Site Servicing & Stormwater Management Report

Commercial Development

3845 Cambrian Road

Ottawa, Ontario

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1.0 INTRODUCTION

Parsons Inc. was retained by Loblaw Properties Limited to provide engineering services for a new commercial development located at 3845 Cambrian Road in Ottawa, Ontario.

The site encompasses a total area of approximately 1.50 ha and is bordered by Cambrian Road to the north, a future residential development to the south (currently vacant), potentially a future school to the west (currently vacant) and the future re-aligned Greenbank Road to the east as shown on the following figure.

The proposed development includes the addition of a retail store and another commercial rental unit on the same lot. Servicing of the buildings will be provided by the new on-site storm sewers, sanitary services, and new water services from Cambrian Road. New fire hydrants will be added on-site to provide exterior fire protection.

Figure 1 – Site Context

2.0 PURPOSE

This report summarizes the proposed site servicing, grading and drainage design, documents the proposed method of attenuating stormwater runoff from the subject site, and deals with erosion and sediment control measures to be undertaken during construction.

Stormwater management items addressed include the following:

- establishing the allowable post-development release rate from the site;
- calculating the post-development runoff from the site;
- determining the required on-site stormwater storage volume and storage areas.

3.0 EXISTING CONDITIONS

The subject site is currently vacant. The proposed commercial development is part of the Half Moon Bay West Subdivision. As mentioned earlier, on the east site of the proposed development, the future re-aligned Greenbank Road will be constructed as part of the Greenbank Realignment and Southwest Transitway Extension (GRSWTE) project. Currently, there is no access to the subject site from Greenbank Road. Cambrian Road is currently the only access to the subject site. Cambrian Road will be widened as part of the new Greenbank Road project. Addition of sidewalks and bike lanes is also proposed as part of this future project. A new 1500mm storm sewer, 500mm sanitary sewer and 400mm watermain have been installed in 2019 along Cambrian Road and will be used to provide services to the proposed commercial development. A 750mm storm service, 200mm sanitary service and a 200mm water service have also been installed in 2019 up to the property line to service this future development from Cambrian Road. Refer to **Drawing C102** for more details.

According to the geotechnical investigation report for this development, by Toronto Inspection Limited dated November 17, 2018, soil condition on this site consists of a mixture of organic and silty material fill extending to a depth between 1.5m to 3.7m with an underlayer of very soft silty clay/clayey silt up to 21.0m deep. Also, the average on-site groundwater table is estimated at an elevation of 92.20m. Existing site surface elevation varies between 92.42m and 96.67m. There is also an existing large pile of dirt directly adjacent to the western property line with a maximum elevation of 99.35m

4.0 PROPOSED DEVELOPMENT

As shown on the Architectural Site Plan, the proposed development will consist of a new 3205 m^2 retail store (Building A) and a commercial rental unit of 459 m^2 (Building B). The finished floor elevation of Building A and B are set at 94.05m and 94.12m respectively. Each building is considerably higher than the estimated groundwater table elevation. The proposal will also include parking spaces, concrete sidewalks, concrete curbs, a new entrance from Cambrian Road and an entrance from the future Greenbank Road.

Preliminary grading plan of the residential subdivision that will be constructed south of the site was provided. Based on the information obtained, there is a difference of ±2.0m in elevation between proposed grades at the south property line. A retaining wall might be necessary to accommodate the grade difference, however it is assumed that this commercial development will be constructed before the residential subdivision, thus the retaining wall construction will not be part of this project. No grading information was available for the property located west of the site. In interim conditions, site grading will match the existing conditions along the south and west side of the subject site with maximum 3H:1V slopes. Grading along Cambrian Road and future Greenbank Road will match the future back of sidewalk grades provided by the GRSWTE team and from these future grades, it will tie-in to existing conditions. The estimated limit of grading outside of the site is shown on **Drawing C103**.

5.0 STORMWATER MANAGEMENT PLAN

Drawing C106, appended to this report, depict the boundaries of the post-development drainage areas, and should be read in conjunction with this report.

The design approach for the stormwater management is to ensure that the post-development peak flows do not exceed the allowable release rate to mitigate the risk of flooding and against erosion. The City of Ottawa indicated that the allowable release rate for this site was determined in the *Design Brief for the Half Moon Bay West Phase 1, prepared by DSEL, dated September 5, 2018*. Correspondence with the City can be found in **Appendix E**. The storm sewers installed as part of this new subdivision project are sized to allow a flow of **347.6 L/s** for the proposed commercial development. Parameters used to calculate the allowable release rate are from the DSEL report.

- Runoff Coefficient (C) = 0.80
- Drainage Area (A) = 1.50 ha
- Time of Concentration (Tc) = 10min

The Rational Method formula has been used to calculate stormwater runoff and rainfall data is based on the IDF curve equations from the *Ottawa Sewer Design Guidelines, Second Edition, October 2012.*

$Q = 2.78\,CIA$, where:
- Q = Flow rate (L/s)
- C = Runoff coefficient
- I = Rainfall intensity (mm/hr)
- A = Area (ha)

Rainfall intensity: $I_5 = 998.071 / (Tc + 6.053)^{0.814}$

Using the Rational Method formula and the above parameters, the allowable post-development release rate for this site is **347.6 L/s**.

5.1 Pre-Development Conditions

As mentioned earlier, the subject site is currently vacant. Based on the topographical survey received, the site grading is relatively similar through the site and is lower along the north, south and east property lines. On the west side of the site, a major pile of dirty with a height up to 5.0m is present. A drainage ditch used to flow through this site, however this ditch was abandoned as part of the construction of new infrastructure along Cambrian Rd and future Greenbank Rd. Services for this property were installed in 2019. A Storm maintenance hole (MHST) with a 750m pipe was installed near the property line along Cambrian Rd to collect part of the runoff from this site.

5.2 Post-Development Conditions

The following is a description of each drainage areas through the site, refer to **Drawing C106** attached to this report.

- Areas WS-01 and WS-02 consist of the controlled roof areas;
- Areas WS-03 to WS-05 are located behind Building A;
- Areas WS-06 to WS-09 consist of the main parking lot area;
- Area WS-10 is the site entrance from Cambrian Road;
- Areas WS-11 and WS-12 are the parking lot and refuse disposal area located between Building B and the site entrance from Cambrian Road;
- Area WS-13 is the proposed swale on the corner the Cambrian and future Greenbank intersection, located behind the future Greenbank sidewalk;
- Area WS-14 consist of the driving isle west of Building A;
- Areas WS-15 to WS-17 consist of areas located outside of the site to the west that will drain temporarily towards the site due to the presence of the large dirt pile. It is assumed that this major dirt pile will be removed as part the development of the neighbouring property.

Since this project will be constructed before the new re-aligned Greenbank Rd, the grading of the site must match existing surface elevations at the property line while also considering the future Greenbank Rd project proposed sidewalk and road profile. Due to the important variation in grades between existing conditions and future conditions along Cambrian Rd and Greenbank Rd, grading along all property lines will match existing condition with a maximum slope of 3H:1V. This means that a small portion of this site will drain uncontrolled towards the public right of way. The uncontrolled area of this site is estimated at 0.048 ha and generates a flow of 3.8 L/s and 8.1 L/s for the 5-year and 100-year storm event respectively. Considering the uncontrolled flow, the adjusted allowable 100-year storm event flow is **339.5 L/s**. Refer to **Appendix A** for more details.

All other areas on-site will be captured though a new on-site storm sewer system.

To control the site discharge to the maximum **339.5 L/s** for the 100-year storm event, underground storage, rooftop storage and inlet-control device (ICD) will be used. The stormwater management system was designed using the modeling software PCSWMM. The dynamic model created is described below.

5.3 PCSWMM Modeling

5.3.1 Input Parameters

A dynamic model was created to evaluate the proposed stormwater management system and storm sewer infrastructure using the software PCSWMM. Hydrologic parameters used for the subcatchments in the model were taken from the Ottawa Sewer Design Guidelines and are presented below:

Table 1 – PCSWMM Subcatchment Hydrologic Parameters

Parameter	Value
Design Storm	3-hour Chicago Storm (5-yr, 100-yr, 100-yr + 20%)
Infiltration Method	Horton
Max. Infiltration Rate (mm/hr)	76.2
Min. Infiltration Rate (mm/hr)	13.2
Decay Constant (1/hr)	4.14
Drying Time (days)	7
Impervious Area Manning's Coefficient (N)	0.016
Pervious Area Manning's Coefficient (N)	0.15
Depth of Depression Storage Imp. Area (mm)	1.57
Depth of Depression Storage Perv. Area (mm)	4.67
Zero Impervious Area (%)	25

Other subcatchments parameters such as the area, width, slope and percent of impervious area are taken from **Drawings C103** and **C106**.

Junctions, conduits and outfalls parameters are taken from **Drawing C102.**

Storage and outlet nodes were created to represent the proposed underground storm chambers, the controlled roof drains and surface ponding in the loading dock area. Parameters and storage curve used to model the underground storm chambers are taken from the StormTech Chamber design created using the online Design Tool by ADS, please refer to **Appendix D** for more details. The storage curve created to represent the loading dock ponding was created using the loading dock longitudinal profile and area.

Storage curves for controlled roof drains were created assuming a maximum of 0.15m of ponding for the entire building roof area, while rating curves created for the outlet nodes are based on the Zurn Control-Flo Roof Drains Specifications. Roof drain specifications are shown in **Appendix H.** Based on these specifications, the maximum flow per notch for one roof drain is 2.28 L/s for a ponding height of 0.15m. The number of roof drains per building was estimated by using an area of 232.5m^2 per drain, which represent a conservative approach according to the Zurn specifications. The rating curve for each building roof drain system is the following:

$$f(x) = 2.28x$$

Where,

$f(x)$ = height of ponding of the roof (max. 0.15m)

2.28 = max. flow in L/s per notch per drain

x = number of roof drains on the building

For the ICD, an orifice node was created. The discharge coefficient (C_d = 0.61) used for the orifice was taken from the Ottawa Sewer Design Guidelines. The size of the orifice is based on the allowable discharge for the site.

A summary of the input parameters for the PCSWMM model are presented with the model results in **Appendix G.**

5.3.2 PCSWMM Model Results

The dynamic model was created to ensure that enough storage is provided onsite to attenuate the 100-year post-development flow to the target discharge rate of **339.5 L/s** and that the 100-year + 20 % (climate change event) does not cause any flooding to buildings or neighbouring properties. The 5-year storm event was also evaluated to ensure that the proposed storm sewers are flowing under free-flow conditions.

Based on the 3h Chicago 100-year storm event, the maximum uncontrolled total peak flow from the site is estimated at **703.1 L/s**. To attenuate the maximum peak flow to the allowable target rate, an orifice ICD with a diameter of 335 mm was added on the outlet pipe of MHST-32. The resulting peak flow of the outfall node was reduced at **338.3 L/s** which is under the target flow rate. The following table summarizes the results for the 100-year storm event peak flows.

Table 2 – 100-year Storm Event Peak Flows

Outfall Node	Uncontrolled Peak Flow (L/s)	Allowable Peak Flow (L/s)	Controlled Peak Flow (L/s)	Peak Flow Attenuation	Meets Allowable Discharge
EX-MHST	703.1	339.5	338.3	51.9 %	Yes

To attenuate the 100-year peak flow to the target rate, on-site stormwater will be stored on rooftops and in underground storm chambers. The following table provides a summary of the different storage facilities.

Table 3 – 100-year Storm Event Storage

Storage Node	Available Storage (m³)	Max. Storage Used (m³)	Max. Storage Used (%)	Max. HGL (m)	Ponding Depth (m)
Chambers	84.6	66	78	92.70	0.51
Building A Roof	239.0	98	41	-	0.10
Building B Roof	35.7	15	42	-	0.10
Total	359.3	178	49.5	-	-

As shown in **Table 3**, the ponding depth on all building roofs are under the maximum ponding depth of 0.15 m. Also, only 78% of the available storage in the proposed underground storm chambers is used. However, it is worth noting that some surface ponding is occurring in the loading dock area. The maximum ponding in the loading dock area is only 0.23 m over the trench drain elevation and the ponding area is shown on **Drawing C103**. Except for the loading dock area, only a small amount of ponding is observed at CBMH-21 during the 100-year storm event.

As mentioned above, the 100-year storm event + 20% (climate change event) was evaluated to ensure that it would not cause any flooding to proposed buildings or neighbouring properties. The following table summarizes the maximum hydraulic grade line (HGL) and ponding height over each junction for the 100-year and climate change storm event.

Table 4 – Maximum HGL and Ponding Depth at Junctions

		3h Chicago – 100-Year		3h Chicago – 100-Year + 20%	
Junction ID	Rim Elevation (m)	Max. HGL (m)	Ponding Depth (m)	Max. HGL (m)	Ponding Depth (m)
CB-19	93.38	93.38	-	93.41	0.03
TD-CB-15	92.75	92.98	0.23	93.07	0.32
CBMH-21	93.30	93.32	0.02	93.39	0.09
MHST-22	93.57	93.13	-	93.24	-
MHST-23	93.57	93.21	-	93.33	-
CB-36	93.45	93.22	-	93.34	-
MHST-24	93.65	93.13	-	93.27	-
CBMH-27	93.45	93.40	-	93.50	0.05
CBMH-26	93.49	93.20	-	93.36	-
MHST-25	93.62	93.10	-	93.26	-
CBMH-28	93.47	93.22	-	93.47	-
CBMH-29	93.47	93.20	-	93.26	-
MHST-30	93.61	92.92	-	93.10	-
MHST-31	93.78	92.85	-	93.02	-
MHST-38	93.80	92.85	-	93.02	-
CB-35	93.75	92.85	-	93.03	-
MHST-33	93.94	92.85	-	93.03	-
RYCB-34	93.58	92.85	-	93.03	-
CBMH-20	93.30	92.72	-	92.94	-
MHST-32	93.79	92.69	-	92.91	-
MHST-37	94.06	90.42	-	90.43	-

As shown in **Table 4**, four structures have surface ponding for the climate change storm event. The extent of the maximum ponding area is shown on **Drawing C103**. No flooding is observed as ponding elevations are significantly below buildings finished floor elevation.

Detailed results from the PCSWMM model are provided in **Appendix G**.

6.0 STORM SEWERS AND SWM SYSTEM

6.1 Storm Sewers

Calculations showing the storm sewer capacities are appended to this report under **Appendix B** "Storm Sewer Computation Forms". The storm sewer design spreadsheet is based on the Rational Method and Manning formula and was used to calculate the design flow and required pipe sizes. Capacity required for proposed storm sewers is based on the 5-year rainfall intensity obtained from the Ottawa Sewer Design Guidelines, where T_c is the time of concentration:

- I_5 (mm/hr) = $998.071/(T_c+6.053)^{0.814}$

Drawing C106 shows the proposed drainage areas. Details including pipe lengths, sizes, materials, inverts elevations and structure types are shown on **Drawing C102**.

6.2 Emergency Overland Flow Route

As mentioned above, no significant ponding is expected for the 100-year and climate change storm event. However, in case of blockage, the emergency overland flow routes were added to **Drawing C106.** The emergency overland flow route for majority of the site consists of the south-east corner of the main parking lot area which drains towards the future Greenbank Rd. This represents the only possible overland flow route for this site as the future grading of the GRSWTE project differs from the original design presented in the DSEL report.

6.3 Stormwater Management System

As mentioned above, the stormwater management system includes an ICD on the outlet pipe of MHST-32 that will control the site discharge to a maximum of **338.3 L/s**. The total allowable discharge from the site is **347.6 L/s** including uncontrolled areas. Uncontrolled flow is estimated at **8.1 L/s** for the 100-year storm event. Therefore, the site total discharge is estimated at **346.4 L/s**.

The **Table 5** lists all the requirements for the manufacturer to design the appropriate ICD.

Table 5 - ICD Schedule

ICD ID	Location	Outlet Diameter (mm)	100y (L/s)	Head 100y (m)	Equivalent Diameter (mm)	Model
1	MHST-32	600	332.5	2.35	335	FRAME & PLATE

Below grade storage will be provided by storm structures, pipes, and mainly underground storm chambers. All roof areas will also be controlled to provide additional storage. The design will utilize **66 m³** of storage in the underground storage chambers for the 100-year storm event, however 84.6 m³ are available within the underground chamber system. The proposed system consists of the StormTech SC-310 or equivalent, see **Appendix D** for specifications. The bottom of the proposed chambers is set above the estimated groundwater table elevation (92.20m). Perforated subdrains will be placed on the perimeter of the storm chambers, directly above the elevation 92.20m to collect infiltration from the chambers and redirect it to the storm outlet.

The site stormwater runoff ultimately discharges to the Jock River. There is no on-site stormwater quality treatment required as the runoff from the site is conveyed to the Clarke Pond before discharging in the Jock River. The Clarke Pond was designed and constructed to provide a minimum of 80% TSS removal for all stormwater generated from the Half Moon Bay West Subdivision.

7.0 SANITARY SEWER

The new commercial buildings within the proposed development will be served with a new on-site sanitary system. Each building will have its own sanitary service. The on-site sanitary system will be connected to the existing sanitary service previously installed for this future development located at the property line along Cambrian Road. The peak sanitary flow for the proposed commercial development is calculated to be **0.67 L/s**, including infiltration. The sanitary load calculations can be found in **Appendix C**. The additional flow from the commercial development to the municipal sanitary sewer was accounted for in the Half Moon Bay Subdivision design. Thus, the capacity of the downstream sanitary sewer is considered adequate. The Sanitary Sewer Computation Sheet is included in **Appendix B**. Details concerning the existing and proposed pipe lengths and locations are shown on the site servicing plan.

8.0 WATER SERVICING

Water servicing and fire protection for the proposed commercial development will be provided by a new on-site 200mm watermain connected to the existing 400mm watermain on Cambrian Road. Two new fire hydrants will be installed on-site to provide exterior fire protection. Details regarding the new and existing watermain service connection pipe size and location are shown on **Drawing C102**. Both proposed buildings are exepcted to have interior sprinklers systems, thus the water services for these building will be a 200mm diameter.

The water demands for the proposed development are listed in **Table 6.** The fire flow was calculated using the Fire Underwriters Survey (FUS, 2020) method. Calculation details can be found in **Appendix C.**

Table 6 - Building Water Demands and Fire Flow

	Average Daily Demand (L/s)	Max Daily Demand (L/s)	Peak Hourly Demand (L/s)	Fire Flow Demand (L/s)	Max Daily + Fire Flow Demand (L/s)
Building A	0.10	0.16	0.28	83.0	83.16
Building B	0.02	0.02	0.04	33.0	33.02

Boundary conditions were obtained from the City on April 21, 2023, and are presented in **Appendix E**. Based on the information received, a water model was created using WaterCad to confirm that the proposed watermain and fire hydrants were able to provide domestic and fire flow demands while maintaining adequate pressure in the system. The model analyzed the proposed water system with the existing pressure zone condition (3SW) and with future pressure zone condition (SUC). The water model shows that the proposed system has the required capacity to provide domestic and fire protection demands for both existing and future pressure conditions. However, for the average day demand with existing pressure conditions, the pressure in the system is over 550 kPa (80 psi) meaning that each building water connection will require water pressure reducing valve installed directly downstream of the water meter inside the building. For future pressure zone conditions, the pressure reducing valves will not be required. Water model results are shown in **Appendix F**.

Also, to avoid water quality issues due to the watermain dead end at the connection to Building A, the second fire hydrant was placed at the back of Building A, near the connection to the building, so that any accumulation of debris or sediments can be flushed from the water line.

9.0 EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

To mitigate the impacts due to erosion and sedimentation during construction, erosion and sediment control measures shall be installed and maintained throughout the duration of construction.

Measures shall only be removed once the construction activities are complete, and the site has stabilized.

The measures will include but are not limited to:

- Siltsack® shall be installed between the frame and cover of existing and new catchbasins and maintenance holes, to minimize sediments entering the storm drainage system.
- All grassed areas must be completed prior to the removal of the Siltsack® in catch basins and maintenance holes.
- Light Duty Silt Fence Barriers placed around the perimeter of the site where necessary, installed and maintained according to OPSS 577 and OPSD 219.110.
- Construction mud mat at site entrance along Cambrian Rd to minimize the amount of mud carried out of the site.

Refer to **Drawing C101** notes for more details.

10.0 CONCLUSIONS

A dynamic model using the software PCSWMM was created to design the proposed stormwater management system and to ensure that the site peak flow meets the established allowable discharge of **347.6 L/s** for the 100-year storm event. According to the model, the 100-year peak flow will be controlled to a maximum discharge of **346.4 L/s** including uncontrolled areas, which meets the target discharge. Stormwater storage is provided to attenuate the 100-year storm in underground chambers and on building rooftops prior to discharging to the municipal storm sewer system. On-site stormwater quality treatment is not required as this site is part of the area serviced by the Clarke Pond.

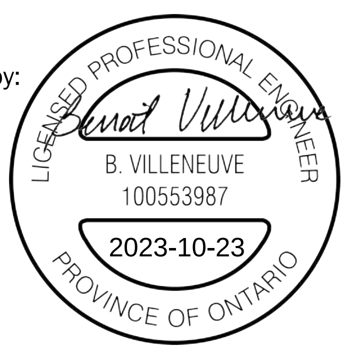
The water servicing of the building addition will be provided by a new on-site 200mm watermain with two new fire hydrants. The maximum fire flow of the two proposed building was estimated at **83.0 L/s**. A water model was used to confirm that adequate pressure in the system could be maintained during a fire flow demand for both existing and future pressure zone conditions. However, pressure in the City system during average day demands for existing pressure conditions is too high and will trigger the addition of pressure reducing valves inside the buildings.

The sanitary servicing of the site will be provided by an on-site sanitary sewer connected to the existing 500mm sanitary along Cambrian Rd. The peak sanitary flow for the proposed development, including infiltration, is calculated to be **0.67 L/s**.

Grading and drainage measures will ensure proper drainage of the site, while erosion and sediment control measures will minimize downstream impacts due to construction activities.

We look forward to receiving approval of this report and the appended plans from the City of Ottawa in order to proceed with construction of the site.

Prepared by:



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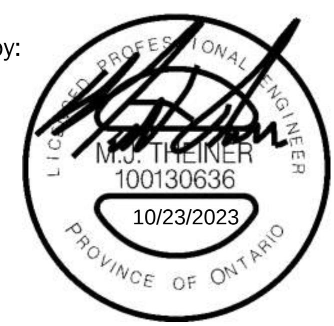

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Appendix A:
Stormwater Management Calculations

TABLE I - ALLOWABLE RUNOFF CALCULATIONS BASED ON EXISTING CONDITIONS

Area Description	Area (ha)	Time of Conc, Tc (min)	Minor Storm			
				I_5 (mm/hr)	C_{AVG}	Q_{ALLOW} (L/s)
EWS-01	1.50	10	Storm = 5 yr	104.19	0.80	**347.6**
TOTAL	1.50					**347.6**

Allowable Capture Rate is based the Design Brief for the Half Moon Bay West Phase 1, prepared by DSEL, Project #16-888, dated September 5, 2018

5-year Storm	$C_{ASPH/ROOF/CONC}$ =	0.90	C_{GRASS} =	0.20
100-year Storm	$C_{ASPH/ROOF/CONC}$ =	1.00	C_{GRASS} =	0.25

TABLE II - POST-DEVELOPMENT AVERAGE RUNOFF COEFFICIENTS

Watershed Area No.	Impervious Areas (m^2)	A * C_{ASPH}	Pervious Areas (m^2)	A * C_{GRASS}	Sum AC	Total Area (m^2)	$C_{AVG\ (5yr)}$	$C_{AVG(100yr)}$	% Impervious
WS-01*	3200.00	2880	0.00	0	2880	3200	0.90	1.00	100%
WS-02*	459.00	413	0.00	0	413	459	0.90	1.00	100%
WS-03	371.00	334	0.00	0	334	371	0.90	1.00	100%
WS-04	440.00	396	239.00	48	444	679	0.65	0.82	65%
WS-05	1384.00	1246	186.00	37	1283	1570	0.82	1.00	88%
WS-06	1614.00	1453	183.00	37	1489	1797	0.83	1.00	90%
WS-07	1489.00	1340	0.00	0	1340	1489	0.90	1.00	100%
WS-08	1310.00	1179	155.00	31	1210	1465	0.83	1.00	89%
WS-09	1354.00	1219	192.00	38	1257	1546	0.81	1.00	88%
WS-10	220.00	198	307.00	61	259	527	0.49	0.62	42%
WS-11	520.00	468	23.00	5	473	543	0.87	1.00	96%
WS-12	77.00	69	9.00	2	71	86	0.83	1.00	90%
WS-13	16.00	14	71.00	14	29	87	0.33	0.41	18%
WS-14	353.00	318	91.00	18	336	444	0.76	0.95	80%
WS-15**	0.00	0	486.00	97	97	486	0.20	0.25	0%
WS-16**	0.00	0	275.00	55	55	275	0.20	0.25	0%
WS-17**	0.00	0	498.00	100	100	498	0.20	0.25	0%
WS-Unc***	49.00	44	431.00	86	130	480	0.27	0.34	10%
Total	12856		2715		12069	16002			

* Roof top storage Areas

**External flow from neighbouring property

***Uncontrolled Areas

TABLE III - TOTAL RUNOFF COEFFICIENT FOR CONTROLLED AREAS (EXCLUDING ROOF TOP AREAS)

$C_{AVG(5yr)} = \frac{\text{Sum AC}}{\text{Total Area}} = \frac{8\,677}{11\,365} = 0.76$

$C_{AVG(100yr)} = 0.95$

TABLE IV - SUMMARY OF POST-DEVELOPMENT RUNOFF

Area No	Area (ha)	Storm = 5 yr				Storm = 100 yr			
		I_5 (mm/hr)	$C_{AVG(5yr)}$	Q_{GEN} (L/s)	Q_{CONT} (L/s)	I_{100} (mm/hr)	$C_{AVG(100yr)}$	Q_{GEN} (L/s)	Q_{CONT} (L/s)
WS-01*	0.320	104.19	0.90	83.4		178.56	1.00	158.8	
WS-02*	0.046	104.19	0.90	12.0		178.56	1.00	22.8	
WS-03	0.037	104.19	0.90	9.7		178.56	1.00	18.4	
WS-04	0.068	104.19	0.65	12.9		178.56	0.82	27.5	
WS-05	0.157	104.19	0.82	37.2		178.56	1.00	77.9	
WS-06	0.180	104.19	0.83	43.1		178.56	1.00	89.2	
WS-07	0.149	104.19	0.90	38.8		178.56	1.00	73.9	
WS-08	0.147	104.19	0.83	35.0		178.56	1.00	72.7	
WS-09	0.155	104.19	0.81	36.4		178.56	1.00	76.7	**339.5**
WS-10	0.053	104.19	0.49	7.5		178.56	0.62	16.1	
WS-11	0.054	104.19	0.87	13.7		178.56	1.00	27.0	
WS-12	0.009	104.19	0.83	2.1		178.56	1.00	4.3	
WS-13	0.009	104.19	0.33	0.8		178.56	0.41	1.8	
WS-14	0.044	104.19	0.76	9.7		178.56	0.95	20.8	
WS-15**	0.049	104.19	0.20	2.8		178.56	0.25	6.0	
WS-16**	0.028	104.19	0.20	1.6		178.56	0.25	3.4	
WS-17**	0.050	104.19	0.20	2.9		178.56	0.25	6.2	
WS-Unc***	0.048	104.19	0.27	3.8		178.56	0.34	8.1	**8.1**
Total	1.600			353.4				711.7	**347.6**

* Roof top storage Areas

$I_5 = 998.071 / (Tc+6.053)^{0.814}$

$I_{100} = 1735.688 / (Tc+6.014)^{0.820}$

Time of concentration (min), Tc = 10 mins

Appendix B:
Storm and Sanitary Sewer Computation Forms

STORM SEWER COMPUTATION FORM

Rational Method

Q = 2.78*A*I*R

Q = Flow (L/sec)
A = Area (ha)
I = Rainfall Intensity (mm/h)
R = Ave. Runoff Coefficient

City of Ottawa IDF Curve - 5-y

I_5 = 998.071/(Tc+6.053) ^ 0.814

Minimum Time of Conc. Tc = **10 min**

Manning's n = **0.013**

Drainage Area	From	To	Area (ha)	Runoff Parameters: Runoff Coeff. R	Indiv. 2.78AR	Accum. 2.78AR	Time of Conc. (min)	Rainfall Intensity (mm/hr)	Roof Flow Q (L/sec)	Peak Flow Q (L/sec)	Pipe Dia. nom. (mm)	Pipe Dia. actual (mm)	Slope (%)	Length (m)	Capacity full (L/sec)	Velocity full (m/sec)	Velocity actual (m/sec)	Time of Flow (min)	Q(d) / Q(f)	REMARKS
WS-04	CB-19	CBMH-21	0.068	0.65	0.12	0.12	10.00	104.19		12.85	250	254	2.31	26.0	94.29	1.86	1.10	0.23	0.14	
WS-03	TD-CB-15	MHST-22	0.037	0.90	0.09	0.09	10.00	104.19		9.67	200	203	1.50	30.0	41.91	1.29	0.88	0.39	0.23	
	MHST-22	MHST-23				0.09	10.39	102.18		9.48	250	254	0.43	32.8	40.68	0.80	0.55	0.68	0.23	
WS-05 & WS-14	CBMH-21	MHST-23	0.206	0.67	0.38	0.51	10.23	102.99		52.22	300	305	1.03	20.3	102.38	1.40	1.19	0.24	0.51	
	MHST-23	MHST-24				0.60	11.07	98.86	28.9	88.15	450	457	0.20	61.7	133.02	0.81	0.75	1.27	0.66	Roof Flow from PCSWMM Model
	MHST-24	MHST-25				0.60	12.34	93.27	28.9	84.80	450	457	0.20	17.9	133.02	0.81	0.75	0.37	0.64	
WS-07	CBMH-27	CBMH-26	0.149	0.90	0.37	0.37	10.00	104.19		38.82	300	305	1.00	35.3	100.88	1.38	1.08	0.43	0.38	
WS-06 & WS-15	CBMH-26	MHST-25	0.207	0.75	0.43	0.80	10.43	101.98		81.77	375	381	1.87	8.5	250.13	2.19	1.62	0.06	0.33	
	MHST-25	MHST-30				1.40	12.71	91.77	28.9	157.48	525	533	0.20	37.9	200.65	0.90	0.88	0.70	0.78	
WS-09	CBMH-28	CBMH-29	0.155	0.81	0.35	0.35	10.00	104.19		36.41	300	305	1.00	35.3	100.88	1.38	1.05	0.43	0.36	
WS-08 & WS-16	CBMH-29	MHST-30	0.196	0.67	0.36	0.71	10.43	101.98		72.76	375	381	1.87	10.8	250.13	2.19	1.58	0.08	0.29	
	MHST-30	MHST-31				2.12	13.41	89.07	28.9	217.26	600	610	0.20	14.8	286.47	0.98	0.95	0.25	0.76	
WS-13	RYCB-34	MHST-33	0.009	0.33	0.01	0.01	10.00	104.19		0.83	250	254	1.00	14.0	62.04	1.22	0.39	0.19	0.01	
	MHST-33	MHST-38				0.01	10.19	103.20		0.82	250	254	0.75	32.1	53.73	1.06	0.39	0.50	0.02	
WS-12	CB-35	MHST-38	0.009	0.83	0.02	0.02	10.00	104.19		2.06	250	254	2.00	19.3	87.74	1.73	0.64	0.19	0.02	
	MHST-38	MHST-31				0.03	10.19	103.20		2.86	300	305	0.80	24.4	90.23	1.24	0.51	0.33	0.03	
	MHST-31	CBMH-20				2.14	13.66	88.15	28.9	217.75	600	610	0.20	30.3	286.47	0.98	0.95	0.51	0.76	
WS-10	CBMH-20	MHST-32	0.053	0.49	0.07	2.22	14.17	86.34	28.9	220.09	600	610	0.20	11.0	286.47	0.98	0.95	0.19	0.77	
WS-11	SC-INLET	MHST-32	0.054	0.87	0.13	0.13	10.00	104.19		13.69	450	457	1.75	2.9	393.47	2.40	0.98	0.02	0.03	
	MSHT-32	MHST-37				2.35	14.36	85.68	28.9	229.90	600	610	0.20	13.8	286.47	0.98	0.96	0.23	0.80	
	MHST-37	*EX. MHST*				2.35	14.59	84.91	33.1	232.29	750	762	1.40	16.2	1374.20	3.01	1.87	0.09	0.17	Roof Flow from PCSWMM Model

Note:

Design: B. Villeneuve
Check: M. Theiner
Date: 2023-10-05

Project: 3845 Cambrian Rd
Commercial Development
Client: Loblaw Properties Ltd.

SANITARY SEWER DESIGN SHEET

Drainage Area	From	To	Peak Flow Q (L/sec)	Sewer Data: Type of Pipe	Pipe Dia. nom. (mm)	Pipe Dia. actual (mm)	Slope (%)	Length (m)	Capacity full (L/sec)	Velocity full (m/sec)	Velocity actual (m/sec)	Time of Flow (min)	Q(d) / Q(f)	REMARKS
	Retail A	MHSA-3	0.65	PVC	200	203.2	3.2	19.9	60.7	1.87	0.77	0.43	0.01	Including Infiltration
	MHSA-3	MHSA-2	0.67	PVC	200	203.2	1.6	92.5	43.3	1.33	0.59	2.63	0.02	
	MHSA-2	MHSA-1	0.67	PVC	200	203.2	1.6	11.7	43.7	1.35	0.59	0.33	0.02	
	MHSA-1	*EX MH-S*	0.67	*PVC*	*200*	*203.2*	*2.7*	*15.0*	*56.2*	*1.73*	*0.71*	*0.35*	*0.01*	

Manning's n = **0.013**

Design:	B. Villeneuve	**Project Name:**	3845 Cambrian Road
Check:	M. Theiner	**Parsons Project #:**	478575
Date:	April, 2023	**Client:**	Loblaw Properties Ltd.
		Client Project #:	

Appendix C:
Sanitary Load and Fire Flow

SANITARY DESIGN FLOWS

Area	COMMERCIAL/RETAIL Retail Area (m^2)	Peak Factor	Peak Flow (L/s)	TOTAL Peak Flow (L/s)	INFILTRATION Site Area (ha)	Infiltration Allowance (L/s/ha)	Infilt. Flow (L/s)	Total Total Peak Flow (L/s)
Subject Site					1.50	0.33	0.50	0.50
Retail A	3 204	1.5	0.16	0.16				0.16
Retail B	459	1.5	0.02	0.02				0.02
							Total	**0.67**

Design:	BV	**Project:**	Commercial Development Loblaw Properties Ltd.
Check :	MT	**Location:**	3845 Cambrian Road Ottawa, Ontario
Dwg reference:		**Project # :**	478575
		Date:	April, 2023
		Sheet:	1 of 1

Average Daily Demands

(Based on City of Ottawa *Sewer Design Guidelines 2012* and *MOE Water Design Guidelines*)

Average Residential Daily Flow =	280	L/p/d
Institutional Flow =	28 000	L/ha/d
Commercial Flow =	28 000	L/ha/d
Light Industrial Flow =	35 000	L/ha/d
Heavy Industrial Flow =	55 000	L/ha/d
Hotel Daily Flow =	225	L/bed/d
Office/Warehouse Daily Flow =	75	L/empl/d
Shopping Centres =	2 500	L/(1000m^2/d)

Population Densities

Average suburban residential dev.	60	p/ha
Single family	3.4	p./unit
Semi-detached	2.7	p./unit
Duplex	2.3	p./unit
Townhouse	2.7	p./unit
Appartment average	1.8	p./unit
Bachelor	1.4	p./unit
1 Bedroom	1.4	p./unit
2 Bedrooms	2.1	p./unit
3 Bedrooms	3.1	p./unit
Hotel room, 18 m2	1	p./unit
Restaurant, 1 m2	1	p./unit
Office	1	p/25m^2
Warehouse	1	p/90m^2
Automotive Service Centre, per bay	1	p/bay (plus management)

Peak Factors

Commercial =	1.5	if commercial contribution > 20%, otherwise
Institutional =	1.5	if institutional contribution > 20%, otherwise
Industrial =		per Appendix 4-B.0 Graph
Residential :		Harmon Equation
		1 + (14/(4+(Capita/1000) ^ 0.5))*8
		min =
		max =

Infiltration allowance (dry weather)	0.05	L/s/ha
Infiltration allowance (wet weather)	0.28	L/s/ha
I/I (total)	0.33	L/s/ha

3845 Cambrian Road Commercial Development - Estimated Water Demands

Area	Units	Population	Gross Floor Area (m2)	Average Daily Demand (ADD) (L/s)	Maximum Daily Demand (MDD) (L/s)	Peak Hourly Demand (PHD) (L/s)	Fire Flow (FF) (L/s)	MDD + FF (L/s)
Proposed Retail A								
Commercial Unit			3204	0.10	0.16	0.28	83	83.16
Proposed Retail B								
Commercial Unit			459	0.01	0.02	0.04	33	33.02

Average Daily Demand

Based on Ottawa Design Guidelines - Water Distribution, 2010 and MOE Design Guidelines for Drinking-Water Systems, 2008

Average Residential Daily Flow =	350	L/p/d
Institutional Flow =	28 000	L/gross ha/d
Commercial Flow =	28 000	L/gross ha/d
Light Industrial Flow =	35 000	L/gross ha/d
Heavy Industrial Flow =	55 000	L/gross ha/d
Hotel Daily Flow =	225	L/bed/d
Office/Warehouse Daily Flow =	75	L/person/d
Office/Warehouse Daily Flow =	8.06	L/m2/day
Restaurant (Ordinary not 24 Hours) =	125	L/seat/d
Restaurant (24 Hours) =	200	L/seat/d
Shopping Centres =	2 500	L/(1000m^2/d)
Amenity Area =	5	L/m2/d

Maximum Daily Demand

Residential =	2.5 x Average Daily Demand
	4.9 x Average Daily Demand **
Industrial =	1.5 x Average Daily Demand
Commercial =	1.5 x Average Daily Demand
Institutional =	1.5 x Average Daily Demand

Peak Hourly Demand

Residential =	2.2 x Maximum Daily Demand
	7.4 x Maximum Daily Demand **
Industrial =	1.8 x Maximum Daily Demand
Commercial =	1.8 x Maximum Daily Demand
Institutional =	1.8 x Maximum Daily Demand

3845 Cambrian Road Commercial Development

Building	Type of Construction C	Total Floor Area (m2) A	Fire Flow (min. 2,000) (L/min) F	Adjusted (nearest 1,000) (L/min)	Occupancy Factor O	Reduction / Increase due to Occupancy	Fire Flow with Occupancy (min. 2,000) (L/min)	Sprinklers Factor S	Reduction due to Sprinklers (L/min)	Exposure Factor % E	Increase due to Exposure (L/min)	Fire Flow (L/min)	Roof Contribution (L/min) R	Required Fire Demand: Adjusted to the nearest 1000 (min. 2,000, max. 45,000) (L/min) F	Required Fire Demand: Minimum 33 (L/s)
Retail A	0.8	3 204	9 962	10 000	0%	0	10 000	50%	5 000	0%	0	5 000	0	5 000	83
Retail B	0.8	459	3 771	4 000	0%	0	4 000	50%	2 000	0%	0	2 000	0	2 000	33

Reference:

References

Water Supply for Public Fire Protection , 2020 by Fire Underwriters Survey (FUS) and
Ottawa Design Guidelines - Water Distribution, July 2010 and subsequent Technical Bulletins

C Type of Construction

Wood Frame (Type V)	1.5
Mass Timber (Type IV-A) - Encapsulated Mass Timber	0.8
Mass Timber (Type IV-B) - Rated Mass Timber	0.9
Mass Timber (Type IV-C) - Ordinary Mass Timber	1.0
Mass Timber (Type IV-D) - Unrated Mass Timber	1.5
Ordinary Construction (Type III also known as joisted masonry)	1.0
Non-Combustible Construction (Type II - minimum 1 hour fire resistance rating)	0.8
Fire resistive Construction (Type I - minimum 2 hour fire resistance rating)	0.6

A Total Effective Floor Area (m²)

Buildings Classified with a Construction Coefficient from 1.0 to 1.5
100% of all Floor Areas

Buildings Classified with a Construction Coefficient below 1.0
Vertical Openings Unprotected
Two (2) Largest Adjoining Floor Areas
Additional Floors (up to eight (8)) at 50%

Vertical Openings Properly Protected
Single Largest Floor
Additional Two (2) Adjoining Floors at 25%

High One Storey Building
When a building has a large single storey space exceeding 3m in height, the number of storeys to be used in determining the total effective area depends upon the use being made of the building.

Subdividing Buildings (Vertical Firewalls)
Minimum two (2) hour fire resistance rating and meets National Building Code requirements.

- Up to 10% can be applied if there is severe risk of fire on the exposed side of the firewall due to hazard conditions.
- An exposure charge of up to 10% can be applied if there are unprotected openings in the firewall

Basement
Basement floor excluded when it is at least 50% below grade.

Open Parking Garages
Use the area of the largest floor.

O Occupancy

Non-Combustible	-25%
Limited Combustible	-15%
Combustible	0%
Free Burning	15%
Rapid Burning	25%

- Table 3 provides recommended Occupancy and Contents Adjustment Factors for Example Major Occupancies from the National Building Code of Canada.
- Adjustment factors should be adjusted accordingly to the specific fore loading and situation that exists in the subject building.
- Values can be interpolated from the examples given considering fire loading and expected combustibility of contents if the subject building is not listed.
- Values can be modified by up to 10% (+/-) depending on the extent to which the fire loading is unusual for the building.
- Buildings with multiple major occupancies should use the most restrictive factor or interpolate based on the percentage of each occupancy and its associated fire loading.

Table 3 Values for Subject Building

Group:	E
Division:	
Description of Occupancy:	Shops/Stores
Occupancy and Contents:	Combustible
Adjustment Factor:	0%

R Roof

Shake Roof	2,000 to 4,000 L/min	additional should be added to the fire flow
Wood Shingle	2,000 to 4,000 L/min	additional should be added to the fire flow

F Fire Flow (L/Min)

220*C*(A^0.5)

S Sprinklers

	Complete Coverage	Partial Coverage
Automatic Sprinklers NFPA Standards	30%	30% * x%
Standard Water Supply	10%	10% * x%
Full Supervision	10%	10% * x%

(x%: percentage of total protected floor area)

Additional Reductions for Community Level Automatic Sprinkler Protection of Area
Buildings located within communities or subdivisions that are completely sprinkler protected may apply up to a maximum additional 25% reduction in required fire flows beyond the normal maximum of 50% reduction for sprinkler protection of an individual building.

Adjustment of Sprinkler Reductions for Community Level Oversight of Sprinkler Maintenance, Testing, and Water Supply Requirements
The reduction in required fire flow for sprinkler protection may be reduced of eliminated if:
- The community does not have a Fire Prevention Program that provides a system of ensuring that the fire sprinkler systems are inspected, tested, and maintained in accordance with NFPA 25
- The community does not maintain the pressure and flow rate requirements for fire sprinkler installations, or otherwise allows the flow rates and pressure levels that were available during sprinkler system design to significantly degrade, increasing the probability of inadequate water supply for effective sprinkler operation.

