUMPTIONS AND SOURCE OF DATA USED IN THIS STUDY

Sources of information and assumptions made in this study are listed below:

- Stormwater management model:	*PCSWMM (version 7.4)*
- Minor system design:	*1:2 year, plus 1:5-year inflows on collector roads and 1:10 year on arterial roads. See the Rational Method Calculations in Appendix A.*
- Major system design:	*1:100 year*
- Max. 100-yr water depth on roads:	*35 cm above the gutter*
- Extent of the major system:	*Shall not touch the building envelope during the 100-year + 20% stress test*
- PCSWMM model parameters:	*Fo = 76.2 mm/hr, Fc = 13.2 mm/hr, DCAY = 4.14/hr, D.Stor.Imp. = 1.57 mm, D.Stor.Per. = 4.67 mm (as per 2012 City of Ottawa Sewer Design Guidelines)* *Detailed Area Imperviousness: based on development layout. Lumped Area Imperviousness: based on runoff coefficient (C) where C = 0.7 x imperviousness ratio+ 0.2.*
- Design storms:	*2-, 5-, 10- and 100-year 3-hour Chicago and 100-year 24-hour SCS Type II storms as per 2012 City of Ottawa Sewer Design Guidelines; peak averaged over 10 minutes.*
- Historical Events:	*July 1st, 1979; August 4th, 1988; and August 8th, 1996 events as per 2012 City of Ottawa Sewer Design Guidelines.*
- Stress Test:	*20% increase in the 100-year 3-hour Chicago storm.*
- Street catchbasin covers:	*City Standard Type S19 (fish) or City Standard Type S22 (side inlet). Type S19 approach flow-capture curves as per MTO design charts (equivalent to OPSD 400.010). Type S22 approach flow-capture curves as per the 2004 City of Ottawa Guidelines.*
- Rearyard catchbasin covers:	*City Standard Type S19, S30 and S31*
- Curb and gutter:	*City Standard SC1.3 (mountable) and SC1.1 (barrier). In the absence of flow capture curves for these curbs and gutters, OPSD 600.010 curb and gutters are assumed.*
- Manning's' roughness coeff.:	*0.013 for concrete and PVC pipes (free flow).*
- Minor system losses:	*Refer to Appendix C for maintenance hole loss coefficients.*
- Underside of footing elevations:	*As provided by DSEL.*
- Freeboard in HGL analysis:	*0.3 m between the underside of footing elevation and 100-year hydraulic gradeline.*
- Inlet Control Devices:	*Refer to Appendix B for Plas-Tech ICD details.*
- Depth of backyard swales:	*As per DSEL's Grading Plan*
- Street and pipe dimensions:	*As per DSEL's Plan and Profiles*
- Right-of-way characteristics:	*As per DSEL's Details of Roads*
- Downstream HGL:	*92.5 m based on the top of bank elevation of the ditch that the SWM pond will outlet to.*

4 PROPOSED MINOR AND MAJOR SYSTEM DRAINAGE

As mentioned above, the Drummond development shares a dry SWM pond with the Ridge Development; a detailed PCSWMM model of the Ridge site was developed by JFSA in July 2020, which included the Drummond lands, but as lumped subcatchments. As additional detail is now available for the Drummond lands the Ridge PCSWMM model has been updated to include all the modelling details (major & minor system) of the Drummond Site. There have also been a few refinements to the total drainage area within the Ridge development, which have been included in this updated analysis, in addition to a few minor stormwater pipe invert updates to reflect the as-built survey. The HGL within the Ridge development has been assessed based on these latest model updates with full details and USF analysis/results provided in Attachment F of this report.

Within the Drummond development, the minor system within the site has been designed to accommodate a minimum of the 2-year post-development flows from within the site and from external areas and 5-year inflows on collector roads (Dundonald Drive & Elevation Road). A Rational Method design was conducted by DSEL (refer to Appendix A) to estimate minor system flows based on the City of Ottawa IDF relationship and selected runoff coefficients. The minor system release rates from the parklands were set to the 5-year flow based on the rational method, with no onsite storage assumed.

As noted earlier in this report, where possible with grading limitations, road ponding areas up to 35 cm deep were used to contain the 100-year major system flows in the development. Note that rear yard catch basins were connected to catch basins on the road where possible, to allow rear yard runoff access to the storage in road ponding areas at regular intervals. In a design of this type where lots are serviced by gravity house connections, inlet control devices (ICDs) can be used to limit minor system capture at each catchbasin to the appropriate level of service.

Within the development, circular orifice plate type Inlet Control Devices (ICDs) of City standard diameters of 83 mm, 94 mm, 102 mm, 108 mm, 127 mm, 152 mm and 178 mm will be used to limit minor system capture to a minimum of the 2-year flow (refer to Appendix B for Plas-Tech ICD details), allowing for sub-surface storage of 0.5 m^3 in single catchbasins, 1.0 m^3 in double catch basins, and 1.9 m^3 in catchbasin manholes. Note that this subsurface catchbasin storage has not been included in the modelling to be conservative.

The street segments within the proposed development have been designed using a 'saw tooth' or 'sagged' road profile. The runoff from within these segments will be conveyed to catch basins located at the lowest point within the street segment. Flows more than the catchbasin capture rate will be temporarily stored within the 'sagged' street segments and released slowly to the storm sewers, up to the 100-year design storm. When the storage on a specific street segment is surpassed due to blockage or an event greater than the 100-year storm, the excess water will flow towards the next downstream street sag, and eventually to the pond. It should be noted that the major system would outlet during the 100-year + 20% stress test without flooding any of the properties within the subdivision.

Additionally, surface storage volumes that may exist in the rear yards have not been considered in this model, and runoff from these areas has been directed straight to the catchbasin on the road that each rear yard swale will discharge to. This has been completed to ensure that the peak flows and ponding volumes calculated in the model are conservative.

The PCSWMM analysis, discussed in Sections 4.1 and 4.2, demonstrates that the proposed drainage system for the subdivision will have sufficient capacity to control the excess flow during a 100-year storm and safely capture and convey the 2-year (plus 5-year on collector roads) flow to the pond.

It is important to note that all values presented in this report are based on the maximum reported value (at 1-minute intervals), instead of the maximum simulated values (at 1-second intervals) as this avoids the model reporting any small blips/instabilities that may occur during any model simulation as real values, the justification for this being that there may be simply short-term model convergence issues reflected in the maximum simulated values that are not reflective of the real result. Taking the results reported by the model every minute, instead of every second ensures that these minor model convergence issues are not reported as real results.

4.1 Major System and SWM Analysis

The PCSWMM model was developed based on the information provided in Figures 2 and 3. Nine (9) simulations were conducted, one for each of the following rainfall events:

i) the 2-year, 3-hour Chicago storm;
ii) the 5-year, 3-hour Chicago storm;
iii) the 100-year, 3-hour Chicago storm;
iv) the 100-year, 24-hour SCS Type II storm
v) the July 1st, 1979 historical event;
vi) the August 4th, 1988 historical event;
vii) the August 8th, 1996 historical event; and
viii) the 100-year, 3-hour Chicago storm + 20%.

Note that the purpose of simulating the 100-year, 3-hour Chicago storm with a 20% increase is to stress test the drainage system for potential flooding, as per the October 2012 *City of Ottawa Sewer Design Guidelines*. The depression storage and infiltration parameters in both the PCSWMM and SWMHYMO models are as per the October 2012 *City of Ottawa Sewer Design Guidelines*. The percent imperviousness of the detailed drainage areas has been established based on zoning requirements and represents the largest allowable footprint on each lot. Figure 3 provides an overview of the subcatchments. Table D-3 provides a full summary of all Drummond subcatchment parameters modelled in PCSWMM.

Where required inflows are limited by circular orifice plate type Inlet Control Devices (ICDs) of City standard diameters 83 mm, 94 mm, 102 mm, 108 mm, 127 mm, 152 mm and 178 mm. In locations where these CBs only capture flow from the road (no rear yard contribution), these

ICDs have simply been represented as depth/flow curves based on the ponding at the CB grate, that reflect the function of the respective ICDs under a full head (ICD invert to road ponding elevation). Refer to Table D-4A in Appendix D for inflow curves for catch basins at localized depressions with ICDs.

To best represent the connection between the minor and major systems, each grate and ICD/lead pipe of the catch basins has been explicitly represented in the model. Each CB in the model has been represented as a node, with the hydraulic operations of each CB grate explicitly represented as either a bottom or side rectangular orifice depending on the implementation of the conventional CB or Curb Inlet CB, with the associated equivalent opening area and dimension. ICDs have been represented as vertical orifices with the respective ICD size, where no ICD is required the proposed lead pipe has been represented in the model as a short tube orifice (C_o=0.82) with the corresponding pipe diameter applied. When CBs also have flow contributions from rear yards, flows from the rear yards are placed directly to the CB node, while flows from the road are placed on the road which ensures that these flows first have to pass through the CB grate before entering the CB. This configuration allows the model to independently determine if at any given instant during a simulation whether the grate or ICD/lead pipe is controlling flow, this modelling approach is also the preferred approach as it will perform accurately under backwater conditions or in conditions where the ICD outlet is submerged. Refer to the figures and tables provided in Appendix B, which compare the various CB grate approach flow capture curves of these theoretical orifices against the empirical approach flow capture curves per the City of Ottawa guidelines. As can be seen from the figures and tables, the two methods correspond well at lower flows with a difference in capture of approximately ± 8 L/s for approach flows between 0 and 150 L/s and less well at greater flows (approach flows above 200 L/s) with longitudinal slopes below 1% and above 3%. It is important to reiterate that the ICDs are typically the feature that determines the split between the minor and major system and the representation of grates as an orifice is the preferred approach since it performs accurately under backwater conditions or in conditions where the ICD outlet is submerged, significantly reducing instability issues in the model. Although it is acknowledged that this representation is not a perfect fit to the empirically derived values, they currently provide a reasonable representation of the flow constrictions provided by the various grate options. Future investigations will be completed by JFSA using this methodology to get a closer match to the empirically derived results, per the City guidelines.

Note that for this development 200 mm diameter lead pipes were assumed and are required between single catchbasins and the storm sewers, and 250 mm diameter lead pipes were assumed and are required between rearyard catchbasins or single catchbasin maintenance holes and the storm sewers (note that this detail has not been included in the modelling). No temporary CBs are required within the development.

Table D2 provides a comparison of the simulated Level of service (mix of 2 and 5-year flows) for each subcatchment against the rational method peak flows for each area. From this analysis, it is seen that the average difference between the rational method and simulated level of service flow is on average 0.9 L/s, with larger discrepancies for larger lumped areas, where determining the time of concentration is more subjective / less well-defined.

Within the proposed subdivision, the dynamic flow depth on the road (at the gutter) will be minimal during the 100-year Chicago storm, as the 100-year flows are mostly retained within the road ponding areas and do not accumulate as in a typical subdivision design. Furthermore, it was determined that for the 100-year storm at all major system segments, the product of the depth of water (m) at the gutter multiplied by the velocity of flow (m/s) will not exceed the maximum allowable 0.6 m^2/s (refer to Table D-8 of Appendix D, where the calculated maximum was determined to be 0.25 m^2/s). Table D-9 of Appendix D presents the stress test results for dynamic flow depth on the road based on a 20% increase in the 100-year storm, as per the October 2012 *City of Ottawa Sewer Design Guidelines*. As shown in Table D-9, the maximum dynamic flow depth under these conditions is calculated as 43 cm, and the product of the depth of water at the gutter multiplied by the velocity of flow is 0.35 m^2/s.

Details of the 100-year street maximum water depth and surf elevations are provided in Table D-7 of Appendix D. Depths calculated by the PCSWMM model demonstrate that a total 100-year depth of water (static and dynamic) on the street at these ponding areas will not exceed the maximum depth of 35 cm.

Table D-7 of Appendix D also presents the street storage stress test results based on a 20% increase in the 100-year storm, as per the October 2012 *City of Ottawa Sewer Design Guidelines*. As shown in Table D-7, the maximum depth of water (static + dynamic overflow) at any ponding area under these conditions is calculated as 45 cm. The maximum extent of surface water during the 100-year + 20% stress test will not touch the building envelopes, refer to stress test ponding extent figures provided by DSEL.

An overland flow route is to be provided on Expansion Road in the subdivision to safely convey flows to the pond (Junction C144). This overflow has been set that the crest of the spill elevation and has been represented in the model as a 5m wide open rectangular cross-section. The maximum 100-year major system flow to the pond was found to be 0.412 m^3/s. as required to convey the 100-year major system flow without exceeding 35 cm during the 100-year storm, and without touching the building envelopes during the 100-year + 20% stress test. Based on the PCSWMM model the overland flow route will have a maximum flow depth of 8 cm during the 100-year 3-hour Chicago storm and 18 cm during the 100-year + 20% stress test. Table 1 presents a summary of the major system results simulated in PCSWMM during the 100-year Chicago storm.

For the lands that drain to the Halfmoon Bay SWM facility, 100-Year capture has been provided within the Drummond site and as such, there is no major system flow from the Drummond site to future Greenbank Road. Table 1 provides a summary of the approach flow and capture flow at each respective CB and the associated maximum ponding depth during the 100-year event.

Table 1: Approach Flows and Captured Flows for the 100-Year Chicago Storm

Catch Basin ID	Total Approach Flow (m³/s)	Total Capture (m³/s)	Max Ponding Depth (cm)
CB_124	0.170	0.029	25
CB_126	0.134	0.044	22
CB_127	0.134	0.044	22
CB_129	0.111	0.028	9
CB_130	0.111	0.028	9
CB-1	0.047	0.021	4
CB-104	0.049	0.017	4
CB-107	0.031	0.023	4
CB-91	0.266	0.090	29
CB-12	0.108	0.044	21
CB-13	0.108	0.024	21
CB-14	0.098	0.024	15
CB-16	0.108	0.062	17
CB-17	0.108	0.062	17
CB-2	0.047	0.021	4
CB-3	0.056	0.034	6
CB-4	0.244	0.061	9
CB-47	0.037	0.029	5
CB-48	0.063	0.030	5
CB-49	0.139	0.065	26
CB-5	0.200	0.032	18
CB-50	0.139	0.065	26
CB-51	0.113	0.045	24
CB-52	0.113	0.045	24
CB-53	0.079	0.030	5
CB-54	0.079	0.030	5
CB-55	0.009	0.009	3
CB-56	0.039	0.031	5
CB-57	0.031	0.027	5
CB-58	0.029	0.024	4
CB-59	0.050	0.036	6
CB-6	0.200	0.032	18
CB-60	0.065	0.029	5
CB-61	0.193	0.065	28
CB-62	0.193	0.065	28
CB-7	0.015	0.010	2
CB-70	0.081	0.030	5
CB-71	0.081	0.030	5
CB-72	0.142	0.065	26
CB-73	0.142	0.045	26
CB-8	0.015	0.010	2
CB-92	0.266	0.046	29
CB-93	0.378	0.020	30
CB-94	0.378	0.020	30
DCB_117	0.235	0.030	6
DCB_122	0.235	0.027	6
ICD-CB_100	0.013	0.013	3
ICD-CB_101	0.119	0.023	8
ICD-CB_102	0.132	0.018	9
ICD-CB_103	0.143	0.041	9
ICD-CB_105	0.153	0.043	8
ICD-CB_106	0.129	0.018	8
ICD-CB_108	0.027	0.017	4
ICD-CB_109	0.147	0.059	29
ICD-CB_11	0.071	0.059	10
ICD-CB_110	0.147	0.041	29
ICD-CB_111	0.110	0.033	7
ICD-CB_112	0.110	0.020	7
ICD-CB_20	0.065	0.061	5

Table 1: Approach Flows and Captured Flows for the 100-Year Chicago Storm

Catch Basin ID	Total Approach Flow (m³/s)	Total Capture (m³/s)	Max Ponding Depth (cm)
ICD-CB_21	0.026	0.016	3
ICD-CB_22	0.025	0.019	4
ICD-CB_23	0.074	0.059	9
ICD-CB_24	0.018	0.017	4
ICD-CB_25	0.026	0.019	4
ICD-CB_27	0.064	0.064	12
ICD-CB_28	0.061	0.019	23
ICD-CB_29	0.061	0.019	23
ICD-CB_30	0.084	0.018	6
ICD-CB_31	0.084	0.062	6
ICD-CB_32	0.032	0.018	4
ICD-CB_33	0.053	0.043	7
ICD-CB_34	0.071	0.018	6
ICD-CB_35	0.079	0.018	7
ICD-CB_36	0.082	0.017	7
ICD-CB_37	0.113	0.028	8
ICD-CB_40	0.075	0.024	24
ICD-CB_41	0.075	0.024	24
ICD-CB_42	0.021	0.021	4
ICD-CB_43	0.055	0.018	7
ICD-CB_44	0.031	0.024	6
ICD-CB_45	0.070	0.044	27
ICD-CB_46	0.076	0.043	25
ICD-CB_63	0.077	0.018	8
ICD-CB_64	0.098	0.062	9
ICD-CB_65	0.129	0.018	8
ICD-CB_66	0.033	0.018	4
ICD-CB_67	0.159	0.058	9
ICD-CB_68	0.178	0.020	31
ICD-CB_69	0.178	0.020	31
ICD-CB_74	0.175	0.019	29
ICD-CB_75	0.175	0.019	29
ICD-CB_76	0.098	0.030	6
ICD-CB_77	0.056	0.028	5
ICD-CB_78	0.040	0.018	5
ICD-CB_79	0.040	0.018	5
ICD-CB_80	0.025	0.012	3
ICD-CB_81	0.023	0.018	4
ICD-CB_82	0.039	0.018	18
ICD-CB_83	0.039	0.024	18
ICD-CB_84	0.087	0.026	6
ICD-CB_85	0.087	0.027	6
ICD-CB_87	0.090	0.023	7
ICD-CB_89	0.135	0.058	27
ICD-CB_9	0.081	0.044	7
ICD-CB_90	0.135	0.058	27
ICD-CB_96	0.161	0.086	31
ICD-CB_97	0.172	0.018	10
ICD-CB_98	0.163	0.063	10
ICD-CB_99	0.150	0.027	9
ICD-CICB_19	0.107	0.107	17
ICD-DCB_38	0.232	0.086	33
ICD-DCB_39	0.232	0.086	33
		Max	**33**

4.2 Minor System and Hydraulic Grade line Analysis

The minor system analysis was completed using the PCSWMM program based on the peak flows captured during the rainfall events. Note that the storm sewer design is as provided by DSEL, and Manning's roughness coefficient of 0.013 was used for concrete and PVC storm sewer pipes. Refer to Appendix C for maintenance hole loss coefficients used in the PCSWMM model.

The minor system performance was analyzed under restrictive downstream conditions. Restrictive downstream conditions for the pond are based on the approximate top-of-bank elevation of 92.5 m at the existing Borrisokane Road ditch that the storm sewer will outlet to. Table 2 presents the peak minor system outflows from both the Drummond & Ridge Sites to the SWM pond (MH-500 & MH-400) based on DSEL rational method calculation tables as well as detailed PCSWMM modelling.

Table 2 – Rational Method & Detailed Modelling Peak Flows

Location	DSEL Rational Method Flow (m^3/s)	2-Year PCSWMM Flow (m^3/s)	5-Year PCSWMM Flow (m^3/s)	100-Year PCSWMM Flow (m^3/s)
MH-500	0.888	2.519	3.485	4.285
MH-400	4.833	3.166	4.599	5.814
Total	5.721	5.685	8.084	10.099

Table 2 shows that the total 2-year flows simulated by the PCSWMM model are slightly smaller but overall similar to the values calculated by DSEL's Rational Method calculations, which is as expected as the rational method is a combination of both the 2- and 5-year flows from the various subcatchments. It is also important to note that the rational method calculations do not consider the Maintenance Hole junction between MH 307 and MH 313, which allows flows from the south (larger of the two) to assess the northern storm sewer inlet to the Pond (MH 500), therefore the individual peak flows to MH 400 and 500 per the rational method do not match the detailed PCSMWM modelling that considers this flow split. Table D2 compares the peak flows from each of the catchments against the peak flows calculated based on the rational method. From this analysis, it is seen that on average there is a difference of 0.9 L/s between the rational method and the PCSWMM model subcatchments.

The PCSWMM simulations have determined that for the selected 2-, 5- and 100-year storms, the total minor system flows would be 5.685 m^3/s, 8.084 m^3/s and 10.099 m^3/s, respectively. It should be noted that the total 100-Year minor system flows within the development are almost twice that of the 2-Year event, the reason for this is that several ICDs within the development had to be upsized to ensure major system ponding levels did not exceed 0.35cm for the 100-year events. The reason that ICDs had to be upsized is due to the cascading design of the major system; best efforts have been made to maximize the major system storage during larger events, but when the runoff from the site exceeds this capacity the major system cascades to the next downstream street segment, which then results in a snowball effect of a major system cascading to the next downstream segment. At some points, this cascading major system flow needs to be captured into the minor system to ensure that ponding elevations and depth x velocity values are not exceeded, as such ICDs have been upsized at various locations throughout the development. And although the 100-year flow will surcharge most parts of the minor system, a freeboard of 0.3 m between the 100-year hydraulic grade line and the underside of footings is expected to be provided throughout the proposed development.

Tables C-1 to C-6 of Appendix C summarize the pipe data and hydraulic simulation results for the 100-year 3-hour Chicago storm, 100-year 24-hour SCS Type II storm, the stress test event and the three historical events. Note that at all locations the flowing full pipe velocities are no less than 0.80 m/s and no greater than 3.0 m/s for all proposed pipes with the development

Table 3 presents the hydraulic grade line results for the 100-year events, stress test and historical events. As detailed lot grading has not been completed at this time USFs are not available, as a proxy the maximum HGL has been compared to the top of the MH elevation. For the 100-year events it is assumed that a minimum freeboard of 2.2m is required to provide adequate separation between HGL and USFs. For the stress test and historical events, a freeboard of 1.9m has been assumed. From Table 3 below it is seen that all locations except for MH-562 meet this freeboard requirement. It is worth noting that MH-562 only services local road drainage and will not have any foundation drain connections to this location, as such the USF freeboard requirement is not applicable at this location.

Table 3: The Drummond Developmnet HGL Summary

MH	Invert	Rim	100YrCHI3Hr		100YrSCS24Hr		Composite 100 Yr HGL		100YrCHI3Hr+20%		July 1st, 1979		August 4th, 1988		August 8th, 1996	
			HGL (m)	Top MH Freeboard (m)	HGL (m)	Top MH Freeboard (m)	HGL (m)	Top MH Freeboard (m)	HGL (m)	Top MH Freeboard (m)	HGL (m)	Top MH Freeboard (m)	HGL (m)	Top MH Freeboard (m)	HGL (m)	Top MH Freeboard (m)
MH-537	102.66	105.65	102.86	2.79	102.85	2.80	102.86	2.79	102.87	2.78	102.84	2.81	102.86	2.79	102.84	2.81
MH-536	102.50	106.02	102.62	3.40	102.62	3.40	102.62	3.40	102.63	3.39	102.61	3.41	102.62	3.40	102.61	3.41
MH-561	103.01	105.89	103.14	2.75	103.13	2.76	103.14	2.75	103.14	2.75	103.12	2.77	103.13	2.76	103.12	2.77
MH-563	100.82	104.35	101.21	3.14	101.19	3.16	101.21	3.14	101.21	3.14	101.17	3.18	101.20	3.15	101.17	3.18
MH-564	100.64	104.05	100.88	3.17	100.87	3.18	100.88	3.17	100.88	3.17	100.86	3.19	100.88	3.17	100.86	3.19
MH-538	100.89	104.20	101.19	3.01	101.16	3.04	101.19	3.01	101.19	3.01	101.14	3.06	101.17	3.03	101.14	3.06
MH-539	99.62	102.47	100.17	2.29	100.09	2.37	100.17	2.29	100.20	2.26	100.05	2.41	100.11	2.35	100.04	2.42
MH-524	102.13	105.48	102.36	3.12	102.36	3.12	102.36	3.12	102.36	3.12	102.35	3.13	102.36	3.12	102.35	3.13
MH-5240	101.92	105.23	102.18	3.05	102.18	3.05	102.18	3.05	102.18	3.05	102.18	3.05	102.18	3.05	102.17	3.06
MH-525	100.70	104.25	100.99	3.26	100.99	3.26	100.99	3.26	101.01	3.24	100.98	3.27	100.99	3.26	100.98	3.27
MH-502	100.92	104.32	101.18	3.15	101.18	3.15	101.18	3.15	101.18	3.15	101.18	3.15	101.18	3.15	101.17	3.16
MH-503	98.95	102.42	99.43	2.99	99.42	3.00	99.43	2.99	99.44	2.98	99.41	3.01	99.41	3.01	99.39	3.03
MH-500	102.40	105.25	102.61	2.64	102.61	2.64	102.61	2.64	102.61	2.64	102.60	2.65	102.61	2.64	102.60	2.65
MH-557	97.32	100.85	98.11	2.74	98.10	2.76	98.11	2.74	98.13	2.72	98.05	2.80	98.08	2.77	97.97	2.88
MH-556	98.61	101.70	98.96	2.74	98.95	2.75	98.96	2.74	98.98	2.72	98.94	2.76	98.95	2.75	98.90	2.80
MH-558	97.12	100.39	97.81	2.58	97.80	2.59	97.81	2.58	97.81	2.58	97.78	2.61	97.80	2.59	97.72	2.67
MH-504	98.68	101.90	99.07	2.82	99.06	2.83	99.07	2.82	99.07	2.82	99.06	2.83	99.06	2.83	99.05	2.84
MH-528	97.32	101.06	98.27	2.80	98.24	2.83	98.27	2.80	98.33	2.74	98.20	2.87	98.21	2.86	98.17	2.90
MH-554	99.65	102.47	99.78	2.69	99.77	2.70	99.78	2.69	99.78	2.69	99.77	2.70	99.78	2.69	99.76	2.71
MH-560	98.24	101.29	98.86	2.43	98.86	2.43	98.86	2.43	98.88	2.41	98.83	2.46	98.85	2.44	98.69	2.60
MH-566	100.59	103.41	100.59	2.82	100.59	2.82	100.59	2.82	100.59	2.82	100.59	2.82	100.59	2.82	100.59	2.82
MH-565	99.47	102.40	99.75	2.65	99.74	2.66	99.75	2.65	99.75	2.65	99.73	2.67	99.73	2.67	99.74	2.66
MH-562	*101.18*	*103.28*	*101.39*	*1.89*	*101.39*	*1.89*	*101.39*	*1.89*	*101.39*	*1.89*	*101.39*	*1.89*	*101.39*	*1.89*	*101.39*	*1.89*
MH-553	99.06	102.00	99.38	2.62	99.37	2.63	99.38	2.62	99.39	2.61	99.35	2.65	99.36	2.64	99.36	2.64
MH-552	100.16	102.99	100.30	2.68	100.30	2.68	100.30	2.68	100.30	2.68	100.29	2.69	100.30	2.68	100.29	2.69
MH-526	98.64	103.00	100.20	2.80	100.05	2.95	100.20	2.80	100.44	2.56	99.91	3.09	99.99	3.01	99.84	3.16
MH-522	102.73	105.64	102.89	2.75	102.89	2.75	102.89	2.75	102.89	2.75	102.88	2.76	102.89	2.75	102.88	2.76
MH-521	102.81	105.72	103.00	2.72	103.00	2.72	103.00	2.72	103.01	2.71	102.99	2.73	103.00	2.72	102.99	2.73
MH-520	103.09	106.01	103.27	2.74	103.27	2.74	103.27	2.74	103.27	2.74	103.26	2.75	103.27	2.74	103.25	2.76
MH-523	103.22	106.20	103.36	2.84	103.35	2.85	103.36	2.84	103.36	2.84	103.35	2.85	103.35	2.85	103.35	2.85
MH-519	103.45	106.29	103.55	2.75	103.55	2.75	103.55	2.75	103.56	2.74	103.54	2.76	103.55	2.75	103.54	2.76
MH-5560	98.81	101.67	99.12	2.55	99.12	2.55	99.12	2.55	99.12	2.55	99.12	2.55	99.12	2.55	99.10	2.57
MH-5020	101.14	104.32	101.18	3.14	101.17	3.15	101.18	3.14	101.18	3.14	101.17	3.15	101.17	3.15	101.17	3.15
MH-559	94.69	100.18	96.20	3.98	96.18	4.00	96.20	3.98	96.22	3.96	96.12	4.06	96.15	4.03	95.96	4.22
MH-551	97.86	100.93	98.35	2.58	98.34	2.59	98.35	2.58	98.43	2.50	98.32	2.61	98.34	2.59	98.31	2.62
MH-550	99.60	102.62	99.86	2.77	99.86	2.77	99.86	2.77	99.86	2.77	99.85	2.78	99.86	2.77	99.85	2.78
MH-549	99.88	102.82	100.34	2.48	100.33	2.49	100.34	2.48	100.34	2.48	100.32	2.50	100.33	2.49	100.31	2.51
MH-546	101.96	104.84	102.19	2.65	102.19	2.65	102.19	2.65	102.19	2.65	102.19	2.65	102.19	2.65	102.19	2.65
MH-547	100.95	103.97	101.18	2.79	101.18	2.79	101.18	2.79	101.19	2.78	101.18	2.79	101.18	2.79	101.18	2.79
MH-548	100.20	103.13	100.71	2.43	100.70	2.44	100.71	2.43	100.72	2.42	100.66	2.48	100.70	2.44	100.64	2.50
			Max	3.98	**Max**	4.00	**Max**	3.98	**Max**	3.96	**Max**	4.06	**Max**	4.03	**Max**	4.22
			Min	1.89	**Min**	1.89	**Min**	1.89	**Min**	1.89	**Min**	1.89	**Min**	1.89	**Min**	1.89
			Average	2.80	**Average**	2.82	**Average**	2.80	**Average**	2.79	**Average**	2.83	**Average**	2.82	**Average**	2.85

*USF assumed to be 1.9m below top of MH

Italics - No USF connections expected to this location -Freeboard not critical

Freeboard less than 2.2m (assumed USF freeboard less than 0.3m)

Freeboard less than 1.9 m (assumed USF freeboard less than 0 m)

4.3 Half Moon Bay West SWM Facility

As mentioned above approximately 5.87 ha of the proposed Drummond development will discharge to the Half Moon Bay Phase 3 SWM pond. In the analysis completed by JFSA in August 2021 of the Half moon bay SWM facility, it was assumed that 9.61 ha of these lands would drain to the Halfmoon Bay SWM Pond with an average imperviousness of 29%. Based on the latest development plan the 5.87 ha at 53% impervious from the Drummond lands will drain to the Halfmoon Bay Facility. **Figure E1 in Attachment E** outlines the changes in drainage areas per the August 2021 analysis (red) and the latest June 2023 design (green). **Table 4** provides a full summary of this difference. From this table, it is seen that the total drainage area is decreasing from what was assumed in the 2021 SWM report and the AxC is also reduced, as such the assumptions made in the 2021 SWM report are conservative, and the fundamental conclusions drawn in this analysis remain valid. It is important to also note that in the JFSA August 2021 report, no onsite controls or storage were assumed for any of these lands, when in fact the peak flows from the Drummond development are controlled by ICDs and major system storage utilized within road sags.

Title	Date	Area (ha)	Imperviousness (%)	Runoff Coefficient	AxC
Halfmoon Bay Phase 3 - SWM Report	JFSA Aug 2021	9.61	29%	0.40	3.87
Drummond SWM Report	JFSA June 2023	5.87	53%	0.57	3.36
Difference		**-3.74**	**24%**	**0.17**	**-0.51**

Since the last analysis of the Drummond site, design has progressed for the Greenbank Road realignment. It is now proposed that the Greenbank truck sewer is to be twinned (storm sewers on both the east and west sides of Greenbank Road). JFSA has been coordinating with Stantec to ensure the proposed storm pipes are adequately sized to convey the flows from the Drummond subdivision. A preliminary proposed storm sewer and associated drainage areas to the west trunk sewer have been included in the PCSWMM model of the Drummond development.

4.4 The Ridge Development

To ensure that the proposed Drummond development does not negatively impact the existing Ridge site, a detailed HGL/USF analysis of the Ridge site has been completed based on the latest modelling. From this analysis, it was found that sufficient freeboard is provided to all units within the development for both 100-Year and stress test events. Full details of this analysis have been provided in Appendix F of this report

4.5 The Ridge/Drummond SWM Pond / OGS

Based on this latest analysis the 100-Year peak flows out of the SWM pond that services both the Drummond and Ridge lands are 1.268 m^3/s and 1.253m^3/s for the 3 Hr Chicago and 24 Hr SCS storm, respectively, with both of these values less than the allowable 1.3 m^3/s specified by the Barrhaven South Master Servicing Study.

Peak flow from the updated modelling (which considered the proposed EES units) were provided to Echelon Environmental to re-assess the OGS sizing for this facility. The following tables outline the peak flows to each of the OGS units for the 2,5,10,15,22 & 50mm events, with Table 5A outlining the latest peak flows and Table 5B outlining the previous OGS sizing completed as a part of the Jan 2021 analysis of the Ridge. It is important to note that the previous analysis for the Ridge has the Drummond lands as simple lumped catchments. Based on the updated modelling the peak flows to the OGS units have slightly increased for the 5-10mm event, but the larger events 15mm-50mm generally see a reduction in the previously assumed peak flows. Given that the larger return periods (15-22mm event) primarily drive the OGS sizing, and the fact that the peak flows for these events are lower than previously assumed, it can be concluded that the previous OGS sizing completed for the Ridge is sufficient. Please refer to the addendum provided by Echelon Environmental in Appendix D of DSEL's report confirming that the OGS units will function as previously intended.

Table 5A - Peak Flows to OGS Units -May 2022 (Detailed Design of Ridge & Drummond)

Unit	2mmCHI4Hr	5mmCHI4Hr	10mmCHI4Hr	15mmCHI4Hr	22mmCHI4Hr	50mmCHI4Hr
OGS 1	0.004	0.055	0.210	0.385	0.734	3.866
OGS 2	0.003	0.048	0.195	0.365	0.725	2.981

Table 5B - Peak Flows to OGS Units -Jan 2021 (Detailed Design of Ridge Only)

Unit	2mmCHI4Hr	5mmCHI4Hr	10mmCHI4Hr	15mmCHI4Hr	22mmCHI4Hr	50mmCHI4Hr
OGS 1	0.004	0.049	0.194	0.494	1.032	3.792
OGS 2	0.003	0.043	0.193	0.497	0.984	3.218

5 EROSION AND SEDIMENT CONTROL DURING AND AFTER CONSTRUCTION

Silt and erosion control strategies shall be implemented during construction activities to minimize the transfer of silt off-site. The following measures should be implemented:

i) Silt control fences shall be installed as required to prevent the movement of silt off-site during rainfall events.

ii) Construction of a mud mat shall be installed at the site entrance to promote self-cleaning of truck tires when leaving the site.

iii) All catch basins shall be equipped with a crushed stone filter to prevent the capture of silt in the storm sewer system.

iv) Regular cleaning of the adjacent roads shall be undertaken during the construction activities.

v) Regular inspection and maintenance of the silt control measures shall be undertaken until the site has been stabilized.

vi) The erosion and sediment control devices shall be removed after the site has been stabilized.

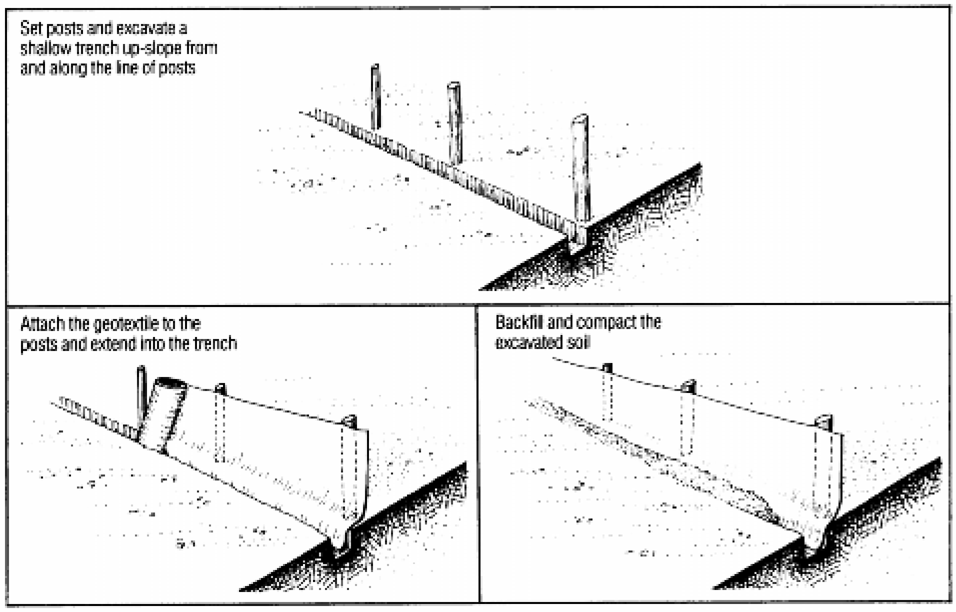

Figure 5: Typical installation of silt fences

Figure 6: Catchbasin with geotextile to protect storm sewer pipes from sediment contamination

6 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

J.F. Sabourin and Associates Inc. (JFSA) were retained by David Schaeffer Engineering Ltd. (DSEL) to prepare a Stormwater Management (SWM) Plan for the Drummond Subdivision, located in Barrhaven within the City of Ottawa. The development is located east of Borrisokane Road and Highway 416, south of Cambrian Road and north of the Ridge Development. Approximately 13.19 ha of the proposed development will be serviced by a dry SWM pond that is implemented in the northwest corner of the development which services both the Ridge and Drummond. The remaining 5.87 ha of the Drummond site will discharge to the east to the Halfmoon Bay SWM facility.

Per the City of Ottawa design guidelines, the minor system has been designed to accommodate a minimum of the 2-year post-development flows from within the site and from external areas (plus 5-year flows on collector roads). The PCSWMM model analysis has determined that the minor system will surcharge in most parts of the system. However, with the use of Inlet Control Devices, a minimum freeboard of 0.3 m is provided between the 100-year hydraulic grade line and the underside of footings throughout the subdivision.

The model simulations have determined that for the selected 2-, 5- and 100-year storms, the total minor system flows would be 5.685 m^3/s, 8.084 m^3/s and 10.099 m^3/s, respectively. Within the subdivision, the peak water depths do not exceed the maximum allowable 35 cm depth at the gutter for the simulated 100-year storm (Table D-7 of Appendix D). Furthermore, it was determined that for the 100-year event, the product of the velocity and depth of flow does not exceed the maximum allowable 0.60 m^2/s. Also as required, the maximum extent of surface water during the 100-year + 20% stress test will not touch the building envelopes. Table C-1A-C6A of Appendix C summarizes the hydraulic grade line analysis for the various storm. Note that the full pipe velocities are generally no less than 0.80 m/s and no greater than 3.0 m/s for the proposed pipes.

Stress test results for the major and minor drainage systems based on a 20% increase in the 100-year storm, as per the October 2012 *City of Ottawa Sewer Design Guidelines*, are summarized in Section 4. The peak flows out of the proposed SWM pond for both 100-year events is less than the allowable 1.3 m^3/s specified by the Barrhaven South Master Servicing Study.

Recommendations for silt and erosion control strategies to be implemented during construction are presented in Section 5.

In conclusion, the proposed design satisfies all selected design guidelines and requirements.

Legend

Conduits - Minor
MinorSystem

Junctions
MH
Site Map

ICD
83mm-ICD
94mm-ICD
102mm-ICD
108mm-ICD
127mm-ICD
152mm-ICD
178mm-ICD
250mm-ICD
No ICD

SCALE: 1:2500

0 50 100 m

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www.jfsa.com

DSEL
david schaeffer engineering ltd

Drummond SWM Report

Figure 2: Minor System

PROJECT	2226-21
DRAWN	ON
DATE	JUNE 2023

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Legend

- Major System
- Major System Junction
- Site Map

SCALE: 1:2500

0 50 100 m

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Drummond SWM Report

Figure 3: Major System

PROJECT	2226-21
DRAWN	ON
DATE	JUNE 2023

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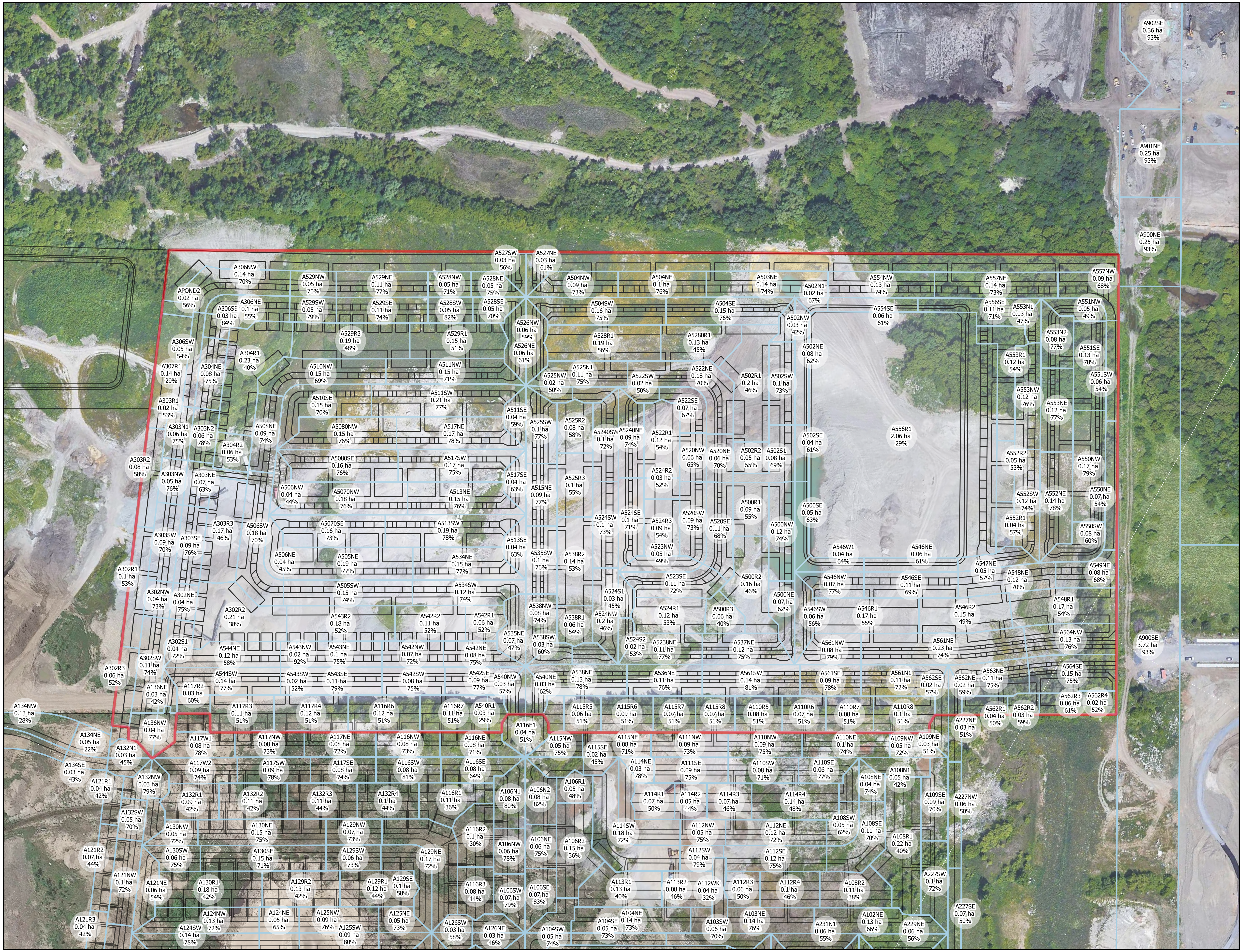

Legend

- Subcatchments
- Lot Layout
- Study Area

SCALE: 1:2500

0 50 100 m

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Drummond SWM Report

Figure 4: Subcatchments

PROJECT	2226-21
DRAWN	JB
DATE	June 2023

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APPENDIX A

Rational Method Design Sheets
(as per DSEL)

JFSA Water Resources and Environmental Consultants

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Ottawa

Manning 0.013

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Arterial Roads Return Frequency = 10 years

LOCATION			AREA (Ha) 2 YEAR				5 YEAR				10 YEAR				100 YEAR				FLOW Time of Conc.	Intensity 2 Year	Intensity 5 Year	Intensity 10 Year	Intensity 100 Year	Peak Flow	SEWER DATA DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATIO
Location	From Node	To Node	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	LOW (min	Q/Q full
Promontory																																	
Contribution From Dundonald Drive, Pipe 539 - 542						0.80				1.88				0.00				0.00	12.73														
Contribution From Elevation Road, Pipe 541 - 542						0.00				0.11				0.00				0.00	10.49														
			0.08	0.52	0.12	0.92			0.00	2.00			0.00	0.00			0.00	0.00															
	542	543	0.31	0.73	0.63	1.55			0.00	2.00			0.00	0.00			0.00	0.00	12.73	67.70	91.69	107.42	156.94	288	750	750	CONC	0.15	53.0	431.1703	0.9760	0.9051	0.668
			0.18	0.57	0.28	1.83			0.00	2.00			0.00	0.00			0.00	0.00															
	543	544	0.25	0.75	0.51	2.34			0.00	2.00			0.00	0.00			0.00	0.00	13.63	65.19	88.25	103.37	150.99	329	825	825	CONC	0.15	118.0	555.9418	1.0400	1.8910	0.592
	544	5440	0.25	0.69	0.47	2.82			0.00	2.00			0.00	0.00			0.00	0.00	15.53	60.55	81.90	95.90	140.03	334	825	825	CONC	1.20	57.5	1572.4410	2.9416	0.3258	0.213
	5440	302			0.00	2.82			0.00	2.00			0.00	0.00			0.00	0.00	15.85	59.83	80.90	94.73	138.32	330	825	825	CONC	1.20	12.5	1572.4410	2.9416	0.0708	0.210
To Expansion Road, Pipe 302 - 303						2.82				2.00				0.00				0.00	15.92														
Jean Davey																																	
	5020	502			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	0	300	300	PVC	0.50	8.5	68.3778	0.9673	0.1464	0.000
To Jean Davey Drive, Pipe 502 - 503						0.00				0.00				0.00				0.00	10.15														
			0.26	0.67	0.48	0.48			0.00	0.00			0.00	0.00			0.00	0.00															
	500	502	0.30	0.52	0.43	0.92			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	71	300	300	PVC	1.45	92.0	116.4431	1.6473	0.9308	0.605
Contribution From CONTROL MH 5020, Pipe 5020 - 502						0.00				0.00				0.00				0.00	10.15														
			0.25	0.54	0.38	1.29			0.00	0.00			0.00	0.00			0.00	0.00															
	502	503	0.32	0.65	0.58	1.87			0.00	0.00			0.00	0.00			0.00	0.00	10.93	73.41	99.52	116.64	170.48	137	450	450	CONC	1.60	118.5	360.6339	2.2675	0.8710	0.381
To Altitude, Pipe 503 - 504						1.87				0.00				0.00				0.00	11.80														
Pumice																																	
					0.00	0.00	0.10	0.63	0.18	0.18			0.00	0.00			0.00	0.00															
			0.11	0.59	0.18	0.18			0.00	0.18			0.00	0.00			0.00	0.00															
	524	538	0.16	0.67	0.30	0.48			0.00	0.18			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	55	300	300	PVC	2.10	58.0	140.1327	1.9825	0.4876	0.392
To Dundonald Drive, Pipe 538 - 539						0.48				0.18				0.00				0.00	10.49														
Contribution From Andesite Terrace, Pipe 523 - 524						0.33				0.00				0.00				0.00	10.78														
			0.12	0.60	0.20	0.53			0.00	0.00			0.00	0.00			0.00	0.00															
	524	5240	0.16	0.73	0.32	0.86			0.00	0.00			0.00	0.00			0.00	0.00	10.78	73.92	100.23	117.47	171.70	63	375	375	PVC	0.30	65.0	96.0323	0.8695	1.2459	0.659
	5240	525	0.25	0.74	0.51	1.37			0.00	0.00			0.00	0.00			0.00	0.00	12.03	69.80	94.57	110.81	161.92	96	375	375	PVC	1.55	63.5	218.2843	1.9764	0.5355	0.438
To Andesite Terrace, Pipe 525 - 526						1.37				0.00				0.00				0.00	12.56														
Andesite																																	
	519	523			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	0	300	300	PVC	0.35	14.0	57.2089	0.8093	0.2883	0.000
	523	524	0.17	0.70	0.33	0.33			0.00	0.00			0.00	0.00			0.00	0.00	10.29	75.72	102.69	120.38	175.97	25	300	300	PVC	1.80	54.5	129.7377	1.8354	0.4949	0.193
To Pumice Place, Pipe 524 - 5240						0.33				0.00				0.00				0.00	10.78														
	519	520	0.20	0.71	0.39	0.39			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	30	300	300	PVC	0.50	53.0	68.3778	0.9673	0.9132	0.443
	520	521	0.12	0.69	0.23	0.62			0.00	0.00			0.00	0.00			0.00	0.00	10.91	73.47	99.60	116.74	170.62	46	375	375	PVC	0.45	56.0	117.6150	1.0649	0.8764	0.390
	521	522			0.00	0.62			0.00	0.00			0.00	0.00			0.00	0.00	11.79	70.55	95.60	112.03	163.70	44	375	375	PVC	0.35	14.0	103.7267	0.9392	0.2484	0.425
			0.12	0.59	0.20	0.82			0.00	0.00			0.00	0.00			0.00	0.00															
	522	525	0.27	0.72	0.54	1.36			0.00	0.00			0.00	0.00			0.00	0.00	12.04	69.78	94.53	110.77	161.85	95	375	375	PVC	2.55	54.5	279.9798	2.5350	0.3583	0.339
Contribution From Pumice Place, Pipe 5240 - 525						1.37				0.00				0.00				0.00	12.56														
	525	526	0.15	0.66	0.28	3.01			0.00	0.00			0.00	0.00			0.00	0.00	12.56	68.18	92.35	108.20	158.08	205	525	525	CONC	1.80	59.0	576.9891	2.6654	0.3689	0.355
To Elevation Road, Pipe 526 - 528						3.01				0.00				0.00				0.00	12.93														
Speckled Adler																																	
	5080	517	0.32	0.73	0.65	0.65			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	50	300	300	PVC	0.55	72.5	71.7152	1.0146	1.1910	0.695
					0.00	0.65	0.04	0.64	0.08	0.08			0.00	0.00			0.00	0.00															
	517	518	0.34	0.74	0.70	1.35			0.00	0.08			0.00	0.00			0.00	0.00	11.19	72.52	98.30	115.20	168.36	105	300	300	PVC	2.30	86.0	146.6540	2.0747	0.6909	0.718
To Elevation Road, Pipe 518 - 526						1.35				0.08				0.00				0.00	11.88														
Catsfoot																																	
	5070	513	0.34	0.72	0.68	0.68			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	52	300	300	PVC	0.50	82.0	68.3778	0.9673	1.4128	0.764
					0.00	0.68	0.04	0.64	0.08	0.08			0.00	0.00			0.00	0.00															
	513	515	0.34	0.74	0.70	1.38			0.00	0.08			0.00	0.00			0.00	0.00	11.41	71.78	97.28	114.00	166.60	106	300	300	PVC	2.30	81.0	146.6540	2.0747	0.6507	0.726
To Elevation Road, Pipe 515 - 518						1.38				0.08				0.00				0.00	12.06														

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: V.W.	PROJECT: Ridge Phases 3 and 4			
Checked: W.L.	LOCATION: City of Ottawa			
Dwg. Reference: Storm Drainage Plan, Dwgs No. 54-55	File Ref: 19-1123	Date: May 2023	Sheet No. SHEET 1 OF 4	

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

Ottawa

LOCATION			AREA (Ha) 2 YEAR				5 YEAR				10 YEAR				100 YEAR				FLOW						SEWER DATA								
Location	From Node	To Node	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	Time of Conc. (min)	Intensity 2 Year (mm/h)	Intensity 5 Year (mm/h)	Intensity 10 Year (mm/h)	Intensity 100 Year (mm/h)	Peak Flow Q (l/s)	DIA. (mm) (actual)	DIA. (mm) (nominal)	TYPE	SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	TIME OF FLOW (min)	RATIO Q/Q full
Beebalm																																	
	505	534	0.34	0.73	0.69	0.69			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	53	375	375	PVC	0.45	94.5	117.6150	1.0649	1.4790	0.452
	534	535	0.27	0.73	0.55	1.24			0.00	0.00			0.00	0.00			0.00	0.00	11.48	71.56	96.98	113.65	166.08	89	375	375	PVC	3.00	78.5	303.6807	2.7496	0.4758	0.292
To Elevation Road, Pipe 535 - 515						1.24				0.00				0.00				0.00	11.95														
	505	506			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	0	300	300	PVC	0.60	13.0	74.9041	1.0597	0.2045	0.000
	506	508	0.26	0.63	0.46	0.46			0.00	0.00			0.00	0.00			0.00	0.00	10.20	76.03	103.13	120.88	176.71	35	300	300	PVC	0.35	79.0	57.2089	0.8093	1.6268	0.605
	508	509	0.09	0.72	0.18	0.64			0.00	0.00			0.00	0.00			0.00	0.00	11.83	70.42	95.42	111.81	163.39	45	300	300	PVC	0.45	41.5	64.8688	0.9177	0.7537	0.690
	509	510			0.00	0.64			0.00	0.00			0.00	0.00			0.00	0.00	12.58	68.13	92.27	108.10	157.94	43	300	300	PVC	0.40	10.5	61.1589	0.8652	0.2023	0.708
	510	511	0.30	0.68	0.57	1.20			0.00	0.00			0.00	0.00			0.00	0.00	12.79	67.54	91.46	107.15	156.54	81	375	375	PVC	0.55	64.0	130.0283	1.1773	0.9060	0.625
					0.00	1.20	0.04	0.61	0.07	0.07			0.00	0.00			0.00	0.00															
	511	526	0.36	0.73	0.73	1.93			0.00	0.07			0.00	0.00			0.00	0.00	13.69	65.03	88.03	103.11	150.62	132	450	450	CONC	2.80	95.5	477.0738	2.9997	0.5306	0.277
To Elevation Road, Pipe 526 - 528						1.93				0.07				0.00				0.00	14.22														
Elevation Road																																	
	527	528			0.00	0.00	0.06	0.61	0.11	0.11			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	11	300	300	PVC	0.35	18.5	57.2089	0.8093	0.3810	0.195
To Expansion Road, Pipe 528 - 529						0.00				0.11				0.00				0.00	10.38														
	535	539			0.00	0.00	0.07	0.53	0.10	0.10			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	10	300	300	PVC	2.40	52.5	149.8082	2.1194	0.4129	0.070
To Dundonald Drive, Pipe 539 - 542						0.00				0.10				0.00				0.00	10.41														
	540	541			0.00	0.00	0.07	0.61	0.11	0.11			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	12	300	300	PVC	0.35	11.5	57.2089	0.8093	0.2368	0.207
	541	542			0.00	0.00			0.00	0.11			0.00	0.00			0.00	0.00	10.24	75.91	102.96	120.69	176.42	12	300	300	PVC	0.35	12.5	57.2089	0.8093	0.2574	0.204
To Promontory, Pipe 542 - 543						0.00				0.11				0.00				0.00	10.49														
Contribution From Beebalm, Pipe 534 - 535						1.24				0.00				0.00				0.00	11.95														
	535	515			0.00	1.24	0.10	0.73	0.20	0.20			0.00	0.00			0.00	0.00	11.95	70.03	94.89	111.19	162.47	106	450	450	CONC	0.20	44.0	127.5033	0.8017	0.9147	0.831
Contribution From Catsfoot, Pipe 513 - 515						1.38				0.08				0.00				0.00	12.06														
			0.10	0.59	0.17	2.79			0.00	0.28			0.00	0.00			0.00	0.00															
	515	518			0.00	2.79	0.09	0.74	0.19	0.46			0.00	0.00			0.00	0.00	12.87	67.30	91.14	106.77	155.98	230	600	600	CONC	0.30	44.0	336.3080	1.1894	0.6165	0.684
Contribution From Speckled Adler, Pipe 517 - 518						1.35				0.08				0.00				0.00	11.88														
	518	526			0.00	4.14			0.00	0.54			0.00	0.00			0.00	0.00	13.49	65.59	88.79	104.01	151.93	319	675	675	CONC	0.30	47.0	460.4091	1.2866	0.6088	0.694
Contribution From Beebalm, Pipe 511 - 526						1.93				0.07				0.00				0.00	14.22														
Contribution From Andesite, Pipe 525 - 526						3.01				0.00				0.00				0.00	12.93														
	526	528			0.00	9.08	0.13	0.63	0.22	0.84			0.00	0.00			0.00	0.00	14.22	63.66	86.15	100.90	147.37	650	675	675	CONC	1.60	59.5	1063.2692	2.9713	0.3337	0.611
To Expansion Road, Pipe 528 - 529						9.08				0.84				0.00				0.00	14.56														
Expansion Road																																	
Contribution From Altitude, Pipe 504 - 528						3.70				0.00				0.00				0.00	13.96														
Contribution From Elevation Road, Pipe 526 - 528						9.08				0.84				0.00				0.00	14.56														
Contribution From Elevation Road, Pipe 527 - 528						0.00				0.11				0.00				0.00	10.38														
					0.00	12.78			0.00	0.94			0.00	0.00			0.00	0.00															
	528	529	0.20	0.73	0.40	13.18			0.00	0.94			0.00	0.00			0.00	0.00	14.56	62.83	85.01	99.57	145.41	909	1050	1050	CONC	0.25	62.5	1365.3626	1.5768	0.6606	0.665
			0.34	0.55	0.52	13.70			0.00	0.94			0.00	0.00			0.00	0.00															
	529	530	0.32	0.73	0.65	14.35			0.00	0.94			0.00	0.00			0.00	0.00	15.22	61.26	82.86	97.03	141.69	957	1200	1200	CONC	0.15	72.0	1509.9717	1.3351	0.8988	0.634
	530	531			0.00	14.35			0.00	0.94			0.00	0.00			0.00	0.00	16.12	59.25	80.11	93.80	136.95	926	1200	1200	CONC	0.15	76.5	1509.9717	1.3351	0.9550	0.613
	531	313			0.00	14.35			0.00	0.94			0.00	0.00			0.00	0.00	17.07	57.27	77.41	90.62	132.29	895	1200	1200	CONC	0.15	21.5	1509.9717	1.3351	0.2684	0.593
To POND INLET, Pipe 313 - 500						14.35				0.94				0.00				0.00	17.34														
Contribution From Haiku Street, Pipe 134 - 135						31.06				0.00				0.00				0.00	14.01														
			0.05	0.54	0.08	31.14			0.00	0.00			0.00	0.00			0.00	0.00															
	135	136	0.18	0.71	0.36	31.49			0.00	0.00			0.00	0.00			0.00	0.00	14.01	64.22	86.91	101.80	148.69	2022	1650	1650	CONC	0.10	37.0	2882.2416	1.3479	0.4575	0.702
	136	302			0.00	31.49			0.00	0.00			0.00	0.00			0.00	0.00	14.46	63.06	85.33	99.94	145.96	1986	2250	2250	CONC	0.10	54.0	6590.6247	1.6576	0.5430	0.301
To Expansion Road, Pipe 136 - 302						31.49				0.00				0.00				0.00	15.01														
Contribution From Haiku Street, Pipe 118 - 136						32.93				4.53				0.00				0.00	20.48														
Contribution From Travertine Way, Pipe 132 - 136						17.85				0.06				0.00				0.00	18.50														
Contribution From Promontory, Pipe 544 - 302						2.82				2.00				0.00				0.00	15.92														
			0.16	0.54	0.24	85.33			0.00	6.59			0.00	0.00			0.00	0.00															
			0.21	0.47	0.27	85.61			0.00	6.59			0.00	0.00			0.00	0.00															
	302	303	0.18	0.71	0.36	85.96			0.00	6.59			0.00	0.00			0.00	0.00	20.48	51.28	69.22	81.00	118.18	4864	2250	2250	CONC	0.10	59.0	6590.6247	1.6576	0.5932	0.738

