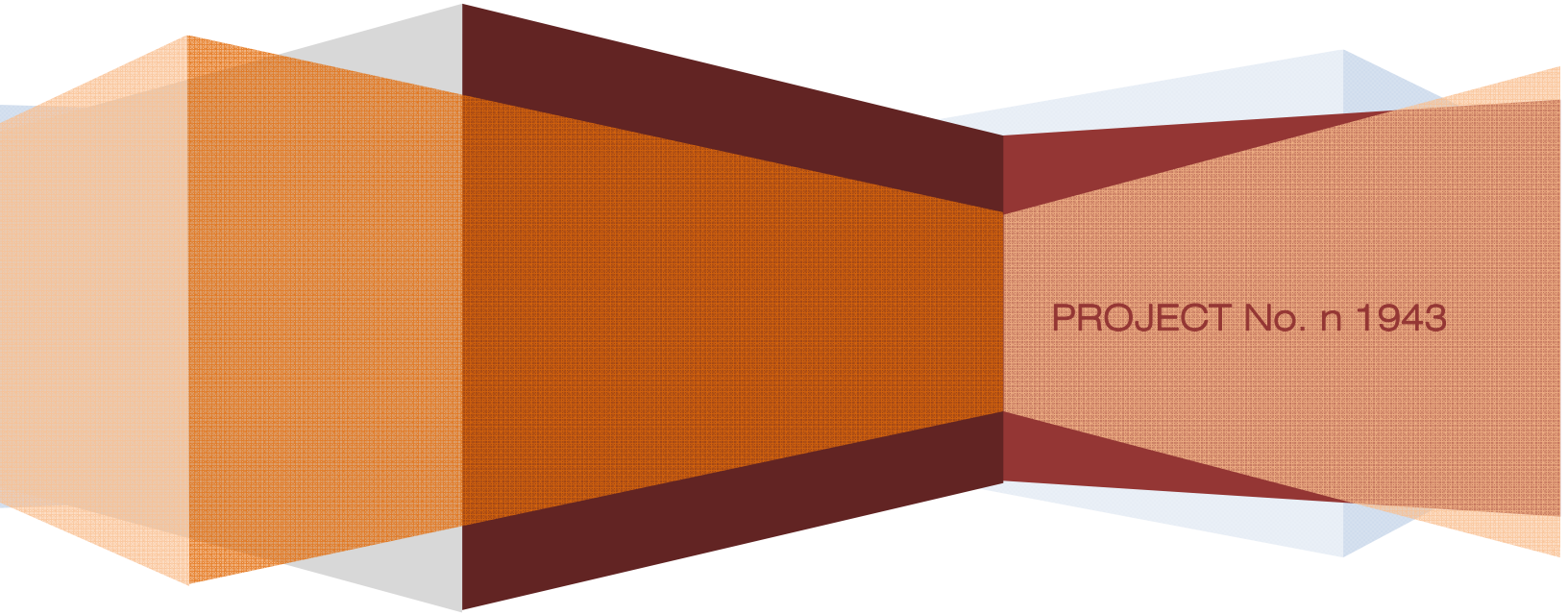
COMMERCIAL DEVELOPMENT
428 AND 432 KING STREET EAST
COBOURG, ONTARIO

Servicing and Stormwater Management Report



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October 30, 2020

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Revision History

Version Number	Date of Update	Purpose of the Issue	Comments
05	30 Oct 2020	Re-issued for SPA3	Updated as per comments from Authorities of Jurisdictions
04	September 30, 2020	Issued for SPA3	Updated as per AOJ comments and Tim Horton's revisions
03	July 07, 2020	Issued for SPA2	Updated as per comments from Authorities of Jurisdictions
02	March 10, 2020	Issued for SPA1	Comments from review addressed
01	12 Feb 2020	Issued for Review	

1.0 Introduction

n Architecture was retained by PLAZACOMM to be the civil engineering consultants responsible for the preparation of servicing and Stormwater management report, site grading plan, site servicing plan and erosion & sediment control plan for the site to obtain approval from the Town of Cobourg for a commercial development.

2.0 Site Location

The site is located at the north-east corner of the intersection of King Street East and Brook Road North as shown at Figure 1. The municipal (mailing) address is 428 and 432 King Street East, Cobourg. This rectangle shaped property is legally described as Part of lot 12, concession A Geographic township of Hamilton, Town of Cobourg, County of Northumberland.

3.0 Development Proposal

The proponent for this site proposes to develop the property consisting of four canopied fuel pumps, a C-store, Tim Horton's and retail stores with associated parking areas and driveways.. The total area of the property is 1.13 ha.

Potential stormwater management (SWM) strategies to mitigate any potential impacts per Ganaraska Region Conservation Authority design guidelines are presented in the report. New site servicing requirements for sanitary and water supply will also be discussed in the following sections.

FIGURE 1: KEY PLAN

4.0 Existing Conditions

FIGURE 2 – SITE EXISTING CONDITION

4.1 Site Characteristics / Topography

The site is mostly covered with grassed area, where also there is one storey house and some paved areas.

The site is sloped naturally from north to the south with highest point 87.0 at North West and lowest point 85.50 at south west, intersection of King St. E. and Brook Rd. N.

4.2 Vegetation

The majority of the site is grassed with some trees at north side.

4.3 Drainage

Currently there is no internal stormwater system within the property and the overall overland flow is in the south direction, towards the King Street. The pre development drainage pattern is shown on DR-101.

4.4 Existing Services

On King Street East, there are 750 mm dia. storm sewer, 200 mm dia. sanitary sewer and 400 mm watermain available and also on Brook Road North, there are 400 mm Watermain, 300 mm sanitary sewer and 750 mm storm sewer available.

Considering the commercial development an assessment of the capacity of sanitary sewer on Brook Road North through Brook Road South up to the pumping station at Lake Shore Drive was done to ensure adequate capacity available for the flow from the development.

5.0 Proposed Development

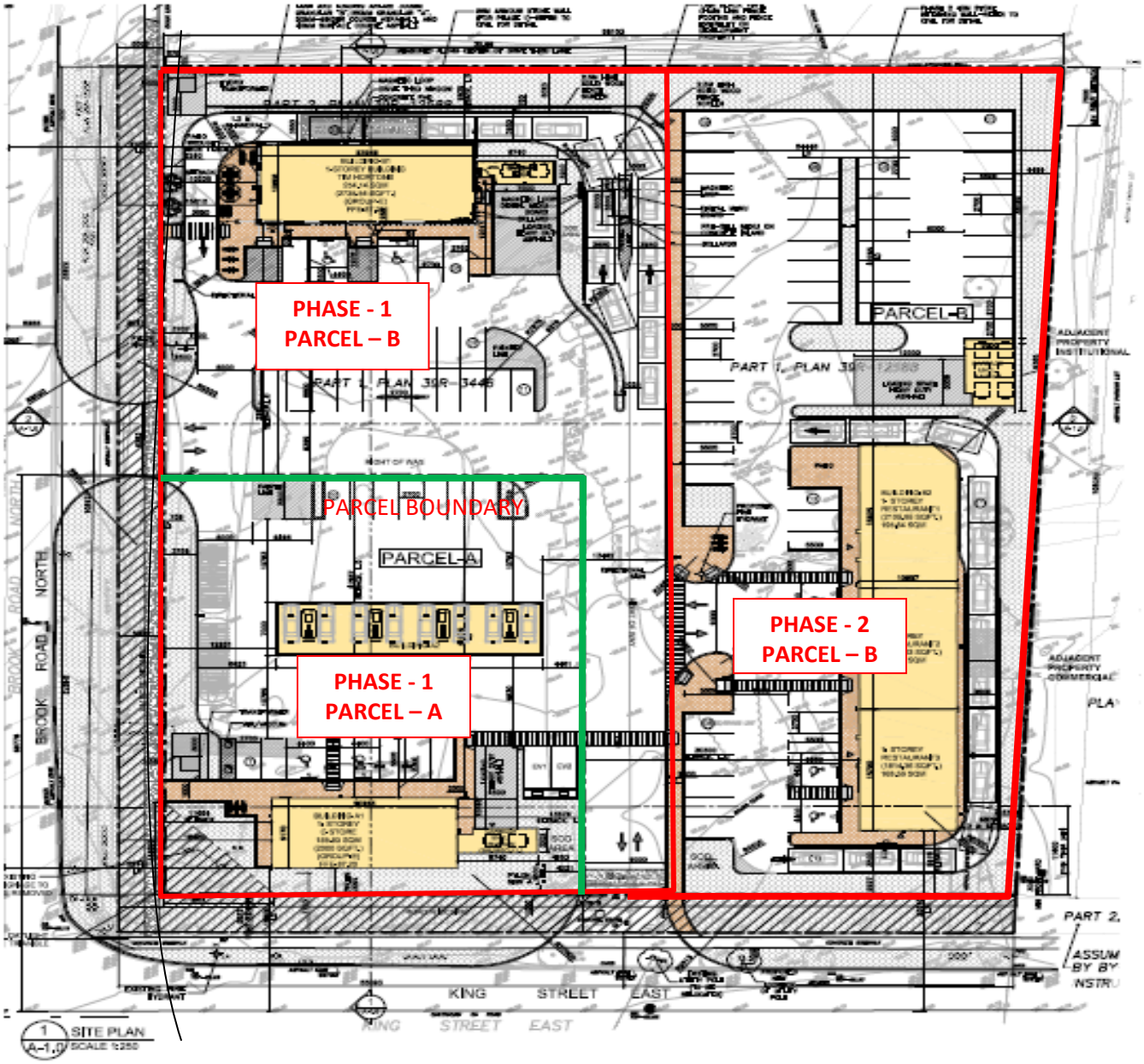


FIGURE 3 – PROPOSED DEVELOPMENT PLAN

The subject site is proposed to divide in two Parcels – namely Parcel A and Parcel B. Parcel A and Part of Parcel B proposed to developed in phase 1 and rest of parcel B proposed to develop in phase 2 as shown in Figure 3. Parcel A proposed to have a gas station consist of canopied 8 pumps and a one story convenient store. Parcel B phase 1 development proposed to have a Tim Horton's restaurant. Phase 2 of Parcel B proposed to have three restaurants. Total Area of the site is 1.13 hectare before road proposed widening and 1.02 hectare after road widening. Area of Parcel A 0.27 ha, Parcel B Phase 1 is 0.33 ha and parcel B phase 2 is 0.42 are included for servicing and stormwater management study.

Stormwater management plan proposed separately with two separate connections for parcel A, parcel B phase 1 and parcel B phase 2. Two separate sanitary sewer service connections proposed for parcel A and parcel B. For water service connection – a separate connection proposed for parcel A and parcel B. (Refer: Site Servicing Plan, DWG C2).

6.0 Stormwater Management Criteria

The proposed development shall follow the respective criteria/guidelines of the *"Technical and Engineering Guidelines for Stormwater Management Submissions" December 2014*, Ganaraska Region Conservation Authority. The criteria for proposed developments summarized as follows:

- **Water Quantity Control** – Post development storm discharge is to be controlled to pre-development levels of for 2 year through 100 years;
- **Water Quality Control** - long-term average removal of 80% of total suspended solids (TSS) on an annual loading basis from all runoff leaving the site;
- **Roof Drain Discharge Rate:** Roof drains should be selected to give a maximum discharge of 42 lps/ha of roof area with maximum drawing down time 24 hours and maximum depth of controlled water 150mm (Ref: Section 7.4.10.4 – OBC).

6.1 Water Quantity Control Plan

Rainfall intensity calculated using Ganaraska Region Conservation Authority rainfall intensity formulas (Beyond Clarington) as follows:

$$I = \frac{a}{(b + T_d)}$$

Where:

I = Rainfall Intensity (mm/hr)

a and b = coefficients

T_d= Time in minutes

Table 1: IDF Curve

Return Period (Years)	2 -Years	5-Years	10 -Years	25 -Years	50 -Years	100-Years
A	1778.0	2464.0	2819.0	3886.0	4750.0	5588.0
B	13.0	16.0	16.0	18.0	24.0	28.0

Design runoff calculated as follows:
$Q = 0.002778\ CIA$

Where:
Q = volume of runoff (m^3/sec)
C = runoff coefficient
A = contributing Area (hectares)
I = rainfall intensity (mm/hr)

7.0 Runoff Quantity Control for the Site

7.1 Quantity Control

Objective of quantity control is to achieve a target of post development discharge be controlled to the pre-development levels for the 2 year through 100 year event and a regional storm event with storage up to and including the 100 year storm event.

This site considered as "not developed" previously, therefore calculated composite runoff co-efficient and pre-development runoff volume are shown in Appendix B.

Considering proposed development runoff coefficients and volume of post-development runoff calculated and presented in Appendix B.

Pre and post-development runoff coefficient and flows from 2-year, 5-year, 10 year, 25 year 50 year and 100-year rainfall event are summarized in Table 2A, 2B and 2C.

Table 2A: Runoff Coefficient and Flows Summary (Parcel A)

Land-use	Run-off Co-efficient	2-yrs	5-yrs	10-yrs	25-yrs	50-yrs	100-yrs
Pre-development (L/sec)	0.52	30.32	37.17	42.52	54.43	54.79	57.67
Post-development (L/sec)	0.82	47.45	58.17	66.55	85.18	85.75	90.26

Table 2B: Runoff Coefficient and Flows Summary (Parcel B – Phase 1)

Land-use	Run-off Co-efficient	2-yrs	5-yrs	10-yrs	25-yrs	50-yrs	100-yrs
Pre-development (L/sec)	0.30	21.32	26.14	29.91	38.28	38.54	40.56
Post-development (L/sec)	0.84	58.71	71.97	82.34	105.40	106.10	111.68

Table 2C: Runoff Coefficient and Flows Summary (Parcel B – Phase 2)

Land-use	Run-off Co-efficient	2-yrs	5-yrs	10-yrs	25-yrs	50-yrs	100-yrs
Pre-development (L/sec)	0.29	26.36	32.31	36.97	47.32	47.63	50.14
Post-development (L/sec)	0.80	72.42	88.79	101.58	130.03	130.89	137.77

7.1.1 Orifice Control

Discharge form storm events from 2 year up to 100 years proposed to be restricted by installing orifice pipes (eccentric reducer) to control flow below allowable discharge limit to municipal sewer system. Orifice sizing calculations are presented in Appendix C and summarized in Table 3. Comparison controlled flow through orifice and allowable flow limit also presented in Table 3.

Table 3: Controlled Flow through Orifice

Drainage Area	Orifice Pipe Size (mm)	Allowable Discharge (L/sec)[1]			Controlled Discharge (L/sec)		
		2-yrs	5-yrs	100-yrs	2-yrs	5-yrs	100-yrs
PARCEL A	110	28.71	35.19	51.44	28.06	30.94	44.46
PARCEL B (PHASE -1)	95	19.11	23.43	36.36	19.00	22.07	33.42
PARCEL B (PHASE -2)	100	26.36	32.31	50.14	26.24	30.72	32.56

7.1.2 On-site Detention Storage

Require detention storage caused by flow restriction calculated for 2, 5, 10, 25, 50 and 100 years rainfall events are calculated and attached in Appendix C. Available detention storage also calculated and attached in Appendix C. Details of storage type and location refer to Site Grading Plan (DWG. C1 and On-Site Available Storage Calculators in Appendix C). Detention calculated result of detention storage summarized in Table 4.

Table 4: Detention Storage Summary

Drainage Area	Detention Storage Required (m^3)			Maximum Available Storage (m^3)
	2-yrs	5-yrs	100-yrs	
PARCEL –A	12.20	17.39	34.17	43.33
PARCEL-B (PHASE -1)	26.54	35.92	71.63	74.32
PARCEL-B (PHASE -2)	29.95	40.16	106.66	110.41

[1] Allowable Flow = Pre-development Flow – Uncontrolled Flow

7.1.3 Roof Flow Control and Storage

Rainwater flow from the roofs proposed to restrict by installing parabolic weirs, (Zurn Z105 Control Flo Drain) from the roofs of building A1, B1 and B2. (Refer: DWG C1).

Number of drains and flow rate calculated and summarized in Table 5. Based on the roof area the maximum ponding depth on the roof is calculated and added in Table 5. Drain specs are attached in Appendix G.

Table 5: Roof Control Summary

Roof Location	Roof Area (m^2)	No of Drains	Flow Allowed (OBC) L/sec	Design Flow (l/sec)	Design Max. Depth of Ponding (mm)
Building - A1	185.83	2	0.78	1.56	31.93
Building-B1	254.14	2	1.06	1.20	43.40
Building-B2	532.72	3	2.22	3.60	36.30

7.1.4 Roof Drain Design

Roof drain proposed to design following criteria described in section 7.4.10.4 (OBC). Detail design will be provided by mechanical consultant. Following is the comparison of proposed design and OBC (7.4.10.4) criteria.

Table 6: Roof Control Validation

Item	OBC Criteria	Proposed Roof Drain
Maximum Drawdown time	24 hr	1) Roof A1: 5.2 hrs 2) Roof B1: 9.7 hrs 3) Roof B2: 6.5 hrs
Maximum Depth (mm)	150	1) Roof A1: 31.9mm 2) Roof B1: 43.40mm 3) Roof B2: 36.40mm
Least number of Drain per 900 m^2	1	Met
Minimum Number of Drain per roof	2	1) Roof A1: 2 2) Roof B1: 2 3) Roof B2: 3

7.2 Minor Storm Sewer System

Designing the storm sewers to makes sure the capacity to transportation of the runoff of only a 5-year storm event to the municipal drain. The post-development drainage areas for the site are shown on Drawing DR-103 in the Appendix A.

Detailed breakdown of the land use and the runoff coefficients during post-development conditions are given in Drawing DR-103. The calculations for the sizing of the pipes for channelling the surface water flow from a 5-year storm event system are presented in Design Sheets (Appendix C).

Hydraulic Load calculations for all parcels performed according to OBC Part 7 and presented in Appendix I.

7.3 Major Drainage System

The overland flow will not impact the proposed developed site since the grading of the site ensures storm flows greater than 100 years will be able to flow overland through the site towards King Road East without any impact on proposed buildings (Refer: Drawing C1).

7.4 Phase 2 Pre and Post development Flow

Topographical Survey elevations indicate that the at existing condition stormwater flows from north to south towards the right of way of King Street East as surface overland flow. There are some pockets of depression exists indicates possibility of some ponding. Ponding depth will be around 50 mm. Since the boundary of the adjacent property and proposed phase 1 development is in higher elevation than the discharge point along King Street East – no impact of flooding is anticipated. On the other hand - the minor nature of ponding will facilitate infiltration and percolation ultimately recharging ground water. Therefore, existing grading of the phase 2 proposed to remain undisturbed during phase 1 development. Existing overland flow path shown in Figure DR 102 (Appendix A, Servicing and Stormwater Management Report)

Post development servicing and grading for proposed phase 2 development designed as per criteria presented in section 6.0 and presented in Site Servicing Plan (DWG. C2) and Grading Plan (DWG. C1).

7.5 Flow restriction along East Boundary

According to topographical survey map the elevation along east property shows a ditch line slopping from north to south. Part of the ditch falls inside the property of proposed development. Elevation of the boundary along east property line proposed to rise to

capture Stromwater inside the property. To prevent Stromwater overflow towards neighbouring property – a low height precast barrier curb proposed to install along south limit of property line. (Refer: Site Grading Plan, DWG C1).

8.0 Water Quality Control Plan

8.1 Oil and Grit Separator

To substantially improve the water quality of the water leaving the site, oil/grit separating devices are proposed that be installed for water quality treatment. The suggested units for the area of the site and the level of treatment desired will be in accordance with the attached "Hydroworks Sizing Summaries". Owner's manual and details also attached in Appendix F. Sizing of Oil and Grit separators summarized in Table 5.

Table 7: TSS Removal Design Summary

Development Area	Proposed Model	Flow Capture (%)	TSS Removal (%)
Parcel A	Hydrostorm HS6	99	83
Parcel B – Phase 1	Hydrostorm HS6	99	84
Parcel B –Phase 2	Hydrostorm HS6	100	80

9.0 Erosion and Sediment Control

During the construction period, total sediment loadings are much greater than for pre-development and post-development conditions. Also, with site regarding, water borne sediment quantities will increase. As a consequence, sediment control will be required during the construction phase. An erosion and sediment control plan prepared and presented in drawing C3.

Sediment control could be effectively implemented by the following procedures that are recommended to minimize the transportation of sediments out of the property, especially during construction:

1. Filter bags shall be attached to hoses where pumping is carried out from excavations and the filter bags shall be maintained on a regular basis;

2. During the construction period, a mud mat shall be provided at the entrance into and the exit from the area under construction, to minimize sediment transportation from the site to the municipal roads;

3. Limit extent of exposed excavation;

4. Installation of a silt fence to prevent sediment from entering the existing conveyance system;

5. Provide sediment traps to existing catch basins;

6. Scheduling construction during times when there is no danger of flooding.

10.0 Inspection and Maintenance of Stormwater Management Works

Regular monitoring and periodic cleaning will have to be undertaken to ensure that the stormwater management works are functioning properly. Inspections of erosion and sediment control devices must be done weekly, after every rainfall event and on a precautionary basis following inclement weather forecasts. Property owners have the obligation to maintain and inspect oil and grit separators located on their sites and parking lots. Oil and Grits separator manufacturer's guidelines for its maintenance must be strictly adhered to for its efficient operation. Owner's manual for operation and maintenance for Oil and Grits separators enclosed in Appendix F.

To ensure the inspection and maintenance for the Oil and Grits Separators following steps are recommended to be taken by own of the gas station:

1. Owners of the property to enter into a service & maintenance agreement for installed oil and grease Separator with Certified Maintenance Operator to clean oil and grease interceptor at least once annually;

2. Provisions in the agreement should include a defined inspection frequency, a commitment to maintain and structured reporting protocols;

3. Owner or operator should ensure inception of installed interceptor regularly to ensure performance is maintained to the manufacturer's specifications for performance and to ensure the surface oil and sediment levels do not exceed the recommended level;

4. Tanks, lids, baffles & Vents to be inspected with solid & oil/grease pumped out each 3 months, or adjusted to suit use(but not less than once per year);

5. The use of solvents, hot water or other agents to facilitate passage of oil & grease through the interceptor in not permitted;

6. In case of failure to adequately maintain the oil and grease interceptor to the satisfaction of the municipality, the municipality may require an alarmed monitoring device to be installed, at the expense of the owner.

7. All manholes, catchbasin to be inspected periodically to ensure no clogging;

8. After every rainfall event – parking lot ponding to be observed to ensure flows are not restricted by clogging;

9. Immediate repair work to be under taken to clean any obstruction in the storm and sanitary sewer system;

10. All documentation of inspector inspection, clean-out, and sediment disposal shall be retained for a minimum of two years as proof for municipal inspections purpose.

11.0 Sanitary Sewer Service Connections

Sanitary sewer service connection proposed for proposed development as follows:

1) Parcel A: a 150 mm diameter at 2.0% slope proposed to connect to existing 150mm sanitary plug.

2) Parcel B: a 150 mm diameter at 2.0% slope proposed to connect to existing 150mm sanitary plug.

3) Proposed phase 1 construction proposed to provide a plug at the boundary of phases to connect phase 2 sanitary sewer.

4) Hydraulic Load analysis performed as per OBC Part 7 and presented in Appendix H (Refer: Sanitary Sewer Capacity Analysis)

5) Hydraulic Analysis for Sanitary sewage and water Load attached in Appendix J.

12.0 Summary and Conclusion

- To control post-development runoff to pre-development runoff up to 100-year rainfall event, quantity controls are required which are provided through orifice control.
- To ensure water quality oil and grit separators are recommended for the site.
- Overland flow route through the site ensures that major overland flows are safely carried through the site.
- Erosion control such as installation of temporary silt fence, mud matt & rock check dams (if necessary) are recommended to minimize off-site sediment transport.

We trust you will find this submission complete and in order. Should you have any questions, please contact the undersigned.

Respectfully submitted.

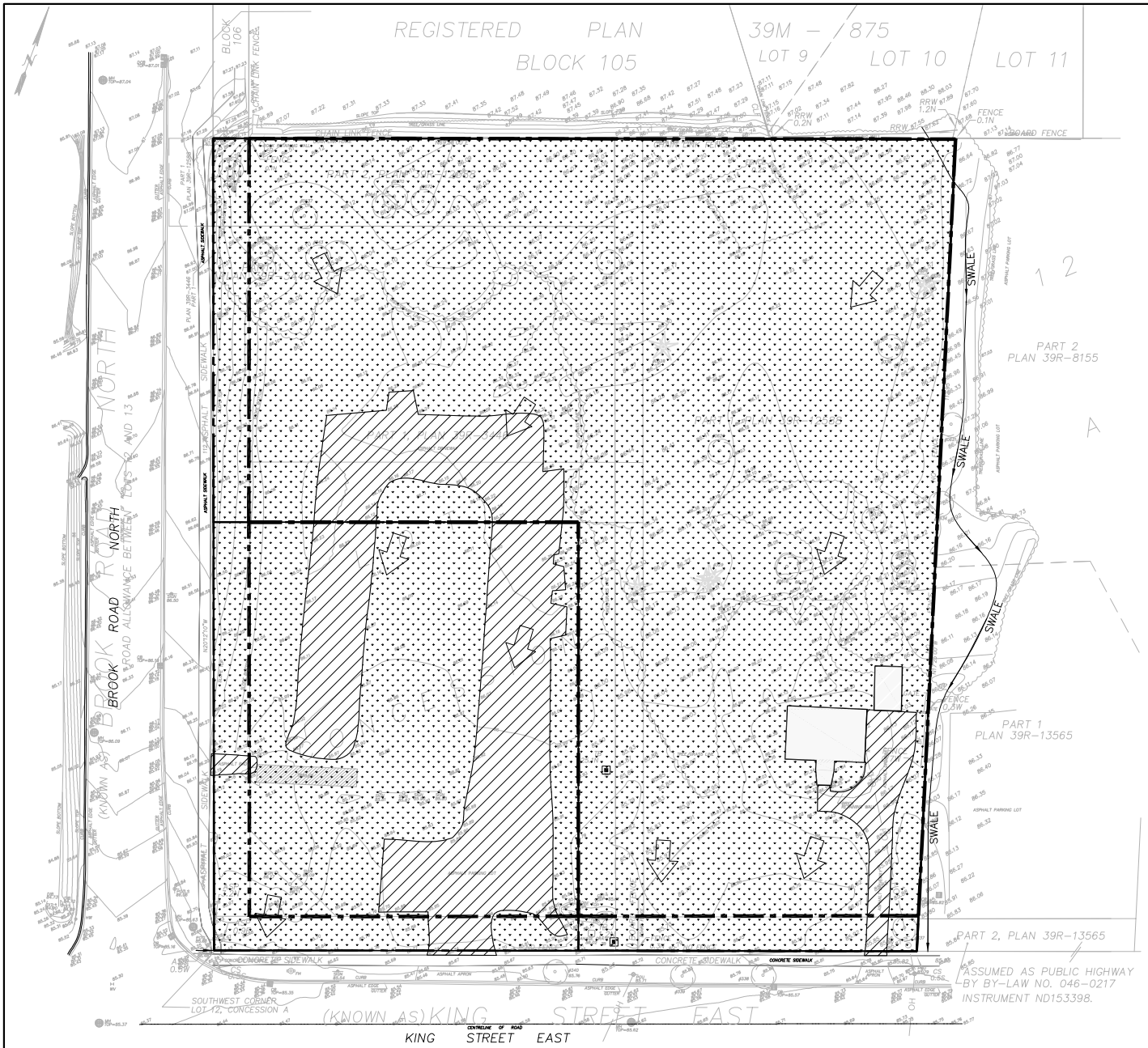
Abu S Ziauddin P. Eng. M.Eng
PROJECT MANAGER

n Architecture Inc

Ramyar Mehraban M. Eng. EIT
MUNICIPAL PROJECT DESIGNER

n Architecture Inc.

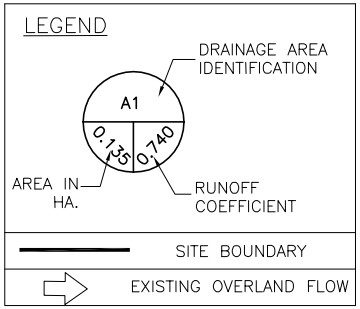
Appendix A
Figures



PRE–DEVELOPMENT LAND USE TABLE

LAND COVER	HATCH	AREA (SQ.M.)	RUNOFF CO–EFFICCIENT
ROOF		113.50	0.95
LANDSCAPING		9544.06	0.25
CONCRETE/ ASPHALT		1663.02	0.95

LEGEND



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PROJECT:

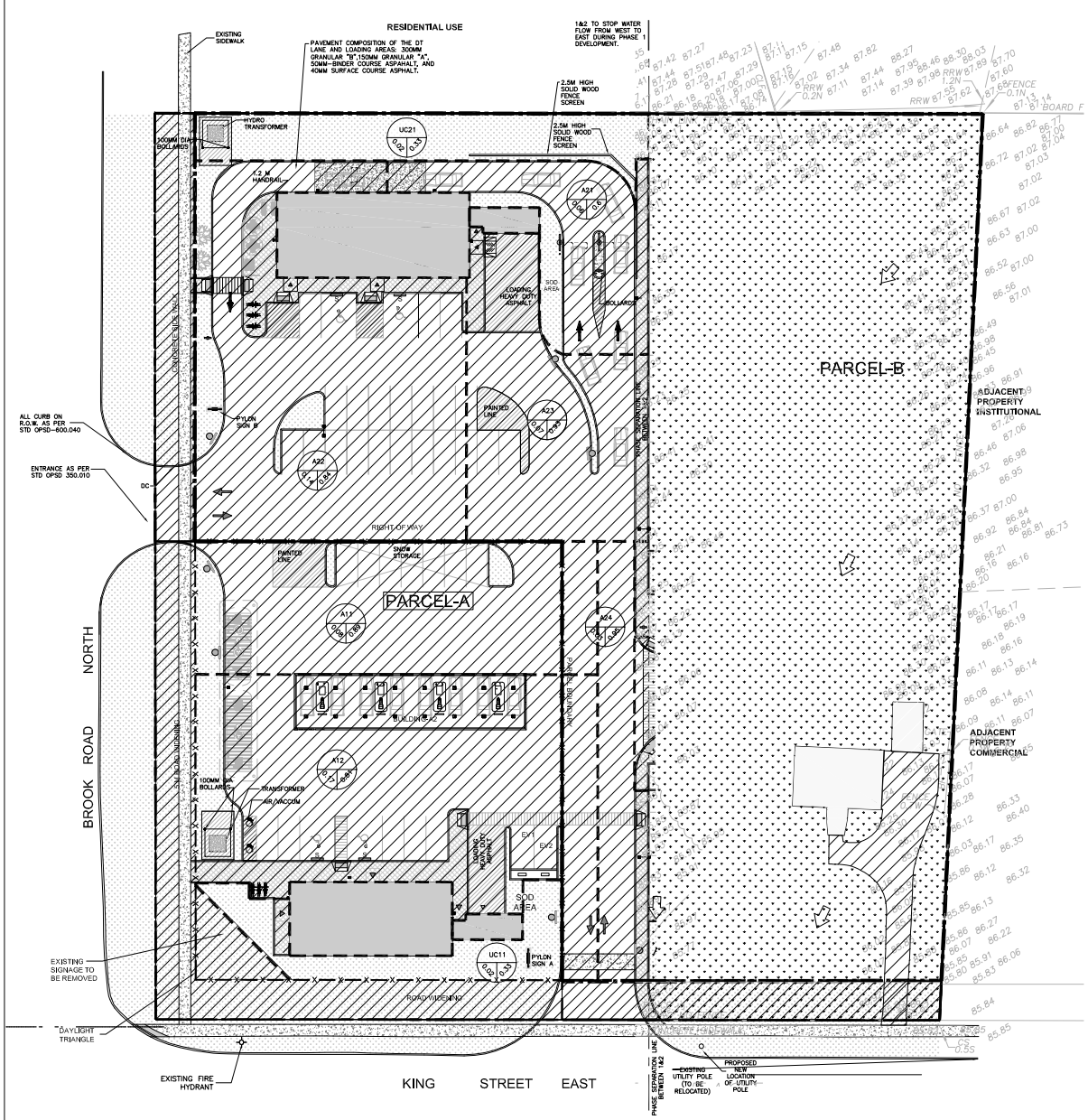
COMMERCIAL DEVELOPMENT 428 AND 432 KING STREET EAST, COBOURG, ON

DRAWING TITLE:

PRE-DEVELOPMENT SITE DRAINAGE PLAN

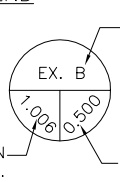
DRAWN BY: AZ	DATE: 21 OCTOBER 2019
CHECKED BY: AZ	SCALE: NTS
PROJECT NO.: **19-43**	DRAWING NO.: **DR-101**

N
(GEODETIC NORTH)
PROJECT NORTH

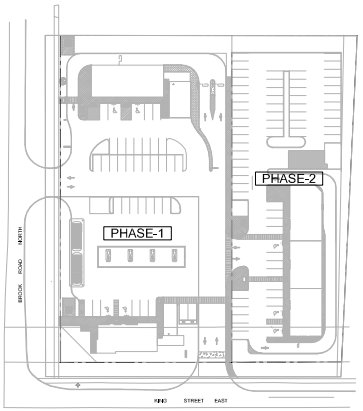


LAND COVER	HATCH	AREA (SQ.M.)	RUNOFF CO-EFFICCIENT
ROOF		1072.73	0.95
LANDSCAPING		1818.75	0.25
CONCRETE/ ASPHALT		7410.86	0.95

LEGEND



- DRAINAGE BOUNDARY
- SITE BOUNDARY
- PARCEL BOUNDARY
- OVERLAND FLOW



PARCEL A

SUBCATCHMENT	GREEN	ROOF	ASPHALT /CONCRETE
A11	67.70	0.00	765.09
A12	88.32	0.00	1250.11
BLD2	0.00	212.47	0.00
UC11	284.80	0.00	68.01

PARCEL B (PHASE 1)

SUBCATCHMENT	GREEN	ROOF	ASPHALT /CONCRETE
A21	63.53	0.00	344.58
A22	113.50	0.00	1198.67
A23	13.30	0.00	655.62
A24	0.00	0.00	297.60
BLD1	0.00	280.80	0.00
UC21	308.44	0.00	32.57

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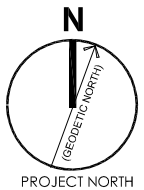
PROJECT:

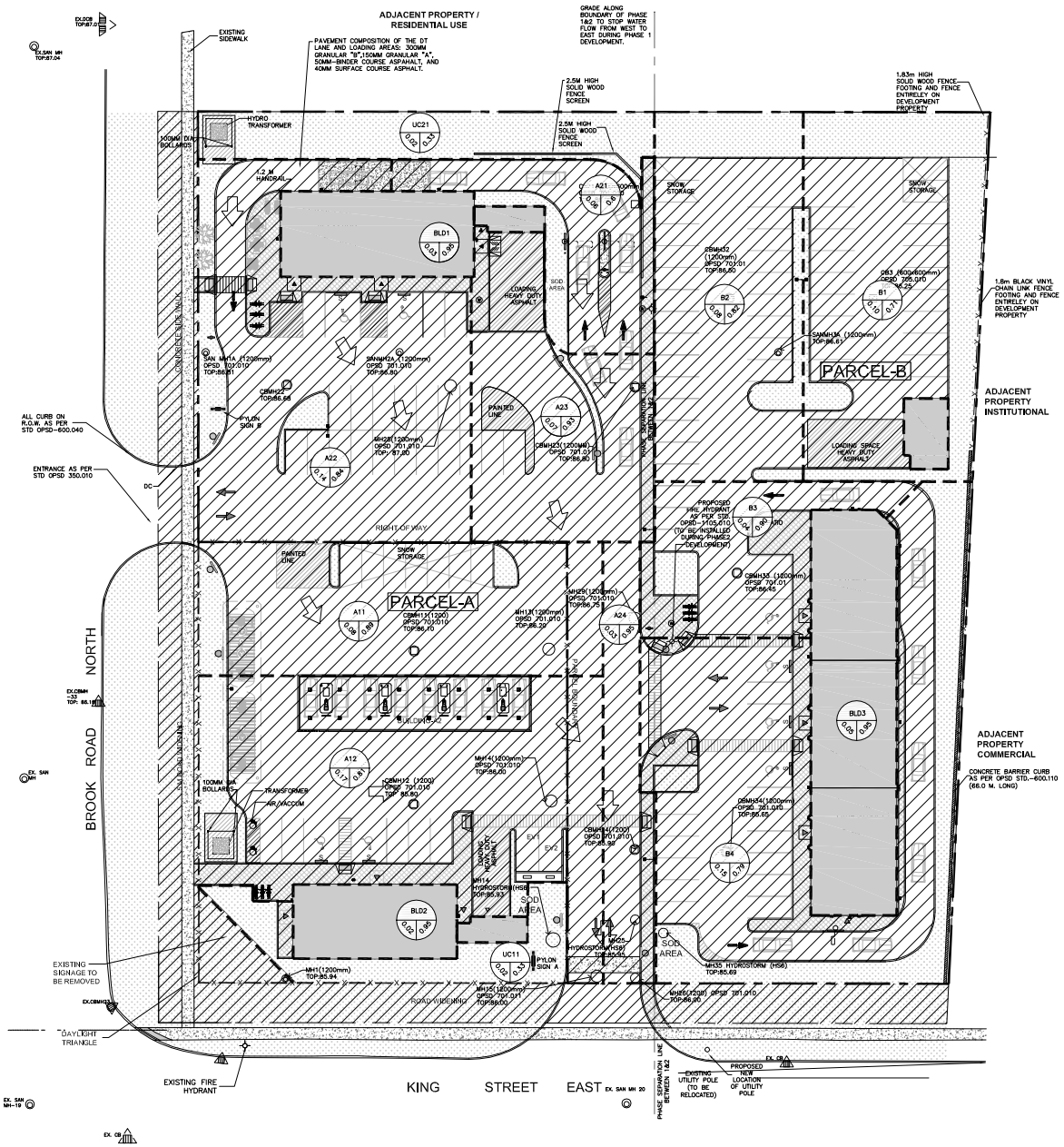
COMMERCIAL DEVELOPMENT 428 AND 432 KING STREET EAST, COBOURG, ON

DRAWING TITLE:

POST-DEVELOPMENT SITE DRAINAGE PLAN (PHASE 1)

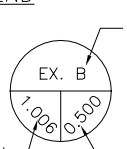
DRAWN BY: AZ	DATE: 21 OCTOBER 2019
CHECKED BY: AZ	SCALE: NTS
PROJECT NO.: **19-43**	DRAWING NO.: **DR-102**



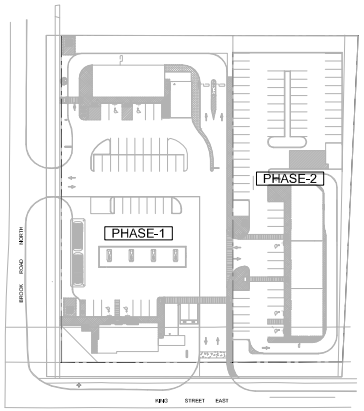


LAND COVER	HATCH	AREA (SQ.M.)	RUNOFF CO-EFFICCIENT
ROOF		1072.73	0.95
LANDSCAPING		1818.75	0.25
CONCRETE/ ASPHALT		7410.86	0.95

LEGEND



- DRAINAGE BOUNDARY
- SITE BOUNDARY
- PARCEL BOUNDARY
- OVERLAND FLOW



PARCEL A

SUBCATCHMENT	GREEN	ROOF	ASPHALT /CONCRETE
A11	67.70	0.00	765.09
A12	88.32	0.00	1250.11
BLD2	0.00	212.47	0.00
UC11	284.80	0.00	68.01

PARCEL B (PHASE 1)

SUBCATCHMENT	GREEN	ROOF	ASPHALT /CONCRETE
A21	63.53	0.00	344.58
A22	113.50	0.00	1198.67
A23	13.30	0.00	655.62
A24	0.00	0.00	297.60
BLD1	0.00	280.80	0.00
UC21	308.44	0.00	32.57

PARCEL B (PHASE 2)

SUBCATCHMENT	GREEN	ROOF	ASPHALT /CONCRETE
B1	346.38	46.74	616.22
B2	160.68	0.00	681.05
B3	28.10	0.00	343.90
B4	344.01	0.00	1157.43
BLD3	0.00	532.72	0.00

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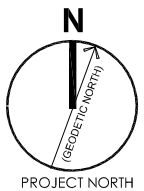
PROJECT:

COMMERCIAL DEVELOPMENT 428 AND 432 KING STREET EAST, COBOURG, ON

DRAWING TITLE:

POST-DEVELOPMENT SITE DRAINAGE PLAN (PHASE 2)

DRAWN BY: AZ	DATE: 21 OCTOBER 2019
CHECKED BY: AZ	SCALE: NTS
PROJECT NO.: 19-43	DRAWING NO.: DR-103



KEY PLAN – NOT TO SCALE

TOPOGRAPHIC BASE PLAN OF

428 & 432 KING STREET EAST
TOWN OF COBURG

SCALE 1 : 250 METRES

0 1 2 3 4 5 10 20

CAUTION

THIS IS NOT A PLAN OF SURVEY AND SHALL NOT BE USED EXCEPT FOR THE PURPOSE INDICATED IN THE TITLE BLOCK.

BOUNDARY INFORMATION SHOWN HEREON IS DERIVED FROM A PLAN OF SURVEY PREPARED BY IVAN B. WALLACE OLS LTD. DATED MARCH 7, 2019.

COORDINATES

COORDINATE VALUES AND DIGITAL FILE ARE IN GRID SYSTEM, UTM ZONE 17N, NAD83(CSRS)(2010).
COMBINED SCALE FACTOR = 1.000237

NOTE

ONLY TAGGED TREES ARE SHOWN ON THIS PLAN.

CONTOURS

CONTOURS SHOWN HEREON ARE DRAWN AT 0.20 METRE INTERVALS.

ELEVATIONS

ELEVATIONS ARE GEODETIC AND REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD28) BY DIRECT MEASUREMENT TO A REAL TIME NETWORK.

IMAGERY

AERIAL IMAGERY SHOWN IS FOR ILLUSTRATIVE PURPOSES ONLY AND MAY NOT DEPICT CURRENT FEATURES.

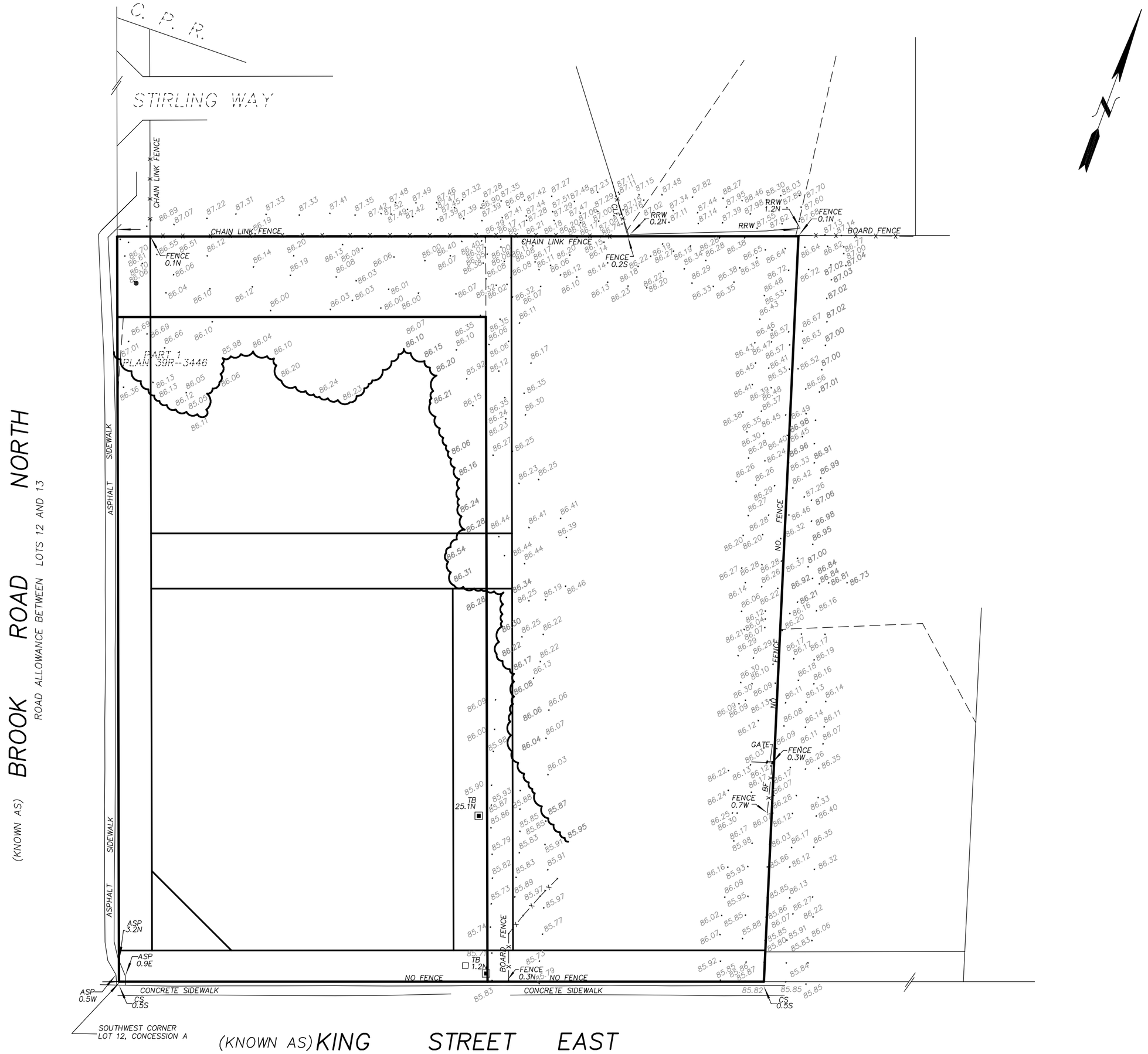
LEGEND

WV	DENOTES WATER VALVE/KEY
FH	DENOTES FIRE HYDRANT
AN	DENOTES ANCHOR POINT
POU	DENOTES UTILITY POLE
POTL	DENOTES TRAFFIC SIGNAL POLE
POUTLS	DENOTES UTILITY/TRAFFIC/LIGHT STANDARD
–OH–	DENOTES OVERHEAD UTILITY WIRES
MH	DENOTES MAINTENANCE HOLE ELEVATION AT CENTRE
CB	DENOTES CATCH BASIN ELEVATION AT TOP CENTRE
TB	DENOTES TERMINAL BOX
	DENOTES SIGN
HW	DENOTES HAND WELL
DIT	DENOTES DITCH INLET ELEVATION AT TOP
DIB	DENOTES DITCH INLET ELEVATION AT BOTTOM
	DENOTES CONIFEROUS TREE W/TRUNK DIAMETER
	DENOTES DECIDUOUS TREE W/TRUNK DIAMETER
+123.45	DENOTES SPOT ELEVATION
	DENOTES POST SIGN

IBW SURVEYORS

IBWSURVEYORS.COM | 1.800.667.0696

PARTY CHIEF: AR | DRAWN BY: WS | CHECKED BY: CC | PLOT DATE: NOV. 7, 2019
FILE NAME: ... 925 topobase - 2.dwg



IBW SURVEYORS

IBWSURVEYORS.COM | 1.800.667.0696

Appendix B
Flow Analysis

Calculation Sheet 1A

(PARCEL A)

n Architecture Inc

Project:	**Commercial Development**
Address:	**428-432 King Street East-Parcel A**
Town/Township/City	**Town of Cobourg, ON**
Project No.	**n1943**
Proposed Development Area (m^2)	**2751.82**
Date:	**9/30/2020**

PRE-DEVELOPMENT RUNOFF COFFICENT

AREA TYPE	AREA (M^2)	RUNOFF COEFFICIENT "C"	AREA x C
ASPHALT	1041.0	0.95	988.95
BUILDING ROOF	0.0	0.95	0.00
LANDSCAPED AREA	1691.8	0.25	422.96
		ΣAREA X C	1411.91
		WEIGHTED AVERAGE "C"	**0.52**
		AREA "A" (Hectares)	0.2733

Rainfall intensity:

$$I = \frac{a}{(b + T_d)}$$

Where:

I = Rainfall Intensity (mm/hr)
a = coefficient
b = coefficient

T_d=Time of concentration(min))

Design Flow:

$$Q = 0.002778CIA$$

Where:

Q= volume of runoff (m^3/second)
C = Runoff coefficient
A = contributing draingae area (hectares)
I= rainfall intensity (milimeters/hour)

Return Period (Years)	2 -Years	5-Years	10 -Years	25 -Years	50 -Years	100-Years
a	1778.0	2464.0	2819.0	3886.0	4750.0	5588.0
b	13.0	16.0	16.0	18.0	24.0	28.0
T_d (mins)	10.00	10.00	10.00	10.00	10.00	10.00
i (mm/hr)	77.30	94.77	108.42	138.79	139.71	147.05
C	0.52	0.52	0.52	0.52	0.52	0.52
Q (m^3/sec)	0.03	0.04	0.04	0.05	0.05	0.06
Q (l/sec)	30.32	37.17	42.52	54.43	54.79	57.67

Rainfall intensity formulas (beyond Clarigton) as per Ganaraska Region Conservation Authority, Dec 2014

Calculation Sheet 2A

(PARCEL-A)

n Architecture Inc

Project:	**Commercial Development**
Address:	**428-432 King Street East-Parcel A**
Town/Township/City	**Town of Cobourg, ON**
Project No.	**n1943**
Proposed Development Area (m^2)	**2751.82**
Date:	**9/30/2020**

POST DEVELOPMENT RUNOFF COFFICENT

AREA TYPE	AREA (M^2)	RUNOFF COEFFICIENT "C"	AREA x C
ASPHALT/CONC.	2013.92	0.95	1913.22
LANDSCAPED AREA	479.39	0.25	119.85
BUILDING	185.83	0.95	176.54
		ΣAREA X C	2209.61
		WEIGHTED AVERAGE "C"	**0.82**
		AREA "A" (Hectares)	0.2679

Rainfall intensity:

$$I = \frac{a}{(b + T_d)}$$

Where:

I = Rainfall Intensity (mm/hr)

a = coefficient

b = coefficient

T_d=Time of concentration(min)

Design Flow:

$$Q = 0.002778CIA$$

Where:

Q= volume of runoff (m^3/second)

C = Runoff coefficient

A = contributing draingae area (hectares)

I= rainfall intensity (milimeters/hour)

I= Average rainfall intensity (milimeters/hour)

Return Period (Years)	2 -Years	5-Years	10 -Years	25 -Years	50 -Years	100-Years
A	1778.0	2464.0	2819.0	3886.0	4750.0	5588.0
B	13.0	16.0	16.0	18.0	24.0	28.0
t (mins)	10.00	10.00	10.00	10.00	10.00	10.00
I (mm/hr)	77.30	94.77	108.42	138.79	139.71	147.05
C	0.82	0.82	0.82	0.82	0.82	0.82
Q (m^3/sec)	0.05	0.06	0.07	0.09	0.09	0.09
Q (l/sec)	47.45	58.17	66.55	85.18	85.75	90.26

Rainfall intensity formulas (beyond Clarigton) as per Ganaraska Region Conservation Authority, Dec 2014

Calculation Sheet 1B1

(PARCEL-B PHASE -1)

n Architecture Inc

Project:	**Commercial Development**
Address:	**428-432 King Street East-Parcel B Phase 1**
Town/Township/City	**Town of Cobourg, ON**
Project No.	**n1943**
Pre-development Development Area (m^2)	**3261**
Date:	**10/27/2020**

PRE-DEVELOPMENT RUNOFF COFFICENT

AREA TYPE	AREA (M^2)	RUNOFF COEFFICIENT "C"	AREA x C
ASPHALT	254.000	0.95	241.30
BUILDING ROOF	0.000	0.95	0.00
LANDSCAPED AREA	3007.000	0.25	751.75
		ΣAREA X C	993.05
		WEIGHTED AVERAGE "C"	**0.30**
		AREA "A" (Hectares)	0.3261

Rainfall intensity:

$$I = \frac{a}{(b + T_d)}$$

Where:
I = Rainfall Intensity (mm/hr)
a = coefficient
b = coefficient
T_d=Time of concentration(hr)

Design Flow:

$$Q = 0.002778CIA$$

Where:

Q= volume of runoff (m^3/second)
C = Runoff coefficient
A = contributing draingae area (hectares)
I= rainfall intensity (milimeters/hour)

Return Period (Years)	2 -Years	5-Years	10 -Years	25 -Years	50 -Years	100-Years
a	1778.0	2464.0	2819.0	3886.0	4750.0	5588.0
b	13.0	16.0	16.0	18.0	24.0	28.0
t (mins)	10.00	10.00	10.00	10.00	10.00	10.00
i (mm/hr)	77.30	94.77	108.42	138.79	139.71	147.05
Modified C	0.30	0.30	0.30	0.30	0.30	0.30
Q (m^3/sec)	0.02	0.03	0.03	0.04	0.04	0.04
Q (l/sec)	21.32	26.14	29.91	38.28	38.54	40.56

Rainfall intensity formulas (beyond Clarigton) as per Ganaraska Region Conservation Authority, Dec 2014

Calculation Sheet 2B1

(PARCEL-B PHASE-1)

n Architecture Inc

Project:	**Commercial Development**
Address:	**428-432 King Street East-Parcel B Phase 1**
Town/Township/City	**Town of Cobourg, ON**
Project No.	**n1943**
Proposed Development Area (m^2)	**3261**
Date:	**10/27/2020**

POST DEVELOPMENT RUNOFF COFFICENT

AREA TYPE	AREA (M^2)	RUNOFF COEFFICIENT "C"	AREA x C
ASPHALT/CONC.	2486.980	0.95	2362.63
LANDSCAPED AREA	520.190	0.25	130.05
BUILDING	254.140	0.95	241.43
		ΣAREA X C	2734.11
		WEIGHTED AVERAGE "C"	**0.84**
		AREA "A" (Hectares)	0.3261

Rainfall intensity:

$$I = \frac{a}{(b + T_d)}$$

Where:

I = Rainfall Intensity (mm/hr)

a = coefficient

b = coefficient

T_d=Time of concentration(min)

Design Flow:

$$Q = 0.002778CIA$$

Where:

Q= volume of runoff (m^3/second)

C = Runoff coefficient

A = contributing draingae area (hectares)

I= rainfall intensity (milimeters/hour)

Return Period (Years)	2 -Years	5-Years	10 -Years	25 -Years	50 -Years	100-Years
a	1778.0	2464.0	2819.0	3886.0	4750.0	5588.0
b	13.0	16.0	16.0	18.0	24.0	28.0
t (mins)	10.00	10.00	10.00	10.00	10.00	10.00
I (mm/hr)	77.30	94.77	108.42	138.79	139.71	147.05
Modified C	0.84	0.84	0.84	0.84	0.84	0.84
Q (m^3/sec)	0.06	0.07	0.08	0.11	0.11	0.11
Q (l/sec)	58.71	71.97	82.34	105.40	106.10	111.68

Rainfall intensity formulas (beyond Clarigton) as per Ganaraska Region Conservation Authority, Dec 2014

Calculation Sheet 1B2

(PARCEL -B PHASE-2)

n Architecture Inc

Project:	**Commercial Development**
Address:	**428-432 King Street East-Parcel B Phase 2**
Town/Township/City	**Town of Cobourg, ON**
Project No.	**n1943**
Pre-development Development Area (m^2)	**4213**
Date:	**10/27/2020**

PRE-DEVELOPMENT RUNOFF COFFICENT

AREA TYPE	AREA (M^2)	RUNOFF COEFFICIENT "C"	AREA x C
ASPHALT	135.230	0.95	128.47
BUILDING ROOF	113.500	0.95	107.83
LANDSCAPED AREA	3964.530	0.25	991.13
		ΣAREA X C	1227.43
		WEIGHTED AVERAGE "C"	**0.29**
		AREA "A" (Hectares)	0.4213

Rainfall intensity:

$$I = \frac{a}{(b + T_d)}$$

Where:
I = Rainfall Intensity (mm/hr)
a = coefficient
b = coefficient
T_d=Time of concentration(min)

Design Flow:

$$Q = 0.002778CIA$$

Where:

Q= volume of runoff (m^3/second)
C = Runoff coefficient
A = contributing draingae area (hectares)
I= rainfall intensity (milimeters/hour)

Return Period (Years)	2 -Years	5-Years	10 -Years	25 -Years	50 -Years	100-Years
a	1778.0	2464.0	2819.0	3886.0	4750.0	5588.0
b	13.0	16.0	16.0	18.0	24.0	28.0
t (mins)	10.00	10.00	10.00	10.00	10.00	10.00
i (mm/hr)	77.30	94.77	108.42	138.79	139.71	147.05
Modified C	0.29	0.29	0.29	0.29	0.29	0.29
Q (m^3/sec)	0.03	0.03	0.04	0.05	0.05	0.05
Q (l/sec)	26.36	32.31	36.97	47.32	47.63	50.14

Rainfall intensity formulas (beyond Clarigton) as per Ganaraska Region Conservation Authority, Dec 2014

Calculation Sheet 2B2

(Parcel B -Phase 2)

n Architecture Inc

Project:	**Commercial Development**
Address:	**428-432 King Street East-Parcel B Phase 2**
Town/Township/City	**Town of Cobourg, ON**
Project No.	**n1943**
Proposed Development Area (m^2)	**3370**
Date:	**9/30/2020**

POST DEVELOPMENT RUNOFF COFFICENT

AREA TYPE	AREA (M^2)	RUNOFF COEFFICIENT "C"	AREA x C
ASPHALT/CONC.	2780.760	0.95	2641.72
LANDSCAPED AREA	899.850	0.25	224.96
BUILDING	532.720	0.95	506.08
		ΣAREA X C	3372.77
		WEIGHTED AVERAGE "C"	**0.80**
		AREA "A" (Hectares)	0.4213

Rainfall intensity:

$$I = \frac{a}{(b + T_d)}$$

Where:

I = Rainfall Intensity (mm/hr)

a = coefficient

b = coefficient

T_d=Time of concentration(min)

Design Flow:

$$Q = 0.002778CIA$$

Where:

Q= volume of runoff (m^3/second)

C = Runoff coefficient

A = contributing draingae area (hectares)

I= rainfall intensity (milimeters/hour)

Return Period (Years)	2 -Years	5-Years	10 -Years	25 -Years	50 -Years	100-Years
a	1778.0	2464.0	2819.0	3886.0	4750.0	5588.0
b	13.0	16.0	16.0	18.0	24.0	28.0
t (mins)	10.00	10.00	10.00	10.00	10.00	10.00
I (mm/hr)	77.30	94.77	108.42	138.79	139.71	147.05
Modified C	0.80	0.80	0.80	0.80	0.80	0.80
Q (m^3/sec)	0.07	0.09	0.10	0.13	0.13	0.14
Q (l/sec)	72.42	88.79	101.58	130.03	130.89	137.77

Rainfall intensity formulas (beyond Clarigton) as per Ganaraska Region Conservation Authority, Dec 2014

Calculation Sheet 3A

(Uncontrolled Flow)

n Architecture Inc

Project:	**Commercial Development**
Address:	**428-432 King Street East-Parcel A**
Town/Township/City	**Town of Cobourg, ON**
Project No.	**n1943**
Proposed Development Area (m^2)	**2751.82**
Date:	**9/30/2020**

POST DEVELOPMENT RUNOFF COFFICENT

AREA TYPE	AREA (M^2)	RUNOFF COEFFICIENT "C"	AREA x C
ASPHALT/CONC.	25.000	0.95	23.75
LANDSCAPED AREA	205.000	0.25	51.25
BUILDING	0.000	0.95	0.00
		ΣAREA X C	75.00
		WEIGHTED AVERAGE "C"	**0.33**
		AREA "A" (Hectares)	0.0230

Rainfall intensity:

$$I = \frac{a}{(b + T_d)}$$

Where:

I = Rainfall Intensity (mm/hr)

a = coefficient

b = coefficient

T_d =Time of concentration(min) 10.00

Design Flow:

$$Q = 0.0028\ CIA$$

Where:

Q= Flow (m^3/second)

C = Runoff coefficient

A = Draingae Area (hectares)

I= Average rainfall intensity (milimeters/hour)

Return Period (Years)	2 -Years	5-Years	10 -Years	25 -Years	50 -Years	100-Years
A	1778.00	2464.00	2819.00	3886.00	4750.00	5588.00
B	13.000	16.000	16.000	18.000	24.000	28.000
t (mins)	10.00	10.00	10.00	10.00	10.00	10.00
I (mm/hr)	77.30	94.77	108.42	138.79	139.71	147.05
C	0.33	0.33	0.46	0.53	0.60	0.66
Q (m^3/sec)	0.00	0.00	0.00	0.00	0.01	0.01
Q (l/sec)	1.61	1.97	3.19	4.68	5.32	6.23

Calculation Sheet 3B1

(PARCEL-B PHASE-1)

n Architecture Inc

Project:	**Commercial Development**
Address:	**428-432 King Street East-Parcel B Phase 1**
Town/Township/City	**Town of Cobourg, ON**
Project No.	**n1943**
Proposed Development Area (m^2)	**3370**
Date:	**9/30/2020**

POST DEVELOPMENT RUNOFF COFFICENT

AREA TYPE	AREA (M^2)	RUNOFF COEFFICIENT "C"	AREA x C
ASPHALT/CONC.	24.500	0.95	23.28
LANDSCAPED AREA	319.000	0.25	79.75
BUILDING	0.000	0.95	0.00
		ΣAREA X C	103.03
		WEIGHTED AVERAGE "C"	**0.30**
		AREA "A" (Hectares)	0.0344

Rainfall intensity:

$$I = \frac{a}{(b + T_d)}$$

Where:

I = Rainfall Intensity (mm/hr)

a = coefficient

b = coefficient

T_d=Time of concentration(min)

Design Flow:

$$Q = 0.002778CIA$$

Where:

Q= volume of runoff (m^3/second)

C = Runoff coefficient

A = contributing draingae area (hectares)

I= rainfall intensity (milimeters/hour)

Return Period (Years)	2 -Years	5-Years	10 -Years	25 -Years	50 -Years	100-Years
a	1778.0	2464.0	2819.0	3886.0	4750.0	5588.0
b	13.0	16.0	16.0	18.0	24.0	28.0
t (mins)	10.00	10.00	10.00	10.00	10.00	10.00
I (mm/hr)	77.30	94.77	108.42	138.79	139.71	147.05
Modified C	0.30	0.30	0.30	0.30	0.30	0.30
Q (m^3/sec)	0.00	0.00	0.00	0.00	0.00	0.00
Q (l/sec)	2.21	2.71	3.10	3.97	4.00	4.21

Rainfall intensity formulas (beyond Clarigton) as per Ganaraska Region Conservation Authority, Dec 2014

Appendix C

Orifice Sizing
Detention Storage Analysis

n Architecture Inc

Table 1A

Orifice Sizing Calculations

(PARCEL -A)

Project:	**Commercial Development**
Address:	**428-432 King Street East-Parcel A**
Town/Township/City	**Town of Cobourg, ON**
Project No.	**n1943**
Proposed Development Area (m^2)	**6477.1**
Date:	**9/30/2020**

Orifice Location	MH1	
Orifice Type	Eccentric Reducer Pipe	
Invert Elevation	84.200	m
Min. Ground Elevation	85.800	m
Orifice Center Elevation	84.255	
Diameter of Orifce Pipe	110	mm
Area of Orifice (A)	0.0094985	m^2
Coefficient of Discharge (C_d)	0.8	
Gravitational Constant	9.81	

Orifice Flow Equation:

$$Q = C_d A_o \sqrt{(2gH)}$$

Where:

Q = Flow (m3/sec)

A_o = Orifice area (m2)

g = Gravitational Constant

H = Center line head (m)

C_d = coefficient of discharge, dimensionless, typically between 0.6 and 0.85, depending on the orifice geometry

	2 years	5 years	10 years	25 years	50 years	100 years
Ponding Depth (m)	-0.850	-0.700	-0.250	0.100	0.150	0.200
Water Elevation	84.95	85.10	85.55	85.90	85.95	86.00
Upstearm Head (m)	0.695	0.845	1.295	1.645	1.695	1.745
Total Controlled Discharge (L/sec)	**28.06**	**30.94**	**38.30**	**43.17**	**43.82**	**44.46**
Discharge Velocity (m/sec)	2.95	3.26	4.03	4.54	4.61	4.68
Pre-developmet Peak Flow (L/sec)	30.32	37.17	42.52	54.43	54.79	57.67
Uncontrolled Flow (L/sec)	1.61	1.97	3.19	4.68	5.32	6.23
Allowable Peak Flow (l/sec)	**28.71**	**35.19**	**39.33**	**49.75**	**49.48**	**51.44**
Detention Storage Required (m^3)	**12.20**	**17.39**	**17.86**	**27.60**	**29.31**	**34.17**
Storage in MH/CB (m^3)	3.07	3.07	3.07	3.07	3.07	3.07
Storage in Pipes (m^3)	4.93	4.93	4.93	4.93	4.93	4.93
Roof Top Storage (m^3)	5.93	5.93	5.93	5.93	5.93	5.93
Ponding on Surface (m^3)	0.00	3.45	3.92	13.66	15.36	20.23
Total Available Storage (m^3)	**13.94**	**13.94**	**43.36**	**43.36**	**43.36**	**43.36**

On-Site Storage Calculator

Town of Cobourg, ON

Project: **Commercial Development**

Project No.: **n1943**

Date: **30-Sep-20**

n Architecture Inc

Table 2A - 2 Years Storage (PARCEL A)

Comp. Runoff Coeff.R =	0.82		
A =	0.27	ha	
$Q_{release}$ =	0.028	m^3/s	
	28.06	L/s	

Equation of IDF:

$$i = \frac{A}{(t+B)^C}$$

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (hr)

a= 1778

b= 13

Storage Required (m^3)	12.20

t_d (min)	i_2 (mm/hr)	Q_2 (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
10	77.30	0.048	0.020	12.203	***
11	74.08	0.046	0.018	12.093	
12	71.12	0.045	0.016	11.856	
13	68.38	0.043	0.015	11.508	
14	65.85	0.041	0.013	11.062	
15	63.50	0.040	0.012	10.526	
16	61.31	0.038	0.010	9.912	
17	59.27	0.037	0.009	9.227	
18	57.35	0.036	0.008	8.477	
19	55.56	0.035	0.007	7.668	
20	53.88	0.034	0.006	6.807	
21	52.29	0.033	0.005	5.897	
22	50.80	0.032	0.004	4.943	
23	49.39	0.031	0.003	3.949	
24	48.05	0.030	0.002	2.917	
25	46.79	0.029	0.001	1.851	

On-Site Storage Calculator

Town of Cobourg, ON

Project: **Commercial Development**

Project No.: **n1943**

Date: **30-Sep-20**

n Architecture Inc

Table 2B - 5 Years Storage (PARCEL A)

Comp. Runoff Coeff.R =	0.82	Equation of IDF:	
A =	0.27 ha	$i = \frac{A}{(t+B)^C}$	I = Rainfall Intensity (mm/hr)
$Q_{release}$ =	0.031 m^3/s		T = Time of Concentration (hr)
	30.94 L/s		a= 2464
			b= 16
		Storage Required (m^3)	17.39

t_d (min)	i_5 (mm/hr)	Q_5 (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
10	94.77	0.059	0.028	17.036	
11	91.26	0.057	0.026	17.289	
12	88.00	0.055	0.024	17.391	***
13	84.97	0.053	0.022	17.359	
14	82.13	0.051	0.020	17.205	
15	79.48	0.050	0.019	16.941	
16	77.00	0.048	0.017	16.577	
17	74.67	0.047	0.016	16.123	
18	72.47	0.045	0.014	15.587	
19	70.40	0.044	0.013	14.975	
20	68.44	0.043	0.012	14.294	
21	66.59	0.042	0.011	13.549	
22	64.84	0.041	0.010	12.746	
23	63.18	0.040	0.009	11.889	
24	61.60	0.039	0.008	10.982	
25	60.10	0.038	0.007	10.028	
26	58.67	0.037	0.006	9.032	
27	57.30	0.036	0.005	7.996	
28	56.00	0.035	0.004	6.922	

On-Site Storage Calculator

Town of Cobourg, ON

Project: **Commercial Development**

Project No.: **n1943**

Date: **30-Sep-20**

n Architecture Inc

Table 2C - 10 Years Storage (PARCEL A)

Comp. Runoff Coeff.R = 0.82

A = 0.27 ha

$Q_{release}$ = 0.038 m^3/s

38.30 L/s

Equation of IDF:

$$i = \frac{A}{(t + B)^C}$$

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (hr)

a= 2819

b= 16

Storage Required (m^3) 17.86

t_d (min)	i_{10} (mm/hr)	Q_{10} (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
10	108.42	0.068	0.030	17.747	
11	104.41	0.065	0.027	17.863	***
12	100.68	0.063	0.025	17.806	
13	97.21	0.061	0.023	17.594	
14	93.97	0.059	0.021	17.243	
15	90.94	0.057	0.019	16.767	
16	88.09	0.055	0.017	16.177	
17	85.42	0.053	0.015	15.483	
18	82.91	0.052	0.014	14.695	
19	80.54	0.050	0.012	13.821	
20	78.31	0.049	0.011	12.867	
21	76.19	0.048	0.009	11.841	
22	74.18	0.046	0.008	10.748	
23	72.28	0.045	0.007	9.593	
24	70.48	0.044	0.006	8.381	
25	68.76	0.043	0.005	7.116	
26	67.12	0.042	0.004	5.802	
27	65.56	0.041	0.003	4.442	
28	64.07	0.040	0.002	3.039	
29	62.64	0.039	0.001	1.597	
30	61.28	0.038	0.000	0.117	

On-Site Storage Calculator

Town of Cobourg, ON

Project: **Commercial Development**

Project No.: **n1943**

Date: **30-Sep-20**

n Architecture Inc

Table 2D - 25 Years Storage (PARCEL A)