E Exposure

The maximum exposure adjustment that can be applied to a building is 75% when summing the percentages of all sides of the building

Separation Distance (m)	Maximum Exposure Adjustment	N	E	S	W
0 to 3	25%				
3.1 to 10	20%				
10.1 to 20	15%				
20.1 to 30	10%				
Greater than 30	0%				

Table 6: Exposure Adjustment Charges for Subject Building Considering Construction Type of Exposed Building Face

Distance to the Exposure (m)	Length-Height Factor of Exposing Building Face	Type V	Type III-IV[2]	Type III-IV[3]	Type I-II[2]	Type I-II[3]
0 to 3	0-20	20%	15%	5%	10%	0%
	21-40	21%	16%	6%	11%	1%
	41-60	22%	17%	7%	12%	2%
	61-80	23%	18%	8%	13%	3%
	81-100	24%	19%	9%	14%	4%
	Over 100	25%	20%	10%	15%	5%
3.1 to 10	0-20	15%	10%	3%	6%	0%
	21-40	16%	11%	4%	7%	0%
	41-60	17%	12%	5%	8%	1%
	61-80	18%	13%	6%	9%	2%
	81-100	19%	14%	7%	10%	3%
	Over 100	20%	15%	8%	11%	4%
10.1 to 20	0-20	10%	5%	0%	3%	0%
	21-40	11%	6%	1%	4%	0%
	41-60	12%	7%	2%	5%	0%
	61-80	13%	8%	3%	6%	1%
	81-100	14%	9%	4%	7%	2%
	Over 100	15%	10%	5%	8%	3%
20.1 to 30	0-20	0%	0%	0%	0%	0%
	21-40	2%	1%	0%	0%	0%
	41-60	4%	2%	0%	1%	0%
	61-80	6%	3%	1%	2%	0%
	81-100	8%	4%	2%	3%	0%
	Over 100	10%	5%	3%	4%	0%
Over 30m	All Sizes	0%	0%	0%	0%	0%

[2] with unprotected openings
[3] without unprotected openings

Automatic Sprinkler Protection in Exposed Buildings
- If the exposed building is fully protected with an automatic sprinkler system (see note Recognition of Automatic Sprinkler), the exposure adjustment charge determined from Table 6 may be reduced by up to 50% of the value determined.

Automatic Sprinkler Protection in both Subject and Exposed Buildings
- If both the subject building and the exposed building are fully protected with automatic sprinkler systems (see note Recognition of Automatic Sprinkler), no exposure adjustment charge should be applied.

Exposure Protection of Area Between Subject and Exposed Buildings
- If the exposed building is fully protected with an automatic sprinkler system (see note Recognition of Automatic Sprinkler), and the area between the buildings is protected with an exterior automatic sprinkler system, no exposure adjustment charge should be applied

Reduction of Exposure Charge for Type V Buildings
- If the exposed building face of a Type V building has an exterior cladding assembly with a minimum 1 hour fire resistive rating, then the exposure charge may be treated as a Type III/IV building for the purposes of looking up the appropriate exposure charge in Table 6.

Appendix D:
Stormwater Storage Chambers Specifications

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

Advanced Drainage Systems, Inc.

SiteAssist™
FOR STORMTECH INSTALLATION INSTRUCTIONS VISIT OUR APP

3845 CAMBRIAN RD R1 COPY

OTTAWA, ON, CANADA

SC-310 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH SC-310.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE OR POLYETHYLENE COPOLYMERS.
3. CHAMBERS SHALL BE CERTIFIED TO CSA B184, "POLYMERIC SUB-SURFACE STORMWATER MANAGEMENT STRUCTURES", AND MEET THE REQUIREMENTS OF ASTM F2922 (POLETHYLENE) OR ASTM F2418 (POLYPROPYLENE), "STANDARD SPECIFICATION FOR CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE CSA S6 CL-625 TRUCK AND THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 50 mm (2").
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2922 SHALL BE GREATER THAN OR EQUAL TO 400 LBS/FT/%. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 23° C / 73° F), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2922 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF THE SC-310 SYSTEM

1. STORMTECH SC-310 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH SC-310 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 150 mm (6") SPACING BETWEEN THE CHAMBER ROWS.
7. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE 20-50 mm (3/4-2").
8. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
9. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

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

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

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

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PROPOSED LAYOUT

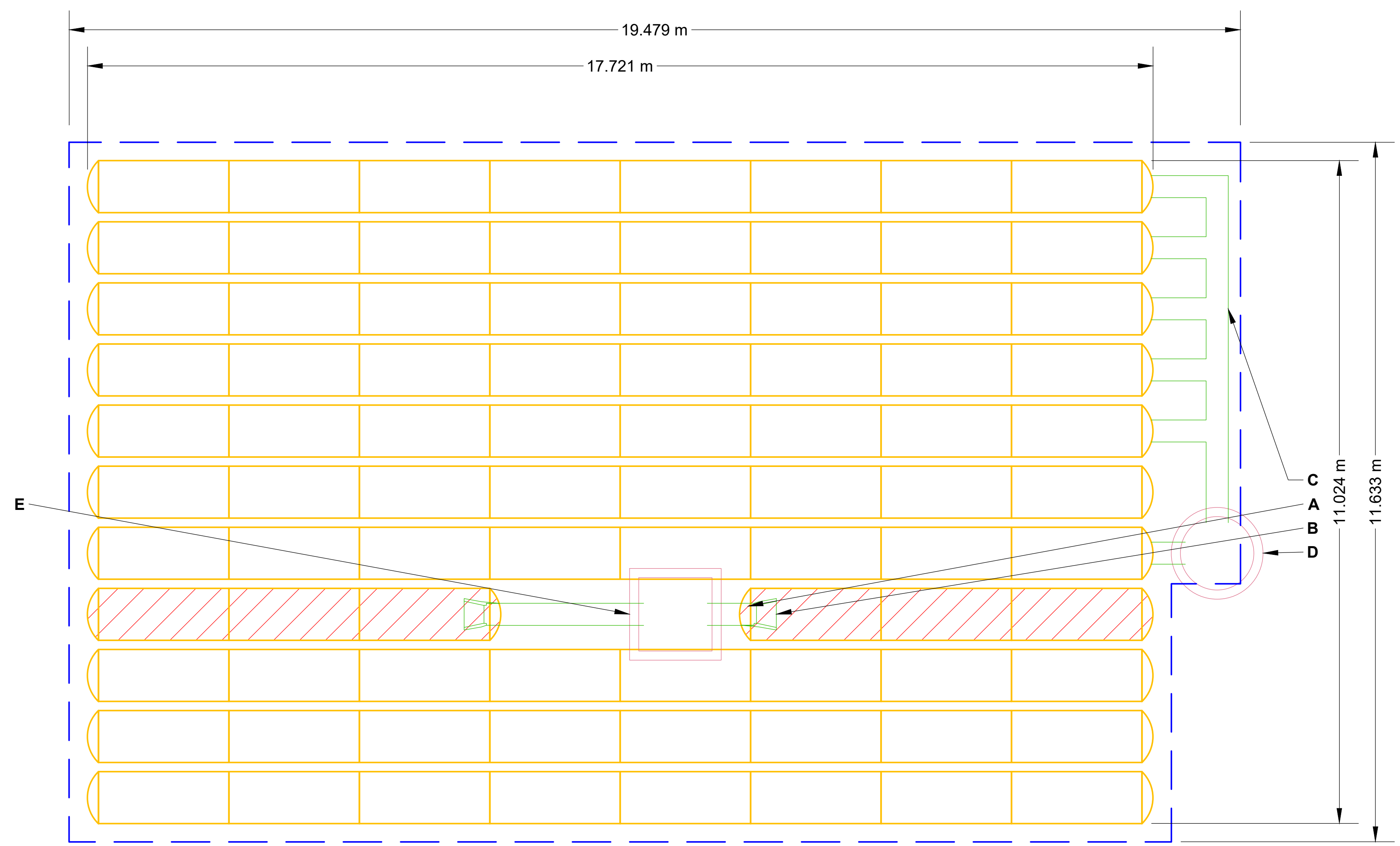
86	STORMTECH SC-310 CHAMBERS
24	STORMTECH SC-310 END CAPS
152	STONE ABOVE (mm)
152	STONE BELOW (mm)
40	STONE VOID
84.6	INSTALLED SYSTEM VOLUME (m^3) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)
221.7	SYSTEM AREA (m^2)
62.2	SYSTEM PERIMETER (m)

PROPOSED ELEVATIONS:

MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	95.197
MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	93.368
MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	93.216
MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	93.216
MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	93.216
TOP OF STONE:	92.911
TOP OF SC-310 CHAMBER:	92.759
300 mm x 300 mm BOTTOM MANIFOLD INVERT:	92.375
300 mm ISOLATOR ROW PLUS INVERT:	92.375
300 mm BOTTOM CONNECTION INVERT:	92.375
BOTTOM OF SC-310 CHAMBER:	92.352
BOTTOM OF STONE:	92.200

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED EZ END CAP	A	300 mm BOTTOM PREFABRICATED EZ END CAP, PART#: SC310ECEZ / TYP OF ALL 300 mm BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	23 mm	
FLAMP	B	INSTALL FLAMP ON 300 mm ACCESS PIPE / PART#: SC31012RAMP (TYP 2 PLACES)		
MANIFOLD	C	300 mm x 300 mm BOTTOM MANIFOLD, ADS N-12	23 mm	
CONCRETE STRUCTURE	D	OCS (DESIGN BY ENGINEER / PROVIDED BY OTHERS)		113 L/s OUT
CONCRETE STRUCTURE	E	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		



ISOLATOR ROW PLUS (SEE DETAIL/TYP 2 PLACES)

NO WOVEN GEOTEXTILE

BED LIMITS

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

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DATE:

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PROJECT #:

CHECKED: N/A

DATE	DRW	CHK	DESCRIPTION

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SCALE = 1 : 100

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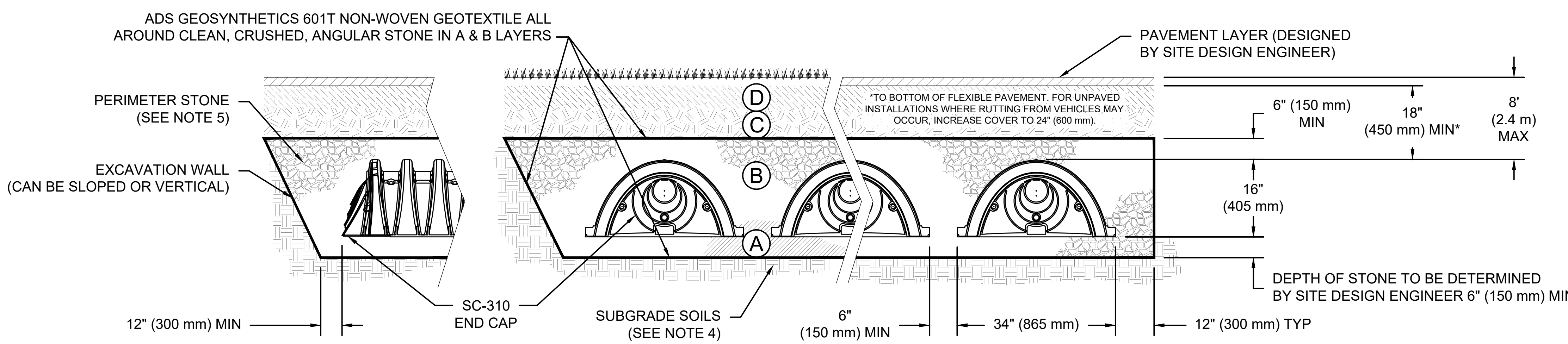
ACCEPTABLE FILL MATERIALS: STORMTECH SC-310 CHAMBER SYSTEMS

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

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 6" (150 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2922 (POLETHYLENE) OR ASTM F2418 (POLYPROPYLENE), "STANDARD SPECIFICATION FOR CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. SC-310 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 2".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 400 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

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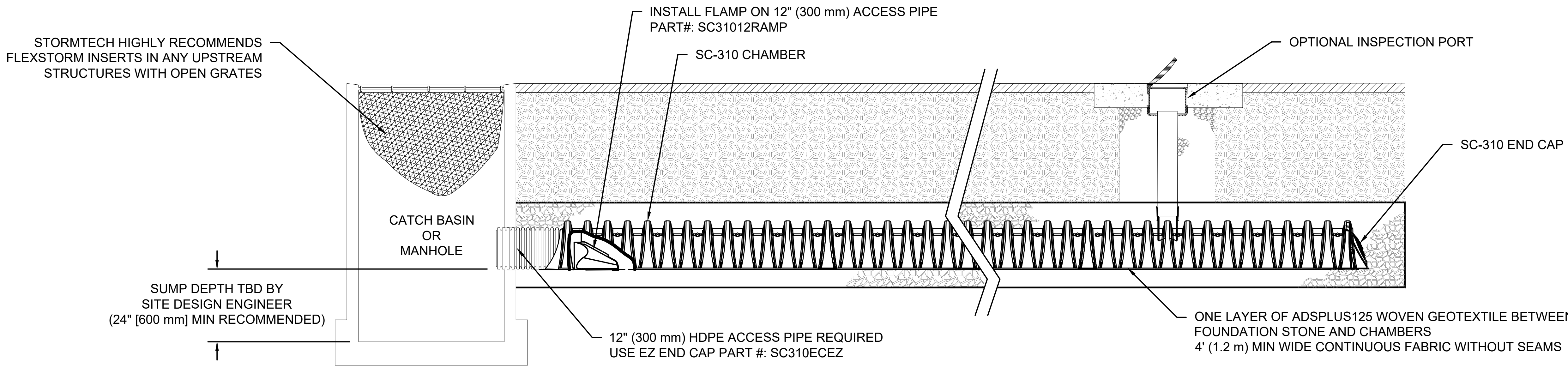

SC-310 ISOLATOR ROW PLUS DETAIL

NTS

INSPECTION & MAINTENANCE

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

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

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

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

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.

2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

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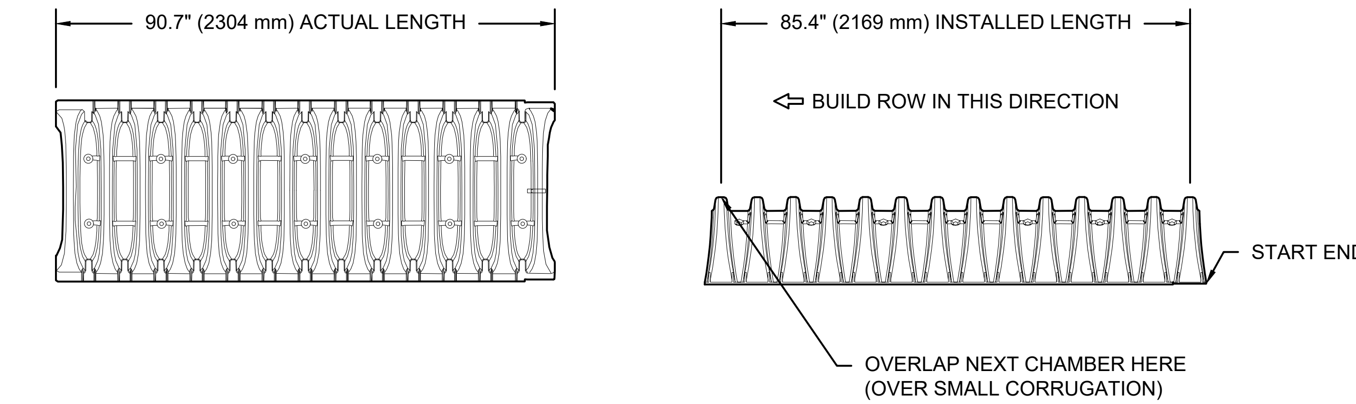
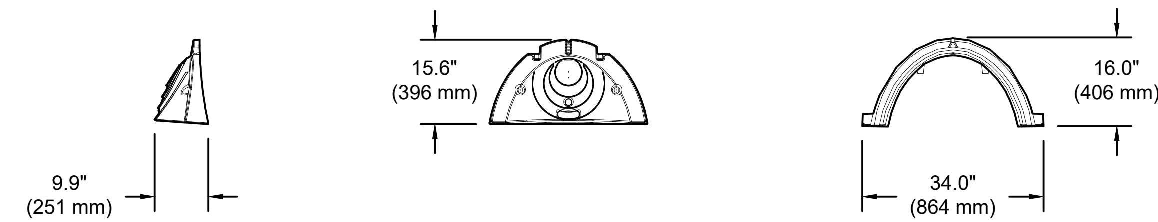
SC-310 TECHNICAL SPECIFICATION

NTS

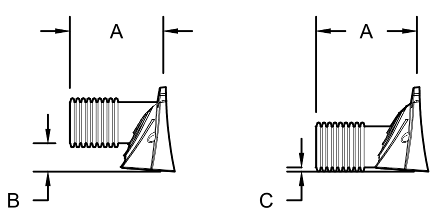




NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	34.0" X 16.0" X 85.4"	(864 mm X 406 mm X 2169 mm)
CHAMBER STORAGE	14.7 CUBIC FEET	(0.42 m³)
MINIMUM INSTALLED STORAGE*	31.0 CUBIC FEET	(0.88 m³)
WEIGHT	35.0 lbs.	(16.8 kg)

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



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

PART #	STUB	A	B	C
SC310EPE06T / SC310EPE06TPC	6" (150 mm)	9.6" (244 mm)	5.8" (147 mm)	---
SC310EPE06B / SC310EPE06BPC			---	0.5" (13 mm)
SC310EPE08T / SC310EPE08TPC	8" (200 mm)	11.9" (302 mm)	3.5" (89 mm)	---
SC310EPE08B / SC310EPE08BPC			---	0.6" (15 mm)
SC310EPE10T / SC310EPE10TPC	10" (250 mm)	12.7" (323 mm)	1.4" (36 mm)	---
SC310EPE10B / SC310EPE10BPC			---	0.7" (18 mm)
SC310ECEZ*	12" (300 mm)	13.5" (343 mm)	---	0.9" (23 mm)

ALL STUBS, EXCEPT FOR THE SC310ECEZ ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694.

* FOR THE SC310ECEZ THE 12" (300 mm) STUB LIES BELOW THE BOTTOM OF THE END CAP APPROXIMATELY 0.25" (6 mm). BACKFILL MATERIAL SHOULD BE REMOVED FROM BELOW THE N-12 STUB SO THAT THE FITTING SITS LEVEL.

NOTE: ALL DIMENSIONS ARE NOMINAL

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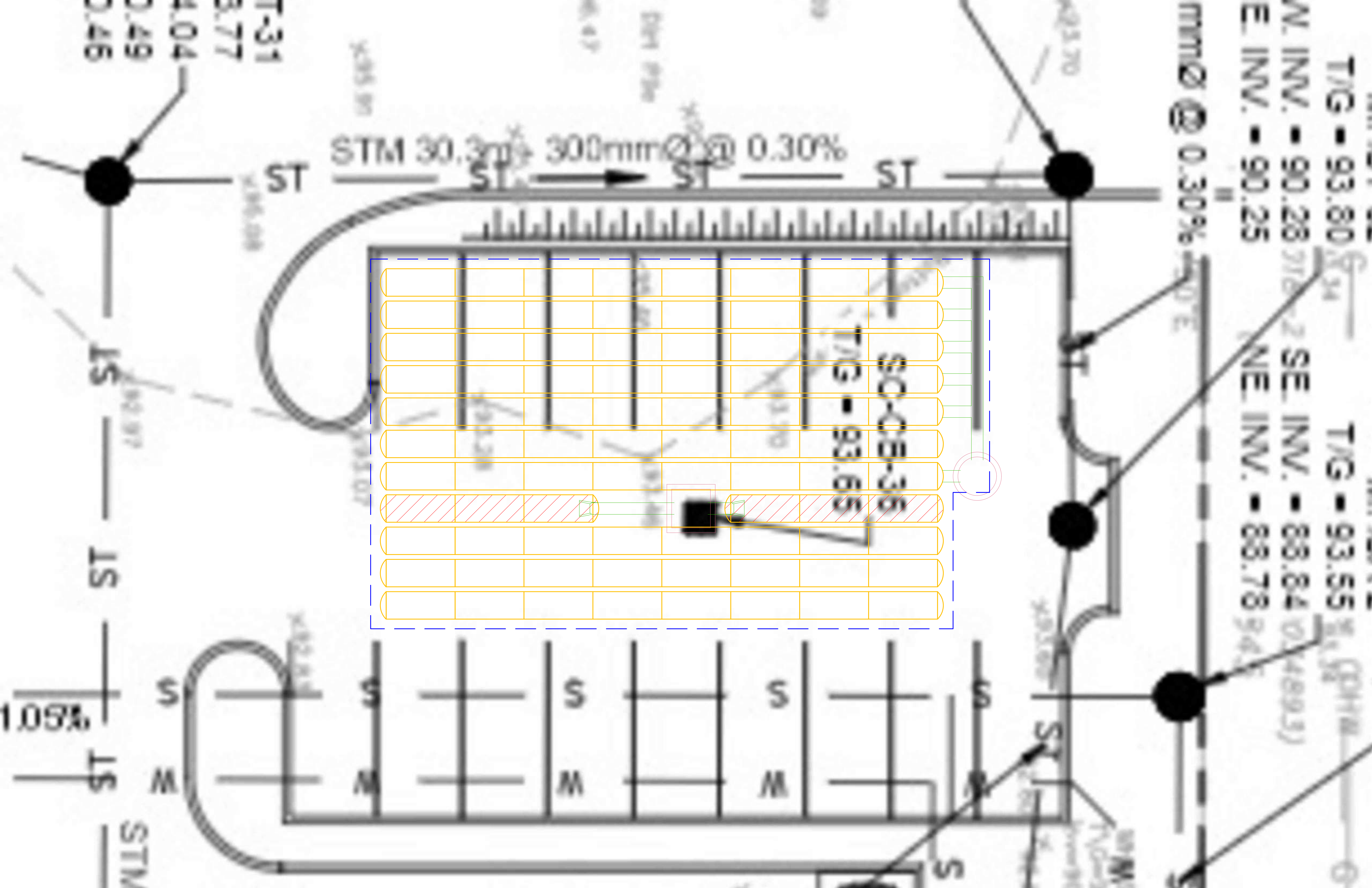

STM 30.3m - 300mmØ @ 0.30%
ST
SC-CB-36
T/G = 93.65
T/G = 93.80
W. INV. = 90.28
E. INV. = 90.25
T/G = 93.55
SE. INV. = 88.84
NE. INV. = 88.78
mmØ @ 0.30%
1.05%
S
W
STM

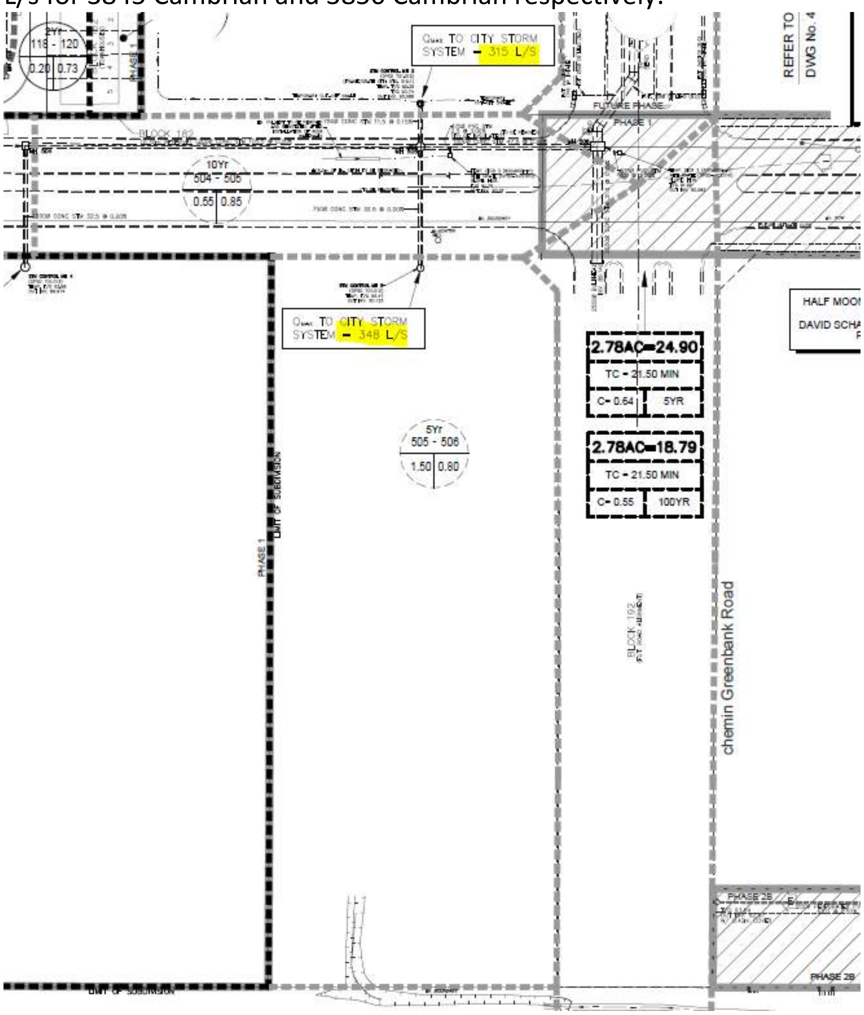
Appendix E:
City Correspondence

Villeneuve, Benoit [NN-CA]

From: Bramah, Bruce <bruce.bramah@ottawa.ca>
Sent: 20 mars 2023 15:00
To: Villeneuve, Benoit [NN-CA]
Cc: Theiner, Mathew [NN-CA]; Harrold, Eric
Subject: [EXTERNAL] RE: 3845 & 3850 Cambrian Rd Commercial Developments - Stormwater Management

Good afternoon Benoit,

Both properties shall comply with the servicing criteria from the final detailed design: Design Brief for the Half Moon Bay West Phase 1, Prepared by DSEL, Project #16-888, dated Sept 5, 2018.
The design brief notes a predevelopment C=0.8, Tc=10min. The resulting pre development flows are 348 L/s and 315 L/s for 3845 Cambrian and 3850 Cambrian respectively.



If you have any further questions, please feel free to call me or we can set up a meeting to discuss.
Thank you,
--

Bruce Bramah, EIT
Project Manager
Planning, Real Estate and Economic Development Department / Direction générale de la planification, des biens immobiliers et du développement économique
Development Review - South Branch

City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste 29686, Bruce.Bramah@ottawa.ca

From: Benoit.Villeneuve@parsons.com <Benoit.Villeneuve@parsons.com>
Sent: March 10, 2023 1:24 PM
To: Bramah, Bruce <bruce.bramah@ottawa.ca>; Charie, Kelsey <kelsey.charie@ottawa.ca>; Harrold, Eric <eric.harrold@ottawa.ca>
Cc: Theiner, Mathew <mathew.theiner@parsons.com>; Moore, Sean <Sean.Moore@ottawa.ca>; O'Callaghan, Katie <katie.ocallaghan@ottawa.ca>
Subject: 3845 & 3850 Cambrian Rd Commercial Developments - Stormwater Management

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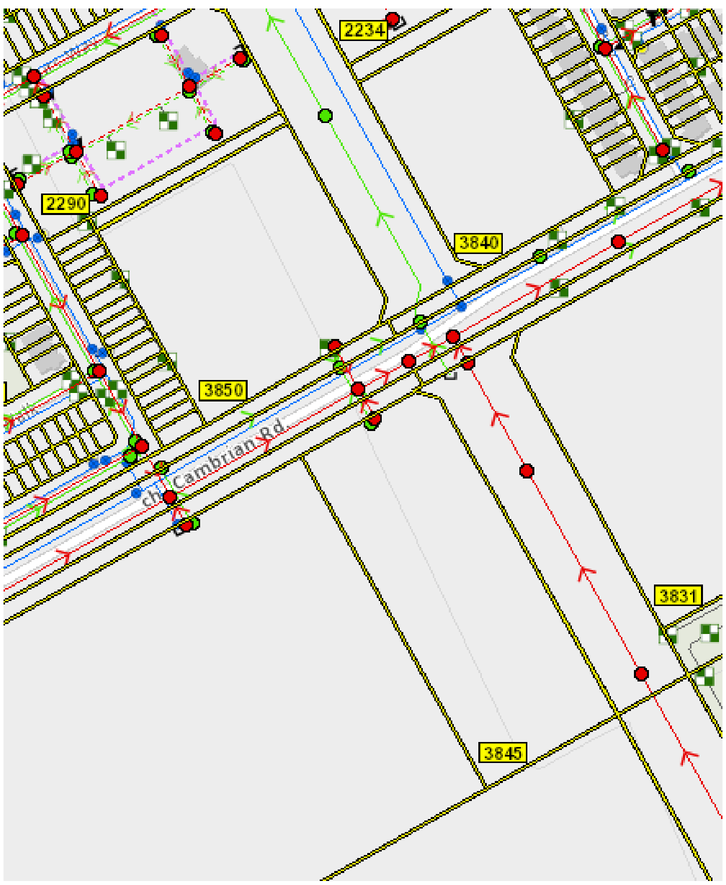
Hi,

Parsons is currently providing municipal engineering services for both commercial development located at 3845 Cambrian Rd and 3850 Cambrian Rd. These two sites are across from each other on Cambrian Rd and are serviced by the same storm sewer previously installed in 2019 for the future re-aligned Greenbank Rd. (see image below)



According to pre-consultation meeting notes for both projects (see attached), the allowable release rate for each site is determined using two different methods.

For 3850 Cambrian Rd the allowable release rate is calculated using the following parameters:

- Allowable runoff coefficient = lesser of existing pre-development to a maximum of 0.5 (in our case C=0.2 as this is a vacant land)
- Time of concentration = pre-development, maximum 10 min
- Allowable flowrate using Tc=10min, C=0.2 and an area of 1.4 ha, Qallowable = 81.1 L/s

For 3845 Cambrian Rd the allowable release rate is calculated using the following parameters:

- Allowable runoff coefficient = 0.8
- Time of concentration = 10 min
- Site area = 1.5 ha
- Allowable flowrate = 348 L/s

Furthermore, as these two properties are part of the Half Moon Bay West Subdivision, these two sites were taken into account in the design of the new storm sewer along future Greenbank Rd and the new Clarke Pond. Based on the *Functional Servicing and Stormwater Management Report for the Half Moon Bay West Subdivision, dated March 8, 2019 by Mattamy Homes and DSEL*, the storm sewer was designed using runoff coefficient of 0.8 for both properties and a time of concentration of 29.62 min and 31.23 min for 3845 Cambrian and 3850 Cambrian respectively. Appendix D of this report showing the storm drainage plan and storm design sheets is attached for your reference.

Using the time of concentration mentioned above and runoff coefficient of 0.8, the allowable release rate for 3845 Cambrian is 181.5 L/s and 163.4 L/s for 3850 Cambrian.

We would like you to discuss and let us know which method of calculations should be used for both of these commercial developments. We could also arrange a meeting in the middle of next week to discuss.

If you have any questions please let us know.

Thank you,

Benoit Villeneuve, EIT
Junior Designer
100-1223 Michael St North, Ottawa, ON K1J 7T2
benoit.villeneuve@parsons.com
P : +1 613.691.1596
Parsons [can01.safelinks.protection.outlook.com] / LinkedIn [can01.safelinks.protection.outlook.com] / Twitter [can01.safelinks.protection.outlook.com] / Facebook [can01.safelinks.protection.outlook.com] / Instagram [can01.safelinks.protection.outlook.com]

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Boundary Conditions
3845 Cambrian Rd

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	7	0.12
Maximum Daily Demand	11	0.18
Peak Hour	19	0.32
Fire Flow Demand #1	4,980	83.00

Location

Results

Existing Conditions (Pressure Zone 3SW)

Connection 1 – Cambrian Rd.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	156.5	89.9
Peak Hour	142.6	70.1
Max Day plus Fire Flow	138.2	63.9

[1] Ground Elevation = 93.3 m

Future Conditions (Pressure Zone SUC)

Connection 1 – Cambrian Rd.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	146.8	76.0
Peak Hour	142.8	70.4
Max Day plus Fire Flow	144.2	72.4
[1] Ground Elevation =	93.3	m

Notes

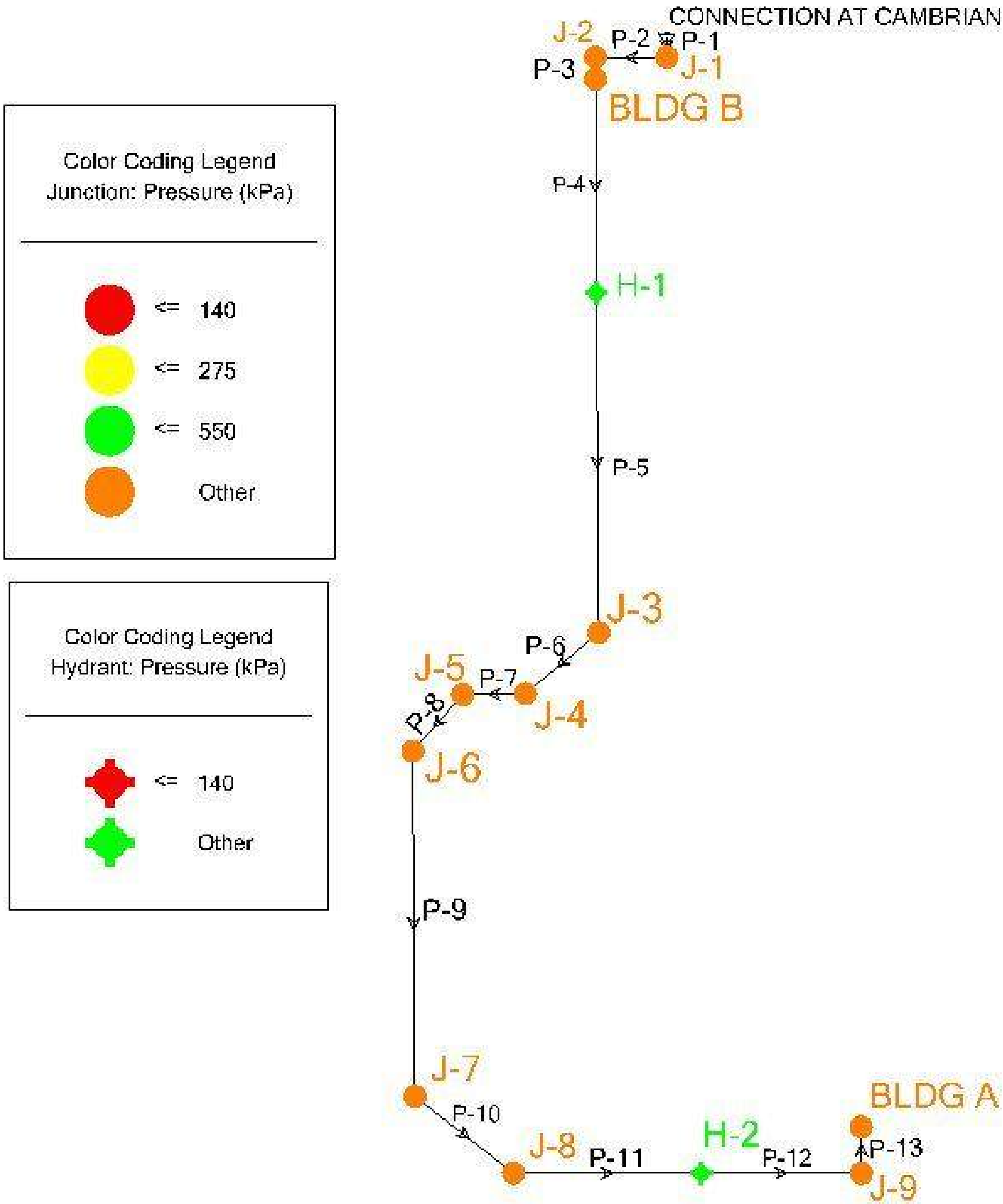
1. As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:
    a. If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
    b. Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

Appendix F:
WaterCad Model Results

Scenario: **Average Day Demand**
Existing Conditions (Pressure Zone 3SW)



Scenario: **Average Day Demand**
Existing Conditions (Pressure Zone 3SW)

PIPE TABLE

	Length (Scaled) (m)	Start Node	Stop Node	Diameter (mm)	Material	Hazen-Williams C	Flow (L/s)	Velocity (m/s)
32: P-1	3	CONNECTION AT CAMBRIAN	J-1	200.0	PVC	110.0	0.12	0.00
76: P-2	11	J-1	J-2	200.0	PVC	110.0	0.12	0.00
38: P-3	3	J-2	BLDG B	200.0	PVC	110.0	0.12	0.00
40: P-4	33	BLDG B	H-1	200.0	PVC	110.0	0.10	0.00
63: P-7	10	J-4	J-5	200.0	PVC	110.0	0.10	0.00
65: P-8	12	J-5	J-6	200.0	PVC	110.0	0.10	0.00
67: P-9	54	J-6	J-7	200.0	PVC	110.0	0.10	0.00
69: P-10	20	J-7	J-8	200.0	PVC	110.0	0.10	0.00
71: P-11	29	J-8	H-2	200.0	PVC	110.0	0.10	0.00
75: P-13	7	J-9	BLDG A	200.0	PVC	110.0	0.10	0.00
44: P-5	53	H-1	J-3	200.0	PVC	110.0	0.10	0.00
61: P-6	15	J-3	J-4	200.0	PVC	110.0	0.10	0.00
73: P-12	25	H-2	J-9	200.0	PVC	110.0	0.10	0.00

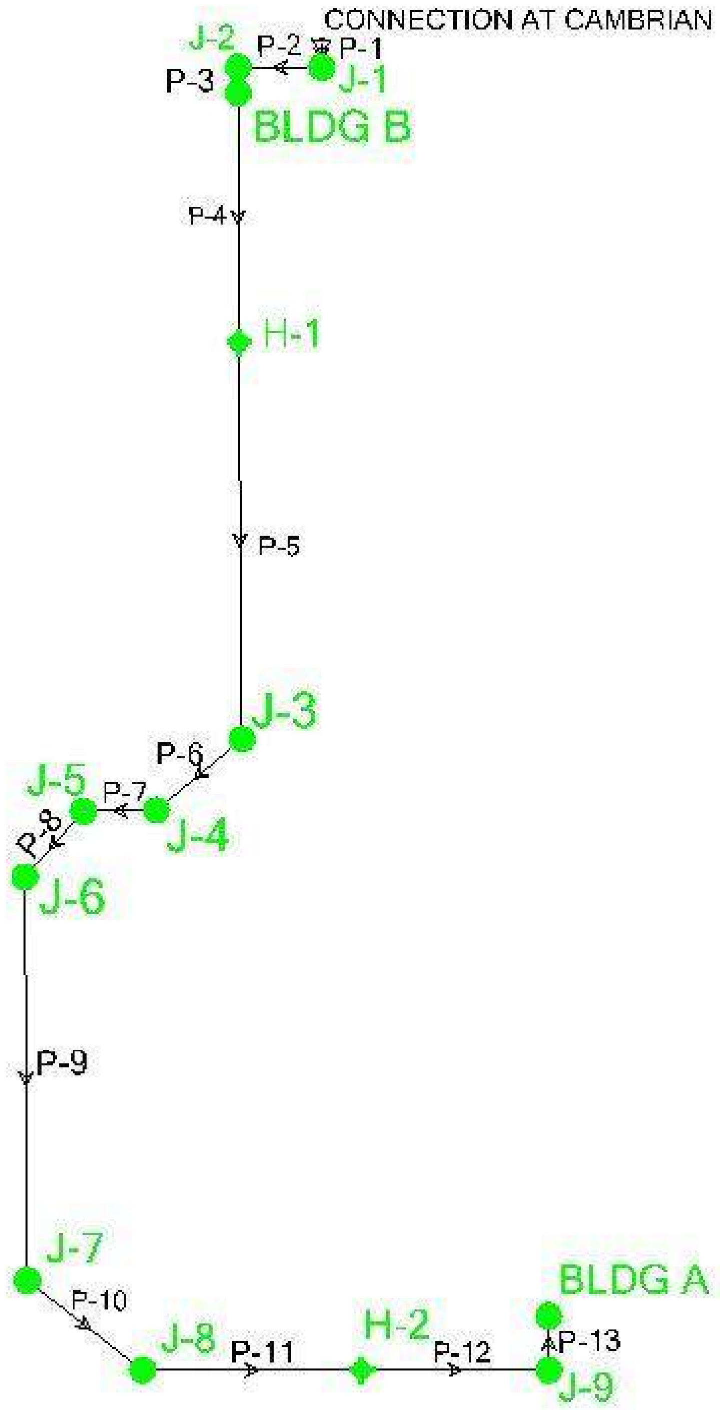
JUNCTION TABLE

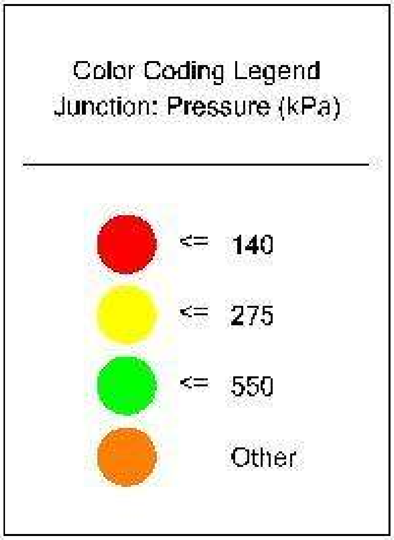
	Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
74: BLDG A	BLDG A	94.05	0.10	156.50	611
37: BLDG B	BLDG B	94.12	0.02	156.50	611
31: J-1	J-1	93.80	0.00	156.50	614
35: J-2	J-2	93.95	0.00	156.50	612
78: J-3	J-3	93.70	0.00	156.50	615
60: J-4	J-4	93.70	0.00	156.50	615
62: J-5	J-5	93.80	0.00	156.50	614
64: J-6	J-6	93.90	0.00	156.50	613
66: J-7	J-7	93.45	0.00	156.50	617
68: J-8	J-8	93.25	0.00	156.50	619
72: J-9	J-9	93.90	0.00	156.50	613

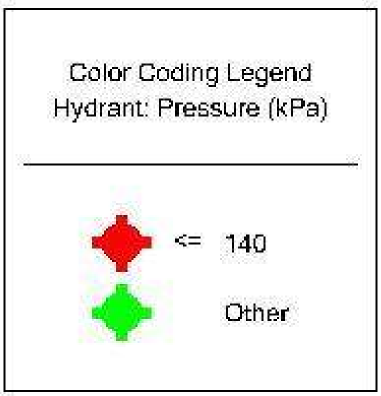
RESERVOIR TABLE

	Label	Elevation (m)	Flow (Out net) (L/s)	Hydraulic Grade (m)
30: CONNECTI	CONNECTION AT CAMBRIAN	156.50	0.12	156.50

Scenario: **Average Day Demand**
Future Conditions (Pressure Zone SUC)







Scenario: **Average Day Demand**
Future Conditions (Pressure Zone SUC)