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: V.W.	PROJECT: Ridge Phases 3 and 4		
Checked: W.L.	LOCATION: City of Ottawa		
Dwg. Reference: Storm Drainage Plan, Dwgs No. 54-55	File Ref: 19-1123	Date: May 2023	Sheet No. SHEET 2 OF 4

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Ottawa

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Arterial Roads Return Frequency = 10 years

Manning 0.013

Location	From Node	To Node	2 YEAR AREA (Ha)	2 YEAR R	2 YEAR Indiv. 2.78 AC	2 YEAR Accum. 2.78 AC	5 YEAR AREA (Ha)	5 YEAR R	5 YEAR Indiv. 2.78 AC	5 YEAR Accum. 2.78 AC	10 YEAR AREA (Ha)	10 YEAR R	10 YEAR Indiv. 2.78 AC	10 YEAR Accum. 2.78 AC	100 YEAR AREA (Ha)	100 YEAR R	100 YEAR Indiv. 2.78 AC	100 YEAR Accum. 2.78 AC	Time of Conc. (min)	Intensity 2 Year (mm/h)	Intensity 5 Year (mm/h)	Intensity 10 Year (mm/h)	Intensity 100 Year (mm/h)	Peak Flow Q (l/s)	DIA. (mm) (actual)	DIA. (mm) (nominal)	TYPE	SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	TIME OF FLOW (min)	RATIO Q/Q full
			0.14	0.54	0.21	86.17			0.00	6.59			0.00	0.00			0.00	0.00															
			0.12	0.71	0.24	86.41			0.00	6.59			0.00	0.00			0.00	0.00															
			0.17	0.52	0.25	86.65			0.00	6.59			0.00	0.00			0.00	0.00															
	303	304	0.30	0.71	0.59	87.25			0.00	6.59			0.00	0.00			0.00	0.00	21.07	50.37	67.99	79.55	116.05	4843	2250	2250	CONC	0.10	134.5	6590.6247	1.6576	1.3524	0.735
			0.29	0.50	0.40	87.65			0.00	6.59			0.00	0.00			0.00	0.00															
	304	306TEE	0.19	0.71	0.38	88.02			0.00	6.59			0.00	0.00			0.00	0.00	22.42	48.43	65.35	76.45	111.51	4694	2250	2250	CONC	0.10	42.5	6590.6247	1.6576	0.4273	0.712
To POND INLET, Pipe 306TEE - 307						88.02				6.59				0.00				0.00	22.85														
BLK 198 (PARK)																																	
	3070	307			0.00	0.00	0.07	0.40	0.08	0.08			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	8	300	300	PVC	0.50	5.5	68.3778	0.9673	0.0948	0.119
To POND INLET, Pipe 307 - 400						0.00				0.08				0.00				0.00	10.09														
POND INLET																																	
Contribution From Expansion Road, Pipe 531 - 313						14.35				0.94				0.00				0.00	17.34														
	313	500			0.00	14.35			0.00	0.94			0.00	0.00			0.00	0.00	17.34	56.74	76.69	89.77	131.04	887	2250	2250	CONC	0.10	33.5	6590.6247	1.6576	0.3368	0.135
	500	HW			0.00	14.35			0.00	0.94			0.00	0.00			0.00	0.00	17.68	56.09	75.80	88.73	129.51	877	2250	2250	CONC	0.10	5.0	6590.6247	1.6576	0.0503	0.133
Contribution From Expansion Road, Pipe 304 - 306TEE						88.02				6.59				0.00				0.00	22.85														
	306TEE	307	0.23	0.65	0.42	88.44			0.00	6.59			0.00	0.00			0.00	0.00	22.85	47.86	64.56	75.52	110.15	4658	2250	2250	CONC	0.10	13.0	6590.6247	1.6576	0.1307	0.707
Contribution From BLK 199 (PARK), Pipe 302 - 303						0.00				0.08				0.00				0.00	10.09														
	307	400			0.00	88.44			0.00	6.67			0.00	0.00			0.00	0.00	22.98	47.68	64.32	75.25	109.74	4646	2250	2250	CONC	0.10	23.5	6590.6247	1.6576	0.2363	0.705
	400	3112			0.00	88.44			0.00	6.67			0.00	0.00			0.00	0.00	23.22	47.37	63.90	74.75	109.01	4616	2250	2250	CONC	0.10	6.0	6590.6247	1.6576	0.0603	0.700
ABIC PROPERTY																								210.40									
	3112	HW			0.00	88.44			0.00	6.67			0.00	0.00			0.00	0.00	23.28	47.29	63.79	74.62	108.83	4819	2250	2250	CONC	0.10	9.5	6590.6247	1.6576	0.0955	0.731
To POND HW						102.79				7.61				0.00				0.00	23.37														
Kootenay																																	
			0.05	0.53	0.07	0.07			0.00	0.00			0.00	0.00			0.00	0.00															
			0.28	0.70	0.54	0.62			0.00	0.00			0.00	0.00			0.00	0.00															
	546	547	0.32	0.56	0.50	1.12			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	86	375	375	PVC	0.90	96.5	166.3328	1.5060	1.0679	0.516
	547	548	0.04	0.59	0.07	1.18			0.00	0.00			0.00	0.00			0.00	0.00	11.07	72.93	98.87	115.87	169.35	86	375	375	PVC	1.15	63.0	188.0206	1.7024	0.6168	0.459
			0.12	0.67	0.22	1.41			0.00	0.00			0.00	0.00			0.00	0.00															
	548	549	0.17	0.57	0.27	1.68			0.00	0.00			0.00	0.00			0.00	0.00	11.68	70.89	96.06	112.57	164.50	119	375	375	PVC	0.85	29.5	161.6464	1.4636	0.3359	0.735
	549	550	0.08	0.68	0.15	1.83			0.00	0.00			0.00	0.00			0.00	0.00	12.02	69.83	94.61	110.85	161.98	128	375	375	PVC	0.90	15.0	166.3328	1.5060	0.1660	0.767
	550	551	0.31	0.75	0.65	2.47			0.00	0.00			0.00	0.00			0.00	0.00	12.19	69.32	93.91	110.03	160.77	171	525	525	CONC	1.55	110.5	535.4232	2.4734	0.7446	0.320
	551	559	0.23	0.74	0.47	2.95			0.00	0.00			0.00	0.00			0.00	0.00	12.93	67.12	90.90	106.49	155.57	198	525	525	CONC	1.40	51.5	508.8565	2.3506	0.3651	0.389
To Kootenay, Pipe 559 - 75						2.95				0.00				0.00				0.00	13.30														
Contribution From Altitude, Pipe 557 - 558						4.48				1.85				0.00				0.00	12.48														
	558	559			0.00	4.48			0.00	1.85			0.00	0.00			0.00	0.00	12.48	68.43	92.69	108.59	158.66	478	675	675	CONC	0.45	15.5	563.8837	1.5758	0.1639	0.848
To Kootenay, Pipe 559 - 75						4.48				1.85				0.00				0.00	12.65														
Contribution From Kootenay Drive, Pipe 551 - 559						4.48				1.85				0.00				0.00	12.65														
Contribution From Kootenay Drive, Pipe 558 - 559						2.95				0.00				0.00				0.00	13.30														
	559	75			0.00	7.43			0.00	1.85			0.00	0.00			0.00	0.00	13.30	66.10	89.50	104.84	153.15	656	675	675	CONC	0.80	15.0	751.8449	2.1010	0.1190	0.873
To GREENBANK ROAD, Pipe 75 - 901						7.43				1.85				0.00				0.00	13.30														
Lepsoe																																	
	552	553	0.30	0.77	0.64	0.64			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	49	300	300	PVC	1.60	64.5	122.3179	1.7304	0.6212	0.403
	553	557	0.43	0.76	0.91	1.55			0.00	0.00			0.00	0.00			0.00	0.00	10.62	74.50	101.02	118.41	173.07	116	375	375	PVC	1.40	103.0	207.4534	1.8783	0.9139	0.557
To Altitude, Pipe 557 - 558						1.55				0.00				0.00				0.00	11.54														
Glaciation Lane																																	
	566	565	0.24	0.72	0.48	0.48			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	37	300	300	PVC	1.55	71.5	120.3915	1.7032	0.6997	0.306
	565	560	0.28	0.73	0.57	1.05			0.00	0.00			0.00	0.00			0.00	0.00	10.70	74.22	100.64	117.95	172.41	78	375	375	PVC	1.05	97.0	179.6599	1.6267	0.9939	0.433
To Altitude Avenue, Pipe 560 - 557						1.05				0.00				0.00				0.00	11.69														
Park Block																																	
Ctrl MH	5560	556			0.00	0.00	1.66	0.40	1.85	1.85			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	192	525	525	CONC	0.55	14.0	318.9427	1.4733	0.1584	0.603
To Altitude, Pipe 556 - 557						0.00				1.85				0.00				0.00	10.16														

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: V.W.
Checked: W.L.
Dwg. Reference: Storm Drainage Plan, Dwgs No. 54-55
PROJECT: Ridge Phases 3 and 4
LOCATION: City of Ottawa
File Ref: 19-1123
Date: May 2023
Sheet No. SHEET 3 OF 4

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

LOCATION			AREA (Ha)																FLOW						SEWER DATA								
			2 YEAR				5 YEAR				10 YEAR				100 YEAR				Time of Conc.	Intensity 2 Year	Intensity 5 Year	Intensity 10 Year	Intensity 100 Year	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF FLOW	RATIO
Location	From Node	To Node	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	AREA (Ha)	R	Indiv. 2.78 AC	Accum. 2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	(min)	Q/Q full
Altitude																																	
			0.03	0.67	0.06	0.06			0.00	0.00			0.00	0.00			0.00	0.00															
	554	556	0.19	0.70	0.37	0.43			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	33	300	300	PVC	0.95	79.5	94.2522	1.3334	0.9937	0.347
Contribution From PARK BLOCK, Pipe 5560 - 556						0.00				1.85				0.00				0.00	10.16														
	556	560	1.66	0.20	0.92	1.35			0.00	1.85			0.00	0.00			0.00	0.00	10.99	73.19	99.22	116.29	169.96	282	525	525	CONC	1.40	25.0	508.8565	2.3506	0.1773	0.554
Contribution From Glaciation Lane, Pipe 565 - 560						1.05				0.00				0.00				0.00	11.69														
	560	557	0.04	0.63	0.07	2.47			0.00	1.85			0.00	0.00			0.00	0.00	11.69	70.86	96.02	112.52	164.43	352	525	525	CONC	0.90	45.5	407.9929	1.8847	0.4024	0.863
Contribution From Lepsoe Lane, Pipe 553 - 557						1.55				0.00				0.00				0.00	11.54														
	557	558	0.24	0.70	0.47	4.48			0.00	1.85			0.00	0.00			0.00	0.00	12.10	69.60	94.29	110.48	161.43	486	675	675	CONC	0.45	36.5	563.8837	1.5758	0.3861	0.862
To Kootenay Drive, Pipe 558 - 559						4.48				1.85				0.00				0.00	12.48														
Contribution From Jean Davey Drive, Pipe 502 - 503						1.87				0.00				0.00				0.00	11.80														
	503	504	0.15	0.72	0.30	2.17			0.00	0.00			0.00	0.00			0.00	0.00	11.80	70.52	95.55	111.96	163.61	153	525	525	CONC	0.25	75.0	215.0311	0.9933	1.2584	0.712
			0.32	0.56	0.50	2.67			0.00	0.00			0.00	0.00			0.00	0.00															
	504	528	0.51	0.73	1.03	3.70			0.00	0.00			0.00	0.00			0.00	0.00	13.06	66.76	90.40	105.90	154.71	247	600	600	CONC	0.85	108.0	566.0907	2.0021	0.8990	0.437
To Expansion Road, Pipe 528 - 529						3.70				0.00				0.00				0.00	13.96														
Obsidian Street																																	
			0.04	0.61	0.07	0.07			0.00	0.00			0.00	0.00			0.00	0.00															
	562	563	0.15	0.60	0.25	0.32			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	24	300	300	PVC	0.45	29.5	64.8688	0.9177	0.5358	0.377
To Dundonald Drive, Pipe 563 - 564						0.32				0.00				0.00				0.00	10.54														
Dundonald Drive																																	
	561	563			0.00	0.00	0.11	0.72	0.22	0.22			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	23	300	300	PVC	2.90	61.0	164.6755	2.3297	0.4364	0.139
Contribution From Obsidian Street, Pipe 562 - 563						0.32				0.00				0.00				0.00	10.54														
	563	564			0.00	0.32	0.34	0.73	0.69	0.91			0.00	0.00			0.00	0.00	10.54	74.81	101.45	118.91	173.81	116	525	525	PVC	0.20	73.5	192.3297	0.8885	1.3788	0.604
	564	77			0.00	0.32	0.28	0.72	0.56	1.47			0.00	0.00			0.00	0.00	11.91	70.16	95.06	111.39	162.77	162	525	525	PVC	2.05	48.5	615.7555	2.8445	0.2842	0.263
To FUTURE GREENBANK ROAD, Pipe 77 - 76						0.32				1.47				0.00				0.00	12.20														
	561	537			0.00	0.00	0.31	0.75	0.65	0.65			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	67	375	375	PVC	0.60	42.5	135.8101	1.2296	0.5760	0.496
	537	536			0.00	0.00	0.12	0.63	0.21	0.86			0.00	0.00			0.00	0.00	10.58	74.66	101.25	118.67	173.46	87	450	450	CONC	0.20	64.5	127.5033	0.8017	1.3409	0.680
	536	538			0.00	0.00	0.11	0.73	0.22	1.08			0.00	0.00			0.00	0.00	11.92	70.15	95.05	111.38	162.75	103	450	450	CONC	2.15	58.0	418.0477	2.6285	0.3678	0.246
Contribution From Pumice Place, Pipe 524 - 538						0.48				0.18				0.00				0.00	10.49														
			0.20	0.58	0.32	0.80			0.00	1.25			0.00	0.00			0.00	0.00															
					0.00	0.80	0.08	0.72	0.16	1.42			0.00	0.00			0.00	0.00															
	538	539			0.00	0.80	0.19	0.70	0.37	1.78			0.00	0.00			0.00	0.00	12.28	69.02	93.50	109.55	160.06	222	525	525	CONC	2.10	59.0	623.2194	2.8789	0.3416	0.356
Contribution From Elevation Road, Pipe 535 - 539						0.00				0.10				0.00				0.00	10.41														
	539	542			0.00	0.80			0.00	1.88			0.00	0.00			0.00	0.00	12.63	68.00	92.10	107.91	157.65	228	525	525	CONC	0.60	9.5	333.1248	1.5389	0.1029	0.685
To Promontory, Pipe 542 - 543						0.80				1.88				0.00				0.00	12.73														
GREENBANK ROAD																																	
	78	77			0.00	0.00			0.00	0.00	1.30	0.85	3.07	3.07			0.00	0.00	14.90	62.00	83.88	98.23	143.45	302	525	525	CONC	0.85	119.5	396.4978	1.8316	1.0874	0.761
Contribution From Dundonald Drive, Pipe 564 - 77						0.32				1.47				0.00				0.00	12.20														
	77	76			0.00	0.32			0.00	1.47	0.22	0.85	0.52	3.59			0.00	0.00	15.99	59.53	80.50	94.25	137.61	476	600	600	CONC	1.75	115.5	812.2609	2.8728	0.6701	0.586
	76	75			0.00	0.32			0.00	1.47	0.30	0.85	0.71	4.30			0.00	0.00	16.66	58.11	78.56	91.97	134.27	530	600	600	CONC	1.90	115.5	846.3565	2.9934	0.6431	0.626
Contribution From Unknown Road4 - 101, Pipe 559 - 75						7.43				1.85				0.00				0.00	13.30														
	75	74			0.00	7.75			0.00	3.32	0.14	0.85	0.33	4.63			0.00	0.00	17.30	56.82	76.79	89.90	131.23	1111	1200	1200	CONC	0.75	108.0	3376.3995	2.9854	0.6029	0.329
	74	73			0.00	7.75			0.00	3.32	0.16	0.85	0.38	5.01			0.00	0.00	17.90	55.67	75.22	88.04	128.51	1122	1200	1200	CONC	0.75	108.0	3376.3995	2.9854	0.6029	0.332
	73	72			0.00	7.75			0.00	3.32	0.33	0.85	0.78	5.79			0.00	0.00	18.51	54.56	73.71	86.27	125.91	1167	1800	1800	CONC	0.15	108.0	4451.9011	1.7495	1.0289	0.262
	72	71			0.00	7.75			0.00	3.32	0.22	0.85	0.52	6.31			0.00	0.00	19.54	52.79	71.29	83.43	121.74	1172	1950	1950	CONC	0.15	108.0	5511.1783	1.8454	0.9754	0.213
	71	70			0.00	7.75			0.00	3.32	0.08	0.85	0.19	6.50			0.00	0.00	20.51	51.22	69.15	80.92	118.05	1152	1950	1950	CONC	0.15	108.0	5511.1783	1.8454	0.9754	0.209
	70	506			0.00	7.75			0.00	3.32	0.21	0.85	0.50	6.99			0.00	0.00	21.49	49.76	67.15	78.57	114.61	1158	2550	2550	CONC	0.15	31.0	11270.0535	2.2068	0.2341	0.103

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed:	PROJECT:		
V.W.	Ridge Phases 3 and 4		
Checked:	LOCATION:		
W.L.	City of Ottawa		
Dwg. Reference:	File Ref:	Date:	Sheet No.
Storm Drainage Plan, Dwgs No. 54-55	19-1123	May 2023	SHEET 4 OF 4

APPENDIX B

Inlet Control Devices

JFSA Water Resources and Environmental Consultants

Products – StormTech Orifice Plate

Our StormTech Orifice Plate uses a calibrated orifice to control the outflow at a specific rate at a specific head in the catch basin. This is our simplest and most economical Inlet Control Device (ICD), and can be sometimes used by municipalities as a starting point for storm water management until more information is gathered. As with all our products, it can be swapped out with another StormTech ICD once more is known about the system.

Orifice Plate units can have any shape or size of orifice customized to meet your needs. Standard designs include Round, Diamond, Keyhole and Diamond Keyhole shaped orifices. Keyholes help create a torsional flow pattern through the orifice that can help unblock some debris.

Orifice plate ICD's do not form water traps to prevent odours and are also prone to blockage by floatables like leaves, twigs, bottles and cans, especially during higher rainfall periods. Monitoring of these types of installs is recommended and sometimes leads to recommendations to upgrade to water trap devices, such as Odour Traps and Sumps, to prevent blockage and odours. But in locations where they work properly they are an economical alternative solution.

Primary Function(s): Flow Control for Medium to High Flow Rates (15 to 100 l/s | 237 to 1585 GPM).

Other Functions(s): None.

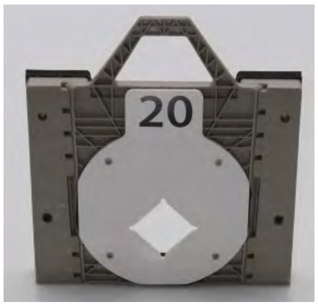
Outflow Pipe Diameter: 150 mm to 300 mm | 6 inch to 12 inch. Special orders can be made for larger sizes.

Catch Basin Types: All – with or without sumps.
Rectangular or Round Catch Basins (Round requires built-in adapter that can be provided).
Standard Round is 600 mm, but larger sizes available (900 mm, 1200 mm, 1600 mm …etc.).
Fits through even small Catch Basin openings (300 mm x 450 mm).

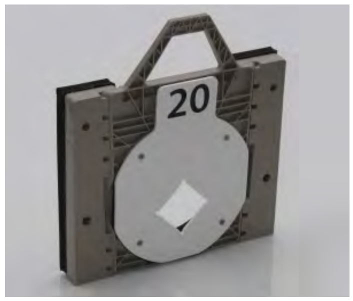
Specifications:
Orifice Plate: HDPE Thermoplastic with UV resistant additives.
Handle Plate (common): HDPE Thermoplastic.
Handle Plate (common): HDPE Thermoplastic.
Mounting Plate (common): HDPE Thermoplastic.
Hardware (common): Stainless Steel Wedge Bolts with Nut and Washer (4).
Welds: None.
Inner Ring Seal: Rubber Bulb Seal EPDM. Held in place and reusable. No need to replace.
Wall Seal: 3/8 or 5/8 inch Neoprene closed cell sponge gasket attached to Mounting Plate.
Identifier: 50 mm high numeric's on top of unit. Peel and stick. Note: Not visible from street surface.
Special Tools: None required.
Weight: Removable Unit: 0.5 kg / 1 lb. Maximum Total Assembly: 2.3 kg / 5 lb.

Products – StormTech Orifice Plate (continued)

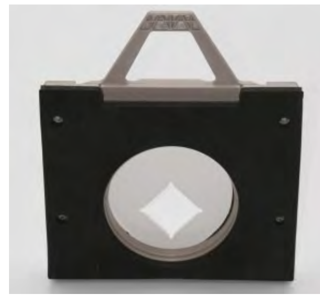
Orifice Plate – Square Adapter (with Diamond Orifice pictured)



Front

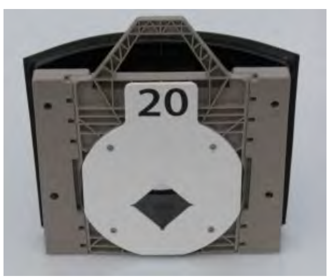


Left Angle

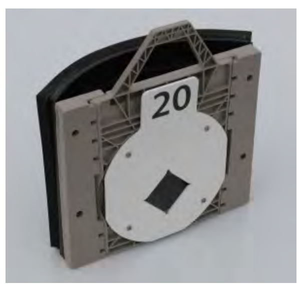


Back – View from Wall

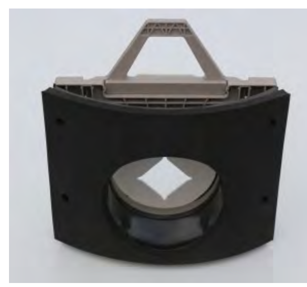
Orifice Plate – Round Adapter



Front



Left Angle



Back – View from Wall

Installation:

1. If necessary, cut protruding out-flowing pipe back flush to Catch Basin wall.
2. Use Mounting Plate as template to mark four hole pattern on Catch Basin wall.
3. Install four Stainless Steel Wedge Bolts (provided) perpendicular to Mounting Plate.
4. Install Mounting Plate and hand secure with four washers and nuts (provided).
5. Torque nuts to 40 N-·m or 30 lbf·ft. Do not over-tighten.
6. Snap unit into place by pushing Handle Plate into dove-tail slot of Mounting Plate.
7. Record Unit Identifier along with Catch Basin Location according to municipal requirements.
8. Note – Unit Identifier with this model is NOT easily seen from street level.

Table B-1: Plas-Tech StormTech Orifice Plate Inlet Control Device (ICD) Capacities [1]

ICD Diameter (mm)	Capture (L/s)							
	CB (1.38 m lead pipe invert depth)				CBMH (1.74 m lead pipe invert depth)			
Water Depth:	*0 cm*	*Average*	*30 cm*	*35 cm*	*0 cm*	*Average*	*30 cm*	*35 cm*
Head:	*1.28 m*	*1.4 m*	*1.58 m*	*1.63 m*	*1.64 m*	*1.76 m*	*1.94 m*	*1.99 m*
83	17.6	18.4	19.6	19.9	19.9	20.7	21.7	22.0
94	22.6	23.6	25.1	25.5	25.6	26.5	27.8	28.2
102	26.6	27.8	29.6	30.0	30.1	31.2	32.8	33.2
108	29.8	31.2	33.2	33.7	33.8	35.0	36.7	37.2
127	41.3	43.2	45.8	46.6	46.7	48.4	50.8	51.5
152	59.1	61.8	65.7	66.7	66.9	69.3	72.8	73.7
178	81.1	84.8	90.1	91.5	91.8	95.0	99.8	101.1

[1] For circular orifices plate type with diameters as specified by City of Ottawa standards.

CB Grate - 0.5% Longitudinal Slope

Approach Flow Capture Per Design Charts/Manual

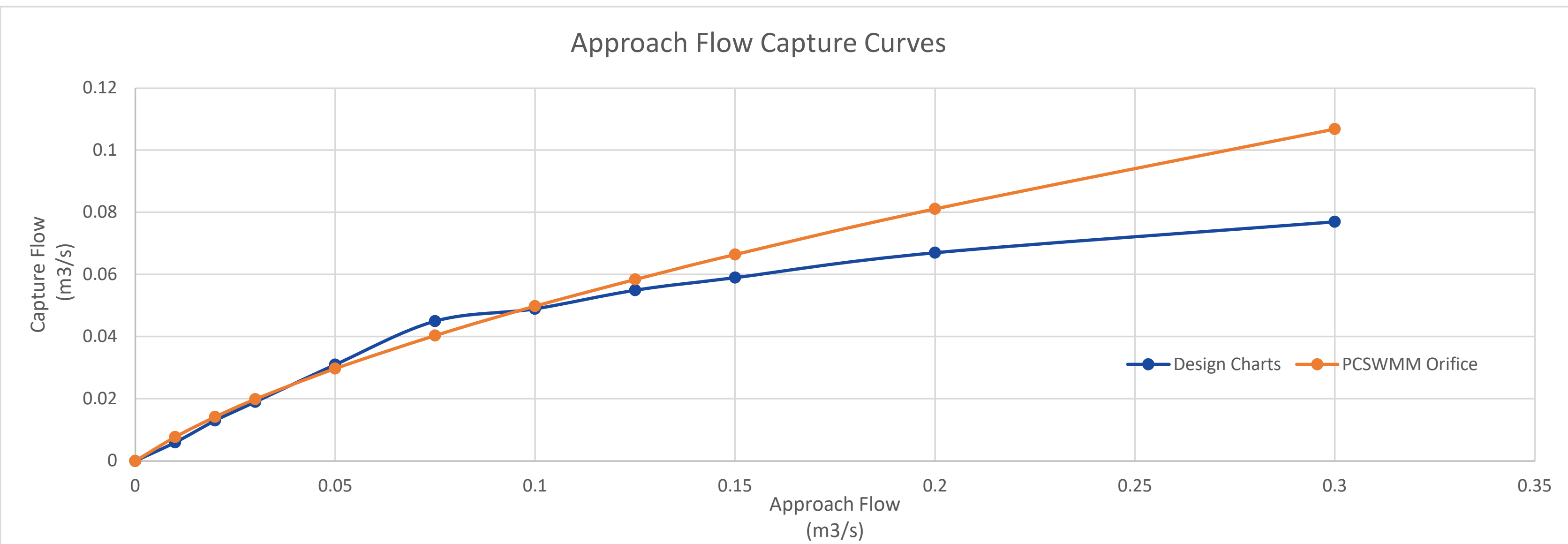
* Curve based on MTO Design Charts,
* derived for 2% cross slope & 0.5% longitudinal slope
* assuming OPSD 400.01 grates and OPSD 600.01 curbs and gutters
* The 250 mm lead pipe does not control the flow.

PCSWMM Model Orifice

2% cross slope & 0.5% longitudinal slope
0.35m x 0.35m
Rectangular Bottom Opening
$C_o = 0.62$

Approach Flow (m^3/s)	Capture Flow (m^3/s)
0.000	0
0.010	0.006
0.020	0.013
0.030	0.019
0.050	0.031
0.075	0.045
0.100	0.049
0.125	0.055
0.150	0.059
0.200	0.067
0.300	0.077

Approach Flow (m^3/s)	Capture Flow (m^3/s)
0.000	0.000
0.010	0.008
0.020	0.014
0.030	0.020
0.050	0.030
0.075	0.040
0.100	0.050
0.125	0.058
0.150	0.066
0.200	0.081
0.300	0.107



R^2 = **0.953**

CB Grate - 1% Longitudinal Slope

Approach Flow Capture Per Design Charts/Manual

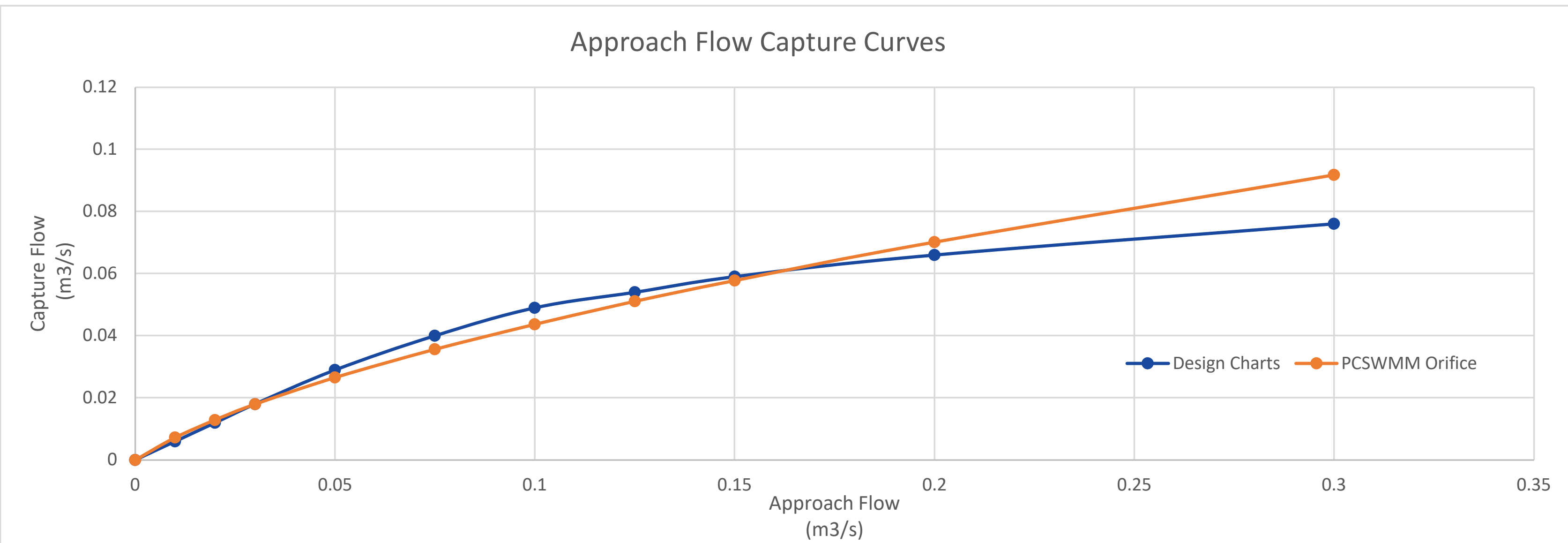
* Curve based on MTO Design Charts,
* derived for 2% cross slope & 1% longitudinal slope
* assuming OPSD 400.01 grates and OPSD 600.01 curbs and gutters
* The 250 mm lead pipe does not control the flow.

PCSWMM Model Orifice

2% cross slope & 1% longitudinal slope
0.35m x 0.35m
Rectangular Bottom Opening
$C_o = 0.62$

Approach Flow (m^3/s)	Capture Flow (m^3/s)
0.000	0
0.010	0.006
0.020	0.012
0.030	0.018
0.050	0.029
0.075	0.04
0.100	0.049
0.125	0.054
0.150	0.059
0.200	0.066
0.300	0.076

Approach Flow (m^3/s)	Capture Flow (m^3/s)
0.000	0.000
0.010	0.007
0.020	0.013
0.030	0.018
0.050	0.027
0.075	0.036
0.100	0.044
0.125	0.051
0.150	0.058
0.200	0.070
0.300	0.092



R^2 = 0.965

CB Grate - 2% Longitudinal Slope

Approach Flow Capture Per Design Charts/Manual

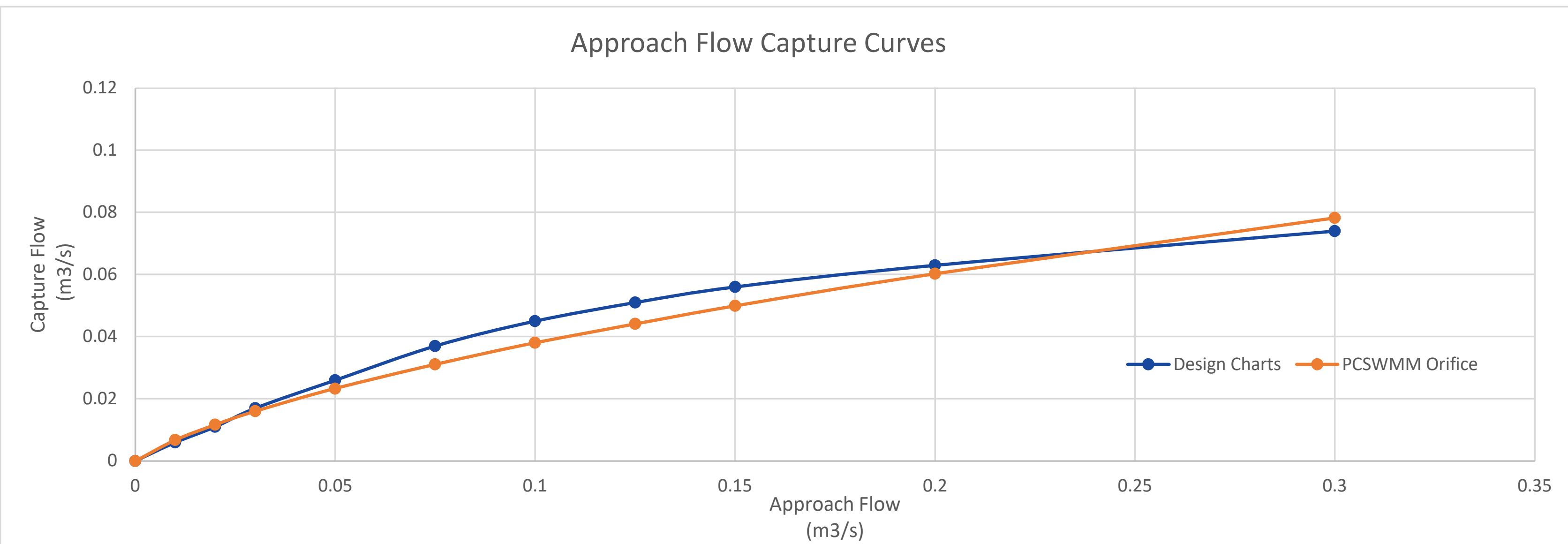
* Curve based on MTO Design Charts,
* derived for 2% cross slope & 2% longitudinal slope
* assuming OPSD 400.01 grates and OPSD 600.01 curbs and gutters
* The 250 mm lead pipe does not control the flow.

Approach Flow (m^3/s)	Capture Flow (m^3/s)
0.000	0
0.010	0.006
0.020	0.011
0.030	0.017
0.050	0.026
0.075	0.037
0.100	0.045
0.125	0.051
0.150	0.056
0.200	0.063
0.300	0.074

PCSWMM Model Orifice

2% cross slope & 2% longitudinal slope
0.35m x 0.35m
Rectangular Bottom Opening
C_o = 0.62

Approach Flow (m^3/s)	Capture Flow (m^3/s)
0.000	0.000
0.010	0.007
0.020	0.012
0.030	0.016
0.050	0.023
0.075	0.031
0.100	0.038
0.125	0.044
0.150	0.050
0.200	0.060
0.300	0.078



R^2 = 0.978

CB Grate - 3% Longitudinal Slope

Approach Flow Capture Per Design Charts/Manual

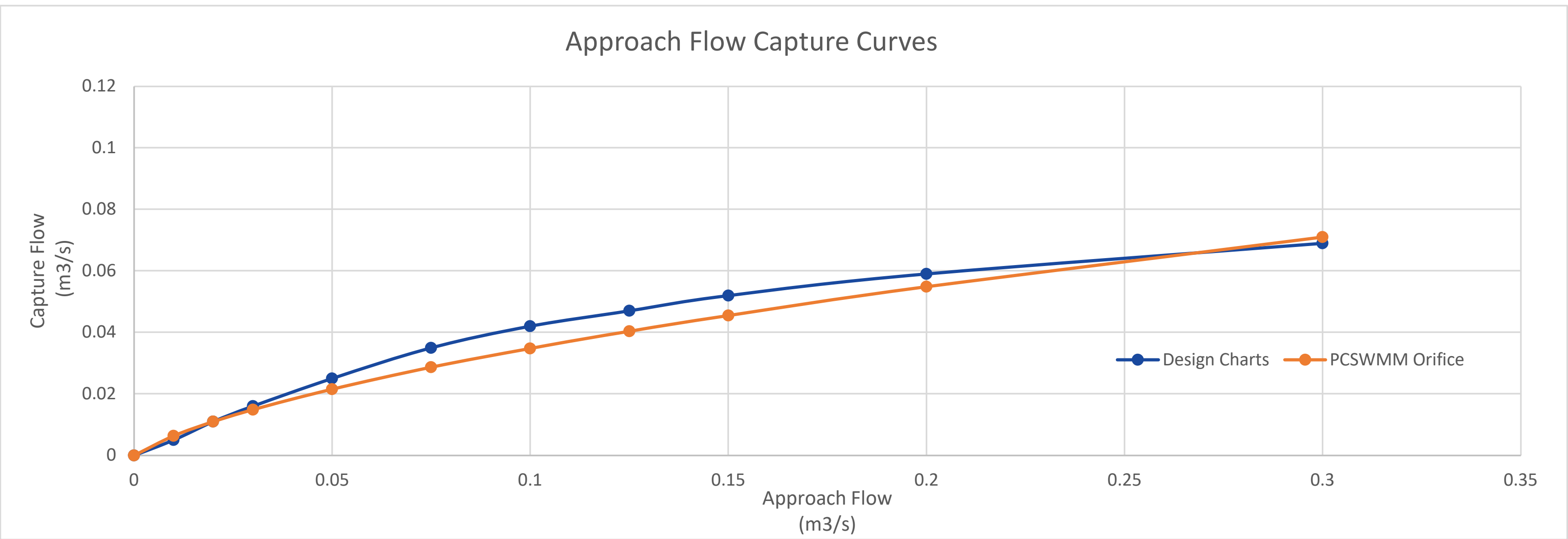
* Curve based on MTO Design Charts,
* derived for 2% cross slope & 3% longitudinal slope
* assuming OPSD 400.01 grates and OPSD 600.01 curbs and gutters
* The 250 mm lead pipe does not control the flow.

Approach Flow (m^3/s)	Capture Flow (m^3/s)
0.000	0
0.010	0.005
0.020	0.011
0.030	0.016
0.050	0.025
0.075	0.035
0.100	0.042
0.125	0.047
0.150	0.052
0.200	0.059
0.300	0.069

PCSWMM Model Orifice

2% cross slope & 3% longitudinal slope
0.35m x 0.35m
Rectangular Bottom Opening
$C_o = 0.62$

Approach Flow (m^3/s)	Capture Flow (m^3/s)
0.000	0.000
0.010	0.006
0.020	0.011
0.030	0.015
0.050	0.022
0.075	0.029
0.100	0.035
0.125	0.040
0.150	0.046
0.200	0.055
0.300	0.071



R^2 = **0.979**

CICB Grate - 1% Longitudinal Slope

Approach Flow Capture Per Design Charts/Manual

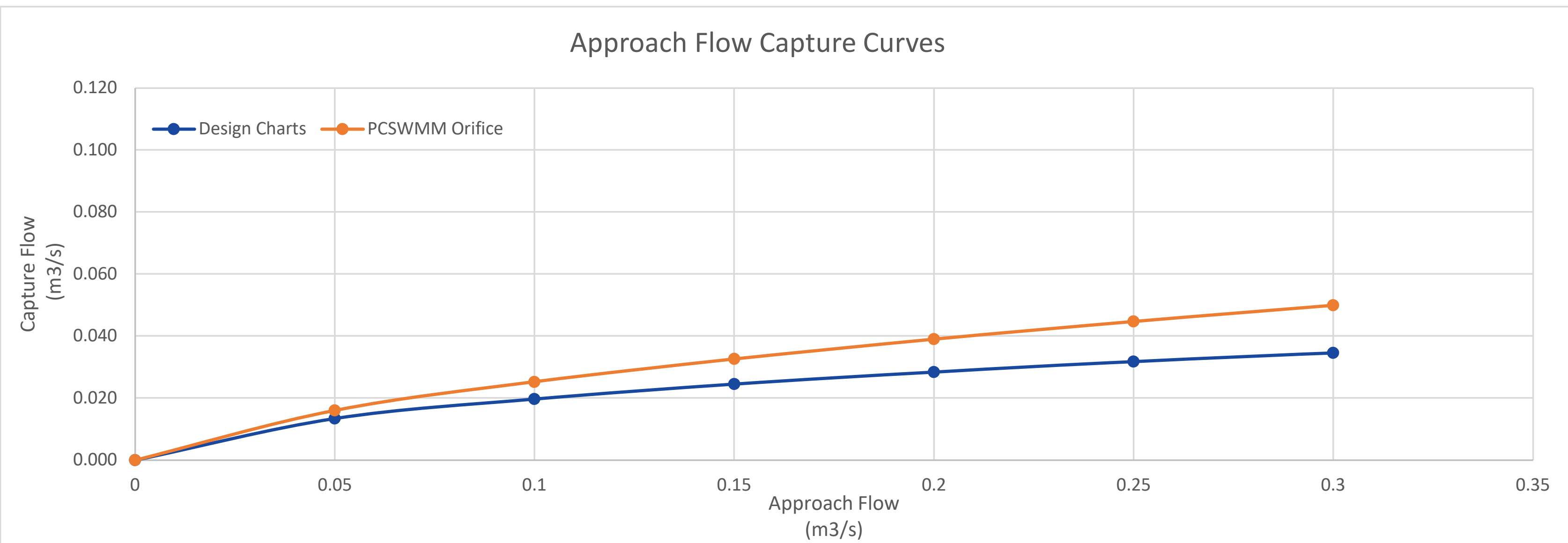
* Curve based on City of Ottawa Sewer Design Guidelines(Appendix 7-A.13),
* derived for 3% cross slope & 1% longitudinal slope
* Assuming Type S22 Curb Inlet and OPSD 600.01 curbs and gutters
* The 250 mm lead pipe does not control the flow.

Approach Flow (m^3/s)	Capture Flow (m^3/s)
0.000	0.000
0.050	0.013
0.100	0.020
0.150	0.025
0.200	0.028
0.250	0.032
0.300	0.035

PCSWMM Model Orifice

3% cross slope & 1% longitudinal slope
0.65m x 0.13m
Rectangular Side Opening
C_o = 0.62

Approach Flow (m^3/s)	Capture Flow (m^3/s)
0.000	0.000
0.050	0.016
0.100	0.025
0.150	0.033
0.200	0.039
0.250	0.045
0.300	0.050



R^2 = **0.993**

CICB Grate - 2% Longitudinal Slope

Approach Flow Capture Per Design Charts/Manual

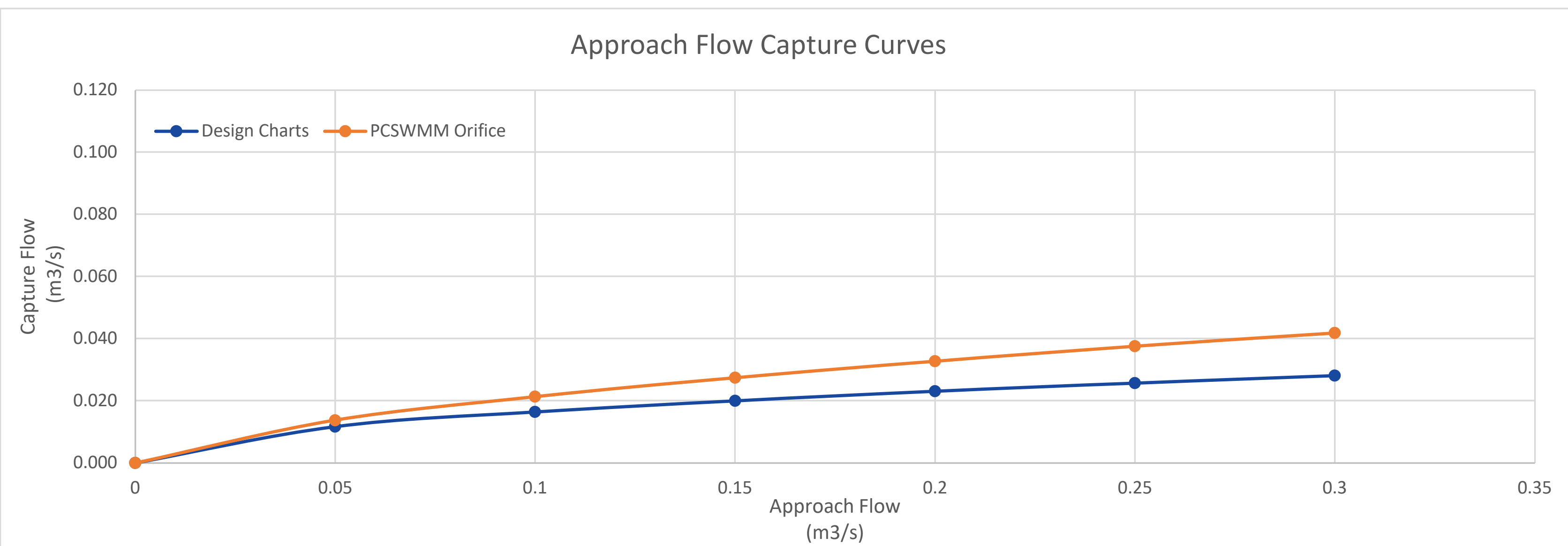
* Curve based on City of Ottawa Sewer Design Guidelines(Appendix 7-A.13),
* derived for 3% cross slope & 2% longitudinal slope
* Assuming Type S22 Curb Inlet and OPSD 600.01 curbs and gutters
* The 250 mm lead pipe does not control the flow.

Approach Flow (m^3/s)	Capture Flow (m^3/s)
0.000	0.000
0.050	0.012
0.100	0.016
0.150	0.020
0.200	0.023
0.250	0.026
0.300	0.028

PCSWMM Model Orifice

3% cross slope & 2% longitudinal slope
0.65m x 0.13m
Rectangular Side Opening
C_o = 0.62

Approach Flow (m^3/s)	Capture Flow (m^3/s)
0.000	0.000
0.050	0.014
0.100	0.021
0.150	0.027
0.200	0.033
0.250	0.038
0.300	0.042



R^2 = 0.990

CICB Grate - 3% Longitudinal Slope

Approach Flow Capture Per Design Charts/Manual

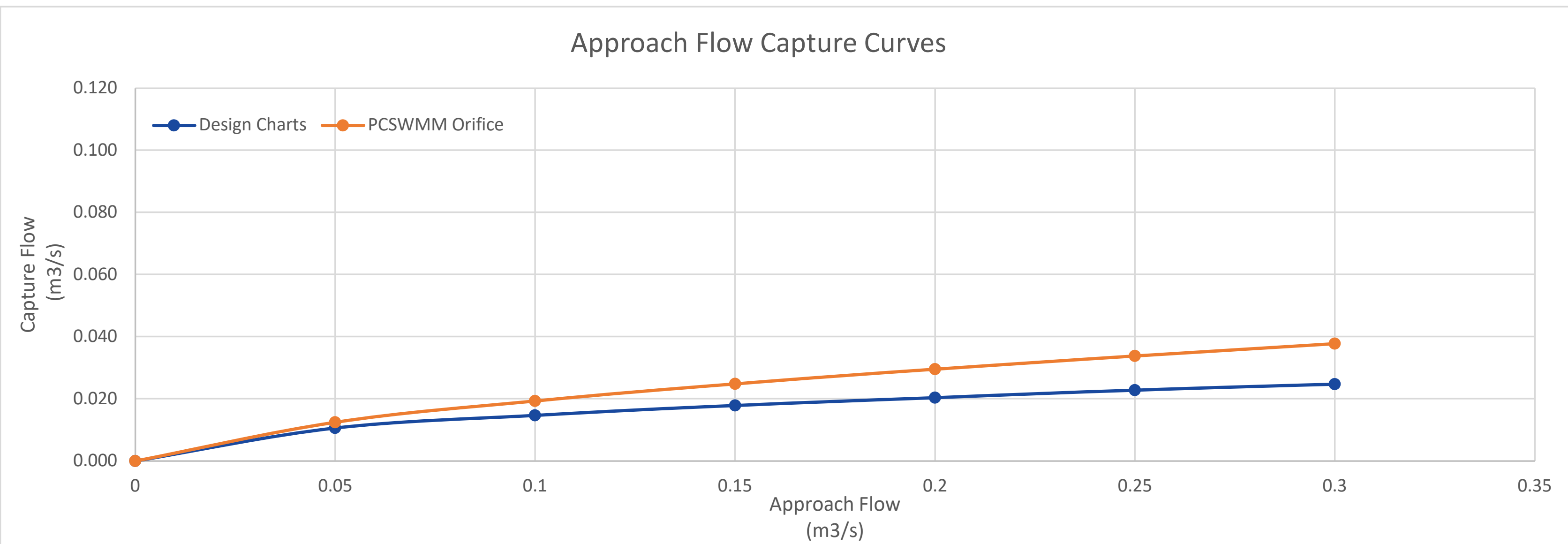
* Curve based on City of Ottawa Sewer Design Guidelines(Appendix 7-A.13),
* derived for 3% cross slope & 3% longitudinal slope
* Assuming Type S22 Curb Inlet and OPSD 600.01 curbs and gutters
* The 250 mm lead pipe does not control the flow.