Comp. Runoff Coeff.R = 0.82

A = 0.27 ha

$Q_{release}$ = 0.043 m^3/s

43.17 L/s

Equation of IDF:

$$i = \frac{A}{(t + B)^C}$$

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (hr)

a= 3886

b= 18

Storage Required (m^3) 27.60

t_d (min)	i_{25} (mm/hr)	Q_{25} (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
10	138.79	0.087	0.044	26.233	
11	134.00	0.084	0.041	26.878	
12	129.53	0.081	0.038	27.309	
13	125.35	0.078	0.035	27.544	
14	121.44	0.076	0.033	27.602	***
15	117.76	0.074	0.031	27.500	
16	114.29	0.072	0.028	27.252	
17	111.03	0.070	0.026	26.870	
18	107.94	0.068	0.024	26.365	
19	105.03	0.066	0.023	25.748	
20	102.26	0.064	0.021	25.026	
21	99.64	0.062	0.019	24.209	
22	97.15	0.061	0.018	23.303	
23	94.78	0.059	0.016	22.315	
24	92.52	0.058	0.015	21.251	
25	90.37	0.057	0.013	20.116	
26	88.32	0.055	0.012	18.914	
27	86.36	0.054	0.011	17.651	
28	84.48	0.053	0.010	16.330	
29	82.68	0.052	0.009	14.956	
30	80.96	0.051	0.008	13.530	
31	79.31	0.050	0.006	12.057	
32	77.72	0.049	0.005	10.539	
33	76.20	0.048	0.005	8.980	
34	74.73	0.047	0.004	7.380	
35	73.32	0.046	0.003	5.743	
36	71.96	0.045	0.002	4.071	
37	70.65	0.044	0.001	2.366	
38	69.39	0.043	0.000	0.629	

On-Site Storage Calculator

Town of Cobourg, ON

Project: **Commercial Developme**

Project No.: **n1943**

Date: **30-Sep-20**

n Architecture Inc

Table 2E - 50 Years Storage (PARCEL A)

Comp. Runoff Coeff.R =	0.82	Equation of IDF:	I = Rainfall Intensity (mm/hr)
A =	0.27 ha	$i = \frac{A}{(t+B)^C}$	T = Time of Concentration (hr)
$Q_{release}$ =	0.044 m^3/s		a= 4750
	43.82 L/s		b= 24
			Storage Required (m^3) 29.31

t_d (min)	i_{50} (mm/hr)	Q_{50} (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
10	139.71	0.087	0.044	26.188	
11	135.71	0.085	0.041	27.157	
12	131.94	0.083	0.039	27.927	
13	128.38	0.080	0.037	28.512	
14	125.00	0.078	0.034	28.929	
15	121.79	0.076	0.032	29.189	
16	118.75	0.074	0.031	29.305	***
17	115.85	0.073	0.029	29.287	
18	113.10	0.071	0.027	29.145	
19	110.47	0.069	0.025	28.887	
20	107.95	0.068	0.024	28.521	
21	105.56	0.066	0.022	28.054	
22	103.26	0.065	0.021	27.494	
23	101.06	0.063	0.019	26.845	
24	98.96	0.062	0.018	26.114	
25	96.94	0.061	0.017	25.306	
26	95.00	0.059	0.016	24.425	
27	93.14	0.058	0.014	23.475	
28	91.35	0.057	0.013	22.460	
29	89.62	0.056	0.012	21.385	
30	87.96	0.055	0.011	20.252	
31	86.36	0.054	0.010	19.064	
32	84.82	0.053	0.009	17.826	

On-Site Storage Calculator

Town of Cobourg, ON

Project: **Commercial Development**

Project No.: **n1943**

Date: **30-Sep-20**

n Architecture Inc

Table 2F - 100 Years Storage (PARCEL A)

Comp. Runoff Coeff.R = 0.82

A = 0.27 ha

$Q_{release}$ = 0.044 m^3/s

44.46 L/s

Equation of IDF:

$$i = \frac{A}{(t + B)^C}$$

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (hr)

a= 5588

b= 28

Storage Required (m^3)	34.17

t_d (min)	i_{100} (mm/hr)	Q_{100} (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
10	147.05	0.092	0.048	28.562	
11	143.28	0.090	0.045	29.861	
12	139.70	0.087	0.043	30.961	
13	136.29	0.085	0.041	31.877	
14	133.05	0.083	0.039	32.622	
15	129.95	0.081	0.037	33.209	
16	127.00	0.080	0.035	33.648	
17	124.18	0.078	0.033	33.948	
18	121.48	0.076	0.032	34.120	
19	118.89	0.074	0.030	34.171	***
20	116.42	0.073	0.028	34.108	
21	114.04	0.071	0.027	33.940	
22	111.76	0.070	0.026	33.671	
23	109.57	0.069	0.024	33.308	
24	107.46	0.067	0.023	32.857	
25	105.43	0.066	0.022	32.321	
26	103.48	0.065	0.020	31.707	
27	101.60	0.064	0.019	31.019	
28	99.79	0.062	0.018	30.259	
29	98.04	0.061	0.017	29.433	
30	96.34	0.060	0.016	28.543	
31	94.71	0.059	0.015	27.593	
32	93.13	0.058	0.014	26.585	
33	91.61	0.057	0.013	25.523	
34	90.13	0.056	0.012	24.410	
35	88.70	0.056	0.011	23.247	
36	87.31	0.055	0.010	22.037	
37	85.97	0.054	0.009	20.782	
38	84.67	0.053	0.009	19.484	
39	83.40	0.052	0.008	18.145	
40	82.18	0.051	0.007	16.768	
41	80.99	0.051	0.006	15.353	
42	79.83	0.050	0.006	13.902	
43	78.70	0.049	0.005	12.417	
44	77.61	0.049	0.004	10.899	
45	76.55	0.048	0.003	9.349	
46	75.51	0.047	0.003	7.770	
47	74.51	0.047	0.002	6.161	

n Architecture Inc

Table 2G - 100 Years Storage (PARCEL A)

Roof Storage Calculator

428-432 King Street East-Parcel A

100 Years Detention Storage

Required Flood Storage Volume: Equation of IDF:

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (hr)

(ASCE Manuals and Reports on Engineering Practice No. 28) A= 5588

Where: B= 28

Composite Runoff Coefficient: R =	0.95		
Site Area, A =	0.02	ha	
Maximum Allowable Discharge Rate $Q_{release}$ =	0.002	m^3/s	Max Storage
	1.56	L/s	5.93

t_c (min)	i_{100} (mm/hr)	Q_{100} (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
10	147.05	0.007	0.006	3.391	
11	143.28	0.007	0.005	3.608	
12	139.70	0.007	0.005	3.809	
13	136.29	0.007	0.005	3.996	
14	133.05	0.007	0.005	4.170	
15	129.95	0.006	0.005	4.331	
16	127.00	0.006	0.005	4.481	
17	124.18	0.006	0.005	4.620	
18	121.48	0.006	0.004	4.749	
19	118.89	0.006	0.004	4.868	
27	101.60	0.005	0.003	5.544	
28	99.79	0.005	0.003	5.600	
29	98.04	0.005	0.003	5.651	
30	96.34	0.005	0.003	5.696	
31	94.71	0.005	0.003	5.737	
32	93.13	0.005	0.003	5.774	
33	91.61	0.004	0.003	5.806	
34	90.13	0.004	0.003	5.834	
35	88.70	0.004	0.003	5.858	
36	87.31	0.004	0.003	5.879	
37	85.97	0.004	0.003	5.896	
38	84.67	0.004	0.003	5.910	
39	83.40	0.004	0.003	5.920	
40	82.18	0.004	0.002	5.928	
41	80.99	0.004	0.002	5.932	
42	79.83	0.004	0.002	5.934	MAX
43	78.70	0.004	0.002	5.933	
44	77.61	0.004	0.002	5.929	

n Architecture Inc

On-Site Avaiable Storage Calculator

Town of Cobourg, ON

Table 3A- Avilable Storage (PARCEL A)

Project:	**Commercial Development**
Address:	**428-432 King Street East-Parcel A**
Project No.:	**n1943**
Date:	**27-Oct-20**

MH/CATCH BASIN

			HWL	**86.00**	
Description	**Length/Dia. (m)**	**Top Elevation**	**Invert Elevation**	**Height (m)**	**Volume (m^3)**
CBMH11	1.2	86.10	84.47	0.10	0.11
CBMH12	1.2	85.80	84.81	0.99	1.12
MH13	1.2	86.20	84.37	1.63	1.84
TOTAL					3.07

PIPES

FROM MH	**TO MH**	**Length (m)**		**DIA (mm)**	**Volume (m^3)**
CBMH11	MH13	15.0		300	1.06
STM PLUG	PIPE	3.5		150	0.06
BLDG. STM PLUG	CBMH12	10.0		150	0.18
CBMH12	PIPE	16.7		300	1.17
MH13	MH14	35.0		300	2.46
TOTAL					4.93

PONDING

Ponding Location	**Lowest Point Elv.**	**Ponding Depth (m)**	**Ponding Area (m^2)**	**Ponding Volume (m^3)**
CBMH12	85.80	0.20	441.3	29.4
TOTAL				29.4

ROOFTOP DETENTION

Location	**Area(m^2)**	**Depth (mm)**	**VOL.**
BLDG.A1	185.83	31.93	5.93

TOTAL Volume (m^3)	**43.33**
REQUIRED VOLUME (m^3) for 100 years rainfall event	**34.17**

n Architecture Inc

Table 1B-1

Orifice Sizing Calculations

(PARCEL- B-PHASE 1)

Project:	**Commercial Development**
Address:	**428-432 King Street East-Parcel B Phase 1**
Town/Township/City	**Town of Cobourg, ON**
Project No.	**n1943**
Proposed Development Area (m^2)	**6814.59**
Date:	**9/30/2020**

Orifice Location	MH1	
Orifice Type	Eccentric Reducer Pipe	
Invert Elevation	84.180	m
Min. Ground Elevation	85.900	m
Orifice Center Elevation	84.228	
Diameter of Orifce Pipe	95	mm
Area of Orifice (A)	0.007084625	m^2
Coefficient of Discharge (C_d)	0.8	
Gravitational Constant	9.81	

Orifice Flow Equation:

$$Q = C_d A_o \sqrt{(2gH)}$$

Where:

Q = Flow (m3/sec)

A_o = Orifice area (m2)

g = Gravitational Constant

H = Center line head (m)

C_d = coefficient of discharge, dimensionless, typically between 0.6 and 0.85, depending on the orifice geometry

	2 years	5 years	10 years	25 years	50 years	100 years
Ponding Depth (m)	-1.100	-0.900	-0.600	-0.200	-0.050	0.100
Water Elevation	84.80	85.00	85.30	85.70	85.85	86.00
Upstearm Head (m)	0.572	0.772	1.072	1.473	1.622	1.772
Total Controlled Discharge (L/sec)	**19.00**	**22.07**	**26.00**	**30.46**	**31.98**	**33.42**
Discharge Velocity (m/sec)	2.68	3.11	3.67	4.30	4.51	4.72
Pre-developmet Peak Flow (L/sec)	21.32	26.14	29.91	38.28	38.54	40.56
Uncontrolled Flow (L/sec)	2.21	2.71	3.10	3.97	4.00	4.21
Allowable Flow (L/sec)	**19.11**	**23.43**	**26.81**	**34.31**	**34.54**	**36.36**

Detention Storage Required (m^3)	**26.54**	**35.92**	**40.17**	**40.17**	**62.83**	**71.63**
Storage Used in Pipe (m^3)	8.44	8.44	8.44	8.44	8.44	8.44
Storage Used in MH (m^3)	5.14	5.14	5.14	5.14	5.14	5.14
Used Roof Storage (m^3)	11.04	11.04	11.04	11.04	11.04	11.04
Stormwater Tank (m^3)	42.10	42.10	42.10	42.10	42.10	42.10
Storage Used in Ponding (m^3)	0.00	0.00	0.00	0.00	0.00	4.91
Total Available Storage	**74.35**	**74.35**	**74.35**	**74.35**	**74.35**	**74.35**

On-Site Storage Calculator

Town of Cobourg, ON

Project: **Commercial Development**

Project No.: **n1943**

Date: **30-Sep-20**

n Architecture Inc

Table 2AB1 - 2 Years Storage (PARCEL - B, PHASE - 1)

Comp. Runoff Coeff.R = 0.84

A = 0.33 ha

$Q_{release}$ = 0.019 m^3/s

19.00 L/s

Equation of IDF:

$$i = \frac{A}{(t+B)^C}$$

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (hr)

a= 1778

b= 13

Storage Required (m^3) 26.54

t_d (min)	i_2 (mm/hr)	Q_2 (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
10	77.30	0.059	0.040	23.829	
11	74.08	0.056	0.037	24.598	
12	71.12	0.054	0.035	25.213	
13	68.38	0.052	0.033	25.694	
14	65.85	0.050	0.031	26.055	
15	63.50	0.048	0.029	26.308	
16	61.31	0.047	0.028	26.466	
17	59.27	0.045	0.026	26.537	***
18	57.35	0.044	0.025	26.530	
19	55.56	0.042	0.023	26.452	
20	53.88	0.041	0.022	26.309	
21	52.29	0.040	0.021	26.108	
22	50.80	0.039	0.020	25.854	
23	49.39	0.038	0.019	25.550	
24	48.05	0.036	0.018	25.201	
25	46.79	0.036	0.017	24.810	
26	45.59	0.035	0.016	24.381	
27	44.45	0.034	0.015	23.917	
28	43.37	0.033	0.014	23.419	
29	42.33	0.032	0.013	22.891	
30	41.35	0.031	0.012	22.335	
31	40.41	0.031	0.012	21.752	
32	39.51	0.030	0.011	21.144	
33	38.65	0.029	0.010	20.513	
34	37.83	0.029	0.010	19.861	
35	37.04	0.028	0.009	19.188	
36	36.29	0.028	0.009	18.496	
37	35.56	0.027	0.008	17.786	
38	34.86	0.026	0.007	17.059	
39	34.19	0.026	0.007	16.317	
40	33.55	0.025	0.006	15.559	
41	32.93	0.025	0.006	14.788	
42	32.33	0.025	0.006	14.003	
43	31.75	0.024	0.005	13.205	
44	31.19	0.024	0.005	12.395	
45	30.66	0.023	0.004	11.574	
46	30.14	0.023	0.004	10.742	
47	29.63	0.023	0.004	9.900	

On-Site Storage Calculator

Town of Cobourg, ON

Project: Commercial Developme
Project No.: n1943
Date: 30-Sep-20

n Architecture Inc

Table 2BB1 - 5 Years Storage (PARCEL - B, PHASE - 1)

Comp. Runoff Coeff.R = 0.84
A = 0.33 ha
$Q_{release}$ = 0.022 m^3/s
22.07 L/s

Equation of IDF:

$$i = \frac{A}{(t + B)^C}$$

I = Rainfall Intensity (mm/hr)
T = Time of Concentration (hr)
a= 2464
b= 16

Storage Required (m^3)	35.92

t_d (min)	i_5 (mm/hr)	Q_5 (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
10	94.77	0.072	0.050	29.946	
11	91.26	0.069	0.047	31.181	
12	88.00	0.067	0.045	32.234	
13	84.97	0.065	0.042	33.122	
14	82.13	0.062	0.040	33.863	
15	79.48	0.060	0.038	34.471	
16	77.00	0.058	0.036	34.958	
17	74.67	0.057	0.035	35.335	
18	72.47	0.055	0.033	35.613	
19	70.40	0.053	0.031	35.798	
20	68.44	0.052	0.030	35.900	
21	66.59	0.051	0.029	35.925	***
22	64.84	0.049	0.027	35.879	
23	63.18	0.048	0.026	35.767	
24	61.60	0.047	0.025	35.595	
25	60.10	0.046	0.024	35.366	
26	58.67	0.045	0.022	35.086	
27	57.30	0.044	0.021	34.756	
28	56.00	0.043	0.020	34.382	
29	54.76	0.042	0.020	33.966	
30	53.57	0.041	0.019	33.509	
31	52.43	0.040	0.018	33.017	
32	51.33	0.039	0.017	32.489	
33	50.29	0.038	0.016	31.929	
34	49.28	0.037	0.015	31.338	
35	48.31	0.037	0.015	30.719	
36	47.38	0.036	0.014	30.072	
37	46.49	0.035	0.013	29.400	
38	45.63	0.035	0.013	28.704	
39	44.80	0.034	0.012	27.985	
40	44.00	0.033	0.011	27.244	
41	43.23	0.033	0.011	26.483	
42	42.48	0.032	0.010	25.703	
43	41.76	0.032	0.010	24.904	
44	41.07	0.031	0.009	24.087	
45	40.39	0.031	0.009	23.254	
46	39.74	0.030	0.008	22.406	
47	39.11	0.030	0.008	21.542	
48	38.50	0.029	0.007	20.663	
49	37.91	0.029	0.007	19.771	
50	37.33	0.028	0.006	18.866	
51	36.78	0.028	0.006	17.948	
52	36.24	0.028	0.005	17.019	

On-Site Storage Calculator

Town of Cobourg, ON

Project: **Commercial Developme**

Project No.: **n1943**

Date: **30-Sep-20**

n Architecture Inc

Table 2CB1 - 10 Years Storage (PARCEL - B, PHASE - 1)

Comp. Runoff Coeff.R = 0.84

A = 0.33 ha

$Q_{release}$ = 0.026 m^3/s

26.00 L/s

Equation of IDF:

$$i = \frac{A}{(t + B)^C}$$

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (hr)

a= 2819

b= 16

Storage Required (m^3)	40.17

t_d (min)	i_{10} (mm/hr)	Q_{10} (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
10	108.42	0.082	0.056	33.807	
11	104.41	0.079	0.053	35.175	
12	100.68	0.076	0.050	36.334	
13	97.21	0.074	0.048	37.305	
14	93.97	0.071	0.045	38.108	
15	90.94	0.069	0.043	38.758	
16	88.09	0.067	0.041	39.270	
17	85.42	0.065	0.039	39.656	
18	82.91	0.063	0.037	39.928	
19	80.54	0.061	0.035	40.095	
20	78.31	0.059	0.033	40.167	***
21	76.19	0.058	0.032	40.150	
22	74.18	0.056	0.030	40.052	
23	72.28	0.055	0.029	39.879	
24	70.48	0.054	0.028	39.636	
25	68.76	0.052	0.026	39.329	
26	67.12	0.051	0.025	38.963	
27	65.56	0.050	0.024	38.541	
28	64.07	0.049	0.023	38.068	
29	62.64	0.048	0.022	37.546	
30	61.28	0.047	0.021	36.979	
31	59.98	0.046	0.020	36.369	
32	58.73	0.045	0.019	35.721	
33	57.53	0.044	0.018	35.034	
34	56.38	0.043	0.017	34.313	
35	55.27	0.042	0.016	33.560	
36	54.21	0.041	0.015	32.775	
37	53.19	0.040	0.014	31.960	
38	52.20	0.040	0.014	31.119	
39	51.25	0.039	0.013	30.251	
40	50.34	0.038	0.012	29.358	
41	49.46	0.038	0.012	28.442	

On-Site Storage Calculator

Town of Cobourg, ON

Project: Commercial Developme
Project No.: n1943
Date: 30-Sep-20

n Architecture

Table 2DB1 - 25 Years Storage (PARCEL - B, PHASE - 1)

Equation of IDF:

$$i = \frac{A}{(t + B)^C}$$

Comp. Runoff Coeff.R = 0.84
A = 0.33 ha
$Q_{release}$ = 0.030 m^3/s
30.46 L/s

I = Rainfall Intensity (mm/hr)
T = Time of Concentration (hr)
a= 3886
b= 18

Storage Required (m^3) 57.32

t_d (min)	i_{25} (mm/hr)	Q_{25} (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
10	138.79	0.105	0.075	44.964	
11	134.00	0.102	0.071	47.062	
12	129.53	0.098	0.068	48.898	
13	125.35	0.095	0.065	50.497	
14	121.44	0.092	0.062	51.883	
15	117.76	0.089	0.059	53.073	
16	114.29	0.087	0.056	54.086	
17	111.03	0.084	0.054	54.937	
18	107.94	0.082	0.052	55.639	
19	105.03	0.080	0.049	56.204	
20	102.26	0.078	0.047	56.643	
21	99.64	0.076	0.045	56.966	
22	97.15	0.074	0.043	57.181	
23	94.78	0.072	0.042	57.297	
24	92.52	0.070	0.040	57.320	***
25	90.37	0.069	0.038	57.257	
26	88.32	0.067	0.037	57.114	
27	86.36	0.066	0.035	56.896	
28	84.48	0.064	0.034	56.608	
29	82.68	0.063	0.032	56.255	
30	80.96	0.061	0.031	55.840	
31	79.31	0.060	0.030	55.367	
32	77.72	0.059	0.029	54.840	
33	76.20	0.058	0.027	54.262	
34	74.73	0.057	0.026	53.636	
35	73.32	0.056	0.025	52.965	
36	71.96	0.055	0.024	52.251	
37	70.65	0.054	0.023	51.496	
38	69.39	0.053	0.022	50.703	
39	68.18	0.052	0.021	49.874	
40	67.00	0.051	0.020	49.011	
41	65.86	0.050	0.020	48.114	
42	64.77	0.049	0.019	47.187	
43	63.70	0.048	0.018	46.230	
44	62.68	0.048	0.017	45.245	
45	61.68	0.047	0.016	44.233	
46	60.72	0.046	0.016	43.196	
47	59.78	0.045	0.015	42.134	

On-Site Storage Calculator

Town of Cobourg, ON

Project: **Commercial Developme**

Project No.: **n1943**

Date: **30-Sep-20**

n Architecture Inc

Table 2EB1 - 50 Years Storage (PARCEL - B, PHASE - 1)

Comp. Runoff Coeff.R = 0.84

A = 0.33 ha

$Q_{release}$ = 0.032 m^3/s

31.98 L/s

Equation of IDF:

$$i = \frac{A}{(t+B)^c}$$

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (hr)

a= 4750

b= 24

Storage Required (m^3)	62.83

t_d (min)	i_{50} (mm/hr)	Q_{50} (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
10	139.71	0.106	0.074	44.475	
11	135.71	0.103	0.071	46.922	
12	131.94	0.100	0.068	49.126	
13	128.38	0.098	0.066	51.107	
14	125.00	0.095	0.063	52.884	
15	121.79	0.093	0.061	54.470	
16	118.75	0.090	0.058	55.882	
17	115.85	0.088	0.056	57.130	
18	113.10	0.086	0.054	58.228	
19	110.47	0.084	0.052	59.186	
20	107.95	0.082	0.050	60.013	
21	105.56	0.080	0.048	60.718	
22	103.26	0.078	0.046	61.309	
23	101.06	0.077	0.045	61.793	
24	98.96	0.075	0.043	62.177	
25	96.94	0.074	0.042	62.467	
26	95.00	0.072	0.040	62.669	
27	93.14	0.071	0.039	62.787	
28	91.35	0.069	0.037	62.828	***
29	89.62	0.068	0.036	62.794	
30	87.96	0.067	0.035	62.690	
31	86.36	0.066	0.034	62.521	
32	84.82	0.064	0.032	62.289	
33	83.33	0.063	0.031	61.997	
34	81.90	0.062	0.030	61.650	
35	80.51	0.061	0.029	61.249	
36	79.17	0.060	0.028	60.798	
37	77.87	0.059	0.027	60.299	
38	76.61	0.058	0.026	59.754	
39	75.40	0.057	0.025	59.165	
40	74.22	0.056	0.024	58.535	
41	73.08	0.056	0.024	57.865	
42	71.97	0.055	0.023	57.157	
43	70.90	0.054	0.022	56.413	
44	69.85	0.053	0.021	55.635	
45	68.84	0.052	0.020	54.823	
46	67.86	0.052	0.020	53.980	
47	66.90	0.051	0.019	53.107	

On-Site Storage Calculator

Town of Cobourg, ON

Project: **Commercial Developme**

Project No.: **n1943**

Date: **30-Sep-20**

n Architecture Inc

Table 2FB1 - 100 Years Storage (PARCEL - B, PHASE - 1)

Equation of IDF:

$$I = \frac{a}{(b + T_d)}$$

Comp. Runoff Coeff.R = 0.84

A = 0.33 ha

$Q_{release}$ = 0.033 m^3/s

33.42 L/s

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (hr)

a= 5588

b= 28

Storage Required (m^3)	71.63

t_d (min)	i_{100} (mm/hr)	Q_{100} (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
10	147.05	0.112	0.078	46.956	
11	143.28	0.109	0.075	49.761	
12	139.70	0.106	0.073	52.326	
13	136.29	0.104	0.070	54.668	
14	133.05	0.101	0.068	56.803	
15	129.95	0.099	0.065	58.746	
16	127.00	0.096	0.063	60.509	
17	124.18	0.094	0.061	62.104	
18	121.48	0.092	0.059	63.543	
19	118.89	0.090	0.057	64.836	
20	116.42	0.088	0.055	65.991	
21	114.04	0.087	0.053	67.017	
22	111.76	0.085	0.051	67.921	
23	109.57	0.083	0.050	68.712	
24	107.46	0.082	0.048	69.395	
25	105.43	0.080	0.047	69.977	
26	103.48	0.079	0.045	70.463	
27	101.60	0.077	0.044	70.858	
28	99.79	0.076	0.042	71.167	
29	98.04	0.074	0.041	71.396	
30	96.34	0.073	0.040	71.547	
31	94.71	0.072	0.039	71.625	
32	93.13	0.071	0.037	71.634	***
33	91.61	0.070	0.036	71.576	
34	90.13	0.068	0.035	71.456	
35	88.70	0.067	0.034	71.276	
36	87.31	0.066	0.033	71.039	
37	85.97	0.065	0.032	70.747	
38	84.67	0.064	0.031	70.404	
39	83.40	0.063	0.030	70.011	
40	82.18	0.062	0.029	69.570	
41	80.99	0.062	0.028	69.085	
42	79.83	0.061	0.027	68.555	
43	78.70	0.060	0.026	67.985	
44	77.61	0.059	0.026	67.374	
45	76.55	0.058	0.025	66.725	
46	75.51	0.057	0.024	66.039	
47	74.51	0.057	0.023	65.319	

Table 2GB1

Roof Storage Calculator

428-432 King Street East-Parcel B Phase 1

100 Years Detention Storage

n Architecture Inc

Required Flood Storage Volume:

Equation of IDF:

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (hr)

(ASCE Manuals and Reports on Engineering Practice No. 28)

A= 5588

Where:

B= 28

Composite Runoff Coefficient: R =	0.95		
Site Area, A =	0.025414	ha	
Maximum Allowable Discharge Rate $Q_{release}$ =	0.001	m^3/s	Max Storage
	1.20	L/s	11.04

t_c (min)	i_{100} (mm/hr)	Q_{100} (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
10	147.05	0.010	0.009	5.197	
11	143.28	0.010	0.008	5.550	
12	139.70	0.009	0.008	5.882	
13	136.29	0.009	0.008	6.194	
14	133.05	0.009	0.008	6.487	
15	129.95	0.009	0.008	6.764	
16	127.00	0.009	0.007	7.025	
17	124.18	0.008	0.007	7.271	
18	121.48	0.008	0.007	7.503	
54	68.15	0.005	0.003	10.919	
55	67.33	0.005	0.003	10.940	
56	66.52	0.004	0.003	10.958	
57	65.74	0.004	0.003	10.974	
58	64.98	0.004	0.003	10.989	
59	64.23	0.004	0.003	11.001	
60	63.50	0.004	0.003	11.011	
61	62.79	0.004	0.003	11.019	
62	62.09	0.004	0.003	11.026	
63	61.41	0.004	0.003	11.031	
64	60.74	0.004	0.003	11.034	
65	60.09	0.004	0.003	11.036	
66	59.45	0.004	0.003	11.036	MAX
67	58.82	0.004	0.003	11.034	
68	58.21	0.004	0.003	11.031	
69	57.61	0.004	0.003	11.027	
70	57.02	0.004	0.003	11.021	
71	56.44	0.004	0.003	11.014	
72	55.88	0.004	0.003	11.006	
73	55.33	0.004	0.003	10.996	

On-Site Avaiable Storage Calc

Town of Cobourg, ON

Table 3B-1- Avilable Storage

(PARCEL -B PHASE - 1)

n Architecture Inc

Project:	**Commercial Development**
Address:	**428-432 King Street East-Parcel B Phase 1**
Project No.:	**n1943**
Date:	**27-Oct-20**

MH/CATCH BASIN HWL 86.00

Description	Length /Dia. (m)	Width (m)	Top Elevation	Invert Elevation	Height (m)	Volume (m^3)
CB21	0.6	0.6		84.75	1.25	0.45
CBMH22	1.2			84.66	1.34	1.52
CBMH23	1.2			84.66	1.34	1.52
MH29	1.2			84.53	1.47	1.66
TOTAL						5.14

PIPES

FROM MH	TO MH	Length (m)		DIA (mm)	Volume (m^3)
BLDG PLUG	CBMH22	14.0		300	0.98
CBMH22	S. TANK	9.0		300	0.63
S. TANK	CBMH23	12.0		300	0.84
CB21	CBMH23	22.5		300	1.58
CBMH23	MH29	28.0		300	1.97
MH29	CBMH24	28.5		300	2.00
CBMH24	MH25	6.0		300	0.42
TOTAL					8.44

PONDING

Ponding Location	Lowest Point Elv.	Ponding Depth (m)	Ponding Area (m^2)	Ponding Volume (m^3)
CBMH24	85.90	0.10	229.0	7.6
TOTAL				7.6

STORMWATER DETENTION TANK

Manufacturer	MODEL	Width(m)	Length(m)	Volume (m^3)
Contech Design Sol.	CHAMBERMAXX	3.39	21.81	42.1
TOTAL				42.1

ROOFTOP DETENTION

Location	Area(m^2)	Design Depth	Volume
BLDG B1	254.14	43.4	11.04
TOTAL AVAILABLE VOLUME (m^3)			**74.32**
REQUIRED VOLUME (m^3) for 100 year rainfall event			**71.63**

n Architecture Inc

Table 1B-2

Orifice Sizing Calculations

(Parcel B, Phase 2)

Project:	**Commercial Development**
Address:	**428-432 King Street East-Parcel B Phase 2**
Town/Township/City	**Town of Cobourg, ON**
Project No.	**n1943**
Proposed Development Area (m^2)	**6814.59**
Date:	**9/30/2020**

Orifice Location	MH1	
Orifice Type	Eccentric Reducer Pipe	
Invert Elevation	84.480	m
Min. Ground Elevation	85.750	m
Orifice Center Elevation	84.530	
Diameter of Orifce Pipe	100	mm
Area of Orifice (A)	0.00785	m^2
Coefficient of Discharge (C_d)	0.8	
Gravitational Constant	9.81	

Orifice Flow Equation:

$$Q = C_d A_o \sqrt{(2gH)}$$

Where:

Q = Flow (m3/sec)

A_o = Orifice area (m2)

g = Gravitational Constant

H = Center line head (m)

C_d = coefficient of discharge, dimensionless, typically between 0.6 and 0.85, depending on the orifice geometry

	2 years	5 years	10 years	25 years	50 years	100 years
Ponding Depth (m)	-0.330	0.000	0.050	0.100	0.100	0.150
Water Elevation	85.42	85.75	85.80	85.85	85.85	85.90
Upstearm Head (m)	0.890	1.220	1.270	1.320	1.320	1.370
Total Discharge (L/sec)	**26.24**	**30.72**	**31.35**	**31.96**	**31.96**	**32.56**
Discharge Velocity (m/sec)	3.34	3.91	3.99	4.07	4.07	4.15
Pre-developmet Peak Flow (L/sec)	**26.36**	**32.31**	**36.97**	**47.32**	**47.63**	**50.14**
Detention Storage Required (m^3)	**29.95**	**40.16**	**50.44**	**79.29**	**91.33**	**106.66**
MH/CB Storage (m^3)	4.29	4.29	4.29	4.29	4.29	4.29
Pipes Storage (m^3)	6.61	6.61	6.61	6.61	6.61	6.61
Roof Storage (m^3)	19.22	19.22	19.22	19.22	19.22	19.22
Stormwater Tank (m^3)	45.00	45.00	45.00	45.00	45.00	45.00
Surface Ponding Storage (m^3)	0.00	0.00	0.00	35.08	35.08	35.08
Total Available Storage	**75.12**	**75.12**	**75.12**	**110.20**	**110.20**	**110.20**

On-Site Storage Calculator

Town of Cobourg, ON

Project: **Commercial Development**

Project No.: **n1943**

Date: **30-Sep-20**

n Architecture Inc

Table 2AB2 - 2 Years Storage

Comp. Runoff Coeff.R = 0.80

A = 0.42 ha

$Q_{release}$ = 0.026 m^3/s

26.24 L/s

Equation of IDF:

$$i = \frac{A}{(t + B)^C}$$

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (hr)

a= 1778

b= 13

Storage Required (m^3) 29.95

t_d (min)	i_2 (mm/hr)	Q_2 (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
10	77.30	0.072	0.046	27.709	
11	74.08	0.069	0.043	28.489	
12	71.12	0.067	0.040	29.080	
13	68.38	0.064	0.038	29.504	
14	65.85	0.062	0.035	29.780	
15	63.50	0.059	0.033	29.925	
16	61.31	0.057	0.031	29.950	***
17	59.27	0.056	0.029	29.869	
18	57.35	0.054	0.027	29.692	
19	55.56	0.052	0.026	29.427	
20	53.88	0.050	0.024	29.083	
21	52.29	0.049	0.023	28.666	
22	50.80	0.048	0.021	28.183	
23	49.39	0.046	0.020	27.640	
24	48.05	0.045	0.019	27.041	
25	46.79	0.044	0.018	26.391	
26	45.59	0.043	0.016	25.693	
27	44.45	0.042	0.015	24.951	
28	43.37	0.041	0.014	24.169	
29	42.33	0.040	0.013	23.349	
30	41.35	0.039	0.012	22.494	
31	40.41	0.038	0.012	21.606	
32	39.51	0.037	0.011	20.687	
33	38.65	0.036	0.010	19.741	
34	37.83	0.035	0.009	18.767	
35	37.04	0.035	0.008	17.768	
36	36.29	0.034	0.008	16.746	
37	35.56	0.033	0.007	15.702	
38	34.86	0.033	0.006	14.637	
39	34.19	0.032	0.006	13.552	
40	33.55	0.031	0.005	12.449	
41	32.93	0.031	0.005	11.329	
42	32.33	0.030	0.004	10.192	
43	31.75	0.030	0.004	9.039	
44	31.19	0.029	0.003	7.872	
45	30.66	0.029	0.002	6.690	
46	30.14	0.028	0.002	5.495	
47	29.63	0.028	0.002	4.288	
48	29.15	0.027	0.001	3.068	
49	28.68	0.027	0.001	1.837	
50	28.22	0.026	0.000	0.595	

On-Site Storage Calculator

Town of Cobourg, ON

Project: **Commercial Developme**

Project No.: **n1943**

Date: **30-Sep-20**

n Architecture Inc

Table 2BB2 - 5 Years Storage

Comp. Runoff Coeff.R = 0.80

A = 0.42 ha

$Q_{release}$ = 0.031 m^3/s

30.72 L/s

Equation of IDF:

$$i = \frac{A}{(t+B)^C}$$

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (hr)

a= 2464

b= 16

Storage Required (m^3)	40.16

td (min)	i_5 (mm/hr)	Q_5 (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
10	94.77	0.089	0.058	34.838	
11	91.26	0.085	0.055	36.151	
12	88.00	0.082	0.052	37.239	
13	84.97	0.080	0.049	38.125	
14	82.13	0.077	0.046	38.828	
15	79.48	0.074	0.044	39.368	
16	77.00	0.072	0.041	39.758	
17	74.67	0.070	0.039	40.013	
18	72.47	0.068	0.037	40.145	
19	70.40	0.066	0.035	40.164	***
20	68.44	0.064	0.033	40.079	
21	66.59	0.062	0.032	39.900	
22	64.84	0.061	0.030	39.632	
23	63.18	0.059	0.028	39.284	
24	61.60	0.058	0.027	38.861	
25	60.10	0.056	0.026	38.369	
26	58.67	0.055	0.024	37.813	
27	57.30	0.054	0.023	37.196	
28	56.00	0.052	0.022	36.524	
29	54.76	0.051	0.021	35.800	
30	53.57	0.050	0.019	35.027	
31	52.43	0.049	0.018	34.208	
32	51.33	0.048	0.017	33.347	
33	50.29	0.047	0.016	32.446	
34	49.28	0.046	0.015	31.507	
35	48.31	0.045	0.015	30.533	
36	47.38	0.044	0.014	29.525	
37	46.49	0.044	0.013	28.485	
38	45.63	0.043	0.012	27.416	
39	44.80	0.042	0.011	26.319	
40	44.00	0.041	0.010	25.195	
41	43.23	0.040	0.010	24.046	
42	42.48	0.040	0.009	22.873	
43	41.76	0.039	0.008	21.677	
44	41.07	0.038	0.008	20.459	
45	40.39	0.038	0.007	19.221	
46	39.74	0.037	0.007	17.964	
47	39.11	0.037	0.006	16.688	
48	38.50	0.036	0.005	15.394	
49	37.91	0.036	0.005	14.083	
50	37.33	0.035	0.004	12.756	
51	36.78	0.034	0.004	11.414	
52	36.24	0.034	0.003	10.057	