PIPE TABLE

	Length (Scaled) (m)	Start Node	Stop Node	Diameter (mm)	Material	Hazen-Williams C	Flow (L/s)	Velocity (m/s)
32: P-1	3	CONNECTION AT CAMBRIAN	J-1	200.0	PVC	110.0	0.12	0.00
76: P-2	11	J-1	J-2	200.0	PVC	110.0	0.12	0.00
38: P-3	3	J-2	BLDG B	200.0	PVC	110.0	0.12	0.00
40: P-4	33	BLDG B	H-1	200.0	PVC	110.0	0.10	0.00
63: P-7	10	J-4	J-5	200.0	PVC	110.0	0.10	0.00
65: P-8	12	J-5	J-6	200.0	PVC	110.0	0.10	0.00
67: P-9	54	J-6	J-7	200.0	PVC	110.0	0.10	0.00
69: P-10	20	J-7	J-8	200.0	PVC	110.0	0.10	0.00
71: P-11	29	J-8	H-2	200.0	PVC	110.0	0.10	0.00
75: P-13	7	J-9	BLDG A	200.0	PVC	110.0	0.10	0.00
44: P-5	53	H-1	J-3	200.0	PVC	110.0	0.10	0.00
61: P-6	15	J-3	J-4	200.0	PVC	110.0	0.10	0.00
73: P-12	25	H-2	J-9	200.0	PVC	110.0	0.10	0.00

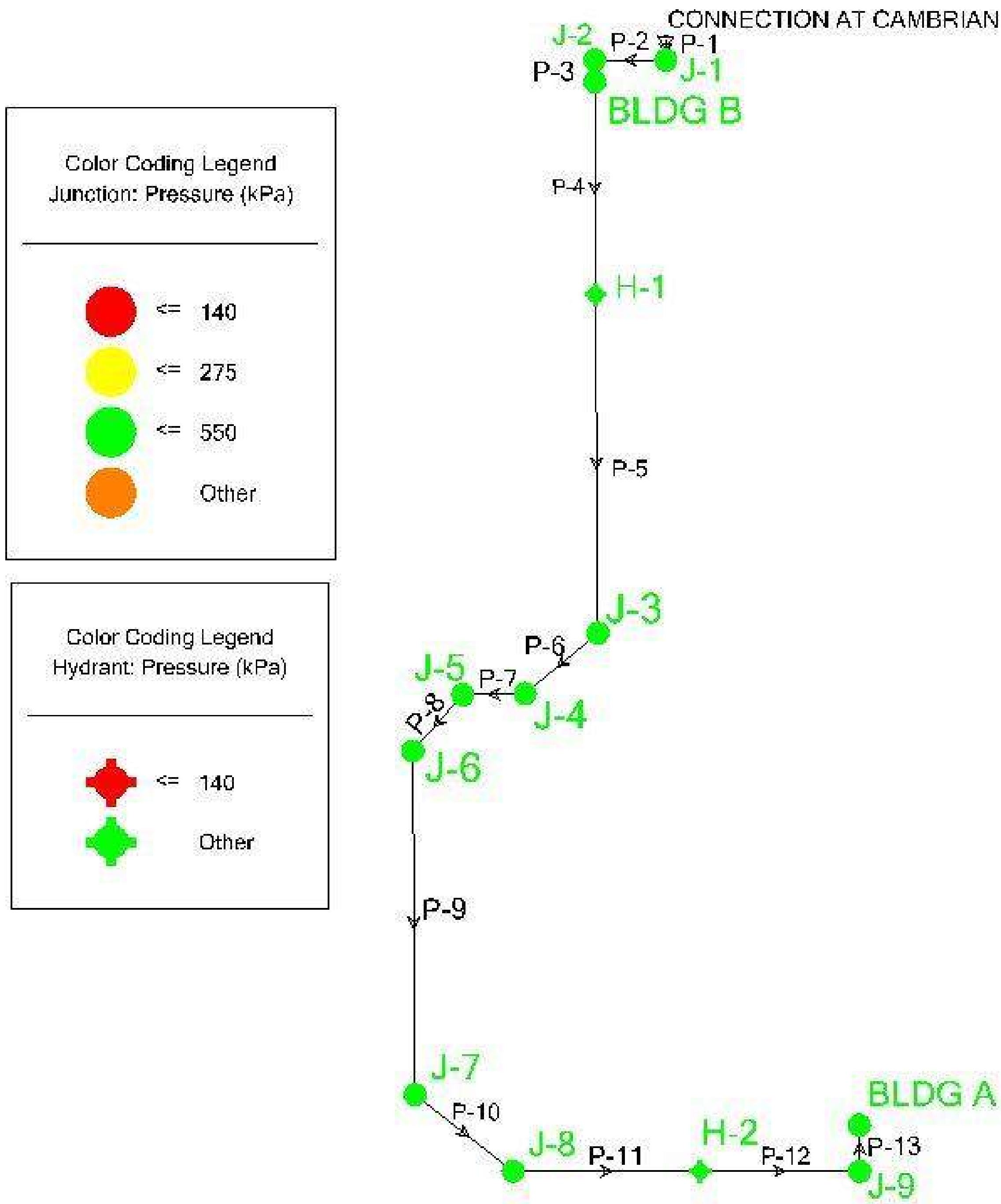
JUNCTION TABLE

	Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
74: BLDG A	BLDG A	94.05	0.10	146.80	516
37: BLDG B	BLDG B	94.12	0.02	146.80	516
31: J-1	J-1	93.80	0.00	146.80	519
35: J-2	J-2	93.95	0.00	146.80	517
78: J-3	J-3	93.70	0.00	146.80	520
60: J-4	J-4	93.70	0.00	146.80	520
62: J-5	J-5	93.80	0.00	146.80	519
64: J-6	J-6	93.90	0.00	146.80	518
66: J-7	J-7	93.45	0.00	146.80	522
68: J-8	J-8	93.25	0.00	146.80	524
72: J-9	J-9	93.90	0.00	146.80	518

RESERVOIR TABLE

	Label	Elevation (m)	Flow (Out net) (L/s)	Hydraulic Grade (m)
30: CONNECTI	CONNECTION AT CAMBRIAN	146.80	0.12	146.80

Scenario: **Peak Hour Demand**
Existing Conditions (Pressure Zone 3SW)



Scenario: **Peak Hour Demand**
Existing Conditions (Pressure Zone 3SW)

PIPE TABLE

	Length (Scaled) (m)	Start Node	Stop Node	Diameter (mm)	Material	Hazen-Williams C	Flow (L/s)	Velocity (m/s)
32: P-1	3	CONNECTION AT CAMBRIAN	J-1	200.0	PVC	110.0	0.32	0.01
76: P-2	11	J-1	J-2	200.0	PVC	110.0	0.32	0.01
38: P-3	3	J-2	BLDG B	200.0	PVC	110.0	0.32	0.01
40: P-4	33	BLDG B	H-1	200.0	PVC	110.0	0.28	0.01
63: P-7	10	J-4	J-5	200.0	PVC	110.0	0.28	0.01
65: P-8	12	J-5	J-6	200.0	PVC	110.0	0.28	0.01
67: P-9	54	J-6	J-7	200.0	PVC	110.0	0.28	0.01
69: P-10	20	J-7	J-8	200.0	PVC	110.0	0.28	0.01
71: P-11	29	J-8	H-2	200.0	PVC	110.0	0.28	0.01
75: P-13	7	J-9	BLDG A	200.0	PVC	110.0	0.28	0.01
44: P-5	53	H-1	J-3	200.0	PVC	110.0	0.28	0.01
61: P-6	15	J-3	J-4	200.0	PVC	110.0	0.28	0.01
73: P-12	25	H-2	J-9	200.0	PVC	110.0	0.28	0.01

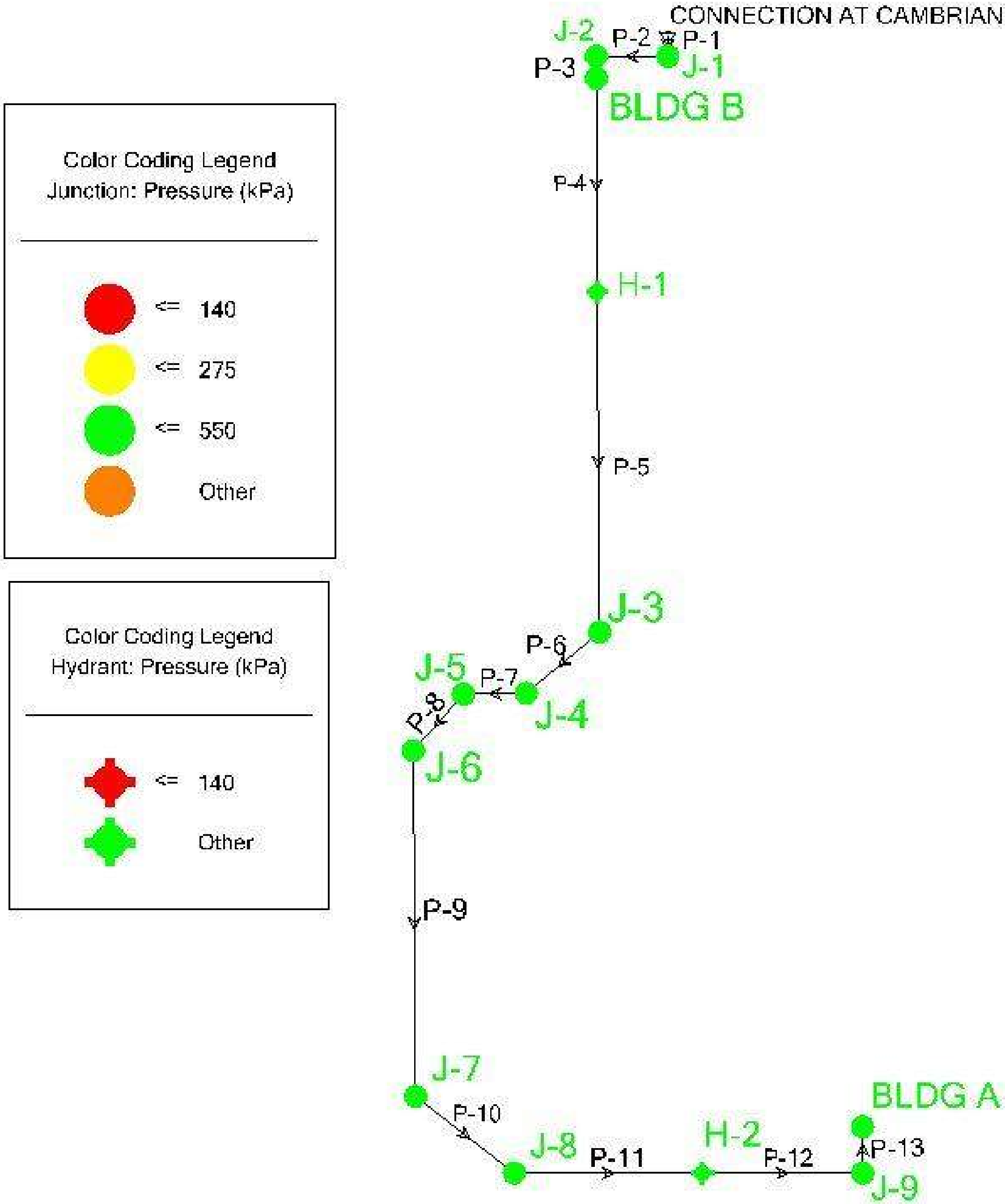
JUNCTION TABLE

	Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
74: BLDG A	BLDG A	94.05	0.28	142.60	475
37: BLDG B	BLDG B	94.12	0.04	142.60	474
31: J-1	J-1	93.80	0.00	142.60	478
35: J-2	J-2	93.95	0.00	142.60	476
78: J-3	J-3	93.70	0.00	142.60	479
60: J-4	J-4	93.70	0.00	142.60	479
62: J-5	J-5	93.80	0.00	142.60	478
64: J-6	J-6	93.90	0.00	142.60	477
66: J-7	J-7	93.45	0.00	142.60	481
68: J-8	J-8	93.25	0.00	142.60	483
72: J-9	J-9	93.90	0.00	142.60	477

RESERVOIR TABLE

	Label	Elevation (m)	Flow (Out net) (L/s)	Hydraulic Grade (m)
30: CONNECTI	CONNECTION AT CAMBRIAN	142.60	0.32	142.60

Scenario: **Peak Hour Demand**
Future Conditions (Pressure Zone SUC)



Scenario: Peak Hour Demand
Future Conditions (Pressure Zone SUC)

PIPE TABLE

	Length (Scaled) (m)	Start Node	Stop Node	Diameter (mm)	Material	Hazen-Williams C	Flow (L/s)	Velocity (m/s)
32: P-1	3	CONNECTION AT CAMBRIAN	J-1	200.0	PVC	110.0	0.32	0.01
76: P-2	11	J-1	J-2	200.0	PVC	110.0	0.32	0.01
38: P-3	3	J-2	BLDG B	200.0	PVC	110.0	0.32	0.01
40: P-4	33	BLDG B	H-1	200.0	PVC	110.0	0.28	0.01
63: P-7	10	J-4	J-5	200.0	PVC	110.0	0.28	0.01
65: P-8	12	J-5	J-6	200.0	PVC	110.0	0.28	0.01
67: P-9	54	J-6	J-7	200.0	PVC	110.0	0.28	0.01
69: P-10	20	J-7	J-8	200.0	PVC	110.0	0.28	0.01
71: P-11	29	J-8	H-2	200.0	PVC	110.0	0.28	0.01
75: P-13	7	J-9	BLDG A	200.0	PVC	110.0	0.28	0.01
44: P-5	53	H-1	J-3	200.0	PVC	110.0	0.28	0.01
61: P-6	15	J-3	J-4	200.0	PVC	110.0	0.28	0.01
73: P-12	25	H-2	J-9	200.0	PVC	110.0	0.28	0.01

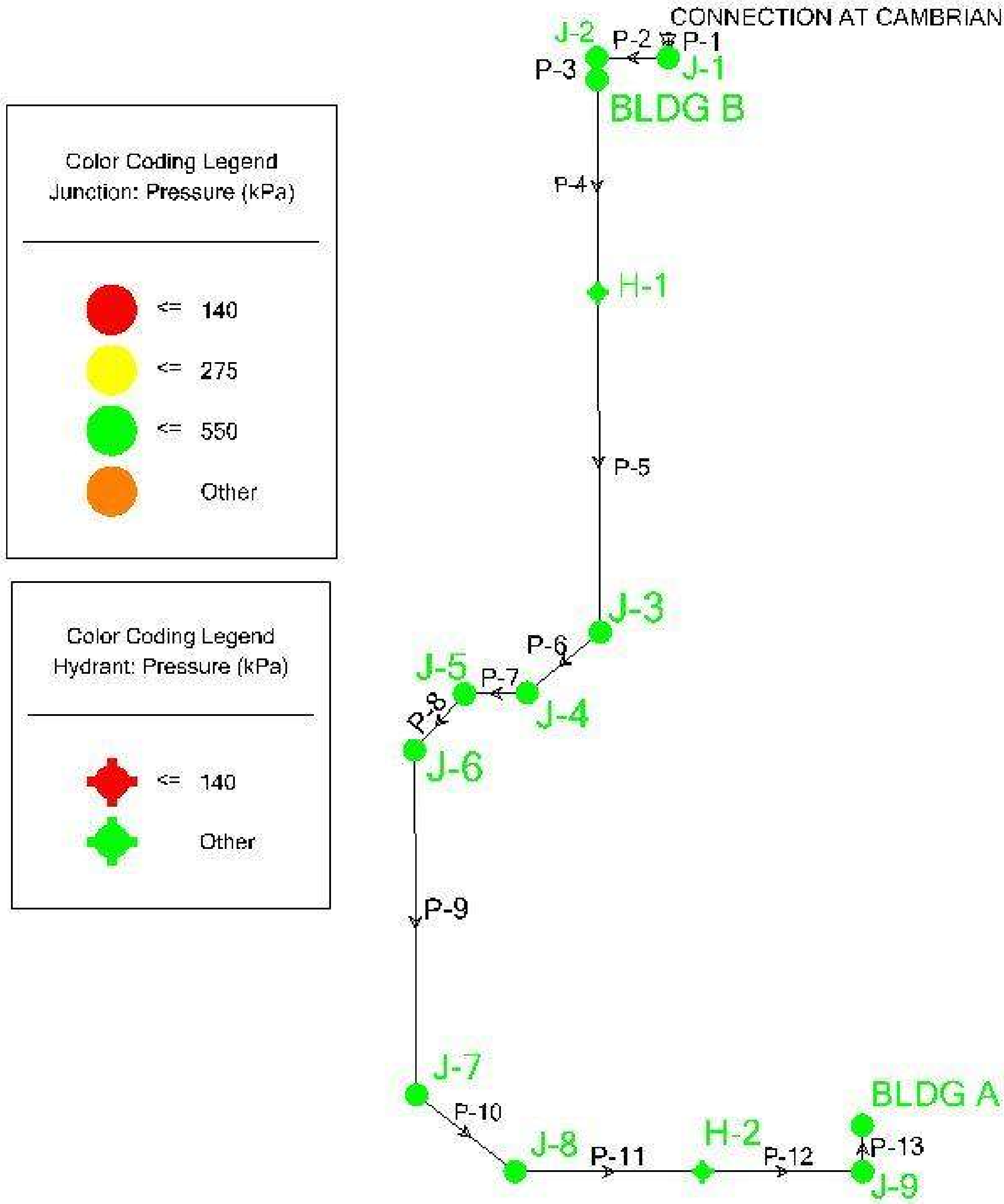
JUNCTION TABLE

	Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
74: BLDG A	BLDG A	94.05	0.28	142.80	477
37: BLDG B	BLDG B	94.12	0.04	142.80	476
31: J-1	J-1	93.80	0.00	142.80	480
35: J-2	J-2	93.95	0.00	142.80	478
78: J-3	J-3	93.70	0.00	142.80	481
60: J-4	J-4	93.70	0.00	142.80	481
62: J-5	J-5	93.80	0.00	142.80	480
64: J-6	J-6	93.90	0.00	142.80	479
66: J-7	J-7	93.45	0.00	142.80	483
68: J-8	J-8	93.25	0.00	142.80	485
72: J-9	J-9	93.90	0.00	142.80	479

RESERVOIR TABLE

	Label	Elevation (m)	Flow (Out net) (L/s)	Hydraulic Grade (m)
30: CONNECTI	CONNECTION AT CAMBRIAN	142.80	0.32	142.80

Scenario: Max Day + Fire Flow
Existing Conditions (Pressure Zone 3SW)



Scenario: **Max Day + Fire Flow**
Existing Conditions (Pressure Zone 3SW)

PIPE TABLE

	Length (Scaled) (m)	Start Node	Stop Node	Diameter (mm)	Material	Hazen-Williams C	Flow (L/s)	Velocity (m/s)
32: P-1	3	CONNECTION AT CAMBRIAN	J-1	200.0	PVC	110.0	83.18	2.65
76: P-2	11	J-1	J-2	200.0	PVC	110.0	83.18	2.65
38: P-3	3	J-2	BLDG B	200.0	PVC	110.0	83.18	2.65
40: P-4	33	BLDG B	H-1	200.0	PVC	110.0	83.16	2.65
63: P-7	10	J-4	J-5	200.0	PVC	110.0	83.16	2.65
65: P-8	12	J-5	J-6	200.0	PVC	110.0	83.16	2.65
67: P-9	54	J-6	J-7	200.0	PVC	110.0	83.16	2.65
69: P-10	20	J-7	J-8	200.0	PVC	110.0	83.16	2.65
71: P-11	29	J-8	H-2	200.0	PVC	110.0	83.16	2.65
75: P-13	7	J-9	BLDG A	200.0	PVC	110.0	0.16	0.01
44: P-5	53	H-1	J-3	200.0	PVC	110.0	83.16	2.65
61: P-6	15	J-3	J-4	200.0	PVC	110.0	83.16	2.65
73: P-12	25	H-2	J-9	200.0	PVC	110.0	0.16	0.01

JUNCTION TABLE

	Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
74: BLDG A	BLDG A	94.05	0.16	127.26	325
37: BLDG B	BLDG B	94.12	0.02	137.40	424
31: J-1	J-1	93.80	0.00	138.06	433
35: J-2	J-2	93.95	0.00	137.56	427
78: J-3	J-3	93.70	0.00	133.52	390
60: J-4	J-4	93.70	0.00	132.85	383
62: J-5	J-5	93.80	0.00	132.41	378
64: J-6	J-6	93.90	0.00	131.88	372
66: J-7	J-7	93.45	0.00	129.46	352
68: J-8	J-8	93.25	0.00	128.58	346
72: J-9	J-9	93.90	0.00	127.26	327

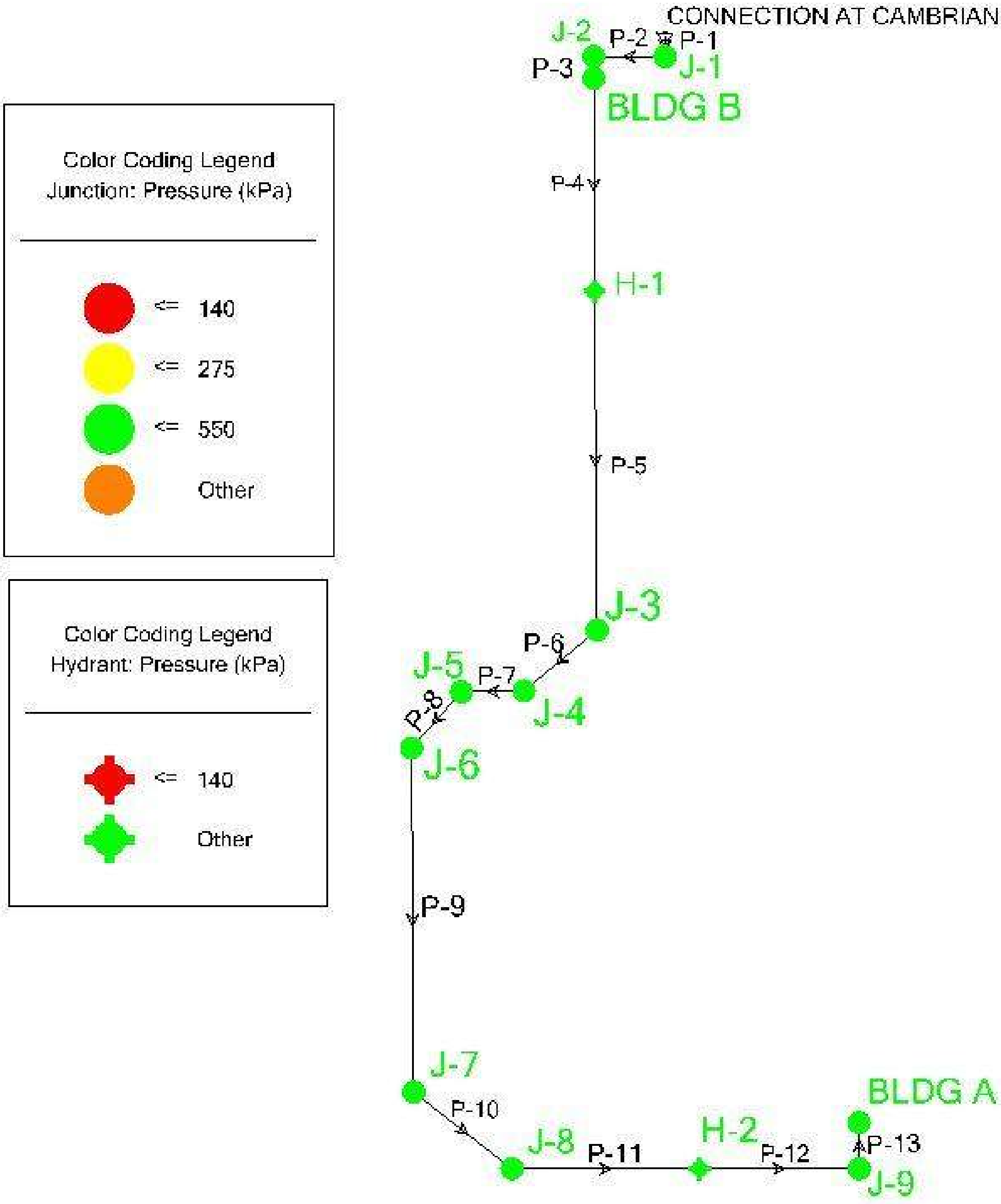
RESERVOIR TABLE

	Label	Elevation (m)	Flow (Out net) (L/s)	Hydraulic Grade (m)
30: CONNECTI	CONNECTION AT CAMBRIAN	138.20	83.18	138.20

HYDRANT TABLE

	Label	Length (Hydrant Lateral) (m)	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
77: H-1	H-1	6	93.85	0.00	135.90	412
79: H-2	H-2	6	93.60	83.00	126.09	318

Scenario: Max Day + Fire Flow
Future Conditions (Pressure Zone SUC)



Scenario: **Max Day + Fire Flow**
Future Conditions (Pressure Zone SUC)

PIPE TABLE

	Length (Scaled) (m)	Start Node	Stop Node	Diameter (mm)	Material	Hazen-Williams C	Flow (L/s)	Velocity (m/s)
32: P-1	3	CONNECTION AT CAMBRIAN	J-1	200.0	PVC	110.0	83.18	2.65
76: P-2	11	J-1	J-2	200.0	PVC	110.0	83.18	2.65
38: P-3	3	J-2	BLDG B	200.0	PVC	110.0	83.18	2.65
40: P-4	33	BLDG B	H-1	200.0	PVC	110.0	83.16	2.65
63: P-7	10	J-4	J-5	200.0	PVC	110.0	83.16	2.65
65: P-8	12	J-5	J-6	200.0	PVC	110.0	83.16	2.65
67: P-9	54	J-6	J-7	200.0	PVC	110.0	83.16	2.65
69: P-10	20	J-7	J-8	200.0	PVC	110.0	83.16	2.65
71: P-11	29	J-8	H-2	200.0	PVC	110.0	83.16	2.65
75: P-13	7	J-9	BLDG A	200.0	PVC	110.0	0.16	0.01
44: P-5	53	H-1	J-3	200.0	PVC	110.0	83.16	2.65
61: P-6	15	J-3	J-4	200.0	PVC	110.0	83.16	2.65
73: P-12	25	H-2	J-9	200.0	PVC	110.0	0.16	0.01

JUNCTION TABLE

	Label	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
74: BLDG A	BLDG A	94.05	0.16	133.26	384
37: BLDG B	BLDG B	94.12	0.02	143.40	482
31: J-1	J-1	93.80	0.00	144.06	492
35: J-2	J-2	93.95	0.00	143.56	485
78: J-3	J-3	93.70	0.00	139.52	448
60: J-4	J-4	93.70	0.00	138.85	442
62: J-5	J-5	93.80	0.00	138.41	437
64: J-6	J-6	93.90	0.00	137.88	430
66: J-7	J-7	93.45	0.00	135.46	411
68: J-8	J-8	93.25	0.00	134.58	405
72: J-9	J-9	93.90	0.00	133.26	385

RESERVOIR TABLE

	Label	Elevation (m)	Flow (Out net) (L/s)	Hydraulic Grade (m)
30: CONNECTI	CONNECTION AT CAMBRIAN	144.20	83.18	144.20

HYDRANT TABLE

	Label	Length (Hydrant Lateral) (m)	Elevation (m)	Demand (L/s)	Hydraulic Grade (m)	Pressure (kPa)
77: H-1	H-1	6	93.85	0.00	141.90	470
79: H-2	H-2	6	93.60	83.00	132.09	377