Approach Flow (m^3/s)	Capture Flow (m^3/s)
0.000	0.000
0.050	0.011
0.100	0.015
0.150	0.018
0.200	0.020
0.250	0.023
0.300	0.025

PCSWMM Model Orifice

3% cross slope & 3% longitudinal slope
0.65m x 0.13m
Rectangular Side Opening
C_o = 0.62

Approach Flow (m^3/s)	Capture Flow (m^3/s)
0.000	0.000
0.050	0.012
0.100	0.019
0.150	0.025
0.200	0.030
0.250	0.034
0.300	0.038



R^2 = 0.988

APPENDIX C

Manhole Loss Coefficient Nomograph and Table

Pipe Data and Hydraulic Simulation Results

JFSA Water Resources and Environmental Consultants

MANHOLE LOSS COEFFICIENT NOMOGRAPH AND TABLE

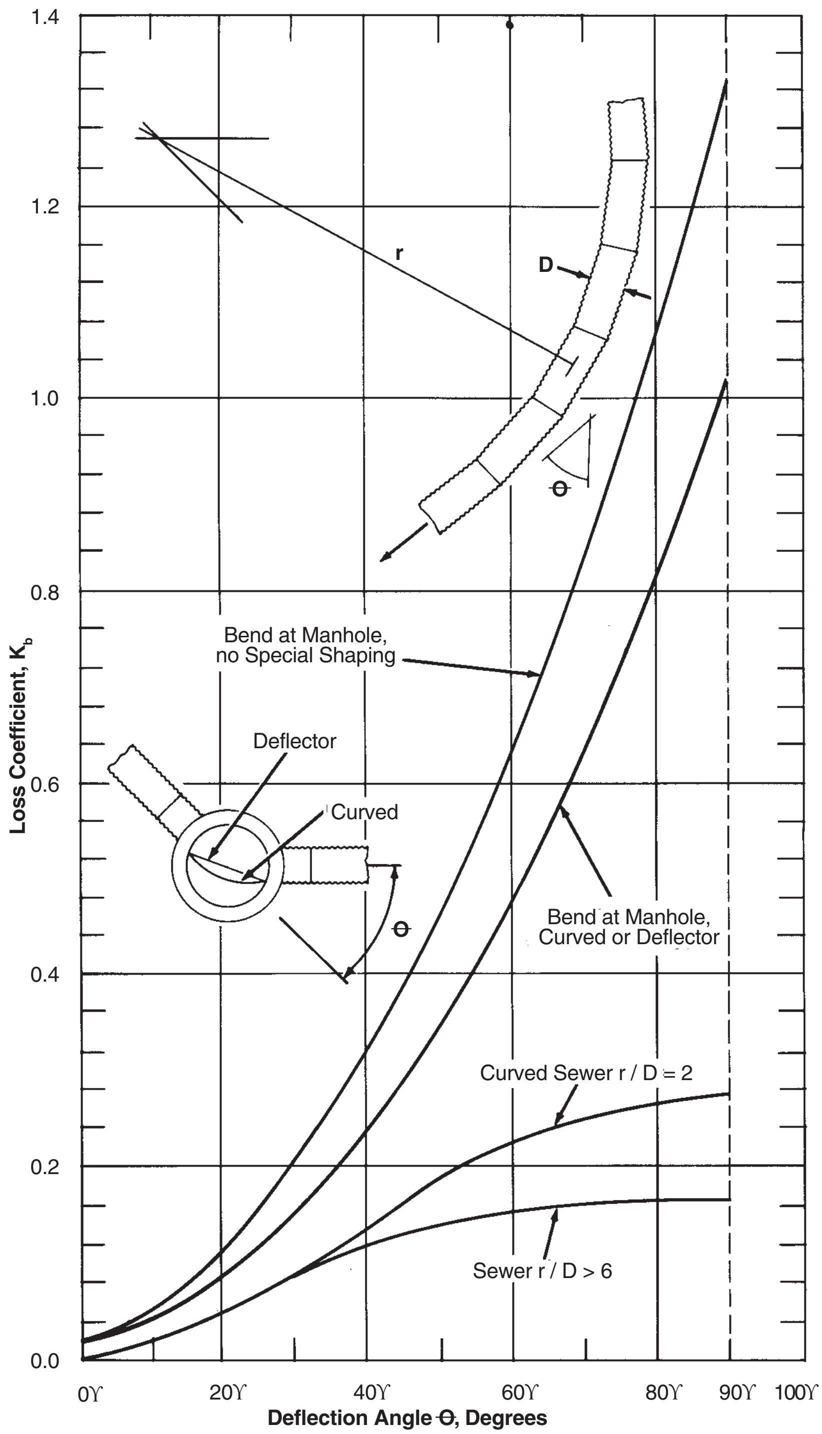


Figure 4.13 Sewer bend loss coefficient[16]

Angle	Exit Loss
0	0.02
5	0.035
10	0.055
15	0.08
20	0.11
25	0.16
30	0.21
35	0.26
40	0.32
45	0.39
50	0.47
55	0.54
60	0.635
65	0.73
70	0.84
75	0.95
80	1.07
85	1.19
90	1.33

Table C1: Pipe Data and Hydraulic Simulation Results - 100-Year Chicago 3 Hour Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	U/S MH Cover Elevation (m)	D/S MH Cover Elevation (m)	Pipe Dia (mm)	Pipe Length (m)	Pipe Slope (%)	n (-)	Design Velocity (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak Flow/ Design Flow	Surcharge U/S (m)	Time To peak (hh:mm)	Max U/S HGL (m)	Max D/S HGL (m)
MH_302	MH_303	96.41	96.33	101.14	101.08	2250	58.9	0.10	0.013	1.66	6.59	8.12	1.23	-0.28	01/01/2019 01:15 AM	98.38	98.28
MH_303	MH_304	96.33	96.18	101.08	100.73	2250	134.3	0.10	0.013	1.67	6.62	8.23	1.24	-0.30	01/01/2019 01:15 AM	98.28	98.05
MH_304	MH_306TEE	96.18	96.13	100.73	100.27	2250	42.5	0.10	0.013	1.67	6.62	8.30	1.25	-0.38	01/01/2019 01:15 AM	98.05	97.81
MH_306TEE	MH_307	96.13	96.10	100.27	100.35	2250	11.2	0.12	0.013	1.79	7.10	8.30	1.17	-0.57	01/01/2019 01:15 AM	97.81	97.63
MH_307	MH_400	96.10	96.07	100.35	100.35	2250	22.7	0.11	0.013	1.71	6.79	5.82	0.86	-0.72	01/01/2019 01:15 AM	97.63	97.59
MH_307	MH-313	96.10	96.10	100.35	99.84	2250	3.8	0.03	0.013	0.85	3.36	2.49	0.74	-0.72	01/01/2019 01:16 AM	97.63	97.58
MH_3112	POND	96.01	95.67	100.35	97.87	2250	8.6	0.12	0.013	1.79	7.10	5.82	0.82	-1.10	01/01/2019 01:15 AM	97.16	96.91
MH_400	OGS_1	96.07	96.04	100.35	100.50	750	4.9	0.20	0.013	1.13	0.50	1.00	2.00	0.77	01/01/2019 01:01 AM	97.59	97.55
MH_500	OGS_2	96.06	96.03	100.35	100.43	750	5.0	0.20	0.013	1.13	0.50	1.00	2.01	0.57	01/01/2019 01:40 AM	97.38	97.35
MH-313	MH_500	96.10	96.06	99.84	100.35	2250	33.0	0.10	0.013	1.68	6.69	4.29	0.64	-0.77	01/01/2019 01:15 AM	97.58	97.38
MH-500	MH-502	102.40	100.92	105.25	104.32	300	91.8	1.45	0.013	1.65	0.12	0.10	0.84	-0.09	01/01/2019 01:10 AM	102.61	101.18
MH-502	MH-503	100.92	98.95	104.32	102.42	450	118.7	1.60	0.013	2.27	0.36	0.23	0.64	-0.19	01/01/2019 01:10 AM	101.18	99.43
MH-5020	MH-502	101.14	100.92	104.32	104.32	300	8.5	0.51	0.013	0.97	0.07	0.00	0.03	-0.26	01/01/2019 01:02 AM	101.18	101.18
MH-503	MH-504	98.95	98.68	102.42	101.90	525	75.0	0.25	0.013	1.00	0.22	0.26	1.20	-0.05	01/01/2019 01:11 AM	99.43	99.07
MH-504	MH-528	98.68	97.32	101.90	101.06	600	108.0	0.85	0.013	2.00	0.57	0.42	0.75	-0.21	01/01/2019 01:11 AM	99.07	98.27
MH-505	MH-506	103.48	103.35	105.84	106.28	300	13.0	0.60	0.013	1.06	0.07	0.01	0.17	-0.22	01/01/2019 01:10 AM	103.56	103.67
MH-505	MH-534	103.48	103.03	105.84	105.41	375	94.5	0.45	0.013	1.06	0.12	0.01	0.10	-0.30	01/01/2019 01:10 AM	103.56	103.22
MH-506	MH-508	103.35	103.05	106.28	105.88	300	79.0	0.35	0.013	0.81	0.06	0.06	1.01	0.02	01/01/2019 01:06 AM	103.67	103.41
MH-5070	MH-513	103.12	102.39	105.92	105.51	300	82.0	0.50	0.013	0.97	0.07	0.06	0.89	0.01	01/01/2019 01:08 AM	103.43	105.27
MH-508	MH-509	103.05	102.84	105.88	105.67	300	41.5	0.45	0.013	0.92	0.06	0.08	1.22	0.06	01/01/2019 01:09 AM	103.41	103.14
MH-5080	MH-517	102.90	102.05	105.70	105.28	300	76.5	0.55	0.013	1.01	0.07	0.06	0.85	-0.09	01/01/2019 01:10 AM	103.11	102.92
MH-509	MH-510	102.84	102.72	105.67	105.60	300	10.5	0.40	0.013	0.87	0.06	0.08	1.29	0.00	01/01/2019 01:10 AM	103.14	102.93
MH-510	MH-511	102.72	102.08	105.60	105.25	375	64.0	0.55	0.013	1.18	0.13	0.08	0.61	-0.17	01/01/2019 01:10 AM	102.93	102.32
MH-511	MH-526	102.08	98.64	105.25	103.00	450	95.5	2.80	0.013	3.00	0.48	0.27	0.57	-0.21	01/01/2019 01:10 AM	102.32	100.20
MH-513	MH-515	102.39	100.23	105.51	104.00	300	81.0	2.30	0.013	2.08	0.15	0.16	1.10	2.58	01/01/2019 01:12 AM	105.27	100.71
MH-515	MH-518	100.23	99.79	104.00	103.59	600	44.0	0.30	0.013	1.19	0.34	0.37	1.09	-0.12	01/01/2019 01:11 AM	100.71	100.38
MH-517	MH-518	102.05	99.79	105.28	103.59	300	82.0	2.30	0.013	2.08	0.15	0.16	1.09	0.57	01/01/2019 01:11 AM	102.92	100.38
MH-518	MH-526	99.79	98.64	103.59	103.00	675	47.0	0.30	0.013	1.29	0.46	0.52	1.13	-0.08	01/01/2019 01:11 AM	100.38	100.20
MH-519	MH-520	103.45	103.09	106.29	106.01	300	53.1	0.47	0.013	0.94	0.07	0.02	0.24	-0.20	01/01/2019 01:10 AM	103.55	103.27
MH-519	MH-523	103.45	103.22	106.29	106.20	300	13.8	0.36	0.013	0.82	0.06	0.01	0.23	-0.20	01/01/2019 01:10 AM	103.55	103.36
MH-520	MH-521	103.09	102.81	106.01	105.72	375	55.9	0.45	0.013	1.07	0.12	0.05	0.43	-0.19	01/01/2019 01:10 AM	103.27	103.00
MH-521	MH-522	102.81	102.73	105.72	105.64	375	13.8	0.36	0.013	0.95	0.10	0.05	0.49	-0.19	01/01/2019 01:10 AM	103.00	102.89
MH-522	MH-525	102.73	100.70	105.64	104.25	375	54.3	2.56	0.013	2.54	0.28	0.11	0.39	-0.22	01/01/2019 01:10 AM	102.89	100.99
MH-523	MH-524	103.22	102.13	106.20	105.48	300	54.3	1.81	0.013	1.84	0.13	0.06	0.42	-0.16	01/01/2019 01:10 AM	103.36	102.36
MH-524	MH-5240	102.13	101.92	105.48	105.23	375	65.2	0.30	0.013	0.87	0.10	0.07	0.69	-0.14	01/01/2019 01:10 AM	102.36	102.18
MH-524	MH-538	102.13	100.89	105.48	104.20	300	58.3	1.74	0.013	1.81	0.13	0.10	0.80	-0.07	01/01/2019 01:10 AM	102.36	101.19
MH-5240	MH-525	101.92	100.70	105.23	104.25	375	63.3	1.56	0.013	1.98	0.22	0.15	0.70	-0.11	01/01/2019 01:11 AM	102.18	100.99
MH-525	MH-526	100.70	98.64	104.25	103.00	525	59.0	1.80	0.013	2.67	0.58	0.34	0.59	-0.23	01/01/2019 01:10 AM	100.99	100.20
MH-526	MH-528	98.64	97.32	103.00	101.06	675	59.5	1.60	0.013	2.97	1.06	1.17	1.10	0.89	01/01/2019 01:12 AM	100.20	98.27
MH-527	MH-528	99.08	97.32	101.18	101.06	300	18.5	0.35	0.013	0.81	0.06	0.02	0.33	-0.16	01/01/2019 01:10 AM	99.22	98.27
MH-528	MH-529	97.32	97.01	101.06	100.82	1050	62.5	0.25	0.013	1.58	1.37	1.64	1.20	-0.10	01/01/2019 01:12 AM	98.27	98.03
MH-529	MH-530	97.01	96.85	100.82	100.58	1200	72.0	0.15	0.013	1.34	1.51	1.64	1.08	-0.18	01/01/2019 01:12 AM	98.03	97.89
MH-530	MH-531	96.85	96.66	100.58	100.45	1200	76.5	0.15	0.013	1.34	1.51	1.77	1.17	-0.16	01/01/2019 01:13 AM	97.89	97.69
MH-531	MH-313	96.66	96.10	100.45	99.84	1200	21.5	0.15	0.013	1.33	1.50	1.76	1.17	-0.17	01/01/2019 01:13 AM	97.69	97.58
MH-534	MH-535	103.03	100.60	105.41	103.89	375	78.5	3.00	0.013	2.75	0.30	0.16	0.52	-0.19	01/01/2019 01:10 AM	103.22	100.98
MH-535	MH-515	100.60	100.23	103.89	104.00	450	44.0	0.20	0.013	0.80	0.13	0.16	1.22	-0.07	01/01/2019 01:11 AM	100.98	100.71
MH-5350	MH-539	101.61	99.62	103.89	102.47	300	52.5	2.40	0.013	2.12	0.15	0.02	0.11	-0.23	01/01/2019 01:10 AM	101.68	100.17
MH-536	MH-538	102.50	100.89	106.02	104.20	450	58.2	2.14	0.013	2.62	0.42	0.07	0.16	-0.33	01/01/2019 01:10 AM	102.62	101.19
MH-537	MH-536	102.66	102.50	105.65	106.02	450	64.3	0.20	0.013	0.80	0.13	0.05	0.41	-0.25	01/01/2019 01:10 AM	102.86	102.62
MH-538	MH-539	100.89	99.62	104.20	102.47	525	59.0	2.10	0.013	2.88	0.62	0.39	0.62	-0.23	01/01/2019 01:10 AM	101.19	100.17
MH-539	MH-542	99.62	99.34	102.47	102.40	525	9.5	0.60	0.013	1.54	0.33	0.40	1.20	0.02	01/01/2019 01:10 AM	100.17	100.01
MH-540	MH-541	100.07	99.96	101.65	102.51	300	14.5	0.35	0.013	0.81	0.06	0.04	0.73	-0.10	01/01/2019 01:10 AM	100.27	100.15
MH-541	MH-542	99.96	99.34	102.51	102.40	300	10.0	0.35	0.013	0.81	0.06	0.04	0.73	-0.11	01/01/2019 01:10 AM	100.15	100.01
MH-542	MH-543	99.34	99.18	102.40	102.19	750	53.0	0.15	0.013	0.98	0.43	0.57	1.31	-0.08	01/01/2019 01:10 AM	100.01	99.86
MH-543	MH-544	99.18	97.99	102.19	102.02	825	118.0	0.15	0.013	1.04	0.56	0.65	1.17	-0.14	01/01/2019 01:11 AM	99.86	98.45
MH-544	MH-5440	97.99	97.27	102.02	101.00	825	57.5	1.20	0.013	2.94	1.57	0.71	0.45	-0.37	01/01/2019 01:11 AM	98.45	98.40
MH-5440	MH_302	97.27	96.41	101.00	101.14	825	12.3	1.22	0.013	2.97	1.59	0.71	0.45	0.30	01/01/2019 01:11 AM	98.40	98.38
MH-546	MH-547	101.96	100.95	104.84	103.97	375	96.5	0.90	0.013	1.51	0.17	0.12	0.70	-0.14	01/01/2019 01:10 AM	102.19	101.18
MH-547	MH-548	100.95	100.20	103.97	103.13	375	63.0	1.15	0.013	1.70	0.19	0.13	0.71	-0.14	01/01/2019 01:10 AM	101.18	100.71
MH-548	MH-549	100.20	99.88	103.13	102.82	375	29.6	0.85	0.013	1.46	0.16	0.18	1.10	0.14	01/01/2019 01:10 AM	100.71	100.34
MH-549	MH-550	99.88	99.60	102.82	102.62	375	15.1	0.90	0.013	1.50	0.17	0.20	1.17	0.08	01/01/2019 01:10 AM	100.34	99.86
MH-550	MH-551	99.60	97.86	102.62	100.93	525	110.3	1.55	0.013	2.48	0.54	0.26	0.48	-0.27	01/01/2019 01:10 AM	99.86	98.35
MH-551	MH-559	97.86	94.69	100.93	100.18	525	51.3	1.41	0.013	2.36	0.51	0.43	0.84	-0.04	01/01/2019 01:12 AM	98.35	96.20
MH-552	MH-553	100.16	99.06	102.99	102.00	300	64.6	1.60	0.013	1.73	0.12	0.05	0.43	-0.16	01/01/2019 01:10 AM	100.30	99.38
MH-553	MH-557	99.06	97.32	102.00	100.85	375	103.0	1.40	0.013	1.88	0.21	0.19	0.94	-0.06	01/01/2019 01:07 AM	99.38	98.11
MH-554	MH-556	99.65	98.61	102.47	101.70	300	79.5	0.95	0.013	1.33	0.09	0.04	0.38	-0.17	01/01/2019 01:10 AM	99.78	98.96
MH-556	MH-560	98.61	98.24	101.70	101.29	525	25.2	1.39	0.013	2.34	0.51	0.32	0.62	-0.18	01/01/2019 01:10 AM	98.96	98.86
MH-5560	MH-556	98.81	98.61	101.67	101.70	525	14.0	0.99	0.013	1.97	0.43	0.28	0.66	-0.22	01/01/2019 01:10 AM	99.12	98.96
MH-557	MH-558	97.32	97.12	100.85	100.39	675	36.4	0.45	0.013	1.58	0.56	0.72	1.27	0.12	01/01/2019 01:11 AM	98.11	97.81
MH-558	MH-559	97.12	94.69	100.39	100.18	675	15.5	0.45	0.013	1.58	0.57	0.72	1.26	0.02	01/01/2019 01:11 AM	97.81	96.20
MH-559	MH-75	94.69	93.16	100.18	97.88	675	15.1	0.79	0.013	2.09	0.75	1.14	1.52	0.84	01/01/2019 01:11 AM	96.20	93.84
MH-560	MH-557	98.24	97.32	101.29	100.85	525	45.4	0.90	0.013	1.89	0.41	0.48	1.18	0.09	01/01/2019 01:10 AM	98.86	98.11
MH-561	MH-537	103.01	102.66	105.89	105.65	375	42.3	0.65	0.013	1.28	0.14	0.03	0.24	-0.25	01/01/2019 01:10 AM	103.14	102.86
MH-561	MH-563	103.01	100.82	105.89	104.35	300	60.8	2.79	0.013	2.29	0.16	0.06	0.37	-0.17	01/01/2019 01:10 AM	103.14	101.21
MH-562	MH-563	101.18	100.82	103.28	104.35	300	29.7	0.45	0.013	0.92	0.06	0.04	0.68	-0.09	01/01/2019 01:10 AM	101.39	101.21
MH-563	MH-564	100.82	100.64	104.35	104.05	525	73.6	0.20	0.013	0.89	0.19	0.18	0.94	-0.14	01/01/2019 01:10 AM	101.21	100.88
MH-564	MH-77	100.64	99.55	104.05	103.38	525	48.6	2.05	0.013	2.84	0.62	0.26	0.43	-0.29	01/01/2019 01:10 AM	100.88	100.00
MH-565	MH-560	99.47	98.24	102.40	101.29	375	97.1	1.05	0.013	1.63	0.18	0.16	0.87	-0.09	01/01/2019 01:07 AM	99.75	98.86
MH-566	MH-565	100.59	99.47	103.41	102.40	300	71.3	1.56	0.013	1.71	0.12	0.00	0.00	-0.30	01/01/2019 00:00 AM	100.59	99.75
OGS_1	OGS_1-Out	96.04	96.02	100.50	100.35	750	4.9	0.20	0.013	1.14	0.50	1.00	1.99	0.76	01/01/2019 01:01 AM	97.55	97.19
OGS_1-Out	MH_3112	96.02	96.01	100.35	100.35	2250	6.2	0.10	0.013	1.63	6.49	5.82	0.90	-1.08	01/01/2019 01:15 AM	97.19	97.16
OGS_2	OGS_2-Out	96.03	96.00	100.43	100.35	750	5.1	0.20	0.013	1.12	0.49	1.00	2.02	0.57	01/01/2019 01:40 AM	97.35	96.97
OGS_2-Out	POND	96.00	95.67	100.35	97.87	2250	5.6	0.07	0.013	1.40	5.55	4.29	0.77	-1.28	01/01/2019 01:15 AM	96.97	96.91

Table C2: Pipe Data and Hydraulic Simulation Results - 100-Year SCS 24 Hour Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	U/S MH Cover Elevation (m)	D/S MH Cover Elevation (m)	Pipe Dia (mm)	Pipe Length (m)	Pipe Slope (%)	n (-)	Design Velocity (m/s)	Design Flow (m³/s)	Peak Pipe Flow (m³/s)	Peak Flow/ Design Flow	Surcharge U/S (m)	Time To peak (hh:mm)	Max U/S HGL (m)	Max D/S HGL (m)
MH_302	MH_303	96.41	96.33	101.14	101.08	2250	58.9	0.10	0.013	1.66	6.59	7.99	1.21	-0.31	01/01/2019 12:03 PM	98.35	98.26
MH_303	MH_304	96.33	96.18	101.08	100.73	2250	134.3	0.10	0.013	1.67	6.62	8.10	1.22	-0.32	01/01/2019 12:03 PM	98.26	98.04
MH_304	MH_306TEE	96.18	96.13	100.73	100.27	2250	42.5	0.10	0.013	1.67	6.62	8.17	1.23	-0.39	01/01/2019 12:03 PM	98.04	97.80
MH_306TEE	MH_307	96.13	96.10	100.27	100.35	2250	11.2	0.12	0.013	1.79	7.10	8.17	1.15	-0.58	01/01/2019 12:03 PM	97.80	97.61
MH_307	MH_400	96.10	96.07	100.35	100.35	2250	22.7	0.11	0.013	1.71	6.79	5.71	0.84	-0.74	01/01/2019 12:03 PM	97.61	97.58
MH_307	MH-313	96.10	96.10	100.35	99.84	2250	3.8	0.03	0.013	0.85	3.36	2.45	0.73	-0.74	01/01/2019 12:03 PM	97.61	97.57
MH_3112	POND	96.01	95.67	100.35	97.87	2250	8.6	0.12	0.013	1.79	7.10	5.71	0.80	-1.12	01/01/2019 12:03 PM	97.14	96.86
MH_400	OGS_1	96.07	96.04	100.35	100.50	750	4.9	0.20	0.013	1.13	0.50	1.00	2.00	0.76	01/01/2019 11:45 AM	97.58	97.54
MH_500	OGS_2	96.06	96.03	100.35	100.43	750	5.0	0.20	0.013	1.13	0.50	1.00	2.01	0.57	01/01/2019 12:20 PM	97.38	97.34
MH-313	MH_500	96.10	96.06	99.84	100.35	2250	33.0	0.10	0.013	1.68	6.69	4.22	0.63	-0.78	01/01/2019 12:03 PM	97.57	97.38
MH-500	MH-502	102.40	100.92	105.25	104.32	300	91.8	1.45	0.013	1.65	0.12	0.10	0.82	-0.09	01/01/2019 12:00 PM	102.61	101.18
MH-502	MH-503	100.92	98.95	104.32	102.42	450	118.7	1.60	0.013	2.27	0.36	0.23	0.64	-0.19	01/01/2019 12:00 PM	101.18	99.42
MH-5020	MH-502	101.14	100.92	104.32	104.32	300	8.5	0.51	0.013	0.97	0.07	0.00	0.00	-0.27	01/01/2019 12:03 PM	101.17	101.18
MH-503	MH-504	98.95	98.68	102.42	101.90	525	75.0	0.25	0.013	1.00	0.22	0.26	1.18	-0.06	01/01/2019 12:01 PM	99.42	99.06
MH-504	MH-528	98.68	97.32	101.90	101.06	600	108.0	0.85	0.013	2.00	0.57	0.42	0.74	-0.22	01/01/2019 12:01 PM	99.06	98.24
MH-505	MH-506	103.48	103.35	105.84	106.28	300	13.0	0.60	0.013	1.06	0.07	0.00	0.03	-0.27	01/01/2019 12:00 PM	103.51	103.60
MH-505	MH-534	103.48	103.03	105.84	105.41	375	94.5	0.45	0.013	1.06	0.12	0.00	0.02	-0.34	01/01/2019 12:00 PM	103.51	103.21
MH-506	MH-508	103.35	103.05	106.28	105.88	300	79.0	0.35	0.013	0.81	0.06	0.06	0.98	-0.05	01/01/2019 12:00 PM	103.60	103.38
MH-5070	MH-513	103.12	102.39	105.92	105.51	300	82.0	0.50	0.013	0.97	0.07	0.06	0.92	0.66	01/01/2019 11:57 AM	104.08	104.88
MH-508	MH-509	103.05	102.84	105.88	105.67	300	41.5	0.45	0.013	0.92	0.06	0.08	1.15	0.03	01/01/2019 12:00 PM	103.38	103.12
MH-5080	MH-517	102.90	102.05	105.70	105.28	300	76.5	0.55	0.013	1.01	0.07	0.05	0.71	-0.11	01/01/2019 12:00 PM	103.09	102.74
MH-509	MH-510	102.84	102.72	105.67	105.60	300	10.5	0.40	0.013	0.87	0.06	0.08	1.23	-0.02	01/01/2019 12:00 PM	103.12	102.93
MH-510	MH-511	102.72	102.08	105.60	105.25	375	64.0	0.55	0.013	1.18	0.13	0.08	0.58	-0.17	01/01/2019 12:01 PM	102.93	102.31
MH-511	MH-526	102.08	98.64	105.25	103.00	450	95.5	2.80	0.013	3.00	0.48	0.26	0.54	-0.22	01/01/2019 12:00 PM	102.31	100.05
MH-513	MH-515	102.39	100.23	105.51	104.00	300	81.0	2.30	0.013	2.08	0.15	0.17	1.15	2.19	01/01/2019 11:57 AM	104.88	100.68
MH-515	MH-518	100.23	99.79	104.00	103.59	600	44.0	0.30	0.013	1.19	0.34	0.34	1.00	-0.15	01/01/2019 11:57 AM	100.68	100.31
MH-517	MH-518	102.05	99.79	105.28	103.59	300	82.0	2.30	0.013	2.08	0.15	0.15	1.04	0.39	01/01/2019 12:01 PM	102.74	100.31
MH-518	MH-526	99.79	98.64	103.59	103.00	675	47.0	0.30	0.013	1.29	0.46	0.48	1.05	-0.16	01/01/2019 12:01 PM	100.31	100.05
MH-519	MH-520	103.45	103.09	106.29	106.01	300	53.1	0.47	0.013	0.94	0.07	0.01	0.21	-0.20	01/01/2019 12:00 PM	103.55	103.27
MH-519	MH-523	103.45	103.22	106.29	106.20	300	13.8	0.36	0.013	0.82	0.06	0.01	0.21	-0.20	01/01/2019 12:00 PM	103.55	103.35
MH-520	MH-521	103.09	102.81	106.01	105.72	375	55.9	0.45	0.013	1.07	0.12	0.05	0.42	-0.19	01/01/2019 12:00 PM	103.27	103.00
MH-521	MH-522	102.81	102.73	105.72	105.64	375	13.8	0.36	0.013	0.95	0.10	0.05	0.48	-0.19	01/01/2019 12:00 PM	103.00	102.89
MH-522	MH-525	102.73	100.70	105.64	104.25	375	54.3	2.56	0.013	2.54	0.28	0.11	0.38	-0.22	01/01/2019 11:59 AM	102.89	100.99
MH-523	MH-524	103.22	102.13	106.20	105.48	300	54.3	1.81	0.013	1.84	0.13	0.05	0.41	-0.17	01/01/2019 12:00 PM	103.35	102.36
MH-524	MH-5240	102.13	101.92	105.48	105.23	375	65.2	0.30	0.013	0.87	0.10	0.07	0.68	-0.14	01/01/2019 12:00 PM	102.36	102.18
MH-524	MH-538	102.13	100.89	105.48	104.20	300	58.3	1.74	0.013	1.81	0.13	0.10	0.79	-0.07	01/01/2019 12:00 PM	102.36	101.16
MH-5240	MH-525	101.92	100.70	105.23	104.25	375	63.3	1.56	0.013	1.98	0.22	0.15	0.69	-0.11	01/01/2019 12:01 PM	102.18	100.99
MH-525	MH-526	100.70	98.64	104.25	103.00	525	59.0	1.80	0.013	2.67	0.58	0.34	0.59	-0.23	01/01/2019 11:59 AM	100.99	100.05
MH-526	MH-528	98.64	97.32	103.00	101.06	675	59.5	1.60	0.013	2.97	1.06	1.13	1.06	0.73	01/01/2019 12:01 PM	100.05	98.24
MH-527	MH-528	99.08	97.32	101.18	101.06	300	18.5	0.35	0.013	0.81	0.06	0.02	0.28	-0.18	01/01/2019 11:55 AM	99.20	98.24
MH-528	MH-529	97.32	97.01	101.06	100.82	1050	62.5	0.25	0.013	1.58	1.37	1.59	1.17	-0.13	01/01/2019 12:01 PM	98.24	98.00
MH-529	MH-530	97.01	96.85	100.82	100.58	1200	72.0	0.15	0.013	1.34	1.51	1.59	1.05	-0.21	01/01/2019 12:01 PM	98.00	97.87
MH-530	MH-531	96.85	96.66	100.58	100.45	1200	76.5	0.15	0.013	1.34	1.51	1.72	1.14	-0.18	01/01/2019 12:02 PM	97.87	97.68
MH-531	MH-313	96.66	96.10	100.45	99.84	1200	21.5	0.15	0.013	1.33	1.50	1.72	1.14	-0.18	01/01/2019 12:02 PM	97.68	97.57
MH-534	MH-535	103.03	100.60	105.41	103.89	375	78.5	3.00	0.013	2.75	0.30	0.14	0.46	-0.19	01/01/2019 12:00 PM	103.21	100.94
MH-535	MH-515	100.60	100.23	103.89	104.00	450	44.0	0.20	0.013	0.80	0.13	0.14	1.08	-0.11	01/01/2019 12:00 PM	100.94	100.68
MH-5350	MH-539	101.61	99.62	103.89	102.47	300	52.5	2.40	0.013	2.12	0.15	0.02	0.11	-0.23	01/01/2019 12:00 PM	101.68	100.09
MH-536	MH-538	102.50	100.89	106.02	104.20	450	58.2	2.14	0.013	2.62	0.42	0.06	0.14	-0.33	01/01/2019 11:59 AM	102.62	101.16
MH-537	MH-536	102.66	102.50	105.65	106.02	450	64.3	0.20	0.013	0.80	0.13	0.05	0.37	-0.26	01/01/2019 12:00 PM	102.85	102.62
MH-538	MH-539	100.89	99.62	104.20	102.47	525	59.0	2.10	0.013	2.88	0.62	0.34	0.54	-0.26	01/01/2019 12:00 PM	101.16	100.09
MH-539	MH-542	99.62	99.34	102.47	102.40	525	9.5	0.60	0.013	1.54	0.33	0.35	1.06	-0.06	01/01/2019 12:00 PM	100.09	99.95
MH-540	MH-541	100.07	99.96	101.65	102.51	300	14.5	0.35	0.013	0.81	0.06	0.03	0.59	-0.13	01/01/2019 12:00 PM	100.24	100.13
MH-541	MH-542	99.96	99.34	102.51	102.40	300	10.0	0.35	0.013	0.81	0.06	0.03	0.59	-0.13	01/01/2019 12:00 PM	100.13	99.95
MH-542	MH-543	99.34	99.18	102.40	102.19	750	53.0	0.15	0.013	0.98	0.43	0.51	1.18	-0.14	01/01/2019 12:00 PM	99.95	99.81
MH-543	MH-544	99.18	97.99	102.19	102.02	825	118.0	0.15	0.013	1.04	0.56	0.59	1.06	-0.20	01/01/2019 12:01 PM	99.81	98.41
MH-544	MH-5440	97.99	97.27	102.02	101.00	825	57.5	1.20	0.013	2.94	1.57	0.65	0.41	-0.41	01/01/2019 12:01 PM	98.41	98.37
MH-5440	MH_302	97.27	96.41	101.00	101.14	825	12.3	1.22	0.013	2.97	1.59	0.65	0.41	0.27	01/01/2019 12:01 PM	98.37	98.35
MH-546	MH-547	101.96	100.95	104.84	103.97	375	96.5	0.90	0.013	1.51	0.17	0.12	0.70	-0.14	01/01/2019 12:00 PM	102.19	101.18
MH-547	MH-548	100.95	100.20	103.97	103.13	375	63.0	1.15	0.013	1.70	0.19	0.13	0.71	-0.14	01/01/2019 12:00 PM	101.18	100.70
MH-548	MH-549	100.20	99.88	103.13	102.82	375	29.6	0.85	0.013	1.46	0.16	0.18	1.08	0.13	01/01/2019 12:00 PM	100.70	100.33
MH-549	MH-550	99.88	99.60	102.82	102.62	375	15.1	0.90	0.013	1.50	0.17	0.19	1.16	0.08	01/01/2019 12:00 PM	100.33	99.86
MH-550	MH-551	99.60	97.86	102.62	100.93	525	110.3	1.55	0.013	2.48	0.54	0.26	0.48	-0.27	01/01/2019 12:00 PM	99.86	98.34
MH-551	MH-559	97.86	94.69	100.93	100.18	525	51.3	1.41	0.013	2.36	0.51	0.42	0.83	-0.05	01/01/2019 12:01 PM	98.34	96.18
MH-552	MH-553	100.16	99.06	102.99	102.00	300	64.6	1.60	0.013	1.73	0.12	0.05	0.43	-0.16	01/01/2019 12:00 PM	100.30	99.37
MH-553	MH-557	99.06	97.32	102.00	100.85	375	103.0	1.40	0.013	1.88	0.21	0.19	0.91	-0.06	01/01/2019 11:53 AM	99.37	98.10
MH-554	MH-556	99.65	98.61	102.47	101.70	300	79.5	0.95	0.013	1.33	0.09	0.03	0.35	-0.18	01/01/2019 12:00 PM	99.77	98.95
MH-556	MH-560	98.61	98.24	101.70	101.29	525	25.2	1.39	0.013	2.34	0.51	0.31	0.62	-0.19	01/01/2019 12:00 PM	98.95	98.86
MH-5560	MH-556	98.81	98.61	101.67	101.70	525	14.0	0.99	0.013	1.97	0.43	0.28	0.66	-0.22	01/01/2019 12:00 PM	99.12	98.95
MH-557	MH-558	97.32	97.12	100.85	100.39	675	36.4	0.45	0.013	1.58	0.56	0.71	1.26	0.11	01/01/2019 12:00 PM	98.10	97.80
MH-558	MH-559	97.12	94.69	100.39	100.18	675	15.5	0.45	0.013	1.58	0.57	0.71	1.25	0.01	01/01/2019 12:00 PM	97.80	96.18
MH-559	MH-75	94.69	93.16	100.18	97.88	675	15.1	0.79	0.013	2.09	0.75	1.13	1.51	0.81	01/01/2019 12:01 PM	96.18	93.81
MH-560	MH-557	98.24	97.32	101.29	100.85	525	45.4	0.90	0.013	1.89	0.41	0.48	1.18	0.09	01/01/2019 12:00 PM	98.86	98.10
MH-561	MH-537	103.01	102.66	105.89	105.65	375	42.3	0.65	0.013	1.28	0.14	0.03	0.22	-0.25	01/01/2019 12:00 PM	103.13	102.85
MH-561	MH-563	103.01	100.82	105.89	104.35	300	60.8	2.79	0.013	2.29	0.16	0.05	0.33	-0.18	01/01/2019 12:00 PM	103.13	101.19
MH-562	MH-563	101.18	100.82	103.28	104.35	300	29.7	0.45	0.013	0.92	0.06	0.04	0.68	-0.09	01/01/2019 12:00 PM	101.39	101.19
MH-563	MH-564	100.82	100.64	104.35	104.05	525	73.6	0.20	0.013	0.89	0.19	0.17	0.90	-0.16	01/01/2019 12:00 PM	101.19	100.87
MH-564	MH-77	100.64	99.55	104.05	103.38	525	48.6	2.05	0.013	2.84	0.62	0.25	0.41	-0.30	01/01/2019 12:00 PM	100.87	99.96
MH-565	MH-560	99.47	98.24	102.40	101.29	375	97.1	1.05	0.013	1.63	0.18	0.15	0.85	-0.11	01/01/2019 11:54 AM	99.74	98.86
MH-566	MH-565	100.59	99.47	103.41	102.40	300	71.3	1.56	0.013	1.71	0.12	0.00	0.00	-0.30	01/01/2019 00:00 AM	100.59	99.74
OGS_1	OGS_1-Out	96.04	96.02	100.50	100.35	750	4.9	0.20	0.013	1.14	0.50	1.00	1.99	0.75	01/01/2019 11:45 AM	97.54	97.18
OGS_1-Out	MH_3112	96.02	96.01	100.35	100.35	2250	6.2	0.10	0.013	1.63	6.49	5.71	0.88	-1.09	01/01/2019 12:03 PM	97.18	97.14
OGS_2	OGS_2-Out	96.03	96.00	100.43	100.35	750	5.1	0.20	0.013	1.12	0.49	1.00	2.03	0.56	01/01/2019 12:20 PM	97.34	96.97
OGS_2-Out	POND	96.00	95.67	100.35	97.87	2250	5.6	0.07	0.013	1.40	5.55	4.22	0.76	-1.28	01/01/2019 12:03 PM	96.97	96.86

Table C3: Pipe Data and Hydraulic Simulation Results - 1979 Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	U/S MH Cover Elevation (m)	D/S MH Cover Elevation (m)	Pipe Dia (mm)	Pipe Length (m)	Pipe Slope (%)	n (-)	Design Velocity (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak Flow/ Design Flow	Surcharge U/S (m)	Time To peak (hh:mm)	Max U/S HGL (m)	Max D/S HGL (m)
MH_302	MH_303	96.41	96.33	101.14	101.08	2250	58.9	0.10	0.013	1.66	6.59	7.70	1.17	-0.36	01/01/2019 01:35 AM	98.30	98.21
MH_303	MH_304	96.33	96.18	101.08	100.73	2250	134.3	0.10	0.013	1.67	6.62	7.81	1.18	-0.37	01/01/2019 01:36 AM	98.21	98.00
MH_304	MH_306TEE	96.18	96.13	100.73	100.27	2250	42.5	0.10	0.013	1.67	6.62	7.88	1.19	-0.43	01/01/2019 01:36 AM	98.00	97.77
MH_306TEE	MH_307	96.13	96.10	100.27	100.35	2250	11.2	0.12	0.013	1.79	7.10	7.88	1.11	-0.61	01/01/2019 01:36 AM	97.77	97.59
MH_307	MH_400	96.10	96.07	100.35	100.35	2250	22.7	0.11	0.013	1.71	6.79	5.49	0.81	-0.76	01/01/2019 01:35 AM	97.59	97.56
MH_307	MH-313	96.10	96.10	100.35	99.84	2250	3.8	0.03	0.013	0.85	3.36	2.39	0.71	-0.76	01/01/2019 01:36 AM	97.59	97.54
MH_3112	POND	96.01	95.67	100.35	97.87	2250	8.6	0.12	0.013	1.79	7.10	5.49	0.77	-1.08	01/01/2019 01:35 AM	97.18	97.18
MH_400	OGS_1	96.07	96.04	100.35	100.50	750	4.9	0.20	0.013	1.13	0.50	1.00	2.01	0.74	01/01/2019 01:09 AM	97.56	97.52
MH_500	OGS_2	96.06	96.03	100.35	100.43	750	5.0	0.20	0.013	1.13	0.50	1.00	2.01	0.55	01/01/2019 01:17 AM	97.36	97.32
MH-313	MH_500	96.10	96.06	99.84	100.35	2250	33.0	0.10	0.013	1.68	6.69	4.07	0.61	-0.81	01/01/2019 01:34 AM	97.54	97.36
MH-500	MH-502	102.40	100.92	105.25	104.32	300	91.8	1.45	0.013	1.65	0.12	0.09	0.79	-0.10	01/01/2019 01:30 AM	102.60	101.18
MH-502	MH-503	100.92	98.95	104.32	102.42	450	118.7	1.60	0.013	2.27	0.36	0.22	0.62	-0.19	01/01/2019 01:30 AM	101.18	99.41
MH-5020	MH-502	101.14	100.92	104.32	104.32	300	8.5	0.51	0.013	0.97	0.07	0.00	0.00	-0.27	01/01/2019 01:18 AM	101.17	101.18
MH-503	MH-504	98.95	98.68	102.42	101.90	525	75.0	0.25	0.013	1.00	0.22	0.25	1.14	-0.07	01/01/2019 01:34 AM	99.41	99.06
MH-504	MH-528	98.68	97.32	101.90	101.06	600	108.0	0.85	0.013	2.00	0.57	0.41	0.72	-0.22	01/01/2019 01:34 AM	99.06	98.20
MH-505	MH-506	103.48	103.35	105.84	106.28	300	13.0	0.60	0.013	1.06	0.07	0.00	0.00	-0.30	01/01/2019 01:30 AM	103.48	103.57
MH-505	MH-534	103.48	103.03	105.84	105.41	375	94.5	0.45	0.013	1.06	0.12	0.00	0.00	-0.38	01/01/2019 01:31 AM	103.48	103.20
MH-506	MH-508	103.35	103.05	106.28	105.88	300	79.0	0.35	0.013	0.81	0.06	0.05	0.87	-0.08	01/01/2019 01:30 AM	103.57	103.31
MH-5070	MH-513	103.12	102.39	105.92	105.51	300	82.0	0.50	0.013	0.97	0.07	0.04	0.63	-0.11	01/01/2019 01:29 AM	103.31	103.21
MH-508	MH-509	103.05	102.84	105.88	105.67	300	41.5	0.45	0.013	0.92	0.06	0.07	1.02	-0.04	01/01/2019 01:30 AM	103.31	103.09
MH-5080	MH-517	102.90	102.05	105.70	105.28	300	76.5	0.55	0.013	1.01	0.07	0.04	0.61	-0.13	01/01/2019 01:30 AM	103.07	102.63
MH-509	MH-510	102.84	102.72	105.67	105.60	300	10.5	0.40	0.013	0.87	0.06	0.07	1.08	-0.05	01/01/2019 01:30 AM	103.09	102.91
MH-510	MH-511	102.72	102.08	105.60	105.25	375	64.0	0.55	0.013	1.18	0.13	0.07	0.51	-0.19	01/01/2019 01:31 AM	102.91	102.30
MH-511	MH-526	102.08	98.64	105.25	103.00	450	95.5	2.80	0.013	3.00	0.48	0.23	0.49	-0.23	01/01/2019 01:30 AM	102.30	99.91
MH-513	MH-515	102.39	100.23	105.51	104.00	300	81.0	2.30	0.013	2.08	0.15	0.16	1.08	0.52	01/01/2019 01:32 AM	103.21	100.66
MH-515	MH-518	100.23	99.79	104.00	103.59	600	44.0	0.30	0.013	1.19	0.34	0.32	0.94	-0.17	01/01/2019 01:30 AM	100.66	100.29
MH-517	MH-518	102.05	99.79	105.28	103.59	300	82.0	2.30	0.013	2.08	0.15	0.14	0.98	0.28	01/01/2019 01:33 AM	102.63	100.29
MH-518	MH-526	99.79	98.64	103.59	103.00	675	47.0	0.30	0.013	1.29	0.46	0.46	0.99	-0.17	01/01/2019 01:30 AM	100.29	99.91
MH-519	MH-520	103.45	103.09	106.29	106.01	300	53.1	0.47	0.013	0.94	0.07	0.01	0.20	-0.21	01/01/2019 01:30 AM	103.54	103.26
MH-519	MH-523	103.45	103.22	106.29	106.20	300	13.8	0.36	0.013	0.82	0.06	0.01	0.19	-0.21	01/01/2019 01:30 AM	103.54	103.35
MH-520	MH-521	103.09	102.81	106.01	105.72	375	55.9	0.45	0.013	1.07	0.12	0.05	0.39	-0.20	01/01/2019 01:30 AM	103.26	102.99
MH-521	MH-522	102.81	102.73	105.72	105.64	375	13.8	0.36	0.013	0.95	0.10	0.05	0.44	-0.19	01/01/2019 01:30 AM	102.99	102.88
MH-522	MH-525	102.73	100.70	105.64	104.25	375	54.3	2.56	0.013	2.54	0.28	0.10	0.35	-0.22	01/01/2019 01:30 AM	102.88	100.98
MH-523	MH-524	103.22	102.13	106.20	105.48	300	54.3	1.81	0.013	1.84	0.13	0.05	0.40	-0.17	01/01/2019 01:30 AM	103.35	102.35
MH-524	MH-5240	102.13	101.92	105.48	105.23	375	65.2	0.30	0.013	0.87	0.10	0.06	0.67	-0.16	01/01/2019 01:30 AM	102.35	102.18
MH-524	MH-538	102.13	100.89	105.48	104.20	300	58.3	1.74	0.013	1.81	0.13	0.10	0.78	-0.08	01/01/2019 01:31 AM	102.35	101.14
MH-5240	MH-525	101.92	100.70	105.23	104.25	375	63.3	1.56	0.013	1.98	0.22	0.15	0.68	-0.11	01/01/2019 01:32 AM	102.18	100.98
MH-525	MH-526	100.70	98.64	104.25	103.00	525	59.0	1.80	0.013	2.67	0.58	0.33	0.57	-0.25	01/01/2019 01:30 AM	100.98	99.91
MH-526	MH-528	98.64	97.32	103.00	101.06	675	59.5	1.60	0.013	2.97	1.06	1.09	1.02	0.59	01/01/2019 01:29 AM	99.91	98.20
MH-527	MH-528	99.08	97.32	101.18	101.06	300	18.5	0.35	0.013	0.81	0.06	0.01	0.23	-0.19	01/01/2019 01:28 AM	99.19	98.20
MH-528	MH-529	97.32	97.01	101.06	100.82	1050	62.5	0.25	0.013	1.58	1.37	1.53	1.12	-0.17	01/01/2019 01:30 AM	98.20	97.97
MH-529	MH-530	97.01	96.85	100.82	100.58	1200	72.0	0.15	0.013	1.34	1.51	1.53	1.01	-0.24	01/01/2019 01:30 AM	97.97	97.84
MH-530	MH-531	96.85	96.66	100.58	100.45	1200	76.5	0.15	0.013	1.34	1.51	1.66	1.10	-0.21	01/01/2019 01:32 AM	97.84	97.65
MH-531	MH-313	96.66	96.10	100.45	99.84	1200	21.5	0.15	0.013	1.33	1.50	1.65	1.10	-0.21	01/01/2019 01:32 AM	97.65	97.54
MH-534	MH-535	103.03	100.60	105.41	103.89	375	78.5	3.00	0.013	2.75	0.30	0.13	0.42	-0.20	01/01/2019 01:30 AM	103.20	100.93
MH-535	MH-515	100.60	100.23	103.89	104.00	450	44.0	0.20	0.013	0.80	0.13	0.13	1.01	-0.12	01/01/2019 01:30 AM	100.93	100.66
MH-5350	MH-539	101.61	99.62	103.89	102.47	300	52.5	2.40	0.013	2.12	0.15	0.02	0.11	-0.23	01/01/2019 01:30 AM	101.68	100.05
MH-536	MH-538	102.50	100.89	106.02	104.20	450	58.2	2.14	0.013	2.62	0.42	0.05	0.12	-0.34	01/01/2019 01:30 AM	102.61	101.14
MH-537	MH-536	102.66	102.50	105.65	106.02	450	64.3	0.20	0.013	0.80	0.13	0.04	0.32	-0.27	01/01/2019 01:30 AM	102.84	102.61
MH-538	MH-539	100.89	99.62	104.20	102.47	525	59.0	2.10	0.013	2.88	0.62	0.29	0.46	-0.28	01/01/2019 01:30 AM	101.14	100.05
MH-539	MH-542	99.62	99.34	102.47	102.40	525	9.5	0.60	0.013	1.54	0.33	0.30	0.90	-0.09	01/01/2019 01:30 AM	100.05	99.90
MH-540	MH-541	100.07	99.96	101.65	102.51	300	14.5	0.35	0.013	0.81	0.06	0.03	0.49	-0.14	01/01/2019 01:30 AM	100.23	100.11
MH-541	MH-542	99.96	99.34	102.51	102.40	300	10.0	0.35	0.013	0.81	0.06	0.03	0.49	-0.15	01/01/2019 01:30 AM	100.11	99.90
MH-542	MH-543	99.34	99.18	102.40	102.19	750	53.0	0.15	0.013	0.98	0.43	0.45	1.04	-0.19	01/01/2019 01:30 AM	99.90	99.77
MH-543	MH-544	99.18	97.99	102.19	102.02	825	118.0	0.15	0.013	1.04	0.56	0.53	0.96	-0.23	01/01/2019 01:31 AM	99.77	98.34
MH-544	MH-5440	97.99	97.27	102.02	101.00	825	57.5	1.20	0.013	2.94	1.57	0.60	0.38	-0.48	01/01/2019 01:31 AM	98.34	98.32
MH-5440	MH_302	97.27	96.41	101.00	101.14	825	12.3	1.22	0.013	2.97	1.59	0.60	0.38	0.22	01/01/2019 01:31 AM	98.32	98.30
MH-546	MH-547	101.96	100.95	104.84	103.97	375	96.5	0.90	0.013	1.51	0.17	0.11	0.69	-0.14	01/01/2019 01:30 AM	102.19	101.18
MH-547	MH-548	100.95	100.20	103.97	103.13	375	63.0	1.15	0.013	1.70	0.19	0.13	0.68	-0.14	01/01/2019 01:30 AM	101.18	100.66
MH-548	MH-549	100.20	99.88	103.13	102.82	375	29.6	0.85	0.013	1.46	0.16	0.17	1.05	0.08	01/01/2019 01:30 AM	100.66	100.32
MH-549	MH-550	99.88	99.60	102.82	102.62	375	15.1	0.90	0.013	1.50	0.17	0.19	1.13	0.06	01/01/2019 01:30 AM	100.32	99.85
MH-550	MH-551	99.60	97.86	102.62	100.93	525	110.3	1.55	0.013	2.48	0.54	0.25	0.47	-0.28	01/01/2019 01:30 AM	99.85	98.32
MH-551	MH-559	97.86	94.69	100.93	100.18	525	51.3	1.41	0.013	2.36	0.51	0.41	0.81	-0.07	01/01/2019 01:31 AM	98.32	96.12
MH-552	MH-553	100.16	99.06	102.99	102.00	300	64.6	1.60	0.013	1.73	0.12	0.05	0.39	-0.17	01/01/2019 01:30 AM	100.29	99.35
MH-553	MH-557	99.06	97.32	102.00	100.85	375	103.0	1.40	0.013	1.88	0.21	0.18	0.88	-0.08	01/01/2019 01:30 AM	99.35	98.05
MH-554	MH-556	99.65	98.61	102.47	101.70	300	79.5	0.95	0.013	1.33	0.09	0.03	0.34	-0.18	01/01/2019 01:30 AM	99.77	98.94
MH-556	MH-560	98.61	98.24	101.70	101.29	525	25.2	1.39	0.013	2.34	0.51	0.31	0.61	-0.20	01/01/2019 01:30 AM	98.94	98.83
MH-5560	MH-556	98.81	98.61	101.67	101.70	525	14.0	0.99	0.013	1.97	0.43	0.28	0.65	-0.22	01/01/2019 01:30 AM	99.12	98.94
MH-557	MH-558	97.32	97.12	100.85	100.39	675	36.4	0.45	0.013	1.58	0.56	0.68	1.21	0.06	01/01/2019 01:30 AM	98.05	97.78
MH-558	MH-559	97.12	94.69	100.39	100.18	675	15.5	0.45	0.013	1.58	0.57	0.68	1.20	-0.02	01/01/2019 01:30 AM	97.78	96.12
MH-559	MH-75	94.69	93.16	100.18	97.88	675	15.1	0.79	0.013	2.09	0.75	1.09	1.46	0.76	01/01/2019 01:30 AM	96.12	93.78
MH-560	MH-557	98.24	97.32	101.29	100.85	525	45.4	0.90	0.013	1.89	0.41	0.47	1.16	0.06	01/01/2019 01:30 AM	98.83	98.05
MH-561	MH-537	103.01	102.66	105.89	105.65	375	42.3	0.65	0.013	1.28	0.14	0.03	0.19	-0.27	01/01/2019 01:30 AM	103.12	102.84
MH-561	MH-563	103.01	100.82	105.89	104.35	300	60.8	2.79	0.013	2.29	0.16	0.05	0.29	-0.19	01/01/2019 01:30 AM	103.12	101.17
MH-562	MH-563	101.18	100.82	103.28	104.35	300	29.7	0.45	0.013	0.92	0.06	0.04	0.66	-0.09	01/01/2019 01:30 AM	101.39	101.17
MH-563	MH-564	100.82	100.64	104.35	104.05	525	73.6	0.20	0.013	0.89	0.19	0.16	0.81	-0.18	01/01/2019 01:30 AM	101.17	100.86
MH-564	MH-77	100.64	99.55	104.05	103.38	525	48.6	2.05	0.013	2.84	0.62	0.23	0.38	-0.31	01/01/2019 01:30 AM	100.86	99.93
MH-565	MH-560	99.47	98.24	102.40	101.29	375	97.1	1.05	0.013	1.63	0.18	0.15	0.81	-0.11	01/01/2019 01:30 AM	99.73	98.83
MH-566	MH-565	100.59	99.47	103.41	102.40	300	71.3	1.56	0.013	1.71	0.12	0.00	0.00	-0.30	01/01/2019 00:00 AM	100.59	99.73
OGS_1	OGS_1-Out	96.04	96.02	100.50	100.35	750	4.9	0.20	0.013	1.14	0.50	1.00	2.00	0.73	01/01/2019 01:09 AM	97.52	97.19
OGS_1-Out	MH_3112	96.02	96.01	100.35	100.35	2250	6.2	0.10	0.013	1.63	6.49	5.49	0.85	-1.08	01/01/2019 01:35 AM	97.19	97.18
OGS_2	OGS_2-Out	96.03	96.00	100.43	100.35	750	5.1	0.20	0.013	1.12	0.49	1.00	2.02	0.54	01/01/2019 01:17 AM	97.32	97.18
OGS_2-Out	POND	96.00	95.67	100.35	97.87	2250	5.6	0.07	0.013	1.40	5.55	4.07	0.73	-1.07	01/01/2019 01:35 AM	97.18	97.18

Table C4: Pipe Data and Hydraulic Simulation Results - 1988 Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	U/S MH Cover Elevation (m)	D/S MH Cover Elevation (m)	Pipe Dia (mm)	Pipe Length (m)	Pipe Slope (%)	n (-)	Design Velocity (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak Flow/ Design Flow	Surcharge U/S (m)	Time To peak (hh:mm)	Max U/S HGL (m)	Max D/S HGL (m)
MH_302	MH_303	96.41	96.33	101.14	101.08	2250	58.9	0.10	0.013	1.66	6.59	7.66	1.16	-0.37	01/01/2019 02:03 AM	98.29	98.20
MH_303	MH_304	96.33	96.18	101.08	100.73	2250	134.3	0.10	0.013	1.67	6.62	7.75	1.17	-0.38	01/01/2019 02:03 AM	98.20	97.99
MH_304	MH_306TEE	96.18	96.13	100.73	100.27	2250	42.5	0.10	0.013	1.67	6.62	7.81	1.18	-0.44	01/01/2019 02:04 AM	97.99	97.76
MH_306TEE	MH_307	96.13	96.10	100.27	100.35	2250	11.2	0.12	0.013	1.79	7.10	7.81	1.10	-0.62	01/01/2019 02:04 AM	97.76	97.58
MH_307	MH_400	96.10	96.07	100.35	100.35	2250	22.7	0.11	0.013	1.71	6.79	5.48	0.81	-0.77	01/01/2019 02:03 AM	97.58	97.55
MH_307	MH-313	96.10	96.10	100.35	99.84	2250	3.8	0.03	0.013	0.85	3.36	2.43	0.72	-0.77	01/01/2019 02:08 AM	97.58	97.54
MH_3112	POND	96.01	95.67	100.35	97.87	2250	8.6	0.12	0.013	1.79	7.10	5.48	0.77	-1.14	01/01/2019 02:03 AM	97.12	96.96
MH_400	OGS_1	96.07	96.04	100.35	100.50	750	4.9	0.20	0.013	1.13	0.50	1.00	2.00	0.73	01/01/2019 01:30 AM	97.55	97.52
MH_500	OGS_2	96.06	96.03	100.35	100.43	750	5.0	0.20	0.013	1.13	0.50	1.00	2.01	0.55	01/01/2019 01:31 AM	97.36	97.32
MH-313	MH_500	96.10	96.06	99.84	100.35	2250	33.0	0.10	0.013	1.68	6.69	4.06	0.61	-0.81	01/01/2019 02:03 AM	97.54	97.36
MH-500	MH-502	102.40	100.92	105.25	104.32	300	91.8	1.45	0.013	1.65	0.12	0.10	0.83	-0.09	01/01/2019 02:00 AM	102.61	101.18
MH-502	MH-503	100.92	98.95	104.32	102.42	450	118.7	1.60	0.013	2.27	0.36	0.23	0.64	-0.19	01/01/2019 02:00 AM	101.18	99.41
MH-5020	MH-502	101.14	100.92	104.32	104.32	300	8.5	0.51	0.013	0.97	0.07	0.00	0.01	-0.27	01/01/2019 01:28 AM	101.17	101.18
MH-503	MH-504	98.95	98.68	102.42	101.90	525	75.0	0.25	0.013	1.00	0.22	0.25	1.15	-0.07	01/01/2019 02:01 AM	99.41	99.06
MH-504	MH-528	98.68	97.32	101.90	101.06	600	108.0	0.85	0.013	2.00	0.57	0.41	0.72	-0.22	01/01/2019 02:01 AM	99.06	98.21
MH-505	MH-506	103.48	103.35	105.84	106.28	300	13.0	0.60	0.013	1.06	0.07	0.01	0.07	-0.26	01/01/2019 02:00 AM	103.52	103.62
MH-505	MH-534	103.48	103.03	105.84	105.41	375	94.5	0.45	0.013	1.06	0.12	0.00	0.02	-0.33	01/01/2019 02:01 AM	103.52	103.21
MH-506	MH-508	103.35	103.05	106.28	105.88	300	79.0	0.35	0.013	0.81	0.06	0.06	1.01	-0.03	01/01/2019 01:59 AM	103.62	103.38
MH-5070	MH-513	103.12	102.39	105.92	105.51	300	82.0	0.50	0.013	0.97	0.07	0.05	0.79	-0.09	01/01/2019 02:00 AM	103.33	103.23
MH-508	MH-509	103.05	102.84	105.88	105.67	300	41.5	0.45	0.013	0.92	0.06	0.08	1.19	0.03	01/01/2019 02:00 AM	103.38	103.13
MH-5080	MH-517	102.90	102.05	105.70	105.28	300	76.5	0.55	0.013	1.01	0.07	0.05	0.75	-0.11	01/01/2019 02:00 AM	103.09	102.66
MH-509	MH-510	102.84	102.72	105.67	105.60	300	10.5	0.40	0.013	0.87	0.06	0.08	1.26	-0.01	01/01/2019 02:00 AM	103.13	102.93
MH-510	MH-511	102.72	102.08	105.60	105.25	375	64.0	0.55	0.013	1.18	0.13	0.08	0.58	-0.17	01/01/2019 02:01 AM	102.93	102.31
MH-511	MH-526	102.08	98.64	105.25	103.00	450	95.5	2.80	0.013	3.00	0.48	0.26	0.54	-0.22	01/01/2019 02:00 AM	102.31	99.99
MH-513	MH-515	102.39	100.23	105.51	104.00	300	81.0	2.30	0.013	2.08	0.15	0.16	1.10	0.54	01/01/2019 02:01 AM	103.23	100.68
MH-515	MH-518	100.23	99.79	104.00	103.59	600	44.0	0.30	0.013	1.19	0.34	0.34	1.01	-0.15	01/01/2019 02:00 AM	100.68	100.30
MH-517	MH-518	102.05	99.79	105.28	103.59	300	82.0	2.30	0.013	2.08	0.15	0.15	0.99	0.31	01/01/2019 02:02 AM	102.66	100.30
MH-518	MH-526	99.79	98.64	103.59	103.00	675	47.0	0.30	0.013	1.29	0.46	0.48	1.04	-0.16	01/01/2019 02:01 AM	100.30	99.99
MH-519	MH-520	103.45	103.09	106.29	106.01	300	53.1	0.47	0.013	0.94	0.07	0.02	0.23	-0.20	01/01/2019 02:00 AM	103.55	103.27
MH-519	MH-523	103.45	103.22	106.29	106.20	300	13.8	0.36	0.013	0.82	0.06	0.01	0.21	-0.20	01/01/2019 02:00 AM	103.55	103.35
MH-520	MH-521	103.09	102.81	106.01	105.72	375	55.9	0.45	0.013	1.07	0.12	0.05	0.42	-0.19	01/01/2019 02:00 AM	103.27	103.00
MH-521	MH-522	102.81	102.73	105.72	105.64	375	13.8	0.36	0.013	0.95	0.10	0.05	0.48	-0.19	01/01/2019 02:01 AM	103.00	102.89
MH-522	MH-525	102.73	100.70	105.64	104.25	375	54.3	2.56	0.013	2.54	0.28	0.11	0.38	-0.22	01/01/2019 02:00 AM	102.89	100.99
MH-523	MH-524	103.22	102.13	106.20	105.48	300	54.3	1.81	0.013	1.84	0.13	0.05	0.42	-0.17	01/01/2019 02:00 AM	103.35	102.36
MH-524	MH-5240	102.13	101.92	105.48	105.23	375	65.2	0.30	0.013	0.87	0.10	0.07	0.68	-0.14	01/01/2019 02:00 AM	102.36	102.18
MH-524	MH-538	102.13	100.89	105.48	104.20	300	58.3	1.74	0.013	1.81	0.13	0.10	0.79	-0.07	01/01/2019 02:01 AM	102.36	101.17
MH-5240	MH-525	101.92	100.70	105.23	104.25	375	63.3	1.56	0.013	1.98	0.22	0.15	0.69	-0.11	01/01/2019 02:01 AM	102.18	100.99
MH-525	MH-526	100.70	98.64	104.25	103.00	525	59.0	1.80	0.013	2.67	0.58	0.34	0.58	-0.23	01/01/2019 02:00 AM	100.99	99.99
MH-526	MH-528	98.64	97.32	103.00	101.06	675	59.5	1.60	0.013	2.97	1.06	1.11	1.04	0.67	01/01/2019 02:01 AM	99.99	98.21
MH-527	MH-528	99.08	97.32	101.18	101.06	300	18.5	0.35	0.013	0.81	0.06	0.02	0.31	-0.17	01/01/2019 01:58 AM	99.21	98.21
MH-528	MH-529	97.32	97.01	101.06	100.82	1050	62.5	0.25	0.013	1.58	1.37	1.56	1.14	-0.16	01/01/2019 02:02 AM	98.21	97.98
MH-529	MH-530	97.01	96.85	100.82	100.58	1200	72.0	0.15	0.013	1.34	1.51	1.55	1.03	-0.23	01/01/2019 02:02 AM	97.98	97.85
MH-530	MH-531	96.85	96.66	100.58	100.45	1200	76.5	0.15	0.013	1.34	1.51	1.68	1.11	-0.20	01/01/2019 02:02 AM	97.85	97.65
MH-531	MH-313	96.66	96.10	100.45	99.84	1200	21.5	0.15	0.013	1.33	1.50	1.68	1.12	-0.21	01/01/2019 02:03 AM	97.65	97.54
MH-534	MH-535	103.03	100.60	105.41	103.89	375	78.5	3.00	0.013	2.75	0.30	0.14	0.46	-0.19	01/01/2019 02:00 AM	103.21	100.95
MH-535	MH-515	100.60	100.23	103.89	104.00	450	44.0	0.20	0.013	0.80	0.13	0.14	1.11	-0.10	01/01/2019 02:00 AM	100.95	100.68
MH-5350	MH-539	101.61	99.62	103.89	102.47	300	52.5	2.40	0.013	2.12	0.15	0.02	0.11	-0.23	01/01/2019 02:00 AM	101.68	100.11
MH-536	MH-538	102.50	100.89	106.02	104.20	450	58.2	2.14	0.013	2.62	0.42	0.06	0.15	-0.33	01/01/2019 02:00 AM	102.62	101.17
MH-537	MH-536	102.66	102.50	105.65	106.02	450	64.3	0.20	0.013	0.80	0.13	0.05	0.39	-0.25	01/01/2019 02:00 AM	102.86	102.62
MH-538	MH-539	100.89	99.62	104.20	102.47	525	59.0	2.10	0.013	2.88	0.62	0.35	0.57	-0.25	01/01/2019 02:00 AM	101.17	100.11
MH-539	MH-542	99.62	99.34	102.47	102.40	525	9.5	0.60	0.013	1.54	0.33	0.37	1.11	-0.04	01/01/2019 02:00 AM	100.11	99.96
MH-540	MH-541	100.07	99.96	101.65	102.51	300	14.5	0.35	0.013	0.81	0.06	0.04	0.64	-0.12	01/01/2019 02:00 AM	100.25	100.14
MH-541	MH-542	99.96	99.34	102.51	102.40	300	10.0	0.35	0.013	0.81	0.06	0.04	0.65	-0.12	01/01/2019 02:00 AM	100.14	99.96
MH-542	MH-543	99.34	99.18	102.40	102.19	750	53.0	0.15	0.013	0.98	0.43	0.53	1.21	-0.13	01/01/2019 02:00 AM	99.96	99.82
MH-543	MH-544	99.18	97.99	102.19	102.02	825	118.0	0.15	0.013	1.04	0.56	0.60	1.07	-0.19	01/01/2019 02:01 AM	99.82	98.36
MH-544	MH-5440	97.99	97.27	102.02	101.00	825	57.5	1.20	0.013	2.94	1.57	0.66	0.42	-0.45	01/01/2019 02:01 AM	98.36	98.31
MH-5440	MH_302	97.27	96.41	101.00	101.14	825	12.3	1.22	0.013	2.97	1.59	0.66	0.42	0.22	01/01/2019 02:01 AM	98.31	98.29
MH-546	MH-547	101.96	100.95	104.84	103.97	375	96.5	0.90	0.013	1.51	0.17	0.12	0.69	-0.14	01/01/2019 02:00 AM	102.19	101.18
MH-547	MH-548	100.95	100.20	103.97	103.13	375	63.0	1.15	0.013	1.70	0.19	0.13	0.71	-0.14	01/01/2019 02:00 AM	101.18	100.70
MH-548	MH-549	100.20	99.88	103.13	102.82	375	29.6	0.85	0.013	1.46	0.16	0.18	1.08	0.13	01/01/2019 02:00 AM	100.70	100.33
MH-549	MH-550	99.88	99.60	102.82	102.62	375	15.1	0.90	0.013	1.50	0.17	0.19	1.16	0.08	01/01/2019 02:00 AM	100.33	99.86
MH-550	MH-551	99.60	97.86	102.62	100.93	525	110.3	1.55	0.013	2.48	0.54	0.26	0.48	-0.27	01/01/2019 02:00 AM	99.86	98.34
MH-551	MH-559	97.86	94.69	100.93	100.18	525	51.3	1.41	0.013	2.36	0.51	0.42	0.82	-0.05	01/01/2019 02:01 AM	98.34	96.15
MH-552	MH-553	100.16	99.06	102.99	102.00	300	64.6	1.60	0.013	1.73	0.12	0.05	0.43	-0.16	01/01/2019 02:00 AM	100.30	99.36
MH-553	MH-557	99.06	97.32	102.00	100.85	375	103.0	1.40	0.013	1.88	0.21	0.19	0.91	-0.08	01/01/2019 02:01 AM	99.36	98.08
MH-554	MH-556	99.65	98.61	102.47	101.70	300	79.5	0.95	0.013	1.33	0.09	0.03	0.36	-0.17	01/01/2019 02:00 AM	99.78	98.95
MH-556	MH-560	98.61	98.24	101.70	101.29	525	25.2	1.39	0.013	2.34	0.51	0.31	0.62	-0.19	01/01/2019 02:00 AM	98.95	98.85
MH-5560	MH-556	98.81	98.61	101.67	101.70	525	14.0	0.99	0.013	1.97	0.43	0.28	0.65	-0.22	01/01/2019 02:00 AM	99.12	98.95
MH-557	MH-558	97.32	97.12	100.85	100.39	675	36.4	0.45	0.013	1.58	0.56	0.70	1.24	0.09	01/01/2019 02:00 AM	98.08	97.80
MH-558	MH-559	97.12	94.69	100.39	100.18	675	15.5	0.45	0.013	1.58	0.57	0.70	1.23	0.01	01/01/2019 02:00 AM	97.80	96.15
MH-559	MH-75	94.69	93.16	100.18	97.88	675	15.1	0.79	0.013	2.09	0.75	1.12	1.49	0.78	01/01/2019 02:01 AM	96.15	93.81
MH-560	MH-557	98.24	97.32	101.29	100.85	525	45.4	0.90	0.013	1.89	0.41	0.48	1.17	0.08	01/01/2019 02:00 AM	98.85	98.08
MH-561	MH-537	103.01	102.66	105.89	105.65	375	42.3	0.65	0.013	1.28	0.14	0.03	0.23	-0.25	01/01/2019 02:00 AM	103.13	102.86
MH-561	MH-563	103.01	100.82	105.89	104.35	300	60.8	2.79	0.013	2.29	0.16	0.06	0.36	-0.18	01/01/2019 02:00 AM	103.13	101.20
MH-562	MH-563	101.18	100.82	103.28	104.35	300	29.7	0.45	0.013	0.92	0.06	0.04	0.68	-0.09	01/01/2019 02:00 AM	101.39	101.20
MH-563	MH-564	100.82	100.64	104.35	104.05	525	73.6	0.20	0.013	0.89	0.19	0.18	0.93	-0.15	01/01/2019 02:00 AM	101.20	100.88
MH-564	MH-77	100.64	99.55	104.05	103.38	525	48.6	2.05	0.013	2.84	0.62	0.26	0.42	-0.29	01/01/2019 02:00 AM	100.88	99.96
MH-565	MH-560	99.47	98.24	102.40	101.29	375	97.1	1.05	0.013	1.63	0.18	0.15	0.83	-0.11	01/01/2019 02:01 AM	99.73	98.85
MH-566	MH-565	100.59	99.47	103.41	102.40	300	71.3	1.56	0.013	1.71	0.12	0.00	0.00	-0.30	01/01/2019 00:00 AM	100.59	99.73
OGS_1	OGS_1-Out	96.04	96.02	100.50	100.35	750	4.9	0.20	0.013	1.14	0.50	1.00	1.99	0.73	01/01/2019 01:30 AM	97.52	97.15
OGS_1-Out	MH_3112	96.02	96.01	100.35	100.35	2250	6.2	0.10	0.013	1.63	6.49	5.48	0.84	-1.12	01/01/2019 02:03 AM	97.15	97.12
OGS_2	OGS_2-Out	96.03	96.00	100.43	100.35	750	5.1	0.20	0.013	1.12	0.49	1.00	2.02	0.54	01/01/2019 01:31 AM	97.32	96.96
OGS_2-Out	POND	96.00	95.67	100.35	97.87	2250	5.6	0.07	0.013	1.40	5.55	4.06	0.73	-1.29	01/01/2019 02:03 AM	96.96	96.96