On-Site Storage Calculator

Town of Cobourg, ON

Project: **Commercial Developme**

Project No.: **n1943**

Date: **30-Sep-20**

n Architecture Inc

Table 2CB2 - 10 Years Storage

Comp. Runoff Coeff.R = 0.80

A = 0.42 ha

$Q_{release}$ = 0.031 m^3/s

31.35 L/s

Equation of IDF:

$$i = \frac{A}{(t + B)^C}$$

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (hr)

a= 2819

b= 16

Storage Required (m^3)	50.44

td (min)	i_{10} (mm/hr)	Q_{10} (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
10	108.42	0.102	0.070	42.139	
11	104.41	0.098	0.066	43.870	
12	100.68	0.094	0.063	45.342	
13	97.21	0.091	0.060	46.584	
14	93.97	0.088	0.057	47.617	
15	90.94	0.085	0.054	48.463	
16	88.09	0.083	0.051	49.138	
17	85.42	0.080	0.049	49.658	
18	82.91	0.078	0.046	50.037	
19	80.54	0.075	0.044	50.286	
20	78.31	0.073	0.042	50.418	
21	76.19	0.071	0.040	50.440	***
22	74.18	0.070	0.038	50.363	
23	72.28	0.068	0.036	50.193	
24	70.48	0.066	0.035	49.937	
25	68.76	0.064	0.033	49.602	
26	67.12	0.063	0.032	49.194	
27	65.56	0.061	0.030	48.717	
28	64.07	0.060	0.029	48.176	
29	62.64	0.059	0.027	47.576	
30	61.28	0.057	0.026	46.919	
31	59.98	0.056	0.025	46.211	
32	58.73	0.055	0.024	45.454	
33	57.53	0.054	0.023	44.651	
34	56.38	0.053	0.021	43.805	
35	55.27	0.052	0.020	42.919	
36	54.21	0.051	0.019	41.994	
37	53.19	0.050	0.018	41.033	
38	52.20	0.049	0.018	40.038	
39	51.25	0.048	0.017	39.011	
40	50.34	0.047	0.016	37.953	
41	49.46	0.046	0.015	36.867	
42	48.60	0.046	0.014	35.753	
43	47.78	0.045	0.013	34.613	
44	46.98	0.044	0.013	33.448	
45	46.21	0.043	0.012	32.260	
46	45.47	0.043	0.011	31.049	
47	44.75	0.042	0.011	29.818	

On-Site Storage Calculator

Town of Cobourg, ON

Project: **Commercial Developme**

Project No.: **n1943**

Date: **30-Sep-20**

n Architecture Inc

Table 2BB2 - 25 Years Storage

Equation of IDF:

$$i = \frac{A}{(t + B)^C}$$

Comp. Runoff Coeff.R = 0.80

A = 0.42 ha

$Q_{release}$ = 0.032 m^3/s

31.96 L/s

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (hr)

a= 3886

b= 18

Storage Required (m^3)	79.29

t_d (min)	i_{25} (mm/hr)	Q_{25} (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
10	138.79	0.130	0.098	58.840	
11	134.00	0.126	0.094	61.765	
12	129.53	0.121	0.089	64.367	
13	125.35	0.117	0.085	66.677	
14	121.44	0.114	0.082	68.723	
15	117.76	0.110	0.078	70.529	
16	114.29	0.107	0.075	72.116	
17	111.03	0.104	0.072	73.502	
18	107.94	0.101	0.069	74.706	
19	105.03	0.098	0.066	75.740	
20	102.26	0.096	0.064	76.619	
21	99.64	0.093	0.061	77.355	
22	97.15	0.091	0.059	77.957	
23	94.78	0.089	0.057	78.437	
24	92.52	0.087	0.055	78.803	
25	90.37	0.085	0.053	79.063	
26	88.32	0.083	0.051	79.224	
27	86.36	0.081	0.049	79.292	***
28	84.48	0.079	0.047	79.274	
29	82.68	0.077	0.046	79.175	
30	80.96	0.076	0.044	79.000	
31	79.31	0.074	0.042	78.754	
32	77.72	0.073	0.041	78.442	
33	76.20	0.071	0.039	78.066	
34	74.73	0.070	0.038	77.631	
35	73.32	0.069	0.037	77.140	
36	71.96	0.067	0.035	76.597	
37	70.65	0.066	0.034	76.003	
38	69.39	0.065	0.033	75.362	
39	68.18	0.064	0.032	74.676	
40	67.00	0.063	0.031	73.948	
41	65.86	0.062	0.030	73.180	
42	64.77	0.061	0.029	72.373	
43	63.70	0.060	0.028	71.530	
44	62.68	0.059	0.027	70.652	
45	61.68	0.058	0.026	69.741	
46	60.72	0.057	0.025	68.798	
47	59.78	0.056	0.024	67.826	

On-Site Storage Calculator

Town of Cobourg, ON

Project: **Commercial Developme**

Project No.: **n1943**

Date: **30-Sep-20**

n Architecture Inc

Table 2EB2- 50 Years Storage

Equation of IDF:

$$i = \frac{A}{(t + B)^C}$$

Comp. Runoff Coeff.R = 0.80

A = 0.42 ha

$Q_{release}$ = 0.032 m^3/s

31.96 L/s

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (hr)

a= 4750

b= 24

Storage Required (m^3)	91.33

td (min)	i_{50} (mm/hr)	Q_{50} (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
10	139.71	0.131	0.099	59.357	
11	135.71	0.127	0.095	62.825	
12	131.94	0.124	0.092	65.993	
13	128.38	0.120	0.088	68.886	
14	125.00	0.117	0.085	71.527	
15	121.79	0.114	0.082	73.933	
16	118.75	0.111	0.079	76.123	
17	115.85	0.109	0.077	78.113	
18	113.10	0.106	0.074	79.917	
19	110.47	0.103	0.072	81.548	
20	107.95	0.101	0.069	83.018	
21	105.56	0.099	0.067	84.336	
22	103.26	0.097	0.065	85.515	
23	101.06	0.095	0.063	86.561	
24	98.96	0.093	0.061	87.484	
25	96.94	0.091	0.059	88.291	
26	95.00	0.089	0.057	88.989	
27	93.14	0.087	0.055	89.585	
28	91.35	0.086	0.054	90.084	
29	89.62	0.084	0.052	90.491	
30	87.96	0.082	0.050	90.813	
31	86.36	0.081	0.049	91.053	
32	84.82	0.079	0.048	91.216	
33	83.33	0.078	0.046	91.306	
34	81.90	0.077	0.045	91.327	***
35	80.51	0.075	0.043	91.282	
36	79.17	0.074	0.042	91.175	
37	77.87	0.073	0.041	91.008	
38	76.61	0.072	0.040	90.785	
39	75.40	0.071	0.039	90.508	
40	74.22	0.070	0.038	90.180	
41	73.08	0.068	0.037	89.803	
42	71.97	0.067	0.035	89.379	
43	70.90	0.066	0.034	88.910	
44	69.85	0.065	0.033	88.399	
45	68.84	0.064	0.033	87.848	
46	67.86	0.064	0.032	87.257	
47	66.90	0.063	0.031	86.629	

On-Site Storage Calculator

Town of Cobourg, ON

Project: **Commercial Developme**

Project No.: **n1943**

Date: **30-Sep-20**

n Architecture Inc

Table 2FB2 - 100 Years Storage

Comp. Runoff Coeff.R = 0.80

A = 0.42 ha

$Q_{release}$ = 0.033 m^3/s

32.56 L/s

Equation of IDF:

$$i = \frac{A}{(t+B)^C}$$

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (hr)

a= 5588

b= 28

Storage Required (m^3)	106.66

td (min)	i_{100} (mm/hr)	Q_{100} (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
10	147.05	0.138	0.105	63.127	
11	143.28	0.134	0.102	67.108	
12	139.70	0.131	0.098	70.793	
13	136.29	0.128	0.095	74.202	
14	133.05	0.125	0.092	77.356	
15	129.95	0.122	0.089	80.273	
16	127.00	0.119	0.086	82.968	
17	124.18	0.116	0.084	85.456	
18	121.48	0.114	0.081	87.752	
19	118.89	0.111	0.079	89.866	
20	116.42	0.109	0.077	91.812	
21	114.04	0.107	0.074	93.597	
22	111.76	0.105	0.072	95.234	
23	109.57	0.103	0.070	96.729	
24	107.46	0.101	0.068	98.092	
25	105.43	0.099	0.066	99.330	
26	103.48	0.097	0.064	100.450	
27	101.60	0.095	0.063	101.458	
28	99.79	0.093	0.061	102.360	
29	98.04	0.092	0.059	103.162	
30	96.34	0.090	0.058	103.868	
31	94.71	0.089	0.056	104.485	
32	93.13	0.087	0.055	105.016	
33	91.61	0.086	0.053	105.466	
34	90.13	0.084	0.052	105.838	
35	88.70	0.083	0.051	106.136	
36	87.31	0.082	0.049	106.364	
37	85.97	0.081	0.048	106.524	
38	84.67	0.079	0.047	106.621	
39	83.40	0.078	0.046	106.657	***
40	82.18	0.077	0.044	106.634	
58	64.98	0.061	0.028	98.542	
59	64.23	0.060	0.028	97.764	
60	63.50	0.059	0.027	96.959	
61	62.79	0.059	0.026	96.128	
62	62.09	0.058	0.026	95.273	
63	61.41	0.058	0.025	94.393	
64	60.74	0.057	0.024	93.490	
65	60.09	0.056	0.024	92.565	
66	59.45	0.056	0.023	91.617	
67	58.82	0.055	0.023	90.649	
68	58.21	0.055	0.022	89.659	
69	57.61	0.054	0.021	88.650	

n Architecture Inc

Table 2GB2

Roof Storage Calculator

428-432 King Street East-Parcel B Phase 2

100 Years Detention Storage

Required Flood Storage Volume:

Equation of IDF:

I = Rainfall Intensity (mm/hr)

T = Time of Concentration (hr)

(ASCE Manuals and Reports on Engineering Practice No. 28)

A= 5588

Where:

B= 28

Composite Runoff Coefficient: R =	0.95		
Site Area, A =	0.0533	ha	
Maximum Allowable Discharge Rate $Q_{release}$ =	0.004	m^3/s	Max Storage
	3.60	L/s	19.41

t_c (min)	i100 (mm/hr)	Q_{100} (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
10	147.05	0.021	0.017	10.243	
11	143.28	0.020	0.017	10.918	
12	139.70	0.020	0.016	11.548	
13	136.29	0.019	0.016	12.137	
14	133.05	0.019	0.015	12.687	
15	129.95	0.018	0.015	13.202	
16	127.00	0.018	0.014	13.683	
17	124.18	0.017	0.014	14.134	
18	121.48	0.017	0.013	14.555	
42	79.83	0.011	0.008	19.208	
43	78.70	0.011	0.007	19.258	
44	77.61	0.011	0.007	19.300	
45	76.55	0.011	0.007	19.335	
46	75.51	0.011	0.007	19.363	
47	74.51	0.010	0.007	19.385	
48	73.53	0.010	0.007	19.400	
49	72.57	0.010	0.007	19.410	
50	71.64	0.010	0.006	19.414	MAX
51	70.73	0.010	0.006	19.412	
52	69.85	0.010	0.006	19.405	
53	68.99	0.010	0.006	19.392	
54	68.15	0.010	0.006	19.375	
55	67.33	0.009	0.006	19.353	
56	66.52	0.009	0.006	19.326	
57	65.74	0.009	0.006	19.295	
58	64.98	0.009	0.006	19.260	
59	64.23	0.009	0.005	19.220	
60	63.50	0.009	0.005	19.176	
61	62.79	0.009	0.005	19.129	
62	62.09	0.009	0.005	19.078	

On-Site Avaiable Storage Calculator

Town of Cobourg, ON

Table 3B-2 Avilable Storage

n Architecture Inc

Project:	**Commercial Development**
Address:	**428-432 King Street East-Parcel B Phase 2**
Project No.:	**n1943**
Date:	**27-Oct-20**

MH/CATCH BASIN — **HWL** **85.90**

Description	Length/Dia. (m)	Width (m)	Elevation	Height (m)	Volume (m^3)
CB31	0.6	0.6	85.01	0.89	0.32
CBMH32	1.2		84.91	0.99	1.12
CBMH33	1.2		84.73	1.17	1.32
CBMH34	1.2		84.55	1.35	1.53
TOTAL					4.29

PIPES

FROM MH	TO MH	Length (m)		DIA (mm)	Volume (m^3)
CB31	CBMH32	16.0		300	1.13
CBMH32	CBMH33	33.0		300	2.32
CBMH33	CBMH24	33.5		300	2.36
PLUG	CBMH34	11.5		300	0.81
TOTAL					6.62

PONDING

Ponding Location	Lowest Point Elv.	Ponding Depth (m)	Ponding Area (m^2)	Ponding Volume (m^3)
CBMH34	85.65	0.25	421.0	35.1
TOTAL				35.1

STORMWATER DETENTION TANK

Manufacturer	MODEL	Width (m)	Length (m)	Volume (m^3)	
Stormtech	DC-780	2.09	5.55	45.0	
TOTAL				45.0	

ROOF STORAGE

Location	Area (m2)	Depth of Ponding (mm)	VOLUME(m^3)
BUILDING B2	532.72	36.5	19.42
TOTAL AVAILABLE VOLUME (m^3)			**110.41**
REQUIRED VOLUME (m^3) for 100 yrs rainfall event			**106.66**

Appendix D

Storm Drainage Design Sheets

N Architecture Inc.

PREPARED BY: A.Z

DATE PREPARED 27-Oct-20

Td (start): 10.00 min

Engineering Department
Storm Drainage Design Chart
For Circular Drains Flowing Full
428-432 King Street East-Parcel A
Town of Cobourg, ON
(PARCEL A)

IDF CURVE	
Constants	**5 -yrs**
a	2464.0
b	16.0

$$I = \frac{a}{(b + T_d)}$$

Catchments							td (min)	Hydrology		Hyraulics						Comments
				R		ACC.		Rainfall	Peak	STORM SEWER DESIGN INFORMATION					TIME	
Catchment ID	**Total Area (m^2)**	**Captured By**	**Outlet to**	runoff Coeffi.	**A x R**	A x R		**I5**	**5-yrs**	size (mm)	slope (%)	length (m)	Q full (m^3/s)	V full (m/s)	SECT. (min)	
Canopy	187.00	STM Plug	CBMH11	0.95	0.02	0.02	10.00	94.77	0.005	150	1.00	3.5	0.015	0.862	0.07	
A11	630.59	CBMH11	MH13	0.89	0.06	0.07	10.00	94.77	0.019	300	0.50	15.0	0.068	0.967	0.26	
Conveyance		MH13	MH14	0.00	0.00	0.07	10.26	93.84	0.019	300	0.50	18.0	0.068	0.967	0.31	
BLDG A1	212.51	STM Plug	CBMH12	0.95	0.02	0.02	10.00	94.77	0.005	150	1.00	10.0	0.015	0.862	0.19	
A12	1702.40	CBMH12	MH14	0.78	0.13	0.15	10.19	94.07	0.040	300	0.50	16.7	0.068	0.967	0.29	
Conveyance		MH14	HG6			0.23	10.48	93.05	0.059	300	0.50	16.0	0.068	0.967	0.28	
Conveyance		HG6	MH15			0.23	10.55	0.00	0.000	450	0.50	5.50	0.202	1.267	0.07	
		MH15	Ex. Pipe			0.23	10.64	0.00	0.000	375	1.50	10.00	0.215	1.944	0.09	

N Architecture Inc.

PREPARED BY: A.Z

DATE PREPARED 27-Oct-20

td (start): 10.00 min

Engineering Department
Storm Drainage Design Chart
For Circular Drains Flowing Full
428-432 King Street East-Parcel B Phase 1
Town of Cobourg, ON
(PARCEL B- PHASE 1)

IDF CURVE	
Constants	5 -yrs
a	2464.0
b	16.0

$$I = \frac{a}{(b + T_d)}$$

Catchments							td (min)	Hydrology		Hyraulics						Comments
				R		ACC.		Rainfall	Peak	STORM SEWER DESIGN INFORMATION					TIME	
Catchment ID	Total Area (m^2)	Captured By	Outlet to	runoff Coeffi.	A x R	A x R		I_5	5-yrs	size (mm)	slope (%)	length (m)	Q full (m^3/s)	V full (m/s)	SECT. (min)	
A21	595.39	CB21	CBMH23	0.64	0.04	0.04	10.00	94.77	0.010	300	1.00	22.5	0.097	1.368	0.27	
BLD-B1	254.14	STM PLUG	CBMH22	0.95	0.02	0.02	10.00	94.77	0.006	300	1.00	14.0	0.097	1.368	0.27	
A22	1418.17	CBMH22	MH28	0.84	0.12	0.14	10.27	93.78	0.037	300	0.50	20.0	0.068	1.368	0.17	
Conveyance		MH28	CBMH23		0.00	0.14	10.44	93.18	0.037	300	0.50	21.0	0.068	1.368	0.17	
A23	698.80	CBMH23	S. TANK	0.93	0.06	0.25	10.27	93.78	0.064	300	1.00	1.0	0.097	1.368	0.26	
Storage		S. TANK	MH29		0.00	0.25	10.27	93.78	0.064	300	1.00	6.0	0.097	1.368	0.01	
Conveyance		MH29	CBMH24	0.00	0.00	0.25	10.29	93.74	0.064	300	0.50	28.5	0.068	0.967	0.49	
Conveyance		CBMH24	MH25(OGS)		0.00	0.27	10.54	92.83	0.071	300	0.50	7.5	0.068	0.967	0.13	
Conveyance		MH25	Ex. Pipe		0.00	0.27	10.63	92.51	0.070	150	2.00	10.0	0.022	1.219	0.14	

N Architecture Inc.

PREPARED BY: A.Z

DATE PREPARED 30-Sep-20

td (start): 10.00 min

Engineering Department

Storm Drainage Design Chart

For Circular Drains Flowing Full

428-432 King Street East-Parcel B Phase 2

Town of Cobourg, ON

(PARCEL B PHASE 2)

IDF CURVE

Constants	5 -yrs
a	1778.0
b	13.0

$$I = \frac{a}{(b + T_d)}$$

Catchments							td	Hydrology		Hyraulics						Comments
				R		ACC.		Rainfall	Peak	STORM SEWER DESIGN INFORMATION					TIME	
Catchment ID	Total Area (m^2)	Captured By	Outlet to	runoff Coeffi.	A x R	A x R	(min)	I_2	2-yrs	size (mm)	slope (%)	length (m)	Q full (m^3/s)	V full (m/s)	SECT. (min)	
B1	963.19	CB31	TANK	0.70	0.07	0.07	10.00	77.30	0.014	300	1.00	3.0	0.097	1.368	0.04	
		TANK	CBMH32			0.07	10.04	77.18	0.014	300	1.00	3.0	0.097	1.368	0.04	
B2	841.79	CBMH32	CBMH33	0.82	0.07	0.14	10.07	77.06	0.029	300	0.50	33.0	0.068	0.967	0.57	
B3	897.13	CBMH33	CBMH34	0.90	0.08	0.22	10.64	75.21	0.045	300	0.50	33.5	0.068	0.967	0.58	
BLDG	529.29	PLUG	CBMH34	0.95	0.05	0.05	10.00	77.30	0.011	200	1.00	11.5	0.033	1.044	0.18	
B4	981.95	CBMH34	MH35	0.71	0.07	0.34	11.22	73.41	0.069	375	0.75	9.0	0.152	1.375	0.11	
Conveyance		MH35	MH26			0.34	11.37	72.97	0.068	300	0.55	10.5	0.072	1.014	0.17	

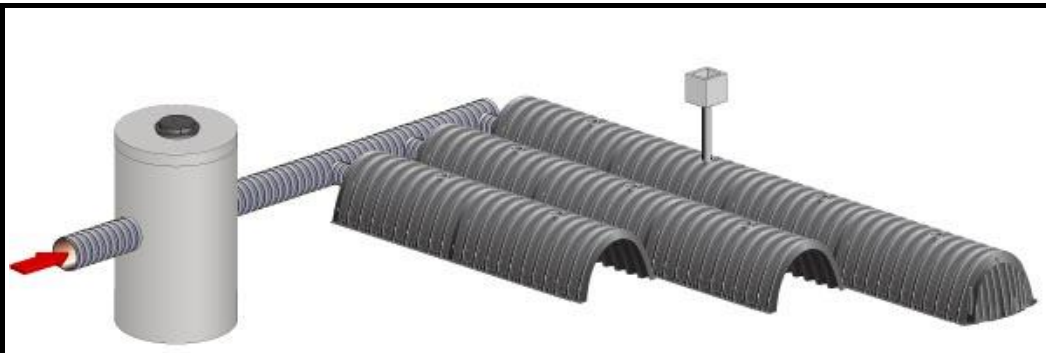
Appendix E

Stormwater Détention Chambers

DYODS™
Design Your Own Detention System

CHAMBERMaxx™

CONTECH ENGINEERED SOLUTIONS



Project Summary

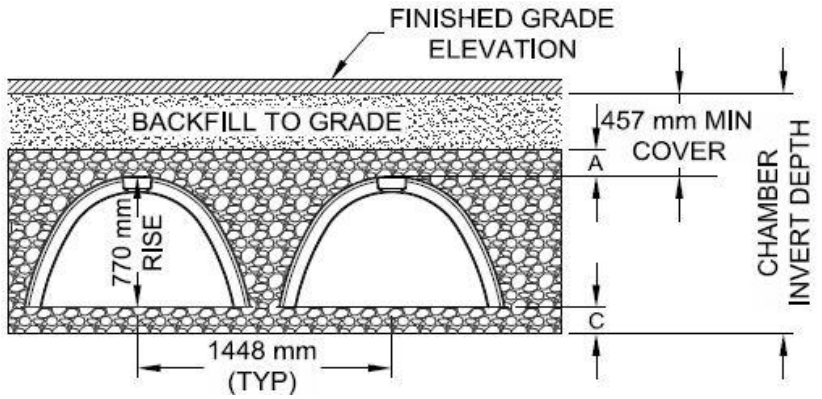
Date:	6/16/2020
Project Name:	King Street East, 428 & 432 (Gas Static
City, Province:	Cobourg, ON
Designed By:	JAK
Company:	CES
Telephone:	

Enter Information in Blue Cells

ChamberMaxx Calculator

Storage Volume Required (m^3):	35.0
Chamber Invert Depth Below Asphalt (m):	2.19
Limiting Width (m):	4.0
Porous Stone Backfill Included For Storage:	Yes
Depth A: Porous Stone Above Chamber (mm):	150
Depth C: Porous Stone Below Chamber (mm):	150
Stone Porosity (0 to 40%):	40

Waterway Area (m^2) 0.978



System Sizing

Use Custom Layout (at right) for layout adjustment

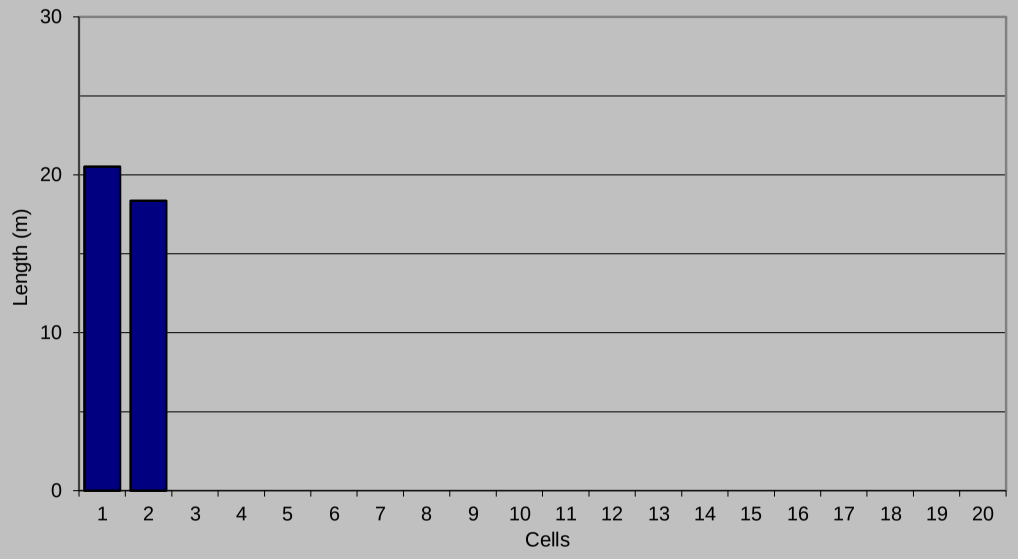
Required Chambers:	17	Chambers	
Chamber Storage:	22.8	m^3	
Porous Stone Storage:	19.3	m^3	
Total Storage Provided:	42.1	m^3	120.4% of Req'd Storage
Rectangular Footprint (W x L):	3.39 m x 21.81 m		

Additional Units Required = 0

Custom Layout

To adjust layout, select the appropriate number of chambers in the light blue boxes below.

9	8																		



CONTECH Materials

ChamberMaxx Middle Units:	13	Chambers @ 2.17m installed length
ChamberMaxx Start Units:	2	Chambers @ 2.44m installed length
ChamberMaxx End Units:	2	Chambers @ 2.26m installed length
Manifold Fittings (1 manifold):	1	ea Tees and 1ea Elbow
Scour Protection Netting:	4	m long x 2.3 m wide
Approximate Truckloads:	1	Trucks

Construction Quantities

Total Excavation:	180	m^3 (assumes 100mm thick asphalt)
Stone Backfill:	48	m^3 stone
Remaining Backfill to Asphalt:	102	m^3 backfill per specifications
Non-Woven Geotextile:	141	m^2 for top and sides of excavation

***Construction Quantities are approximate and should be verified upon final design*

CONTECH®
ENGINEERED SOLUTIONS

ChamberMaxx®
Open-Bottom Infiltration

The experts you need to solve your stormwater challenges

Contech is the leader in stormwater solutions, helping engineers, contractors and owners with infrastructure and land development projects throughout North America.

With our responsive team of stormwater experts, local regulatory expertise and flexible solutions, Contech is the trusted partner you can count on for stormwater management solutions.

Your Contech Team

STORMWATER CONSULTANT

It's my job to recommend the best solution to meet permitting requirements.

STORMWATER DESIGN ENGINEER

I work with consultants to design the best approved solution to meet your project's needs.

REGULATORY MANAGER

I understand the local stormwater regulations and what solutions will be approved.

SALES ENGINEER

I make sure our solutions meet the needs of the contractor during construction.

Contech is your partner in stormwater management solutions

Maximize Stormwater Storage in Shallow Footprints – ChamberMaxx®

ChamberMaxx® can be installed by hand without the need of heavy equipment.

The ChamberMaxx corrugated, open-bottom plastic infiltration chamber system allows you to meet stormwater runoff reduction requirements and maximize available land space by providing economic infiltration below grade. By utilizing subsurface infiltration, space is preserved for development or green space, runoff is reduced or eliminated, and groundwater recharge can occur.

ChamberMaxx maximizes storage volume in a small footprint, and its low profile shape is ideal for sights with shallow footprints. Each chamber provides 47 ft3 (1.3 m3) of storage.

The integrated end caps eliminate the expense associated with loose end caps that are common on many chamber systems and add to chamber strength.

ChamberMaxx is manufactured per ASTM F 2418 and is structurally designed to exceed HS-20/HS-25 live loads in accordance with AASHTO LRFD design specifications for stormwater chambers.

ChamberMaxx® Features and Benefits

FEATURE	BENEFIT
Each chamber provides 47 ft3 (1.3 m3) of storage	Maximized storage space
Low profile (51″ span x 30″ rise x 91″)	Allows for infiltration on sites with shallow footprint
Integrated end caps	Structural integrity and fewer parts to handle during installation
Manufactured per ASTM F 2418	Strength and durability
Lightweight	Installed by hand without the need of heavy equipment

APPLICATION TIPS

- Best practice designs for subsurface infiltration include pretreatment to reduce cost and frequency of maintenance while ensuring the infiltration capacity of the facility.
- Look for chamber systems that have integrated end caps to reduce installation time

ChamberMaxx® Applications

Bioretention

ChamberMaxx is designed with a minimum of 6″ stone above and below the units. The ChamberMaxx can help make bioretention practical by storing 75.1 CF per unit, including storage in stone, before discharging back into the surrounding soil.

Subsurface Infiltration

The open-bottom plastic chamber allows infiltration into surrounding soil, effectively achieving runoff reduction objectives often required by an LID design. By utilizing subsurface infiltration, space is preserved for development, runoff is reduced or eliminated and groundwater recharge can occur. The ChamberMaxx is ideal when you need to maximize storage capacity in a shallow footprint.

Practical for sites with marginal soils

ChamberMaxx® System Sizing

The ChamberMaxx system combines middle chambers, which are open on both ends, with start and end chambers, which include an integral end wall. Water is stored in both the chamber and in the void space in the surrounding stone backfill providing 75.1 cubic feet of storage per chamber. The ChamberMaxx system can be configured with up to 24-inch diameter (0.61 m) inlet/outlet manifold.

CHAMBER PART	WIDTH (IN) (M)	HEIGHT (IN) (M)	WEIGHT (LBS) (KG)	ACTUAL LENGTH (IN) (M)	INSTALLED LENGTH (IN) (M)	STORAGE VOLUME (CF) (M^3)	INSTALLED STORAGE VOLUME (CF) (M^3)*
Start	51.4 (1.31)	30.3 (0.77)	83.0 (37.65)	98.4 (2.50)	96.2 (2.44)	50.2 (1.42)	78.1 (2.21)
Middle	51.4 (1.31)	30.3 (0.77)	73.0 (33.11)	91.0 (2.31)	85.4 (2.17)	47.2 (1.34)	75.1 (2.31)
End	51.4 (1.31)	30.3 (0.77)	76.0 (34.47)	92.0 (2.34)	88.5 (2.25)	46.2 (1.31)	74.1 (2.10)

** 6" (152 mm) of stone above and below chamber, 5.6" (142 mm) chamber spacing and 40% porosity.*

Integral end caps eliminate loose end caps and add to chamber strength.

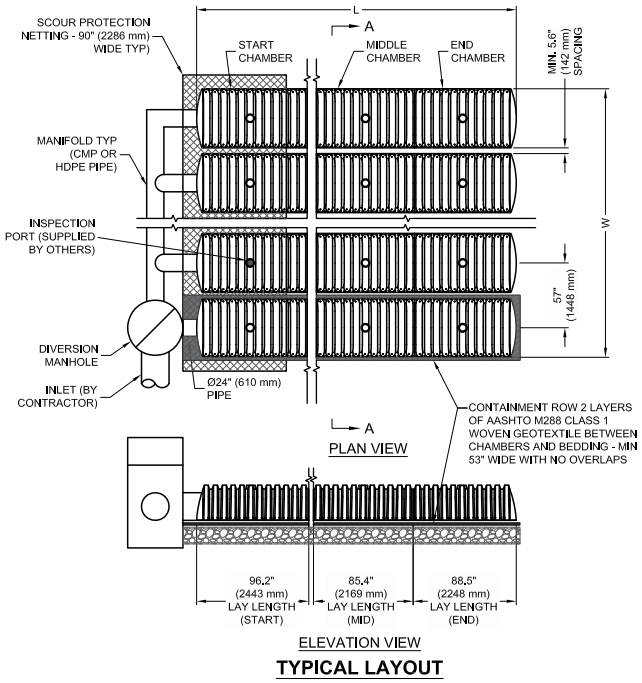
ChamberMaxx allows for infiltration on site with shallow footprint.

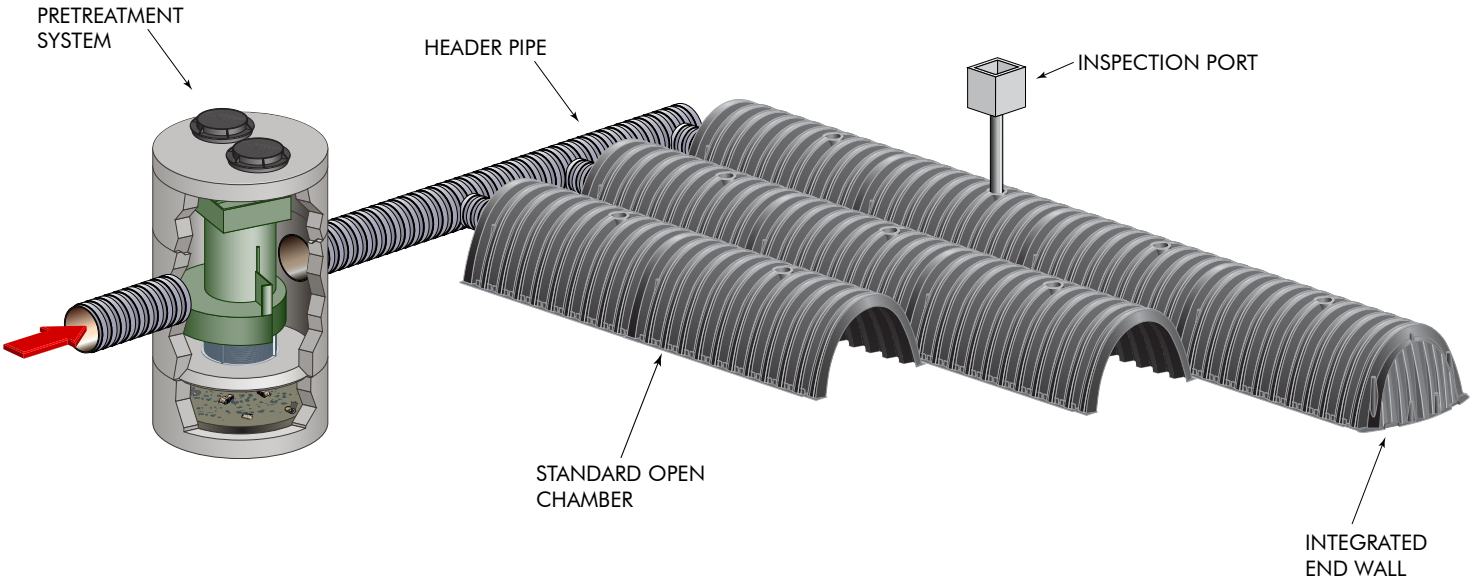
Learn More:
www.ContechES.com/chambermaxx

ChamberMaxx® Configuration Option

Optional Containment Row

Hydrodynamic separators and filtration devices provide the most efficient sediment removal and extended maintenance interval, and are recommended as pretreatment for ChamberMaxx systems. The ChamberMaxx Containment Row should be considered as basic, low cost treatment strategy and should only be considered where sediment loading to the ChamberMaxx system is assumed to be minimal. The Containment Row is designed to provide TSS removal by direct screening.