Appendix G:
PCSWMM Model Results

PCSWMM Report

SWM Report - 100y

Model 3845 Cambrian Rd - SWM Model.inp

Parsons

October 23, 2023

Table of Contents

Figure 1: Extent 1

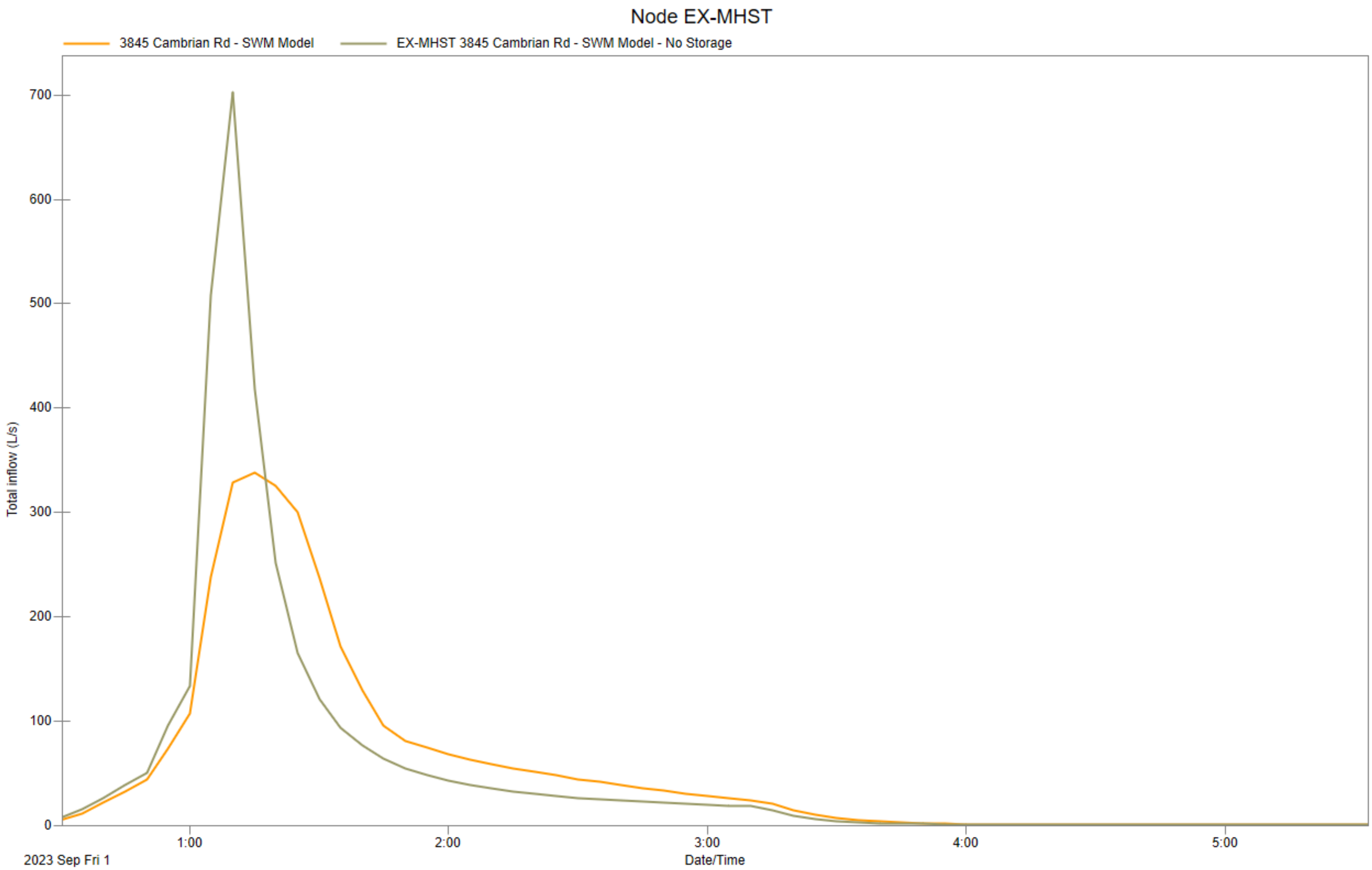


Figure 2: Controlled vs Uncontrolled

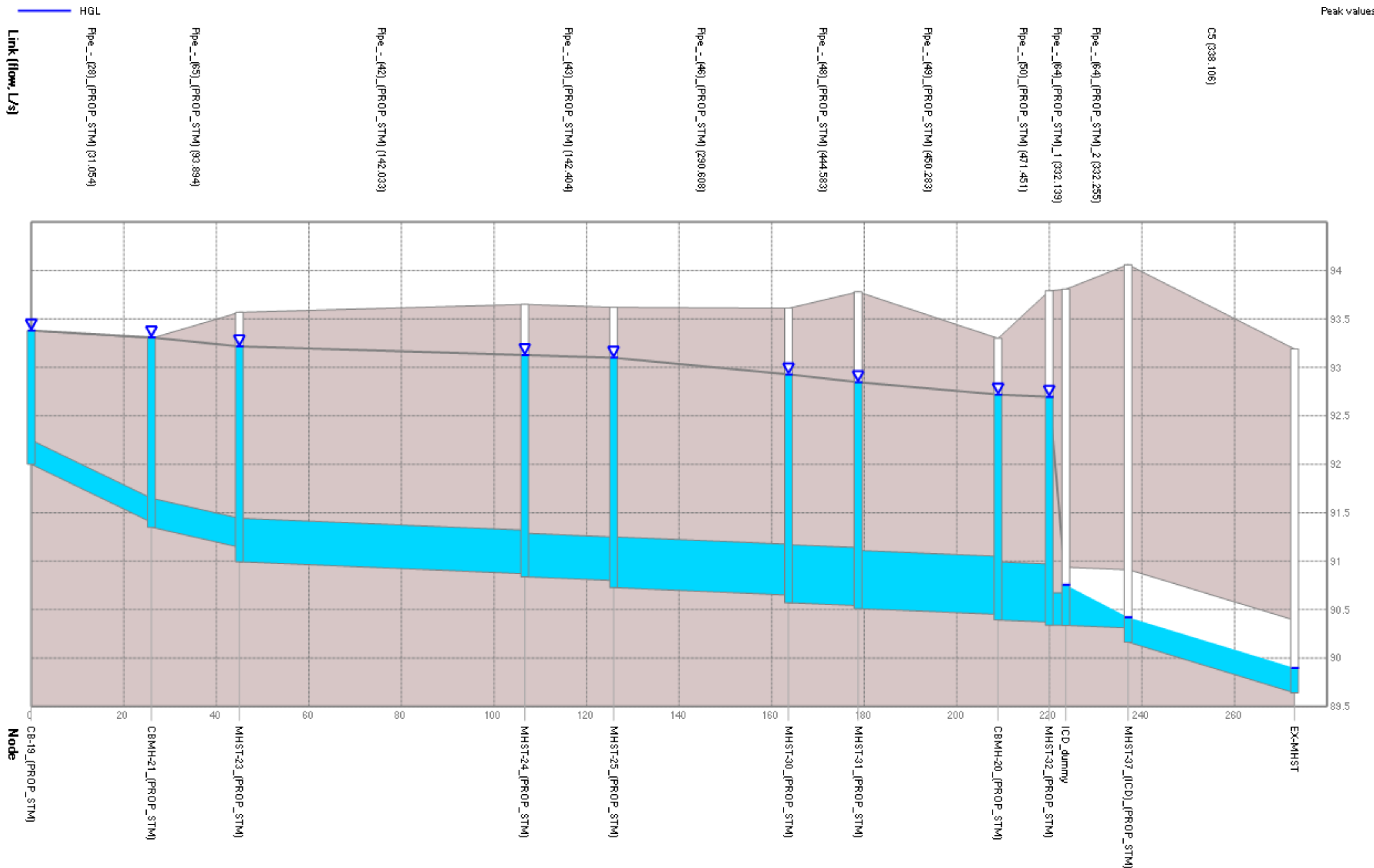


Figure 3: Node CB-19_(PROP_STM) to Node EX-MHST

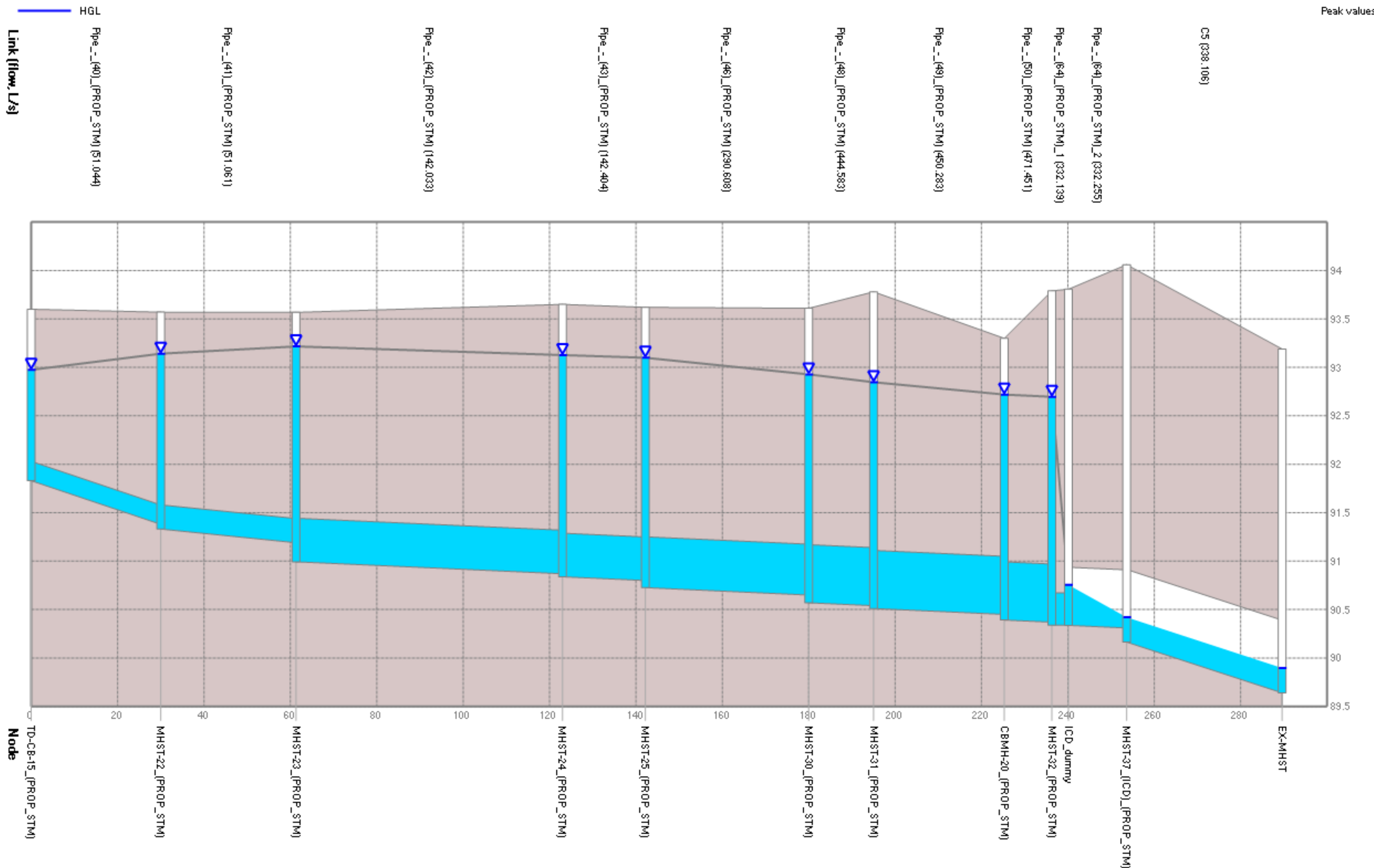


Figure 4: Node TD-CB-15_(PROP_STM) to Node EX-MHST

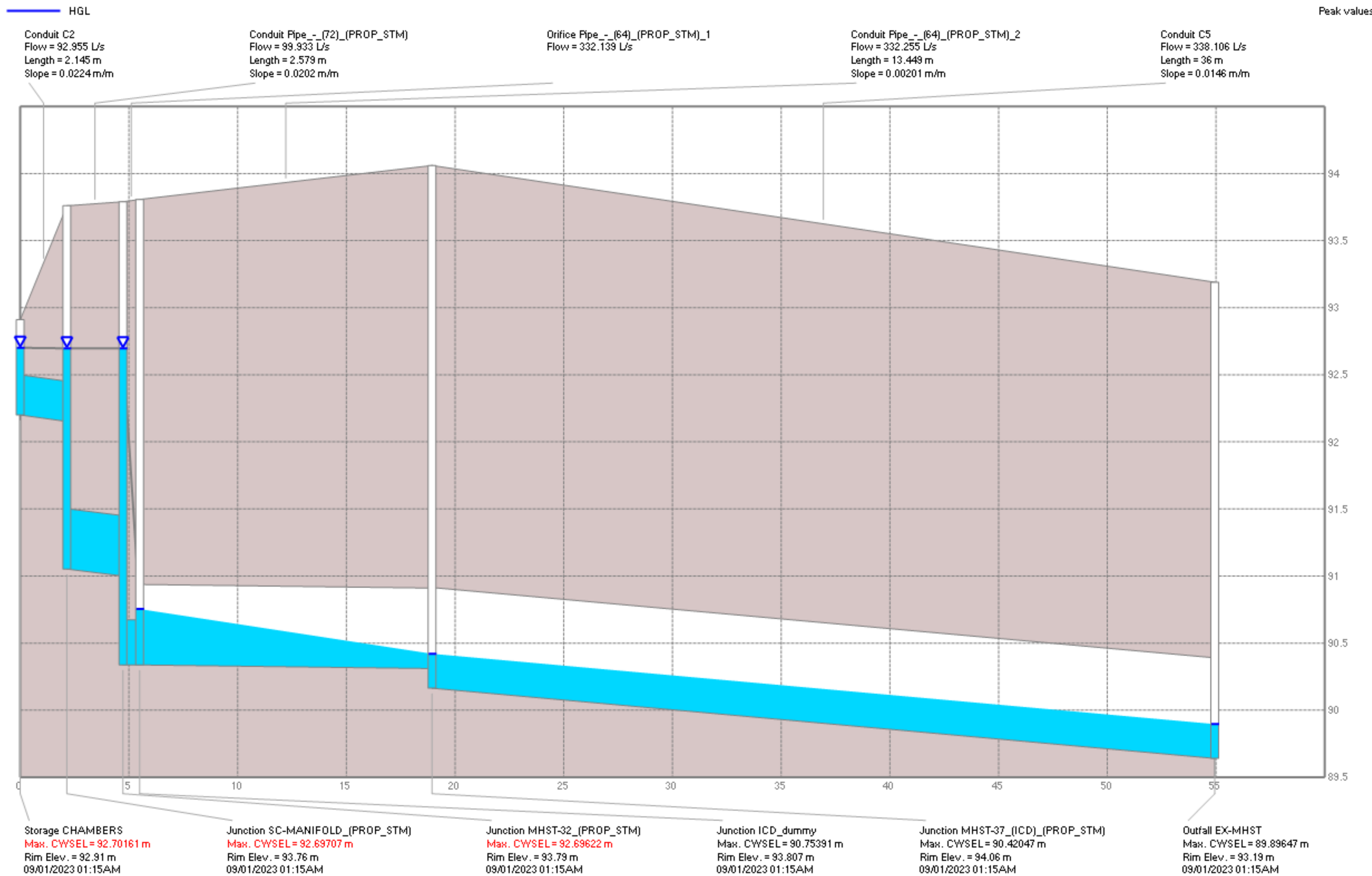


Figure 5: Node CHAMBERS to Node EX-MHST

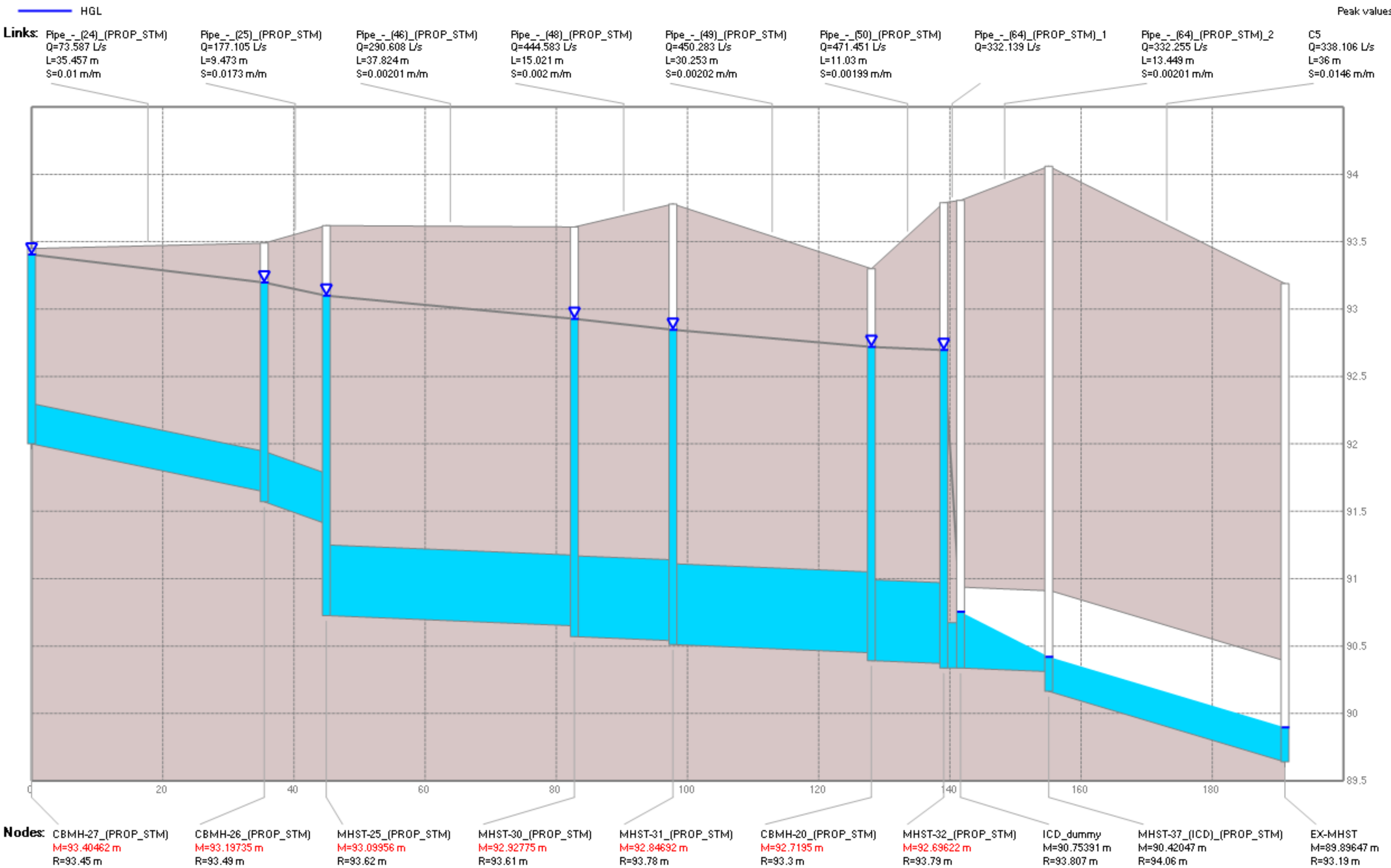


Figure 6: Node CBMH-27_(PROP_STM) to Node EX-MHST

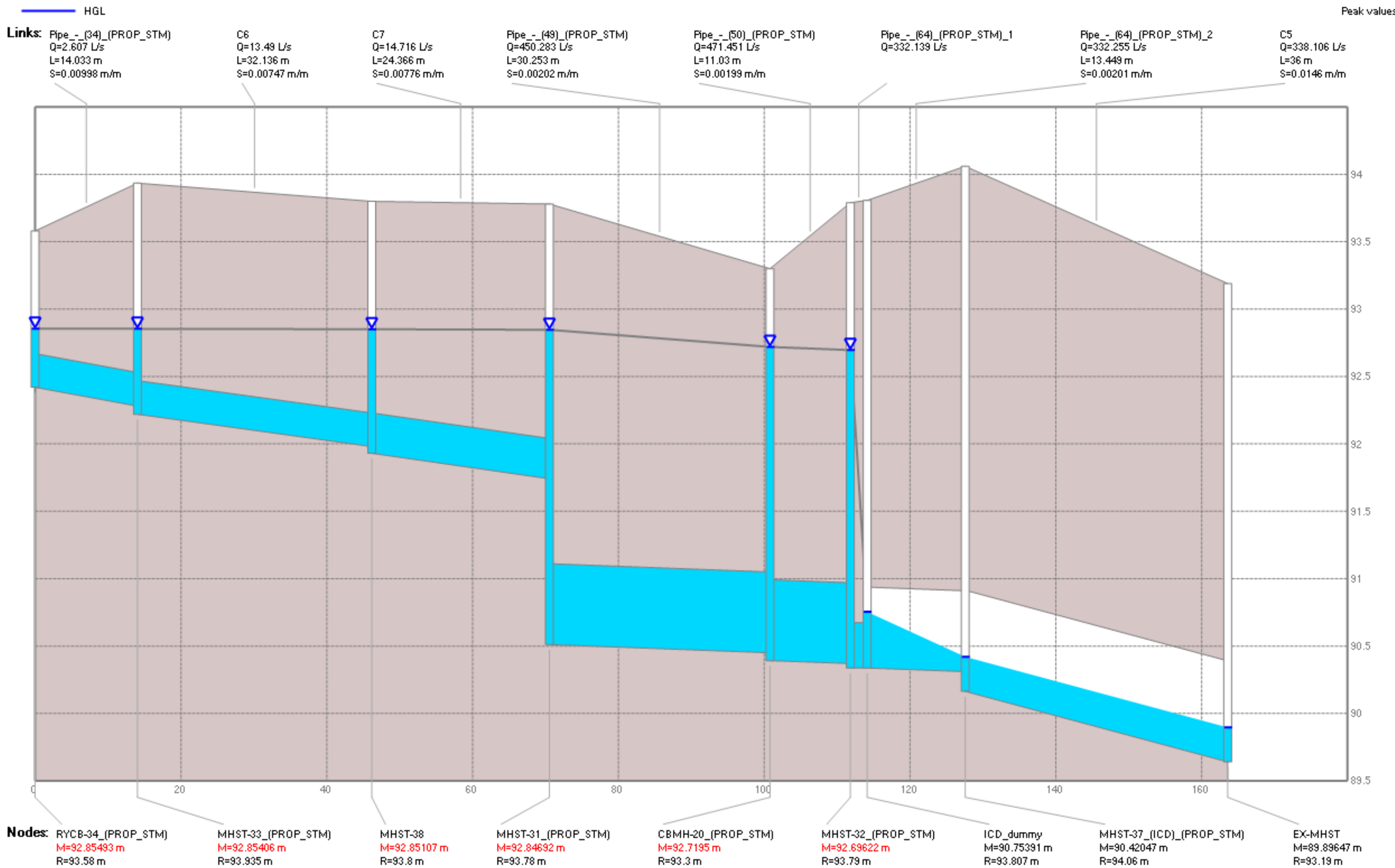


Figure 7: Node RYCB-34_(PROP_STM) to Node EX-MHST

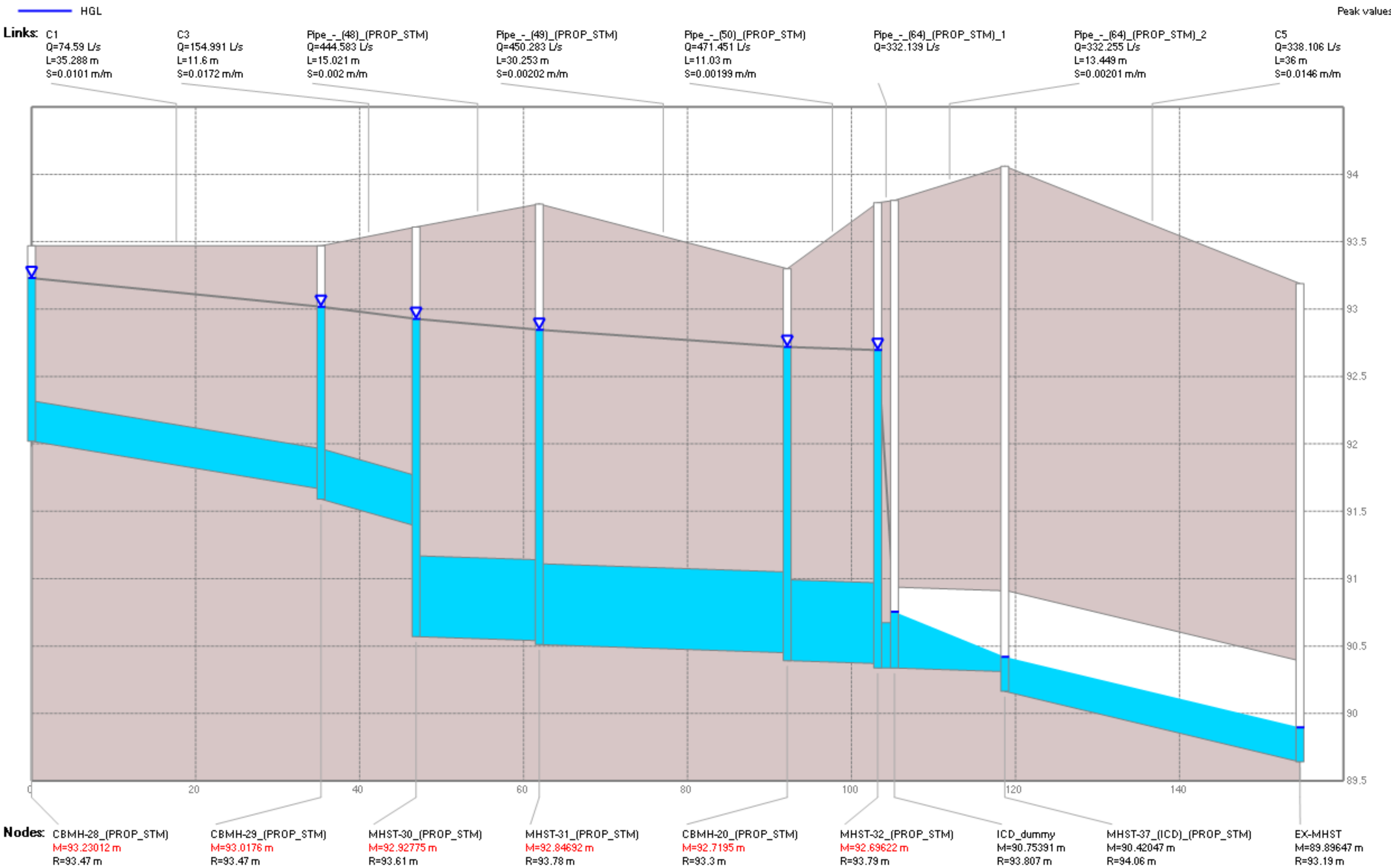


Figure 8: Node CBMH-28_(PROP_STM) to Node EX-MHST

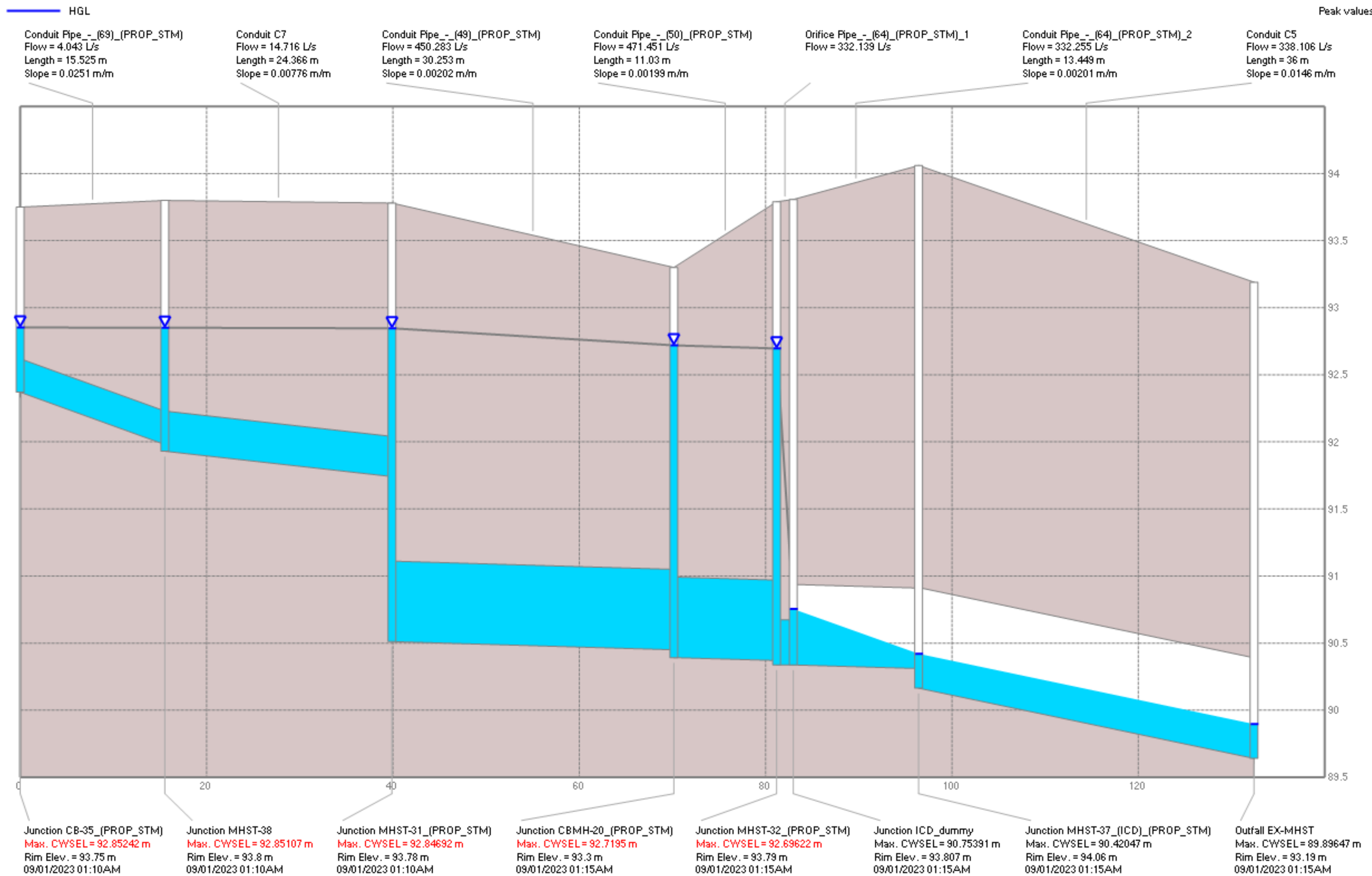


Figure 9: Node CB-35_(PROP_STM) to Node EX-MHST

Table 1: Storages Table Output

Name	Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Avg. Depth (m)	Max. Depth (m)	Max. Total Inflow (L/s)	Avg. Volume (1000 m³)	Avg. Percent Full (%)	Max. Volume (1000 m³)	Max. Percent Full (%)	Max. Outflow (L/s)	Contributing Area (ha)	Max. HGL (m)	Storage Curve
CHAMBERS	92.2	92.91	0.71	0.02	0.51	178.91	0.002	2	0.066	78	112.49	0	92.71	TABULAR
RD-BLDGA	97	97.15	0.15	0.02	0.1	157.17	0.014	6	0.098	41	40.7	0.321	97.1	TABULAR
RD-BLDGB	97	97.15	0.15	0.02	0.1	22.8	0.002	6	0.014	42	5.88	0.046	97.1	TABULAR
TD-CB-15_(PROP_STM)	91.83	93.6	1.77	0.08	1.15	46.96	0.001	0	0.023	11	51.8	0.037	92.98	TABULAR

Table 2: Outfalls Table Output

Name	Invert Elev. (m)	Rim Elev. (m)	Avg. Depth (m)	Max. Depth (m)	Max. HGL (m)	Rep. Max. Depth (m)	Max. Total Inflow (L/s)	Avg. Flow (L/s)	Contributing Area (ha)	Contributing Imp. Area (ha)
EX-MHST	89.64	93.19	0.05	0.26	89.9	0.26	338.27	73.81	1.553	1.282

Table 3: Junctions Output Table

Name	Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Avg. Depth (m)	Max. Depth (m)	Max. HGL (m)	Max. Total Inflow (L/s)	Max. Surcharge (m)	Max. Ponded Depth (m)	Contributing Area (ha)	Contributing Imp. Area (ha)
CB-19_(PROP_STM)	92	93.38	1.38	0.06	1.38	93.38	31.14	1.13	0	0.069	0.045
CB-35_(PROP_STM)	92.37	93.75	1.38	0.01	1.38	93.75	38.12	1.13	0	0.009	0.008
CB-36_(PROP_STM)	91.18	93.45	2.27	0.11	2.13	93.31	76.39	1.876	0	0.094	0.036
CBMH-20_(PROP_STM)	90.392	93.3	2.908	0.21	2.34	92.73	472.89	1.682	0	1.453	1.184
CBMH-21_(PROP_STM)	91.35	93.3	1.95	0.11	1.97	93.32	106.5	1.667	0.017	0.225	0.182
CBMH-26_(PROP_STM)	91.57	93.49	1.92	0.08	1.76	93.33	177.67	1.385	0	0.377	0.311
CBMH-27_(PROP_STM)	92	93.45	1.45	0.06	1.45	93.45	73.71	1.15	0	0.149	0.149
CBMH-28_(PROP_STM)	92.02	93.47	1.45	0.05	1.45	93.47	74.7	1.15	0	0.154	0.136
CBMH-29_(PROP_STM)	91.59	93.47	1.88	0.07	1.59	93.18	155.39	1.216	0	0.329	0.266
ICD_dummy	90.337	93.807	3.47	0.08	0.42	90.75	332.48	0	0	1.507	1.236
MHST-22_(PROP_STM)	91.331	93.57	2.239	0.1	1.97	93.3	72.44	1.718	0	0.037	0.037
MHST-23_(PROP_STM)	90.993	93.568	2.575	0.16	2.29	93.28	161.66	1.84	0	0.676	0.575
MHST-24_(PROP_STM)	90.838	93.65	2.812	0.16	2.81	93.65	142.12	2.33	0	0.676	0.575
MHST-25_(PROP_STM)	90.726	93.62	2.894	0.18	2.51	93.24	294.75	1.454	0	1.054	0.886
MHST-30_(PROP_STM)	90.57	93.61	3.04	0.19	2.51	93.08	445.64	1.311	0	1.382	1.152
MHST-31_(PROP_STM)	90.511	93.78	3.269	0.19	2.48	93	452.93	0.954	0	1.4	1.161
MHST-32_(PROP_STM)	90.338	93.79	3.452	0.22	2.36	92.7	472.2	1.252	0	1.507	1.236
MHST-33_(PROP_STM)	92.22	93.935	1.715	0.02	1.72	93.94	47.99	1.405	0	0.009	0.002
MHST-37_(ICD)_(PROP_STM)	90.164	94.06	3.896	0.05	0.26	90.42	338.25	0	0	1.553	1.282
MHST-38	91.93	93.8	1.87	0.04	1.87	93.8	111.19	1.57	0	0.017	0.009
RYCB-34_(PROP_STM)	92.42	93.58	1.16	0.01	1.16	93.58	30.09	0.91	0	0.009	0.002
SC-MANIFOLD_(PROP_STM)	91.052	93.76	2.708	0.09	1.65	92.7	178.77	0.251	0	0.054	0.052

Table 4: Orifices Output Table

Name	Inlet Node	Outlet Node	Cross-Section	Height (m)	Inlet Offset (m)	Discharge Coeff.	Max. |Flow| (L/s)	Contributing Area (ha)	Contributing Imp. Area (ha)
Pipe_-_(64)_(PROP_STM)_1	MHST-32_(PROP_STM)	ICD_dummy	CIRCULAR	0.335	0	0.61	332.48	1.507	1.236

Table 5: Outlets Output Table

Name	Inlet Node	Outlet Node	Rating Curve	Curve Name	Max. |Flow| (L/s)	Contributing Area (ha)	Contributing Imp. Area (ha)
OL1	RD-BLDGB	MHST-37_(ICD)_(PROP_STM)	TABULAR/DEPTH	BldgB	5.88	0.046	0.046
OL2	RD-BLDGA	MHST-23_(PROP_STM)	TABULAR/DEPTH	BldgA	40.7	0.321	0.321

Table 6A: Subcatchments Output Table

Name	Rain Gage	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Zero Imperv (%)
WS-01	Chicago3h-100y	0.320505	41.09	78.001	1.5	100	0.016	0.15	1.57	4.67	25
WS-02	Chicago3h-100y	0.045987	15.33	29.998	1.5	100	0.016	0.15	1.57	4.67	25
WS-03	Chicago3h-100y	0.037062	13.986	26.499	1.5	100	0.016	0.15	1.57	4.67	25
WS-04	Chicago3h-100y	0.068825	22.202	30.999	1.5	65	0.016	0.15	1.57	4.67	25
WS-05	Chicago3h-100y	0.155883	28.342	55.001	1.5	88	0.016	0.15	1.57	4.67	25
WS-06	Chicago3h-100y	0.179531	29.922	60	1.5	90	0.016	0.15	1.57	4.67	25
WS-07	Chicago3h-100y	0.149232	26.181	57	1.5	100	0.016	0.15	1.57	4.67	25
WS-08	Chicago3h-100y	0.146557	27.652	53.001	1.5	89	0.016	0.15	1.57	4.67	25
WS-09	Chicago3h-100y	0.154454	27.097	57	1.5	88	0.016	0.15	1.57	4.67	25
WS-10	Chicago3h-100y	0.053006	15.59	34	1.5	42	0.016	0.15	1.57	4.67	25
WS-11	Chicago3h-100y	0.054405	18.76	29.001	1.5	96	0.016	0.15	1.57	4.67	25
WS-12	Chicago3h-100y	0.0086	3.308	25.998	1.5	90	0.016	0.15	1.57	4.67	25
WS-13	Chicago3h-100y	0.0087	3.223	26.993	1.5	18	0.016	0.15	1.57	4.67	25
WS-14	Chicago3h-100y	0.04442	9.451	47	1.5	80	0.016	0.15	1.57	4.67	25
WS-15	Chicago3h-100y	0.048603	48.603	10	33	0	0.016	0.15	1.57	4.67	25
WS-16	Chicago3h-100y	0.027509	27.509	10	33	0	0.016	0.15	1.57	4.67	25
WS-17	Chicago3h-100y	0.049802	49.802	10	33	0	0.016	0.15	1.57	4.67	25

Table 6B: Subcatchments Output Table

Name	Infiltration Method	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Peak Runoff (L/s)	Runoff Coefficient
WS-01	HORTON	76.2	13.2	4.14	7	157.17	0.992
WS-02	HORTON	76.2	13.2	4.14	7	22.8	0.99
WS-03	HORTON	76.2	13.2	4.14	7	18.38	0.989
WS-04	HORTON	76.2	13.2	4.14	7	31.14	0.784
WS-05	HORTON	76.2	13.2	4.14	7	75.44	0.923
WS-06	HORTON	76.2	13.2	4.14	7	104.01	0.942
WS-07	HORTON	76.2	13.2	4.14	7	73.71	0.992
WS-08	HORTON	76.2	13.2	4.14	7	80.75	0.934
WS-09	HORTON	76.2	13.2	4.14	7	74.7	0.923
WS-10	HORTON	76.2	13.2	4.14	7	20.42	0.64
WS-11	HORTON	76.2	13.2	4.14	7	26.82	0.968
WS-12	HORTON	76.2	13.2	4.14	7	4.2	0.934
WS-13	HORTON	76.2	13.2	4.14	7	2.84	0.494
WS-14	HORTON	76.2	13.2	4.14	7	38.63	0.917
WS-15	HORTON	76.2	13.2	4.14	7	20.53	0.449
WS-16	HORTON	76.2	13.2	4.14	7	11.62	0.449
WS-17	HORTON	76.2	13.2	4.14	7	21.04	0.449

Table 7: Conduits Output Table

Inlet Node	Outlet Node	Length (m)	Roughness	Geom1 (m)	Slope (m/m)	Max. |Flow| (L/s)	Max. |Velocity| (m/s)	Max/Full Flow	Max/Full Depth	Contributing Area (ha)
CBMH-28_(PROP_STM)	CBMH-29_(PROP_STM)	35.288	0.013	0.3	0.01006	82.77	1.45	0.85	1	0.154
CHAMBERS	SC-MANIFOLD_(PROP_STM)	2.145	0.013	0.3	0.02238	178.91	4	1.24	1	0
CBMH-29_(PROP_STM)	MHST-30_(PROP_STM)	11.6	0.013	0.375	0.01724	155.08	2.08	0.67	1	0.329
CB-36_(PROP_STM)	MHST-23_(PROP_STM)	1.5	0.013	0.25	0.00467	60.11	1.22	1.48	1	0.094
MHST-37_(ICD)_(PROP_STM)	EX-MHST	36	0.013	0.75	0.01456	338.27	2.53	0.25	0.34	1.553
MHST-33_(PROP_STM)	MHST-38	32.136	0.013	0.25	0.00747	46.31	1.09	0.9	1	0.009
MHST-38	MHST-31_(PROP_STM)	24.366	0.013	0.3	0.00776	105.74	1.59	1.24	1	0.017
CBMH-27_(PROP_STM)	CBMH-26_(PROP_STM)	35.457	0.013	0.3	0.01001	73.66	1.44	0.76	1	0.149
CBMH-26_(PROP_STM)	MHST-25_(PROP_STM)	9.473	0.013	0.375	0.01731	177.43	2.14	0.77	1	0.377
CB-19_(PROP_STM)	CBMH-21_(PROP_STM)	25.969	0.013	0.25	0.02311	31.81	1	0.35	1	0.069
RYCB-34_(PROP_STM)	MHST-33_(PROP_STM)	14.033	0.013	0.25	0.00998	28.31	0.92	0.48	1	0.009
TD-CB-15_(PROP_STM)	MHST-22_(PROP_STM)	29.983	0.013	0.2	0.01501	51.8	1.65	1.29	1	0.037
MHST-22_(PROP_STM)	MHST-23_(PROP_STM)	31.33	0.013	0.25	0.0045	56.38	1.17	1.41	1	0.037
MHST-23_(PROP_STM)	MHST-24_(PROP_STM)	61.685	0.013	0.45	0.00199	142.12	0.96	1.12	1	0.676
MHST-24_(PROP_STM)	MHST-25_(PROP_STM)	19.174	0.013	0.45	0.00198	142.53	0.97	1.12	1	0.676
MHST-25_(PROP_STM)	MHST-30_(PROP_STM)	37.824	0.013	0.525	0.00201	294.78	1.36	1.53	1	1.054
MHST-30_(PROP_STM)	MHST-31_(PROP_STM)	15.021	0.013	0.6	0.002	446.12	1.58	1.63	1	1.382
MHST-31_(PROP_STM)	CBMH-20_(PROP_STM)	30.253	0.013	0.6	0.00202	452.58	1.6	1.64	1	1.4
CBMH-20_(PROP_STM)	MHST-32_(PROP_STM)	11.03	0.013	0.6	0.00199	472.2	1.67	1.72	1	1.453
ICD_dummy	MHST-37_(ICD)_(PROP_STM)	13.449	0.013	0.6	0.00201	332.49	1.68	1.21	0.66	1.507
CBMH-21_(PROP_STM)	MHST-23_(PROP_STM)	18.995	0.013	0.3	0.0109	108.86	1.54	1.08	1	0.225
CB-35_(PROP_STM)	MHST-38	15.525	0.013	0.25	0.02513	34.01	1.05	0.36	1	0.009
SC-MANIFOLD_(PROP_STM)	MHST-32_(PROP_STM)	2.579	0.013	0.45	0.02017	152.11	1.28	0.38	1	0.054

PCSWMM Report

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Model 3845 Cambrian Rd - SWM Model.inp