Table C5: Pipe Data and Hydraulic Simulation Results - 1996 Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	U/S MH Cover Elevation (m)	D/S MH Cover Elevation (m)	Pipe Dia (mm)	Pipe Length (m)	Pipe Slope (%)	n (-)	Design Velocity (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak Flow/ Design Flow	Surcharge U/S (m)	Time To peak (hh:mm)	Max U/S HGL (m)	Max D/S HGL (m)
MH_302	MH_303	96.41	96.33	101.14	101.08	2250	58.9	0.10	0.013	1.66	6.59	7.09	1.08	-0.46	01/01/2019 01:32 AM	98.20	98.11
MH_303	MH_304	96.33	96.18	101.08	100.73	2250	134.3	0.10	0.013	1.67	6.62	7.17	1.08	-0.47	01/01/2019 01:32 AM	98.11	97.91
MH_304	MH_306TEE	96.18	96.13	100.73	100.27	2250	42.5	0.10	0.013	1.67	6.62	7.23	1.09	-0.52	01/01/2019 01:32 AM	97.91	97.70
MH_306TEE	MH_307	96.13	96.10	100.27	100.35	2250	11.2	0.12	0.013	1.79	7.10	7.23	1.02	-0.68	01/01/2019 01:32 AM	97.70	97.53
MH_307	MH_400	96.10	96.07	100.35	100.35	2250	22.7	0.11	0.013	1.71	6.79	5.07	0.75	-0.82	01/01/2019 01:32 AM	97.53	97.51
MH_307	MH-313	96.10	96.10	100.35	99.84	2250	3.8	0.03	0.013	0.85	3.36	2.27	0.67	-0.82	01/01/2019 01:36 AM	97.53	97.50
MH_3112	POND	96.01	95.67	100.35	97.87	2250	8.6	0.12	0.013	1.79	7.10	5.07	0.71	-1.18	01/01/2019 01:32 AM	97.08	96.78
MH_400	OGS_1	96.07	96.04	100.35	100.50	750	4.9	0.20	0.013	1.13	0.50	1.01	2.01	0.69	01/01/2019 03:26 AM	97.51	97.47
MH_500	OGS_2	96.06	96.03	100.35	100.43	750	5.0	0.20	0.013	1.13	0.50	1.00	2.01	0.51	01/01/2019 01:40 AM	97.32	97.29
MH-313	MH_500	96.10	96.06	99.84	100.35	2250	33.0	0.10	0.013	1.68	6.69	3.79	0.57	-0.85	01/01/2019 01:32 AM	97.50	97.32
MH-500	MH-502	102.40	100.92	105.25	104.32	300	91.8	1.45	0.013	1.65	0.12	0.09	0.77	-0.10	01/01/2019 01:26 AM	102.60	101.17
MH-502	MH-503	100.92	98.95	104.32	102.42	450	118.7	1.60	0.013	2.27	0.36	0.22	0.61	-0.20	01/01/2019 01:27 AM	101.17	99.39
MH-5020	MH-502	101.14	100.92	104.32	104.32	300	8.5	0.51	0.013	0.97	0.07	0.00	0.01	-0.27	01/01/2019 01:22 AM	101.17	101.17
MH-503	MH-504	98.95	98.68	102.42	101.90	525	75.0	0.25	0.013	1.00	0.22	0.24	1.10	-0.09	01/01/2019 01:28 AM	99.39	99.05
MH-504	MH-528	98.68	97.32	101.90	101.06	600	108.0	0.85	0.013	2.00	0.57	0.40	0.70	-0.23	01/01/2019 01:29 AM	99.05	98.17
MH-505	MH-506	103.48	103.35	105.84	106.28	300	13.0	0.60	0.013	1.06	0.07	0.00	0.00	-0.30	01/01/2019 00:00 AM	103.48	103.55
MH-505	MH-534	103.48	103.03	105.84	105.41	375	94.5	0.45	0.013	1.06	0.12	0.00	0.00	-0.38	01/01/2019 00:00 AM	103.48	103.20
MH-506	MH-508	103.35	103.05	106.28	105.88	300	79.0	0.35	0.013	0.81	0.06	0.05	0.79	-0.10	01/01/2019 01:25 AM	103.55	103.29
MH-5070	MH-513	103.12	102.39	105.92	105.51	300	82.0	0.50	0.013	0.97	0.07	0.04	0.60	-0.11	01/01/2019 01:25 AM	103.31	103.21
MH-508	MH-509	103.05	102.84	105.88	105.67	300	41.5	0.45	0.013	0.92	0.06	0.06	0.91	-0.06	01/01/2019 01:26 AM	103.29	103.07
MH-5080	MH-517	102.90	102.05	105.70	105.28	300	76.5	0.55	0.013	1.01	0.07	0.04	0.57	-0.14	01/01/2019 01:26 AM	103.06	102.50
MH-509	MH-510	102.84	102.72	105.67	105.60	300	10.5	0.40	0.013	0.87	0.06	0.06	0.96	-0.07	01/01/2019 01:26 AM	103.07	102.90
MH-510	MH-511	102.72	102.08	105.60	105.25	375	64.0	0.55	0.013	1.18	0.13	0.06	0.45	-0.19	01/01/2019 01:27 AM	102.90	102.30
MH-511	MH-526	102.08	98.64	105.25	103.00	450	95.5	2.80	0.013	3.00	0.48	0.22	0.46	-0.23	01/01/2019 01:27 AM	102.30	99.84
MH-513	MH-515	102.39	100.23	105.51	104.00	300	81.0	2.30	0.013	2.08	0.15	0.16	1.07	0.52	01/01/2019 01:30 AM	103.21	100.65
MH-515	MH-518	100.23	99.79	104.00	103.59	600	44.0	0.30	0.013	1.19	0.34	0.31	0.92	-0.18	01/01/2019 01:28 AM	100.65	100.28
MH-517	MH-518	102.05	99.79	105.28	103.59	300	82.0	2.30	0.013	2.08	0.15	0.14	0.96	0.15	01/01/2019 01:25 AM	102.50	100.28
MH-518	MH-526	99.79	98.64	103.59	103.00	675	47.0	0.30	0.013	1.29	0.46	0.45	0.97	-0.19	01/01/2019 01:29 AM	100.28	99.84
MH-519	MH-520	103.45	103.09	106.29	106.01	300	53.1	0.47	0.013	0.94	0.07	0.01	0.18	-0.21	01/01/2019 01:25 AM	103.54	103.25
MH-519	MH-523	103.45	103.22	106.29	106.20	300	13.8	0.36	0.013	0.82	0.06	0.01	0.17	-0.21	01/01/2019 01:25 AM	103.54	103.35
MH-520	MH-521	103.09	102.81	106.01	105.72	375	55.9	0.45	0.013	1.07	0.12	0.04	0.37	-0.22	01/01/2019 01:25 AM	103.25	102.99
MH-521	MH-522	102.81	102.73	105.72	105.64	375	13.8	0.36	0.013	0.95	0.10	0.04	0.42	-0.19	01/01/2019 01:26 AM	102.99	102.88
MH-522	MH-525	102.73	100.70	105.64	104.25	375	54.3	2.56	0.013	2.54	0.28	0.10	0.34	-0.22	01/01/2019 01:25 AM	102.88	100.98
MH-523	MH-524	103.22	102.13	106.20	105.48	300	54.3	1.81	0.013	1.84	0.13	0.05	0.39	-0.17	01/01/2019 01:26 AM	103.35	102.35
MH-524	MH-5240	102.13	101.92	105.48	105.23	375	65.2	0.30	0.013	0.87	0.10	0.06	0.66	-0.16	01/01/2019 01:26 AM	102.35	102.17
MH-524	MH-538	102.13	100.89	105.48	104.20	300	58.3	1.74	0.013	1.81	0.13	0.10	0.78	-0.08	01/01/2019 01:26 AM	102.35	101.14
MH-5240	MH-525	101.92	100.70	105.23	104.25	375	63.3	1.56	0.013	1.98	0.22	0.15	0.67	-0.13	01/01/2019 01:30 AM	102.17	100.98
MH-525	MH-526	100.70	98.64	104.25	103.00	525	59.0	1.80	0.013	2.67	0.58	0.32	0.56	-0.25	01/01/2019 01:26 AM	100.98	99.84
MH-526	MH-528	98.64	97.32	103.00	101.06	675	59.5	1.60	0.013	2.97	1.06	1.04	0.97	0.53	01/01/2019 01:30 AM	99.84	98.17
MH-527	MH-528	99.08	97.32	101.18	101.06	300	18.5	0.35	0.013	0.81	0.06	0.01	0.23	-0.19	01/01/2019 01:25 AM	99.19	98.17
MH-528	MH-529	97.32	97.01	101.06	100.82	1050	62.5	0.25	0.013	1.58	1.37	1.48	1.08	-0.20	01/01/2019 01:30 AM	98.17	97.94
MH-529	MH-530	97.01	96.85	100.82	100.58	1200	72.0	0.15	0.013	1.34	1.51	1.47	0.98	-0.27	01/01/2019 01:31 AM	97.94	97.81
MH-530	MH-531	96.85	96.66	100.58	100.45	1200	76.5	0.15	0.013	1.34	1.51	1.60	1.06	-0.24	01/01/2019 01:31 AM	97.81	97.61
MH-531	MH-313	96.66	96.10	100.45	99.84	1200	21.5	0.15	0.013	1.33	1.50	1.60	1.06	-0.25	01/01/2019 01:31 AM	97.61	97.50
MH-534	MH-535	103.03	100.60	105.41	103.89	375	78.5	3.00	0.013	2.75	0.30	0.13	0.42	-0.20	01/01/2019 01:25 AM	103.20	100.93
MH-535	MH-515	100.60	100.23	103.89	104.00	450	44.0	0.20	0.013	0.80	0.13	0.13	1.00	-0.12	01/01/2019 01:26 AM	100.93	100.65
MH-5350	MH-539	101.61	99.62	103.89	102.47	300	52.5	2.40	0.013	2.12	0.15	0.02	0.11	-0.23	01/01/2019 01:25 AM	101.68	100.04
MH-536	MH-538	102.50	100.89	106.02	104.20	450	58.2	2.14	0.013	2.62	0.42	0.05	0.12	-0.34	01/01/2019 01:26 AM	102.61	101.14
MH-537	MH-536	102.66	102.50	105.65	106.02	450	64.3	0.20	0.013	0.80	0.13	0.04	0.31	-0.27	01/01/2019 01:26 AM	102.84	102.61
MH-538	MH-539	100.89	99.62	104.20	102.47	525	59.0	2.10	0.013	2.88	0.62	0.28	0.46	-0.28	01/01/2019 01:25 AM	101.14	100.04
MH-539	MH-542	99.62	99.34	102.47	102.40	525	9.5	0.60	0.013	1.54	0.33	0.30	0.90	-0.11	01/01/2019 01:25 AM	100.04	99.89
MH-540	MH-541	100.07	99.96	101.65	102.51	300	14.5	0.35	0.013	0.81	0.06	0.03	0.49	-0.15	01/01/2019 01:25 AM	100.22	100.11
MH-541	MH-542	99.96	99.34	102.51	102.40	300	10.0	0.35	0.013	0.81	0.06	0.03	0.49	-0.15	01/01/2019 01:25 AM	100.11	99.89
MH-542	MH-543	99.34	99.18	102.40	102.19	750	53.0	0.15	0.013	0.98	0.43	0.44	1.03	-0.20	01/01/2019 01:26 AM	99.89	99.76
MH-543	MH-544	99.18	97.99	102.19	102.02	825	118.0	0.15	0.013	1.04	0.56	0.52	0.93	-0.25	01/01/2019 01:27 AM	99.76	98.34
MH-544	MH-5440	97.99	97.27	102.02	101.00	825	57.5	1.20	0.013	2.94	1.57	0.58	0.37	-0.48	01/01/2019 01:27 AM	98.34	98.21
MH-5440	MH_302	97.27	96.41	101.00	101.14	825	12.3	1.22	0.013	2.97	1.59	0.59	0.37	0.11	01/01/2019 01:28 AM	98.21	98.20
MH-546	MH-547	101.96	100.95	104.84	103.97	375	96.5	0.90	0.013	1.51	0.17	0.11	0.69	-0.14	01/01/2019 01:26 AM	102.19	101.18
MH-547	MH-548	100.95	100.20	103.97	103.13	375	63.0	1.15	0.013	1.70	0.19	0.13	0.67	-0.14	01/01/2019 01:26 AM	101.18	100.64
MH-548	MH-549	100.20	99.88	103.13	102.82	375	29.6	0.85	0.013	1.46	0.16	0.17	1.05	0.06	01/01/2019 01:26 AM	100.64	100.31
MH-549	MH-550	99.88	99.60	102.82	102.62	375	15.1	0.90	0.013	1.50	0.17	0.19	1.13	0.06	01/01/2019 01:26 AM	100.31	99.85
MH-550	MH-551	99.60	97.86	102.62	100.93	525	110.3	1.55	0.013	2.48	0.54	0.25	0.46	-0.28	01/01/2019 01:26 AM	99.85	98.31
MH-551	MH-559	97.86	94.69	100.93	100.18	525	51.3	1.41	0.013	2.36	0.51	0.40	0.79	-0.08	01/01/2019 01:27 AM	98.31	95.96
MH-552	MH-553	100.16	99.06	102.99	102.00	300	64.6	1.60	0.013	1.73	0.12	0.05	0.39	-0.17	01/01/2019 01:25 AM	100.29	99.36
MH-553	MH-557	99.06	97.32	102.00	100.85	375	103.0	1.40	0.013	1.88	0.21	0.18	0.87	-0.08	01/01/2019 01:26 AM	99.36	97.97
MH-554	MH-556	99.65	98.61	102.47	101.70	300	79.5	0.95	0.013	1.33	0.09	0.03	0.28	-0.19	01/01/2019 01:25 AM	99.76	98.90
MH-556	MH-560	98.61	98.24	101.70	101.29	525	25.2	1.39	0.013	2.34	0.51	0.28	0.54	-0.23	01/01/2019 01:30 AM	98.90	98.69
MH-5560	MH-556	98.81	98.61	101.67	101.70	525	14.0	0.99	0.013	1.97	0.43	0.25	0.59	-0.23	01/01/2019 01:30 AM	99.10	98.90
MH-557	MH-558	97.32	97.12	100.85	100.39	675	36.4	0.45	0.013	1.58	0.56	0.62	1.09	-0.02	01/01/2019 01:31 AM	97.97	97.72
MH-558	MH-559	97.12	94.69	100.39	100.18	675	15.5	0.45	0.013	1.58	0.57	0.62	1.09	-0.08	01/01/2019 01:31 AM	97.72	95.96
MH-559	MH-75	94.69	93.16	100.18	97.88	675	15.1	0.79	0.013	2.09	0.75	1.00	1.33	0.59	01/01/2019 01:30 AM	95.96	93.74
MH-560	MH-557	98.24	97.32	101.29	100.85	525	45.4	0.90	0.013	1.89	0.41	0.42	1.03	-0.08	01/01/2019 01:30 AM	98.69	97.97
MH-561	MH-537	103.01	102.66	105.89	105.65	375	42.3	0.65	0.013	1.28	0.14	0.03	0.19	-0.27	01/01/2019 01:25 AM	103.12	102.84
MH-561	MH-563	103.01	100.82	105.89	104.35	300	60.8	2.79	0.013	2.29	0.16	0.05	0.30	-0.19	01/01/2019 01:25 AM	103.12	101.17
MH-562	MH-563	101.18	100.82	103.28	104.35	300	29.7	0.45	0.013	0.92	0.06	0.04	0.66	-0.09	01/01/2019 01:25 AM	101.39	101.17
MH-563	MH-564	100.82	100.64	104.35	104.05	525	73.6	0.20	0.013	0.89	0.19	0.16	0.81	-0.18	01/01/2019 01:25 AM	101.17	100.86
MH-564	MH-77	100.64	99.55	104.05	103.38	525	48.6	2.05	0.013	2.84	0.62	0.23	0.38	-0.31	01/01/2019 01:25 AM	100.86	99.89
MH-565	MH-560	99.47	98.24	102.40	101.29	375	97.1	1.05	0.013	1.63	0.18	0.14	0.79	-0.11	01/01/2019 01:27 AM	99.74	98.69
MH-566	MH-565	100.59	99.47	103.41	102.40	300	71.3	1.56	0.013	1.71	0.12	0.00	0.00	-0.30	01/01/2019 00:00 AM	100.59	99.74
OGS_1	OGS_1-Out	96.04	96.02	100.50	100.35	750	4.9	0.20	0.013	1.14	0.50	1.01	2.00	0.68	01/01/2019 03:26 AM	97.47	97.11
OGS_1-Out	MH_3112	96.02	96.01	100.35	100.35	2250	6.2	0.10	0.013	1.63	6.49	5.07	0.78	-1.16	01/01/2019 01:32 AM	97.11	97.08
OGS_2	OGS_2-Out	96.03	96.00	100.43	100.35	750	5.1	0.20	0.013	1.12	0.49	1.00	2.03	0.51	01/01/2019 01:40 AM	97.29	96.91
OGS_2-Out	POND	96.00	95.67	100.35	97.87	2250	5.6	0.07	0.013	1.40	5.55	3.79	0.68	-1.34	01/01/2019 01:32 AM	96.91	96.78

Table C6: Pipe Data and Hydraulic Simulation Results - 100YrCHI+20% Event

U/S MH	D/S MH	U/S Invert (m)	D/S Invert (m)	U/S MH Cover Elevation (m)	D/S MH Cover Elevation (m)	Pipe Dia (mm)	Pipe Length (m)	Pipe Slope (%)	n (-)	Design Velocity (m/s)	Design Flow (m^3/s)	Peak Pipe Flow (m^3/s)	Peak Flow/ Design Flow	Surcharge U/S (m)	Time To peak (hh:mm)	Max U/S HGL (m)	Max D/S HGL (m)
MH_302	MH_303	96.41	96.33	101.14	101.08	2250	58.9	0.10	0.013	1.66	6.59	8.82	1.34	-0.15	01/01/2019 01:14 AM	98.51	98.40
MH_303	MH_304	96.33	96.18	101.08	100.73	2250	134.3	0.10	0.013	1.67	6.62	8.97	1.35	-0.18	01/01/2019 01:14 AM	98.40	98.15
MH_304	MH_306TEE	96.18	96.13	100.73	100.27	2250	42.5	0.10	0.013	1.67	6.62	9.03	1.36	-0.28	01/01/2019 01:14 AM	98.15	97.89
MH_306TEE	MH_307	96.13	96.10	100.27	100.35	2250	11.2	0.12	0.013	1.79	7.10	9.04	1.27	-0.49	01/01/2019 01:14 AM	97.89	97.68
MH_307	MH_400	96.10	96.07	100.35	100.35	2250	22.7	0.11	0.013	1.71	6.79	6.31	0.93	-0.67	01/01/2019 01:14 AM	97.68	97.65
MH_307	MH-313	96.10	96.10	100.35	99.84	2250	3.8	0.03	0.013	0.85	3.36	2.72	0.81	-0.67	01/01/2019 01:15 AM	97.68	97.64
MH_3112	POND	96.01	95.67	100.35	97.87	2250	8.6	0.12	0.013	1.79	7.10	6.31	0.89	-1.05	01/01/2019 01:14 AM	97.21	97.18
MH_400	OGS_1	96.07	96.04	100.35	100.50	750	4.9	0.20	0.013	1.13	0.50	1.00	2.01	0.83	01/01/2019 00:59 AM	97.65	97.61
MH_500	OGS_2	96.06	96.03	100.35	100.43	750	5.0	0.20	0.013	1.13	0.50	1.00	2.01	0.61	01/01/2019 01:03 AM	97.42	97.38
MH-313	MH_500	96.10	96.06	99.84	100.35	2250	33.0	0.10	0.013	1.68	6.69	4.61	0.69	-0.71	01/01/2019 01:14 AM	97.64	97.42
MH-500	MH-502	102.40	100.92	105.25	104.32	300	91.8	1.45	0.013	1.65	0.12	0.10	0.85	-0.09	01/01/2019 01:10 AM	102.61	101.18
MH-502	MH-503	100.92	98.95	104.32	102.42	450	118.7	1.60	0.013	2.27	0.36	0.23	0.65	-0.19	01/01/2019 01:10 AM	101.18	99.44
MH-5020	MH-502	101.14	100.92	104.32	104.32	300	8.5	0.51	0.013	0.97	0.07	0.00	0.03	-0.26	01/01/2019 01:02 AM	101.18	101.18
MH-503	MH-504	98.95	98.68	102.42	101.90	525	75.0	0.25	0.013	1.00	0.22	0.26	1.21	-0.04	01/01/2019 01:11 AM	99.44	99.07
MH-504	MH-528	98.68	97.32	101.90	101.06	600	108.0	0.85	0.013	2.00	0.57	0.43	0.76	-0.21	01/01/2019 01:11 AM	99.07	98.33
MH-505	MH-506	103.48	103.35	105.84	106.28	300	13.0	0.60	0.013	1.06	0.07	0.03	0.35	-0.18	01/01/2019 01:10 AM	103.60	103.73
MH-505	MH-534	103.48	103.03	105.84	105.41	375	94.5	0.45	0.013	1.06	0.12	0.03	0.22	-0.25	01/01/2019 01:10 AM	103.60	103.24
MH-506	MH-508	103.35	103.05	106.28	105.88	300	79.0	0.35	0.013	0.81	0.06	0.06	1.03	0.08	01/01/2019 01:03 AM	103.73	103.46
MH-5070	MH-513	103.12	102.39	105.92	105.51	300	82.0	0.50	0.013	0.97	0.07	0.08	1.10	0.52	01/01/2019 01:07 AM	103.94	104.51
MH-508	MH-509	103.05	102.84	105.88	105.67	300	41.5	0.45	0.013	0.92	0.06	0.08	1.29	0.11	01/01/2019 01:10 AM	103.46	103.16
MH-5080	MH-517	102.90	102.05	105.70	105.28	300	76.5	0.55	0.013	1.01	0.07	0.08	1.17	0.13	01/01/2019 01:08 AM	103.33	103.01
MH-509	MH-510	102.84	102.72	105.67	105.60	300	10.5	0.40	0.013	0.87	0.06	0.08	1.37	0.02	01/01/2019 01:10 AM	103.16	102.94
MH-510	MH-511	102.72	102.08	105.60	105.25	375	64.0	0.55	0.013	1.18	0.13	0.08	0.65	-0.16	01/01/2019 01:10 AM	102.94	102.35
MH-511	MH-526	102.08	98.64	105.25	103.00	450	95.5	2.80	0.013	3.00	0.48	0.29	0.61	-0.18	01/01/2019 01:09 AM	102.35	100.44
MH-513	MH-515	102.39	100.23	105.51	104.00	300	81.0	2.30	0.013	2.08	0.15	0.17	1.17	1.82	01/01/2019 01:07 AM	104.51	100.83
MH-515	MH-518	100.23	99.79	104.00	103.59	600	44.0	0.30	0.013	1.19	0.34	0.42	1.25	0.00	01/01/2019 01:10 AM	100.83	100.65
MH-517	MH-518	102.05	99.79	105.28	103.59	300	82.0	2.30	0.013	2.08	0.15	0.17	1.15	0.66	01/01/2019 01:08 AM	103.01	100.65
MH-518	MH-526	99.79	98.64	103.59	103.00	675	47.0	0.30	0.013	1.29	0.46	0.56	1.22	0.19	01/01/2019 01:13 AM	100.65	100.44
MH-519	MH-520	103.45	103.09	106.29	106.01	300	53.1	0.47	0.013	0.94	0.07	0.02	0.27	-0.19	01/01/2019 01:10 AM	103.56	103.27
MH-519	MH-523	103.45	103.22	106.29	106.20	300	13.8	0.36	0.013	0.82	0.06	0.02	0.26	-0.19	01/01/2019 01:10 AM	103.56	103.36
MH-520	MH-521	103.09	102.81	106.01	105.72	375	55.9	0.45	0.013	1.07	0.12	0.05	0.45	-0.19	01/01/2019 01:10 AM	103.27	103.01
MH-521	MH-522	102.81	102.73	105.72	105.64	375	13.8	0.36	0.013	0.95	0.10	0.05	0.51	-0.17	01/01/2019 01:10 AM	103.01	102.89
MH-522	MH-525	102.73	100.70	105.64	104.25	375	54.3	2.56	0.013	2.54	0.28	0.11	0.40	-0.22	01/01/2019 01:10 AM	102.89	101.01
MH-523	MH-524	103.22	102.13	106.20	105.48	300	54.3	1.81	0.013	1.84	0.13	0.06	0.44	-0.16	01/01/2019 01:10 AM	103.36	102.36
MH-524	MH-5240	102.13	101.92	105.48	105.23	375	65.2	0.30	0.013	0.87	0.10	0.07	0.70	-0.14	01/01/2019 01:10 AM	102.36	102.18
MH-524	MH-538	102.13	100.89	105.48	104.20	300	58.3	1.74	0.013	1.81	0.13	0.10	0.82	-0.07	01/01/2019 01:10 AM	102.36	101.19
MH-5240	MH-525	101.92	100.70	105.23	104.25	375	63.3	1.56	0.013	1.98	0.22	0.16	0.71	-0.11	01/01/2019 01:11 AM	102.18	101.01
MH-525	MH-526	100.70	98.64	104.25	103.00	525	59.0	1.80	0.013	2.67	0.58	0.35	0.60	-0.22	01/01/2019 01:09 AM	101.01	100.44
MH-526	MH-528	98.64	97.32	103.00	101.06	675	59.5	1.60	0.013	2.97	1.06	1.25	1.17	1.13	01/01/2019 01:11 AM	100.44	98.33
MH-527	MH-528	99.08	97.32	101.18	101.06	300	18.5	0.35	0.013	0.81	0.06	0.02	0.38	-0.15	01/01/2019 01:10 AM	99.23	98.33
MH-528	MH-529	97.32	97.01	101.06	100.82	1050	62.5	0.25	0.013	1.58	1.37	1.72	1.26	-0.04	01/01/2019 01:11 AM	98.33	98.08
MH-529	MH-530	97.01	96.85	100.82	100.58	1200	72.0	0.15	0.013	1.34	1.51	1.71	1.14	-0.13	01/01/2019 01:11 AM	98.08	97.95
MH-530	MH-531	96.85	96.66	100.58	100.45	1200	76.5	0.15	0.013	1.34	1.51	1.84	1.22	-0.10	01/01/2019 01:13 AM	97.95	97.75
MH-531	MH-313	96.66	96.10	100.45	99.84	1200	21.5	0.15	0.013	1.33	1.50	1.84	1.22	-0.11	01/01/2019 01:13 AM	97.75	97.64
MH-534	MH-535	103.03	100.60	105.41	103.89	375	78.5	3.00	0.013	2.75	0.30	0.18	0.60	-0.17	01/01/2019 01:10 AM	103.24	101.03
MH-535	MH-515	100.60	100.23	103.89	104.00	450	44.0	0.20	0.013	0.80	0.13	0.18	1.42	-0.02	01/01/2019 01:11 AM	101.03	100.83
MH-5350	MH-539	101.61	99.62	103.89	102.47	300	52.5	2.40	0.013	2.12	0.15	0.02	0.11	-0.23	01/01/2019 01:10 AM	101.68	100.20
MH-536	MH-538	102.50	100.89	106.02	104.20	450	58.2	2.14	0.013	2.62	0.42	0.07	0.18	-0.32	01/01/2019 01:10 AM	102.63	101.19
MH-537	MH-536	102.66	102.50	105.65	106.02	450	64.3	0.20	0.013	0.80	0.13	0.06	0.45	-0.24	01/01/2019 01:10 AM	102.87	102.63
MH-538	MH-539	100.89	99.62	104.20	102.47	525	59.0	2.10	0.013	2.88	0.62	0.40	0.64	-0.23	01/01/2019 01:10 AM	101.19	100.20
MH-539	MH-542	99.62	99.34	102.47	102.40	525	9.5	0.60	0.013	1.54	0.33	0.41	1.24	0.05	01/01/2019 01:10 AM	100.20	100.05
MH-540	MH-541	100.07	99.96	101.65	102.51	300	14.5	0.35	0.013	0.81	0.06	0.06	1.10	-0.04	01/01/2019 01:10 AM	100.33	100.21
MH-541	MH-542	99.96	99.34	102.51	102.40	300	10.0	0.35	0.013	0.81	0.06	0.06	1.10	-0.05	01/01/2019 01:11 AM	100.21	100.05
MH-542	MH-543	99.34	99.18	102.40	102.19	750	53.0	0.15	0.013	0.98	0.43	0.60	1.39	-0.04	01/01/2019 01:11 AM	100.05	99.88
MH-543	MH-544	99.18	97.99	102.19	102.02	825	118.0	0.15	0.013	1.04	0.56	0.68	1.23	-0.13	01/01/2019 01:11 AM	99.88	98.63
MH-544	MH-5440	97.99	97.27	102.02	101.00	825	57.5	1.20	0.013	2.94	1.57	0.74	0.47	-0.19	01/01/2019 01:12 AM	98.63	98.54
MH-5440	MH_302	97.27	96.41	101.00	101.14	825	12.3	1.22	0.013	2.97	1.59	0.74	0.46	0.44	01/01/2019 01:12 AM	98.54	98.51
MH-546	MH-547	101.96	100.95	104.84	103.97	375	96.5	0.90	0.013	1.51	0.17	0.12	0.71	-0.14	01/01/2019 01:10 AM	102.19	101.19
MH-547	MH-548	100.95	100.20	103.97	103.13	375	63.0	1.15	0.013	1.70	0.19	0.14	0.72	-0.14	01/01/2019 01:10 AM	101.19	100.72
MH-548	MH-549	100.20	99.88	103.13	102.82	375	29.6	0.85	0.013	1.46	0.16	0.18	1.10	0.14	01/01/2019 01:10 AM	100.72	100.34
MH-549	MH-550	99.88	99.60	102.82	102.62	375	15.1	0.90	0.013	1.50	0.17	0.20	1.18	0.08	01/01/2019 01:10 AM	100.34	99.86
MH-550	MH-551	99.60	97.86	102.62	100.93	525	110.3	1.55	0.013	2.48	0.54	0.26	0.48	-0.27	01/01/2019 01:10 AM	99.86	98.43
MH-551	MH-559	97.86	94.69	100.93	100.18	525	51.3	1.41	0.013	2.36	0.51	0.43	0.85	0.04	01/01/2019 01:13 AM	98.43	96.22
MH-552	MH-553	100.16	99.06	102.99	102.00	300	64.6	1.60	0.013	1.73	0.12	0.05	0.43	-0.16	01/01/2019 01:10 AM	100.30	99.39
MH-553	MH-557	99.06	97.32	102.00	100.85	375	103.0	1.40	0.013	1.88	0.21	0.19	0.94	-0.05	01/01/2019 01:05 AM	99.39	98.13
MH-554	MH-556	99.65	98.61	102.47	101.70	300	79.5	0.95	0.013	1.33	0.09	0.04	0.40	-0.17	01/01/2019 01:10 AM	99.78	98.98
MH-556	MH-560	98.61	98.24	101.70	101.29	525	25.2	1.39	0.013	2.34	0.51	0.32	0.63	-0.16	01/01/2019 01:10 AM	98.98	98.88
MH-5560	MH-556	98.81	98.61	101.67	101.70	525	14.0	0.99	0.013	1.97	0.43	0.28	0.66	-0.22	01/01/2019 01:10 AM	99.12	98.98
MH-557	MH-558	97.32	97.12	100.85	100.39	675	36.4	0.45	0.013	1.58	0.56	0.72	1.28	0.14	01/01/2019 01:11 AM	98.13	97.81
MH-558	MH-559	97.12	94.69	100.39	100.18	675	15.5	0.45	0.013	1.58	0.57	0.72	1.28	0.02	01/01/2019 01:11 AM	97.81	96.22
MH-559	MH-75	94.69	93.16	100.18	97.88	675	15.1	0.79	0.013	2.09	0.75	1.15	1.54	0.86	01/01/2019 01:11 AM	96.22	93.90
MH-560	MH-557	98.24	97.32	101.29	100.85	525	45.4	0.90	0.013	1.89	0.41	0.49	1.20	0.11	01/01/2019 01:10 AM	98.88	98.13
MH-561	MH-537	103.01	102.66	105.89	105.65	375	42.3	0.65	0.013	1.28	0.14	0.04	0.25	-0.25	01/01/2019 01:10 AM	103.14	102.87
MH-561	MH-563	103.01	100.82	105.89	104.35	300	60.8	2.79	0.013	2.29	0.16	0.06	0.37	-0.17	01/01/2019 01:10 AM	103.14	101.21
MH-562	MH-563	101.18	100.82	103.28	104.35	300	29.7	0.45	0.013	0.92	0.06	0.04	0.68	-0.09	01/01/2019 01:10 AM	101.39	101.21
MH-563	MH-564	100.82	100.64	104.35	104.05	525	73.6	0.20	0.013	0.89	0.19	0.19	0.97	-0.14	01/01/2019 01:10 AM	101.21	100.88
MH-564	MH-77	100.64	99.55	104.05	103.38	525	48.6	2.05	0.013	2.84	0.62	0.27	0.43	-0.29	01/01/2019 01:10 AM	100.88	100.11
MH-565	MH-560	99.47	98.24	102.40	101.29	375	97.1	1.05	0.013	1.63	0.18	0.16	0.88	-0.09	01/01/2019 01:05 AM	99.75	98.88
MH-566	MH-565	100.59	99.47	103.41	102.40	300	71.3	1.56	0.013	1.71	0.12	0.00	0.00	-0.30	01/01/2019 00:00 AM	100.59	99.75
OGS_1	OGS_1-Out	96.04	96.02	100.50	100.35	750	4.9	0.20	0.013	1.14	0.50	1.00	2.00	0.82	01/01/2019 00:59 AM	97.61	97.24
OGS_1-Out	MH_3112	96.02	96.01	100.35	100.35	2250	6.2	0.10	0.013	1.63	6.49	6.31	0.97	-1.03	01/01/2019 01:14 AM	97.24	97.21
OGS_2	OGS_2-Out	96.03	96.00	100.43	100.35	750	5.1	0.20	0.013	1.12	0.49	1.00	2.02	0.60	01/01/2019 01:03 AM	97.38	97.18
OGS_2-Out	POND	96.00	95.67	100.35	97.87	2250	5.6	0.07	0.013	1.40	5.55	4.61	0.83	-1.07	01/01/2019 01:14 AM	97.18	97.18

APPENDIX D

Tables and Calculation Sheets

JFSA Water Resources and Environmental Consultants

Table D-1: Approach Flows and Captured Flows for the 100-Year Chicago Storm

Catch Basin ID	Type	Total Approach Flow (m³/s)	Total Capture (m³/s)	Max Ponding Depth (cm)
CB_124	Low Point	0.170	0.029	25
CB_126	Low Point	0.134	0.044	22
CB_127	Low Point	0.134	0.044	22
CB_129	CB Slope	0.111	0.028	9
CB_130	CB Slope	0.111	0.028	9
CB-1	CB Slope	0.047	0.021	4
CB-104	CB Slope + Rear Yard	0.049	0.017	4
CB-107	CB Slope	0.031	0.023	4
CB-91	Low Point	0.266	0.090	29
CB-12	Low Point	0.108	0.044	21
CB-13	Low Point	0.108	0.024	21
CB-14	Low Point	0.098	0.024	15
CB-16	Low Point	0.108	0.062	17
CB-17	Low Point	0.108	0.062	17
CB-2	CB Slope	0.047	0.021	4
CB-3	CB Slope + Rear Yard	0.056	0.034	6
CB-4	CB Slope + Rear Yard	0.244	0.061	9
CB-47	CB Slope	0.037	0.029	5
CB-48	CB Slope	0.063	0.030	5
CB-49	Low Point	0.139	0.065	26
CB-5	Low Point	0.200	0.032	18
CB-50	Low Point	0.139	0.065	26
CB-51	Low Point	0.113	0.045	24
CB-52	Low Point	0.113	0.045	24
CB-53	CB Slope	0.079	0.030	5
CB-54	CB Slope	0.079	0.030	5
CB-55	CB Slope	0.009	0.009	3
CB-56	CB Slope	0.039	0.031	5
CB-57	CB Slope	0.031	0.027	5
CB-58	CB Slope	0.029	0.024	4
CB-59	CB Slope	0.050	0.036	6
CB-6	Low Point	0.200	0.032	18
CB-60	CB Slope	0.065	0.029	5
CB-61	Low Point	0.193	0.065	28
CB-62	Low Point	0.193	0.065	28
CB-7	CB Slope	0.015	0.010	2
CB-70	CB Slope	0.081	0.030	5
CB-71	CB Slope	0.081	0.030	5
CB-72	Low Point	0.142	0.065	26
CB-73	Low Point	0.142	0.045	26
CB-8	CB Slope	0.015	0.010	2
CB-92	Low Point	0.266	0.046	29
CB-93	Low Point	0.378	0.020	30
CB-94	Low Point	0.378	0.020	30
DCB_117	Low Point	0.235	0.030	6
DCB_122	Low Point	0.235	0.027	6
ICD-CB_100	CB Slope	0.013	0.013	3
ICD-CB_101	CB Slope	0.119	0.023	8
ICD-CB_102	CB Slope	0.132	0.018	9
ICD-CB_103	CB Slope	0.143	0.041	9
ICD-CB_105	CB Slope	0.153	0.043	8
ICD-CB_106	CB Slope	0.129	0.018	8
ICD-CB_108	CB Slope	0.027	0.017	4
ICD-CB_109	CB Slope	0.147	0.059	29
ICD-CB_11	CB Slope	0.071	0.059	10
ICD-CB_110	CB Slope	0.147	0.041	29
ICD-CB_111	CB Slope	0.110	0.033	7
ICD-CB_112	CB Slope	0.110	0.020	7
ICD-CB_20	CB Slope	0.065	0.061	5

Table D-1: Approach Flows and Captured Flows for the 100-Year Chicago Storm

Catch Basin ID	Type	Total Approach Flow (m³/s)	Total Capture (m³/s)	Max Ponding Depth (cm)
ICD-CB_21	CB Slope	0.026	0.016	3
ICD-CB_22	CB Slope	0.025	0.019	4
ICD-CB_23	CB Slope	0.074	0.059	9
ICD-CB_24	CB Slope	0.018	0.017	4
ICD-CB_25	CB Slope	0.026	0.019	4
ICD-CB_27	CB Slope	0.064	0.064	12
ICD-CB_28	CB Slope	0.061	0.019	23
ICD-CB_29	CB Slope	0.061	0.019	23
ICD-CB_30	CB Slope	0.084	0.018	6
ICD-CB_31	CB Slope	0.084	0.062	6
ICD-CB_32	CB Slope	0.032	0.018	4
ICD-CB_33	CB Slope	0.053	0.043	7
ICD-CB_34	CB Slope	0.071	0.018	6
ICD-CB_35	CB Slope	0.079	0.018	7
ICD-CB_36	CB Slope	0.082	0.017	7
ICD-CB_37	CB Slope	0.113	0.028	8
ICD-CB_40	CB Slope	0.075	0.024	24
ICD-CB_41	CB Slope	0.075	0.024	24
ICD-CB_42	CB Slope	0.021	0.021	4
ICD-CB_43	CB Slope	0.055	0.018	7
ICD-CB_44	CB Slope	0.031	0.024	6
ICD-CB_45	CB Slope	0.070	0.044	27
ICD-CB_46	CB Slope	0.076	0.043	25
ICD-CB_63	CB Slope	0.077	0.018	8
ICD-CB_64	CB Slope	0.098	0.062	9
ICD-CB_65	CB Slope	0.129	0.018	8
ICD-CB_66	CB Slope	0.033	0.018	4
ICD-CB_67	CB Slope	0.159	0.058	9
ICD-CB_68	CB Slope	0.178	0.020	31
ICD-CB_69	CB Slope	0.178	0.020	31
ICD-CB_74	CB Slope	0.175	0.019	29
ICD-CB_75	CB Slope	0.175	0.019	29
ICD-CB_76	CB Slope	0.098	0.030	6
ICD-CB_77	CB Slope	0.056	0.028	5
ICD-CB_78	CB Slope	0.040	0.018	5
ICD-CB_79	CB Slope	0.040	0.018	5
ICD-CB_80	CB Slope	0.025	0.012	3
ICD-CB_81	CB Slope	0.023	0.018	4
ICD-CB_82	CB Slope	0.039	0.018	18
ICD-CB_83	CB Slope	0.039	0.024	18
ICD-CB_84	CB Slope	0.087	0.026	6
ICD-CB_85	CB Slope	0.087	0.027	6
ICD-CB_87	CB Slope	0.090	0.023	7
ICD-CB_89	CB Slope	0.135	0.058	27
ICD-CB_9	CB Slope	0.081	0.044	7
ICD-CB_90	CB Slope	0.135	0.058	27
ICD-CB_96	CB Slope	0.161	0.086	31
ICD-CB_97	CB Slope	0.172	0.018	10
ICD-CB_98	CB Slope	0.163	0.063	10
ICD-CB_99	CB Slope	0.150	0.027	9
ICD-CICB_19	CB Slope	0.107	0.107	17
ICD-DCB_38	CB Slope	0.232	0.086	33
ICD-DCB_39	CB Slope	0.232	0.086	33

Table D2 - Subcacthments Level of Service - PCSWMM Vs Rational Method

Name	PCSWMM Area (ha)	Imperv. (%)	Peak Runoff (L/s)	Rational Area (ha)	C	Tc (mins)	Level of Service	Intensity (mm/hr)	Runoff (L/s)	Difference (L/s)
A136NE	0.026	42	2	0.026	0.49	10	2	76.81	3	0
A302NE	0.042	75	7	0.042	0.73	10	2	76.81	7	0
A302NW	0.043	73	7	0.043	0.71	10	2	76.81	7	0
A302R1	0.099	53	17	0.099	0.57	10	2	76.81	12	5
A302R2	0.206	38	13	0.206	0.47	10	2	76.81	20	-7
A302R3	0.064	52	11	0.064	0.56	10	2	76.81	8	3
A302S1	0.040	72	6	0.040	0.70	10	2	76.81	6	0
A302SW	0.113	74	18	0.113	0.72	10	2	76.81	17	1
A303N1	0.062	66	9	0.062	0.66	10	2	76.81	9	0
A303N2	0.062	78	10	0.062	0.75	10	2	76.81	10	1
A303N3	0.048	70	7	0.048	0.69	10	2	76.81	7	0
A303NE	0.066	63	9	0.066	0.64	10	2	76.81	9	0
A303NW	0.053	76	9	0.053	0.73	10	2	76.81	8	0
A303R1	0.016	53	3	0.016	0.57	10	2	76.81	2	1
A303R2	0.081	58	14	0.081	0.61	10	2	76.81	10	4
A303R3	0.168	46	20	0.168	0.52	10	2	76.81	19	2
A303SE	0.091	76	15	0.091	0.73	10	2	76.81	14	1
A303SW	0.091	70	14	0.091	0.69	10	2	76.81	13	0
A304NE	0.083	75	13	0.083	0.73	10	2	76.81	13	1
A304R1	0.231	40	23	0.231	0.48	10	2	76.81	24	-1
A304R2	0.059	53	9	0.059	0.57	10	2	76.81	7	1
A306NE	0.095	55	11	0.095	0.59	10	2	76.81	12	-1
A306NW	0.136	70	20	0.136	0.69	10	2	76.81	20	0
A306SE	0.027	84	5	0.027	0.79	10	2	76.81	5	0
A306SW_1	0.030	54	4	0.030	0.58	10	2	76.81	4	0
A307R1_1	0.070	7	0	0.070	0.25	10	2	76.81	4	-3
A307R1_3	0.038	57	6	0.038	0.60	10	2	76.81	5	1
A500NE	0.091	58	11	0.091	0.61	10	2	76.81	12	0
A500NW	0.120	73	19	0.120	0.71	10	2	76.81	18	1
A500R1	0.087	54	12	0.087	0.58	10	2	76.81	11	1
A500R2	0.147	43	17	0.147	0.50	10	2	76.81	16	1
A500R3	0.058	37	5	0.058	0.46	10	2	76.81	6	-1
A500SE	0.049	70	7	0.049	0.69	10	2	76.81	7	0
A502N1	0.014	76	2	0.014	0.73	10	2	76.81	2	0
A502NE	0.073	69	11	0.073	0.68	10	2	76.81	11	0
A502NW	0.029	43	3	0.029	0.50	10	2	76.81	3	0
A502R1	0.200	47	27	0.200	0.53	10	2	76.81	23	5
A502R2	0.051	56	9	0.051	0.59	10	2	76.81	6	2
A502S1	0.083	55	10	0.083	0.59	10	2	76.81	10	0
A502SE	0.034	67	5	0.034	0.67	10	2	76.81	5	0
A502SW	0.101	73	16	0.101	0.71	10	2	76.81	15	1
A503NE	0.148	74	24	0.148	0.72	10	2	76.81	23	1
A504NE	0.107	76	18	0.107	0.73	10	2	76.81	17	1
A504NW	0.096	72	15	0.096	0.70	10	2	76.81	14	0
A504SE	0.149	79	25	0.149	0.75	10	2	76.81	24	1
A504SW	0.152	77	25	0.152	0.74	10	2	76.81	24	1
A505NE	0.191	77	31	0.191	0.74	10	2	76.81	30	1
A505SW	0.150	74	24	0.150	0.72	10	2	76.81	23	1
A506NE	0.043	45	4	0.043	0.52	10	2	76.81	5	-1
A506NW	0.039	44	4	0.039	0.51	10	2	76.81	4	0
A506SW	0.175	70	26	0.175	0.69	10	2	76.81	26	0
A5070NW	0.181	76	29	0.181	0.73	10	2	76.81	28	1
A5070SE	0.157	73	25	0.157	0.71	10	2	76.81	24	1
A5080NW	0.153	76	25	0.153	0.73	10	2	76.81	24	1
A5080SE	0.164	76	27	0.164	0.73	10	2	76.81	26	1
A508NE	0.090	74	14	0.090	0.72	10	2	76.81	14	1
A510NW	0.154	69	23	0.154	0.68	10	2	76.81	22	0
A510SE	0.150	70	23	0.150	0.69	10	2	76.81	22	0
A511NW	0.148	71	23	0.148	0.70	10	2	76.81	22	1
A511SE	0.042	59	9	0.042	0.61	10	5	104.19	7	2
A511SW	0.207	77	34	0.207	0.74	10	2	76.81	33	2
A513NE	0.153	76	25	0.153	0.73	10	2	76.81	24	1
A513SE	0.043	63	10	0.043	0.64	10	5	104.19	8	2
A513SW	0.186	78	31	0.186	0.75	10	2	76.81	30	2
A515NE	0.088	77	23	0.088	0.74	10	5	104.19	19	4
A517NE	0.170	78	29	0.170	0.75	10	2	76.81	27	2
A517SE	0.043	63	10	0.043	0.64	10	5	104.19	8	2
A517SW	0.167	75	27	0.167	0.73	10	2	76.81	26	1
A520NE	0.058	67	8	0.058	0.67	10	2	76.81	8	0
A520NW	0.059	73	9	0.059	0.71	10	2	76.81	9	0
A520SE	0.109	72	17	0.109	0.70	10	2	76.81	16	0
A520SW	0.091	74	14	0.091	0.72	10	2	76.81	14	1
A522NE	0.176	78	30	0.176	0.75	10	2	76.81	28	2
A522R1	0.123	55	19	0.123	0.59	10	2	76.81	15	4
A522SE	0.065	67	9	0.065	0.67	10	2	76.81	9	0
A522SW	0.023	56	3	0.023	0.59	10	2	76.81	3	0

Table D2 - Subcacthments Level of Service - PCSWMM Vs Rational Method

Name	PCSWMM Area (ha)	Imperv. (%)	Peak Runoff (L/s)	Rational Area (ha)	C	Tc (mins)	Level of Service	Intensity (mm/hr)	Runoff (L/s)	Difference (L/s)
A5238NE	0.103	62	23	0.103	0.63	10	5	104.19	19	4
A523NW	0.051	50	6	0.051	0.55	10	2	76.81	6	0
A523SE	0.115	80	20	0.115	0.76	10	2	76.81	19	1
A5240NE	0.147	81	26	0.147	0.77	10	2	76.81	24	2
A5240SW	0.099	71	15	0.099	0.70	10	2	76.81	15	0
A524NW	0.102	72	16	0.102	0.70	10	2	76.81	15	1
A524R1	0.113	56	19	0.113	0.59	10	2	76.81	14	5
A524R2	0.034	55	5	0.034	0.59	10	2	76.81	4	1
A524R3	0.093	57	14	0.093	0.60	10	2	76.81	12	2
A524S1	0.028	57	4	0.028	0.60	10	2	76.81	4	0
A524S2	0.025	63	3	0.025	0.64	10	2	76.81	3	0
A524SE	0.053	74	8	0.053	0.72	10	2	76.81	8	0
A524SW	0.108	76	18	0.108	0.73	10	2	76.81	17	1
A525N1	0.103	76	17	0.103	0.73	10	2	76.81	16	1
A525NE	0.026	45	3	0.026	0.52	10	2	76.81	3	0
A525NW	0.023	48	2	0.023	0.54	10	2	76.81	3	0
A525R2	0.083	58	13	0.083	0.61	10	2	76.81	11	2
A525R3	0.103	56	17	0.103	0.59	10	2	76.81	13	4
A525SW	0.096	77	24	0.096	0.74	10	5	104.19	21	4
A526NE	0.064	61	14	0.064	0.63	10	5	104.19	12	3
A526NW	0.064	59	15	0.064	0.61	10	5	104.19	11	3
A527NE	0.031	61	7	0.031	0.63	10	5	104.19	6	2
A527SW	0.032	56	7	0.032	0.59	10	5	104.19	5	2
A5280R1	0.128	44	17	0.128	0.51	10	2	76.81	14	3
A528NE	0.049	75	8	0.049	0.73	10	2	76.81	8	0
A528NW	0.050	71	8	0.050	0.70	10	2	76.81	7	0
A528R1	0.188	56	28	0.188	0.59	10	2	76.81	24	4
A528SE	0.047	70	7	0.047	0.69	10	2	76.81	7	0
A528SW	0.052	82	9	0.052	0.77	10	2	76.81	9	1
A529NE	0.107	77	18	0.107	0.74	10	2	76.81	17	1
A529NW	0.054	70	8	0.054	0.69	10	2	76.81	8	0
A529R1	0.153	51	25	0.153	0.56	10	2	76.81	18	7
A529R3	0.191	48	24	0.191	0.54	10	2	76.81	22	2
A529SE	0.107	74	17	0.107	0.72	10	2	76.81	16	1
A529SW	0.054	79	9	0.054	0.75	10	2	76.81	9	0
A534NE	0.146	77	24	0.146	0.74	10	2	76.81	23	1
A534SW	0.123	74	20	0.123	0.72	10	2	76.81	19	1
A535NE	0.068	47	13	0.068	0.53	10	5	104.19	10	3
A535SW	0.096	76	25	0.096	0.73	10	5	104.19	20	4
A536NE	0.107	76	27	0.107	0.73	10	5	104.19	23	4
A537NE	0.117	61	24	0.117	0.63	10	5	104.19	21	3
A538NE	0.126	78	32	0.126	0.75	10	5	104.19	27	5
A538NW	0.083	74	20	0.083	0.72	10	5	104.19	17	3
A538R1	0.062	56	11	0.062	0.59	10	2	76.81	8	3
A538R2	0.143	53	20	0.143	0.57	10	2	76.81	17	2
A538SE	0.034	57	8	0.034	0.60	10	5	104.19	6	2
A538SW	0.032	53	7	0.032	0.57	10	5	104.19	5	1
A540NE	0.033	62	8	0.033	0.63	10	5	104.19	6	2
A540NW	0.034	57	8	0.034	0.60	10	5	104.19	6	2
A540R1	0.028	29	5	0.028	0.40	10	5	104.19	3	2
A540R2	0.028	29	5	0.028	0.40	10	5	104.19	3	2
A542NE	0.075	75	18	0.075	0.73	10	5	104.19	16	3
A542NW	0.072	72	17	0.072	0.70	10	5	104.19	15	2
A542R1	0.060	52	9	0.060	0.56	10	2	76.81	7	2
A542R2	0.114	52	16	0.114	0.56	10	2	76.81	14	2
A542SE	0.086	77	21	0.086	0.74	10	5	104.19	18	3
A542SW	0.079	75	19	0.079	0.73	10	5	104.19	17	2
A543NE	0.100	75	24	0.100	0.73	10	5	104.19	21	3
A543NW	0.019	92	5	0.019	0.84	10	5	104.19	5	1
A543R2	0.175	52	25	0.175	0.56	10	2	76.81	21	4
A543SE	0.113	79	28	0.113	0.75	10	5	104.19	25	3
A543SW	0.015	52	3	0.015	0.56	10	5	104.19	2	0
A544NE	0.117	58	23	0.117	0.61	10	5	104.19	21	3
A544SW	0.136	77	33	0.136	0.74	10	5	104.19	29	4
A546NE	0.063	69	10	0.063	0.68	10	2	76.81	9	0
A546NW	0.067	76	11	0.067	0.73	10	2	76.81	10	1
A546R1	0.170	56	26	0.170	0.59	10	2	76.81	21	5
A546R2	0.148	47	18	0.148	0.53	10	2	76.81	17	2
A546SE	0.114	70	17	0.114	0.69	10	2	76.81	17	0
A546SW	0.053	47	5	0.053	0.53	10	2	76.81	6	-1
A546W1	0.037	71	6	0.037	0.70	10	2	76.81	6	0
A547NE	0.043	56	5	0.043	0.59	10	2	76.81	5	0
A548NE	0.119	67	17	0.119	0.67	10	2	76.81	17	0
A548R1	0.171	53	23	0.171	0.57	10	2	76.81	21	2
A549NE	0.082	69	12	0.082	0.68	10	2	76.81	12	0
A550NE	0.055	71	9	0.055	0.70	10	2	76.81	8	0