The open-bottom chamber system allows for runoff reduction and economic infiltration.

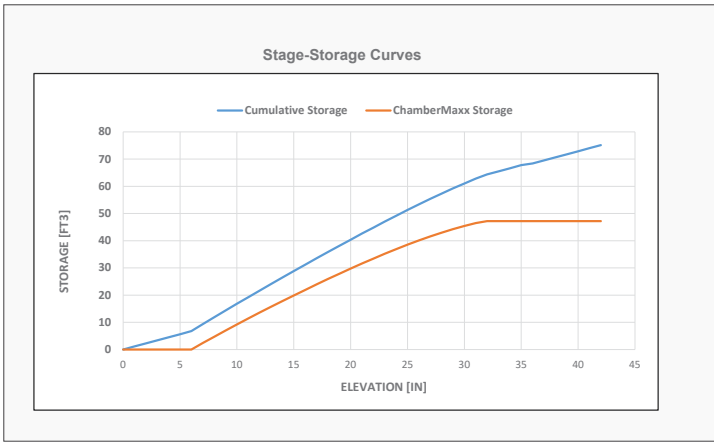
Include pretreatment for your best practice designs

ChamberMaxx® Stage Storage Table

	ELEVATION		CHAMBER STORAGE VOLUME		STONE STORAGE VOLUME		CUMULATIVE VOLUME INCREMENT		CUMULATIVE STORAGE VOLUME	
	(in)	(m)	(cf)	(m^3)	(cf)	(m^3)	(cf)	(m^3)	(cf)	(m^3)
STONE	42.30	1.07	47.20	1.34	27.94	0.79	1.13	0.03	75.14	2.13
	41.30	1.05	47.20	1.34	26.82	0.76	1.13	0.03	74.02	2.09
	40.30	1.02	47.20	1.34	25.69	0.73	1.13	0.03	72.89	2.06
	39.30	1.00	47.20	1.34	24.56	0.70	1.13	0.03	71.76	2.03
	38.30	0.97	47.20	1.34	23.44	0.66	1.13	0.03	70.64	2.00
	37.30	0.95	47.20	1.34	22.31	0.63	1.13	0.03	69.51	1.97
	36.30	0.92	47.20	1.34	21.18	0.60	0.62	0.02	68.38	1.94
	35.00	0.89	47.20	1.34	20.56	0.58	1.13	0.03	67.76	1.92
	34.00	0.86	47.20	1.34	19.43	0.55	1.13	0.03	66.63	1.89
	33.00	0.84	47.20	1.34	18.30	0.52	1.13	0.03	65.50	1.85
	32.00	0.81	47.20	1.34	17.18	0.49	1.56	0.04	64.38	1.82
	31.00	0.79	46.48	1.32	16.34	0.46	1.76	0.05	62.82	1.78
	30.00	0.76	45.43	1.29	15.63	0.44	1.83	0.05	61.06	1.73
CHAMBERMAXX CHAMBERS	29.00	0.74	44.26	1.25	14.98	0.42	1.90	0.05	59.23	1.68
	28.00	0.71	42.97	1.22	14.36	0.41	1.96	0.06	57.33	1.62
	27.00	0.69	41.58	1.18	13.79	0.39	2.02	0.06	55.37	1.57
	26.00	0.66	40.09	1.13	13.26	0.38	2.07	0.06	53.35	1.51
	25.00	0.64	38.53	1.09	12.76	0.36	2.11	0.06	51.29	1.45
	24.00	0.61	36.89	1.04	12.29	0.35	2.15	0.06	49.18	1.39
	23.00	0.58	35.18	1.00	11.84	0.34	2.18	0.06	47.03	1.33
	22.00	0.56	33.42	0.95	11.42	0.32	2.22	0.06	44.84	1.27
	21.00	0.53	31.60	0.89	11.02	0.31	2.24	0.06	42.63	1.21
	20.00	0.51	29.74	0.84	10.64	0.30	2.27	0.06	40.38	1.14
	19.00	0.48	27.84	0.79	10.27	0.29	2.29	0.06	38.11	1.08
	18.00	0.46	25.90	0.73	9.92	0.28	2.31	0.07	35.82	1.01
	17.00	0.43	23.93	0.68	9.59	0.27	2.33	0.07	33.51	0.95
	16.00	0.41	21.92	0.62	9.26	0.26	2.35	0.07	31.18	0.88
	15.00	0.38	19.88	0.56	8.95	0.25	2.37	0.07	28.83	0.82
	14.00	0.36	17.82	0.50	8.65	0.24	2.39	0.07	26.46	0.75
	13.00	0.33	15.72	0.44	8.36	0.24	2.40	0.07	24.08	0.68
	12.00	0.30	13.59	0.38	8.09	0.23	2.42	0.07	21.68	0.61
	11.00	0.28	11.43	0.32	7.82	0.22	2.45	0.07	19.25	0.54
	10.00	0.25	9.23	0.26	7.58	0.21	2.47	0.07	16.81	0.48
	9.00	0.23	6.99	0.20	7.34	0.21	2.50	0.07	14.34	0.41
	8.00	0.20	4.71	0.13	7.13	0.20	2.52	0.07	11.84	0.34
	7.00	0.18	2.38	0.07	6.93	0.20	2.56	0.07	9.32	0.26
	6.00	0.15	0.00	0.00	6.76	0.19	1.13	0.03	6.76	0.19
STONE	5.00	0.13	0.00	0.00	5.63	0.16	1.13	0.03	5.63	0.16
	4.00	0.10	0.00	0.00	4.51	0.13	1.13	0.03	4.51	0.13
	3.00	0.08	0.00	0.00	3.38	0.10	1.13	0.03	3.38	0.10
	2.00	0.05	0.00	0.00	2.25	0.06	1.13	0.03	2.25	0.06
	1.00	0.03	0.00	0.00	1.13	0.03	0.00	0.00	1.13	0.03

ChamberMaxx® Flow Routing

Proper design of any detention system typically requires that flow routing be performed. Engineers at Contech can be a valuable resource when designing a ChamberMaxx retention system. Typically, stage-storage curves like those shown are utilized in the analysis. Contech stage-storage calculator is available for download on www.ContechES.com. This information can simply be inserted into common hydrology/hydraulic software such as HydroCAD, HydroFlow, PondPack or TR20. This makes a flow routing design with ChamberMaxx just as simple as an aboveground pond design.



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PIPE SOLUTIONS

STRUCTURES SOLUTIONS

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Contech provides innovative, cost-effective site solutions to engineers, contractors, and developers on projects across North America. Our portfolio includes bridges, drainage, erosion control, retaining wall, sanitary sewer and stormwater management products.

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Detention Storage
Project: Commercial Development, Cobourg
Parcel B, Phase 2

User Inputs

Chamber Model	SC-310
Outlet Control Structure	Yes (Outlet)
Project Name	Cobourg Gas and Plaza
Engineer	Abu S. Ziauddin
Project Location	Cobourg, ON
Project Date	04/28/2020
Measurement Type	Metric
Required Storage Volume	45 cubic meters
Stone Porosity	40%
Stone Foundation Depth	152 mm.
Stone Above Chambers	152 mm.
Average Cover Over Chambers	460 mm.
Design Constraint	Length
Design Constraint Dimension	15 meters

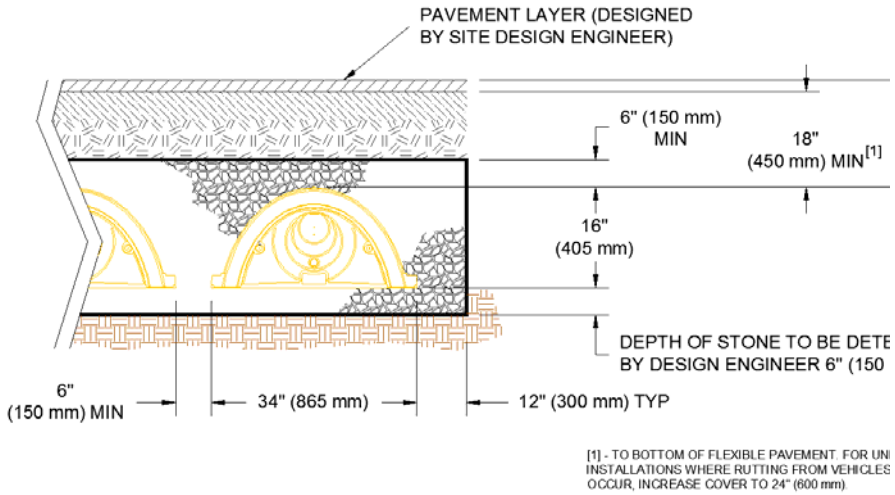
Results

System Volume and Bed Size

Installed Storage Volume	46 cubic meters
Storage Volume Per Chamber	0.88 cubic meters
Number Of Chambers Required	44 each
Number Of End Caps Required	16 each
Rows/Chambers	7 row(s) of 6 chamber(s)
Leftover Rows/Chambers	1 row(s) of 2 chamber(s)
Maximum Length	15.05 meters
Maximum Width	8.77 meters
Approx. Bed Size Required	123 square meters

System Components

Amount Of Stone Required	69 cubic meters
Volume Of Excavation (Not Including Fill)	87 cubic meters
Non-woven Filter Fabric Required	278 square meters
Length Of Isolator Row	13.38 meters 20 square meters
Non-Woven Isolator Row Fabric	16 square meters
Woven Isolator Row Fabric	



StormTech
Detention • Retention • Water Quality
An ADS company

Isolator® Row O&M Manual

THE MOST ADVANCED NAME IN WATER MANAGEMENT SOLUTIONS™

ADS®

THE ISOLATOR® ROW

INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.

THE ISOLATOR ROW

The Isolator Row is a row of StormTech chambers, either SC-160LP, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the SC-160LP, DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

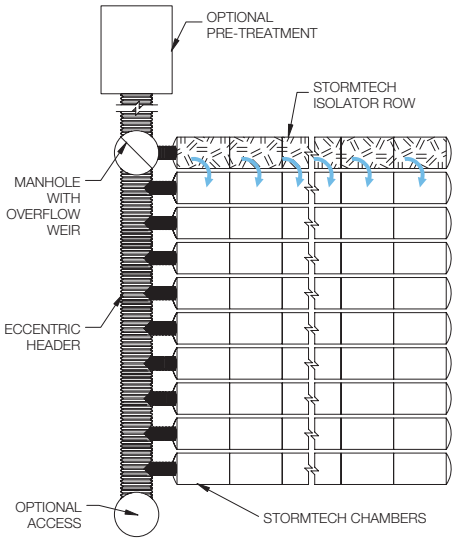
The Isolator Row is typically designed to capture the “first flush” and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the over flow weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.

StormTech Isolator Row with Overflow Spillway (not to scale)



ISOLATOR ROW INSPECTION/MAINTENANCE

INSPECTION

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

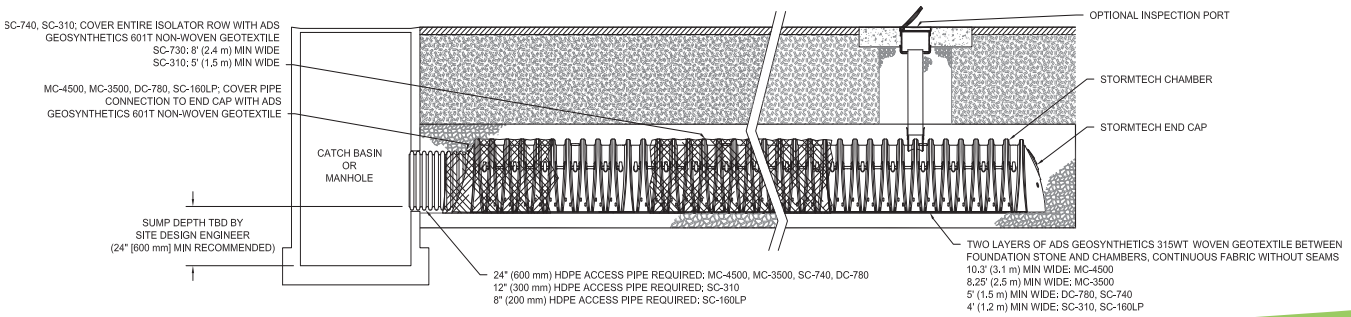
MAINTENANCE

The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)

Note: Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-4500 chamber models and is not required over the entire Isolator Row.



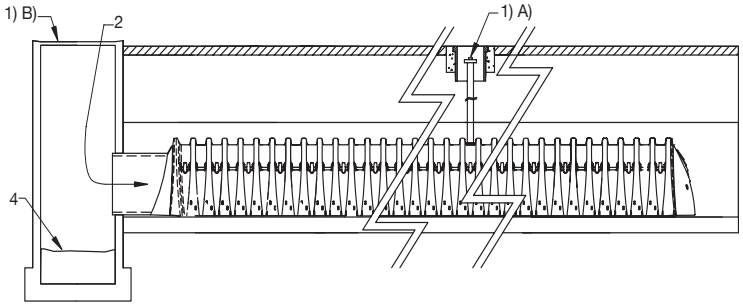
ISOLATOR ROW STEP BY STEP MAINTENANCE PROCEDURES

STEP 1
Inspect Isolator Row for sediment.
- A) Inspection ports (if present)
  - i. Remove lid from floor box frame
  - ii. Remove cap from inspection riser
  - iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
  - iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.
- B) All Isolator Rows
  - i. Remove cover from manhole at upstream end of Isolator Row
  - ii. Using a flashlight, inspect down Isolator Row through outlet pipe
    1. Mirrors on poles or cameras may be used to avoid a confined space entry
    2. Follow OSHA regulations for confined space entry if entering manhole
  - iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2. If not, proceed to Step 3.

STEP 2
Clean out Isolator Row using the JetVac process.
- A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
- B) Apply multiple passes of JetVac until backflush water is clean
- C) Vacuum manhole sump as required

STEP 3
Replace all caps, lids and covers, record observations and actions.

STEP 4
Inspect & clean catch basins and manholes upstream of the StormTech system.



SAMPLE MAINTENANCE LOG

Date	Stadia Rod Readings		Sediment Depth (1)–(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

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1-800-821-6710 www.ads-pipe.com

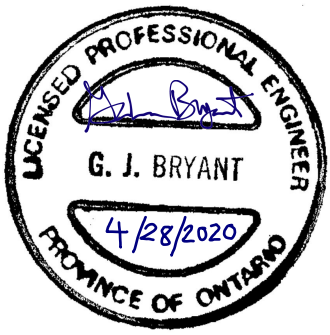
Appendix F

Oil and Grit Separators

Hydroworks Sizing Summary

Cobourg Gas
Parcel A

04-28-2020



Recommended Size: HS 6

A HydroStorm HS 6 is recommended to provide 80 % annual TSS removal based on a drainage area of 0.2752 (ha) with an imperviousness of 84 % and Peterborough, Ontario rainfall for the ETV Canada particle size distribution.

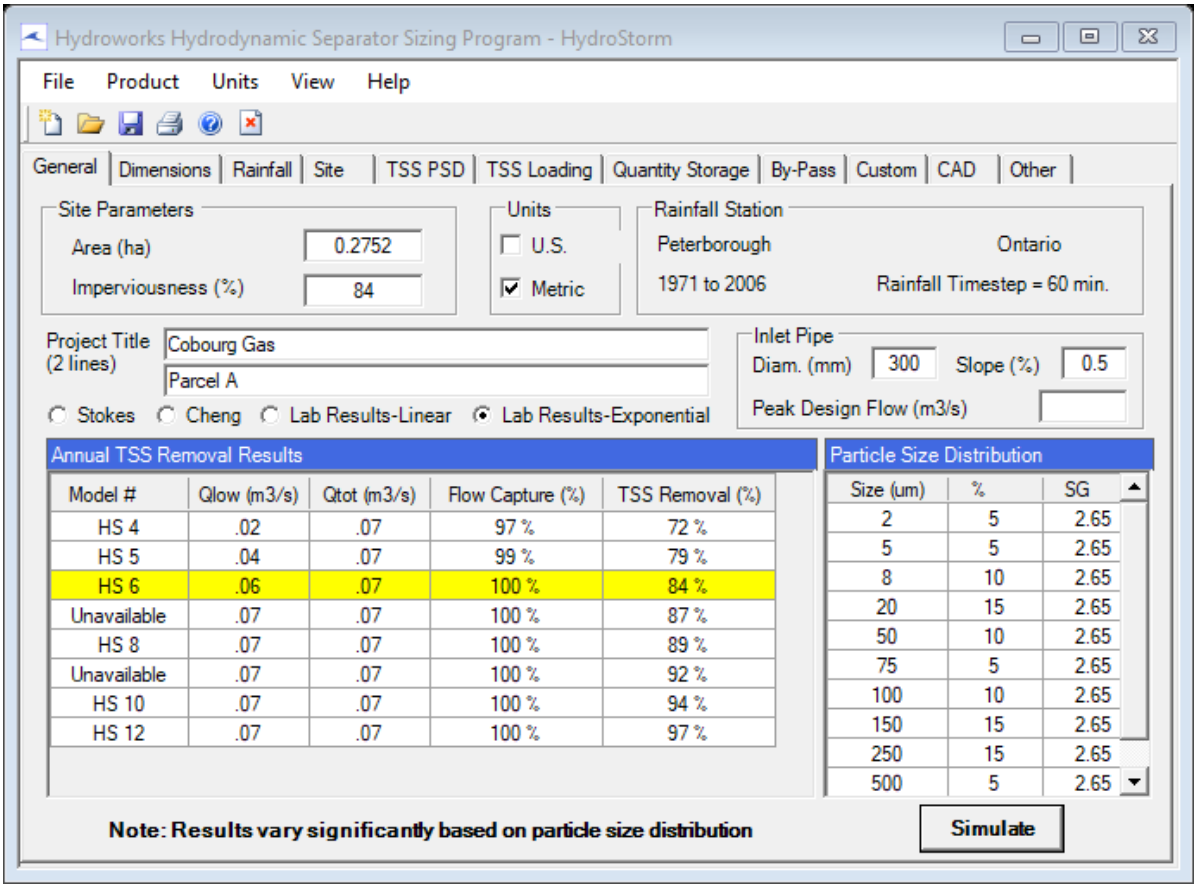
The recommended HydroStorm HS 6 treats 100 % of the annual runoff and provides 84 % annual TSS removal for the Peterborough rainfall records and ETV Canada particle size distribution.

The HydroStorm has a headloss coefficient (K) of 1.04. Since a peak flow was not specified, headloss was calculated using the full pipe flow of .07 (m3/s) for the given 300 (mm) pipe diameter at .5% slope. The headloss was calculated to be 50 (mm) based on a flow depth of 300 (mm) (full pipe flow).

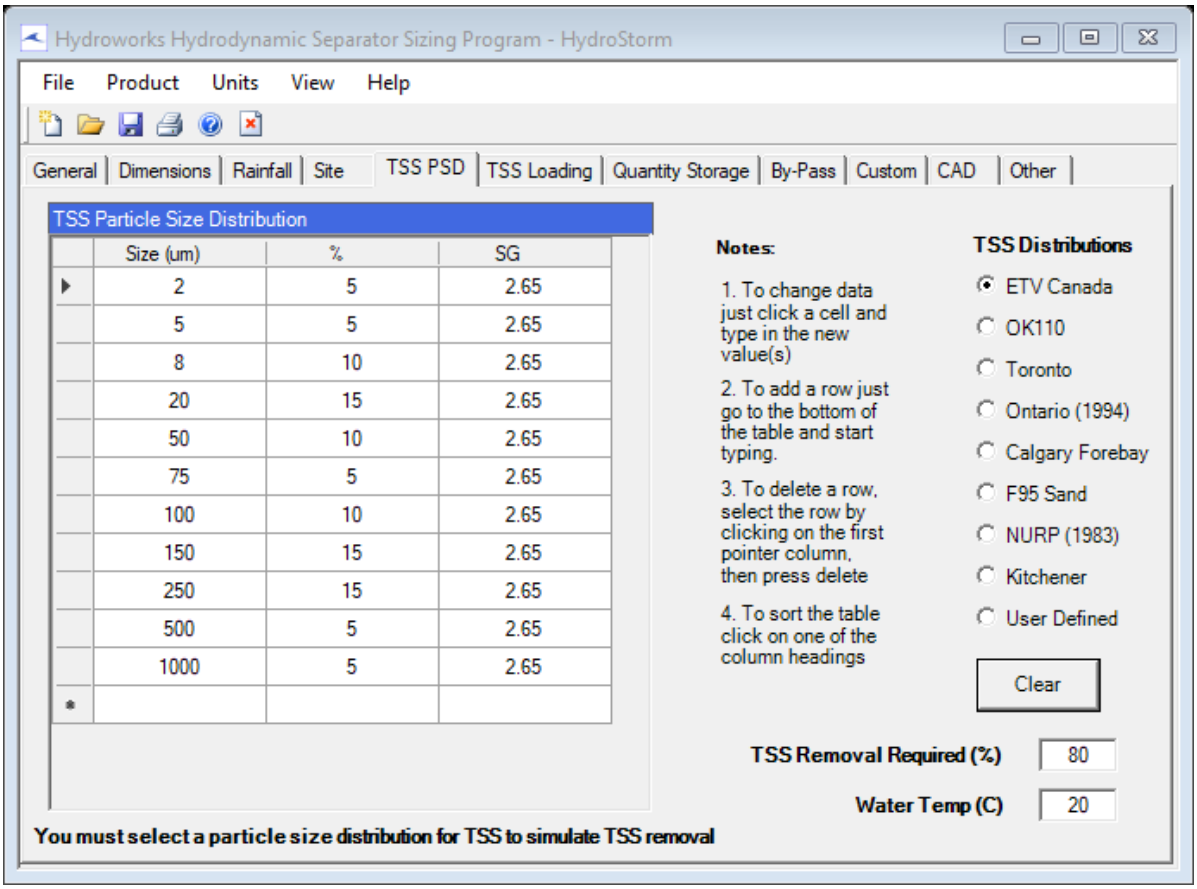
This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.

If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.

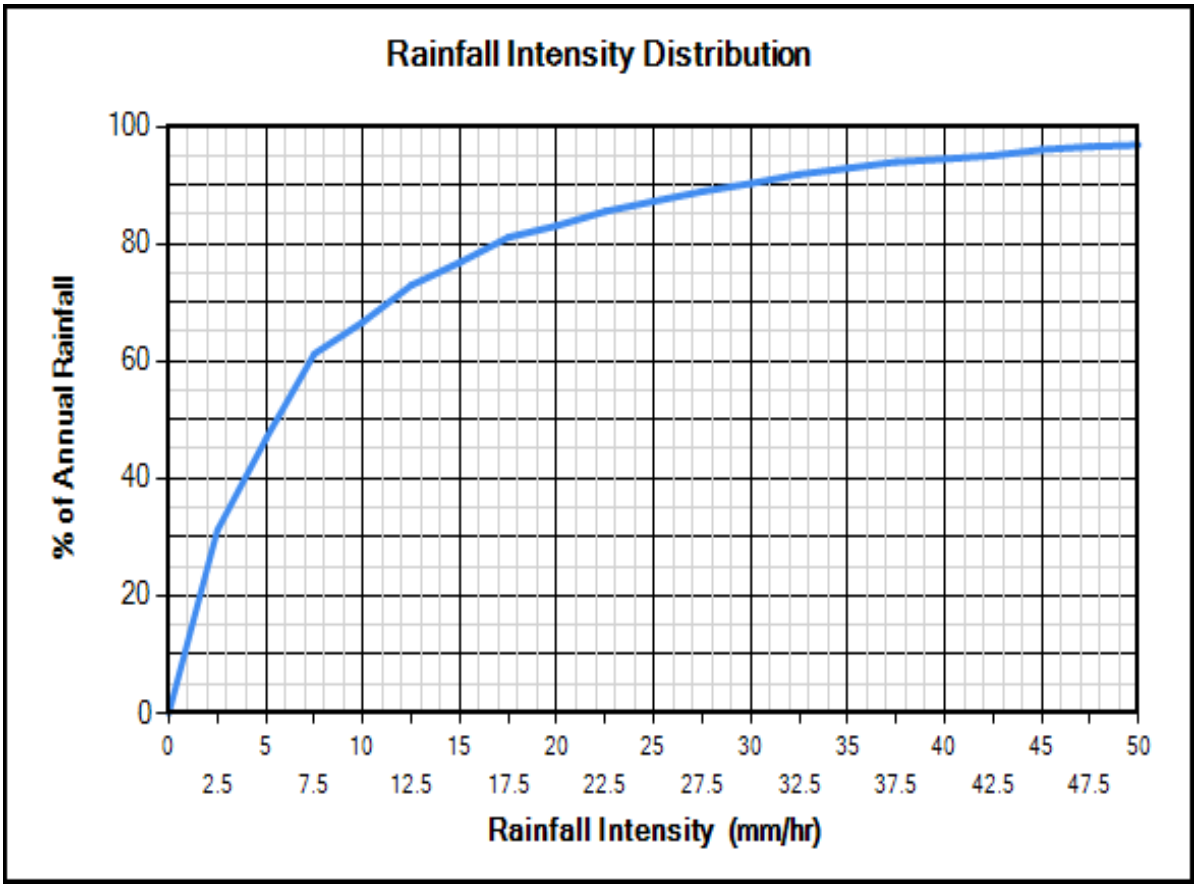
TSS Removal Sizing Summary



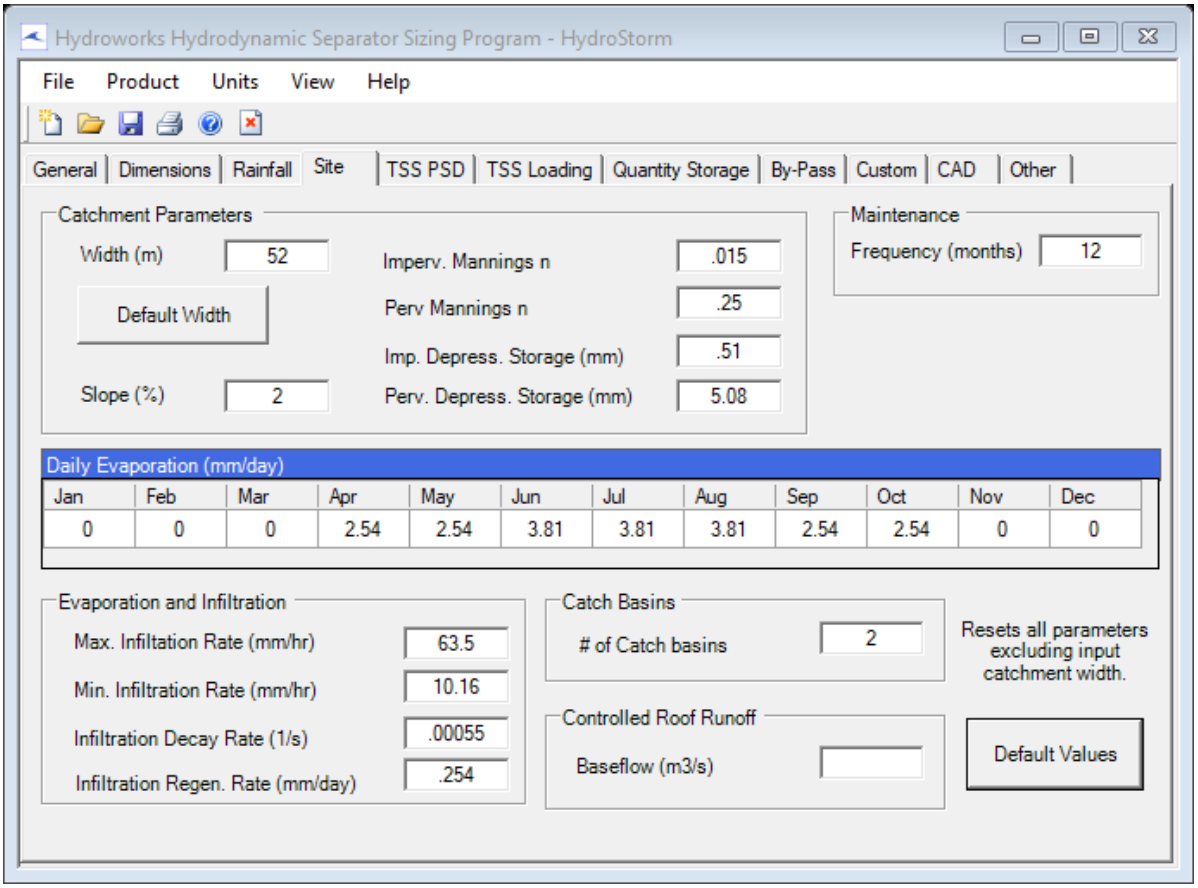
TSS Particle Size Distribution



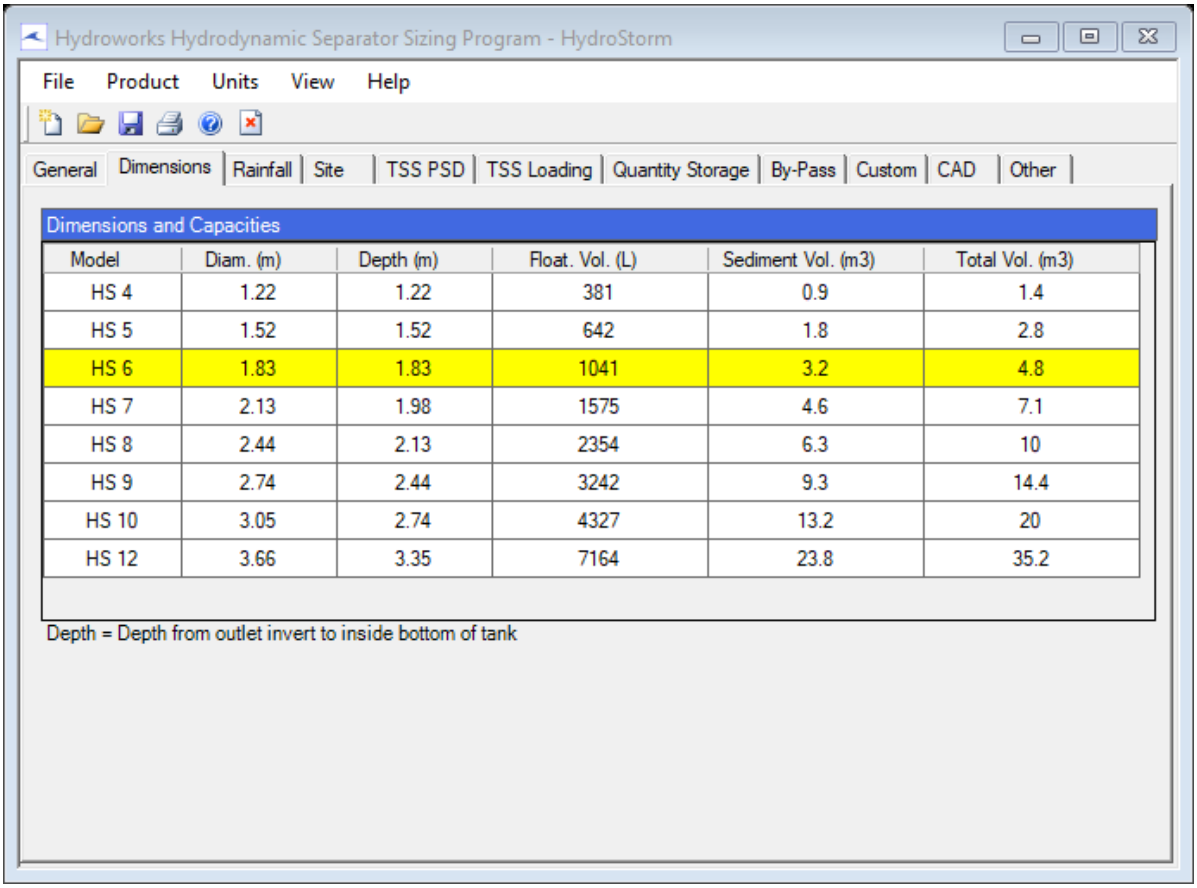
Rainfall Station - Peterborough, Ontario(1971 to 2006)