Parsons

October 23, 2023

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Figure 1: Extent 1

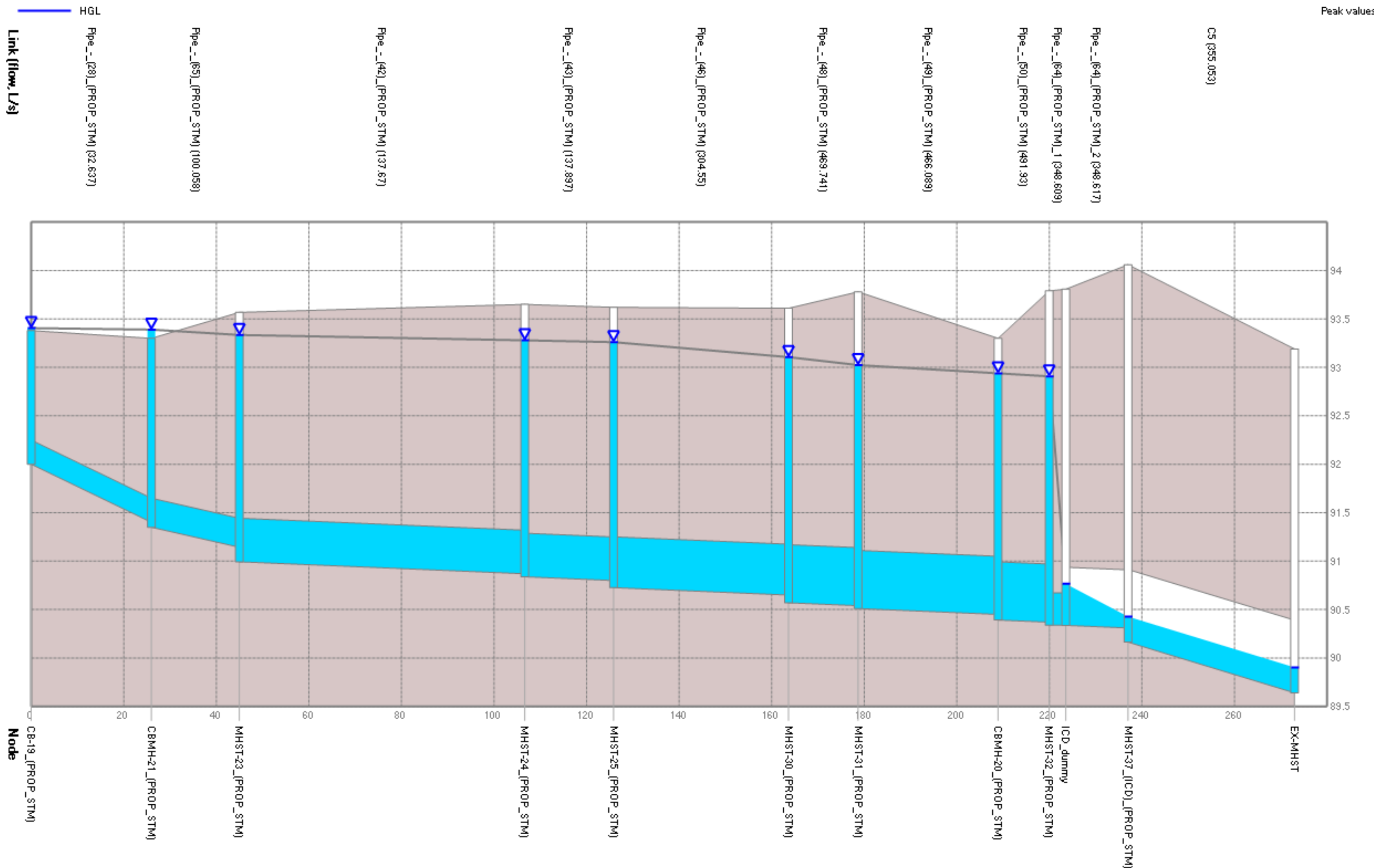


Figure 2: Node CB-19_(PROP_STM) to Node EX-MHST

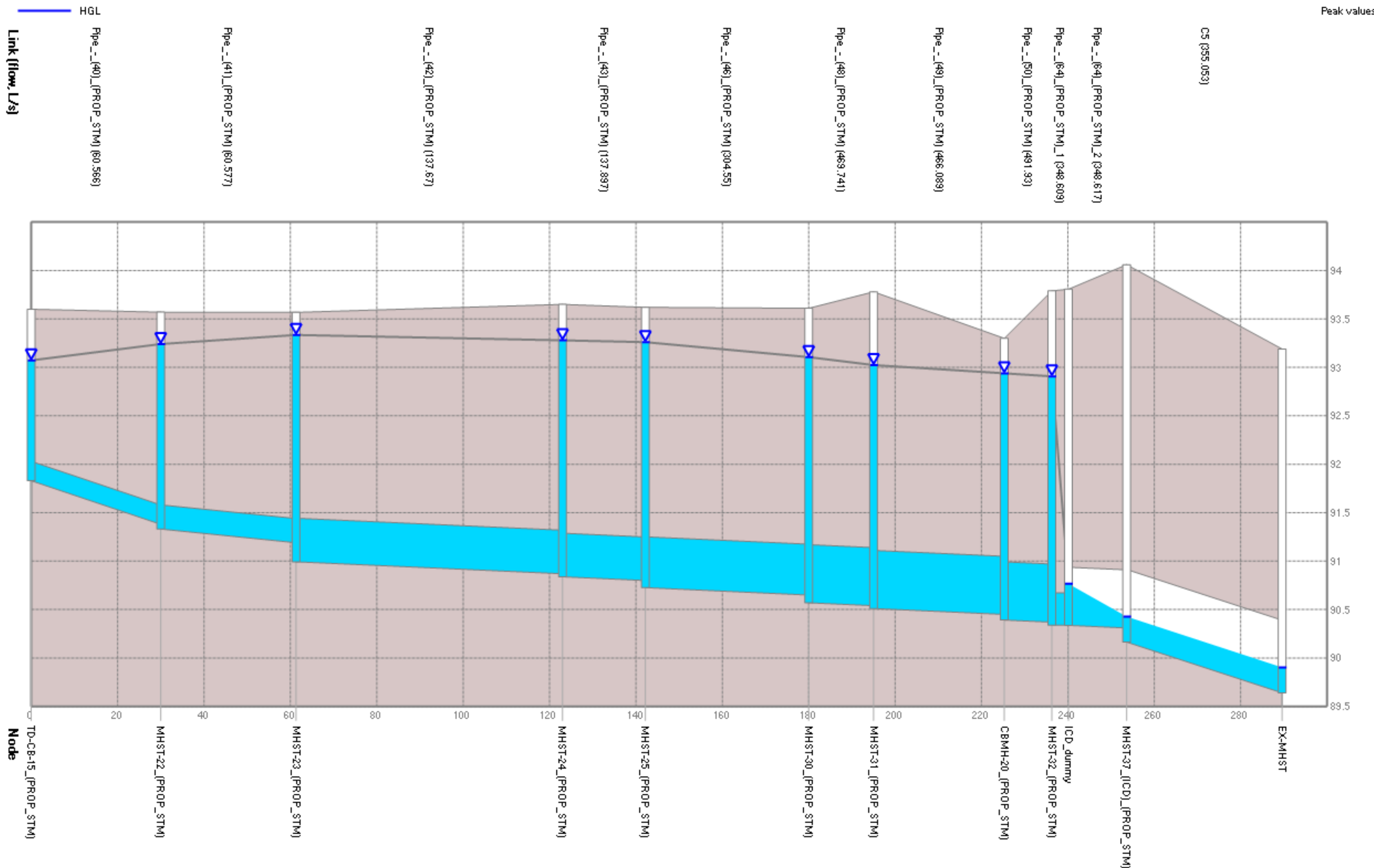


Figure 3: Node TD-CB-15_(PROP_STM) to Node EX-MHST

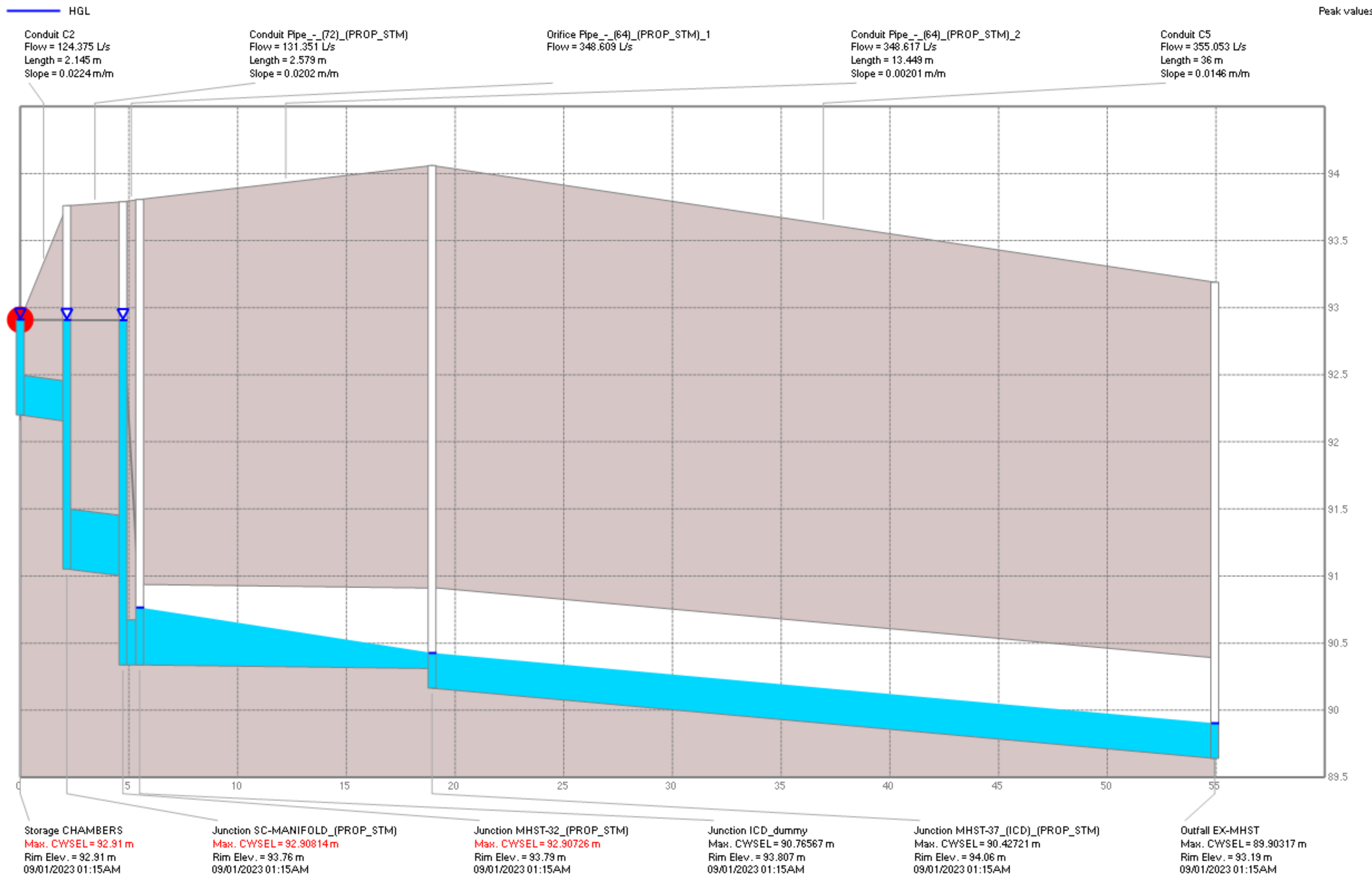


Figure 4: Node CHAMBERS to Node EX-MHST

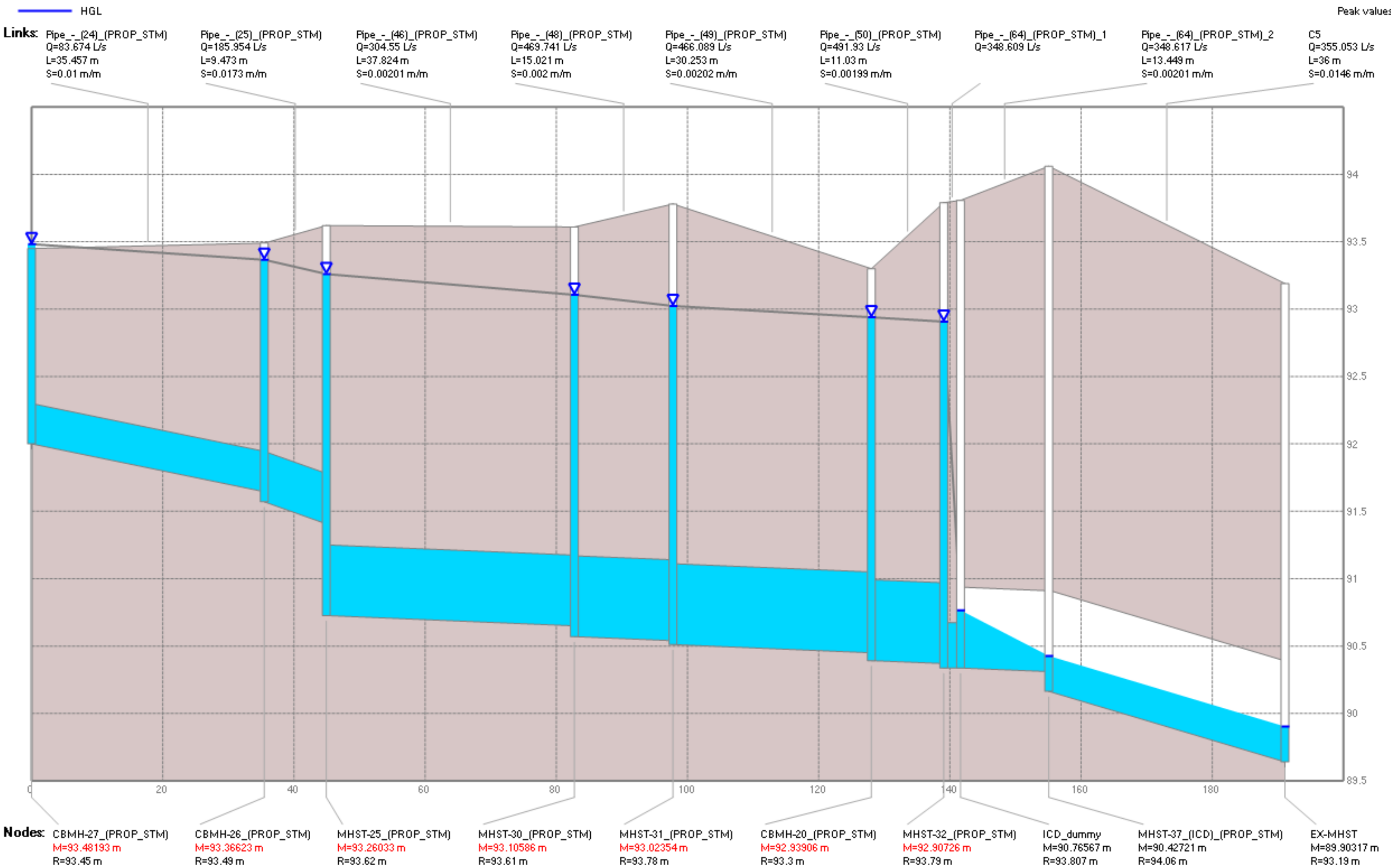


Figure 5: Node CBMH-27_(PROP_STM) to Node EX-MHST

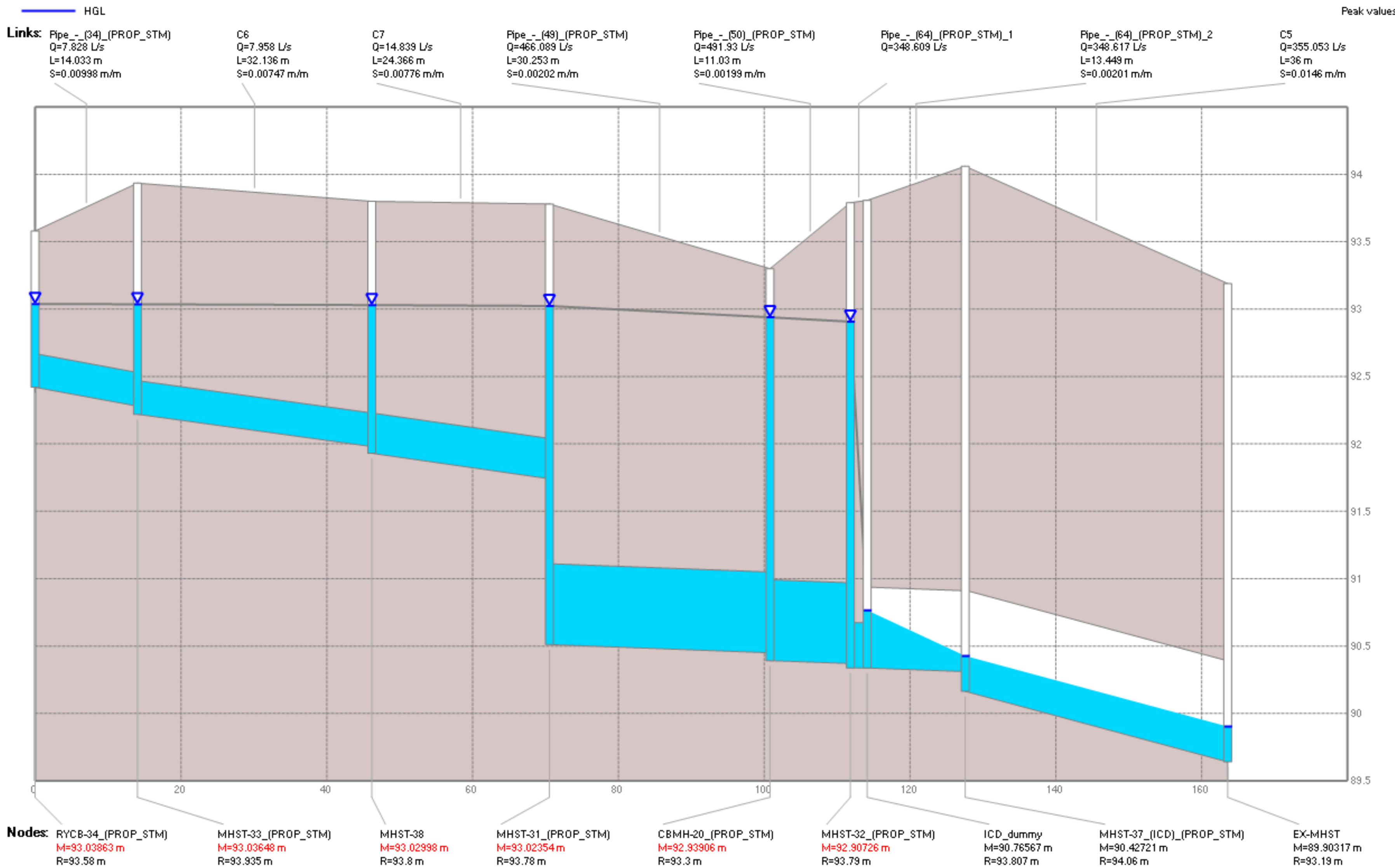


Figure 6: Node RYCB-34_(PROP_STM) to Node EX-MHST

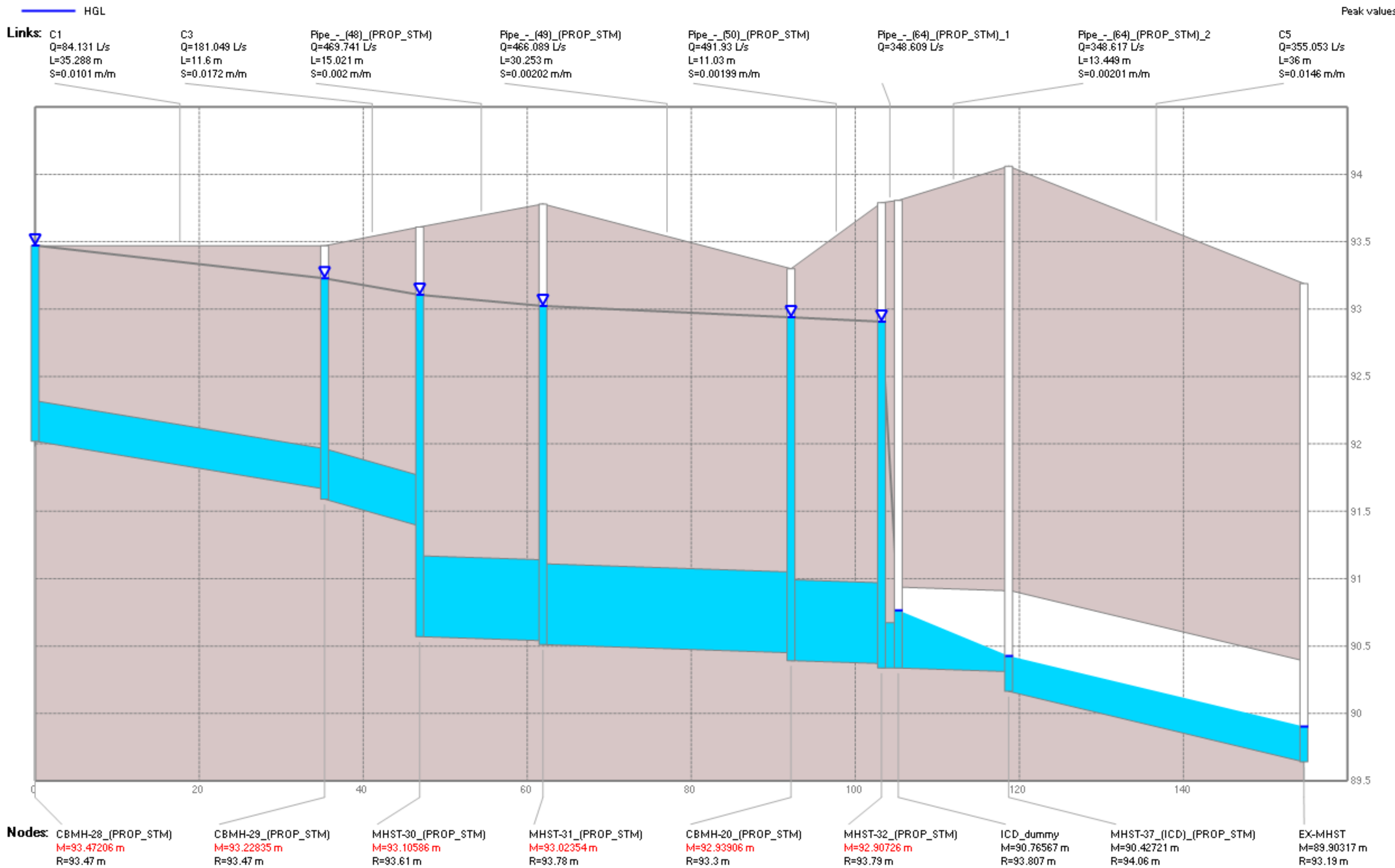


Figure 7: Node CBMH-28_(PROP_STM) to Node EX-MHST

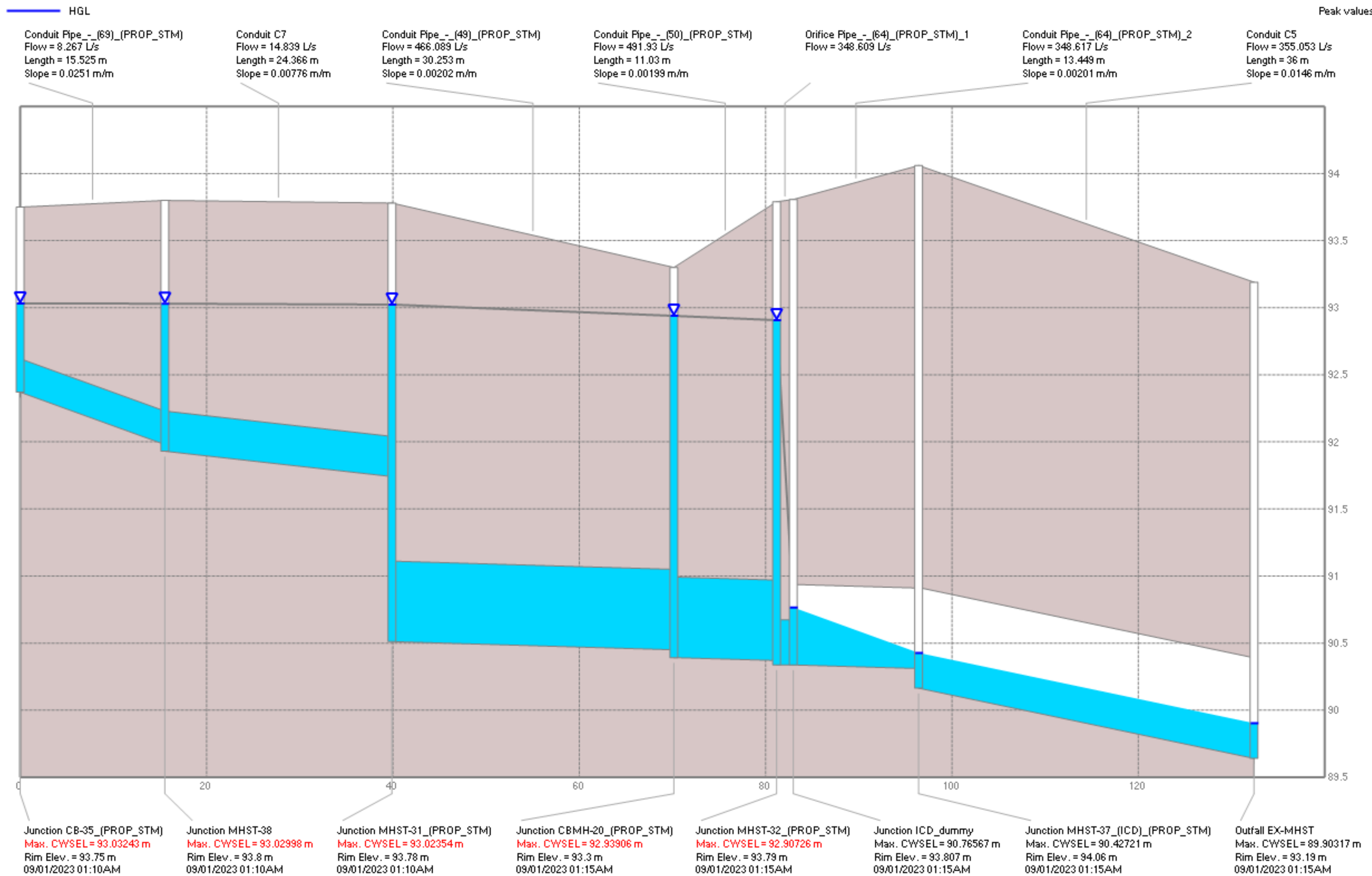


Figure 8: Node CB-35_(PROP_STM) to Node EX-MHST

Table 1: Storages Table Output

Name	Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Avg. Depth (m)	Max. Depth (m)	Max. Total Inflow (L/s)	Avg. Volume (1000 m³)	Avg. Percent Full (%)	Max. Volume (1000 m³)	Max. Percent Full (%)	Max. Outflow (L/s)	Contributing Area (ha)	Max. HGL (m)	Storage Curve
CHAMBERS	92.2	92.91	0.71	0.02	0.71	218.87	0.002	3	0.085	100	144.73	0	92.91	TABULAR
RD-BLDGA	97	97.15	0.15	0.02	0.11	189.26	0.018	7	0.122	51	45.59	0.321	97.11	TABULAR
RD-BLDGB	97	97.15	0.15	0.02	0.11	27.37	0.003	7	0.018	52	6.57	0.046	97.11	TABULAR
TD-CB-15_(PROP_STM)	91.83	93.6	1.77	0.1	1.24	54.55	0.002	1	0.045	22	60.66	0.037	93.07	TABULAR

Table 2: Outfalls Table Output

Name	Invert Elev. (m)	Rim Elev. (m)	Avg. Depth (m)	Max. Depth (m)	Max. HGL (m)	Rep. Max. Depth (m)	Max. Total Inflow (L/s)	Avg. Flow (L/s)	Contributing Area (ha)	Contributing Imp. Area (ha)
EX-MHST	89.64	93.19	0.05	0.26	89.9	0.26	356.32	79.53	1.553	1.282

Table 3: Junctions Output Table

Name	Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Avg. Depth (m)	Max. Depth (m)	Max. HGL (m)	Max. Total Inflow (L/s)	Max. Surcharge (m)	Max. Ponded Depth (m)	Contributing Area (ha)	Contributing Imp. Area (ha)
CB-19_(PROP_STM)	92	93.38	1.38	0.07	1.41	93.41	38.49	1.156	0.026	0.069	0.045
CB-35_(PROP_STM)	92.37	93.75	1.38	0.02	1.38	93.75	44.01	1.13	0	0.009	0.008
CB-36_(PROP_STM)	91.18	93.45	2.27	0.12	2.27	93.45	74.67	2.02	0	0.094	0.036
CBMH-20_(PROP_STM)	90.392	93.3	2.908	0.22	2.58	92.97	506.48	1.924	0	1.453	1.184
CBMH-21_(PROP_STM)	91.35	93.3	1.95	0.12	2.04	93.39	118.53	1.74	0.09	0.225	0.182
CBMH-26_(PROP_STM)	91.57	93.49	1.92	0.09	1.8	93.37	192.25	1.422	0	0.377	0.311
CBMH-27_(PROP_STM)	92	93.45	1.45	0.07	1.5	93.5	88.58	1.204	0.054	0.149	0.149
CBMH-28_(PROP_STM)	92.02	93.47	1.45	0.06	1.45	93.47	90.33	1.154	0.004	0.154	0.136
CBMH-29_(PROP_STM)	91.59	93.47	1.88	0.08	1.65	93.24	184.79	1.275	0	0.329	0.266
ICD_dummy	90.337	93.807	3.47	0.08	0.43	90.77	349.88	0	0	1.507	1.236
MHST-22_(PROP_STM)	91.331	93.57	2.239	0.12	2.24	93.57	71.91	1.989	0	0.037	0.037
MHST-23_(PROP_STM)	90.993	93.568	2.575	0.18	2.43	93.42	164.46	1.981	0	0.676	0.575
MHST-24_(PROP_STM)	90.838	93.65	2.812	0.18	2.81	93.65	160.52	2.33	0	0.676	0.575
MHST-25_(PROP_STM)	90.726	93.62	2.894	0.19	2.55	93.28	306.69	1.496	0	1.054	0.886
MHST-30_(PROP_STM)	90.57	93.61	3.04	0.2	2.58	93.15	476.52	1.388	0	1.382	1.152
MHST-31_(PROP_STM)	90.511	93.78	3.269	0.21	2.58	93.09	484.31	1.049	0	1.4	1.161
MHST-32_(PROP_STM)	90.338	93.79	3.452	0.24	2.59	92.93	506.43	1.475	0	1.507	1.236
MHST-33_(PROP_STM)	92.22	93.935	1.715	0.03	1.72	93.94	54.18	1.405	0	0.009	0.002
MHST-37_(ICD)_(PROP_STM)	90.164	94.06	3.896	0.05	0.26	90.43	356.21	0	0	1.553	1.282
MHST-38	91.93	93.8	1.87	0.04	1.87	93.8	126.26	1.57	0	0.017	0.009
RYCB-34_(PROP_STM)	92.42	93.58	1.16	0.02	1.16	93.58	35.82	0.91	0	0.009	0.002
SC-MANIFOLD_(PROP_STM)	91.052	93.76	2.708	0.1	1.87	92.93	219.19	0.473	0	0.054	0.052

Table 4: Orifices Output Table

Name	Inlet Node	Outlet Node	Cross-Section	Height (m)	Inlet Offset (m)	Discharge Coeff.	Max. |Flow| (L/s)	Contributing Area (ha)	Contributing Imp. Area (ha)
Pipe_-_(64)_(PROP_STM)_1	MHST-32_(PROP_STM)	ICD_dummy	CIRCULAR	0.335	0	0.61	349.88	1.507	1.236

Table 5: Outlets Output Table

Name	Inlet Node	Outlet Node	Rating Curve	Curve Name	Max. |Flow| (L/s)	Contributing Area (ha)	Contributing Imp. Area (ha)
OL1	RD-BLDGB	MHST-37_(ICD)_(PROP_STM)	TABULAR/DEPTH	BldgB	6.57	0.046	0.046
OL2	RD-BLDGA	MHST-23_(PROP_STM)	TABULAR/DEPTH	BldgA	45.59	0.321	0.321

Table 6A: Subcatchments Output Table

Name	Rain Gage	Area (ha)	Width (m)	Flow Length (m)	Slope (%)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Zero Imperv (%)
WS-01	Chicago3h-StressTest	0.320505	41.09	78.001	1.5	100	0.016	0.15	1.57	4.67	25
WS-02	Chicago3h-StressTest	0.045987	15.33	29.998	1.5	100	0.016	0.15	1.57	4.67	25
WS-03	Chicago3h-StressTest	0.037062	13.986	26.499	1.5	100	0.016	0.15	1.57	4.67	25
WS-04	Chicago3h-StressTest	0.068825	22.202	30.999	1.5	65	0.016	0.15	1.57	4.67	25
WS-05	Chicago3h-StressTest	0.155883	28.342	55.001	1.5	88	0.016	0.15	1.57	4.67	25
WS-06	Chicago3h-StressTest	0.179531	29.922	60	1.5	90	0.016	0.15	1.57	4.67	25
WS-07	Chicago3h-StressTest	0.149232	26.181	57	1.5	100	0.016	0.15	1.57	4.67	25
WS-08	Chicago3h-StressTest	0.146557	27.652	53.001	1.5	89	0.016	0.15	1.57	4.67	25
WS-09	Chicago3h-StressTest	0.154454	27.097	57	1.5	88	0.016	0.15	1.57	4.67	25
WS-10	Chicago3h-StressTest	0.053006	15.59	34	1.5	42	0.016	0.15	1.57	4.67	25
WS-11	Chicago3h-StressTest	0.054405	18.76	29.001	1.5	96	0.016	0.15	1.57	4.67	25
WS-12	Chicago3h-StressTest	0.0086	3.308	25.998	1.5	90	0.016	0.15	1.57	4.67	25
WS-13	Chicago3h-StressTest	0.0087	3.223	26.993	1.5	18	0.016	0.15	1.57	4.67	25
WS-14	Chicago3h-StressTest	0.04442	9.451	47	1.5	80	0.016	0.15	1.57	4.67	25
WS-15	Chicago3h-StressTest	0.048603	48.603	10	33	0	0.016	0.15	1.57	4.67	25
WS-16	Chicago3h-StressTest	0.027509	27.509	10	33	0	0.016	0.15	1.57	4.67	25
WS-17	Chicago3h-StressTest	0.049802	49.802	10	33	0	0.016	0.15	1.57	4.67	25

Table 6B: Subcatchments Output Table

Name	Infiltration Method	Max. Infil. Rate (mm/hr)	Min. Infil. Rate (mm/hr)	Decay Constant (1/hr)	Drying Time (days)	Peak Runoff (L/s)	Runoff Coefficient
WS-01	HORTON	76.2	13.2	4.14	7	189.26	0.995
WS-02	HORTON	76.2	13.2	4.14	7	27.37	0.992
WS-03	HORTON	76.2	13.2	4.14	7	22.06	0.992
WS-04	HORTON	76.2	13.2	4.14	7	38.49	0.813
WS-05	HORTON	76.2	13.2	4.14	7	91.21	0.934
WS-06	HORTON	76.2	13.2	4.14	7	128.61	0.951
WS-07	HORTON	76.2	13.2	4.14	7	88.58	0.994
WS-08	HORTON	76.2	13.2	4.14	7	99.21	0.944
WS-09	HORTON	76.2	13.2	4.14	7	90.33	0.934
WS-10	HORTON	76.2	13.2	4.14	7	26.42	0.687
WS-11	HORTON	76.2	13.2	4.14	7	32.23	0.972
WS-12	HORTON	76.2	13.2	4.14	7	5.06	0.942
WS-13	HORTON	76.2	13.2	4.14	7	3.87	0.56
WS-14	HORTON	76.2	13.2	4.14	7	49.93	0.931
WS-15	HORTON	76.2	13.2	4.14	7	25.64	0.505
WS-16	HORTON	76.2	13.2	4.14	7	14.51	0.505
WS-17	HORTON	76.2	13.2	4.14	7	26.27	0.505

Table 7: Conduits Output Table

Inlet Node	Outlet Node	Length (m)	Roughness	Geom1 (m)	Slope (m/m)	Max. |Flow| (L/s)	Max. |Velocity| (m/s)	Max/Full Flow	Max/Full Depth	Contributing Area (ha)
CBMH-28_(PROP_STM)	CBMH-29_(PROP_STM)	35.288	0.013	0.3	0.01006	94.47	1.46	0.97	1	0.154
CHAMBERS	SC-MANIFOLD_(PROP_STM)	2.145	0.013	0.3	0.02238	218.87	4.52	1.51	1	0
CBMH-29_(PROP_STM)	MHST-30_(PROP_STM)	11.6	0.013	0.375	0.01724	184.61	2.1	0.8	1	0.329
CB-36_(PROP_STM)	MHST-23_(PROP_STM)	1.5	0.013	0.25	0.00467	57.28	1.17	1.41	1	0.094
MHST-37_(ICD)_(PROP_STM)	EX-MHST	36	0.013	0.75	0.01456	356.32	2.57	0.27	0.35	1.553
MHST-33_(PROP_STM)	MHST-38	32.136	0.013	0.25	0.00747	51.98	1.21	1.01	1	0.009
MHST-38	MHST-31_(PROP_STM)	24.366	0.013	0.3	0.00776	119.88	1.73	1.41	1	0.017
CBMH-27_(PROP_STM)	CBMH-26_(PROP_STM)	35.457	0.013	0.3	0.01001	86.72	1.45	0.9	1	0.149
CBMH-26_(PROP_STM)	MHST-25_(PROP_STM)	9.473	0.013	0.375	0.01731	192.24	2.16	0.83	1	0.377
CB-19_(PROP_STM)	CBMH-21_(PROP_STM)	25.969	0.013	0.25	0.02311	32.67	1.01	0.36	1	0.069
RYCB-34_(PROP_STM)	MHST-33_(PROP_STM)	14.033	0.013	0.25	0.00998	33.5	0.95	0.56	1	0.009
TD-CB-15_(PROP_STM)	MHST-22_(PROP_STM)	29.983	0.013	0.2	0.01501	60.66	1.93	1.51	1	0.037
MHST-22_(PROP_STM)	MHST-23_(PROP_STM)	31.33	0.013	0.25	0.0045	60.67	1.24	1.52	1	0.037
MHST-23_(PROP_STM)	MHST-24_(PROP_STM)	61.685	0.013	0.45	0.00199	160.52	1.01	1.26	1	0.676
MHST-24_(PROP_STM)	MHST-25_(PROP_STM)	19.174	0.013	0.45	0.00198	160.77	1.01	1.27	1	0.676
MHST-25_(PROP_STM)	MHST-30_(PROP_STM)	37.824	0.013	0.525	0.00201	306.87	1.42	1.59	1	1.054
MHST-30_(PROP_STM)	MHST-31_(PROP_STM)	15.021	0.013	0.6	0.002	476.48	1.69	1.74	1	1.382
MHST-31_(PROP_STM)	CBMH-20_(PROP_STM)	30.253	0.013	0.6	0.00202	484.27	1.71	1.76	1	1.4
CBMH-20_(PROP_STM)	MHST-32_(PROP_STM)	11.03	0.013	0.6	0.00199	506.43	1.79	1.85	1	1.453
ICD_dummy	MHST-37_(ICD)_(PROP_STM)	13.449	0.013	0.6	0.00201	349.96	1.71	1.27	0.68	1.507
CBMH-21_(PROP_STM)	MHST-23_(PROP_STM)	18.995	0.013	0.3	0.0109	107.34	1.56	1.06	1	0.225
CB-35_(PROP_STM)	MHST-38	15.525	0.013	0.25	0.02513	39.2	1.19	0.42	1	0.009
SC-MANIFOLD_(PROP_STM)	MHST-32_(PROP_STM)	2.579	0.013	0.45	0.02017	187.23	1.27	0.46	1	0.054

Appendix H:
Zurn Control-Flo Specifications

ZURN CANADA

SPECIFICATION DRAINAGE

Control-Flo
Roof Drainage System

www.zurn.com

THE ZURN "CONTROL-FLO CONCEPT"

Originally, Zurn introduced the scientifically-advanced "Control-Flo" drainage principle for dead-level roofs. Today, after thousands of successful applications in modern, large dead-level roof areas, Zurn engineers have adapted the comprehensive "Control-Flo" data to **sloped roof** areas.

WHAT IS "CONTROL-FLO"?

It is an advanced method of removing rain water off dead-level or sloped roofs. As contrasted with conventional drainage practices, which attempt to drain off storm water as quickly as it falls on the roof's surface, "Control-Flo" drains the roof at a controlled rate. Excess water accumulates on the roof under controlled conditions...then drains off at a lower rate after a storm abates.

CUTS DRAINAGE COSTS

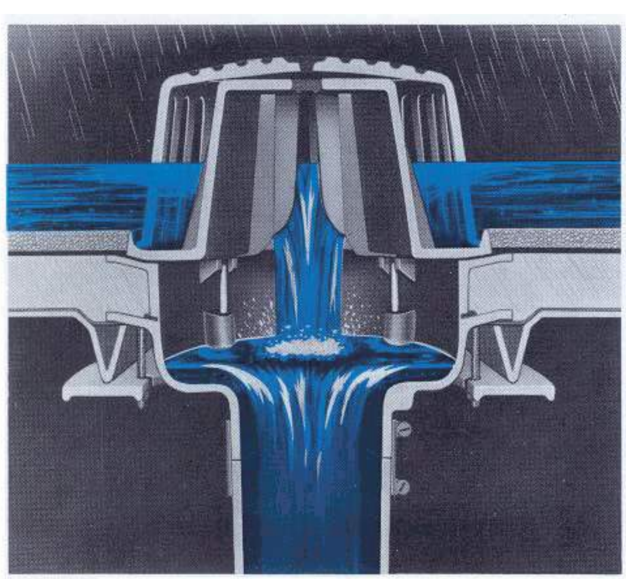
Fewer roof drains, smaller diameter piping, smaller sewer sizes, and lower installation costs are possible with a "Control-Flo" drainage system because roof areas are utilized as temporary storage reservoirs.

REDUCES PROBABILITY OF STORM DAMAGE

Lightens load on combination sewers by reducing rate of water drained from roof tops during severe storms thereby reducing probability of flooded sewers, and consequent backflow into basements and other low areas.

THANKS TO EXCLUSIVE ZURN "AQUA-WEIR" ACTION

Key to successful "Control-Flo" drainage is a unique scientifically-designed weir containing accurately calibrated notches with sides formed by parabolic curves which provide flow rates directly proportional to the head. Shape and size of notches are based on predetermined flow rates, and all factors involved in roof drainage to assure permanent regulation of drainage flow rates for specific geographic locations and rainfall intensities.

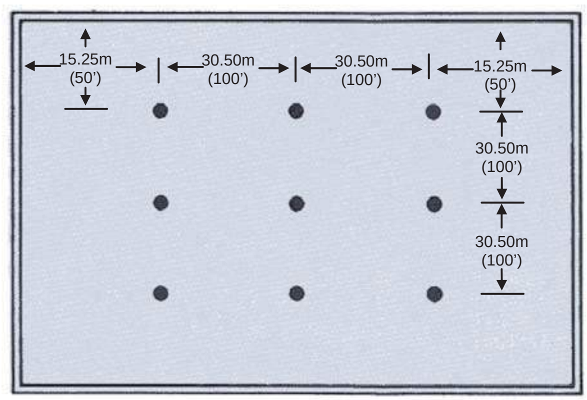


DEFINITION

DEAD LEVEL ROOFS

DIAGRAM "A"

A dead-level roof for purposes of applying the Zurn "Control-Flo" drainage principle is one which has been designed for zero slope across its entire surface. Measurements shown are for maximum distances.



(Plan View)

(Section View)

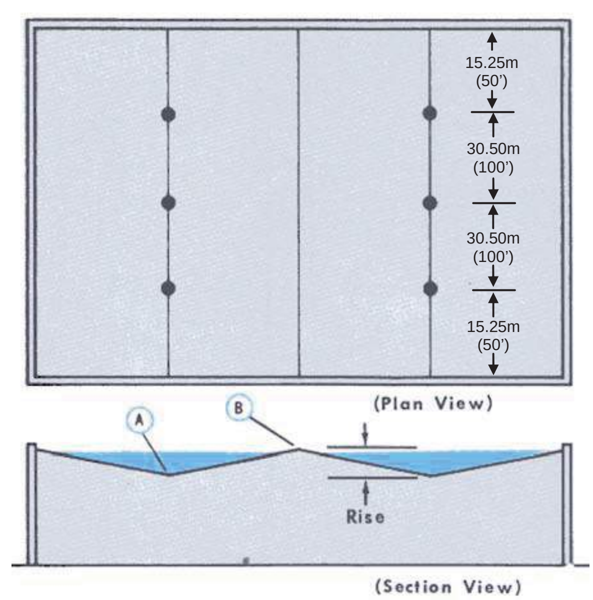
SLOPED ROOFS

DIAGRAM "B"

A sloped roof is one designed commonly with a shallow slope. The Zurn "Control-Flo" drainage system can be applied to any slope which results in a total rise up to 152mm (6").

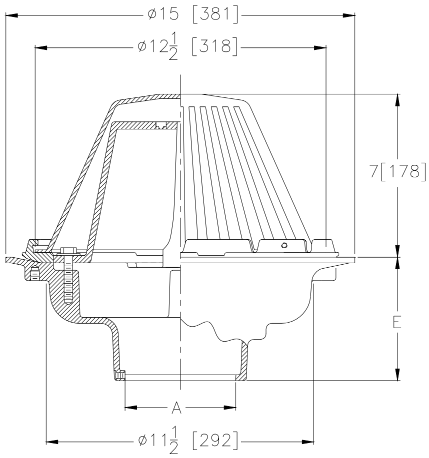
The total rise of a roof as calculated for "Control-Flo" application is defined as the vertical increase in height in inches, from the low point or valley of a sloping roof (A) to the top of the sloping section (B). (Example: a roof that slopes 3mm (1/8") per foot having a 7.25m (24') span would have a rise of 7.25m x 3mm or 76mm (24' x 1/8" or 3")).

Measurements shown are for maximum distances.



Dimensions and other measurements given in metric and imperial forms.

SPECIFICATION DATA



ENGINEERING SPECIFICATION: ZURN Z-105 "Control-Flo" roof drain for dead -level or sloped roof construction, Dura-Coated cast iron body. "Control-Flo" weir shall be linear functioning with integral membrane flashing clamp/ gravel guard and Poly-Dome. All data shall be verified proportional to flow rates.

ROOF DESIGN RECOMMENDATIONS

Basic roofing design should incorporate protection that will prevent roof overloading by installing adequate over-flow scuppers in parapet walls.

GENERAL INFORMATION

The "Control-Flo" roof drainage data is tabulated for four areas (232.25m^2 (2500 sq. ft.), 464.502m^2 (5000 sq. ft.), 696.75m^2 (7500 sq. ft.), 929m^2 (10,000 sq. ft.) notch areas ratings) for each locality. For each notch area rating the maximum discharge in L.P.M. (G.P.M.) - draindown in hours, and maximum water depth at the drain in inches for a dead level roof — 51mm (2 inch) rise — 102mm (4 inch) rise and 152mm (6 inch) rise—are tabulated. The rise is the total change in elevation from the valley to the peak. Values for areas, rise or combination thereof other than those listed, can be arrived at by extrapolation. All data listed is based on the fifty-year return frequency storm. In other words the maximum conditions as listed will occur on the average of once every fifty years.

NOTE: The tabulated "Control-Flo" data enables the individual engineer to select his own design limiting condition. The limiting condition can be draindown time, roof load factor, or maximum water depth at the drain. If draindown time is the limiting factor because of possible freezing conditions, it must be recognized that the maximum time listed will occur on the average of once every 50 years and would most likely be during a heavy summer thunder storm. Average winter draindown times would be much shorter in duration than those listed.

GENERAL RECOMMENDATIONS

On sloping roofs, we recommend a design depth referred to as an equivalent depth. An equivalent depth is the depth of water attained at the drains that results in the same roof stresses as those realized on a dead-level roof. In all cases this equivalent depth is almost equal to that attained by using the same notch area rating for the different rises to 152mm (6"). With the same depth of water at the drain the roof stresses will decrease with increasing total rise. Therefore, it would be possible to have a depth in excess of 152mm (6") at the drain on a sloping roof without exceeding stresses normally encountered in a 152mm (6") depth on a dead-level roof. However, it is recommended that scuppers be placed to limit the maximum water depth on any roof to 152mm (6") to prevent the overflow of the weirs on the drains and consequent overloading of drain piping. In the few cases where the data shows a flow rate in excess of 136 L.P.M. (30 G.P.M.) if all drains and drain lines are sized according to recommendations, and the one storm in fifty years occurs, the only consequence will be a brief flow through the scuppers or over-flow drains.

NOTE: An equivalent depth is that depth of water attained at the drains at the lowest line or valley of the roof with all other conditions such as notch area and rainfall intensity being equal. For Toronto, Ontario a notch area rating of 464.50m^2 (5,000 sq. ft.) results in a 74mm (2.9 inch) depth on a dead level roof for a 50-year storm. For the same notch area and conditions, equivalent depths for a 51mm (2"), 102mm (4") and 152mm (6") rise respectively on a sloped roof would be 86mm (3.4"), 104mm (4.1") and 124mm (4.9"). Roof stresses will be approximately equal in all cases.

Control-Flo Drain Selection Is Quick and Easy...

The exclusive Zurn "Selecta-Drain" Chart (pages 8—11) tabulates selection data for 34 localities in Canada. Proper use of this chart constitutes your best assurance of sure, safe, economical application of Zurn "Control-Flo" systems for your specific geographical area. If the "Selecta-Drain Chart does not cover your specific design criteria, contact Zurn Industries Limited, Mississauga, Ontario, for additional data for your locality. Listed below is additional information pertinent to proper engineering of the "Control-Flo" system.

ROOF USED AS TEMPORARY RETENTION

The key to economical "Control-Flo" is the utilization of large roof areas to temporarily store the maximum amount of water without overloading average roofs or creating excessive draindown time during periods of heavy rainfall. The data shown in the "Selecta-Drain" Chart enables the engineer to select notch area ratings from 232.25 m^2 (2,500 $ft.^2$) to 929m^2 (10,000 $ft.^2$) and to accurately predict all other design factors such as maximum roof load, L.P.M. (G.P.M.) discharge, draindown time and water depth at the drain. Obviously, as design factors permit the notch area rating to increase the resulting money saved in being able to use small leaders and drain lines will also increase.

ROOF LOADING AND RUN-OFF RATES

The four values listed in the "Selecta-Drain" Chart for notch area ratings for different localities will normally span the range of good design. If areas per notch below 232.25m^2 (2,500 $ft.^2$) are used considerable economy of the "Control-Flo" concept is being lost. The area per notch is limited to 929m^2 (10,000 $ft.^2$) to keep the draindown time within reasonable limits. Extensive studies show that stresses due to water load on a sloping roof for any fixed set of conditions are very nearly the same as those on a dead-level roof. A sloping roof tends to concentrate more water in the valleys and increase the water depth at this point. The greater depth around the drain leads to a faster run-off rate, particularly a faster early run -off rate. As a result, the total volume of water stored on the roof is less, and the total load on the sloping roof is less. By using the same area on the sloping roof as on the dead-level roof the increase in roof stresses due to increased water depth in the valleys is offset by the decrease in the total load due to less water stored. The net result of the maximum roof stress is approximately the same for any single span rise and fixed set of conditions. A fixed set of conditions, would be the same notch area, the same frequency store, and the same locality.

SPECIAL CONSIDERATIONS FOR STRUCTURAL SAFETY: Normal practice of roof design is based on 18kg (40 lbs.) per 929 cm^2 (sq ft.). (Subject to local codes and by-laws.) Thus it is extremely important that design is in accordance with normal load factors so deflection will be slight enough in any bay to prevent progressive deflection which could cause water depths to load the roof beyond its design limits.

ADDITIONAL NOTCH RATINGS

The 'Selecta-Drain" Chart along with Tables I and II enables the engineer to select "Control-Flo" Drains and drain pipe sizes for most Canadian applications. These calculations are computed for a proportional flow weir that is sized to give a flow of 23 L.P.M. (5 G.P.M.) per inch of head. The 23 L.P.M. (5 G.P.M.) per inch of head notch opening is selected as the bases of design as it offers the most economical installation as applied to actual rainfall experienced in Canada.
Should you require design criteria for locations outside of Canada or for special project applications please contact Zurn Industries Limited, Mississauga, Ontario.

LEADER AND DRAIN PIPE SIZING

Since all data in the "Selecta-Drain" Chart is based on the 50-year-storm it is possible to exceed the water depth listed in these charts if a 100-year or 1000-year storm would occur. Therefore, for good design it is recommended that scuppers or other methods be used to limit water depth to the design depth and tables I and II be used to size the leaders and drain pipes. If the roof is capable of supporting more water than the design depth it is permissible to locate the scuppers or other overflow means at a height that will allow a greater water depth on the roof. However, in this case the leader and drain pipes should be sized to handle the higher flow rates possible based on a flow rate of 23 L.P.M. (5 G.P.M.) per inch of depth at the drain.

PROPER DRAIN LOCATION

The following good design practice is recommended for selecting the proper number of "Control-Flo" drains for a given area. **On dead-level roofs**, drains should be located no further than 15.25m (50 feet) from edge of roof and no further than 30.50m (100 feet) between drains. See diagram "A" page 2. **On sloping roofs**, drains should be located in the valleys at a distance no greater than 15.25m (50 feet) from each end of the valleys and no further than 30.50m (100 feet) between drains. See diagram "B" page 2. Compliance with these recommendations will assure good run off regardless of wind direction.

Saves Specification Time, Assures Proper Application

QUICK, EASY SELECTION

Using the “Selecta-Drain” Chart (pages 9—13) in combination with the steps and examples appearing below, should save you countless hours in engineering specification time. This vast compilation of data is related to the proper selection of drains for 34 cities. All cities in alphabetical order by province. If a specific city does not appear in the tabulation, chooses the city nearest your area and select the proper drain using these factors.

3 EASY STEPS…

AND 3 TYPICAL EXAMPLES FOR APPLICATION OF SURE, SCIENTIFIC CONTROL OF DRAINAGE FROM DEAD-LEVEL AND SLOPING ROOFS WITH THE ZURN CONCEPT.

NOTE: Where roof area to be drained is adjacent to one or more vertical walls projecting above the roof, then a percentage of the of the wall(s) must be added to the roof area in determining total roof area to be drained.

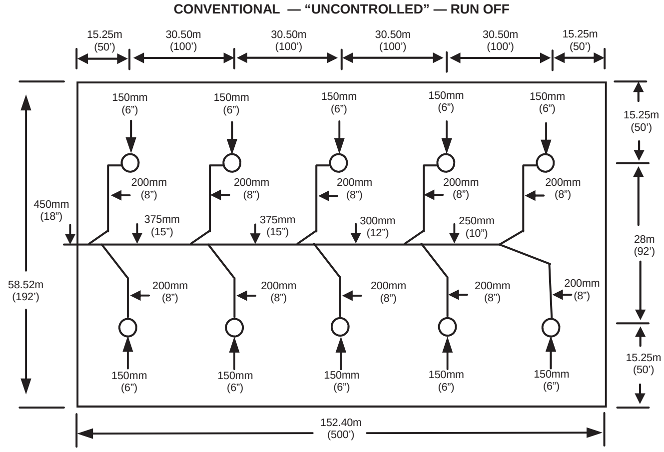
	TORONTO, ONTARIO	DEAD-LEVEL ROOF	102mm (4 INCH) SLOPE	152mm (6 INCH) SLOPE
1	Determine total roof area or individual areas when roof is divided by expansion joints or peaks in the case of sloping roof.	Roof Area: 56.52m x 152.40m = 8918.40m^2 (192ft x 500ft = 96,000 sq. ft.) (See Z105 layout bottom of this page.)	3 Individual Roof Areas: 19.50m x 152.40m = 2972.80m^2 (64ft x 500ft = 32,000 sq. ft.) Valleys 152.40m (500ft) long 3 x 2972.80 = 8918.40m^2 (3 x 32,000 = 96,000 sq. ft.)	2 Individual Roof Areas: 29.87m x 152.40m = 4552m^2 (98ft x 500ft = 49,000 sq. ft.) Valleys 152.40m (500ft) long 2 x 4552 = 9104m^2 (2 x 49,000 = 98,000 sq. ft.)
2	Divide roof area or individual areas by Zurn Notch Area Rating selected to obtain the total number of notches required.	Zurn Notch Area Rating selected for Toronto = 464.50m^2 (5,000 sq. ft.) from “Selecta-Drain Chart, page 11. Total Roof Area = 8918.40m^2 (96,000 sq. ft.) Entire roof. 464.50m^2 (5,000 sq. ft.) notch area = 19.2 notches—USE 20.	Zurn Notch Area Rating selected for Toronto = 464.50m^2 (5,000 sq. ft.) from “Selecta-Drain Chart, page 11. Total Roof Area = 2972.80m^2 (32,000 sq. ft.) Each area. 464.50m^2 (5,000 sq. ft.) notch area = 6.4 notches—USE 7 PER AREA.	Zurn Notch Area Rating selected for Toronto = 464.50m^2 (5,000 sq. ft.) from “Selecta-Drain Chart, page 11. Total Roof Area = 4552m^2 (49,000 sq. ft.) Each area. 464.50m^2 (5,000 sq. ft.) notch area = 9.8 notches—USE 10 PER AREA.
3	Determine total number of drains required by not exceeding maximum spacing dimensions in the preceding instructions. See Diagrams “A” or “B”, page 2. Divide total number of notches required to determine the number of notches per drain. Note maximum water depth at drain and use this dimension to determine scupper height. Maximum scupper height to be used is 152mm (6”). *Use this flow rate to size leaders and drain lines.*	*10 drains required. All drains must have two notches each for a total of 20 notches. Flow rate is 66 L.P.M. (14.5 G.P.M.) per notch. Size leaders for 2 notch weirs for a flow rate of 66 L.P.M. (14.5 G.P.M.) 50 mm (two inch) pipe size leaders required. Maximum water depth and scupper height is 74mm (2.9“). Requires 19 hours draindown time maximum. For drain, vertical and horizontal pipe sizing data see Tables I and II on page 6 and 7.	**5 drains per area required located in the valleys 15.25m (50ft.) from each end with 3 in the middle at 30.50m (100ft.) spacings. Two drains on ends with two notches—3 drains in middle on notch each for a total of 7 notches. Maximum flow rate 93 L.P.M. (20.5 G.P.M.) per notch. Leader size 50mm (2”) for single notch weirs—75mm (3”) notch weirs. Maximum water depth and scupper height is 104mm (4.1”). Requires 11 hours draindown time maximum. For drain, vertical and horizontal pipe sizing data see Tables I and II on page 6 and 7.	**5 drains per area required located in the valleys 15.25m (50ft.) from each end with 3 in the middle at 30.50m (100ft.) spacing in the middle. 10 notches are required therefore all drains must have two notches. Flow rate is 111 L.P.M. (24.5 G.P.M.) per notch. Size all leaders for 2 notch weirs. 75mm (3”) pipe size required. Maximum water depth and scupper height is 124mm (4.9”). Requires 9 hours draindown time maximum. For drain, vertical and horizontal pipe sizing data see Tables I and II on page 6 and 7.