Table D2 - Subcacthments Level of Service - PCSWMM Vs Rational Method

Name	PCSWMM Area (ha)	Imperv. (%)	Peak Runoff (L/s)	Rational Area (ha)	C	Tc (mins)	Level of Service	Intensity (mm/hr)	Runoff (L/s)	Difference (L/s)
A550NW	0.169	84	31	0.169	0.79	10	2	76.81	28	2
A550SW	0.076	72	12	0.076	0.70	10	2	76.81	11	0
A551NW	0.050	66	7	0.050	0.66	10	2	76.81	7	0
A551SE	0.135	83	24	0.135	0.78	10	2	76.81	23	2
A551SW	0.043	70	7	0.043	0.69	10	2	76.81	6	0
A552NE	0.146	84	26	0.146	0.79	10	2	76.81	25	2
A552SW	0.154	79	26	0.154	0.75	10	2	76.81	25	1
A553N1	0.209	78	35	0.209	0.75	10	2	76.81	33	2
A553N2	0.086	82	15	0.086	0.77	10	2	76.81	14	1
A553NE	0.128	82	23	0.128	0.77	10	2	76.81	21	1
A554NW	0.129	74	21	0.129	0.72	10	2	76.81	20	1
A554SE	0.055	67	8	0.055	0.67	10	2	76.81	8	0
A5560PK1	1.660	29	124	1.660	0.40	10	5	104.19	194	-69
A556SE	0.047	62	6	0.047	0.63	10	2	76.81	6	0
A557NE	0.149	73	23	0.149	0.71	10	2	76.81	23	1
A557NW	0.087	70	13	0.087	0.69	10	2	76.81	13	0
A561N1	0.114	74	28	0.114	0.72	10	5	104.19	24	5
A561NE	0.233	75	57	0.233	0.73	10	5	104.19	49	8
A561NW	0.076	78	19	0.076	0.75	10	5	104.19	16	3
A561SE	0.087	79	22	0.087	0.75	10	5	104.19	19	3
A561SW	0.139	78	34	0.139	0.75	10	5	104.19	30	4
A562NE	0.021	59	3	0.021	0.61	10	2	76.81	3	0
A562R1	0.039	50	5	0.039	0.55	10	2	76.81	5	1
A562R2	0.029	59	5	0.029	0.61	10	2	76.81	4	1
A562R3	0.063	62	10	0.063	0.63	10	2	76.81	9	2
A562R4	0.016	50	2	0.016	0.55	10	2	76.81	2	0
A562SE	0.021	57	3	0.021	0.60	10	2	76.81	3	0
A563NE	0.111	75	27	0.111	0.73	10	5	104.19	23	4
A564NW	0.129	75	31	0.129	0.73	10	5	104.19	27	4
A564SE	0.146	74	35	0.146	0.72	10	5	104.19	30	5
A565SE	0.083	67	12	0.083	0.67	10	2	76.81	12	0
A565SW_1	0.198	79	34	0.198	0.75	10	2	76.81	32	2
A565SW_3	0.031	67	4	0.031	0.67	10	2	76.81	4	0
A566SE	0.074	69	11	0.074	0.68	10	2	76.81	11	0
A566SW	0.170	77	28	0.170	0.74	10	2	76.81	27	1
APOND2	0.019	56	2	0.019	0.59	10	2	76.81	2	0
									Average	**0.9**
									Max	**8**
									Min	**-69**

Table D-3: PCSWMM Subcatchment Parameters

Name	Area (ha)	Width (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Subarea Routing	Percent Routed (%)	Infiltration Method	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)
A136NE	0.026	30	0.5	42	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A302NE	0.042	24	0.5	75	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A302NW	0.043	24	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A302R1	0.099	164	1.5	53	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A302R2	0.206	100	1.5	38	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A302R3	0.064	106	1.5	52	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A302S1	0.040	34	0.5	72	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A302SW	0.113	64	0.5	74	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A303N1	0.062	35	0.6	66	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A303N2	0.062	36	0.5	78	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A303N3	0.048	27	1.0	70	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A303NE	0.066	30	0.5	63	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A303NW	0.053	30	0.5	76	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A303R1	0.016	20	1.5	53	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A303R2	0.081	126	1.5	58	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A303R3	0.168	142	1.5	46	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A303SE	0.091	53	0.5	76	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A303SW	0.091	53	0.5	70	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A304NE	0.083	48	0.5	75	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A304R1	0.231	188	1.5	40	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A304R2	0.059	48	1.5	53	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A306NE	0.095	64	0.5	55	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A306NW	0.136	21	0.5	70	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A306SE	0.027	16	1.0	84	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A306SW_1	0.030	36	0.5	54	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A307R1_1	0.070	33	1.5	7	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A307R1_3	0.038	32	1.5	57	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A500NE	0.091	56	0.9	58	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A500NW	0.120	67	1.1	73	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A500R1	0.087	72	1.0	54	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A500R2	0.147	116	2.0	43	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A500R3	0.058	52	1.2	37	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A500SE	0.049	60	1.3	70	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A502N1	0.014	20	0.4	76	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A502NE	0.073	85	1.6	69	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A502NW	0.029	29	1.4	43	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A502R1	0.200	148	3.2	47	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A502R2	0.051	42	3.1	56	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A502S1	0.083	38	2.1	55	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A502SE	0.034	38	2.1	67	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A502SW	0.101	56	2.2	73	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A503NE	0.148	82	0.5	74	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A504NE	0.107	59	1.1	76	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A504NW	0.096	62	0.7	72	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A504SE	0.149	90	0.6	79	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A504SW	0.152	93	0.8	77	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A505NE	0.191	87	0.5	77	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A505SW	0.150	87	0.5	74	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A506NE	0.043	52	0.5	45	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A506NW	0.039	44	0.5	44	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A506SW	0.175	49	0.5	70	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A5070NW	0.181	84	0.5	76	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A5070SE	0.157	78	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A5080NW	0.153	74	0.5	76	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A5080SE	0.164	82	0.5	76	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A508NE	0.090	83	0.5	74	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7

Table D-3: PCSWMM Subcatchment Parameters

Name	Area (ha)	Width (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Subarea Routing	Percent Routed (%)	Infiltration Method	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)
A510NW	0.154	72	0.5	69	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A510SE	0.150	100	0.5	70	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A511NW	0.148	94	3.0	71	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A511SE	0.042	43	1.0	59	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A511SW	0.207	102	3.0	77	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A513NE	0.153	89	2.0	76	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A513SE	0.043	44	1.0	63	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A513SW	0.186	95	2.0	78	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A515NE	0.088	88	1.5	77	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A517NE	0.170	94	2.0	78	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A517SE	0.043	44	1.0	63	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A517SW	0.167	86	3.0	75	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A520NE	0.058	32	0.5	67	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A520NW	0.059	33	0.5	73	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A520SE	0.109	54	0.6	72	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A520SW	0.091	54	0.6	74	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A522NE	0.176	81	1.6	78	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A522R1	0.123	106	1.6	55	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A522SE	0.065	57	1.3	67	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A522SW	0.023	29	3.5	56	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A5238NE	0.103	56	2.9	62	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A523NW	0.051	61	2.1	50	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A523SE	0.115	61	2.1	80	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A5240NE	0.147	88	1.7	81	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A5240SW	0.099	62	2.0	71	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A524NW	0.102	65	2.3	72	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A524R1	0.113	98	3.5	56	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A524R2	0.034	28	1.5	55	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A524R3	0.093	82	1.1	57	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A524S1	0.028	31	3.1	57	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A524S2	0.025	31	1.8	63	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A524SE	0.053	36	0.7	74	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A524SW	0.108	60	0.6	76	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A525N1	0.103	68	2.3	76	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A525NE	0.026	32	3.5	45	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A525NW	0.023	31	1.4	48	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A525R2	0.083	72	1.1	58	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A525R3	0.103	86	2.0	56	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A525SW	0.096	53	1.5	77	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A526NE	0.064	59	1.5	61	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A526NW	0.064	59	3.0	59	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A527NE	0.031	29	2.0	61	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A527SW	0.032	29	2.0	56	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A5280R1	0.128	108	2.7	44	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A528NE	0.049	37	1.0	75	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A528NW	0.050	29	0.5	71	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A528R1	0.188	158	1.0	56	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A528SE	0.047	33	1.0	70	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A528SW	0.052	33	0.5	82	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A529NE	0.107	93	0.5	77	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A529NW	0.054	93	0.5	70	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A529R1	0.153	264	1.5	51	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A529R3	0.191	158	1.5	48	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A529SE	0.107	59	0.5	74	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A529SW	0.054	34	0.5	79	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A534NE	0.146	76	3.0	77	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7

Table D-3: PCSWMM Subcatchment Parameters

Name	Area (ha)	Width (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Subarea Routing	Percent Routed (%)	Infiltration Method	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)
A534SW	0.123	76	3.0	74	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A535NE	0.068	48	3.0	47	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A535SW	0.096	88	1.5	76	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A536NE	0.107	51	2.9	76	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A537NE	0.117	64	0.6	61	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A538NE	0.126	68	2.3	78	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A538NW	0.083	48	1.5	74	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A538R1	0.062	56	4.2	56	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A538R2	0.143	120	1.1	53	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A538SE	0.034	32	2.8	57	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A538SW	0.032	31	1.5	53	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A540NE	0.033	32	4.0	62	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A540NW	0.034	32	4.0	57	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A540R1	0.028	28	1.5	29	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A540R2	0.028	28	1.5	29	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A542NE	0.075	55	0.5	75	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A542NW	0.072	41	0.5	72	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A542R1	0.060	58	1.5	52	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A542R2	0.114	94	1.5	52	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A542SE	0.086	53	0.5	77	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A542SW	0.079	44	0.5	75	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A543NE	0.100	57	0.5	75	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A543NW	0.019	11	0.5	92	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A543R2	0.175	146	1.5	52	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A543SE	0.113	57	0.5	79	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A543SW	0.015	11	0.5	52	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A544NE	0.117	79	0.5	58	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A544SW	0.136	79	0.5	77	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A546NE	0.063	73	2.0	69	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A546NW	0.067	45	1.0	76	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A546R1	0.170	146	1.3	56	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A546R2	0.148	122	1.5	47	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A546SE	0.114	64	1.9	70	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A546SW	0.053	63	0.9	47	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A546W1	0.037	45	1.0	71	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A547NE	0.043	46	0.8	56	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A548NE	0.119	66	1.4	67	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A548R1	0.171	142	0.9	53	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A549NE	0.082	37	1.0	69	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A550NE	0.055	87	1.5	71	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A550NW	0.169	75	1.5	84	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A550SW	0.076	66	1.1	72	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A551NW	0.050	54	0.5	66	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A551SE	0.135	60	1.3	83	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A551SW	0.043	68	1.3	70	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A552NE	0.146	74	1.4	84	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A552SW	0.154	76	1.4	79	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A553N1	0.209	101	1.3	78	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A553N2	0.086	47	1.2	82	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A553NE	0.128	56	1.6	82	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A554NW	0.129	72	1.1	74	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A554SE	0.055	61	1.1	67	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A5560PK1	1.660	332	2.5	29	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A556SE	0.047	45	0.5	62	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A557NE	0.149	83	1.1	73	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A557NW	0.087	43	1.5	70	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7

Table D-3: PCSWMM Subcatchment Parameters

Name	Area (ha)	Width (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Subarea Routing	Percent Routed (%)	Infiltration Method	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)
A561N1	0.114	59	2.5	74	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A561NE	0.233	112	1.4	75	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A561NW	0.076	43	0.7	78	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A561SE	0.087	41	0.8	79	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A561SW	0.139	66	0.6	78	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A562NE	0.021	33	1.5	59	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A562R1	0.039	31	1.4	50	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A562R2	0.029	21	1.4	59	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A562R3	0.063	41	1.2	62	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A562R4	0.016	10	2.5	50	0.013	0.25	1.57	4.67	PERVIOUS	100	HORTON	76.2	13.2	4.14	7
A562SE	0.021	33	1.5	57	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A563NE	0.111	53	1.0	75	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A564NW	0.129	60	0.7	75	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A564SE	0.146	60	1.9	74	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A565SE	0.083	96	1.3	67	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A565SW_1	0.198	96	1.3	79	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A565SW_3	0.031	38	1.3	67	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A566SE	0.074	86	1.5	69	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
A566SW	0.170	86	1.5	77	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7
APOND2	0.019	9	0.5	56	0.013	0.25	1.57	4.67	OUTLET	100	HORTON	76.2	13.2	4.14	7

Table D-4A: ICD Head Flow Rating Curves

Head (m)	Release Rate (L/s) by ICD Diameter (mm)						
	83	94	102	108	127	152	178
0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.050	3.3	4.3	5.0	5.6	7.8	11.1	15.3
0.100	4.7	6.0	7.1	8.0	11.0	15.8	21.6
0.150	5.8	7.4	8.7	9.7	13.5	19.3	26.5
0.200	6.6	8.5	10.0	11.3	15.6	22.3	30.6
0.250	7.4	9.5	11.2	12.6	17.4	24.9	34.2
0.300	8.1	10.4	12.3	13.8	19.1	27.3	37.4
0.350	8.8	11.3	13.3	14.9	20.6	29.5	40.4
0.400	9.4	12.1	14.2	15.9	22.0	31.5	43.2
0.450	10.0	12.8	15.1	16.9	23.3	33.4	45.8
0.500	10.5	13.5	15.9	17.8	24.6	35.2	48.3
0.550	11.0	14.1	16.6	18.7	25.8	37.0	50.7
0.600	11.5	14.8	17.4	19.5	26.9	38.6	52.9
0.650	12.0	15.4	18.1	20.3	28.0	40.2	55.1
0.700	12.4	15.9	18.8	21.0	29.1	41.7	57.2
0.750	12.9	16.5	19.4	21.8	30.1	43.2	59.2
0.800	13.3	17.0	20.1	22.5	31.1	44.6	61.1
0.850	13.7	17.6	20.7	23.2	32.1	45.9	63.0
0.900	14.1	18.1	21.3	23.9	33.0	47.3	64.8
0.950	14.5	18.6	21.9	24.5	33.9	48.6	66.6
1.000	14.9	19.1	22.4	25.2	34.8	49.8	68.3
1.050	15.2	19.5	23.0	25.8	35.6	51.1	70.0
1.100	15.6	20.0	23.5	26.4	36.5	52.3	71.7
1.150	15.9	20.4	24.1	27.0	37.3	53.4	73.3
1.200	16.3	20.9	24.6	27.6	38.1	54.6	74.9
1.250	16.6	21.3	25.1	28.1	38.9	55.7	76.4
1.300	16.9	21.7	25.6	28.7	39.7	56.8	77.9
1.350	17.3	22.1	26.1	29.2	40.4	57.9	79.4
1.400	17.6	22.6	26.6	29.8	41.2	59.0	80.9
1.450	17.9	22.9	27.0	30.3	41.9	60.0	82.3
1.500	18.2	23.3	27.5	30.8	42.6	61.0	83.7
1.550	18.5	23.7	27.9	31.3	43.3	62.0	85.1
1.600	18.8	24.1	28.4	31.8	44.0	63.0	86.4

(1) Head take from the centre of the Orifice

Coefficient of Discharge = 0.62

Table D-5A: Capacity of Grates

Water Depth H (m)	$Q_{captured}$ (L/s) OPSD 400.01 SINGLE * (L/s)	$Q_{captured}$ (L/s) OPSD 400.01 TWIN * (L/s)
0.00	0	0
0.01	1	1
0.02	2	3
0.03	4	5
0.04	7	9
0.05	11	16
0.06	16	27
0.07	20	36
0.08	36	54
0.09	48	71
0.10	61	91
0.11	73	109
0.12	86	127
0.13	99	140
0.14	109	155
0.15	120	169
0.16	129	183
0.17	136	196
0.18	145	211
0.19	150	228
0.20	156	243
0.21	161	259
0.22	167	275
0.23	172	291
0.24	176	307
0.25	181	322
0.26	186	337
0.27	189	354
0.28	194	371
0.29	199	387
0.30	202	403

* From MTO Drainage Management Manual (1997), Design Chart 4.19

Table D-5B: Capacity of Side Inlet [1]

Water Depth (m)	SINGLE Capacity (L/s)	TWIN Capacity (L/s)
0.00	0	0
0.01	1	2
0.02	3	6
0.03	6	12
0.04	9	18
0.05	13	26
0.06	17	34
0.07	22	44
0.08	26	52
0.09	32	64
0.10	37	74
0.11	43	86
0.12	49	98
0.13	62	124
0.14	67	134
0.15	71	142
0.16	75	150
0.17	79	158
0.18	83	166
0.19	86	172
0.20	89	178
0.21	93	186
0.22	96	192
0.23	99	198
0.24	102	204
0.25	105	210
0.26	107	214
0.27	110	220
0.28	113	226
0.29	115	230
0.30	118	236

(1) As per $Q_{weir} = CLH^{3/2}$ where C = 1.8, and $Q_{orifice} = CA\times(2gh)^{0.5}$ where C = 0.65 for a 13 cm high x 65 cm wide side inlet.

Table D-5C: Capacity of Lead Pipes

	Release Rate (L/s) by Pipe Diameter (mm)						
Head (m)	**100**	**150**	**200**	**250**	**300**	**375**	**450**
0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.050	6.4	14.4	25.5	39.9	57.4	89.7	129.2
0.100	9.0	20.3	36.1	56.4	81.2	126.9	182.7
0.150	11.0	24.9	44.2	69.1	99.4	155.4	223.7
0.200	12.8	28.7	51.0	79.7	114.8	179.4	258.3
0.250	14.3	32.1	57.1	89.1	128.4	200.6	288.8
0.300	15.6	35.2	62.5	97.7	140.6	219.7	316.4
0.350	16.9	38.0	67.5	105.5	151.9	237.3	341.8
0.400	18.0	40.6	72.2	112.8	162.4	253.7	365.3
0.450	19.1	43.1	76.5	119.6	172.2	269.1	387.5
0.500	20.2	45.4	80.7	126.1	181.5	283.7	408.5
0.550	21.2	47.6	84.6	132.2	190.4	297.5	428.4
0.600	22.1	49.7	88.4	138.1	198.9	310.7	447.5
0.650	23.0	51.7	92.0	143.7	207.0	323.4	465.7
0.700	23.9	53.7	95.5	149.2	214.8	335.6	483.3
0.750	24.7	55.6	98.8	154.4	222.3	347.4	500.3
0.800	25.5	57.4	102.1	159.5	229.6	358.8	516.7
0.850	26.3	59.2	105.2	164.4	236.7	369.8	532.6
0.900	27.1	60.9	108.3	169.1	243.6	380.6	548.0
0.950	27.8	62.6	111.2	173.8	250.2	391.0	563.0
1.000	28.5	64.2	114.1	178.3	256.7	401.2	577.7
1.050	29.2	65.8	116.9	182.7	263.1	411.1	591.9
1.100	29.9	67.3	119.7	187.0	269.3	420.7	605.9
1.150	30.6	68.8	122.4	191.2	275.3	430.2	619.5
1.200	31.2	70.3	125.0	195.3	281.2	439.4	632.8
1.250	31.9	71.8	127.6	199.3	287.0	448.5	645.9
1.300	32.5	73.2	130.1	203.3	292.7	457.4	658.6
1.350	33.1	74.6	132.6	207.2	298.3	466.1	671.2
1.400	33.8	75.9	135.0	211.0	303.8	474.7	683.5
1.450	34.4	77.3	137.4	214.7	309.2	483.1	695.6
1.500	34.9	78.6	139.8	218.4	314.4	491.3	707.5
1.550	35.5	79.9	142.1	222.0	319.6	499.4	719.2
1.600	36.1	81.2	144.3	225.5	324.8	507.4	730.7

Short tube orifice coefficient = 0.82

Short tube release rate = $C\pi(Dia/1000)^2/4\times(2\times9.81\times H)^{0.5}\times1000$

Table D-6: ICD Type and Inlet Capture Results for the 2-Year Chicago Storm

Catch Basin ID	Type	Applied ICD	Total Simulated Approach Flow (m^3/s)	Total Simulated Capture (m^3/s)	Max Ponding Depth (cm)	Flow Spread (m)	% of Total Travel Lane (1)
CB_124	Low Point	102mm-ICD	0.033	0.026	0	0.00	0%
CB_126	Low Point	127mm-ICD	0.040	0.039	0	0.00	0%
CB_127	Low Point	127mm-ICD	0.040	0.039	0	0.00	0%
CB_129	CB Slope	-	0.021	0.009	4	1.31	15%
CB_130	CB Slope	-	0.021	0.009	4	1.31	15%
CB-1	CB Slope	-	0.011	0.007	2	0.65	8%
CB-104	CB Slope + Rear Yard	83mm-ICD	0.013	0.013	1	0.33	4%
CB-107	CB Slope	-	0.008	0.008	2	0.65	8%
CB-91	Low Point	178mm-ICD	0.051	0.051	0	0.00	0%
CB-12	Low Point	127mm-ICD	0.019	0.019	0	0.00	0%
CB-13	Low Point	94mm-ICD	0.019	0.000	0	0.00	0%
CB-14	Low Point	94mm-ICD	0.033	0.018	0	0.00	0%
CB-16	Low Point	152mm-ICD	0.034	0.034	0	0.00	0%
CB-17	Low Point	152mm-ICD	0.034	0.034	0	0.00	0%
CB-2	CB Slope	-	0.011	0.007	2	0.65	8%
CB-3	CB Slope + Rear Yard	127mm-ICD	0.014	0.014	3	0.98	12%
CB-4	CB Slope + Rear Yard	152mm-ICD	0.050	0.050	4	1.31	15%
CB-47	CB Slope	-	0.013	0.013	3	0.98	12%
CB-48	CB Slope	-	0.020	0.018	4	1.31	15%
CB-49	Low Point	152mm-ICD	0.042	0.042	0	0.00	0%
CB-5	CB Slope	-	0.017	0.016	0	0.00	0%
CB-50	Low Point	152mm-ICD	0.042	0.042	0	0.00	0%
CB-51	CB Slope	-	0.033	0.032	0	0.00	0%
CB-52	Low Point	127mm-ICD	0.033	0.032	0	0.00	0%
CB-53	CB Slope	-	0.028	0.017	4	1.31	15%
CB-54	CB Slope	-	0.028	0.017	4	1.31	15%
CB-55	CB Slope	-	0.002	0.002	1	0.33	4%
CB-56	CB Slope	-	0.013	0.013	3	0.98	12%
CB-57	CB Slope	-	0.008	0.008	2	0.65	8%
CB-58	CB Slope	-	0.009	0.009	2	0.65	8%
CB-59	CB Slope	-	0.015	0.015	3	0.98	12%
CB-6	Low Point	108mm-ICD	0.017	0.016	0	0.00	0%
CB-60	CB Slope	-	0.019	0.017	3	0.98	12%
CB-61	Low Point	152mm-ICD	0.041	0.041	0	0.00	0%
CB-62	Low Point	152mm-ICD	0.041	0.041	0	0.00	0%
CB-7	CB Slope	-	0.004	0.003	1	0.33	4%
CB-70	CB Slope	-	0.027	0.017	4	1.31	15%
CB-71	CB Slope	-	0.027	0.017	4	1.31	15%
CB-72	Low Point	152mm-ICD	0.041	0.041	0	0.00	0%
CB-73	Low Point	127mm-ICD	0.041	0.033	0	0.00	0%
CB-8	CB Slope	-	0.004	0.003	1	0.33	4%
CB-92	Low Point	127mm-ICD	0.051	0.034	0	0.00	0%
CB-93	Low Point	83mm-ICD	0.016	0.016	0	0.00	0%
CB-94	Low Point	83mm-ICD	0.016	0.016	0	0.00	0%
DCB_117	Low Point	108mm-ICD	0.028	0.026	0	0.00	0%
DCB_122	Low Point	102mm-ICD	0.028	0.024	0	0.00	0%
ICD-CB_100	CB Slope	-	0.004	0.004	2	0.65	8%
ICD-CB_101	CB Slope	-	0.012	0.011	3	0.98	12%
ICD-CB_102	CB Slope	-	0.006	0.006	2	0.65	8%
ICD-CB_103	CB Slope	-	0.019	0.016	3	0.98	12%
ICD-CB_105	CB Slope	-	0.008	0.008	2	0.65	8%
ICD-CB_106	CB Slope	-	0.019	0.011	3	0.98	12%
ICD-CB_108	CB Slope	-	0.009	0.008	2	0.65	8%
ICD-CB_109	CB Slope	-	0.038	0.038	6	1.96	23%
ICD-CB_11	CB Slope	-	0.023	0.023	6	1.96	23%
ICD-CB_110	CB Slope	-	0.038	0.038	6	1.96	23%
ICD-CB_111	CB Slope	-	0.023	0.014	3	0.98	12%
ICD-CB_112	CB Slope	-	0.023	0.014	3	0.98	12%

Table D-6: ICD Type and Inlet Capture Results for the 2-Year Chicago Storm

Catch Basin ID	Type	Applied ICD	Total Simulated Approach Flow (m³/s)	Total Simulated Capture (m³/s)	Max Ponding Depth (cm)	Flow Spread (m)	% of Total Travel Lane [(1)]
ICD-CB_20	CB Slope	-	0.005	0.005	2	0.65	8%
ICD-CB_21	CB Slope	-	0.009	0.008	2	0.65	8%
ICD-CB_22	CB Slope	-	0.008	0.008	2	0.65	8%
ICD-CB_23	CB Slope	-	0.024	0.024	6	1.96	23%
ICD-CB_24	CB Slope	-	0.007	0.007	2	0.65	8%
ICD-CB_25	CB Slope	-	0.009	0.009	2	0.65	8%
ICD-CB_27	CB Slope	-	0.022	0.022	4	1.31	15%
ICD-CB_28	CB Slope	-	0.014	0.014	3	0.98	12%
ICD-CB_29	CB Slope	-	0.014	0.014	3	0.98	12%
ICD-CB_30	CB Slope	-	0.014	0.008	2	0.65	8%
ICD-CB_31	CB Slope	-	0.014	0.014	2	0.65	8%
ICD-CB_32	CB Slope	-	0.004	0.004	2	0.65	8%
ICD-CB_33	CB Slope	-	0.009	0.009	3	0.98	12%
ICD-CB_34	CB Slope	-	0.010	0.010	2	0.65	8%
ICD-CB_35	CB Slope	-	0.011	0.011	3	0.98	12%
ICD-CB_36	CB Slope	-	0.010	0.010	2	0.65	8%
ICD-CB_37	CB Slope	-	0.020	0.016	3	0.98	12%
ICD-CB_40	CB Slope	-	0.020	0.019	4	1.31	15%
ICD-CB_41	CB Slope	-	0.020	0.019	4	1.31	15%
ICD-CB_42	CB Slope	-	0.002	0.002	1	0.33	4%
ICD-CB_43	CB Slope	-	0.011	0.011	3	0.98	12%
ICD-CB_44	CB Slope	-	0.004	0.004	2	0.65	8%
ICD-CB_45	CB Slope	-	0.019	0.019	6	1.96	23%
ICD-CB_46	CB Slope	-	0.019	0.019	4	1.31	15%
ICD-CB_63	CB Slope	-	0.017	0.016	3	0.98	12%
ICD-CB_64	CB Slope	-	0.019	0.019	3	0.98	12%
ICD-CB_65	CB Slope	-	0.019	0.011	3	0.98	12%
ICD-CB_66	CB Slope	-	0.007	0.007	2	0.65	8%
ICD-CB_67	CB Slope	-	0.015	0.015	3	0.98	12%
ICD-CB_68	CB Slope	-	0.017	0.017	4	1.31	15%
ICD-CB_69	CB Slope	-	0.017	0.017	4	1.31	15%
ICD-CB_74	CB Slope	-	0.019	0.018	6	1.96	23%
ICD-CB_75	CB Slope	-	0.019	0.018	6	1.96	23%
ICD-CB_76	CB Slope	-	0.020	0.014	3	0.98	12%
ICD-CB_77	CB Slope	-	0.009	0.009	2	0.65	8%
ICD-CB_78	CB Slope	-	0.012	0.010	2	0.65	8%
ICD-CB_79	CB Slope	-	0.012	0.010	2	0.65	8%
ICD-CB_80	CB Slope	-	0.009	0.004	1	0.33	4%
ICD-CB_81	CB Slope	-	0.009	0.009	3	0.98	12%
ICD-CB_82	CB Slope	-	0.013	0.013	3	0.98	12%
ICD-CB_83	CB Slope	-	0.013	0.013	3	0.98	12%
ICD-CB_84	CB Slope	-	0.027	0.016	3	0.98	12%
ICD-CB_85	CB Slope	-	0.027	0.016	3	0.98	12%
ICD-CB_87	CB Slope	-	0.023	0.018	4	1.31	15%
ICD-CB_89	CB Slope	-	0.040	0.040	6	1.96	23%
ICD-CB_9	CB Slope	-	0.011	0.011	2	0.65	8%
ICD-CB_90	CB Slope	-	0.040	0.040	6	1.96	23%
ICD-CB_96	CB Slope	-	0.031	0.031	5	1.63	19%
ICD-CB_97	CB Slope	-	0.020	0.017	3	0.98	12%
ICD-CB_98	CB Slope	-	0.019	0.019	3	0.98	12%
ICD-CB_99	CB Slope	-	0.012	0.012	3	0.98	12%
ICD-CICB_19	CB Slope	-	0.017	0.017	4	1.31	15%
ICD-DCB_38	CB Slope	-	0.042	0.041	5	1.63	19%
ICD-DCB_39	CB Slope	-	0.042	0.041	5	1.63	19%

Table D-7: Ponding at Major Low Points for the 100-Year Chicago Storm & 100-Year Chicago Storm +20%

Catch Basin ID	Major Node	Total Depth		Water Surface Elevation	
		100 Year 3 Hr Chi (cm)	100 Year 3 Hr Chi+20% (cm)	100 Year 3 Hr Chi (m)	100 Year 3 Hr Chi+20% (m)
CB_124	Maj_127	25.0	31.0	100.96	101.02
CB_126	Maj_125	22.0	30.0	101.05	101.13
CB_127	Maj_125	22.0	30.0	101.05	101.13
CB_129	Maj_132	9.0	12.0	100.78	100.82
CB_130	Maj_132	9.0	12.0	100.78	100.82
CB-1	Maj_120	4.0	5.0	101.99	102.01
CB-104	Maj_018	4.0	4.0	103.89	103.89
CB-107	Maj_150	4.0	6.0	103.97	103.99
CB-91	Maj_135	29.0	38.0	100.71	100.81
CB-12	Maj_008	21.0	32.0	101.06	101.17
CB-13	Maj_008	21.0	32.0	101.06	101.17
CB-14	Maj_013	15.0	16.0	102.65	102.66
CB-16	Maj_015	17.0	23.0	102.74	102.80
CB-17	Maj_015	17.0	23.0	102.74	102.80
CB-2	Maj_120	4.0	5.0	101.99	102.01
CB-3	Maj_087	6.0	9.0	103.59	103.63
CB-4	Maj_130	9.0	12.0	100.45	100.47
CB-47	Maj_108	5.0	6.0	105.51	105.52
CB-48	Maj_107	5.0	6.0	105.44	105.45
CB-49	Maj_106	26.0	30.0	103.90	103.94
CB-5	Maj_121	18.0	23.0	101.12	101.18
CB-50	Maj_106	26.0	30.0	103.90	103.94
CB-51	Maj_077	24.0	27.0	104.30	104.33
CB-52	Maj_077	24.0	27.0	104.30	104.33
CB-53	Maj_080	5.0	6.0	105.86	105.86
CB-54	Maj_080	5.0	6.0	105.86	105.86
CB-55	Maj_097	3.0	3.0	106.07	106.07
CB-56	Maj_096	5.0	6.0	105.88	105.89
CB-57	Maj_094	5.0	5.0	105.87	105.87
CB-58	Maj_092	4.0	5.0	105.62	105.63
CB-59	Maj_090	6.0	6.0	105.27	105.27
CB-6	Maj_121	18.0	23.0	101.12	101.18
CB-60	Maj_089	5.0	6.0	105.20	105.21
CB-61	Maj_083	28.0	31.0	103.02	103.05
CB-62	Maj_083	28.0	31.0	103.02	103.05
CB-7	Maj_124	2.0	3.0	101.18	101.18
CB-70	Maj_104	5.0	6.0	105.29	105.29
CB-71	Maj_104	5.0	6.0	105.29	105.29
CB-72	Maj_103	26.0	30.0	103.50	103.54
CB-73	Maj_103	26.0	30.0	103.50	103.54
CB-8	Maj_124	2.0	3.0	101.18	101.18
CB-92	Maj_135	29.0	38.0	100.71	100.81
CB-93	Maj_138	30.0	38.0	100.88	100.97
CB-94	Maj_138	30.0	38.0	100.88	100.97
DCB_117	Maj_129	6.0	13.0	100.28	100.35
DCB_122	Maj_129	6.0	13.0	100.28	100.35
ICD-CB_100	J134	3.0	3.0	101.75	101.75
ICD-CB_101	J135	8.0	10.0	101.66	101.68
ICD-CB_102	J156	9.0	11.0	101.08	101.10
ICD-CB_103	J159	9.0	12.0	100.68	100.71
ICD-CB_105	J085	7.0	9.0	103.18	103.19
ICD-CB_106	J30	8.0	9.0	103.66	103.67
ICD-CB_108	J007	4.0	4.0	104.53	104.54
ICD-CB_109	LP015	29.0	32.0	101.22	101.25
ICD-CB_11	LP002	10.0	10.0	104.30	104.31
ICD-CB_110	LP015	29.0	32.0	101.22	101.25
ICD-CB_111	J161	7.0	8.0	102.28	102.29
ICD-CB_112	J161	7.0	8.0	102.28	102.29
ICD-CB_20	J032	5.0	7.0	103.12	103.13
ICD-CB_21	J030	3.0	4.0	104.46	104.46
ICD-CB_22	J004	4.0	4.0	105.69	105.69
ICD-CB_23	LP001	9.0	9.0	105.59	105.59
ICD-CB_24	J002	4.0	5.0	105.59	105.60
ICD-CB_25	J014	4.0	4.0	104.32	104.32
ICD-CB_27	LP003	12.0	13.0	103.06	103.07
ICD-CB_28	LP013	23.0	26.0	104.91	104.95
ICD-CB_29	LP013	23.0	26.0	104.91	104.95

Table D-7: Ponding at Major Low Points for the 100-Year Chicago Storm & 100-Year Chicago Storm +20%

Catch Basin ID	Major Node	Total Depth		Water Surface Elevation	
		100 Year 3 Hr Chi (cm)	100 Year 3 Hr Chi+20% (cm)	100 Year 3 Hr Chi (m)	100 Year 3 Hr Chi+20% (m)
ICD-CB_30	J123_m	6.0	7.0	103.93	103.94
ICD-CB_31	J123_m	6.0	7.0	103.93	103.94
ICD-CB_32	J118_m	4.0	5.0	103.25	103.26
ICD-CB_33	J111_m	7.0	8.0	103.04	103.06
ICD-CB_34	J107	6.0	7.0	102.65	102.66
ICD-CB_35	J106	7.0	7.0	102.31	102.32
ICD-CB_36	J110	7.0	8.0	101.26	101.27
ICD-CB_37	J108	7.0	9.0	101.16	101.17
ICD-CB_40	LP005	24.0	25.0	104.19	104.20
ICD-CB_41	LP005	24.0	25.0	104.19	104.20
ICD-CB_42	J044	4.0	4.0	104.47	104.47
ICD-CB_43	J037	7.0	8.0	105.18	105.19
ICD-CB_44	J036	6.0	7.0	105.30	105.31
ICD-CB_45	LP006	26.0	28.0	104.27	104.28
ICD-CB_46	J050	25.0	26.0	104.27	104.28
ICD-CB_63	J062	8.0	9.0	105.02	105.03
ICD-CB_64	J131_m	9.0	11.0	104.45	104.47
ICD-CB_65	J30	8.0	9.0	103.66	103.67
ICD-CB_66	J054	4.0	5.0	104.42	104.42
ICD-CB_67	J057	9.0	10.0	102.43	102.44
ICD-CB_68	LP007	31.0	32.0	102.39	102.41
ICD-CB_69	LP007	31.0	32.0	102.39	102.41
ICD-CB_74	LP010	29.0	32.0	103.04	103.07
ICD-CB_75	LP010	29.0	32.0	103.04	103.07
ICD-CB_76	J083	6.0	7.0	104.77	104.78
ICD-CB_77	J082	5.0	6.0	105.32	105.33
ICD-CB_78	J089	5.0	6.0	105.78	105.79
ICD-CB_79	J089	5.0	6.0	105.78	105.79
ICD-CB_80	J132_m	3.0	3.0	105.92	105.92
ICD-CB_81	J093	4.0	5.0	105.92	105.92
ICD-CB_82	LP011	18.0	21.0	105.37	105.41
ICD-CB_83	LP011	18.0	21.0	105.37	105.41
ICD-CB_84	J077	6.0	7.0	101.96	101.97
ICD-CB_85	J077	6.0	7.0	101.96	101.97
ICD-CB_87	J074	7.0	8.0	101.12	101.14
ICD-CB_89	LP009	27.0	30.0	100.79	100.83
ICD-CB_9	J068	7.0	8.0	103.18	103.19
ICD-CB_90	LP009	27.0	30.0	100.79	100.83
ICD-CB_96	LP014	31.0	36.0	101.10	101.15
ICD-CB_97	J151_m	10.0	12.0	101.34	101.36
ICD-CB_98	J145	10.0	11.0	101.68	101.70
ICD-CB_99	J144_m	9.0	11.0	102.00	102.01
ICD-CICB_19	LP004	17.0	26.0	102.90	102.99
ICD-DCB_38	LP012	33.0	45.0	100.51	100.63
ICD-DCB_39	LP012	33.0	45.0	100.51	100.63
MAX		33.00	45.00		

Table D-8: Major System Flow Depths 100-Year Peak Flow

Link Name	Transect	Max Velocity (m/s)	Max Depth (m)	Depth x Velocity (m^2/s)
C1	1	1.89	0.10	0.19
C10	1	0.00	0.02	0.00
C100_m	1	0.54	0.05	0.03
C101_m	1	0.50	0.05	0.03
C103	1	0.45	0.16	0.07
C104_m	1	0.31	0.27	0.08
C105_m	1	0.10	0.15	0.02
C106_m	1	0.00	0.06	0.00
C107_m	1	0.38	0.05	0.02
C108	1	0.00	0.00	0.00
C109_m	1	0.00	0.02	0.00
C11_m	1	0.59	0.04	0.02
C110_m	1	0.00	0.00	0.00
C111_m	1	0.00	0.00	0.00
C112	1	0.00	0.00	0.00
C113_m	1	0.00	0.00	0.00
C114	1	0.00	0.00	0.00
C116_m	1	0.00	0.06	0.00
C117_m	1	0.09	0.15	0.01
C118_m	1	0.22	0.26	0.06
C119_m	1	0.73	0.16	0.11
C12_m	1	0.37	0.05	0.02
C120_m	1	0.90	0.06	0.05
C121	1	0.89	0.07	0.06
C122	1	0.86	0.06	0.05
C123	1	0.94	0.06	0.06
C124	1	0.72	0.17	0.12
C125	1	0.95	0.07	0.06
C126	1	0.87	0.07	0.06
C127	1	0.77	0.07	0.05
C13_m	1	0.40	0.08	0.03
C130	1	0.59	0.05	0.03
C131_m	1	0.48	0.05	0.03
C133	1	0.70	0.04	0.03
C134	1	0.90	0.04	0.03
C135	1	0.19	0.05	0.01
C136	1	1.29	0.06	0.08
C137	1	0.58	0.31	0.18
C138	1	0.37	0.29	0.11
C140	1	0.00	0.03	0.00
C141	1	0.00	0.00	0.00
C142	1	0.00	0.01	0.00
C143	1	0.19	0.21	0.04
C144_m	1	0.09	0.16	0.01
C145	1	0.03	0.07	0.00
C146	1	0.00	0.00	0.00
C147	1	0.00	0.00	0.00
C148	1	1.13	0.07	0.07
C150	1	0.76	0.10	0.07
C151	1	0.29	0.19	0.05
C152	1	1.76	0.05	0.10
C153	1	0.24	0.02	0.01

Table D-8: Major System Flow Depths 100-Year Peak Flow

Link Name	Transect	Max Velocity (m/s)	Max Depth (m)	Depth x Velocity (m²/s)
C154	1	0.54	0.04	0.02
C155	1	0.03	0.05	0.00
C156	1	0.28	0.05	0.02
C157	1	1.05	0.08	0.08
C158	1	0.24	0.01	0.00
C159	1	0.01	0.01	0.00
C160	1	0.74	0.10	0.07
C164	1	0.87	0.10	0.08
C165	1	0.73	0.10	0.07
C167	1	0.78	0.10	0.07
C168	1	0.86	0.09	0.08
C169	1	0.61	0.25	0.15
C17_m	1	0.00	0.00	0.00
C170	1	0.12	0.26	0.03
C171	1	0.26	0.29	0.08
C173	1	0.27	0.28	0.08
C174	1	0.76	0.16	0.12
C175	1	0.86	0.10	0.08
C176	1	0.35	0.18	0.06
C178	1	0.63	0.10	0.06
C179	1	1.27	0.08	0.11
C18_m	1	0.00	0.02	0.00
C180	1	0.74	0.10	0.07
C181	1	0.95	0.09	0.09
C182	1	0.87	0.09	0.08
C183	1	0.73	0.14	0.11
C184	1	0.63	0.20	0.13
C185	1	0.88	0.09	0.08
C186	1	0.82	0.10	0.08
C187	1	0.75	0.07	0.05
C188	1	0.61	0.17	0.10
C189	1	0.23	0.25	0.06
C19_1	1	0.00	0.00	0.00
C190	1	0.18	0.26	0.05
C191	1	1.05	0.07	0.08
C192	1	0.79	0.13	0.10
C193	1	1.02	0.05	0.06
C194	1	0.91	0.06	0.05
C195_1	1	1.24	0.08	0.10
C195_2	1	1.21	0.07	0.09
C196	1	0.68	0.05	0.04
C2_m	1	0.14	0.07	0.01
C20_m	1	0.00	0.00	0.00
C21	1	0.00	0.03	0.00
C22_m	1	0.00	0.00	0.00
C23_m	1	0.00	0.00	0.00
C26_m	1	0.17	0.08	0.01
C27_m	1	0.43	0.05	0.02
C3	1	0.00	0.02	0.00
C30_m	1	0.06	0.09	0.01
C31	1	0.18	0.08	0.02
C32_m	1	0.00	0.02	0.00

Table D-8: Major System Flow Depths 100-Year Peak Flow

Link Name	Transect	Max Velocity (m/s)	Max Depth (m)	Depth x Velocity (m²/s)
C33	1	0.00	0.00	0.00
C34	1	0.00	0.00	0.00
C35_m	1	0.00	0.00	0.00
C36_m	1	1.06	0.04	0.04
C37	1	0.00	0.02	0.00
C38	1	1.02	0.05	0.05
C4	1	0.00	0.00	0.00
C40	1	0.26	0.10	0.03
C41_m	1	0.34	0.14	0.05
C42_m	1	0.89	0.08	0.07
C43_m	1	1.19	0.05	0.06
C44_m	1	0.00	0.03	0.00
C45_m	1	0.44	0.07	0.03
C46_m	1	1.11	0.05	0.06
C47	1	0.74	0.06	0.04
C48_m	1	1.04	0.05	0.06
C49	1	0.00	0.00	0.00
C5	1	0.51	0.04	0.02
C50_m	1	0.00	0.00	0.00
C51_m	1	0.00	0.00	0.00
C52	1	0.93	0.04	0.03
C53	1	0.00	0.02	0.00
C54_m	1	0.00	0.00	0.00
C55_m	1	0.45	0.11	0.05
C56_m	1	0.51	0.11	0.06
C57	1	0.15	0.20	0.03
C58_m	1	0.09	0.20	0.02
C59_m	1	0.54	0.13	0.07
C6	1	0.36	0.05	0.02
C60	1	0.20	0.23	0.05
C61	1	0.25	0.26	0.06
C62	1	0.24	0.23	0.05
C63	1	0.62	0.14	0.09
C64_m	1	0.78	0.04	0.03
C65_m	1	0.38	0.07	0.03
C66_m	1	1.08	0.08	0.08
C67_m	1	0.96	0.16	0.16
C68_m	1	0.42	0.28	0.12
C69_m	1	0.15	0.28	0.04
C7	1	0.49	0.07	0.04
C70_m	1	0.18	0.17	0.03
C71_m	1	0.63	0.05	0.03
C72_m	1	1.03	0.06	0.06
C73_m	1	0.70	0.07	0.05
C74	1	0.63	0.08	0.05
C75	1	1.01	0.06	0.06
C76	1	0.80	0.07	0.05
C77	1	0.79	0.07	0.05
C78_m	1	0.70	0.07	0.05
C80_m	1	1.16	0.06	0.07
C81_m	1	1.34	0.05	0.07
C82_m	1	1.39	0.05	0.07

Table D-8: Major System Flow Depths 100-Year Peak Flow

Link Name	Transect	Max Velocity (m/s)	Max Depth (m)	Depth x Velocity (m^2/s)
C83	1	1.19	0.05	0.06
C84_m	1	0.88	0.11	0.10
C85_m	1	1.03	0.07	0.07
C86_m	1	0.30	0.22	0.07
C87	1	0.15	0.25	0.04
C88	1	0.36	0.16	0.06
C89_m	1	0.82	0.07	0.05
C9	1	0.00	0.00	0.00
C90_m	1	0.68	0.04	0.02
C91_m	1	0.61	0.04	0.02
C92	1	0.43	0.05	0.02
C93	1	0.66	0.05	0.03
C94_m	1	1.06	0.05	0.06
C95_m	1	1.60	0.07	0.11
C96_m	1	1.55	0.07	0.11
C97_m	1	1.51	0.08	0.12
C98_m	1	1.47	0.07	0.11
C99_m	1	0.64	0.05	0.03
Maj_009_1	1	0.39	0.12	0.05
Maj_009_2	1	0.32	0.13	0.04
Maj_010	1	0.39	0.08	0.03
Maj_012_1	1	0.69	0.21	0.14
Maj_012_3	1	0.39	0.09	0.04
Maj_012_4	1	0.47	0.14	0.06
Maj_014_1	1	0.00	0.13	0.00
Maj_014_2	1	0.00	0.14	0.00
Maj_016_2	1	0.84	0.04	0.03
Maj_016_3	1	0.72	0.16	0.12
Maj_017	1	1.42	0.04	0.06
Maj_018	1	0.65	0.04	0.03
Maj_019_1	1	0.00	0.02	0.00
Maj_019_2	1	0.00	0.01	0.00
Maj_078_2	1	0.10	0.14	0.01
Maj_078_3	1	0.55	0.04	0.02
Maj_078_4	1	0.59	0.05	0.03
Maj_079	1	0.08	0.03	0.00
Maj_080	1	1.44	0.14	0.21
Maj_081	1	0.00	0.02	0.00
Maj_082_1	1	0.00	0.00	0.00
Maj_082_2	1	0.00	0.00	0.00
Maj_084_1	1	1.75	0.08	0.14
Maj_084_2	1	0.68	0.18	0.12
Maj_085	1	1.18	0.07	0.08
Maj_086_1	1	0.74	0.06	0.04
Maj_086_2	1	0.67	0.16	0.11
Maj_087	1	0.77	0.06	0.05
Maj_088_1	1	0.69	0.05	0.04
Maj_088_2	1	0.72	0.16	0.11
Maj_089	1	1.45	0.16	0.23
Maj_090	1	0.64	0.05	0.03
Maj_092	1	0.48	0.05	0.02
Maj_093_1	1	0.21	0.05	0.01

Table D-8: Major System Flow Depths 100-Year Peak Flow

Link Name	Transect	Max Velocity (m/s)	Max Depth (m)	Depth x Velocity (m²/s)
Maj_093_2	1	0.32	0.04	0.01
Maj_094	1	0.57	0.04	0.02
Maj_095_1	1	0.06	0.04	0.00
Maj_095_2	1	0.05	0.04	0.00
Maj_095_3	1	0.05	0.04	0.00
Maj_095_4	1	0.53	0.05	0.03
Maj_097	1	0.44	0.02	0.01
Maj_098	1	0.00	0.01	0.00
Maj_1	1	0.49	0.05	0.02
Maj_104	1	1.33	0.16	0.21
Maj_105	1	0.76	0.06	0.05
Maj_122	1	1.67	0.13	0.22
Maj_123_2	1	0.82	0.14	0.12
Maj_123_3	1	1.16	0.13	0.15
Maj_124	1	0.58	0.06	0.03
Maj_126_1	1	0.29	0.15	0.04
Maj_126_2	1	0.20	0.17	0.03
Maj_128_1	1	0.19	0.17	0.03
Maj_128_2	1	0.65	0.08	0.05
Maj_130	1	1.23	0.08	0.10
Maj_131	1	0.68	0.09	0.06
Maj_132	1	0.72	0.08	0.06
Maj_133	1	1.46	0.09	0.13
Maj_134_1	1	0.80	0.11	0.09
Maj_134_2	1	0.28	0.20	0.06
Maj_136	1	0.95	0.26	0.25
Maj_137_1	1	0.44	0.18	0.08
Maj_137_2	1	0.35	0.21	0.07
Maj_139	1	1.05	0.22	0.23
Maj_2	1	0.37	0.05	0.02
Maj_7	1	1.47	0.16	0.23
Max		**1.89**	**0.31**	**0.25**

Table D-9: Major System Flow Depths 100-Year+20% Peak Flow

Link Name	Transect	Max Velocity (m/s)	Max Depth (m)	Depth x Velocity (m²/s)
C1	1	2.39	0.13	0.32
C10	1	0.00	0.02	0.00
C100_m	1	0.59	0.06	0.04
C101_m	1	0.56	0.06	0.03
C103	1	0.45	0.20	0.09
C104_m	1	0.29	0.31	0.09
C105_m	1	0.13	0.19	0.02
C106_m	1	0.06	0.10	0.01
C107_m	1	0.37	0.05	0.02
C108	1	0.00	0.00	0.00
C109_m	1	0.00	0.02	0.00
C11_m	1	0.63	0.05	0.03
C110_m	1	0.00	0.00	0.00
C111_m	1	0.00	0.00	0.00
C112	1	0.00	0.00	0.00
C113_m	1	0.00	0.00	0.00
C114	1	0.00	0.00	0.00
C116_m	1	0.00	0.08	0.00
C117_m	1	0.12	0.19	0.02
C118_m	1	0.23	0.29	0.07
C119_m	1	0.81	0.18	0.15
C12_m	1	0.38	0.06	0.02
C120_m	1	0.96	0.07	0.06
C121	1	0.96	0.07	0.07
C122	1	0.91	0.07	0.06
C123	1	1.02	0.07	0.07
C124	1	0.77	0.24	0.18
C125	1	1.02	0.08	0.08
C126	1	0.95	0.08	0.07
C127	1	0.81	0.07	0.06
C13_m	1	0.46	0.08	0.04
C130	1	0.63	0.05	0.03
C131_m	1	0.52	0.06	0.03
C133	1	0.75	0.05	0.04
C134	1	0.98	0.04	0.04
C135	1	0.20	0.06	0.01
C136	1	1.36	0.07	0.09
C137	1	0.60	0.43	0.26
C138	1	0.36	0.41	0.15
C140	1	0.07	0.04	0.00
C141	1	0.42	0.01	0.00
C142	1	0.10	0.04	0.00
C143	1	0.18	0.25	0.04
C144_m	1	0.10	0.20	0.02
C145	1	0.05	0.11	0.01
C146	1	0.59	0.01	0.01
C147	1	0.54	0.01	0.00
C148	1	1.22	0.07	0.09
C150	1	0.82	0.13	0.10
C151	1	0.31	0.22	0.07
C152	1	2.01	0.06	0.12
C153	1	0.25	0.02	0.01

Table D-9: Major System Flow Depths 100-Year+20% Peak Flow

Link Name	Transect	Max Velocity (m/s)	Max Depth (m)	Depth x Velocity (m²/s)
C154	1	0.53	0.04	0.02
C155	1	0.06	0.07	0.00
C156	1	0.28	0.07	0.02
C157	1	1.07	0.10	0.10
C158	1	0.47	0.01	0.01
C159	1	0.10	0.02	0.00
C160	1	0.81	0.11	0.09
C164	1	0.92	0.11	0.10
C165	1	0.79	0.11	0.09
C167	1	0.87	0.11	0.09
C168	1	0.92	0.11	0.10
C169	1	0.63	0.29	0.19
C17_m	1	0.00	0.00	0.00
C170	1	0.16	0.32	0.05
C171	1	0.26	0.35	0.09
C173	1	0.29	0.34	0.10
C174	1	0.81	0.20	0.16
C175	1	1.03	0.11	0.12
C176	1	0.38	0.23	0.09
C178	1	0.78	0.13	0.10
C179	1	1.33	0.11	0.15
C18_m	1	0.00	0.02	0.00
C180	1	0.89	0.12	0.11
C181	1	1.05	0.11	0.12
C182	1	0.97	0.12	0.12
C183	1	0.73	0.27	0.20
C184	1	0.66	0.32	0.21
C185	1	1.11	0.12	0.13
C186	1	0.92	0.18	0.17
C187	1	0.80	0.07	0.06
C188	1	0.65	0.19	0.12
C189	1	0.24	0.28	0.07
C19_1	1	0.00	0.00	0.00
C190	1	0.19	0.29	0.05
C191	1	1.11	0.08	0.09
C192	1	0.84	0.16	0.13
C193	1	1.10	0.06	0.07
C194	1	0.97	0.07	0.06
C195_1	1	1.26	0.09	0.11
C195_2	1	1.22	0.08	0.10
C196	1	0.77	0.07	0.06
C2_m	1	0.16	0.07	0.01
C20_m	1	0.00	0.00	0.00
C21	1	0.00	0.04	0.00
C22_m	1	0.00	0.00	0.00
C23_m	1	0.00	0.00	0.00
C26_m	1	0.17	0.09	0.02
C27_m	1	0.44	0.06	0.03
C3	1	0.00	0.02	0.00
C30_m	1	0.09	0.10	0.01
C31	1	0.23	0.10	0.02
C32_m	1	0.00	0.02	0.00

Table D-9: Major System Flow Depths 100-Year+20% Peak Flow

Link Name	Transect	Max Velocity (m/s)	Max Depth (m)	Depth x Velocity (m²/s)
C33	1	0.00	0.00	0.00
C34	1	0.00	0.00	0.00
C35_m	1	0.00	0.00	0.00
C36_m	1	1.13	0.05	0.05
C37	1	0.00	0.02	0.00
C38	1	1.18	0.06	0.07
C4	1	0.00	0.00	0.00
C40	1	0.26	0.16	0.04
C41_m	1	0.33	0.23	0.08
C42_m	1	0.83	0.14	0.11
C43_m	1	1.38	0.07	0.10
C44_m	1	0.00	0.04	0.00
C45_m	1	0.45	0.07	0.03
C46_m	1	1.17	0.06	0.07
C47	1	0.74	0.07	0.05
C48_m	1	1.12	0.06	0.07
C49	1	0.05	0.02	0.00
C5	1	0.55	0.05	0.03
C50_m	1	0.54	0.03	0.02
C51_m	1	0.72	0.02	0.02
C52	1	1.04	0.04	0.04
C53	1	0.56	0.03	0.02
C54_m	1	1.00	0.02	0.02
C55_m	1	0.50	0.12	0.06
C56_m	1	0.54	0.13	0.07
C57	1	0.15	0.22	0.03
C58_m	1	0.11	0.22	0.02
C59_m	1	0.50	0.14	0.07
C6	1	0.38	0.05	0.02
C60	1	0.21	0.25	0.05
C61	1	0.24	0.27	0.06
C62	1	0.25	0.24	0.06
C63	1	0.67	0.15	0.10
C64_m	1	0.91	0.05	0.05
C65_m	1	0.66	0.07	0.05
C66_m	1	1.14	0.09	0.10
C67_m	1	1.05	0.18	0.19
C68_m	1	0.43	0.29	0.13
C69_m	1	0.18	0.29	0.05
C7	1	0.58	0.08	0.05
C70_m	1	0.24	0.19	0.05
C71_m	1	0.76	0.06	0.05
C72_m	1	1.10	0.07	0.08
C73_m	1	0.74	0.08	0.06
C74	1	0.65	0.09	0.06
C75	1	1.08	0.07	0.07
C76	1	0.83	0.08	0.06
C77	1	0.82	0.08	0.06
C78_m	1	0.68	0.08	0.06
C80_m	1	1.07	0.07	0.07
C81_m	1	1.45	0.06	0.09
C82_m	1	1.50	0.06	0.09