Site Physical Characteristics



Dimensions And Capacities

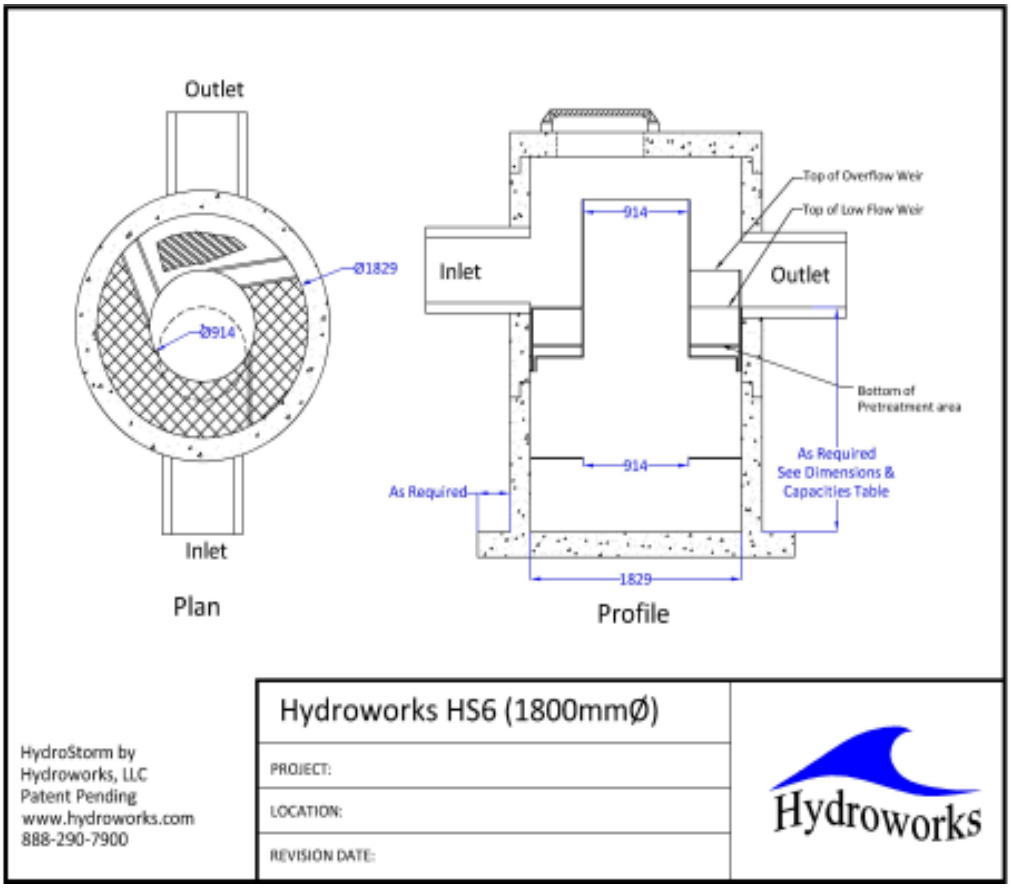


Dimensions and Capacities

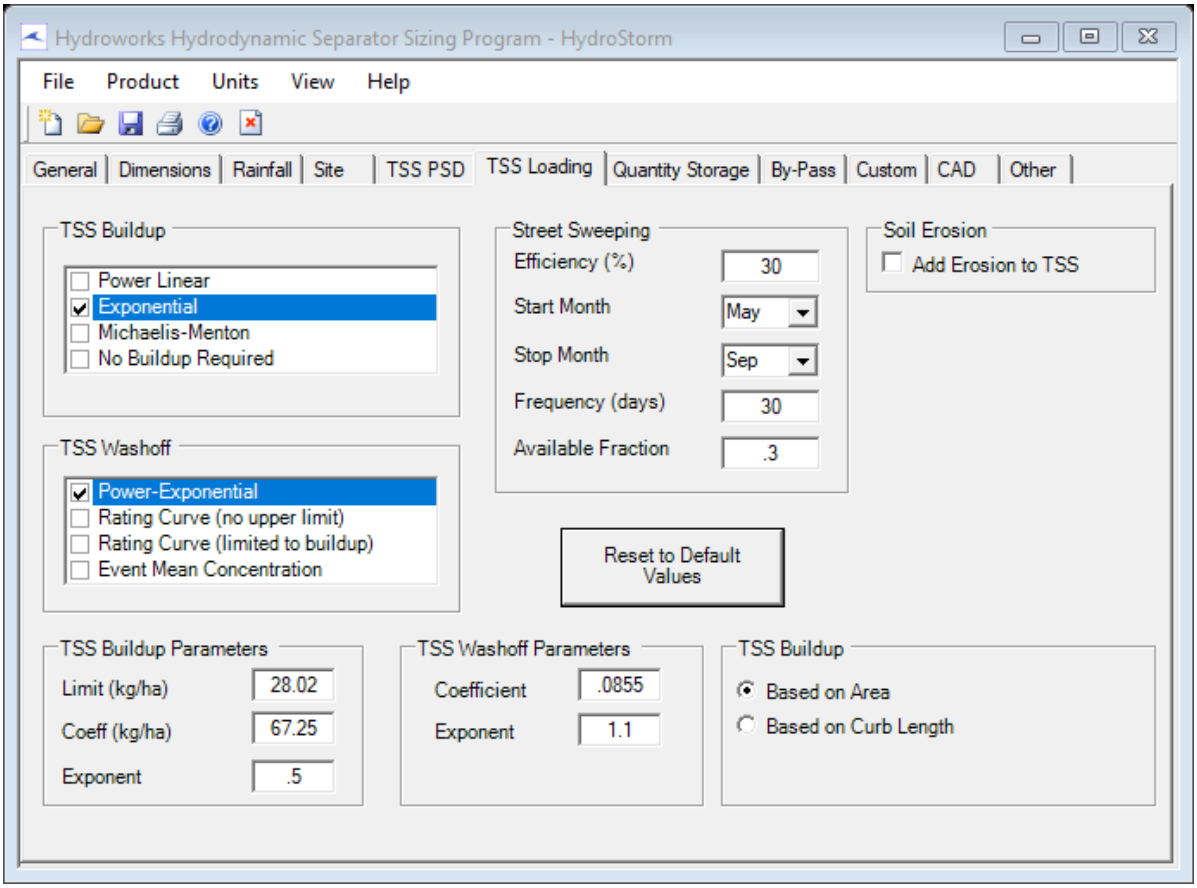
Model	Diam. (m)	Depth (m)	Float. Vol. (L)	Sediment Vol. (m3)	Total Vol. (m3)
HS 4	1.22	1.22	381	0.9	1.4
HS 5	1.52	1.52	642	1.8	2.8
HS 6	1.83	1.83	1041	3.2	4.8
HS 7	2.13	1.98	1575	4.6	7.1
HS 8	2.44	2.13	2354	6.3	10
HS 9	2.74	2.44	3242	9.3	14.4
HS 10	3.05	2.74	4327	13.2	20
HS 12	3.66	3.35	7164	23.8	35.2

Depth = Depth from outlet invert to inside bottom of tank

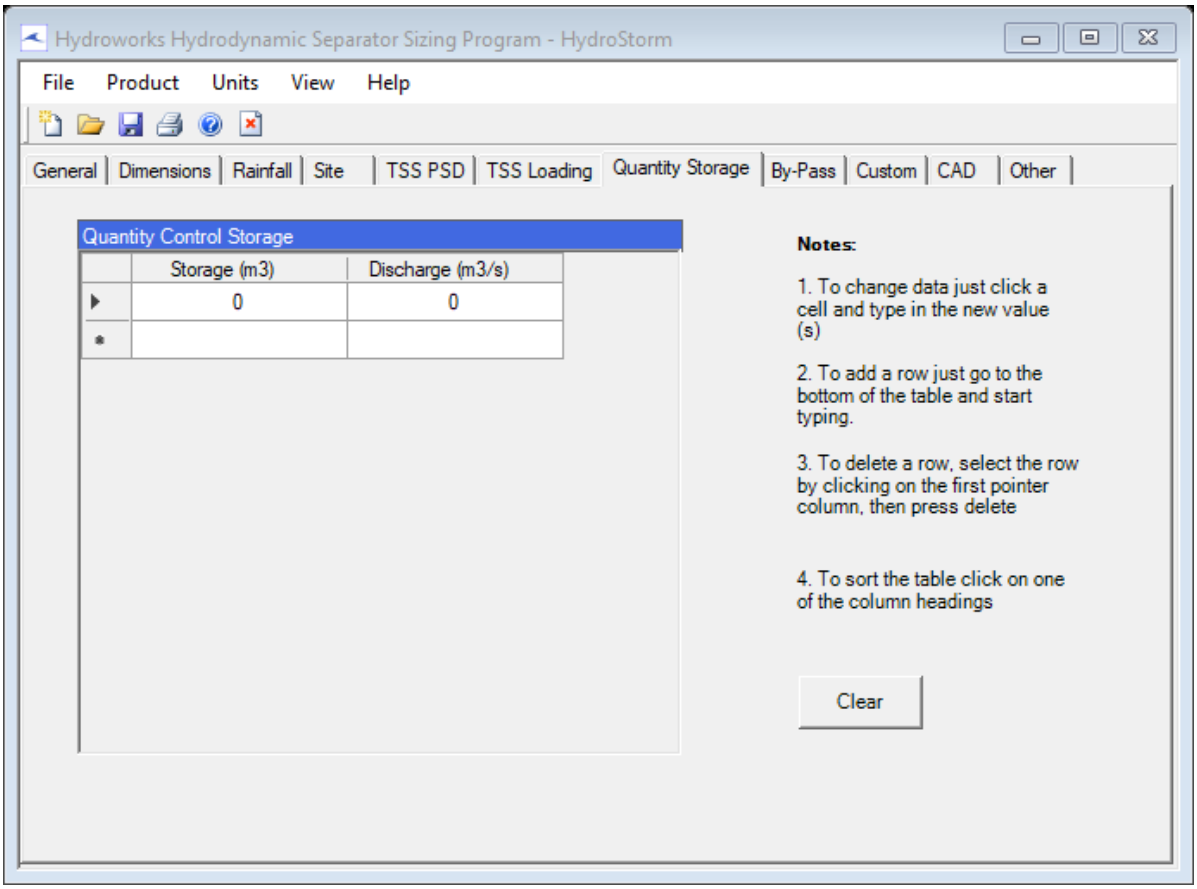
Generic HS 6 CAD Drawing



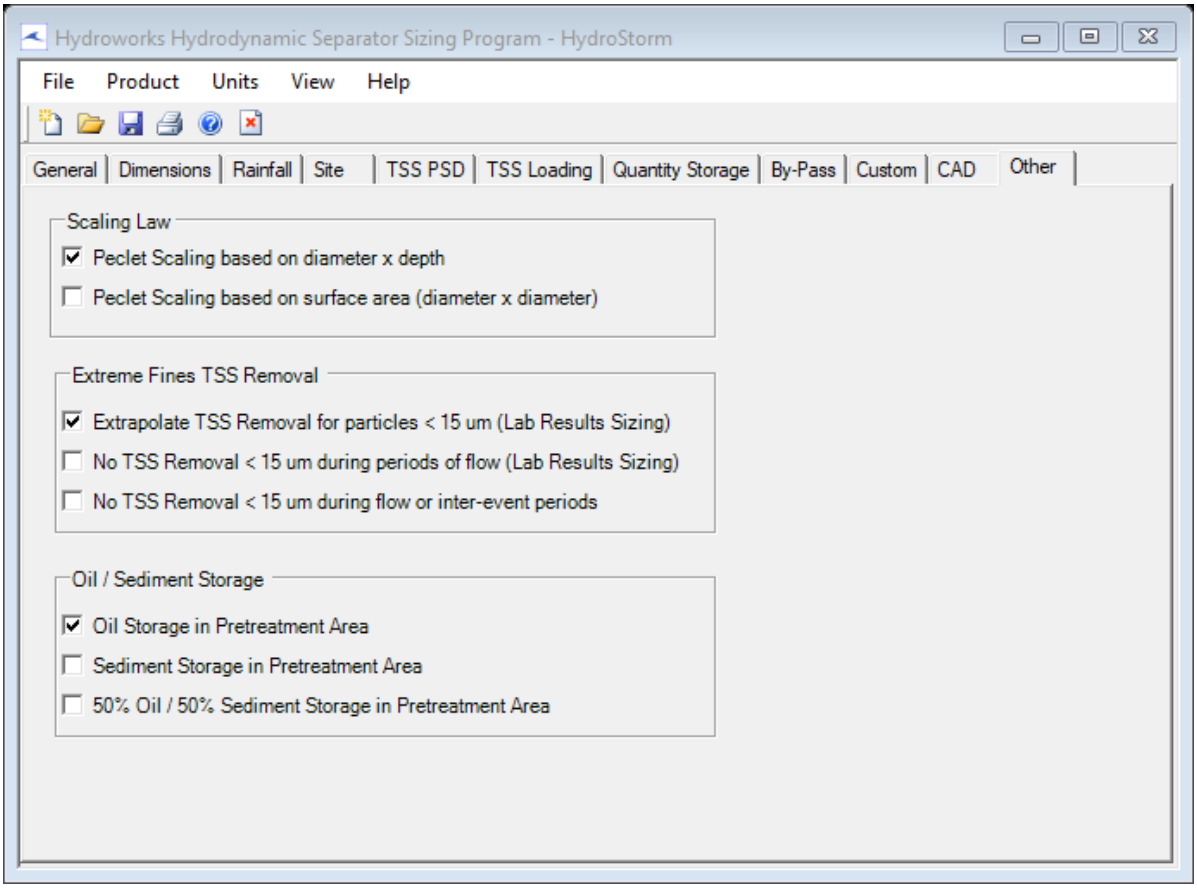
TSS Buildup And Washoff



Upstream Quantity Storage



Other Parameters

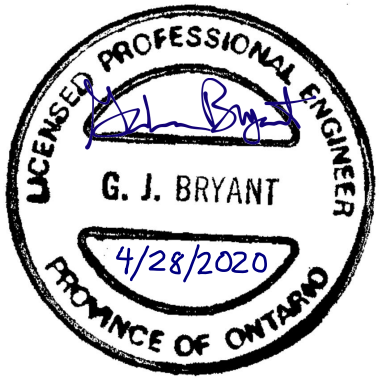


Hydroworks Sizing Program - Version 4.9

Hydroworks Sizing Summary

Cobourg Gas
Parcel B Phase 1

04-28-2020



Recommended Size: HS 6

A HydroStorm HS 6 is recommended to provide 80 % annual TSS removal based on a drainage area of .2752 (ha) with an imperviousness of 84 % and Kingston Pumping Station, Ontario rainfall for the ETV Canada particle size distribution.

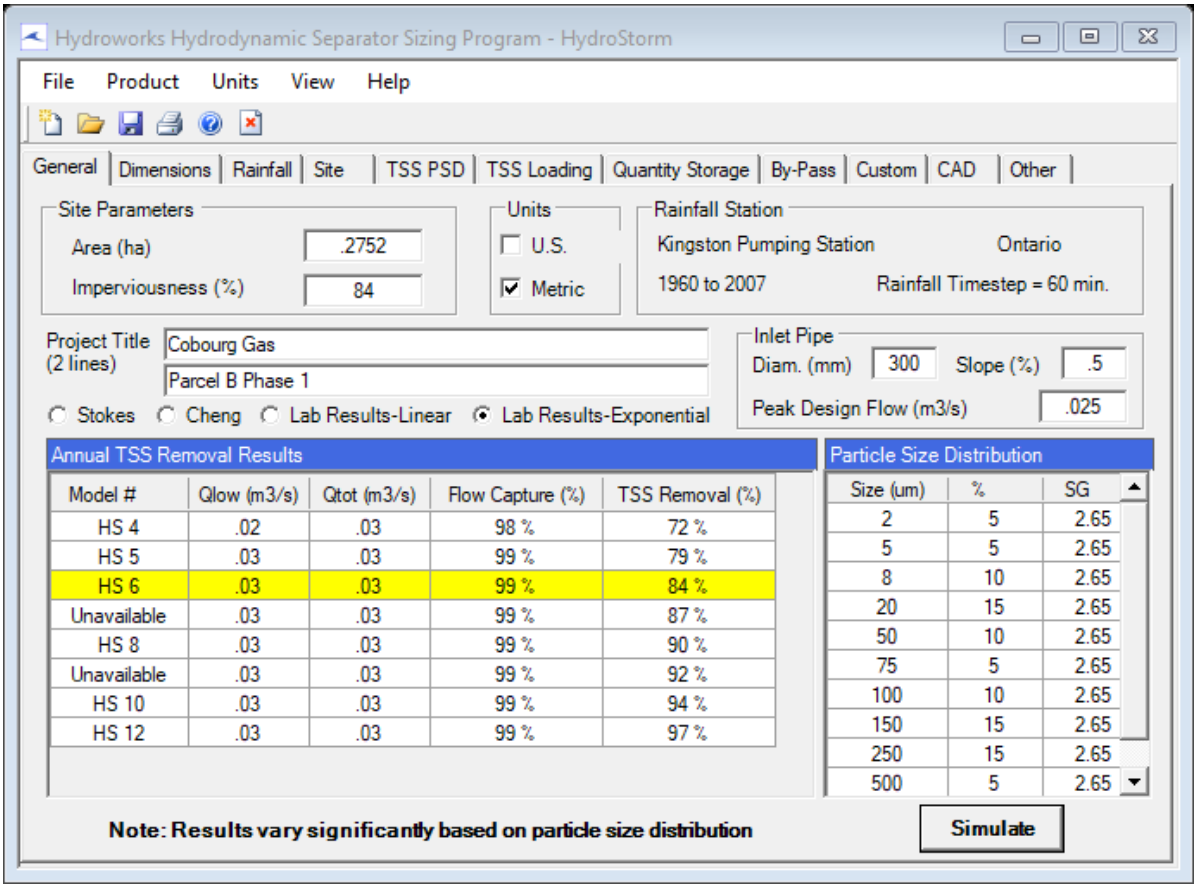
The recommended HydroStorm HS 6 treats 99 % of the annual runoff and provides 84 % annual TSS removal for the Kingston Pumping Station rainfall records and ETV Canada particle size distribution.

The HydroStorm has a headloss coefficient (K) of 1.04. The given peak flow of .025 (m3/s) is less than the full pipe flow of .07 (m3/s) indicating free flow in the pipe during the peak flow assuming no tailwater condition. Partial pipe flow was assumed For the headloss calculations. The normal depth is greater than the critical depth for the peak flow and 300 (mm) pipe diameter and .5 % slope given. Normal depth was assumed For the headloss calculations. The headloss was calculated To be 42 (mm) based on a flow depth of 126 (mm) .

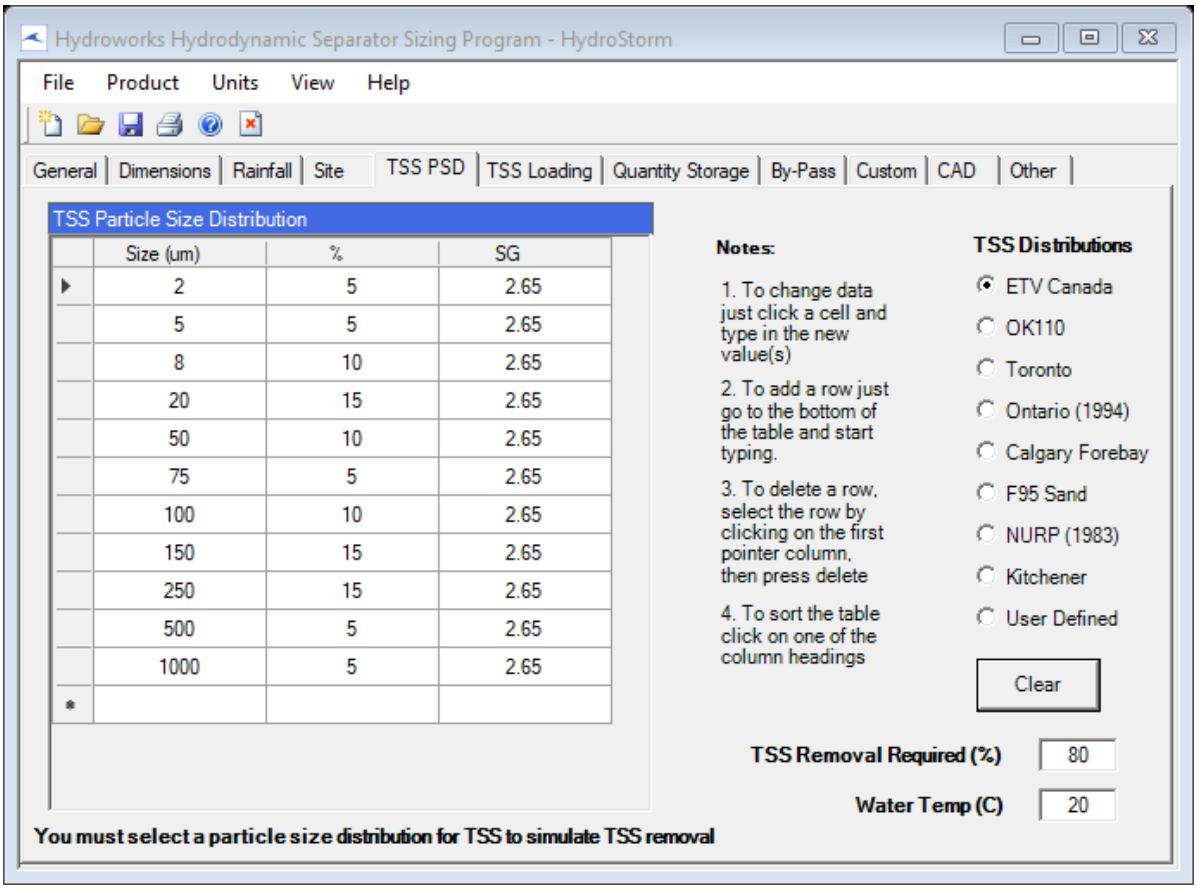
This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.

If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.

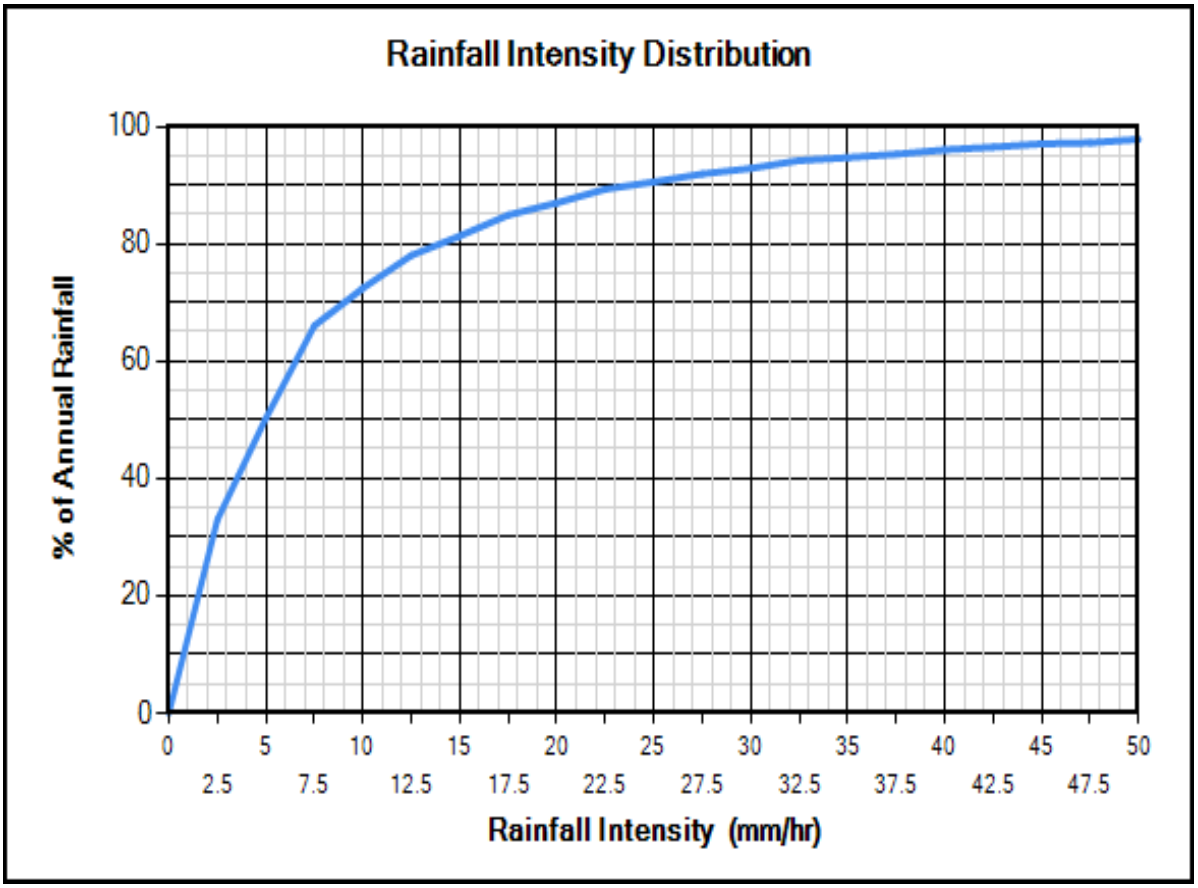
TSS Removal Sizing Summary



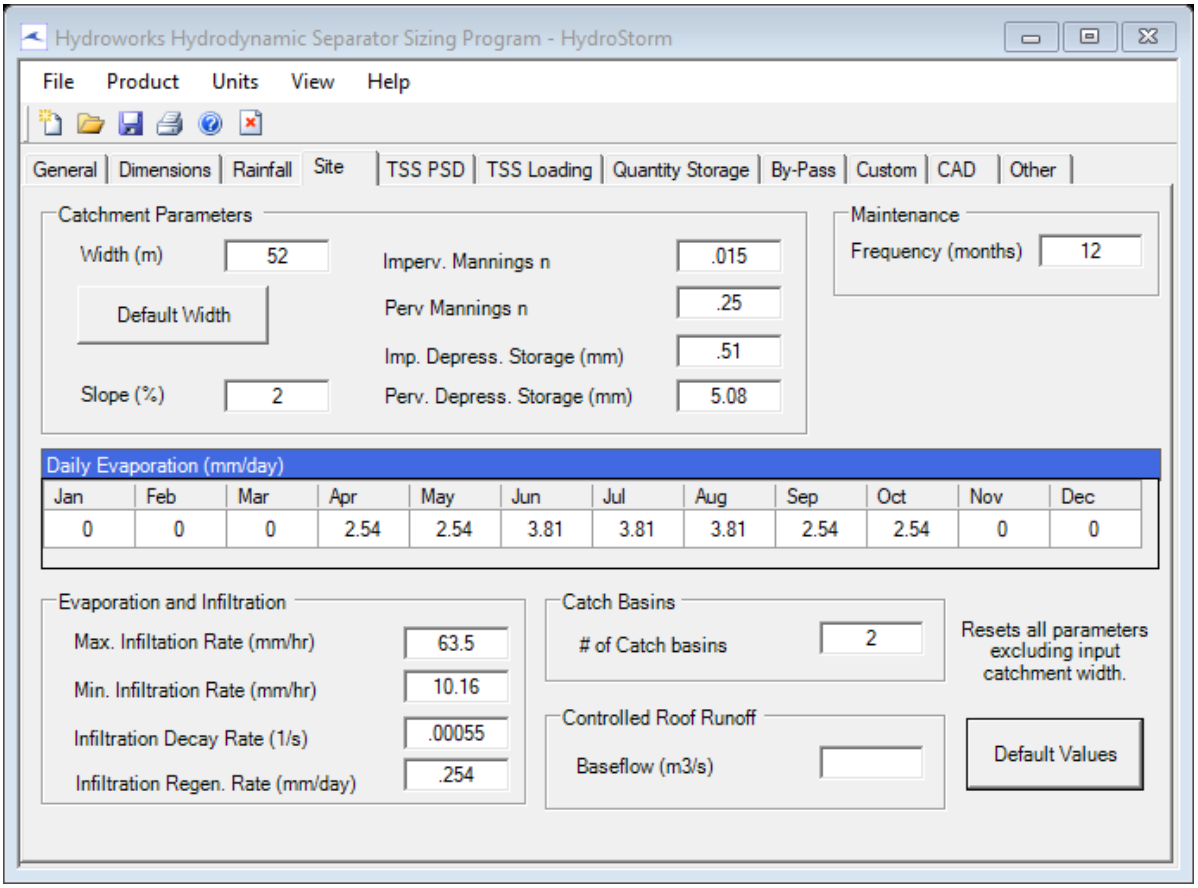
TSS Particle Size Distribution



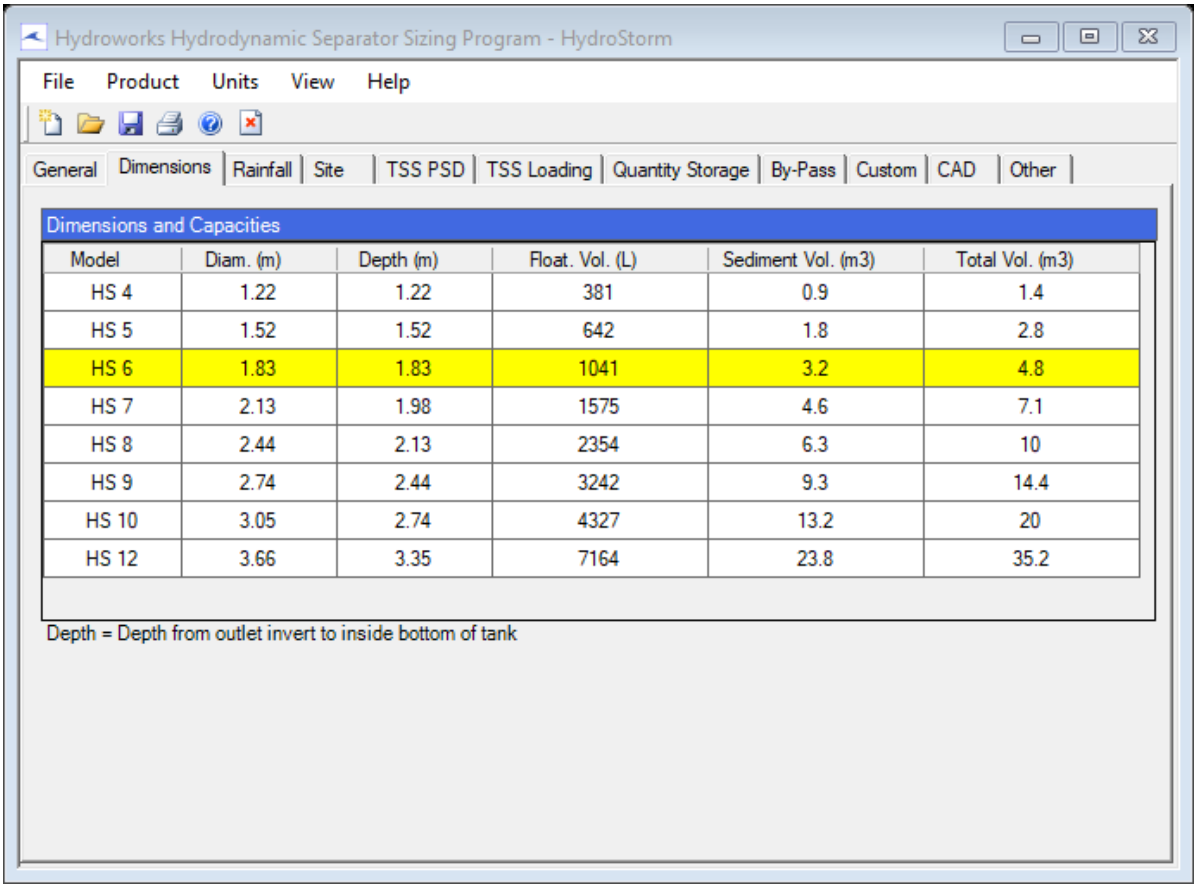
Rainfall Station - Kingston Pumping Station, Ontario(1960 to 2007)



Site Physical Characteristics



Dimensions And Capacities



Dimensions and Capacities

Model	Diam. (m)	Depth (m)	Float. Vol. (L)	Sediment Vol. (m3)	Total Vol. (m3)
HS 4	1.22	1.22	381	0.9	1.4
HS 5	1.52	1.52	642	1.8	2.8
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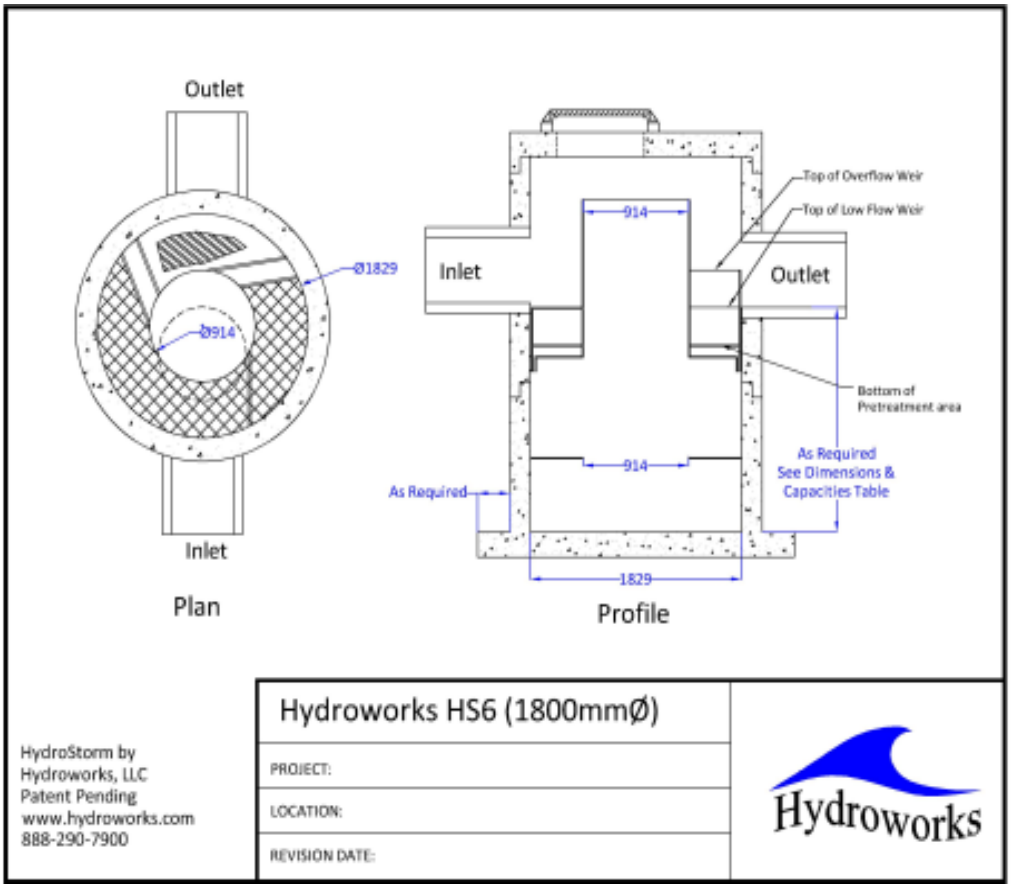
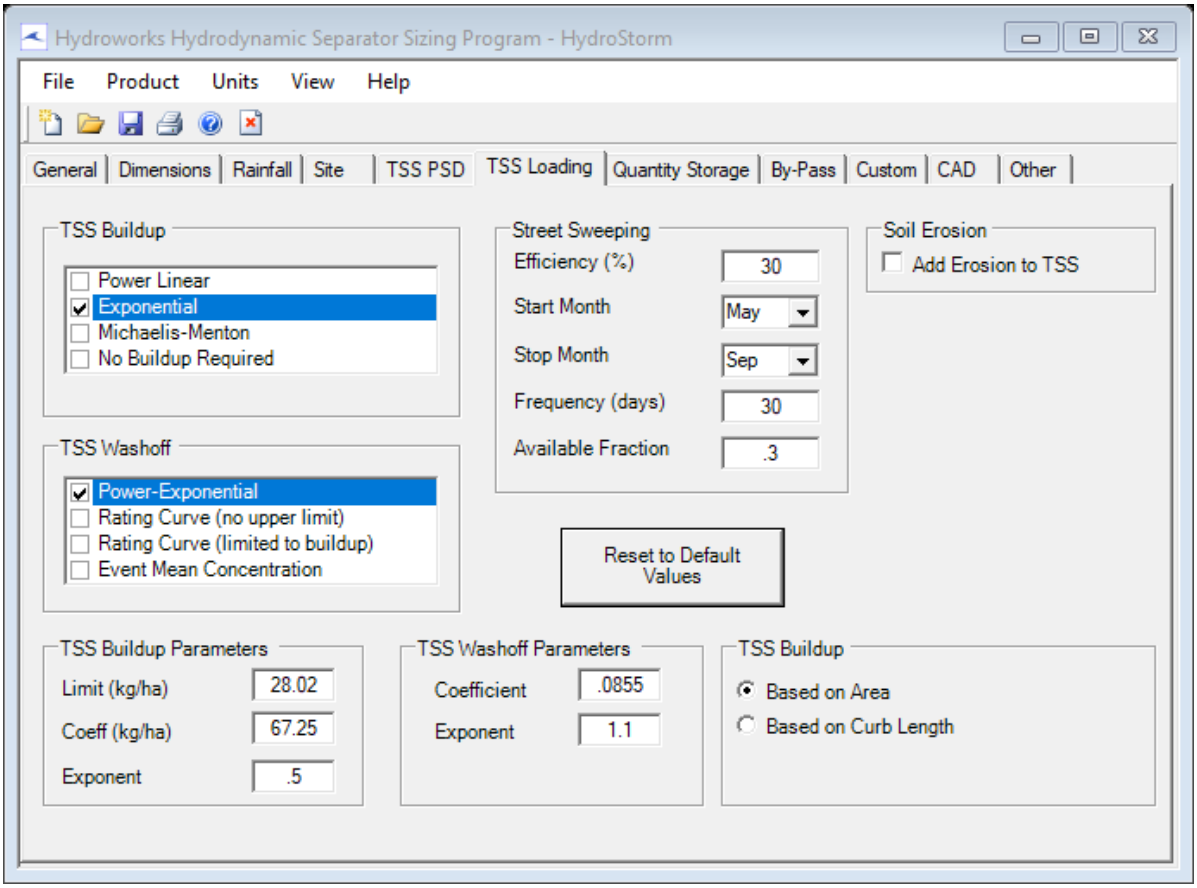
HS 7	2.13	1.98	1575	4.6	7.1
HS 8	2.44	2.13	2354	6.3	10
HS 9	2.74	2.44	3242	9.3	14.4
HS 10	3.05	2.74	4327	13.2	20
HS 12	3.66	3.35	7164	23.8	35.2