*See Diagram “A” page 2 for recommended drain placement.
**See Diagram “B” page 2 for recommended drain placement.

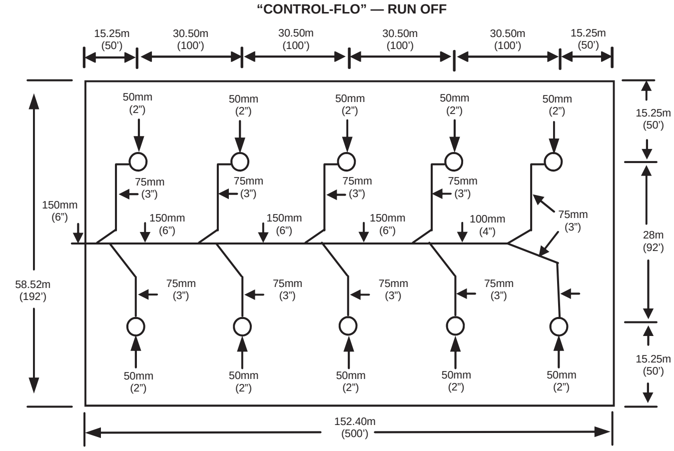
DEAD LEVEL ROOF

6mm (1/4”) PER FT. SLOPE STORM DRAIN

CONVENTIONAL — “UNCONTROLLED” — RUN OFF



“CONTROL-FLO” — RUN OFF



ROOF DRAINAGE DATA

The flow rate for any design condition can be easily read from the data contained on the following pages; the tabulations shown below (and on the opposite page) can be used to simplify selection of drain line sizes.

TABLE 1 - SUGGESTED RELATION OF DRAIN OUTLET AND VERTICAL LEADER SIZE TO ZURN CONTROL-FLO ROOF DRAINS (BASED ON NATIONAL PLUMBING CODE ASA -A40.8 DATA ON VERTICAL LEADERS).

No. of Notches in Drain	Max. Flow per Notch in L.P.M. (G.P.M.) Pipe Size		
	50mm (2")	75mm (3")	100mm (4")
1	136* (30*)	—	—
2	68 (15)	136* (30*)	—
3	45 (10)	136* (30*)	—
4	—	105 (23)	136* (30*)
5	—	82 (18)	136* (30*)
6	—	68 (15)	136* (30*)

*Maximum flow obtainable from 1 notch with 152mm (6") water depth at drain.

Table 1 should be used to select **vertical drain** leaders which at the same time establishes the drain outlet size. This table illustrates the minimum flow per notch in L.P.M. (G.P.M.) Since the Z-105 drain is available with a minimum of one and a maximum of six notches, calculations have already been a made and are listed in this table for any quantity of weir notch openings established in your design. It was determined ten drains with two notches each weir would be required in the Dead-Level Roof example on page 5. A 66 L.P.M. (14.5 G.P.M.) discharge per notch flow rate was also established.

Once this design criteria has been determined it will be the key to the proper selection of all drain outlet sizes, vertical and horizontal storm drain sizes in Table I and II. Enter the column "Number of Notches in Drain", Table I, read down the column to the figure 2 which indicates two notches in weir, then read across until you reach a figure equal to or closest figure in excess of 66 L.P.M. (14.5 G.P.M.) You will find fifteen in the column under 50mm (2") which represents the pipe size. Therefore all drain outlets and vertical leaders are 50mm (2") size.

Let us digress for a moment assuming a specific structure requires a total of six drains each containing a weir with a different number of notches. One with 1, one with 2, etc. Table 1 discloses the pipe size for one notch is 50mm (2"), two notch is 50mm (2"), three notch is 75mm (3"), four notch is 75mm (3"), five notch is 75mm (3") and six notch is 75mm (3") as they all equal or closely exceed the 66 L.P.M. (14.5 G.P.M.) design.

NOTE: Although pipe size calculations should be based on accumulated flow rate, local by-laws should be referred to for minimum pipe size requirements and roof drain spacing.

TABLE II should be used to select **horizontal** storm drain piping. Use the same flow rate 66 L.P.M. (14.5 G.P.M.) used to establish the vertical leaders to size the storm drainage system and main storm drain. Let us assume the ten drains each with two notch weirs were actually on the roof in two separate lines of five drains each and joined at a common point before leaving the building. Since Table II includes 3mm (1/8"), 6mm (1/4") and 13mm (1/2") per foot slope, let **us use 6mm (1/4") as our basis for selection** which will take us to the centre section. Starting with the first of five drains we enter the extreme left column in Table II and read down to the figure 2 since this drain has two notches in weir, read across horizontally and the size of first section of horizontal storm drain is 75mm (3") between 1st and 2nd drain, return to left hand column proceed reading down until you reach figure 4 then read across horizontally and the pipe size will be 100mm (4") between 2nd and 3rd drain, 100mm (4") between 3rd and 4th and 125mm (5") (if available) between 4th and 5th. If not available use 150mm (6"). (You may be tempted to use 100mm (4") since the capacity is close. We recommend you go to the larger size.) Pipe size leaving 5th drain would be 150mm (6"). The same sizing would hold true for the second line of five drains. Since both columns of five drains each are being joined together before leaving the building there will be total of twenty notches discharging into the main building storm sewer. Enter left hand column Table II, read down until you reach the figure twenty, then read across horizontally to the 6mm (1/4") per 305mm (1') slope column and you will see a 150mm (6") storm drain will handle the job adequately. The same procedure should be followed for sloped roof installations. The above method of sizing was done to better acquaint you with Table II and its use. The more economical and practical way of laying out and installing this same job is illustrated in the control-flo layout shown on bottom of page 5.

NOTE: Although pipe size calculations should be based on accumulated flow rates, local by-laws should be referred to for minimum pipe size requirements and roof drain spacing.

Select Proper Horizontal Storm Drain Piping

Table II — SUGGESTED RELATION OF HORIZONTAL STORM DRAIN SIZE TO ZURN CONTROL-FLO ROOF DRAINAGE

Total No. of Notches Discharging to Storm Drain	MAX. FLOW PER NOTCH IN L.P.M. (G.P.M.)								MAX. FLOW PER NOTCH IN L.P.M. (G.P.M.)							MAX. FLOW PER NOTCH IN L.P.M. (G.P.M.)						
	Storm Drain Size 3mm (1/8") per 305mm (1') Slope								Storm Drain Size 6mm (1/4") per 305mm (1') Slope							Storm Drain Size 13mm (1/2") per 305mm (1') Slope						
	75 (3")	100 (4")	125 (5")	150 (6")	200 (8")	250 (10")	300 (12")	375 (15")	75 (3")	100 (4")	125 (5")	150 (6")	200 (8")	250 (10")	300 (12")	75 (3")	100 (4")	125 (5")	150 (6")	200 (8")	250 (10")	300 (12")
1	136* (30*)	—	—	—	—	—	—	—	136* (30*)	—	—	—	—	—	—	136* (30*)	—	—	—	—	—	—
2	77 (17)	136* (30*)	—	—	—	—	—	—	109 (24)	136* (30*)	—	—	—	—	—	136* (30*)	—	—	—	—	—	—
3	50 (11)	118 (26)	136* (30*)	—	—	—	—	—	73 (16)	136* (30*)	—	—	—	—	—	100 (22)	136* (30*)	—	—	—	—	—
4	36 (8)	86 (19)	136* (30*)	—	—	—	—	—	55 (12)	127 (28)	136* (30*)	—	—	—	—	77 (17)	136* (30*)	—	—	—	—	—
5	—	65 (15)	127* (28*)	136* (30*)	—	—	—	—	—	100 (22)	136* (30*)	—	—	—	—	59 (13)	136* (30*)	—	—	—	—	—
6	—	59 (13)	105 (23)	136* (30*)	—	—	—	—	—	82 (18)	136* (30*)	—	—	—	—	50 (11)	118 (26)	136* (30*)	—	—	—	—
7	—	50 (11)	91 (20)	136* (30*)	—	—	—	—	—	73 (16)	127 (28)	136* (30*)	—	—	—	—	100 (22)	136* (30*)	—	—	—	—
8	—	—	77 (17)	127 (28)	136* (30*)	—	—	—	—	64 (14)	114 (25)	136* (30*)	—	—	—	—	86 (19)	136* (30*)	—	—	—	—
9	—	—	68 (15)	114 (25)	136* (30*)	—	—	—	—	55 (12)	100 (22)	136* (30*)	—	—	—	—	77 (17)	136* (30*)	—	—	—	—
10	—	—	64 (14)	100 (22)	136* (30*)	—	—	—	—	—	91 (20)	136* (30*)	—	—	—	—	68 (15)	123 (27)	136* (30*)	—	—	—
11	—	—	55 (12)	91 (20)	136* (30*)	—	—	—	—	—	82 (18)	132 (29)	136* (30*)	—	—	—	64 (14)	114 (25)	136* (30*)	—	—	—
12	—	—	—	82 (18)	136* (30*)	—	—	—	—	—	73 (16)	118 (26)	136* (30*)	—	—	—	59 (13)	105 (23)	136* (30*)	—	—	—
13	—	—	—	77 (17)	136* (30*)	—	—	—	—	—	68 (15)	109 (24)	136* (30*)	—	—	—	55 (12)	95 (21)	136* (30*)	—	—	—
14	—	—	—	73 (16)	136* (30*)	—	—	—	—	—	64 (14)	100 (22)	136* (30*)	—	—	—	—	86 (19)	136* (30*)	—	—	—
15	—	—	—	68 (15)	136* (30*)	—	—	—	—	—	59 (13)	95 (21)	136* (30*)	—	—	—	—	82 (18)	132 (29)	136* (30*)	—	—
16	—	—	—	64 (14)	136* (30*)	—	—	—	—	—	—	91 (20)	136* (30*)	—	—	—	—	77 (17)	123 (27)	136* (30*)	—	—
17	—	—	—	59 (13)	127 (28)	136* (30*)	—	—	—	—	—	82 (18)	136* (30*)	—	—	—	—	73 (16)	118 (26)	136* (30*)	—	—
18	—	—	—	55 (12)	118 (26)	136* (30*)	—	—	—	—	—	77 (17)	136* (30*)	—	—	—	—	68 (15)	109 (24)	136* (30*)	—	—
19	—	—	—	—	114 (25)	136* (30*)	—	—	—	—	—	73 (16)	136* (30*)	—	—	—	—	64 (14)	105 (23)	136* (30*)	—	—
20	—	—	—	—	109 (24)	136* (30*)	—	—	—	—	—	68 (15)	136* (30*)	—	—	—	—	59 (13)	100 (22)	136* (30*)	—	—
23	—	—	—	—	91 (20)	136* (30*)	—	—	—	—	—	64 (14)	132 (29)	136* (30*)	—	—	—	55 (12)	86 (19)	136* (30*)	—	—
25	—	—	—	—	86 (19)	136* (30*)	—	—	—	—	—	59 (13)	123 (27)	136* (30*)	—	—	—	—	77 (17)	136* (30*)	—	—
30	—	—	—	—	73 (16)	127 (28)	136* (30*)	—	—	—	—	—	100 (22)	136* (30*)	—	—	—	—	64 (14)	136* (30*)	—	—
35	—	—	—	—	59 (13)	109 (24)	136* (30*)	—	—	—	—	—	86 (19)	136* (30*)	—	—	—	—	55 (12)	123 (27)	136* (30*)	—
40	—	—	—	—	55 (12)	95 (21)	136* (30*)	—	—	—	—	—	77 (17)	136* (30*)	—	—	—	—	—	105 (23)	136* (30*)	—
45	—	—	—	—	—	86 (19)	136* (30*)	—	—	—	—	—	68 (15)	123 (27)	136* (30*)	—	—	—	—	95 (21)	136* (30*)	—
50	—	—	—	—	—	77 (17)	123 (27)	136* (30*)	—	—	—	—	59 (13)	109 (24)	136* (30*)	—	—	—	—	86 (19)	136* (30*)	—
55	—	—	—	—	—	68 (15)	114 (25)	136* (30*)	—	—	—	—	—	100 (22)	136* (30*)	—	—	—	—	77 (17)	136* (30*)	—
60	—	—	—	—	—	64 (14)	105 (23)	136* (30*)	—	—	—	—	—	91 (20)	136* (30*)	—	—	—	—	68 (15)	127 (28)	136* (30*)
65	—	—	—	—	—	59 (13)	95 (21)	136* (30*)	—	—	—	—	—	82 (18)	136* (30*)	—	—	—	—	64 (14)	118 (26)	136* (30*)
70	—	—	—	—	—	55 (12)	91 (20)	136* (30*)	—	—	—	—	—	77 (17)	127 (28)	—	—	—	—	59 (13)	109 (24)	136* (30*)

*Maximum flow obtainable from 1 notch with 152mm (6") water depth at drain.

TABLE III - TO BE USED WHEN ROOF STORM WATER RUN OFF AND OTHER SURFACE WATER RUN OFF IS BEING CONSOLIDATED INTO ONE COMMON MAIN HORIZONTAL STORM SEWER.

Flow capacity of vertical leaders litres per minute (gallons per minute)

Pipe Size	Maximum Capacity L.P.M. (G.P.M.)
50mm (2”)	136 (30)
75mm (3”)	409 (90)
100mm (4”)	864 (190)
†125mm (5”)	1582 (348)
150mm (6”)	2550 (561)

†In some areas 125mm (5”) drainage pipe may not be available.

Flow capacity of horizontal storm sewers litres per minute (gallons per minute).

Pipe Size	Slope per 305mm (1’0”)		
	3mm (1/8”)	6mm (1/4”)	13mm (1/2”)
75mm (3”)	163 (36)	232 (51)	327 (72)
100mm (4”)	355 (78)	505 (111)	714 (157)
†125mm (5”)	646 (142)	914 (201)	1291 (284)
150mm (6”)	1050 (231)	1487 (327)	2100 (462)
200mm (8”)	2264 (498)	3205 (705)	4528 (996)
250mm (10”)	4100 (902)	5796 (1275)	8201 (1804)
300mm (12”)	6669 (1467)	9437 (2076)	13338 (2934)
375mm (15”)	12120 (2666)	17157 (3774)	24239 (5332)

Note: Although pipe size calculations should be based on accumulated flow rate, local by-laws should be referred to for minimum pipe size requirements and roof drain spacing.

SCUPPER AND OVERFLOW DRAINS

Roofing members and understructures, weakened by seepage and rot resulting from improper drainage and roof construction can give away under the weight of rapidly accumulated water during flash storms. Thus, it is recommended, and often required by building codes, to install scuppers and overflow drains in parapet-type roofs. Properly selected and sized scuppers and overflow drains are vital to a well-engineered drainage system to prevent excessive loading, erosion, seepage and rotting.

Selecta-Drain Chart

LOCATION	SQUARE METRE (SQUARE FOOT) / NOTCH AREA RATING	ROOF LOAD FACTOR KGS. (LBS.)	TOTAL ROOF SLOPE											
			DEAD LEVEL			51mm (2") RISE			102mm (4") RISE			152mm (6") RISE		
			L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth
Calgary, Alberta	232 (2,500)	4.7 (10.4)	45.5 (10)	**7**	51 (2)	57 (12.5)	**6**	63.5 (2.5)	72.5 (16)	**4**	81.5 (3.2)	86.5 (19)	**3.2**	96.5 (3.8)
	465 (5,000)	5.9 (13)	57 (12.5)	**17**	63.5 (2.5)	66 (14.5)	**14**	73.5 (2.9)	82 (18)	**9**	91.5 (3.6)	97.5 (21.5)	**7.5**	109 (4.3)
	697 (7,500)	6.4 (14)	61.5 (13.5)	**28**	68.5 (2.7)	72.5 (16)	**22**	81.5 (3.2)	88.5 (19.5)	**15**	99 (3.9)	104.5 (23)	**12**	117 (4.6)
	929 (10,000)	6.8 (15.1)	66 (14.5)	**38**	73.5 (2.9)	77.5 (17)	**31**	86.5 (3.4)	93 (20.5)	**22**	104 (4.1)	109 (24)	**17**	122 (4.8)
Edmonton, Alberta	232 (2,500)	4.5 (9.9)	43 (9.5)	**7**	48.5 (1.9)	57 (12.5)	**6**	63.5 (2.5)	72.5 (16)	**4**	81.5 (3.2)	82 (18)	**3**	91.5 (3.6)
	465 (5,000)	5.9 (13)	57 (12.5)	**17**	63.5 (2.5)	68 (15)	**14.5**	76 (3)	84 (18.5)	**9.5**	94 (3.7)	97.5 (21.5)	**7.5**	109 (4.3)
	697 (7,500)	6.6 (14.5)	63.5 (14)	**28**	71 (2.8)	75 (16.5)	**24**	84 (3.3)	97.5 (21.5)	**16**	104 (4.1)	107 (23.5)	**12**	119.5 (4.7)
	929 (10,000)	7.1 (15.6)	68 (15)	**38**	76 (3.0)	79.5 (17.5)	**32**	89 (3.5)	100 (22)	**22**	112 (4.4)	113.5 (25)	**18**	127 (5.0)
Penticton, British Columbia	232 (2,500)	3.8 (8.3)	36.5 (8)	**6**	40.5 (1.6)	38.5 (8.5)	**4**	43 (1.7)	52.5 (11.5)	**3**	58.5 (2.3)	61.5 (13.5)	**2.3**	68.5 (2.7)
	465 (5,000)	4.0 (8.8)	38.5 (8.5)	**13**	43 (1.7)	41 (9)	**9**	45.5 (1.8)	57 (12.5)	**6**	63.5 (2.5)	68 (15)	**5**	76 (3)
	697 (7,500)	4.2 (9.3)	41 (9)	**21**	45.5 (1.8)	43 (9.5)	**14.5**	48.5 (1.9)	61.5 (13.5)	**10.5**	68.5 (2.7)	72.5 (16)	**8**	81.5 (3.2)
	929 (10,000)	4.2 (9.3)	41 (9)	**27**	45.5 (1.8)	45.5 (10)	**20**	51 (2)	63.5 (14)	**14**	71 (2.8)	75 (16.5)	**11**	84 (3.3)
Vancouver, British Columbia	232 (2,500)	3.3 (7.3)	32 (7)	**5.5**	35.5 (1.4)	38.5 (8.5)	**4**	43 (1.7)	47.5 (10.5)	**2.8**	53.5 (2.1)	57 (12.5)	**2**	63.5 (2.5)
	465 (5,000)	4.0 (8.8)	38.5 (8.5)	**13**	43 (1.7)	45.5 (10)	**10**	51 (2)	57 (12.5)	**6**	63.5 (2.5)	68 (15)	**5**	76 (3)
	697 (7,500)	4.5 (9.9)	43 (9.5)	**22**	48.5 (1.9)	50 (11)	**17**	56 (2.2)	63.5 (14)	**11**	71 (2.8)	75 (16.5)	**8.5**	84 (3.3)
	929 (10,000)	4.9 (10.9)	47.5 (10.5)	**30**	53.5 (2.1)	54.5 (12)	**24**	61 (2.4)	68 (15)	**15**	76 (3)	79.5 (17.5)	**12**	89 (3.5)
Victoria, British Columbia	232 (2,500)	3.3 (7.3)	32 (7)	**5.5**	35.5 (1.4)	38.5 (8.5)	**4**	43 (1.7)	43 (9.5)	**2.5**	48.5 (1.9)	54.5 (12)	**2**	61 (2.4)
	465 (5,000)	4.0 (8.8)	38.5 (8.5)	**13**	43 (1.7)	45.5 (10)	**10**	51 (2)	54.5 (12)	**6**	61 (2.4)	68 (15)	**5**	76 (3)
	697 (7,500)	4.5 (9.9)	43 (9.5)	**22**	48.5 (1.9)	50 (11)	**16**	56 (2.2)	59 (13)	**10**	66 (2.6)	75 (16.5)	**8**	84 (3.3)
	929 (10,000)	4.7 (10.4)	45.5 (10)	**30**	51 (2)	54.5 (12)	**23**	61 (2.4)	63.5 (14)	**14**	71 (2.8)	79.5 (17.5)	**12**	89 (3.5)
Brandon, Manitoba	232 (2,500)	5.9 (13)	57 (12.5)	**8**	63.5 (2.5)	68 (15)	**7**	76 (3)	82 (18)	**4.5**	91.5 (3.6)	92.5 (21)	**3.5**	106.5 (4.2)
	465 (5,000)	7.3 (16.1)	73 (16)	**20**	81.5 (3.2)	84 (18.5)	**17**	94 (3.7)	97.5 (21.5)	**11**	109 (4.3)	113.5 (25)	**8.5**	127 (5)
	697 (7,500)	8.3 (18.2)	79.5 (17.5)	**32**	89 (3.5)	93 (20.5)	**27**	104 (4.1)	107 (23.5)	**19**	119.5 (4.7)	125 (27.5)	**15**	139.5 (5.5)
	929 (10,000)	9.0 (19.8)	86.5 (19)	**43**	96.5 (3.8)	100 (22)	**38**	112 (4.4)	113.5 (25)	**26**	127 (5.0)	132 (29)	**21**	147.5 (5.8)
Winnipeg, Manitoba	232 (2,500)	4.7 (10.4)	45.5 (10)	**7**	51 (2)	57 (12.5)	**6**	63.5 (2.5)	75 (16.5)	**4**	84 (3.3)	86.5 (19)	**3.2**	96.5 (3.8)
	465 (5,000)	5.9 (13)	57 (12.5)	**17**	63.5 (2.5)	68 (15)	**15**	76 (3)	84 (18.5)	**10**	94 (3.7)	100 (22)	**7.5**	112 (4.4)
	697 (7,500)	6.6 (14.5)	63.5 (14)	**28**	71 (2.8)	75 (16.5)	**24**	84 (3.3)	93 (20.5)	**16**	104 (4.1)	107 (23.5)	**12**	119.5 (4.7)
	929 (10,000)	7.1 (15.6)	68 (15)	**39**	76 (3)	82 (18)	**32**	91.5 (3.6)	97.5 (21.5)	**22**	109 (4.3)	113.5 (25)	**17**	127 (5.0)
Campbellton, New Brunswick	232 (2,500)	6.4 (14)	62 (13.5)	**9**	68.5 (2.7)	70.5 (15.5)	**7**	78.5 (3.1)	79.5 (17.5)	**4.5**	89 (3.5)	91 (20)	**3.5**	101.5 (4.0)
	465 (5,000)	9.0 (19.8)	86.5 (19)	**22**	96.5 (3.8)	91 (20)	**18**	101.5 (4)	102.5 (22.5)	**12**	115 (4.5)	113.5 (25)	**9**	127 (5.0)
	697 (7,500)	10.4 (22.9)	100 (22)	**35**	112 (4.4)	102.5 (22.5)	**28**	114.5 (4.5)	118 (26)	**20**	132 (5.2)	132 (29)	**15**	147.5 (5.8)
	929 (10,000)	11.3 (25)	109 (24)	**47**	122 (4.8)	111.5 (24.5)	**40**	124.5 (4.9)	127.5 (28)	**29**	142 (5.6)	141 (31)	**22**	157.5 (6.2)

Selecta-Drain Chart

LOCATION	SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING	ROOF LOAD FACTOR KGS. (LBS.)	TOTAL ROOF SLOPE											
			DEAD LEVEL			51mm (2") RISE			102mm (4") RISE			152mm (6") RISE		
			L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth
Chatham, New Brunswick	232 (2,500)	4.5 (9.9)	43 (9.5)	**7**	48.5 (1.9)	52.5 (11.5)	**5.5**	58.5 (2.3)	63.5 (14)	**3.5**	71 (2.8)	77.5 (17)	**2.9**	86.5 (3.4)
	465 (5,000)	5.7 (12.5)	54.5 (12)	**16**	61 (2.4)	63.5 (14)	**13**	71 (2.8)	77.5 (17)	**9**	86.5 (3.4)	91 (20)	**7**	101.5 (4.0)
	697 (7,500)	6.4 (14)	61.5 (13.5)	**27**	68.5 (2.7)	68 (15)	**22**	76 (3)	84 (18.5)	**14**	94 (3.7)	102.5 (22.5)	**12**	114.5 (4.5)
	929 (10,000)	6.6 (14.6)	63.5 (14)	**37**	71 (2.8)	75 (16.5)	**30**	84 (3.3)	91 (20)	**20**	101.5 (4.0)	107 (23.5)	**16**	119.5 (4.7)
Moncton, New Brunswick	232 (2,500)	4.3 (9.4)	41 (9)	**7**	45.5 (1.8)	54.5 (12)	**6**	61 (2.4)	63.5 (14)	**3.5**	71 (2.8)	72.5 (16)	**2.7**	81.5 (3.2)
	465 (5,000)	5.9 (13)	57 (12.5)	**17**	63.5 (2.5)	68 (15)	**14**	76 (3)	82 (18)	**9**	91.5 (3.6)	93 (20.5)	**7**	104 (4.1)
	697 (7,500)	6.6 (14.6)	63.5 (14)	**28**	71 (2.8)	79.5 (17.5)	**24**	89 (3.5)	93 (20.5)	**16**	104 (4.1)	104.5 (23)	**12**	117 (4.6)
	929 (10,000)	7.5 (16.6)	73.5 (16)	**39**	81.5 (3.2)	84 (18.5)	**34**	94 (3.7)	100 (22)	**23**	112 (4.4)	113.5 (25)	**17**	127 (5.0)
Saint John, New Brunswick	232 (2,500)	5.7 (12.5)	54.5 (12)	**8**	61 (2.4)	57 (12.5)	**6**	63.5 (2.5)	75 (16.5)	**4**	84 (3.3)	86.5 (19)	**3**	96.5 (3.8)
	465 (5,000)	7.5 (16.6)	72.5 (16)	**20**	81.5 (3.2)	79.5 (17.5)	**16**	89 (3.5)	95.5 (21)	**11**	106.5 (4.2)	104.5 (23)	**8**	117 (4.6)
	697 (7,500)	8.7 (19.2)	84 (18.5)	**32**	94 (3.7)	93 (20.5)	**27**	104 (4.1)	107 (23.5)	**19**	119.5 (4.7)	118 (26)	**13.5**	132 (5.2)
	929 (10,000)	9.7 (21.3)	93 (20.5)	**44**	104 (4.1)	104.5 (23)	**38**	117 (4.6)	113.5 (25)	**27**	127 (5.0)	127.5 (28)	**20**	142 (5.6)
Gander, Newfound-land	232 (2,500)	3.5 (7.8)	34 (7.5)	**5.5**	38 (1.5)	45.5 (10)	**5**	51 (2.0)	57 (12.5)	**3.5**	63.5 (2.5)	68 (15)	**2.5**	76 (3.0)
	465 (5,000)	4.7 (10.4)	45.5 (10)	**15**	51 (2.0)	57 (12.5)	**12**	63.5 (2.5)	72.5 (16)	**8**	81.5 (3.2)	82 (18)	**6.5**	91.5 (3.6)
	697 (7,500)	5.7 (12.5)	54.5 (12)	**25**	61 (2.4)	63.5 (14)	**21**	71 (2.8)	79.5 (17.5)	**13.5**	89 (3.5)	93 (20.5)	**11**	104 (4.1)
	929 (10,000)	6.1 (13.5)	59 (13)	**35**	66 (2.6)	70.5 (15.5)	**29**	78.5 (3.1)	84 (18.5)	**19**	94 (3.7)	100 (22)	**15**	112 (4.4)
St. Andrews, Newfound-land	232 (2,500)	3.5 (7.8)	34 (7.5)	**5.5**	38 (1.5)	45.5 (10)	**5**	51 (2.0)	59 (13)	**3.5**	66 (2.6)	63.5 (14)	**2.5**	71 (2.8)
	465 (5,000)	5.2 (11.4)	47.5 (10.5)	**15**	53.5 (2.1)	59 (13)	**13**	66 (2.6)	72.5 (16)	**8**	81.5 (3.2)	79.5 (17.5)	**6**	89 (3.5)
	697 (7,500)	5.9 (13)	57 (12.5)	**26**	63.5 (2.5)	66 (14.5)	**21**	73.5 (2.9)	82 (18)	**14**	91.5 (3.6)	88.5 (19.5)	**10**	99 (3.9)
	929 (10,000)	6.6 (14.6)	63.5 (14)	**36**	71 (2.8)	72.5 (16)	**30**	81.5 (3.2)	86.5 (19)	**20**	96.5 (3.8)	95.5 (21)	**14.5**	106.5 (4.2)
St. John's, Newfound-land	232 (2,500)	5.9 (13)	57 (12.5)	**8**	63.5 (2.6)	68 (15)	**7**	76 (3.0)	77.5 (17)	**4.5**	86.5 (3.4)	86.5 (19)	**3.2**	96.5 (3.8)
	465 (5,000)	8.5 (18.7)	82 (18)	**21**	91.5 (3.6)	91 (20)	**18**	101 (4.0)	100 (22)	**11**	112 (4.4)	113.5 (25)	**9**	127 (5.0)
	697 (7,500)	10.6 (23.4)	102.5 (22.5)	**34**	114.5 (4.5)	109 (24)	**29**	122 (4.8)	122.5 (27)	**21**	137 (5.4)	132 (29)	**15**	147.5 (5.8)
	929 (10,000)	11.8 (26)	113.5 (25)	**48**	127 (5.0)	129.5 (28.5)	**43**	145 (5.7)	143 (31.5)	**33**	160 (6.3)	150 (33)	**24**	167.5 (6.6)
Torbay, Newfound-land	232 (2,500)	4.9 (10.9)	47.5 (10.5)	**7.5**	53.5 (2.1)	61.5 (13.5)	**6.5**	68.5 (2.7)	75 (16.5)	**4**	84 (3.3)	84 (18.5)	**3**	94 (3.7)
	465 (5,000)	6.4 (14)	61.5 (13.5)	**18**	68.5 (2.7)	75 (16.5)	**15.5**	84 (3.3)	88.5 (19.5)	**10**	99 (3.9)	102.5 (22.5)	**8**	114.5 (4.5)
	697 (7,500)	7.3 (16.1)	70.5 (15.5)	**29**	78.5 (3.1)	84 (18.5)	**25**	94 (3.7)	100 (22)	**17.5**	112 (4.4)	113.5 (25)	**13**	127 (5)
	929 (10,000)	8.0 (17.7)	77.5 (17)	**40**	86.5 (3.4)	88.5 (19.5)	**34**	99 (3.9)	107 (23.5)	**24**	119.5 (4.7)	122.5 (27)	**19**	137 (5.4)
Halifax, Nova Scotia	232 (2,500)	5.9 (13)	57 (12.5)	**8**	63.5 (2.5)	68 (15)	**7**	76 (3.0)	77.5 (17)	**4.5**	86.5 (3.4)	86.5 (19)	**3.2**	96.5 (3.8)
	465 (5,000)	8.5 (18.7)	82 (18)	**21**	91.5 (3.6)	91 (20)	**18**	101.5 (4.0)	100 (22)	**11**	112 (4.4)	113.5 (25)	**9**	127 (5.0)
	697 (7,500)	10.6 (23.4)	102.5 (22.5)	**34**	114.5 (4.5)	109 (24)	**29**	122 (4.8)	122.5 (27)	**21**	137 (5.4)	132 (29)	**15**	147.5 (5.8)
	929 (10,000)	11.8 (26)	113.5 (25)	**48**	127 (5.0)	129.5 (28.5)	**43**	145 (5.7)	143 (31.5)	**33**	160 (6.3)	150 (33)	**24**	167.5 (6.6)

Selecta-Drain Chart

LOCATION	SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING	ROOF LOAD FACTOR KGS. (LBS.)	TOTAL ROOF SLOPE											
			DEAD LEVEL			51mm (2") RISE			102mm (4") RISE			152mm (6") RISE		
			L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth
Sydney, Nova Scotia	232 (2,500)	4.3 (9.4)	41 (9)	**6.5**	45.5 (1.8)	45.5 (10)	**5**	51 (2.0)	57 (12.5)	**3.5**	6.5 (2.5)	68 (15)	**2.5**	76 (3)
	465 (5,000)	5.7 (12.5)	54.5 (12)	**16**	61 (2.4)	59 (13)	**13**	66 (2.6)	75 (16.5)	**8**	84 (3.3)	84 (18.5)	**6.5**	94 (3.7)
	697 (7,500)	6.4 (14)	61.5 (13.5)	**28**	68.5 (2.7)	68 (15)	**22**	76 (3)	84 (18.5)	**14**	94 (3.7)	97.5 (21.5)	**11**	109 (4.3)
	929 (10,000)	7.1 (15.6)	68 (15)	**38**	76 (3)	75 (16.5)	**30**	84 (3.3)	91 (20)	**20**	101.5 (4)	104.5 (23)	**16**	117 (4.6)
Yarmouth, Nova Scotia	232 (2,500)	6.4 (14)	61.5 (13.5)	**9**	68.5 (2.7)	70.5 (15.5)	**7.5**	78.5 (3.1)	82 (18)	**4.5**	91.5 (3.6)	91 (20)	**3.5**	101.5 (4)
	465 (5,000)	8.3 (18.2)	79.5 (17.5)	**21**	89 (3.5)	88.5 (19.5)	**18**	99 (3.9)	104.5 (23)	**12**	117 (4.6)	116 (25.5)	**9**	129.5 (5.1)
	697 (7,500)	9.4 (20.8)	91 (20)	**34**	101.5 (4)	102.5 (22.5)	**29**	114.5 (4.5)	118 (26)	**21**	132 (5.2)	132 (29)	**15**	147.5 (5.8)
	929 (10,000)	10.4 (22.9)	100 (22)	**45**	112 (4.4)	109 (24)	**41**	122 (4.8)	129.5 (28.5)	**29**	145 (5.7)	141 (31)	**22**	157.5 (6.2)
Thunder Bay, Ontario	232 (2,500)	4.9 (10.9)	47.5 (10.5)	**7.5**	53.5 (2.1)	61.5 (13.5)	**6.5**	68.5 (2.7)	75 (16.5)	**4**	84 (3.3)	88.5 (19.5)	**3.5**	91.5 (3.6)
	465 (5,000)	6.1 (13.5)	59 (13)	**18**	66 (2.6)	72.5 (16)	**15**	81.5 (3.2)	86.5 (19)	**9.5**	96.5 (3.8)	102.5 (22.5)	**7.5**	114.5 (4.5)
	697 (7,500)	6.6 (14.6)	63.5 (14)	**28**	71 (2.8)	77.5 (17)	**24**	86.5 (3.4)	93 (20.5)	**16**	104 (4.1)	109 (24)	**13**	122 (4.8)
	929 (10,000)	7.1 (15.6)	68 (15)	**38**	76 (3)	84 (18.5)	**33**	94 (3.7)	97.5 (21.5)	**22**	109 (4.3)	116 (25.5)	**18**	129.5 (5.1)
Guelph, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	**8**	61 (2.4)	63.5 (14)	**7**	71 (2.8)	86.5 (19)	**5**	96.5 (3.8)	100 (22)	**3.7**	112 (4.4)
	465 (5,000)	6.6 (14.6)	63.5 (14)	**19**	71 (2.8)	75 (16.5)	**15.5**	84 (3.3)	97.5 (21.5)	**11**	109 (4.3)	116 (25.5)	**9**	129.5 (5.1)
	697 (7,500)	7.3 (16.1)	70.5 (15.5)	**29**	78.5 (3.1)	82 (18)	**25**	91.5 (3.6)	104.5 (23)	**18**	117 (4.6)	125 (27.5)	**14**	139.5 (5.5)
	929 (10,000)	8.0 (17.7)	77.5 (17)	**40**	86.5 (3.4)	84 (18.5)	**34**	94 (3.7)	109 (24)	**26**	122 (4.8)	132 (29)	**20**	147.5 (5.8)
Hamilton, Ontario	232 (2,500)	5.9 (13)	57 (12.5)	**8.5**	63.5 (2.5)	72.5 (16)	**7.5**	81.5 (3.2)	93 (20.5)	**5**	104 (4.1)	109 (24)	**4**	122 (4.8)
	465 (5,000)	6.6 (14.6)	63.5 (14)	**19**	71 (2.8)	79.5 (17.5)	**16**	89 (3.5)	104.5 (23)	**12**	117 (4.6)	122.5 (27)	**9**	137 (5.4)
	697 (7,500)	6.8 (15.1)	66 (14.5)	**28**	73.5 (2.9)	84 (18.5)	**26**	94 (3.7)	111.5 (24.5)	**20**	124.5 (4.9)	127.5 (28)	**15**	142 (5.6)
	929 (10,000)	7.1 (15.6)	68 (15)	**39**	76 (3)	86.5 (19)	**34**	96.5 (3.8)	116 (25.5)	**27**	129.5 (5.1)	134 (29.5)	**21**	150 (5.9)
Kingston, Ontario	232 (2,500)	6.4 (14)	61.5 (13.5)	**9**	68.5 (2.7)	77.5 (17)	**8**	86.5 (3.4)	91 (20)	**5**	101.5 (4)	109 (24)	**4**	122 (4.8)
	465 (5,000)	7.5 (16.6)	72.5 (16)	**20**	81.5 (3.2)	86.5 (19)	**18**	96.5 (3.8)	104.5 (23)	**12**	117 (4.6)	122.5 (27)	**9.5**	137 (5.4)
	697 (7,500)	8.5 (18.7)	82 (18)	**31**	91.5 (3.6)	93 (20.5)	**28**	104 (4.1)	111.5 (24.5)	**20**	124.5 (4.9)	132 (29)	**15**	147.5 (5.8)
	929 (10,000)	8.7 (19.2)	86.5 (19)	**42**	96.5 (3.8)	97.5 (21.5)	**38**	109 (4.3)	116 (25.5)	**27**	129.5 (5.1)	68 (15)	**21**	152.5 (6)
London, Ontario	232 (2,500)	6.1 (13.5)	59 (13)	**8.5**	66 (2.6)	72.5 (16)	**7.5**	81.5 (3.2)	88.5 (19.5)	**5**	99 (3.9)	107 (23.5)	**4**	119.5 (4.7)
	465 (5,000)	7.1 (15.6)	68 (15)	**20**	76 (3)	84 (18.5)	**17**	94 (3.7)	102.5 (22.5)	**12**	114.5 (4.5)	122.5 (27)	**9.5**	137 (5.4)
	697 (7,500)	8.0 (17.7)	77.5 (17)	**30**	86.5 (3.4)	88.5 (19.5)	**27**	99 (3.9)	109 (24)	**19**	122 (4.8)	129.5 (28.5)	**15**	145 (5.7)
	929 (10,000)	8.5 (18.7)	82 (18)	**41**	91.5 (3.6)	91 (20)	**36**	101.5 (4)	113.5 (25)	**27**	127 (5)	134 (29.5)	**21**	150 (5.9)
North Bay, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	**8**	61 (2.4)	68 (15)	**7**	76 (3)	86.5 (19)	**5**	96.5 (3.8)	100 (22)	**3.8**	112 (4.4)
	465 (5,000)	6.6 (14.6)	63.5 (14)	**19**	71 (2.8)	79.5 (17.5)	**16**	89 (3.5)	97.5 (21.5)	**11**	109 (4.3)	113.5 (25)	**9**	127 (5)
	697 (7,500)	7.5 (16.6)	72.5 (16)	**30**	81.5 (3.2)	86.5 (19)	**26**	96.5 (3.8)	107 (23.5)	**19**	119.5 (4.7)	122.5 (27)	**14**	137 (5.4)
	929 (10,000)	8.3 (18.2)	77.5 (17)	**40**	86.5 (3.4)	93 (20.5)	**36**	104 (4.1)	111.5 (24.5)	**26**	124.5 (4.9)	127.5 (28)	**20**	142 (5.6)