Table D-9: Major System Flow Depths 100-Year+20% Peak Flow

Link Name	Transect	Max Velocity (m/s)	Max Depth (m)	Depth x Velocity (m²/s)
C83	1	1.29	0.06	0.08
C84_m	1	0.94	0.14	0.13
C85_m	1	1.06	0.08	0.08
C86_m	1	0.31	0.25	0.08
C87	1	0.15	0.28	0.04
C88	1	0.35	0.19	0.07
C89_m	1	0.86	0.08	0.07
C9	1	0.00	0.00	0.00
C90_m	1	0.72	0.04	0.03
C91_m	1	0.67	0.04	0.03
C92	1	0.47	0.05	0.03
C93	1	0.75	0.05	0.04
C94_m	1	1.16	0.07	0.08
C95_m	1	1.73	0.08	0.13
C96_m	1	1.72	0.08	0.14
C97_m	1	1.68	0.09	0.15
C98_m	1	1.63	0.08	0.14
C99_m	1	0.71	0.05	0.04
Maj_009_1	1	0.40	0.23	0.09
Maj_009_2	1	0.44	0.22	0.10
Maj_010	1	0.43	0.23	0.10
Maj_012_1	1	0.36	0.27	0.10
Maj_012_3	1	0.43	0.10	0.04
Maj_012_4	1	0.52	0.14	0.07
Maj_014_1	1	0.38	0.14	0.05
Maj_014_2	1	0.35	0.21	0.07
Maj_016_2	1	1.26	0.05	0.07
Maj_016_3	1	0.70	0.23	0.16
Maj_017	1	1.50	0.05	0.07
Maj_018	1	0.74	0.05	0.04
Maj_019_1	1	0.02	0.02	0.00
Maj_019_2	1	0.08	0.02	0.00
Maj_078_2	1	0.14	0.17	0.02
Maj_078_3	1	0.78	0.07	0.05
Maj_078_4	1	0.62	0.08	0.05
Maj_079	1	0.08	0.05	0.00
Maj_080	1	1.46	0.16	0.24
Maj_081	1	0.00	0.03	0.00
Maj_082_1	1	0.00	0.00	0.00
Maj_082_2	1	0.00	0.00	0.00
Maj_084_1	1	2.17	0.11	0.25
Maj_084_2	1	0.71	0.21	0.15
Maj_085	1	1.25	0.10	0.13
Maj_086_1	1	1.07	0.10	0.10
Maj_086_2	1	0.71	0.20	0.14
Maj_087	1	0.84	0.10	0.08
Maj_088_1	1	0.92	0.09	0.08
Maj_088_2	1	0.70	0.19	0.13
Maj_089	1	1.46	0.19	0.27
Maj_090	1	0.70	0.06	0.04
Maj_092	1	0.51	0.05	0.03
Maj_093_1	1	0.24	0.05	0.01

Table D-9: Major System Flow Depths 100-Year+20% Peak Flow

Link Name	Transect	Max Velocity (m/s)	Max Depth (m)	Depth x Velocity (m²/s)
Maj_093_2	1	0.35	0.04	0.01
Maj_094	1	0.63	0.05	0.03
Maj_095_1	1	0.07	0.04	0.00
Maj_095_2	1	0.06	0.04	0.00
Maj_095_3	1	0.06	0.04	0.00
Maj_095_4	1	0.56	0.05	0.03
Maj_097	1	0.47	0.02	0.01
Maj_098	1	0.00	0.02	0.00
Maj_1	1	0.53	0.05	0.03
Maj_104	1	1.36	0.18	0.24
Maj_105	1	0.79	0.07	0.05
Maj_122	1	1.53	0.17	0.27
Maj_123_2	1	0.81	0.20	0.16
Maj_123_3	1	1.56	0.19	0.30
Maj_124	1	0.61	0.09	0.05
Maj_126_1	1	0.40	0.22	0.09
Maj_126_2	1	0.38	0.23	0.09
Maj_128_1	1	0.33	0.22	0.07
Maj_128_2	1	0.93	0.13	0.12
Maj_130	1	1.58	0.11	0.18
Maj_131	1	0.97	0.11	0.11
Maj_132	1	0.91	0.12	0.11
Maj_133	1	1.68	0.14	0.24
Maj_134_1	1	1.24	0.17	0.21
Maj_134_2	1	0.49	0.28	0.14
Maj_136	1	0.96	0.36	0.35
Maj_137_1	1	0.67	0.26	0.17
Maj_137_2	1	0.56	0.28	0.16
Maj_139	1	1.04	0.30	0.31
Maj_2	1	0.39	0.06	0.02
Maj_7	1	1.48	0.17	0.26
Max		**2.39**	**0.43**	**0.35**

APPENDIX

JFSA Water Resources and Environmental Consultants

N

Legend

- Drummond SWM Report (JFSA June 2023)
- Halfmoon Bay Phase 3 - SWM Report (JFSA Aug 2021)

SCALE: 1:3000

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DSEL
david schaeffer engineering ltd

Drummond

Figure E1: Drainage to Halfmoon Bay SWM

PROJECT	2226
DRAWN	JB
DATE	FEB 2022

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APPENDIX

JFSA Water Resources and Environmental Consultants

Table F1: USF Freeboard Results - 100-Year Chicago 3 Hour Event

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH_105	MH_106	148	100.03	12.7	91	100.01	99.12	99.24	0.79
MH_105	MH_106	147	100.16	24.9	91	100.01	99.12	99.36	0.80
MH_105	MH_106	146	100.3	35.1	91	100.01	99.12	99.46	0.84
MH_105	MH_106	145	100.42	46.4	91	100.01	99.12	99.57	0.85
MH_105	MH_106	144	100.56	60.6	91	100.01	99.12	99.71	0.85
MH_105	MH_106	143	100.93	74.3	91	100.01	99.12	99.85	1.08
MH_105	MH_106	142	101.5	89.0	91	100.01	99.12	99.99	1.51
MH_106	MH_116	156	99.69	17.5	122	99.12	98.89	98.92	0.77
MH_106	MH_116	166-1	99.53	19.1	122	99.12	98.89	98.93	0.60
MH_106	MH_116	166-2	99.53	27.1	122	99.12	98.89	98.94	0.59
MH_106	MH_116	155	99.69	29.2	122	99.12	98.89	98.94	0.75
MH_106	MH_116	166-3	99.53	34.3	122	99.12	98.89	98.95	0.58
MH_106	MH_116	154	99.59	40.4	122	99.12	98.89	98.96	0.63
MH_106	MH_116	166-4	99.53	42.3	122	99.12	98.89	98.97	0.56
MH_106	MH_116	153	99.56	50.6	122	99.12	98.89	98.98	0.58
MH_106	MH_116	167-1	99.61	52.9	122	99.12	98.89	98.99	0.62
MH_106	MH_116	167-2	99.61	60.6	122	99.12	98.89	99.00	0.61
MH_106	MH_116	152	99.6	61.8	122	99.12	98.89	99.00	0.60
MH_106	MH_116	167-3	99.61	68.6	122	99.12	98.89	99.02	0.59
MH_106	MH_116	151	99.73	76.3	122	99.12	98.89	99.03	0.70
MH_106	MH_116	168-1	99.73	79.2	122	99.12	98.89	99.04	0.69
MH_106	MH_116	168-2	99.73	87.2	122	99.12	98.89	99.05	0.68
MH_106	MH_116	150	99.81	92.1	122	99.12	98.89	99.06	0.75
MH_106	MH_116	168-3	99.73	94.4	122	99.12	98.89	99.06	0.67
MH_106	MH_116	168-4	99.73	102.4	122	99.12	98.89	99.08	0.65
MH_106	MH_116	149	99.81	106.0	122	99.12	98.89	99.08	0.73
MH_107	MH_108	176-1	100.1	3.5	13	99.42	99.48	99.46	0.64
MH_107	MH_108	176-2	100.1	6.3	13	99.42	99.48	99.45	0.65
MH_107	MH_108	176-3	100.1	9.3	13	99.42	99.48	99.44	0.66
MH_107	MH_112	185-1	99.89	1.3	74	99.42	99.36	99.36	0.53
MH_107	MH_112	178-4	100	3.8	74	99.42	99.36	99.36	0.64
MH_107	MH_112	185-2	99.89	9.3	74	99.42	99.36	99.37	0.52
MH_107	MH_112	178-3	100	11.8	74	99.42	99.36	99.37	0.63
MH_107	MH_112	185-3	99.89	16.5	74	99.42	99.36	99.37	0.52
MH_107	MH_112	178-2	100	19.0	74	99.42	99.36	99.37	0.63
MH_107	MH_112	185-4	99.89	24.5	74	99.42	99.36	99.38	0.51
MH_107	MH_112	178-1	100	27.0	74	99.42	99.36	99.38	0.62
MH_107	MH_112	185-5	99.89	32.2	74	99.42	99.36	99.39	0.50
MH_107	MH_112	177-5	100.04	37.7	74	99.42	99.36	99.39	0.65
MH_107	MH_112	186-1	99.91	42.8	74	99.42	99.36	99.39	0.52
MH_107	MH_112	177-4	100.04	45.3	74	99.42	99.36	99.40	0.64
MH_107	MH_112	186-2	99.91	50.8	74	99.42	99.36	99.40	0.51
MH_107	MH_112	177-3	100.04	53.3	74	99.42	99.36	99.40	0.64
MH_107	MH_112	186-3	99.91	58.0	74	99.42	99.36	99.41	0.50
MH_107	MH_112	177-2	100.04	60.5	74	99.42	99.36	99.41	0.63
MH_107	MH_112	186-4	99.91	66.0	74	99.42	99.36	99.41	0.50
MH_107	MH_112	177-1	100.04	68.5	74	99.42	99.36	99.42	0.62
MH_108	MH_110	175-1	100.15	16.1	54	99.48	99.48	99.48	0.67
MH_108	MH_110	175-2	100.15	24.1	54	99.48	99.48	99.48	0.67
MH_108	MH_110	175-3	100.15	31.3	54	99.48	99.48	99.48	0.67
MH_108	MH_110	175-4	100.15	39.3	54	99.48	99.48	99.48	0.67
MH_108	MH_110	175-5	100.15	46.9	54	99.48	99.48	99.48	0.67
MH_109	MH_110	164-2	100.2	1.8	60	99.78	99.48	99.49	0.71
MH_109	MH_110	164-3	100.2	6.6	60	99.78	99.48	99.51	0.69
MH_109	MH_110	164-4	100.2	14.6	60	99.78	99.48	99.55	0.65
MH_109	MH_110	165-1	100.43	25.3	60	99.78	99.48	99.60	0.83
MH_109	MH_110	165-2	100.43	32.9	60	99.78	99.48	99.64	0.79
MH_109	MH_110	165-3	100.43	40.9	60	99.78	99.48	99.68	0.75
MH_110	MH_111	188-4	99.86	2.1	75	99.48	99.26	99.26	0.60
MH_110	MH_111	162-1	99.74	6.3	75	99.48	99.26	99.27	0.47
MH_110	MH_111	188-3	99.86	9.3	75	99.48	99.26	99.28	0.58
MH_110	MH_111	162-2	99.75	14.3	75	99.48	99.26	99.30	0.45
MH_110	MH_111	188-2	99.86	17.3	75	99.48	99.26	99.31	0.55
MH_110	MH_111	162-3	99.75	21.5	75	99.48	99.26	99.32	0.43
MH_110	MH_111	188-1	99.86	24.9	75	99.48	99.26	99.33	0.53
MH_110	MH_111	162-4	99.75	29.5	75	99.48	99.26	99.34	0.41
MH_110	MH_111	187-4	99.86	35.6	75	99.48	99.26	99.36	0.50
MH_110	MH_111	163-1	99.83	40.1	75	99.48	99.26	99.37	0.46
MH_110	MH_111	187-3	99.86	43.6	75	99.48	99.26	99.38	0.48
MH_110	MH_111	163-2	99.83	47.8	75	99.48	99.26	99.40	0.43
MH_110	MH_111	187-2	99.9	50.8	75	99.48	99.26	99.40	0.50
MH_110	MH_111	163-3	99.83	55.8	75	99.48	99.26	99.42	0.41
MH_110	MH_111	187-1	99.9	58.8	75	99.48	99.26	99.43	0.47
MH_110	MH_111	164-1	100.2	66.4	75	99.48	99.26	99.45	0.75
MH_111	MH_115	159-1	99.58	10.7	91	99.26	99.06	99.08	0.50
MH_111	MH_115	190-4	99.7	17.1	91	99.26	99.06	99.09	0.61
MH_111	MH_115	159-2	99.58	18.7	91	99.26	99.06	99.10	0.48

Table F1: USF Freeboard Results - 100-Year Chicago 3 Hour Event

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH_111	MH_115	190-3	99.7	25.1	91	99.26	99.06	99.11	0.59
MH_111	MH_115	159-3	99.58	25.9	91	99.26	99.06	99.11	0.47
MH_111	MH_115	190-2	99.7	32.3	91	99.26	99.06	99.13	0.57
MH_111	MH_115	159-4	99.58	33.9	91	99.26	99.06	99.13	0.45
MH_111	MH_115	190-1	99.7	40.3	91	99.26	99.06	99.14	0.56
MH_111	MH_115	160-1	99.71	44.5	91	99.26	99.06	99.15	0.56
MH_111	MH_115	189-4	99.82	51.0	91	99.26	99.06	99.17	0.65
MH_111	MH_115	160-2	99.71	52.2	91	99.26	99.06	99.17	0.54
MH_111	MH_115	189-3	99.82	59.0	91	99.26	99.06	99.19	0.63
MH_111	MH_115	160-3	99.71	60.2	91	99.26	99.06	99.19	0.52
MH_111	MH_115	189-2	99.82	66.2	91	99.26	99.06	99.20	0.62
MH_111	MH_115	161-1	99.71	70.8	91	99.26	99.06	99.21	0.50
MH_111	MH_115	189-1	99.82	74.2	91	99.26	99.06	99.22	0.60
MH_111	MH_115	161-2	99.71	76.2	91	99.26	99.06	99.22	0.49
MH_111	MH_115	188-5	99.86	84.8	91	99.26	99.06	99.24	0.62
MH_111	MH_115	161-3	99.71	86.4	91	99.26	99.06	99.25	0.46
MH_112	MH_113	180-4	99.8	5.0	74	99.36	99.23	99.24	0.56
MH_112	MH_113	183-1	99.74	7.1	74	99.36	99.23	99.24	0.50
MH_112	MH_113	180-3	99.8	11.2	74	99.36	99.23	99.25	0.55
MH_112	MH_113	183-2	99.74	15.1	74	99.36	99.23	99.26	0.48
MH_112	MH_113	180-2	99.8	19.2	74	99.36	99.23	99.27	0.53
MH_112	MH_113	183-3	99.91	22.3	74	99.36	99.23	99.27	0.64
MH_112	MH_113	180-1	99.8	28.1	74	99.36	99.23	99.28	0.52
MH_112	MH_113	183-4	99.91	30.3	74	99.36	99.23	99.28	0.63
MH_112	MH_113	179-3	99.82	36.1	74	99.36	99.23	99.29	0.53
MH_112	MH_113	184-1	99.91	40.9	74	99.36	99.23	99.30	0.61
MH_112	MH_113	179-2	99.82	45.0	74	99.36	99.23	99.31	0.51
MH_112	MH_113	184-2	99.91	48.9	74	99.36	99.23	99.32	0.59
MH_112	MH_113	179-1	99.82	52.0	74	99.36	99.23	99.32	0.50
MH_112	MH_113	184-3	99.91	56.2	74	99.36	99.23	99.33	0.58
MH_112	MH_113	184-4	99.91	64.2	74	99.36	99.23	99.34	0.57
MH_112	MH_113	178-5	100	69.7	74	99.36	99.23	99.35	0.65
MH_113	MH_114	181-3	99.85	3.4	13	99.23	99.19	99.20	0.65
MH_113	MH_114	181-2	99.85	7.0	13	99.23	99.19	99.21	0.64
MH_113	MH_114	181-1	99.85	8.2	13	99.23	99.19	99.22	0.63
MH_114	MH_115	182-5	99.58	18.5	54	99.19	99.06	99.10	0.48
MH_114	MH_115	182-4	99.58	26.5	54	99.19	99.06	99.12	0.46
MH_114	MH_115	182-3	99.58	33.7	54	99.19	99.06	99.14	0.44
MH_114	MH_115	182-2	99.58	41.7	54	99.19	99.06	99.16	0.42
MH_114	MH_115	182-1	99.6	49.3	54	99.19	99.06	99.18	0.42
MH_115	MH_116	157-1	99.46	17.0	59	99.06	98.89	98.94	0.52
MH_115	MH_116	157-2	99.46	25.0	59	99.06	98.89	98.96	0.50
MH_115	MH_116	157-3	99.46	32.6	59	99.06	98.89	98.98	0.48
MH_115	MH_116	158-1	99.51	43.3	59	99.06	98.89	99.01	0.50
MH_115	MH_116	158-2	99.51	51.3	59	99.06	98.89	99.03	0.48
MH_115	MH_116	158-3	99.51	56.1	59	99.06	98.89	99.05	0.46
MH_116	MH_117	26	99.43	6.8	123	98.89	98.72	98.73	0.70
MH_116	MH_117	10	99.46	12.9	123	98.89	98.72	98.74	0.72
MH_116	MH_117	27	99.43	22.6	123	98.89	98.72	98.75	0.68
MH_116	MH_117	11	99.46	27.6	123	98.89	98.72	98.76	0.70
MH_116	MH_117	28	99.42	37.0	123	98.89	98.72	98.77	0.65
MH_116	MH_117	12	99.41	43.4	123	98.89	98.72	98.78	0.63
MH_116	MH_117	29	99.35	48.5	123	98.89	98.72	98.79	0.56
MH_116	MH_117	13	99.41	57.8	123	98.89	98.72	98.80	0.61
MH_116	MH_117	30	99.32	60.7	123	98.89	98.72	98.80	0.52
MH_116	MH_117	14	99.38	69.1	123	98.89	98.72	98.81	0.57
MH_116	MH_117	31	99.32	71.9	123	98.89	98.72	98.82	0.50
MH_116	MH_117	15	99.47	79.3	123	98.89	98.72	98.83	0.64
MH_116	MH_117	32	99.49	82.1	123	98.89	98.72	98.83	0.66
MH_116	MH_117	16	99.57	90.4	123	98.89	98.72	98.84	0.73
MH_116	MH_117	17	99.84	102.1	123	98.89	98.72	98.86	0.98
MH_117	MH_118	18	99.18	4.5	121	98.72	98.54	98.54	0.64
MH_117	MH_118	2	99.16	7.6	121	98.72	98.54	98.55	0.61
MH_117	MH_118	406	99.18	16.2	121	98.72	98.54	98.56	0.62
MH_117	MH_118	404	99.18	23.0	121	98.72	98.54	98.57	0.61
MH_117	MH_118	407	99.16	25.8	121	98.72	98.54	98.57	0.59
MH_117	MH_118	405	99.18	30.5	121	98.72	98.54	98.58	0.60
MH_117	MH_118	19	99.16	38.0	121	98.72	98.54	98.59	0.57
MH_117	MH_118	3	99.14	40.7	121	98.72	98.54	98.60	0.54
MH_117	MH_118	20	99.11	48.2	121	98.72	98.54	98.61	0.50
MH_117	MH_118	4	99.14	51.8	121	98.72	98.54	98.61	0.53
MH_117	MH_118	21	99.12	59.3	121	98.72	98.54	98.62	0.50
MH_117	MH_118	5	99.22	62.0	121	98.72	98.54	98.63	0.59
MH_117	MH_118	22	99.21	71.5	121	98.72	98.54	98.64	0.57
MH_117	MH_118	6	99.23	73.3	121	98.72	98.54	98.65	0.58
MH_117	MH_118	23	99.22	82.9	121	98.72	98.54	98.66	0.56
MH_117	MH_118	7	99.24	87.7	121	98.72	98.54	98.67	0.57

Table F1: USF Freeboard Results - 100-Year Chicago 3 Hour Event

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH_117	MH_118	24	99.28	97.4	121	98.72	98.54	98.68	0.60
MH_117	MH_118	8	99.31	103.5	121	98.72	98.54	98.69	0.62
MH_117	MH_118	25	99.36	113.2	121	98.72	98.54	98.71	0.65
MH_117	MH_118	9	99.4	118.2	121	98.72	98.54	98.71	0.69
MH_119	MH_120	118	101.07	4.8	103	100.12	99.70	99.72	1.35
MH_119	MH_120	101	100.65	9.0	103	100.12	99.70	99.74	0.91
MH_119	MH_120	418	100.99	17.0	103	100.12	99.70	99.77	1.22
MH_119	MH_120	416	100.7	20.7	103	100.12	99.70	99.78	0.92
MH_119	MH_120	419	100.98	28.2	103	100.12	99.70	99.81	1.17
MH_119	MH_120	417	100.76	31.9	103	100.12	99.70	99.83	0.93
MH_119	MH_120	119	100.98	40.4	103	100.12	99.70	99.87	1.11
MH_119	MH_120	100	100.81	42.5	103	100.12	99.70	99.87	0.94
MH_119	MH_120	120	100.98	51.8	103	100.12	99.70	99.91	1.07
MH_119	MH_120	99	100.86	52.7	103	100.12	99.70	99.92	0.94
MH_119	MH_120	98	100.92	63.9	103	100.12	99.70	99.96	0.96
MH_119	MH_120	121	101.03	66.0	103	100.12	99.70	99.97	1.06
MH_119	MH_120	97	100.97	74.1	103	100.12	99.70	100.00	0.97
MH_119	MH_120	122	101.12	77.4	103	100.12	99.70	100.02	1.10
MH_119	MH_120	96	101.03	85.4	103	100.12	99.70	100.05	0.98
MH_119	MH_120	123	101.12	91.1	103	100.12	99.70	100.08	1.04
MH_119	MH_120	95	101.03	99.6	103	100.12	99.70	100.11	0.92
MH_119	MH_122	130	100.77	3.3	90	100.12	99.66	99.68	1.09
MH_119	MH_122	89	100.62	7.4	90	100.12	99.66	99.70	0.92
MH_119	MH_122	129	100.82	14.1	90	100.12	99.66	99.74	1.08
MH_119	MH_122	90	100.68	21.1	90	100.12	99.66	99.77	0.91
MH_119	MH_122	128	100.88	27.7	90	100.12	99.66	99.80	1.08
MH_119	MH_122	91	100.76	34.7	90	100.12	99.66	99.84	0.92
MH_119	MH_122	127	100.88	39.9	90	100.12	99.66	99.87	1.01
MH_119	MH_122	92	100.84	49.4	90	100.12	99.66	99.92	0.92
MH_119	MH_122	126	100.88	51.1	90	100.12	99.66	99.92	0.96
MH_119	MH_122	125	100.92	61.3	90	100.12	99.66	99.98	0.94
MH_119	MH_122	93	100.91	65.1	90	100.12	99.66	100.00	0.91
MH_119	MH_122	124	100.97	73.4	90	100.12	99.66	100.04	0.93
MH_119	MH_122	94	100.99	79.8	90	100.12	99.66	100.07	0.92
MH_120	MH_121	116	101.03	4.3	14	99.70	99.31	99.43	1.60
MH_120	MH_121	117	101.07	10.9	14	99.70	99.31	99.61	1.46
MH_121	MH_132	106	99.54	7.3	114	99.31	98.60	98.64	0.90
MH_121	MH_132	107	99.71	19.5	114	99.31	98.60	98.72	0.99
MH_121	MH_132	108	99.88	30.6	114	99.31	98.60	98.79	1.09
MH_121	MH_132	109	100.05	40.8	114	99.31	98.60	98.85	1.20
MH_121	MH_132	110	100.15	53.5	114	99.31	98.60	98.93	1.22
MH_121	MH_132	111	100.32	64.9	114	99.31	98.60	99.00	1.32
MH_121	MH_132	112	100.48	77.1	114	99.31	98.60	99.08	1.40
MH_121	MH_132	113	100.57	88.2	114	99.31	98.60	99.15	1.42
MH_121	MH_132	114	100.57	98.4	114	99.31	98.60	99.21	1.36
MH_121	MH_132	115	100.65	109.2	114	99.31	98.60	99.28	1.37
MH_122	MH_123	131	100.61	5.0	13	99.66	99.52	99.57	1.04
MH_123	MH_127	135	99.89	11.7	50	99.52	99.10	99.20	0.69
MH_123	MH_127	134	100.02	23.4	50	99.52	99.10	99.30	0.72
MH_123	MH_127	133	100.23	34.7	50	99.52	99.10	99.39	0.84
MH_123	MH_127	132	100.36	45.3	50	99.52	99.10	99.48	0.88
MH_124	MH_125	82	99.89	5.4	101	99.35	99.31	99.31	0.58
MH_124	MH_125	69	99.84	8.5	101	99.35	99.31	99.31	0.53
MH_124	MH_125	70	99.78	18.7	101	99.35	99.31	99.32	0.46
MH_124	MH_125	81	99.89	19.6	101	99.35	99.31	99.32	0.57
MH_124	MH_125	71	99.78	29.8	101	99.35	99.31	99.32	0.46
MH_124	MH_125	80	99.92	31.0	101	99.35	99.31	99.32	0.60
MH_124	MH_125	72	99.77	40.0	101	99.35	99.31	99.33	0.44
MH_124	MH_125	79	100.04	46.9	101	99.35	99.31	99.33	0.71
MH_124	MH_125	73	99.82	51.2	101	99.35	99.31	99.33	0.49
MH_124	MH_125	78	100.04	54.3	101	99.35	99.31	99.33	0.71
MH_124	MH_125	74	99.88	61.4	101	99.35	99.31	99.34	0.54
MH_124	MH_125	77	100	64.5	101	99.35	99.31	99.34	0.66
MH_124	MH_125	413	99.93	73.5	101	99.35	99.31	99.34	0.59
MH_124	MH_125	415	100.08	75.2	101	99.35	99.31	99.34	0.74
MH_124	MH_125	412	99.98	83.2	101	99.35	99.31	99.35	0.63
MH_124	MH_125	414	100.1	86.3	101	99.35	99.31	99.35	0.75
MH_124	MH_125	75	99.98	94.9	101	99.35	99.31	99.35	0.63
MH_124	MH_125	76	100.16	98.0	101	99.35	99.31	99.35	0.81
MH_125	MH_127	88	99.82	15.9	92	99.31	99.10	99.14	0.68
MH_125	MH_127	63	99.59	16.7	92	99.31	99.10	99.14	0.45
MH_125	MH_127	87	99.82	29.6	92	99.31	99.10	99.17	0.65
MH_125	MH_127	64	99.59	30.4	92	99.31	99.10	99.17	0.42
MH_125	MH_127	86	99.72	41.0	92	99.31	99.10	99.20	0.52
MH_125	MH_127	65	99.58	44.0	92	99.31	99.10	99.20	0.38
MH_125	MH_127	85	99.74	55.5	92	99.31	99.10	99.23	0.51
MH_125	MH_127	66	99.69	58.7	92	99.31	99.10	99.24	0.45

Table F1: USF Freeboard Results - 100-Year Chicago 3 Hour Event

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH_125	MH_127	84	99.76	71.2	92	99.31	99.10	99.26	0.50
MH_125	MH_127	67	99.78	74.4	92	99.31	99.10	99.27	0.51
MH_125	MH_127	83	99.89	85.7	92	99.31	99.10	99.30	0.59
MH_125	MH_127	68	99.84	88.9	92	99.31	99.10	99.30	0.54
MH_127	MH_128	47	99.56	11.9	54	99.10	99.01	99.03	0.53
MH_127	MH_128	48	99.66	23.3	54	99.10	99.01	99.05	0.61
MH_127	MH_128	49	99.66	37.0	54	99.10	99.01	99.07	0.59
MH_128	MH_129	45	99.49	6.6	13	99.01	99.03	99.02	0.47
MH_128	MH_129	46	99.51	10.5	13	99.01	99.03	99.02	0.49
MH_129	MH_130	39	99.47	1.7	77	99.03	98.84	98.85	0.62
MH_129	MH_130	57	99.48	5.1	77	99.03	98.84	98.85	0.63
MH_129	MH_130	40	99.49	15.9	77	99.03	98.84	98.88	0.61
MH_129	MH_130	58	99.53	17.3	77	99.03	98.84	98.88	0.65
MH_129	MH_130	59	99.53	28.7	77	99.03	98.84	98.91	0.62
MH_129	MH_130	41	99.49	29.5	77	99.03	98.84	98.91	0.58
MH_129	MH_130	60	99.48	43.2	77	99.03	98.84	98.95	0.53
MH_129	MH_130	42	99.42	44.2	77	99.03	98.84	98.95	0.47
MH_129	MH_130	61	99.48	56.8	77	99.03	98.84	98.98	0.50
MH_129	MH_130	43	99.41	60.0	77	99.03	98.84	98.99	0.42
MH_129	MH_130	62	99.48	70.5	77	99.03	98.84	99.01	0.47
MH_129	MH_130	44	99.44	72.6	77	99.03	98.84	99.02	0.42
MH_130	MH_131	50	99.37	3.8	100	98.84	98.62	98.62	0.75
MH_130	MH_131	33	99.18	6.7	100	98.84	98.62	98.63	0.55
MH_130	MH_131	410	99.37	15.5	100	98.84	98.62	98.65	0.72
MH_130	MH_131	408	99.21	18.4	100	98.84	98.62	98.66	0.55
MH_130	MH_131	411	99.25	26.2	100	98.84	98.62	98.67	0.58
MH_130	MH_131	409	99.22	29.5	100	98.84	98.62	98.68	0.54
MH_130	MH_131	51	99.29	37.3	100	98.84	98.62	98.70	0.59
MH_130	MH_131	34	99.23	39.7	100	98.84	98.62	98.71	0.52
MH_130	MH_131	52	99.29	47.5	100	98.84	98.62	98.72	0.57
MH_130	MH_131	35	99.23	51.0	100	98.84	98.62	98.73	0.50
MH_130	MH_131	53	99.35	58.7	100	98.84	98.62	98.75	0.60
MH_130	MH_131	36	99.29	65.2	100	98.84	98.62	98.76	0.53
MH_130	MH_131	54	99.39	70.9	100	98.84	98.62	98.78	0.61
MH_130	MH_131	37	99.39	76.6	100	98.84	98.62	98.79	0.60
MH_130	MH_131	55	99.39	82.3	100	98.84	98.62	98.80	0.59
MH_130	MH_131	38	99.39	90.8	100	98.84	98.62	98.82	0.57
MH_130	MH_131	56	99.41	94.5	100	98.84	98.62	98.83	0.58
MH_132	MH_136	102	99.36	20.4	60	98.60	98.44	98.50	0.86
MH_132	MH_136	103	99.33	32.1	60	98.60	98.44	98.53	0.80
MH_132	MH_136	104	99.35	43.2	60	98.60	98.44	98.56	0.79
MH_132	MH_136	105	99.41	55.4	60	98.60	98.44	98.59	0.82
MH_136	MH_302	1	99.35	45.2	54	98.44	98.38	98.43	0.92
MH_201	MH_202	321	105.28	8.5	120	105.43	104.47	104.54	0.74
MH_201	MH_202	430	107.31	10.7	120	105.43	104.47	104.56	2.75
MH_201	MH_202	431	107.37	16.4	120	105.43	104.47	104.60	2.77
MH_201	MH_202	428	105.36	22.2	120	105.43	104.47	104.65	0.71
MH_201	MH_202	233	107.4	28.8	120	105.43	104.47	104.70	2.70
MH_201	MH_202	429	105.37	33.4	120	105.43	104.47	104.74	0.63
MH_201	MH_202	234	107.46	36.0	120	105.43	104.47	104.76	2.70
MH_201	MH_202	320	105.45	43.6	120	105.43	104.47	104.82	0.63
MH_201	MH_202	235	107.5	48.5	120	105.43	104.47	104.86	2.64
MH_201	MH_202	236	107.62	54.2	120	105.43	104.47	104.91	2.71
MH_201	MH_202	319	105.56	54.8	120	105.43	104.47	104.91	0.65
MH_201	MH_202	318	105.66	65.0	120	105.43	104.47	105.00	0.66
MH_201	MH_202	237	107.69	67.4	120	105.43	104.47	105.01	2.68
MH_201	MH_202	238	107.8	73.1	120	105.43	104.47	105.06	2.74
MH_201	MH_202	317	105.77	76.1	120	105.43	104.47	105.08	0.69
MH_201	MH_202	239	107.87	85.5	120	105.43	104.47	105.16	2.71
MH_201	MH_202	316	105.9	88.3	120	105.43	104.47	105.18	0.72
MH_201	MH_202	240	107.99	92.7	120	105.43	104.47	105.22	2.77
MH_201	MH_202	315	106.02	99.7	120	105.43	104.47	105.27	0.75
MH_201	MH_202	241	108.06	105.2	120	105.43	104.47	105.32	2.74
MH_201	MH_202	242	108.16	110.9	120	105.43	104.47	105.36	2.80
MH_201	MH_202	314	106.13	113.9	120	105.43	104.47	105.39	0.74
MH_202	MH_203	230	105.39	3.3	14	104.47	104.42	104.43	0.96
MH_202	MH_203	231	106.96	9.7	14	104.47	104.42	104.45	2.51
MH_202	MH_203	232	107.27	11.7	14	104.47	104.42	104.46	2.81
MH_203	MH_206	225	104.9	1.9	54	104.42	103.81	103.83	1.07
MH_203	MH_206	226	105.06	12.1	54	104.42	103.81	103.94	1.12
MH_203	MH_206	227	105.11	24.3	54	104.42	103.81	104.08	1.03
MH_203	MH_206	228	105.11	34.9	54	104.42	103.81	104.20	0.91
MH_203	MH_206	229	105.13	45.6	54	104.42	103.81	104.32	0.81
MH_204	MH_205	293	104.81	3.0	118	104.00	103.89	103.90	0.91
MH_204	MH_205	292	104.65	4.1	118	104.00	103.89	103.90	0.75
MH_204	MH_205	426	104.89	12.3	118	104.00	103.89	103.90	0.99
MH_204	MH_205	424	104.71	18.3	118	104.00	103.89	103.91	0.80

Table F1: USF Freeboard Results - 100-Year Chicago 3 Hour Event

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH_204	MH_205	427	104.89	23.4	118	104.00	103.89	103.91	0.98
MH_204	MH_205	425	104.76	27.4	118	104.00	103.89	103.92	0.84
MH_204	MH_205	294	104.86	33.6	118	104.00	103.89	103.92	0.94
MH_204	MH_205	291	104.81	37.6	118	104.00	103.89	103.93	0.88
MH_204	MH_205	295	104.92	44.7	118	104.00	103.89	103.93	0.99
MH_204	MH_205	290	104.87	48.7	118	104.00	103.89	103.94	0.93
MH_204	MH_205	296	104.92	54.9	118	104.00	103.89	103.94	0.98
MH_204	MH_205	289	104.83	61.8	118	104.00	103.89	103.95	0.88
MH_204	MH_205	297	104.87	66.2	118	104.00	103.89	103.95	0.92
MH_204	MH_205	288	104.83	72.3	118	104.00	103.89	103.96	0.87
MH_204	MH_205	298	104.86	80.4	118	104.00	103.89	103.97	0.89
MH_204	MH_205	287	104.77	86.5	118	104.00	103.89	103.97	0.80
MH_204	MH_205	299	104.82	91.8	118	104.00	103.89	103.98	0.84
MH_204	MH_205	286	104.7	100.4	118	104.00	103.89	103.98	0.72
MH_204	MH_205	300	104.72	106.3	118	104.00	103.89	103.99	0.73
MH_206	MH_207	221	104.52	5.5	50	103.81	103.34	103.39	1.13
MH_206	MH_207	222	104.57	16.7	50	103.81	103.34	103.50	1.07
MH_206	MH_207	223	104.65	26.9	50	103.81	103.34	103.59	1.06
MH_206	MH_207	224	104.77	38.0	50	103.81	103.34	103.70	1.07
MH_207	MH_208	219	104.39	4.9	13	103.34	103.03	103.15	1.24
MH_207	MH_208	220	104.46	10.7	13	103.34	103.03	103.29	1.17
MH_208	MH_215	212	102.46	12.7	112	103.03	101.44	101.62	0.84
MH_208	MH_215	271	102.46	14.8	112	103.03	101.44	101.65	0.81
MH_208	MH_215	213	102.68	24.9	112	103.03	101.44	101.80	0.88
MH_208	MH_215	270	102.67	26.2	112	103.03	101.44	101.82	0.85
MH_208	MH_215	214	102.89	35.1	112	103.03	101.44	101.94	0.95
MH_208	MH_215	269	102.93	38.4	112	103.03	101.44	101.99	0.94
MH_208	MH_215	215	103.1	46.2	112	103.03	101.44	102.10	1.00
MH_208	MH_215	268	103.18	49.5	112	103.03	101.44	102.15	1.03
MH_208	MH_215	216	103.36	58.4	112	103.03	101.44	102.27	1.09
MH_208	MH_215	267	103.42	59.7	112	103.03	101.44	102.29	1.13
MH_208	MH_215	217	103.62	69.8	112	103.03	101.44	102.43	1.19
MH_208	MH_215	266	103.68	70.9	112	103.03	101.44	102.45	1.23
MH_208	MH_215	423	103.94	80.8	112	103.03	101.44	102.59	1.35
MH_208	MH_215	421	103.83	82.0	112	103.03	101.44	102.61	1.22
MH_208	MH_215	422	104.04	91.9	112	103.03	101.44	102.75	1.29
MH_208	MH_215	420	104.04	93.2	112	103.03	101.44	102.77	1.27
MH_208	MH_215	265	104.35	103.6	112	103.03	101.44	102.91	1.44
MH_208	MH_215	218	104.3	105.6	112	103.03	101.44	102.94	1.36
MH_209	MH_201	243	108.2	4.5	94	105.83	105.43	105.45	2.75
MH_209	MH_201	244	108.3	10.2	94	105.83	105.43	105.48	2.82
MH_209	MH_201	313	106.24	10.6	94	105.83	105.43	105.48	0.76
MH_209	MH_201	245	108.34	23.4	94	105.83	105.43	105.53	2.81
MH_209	MH_201	312	106.36	25.8	94	105.83	105.43	105.54	0.82
MH_209	MH_201	246	108.44	29.1	94	105.83	105.43	105.56	2.88
MH_209	MH_201	311	106.45	40.1	94	105.83	105.43	105.60	0.85
MH_209	MH_201	247	108.49	42.3	94	105.83	105.43	105.61	2.88
MH_209	MH_201	248	108.57	48.0	94	105.83	105.43	105.64	2.93
MH_209	MH_201	310	106.53	51.5	94	105.83	105.43	105.65	0.88
MH_209	MH_201	249	108.61	61.2	94	105.83	105.43	105.69	2.92
MH_209	MH_201	309	106.58	63.7	94	105.83	105.43	105.70	0.88
MH_209	MH_201	250	108.67	66.9	94	105.83	105.43	105.72	2.95
MH_209	MH_201	308	106.63	74.8	94	105.83	105.43	105.75	0.88
MH_209	MH_201	251	108.7	79.4	94	105.83	105.43	105.77	2.93
MH_209	MH_201	307	106.63	85.0	94	105.83	105.43	105.79	0.84
MH_209	MH_201	252	108.76	86.6	94	105.83	105.43	105.80	2.96
MH_209	MH_210	254	108.31	7.1	13	105.83	105.60	105.72	2.59
MH_209	MH_210	253	108.73	10.0	13	105.83	105.60	105.77	2.96
MH_210	MH_212	258	105.12	15.6	54	105.60	103.58	104.16	0.96
MH_210	MH_212	257	105.54	27.3	54	105.60	103.58	104.60	0.94
MH_210	MH_212	256	106.05	38.6	54	105.60	103.58	105.03	1.02
MH_210	MH_212	255	106.58	48.8	54	105.60	103.58	105.41	1.17
MH_212	MH_204	285	104.64	2.7	92	103.58	104.00	103.99	0.65
MH_212	MH_204	301	104.77	9.6	92	103.58	104.00	103.96	0.81
MH_212	MH_204	284	104.71	19.0	92	103.58	104.00	103.91	0.80
MH_212	MH_204	302	104.8	24.9	92	103.58	104.00	103.89	0.91
MH_212	MH_204	283	104.78	34.1	92	103.58	104.00	103.84	0.94
MH_212	MH_204	303	104.92	40.7	92	103.58	104.00	103.81	1.11
MH_212	MH_204	282	104.84	44.6	92	103.58	104.00	103.80	1.04
MH_212	MH_204	304	104.96	55.4	92	103.58	104.00	103.75	1.21
MH_212	MH_204	281	104.91	58.8	92	103.58	104.00	103.73	1.18
MH_212	MH_204	305	105.09	68.9	92	103.58	104.00	103.69	1.40
MH_212	MH_204	280	104.96	69.8	92	103.58	104.00	103.68	1.28
MH_212	MH_204	279	104.96	82.3	92	103.58	104.00	103.62	1.34
MH_212	MH_204	306	105.11	82.6	92	103.58	104.00	103.62	1.49
MH_212	MH_213	203	104.1	3.4	50	103.58	103.23	103.26	0.84
MH_212	MH_213	202	104.35	11.8	50	103.58	103.23	103.32	1.03

Table F1: USF Freeboard Results - 100-Year Chicago 3 Hour Event

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH_212	MH_213	201	104.6	23.2	50	103.58	103.23	103.39	1.21
MH_212	MH_213	200	104.77	36.9	50	103.58	103.23	103.49	1.28
MH_213	MH_214	204	104.02	7.2	13	103.23	103.05	103.15	0.87
MH_214	MH_215	272	102.37	7.0	90	103.05	101.44	101.57	0.80
MH_214	MH_215	273	102.59	15.4	90	103.05	101.44	101.72	0.87
MH_214	MH_215	211	102.46	15.7	90	103.05	101.44	101.72	0.74
MH_214	MH_215	210	102.68	27.9	90	103.05	101.44	101.94	0.74
MH_214	MH_215	274	102.86	30.1	90	103.05	101.44	101.98	0.88
MH_214	MH_215	209	102.89	38.1	90	103.05	101.44	102.13	0.76
MH_214	MH_215	275	103.11	45.9	90	103.05	101.44	102.27	0.84
MH_214	MH_215	208	103.15	49.4	90	103.05	101.44	102.33	0.82
MH_214	MH_215	276	103.37	60.4	90	103.05	101.44	102.52	0.85
MH_214	MH_215	207	103.4	63.6	90	103.05	101.44	102.58	0.82
MH_214	MH_215	277	103.55	71.6	90	103.05	101.44	102.73	0.82
MH_214	MH_215	206	103.66	75.0	90	103.05	101.44	102.79	0.87
MH_214	MH_215	278	103.64	83.3	90	103.05	101.44	102.93	0.71
MH_214	MH_215	205	103.83	85.5	90	103.05	101.44	102.97	0.86
MH_216	MH_217	335	106.02	0.2	76	105.52	105.10	105.10	0.92
MH_216	MH_217	348	105.98	4.0	76	105.52	105.10	105.13	0.85
MH_216	MH_217	336	106.02	11.5	76	105.52	105.10	105.17	0.85
MH_216	MH_217	347	105.92	18.2	76	105.52	105.10	105.20	0.72
MH_216	MH_217	337	106.01	25.7	76	105.52	105.10	105.24	0.77
MH_216	MH_217	346	105.85	29.5	76	105.52	105.10	105.27	0.58
MH_216	MH_217	338	106.05	37.1	76	105.52	105.10	105.31	0.74
MH_216	MH_217	345	105.92	39.7	76	105.52	105.10	105.32	0.60
MH_216	MH_217	344	105.98	50.9	76	105.52	105.10	105.38	0.60
MH_216	MH_217	339	106.1	51.3	76	105.52	105.10	105.39	0.71
MH_216	MH_217	343	106.04	61.1	76	105.52	105.10	105.44	0.60
MH_216	MH_217	340	106.1	62.6	76	105.52	105.10	105.45	0.65
MH_216	MH_217	342	106.04	73.2	76	105.52	105.10	105.51	0.53
MH_216	MH_217	341	106.39	74.3	76	105.52	105.10	105.51	0.88
MH_217	MH_218	356	105.71	5.1	113	105.10	104.93	104.93	0.78
MH_217	MH_218	328	105.81	10.1	113	105.10	104.93	104.94	0.87
MH_217	MH_218	355	105.78	19.3	113	105.10	104.93	104.96	0.82
MH_217	MH_218	329	105.94	24.6	113	105.10	104.93	104.97	0.97
MH_217	MH_218	354	105.85	33.8	113	105.10	104.93	104.98	0.87
MH_217	MH_218	330	105.94	40.3	113	105.10	104.93	104.99	0.95
MH_217	MH_218	353	105.93	47.5	113	105.10	104.93	105.00	0.93
MH_217	MH_218	331	105.96	55.0	113	105.10	104.93	105.01	0.95
MH_217	MH_218	352	106	63.3	113	105.10	104.93	105.03	0.97
MH_217	MH_218	332	106.04	70.3	113	105.10	104.93	105.04	1.00
MH_217	MH_218	351	106.08	78.0	113	105.10	104.93	105.05	1.03
MH_217	MH_218	333	106.08	85.5	113	105.10	104.93	105.06	1.02
MH_217	MH_218	350	106.08	90.9	113	105.10	104.93	105.07	1.01
MH_217	MH_218	334	106.08	99.1	113	105.10	104.93	105.08	1.00
MH_217	MH_218	349	106.05	105.8	113	105.10	104.93	105.09	0.96
MH_218	MH_220	362	105.77	15.7	81	104.93	103.89	104.10	1.67
MH_218	MH_220	322	106.2	16.4	81	104.93	103.89	104.10	2.10
MH_218	MH_220	361	105.87	27.4	81	104.93	103.89	104.25	1.62
MH_218	MH_220	323	105.94	28.1	81	104.93	103.89	104.25	1.69
MH_218	MH_220	360	105.87	38.5	81	104.93	103.89	104.39	1.48
MH_218	MH_220	324	105.88	39.4	81	104.93	103.89	104.40	1.48
MH_218	MH_220	359	105.86	48.7	81	104.93	103.89	104.52	1.34
MH_218	MH_220	325	105.92	53.6	81	104.93	103.89	104.58	1.34
MH_218	MH_220	358	105.81	60.0	81	104.93	103.89	104.66	1.15
MH_218	MH_220	326	105.92	65.0	81	104.93	103.89	104.73	1.19
MH_218	MH_220	357	105.75	74.2	81	104.93	103.89	104.85	0.90
MH_218	MH_220	327	105.82	79.2	81	104.93	103.89	104.91	0.91
MH_219	MH_220	263	106.53	8.5	25	105.65	103.89	104.50	2.03
MH_219	MH_220	264	108.04	22.7	25	105.65	103.89	105.50	2.54
MH_220	MH_224	259	104.74	16.3	59	103.89	102.03	102.54	2.20
MH_220	MH_224	260	105.06	28.5	59	103.89	102.03	102.93	2.13
MH_220	MH_224	261	105.61	43.3	59	103.89	102.03	103.39	2.22
MH_220	MH_224	262	106.07	54.7	59	103.89	102.03	103.76	2.31
MH_221	MH_222	396-5	103.56	6.9	78	103.10	102.81	102.84	0.72
MH_221	MH_222	396-4	103.56	14.9	78	103.10	102.81	102.87	0.69
MH_221	MH_222	396-3	103.56	22.1	78	103.10	102.81	102.89	0.67
MH_221	MH_222	396-2	103.56	30.1	78	103.10	102.81	102.92	0.64
MH_221	MH_222	396-1	103.56	39.5	78	103.10	102.81	102.96	0.60
MH_221	MH_222	395-5	103.91	48.4	78	103.10	102.81	102.99	0.92
MH_221	MH_222	395-4	103.91	56.0	78	103.10	102.81	103.02	0.89
MH_221	MH_222	395-3	104.7	64.0	78	103.10	102.81	103.05	1.65
MH_221	MH_222	395-2	104.51	71.2	78	103.10	102.81	103.07	1.44
MH_221	MH_222	395-1	104.7	77.6	78	103.10	102.81	103.10	1.60
MH_222	MH_223	365-2	103.42	2.1	95	102.81	102.71	102.71	0.71
MH_222	MH_223	399-3	103.51	3.9	95	102.81	102.71	102.71	0.80
MH_222	MH_223	365-3	103.42	9.4	95	102.81	102.71	102.72	0.70

Table F1: USF Freeboard Results - 100-Year Chicago 3 Hour Event

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH_222	MH_223	399-2	103.51	11.9	95	102.81	102.71	102.72	0.79
MH_222	MH_223	365-4	103.42	17.4	95	102.81	102.71	102.73	0.69
MH_222	MH_223	399-1	103.51	19.5	95	102.81	102.71	102.73	0.78
MH_222	MH_223	366-1	103.37	28.0	95	102.81	102.71	102.74	0.63
MH_222	MH_223	398-5	103.52	30.2	95	102.81	102.71	102.74	0.78
MH_222	MH_223	366-2	103.37	36.0	95	102.81	102.71	102.75	0.62
MH_222	MH_223	398-4	103.52	38.2	95	102.81	102.71	102.75	0.77
MH_222	MH_223	366-3	103.37	43.3	95	102.81	102.71	102.75	0.62
MH_222	MH_223	398-3	103.52	45.4	95	102.81	102.71	102.76	0.76
MH_222	MH_223	366-4	103.37	51.3	95	102.81	102.71	102.76	0.61
MH_222	MH_223	398-2	103.52	53.4	95	102.81	102.71	102.77	0.75
MH_222	MH_223	398-1	103.52	61.1	95	102.81	102.71	102.77	0.75
MH_222	MH_223	397-3	103.54	71.7	95	102.81	102.71	102.79	0.75
MH_222	MH_223	397-2	103.54	79.7	95	102.81	102.71	102.79	0.75
MH_222	MH_223	397-1	103.54	87.3	95	102.81	102.71	102.80	0.74
MH_223	MH_224	363-1	103.63	16.0	97	102.71	102.03	102.14	1.49
MH_223	MH_224	401-5	104.22	18.1	97	102.71	102.03	102.15	2.07
MH_223	MH_224	363-2	103.63	24.0	97	102.71	102.03	102.19	1.44
MH_223	MH_224	401-4	104.22	26.1	97	102.71	102.03	102.21	2.01
MH_223	MH_224	363-3	103.63	31.2	97	102.71	102.03	102.24	1.39
MH_223	MH_224	401-3	104.22	33.4	97	102.71	102.03	102.26	1.96
MH_223	MH_224	363-4	103.63	39.2	97	102.71	102.03	102.30	1.33
MH_223	MH_224	401-2	104.07	41.4	97	102.71	102.03	102.32	1.75
MH_223	MH_224	401-1	104.07	49.0	97	102.71	102.03	102.37	1.70
MH_223	MH_224	364-1	103.63	49.8	97	102.71	102.03	102.37	1.26
MH_223	MH_224	364-2	103.63	57.8	97	102.71	102.03	102.43	1.20
MH_223	MH_224	400-5	103.58	59.6	97	102.71	102.03	102.44	1.14
MH_223	MH_224	364-3	103.63	65.1	97	102.71	102.03	102.48	1.15
MH_223	MH_224	400-4	103.58	67.6	97	102.71	102.03	102.50	1.08
MH_223	MH_224	364-4	103.63	73.1	97	102.71	102.03	102.54	1.09
MH_223	MH_224	400-3	103.58	74.9	97	102.71	102.03	102.55	1.03
MH_223	MH_224	364-5	103.63	80.7	97	102.71	102.03	102.59	1.04
MH_223	MH_224	400-2	103.58	82.9	97	102.71	102.03	102.61	0.97
MH_223	MH_224	400-1	103.58	90.5	97	102.71	102.03	102.66	0.92
MH_223	MH_224	365-1	103.42	91.3	97	102.71	102.03	102.67	0.75
MH_224	MH_105	141	101.9	11.6	82	102.03	100.01	100.30	1.60
MH_224	MH_105	140	102.18	25.8	82	102.03	100.01	100.65	1.53
MH_224	MH_105	139	102.55	37.0	82	102.03	100.01	100.92	1.63
MH_224	MH_105	138	102.92	47.2	82	102.03	100.01	101.17	1.75
MH_224	MH_105	137	103.3	58.4	82	102.03	100.01	101.45	1.85
MH_224	MH_105	136	103.81	71.8	82	102.03	100.01	101.78	2.03
MH_225	MH_226	389-2	103.58	5.9	87	103.88	102.61	102.70	0.88
MH_225	MH_226	389-1	103.74	13.9	87	103.88	102.61	102.82	0.92
MH_225	MH_226	388-3	103.75	24.5	87	103.88	102.61	102.97	0.78
MH_225	MH_226	388-2	103.88	32.2	87	103.88	102.61	103.08	0.80
MH_225	MH_226	388-1	103.88	40.2	87	103.88	102.61	103.20	0.68
MH_225	MH_226	387-4	104.02	50.8	87	103.88	102.61	103.35	0.67
MH_225	MH_226	387-3	104.02	58.8	87	103.88	102.61	103.47	0.55
MH_225	MH_226	387-2	104.02	66.0	87	103.88	102.61	103.57	0.45
MH_225	MH_226	387-1	104.02	74.0	87	103.88	102.61	103.69	0.33
MH_226	MH_2260	391-4	102.73	19.0	64	102.61	101.41	101.77	0.96
MH_226	MH_2260	391-3	102.73	27.0	64	102.61	101.41	101.92	0.81
MH_226	MH_2260	391-2	102.73	34.3	64	102.61	101.41	102.06	0.67
MH_226	MH_2260	391-1	102.73	42.3	64	102.61	101.41	102.21	0.52
MH_226	MH_2260	390-3	103.12	52.9	64	102.61	101.41	102.41	0.71
MH_226	MH_2260	390-2	103.12	60.9	64	102.61	101.41	102.56	0.56
MH_226	MH_2260	390-1	103.12	61.0	64	102.61	101.41	102.56	0.56
MH_226	MH_2260	389-4	103.58	62.5	64	102.61	101.41	102.59	0.99
MH_226	MH_2260	389-3	103.58	63.0	64	102.61	101.41	102.60	0.98
MH_2260	MH_227	392-2	102.29	3.6	50	101.41	101.14	101.16	1.13
MH_2260	MH_227	392-1	102.29	11.6	50	101.41	101.14	101.20	1.09
MH_227	MH_109	394-4	101.34	19.3	93	101.14	99.78	100.06	1.28
MH_227	MH_109	394-3	101.34	27.3	93	101.14	99.78	100.18	1.16
MH_227	MH_109	394-2	101.61	34.6	93	101.14	99.78	100.28	1.33
MH_227	MH_109	394-1	101.61	42.6	93	101.14	99.78	100.40	1.21
MH_227	MH_109	393-3	102.29	54.2	93	101.14	99.78	100.57	1.72
MH_227	MH_109	393-2	102.29	61.8	93	101.14	99.78	100.68	1.61
MH_227	MH_109	393-1	102.29	69.8	93	101.14	99.78	100.80	1.49
MH_227	MH_109	392-4	102.29	81.5	93	101.14	99.78	100.97	1.32
MH_227	MH_109	392-3	102.29	89.5	93	101.14	99.78	101.09	1.20
MH_228	MH_229	384-3	102.12	2.3	75	102.62	101.07	101.12	1.00
MH_228	MH_229	379-2	102.14	3.4	75	102.62	101.07	101.14	1.00
MH_228	MH_229	384-4	102.12	10.3	75	102.62	101.07	101.29	0.83
MH_228	MH_229	379-1	102.14	11.4	75	102.62	101.07	101.31	0.83
MH_228	MH_229	385-1	102.35	20.9	75	102.62	101.07	101.51	0.84
MH_228	MH_229	378-3	102.57	22.1	75	102.62	101.07	101.53	1.04
MH_228	MH_229	385-2	102.65	28.5	75	102.62	101.07	101.66	0.99