Depth = Depth from outlet invert to inside bottom of tank

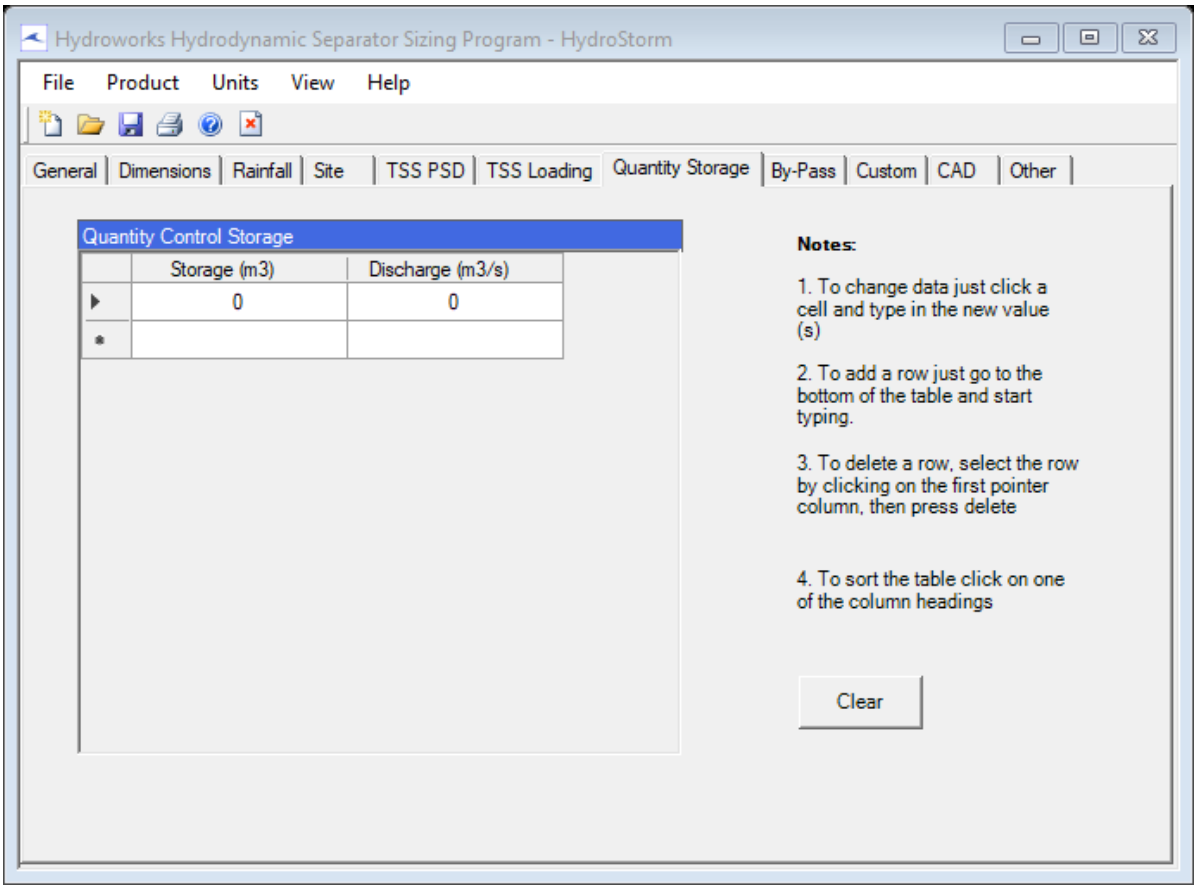
Generic HS 6 CAD Drawing



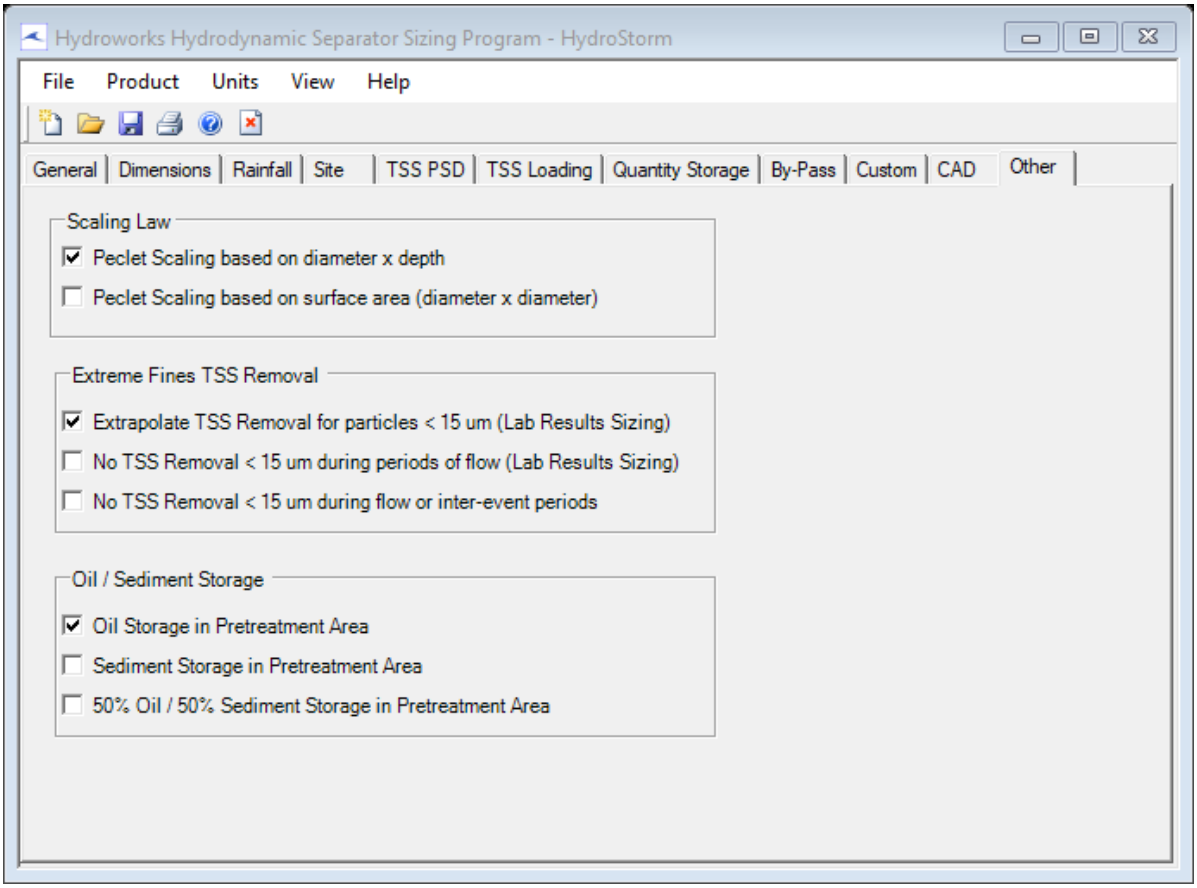
TSS Buildup And Washoff



Upstream Quantity Storage



Other Parameters



Hydroworks Sizing Program - Version 4.9

Hydroworks Sizing Summary

Cobourg Plaza
Parcel 2 - Phase 2

06-12-2020

Recommended Size: HS 6

A HydroStorm HS 6 is recommended to provide 80 % annual TSS removal based on a drainage area of .42 (ha) with an imperviousness of 80 % and Kingston Pumping Station, Ontario rainfall for the ETV Canada particle size distribution.

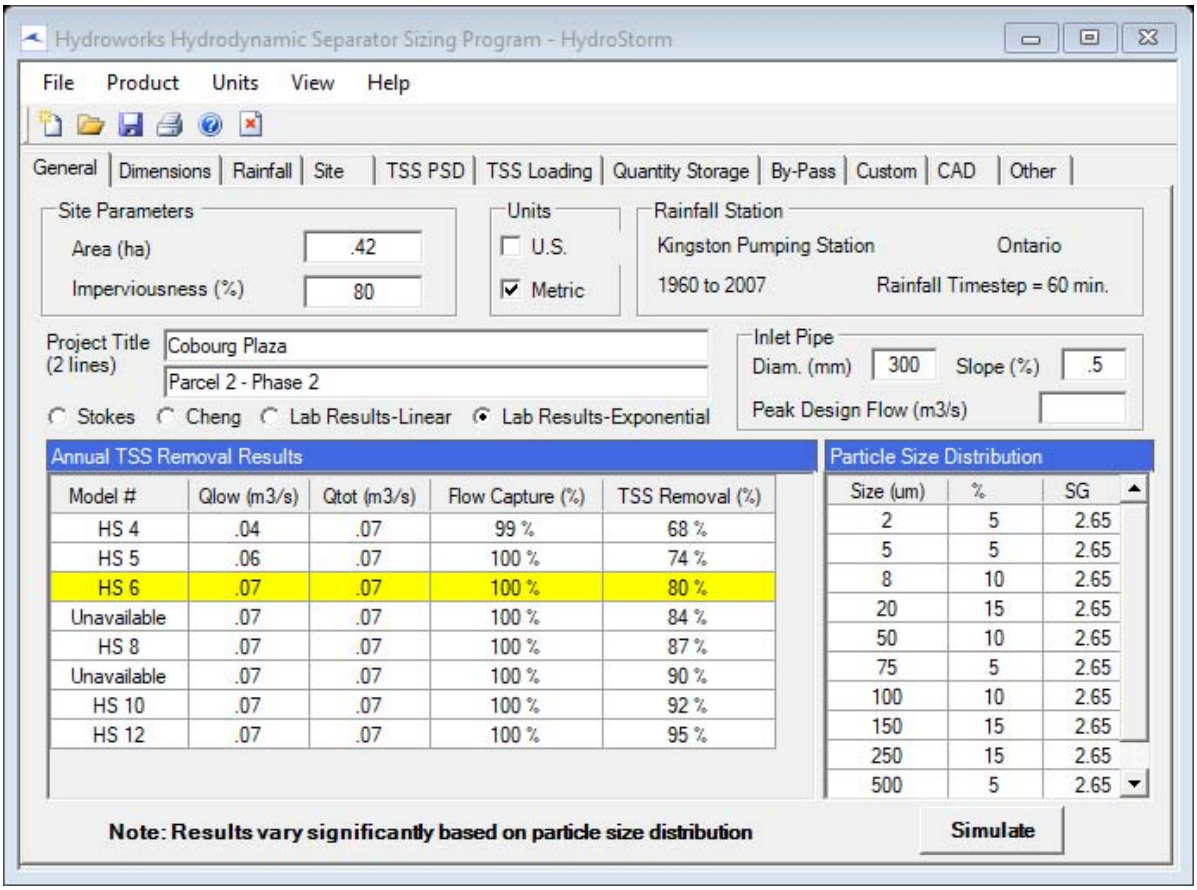
The recommended HydroStorm HS 6 treats 100 % of the annual runoff and provides 80 % annual TSS removal for the Kingston Pumping Station rainfall records and ETV Canada particle size distribution.

The HydroStorm has a headloss coefficient (K) of 1.04. Since a peak flow was not specified, headloss was calculated using the full pipe flow of .1 (m3/s) for the given 300 (mm) pipe diameter at .5% slope. The headloss was calculated to be 50 (mm) based on a flow depth of 300 (mm) (full pipe flow).

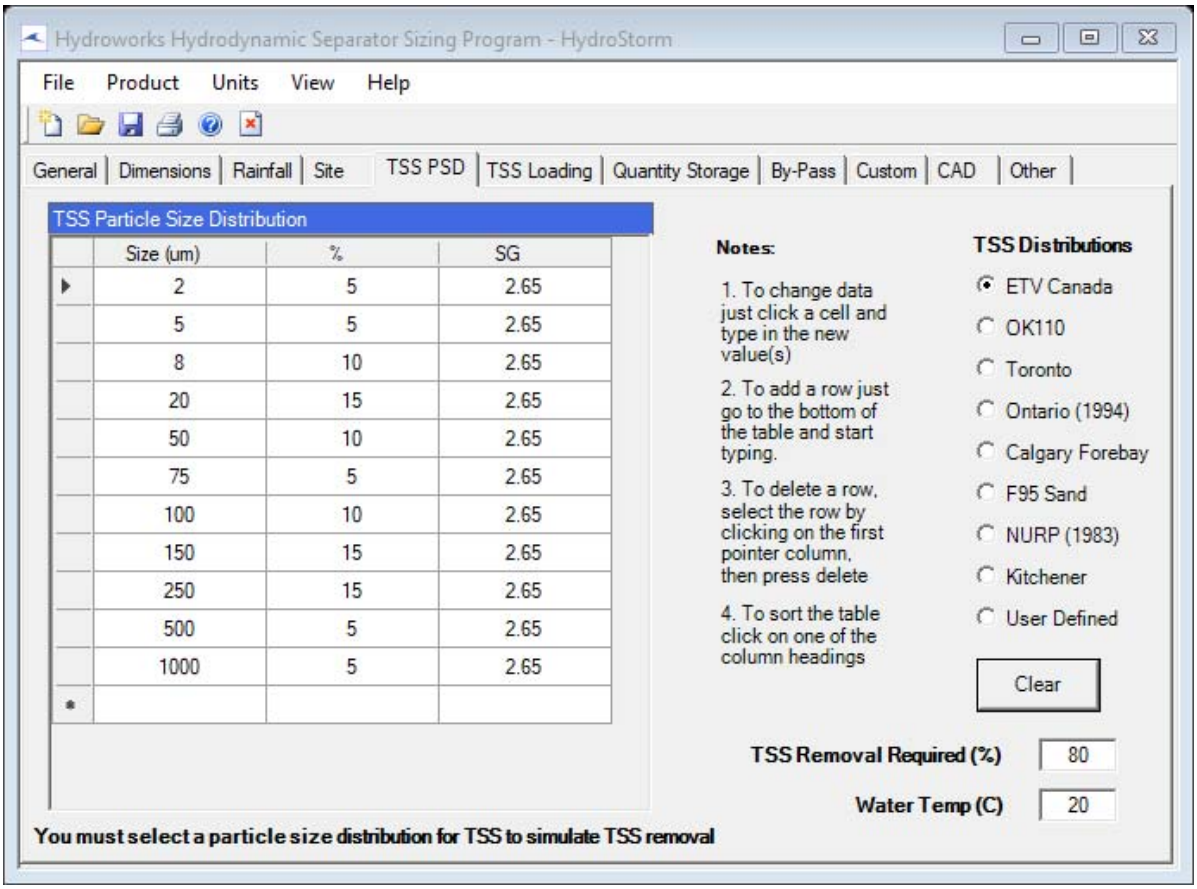
This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.

If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.

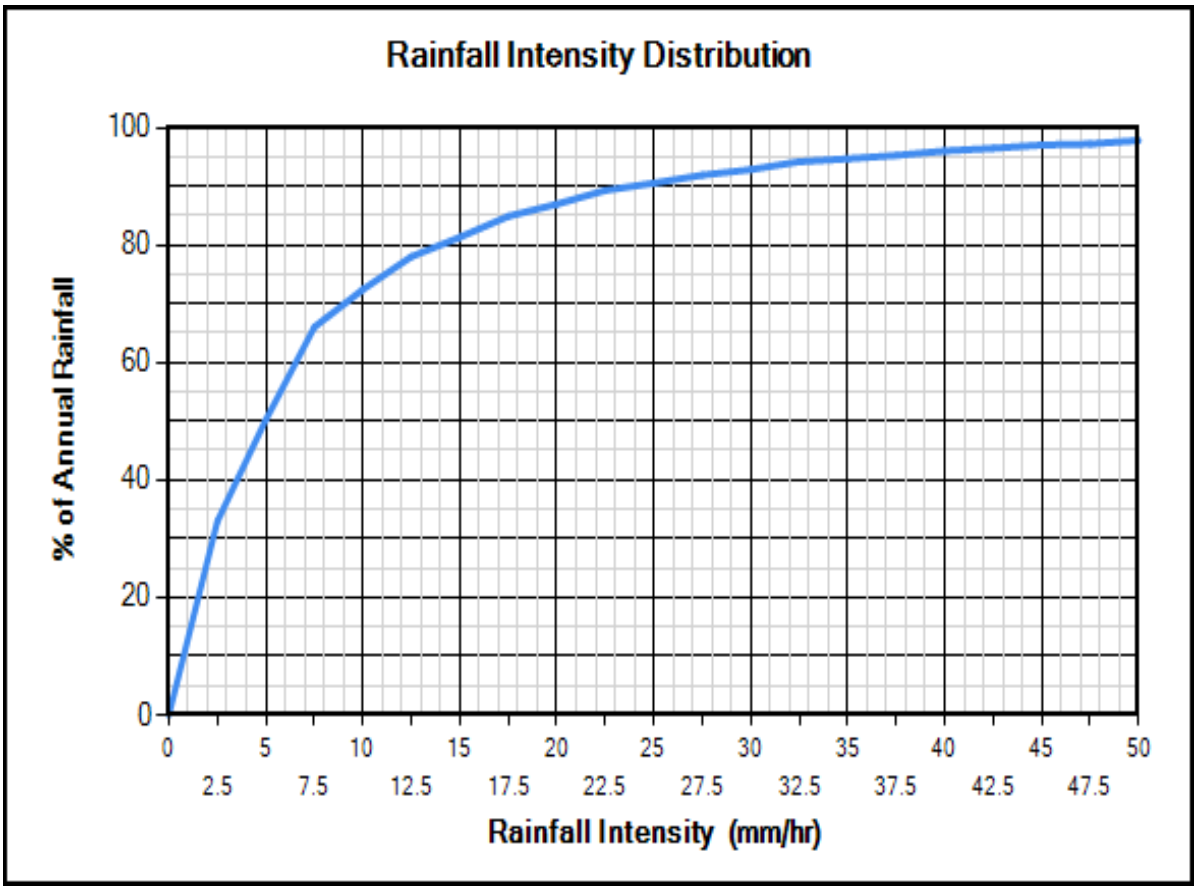
TSS Removal Sizing Summary



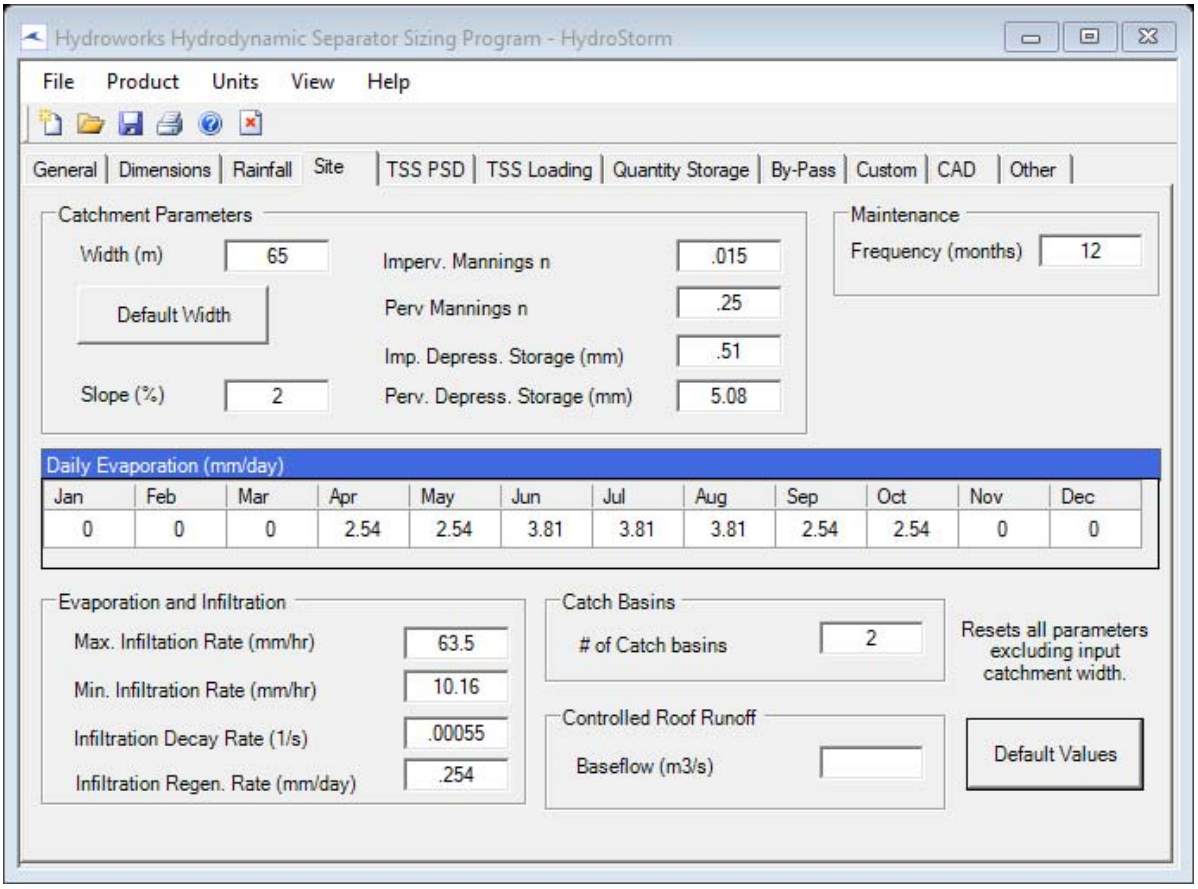
TSS Particle Size Distribution



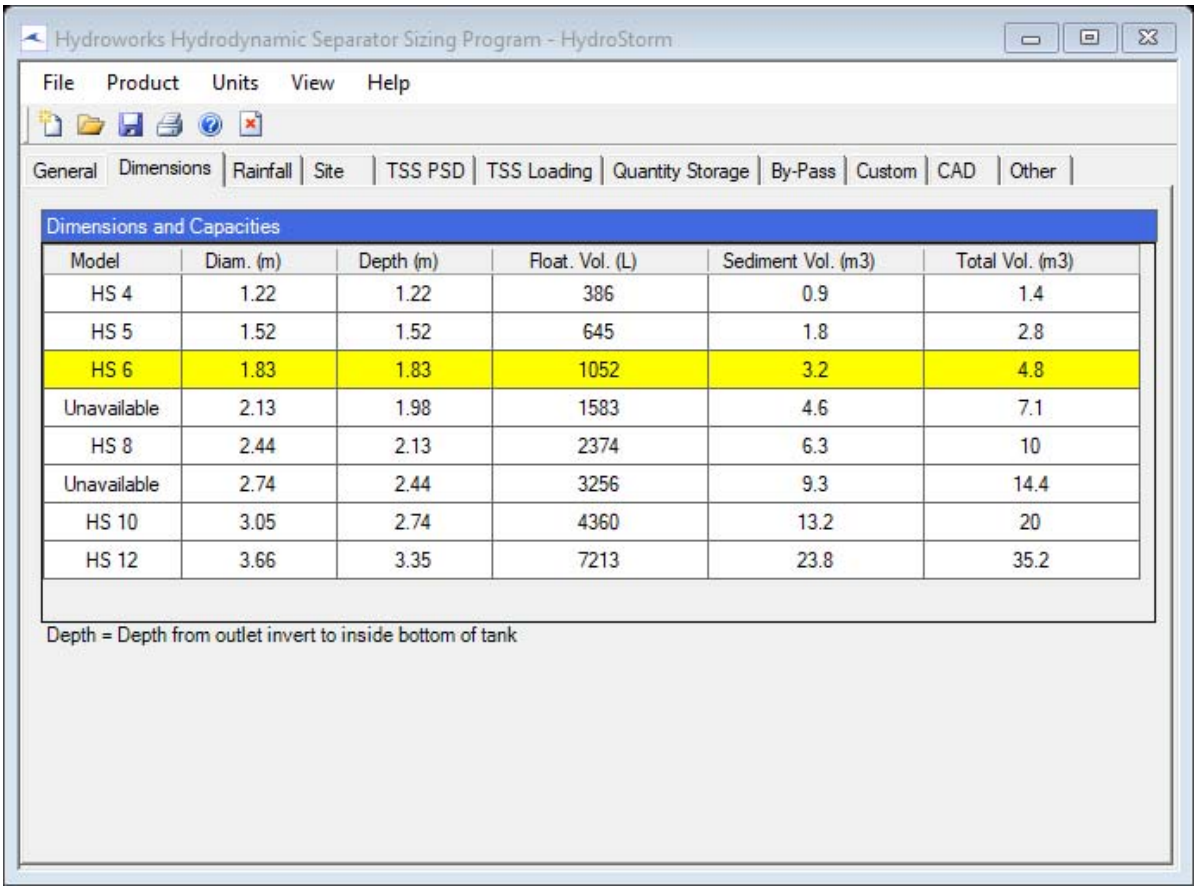
Rainfall Station - Kingston Pumping Station, Ontario(1960 to 2007)



Site Physical Characteristics



Dimensions And Capacities

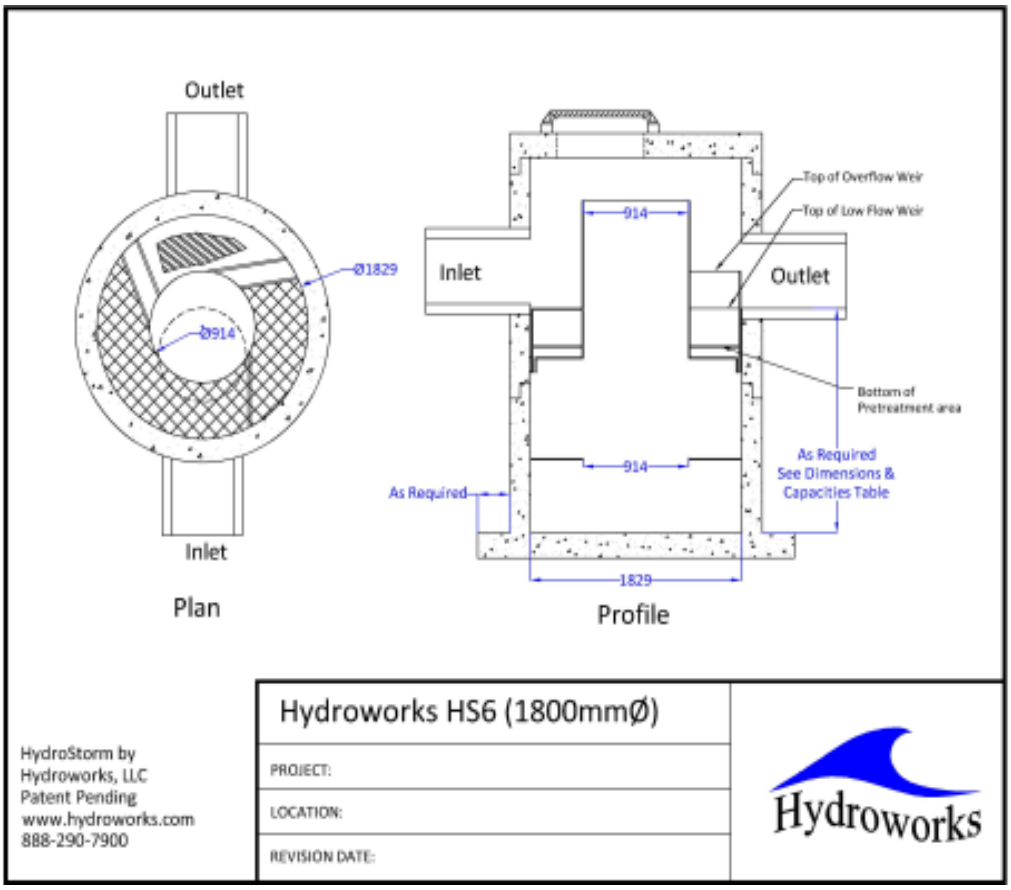


Dimensions and Capacities

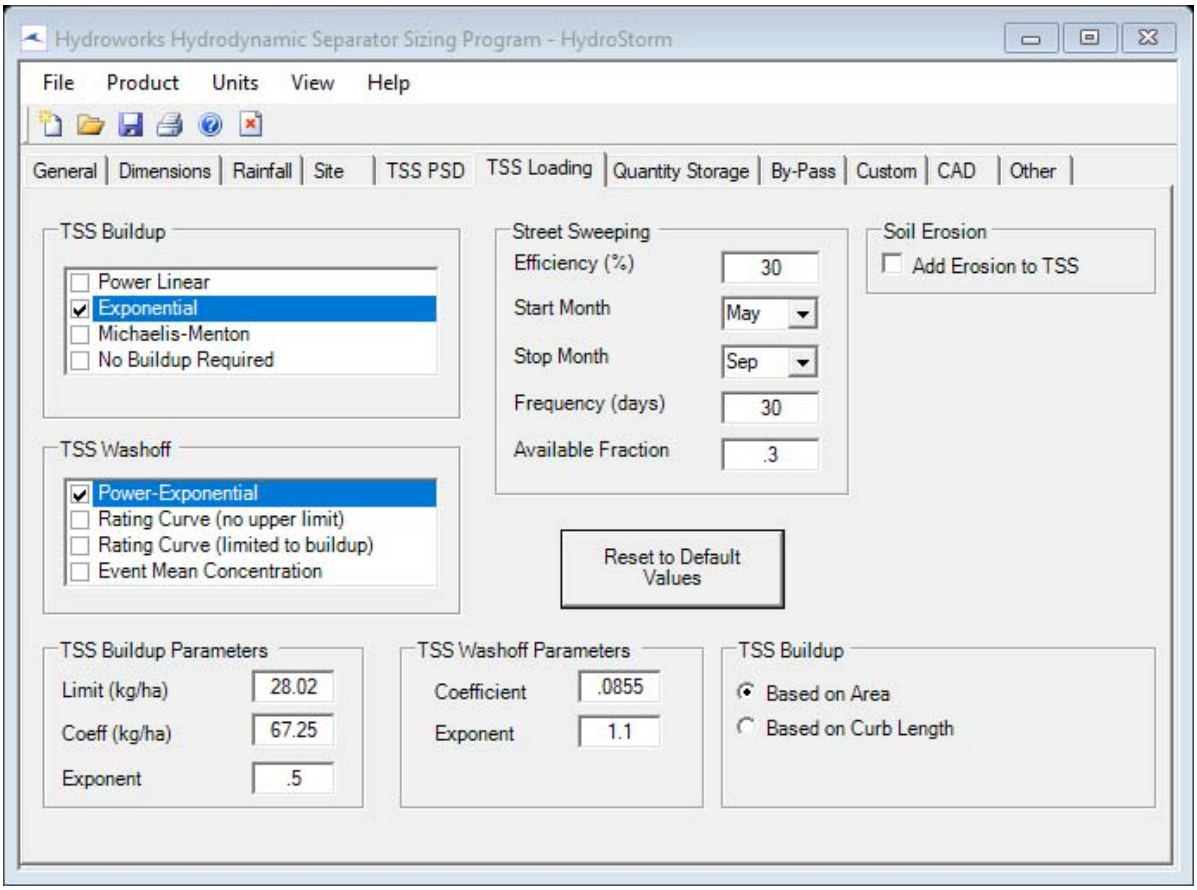
Model	Diam. (m)	Depth (m)	Float. Vol. (L)	Sediment Vol. (m3)	Total Vol. (m3)
HS 4	1.22	1.22	386	0.9	1.4
HS 5	1.52	1.52	645	1.8	2.8
HS 6	1.83	1.83	1052	3.2	4.8
Unavailable	2.13	1.98	1583	4.6	7.1
HS 8	2.44	2.13	2374	6.3	10
Unavailable	2.74	2.44	3256	9.3	14.4
HS 10	3.05	2.74	4360	13.2	20
HS 12	3.66	3.35	7213	23.8	35.2

Depth = Depth from outlet invert to inside bottom of tank

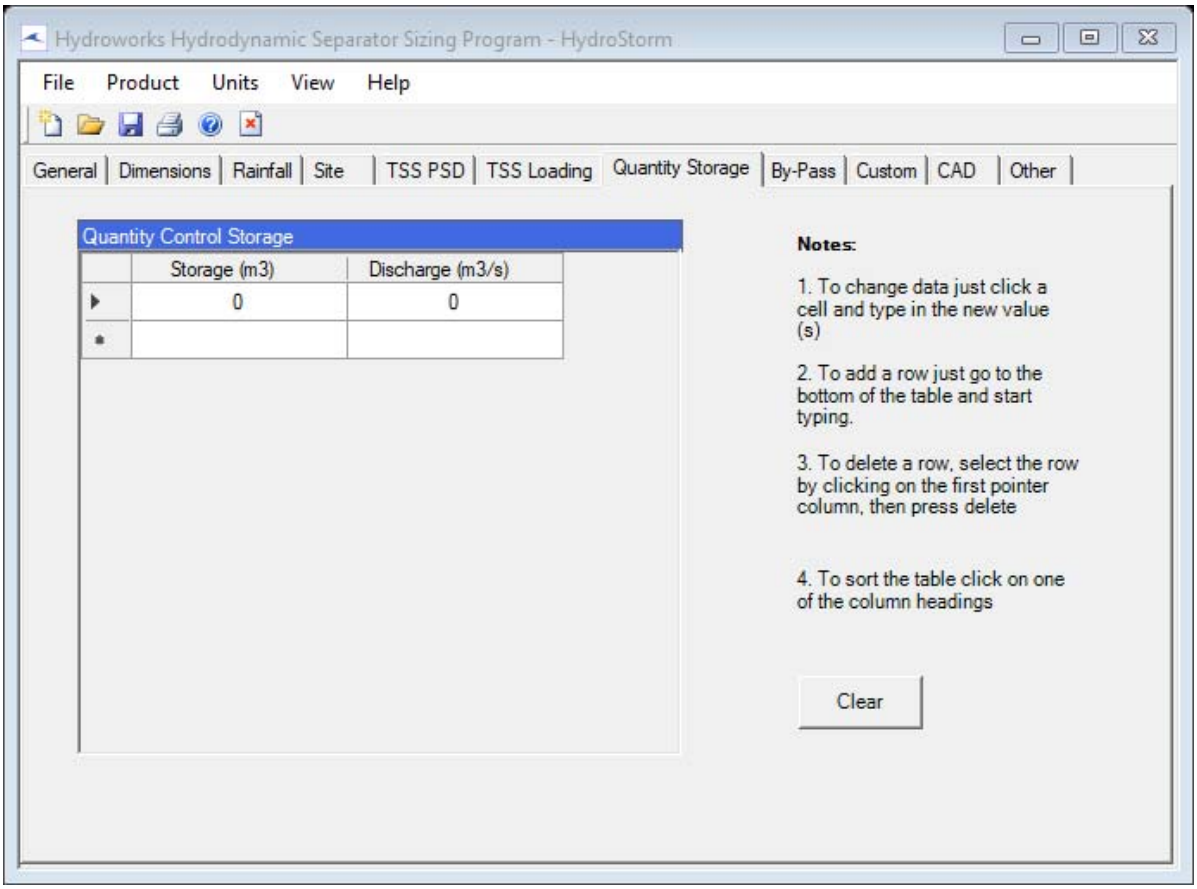
Generic HS 6 CAD Drawing



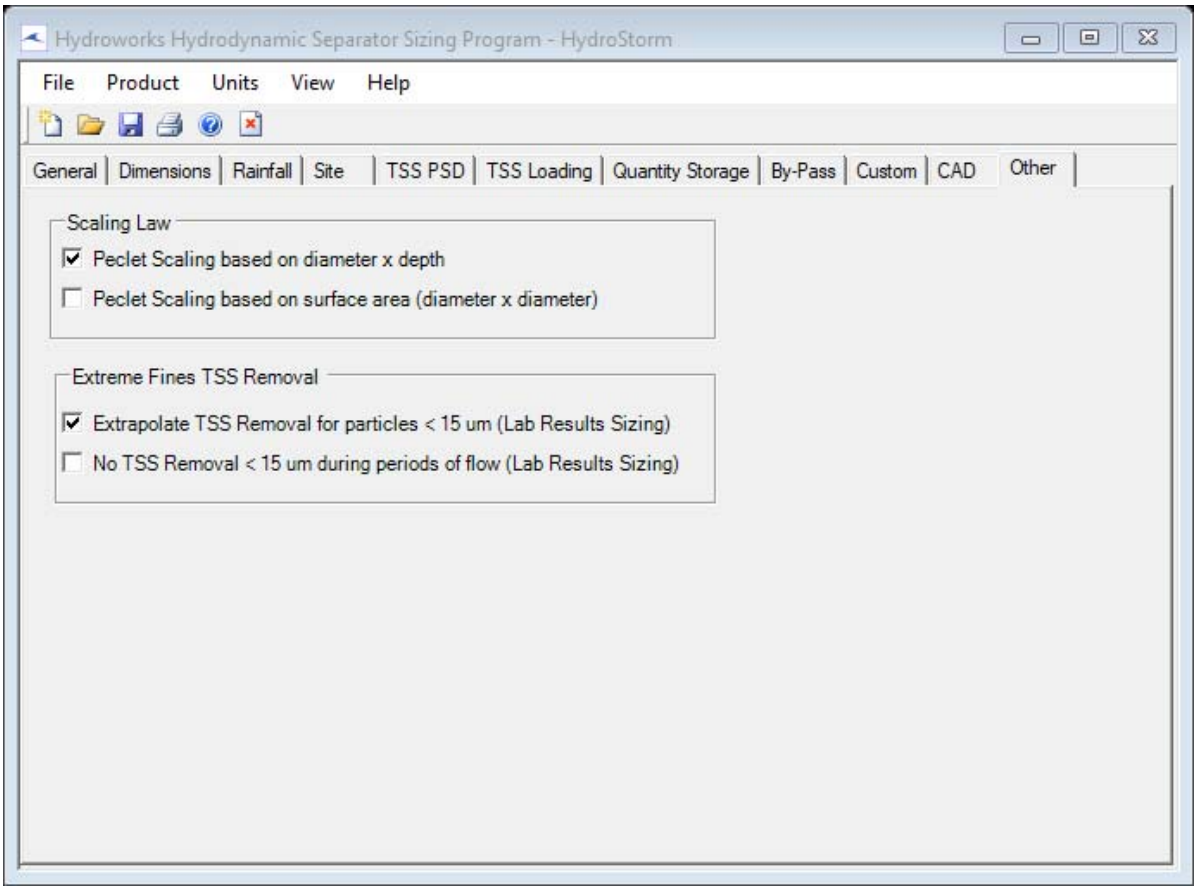
TSS Buildup And Washoff



Upstream Quantity Storage



Other Parameters



Hydroworks Sizing Program - Version 4.9

Canadian Infrastructure Products

Date: April 28, 2020

Mr. Abu Ziauddin, M. Eng., P. Eng.
Project Manager
N Engineering Inc.
9120 Leslie St., Suite 208
Richmond Hill, Ontario L4B 3J9

Reference: HydroStorm Separator

Dear Mr. Ziauddin:

Thank you for specifying a HydroStorm separator for the proposed gas station site in Cobourg, Ontario. HydroStorm was developed by an Ontario Engineer to capture pollutant laden sediment and spills from stormwater run-off prior to discharging to the watershed. They are suitable for gas station applications for storm drainage.