Selecta-Drain Chart

ZURN

LOCATION	SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING	ROOF LOAD FACTOR KGS. (LBS.)	TOTAL ROOF SLOPE											
			DEAD LEVEL			51mm (2") RISE			102mm (4") RISE			152mm (6") RISE		
			L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth
Ottawa, Ontario	232 (2,500)	4.7 (10.4)	45.5 (10)	**7**	51 (2)	59 (13)	**6.5**	66 (2.6)	77.5 (17)	**4.5**	86.5 (3.4)	86.5 (19)	**3.2**	96.5 (3.8)
	465 (5,000)	5.9 (13)	57 (12.5)	**17**	63.5 (2.5)	68 (15)	**14**	76 (3)	86.5 (19)	**10**	96.5 (3.8)	100 (22)	**7.5**	112 (4.4)
	697 (7,500)	6.4 (14)	61.5 (13.5)	**27**	68.5 (2.7)	75 (16.5)	**23**	84 (3.3)	93 (20.5)	**16**	104 (4.1)	107 (23.5)	**12**	119.5 (4.7)
	929 (10,000)	6.6 (14.6)	63.5 (14)	**36**	71 (2.8)	79.5 (17.5)	**32**	89 (3.5)	97.5 (21.5)	**22**	109 (4.3)	113.5 (25)	**18**	127 (5)
St. Thomas, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	**8**	61 (2.4)	68 (15)	**7**	76 (3.0)	86.5 (19)	**5**	96.5 (3.8)	104.5 (23)	**4**	117 (4.6)
	465 (5,000)	6.6 (14.6)	63.5 (14)	**19**	71 (2.8)	77.5 (17)	**16**	86.5 (3.4)	97.5 (21.5)	**11**	109 (4.3)	118 (26)	**9**	132 (5.2)
	697 (7,500)	7.1 (16.6)	68 (15)	**29**	76 (3.0)	82 (18)	**26**	91.5 (3.6)	102.5 (22.5)	**18**	114.5 (4.5)	125 (27.5)	**15**	139.5 (5.5)
	929 (10,000)	7.5 (16.6)	72.5 (16)	**40**	81.5 (3.2)	86.5 (19)	**34**	96.5 (3.8)	107 (23.5)	**24**	119.5 (4.7)	132 (29)	**20**	147.5 (5.8)
Timmins, Ontario	232 (2,500)	4.3 (9.4)	41 (9)	**7**	45.5 (1.8)	57 (12.5)	**6**	63.5 (2.5)	72.5 (16)	**4**	81.5 (3.2)	86.5 (19)	**3.3**	96.5 (3.8)
	465 (5,000)	5.7 (12.5)	54.5 (12)	**16**	61 (2.4)	63.5 (14)	**14**	71 (2.8)	82 (18)	**9**	91.5 (3.6)	97.5 (21.5)	**7.5**	109 (4.3)
	697 (7,500)	6.4 (14)	61.5 (13.5)	**27**	68.5 (2.7)	70.5 (15.5)	**22**	78.5 (3.1)	86.5 (19)	**15**	96.5 (3.8)	104.5 (23)	**12**	117 (4.6)
	929 (10,000)	6.6 (14.6)	63.5 (14)	**36**	71 (2.8)	72.5 (16)	**30**	81.5 (3.2)	91 (20)	**21**	101.5 (4.0)	109 (24)	**17**	122 (4.8)
Toronto, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	**8**	61 (2.4)	66 (14.5)	**7**	73.5 (2.9)	82 (18)	**4.5**	91.5 (3.6)	97.5 (21.5)	**3.5**	109 (4.3)
	465 (5,000)	6.8 (15.1)	66 (14.5)	**19**	73.5 (2.9)	77.5 (17)	**16**	86.5 (3.4)	93 (20.5)	**11**	104 (4.1)	111.5 (24.5)	**9**	124.5 (4.9)
	697 (7,500)	8.0 (17.7)	77.5 (17)	**30**	86.5 (3.4)	84 (18.5)	**26**	94 (3.7)	100 (22)	**18**	112 (4.4)	120.5 (26.5)	**14**	134.5 (5.3)
	929 (10,000)	8.7 (19.2)	82 (18)	**42**	91.5 (3.6)	86.5 (19)	**34**	96.5 (3.8)	104.5 (23)	**24**	117 (4.6)	127.5 (28)	**20**	142 (5.6)
Windsor, Ontario	232 (2,500)	6.1 (13.5)	59 (13)	**8.5**	66 (2.6)	70.5 (15.5)	**7.5**	78.5 (3.1)	84 (18.5)	**4.5**	94 (3.7)	107 (23.5)	**4**	119.5 (4.7)
	465 (5,000)	7.1 (15.6)	68 (15)	**20**	76 (3.0)	79.5 (17.5)	**16**	89 (3.5)	97.5 (21.5)	**11**	109 (4.3)	118 (26)	**9**	132 (5.2)
	697 (7,500)	8.0 (17.7)	77.5 (17)	**30**	86.5 (3.4)	86.5 (19)	**26**	96.5 (3.8)	107 (23.5)	**18**	119.5 (4.7)	125 (27.5)	**15**	139.5 (5.5)
	929 (10,000)	8.7 (19.2)	82 (18)	**42**	91.5 (3.6)	91 (20)	**36**	101.5 (4.0)	113.5 (25)	**26**	127 (5.0)	129.5 (28.5)	**20**	145 (5.7)
Charlottetown, Prince Edward Island	232 (2,500)	4.9 (10.9)	47.5 (10.5)	**7.5**	53.5 (2.1)	57 (12.5)	**6**	63.5 (2.5)	68 (15)	**3.8**	76 (3.0)	79.5 (17.5)	**3**	89 (3.5)
	465 (5,000)	6.6 (14.6)	63.5 (14)	**19**	71 (2.8)	75 (16.5)	**15.5**	84 (3.3)	88.5 (19.5)	**10**	99 (3.9)	100 (22)	**7.5**	112 (4.4)
	697 (7,500)	7.8 (17.2)	75 (16.5)	**31**	84 (3.3)	86.5 (19)	**26**	96.5 (3.8)	102.5 (22.5)	**18**	114.5 (4.5)	113.5 (25)	**13**	127 (5.0)
	929 (10,000)	8.7 (19.2)	84 (18.5)	**42**	94 (3.7)	97.5 (21.5)	**37**	106.5 (4.2)	111.5 (24.5)	**26**	124.5 (4.9)	125 (27.5)	**20**	139.5 (5.5)
Montreal, Quebec	232 (2,500)	5.2 (11.4)	50 (11)	**7.5**	56 (2.2)	61.5 (13.5)	**7**	68.5 (2.7)	79.5 (17.5)	**4.5**	89 (3.5)	97.5 (21.5)	**3.5**	109 (4.36)
	465 (5,000)	5.9 (13)	57 (12.5)	**17**	63.5 (2.5)	70.5 (15.5)	**15**	78.5 (3.1)	88.5 (19.5)	**10**	99 (3.9)	109 (24)	**8**	122 (4.8)
	697 (7,500)	6.1 (13.5)	59 (13)	**27**	66 (2.6)	72.5 (16)	**23**	81.5 (3.2)	93 (20.5)	**16**	104 (4.1)	113.5 (25)	**13**	127 (5.0)
	929 (10,000)	6.4 (14)	61.5 (13.5)	**36**	68.5 (2.7)	77.5 (17)	**31**	86.5 (3.4)	95.5 (21)	**22**	106.5 (4.2)	120.5 (26.5)	**19**	134.5 (5.3)
Quebec City, Quebec	232 (2,500)	5.4 (12)	52.5 (11.5)	**8**	58.5 (2.3)	63.5 (14)	**7**	71 (2.8)	79.5 (17.5)	**4.5**	89 (3.5)	97.5 (21.5)	**3.5**	109 (4.3)
	465 (5,000)	6.4 (14)	61.5 (13.5)	**18**	68.5 (2.7)	70.5 (15.5)	**15**	78.5 (3.1)	84 (18.5)	**10**	94 (3.7)	104.5 (23)	**8**	117 (4.6)
	697 (7,500)	6.6 (14.6)	63.5 (14)	**28**	71 (2.8)	72.5 (16)	**23**	81.5 (3.2)	86.5 (19)	**15**	96.5 (3.8)	107 (23.5)	**12**	119.5 (4.7)
	929 (10,000)	7.1 (15.6)	68 (15)	**37**	76 (3.0)	77.5 (17)	**31**	86.5 (3.4)	88.5 (19.5)	**20**	99 (3.9)	109 (24)	**17**	122 (4.8)

Selecta-Drain Chart

LOCATION	SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING	ROOF LOAD FACTOR KGS. (LBS.)	TOTAL ROOF SLOPE											
			DEAD LEVEL			51mm (2”) RISE			102mm (4”) RISE			152mm (6”) RISE		
			L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth
Regina, Saskatchewan	232 (2,500)	4.5 (9.9)	43 (9.5)	**7**	48.5 (1.9)	54.5 (12)	**6**	61 (2.4)	72.5 (16)	**4**	81.5 (3.2)	79.5 (17.5)	**3**	89 (3.5)
	465 (5,000)	6.4 (14)	61.5 (13.5)	**18**	68.5 (2.7)	68 (15)	**14**	76 (3.0)	86.5 (19)	**10**	96.5 (3.8)	97.5 (21.5)	**7.5**	109 (4.3)
	697 (7,500)	7.3 (16.1)	70.5 (15.5)	**29**	78.5 (3.1)	77.5 (17)	**24**	86.5 (3.4)	100 (22)	**17**	112 (4.4)	109 (24)	**12**	122 (4.8)
	929 (10,000)	8.3 (18.2)	79.5 (17.5)	**40**	89 (3.5)	82 (18)	**32**	91.5 (3.6)	104.5 (23)	**24**	117 (4.6)	118 (26)	**18**	132 (5.2)
Saskatoon, Saskatchewan	232 (2,500)	4.0 (8.8)	38.5 (8.5)	**6**	43 (1.7)	57 (12.5)	**6**	63.5 (2.5)	66 (14.5)	**3.8**	73.5 (2.9)	77.5 (17)	**2.8**	86.5 (3.4)
	465 (5,000)	5.7 (12.5)	54.5 (12)	**16**	61 (2.4)	68 (15)	**14.5**	76 (3.0)	82 (18)	**9**	91.5 (3.6)	95.5 (21)	**7**	106.5 (4.2)
	697 (7,500)	6.6 (14.6)	63.5 (14)	**28**	71 (2.8)	75 (16.5)	**24**	84 (3.3)	91 (20)	**16**	101.5 (4.0)	104.5 (23)	**12**	117 (4.6)
	929 (10,000)	7.1 (15.6)	68 (15)	**38**	76 (3.0)	82 (18)	**32**	91.5 (3.6)	97.5 (21.5)	**22**	109 (4.3)	113.5 (25)	**18**	127 (5.0)

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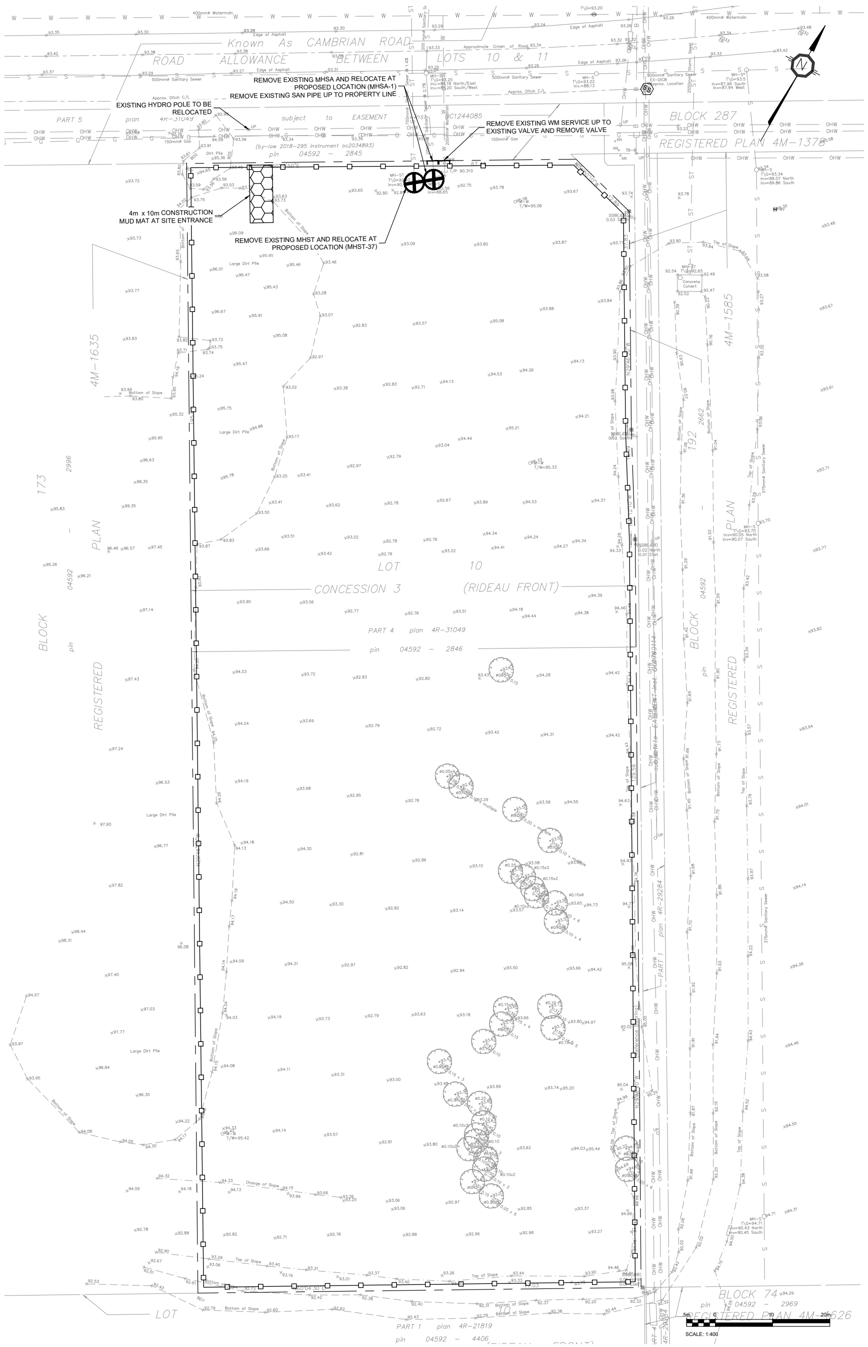
DRAWINGS



LEGEND:

	EXISTING PROPERTY LINE
— W — W — W —	EXISTING WATERMAIN
	EXISTING V&VB
	EXISTING VALVE CHAMBER
— S — S —○ S —	EXISTING SANITARY SEWER AND MAINTENANCE HOLE
— ST — ST —○ ST —	EXISTING STORM SEWER AND MAINTENANCE HOLE
99.99	EXISTING GRADE
— OHW — OHW —	EXISTING OVERHEAD HYDRO
— G — G — G —	EXISTING GAS
— B — B — B —	EXISTING BELL
	4m x 10m CONSTRUCTION MUD MAT
	PROPOSED SILT FENCE AS PER OPSD 219.110
SS	SILT SACK PER DETAIL D1
⊗	STRUCTURE TO BE REMOVED

EROSION AND SEDIMENT CONTROL MEASURES:

- CONTRACTOR IS RESPONSIBLE FOR ALL INSTALLATION, MONITORING, REPAIR AND REMOVAL OF ALL EROSION AND SEDIMENT CONTROL FEATURES. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES, TO PROVIDE FOR PROTECTION OF THE AREA DRAINAGE SYSTEM AND THE RECEIVING WATERCOURSE, DURING CONSTRUCTION ACTIVITIES. THE CONTRACTOR ACKNOWLEDGES THAT FAILURE TO IMPLEMENT APPROPRIATE EROSION AND SEDIMENT CONTROL MEASURE MAY BE SUBJECT TO PENALTIES IMPOSED BY ANY APPLICABLE REGULATORY AGENCY.
- SEDIMENT AND EROSION CONTROL PLAN OBJECTIVES:
- PREVENT SOIL EROSION. THIS CAN RESULT FROM STREAMING RAIN WATER OR WIND EROSION DURING CONSTRUCTION,
- PREVENT SEDIMENT DEPOSITS IN THE SEWER PIPES AND NEARBY COLLECTING STREAMS (AS APPLICABLE),
- PREVENT AIR POLLUTION FROM PARTICULATE MATTER AND DUST.

1. PRIOR TO START OF CONSTRUCTION:

PRIOR TO THE REMOVAL OF ANY VEGETATIVE COVER, MOVING OF SOIL AND CONSTRUCTION:

- INSTALL SILT FENCE (AS PER OPSD 219.110) ALONG DITCHES IMMEDIATELY DOWNSTREAM FROM AREAS TO BE DISTURBED (SEE PLAN FOR LOCATION).
- INSTALL FILTER CLOTH ON DOWNSTREAM MANHOLE COVERS.
- INSTALL SILTSACK FILTERS IN ALL CONCRETE CATCH BASINS STRUCTURES.
- INSPECT MEASURES IMMEDIATELY AFTER INSTALLATION.
- THE CONTRACTOR MUST SET UP THE MEASURES INDICATED ON THE PLAN, INSPECT THEM FREQUENTLY AND CLEAN AND REPAIR OR REPLACE THE DETERIORATED STRUCTURES. AT THE END OF THE CONSTRUCTION PERIOD, THE CONTRACTOR IS RESPONSIBLE FOR REMOVAL OF THE TEMPORARY STRUCTURES AND RECONDITIONING THE AFFECTED AREAS

2. DURING CONSTRUCTION:

- SEDIMENT AND EROSION CONTROL MEASURES TO BE CONSTRUCTED AS PER OPSS 805.
- WHEN SEDIMENT AND EROSION CONTROL MEASURES MUST BE REMOVED TO COMPLETE A PORTION OF THE WORK, THE SAME MEASURES MUST BE REINSTATED UPON THE WORK'S COMPLETION.
- WORK TO BE DONE IN THE VICINITY OF MAJOR WATERWAYS TO BE CARRIED OUT FROM JULY AND SEPTEMBER ONLY.
- MINIMIZE THE EXTENT OF DISTURBED AREAS AND THE DURATION OF EXPOSURE.
- PROTECT DISTURBED AREAS FROM RUNOFF.
- PROVIDE TEMPORARY COVER SUCH AS SEEDING OR MULCHING IF DISTURBED AREA WILL NOT BE REHABILITATED SHORTLY.
- INSPECT STRAW BALE FLOW CHECK DAMS, SILT FENCES, SILT SACKS, AND CATCH BASIN SUMPS REGULARLY AND AFTER EVERY MAJOR STORM EVENT. CLEAN AND REPAIR WHEN NECESSARY.
- PLAN TO BE REVIEWED AND REVISED AS REQUIRED DURING CONSTRUCTION.
- EROSION CONTROL FENCING TO BE ALSO INSTALLED AROUND THE BASE OF ALL STOCKPILES.
- DO NOT LOCATE TOPSOIL PILES AND EXCAVATION MATERIAL CLOSER THAN 2.5m FROM ANY PAVED SURFACE, OR ONE WHICH IS TO BE PAVED BEFORE THE PILE IS REMOVED. ALL TOPSOIL PILES ARE TO BE SEEDED IF THEY ARE TO REMAIN ON SITE LONG ENOUGH FOR SEEDS TO GROW (LONGER THAN 30 DAYS). WHEN STORING SOIL ON SITE IN PILES THE CONTRACTOR MUST COVER EACH PILE WITH TARPS, STRAW OR A GEOTEXTILE FABRIC TO AVOID FINE PARTICLE TRANSPORT BY WIND AND/OR STREAMING RAIN WATER.
- CONTROL WIND-BLOWN DUST OFF SITE TO ACCEPTABLE LEVELS BY SEEDING TOPSOIL PILES AND OTHER AREAS TEMPORARILY (PROVIDE WATERING AS REQUIRED). FOR DUST CONTROL, CONTRACTOR TO APPLY CALCIUM CHLORIDE (TYPE I – OPSS 2501 AND CAN/CGSB-15-1) AND WATER WITH EQUIPMENT APPROVED BY THE OWNER’S REPRESENTATIVE AT RATE IN ACCORDANCE TO OPSS 506 WHEN DIRECTED BY OWNER’S REPRESENTATIVE.
- ALL EROSION CONTROL STRUCTURE TO REMAIN IN PLACE UNTIL ALL DISTURBED GROUND SURFACES HAVE BEEN STABILIZED EITHER BY PAVING OR RESTORATION OF VEGETATIVE GROUND COVER. SEDIMENT CAPTURE SILT SACKS MUST BE MAINTAINED AND CANNOT BE REMOVED UNTIL ALL LANDSCAPING AREAS ARE COMPLETED.
- NO ALTERNATE METHODS OF EROSION PROTECTION SHALL BE PERMITTED UNLESS APPROVES BY THIS CONSULTING ENGINEER AND THE TOWN DEPARTMENT OF PUBLIC WORKS.
- CONTRACTOR RESPONSIBLE FOR MUNICIPAL ROADWAY AND SIDEWALK TO BE CLEANED OF ALL SEDIMENT FROM VEHICULAR TRACKING ETC. AT THE END OF EACH WORK DAY.
- DURING WET CONDITIONS, TIRES OF ALL VEHICLES/EQUIPMENT LEAVING THE SITE ARE TO BE SCRAPED.
- ANY MUD/MATERIAL TRACKED ONTO THE ROAD SHALL BE REMOVED IMMEDIATELY BY HAND OR RUBBER TIRE LOADER.
- TAKE ALL NECESSARY STEPS TO PREVENT BUILDING MATERIAL, CONSTRUCTION DEBRIS OR WASTE BEING SPILLED OR TRACKED ONTO ABUTTING PROPERTIES OR PUBLIC STREETS DURING CONSTRUCTION AND PROCEED IMMEDIATELY TO CLEAN UP ANY AREAS SO AFFECTED.
- PROVIDE GRAVEL ENTRANCE WHEREVER EQUIPMENT LEAVES THE SITE TO PROVIDE MUD TRACKING ONTO PAVED SURFACES. GRAVEL BED SHALL BE A MINIMUM OF 10m LONG, 4m WIDE, AND 0.15m DEEP AND SHALL CONSIST OF COARSE MATERIAL. MAINTAIN GRAVEL ENTRANCE IN CLEAN CONDITION.

3. AFTER CONSTRUCTION:

- PROVIDE PERMANENT COVER CONSISTING OF TOPSOIL AND SEED TO DISTURBED AREAS.
- ALL SEDIMENT AND EROSION CONTROL MEASURES TO BE REMOVED BY THE CONTRACTOR FOLLOWING THE COMPLETION OF WORK AND AFTER DISTURBED AREAS HAVE BEEN REHABILITATED AND STABILIZED, THIS INCLUDES REMOVE STRAW BALE FLOW CHECK DAMS, SILT FENCES AND FILTER CLOTHS ON CATCH BASINS AND MANHOLE COVERS.
- INSPECT AND CLEAN CATCH BASIN SUMPS AND STORM SEWERS.

NOTES: REMOVALS AND DEMOLITION

1. PRE-REMOVAL, THE CONTRACTOR MUST VISIT THE PREMISES IN ORDER TO BE FULLY AWARE OF EXISTING CONDITIONS ON SITE, INCLUDING ALL ELEMENTS TO BE REMOVED AND DEMOLISHED. NO CLAIM WILL BE ACCEPTED DUE TO A POOR EVALUATION OF THE WORK TO BE COMPLETED.
2. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING AND THE REQUEST FOR INTERRUPTION OF PUBLIC UTILITY SERVICES, SUCH AS GAS, TELEPHONE, POWER, CABLE, SEWERS, WATERMAIN, ETC. BEFORE PROCEEDING WITH WORK, COORDINATE WITH ALL APPLICABLE UTILITY COMPANIES.
3. FIRE HYDRANTS TO BE TAGGED AND BAGGED AND/OR PROTECTED AS INDICATED ON DRAWING.
4. CURB, ASPHALT, SIDEWALK, AND GRANULAR BASE TO BE EXCAVATED WITHIN LIMITS OF DEMOLITION REMOVAL. THE CONTRACTOR MUST CARRY OUT NECESSARY SAW CUTS.
5. SEWER / WATERMAIN PIPES TO BE ABANDONED MUST BE CUT, FILL WITH UNSHRINKABLE CONCRETE CONFORMING TO OPSS 1359, AND CAPPED.
6. REMOVE AND DISPOSE SEWERS AS INDICATED. PLUG ANY SERVICE LATERALS TO BE ABANDONED.
7. THE CONTRACTOR MUST ENTIRELY REMOVE THE DEMOLITION WRECKAGE FROM THE CONSTRUCTION SITE OFFSITE IN ACCORDANCE WITH THE REQUIREMENTS OF THE MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE (MOECC).
   a. THE CONTRACTOR MUST DISCARD RECYCLABLE DEMOLITION MATERIALS IN COLLABORATION WITH A REGIONAL RECYCLING COMPANY.
   b. ALL OTHER DEMOLITION MATERIALS MUST BE DISPOSED OFF-SITE AT AUTHORIZED LICENSED LANDFILLS AND IN CONFORMITY WITH THE APPLICABLE LAWS AND REGULATIONS. THE CONTRACTOR MUST BE ABLE TO PROVIDE, UPON REQUEST, COPIES OF THE DISPOSAL TICKETS TO THE OWNER’S REPRESENTATIVE.
8. SURFACES AND WORKS LOCATED OUTSIDE OF THE CONSTRUCTION WORK LIMIT MUST BE REINSTATED AS THEY WERE BEFORE BEGINNING OF WORK. CONTRACTOR IS RESPONSIBLE TO MAKE GOOD ON ANY DAMAGES TO EXISTING CURB AND ASPHALT NOT SCHEDULED FOR REMOVAL.
9. ALL MATERIALS, PRODUCTS AND OTHERS COMING FROM THE DEMOLITION BELONG TO THE CONTRACTOR, UNLESS SPECIFIED OTHERWISE.
10. THE CONTRACTOR MUST COMPLETE ALL REMOVALS AS SHOWN ON THE DRAWINGS AND AS REQUIRED TO MAKE THE WORK COMPLETE.
11. THE CONTRACTOR MUST PROTECT AND MAINTAIN IN SERVICE THE EXISTING WORKS WHICH MUST REMAIN IN PLACE. IF THEY ARE DAMAGED, THE CONTRACTOR MUST IMMEDIATELY MAKE THE REPLACEMENTS AND NECESSARY REPAIRS TO THE SATISFACTION OF THE OWNER’S REPRESENTATIVE AND WITHOUT ADDITIONAL EXPENSE TO THE OWNER.
12. THE CONTRACTOR MUST NOT PERFORM ANY TREE CUTTING DURING THE CORE MIGRATORY BIRDS NESTING PERIOD, WHICH IS APRIL 15 TO AUGUST 15.

TURNER FLEISCHER
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PARSONS
1223 MICHAEL STREET, SUITE 100, OTTAWA, ONTARIO K1J 7T2
Tel: 613-738-4160 Fax: 613-739-7105

TOPOGRAPHIC INFORMATION & BENCHMARK

SURVEY COMPLETED BY ANNIS, O'SULLIVAN, VOLLEBEKK LTD. ON MARCH 28, 2023. ELEVATIONS SHOWN ARE GEODETIC AND ARE REFERRED TO THE CGVD28 GEODETIC DATUM, DERIVED FROM CONTROL MONUMENT NO. 019680071 HAVING AN ELEVATION OF 99.742m.

#	DATE	DESCRIPTION	BY
2	2023-10-23	RE-ISSUED FOR SPA	BV
1	2023-05-01	ISSUED FOR SPA	BV

Loblaw Companies Limited

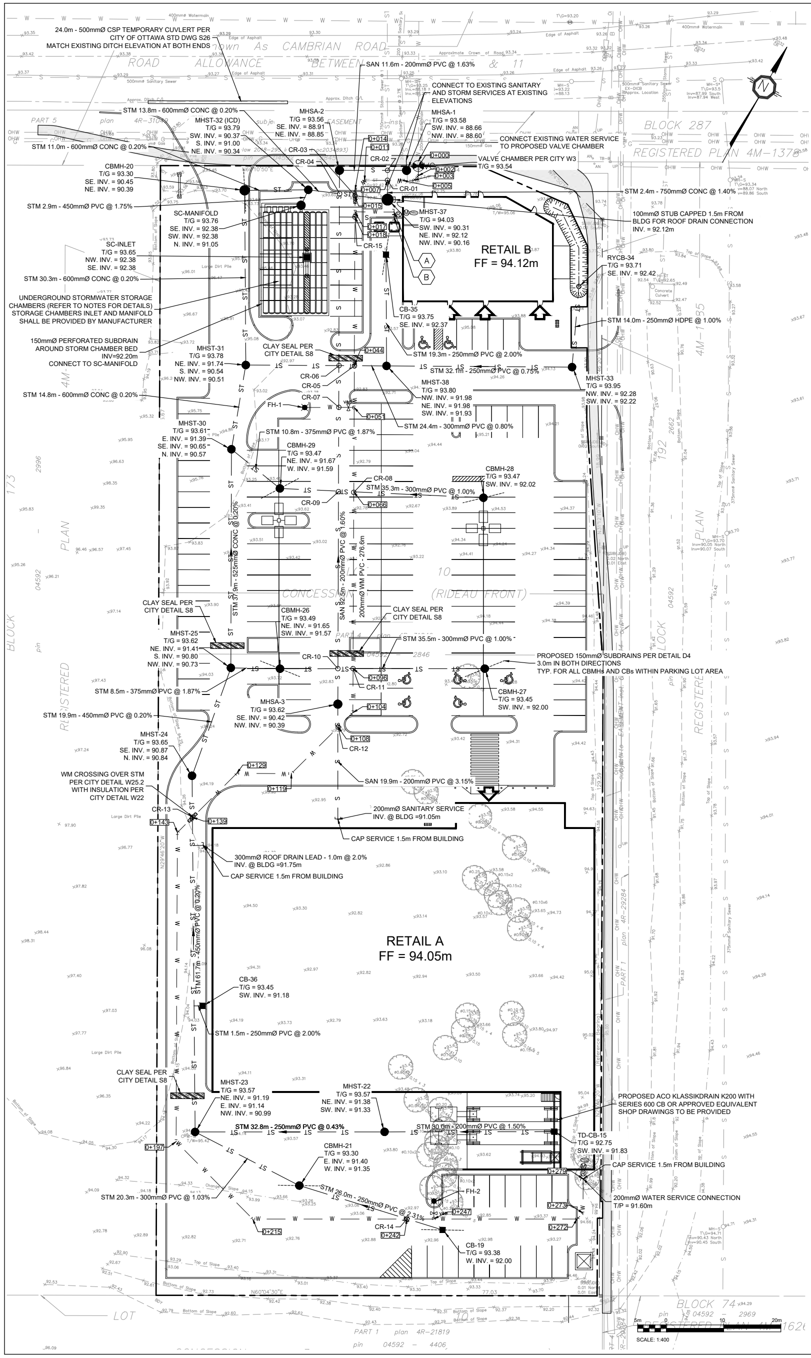
PROJECT
3845 CAMBRIAN RD
BARRHAVEN, ONTARIO

DRAWING
EROSION/SEDIMENT CONTROL & REMOVALS PLAN

PROJECT NO.	478575
PROJECT DATE	2023-02-27
DRAWN BY	BV
CHECKED BY	MT
SCALE	As indicated
DRAWING NO.	C101
REV.	

LICENSED PROFESSIONAL ENGINEER
B. VILLENEUVE
100553987
2023-10-23
PROVINCE OF ONTARIO

#18983 D07-12-23-0058



LEGEND:

- FUTURE PROPERTY LINE
- EXISTING PROPERTY LINE
- EXISTING WATERMAIN
- EXISTING V&VB
- EXISTING VALVE CHAMBER
- PROPOSED WATERMAIN
- PROPOSED VALVE CHAMBER PER CITY STD DWG W3
- PROPOSED FIRE HYDRANT PER CITY STD DWG W19
- PROPOSED V&VB
- WATER METER LOCATION
- REMOTE WATER METER LOCATION
- PRESSURE REDUCING VALVE
- WATERMAIN INSULATION PER CITY STD DWG W22
- EXISTING SANITARY SEWER AND MAINTENANCE HOLE
- PROPOSED SANITARY SEWER AND MAINTENANCE HOLE
- EXISTING STORM SEWER AND MAINTENANCE HOLE
- PROPOSED STORM SEWER AND MAINTENANCE HOLE
- PROPOSED REAR YARD CATCH BASIN AS PER CITY STD DWG S31
- PROPOSED CATCH BASIN WITH SUBDRAINS PER DETAIL D4
- TERRACE (3:1 MAX)
- PROPOSED CENTERLINE SWALE
- PROPOSED LIGHT STANDARD
- CLAY SEAL PER CITY STD DWG S8
- FUTURE SIDEWALK ALONG RE-ALIGNED GREENBANK RD/CAMBRIAN RD BY OTHERS

CROSSING TABLE

CROSSING No.	PIPE ELEV. AT CROSSING	PIPE ELEV. AT CROSSING	CLEARANCE	CROSSING No.	PIPE ELEV. AT CROSSING	PIPE ELEV. AT CROSSING	CLEARANCE
CR-01	STM, TOP. 90.95	WM, INV. 91.20	0.25m	CR-08	WM, TOP. 91.30	STM, INV. 91.80	0.50m
CR-02	SAN, TOP. 88.91	STM, INV. 90.09	1.18m	CR-09	SAN, TOP. 90.00	STM, INV. 91.77	1.77m
CR-03	STM, TOP. 91.02	WM, INV. 91.27	0.25m	CR-10	SAN, TOP. 90.49	STM, INV. 91.75	1.26m
CR-04	SAN, TOP. 89.17	STM, INV. 90.35	1.18m	CR-11	WM, TOP. 91.23	STM, INV. 91.80	0.57m
CR-05	WM, TOP. 91.39	STM, INV. 91.89	0.50m	CR-12	SAN, TOP. 90.75	WM., INV. 91.01	0.26m
CR-06	SAN, TOP. 89.65	STM, INV. 91.87	2.22m	CR-13	STM, TOP. 91.34	WM, INV. 91.59	0.25m
CR-07	SAN, TOP. 89.76	FH LAT., INV. 91.15	1.39m	CR-14	WM, TOP. 91.11	STM., INV. 91.85	0.74m
				CR-15	WM, TOP. 91.40	SAN., INV. 91.98	0.58m

KEYNOTES:

(A) 6.8m WM SERVICE - 200mmØ - T/P = 91.72m CAP 1.5m FROM BUILDING

(B) 135mmØ SAN SERVICE - 9.5m INV. @ BLDG =92.12m CROSS OVER WM WITH MIN. 0.5m CLEARANCE CONNECT TO SAN SEWER PER CITY DETAIL S11.1 CAP 1.5m FROM BUILDING

WATERMAIN TABLE

STATION	SURFACE ELEVATION	W/M DEPTH	TOP OF W/M ELEV.	INV. OF W/M ELEV.	NOTES
0+000	93.54	3.23m	90.31	90.11	CONNECTION TO EXISTING SERVICE WITH VALVE CHAMBER PER CITY STD DETAIL W3
0+002	93.70	3.39m	90.31	90.11	45° HORIZONTAL BEND
0+003	93.78	3.47m	90.31	90.11	45° HORIZONTAL BEND
0+005	93.78	2.40m	91.38	91.18	2 x 45° VERTICAL BENDS
0+007	93.80	2.40m	91.40	91.20	CR-01 REFER TO CROSSING TABLE
0+011	93.80	2.40m	91.40	91.20	45° HORIZONTAL BEND
0+014	93.93	2.40m	91.40	91.20	45° HORIZONTAL BEND
0+015	93.80	2.33m	91.47	91.27	CR-03 REFER TO CROSSING TABLE, INSULATION PER CITY W22 REQUIRED
0+017	93.78	2.40m	91.38	91.18	200x200 TEE, 200mm WATER SERVICE CONNECTION
0+018	93.78	2.40m	91.38	91.18	CR-15 REFER TO CROSSING TABLE
0+044	93.79	2.40m	91.39	91.19	CR-05 REFER TO CROSSING TABLE
0+051	93.70	2.40m	91.30	91.10	200x150 TEE FOR FIRE HYDRANT LATERAL
0+066	93.70	2.40m	91.30	91.10	CR-08 REFER TO CROSSING TABLE
0+096	93.63	2.40m	91.23	91.03	CR-11 REFER TO CROSSING TABLE
0+104	93.63	2.40m	91.23	91.03	45° HORIZONTAL BEND
0+108	93.61	2.40m	91.21	91.01	CR-12 REFER TO CROSSING TABLE
0+119	93.74	2.40m	91.34	91.14	45° HORIZONTAL BEND
0+129	93.75	2.40m	91.35	91.15	45° HORIZONTAL BEND
0+139	93.75	1.96m	91.79	91.59	CR-13 REFER TO CROSSING TABLE, CROSSING OVER STM SEWER PER CITY W25.2 WITH INSULATION PER CITY W22
0+143	93.73	2.40m	91.33	91.13	45° HORIZONTAL BEND
0+197	93.62	2.40m	91.22	91.02	45° HORIZONTAL BEND
0+215	93.42	2.40m	91.02	90.82	45° HORIZONTAL BEND
0+242	93.51	2.40m	91.11	90.91	CR-14 REFER TO CROSSING TABLE
0+247	93.43	2.40m	91.03	90.83	200x150 TEE FOR FIRE HYDRANT LATERAL
0+272	93.81	2.40m	91.41	91.21	45° HORIZONTAL BEND
0+273	93.98	2.40m	91.58	91.38	45° HORIZONTAL BEND
0+279	94.00	2.40m	91.60	91.40	SERVICE CONNECTION, CAPPED 1.5m FROM BLDG

ICD SCHEDULE

ICD ID	LOCATION	ORIFICE INVERT (m)	FLOW 100y (L/s)	HEAD 100y (m)	EQUIVALENT DIAMETER (mm)	MODEL*
1	MHST-32	90.34	332.5	2.35	335	SEE D2 ON DWG C104

* ICD SHOP DRAWINGS SHALL BE SUBMITTED TO PARSONS BEFORE COMMENCING ANY WORK

NOTES: UNDERGROUND STORMWATER STORAGE

1. UNDERGROUND STORMWATER STORAGE SYSTEM CHAMBER TYPE OR EQUIVALENT STORAGE REQUIREMENT: 84.6m³.
2. CHAMBER TYPE: STORMTECH SC-310 OR EQUIVALENT
3. BOTTOM GRANULAR PAD ELEVATION & PERFORATED SUBDRAIN INVERT: 92.20m.
4. BOTTOM OF CHAMBER ELEVATION: 92.35m
5. TOP OF CHAMBER ELEVATION: 92.76m.
6. TOP OF SYSTEM TO BE A MINIMUM OF 450mm BELOW PARKING LOT PAVEMENT

NOTES: SEWER

1. CONTRACTOR TO CONFIRM ELEVATION OF EXISTING STORM AND SANITARY SEWERS AT PROPOSED CONNECTION POINTS AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE COMMENCING ANY WORK.
2. ALL WORK SHALL BE PERFORMED, AS APPLICABLE IN ACCORDANCE WITH OPSS 407, 408 AND 410.
3. **ALL STORM AND SANITARY SEWERS INSTALLED BELOW THE GROUNDWATER TABLE ELEVATION (±92.20m) SHALL BE WATERTIGHT AND INFILTRATION TESTS SHALL BE CARRIED OUT ACCORDING TO OPSS.MUNI 410.**
4. **CLAY SEALS SHALL BE ACCORDING CITY OF OTTAWA STD DETAIL S8 AND EXTENDED AT LEAST 1.0m ABOVE THE GROUNDWATER TABLE ELEVATION.**
5. PIPE MATERIAL TO BE PVC SDR-35 AND CONFORMING TO OPSS 1841, UNLESS INDICATED OTHERWISE. PVC SEWERS TO BE INSTALLED PER OPSD 802.010 (MODIFIED). BEDDING AND COVER MATERIALS TO BE OPSS 1010 GRANULAR 'A' CRUSHER-RUN LIMESTONE BEDDING COMPACTED TO 95% SPMDD.
6. ALL SEWERS WITH LESS THAN 1.5 METERS OF COVER ARE SUBJECTED TO INSULATION PER CITY OF OTTAWA STD DETAIL S35
7. PIPE BACKFILL MATERIAL TO BE APPROVED NATIVE MATERIAL OR SELECT SUBGRADE MATERIAL IN CONFORMANCE WITH OPSS 212.
8. ALL MAINTENANCE HOLES AND CATCH BASIN MAINTENANCE HOLES TO BE 1200mmØ AS PER OPSD 701.010, UNLESS INDICATED OTHERWISE. MAINTENANCE HOLES AND CATCH BASIN MAINTENANCE HOLES TO BE INSTALLED PER OPSS 407.
9. ALL CATCH BASINS TO BE 600x600mm AS PER OPSD 705.010, UNLESS INDICATED OTHERWISE. CATCH BASINS TO BE INSTALLED PER OPSS 407.
10. EXCAVATING, BACKFILLING, AND COMPACTING REQUIRED FOR MAINTENANCE HOLES, CATCH BASIN MAINTENANCE HOLES, AND CATCH BASINS TO BE COMPLETED AS PER OPSS 402. THEY ARE TO BE BACKFILLED WITH OPSS GRANULAR 'B' COMPACTED TO 98% SPMDD. JOINTS BETWEEN SECTIONS TO BE WRAPPED WITH NON-WOVEN GEOTEXTILE.
11. FOR SANITARY STRUCTURES: CAST IRON MAINTENANCE HOLE COVER AS PER OPSD 401.010 TYPE 'A'.
12. FOR STORM STRUCTURES: CAST IRON CATCH BASIN MAINTENANCE HOLE COVER AS PER OPSD 401.010 TYPE 'B' AND CAST IRON CATCH BASIN COVER AS PER OPSD 400.020.
13. SANITARY MAINTENANCE HOLES REQUIRE BENCHING AS PER OPSD 701.021.
14. THE CONTRACTOR IS RESPONSIBLE FOR MAKING OR ARRANGING ALL CONNECTIONS TO THE EXISTING SEWERS AS PER MUNICIPAL REQUIREMENTS. PRIOR TO CONNECTION, THE CONTRACTOR MUST PROVIDE, TO THE CONSULTANT / ENGINEER AND THE CITY FOR APPROVAL, ALL TEST RESULTS PERFORMED ON THE INTERNAL SERVICES.
15. ADVISE THE CITY PUBLIC WORKS AT LEAST 72 HOURS IN ADVANCE BEFORE ANY CONNECTION TO THE CITY SERVICES. CO-ORDINATE WITH CITY AS REQUIRED.
16. TERMINATE AND PLUG ALL SERVICE CONNECTIONS AT 1.0 m FROM EDGE OF THE BUILDING.
17. ALL SEWERS TO BE C.C.T.V. INSPECTED BY THE CONTRACTOR AS PER OPSS 409. TWO COPIES OF THE INSPECTION REPORT MUST BE PROVIDED TO THE CONSULTANT AND THE C.C.T.V. INSPECTION IN DVD FORMAT ONLY.

NOTES: WATERMAIN

1. ALL WATERMAIN TO BE INSTALLED AT MINIMUM COVER OF 2.4m BELOW FINISHED GRADE. WHERE THE MINIMUM COVER OF 2.4m IS NOT REACHED, THERMAL INSULATION IS REQUIRED AS PER CITY OF OTTAWA DETAIL W22.
2. WATERMAIN PIPE MATERIALS TO BE CLASS PVC DR-18, OR APPROVED EQUIVALENT, UNLESS INDICATED OTHERWISE.
3. WATERMAIN TO BE CONSTRUCTED AS PER OPSS 441 AND OPSD 802.010. WATERMAIN BEDDING AND COVER MATERIAL TO BE OPSS 1010 GRANULAR 'A' CRUSHER-RUN LIMESTONE COMPACTED TO 95% SPMDD.
4. A CONTINUOUS 12 GAUGE COPPER TRACER WIRE MUST BE INSTALLED OVER ALL WATERMAINS. TRACER WIRE SHALL BE TIED TO ALL FIRE HYDRANTS.
5. INSTALLATION OF A WATERMAIN PIPE CROSSING A SEWER PIPE SHALL BE AS PER CITY OF OTTAWA DETAILS W25 AND W25.2.
6. IF WATERMAIN PIPE MUST BE DEFLECTED TO MEET ALIGNMENT, ENSURE THAT THE AMOUNT OF DEFLECTION USED IS LESS THAN HALF THAT RECOMMENDED BY THE MANUFACTURER.
7. CATHODIC PROTECTION REQUIRED FOR ALL IRON FITTINGS AS PER OPSD 1109.011.
8. THRUST BLOCKS AND RESTRAINING AS PER OPSD 1103.010 AND OPSD 1103.020.
9. HYDRANT INSTALLATION AS PER OPSD 1105.010 AND OPSS 441. HYDRANT TO COMPLY WITH AWWA C502.
   a. HYDRANTS MUST HAVE THREE EXITS (TWO 65.5 mm AND ONE 100.0 mm 'STORZ' OF STAINLESS STEEL) WITHOUT DRAIN. FIRE HYDRANTS MUST BE INSTALLED SUCH THAT THE 'STORZ' EXIT POINTS TOWARDS THE BUILDING IT WILL SERVICE. THE CONTRACTOR MUST ENSURE THAT THE BREAKAWAY FLANGE IS LOCATED ABOVE THE FINISHED GROUND (APPROXIMATELY 150 mm).
   b. FIRE FLOW TESTS FOLLOWED BY COLOUR CODING OF HYDRANTS (AS PER NFPA-291) SHALL BE CARRIED OUT PRIOR TO SUBSTANTIAL COMPLETION OF THE WORK.
10. WATERMAIN AND HYDRANT CONTROL VALVES IN THE 100 – 300 mm RANGE WILL BE RESILIENT SEATING GATE VALVES (AWWA C509) WITH MECHANICAL JOINT CONNECTIONS. VALVES WILL OPERATE COUNTER-CLOCKWISE TO OPEN WITH A NON-RISING STEM. VALVES WILL BE COMPLETE WITH THE STANDARD AWWA 50 mm OPERATING NUT. VALVES TO BE INSTALLED AS PER OPSS 441.
11. PIPE FITTINGS (BENDS, TEES, CROSSES, REDUCERS, ETC.) WILL BE MECHANICAL JOINT (AWWA C-111) WITH CEMENT MORTAR LINING (AWWA C-104).
12. COUPLERS MUST BE COMPRESSION TYPE WITH MINIMUM PRESSURE RATING OF 1035 kPa. COUPLERS MUST BE MUELLER 11-12940.
13. VALVE BOXES MUST BE COMPLETE (FULLY METALLIC) 3 PIECE SLIDING TYPE WITH GUIDE PLATES.
14. WATERMAINS MUST BE THOROUGHLY FLUSHED AND CLEANED TO REMOVE ALL DIRT AND DEBRIS PRIOR TO THE DISINFECTION PROCESS.
15. ALL WATERMAINS SHALL BE HYDROSTATICALLY AND BACTERIOLOGICALLY TESTED AS PER PROVINCIAL AND MUNICIPAL REGULATIONS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT ALL REQUIREMENTS ARE FOLLOWED.
16. THE DISINFECTION PROCEDURE WHICH FOLLOWS INITIAL FLUSHING AND CLEANING CONSISTS OF CHLORINATION, FINAL FLUSHING AND BACTERIOLOGICAL TESTING. DISINFECTION MUST BE PERFORMED BY THE CONTRACTOR USING METHODS APPROVED BY THE CITY AND IN ACCORDANCE WITH MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE GUIDELINES. DOSAGE MUST BE 100 ppm WITH A MINIMUM RESIDUAL OF 25 ppm AFTER 24 HOURS. DISINFECTANT MUST BE SUPPLIED BY THE CONTRACTOR AND MUST BE ANSI APPROVED. TESTING AND TEST RESULTS MUST BE WITNESSED BY CITY PERSONNEL.
17. ALL DISINFECTANT WATER IS TO BE REMOVED FROM THE NEW WATERMAINS AND REPLACED WITH DISTRIBUTION SYSTEM WATER PRIOR TO PRESSURE TESTING OF THE WATERMAIN.
18. PRESSURE TESTING OF ALL WATERMAINS AND APPURTENANCES INSTALLED BY THE CONTRACTOR MUST BE PERFORMED BY THE CONTRACTOR USING METHODS MEETING THE APPROVAL OF THE CITY. TESTING AND RESULTS MUST BE WITNESSED BY CITY PERSONNEL.
19. MAINS AND SERVICES MUST BE PRESSURE TESTED AT 1035 kPa (150 psi) IN ACCORDANCE WITH AWWA C-600-82 (MINIMUM REQUIREMENT).
20. LEAKAGE TESTS MUST BE CONDUCTED AS PER AWWA C-600-82 (MINIMUM REQUIREMENT).
21. ONCE THE DISINFECTION AND PRESSURE TESTING RESULTS HAVE BEEN APPROVED, THE CONTRACTOR MUST ENSURE THAT ALL WATERMAIN PIPES ARE FLUSHED UNTIL THE CHLORINE LEVEL IN THE WATER IS SIMILAR TO THE LEVEL OF CHLORINE IN THE MUNICIPAL WATERMAIN NETWORK IN THE AREA.
22. BACTERIOLOGICAL TESTING MUST CONSIST OF TWO SAMPLINGS TWENTY FOUR HOURS APART. IF BACTERIOLOGICAL SAMPLES ARE SATISFACTORY THE WATERMAIN MAY BE PLACED ON LINE.
23. ALL WATERMAIN VALVES TO BE OPERATED BY THE CITY OF OTTAWA ONLY.