Table F1: USF Freeboard Results - 100-Year Chicago 3 Hour Event

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH_228	MH_229	378-2	102.67	29.7	75	102.62	101.07	101.69	0.98
MH_228	MH_229	385-3	102.65	36.5	75	102.62	101.07	101.83	0.82
MH_228	MH_229	378-1	102.67	37.7	75	102.62	101.07	101.86	0.81
MH_228	MH_229	386-1	102.73	47.2	75	102.62	101.07	102.05	0.68
MH_228	MH_229	377-4	103.02	48.3	75	102.62	101.07	102.08	0.94
MH_228	MH_229	386-2	103.08	55.2	75	102.62	101.07	102.22	0.86
MH_228	MH_229	377-3	103.28	56.3	75	102.62	101.07	102.24	1.04
MH_228	MH_229	386-3	103.08	62.4	75	102.62	101.07	102.37	0.71
MH_228	MH_229	377-2	103.34	63.6	75	102.62	101.07	102.39	0.95
MH_228	MH_229	386-4	103.47	70.4	75	102.62	101.07	102.54	0.93
MH_228	MH_229	377-1	103.34	71.6	75	102.62	101.07	102.56	0.78
MH_229	MH_102	382-1	101.52	13.6	87	101.07	100.20	100.33	1.19
MH_229	MH_102	381-4	101.35	14.8	87	101.07	100.20	100.35	1.00
MH_229	MH_102	382-2	101.52	21.6	87	101.07	100.20	100.42	1.10
MH_229	MH_102	381-3	101.35	22.8	87	101.07	100.20	100.43	0.92
MH_229	MH_102	382-3	101.52	28.8	87	101.07	100.20	100.49	1.03
MH_229	MH_102	381-2	101.35	30.0	87	101.07	100.20	100.50	0.85
MH_229	MH_102	382-4	101.52	36.8	87	101.07	100.20	100.57	0.95
MH_229	MH_102	381-1	101.35	38.0	87	101.07	100.20	100.58	0.77
MH_229	MH_102	383-1	101.62	47.5	87	101.07	100.20	100.68	0.94
MH_229	MH_102	380-3	101.59	48.6	87	101.07	100.20	100.69	0.90
MH_229	MH_102	383-2	101.62	55.5	87	101.07	100.20	100.76	0.86
MH_229	MH_102	380-2	101.59	56.6	87	101.07	100.20	100.77	0.82
MH_229	MH_102	383-3	101.62	63.1	87	101.07	100.20	100.83	0.79
MH_229	MH_102	380-1	101.59	64.3	87	101.07	100.20	100.85	0.74
MH_229	MH_102	384-1	101.74	73.7	87	101.07	100.20	100.94	0.80
MH_229	MH_102	379-4	101.96	74.9	87	101.07	100.20	100.95	1.01
MH_229	MH_102	384-2	101.74	81.7	87	101.07	100.20	101.02	0.72
MH_229	MH_102	379-3	101.96	82.9	87	101.07	100.20	101.03	0.93
MH_230	MH_231	374-3	102.03	2.4	73	102.56	100.98	101.03	1.00
MH_230	MH_231	368-3	102.24	5.1	73	102.56	100.98	101.09	1.15
MH_230	MH_231	374-4	102.03	10.4	73	102.56	100.98	101.21	0.82
MH_230	MH_231	368-2	102.24	13.1	73	102.56	100.98	101.26	0.98
MH_230	MH_231	368-1	102.24	20.7	73	102.56	100.98	101.43	0.81
MH_230	MH_231	375-1	102.4	21.1	73	102.56	100.98	101.43	0.97
MH_230	MH_231	375-2	102.57	28.7	73	102.56	100.98	101.60	0.97
MH_230	MH_231	367-3	102.71	31.3	73	102.56	100.98	101.65	1.06
MH_230	MH_231	375-3	102.57	36.7	73	102.56	100.98	101.77	0.80
MH_230	MH_231	367-2	102.71	39.3	73	102.56	100.98	101.82	0.89
MH_230	MH_231	367-1	102.71	47.0	73	102.56	100.98	101.99	0.72
MH_230	MH_231	376-1	103	47.3	73	102.56	100.98	102.00	1.00
MH_230	MH_231	376-2	103	55.3	73	102.56	100.98	102.17	0.83
MH_230	MH_231	376-3	103.37	62.6	73	102.56	100.98	102.32	1.05
MH_230	MH_231	376-4	103.37	70.6	73	102.56	100.98	102.50	0.87
MH_231	MH_103	371-3	100.56	13.1	87	100.98	99.53	99.74	0.82
MH_231	MH_103	372-1	100.95	13.8	87	100.98	99.53	99.76	1.19
MH_231	MH_103	371-2	100.56	21.1	87	100.98	99.53	99.88	0.68
MH_231	MH_103	372-2	100.95	21.8	87	100.98	99.53	99.89	1.06
MH_231	MH_103	371-1	100.56	28.7	87	100.98	99.53	100.01	0.55
MH_231	MH_103	372-3	100.95	29.1	87	100.98	99.53	100.01	0.94
MH_231	MH_103	372-4	100.95	37.1	87	100.98	99.53	100.15	0.80
MH_231	MH_103	370-3	101.09	39.3	87	100.98	99.53	100.18	0.91
MH_231	MH_103	370-2	101.09	47.3	87	100.98	99.53	100.32	0.77
MH_231	MH_103	373-1	100.97	47.7	87	100.98	99.53	100.33	0.64
MH_231	MH_103	370-1	101.09	54.9	87	100.98	99.53	100.45	0.64
MH_231	MH_103	373-2	101.39	55.7	87	100.98	99.53	100.46	0.93
MH_231	MH_103	373-3	101.39	63.3	87	100.98	99.53	100.59	0.80
MH_231	MH_103	369-3	101.61	65.6	87	100.98	99.53	100.63	0.98
MH_231	MH_103	369-2	101.61	73.6	87	100.98	99.53	100.76	0.85
MH_231	MH_103	374-1	101.56	74.0	87	100.98	99.53	100.77	0.79
MH_231	MH_103	369-1	101.61	81.2	87	100.98	99.53	100.89	0.72
MH_231	MH_103	374-2	101.56	82.0	87	100.98	99.53	100.90	0.66

Key:

- (yellow) Freeboard to USF less than 0.30 m
- (red) Freeboard to USF less than 0.00 m

Min	0.33
Max	2.96
Average	0.93

Table F2: USF Freeboard Results - 100-Year SCS 24 Hour Event

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH_105	MH_106	148	100.03	12.7	91	100.01	99.07	99.20	0.83
MH_105	MH_106	147	100.16	24.9	91	100.01	99.07	99.32	0.84
MH_105	MH_106	146	100.3	35.1	91	100.01	99.07	99.43	0.87
MH_105	MH_106	145	100.42	46.4	91	100.01	99.07	99.55	0.87
MH_105	MH_106	144	100.56	60.6	91	100.01	99.07	99.70	0.86
MH_105	MH_106	143	100.93	74.3	91	100.01	99.07	99.84	1.09
MH_105	MH_106	142	101.5	89.0	91	100.01	99.07	99.99	1.51
MH_106	MH_116	156	99.69	17.5	122	99.07	98.85	98.88	0.81
MH_106	MH_116	166-1	99.53	19.1	122	99.07	98.85	98.88	0.65
MH_106	MH_116	166-2	99.53	27.1	122	99.07	98.85	98.90	0.63
MH_106	MH_116	155	99.69	29.2	122	99.07	98.85	98.90	0.79
MH_106	MH_116	166-3	99.53	34.3	122	99.07	98.85	98.91	0.62
MH_106	MH_116	154	99.59	40.4	122	99.07	98.85	98.92	0.67
MH_106	MH_116	166-4	99.53	42.3	122	99.07	98.85	98.92	0.61
MH_106	MH_116	153	99.56	50.6	122	99.07	98.85	98.94	0.62
MH_106	MH_116	167-1	99.61	52.9	122	99.07	98.85	98.94	0.67
MH_106	MH_116	167-2	99.61	60.6	122	99.07	98.85	98.96	0.65
MH_106	MH_116	152	99.6	61.8	122	99.07	98.85	98.96	0.64
MH_106	MH_116	167-3	99.61	68.6	122	99.07	98.85	98.97	0.64
MH_106	MH_116	151	99.73	76.3	122	99.07	98.85	98.98	0.75
MH_106	MH_116	168-1	99.73	79.2	122	99.07	98.85	98.99	0.74
MH_106	MH_116	168-2	99.73	87.2	122	99.07	98.85	99.00	0.73
MH_106	MH_116	150	99.81	92.1	122	99.07	98.85	99.01	0.80
MH_106	MH_116	168-3	99.73	94.4	122	99.07	98.85	99.02	0.71
MH_106	MH_116	168-4	99.73	102.4	122	99.07	98.85	99.03	0.70
MH_106	MH_116	149	99.81	106.0	122	99.07	98.85	99.04	0.77
MH_107	MH_108	176-1	100.1	3.5	13	99.37	99.45	99.43	0.67
MH_107	MH_108	176-2	100.1	6.3	13	99.37	99.45	99.41	0.69
MH_107	MH_108	176-3	100.1	9.3	13	99.37	99.45	99.39	0.71
MH_107	MH_112	185-1	99.89	1.3	74	99.37	99.48	99.48	0.41
MH_107	MH_112	178-4	100	3.8	74	99.37	99.48	99.47	0.53
MH_107	MH_112	185-2	99.89	9.3	74	99.37	99.48	99.47	0.42
MH_107	MH_112	178-3	100	11.8	74	99.37	99.48	99.46	0.54
MH_107	MH_112	185-3	99.89	16.5	74	99.37	99.48	99.45	0.44
MH_107	MH_112	178-2	100	19.0	74	99.37	99.48	99.45	0.55
MH_107	MH_112	185-4	99.89	24.5	74	99.37	99.48	99.44	0.45
MH_107	MH_112	178-1	100	27.0	74	99.37	99.48	99.44	0.56
MH_107	MH_112	185-5	99.89	32.2	74	99.37	99.48	99.43	0.46
MH_107	MH_112	177-5	100.04	37.7	74	99.37	99.48	99.42	0.62
MH_107	MH_112	186-1	99.91	42.8	74	99.37	99.48	99.42	0.49
MH_107	MH_112	177-4	100.04	45.3	74	99.37	99.48	99.41	0.63
MH_107	MH_112	186-2	99.91	50.8	74	99.37	99.48	99.40	0.51
MH_107	MH_112	177-3	100.04	53.3	74	99.37	99.48	99.40	0.64
MH_107	MH_112	186-3	99.91	58.0	74	99.37	99.48	99.39	0.52
MH_107	MH_112	177-2	100.04	60.5	74	99.37	99.48	99.39	0.65
MH_107	MH_112	186-4	99.91	66.0	74	99.37	99.48	99.38	0.53
MH_107	MH_112	177-1	100.04	68.5	74	99.37	99.48	99.38	0.66
MH_108	MH_110	175-1	100.15	16.1	54	99.45	99.45	99.45	0.70
MH_108	MH_110	175-2	100.15	24.1	54	99.45	99.45	99.45	0.70
MH_108	MH_110	175-3	100.15	31.3	54	99.45	99.45	99.45	0.70
MH_108	MH_110	175-4	100.15	39.3	54	99.45	99.45	99.45	0.70
MH_108	MH_110	175-5	100.15	46.9	54	99.45	99.45	99.45	0.70
MH_109	MH_110	164-2	100.2	1.8	60	99.74	99.45	99.45	0.75
MH_109	MH_110	164-3	100.2	6.6	60	99.74	99.45	99.48	0.72
MH_109	MH_110	164-4	100.2	14.6	60	99.74	99.45	99.52	0.68
MH_109	MH_110	165-1	100.43	25.3	60	99.74	99.45	99.57	0.86
MH_109	MH_110	165-2	100.43	32.9	60	99.74	99.45	99.61	0.82
MH_109	MH_110	165-3	100.43	40.9	60	99.74	99.45	99.64	0.79
MH_110	MH_111	188-4	99.86	2.1	75	99.45	99.23	99.23	0.63
MH_110	MH_111	162-1	99.74	6.3	75	99.45	99.23	99.24	0.50
MH_110	MH_111	188-3	99.86	9.3	75	99.45	99.23	99.25	0.61
MH_110	MH_111	162-2	99.75	14.3	75	99.45	99.23	99.27	0.48
MH_110	MH_111	188-2	99.86	17.3	75	99.45	99.23	99.28	0.58
MH_110	MH_111	162-3	99.75	21.5	75	99.45	99.23	99.29	0.46
MH_110	MH_111	188-1	99.86	24.9	75	99.45	99.23	99.30	0.56
MH_110	MH_111	162-4	99.75	29.5	75	99.45	99.23	99.31	0.44
MH_110	MH_111	187-4	99.86	35.6	75	99.45	99.23	99.33	0.53
MH_110	MH_111	163-1	99.83	40.1	75	99.45	99.23	99.34	0.49
MH_110	MH_111	187-3	99.86	43.6	75	99.45	99.23	99.35	0.51
MH_110	MH_111	163-2	99.83	47.8	75	99.45	99.23	99.37	0.46
MH_110	MH_111	187-2	99.9	50.8	75	99.45	99.23	99.37	0.53
MH_110	MH_111	163-3	99.83	55.8	75	99.45	99.23	99.39	0.44
MH_110	MH_111	187-1	99.9	58.8	75	99.45	99.23	99.40	0.50
MH_110	MH_111	164-1	100.2	66.4	75	99.45	99.23	99.42	0.78
MH_111	MH_115	159-1	99.58	10.7	91	99.23	99.04	99.06	0.52
MH_111	MH_115	190-4	99.7	17.1	91	99.23	99.04	99.07	0.63
MH_111	MH_115	159-2	99.58	18.7	91	99.23	99.04	99.07	0.51

Table F2: USF Freeboard Results - 100-Year SCS 24 Hour Event

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH_111	MH_115	190-3	99.7	25.1	91	99.23	99.04	99.09	0.61
MH_111	MH_115	159-3	99.58	25.9	91	99.23	99.04	99.09	0.49
MH_111	MH_115	190-2	99.7	32.3	91	99.23	99.04	99.10	0.60
MH_111	MH_115	159-4	99.58	33.9	91	99.23	99.04	99.11	0.47
MH_111	MH_115	190-1	99.7	40.3	91	99.23	99.04	99.12	0.58
MH_111	MH_115	160-1	99.71	44.5	91	99.23	99.04	99.13	0.58
MH_111	MH_115	189-4	99.82	51.0	91	99.23	99.04	99.14	0.68
MH_111	MH_115	160-2	99.71	52.2	91	99.23	99.04	99.14	0.57
MH_111	MH_115	189-3	99.82	59.0	91	99.23	99.04	99.16	0.66
MH_111	MH_115	160-3	99.71	60.2	91	99.23	99.04	99.16	0.55
MH_111	MH_115	189-2	99.82	66.2	91	99.23	99.04	99.17	0.65
MH_111	MH_115	161-1	99.71	70.8	91	99.23	99.04	99.18	0.53
MH_111	MH_115	189-1	99.82	74.2	91	99.23	99.04	99.19	0.63
MH_111	MH_115	161-2	99.71	76.2	91	99.23	99.04	99.19	0.52
MH_111	MH_115	188-5	99.86	84.8	91	99.23	99.04	99.21	0.65
MH_111	MH_115	161-3	99.71	86.4	91	99.23	99.04	99.22	0.49
MH_112	MH_113	180-4	99.8	5.0	74	99.48	99.25	99.27	0.53
MH_112	MH_113	183-1	99.74	7.1	74	99.48	99.25	99.27	0.47
MH_112	MH_113	180-3	99.8	11.2	74	99.48	99.25	99.29	0.51
MH_112	MH_113	183-2	99.74	15.1	74	99.48	99.25	99.30	0.44
MH_112	MH_113	180-2	99.8	19.2	74	99.48	99.25	99.31	0.49
MH_112	MH_113	183-3	99.91	22.3	74	99.48	99.25	99.32	0.59
MH_112	MH_113	180-1	99.8	28.1	74	99.48	99.25	99.34	0.46
MH_112	MH_113	183-4	99.91	30.3	74	99.48	99.25	99.35	0.56
MH_112	MH_113	179-3	99.82	36.1	74	99.48	99.25	99.36	0.46
MH_112	MH_113	184-1	99.91	40.9	74	99.48	99.25	99.38	0.53
MH_112	MH_113	179-2	99.82	45.0	74	99.48	99.25	99.39	0.43
MH_112	MH_113	184-2	99.91	48.9	74	99.48	99.25	99.40	0.51
MH_112	MH_113	179-1	99.82	52.0	74	99.48	99.25	99.41	0.41
MH_112	MH_113	184-3	99.91	56.2	74	99.48	99.25	99.43	0.48
MH_112	MH_113	184-4	99.91	64.2	74	99.48	99.25	99.45	0.46
MH_112	MH_113	178-5	100	69.7	74	99.48	99.25	99.47	0.53
MH_113	MH_114	181-3	99.85	3.4	13	99.25	99.20	99.21	0.64
MH_113	MH_114	181-2	99.85	7.0	13	99.25	99.20	99.23	0.62
MH_113	MH_114	181-1	99.85	8.2	13	99.25	99.20	99.23	0.62
MH_114	MH_115	182-5	99.58	18.5	54	99.20	99.04	99.09	0.49
MH_114	MH_115	182-4	99.58	26.5	54	99.20	99.04	99.11	0.47
MH_114	MH_115	182-3	99.58	33.7	54	99.20	99.04	99.14	0.44
MH_114	MH_115	182-2	99.58	41.7	54	99.20	99.04	99.16	0.42
MH_114	MH_115	182-1	99.6	49.3	54	99.20	99.04	99.18	0.42
MH_115	MH_116	157-1	99.46	17.0	59	99.04	98.85	98.90	0.56
MH_115	MH_116	157-2	99.46	25.0	59	99.04	98.85	98.93	0.53
MH_115	MH_116	157-3	99.46	32.6	59	99.04	98.85	98.95	0.51
MH_115	MH_116	158-1	99.51	43.3	59	99.04	98.85	98.99	0.52
MH_115	MH_116	158-2	99.51	51.3	59	99.04	98.85	99.01	0.50
MH_115	MH_116	158-3	99.51	56.1	59	99.04	98.85	99.03	0.48
MH_116	MH_117	26	99.43	6.8	123	98.85	98.69	98.70	0.73
MH_116	MH_117	10	99.46	12.9	123	98.85	98.69	98.70	0.76
MH_116	MH_117	27	99.43	22.6	123	98.85	98.69	98.72	0.71
MH_116	MH_117	11	99.46	27.6	123	98.85	98.69	98.72	0.74
MH_116	MH_117	28	99.42	37.0	123	98.85	98.69	98.74	0.68
MH_116	MH_117	12	99.41	43.4	123	98.85	98.69	98.74	0.67
MH_116	MH_117	29	99.35	48.5	123	98.85	98.69	98.75	0.60
MH_116	MH_117	13	99.41	57.8	123	98.85	98.69	98.76	0.65
MH_116	MH_117	30	99.32	60.7	123	98.85	98.69	98.77	0.55
MH_116	MH_117	14	99.38	69.1	123	98.85	98.69	98.78	0.60
MH_116	MH_117	31	99.32	71.9	123	98.85	98.69	98.78	0.54
MH_116	MH_117	15	99.47	79.3	123	98.85	98.69	98.79	0.68
MH_116	MH_117	32	99.49	82.1	123	98.85	98.69	98.80	0.69
MH_116	MH_117	16	99.57	90.4	123	98.85	98.69	98.81	0.76
MH_116	MH_117	17	99.84	102.1	123	98.85	98.69	98.82	1.02
MH_117	MH_118	18	99.18	4.5	121	98.69	98.51	98.51	0.67
MH_117	MH_118	2	99.16	7.6	121	98.69	98.51	98.52	0.64
MH_117	MH_118	406	99.18	16.2	121	98.69	98.51	98.53	0.65
MH_117	MH_118	404	99.18	23.0	121	98.69	98.51	98.54	0.64
MH_117	MH_118	407	99.16	25.8	121	98.69	98.51	98.54	0.62
MH_117	MH_118	405	99.18	30.5	121	98.69	98.51	98.55	0.63
MH_117	MH_118	19	99.16	38.0	121	98.69	98.51	98.56	0.60
MH_117	MH_118	3	99.14	40.7	121	98.69	98.51	98.57	0.57
MH_117	MH_118	20	99.11	48.2	121	98.69	98.51	98.58	0.53
MH_117	MH_118	4	99.14	51.8	121	98.69	98.51	98.58	0.56
MH_117	MH_118	21	99.12	59.3	121	98.69	98.51	98.59	0.53
MH_117	MH_118	5	99.22	62.0	121	98.69	98.51	98.60	0.62
MH_117	MH_118	22	99.21	71.5	121	98.69	98.51	98.61	0.60
MH_117	MH_118	6	99.23	73.3	121	98.69	98.51	98.62	0.61
MH_117	MH_118	23	99.22	82.9	121	98.69	98.51	98.63	0.59
MH_117	MH_118	7	99.24	87.7	121	98.69	98.51	98.64	0.60

Table F2: USF Freeboard Results - 100-Year SCS 24 Hour Event

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH_117	MH_118	24	99.28	97.4	121	98.69	98.51	98.65	0.63
MH_117	MH_118	8	99.31	103.5	121	98.69	98.51	98.66	0.65
MH_117	MH_118	25	99.36	113.2	121	98.69	98.51	98.68	0.68
MH_117	MH_118	9	99.4	118.2	121	98.69	98.51	98.68	0.72
MH_119	MH_120	118	101.07	4.8	103	100.08	99.68	99.70	1.37
MH_119	MH_120	101	100.65	9.0	103	100.08	99.68	99.71	0.94
MH_119	MH_120	418	100.99	17.0	103	100.08	99.68	99.75	1.24
MH_119	MH_120	416	100.7	20.7	103	100.08	99.68	99.76	0.94
MH_119	MH_120	419	100.98	28.2	103	100.08	99.68	99.79	1.19
MH_119	MH_120	417	100.76	31.9	103	100.08	99.68	99.80	0.96
MH_119	MH_120	119	100.98	40.4	103	100.08	99.68	99.84	1.14
MH_119	MH_120	100	100.81	42.5	103	100.08	99.68	99.85	0.96
MH_119	MH_120	120	100.98	51.8	103	100.08	99.68	99.88	1.10
MH_119	MH_120	99	100.86	52.7	103	100.08	99.68	99.89	0.97
MH_119	MH_120	98	100.92	63.9	103	100.08	99.68	99.93	0.99
MH_119	MH_120	121	101.03	66.0	103	100.08	99.68	99.94	1.09
MH_119	MH_120	97	100.97	74.1	103	100.08	99.68	99.97	1.00
MH_119	MH_120	122	101.12	77.4	103	100.08	99.68	99.98	1.14
MH_119	MH_120	96	101.03	85.4	103	100.08	99.68	100.02	1.01
MH_119	MH_120	123	101.12	91.1	103	100.08	99.68	100.04	1.08
MH_119	MH_120	95	101.03	99.6	103	100.08	99.68	100.07	0.96
MH_119	MH_122	130	100.77	3.3	90	100.08	99.66	99.68	1.09
MH_119	MH_122	89	100.62	7.4	90	100.08	99.66	99.70	0.92
MH_119	MH_122	129	100.82	14.1	90	100.08	99.66	99.73	1.09
MH_119	MH_122	90	100.68	21.1	90	100.08	99.66	99.76	0.92
MH_119	MH_122	128	100.88	27.7	90	100.08	99.66	99.79	1.09
MH_119	MH_122	91	100.76	34.7	90	100.08	99.66	99.83	0.93
MH_119	MH_122	127	100.88	39.9	90	100.08	99.66	99.85	1.03
MH_119	MH_122	92	100.84	49.4	90	100.08	99.66	99.89	0.95
MH_119	MH_122	126	100.88	51.1	90	100.08	99.66	99.90	0.98
MH_119	MH_122	125	100.92	61.3	90	100.08	99.66	99.95	0.97
MH_119	MH_122	93	100.91	65.1	90	100.08	99.66	99.97	0.94
MH_119	MH_122	124	100.97	73.4	90	100.08	99.66	100.01	0.96
MH_119	MH_122	94	100.99	79.8	90	100.08	99.66	100.04	0.95
MH_120	MH_121	116	101.03	4.3	14	99.68	99.30	99.41	1.62
MH_120	MH_121	117	101.07	10.9	14	99.68	99.30	99.59	1.48
MH_121	MH_132	106	99.54	7.3	114	99.30	98.57	98.61	0.93
MH_121	MH_132	107	99.71	19.5	114	99.30	98.57	98.69	1.02
MH_121	MH_132	108	99.88	30.6	114	99.30	98.57	98.76	1.12
MH_121	MH_132	109	100.05	40.8	114	99.30	98.57	98.83	1.22
MH_121	MH_132	110	100.15	53.5	114	99.30	98.57	98.91	1.24
MH_121	MH_132	111	100.32	64.9	114	99.30	98.57	98.99	1.33
MH_121	MH_132	112	100.48	77.1	114	99.30	98.57	99.06	1.42
MH_121	MH_132	113	100.57	88.2	114	99.30	98.57	99.14	1.43
MH_121	MH_132	114	100.57	98.4	114	99.30	98.57	99.20	1.37
MH_121	MH_132	115	100.65	109.2	114	99.30	98.57	99.27	1.38
MH_122	MH_123	131	100.61	5.0	13	99.66	99.51	99.57	1.04
MH_123	MH_127	135	99.89	11.7	50	99.51	99.06	99.17	0.72
MH_123	MH_127	134	100.02	23.4	50	99.51	99.06	99.27	0.75
MH_123	MH_127	133	100.23	34.7	50	99.51	99.06	99.37	0.86
MH_123	MH_127	132	100.36	45.3	50	99.51	99.06	99.47	0.89
MH_124	MH_125	82	99.89	5.4	101	99.30	99.25	99.25	0.64
MH_124	MH_125	69	99.84	8.5	101	99.30	99.25	99.26	0.58
MH_124	MH_125	70	99.78	18.7	101	99.30	99.25	99.26	0.52
MH_124	MH_125	81	99.89	19.6	101	99.30	99.25	99.26	0.63
MH_124	MH_125	71	99.78	29.8	101	99.30	99.25	99.27	0.51
MH_124	MH_125	80	99.92	31.0	101	99.30	99.25	99.27	0.65
MH_124	MH_125	72	99.77	40.0	101	99.30	99.25	99.27	0.50
MH_124	MH_125	79	100.04	46.9	101	99.30	99.25	99.28	0.76
MH_124	MH_125	73	99.82	51.2	101	99.30	99.25	99.28	0.54
MH_124	MH_125	78	100.04	54.3	101	99.30	99.25	99.28	0.76
MH_124	MH_125	74	99.88	61.4	101	99.30	99.25	99.28	0.60
MH_124	MH_125	77	100	64.5	101	99.30	99.25	99.28	0.72
MH_124	MH_125	413	99.93	73.5	101	99.30	99.25	99.29	0.64
MH_124	MH_125	415	100.08	75.2	101	99.30	99.25	99.29	0.79
MH_124	MH_125	412	99.98	83.2	101	99.30	99.25	99.29	0.69
MH_124	MH_125	414	100.1	86.3	101	99.30	99.25	99.30	0.80
MH_124	MH_125	75	99.98	94.9	101	99.30	99.25	99.30	0.68
MH_124	MH_125	76	100.16	98.0	101	99.30	99.25	99.30	0.86
MH_125	MH_127	88	99.82	15.9	92	99.25	99.06	99.09	0.73
MH_125	MH_127	63	99.59	16.7	92	99.25	99.06	99.10	0.49
MH_125	MH_127	87	99.82	29.6	92	99.25	99.06	99.12	0.70
MH_125	MH_127	64	99.59	30.4	92	99.25	99.06	99.12	0.47
MH_125	MH_127	86	99.72	41.0	92	99.25	99.06	99.15	0.57
MH_125	MH_127	65	99.58	44.0	92	99.25	99.06	99.15	0.43
MH_125	MH_127	85	99.74	55.5	92	99.25	99.06	99.18	0.56
MH_125	MH_127	66	99.69	58.7	92	99.25	99.06	99.18	0.51

Table F2: USF Freeboard Results - 100-Year SCS 24 Hour Event

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH_125	MH_127	84	99.76	71.2	92	99.25	99.06	99.21	0.55
MH_125	MH_127	67	99.78	74.4	92	99.25	99.06	99.22	0.56
MH_125	MH_127	83	99.89	85.7	92	99.25	99.06	99.24	0.65
MH_125	MH_127	68	99.84	88.9	92	99.25	99.06	99.25	0.59
MH_127	MH_128	47	99.56	11.9	54	99.06	98.96	98.99	0.57
MH_127	MH_128	48	99.66	23.3	54	99.06	98.96	99.01	0.65
MH_127	MH_128	49	99.66	37.0	54	99.06	98.96	99.03	0.63
MH_128	MH_129	45	99.49	6.6	13	98.96	98.92	98.94	0.55
MH_128	MH_129	46	99.51	10.5	13	98.96	98.92	98.95	0.56
MH_129	MH_130	39	99.47	1.7	77	98.92	98.81	98.81	0.66
MH_129	MH_130	57	99.48	5.1	77	98.92	98.81	98.82	0.66
MH_129	MH_130	40	99.49	15.9	77	98.92	98.81	98.83	0.66
MH_129	MH_130	58	99.53	17.3	77	98.92	98.81	98.84	0.69
MH_129	MH_130	59	99.53	28.7	77	98.92	98.81	98.85	0.68
MH_129	MH_130	41	99.49	29.5	77	98.92	98.81	98.85	0.64
MH_129	MH_130	60	99.48	43.2	77	98.92	98.81	98.87	0.61
MH_129	MH_130	42	99.42	44.2	77	98.92	98.81	98.87	0.55
MH_129	MH_130	61	99.48	56.8	77	98.92	98.81	98.89	0.59
MH_129	MH_130	43	99.41	60.0	77	98.92	98.81	98.89	0.52
MH_129	MH_130	62	99.48	70.5	77	98.92	98.81	98.91	0.57
MH_129	MH_130	44	99.44	72.6	77	98.92	98.81	98.91	0.53
MH_130	MH_131	50	99.37	3.8	100	98.81	98.59	98.59	0.78
MH_130	MH_131	33	99.18	6.7	100	98.81	98.59	98.60	0.58
MH_130	MH_131	410	99.37	15.5	100	98.81	98.59	98.62	0.75
MH_130	MH_131	408	99.21	18.4	100	98.81	98.59	98.63	0.58
MH_130	MH_131	411	99.25	26.2	100	98.81	98.59	98.64	0.61
MH_130	MH_131	409	99.22	29.5	100	98.81	98.59	98.65	0.57
MH_130	MH_131	51	99.29	37.3	100	98.81	98.59	98.67	0.62
MH_130	MH_131	34	99.23	39.7	100	98.81	98.59	98.68	0.55
MH_130	MH_131	52	99.29	47.5	100	98.81	98.59	98.69	0.60
MH_130	MH_131	35	99.23	51.0	100	98.81	98.59	98.70	0.53
MH_130	MH_131	53	99.35	58.7	100	98.81	98.59	98.72	0.63
MH_130	MH_131	36	99.29	65.2	100	98.81	98.59	98.73	0.56
MH_130	MH_131	54	99.39	70.9	100	98.81	98.59	98.75	0.64
MH_130	MH_131	37	99.39	76.6	100	98.81	98.59	98.76	0.63
MH_130	MH_131	55	99.39	82.3	100	98.81	98.59	98.77	0.62
MH_130	MH_131	38	99.39	90.8	100	98.81	98.59	98.79	0.60
MH_130	MH_131	56	99.41	94.5	100	98.81	98.59	98.80	0.61
MH_132	MH_136	102	99.36	20.4	60	98.57	98.42	98.47	0.89
MH_132	MH_136	103	99.33	32.1	60	98.57	98.42	98.50	0.83
MH_132	MH_136	104	99.35	43.2	60	98.57	98.42	98.53	0.82
MH_132	MH_136	105	99.41	55.4	60	98.57	98.42	98.56	0.85
MH_136	MH_302	1	99.35	45.2	54	98.42	98.35	98.41	0.94
MH_201	MH_202	321	105.28	8.5	120	105.41	104.42	104.49	0.79
MH_201	MH_202	430	107.31	10.7	120	105.41	104.42	104.51	2.80
MH_201	MH_202	431	107.37	16.4	120	105.41	104.42	104.56	2.81
MH_201	MH_202	428	105.36	22.2	120	105.41	104.42	104.61	0.75
MH_201	MH_202	233	107.4	28.8	120	105.41	104.42	104.66	2.74
MH_201	MH_202	429	105.37	33.4	120	105.41	104.42	104.70	0.67
MH_201	MH_202	234	107.46	36.0	120	105.41	104.42	104.72	2.74
MH_201	MH_202	320	105.45	43.6	120	105.41	104.42	104.78	0.67
MH_201	MH_202	235	107.5	48.5	120	105.41	104.42	104.83	2.67
MH_201	MH_202	236	107.62	54.2	120	105.41	104.42	104.87	2.75
MH_201	MH_202	319	105.56	54.8	120	105.41	104.42	104.88	0.68
MH_201	MH_202	318	105.66	65.0	120	105.41	104.42	104.96	0.70
MH_201	MH_202	237	107.69	67.4	120	105.41	104.42	104.98	2.71
MH_201	MH_202	238	107.8	73.1	120	105.41	104.42	105.03	2.77
MH_201	MH_202	317	105.77	76.1	120	105.41	104.42	105.05	0.72
MH_201	MH_202	239	107.87	85.5	120	105.41	104.42	105.13	2.74
MH_201	MH_202	316	105.9	88.3	120	105.41	104.42	105.15	0.75
MH_201	MH_202	240	107.99	92.7	120	105.41	104.42	105.19	2.80
MH_201	MH_202	315	106.02	99.7	120	105.41	104.42	105.25	0.77
MH_201	MH_202	241	108.06	105.2	120	105.41	104.42	105.30	2.76
MH_201	MH_202	242	108.16	110.9	120	105.41	104.42	105.34	2.82
MH_201	MH_202	314	106.13	113.9	120	105.41	104.42	105.37	0.76
MH_202	MH_203	230	105.39	3.3	14	104.42	104.35	104.36	1.03
MH_202	MH_203	231	106.96	9.7	14	104.42	104.35	104.40	2.56
MH_202	MH_203	232	107.27	11.7	14	104.42	104.35	104.41	2.86
MH_203	MH_206	225	104.9	1.9	54	104.35	103.77	103.79	1.11
MH_203	MH_206	226	105.06	12.1	54	104.35	103.77	103.90	1.16
MH_203	MH_206	227	105.11	24.3	54	104.35	103.77	104.03	1.08
MH_203	MH_206	228	105.11	34.9	54	104.35	103.77	104.14	0.97
MH_203	MH_206	229	105.13	45.6	54	104.35	103.77	104.25	0.88
MH_204	MH_205	293	104.81	3.0	118	103.96	103.85	103.86	0.95
MH_204	MH_205	292	104.65	4.1	118	103.96	103.85	103.86	0.79
MH_204	MH_205	426	104.89	12.3	118	103.96	103.85	103.86	1.03
MH_204	MH_205	424	104.71	18.3	118	103.96	103.85	103.87	0.84

Table F2: USF Freeboard Results - 100-Year SCS 24 Hour Event

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH_204	MH_205	427	104.89	23.4	118	103.96	103.85	103.87	1.02
MH_204	MH_205	425	104.76	27.4	118	103.96	103.85	103.88	0.88
MH_204	MH_205	294	104.86	33.6	118	103.96	103.85	103.88	0.98
MH_204	MH_205	291	104.81	37.6	118	103.96	103.85	103.89	0.92
MH_204	MH_205	295	104.92	44.7	118	103.96	103.85	103.89	1.03
MH_204	MH_205	290	104.87	48.7	118	103.96	103.85	103.90	0.97
MH_204	MH_205	296	104.92	54.9	118	103.96	103.85	103.90	1.02
MH_204	MH_205	289	104.83	61.8	118	103.96	103.85	103.91	0.92
MH_204	MH_205	297	104.87	66.2	118	103.96	103.85	103.91	0.96
MH_204	MH_205	288	104.83	72.3	118	103.96	103.85	103.92	0.91
MH_204	MH_205	298	104.86	80.4	118	103.96	103.85	103.93	0.93
MH_204	MH_205	287	104.77	86.5	118	103.96	103.85	103.93	0.84
MH_204	MH_205	299	104.82	91.8	118	103.96	103.85	103.94	0.88
MH_204	MH_205	286	104.7	100.4	118	103.96	103.85	103.94	0.76
MH_204	MH_205	300	104.72	106.3	118	103.96	103.85	103.95	0.77
MH_206	MH_207	221	104.52	5.5	50	103.77	103.33	103.38	1.14
MH_206	MH_207	222	104.57	16.7	50	103.77	103.33	103.48	1.09
MH_206	MH_207	223	104.65	26.9	50	103.77	103.33	103.57	1.08
MH_206	MH_207	224	104.77	38.0	50	103.77	103.33	103.66	1.11
MH_207	MH_208	219	104.39	4.9	13	103.33	103.00	103.13	1.26
MH_207	MH_208	220	104.46	10.7	13	103.33	103.00	103.28	1.18
MH_208	MH_215	212	102.46	12.7	112	103.00	101.29	101.49	0.97
MH_208	MH_215	271	102.46	14.8	112	103.00	101.29	101.52	0.94
MH_208	MH_215	213	102.68	24.9	112	103.00	101.29	101.67	1.01
MH_208	MH_215	270	102.67	26.2	112	103.00	101.29	101.69	0.98
MH_208	MH_215	214	102.89	35.1	112	103.00	101.29	101.83	1.06
MH_208	MH_215	269	102.93	38.4	112	103.00	101.29	101.88	1.05
MH_208	MH_215	215	103.1	46.2	112	103.00	101.29	102.00	1.10
MH_208	MH_215	268	103.18	49.5	112	103.00	101.29	102.05	1.13
MH_208	MH_215	216	103.36	58.4	112	103.00	101.29	102.19	1.17
MH_208	MH_215	267	103.42	59.7	112	103.00	101.29	102.21	1.21
MH_208	MH_215	217	103.62	69.8	112	103.00	101.29	102.36	1.26
MH_208	MH_215	266	103.68	70.9	112	103.00	101.29	102.38	1.30
MH_208	MH_215	423	103.94	80.8	112	103.00	101.29	102.53	1.41
MH_208	MH_215	421	103.83	82.0	112	103.00	101.29	102.55	1.28
MH_208	MH_215	422	104.04	91.9	112	103.00	101.29	102.70	1.34
MH_208	MH_215	420	104.04	93.2	112	103.00	101.29	102.72	1.32
MH_208	MH_215	265	104.35	103.6	112	103.00	101.29	102.88	1.47
MH_208	MH_215	218	104.3	105.6	112	103.00	101.29	102.91	1.39
MH_209	MH_201	243	108.2	4.5	94	105.83	105.41	105.43	2.77
MH_209	MH_201	244	108.3	10.2	94	105.83	105.41	105.46	2.84
MH_209	MH_201	313	106.24	10.6	94	105.83	105.41	105.46	0.78
MH_209	MH_201	245	108.34	23.4	94	105.83	105.41	105.52	2.82
MH_209	MH_201	312	106.36	25.8	94	105.83	105.41	105.53	0.83
MH_209	MH_201	246	108.44	29.1	94	105.83	105.41	105.54	2.90
MH_209	MH_201	311	106.45	40.1	94	105.83	105.41	105.59	0.86
MH_209	MH_201	247	108.49	42.3	94	105.83	105.41	105.60	2.89
MH_209	MH_201	248	108.57	48.0	94	105.83	105.41	105.63	2.94
MH_209	MH_201	310	106.53	51.5	94	105.83	105.41	105.64	0.89
MH_209	MH_201	249	108.61	61.2	94	105.83	105.41	105.69	2.92
MH_209	MH_201	309	106.58	63.7	94	105.83	105.41	105.70	0.88
MH_209	MH_201	250	108.67	66.9	94	105.83	105.41	105.71	2.96
MH_209	MH_201	308	106.63	74.8	94	105.83	105.41	105.75	0.88
MH_209	MH_201	251	108.7	79.4	94	105.83	105.41	105.77	2.93
MH_209	MH_201	307	106.63	85.0	94	105.83	105.41	105.79	0.84
MH_209	MH_201	252	108.76	86.6	94	105.83	105.41	105.80	2.96
MH_209	MH_210	254	108.31	7.1	13	105.83	105.59	105.72	2.59
MH_209	MH_210	253	108.73	10.0	13	105.83	105.59	105.77	2.96
MH_210	MH_212	258	105.12	15.6	54	105.59	103.58	104.16	0.96
MH_210	MH_212	257	105.54	27.3	54	105.59	103.58	104.60	0.94
MH_210	MH_212	256	106.05	38.6	54	105.59	103.58	105.02	1.03
MH_210	MH_212	255	106.58	48.8	54	105.59	103.58	105.40	1.18
MH_212	MH_204	285	104.64	2.7	92	103.58	103.96	103.95	0.69
MH_212	MH_204	301	104.77	9.6	92	103.58	103.96	103.92	0.85
MH_212	MH_204	284	104.71	19.0	92	103.58	103.96	103.88	0.83
MH_212	MH_204	302	104.8	24.9	92	103.58	103.96	103.86	0.94
MH_212	MH_204	283	104.78	34.1	92	103.58	103.96	103.82	0.96
MH_212	MH_204	303	104.92	40.7	92	103.58	103.96	103.79	1.13
MH_212	MH_204	282	104.84	44.6	92	103.58	103.96	103.78	1.06
MH_212	MH_204	304	104.96	55.4	92	103.58	103.96	103.73	1.23
MH_212	MH_204	281	104.91	58.8	92	103.58	103.96	103.72	1.19
MH_212	MH_204	305	105.09	68.9	92	103.58	103.96	103.68	1.41
MH_212	MH_204	280	104.96	69.8	92	103.58	103.96	103.67	1.29
MH_212	MH_204	279	104.96	82.3	92	103.58	103.96	103.62	1.34
MH_212	MH_204	306	105.11	82.6	92	103.58	103.96	103.62	1.49
MH_212	MH_213	203	104.1	3.4	50	103.58	103.23	103.26	0.84
MH_212	MH_213	202	104.35	11.8	50	103.58	103.23	103.32	1.03

Table F2: USF Freeboard Results - 100-Year SCS 24 Hour Event

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH_212	MH_213	201	104.6	23.2	50	103.58	103.23	103.39	1.21
MH_212	MH_213	200	104.77	36.9	50	103.58	103.23	103.49	1.28
MH_213	MH_214	204	104.02	7.2	13	103.23	103.05	103.15	0.87
MH_214	MH_215	272	102.37	7.0	90	103.05	101.29	101.43	0.94
MH_214	MH_215	273	102.59	15.4	90	103.05	101.29	101.59	1.00
MH_214	MH_215	211	102.46	15.7	90	103.05	101.29	101.60	0.86
MH_214	MH_215	210	102.68	27.9	90	103.05	101.29	101.84	0.84
MH_214	MH_215	274	102.86	30.1	90	103.05	101.29	101.88	0.98
MH_214	MH_215	209	102.89	38.1	90	103.05	101.29	102.04	0.85
MH_214	MH_215	275	103.11	45.9	90	103.05	101.29	102.19	0.92
MH_214	MH_215	208	103.15	49.4	90	103.05	101.29	102.26	0.89
MH_214	MH_215	276	103.37	60.4	90	103.05	101.29	102.48	0.89
MH_214	MH_215	207	103.4	63.6	90	103.05	101.29	102.54	0.86
MH_214	MH_215	277	103.55	71.6	90	103.05	101.29	102.69	0.86
MH_214	MH_215	206	103.66	75.0	90	103.05	101.29	102.76	0.90
MH_214	MH_215	278	103.64	83.3	90	103.05	101.29	102.92	0.72
MH_214	MH_215	205	103.83	85.5	90	103.05	101.29	102.97	0.86
MH_216	MH_217	335	106.02	0.2	76	105.51	105.09	105.09	0.93
MH_216	MH_217	348	105.98	4.0	76	105.51	105.09	105.12	0.86
MH_216	MH_217	336	106.02	11.5	76	105.51	105.09	105.16	0.86
MH_216	MH_217	347	105.92	18.2	76	105.51	105.09	105.19	0.73
MH_216	MH_217	337	106.01	25.7	76	105.51	105.09	105.23	0.78
MH_216	MH_217	346	105.85	29.5	76	105.51	105.09	105.26	0.59
MH_216	MH_217	338	106.05	37.1	76	105.51	105.09	105.30	0.75
MH_216	MH_217	345	105.92	39.7	76	105.51	105.09	105.31	0.61
MH_216	MH_217	344	105.98	50.9	76	105.51	105.09	105.37	0.61
MH_216	MH_217	339	106.1	51.3	76	105.51	105.09	105.38	0.72
MH_216	MH_217	343	106.04	61.1	76	105.51	105.09	105.43	0.61
MH_216	MH_217	340	106.1	62.6	76	105.51	105.09	105.44	0.66
MH_216	MH_217	342	106.04	73.2	76	105.51	105.09	105.50	0.54
MH_216	MH_217	341	106.39	74.3	76	105.51	105.09	105.50	0.89
MH_217	MH_218	356	105.71	5.1	113	105.09	104.93	104.93	0.78
MH_217	MH_218	328	105.81	10.1	113	105.09	104.93	104.94	0.87
MH_217	MH_218	355	105.78	19.3	113	105.09	104.93	104.96	0.82
MH_217	MH_218	329	105.94	24.6	113	105.09	104.93	104.96	0.98
MH_217	MH_218	354	105.85	33.8	113	105.09	104.93	104.98	0.87
MH_217	MH_218	330	105.94	40.3	113	105.09	104.93	104.99	0.95
MH_217	MH_218	353	105.93	47.5	113	105.09	104.93	105.00	0.93
MH_217	MH_218	331	105.96	55.0	113	105.09	104.93	105.01	0.95
MH_217	MH_218	352	106	63.3	113	105.09	104.93	105.02	0.98
MH_217	MH_218	332	106.04	70.3	113	105.09	104.93	105.03	1.01
MH_217	MH_218	351	106.08	78.0	113	105.09	104.93	105.04	1.04
MH_217	MH_218	333	106.08	85.5	113	105.09	104.93	105.05	1.03
MH_217	MH_218	350	106.08	90.9	113	105.09	104.93	105.06	1.02
MH_217	MH_218	334	106.08	99.1	113	105.09	104.93	105.07	1.01
MH_217	MH_218	349	106.05	105.8	113	105.09	104.93	105.08	0.97
MH_218	MH_220	362	105.77	15.7	81	104.93	103.89	104.10	1.67
MH_218	MH_220	322	106.2	16.4	81	104.93	103.89	104.10	2.10
MH_218	MH_220	361	105.87	27.4	81	104.93	103.89	104.25	1.62
MH_218	MH_220	323	105.94	28.1	81	104.93	103.89	104.25	1.69
MH_218	MH_220	360	105.87	38.5	81	104.93	103.89	104.39	1.48
MH_218	MH_220	324	105.88	39.4	81	104.93	103.89	104.40	1.48
MH_218	MH_220	359	105.86	48.7	81	104.93	103.89	104.52	1.34
MH_218	MH_220	325	105.92	53.6	81	104.93	103.89	104.58	1.34
MH_218	MH_220	358	105.81	60.0	81	104.93	103.89	104.66	1.15
MH_218	MH_220	326	105.92	65.0	81	104.93	103.89	104.73	1.19
MH_218	MH_220	357	105.75	74.2	81	104.93	103.89	104.85	0.90
MH_218	MH_220	327	105.82	79.2	81	104.93	103.89	104.91	0.91
MH_219	MH_220	263	106.53	8.5	25	105.65	103.89	104.50	2.03
MH_219	MH_220	264	108.04	22.7	25	105.65	103.89	105.50	2.54
MH_220	MH_224	259	104.74	16.3	59	103.89	102.03	102.54	2.20
MH_220	MH_224	260	105.06	28.5	59	103.89	102.03	102.93	2.13
MH_220	MH_224	261	105.61	43.3	59	103.89	102.03	103.39	2.22
MH_220	MH_224	262	106.07	54.7	59	103.89	102.03	103.76	2.31
MH_221	MH_222	396-5	103.56	6.9	78	103.09	102.81	102.84	0.72
MH_221	MH_222	396-4	103.56	14.9	78	103.09	102.81	102.86	0.70
MH_221	MH_222	396-3	103.56	22.1	78	103.09	102.81	102.89	0.67
MH_221	MH_222	396-2	103.56	30.1	78	103.09	102.81	102.92	0.64
MH_221	MH_222	396-1	103.56	39.5	78	103.09	102.81	102.95	0.61
MH_221	MH_222	395-5	103.91	48.4	78	103.09	102.81	102.98	0.93
MH_221	MH_222	395-4	103.91	56.0	78	103.09	102.81	103.01	0.90
MH_221	MH_222	395-3	104.7	64.0	78	103.09	102.81	103.04	1.66
MH_221	MH_222	395-2	104.51	71.2	78	103.09	102.81	103.06	1.45
MH_221	MH_222	395-1	104.7	77.6	78	103.09	102.81	103.09	1.61
MH_222	MH_223	365-2	103.42	2.1	95	102.81	102.71	102.71	0.71
MH_222	MH_223	399-3	103.51	3.9	95	102.81	102.71	102.71	0.80
MH_222	MH_223	365-3	103.42	9.4	95	102.81	102.71	102.72	0.70

Table F2: USF Freeboard Results - 100-Year SCS 24 Hour Event

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH_222	MH_223	399-2	103.51	11.9	95	102.81	102.71	102.72	0.79
MH_222	MH_223	365-4	103.42	17.4	95	102.81	102.71	102.73	0.69
MH_222	MH_223	399-1	103.51	19.5	95	102.81	102.71	102.73	0.78
MH_222	MH_223	366-1	103.37	28.0	95	102.81	102.71	102.74	0.63
MH_222	MH_223	398-5	103.52	30.2	95	102.81	102.71	102.74	0.78
MH_222	MH_223	366-2	103.37	36.0	95	102.81	102.71	102.75	0.62
MH_222	MH_223	398-4	103.52	38.2	95	102.81	102.71	102.75	0.77
MH_222	MH_223	366-3	103.37	43.3	95	102.81	102.71	102.75	0.62
MH_222	MH_223	398-3	103.52	45.4	95	102.81	102.71	102.76	0.76
MH_222	MH_223	366-4	103.37	51.3	95	102.81	102.71	102.76	0.61
MH_222	MH_223	398-2	103.52	53.4	95	102.81	102.71	102.77	0.75
MH_222	MH_223	398-1	103.52	61.1	95	102.81	102.71	102.77	0.75
MH_222	MH_223	397-3	103.54	71.7	95	102.81	102.71	102.79	0.75
MH_222	MH_223	397-2	103.54	79.7	95	102.81	102.71	102.79	0.75
MH_222	MH_223	397-1	103.54	87.3	95	102.81	102.71	102.80	0.74
MH_223	MH_224	363-1	103.63	16.0	97	102.71	102.03	102.14	1.49
MH_223	MH_224	401-5	104.22	18.1	97	102.71	102.03	102.15	2.07
MH_223	MH_224	363-2	103.63	24.0	97	102.71	102.03	102.19	1.44
MH_223	MH_224	401-4	104.22	26.1	97	102.71	102.03	102.21	2.01
MH_223	MH_224	363-3	103.63	31.2	97	102.71	102.03	102.24	1.39
MH_223	MH_224	401-3	104.22	33.4	97	102.71	102.03	102.26	1.96
MH_223	MH_224	363-4	103.63	39.2	97	102.71	102.03	102.30	1.33
MH_223	MH_224	401-2	104.07	41.4	97	102.71	102.03	102.32	1.75
MH_223	MH_224	401-1	104.07	49.0	97	102.71	102.03	102.37	1.70
MH_223	MH_224	364-1	103.63	49.8	97	102.71	102.03	102.37	1.26
MH_223	MH_224	364-2	103.63	57.8	97	102.71	102.03	102.43	1.20
MH_223	MH_224	400-5	103.58	59.6	97	102.71	102.03	102.44	1.14
MH_223	MH_224	364-3	103.63	65.1	97	102.71	102.03	102.48	1.15
MH_223	MH_224	400-4	103.58	67.6	97	102.71	102.03	102.50	1.08
MH_223	MH_224	364-4	103.63	73.1	97	102.71	102.03	102.54	1.09
MH_223	MH_224	400-3	103.58	74.9	97	102.71	102.03	102.55	1.03
MH_223	MH_224	364-5	103.63	80.7	97	102.71	102.03	102.59	1.04
MH_223	MH_224	400-2	103.58	82.9	97	102.71	102.03	102.61	0.97
MH_223	MH_224	400-1	103.58	90.5	97	102.71	102.03	102.66	0.92
MH_223	MH_224	365-1	103.42	91.3	97	102.71	102.03	102.67	0.75
MH_224	MH_105	141	101.9	11.6	82	102.03	100.01	100.30	1.60
MH_224	MH_105	140	102.18	25.8	82	102.03	100.01	100.65	1.53
MH_224	MH_105	139	102.55	37.0	82	102.03	100.01	100.92	1.63
MH_224	MH_105	138	102.92	47.2	82	102.03	100.01	101.17	1.75
MH_224	MH_105	137	103.3	58.4	82	102.03	100.01	101.45	1.85
MH_224	MH_105	136	103.81	71.8	82	102.03	100.01	101.78	2.03
MH_225	MH_226	389-2	103.58	5.9	87	103.85	102.61	102.70	0.88
MH_225	MH_226	389-1	103.74	13.9	87	103.85	102.61	102.81	0.93
MH_225	MH_226	388-3	103.75	24.5	87	103.85	102.61	102.96	0.79
MH_225	MH_226	388-2	103.88	32.2	87	103.85	102.61	103.07	0.81
MH_225	MH_226	388-1	103.88	40.2	87	103.85	102.61	103.18	0.70
MH_225	MH_226	387-4	104.02	50.8	87	103.85	102.61	103.33	0.69
MH_225	MH_226	387-3	104.02	58.8	87	103.85	102.61	103.45	0.57
MH_225	MH_226	387-2	104.02	66.0	87	103.85	102.61	103.55	0.47
MH_225	MH_226	387-1	104.02	74.0	87	103.85	102.61	103.66	0.36
MH_226	MH_2260	391-4	102.73	19.0	64	102.61	101.40	101.76	0.97
MH_226	MH_2260	391-3	102.73	27.0	64	102.61	101.40	101.91	0.82
MH_226	MH_2260	391-2	102.73	34.3	64	102.61	101.40	102.05	0.68
MH_226	MH_2260	391-1	102.73	42.3	64	102.61	101.40	102.20	0.53
MH_226	MH_2260	390-3	103.12	52.9	64	102.61	101.40	102.40	0.72
MH_226	MH_2260	390-2	103.12	60.9	64	102.61	101.40	102.56	0.56
MH_226	MH_2260	390-1	103.12	61.0	64	102.61	101.40	102.56	0.56
MH_226	MH_2260	389-4	103.58	62.5	64	102.61	101.40	102.59	0.99
MH_226	MH_2260	389-3	103.58	63.0	64	102.61	101.40	102.60	0.98
MH_2260	MH_227	392-2	102.29	3.6	50	101.40	101.13	101.15	1.14
MH_2260	MH_227	392-1	102.29	11.6	50	101.40	101.13	101.19	1.10
MH_227	MH_109	394-4	101.34	19.3	93	101.13	99.74	100.03	1.31
MH_227	MH_109	394-3	101.34	27.3	93	101.13	99.74	100.15	1.19
MH_227	MH_109	394-2	101.61	34.6	93	101.13	99.74	100.25	1.36
MH_227	MH_109	394-1	101.61	42.6	93	101.13	99.74	100.37	1.24
MH_227	MH_109	393-3	102.29	54.2	93	101.13	99.74	100.55	1.74
MH_227	MH_109	393-2	102.29	61.8	93	101.13	99.74	100.66	1.63
MH_227	MH_109	393-1	102.29	69.8	93	101.13	99.74	100.78	1.51
MH_227	MH_109	392-4	102.29	81.5	93	101.13	99.74	100.96	1.33
MH_227	MH_109	392-3	102.29	89.5	93	101.13	99.74	101.08	1.21
MH_228	MH_229	384-3	102.12	2.3	75	102.61	101.06	101.11	1.01
MH_228	MH_229	379-2	102.14	3.4	75	102.61	101.06	101.13	1.01
MH_228	MH_229	384-4	102.12	10.3	75	102.61	101.06	101.28	0.84
MH_228	MH_229	379-1	102.14	11.4	75	102.61	101.06	101.30	0.84
MH_228	MH_229	385-1	102.35	20.9	75	102.61	101.06	101.50	0.85
MH_228	MH_229	378-3	102.57	22.1	75	102.61	101.06	101.52	1.05
MH_228	MH_229	385-2	102.65	28.5	75	102.61	101.06	101.65	1.00

Table F2: USF Freeboard Results - 100-Year SCS 24 Hour Event

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH_228	MH_229	378-2	102.67	29.7	75	102.61	101.06	101.68	0.99
MH_228	MH_229	385-3	102.65	36.5	75	102.61	101.06	101.82	0.83
MH_228	MH_229	378-1	102.67	37.7	75	102.61	101.06	101.85	0.82
MH_228	MH_229	386-1	102.73	47.2	75	102.61	101.06	102.04	0.69
MH_228	MH_229	377-4	103.02	48.3	75	102.61	101.06	102.07	0.95
MH_228	MH_229	386-2	103.08	55.2	75	102.61	101.06	102.21	0.87
MH_228	MH_229	377-3	103.28	56.3	75	102.61	101.06	102.23	1.05
MH_228	MH_229	386-3	103.08	62.4	75	102.61	101.06	102.36	0.72
MH_228	MH_229	377-2	103.34	63.6	75	102.61	101.06	102.38	0.96
MH_228	MH_229	386-4	103.47	70.4	75	102.61	101.06	102.53	0.94
MH_228	MH_229	377-1	103.34	71.6	75	102.61	101.06	102.55	0.79
MH_229	MH_102	382-1	101.52	13.6	87	101.06	100.19	100.32	1.20
MH_229	MH_102	381-4	101.35	14.8	87	101.06	100.19	100.34	1.01
MH_229	MH_102	382-2	101.52	21.6	87	101.06	100.19	100.41	1.11
MH_229	MH_102	381-3	101.35	22.8	87	101.06	100.19	100.42	0.93
MH_229	MH_102	382-3	101.52	28.8	87	101.06	100.19	100.48	1.04
MH_229	MH_102	381-2	101.35	30.0	87	101.06	100.19	100.49	0.86
MH_229	MH_102	382-4	101.52	36.8	87	101.06	100.19	100.56	0.96
MH_229	MH_102	381-1	101.35	38.0	87	101.06	100.19	100.57	0.78
MH_229	MH_102	383-1	101.62	47.5	87	101.06	100.19	100.67	0.95
MH_229	MH_102	380-3	101.59	48.6	87	101.06	100.19	100.68	0.91
MH_229	MH_102	383-2	101.62	55.5	87	101.06	100.19	100.75	0.87
MH_229	MH_102	380-2	101.59	56.6	87	101.06	100.19	100.76	0.83
MH_229	MH_102	383-3	101.62	63.1	87	101.06	100.19	100.82	0.80
MH_229	MH_102	380-1	101.59	64.3	87	101.06	100.19	100.84	0.75
MH_229	MH_102	384-1	101.74	73.7	87	101.06	100.19	100.93	0.81
MH_229	MH_102	379-4	101.96	74.9	87	101.06	100.19	100.94	1.02
MH_229	MH_102	384-2	101.74	81.7	87	101.06	100.19	101.01	0.73
MH_229	MH_102	379-3	101.96	82.9	87	101.06	100.19	101.02	0.94
MH_230	MH_231	374-3	102.03	2.4	73	102.55	100.97	101.02	1.01
MH_230	MH_231	368-3	102.24	5.1	73	102.55	100.97	101.08	1.16
MH_230	MH_231	374-4	102.03	10.4	73	102.55	100.97	101.20	0.83
MH_230	MH_231	368-2	102.24	13.1	73	102.55	100.97	101.25	0.99
MH_230	MH_231	368-1	102.24	20.7	73	102.55	100.97	101.42	0.82
MH_230	MH_231	375-1	102.4	21.1	73	102.55	100.97	101.42	0.98
MH_230	MH_231	375-2	102.57	28.7	73	102.55	100.97	101.59	0.98
MH_230	MH_231	367-3	102.71	31.3	73	102.55	100.97	101.64	1.07
MH_230	MH_231	375-3	102.57	36.7	73	102.55	100.97	101.76	0.81
MH_230	MH_231	367-2	102.71	39.3	73	102.55	100.97	101.81	0.90
MH_230	MH_231	367-1	102.71	47.0	73	102.55	100.97	101.98	0.73
MH_230	MH_231	376-1	103	47.3	73	102.55	100.97	101.99	1.01
MH_230	MH_231	376-2	103	55.3	73	102.55	100.97	102.16	0.84
MH_230	MH_231	376-3	103.37	62.6	73	102.55	100.97	102.31	1.06
MH_230	MH_231	376-4	103.37	70.6	73	102.55	100.97	102.49	0.88
MH_231	MH_103	371-3	100.56	13.1	87	100.97	99.44	99.67	0.89
MH_231	MH_103	372-1	100.95	13.8	87	100.97	99.44	99.68	1.27
MH_231	MH_103	371-2	100.56	21.1	87	100.97	99.44	99.81	0.75
MH_231	MH_103	372-2	100.95	21.8	87	100.97	99.44	99.82	1.13
MH_231	MH_103	371-1	100.56	28.7	87	100.97	99.44	99.94	0.62
MH_231	MH_103	372-3	100.95	29.1	87	100.97	99.44	99.95	1.00
MH_231	MH_103	372-4	100.95	37.1	87	100.97	99.44	100.09	0.86
MH_231	MH_103	370-3	101.09	39.3	87	100.97	99.44	100.13	0.96
MH_231	MH_103	370-2	101.09	47.3	87	100.97	99.44	100.27	0.82
MH_231	MH_103	373-1	100.97	47.7	87	100.97	99.44	100.28	0.69
MH_231	MH_103	370-1	101.09	54.9	87	100.97	99.44	100.41	0.68
MH_231	MH_103	373-2	101.39	55.7	87	100.97	99.44	100.42	0.97
MH_231	MH_103	373-3	101.39	63.3	87	100.97	99.44	100.56	0.83
MH_231	MH_103	369-3	101.61	65.6	87	100.97	99.44	100.60	1.01
MH_231	MH_103	369-2	101.61	73.6	87	100.97	99.44	100.74	0.87
MH_231	MH_103	374-1	101.56	74.0	87	100.97	99.44	100.75	0.81
MH_231	MH_103	369-1	101.61	81.2	87	100.97	99.44	100.87	0.74
MH_231	MH_103	374-2	101.56	82.0	87	100.97	99.44	100.89	0.67