TURNER FLEISCHER

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PARSONS

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TOPOGRAPHIC INFORMATION & BENCHMARK

SURVEY COMPLETED BY ANNIS, O'SULLIVAN, VOLLEBEKK LTD. ON MARCH 28, 2023. ELEVATIONS SHOWN ARE GEODETIC AND ARE REFERRED TO THE CGVD28 GEODETIC DATUM, DERIVED FROM CONTROL MONUMENT NO. 019680071 HAVING AN ELEVATION OF 99.742m.

#	DATE	DESCRIPTION	BY
2	2023-10-23	RE-ISSUED FOR SPA	BV
1	2023-05-01	ISSUED FOR SPA	BV

Loblaw Companies Limited

PROJECT
3845 CAMBRIAN RD
BARRHAVEN, ONTARIO

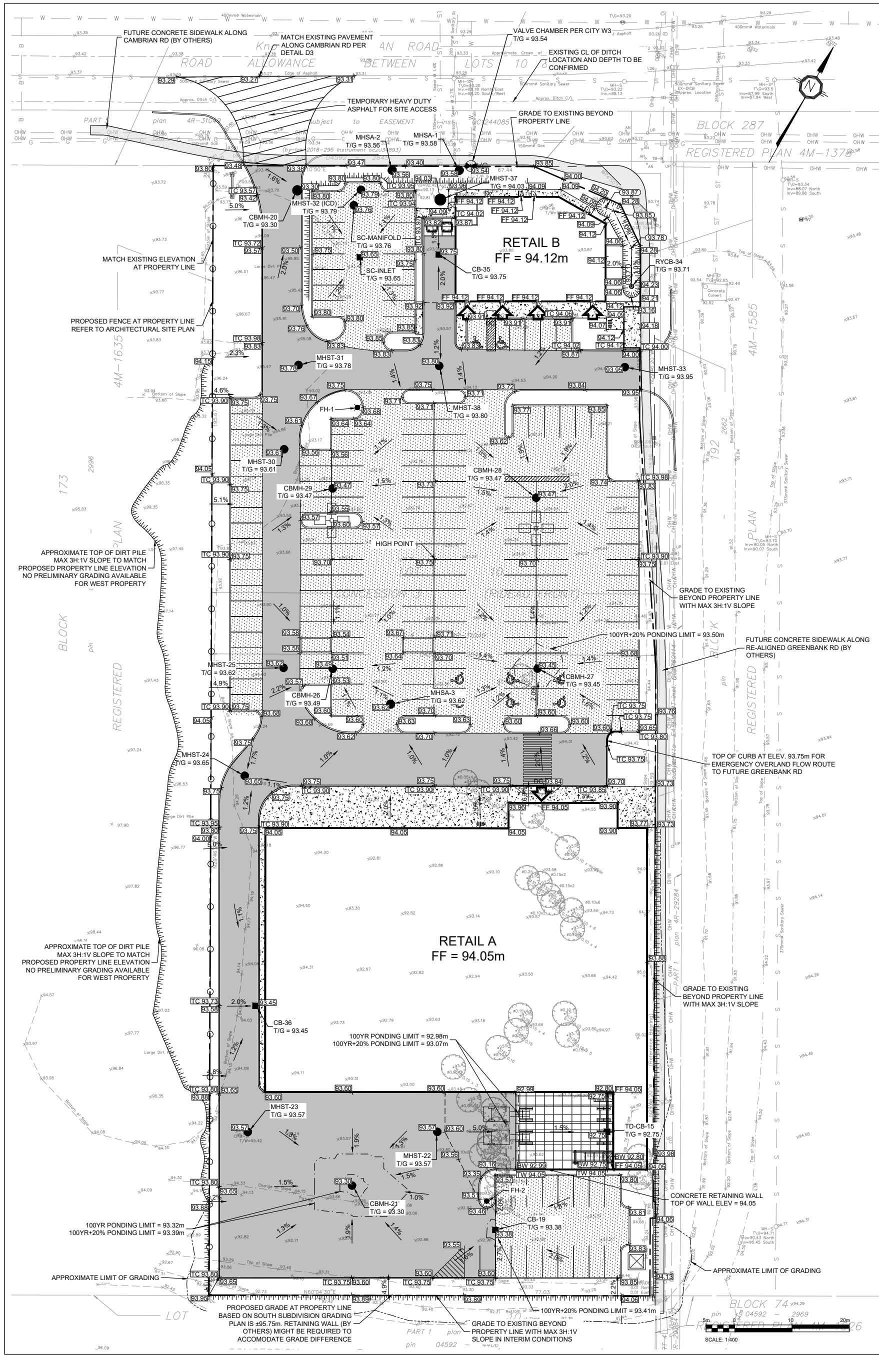
DRAWING
SITE SERVICING PLAN

PROJECT NO.	478575
PROJECT DATE	2023-02-27
DRAWN BY	BV
CHECKED BY	MT
SCALE	As indicated

LICENSED PROFESSIONAL ENGINEER B. VILLENEUVE 100553987 2023-10-23 PROVINCE OF ONTARIO

DRAWING NO. C102 REV.

#18983 D07-12-23-0058



LEGEND:

- FUTURE PROPERTY LINE
- EXISTING PROPERTY LINE
- PROPOSED DITCH/SWALE CENTERLINE
- TERRACE (3:1 MAX)
- EXISTING GRADE
- PROPOSED GRADE
- PROPOSED TOP OF WALL GRADE
- PROPOSED BOTTOM OF WALL GRADE
- PROPOSED FINISHED FLOOR ELEVATION
- PROPOSED TOP OF CURB ELEVATION
- PROPOSED CENTRELINE OF DITCH/SWALE GRADE
- PROPOSED SLOPE DIRECTION AND PERCENTAGE
- PROPOSED VALVE CHAMBER PER CITY STD DWG W3
- PROPOSED STORM MAINTENANCE HOLE
- PROPOSED SANITARY MAINTENANCE HOLE
- PROPOSED CATCH BASIN
- PROPOSED REAR YARD CATCH BASIN AS PER CITY STD DWG S31
- PROPOSED LIGHT DUTY PAVEMENT
- PROPOSED HEAVY DUTY PAVEMENT
- PROPOSED TEMPORARY HEAVY DUTY PAVEMENT
- PROPOSED CONCRETE SIDEWALK
- PROPOSED CONCRETE STRUCTURAL SLAB PER STRUCTURAL
- PROPOSED CONCRETE CURB
- PROPOSED DEPRESSED CONCRETE CURB WITH TWSI PER CITY STD DWG SC7.3
- PROPOSED LIGHT STANDARD
- APPROXIMATE LIMIT OF GRADING ON NEIGHBOURING PROPERTY
- FUTURE SIDEWALK ALONG RE-ALIGNED GREENBANK RD/CAMBRIAN RD BY OTHERS
- PROPOSED FENCE AT PROPERTY LINE REFER TO ARCHITECTURAL SITE PLAN

PAVEMENT STRUCTURES

MATERIAL	LIGHT DUTY	HEAVY DUTY	COMPACTION
SURFACE LAYER : HL3	65 mm	40 mm	≥ 96%*
BASE LAYER : HL8	--	60 mm	≥ 96%*
GRANULAR BASE : OPSS.MUNI 1010 GRANULAR A	150 mm	150 mm	100%**
GRANULAR SUB-BASE : OPSS.MUNI 1010 GRANULAR B	300 mm	450 mm	100%**

*MINIMUM PAVEMENT COMPACTION BASED ON MARSHALL DENSITY TEST
**OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY

SOURCE: GEOTECHNICAL INVESTIGATION, WEST OF CAMBRIAN ROAD AND GREENBANK ROAD, BARRHAVEN, ONTARIO, BY TORONTO INSPECTION LTD, DATED NOVEMBER 13, 2018

NOTES: GENERAL

1. THE CONTRACTOR MUST CONFORM TO ALL LAWS, CODES, ORDINANCES, AND REGULATIONS ADOPTED BY FEDERAL, PROVINCIAL OR MUNICIPAL GOVERNMENT COUNCILS AND GOVERNMENT AGENCIES, APPLYING TO WORK TO BE CARRIED OUT. WHEREVER STANDARDS, LAWS AND/OR REGULATIONS ARE MENTIONED THEY REFER TO THEIR CURRENT VERSIONS, MODIFICATIONS INCLUDED.
2. ALL MATERIALS AND CONSTRUCTION METHODS SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF THE ONTARIO PROVINCIAL STANDARD SPECIFICATIONS AND DRAWINGS (OPSS AND OPSD), THE ONTARIO MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE, THE ONTARIO MINISTRY OF NATURAL RESOURCES, APPLICABLE CONSERVATION AUTHORITIES, THE MUNICIPAL STANDARD SPECIFICATIONS AND DRAWINGS, AND ALL OTHER GOVERNING AUTHORITIES AS THEY APPLY, UNLESS OTHERWISE INDICATED.
3. ALL MATERIAL SUPPLIED AND PLACED FOR PARKING LOT AND ACCESS ROAD CONSTRUCTION SHALL BE TO OPSS STANDARDS AND SPECIFICATIONS UNLESS OTHERWISE NOTED. CONSTRUCTION TO OPSS 206, 310 & 314. MATERIALS TO OPSS 1001, 1003 & 1010.
4. THE LOCATION OF EXISTING UNDERGROUND MUNICIPAL SERVICES AND PUBLIC UTILITIES AS SHOWN ON THE PLANS ARE APPROXIMATE. THE CONTRACTOR MUST DETERMINE THE EXACT LOCATION, SIZE, MATERIAL AND ELEVATION OF ALL EXISTING UTILITIES (ON-SITE AND OFF-SITE) PRIOR TO ANY EXCAVATION WORK. DAMAGE TO ANY EXISTING SERVICES AND/OR EXISTING UTILITIES DURING CONSTRUCTION, WHETHER OR NOT SHOWN ON THE DRAWINGS MUST BE REPAIRED BY THE CONTRACTOR AT HIS OWN EXPENSE.
5. THE CONTRACTOR SHALL DETERMINE THE EXACT INVERT (GEODETIC ELEVATION), DIAMETER AND CONSTRUCTION MATERIAL OF THE EXISTING CONDUITS AT THE PROPOSED CONNECTIONS. THEY SHALL ALSO CARRY OUT, IF NECESSARY, EXPLORATORY DIGS IN ORDER TO DETERMINE THE EXACT LOCATION AND INVERTS OF EXISTING DUCK BANKS. THIS INFORMATION SHALL IMMEDIATELY BE PROVIDED TO THE CONSULTANT PRIOR TO START UNDERTAKING ANY MUNICIPAL SERVICES WORK AND A 48 HOUR PERIOD MUST BE ALLOCATED TO THE CONSULTANT FOR DESIGN REVIEW.
6. AT PROPOSED UTILITY CONNECTION POINTS AND CROSSINGS (I.E. STORM SEWER, SANITARY SEWER, WATER, ETC.) THE CONTRACTOR SHALL DETERMINE THE PRECISE LOCATION AND DEPTH OF EXISTING UTILITIES AND REPORT ANY DISCREPANCIES OR CONFLICTS TO THE ENGINEER BEFORE COMMENCING WORK.
7. CONTRACTOR IS RESPONSIBLE FOR ALL LAYOUT FOR CONSTRUCTION PURPOSES.
8. THE CONTRACTOR IS RESPONSIBLE FOR THE COORDINATION OF ALL WORK AND ACTIVITIES WITH OTHERS TRADES AND CONTRACTORS.
9. THE CONTRACTOR IS THE ONLY PERSON IN CHARGE OF SAFETY ON THE BUILDING SITE. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING ADEQUATE PROTECTION OF THE WORKERS, OTHER PERSONNEL AND THE GENERAL PUBLIC, PROTECTION OF MATERIALS, AS WELL AS MAINTAINING IN GOOD CONDITION THE COMPLETED WORKS AND WORKS TO BE COMPLETED. THE CONTRACTOR MUST PROVIDE AT ANY TIME:
   a. A SUFFICIENT NUMBER OF FENCES, BARRIERS, POSTERS, GUARDS AND OTHERS TO ENSURE SAFETY;
   b. NECESSARY CONVENIENCES FOR THE COMPLETION OF WORK SUCH AS HEATING, LIGHTING, VENTILATION ETC.
10. CONTRACTOR IS RESPONSIBLE TO OBTAIN THE VARIOUS PERMITS/APPROVALS REQUIRED TO COMPLETE ALL THE WORKS AND ACTIVITIES AND BEAR COST OF THE SAME, SUCH AS BUT NOT LIMITED TO; ROAD CUT PERMITS, SEWER PERMITS, WATER PERMIT, ETC. AND THEIR ASSOCIATED COSTS.
11. ALL ELEVATIONS ARE GEODETIC AND UTILIZE METRIC UNITS.
12. JOB BENCH MARK - CONFIRM WITH PARSONS PRIOR TO UTILIZATION. THE CONTRACTOR MUST MAINTAIN BENCHMARKS AND LANDMARK REFERENCES AS IS. OTHERWISE THESE REFERENCES WILL BE REPOSITIONED BY A CERTIFIED LAND SURVEYOR AT THE CONTRACTOR'S EXPENSE.
13. ALL GROUND SURFACES SHALL BE EVENLY GRADED WITHOUT PONDING AREAS AND LOW POINTS EXCEPT WHERE APPROVED SWALE OR CATCH BASIN OUTLETS ARE PROVIDED.
14. IF GROUNDWATER IS ENCOUNTERED DURING CONSTRUCTION, DEWATERING OF EXCAVATIONS COULD BE REQUIRED. IT IS ASSUMED THAT GROUNDWATER MAY BE CONTROLLED BY SUMP AND PUMPING METHODS. THE CONTRACTOR SHALL OBTAIN A PERMIT TO TAKE WATER IF SITE CONDITIONS REQUIRE TAKING MORE THAN A TOTAL OF 400 000 L/DAY.
15. STRIP AND REMOVE ALL TOPSOIL FROM IMPROVED AREAS. SITE PREPARATION INCLUDES CLEARING, GRUBBING, STRIPPING OF TOPSOIL, DEMOLITION, REMOVAL OF UNSUITABLE MATERIALS, CUT, FILL AND ROUGH GRADING OF ALL AREAS TO RECEIVE FINISHED SURFACES.
16. ABUTTING PROPERTY GRADE TO BE MATCHED.
17. ALL EDGES OF DISTURBED PAVEMENT SHALL BE SAW CUT TO FORM A NEAT AND STRAIGHT LINE PRIOR TO PLACING NEW PAVEMENT. PAVEMENT REINSTATEMENT SHALL BE WITH STEP JOINTS OF 300mm WIDTH MINIMUM.
18. CURBS TO BE BARRIER, CONSTRUCTED AS PER OPSD 600.110, EXCEPT WHERE INDICATED OTHERWISE. ELEVATION AT TOP OF CONCRETE CURBS TO BE 150 mm ABOVE THE ASPHALT, UNLESS OTHERWISE INDICATED ON THE DRAWINGS.
19. DEPRESSED CURBS TO BE MOUNTABLE, CONSTRUCTED AS PER OPSD 600.100.
20. LIGHT DUTY AND HEAVY DUTY ASPHALT PAVEMENTS TO BE CONSTRUCTED AS PER TABLE ON DRAWING C103.
21. TRANSITION BETWEEN EXISTING AND PROPOSED PAVEMENT SHALL BE CONSTRUCTED AS PER DETAIL D3 ON DRAWING C104.
22. RESTORE PAVEMENT STRUCTURE AND SURFACES ON EXISTING ROADS TO A CONDITION AT LEAST EQUAL TO ORIGINAL AND TO THE SATISFACTION OF THE MUNICIPAL AUTHORITIES.
23. CLEANLINESS ON THE SITE, INCLUDES THE CONTRACTOR SHALL CLEAN ROADWAYS AT HIS OWN COST AS DIRECTED BY THE OWNER'S REPRESENTATIVE, MATERIALS AND EQUIPMENT MUST BE LAID OUT IN AN ORGANIZED AND SAFE MANNER, AND ALL MATERIAL, EQUIPMENT AND TEMPORARY STRUCTURES WHICH ARE NO LONGER NECESSARY FOR THE EXECUTION OF THE CONTRACT MUST BE REMOVED FROM THE SITE.
24. CONTRACTOR TO ENSURE MITIGATION MEASURES ARE IMPLEMENTED TO REDUCED THE RISK OF GROUND CONTAMINATION FROM PETROLEUM PRODUCTS.
25. THE CONTRACTOR MUST ENSURE THE FOLLOWING MEASURES ARE IMPLEMENTED REGARDING THE HANDLING OF CONCRETE:
   a. CONCRETE SHOULD EITHER BE MIXED AWAY FROM THE SITE OR SHOULD BE PREPARED ON PAVED SURFACES IF ONLY SMALL QUANTITIES ARE REQUIRED (I.E. MINOR REPAIRS);
   b. EXCESS CONCRETE MUST BE DISPOSED OFF-SITE AT A LOCATION THAT MEETS ALL REGULATORY REQUIREMENTS;
   c. THE WASHING OF CONCRETE TRUCKS AND OTHER EQUIPMENT USED FOR MIXING CONCRETE SHOULD NOT BE CARRIED OUT WITHIN 30 METERS OF A WATERCOURSE OR WETLAND AND SHOULD TAKE PLACE OUTSIDE OF THE WORK SITE;
   d. ALL CONCRETE TRUCKS SHOULD COLLECT THEIR WASH WATER AND RECYCLE IT BACK INTO THEIR TRUCKS FOR DISPOSAL OFF-SITE AT A LOCATION MEETING ALL REGULATORY REQUIREMENTS.
26. THE CONTRACTOR SHALL ENSURE THAT ALL EXCAVATED SURPLUS MATERIALS THAT WILL BE REQUIRED TO BE DISPOSED OFFSITE BE STOCKPILED TEMPORALLY FOR SAMPLING PRIOR BEING LOADED OFFSITE.
27. MINIMIZE DISTURBANCE TO EXISTING VEGETATION DURING THE EXECUTION OF ALL WORKS.
28. TRENCHING, BACKFILLING AND COMPACTING MUST CONFORM TO OPSS 401.
29. DEWATERING OF PIPELINE, UTILITY AND ASSOCIATED STRUCTURE EXCAVATIONS TO BE COMPLETED AS PER OPSS 517.
30. THE CONTRACTOR MUST CONTROL SURFACE RUNOFF FROM PRECIPITATION DURING CONSTRUCTION.
31. FOR ALL GEOTECHNICAL WORK, CONTRACTOR TO REFER TO "GEOTECHNICAL INVESTIGATION WEST OF CAMBRIAN ROAD AND GREENBANK ROAD, BARRHAVEN, ONTARIO, BY TORONTO INSPECTION LTD. DATED NOVEMBER 13, 2018"
32. REMOVE FROM SITE ALL EXCESS EXCAVATED MATERIAL UNLESS OTHERWISE DIRECTED FROM THE ENGINEER. EXCAVATE AND REMOVE ALL ORGANIC MATERIAL AND DEBRIS LOCATED WITHIN THE PROPOSED BUILDING, PARKING AND ROADWAY LOCATIONS.
33. THE CONTRACTOR IS RESPONSIBLE FOR ALL EXCAVATION, BACKFILL AND REINSTATEMENT OFF ALL AREAS DISTURBED DURING CONSTRUCTION TO EXISTING CONDITIONS OR BETTER AND ALL ASSOCIATED WORKS TO THE SATISFACTION OF THE CONSULTANT AND MUNICIPAL AUTHORITIES. ASPHALT REINSTATEMENT MUST BE IN ACCORDANCE WITH OPSS 310. LANDSCAPE AREAS TO BE REINSTATED WITH 150 mm OF TOPSOIL AND SOD IN ACCORDANCE WITH OPSS 802 AND OPSS 803.
34. DURING THE CONSTRUCTION PERIOD THE CONTRACTOR IS RESPONSIBLE FOR INSTALLING AND MAINTAINING TEMPORARY TRAFFIC SIGNAGE, INCLUDING TRAFFIC SIGNS, TRAFFIC MARKINGS AND TEMPORARY TRAFFIC LIGHTS, AND FLAGMEN, AS REQUIRED BY THE OWNER, THE CONSULTANT, THE MUNICIPALITY, THE MTO, AND OTHER GOVERNING AUTHORITIES.
35. CONSTRUCT SIDEWALK EXPANSION JOINTS & CONTROL JOINTS AS PER OPSD 310.020.
36. CONSTRUCT CONCRETE SIDEWALK AS PER OPSD 310.020 AND OPSS 351. TACTILE WALKING SURFACE INDICATORS PER OPSS 351.
37. DISPOSE OF CONTAMINATED MATERIALS AT APPROPRIATE OFF-SITE FACILITY THAT MEETS ALL REGULATORY REQUIREMENTS.
38. BE PREPARED TO INTERCEPT, CLEAN UP, AND DISPOSE OF SPILLS OR RELEASES THAT MAY OCCUR WHETHER ON LAND OR WATER. MAINTAIN MATERIALS AND EQUIPMENT REQUIRED FOR CLEANUP OF SPILLS OR RELEASES READILY ACCESSIBLE ON SITE.
39. PROMPTLY REPORT SPILLS AND RELEASES POTENTIALLY CAUSING DAMAGE TO ENVIRONMENT TO: AUTHORITY HAVING JURISDICTION OR INTEREST IN SPILL OR RELEASE INCLUDING CONSERVATION AUTHORITY, WATER SUPPLY AUTHORITIES, DRAINAGE AUTHORITY, ROAD AUTHORITY, AND FIRE DEPARTMENT.
40. DECONTAMINATE EQUIPMENT AFTER WORKING IN POTENTIALLY CONTAMINATED WORK AREAS AND PRIOR TO SUBSEQUENT WORK OR TRAVEL ON CLEAN AREAS.
41. DO NOT DISCHARGE DECONTAMINATED WATER, OR SURFACE WATER RUNOFF, OR GROUNDWATER WHICH MAY HAVE COME IN CONTACT WITH POTENTIALLY CONTAMINATED MATERIAL, OFF SITE OR TO MUNICIPAL SEWERS.
42. CONTRACTOR IS TO SUBMIT A TRAFFIC MANAGEMENT PLAN FOR APPROVAL ONE (1) WEEK PRIOR TO ANY WORK WITHIN THE ROW LIMITS TO MEET THE REQUIREMENTS OF MTO BOOK 7. THE CONTRACTOR WILL BE REQUIRED TO IMPLEMENT ALL REQUIREMENTS OF THE MTO BOOK 7.
43. CITY PUBLIC WORKS DEPARTMENT TO BE CONTACTED MINIMUM 7 DAYS PRIOR TO PLANNED DATE FOR CONNECTION TO EXISTING STORM SEWERS, SANITARY SEWERS, AND WATERMAIN. CONNECTION TO EXISTING TO TAKE PLACE IN THE PRESENCE OF APPROPRIATE CITY OF OTTAWA STAFF.

TURNER FLEISCHER

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TOPOGRAPHIC INFORMATION & BENCHMARK

SURVEY COMPLETED BY ANNIS, O'SULLIVAN, VOLLEBEKK LTD. ON MARCH 28, 2023. ELEVATIONS SHOWN ARE GEODETIC AND ARE REFERRED TO THE CGVD28 GEODETIC DATUM, DERIVED FROM CONTROL MONUMENT NO. 019680071 HAVING AN ELEVATION OF 99.742m.

#	DATE	DESCRIPTION	BY
2	2023-10-23	RE-ISSUED FOR SPA	BV
1	2023-05-01	ISSUED FOR SPA	BV

Loblaw Companies Limited

PROJECT
3845 CAMBRIAN RD
BARRHAVEN, ONTARIO

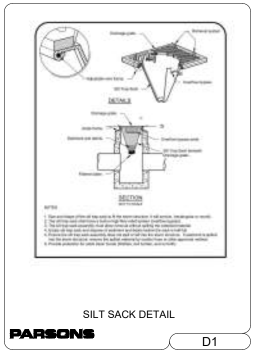
DRAWING
GRADING PLAN

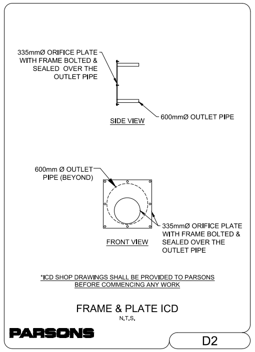
PROJECT NO.	478575
PROJECT DATE	2023-02-27
DRAWN BY	BV
CHECKED BY	MT
SCALE	As indicated

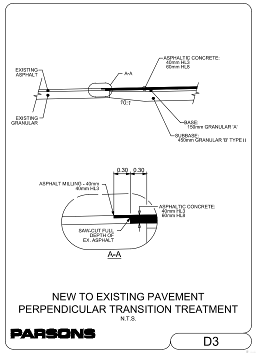
LICENSED PROFESSIONAL ENGINEER
B. VILLENEUVE
100553987
2023-10-23
PROVINCE OF ONTARIO

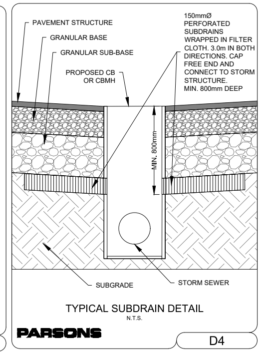
DRAWING NO. C103
REV.

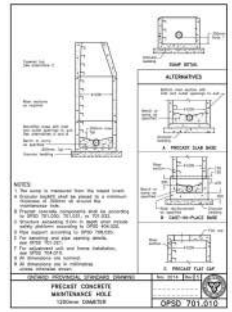
#18983 D07-12-23-0058

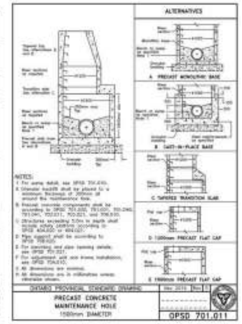


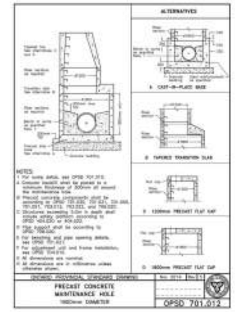


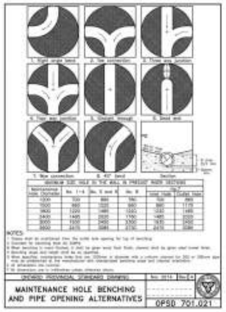


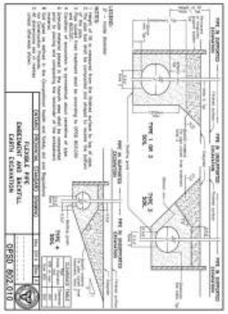


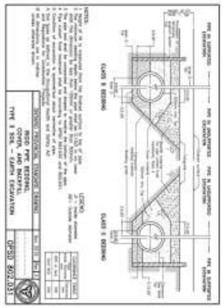


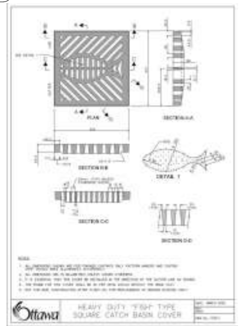


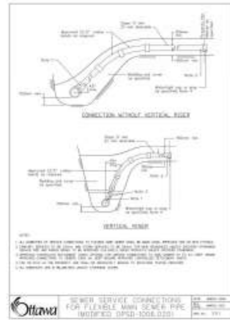


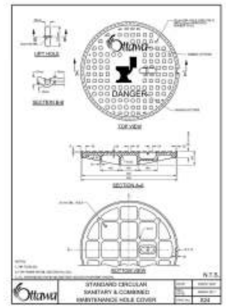


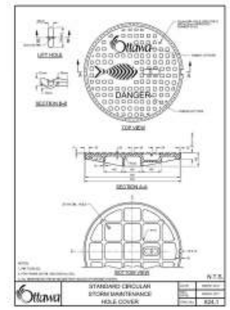


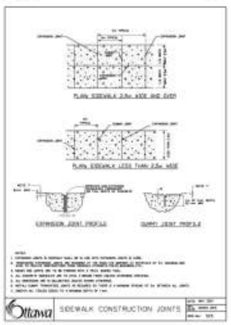


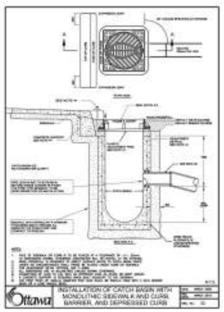


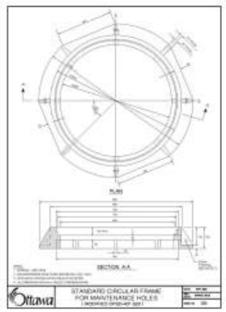


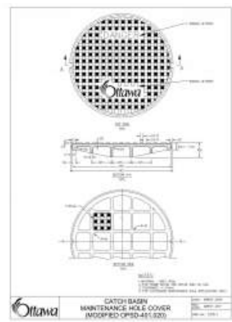


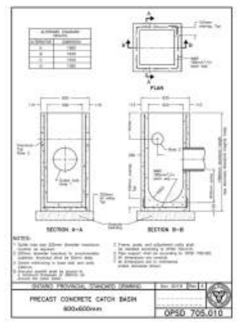


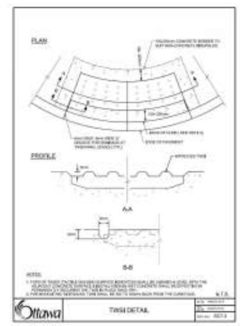


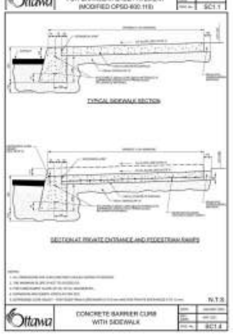


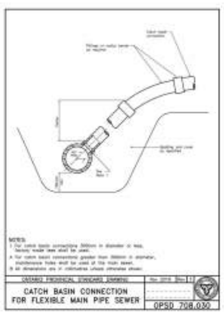


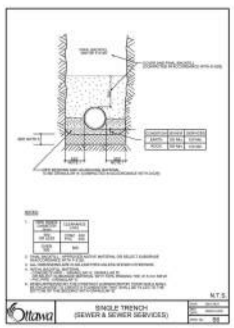


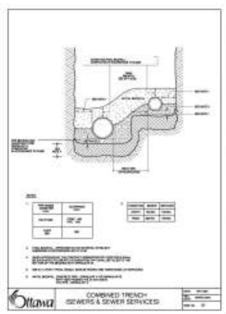


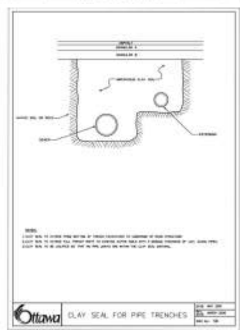


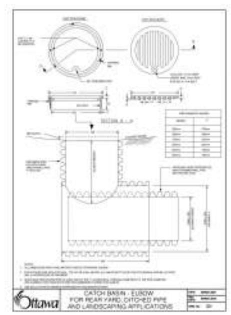


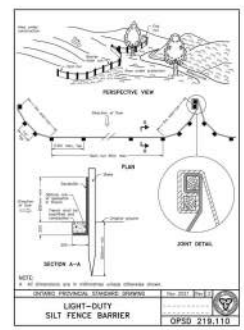












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PARSONS
1223 MICHAEL STREET, SUITE 100, OTTAWA, ONTARIO K1J 7T2
Tel: 613-738-4160 Fax: 613-739-7105

#	DATE	DESCRIPTION	BY
2	2023-10-23	RE-ISSUED FOR SPA	BV
1	2023-05-01	ISSUED FOR SPA	BV

Loblaw Companies Limited

PROJECT
3845 CAMBRIAN RD
BARRHAVEN, ONTARIO

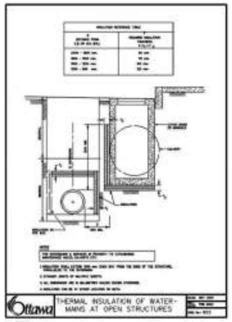
DRAWING
DETAIL PAGE 1

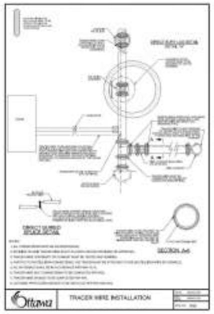
PROJECT NO. 478575
PROJECT DATE 2023-02-27
DRAWN BY BV
CHECKED BY MT
SCALE As indicated

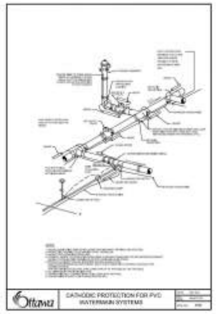
LICENSED PROFESSIONAL ENGINEER
B. VILLENEUVE
100553987
2023-10-23
PROVINCE OF ONTARIO

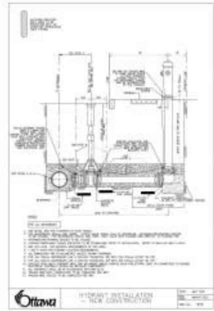
DRAWING NO. C104
REV.

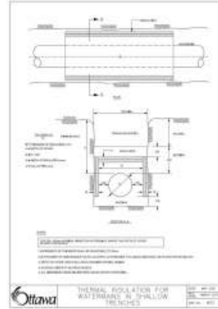
D07-12-23-0058
#18983

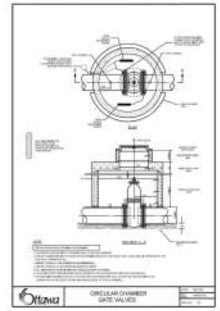


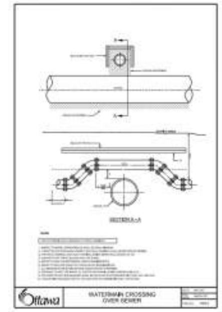


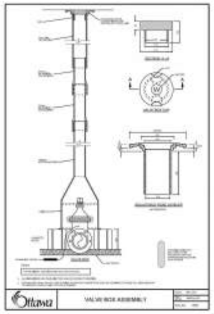


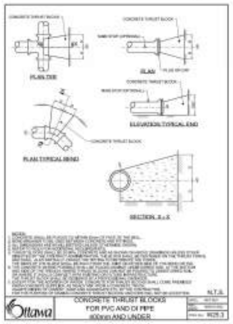


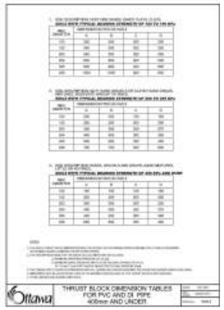


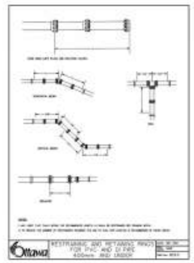


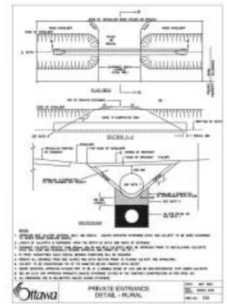












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PARSONS

1223 MICHAEL STREET, SUITE 100, OTTAWA, ONTARIO K1J 7T2
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#	DATE	DESCRIPTION	BY
2	2023-10-23	RE-ISSUED FOR SPA	BV
1	2023-05-01	ISSUED FOR SPA	BV

Loblaw Companies Limited

PROJECT

3845 CAMBRIAN RD

BARRHAVEN, ONTARIO

DRAWING

DETAIL PAGE 2

PROJECT NO.
478575

PROJECT DATE
2023-02-27

DRAWN BY
BV

CHECKED BY
MT

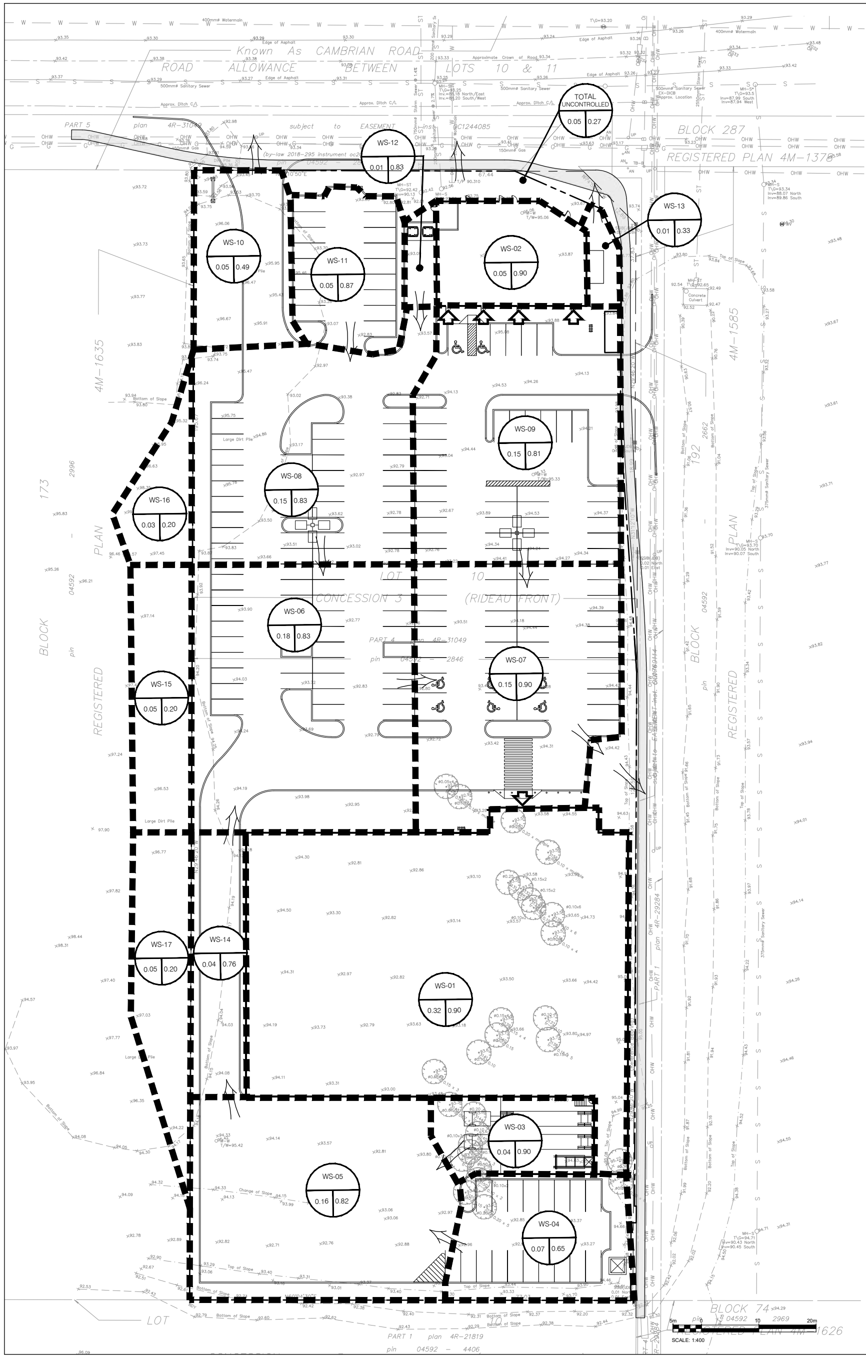
SCALE
As indicated

LICENSED PROFESSIONAL ENGINEER
B. VILLENEUVE
100553987
2023-10-23
PROVINCE OF ONTARIO

DRAWING NO.
C105

REV.

#18983 D07-12-23-0058



LEGEND:

- WATERSHED BOUNDARY
- WS-XX — WATERSHED NAME
- 0.61 — AREA IN HECTARES
- 0.90 — RUNOFF COEFFICIENT
- MAJOR OVERLAND FLOW ROUTE

TURNER FLEISCHER

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#	DATE	DESCRIPTION	BY
2	2023-10-23	RE-ISSUED FOR SPA	BV
1	2023-05-01	ISSUED FOR SPA	BV

Loblaw Companies Limited

PROJECT
3845 CAMBRIAN RD
BARRHAVEN, ONTARIO

DRAWING
POST-DEVELOPMENT DRAINAGE AREAS

PROJECT NO. 478575
PROJECT DATE 2023-02-27
DRAWN BY BV
CHECKED BY MT
SCALE As indicated

LICENSED PROFESSIONAL ENGINEER
B. VILLENEUVE
100553987
2023-10-23
PROVINCE OF ONTARIO

DRAWING NO. C106
REV.

#18983 D07-12-23-0058