Key:

- (Yellow) Freeboard to USF less than 0.30 m
- (Red) Freeboard to USF less than 0.00 m

Min	0.36
Max	2.96
Average	0.95

Table F3: USF Freeboard Results - 100-Year Chicago 3 Hour Event +20%

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH_105	MH_106	148	100.03	12.7	91	100.15	99.43	99.53	0.50
MH_105	MH_106	147	100.16	24.9	91	100.15	99.43	99.62	0.54
MH_105	MH_106	146	100.3	35.1	91	100.15	99.43	99.71	0.59
MH_105	MH_106	145	100.42	46.4	91	100.15	99.43	99.80	0.62
MH_105	MH_106	144	100.56	60.6	91	100.15	99.43	99.91	0.65
MH_105	MH_106	143	100.93	74.3	91	100.15	99.43	100.02	0.91
MH_105	MH_106	142	101.5	89.0	91	100.15	99.43	100.14	1.36
MH_106	MH_116	156	99.69	17.5	122	99.43	99.14	99.18	0.51
MH_106	MH_116	166-1	99.53	19.1	122	99.43	99.14	99.18	0.35
MH_106	MH_116	166-2	99.53	27.1	122	99.43	99.14	99.20	0.33
MH_106	MH_116	155	99.69	29.2	122	99.43	99.14	99.21	0.48
MH_106	MH_116	166-3	99.53	34.3	122	99.43	99.14	99.22	0.31
MH_106	MH_116	154	99.59	40.4	122	99.43	99.14	99.23	0.36
MH_106	MH_116	166-4	99.53	42.3	122	99.43	99.14	99.24	0.29
MH_106	MH_116	153	99.56	50.6	122	99.43	99.14	99.26	0.30
MH_106	MH_116	167-1	99.61	52.9	122	99.43	99.14	99.26	0.35
MH_106	MH_116	167-2	99.61	60.6	122	99.43	99.14	99.28	0.33
MH_106	MH_116	152	99.6	61.8	122	99.43	99.14	99.28	0.32
MH_106	MH_116	167-3	99.61	68.6	122	99.43	99.14	99.30	0.31
MH_106	MH_116	151	99.73	76.3	122	99.43	99.14	99.32	0.41
MH_106	MH_116	168-1	99.73	79.2	122	99.43	99.14	99.32	0.41
MH_106	MH_116	168-2	99.73	87.2	122	99.43	99.14	99.34	0.39
MH_106	MH_116	150	99.81	92.1	122	99.43	99.14	99.35	0.46
MH_106	MH_116	168-3	99.73	94.4	122	99.43	99.14	99.36	0.37
MH_106	MH_116	168-4	99.73	102.4	122	99.43	99.14	99.38	0.35
MH_106	MH_116	149	99.81	106.0	122	99.43	99.14	99.39	0.42
MH_107	MH_108	176-1	100.1	3.5	13	99.80	99.89	99.86	0.24
MH_107	MH_108	176-2	100.1	6.3	13	99.80	99.89	99.85	0.25
MH_107	MH_108	176-3	100.1	9.3	13	99.80	99.89	99.83	0.27
MH_107	MH_112	185-1	99.89	1.3	74	99.80	99.68	99.68	0.21
MH_107	MH_112	178-4	100	3.8	74	99.80	99.68	99.69	0.31
MH_107	MH_112	185-2	99.89	9.3	74	99.80	99.68	99.69	0.20
MH_107	MH_112	178-3	100	11.8	74	99.80	99.68	99.70	0.30
MH_107	MH_112	185-3	99.89	16.5	74	99.80	99.68	99.71	0.18
MH_107	MH_112	178-2	100	19.0	74	99.80	99.68	99.71	0.29
MH_107	MH_112	185-4	99.89	24.5	74	99.80	99.68	99.72	0.17
MH_107	MH_112	178-1	100	27.0	74	99.80	99.68	99.72	0.28
MH_107	MH_112	185-5	99.89	32.2	74	99.80	99.68	99.73	0.16
MH_107	MH_112	177-5	100.04	37.7	74	99.80	99.68	99.74	0.30
MH_107	MH_112	186-1	99.91	42.8	74	99.80	99.68	99.75	0.16
MH_107	MH_112	177-4	100.04	45.3	74	99.80	99.68	99.75	0.29
MH_107	MH_112	186-2	99.91	50.8	74	99.80	99.68	99.76	0.15
MH_107	MH_112	177-3	100.04	53.3	74	99.80	99.68	99.77	0.27
MH_107	MH_112	186-3	99.91	58.0	74	99.80	99.68	99.77	0.14
MH_107	MH_112	177-2	100.04	60.5	74	99.80	99.68	99.78	0.26
MH_107	MH_112	186-4	99.91	66.0	74	99.80	99.68	99.79	0.12
MH_107	MH_112	177-1	100.04	68.5	74	99.80	99.68	99.79	0.25
MH_108	MH_110	175-1	100.15	16.1	54	99.89	99.89	99.89	0.26
MH_108	MH_110	175-2	100.15	24.1	54	99.89	99.89	99.89	0.26
MH_108	MH_110	175-3	100.15	31.3	54	99.89	99.89	99.89	0.26
MH_108	MH_110	175-4	100.15	39.3	54	99.89	99.89	99.89	0.26
MH_108	MH_110	175-5	100.15	46.9	54	99.89	99.89	99.89	0.26
MH_109	MH_110	164-2	100.2	1.8	60	100.32	99.89	99.90	0.30
MH_109	MH_110	164-3	100.2	6.6	60	100.32	99.89	99.93	0.27
MH_109	MH_110	164-4	100.2	14.6	60	100.32	99.89	99.99	0.21
MH_109	MH_110	165-1	100.43	25.3	60	100.32	99.89	100.07	0.36
MH_109	MH_110	165-2	100.43	32.9	60	100.32	99.89	100.12	0.31
MH_109	MH_110	165-3	100.43	40.9	60	100.32	99.89	100.18	0.25
MH_110	MH_111	188-4	99.86	2.1	75	99.89	99.60	99.60	0.26
MH_110	MH_111	162-1	99.74	6.3	75	99.89	99.60	99.62	0.12
MH_110	MH_111	188-3	99.86	9.3	75	99.89	99.60	99.63	0.23
MH_110	MH_111	162-2	99.75	14.3	75	99.89	99.60	99.65	0.10
MH_110	MH_111	188-2	99.86	17.3	75	99.89	99.60	99.66	0.20
MH_110	MH_111	162-3	99.75	21.5	75	99.89	99.60	99.68	0.07
MH_110	MH_111	188-1	99.86	24.9	75	99.89	99.60	99.69	0.17
MH_110	MH_111	162-4	99.75	29.5	75	99.89	99.60	99.71	0.04
MH_110	MH_111	187-4	99.86	35.6	75	99.89	99.60	99.73	0.13
MH_110	MH_111	163-1	99.83	40.1	75	99.89	99.60	99.75	0.08
MH_110	MH_111	187-3	99.86	43.6	75	99.89	99.60	99.76	0.10
MH_110	MH_111	163-2	99.83	47.8	75	99.89	99.60	99.78	0.05
MH_110	MH_111	187-2	99.9	50.8	75	99.89	99.60	99.79	0.11
MH_110	MH_111	163-3	99.83	55.8	75	99.89	99.60	99.81	0.02
MH_110	MH_111	187-1	99.9	58.8	75	99.89	99.60	99.82	0.08
MH_110	MH_111	164-1	100.2	66.4	75	99.89	99.60	99.85	0.35
MH_111	MH_115	159-1	99.58	10.7	91	99.60	99.35	99.38	0.20
MH_111	MH_115	190-4	99.7	17.1	91	99.60	99.35	99.39	0.31
MH_111	MH_115	159-2	99.58	18.7	91	99.60	99.35	99.40	0.18

Table F3: USF Freeboard Results - 100-Year Chicago 3 Hour Event +20%

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH_111	MH_115	190-3	99.7	25.1	91	99.60	99.35	99.41	0.29
MH_111	MH_115	159-3	99.58	25.9	91	99.60	99.35	99.42	0.16
MH_111	MH_115	190-2	99.7	32.3	91	99.60	99.35	99.43	0.27
MH_111	MH_115	159-4	99.58	33.9	91	99.60	99.35	99.44	0.14
MH_111	MH_115	190-1	99.7	40.3	91	99.60	99.35	99.46	0.24
MH_111	MH_115	160-1	99.71	44.5	91	99.60	99.35	99.47	0.24
MH_111	MH_115	189-4	99.82	51.0	91	99.60	99.35	99.49	0.33
MH_111	MH_115	160-2	99.71	52.2	91	99.60	99.35	99.49	0.22
MH_111	MH_115	189-3	99.82	59.0	91	99.60	99.35	99.51	0.31
MH_111	MH_115	160-3	99.71	60.2	91	99.60	99.35	99.51	0.20
MH_111	MH_115	189-2	99.82	66.2	91	99.60	99.35	99.53	0.29
MH_111	MH_115	161-1	99.71	70.8	91	99.60	99.35	99.54	0.17
MH_111	MH_115	189-1	99.82	74.2	91	99.60	99.35	99.55	0.27
MH_111	MH_115	161-2	99.71	76.2	91	99.60	99.35	99.55	0.16
MH_111	MH_115	188-5	99.86	84.8	91	99.60	99.35	99.58	0.28
MH_111	MH_115	161-3	99.71	86.4	91	99.60	99.35	99.58	0.13
MH_112	MH_113	180-4	99.8	5.0	74	99.68	99.53	99.54	0.26
MH_112	MH_113	183-1	99.74	7.1	74	99.68	99.53	99.55	0.19
MH_112	MH_113	180-3	99.8	11.2	74	99.68	99.53	99.55	0.25
MH_112	MH_113	183-2	99.74	15.1	74	99.68	99.53	99.56	0.18
MH_112	MH_113	180-2	99.8	19.2	74	99.68	99.53	99.57	0.23
MH_112	MH_113	183-3	99.91	22.3	74	99.68	99.53	99.58	0.33
MH_112	MH_113	180-1	99.8	28.1	74	99.68	99.53	99.59	0.21
MH_112	MH_113	183-4	99.91	30.3	74	99.68	99.53	99.59	0.32
MH_112	MH_113	179-3	99.82	36.1	74	99.68	99.53	99.60	0.22
MH_112	MH_113	184-1	99.91	40.9	74	99.68	99.53	99.61	0.30
MH_112	MH_113	179-2	99.82	45.0	74	99.68	99.53	99.62	0.20
MH_112	MH_113	184-2	99.91	48.9	74	99.68	99.53	99.63	0.28
MH_112	MH_113	179-1	99.82	52.0	74	99.68	99.53	99.64	0.18
MH_112	MH_113	184-3	99.91	56.2	74	99.68	99.53	99.64	0.27
MH_112	MH_113	184-4	99.91	64.2	74	99.68	99.53	99.66	0.25
MH_112	MH_113	178-5	100	69.7	74	99.68	99.53	99.67	0.33
MH_113	MH_114	181-3	99.85	3.4	13	99.53	99.49	99.50	0.35
MH_113	MH_114	181-2	99.85	7.0	13	99.53	99.49	99.51	0.34
MH_113	MH_114	181-1	99.85	8.2	13	99.53	99.49	99.52	0.33
MH_114	MH_115	182-5	99.58	18.5	54	99.49	99.35	99.39	0.19
MH_114	MH_115	182-4	99.58	26.5	54	99.49	99.35	99.41	0.17
MH_114	MH_115	182-3	99.58	33.7	54	99.49	99.35	99.43	0.15
MH_114	MH_115	182-2	99.58	41.7	54	99.49	99.35	99.45	0.13
MH_114	MH_115	182-1	99.6	49.3	54	99.49	99.35	99.47	0.13
MH_115	MH_116	157-1	99.46	17.0	59	99.35	99.14	99.20	0.26
MH_115	MH_116	157-2	99.46	25.0	59	99.35	99.14	99.23	0.23
MH_115	MH_116	157-3	99.46	32.6	59	99.35	99.14	99.25	0.21
MH_115	MH_116	158-1	99.51	43.3	59	99.35	99.14	99.29	0.22
MH_115	MH_116	158-2	99.51	51.3	59	99.35	99.14	99.32	0.19
MH_115	MH_116	158-3	99.51	56.1	59	99.35	99.14	99.34	0.17
MH_116	MH_117	26	99.43	6.8	123	99.14	98.93	98.94	0.49
MH_116	MH_117	10	99.46	12.9	123	99.14	98.93	98.95	0.51
MH_116	MH_117	27	99.43	22.6	123	99.14	98.93	98.97	0.46
MH_116	MH_117	11	99.46	27.6	123	99.14	98.93	98.97	0.49
MH_116	MH_117	28	99.42	37.0	123	99.14	98.93	98.99	0.43
MH_116	MH_117	12	99.41	43.4	123	99.14	98.93	99.00	0.41
MH_116	MH_117	29	99.35	48.5	123	99.14	98.93	99.01	0.34
MH_116	MH_117	13	99.41	57.8	123	99.14	98.93	99.03	0.38
MH_116	MH_117	30	99.32	60.7	123	99.14	98.93	99.03	0.29
MH_116	MH_117	14	99.38	69.1	123	99.14	98.93	99.05	0.33
MH_116	MH_117	31	99.32	71.9	123	99.14	98.93	99.05	0.27
MH_116	MH_117	15	99.47	79.3	123	99.14	98.93	99.06	0.41
MH_116	MH_117	32	99.49	82.1	123	99.14	98.93	99.07	0.42
MH_116	MH_117	16	99.57	90.4	123	99.14	98.93	99.08	0.49
MH_116	MH_117	17	99.84	102.1	123	99.14	98.93	99.10	0.74
MH_117	MH_118	18	99.18	4.5	121	98.93	98.69	98.69	0.49
MH_117	MH_118	2	99.16	7.6	121	98.93	98.69	98.70	0.46
MH_117	MH_118	406	99.18	16.2	121	98.93	98.69	98.72	0.46
MH_117	MH_118	404	99.18	23.0	121	98.93	98.69	98.73	0.45
MH_117	MH_118	407	99.16	25.8	121	98.93	98.69	98.74	0.42
MH_117	MH_118	405	99.18	30.5	121	98.93	98.69	98.75	0.43
MH_117	MH_118	19	99.16	38.0	121	98.93	98.69	98.76	0.40
MH_117	MH_118	3	99.14	40.7	121	98.93	98.69	98.77	0.37
MH_117	MH_118	20	99.11	48.2	121	98.93	98.69	98.78	0.33
MH_117	MH_118	4	99.14	51.8	121	98.93	98.69	98.79	0.35
MH_117	MH_118	21	99.12	59.3	121	98.93	98.69	98.80	0.32
MH_117	MH_118	5	99.22	62.0	121	98.93	98.69	98.81	0.41
MH_117	MH_118	22	99.21	71.5	121	98.93	98.69	98.83	0.38
MH_117	MH_118	6	99.23	73.3	121	98.93	98.69	98.83	0.40
MH_117	MH_118	23	99.22	82.9	121	98.93	98.69	98.85	0.37
MH_117	MH_118	7	99.24	87.7	121	98.93	98.69	98.86	0.38

Table F3: USF Freeboard Results - 100-Year Chicago 3 Hour Event +20%

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH_117	MH_118	24	99.28	97.4	121	98.93	98.69	98.88	0.40
MH_117	MH_118	8	99.31	103.5	121	98.93	98.69	98.89	0.42
MH_117	MH_118	25	99.36	113.2	121	98.93	98.69	98.91	0.45
MH_117	MH_118	9	99.4	118.2	121	98.93	98.69	98.92	0.48
MH_119	MH_120	118	101.07	4.8	103	100.21	99.75	99.77	1.30
MH_119	MH_120	101	100.65	9.0	103	100.21	99.75	99.79	0.86
MH_119	MH_120	418	100.99	17.0	103	100.21	99.75	99.83	1.16
MH_119	MH_120	416	100.7	20.7	103	100.21	99.75	99.84	0.86
MH_119	MH_120	419	100.98	28.2	103	100.21	99.75	99.88	1.10
MH_119	MH_120	417	100.76	31.9	103	100.21	99.75	99.89	0.87
MH_119	MH_120	119	100.98	40.4	103	100.21	99.75	99.93	1.05
MH_119	MH_120	100	100.81	42.5	103	100.21	99.75	99.94	0.87
MH_119	MH_120	120	100.98	51.8	103	100.21	99.75	99.98	1.00
MH_119	MH_120	99	100.86	52.7	103	100.21	99.75	99.99	0.87
MH_119	MH_120	98	100.92	63.9	103	100.21	99.75	100.04	0.88
MH_119	MH_120	121	101.03	66.0	103	100.21	99.75	100.05	0.98
MH_119	MH_120	97	100.97	74.1	103	100.21	99.75	100.08	0.89
MH_119	MH_120	122	101.12	77.4	103	100.21	99.75	100.10	1.02
MH_119	MH_120	96	101.03	85.4	103	100.21	99.75	100.14	0.89
MH_119	MH_120	123	101.12	91.1	103	100.21	99.75	100.16	0.96
MH_119	MH_120	95	101.03	99.6	103	100.21	99.75	100.20	0.83
MH_119	MH_122	130	100.77	3.3	90	100.21	99.68	99.70	1.07
MH_119	MH_122	89	100.62	7.4	90	100.21	99.68	99.73	0.89
MH_119	MH_122	129	100.82	14.1	90	100.21	99.68	99.77	1.05
MH_119	MH_122	90	100.68	21.1	90	100.21	99.68	99.81	0.87
MH_119	MH_122	128	100.88	27.7	90	100.21	99.68	99.85	1.03
MH_119	MH_122	91	100.76	34.7	90	100.21	99.68	99.89	0.87
MH_119	MH_122	127	100.88	39.9	90	100.21	99.68	99.92	0.96
MH_119	MH_122	92	100.84	49.4	90	100.21	99.68	99.97	0.87
MH_119	MH_122	126	100.88	51.1	90	100.21	99.68	99.98	0.90
MH_119	MH_122	125	100.92	61.3	90	100.21	99.68	100.04	0.88
MH_119	MH_122	93	100.91	65.1	90	100.21	99.68	100.07	0.84
MH_119	MH_122	124	100.97	73.4	90	100.21	99.68	100.12	0.85
MH_119	MH_122	94	100.99	79.8	90	100.21	99.68	100.15	0.84
MH_120	MH_121	116	101.03	4.3	14	99.75	99.39	99.50	1.53
MH_120	MH_121	117	101.07	10.9	14	99.75	99.39	99.66	1.41
MH_121	MH_132	106	99.54	7.3	114	99.39	98.77	98.81	0.73
MH_121	MH_132	107	99.71	19.5	114	99.39	98.77	98.87	0.84
MH_121	MH_132	108	99.88	30.6	114	99.39	98.77	98.94	0.94
MH_121	MH_132	109	100.05	40.8	114	99.39	98.77	98.99	1.06
MH_121	MH_132	110	100.15	53.5	114	99.39	98.77	99.06	1.09
MH_121	MH_132	111	100.32	64.9	114	99.39	98.77	99.12	1.20
MH_121	MH_132	112	100.48	77.1	114	99.39	98.77	99.19	1.29
MH_121	MH_132	113	100.57	88.2	114	99.39	98.77	99.25	1.32
MH_121	MH_132	114	100.57	98.4	114	99.39	98.77	99.31	1.26
MH_121	MH_132	115	100.65	109.2	114	99.39	98.77	99.36	1.29
MH_122	MH_123	131	100.61	5.0	13	99.68	99.53	99.59	1.02
MH_123	MH_127	135	99.89	11.7	50	99.53	99.31	99.36	0.53
MH_123	MH_127	134	100.02	23.4	50	99.53	99.31	99.41	0.61
MH_123	MH_127	133	100.23	34.7	50	99.53	99.31	99.46	0.77
MH_123	MH_127	132	100.36	45.3	50	99.53	99.31	99.51	0.85
MH_124	MH_125	82	99.89	5.4	101	99.57	99.52	99.52	0.37
MH_124	MH_125	69	99.84	8.5	101	99.57	99.52	99.53	0.31
MH_124	MH_125	70	99.78	18.7	101	99.57	99.52	99.53	0.25
MH_124	MH_125	81	99.89	19.6	101	99.57	99.52	99.53	0.36
MH_124	MH_125	71	99.78	29.8	101	99.57	99.52	99.54	0.24
MH_124	MH_125	80	99.92	31.0	101	99.57	99.52	99.54	0.38
MH_124	MH_125	72	99.77	40.0	101	99.57	99.52	99.54	0.23
MH_124	MH_125	79	100.04	46.9	101	99.57	99.52	99.55	0.49
MH_124	MH_125	73	99.82	51.2	101	99.57	99.52	99.55	0.27
MH_124	MH_125	78	100.04	54.3	101	99.57	99.52	99.55	0.49
MH_124	MH_125	74	99.88	61.4	101	99.57	99.52	99.55	0.33
MH_124	MH_125	77	100	64.5	101	99.57	99.52	99.55	0.45
MH_124	MH_125	413	99.93	73.5	101	99.57	99.52	99.56	0.37
MH_124	MH_125	415	100.08	75.2	101	99.57	99.52	99.56	0.52
MH_124	MH_125	412	99.98	83.2	101	99.57	99.52	99.56	0.42
MH_124	MH_125	414	100.1	86.3	101	99.57	99.52	99.57	0.53
MH_124	MH_125	75	99.98	94.9	101	99.57	99.52	99.57	0.41
MH_124	MH_125	76	100.16	98.0	101	99.57	99.52	99.57	0.59
MH_125	MH_127	88	99.82	15.9	92	99.52	99.31	99.35	0.47
MH_125	MH_127	63	99.59	16.7	92	99.52	99.31	99.35	0.24
MH_125	MH_127	87	99.82	29.6	92	99.52	99.31	99.38	0.44
MH_125	MH_127	64	99.59	30.4	92	99.52	99.31	99.38	0.21
MH_125	MH_127	86	99.72	41.0	92	99.52	99.31	99.41	0.31
MH_125	MH_127	65	99.58	44.0	92	99.52	99.31	99.41	0.17
MH_125	MH_127	85	99.74	55.5	92	99.52	99.31	99.44	0.30
MH_125	MH_127	66	99.69	58.7	92	99.52	99.31	99.45	0.24

Table F3: USF Freeboard Results - 100-Year Chicago 3 Hour Event +20%

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH_125	MH_127	84	99.76	71.2	92	99.52	99.31	99.47	0.29
MH_125	MH_127	67	99.78	74.4	92	99.52	99.31	99.48	0.30
MH_125	MH_127	83	99.89	85.7	92	99.52	99.31	99.51	0.38
MH_125	MH_127	68	99.84	88.9	92	99.52	99.31	99.51	0.33
MH_127	MH_128	47	99.56	11.9	54	99.31	99.19	99.22	0.34
MH_127	MH_128	48	99.66	23.3	54	99.31	99.19	99.25	0.41
MH_127	MH_128	49	99.66	37.0	54	99.31	99.19	99.27	0.39
MH_128	MH_129	45	99.49	6.6	13	99.19	99.15	99.17	0.32
MH_128	MH_129	46	99.51	10.5	13	99.19	99.15	99.18	0.33
MH_129	MH_130	39	99.47	1.7	77	99.15	99.03	99.03	0.44
MH_129	MH_130	57	99.48	5.1	77	99.15	99.03	99.04	0.44
MH_129	MH_130	40	99.49	15.9	77	99.15	99.03	99.06	0.43
MH_129	MH_130	58	99.53	17.3	77	99.15	99.03	99.06	0.47
MH_129	MH_130	59	99.53	28.7	77	99.15	99.03	99.08	0.45
MH_129	MH_130	41	99.49	29.5	77	99.15	99.03	99.08	0.41
MH_129	MH_130	60	99.48	43.2	77	99.15	99.03	99.10	0.38
MH_129	MH_130	42	99.42	44.2	77	99.15	99.03	99.10	0.32
MH_129	MH_130	61	99.48	56.8	77	99.15	99.03	99.12	0.36
MH_129	MH_130	43	99.41	60.0	77	99.15	99.03	99.12	0.29
MH_129	MH_130	62	99.48	70.5	77	99.15	99.03	99.14	0.34
MH_129	MH_130	44	99.44	72.6	77	99.15	99.03	99.14	0.30
MH_130	MH_131	50	99.37	3.8	100	99.03	98.79	98.80	0.57
MH_130	MH_131	33	99.18	6.7	100	99.03	98.79	98.80	0.38
MH_130	MH_131	410	99.37	15.5	100	99.03	98.79	98.82	0.55
MH_130	MH_131	408	99.21	18.4	100	99.03	98.79	98.83	0.38
MH_130	MH_131	411	99.25	26.2	100	99.03	98.79	98.85	0.40
MH_130	MH_131	409	99.22	29.5	100	99.03	98.79	98.86	0.36
MH_130	MH_131	51	99.29	37.3	100	99.03	98.79	98.88	0.41
MH_130	MH_131	34	99.23	39.7	100	99.03	98.79	98.88	0.35
MH_130	MH_131	52	99.29	47.5	100	99.03	98.79	98.90	0.39
MH_130	MH_131	35	99.23	51.0	100	99.03	98.79	98.91	0.32
MH_130	MH_131	53	99.35	58.7	100	99.03	98.79	98.93	0.42
MH_130	MH_131	36	99.29	65.2	100	99.03	98.79	98.95	0.34
MH_130	MH_131	54	99.39	70.9	100	99.03	98.79	98.96	0.43
MH_130	MH_131	37	99.39	76.6	100	99.03	98.79	98.97	0.42
MH_130	MH_131	55	99.39	82.3	100	99.03	98.79	98.99	0.40
MH_130	MH_131	38	99.39	90.8	100	99.03	98.79	99.01	0.38
MH_130	MH_131	56	99.41	94.5	100	99.03	98.79	99.02	0.39
MH_132	MH_136	102	99.36	20.4	60	98.77	98.58	98.65	0.71
MH_132	MH_136	103	99.33	32.1	60	98.77	98.58	98.68	0.65
MH_132	MH_136	104	99.35	43.2	60	98.77	98.58	98.72	0.63
MH_132	MH_136	105	99.41	55.4	60	98.77	98.58	98.76	0.65
MH_136	MH_302	1	99.35	45.2	54	98.58	98.51	98.57	0.78
MH_201	MH_202	321	105.28	8.5	120	105.45	104.62	104.68	0.60
MH_201	MH_202	430	107.31	10.7	120	105.45	104.62	104.70	2.61
MH_201	MH_202	431	107.37	16.4	120	105.45	104.62	104.74	2.63
MH_201	MH_202	428	105.36	22.2	120	105.45	104.62	104.78	0.58
MH_201	MH_202	233	107.4	28.8	120	105.45	104.62	104.82	2.58
MH_201	MH_202	429	105.37	33.4	120	105.45	104.62	104.86	0.51
MH_201	MH_202	234	107.46	36.0	120	105.45	104.62	104.87	2.59
MH_201	MH_202	320	105.45	43.6	120	105.45	104.62	104.93	0.52
MH_201	MH_202	235	107.5	48.5	120	105.45	104.62	104.96	2.54
MH_201	MH_202	236	107.62	54.2	120	105.45	104.62	105.00	2.62
MH_201	MH_202	319	105.56	54.8	120	105.45	104.62	105.00	0.56
MH_201	MH_202	318	105.66	65.0	120	105.45	104.62	105.07	0.59
MH_201	MH_202	237	107.69	67.4	120	105.45	104.62	105.09	2.60
MH_201	MH_202	238	107.8	73.1	120	105.45	104.62	105.13	2.67
MH_201	MH_202	317	105.77	76.1	120	105.45	104.62	105.15	0.62
MH_201	MH_202	239	107.87	85.5	120	105.45	104.62	105.22	2.65
MH_201	MH_202	316	105.9	88.3	120	105.45	104.62	105.24	0.66
MH_201	MH_202	240	107.99	92.7	120	105.45	104.62	105.27	2.72
MH_201	MH_202	315	106.02	99.7	120	105.45	104.62	105.32	0.70
MH_201	MH_202	241	108.06	105.2	120	105.45	104.62	105.35	2.71
MH_201	MH_202	242	108.16	110.9	120	105.45	104.62	105.39	2.77
MH_201	MH_202	314	106.13	113.9	120	105.45	104.62	105.41	0.72
MH_202	MH_203	230	105.39	3.3	14	104.62	104.55	104.56	0.83
MH_202	MH_203	231	106.96	9.7	14	104.62	104.55	104.60	2.36
MH_202	MH_203	232	107.27	11.7	14	104.62	104.55	104.61	2.66
MH_203	MH_206	225	104.9	1.9	54	104.55	103.87	103.89	1.01
MH_203	MH_206	226	105.06	12.1	54	104.55	103.87	104.02	1.04
MH_203	MH_206	227	105.11	24.3	54	104.55	103.87	104.17	0.94
MH_203	MH_206	228	105.11	34.9	54	104.55	103.87	104.30	0.81
MH_203	MH_206	229	105.13	45.6	54	104.55	103.87	104.44	0.69
MH_204	MH_205	293	104.81	3.0	118	104.07	103.96	103.97	0.84
MH_204	MH_205	292	104.65	4.1	118	104.07	103.96	103.97	0.68
MH_204	MH_205	426	104.89	12.3	118	104.07	103.96	103.97	0.92
MH_204	MH_205	424	104.71	18.3	118	104.07	103.96	103.98	0.73

Table F3: USF Freeboard Results - 100-Year Chicago 3 Hour Event +20%

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH_204	MH_205	427	104.89	23.4	118	104.07	103.96	103.98	0.91
MH_204	MH_205	425	104.76	27.4	118	104.07	103.96	103.99	0.77
MH_204	MH_205	294	104.86	33.6	118	104.07	103.96	103.99	0.87
MH_204	MH_205	291	104.81	37.6	118	104.07	103.96	104.00	0.81
MH_204	MH_205	295	104.92	44.7	118	104.07	103.96	104.00	0.92
MH_204	MH_205	290	104.87	48.7	118	104.07	103.96	104.01	0.86
MH_204	MH_205	296	104.92	54.9	118	104.07	103.96	104.01	0.91
MH_204	MH_205	289	104.83	61.8	118	104.07	103.96	104.02	0.81
MH_204	MH_205	297	104.87	66.2	118	104.07	103.96	104.02	0.85
MH_204	MH_205	288	104.83	72.3	118	104.07	103.96	104.03	0.80
MH_204	MH_205	298	104.86	80.4	118	104.07	103.96	104.04	0.82
MH_204	MH_205	287	104.77	86.5	118	104.07	103.96	104.04	0.73
MH_204	MH_205	299	104.82	91.8	118	104.07	103.96	104.05	0.77
MH_204	MH_205	286	104.7	100.4	118	104.07	103.96	104.05	0.65
MH_204	MH_205	300	104.72	106.3	118	104.07	103.96	104.06	0.66
MH_206	MH_207	221	104.52	5.5	50	103.87	103.37	103.42	1.10
MH_206	MH_207	222	104.57	16.7	50	103.87	103.37	103.54	1.03
MH_206	MH_207	223	104.65	26.9	50	103.87	103.37	103.64	1.01
MH_206	MH_207	224	104.77	38.0	50	103.87	103.37	103.75	1.02
MH_207	MH_208	219	104.39	4.9	13	103.37	103.10	103.20	1.19
MH_207	MH_208	220	104.46	10.7	13	103.37	103.10	103.33	1.13
MH_208	MH_215	212	102.46	12.7	112	103.10	101.70	101.86	0.60
MH_208	MH_215	271	102.46	14.8	112	103.10	101.70	101.89	0.57
MH_208	MH_215	213	102.68	24.9	112	103.10	101.70	102.01	0.67
MH_208	MH_215	270	102.67	26.2	112	103.10	101.70	102.03	0.64
MH_208	MH_215	214	102.89	35.1	112	103.10	101.70	102.14	0.75
MH_208	MH_215	269	102.93	38.4	112	103.10	101.70	102.18	0.75
MH_208	MH_215	215	103.1	46.2	112	103.10	101.70	102.28	0.82
MH_208	MH_215	268	103.18	49.5	112	103.10	101.70	102.32	0.86
MH_208	MH_215	216	103.36	58.4	112	103.10	101.70	102.43	0.93
MH_208	MH_215	267	103.42	59.7	112	103.10	101.70	102.45	0.97
MH_208	MH_215	217	103.62	69.8	112	103.10	101.70	102.58	1.04
MH_208	MH_215	266	103.68	70.9	112	103.10	101.70	102.59	1.09
MH_208	MH_215	423	103.94	80.8	112	103.10	101.70	102.71	1.23
MH_208	MH_215	421	103.83	82.0	112	103.10	101.70	102.73	1.10
MH_208	MH_215	422	104.04	91.9	112	103.10	101.70	102.85	1.19
MH_208	MH_215	420	104.04	93.2	112	103.10	101.70	102.87	1.17
MH_208	MH_215	265	104.35	103.6	112	103.10	101.70	103.00	1.35
MH_208	MH_215	218	104.3	105.6	112	103.10	101.70	103.02	1.28
MH_209	MH_201	243	108.2	4.5	94	105.83	105.45	105.47	2.73
MH_209	MH_201	244	108.3	10.2	94	105.83	105.45	105.49	2.81
MH_209	MH_201	313	106.24	10.6	94	105.83	105.45	105.50	0.74
MH_209	MH_201	245	108.34	23.4	94	105.83	105.45	105.55	2.79
MH_209	MH_201	312	106.36	25.8	94	105.83	105.45	105.56	0.80
MH_209	MH_201	246	108.44	29.1	94	105.83	105.45	105.57	2.87
MH_209	MH_201	311	106.45	40.1	94	105.83	105.45	105.61	0.84
MH_209	MH_201	247	108.49	42.3	94	105.83	105.45	105.62	2.87
MH_209	MH_201	248	108.57	48.0	94	105.83	105.45	105.65	2.92
MH_209	MH_201	310	106.53	51.5	94	105.83	105.45	105.66	0.87
MH_209	MH_201	249	108.61	61.2	94	105.83	105.45	105.70	2.91
MH_209	MH_201	309	106.58	63.7	94	105.83	105.45	105.71	0.87
MH_209	MH_201	250	108.67	66.9	94	105.83	105.45	105.72	2.95
MH_209	MH_201	308	106.63	74.8	94	105.83	105.45	105.75	0.88
MH_209	MH_201	251	108.7	79.4	94	105.83	105.45	105.77	2.93
MH_209	MH_201	307	106.63	85.0	94	105.83	105.45	105.79	0.84
MH_209	MH_201	252	108.76	86.6	94	105.83	105.45	105.80	2.96
MH_209	MH_210	254	108.31	7.1	13	105.83	105.60	105.72	2.59
MH_209	MH_210	253	108.73	10.0	13	105.83	105.60	105.77	2.96
MH_210	MH_212	258	105.12	15.6	54	105.60	103.58	104.16	0.96
MH_210	MH_212	257	105.54	27.3	54	105.60	103.58	104.60	0.94
MH_210	MH_212	256	106.05	38.6	54	105.60	103.58	105.03	1.02
MH_210	MH_212	255	106.58	48.8	54	105.60	103.58	105.41	1.17
MH_212	MH_204	285	104.64	2.7	92	103.58	104.07	104.05	0.59
MH_212	MH_204	301	104.77	9.6	92	103.58	104.07	104.02	0.75
MH_212	MH_204	284	104.71	19.0	92	103.58	104.07	103.97	0.74
MH_212	MH_204	302	104.8	24.9	92	103.58	104.07	103.94	0.86
MH_212	MH_204	283	104.78	34.1	92	103.58	104.07	103.89	0.89
MH_212	MH_204	303	104.92	40.7	92	103.58	104.07	103.85	1.07
MH_212	MH_204	282	104.84	44.6	92	103.58	104.07	103.83	1.01
MH_212	MH_204	304	104.96	55.4	92	103.58	104.07	103.77	1.19
MH_212	MH_204	281	104.91	58.8	92	103.58	104.07	103.76	1.15
MH_212	MH_204	305	105.09	68.9	92	103.58	104.07	103.70	1.39
MH_212	MH_204	280	104.96	69.8	92	103.58	104.07	103.70	1.26
MH_212	MH_204	279	104.96	82.3	92	103.58	104.07	103.63	1.33
MH_212	MH_204	306	105.11	82.6	92	103.58	104.07	103.63	1.48
MH_212	MH_213	203	104.1	3.4	50	103.58	103.23	103.26	0.84
MH_212	MH_213	202	104.35	11.8	50	103.58	103.23	103.32	1.03

Table F3: USF Freeboard Results - 100-Year Chicago 3 Hour Event +20%

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH_212	MH_213	201	104.6	23.2	50	103.58	103.23	103.39	1.21
MH_212	MH_213	200	104.77	36.9	50	103.58	103.23	103.49	1.28
MH_213	MH_214	204	104.02	7.2	13	103.23	103.06	103.16	0.86
MH_214	MH_215	272	102.37	7.0	90	103.06	101.70	101.81	0.56
MH_214	MH_215	273	102.59	15.4	90	103.06	101.70	101.94	0.65
MH_214	MH_215	211	102.46	15.7	90	103.06	101.70	101.94	0.52
MH_214	MH_215	210	102.68	27.9	90	103.06	101.70	102.13	0.55
MH_214	MH_215	274	102.86	30.1	90	103.06	101.70	102.16	0.70
MH_214	MH_215	209	102.89	38.1	90	103.06	101.70	102.28	0.61
MH_214	MH_215	275	103.11	45.9	90	103.06	101.70	102.40	0.71
MH_214	MH_215	208	103.15	49.4	90	103.06	101.70	102.45	0.70
MH_214	MH_215	276	103.37	60.4	90	103.06	101.70	102.62	0.75
MH_214	MH_215	207	103.4	63.6	90	103.06	101.70	102.67	0.73
MH_214	MH_215	277	103.55	71.6	90	103.06	101.70	102.79	0.76
MH_214	MH_215	206	103.66	75.0	90	103.06	101.70	102.84	0.82
MH_214	MH_215	278	103.64	83.3	90	103.06	101.70	102.96	0.68
MH_214	MH_215	205	103.83	85.5	90	103.06	101.70	103.00	0.83
MH_216	MH_217	335	106.02	0.2	76	105.52	105.11	105.11	0.91
MH_216	MH_217	348	105.98	4.0	76	105.52	105.11	105.13	0.85
MH_216	MH_217	336	106.02	11.5	76	105.52	105.11	105.17	0.85
MH_216	MH_217	347	105.92	18.2	76	105.52	105.11	105.21	0.71
MH_216	MH_217	337	106.01	25.7	76	105.52	105.11	105.25	0.76
MH_216	MH_217	346	105.85	29.5	76	105.52	105.11	105.27	0.58
MH_216	MH_217	338	106.05	37.1	76	105.52	105.11	105.31	0.74
MH_216	MH_217	345	105.92	39.7	76	105.52	105.11	105.33	0.59
MH_216	MH_217	344	105.98	50.9	76	105.52	105.11	105.39	0.59
MH_216	MH_217	339	106.1	51.3	76	105.52	105.11	105.39	0.71
MH_216	MH_217	343	106.04	61.1	76	105.52	105.11	105.44	0.60
MH_216	MH_217	340	106.1	62.6	76	105.52	105.11	105.45	0.65
MH_216	MH_217	342	106.04	73.2	76	105.52	105.11	105.51	0.53
MH_216	MH_217	341	106.39	74.3	76	105.52	105.11	105.51	0.88
MH_217	MH_218	356	105.71	5.1	113	105.11	104.94	104.94	0.77
MH_217	MH_218	328	105.81	10.1	113	105.11	104.94	104.95	0.86
MH_217	MH_218	355	105.78	19.3	113	105.11	104.94	104.97	0.81
MH_217	MH_218	329	105.94	24.6	113	105.11	104.94	104.98	0.96
MH_217	MH_218	354	105.85	33.8	113	105.11	104.94	104.99	0.86
MH_217	MH_218	330	105.94	40.3	113	105.11	104.94	105.00	0.94
MH_217	MH_218	353	105.93	47.5	113	105.11	104.94	105.01	0.92
MH_217	MH_218	331	105.96	55.0	113	105.11	104.94	105.02	0.94
MH_217	MH_218	352	106	63.3	113	105.11	104.94	105.04	0.96
MH_217	MH_218	332	106.04	70.3	113	105.11	104.94	105.05	0.99
MH_217	MH_218	351	106.08	78.0	113	105.11	104.94	105.06	1.02
MH_217	MH_218	333	106.08	85.5	113	105.11	104.94	105.07	1.01
MH_217	MH_218	350	106.08	90.9	113	105.11	104.94	105.08	1.00
MH_217	MH_218	334	106.08	99.1	113	105.11	104.94	105.09	0.99
MH_217	MH_218	349	106.05	105.8	113	105.11	104.94	105.10	0.95
MH_218	MH_220	362	105.77	15.7	81	104.94	103.90	104.11	1.66
MH_218	MH_220	322	106.2	16.4	81	104.94	103.90	104.11	2.09
MH_218	MH_220	361	105.87	27.4	81	104.94	103.90	104.26	1.61
MH_218	MH_220	323	105.94	28.1	81	104.94	103.90	104.26	1.68
MH_218	MH_220	360	105.87	38.5	81	104.94	103.90	104.40	1.47
MH_218	MH_220	324	105.88	39.4	81	104.94	103.90	104.41	1.47
MH_218	MH_220	359	105.86	48.7	81	104.94	103.90	104.53	1.33
MH_218	MH_220	325	105.92	53.6	81	104.94	103.90	104.59	1.33
MH_218	MH_220	358	105.81	60.0	81	104.94	103.90	104.67	1.14
MH_218	MH_220	326	105.92	65.0	81	104.94	103.90	104.74	1.18
MH_218	MH_220	357	105.75	74.2	81	104.94	103.90	104.86	0.89
MH_218	MH_220	327	105.82	79.2	81	104.94	103.90	104.92	0.90
MH_219	MH_220	263	106.53	8.5	25	105.65	103.90	104.50	2.03
MH_219	MH_220	264	108.04	22.7	25	105.65	103.90	105.50	2.54
MH_220	MH_224	259	104.74	16.3	59	103.90	102.05	102.56	2.18
MH_220	MH_224	260	105.06	28.5	59	103.90	102.05	102.94	2.12
MH_220	MH_224	261	105.61	43.3	59	103.90	102.05	103.41	2.20
MH_220	MH_224	262	106.07	54.7	59	103.90	102.05	103.77	2.30
MH_221	MH_222	396-5	103.56	6.9	78	103.11	102.83	102.86	0.70
MH_221	MH_222	396-4	103.56	14.9	78	103.11	102.83	102.88	0.68
MH_221	MH_222	396-3	103.56	22.1	78	103.11	102.83	102.91	0.65
MH_221	MH_222	396-2	103.56	30.1	78	103.11	102.83	102.94	0.62
MH_221	MH_222	396-1	103.56	39.5	78	103.11	102.83	102.97	0.59
MH_221	MH_222	395-5	103.91	48.4	78	103.11	102.83	103.00	0.91
MH_221	MH_222	395-4	103.91	56.0	78	103.11	102.83	103.03	0.88
MH_221	MH_222	395-3	104.7	64.0	78	103.11	102.83	103.06	1.64
MH_221	MH_222	395-2	104.51	71.2	78	103.11	102.83	103.08	1.43
MH_221	MH_222	395-1	104.7	77.6	78	103.11	102.83	103.11	1.59
MH_222	MH_223	365-2	103.42	2.1	95	102.83	102.72	102.72	0.70
MH_222	MH_223	399-3	103.51	3.9	95	102.83	102.72	102.72	0.79
MH_222	MH_223	365-3	103.42	9.4	95	102.83	102.72	102.73	0.69

Table F3: USF Freeboard Results - 100-Year Chicago 3 Hour Event +20%

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH_222	MH_223	399-2	103.51	11.9	95	102.83	102.72	102.73	0.78
MH_222	MH_223	365-4	103.42	17.4	95	102.83	102.72	102.74	0.68
MH_222	MH_223	399-1	103.51	19.5	95	102.83	102.72	102.74	0.77
MH_222	MH_223	366-1	103.37	28.0	95	102.83	102.72	102.75	0.62
MH_222	MH_223	398-5	103.52	30.2	95	102.83	102.72	102.75	0.77
MH_222	MH_223	366-2	103.37	36.0	95	102.83	102.72	102.76	0.61
MH_222	MH_223	398-4	103.52	38.2	95	102.83	102.72	102.76	0.76
MH_222	MH_223	366-3	103.37	43.3	95	102.83	102.72	102.77	0.60
MH_222	MH_223	398-3	103.52	45.4	95	102.83	102.72	102.77	0.75
MH_222	MH_223	366-4	103.37	51.3	95	102.83	102.72	102.78	0.59
MH_222	MH_223	398-2	103.52	53.4	95	102.83	102.72	102.78	0.74
MH_222	MH_223	398-1	103.52	61.1	95	102.83	102.72	102.79	0.73
MH_222	MH_223	397-3	103.54	71.7	95	102.83	102.72	102.80	0.74
MH_222	MH_223	397-2	103.54	79.7	95	102.83	102.72	102.81	0.73
MH_222	MH_223	397-1	103.54	87.3	95	102.83	102.72	102.82	0.72
MH_223	MH_224	363-1	103.63	16.0	97	102.72	102.05	102.16	1.47
MH_223	MH_224	401-5	104.22	18.1	97	102.72	102.05	102.17	2.05
MH_223	MH_224	363-2	103.63	24.0	97	102.72	102.05	102.21	1.42
MH_223	MH_224	401-4	104.22	26.1	97	102.72	102.05	102.23	1.99
MH_223	MH_224	363-3	103.63	31.2	97	102.72	102.05	102.26	1.37
MH_223	MH_224	401-3	104.22	33.4	97	102.72	102.05	102.28	1.94
MH_223	MH_224	363-4	103.63	39.2	97	102.72	102.05	102.32	1.31
MH_223	MH_224	401-2	104.07	41.4	97	102.72	102.05	102.33	1.74
MH_223	MH_224	401-1	104.07	49.0	97	102.72	102.05	102.38	1.69
MH_223	MH_224	364-1	103.63	49.8	97	102.72	102.05	102.39	1.24
MH_223	MH_224	364-2	103.63	57.8	97	102.72	102.05	102.45	1.18
MH_223	MH_224	400-5	103.58	59.6	97	102.72	102.05	102.46	1.12
MH_223	MH_224	364-3	103.63	65.1	97	102.72	102.05	102.50	1.13
MH_223	MH_224	400-4	103.58	67.6	97	102.72	102.05	102.51	1.07
MH_223	MH_224	364-4	103.63	73.1	97	102.72	102.05	102.55	1.08
MH_223	MH_224	400-3	103.58	74.9	97	102.72	102.05	102.56	1.02
MH_223	MH_224	364-5	103.63	80.7	97	102.72	102.05	102.60	1.03
MH_223	MH_224	400-2	103.58	82.9	97	102.72	102.05	102.62	0.96
MH_223	MH_224	400-1	103.58	90.5	97	102.72	102.05	102.67	0.91
MH_223	MH_224	365-1	103.42	91.3	97	102.72	102.05	102.68	0.74
MH_224	MH_105	141	101.9	11.6	82	102.05	100.15	100.42	1.48
MH_224	MH_105	140	102.18	25.8	82	102.05	100.15	100.75	1.43
MH_224	MH_105	139	102.55	37.0	82	102.05	100.15	101.01	1.54
MH_224	MH_105	138	102.92	47.2	82	102.05	100.15	101.24	1.68
MH_224	MH_105	137	103.3	58.4	82	102.05	100.15	101.50	1.80
MH_224	MH_105	136	103.81	71.8	82	102.05	100.15	101.81	2.00
MH_225	MH_226	389-2	103.58	5.9	87	103.90	102.65	102.74	0.84
MH_225	MH_226	389-1	103.74	13.9	87	103.90	102.65	102.85	0.89
MH_225	MH_226	388-3	103.75	24.5	87	103.90	102.65	103.00	0.75
MH_225	MH_226	388-2	103.88	32.2	87	103.90	102.65	103.11	0.77
MH_225	MH_226	388-1	103.88	40.2	87	103.90	102.65	103.23	0.65
MH_225	MH_226	387-4	104.02	50.8	87	103.90	102.65	103.38	0.64
MH_225	MH_226	387-3	104.02	58.8	87	103.90	102.65	103.49	0.53
MH_225	MH_226	387-2	104.02	66.0	87	103.90	102.65	103.60	0.42
MH_225	MH_226	387-1	104.02	74.0	87	103.90	102.65	103.71	0.31
MH_226	MH_2260	391-4	102.73	19.0	64	102.65	101.44	101.80	0.93
MH_226	MH_2260	391-3	102.73	27.0	64	102.65	101.44	101.95	0.78
MH_226	MH_2260	391-2	102.73	34.3	64	102.65	101.44	102.09	0.64
MH_226	MH_2260	391-1	102.73	42.3	64	102.65	101.44	102.24	0.49
MH_226	MH_2260	390-3	103.12	52.9	64	102.65	101.44	102.44	0.68
MH_226	MH_2260	390-2	103.12	60.9	64	102.65	101.44	102.60	0.52
MH_226	MH_2260	390-1	103.12	61.0	64	102.65	101.44	102.60	0.52
MH_226	MH_2260	389-4	103.58	62.5	64	102.65	101.44	102.63	0.95
MH_226	MH_2260	389-3	103.58	63.0	64	102.65	101.44	102.64	0.94
MH_2260	MH_227	392-2	102.29	3.6	50	101.44	101.19	101.21	1.08
MH_2260	MH_227	392-1	102.29	11.6	50	101.44	101.19	101.25	1.04
MH_227	MH_109	394-4	101.34	19.3	93	101.19	100.32	100.50	0.84
MH_227	MH_109	394-3	101.34	27.3	93	101.19	100.32	100.57	0.77
MH_227	MH_109	394-2	101.61	34.6	93	101.19	100.32	100.64	0.97
MH_227	MH_109	394-1	101.61	42.6	93	101.19	100.32	100.72	0.89
MH_227	MH_109	393-3	102.29	54.2	93	101.19	100.32	100.83	1.46
MH_227	MH_109	393-2	102.29	61.8	93	101.19	100.32	100.90	1.39
MH_227	MH_109	393-1	102.29	69.8	93	101.19	100.32	100.97	1.32
MH_227	MH_109	392-4	102.29	81.5	93	101.19	100.32	101.08	1.21
MH_227	MH_109	392-3	102.29	89.5	93	101.19	100.32	101.16	1.13
MH_228	MH_229	384-3	102.12	2.3	75	102.63	101.09	101.14	0.98
MH_228	MH_229	379-2	102.14	3.4	75	102.63	101.09	101.16	0.98
MH_228	MH_229	384-4	102.12	10.3	75	102.63	101.09	101.31	0.81
MH_228	MH_229	379-1	102.14	11.4	75	102.63	101.09	101.33	0.81
MH_228	MH_229	385-1	102.35	20.9	75	102.63	101.09	101.52	0.83
MH_228	MH_229	378-3	102.57	22.1	75	102.63	101.09	101.55	1.02
MH_228	MH_229	385-2	102.65	28.5	75	102.63	101.09	101.68	0.97

Table F3: USF Freeboard Results - 100-Year Chicago 3 Hour Event +20%

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH_228	MH_229	378-2	102.67	29.7	75	102.63	101.09	101.71	0.96
MH_228	MH_229	385-3	102.65	36.5	75	102.63	101.09	101.85	0.80
MH_228	MH_229	378-1	102.67	37.7	75	102.63	101.09	101.87	0.80
MH_228	MH_229	386-1	102.73	47.2	75	102.63	101.09	102.07	0.66
MH_228	MH_229	377-4	103.02	48.3	75	102.63	101.09	102.09	0.93
MH_228	MH_229	386-2	103.08	55.2	75	102.63	101.09	102.23	0.85
MH_228	MH_229	377-3	103.28	56.3	75	102.63	101.09	102.25	1.03
MH_228	MH_229	386-3	103.08	62.4	75	102.63	101.09	102.38	0.70
MH_228	MH_229	377-2	103.34	63.6	75	102.63	101.09	102.41	0.93
MH_228	MH_229	386-4	103.47	70.4	75	102.63	101.09	102.55	0.92
MH_228	MH_229	377-1	103.34	71.6	75	102.63	101.09	102.57	0.77
MH_229	MH_102	382-1	101.52	13.6	87	101.09	100.32	100.44	1.08
MH_229	MH_102	381-4	101.35	14.8	87	101.09	100.32	100.45	0.90
MH_229	MH_102	382-2	101.52	21.6	87	101.09	100.32	100.51	1.01
MH_229	MH_102	381-3	101.35	22.8	87	101.09	100.32	100.52	0.83
MH_229	MH_102	382-3	101.52	28.8	87	101.09	100.32	100.57	0.95
MH_229	MH_102	381-2	101.35	30.0	87	101.09	100.32	100.59	0.76
MH_229	MH_102	382-4	101.52	36.8	87	101.09	100.32	100.65	0.87
MH_229	MH_102	381-1	101.35	38.0	87	101.09	100.32	100.66	0.69
MH_229	MH_102	383-1	101.62	47.5	87	101.09	100.32	100.74	0.88
MH_229	MH_102	380-3	101.59	48.6	87	101.09	100.32	100.75	0.84
MH_229	MH_102	383-2	101.62	55.5	87	101.09	100.32	100.81	0.81
MH_229	MH_102	380-2	101.59	56.6	87	101.09	100.32	100.82	0.77
MH_229	MH_102	383-3	101.62	63.1	87	101.09	100.32	100.88	0.74
MH_229	MH_102	380-1	101.59	64.3	87	101.09	100.32	100.89	0.70
MH_229	MH_102	384-1	101.74	73.7	87	101.09	100.32	100.98	0.76
MH_229	MH_102	379-4	101.96	74.9	87	101.09	100.32	100.99	0.97
MH_229	MH_102	384-2	101.74	81.7	87	101.09	100.32	101.05	0.69
MH_229	MH_102	379-3	101.96	82.9	87	101.09	100.32	101.06	0.90
MH_230	MH_231	374-3	102.03	2.4	73	102.59	101.01	101.06	0.97
MH_230	MH_231	368-3	102.24	5.1	73	102.59	101.01	101.12	1.12
MH_230	MH_231	374-4	102.03	10.4	73	102.59	101.01	101.24	0.79
MH_230	MH_231	368-2	102.24	13.1	73	102.59	101.01	101.29	0.95
MH_230	MH_231	368-1	102.24	20.7	73	102.59	101.01	101.46	0.78
MH_230	MH_231	375-1	102.4	21.1	73	102.59	101.01	101.46	0.94
MH_230	MH_231	375-2	102.57	28.7	73	102.59	101.01	101.63	0.94
MH_230	MH_231	367-3	102.71	31.3	73	102.59	101.01	101.68	1.03
MH_230	MH_231	375-3	102.57	36.7	73	102.59	101.01	101.80	0.77
MH_230	MH_231	367-2	102.71	39.3	73	102.59	101.01	101.85	0.86
MH_230	MH_231	367-1	102.71	47.0	73	102.59	101.01	102.02	0.69
MH_230	MH_231	376-1	103	47.3	73	102.59	101.01	102.03	0.97
MH_230	MH_231	376-2	103	55.3	73	102.59	101.01	102.20	0.80
MH_230	MH_231	376-3	103.37	62.6	73	102.59	101.01	102.35	1.02
MH_230	MH_231	376-4	103.37	70.6	73	102.59	101.01	102.53	0.84
MH_231	MH_103	371-3	100.56	13.1	87	101.01	100.07	100.21	0.35
MH_231	MH_103	372-1	100.95	13.8	87	101.01	100.07	100.22	0.73
MH_231	MH_103	371-2	100.56	21.1	87	101.01	100.07	100.30	0.26
MH_231	MH_103	372-2	100.95	21.8	87	101.01	100.07	100.30	0.65
MH_231	MH_103	371-1	100.56	28.7	87	101.01	100.07	100.38	0.18
MH_231	MH_103	372-3	100.95	29.1	87	101.01	100.07	100.38	0.57
MH_231	MH_103	372-4	100.95	37.1	87	101.01	100.07	100.47	0.48
MH_231	MH_103	370-3	101.09	39.3	87	101.01	100.07	100.49	0.60
MH_231	MH_103	370-2	101.09	47.3	87	101.01	100.07	100.58	0.51
MH_231	MH_103	373-1	100.97	47.7	87	101.01	100.07	100.59	0.38
MH_231	MH_103	370-1	101.09	54.9	87	101.01	100.07	100.66	0.43
MH_231	MH_103	373-2	101.39	55.7	87	101.01	100.07	100.67	0.72
MH_231	MH_103	373-3	101.39	63.3	87	101.01	100.07	100.76	0.63
MH_231	MH_103	369-3	101.61	65.6	87	101.01	100.07	100.78	0.83
MH_231	MH_103	369-2	101.61	73.6	87	101.01	100.07	100.87	0.74
MH_231	MH_103	374-1	101.56	74.0	87	101.01	100.07	100.87	0.69
MH_231	MH_103	369-1	101.61	81.2	87	101.01	100.07	100.95	0.66
MH_231	MH_103	374-2	101.56	82.0	87	101.01	100.07	100.96	0.60

Min	0.02
Max	2.96
Average	0.79

Key:

- (yellow) Freeboard to USF less than 0.30 m
- (red) Freeboard to USF less than 0.00 m