HydroStorm's performance has been independently verified through the Canadian Environmental Technology Verification program (ETV). The program's protocol tests for TSS removal, scour prevention and "light liquid re-entrainment" prevention (spills are captured and retained). HydroStorm's performance has also been certified through the NJDEP testing program.

For this application the HydroStorm unit was sized to capture the ETV particle size distribution (PSD) which is the "finest" and most conservative in North America. Based on local hydrology it will capture 83% of the annual total suspended solids load (TSS) meeting the MOE's "Enhanced Protection Criteria". The HS 6 proposed for this application has a sediment capacity of 3.2 m^3 and spills capacity of 1,022 litres.

HydroStorm's ETV verification can be found at https://etvcanada.ca/home/verify-your-technology/current-verified-technologies/. Please feel free to call if you have any questions.

Sincerely,

Mark Smith

Phone: 519-212-9161• E-Mail: msmith@c-i-p.ca • Web: www.c-i-p.ca

Hydroworks® HydroStorm

Operations & Maintenance Manual

Version 1.0

Please call Hydroworks at 888-290-7900 or email us at support@hydroworks.com if you have any questions regarding the Inspection Checklist. Please fax a copy of the completed checklist to Hydroworks at 888-783-7271 for our records.

Introduction

The HydroStorm is a state of the art hydrodynamic separator. Hydrodynamic separators remove solids, debris and lighter than water (oil, trash, floating debris) pollutants from stormwater. Hydrodynamic separators and other water quality measures are mandated by regulatory agencies (Town/City, State, Federal Government) to protect storm water quality from pollution generated by urban development (traffic, people) as part of new development permitting requirements.

As storm water treatment structures fill up with pollutants they become less and less effective in removing new pollution. Therefore, it is important that storm water treatment structures be maintained on a regular basis to ensure that they are operating at optimum performance. The HydroStorm is no different in this regard and this manual has been assembled to provide the owner/operator with the necessary information to inspect and coordinate maintenance of their HydroStorm.

Hydroworks® HydroStorm Operation

The Hydroworks HydroStorm (HS) separator is a unique hydrodynamic by-pass separator. It incorporates a protected submerged pretreatment zone to collect larger solids, a treatment tank to remove finer solids, and a dual set of weirs to create a high flow bypass. High flows are conveyed directly to the outlet and do not enter the treatment area, however, the submerged pretreatment area still allows removal of coarse solids during high flows.

Under normal or low flows, water enters an inlet area with a horizontal grate. The area underneath the grate is submerged with openings to the main treatment area of the separator. Coarse solids fall through the grate and are either trapped in the pretreatment area or conveyed into the main treatment area depending on the flow rate. Fines are transported into the main treatment area. Openings and weirs in the pretreatment area allow entry of water and solids into the main treatment area and cause water to rotate in the main treatment area creating a vortex motion. Water in the main treatment area is forced to rise along the walls of the separator to discharge from the treatment area to the downstream pipe.

The vortex motion forces solids and floatables to the middle of the inner chamber. Floatables are trapped since the inlet to the treatment area is submerged. The design maximizes the retention of settled solids since solids are forced to the center of the inner chamber by the vortex motion of water while water must flow up the walls of the separator to discharge into the downstream pipe.

A set of high flow weirs near the outlet pipe create a high flow bypass over both the pretreatment area and main treatment chamber. The rate of flow into the treatment area is regulated by the number and size of openings into the treatment chamber and the height of by-pass weirs. High flows flow over the weirs directly to the outlet pipe preventing the scour and resuspension of any fines collected in the treatment chamber.

A central access tube is located in the structure to provide access for cleaning. The arrangement of the inlet area and bypass weirs near the outlet pipe facilitate the use of multiple inlet pipes.

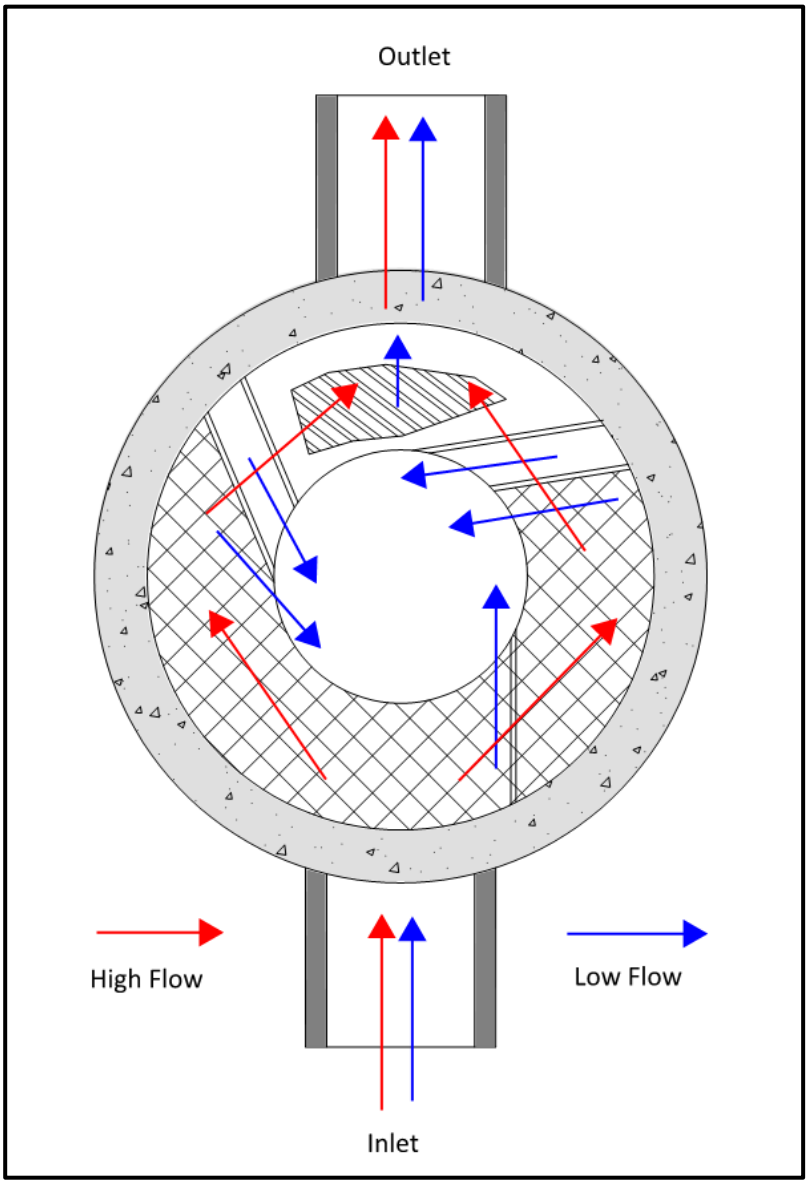


Figure 1. Hydroworks HydroStorm Operation – Plan View

Figure 2 is a profile view of the HydroStorm separator showing the flow patterns for low and high flows.

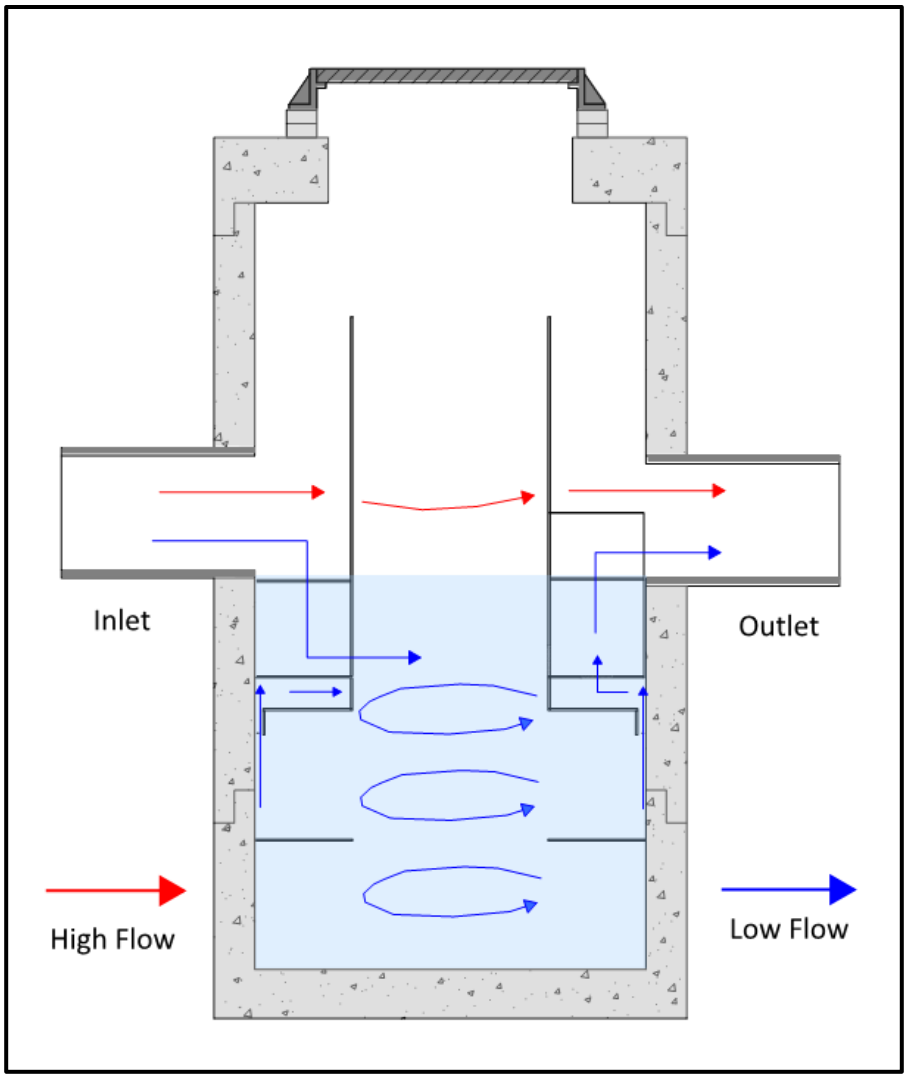


Figure 2. Hydroworks HydroStorm Operation – Profile View

The HS 4i is an inlet version of the HS 4 separator. There is a catch-basin grate on top of the HS 4i. A funnel sits sits underneath the grate on the frame and directs the water to the inlet side of the separator to ensure all lows flows are properly treated. The whole funnel is removed for inspection and cleaning.

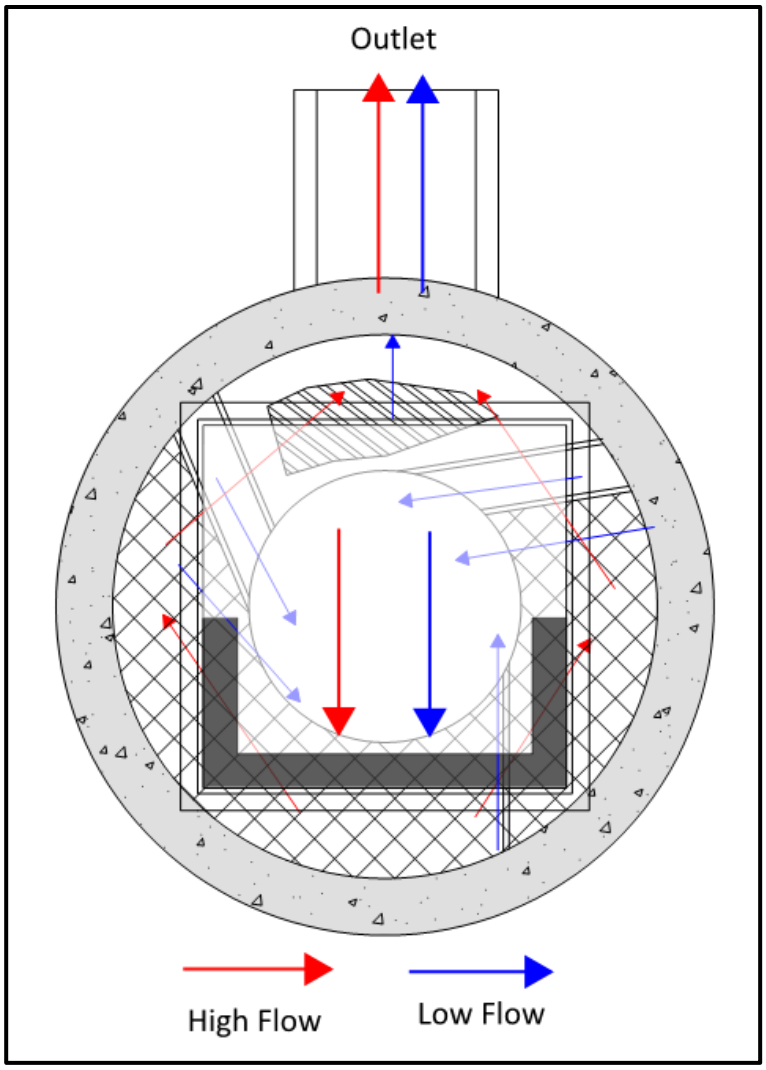


Figure 3. Hydroworks HS 4i Funnel

Inspection

Procedure

Floatables

A visual inspection can be conducted for floatables by removing the covers and looking down into the center access tube of the separator. Separators with an inlet grate (HS 4i or custom separator) will have a plastic funnel located under the grate that must be removed from the frame prior to inspection or maintenance. If you are missing a funnel please contact Hydroworks at the numbers provided at the end of this document.

Hydroworks

TSS/Sediment

Inspection for TSS build-up can be conducted using a Sludge Judge®, Core Pro®, AccuSludge® or equivalent sampling device that allows the measurement of the depth of TSS/sediment in the unit. These devices typically have a ball valve at the bottom of the tube that allows water and TSS to flow into the tube when lowering the tube into the unit. Once the unit touches the bottom of the device, it is quickly pulled upward such that the water and TSS in the tube forces the ball valve closed allowing the user to see a full core of water/TSS in the unit. The unit should be inspected for TSS through each of the access covers. Several readings (2 or 3) should be made at each access cover to ensure that an accurate TSS depth measurement is recorded.

Frequency

Construction Period

The HydroStorm separator should be inspected every four weeks and after every large storm (over 0.5" (12.5 mm) of rain) during the construction period.

Post-Construction Period

The Hydroworks HydroStorm separator should be inspected during the first year of operation for normal stabilized sites (grassed or paved areas). If the unit is subject to oil spills or runoff from unstabilized (storage piles, exposed soils) areas the HydroStorm separator should be inspected more frequently (4 times per year). The initial annual inspection will indicate the required future frequency of inspection and maintenance if the unit was maintained after the construction period.

Reporting

Reports should be prepared as part of each inspection and include the following information:

1. Date of inspection
2. GPS coordinates of Hydroworks unit
3. Time since last rainfall
4. Date of last inspection
5. Installation deficiencies (missing parts, incorrect installation of parts)
6. Structural deficiencies (concrete cracks, broken parts)
7. Operational deficiencies (leaks, blockages)
8. Presence of oil sheen or depth of oil layer
9. Estimate of depth/volume of floatables (trash, leaves) captured
10. Sediment depth measured
11. Recommendations for any repairs and/or maintenance for the unit
12. Estimation of time before maintenance is required if not required at time of inspection

A sample inspection checklist is provided at the end of this manual.

Maintenance

Procedure

The Hydroworks HydroStorm unit is typically maintained using a vacuum truck. There are numerous companies that can maintain the HydroStorm separator. Maintenance with a vacuum truck involves removing all of the water and sediment together. The water is then separated from the sediment on the truck or at the disposal facility.

A central access opening (24” or greater) is provided to the gain access to the lower treatment tank of the unit. This is the primary location to maintain by vacuum truck. The pretreatment area can also be vacuumed and/or flushed into the lower treatment tank of the separator for cleaning via the central access once the water level is lowered below the pretreatment floor.

In instances where a vacuum truck is not available other maintenance methods (i.e. clamshell bucket) can be used, but they will be less effective. If a clamshell bucket is used the water must be decanted prior to cleaning since the sediment is under water and typically fine in nature. Disposal of the water will depend on local requirements. Disposal options for the decanted water may include:

1. Discharge into a nearby sanitary sewer manhole
2. Discharge into a nearby LID practice (grassed swale, bioretention)
3. Discharge through a filter bag into a downstream storm drain connection

The local municipality should be consulted for the allowable disposal options for both water and sediments prior to any maintenance operation. Once the water is decanted the sediment can be removed with the clamshell bucket.

Disposal of the contents of the separator depend on local requirements. Maintenance of a Hydroworks HydroStorm unit will typically take 1 to 2 hours based on a vacuum truck and longer for other cleaning methods (i.e. clamshell bucket).

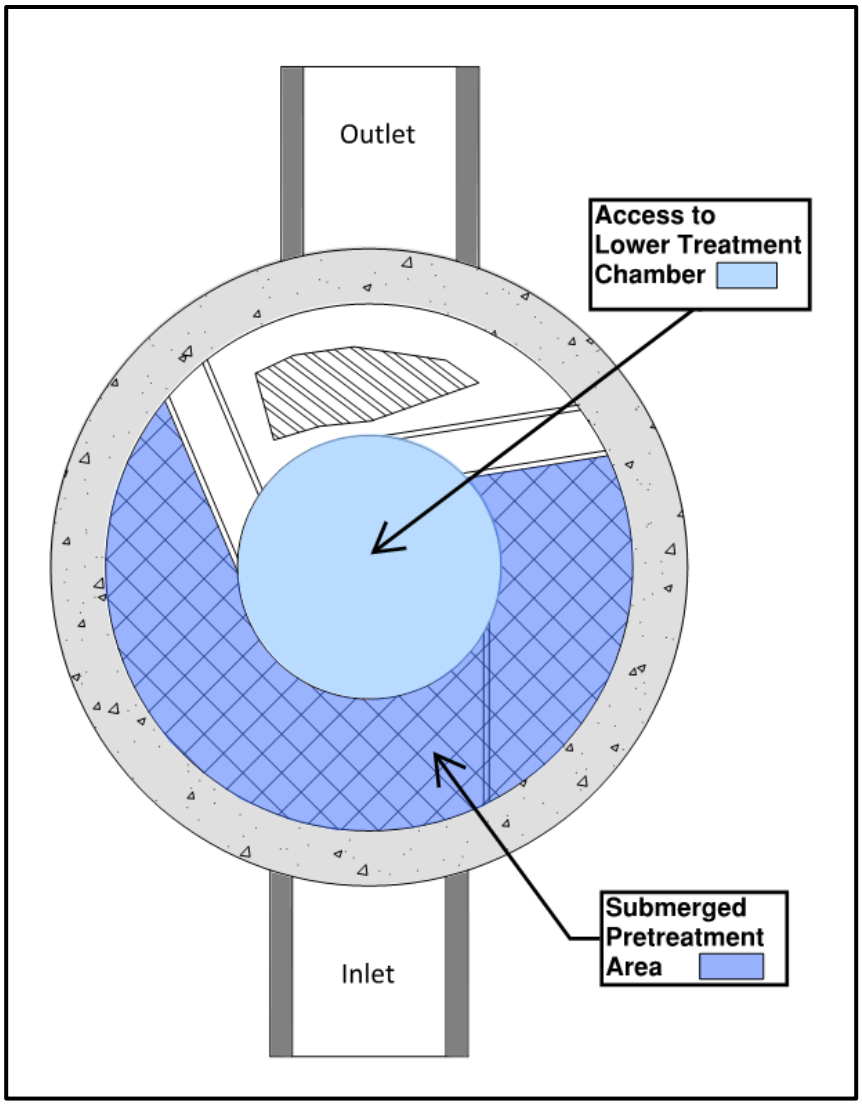


Figure 3. Maintenance Access

Frequency

Construction Period

A HydroStorm separator can fill with construction sediment quickly during the construction period. The HydroStorm must be maintained during the construction period when the depth of TSS/sediment reaches 24” (600 mm). It must also be maintained during the construction period if there is an appreciable depth of oil in the unit (more than a sheen) or if floatables other than oil cover over 50% of the area of the separator

The HydroStorm separator should be maintained at the end of the construction period, prior to operation for the post-construction period.

Post-Construction Period

The HydroStorm was independently tested by Alden Research Laboratory in 2017. A HydroStorm HS 4 was tested for scour with a 50% sediment depth of 0.5 ft. Therefore, maintenance for sediment accumulation is required if the depth of sediment is 1 ft or greater in separators with standard water (sump) depths (Table 1).

There will be designs with increased sediment storage based on specifications or site-specific criteria. A measurement of the total water depth in the separator through the central access tube should be taken and compared to water depth given in Table 1. The standard water depth from Table 1 should be subtracted from the measured water depth and the resulting extra depth should be added to the 1 ft to determine the site-specific sediment maintenance depth for that separator.

For example, if the measured water depth in the HS-7 is 7 feet, then the sediment maintenance depth for that HS-7 is 2 ft (= 1 + 7 – 6) and the separator does not need to be cleaned for sediment accumulation until the measure sediment depth is 2 ft.

The HydroStorm separator must also be maintained if there is an appreciable depth of oil in the unit (more than a sheen) or if floatables other than oil cover over 50% of the water surface of the separator.

Table 1 Standard Dimensions for Hydroworks HydroStorm Models

Model	Diameter (ft)	Total Water Depth (ft)	Sediment Maintenance Depth for Table 1 Total Water Depth(ft)
HS-3	3	3	1
HS-4	4	4	1
HS-5	5	4	1
HS-6	6	4	1
HS-7	7	6	1
HS-8	8	7	1
HS-9	9	7.5	1
HS-10	10	8	1
HS-11	11	9	1
HS-12	12	9.5	1

HYDROSTORM INSPECTION SHEET

Date _____
Date of Last Inspection _____

Site _____
City _____
State _____
Owner _____

GPS Coordinates _____

Date of last rainfall _____

Site Characteristics	**Yes**	**No**
Soil erosion evident	☐	☐
Exposed material storage on site	☐	☐
Large exposure to leaf litter (lots of trees)	☐	☐
High traffic (vehicle) area	☐	☐

HydroStorm	**Yes**	**No**
Obstructions in the inlet or outlet	☐ *	☐
Missing internal components	☐ **	☐
Improperly installed inlet or outlet pipes	☐ ***	☐
Internal component damage (cracked, broken, loose pieces)	☐ **	☐
Floating debris in the separator (oil, leaves, trash)	☐	☐
Large debris visible in the separator	☐ *	☐
Concrete cracks/deficiencies	☐ ***	☐
Exposed rebar	☐ **	☐
Water seepage (water level not at outlet pipe invert)	☐ ***	☐

Water level depth below outlet pipe invert _____“

Routine Measurements

Floating debris depth	**< 0.5” (13mm)**	☐	**>0.5” 13mm)**	☐ *
Floating debris coverage	**< 50% of surface area**	☐	**> 50% surface area**	☐ *
Sludge depth	**< 12” (300mm)**	☐	**> 12” (300mm)**	☐ ****

* Maintenance required
** Repairs required
*** Further investigation is required

Hydroworks

Other Comments:

Hydroworks

Hydroworks® HydroStorm

One Year Limited Warranty

Hydroworks, LLC warrants, to the purchaser and subsequent owner(s) during the warranty period subject to the terms and conditions hereof, the Hydroworks HydroStorm to be free from defects in material and workmanship under normal use and service, when properly installed, used, inspected and maintained in accordance with Hydroworks written instructions, for the period of the warranty. The standard warranty period is 1 year.

The warranty period begins once the separator has been manufactured and is available for delivery. Any components determined to be defective, either by failure or by inspection, in material and workmanship will be repaired, replaced or remanufactured at Hydroworks' option provided, however, that by doing so Hydroworks, LLC will not be obligated to replace an entire insert or concrete section, or the complete unit. This warranty does not cover shipping charges, damages, labor, any costs incurred to obtain access to the unit, any costs to repair/replace any surface treatment/cover after repair/replacement, or other charges that may occur due to product failure, repair or replacement.

This warranty does not apply to any material that has been disassembled or modified without prior approval of Hydroworks, LLC, that has been subjected to misuse, misapplication, neglect, alteration, accident or act of God, or that has not been installed, inspected, operated or maintained in accordance with Hydroworks, LLC instructions and is in lieu of all other warranties expressed or implied. Hydroworks, LLC does not authorize any representative or other person to expand or otherwise modify this limited warranty.

The owner shall provide Hydroworks, LLC with written notice of any alleged defect in material or workmanship including a detailed description of the alleged defect upon discovery of the defect. Hydroworks, LLC should be contacted at 136 Central Ave., Clark, NJ 07066 or any other address as supplied by Hydroworks, LLC. (888-290-7900).

This limited warranty is exclusive. There are no other warranties, express or implied, or merchantability or fitness for a particular purpose and none shall be created whether under the uniform commercial code, custom or usage in the industry or the course of dealings between the parties. Hydroworks, LLC will replace any goods that are defective under this warranty as the sole and exclusive remedy for breach of this warranty.

Subject to the foregoing, all conditions, warranties, terms, undertakings or liabilities (including liability as to negligence), expressed or implied, and howsoever arising, as to the condition, suitability, fitness, safety, or title to the Hydroworks HydroStorm are hereby negated and excluded and Hydroworks, LLC gives and makes no such representation, warranty or undertaking except as expressly set forth herein. Under no circumstances shall Hydroworks, LLC be liable to the Purchaser or to any third party for product liability claims; claims arising from the design, shipment, or installation of the HydroStorm, or the cost of other goods or services related to the purchase and installation of the HydroStorm. For this Limited Warranty to apply, the HydroStorm must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and Hydroworks' written installation instructions.

Hydroworks, LLC expressly disclaims liability for special, consequential or incidental damages (even if it has been advised of the possibility of the same) or breach of expressed or implied warranty. Hydroworks, LLC shall not be liable for penalties or liquidated damages, including loss of production and profits; labor and materials; overhead costs; or other loss or expense incurred by the purchaser or any third party. Specifically excluded from limited warranty coverage are damages to the HydroStorm arising from ordinary wear and tear; alteration, accident, misuse, abuse or neglect; improper maintenance, failure of the product due to improper installation of the concrete sections or improper sizing; or any other event not caused by Hydroworks, LLC. This limited warranty represents Hydroworks' sole liability to the purchaser for claims related to the HydroStorm, whether the claim is based upon contract, tort, or other legal basis.

Appendix G

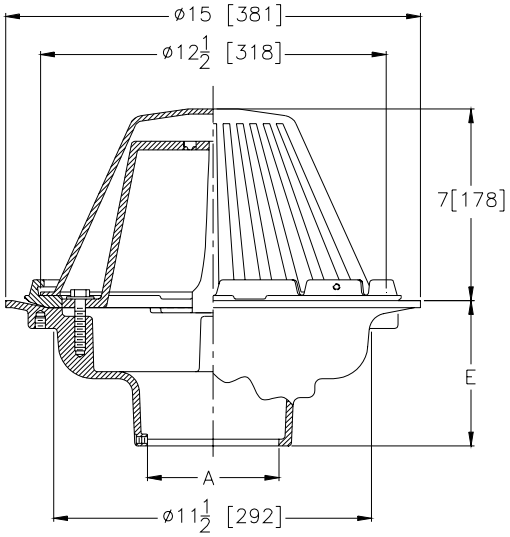
Roof Drains

Z-105
CONTROL-FLO ROOF DRAIN
w/ Parabolic Weir

SPECIFICATION SHEET

TAG_____

Dimensional Data (inches and [mm]) are Subject to Manufacturing Tolerances and Change Without Notice



A Pipe Size Inches / [mm]	Approx. Wt. Lbs. / [kg]	Dome Open Area Sq. In. / [sq cm]
2 - 3 - 4 [51 - 76 - 102]	34 [15]	148 [955]

ENGINEERING SPECIFICATION: ZURN Z-105 "Control-Flo" roof drain for dead -level 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.

OPTIONS (Check/specify appropriate options)

PIPE SIZE

2,3,4 [50,75,100]
2,3,4 [50,75,100]
2,3,4 [50,75,100]
2,3,4 [50,75,100]

(Specify size/type) **OUTLET**

_____ IC Inside Caulk
_____ IP Threaded
_____ NH No-Hub
_____ NL Neo-Loc

E BODY HT. DIM.

5 1/4 [133]
3 3/4 [95]
5 1/4 [133]
4 5/8 [117]

PREFIXES

____ Z- D.C.C.I. Body with Poly-Dome*
____ ZA- D.C.C.I. Body with Aluminum Dome

SUFFIXES

____ -A Waterproof Flange
____ -AR Acid Resistant Epoxy Coated Finish
____ -C Underdeck Clamp
____ -DP Top Set® Roof Deck Plate (Replaces both the -C and -R)
____ -DR Adjustable Drain Riser Extension Assembly 3-5/8" [92] to 7-1/4" [184]
____ -E Static Extension 1 [25] thru 4 [102] (Specify Ht.)
____ -EA Adjustable Extension Assembly 1 3/4 [44] thru 3 1/2 [89]
____ -EB Elevating Body Plate
____ -G Galvanized Cast Iron
____ -R Roof Sump Receiver
____ -VP Vandal Proof Secured Top
____ -90 90º Threaded Side Outlet Body

*REGULARLY FURNISHED UNLESS OTHERWISE SPECIFIED

REV. A DATE: 09/14/05 C.N. NO. 89837

DWG. NO. 63601 PRODUCT NO. Z-105

ZURN INDUSTRIES LIMITED ♦ 3544 Nashua Drive ♦ Mississauga, Ontario L4V 1L2 ♦ Phone: 905/405-8272 Fax: 905/405-1292
In the U.S.: ZURN INDUSTRIES, INC. ♦ SPECIFICATION DRAINAGE OPERATION ♦ 1801 Pittsburgh Ave. ♦ Erie, PA 16514
Phone: 814/455-0921 ♦ Fax: 814/454-7929 ♦ World Wide Web: www.zurn.com

Appendix H

Sanitary and Water Hydraulic Load Analysis

Abu Ziauddin | nEngineering Inc.

From: Ken Richards [krichards@bnz-eng.com]
Sent: Thursday, August 27, 2020 3:50 PM
To: Pankaj Verma
Cc: Vico Chan; Andrew Halvorsen; Stevens, Bob @ CBRE GCS Canada; Aaron Gold (agold@plazacorp.com); az@nengineering.com; Mina Ghasemi | nArchitecture Inc (mg2@narchitecture.com); NM@narchitecture.com; Gurdeep Singh; Monica Sequeira
Subject: TDL19109 108420-Coburg, ON King Rd N & Brook Rd S - 2695RE: 428-432 King St East, Cobourg: Plumbing Design

Pankaj,

I have **commented** below. Please review and let me know if I've missed something, but I think all of the information on our drawings is code compliant and sufficient. It appears that the comments might be directed more to the site works than the building itself. If you need additional information please let me know.

regards,
BnZ engineering,

Ken Richards, P. Eng.
President & CEO

☎: **(905) 319-2819**
☎: **(905) 320-9651 (cell)**
✉: **krichards@bnz-eng.com**
🌎: **www.bnz-eng.com**

471 Locust Street, Burlington, ON L7S 1T9

Humbly serving our clients in the provinces & territories of
BC, AB, SK, MB, ON, QC, NB, PE, NS, NL, YK, NT, NU

From: Pankaj Verma <pverma@kpaularchitect.com>
Sent: August 27, 2020 12:14
To: Ken Richards <krichards@bnz-eng.com>
Cc: Vico Chan <vchan@bnz-eng.com>; Andrew Halvorsen <ahalvorsen@bnz-eng.com>; Stevens, Bob @ CBRE GCS Canada <bob.stevens@cbre.com>; Aaron Gold (agold@plazacorp.com) <agold@plazacorp.com>; az@nengineering.com; Mina Ghasemi | nArchitecture Inc (mg2@narchitecture.com) <mg2@narchitecture.com>; NM@narchitecture.com; Gurdeep Singh <gsingh@kpaularchitect.com>; Monica Sequeira <msequeira@kpaularchitect.com>
Subject: FW: 428-432 King St East, Cobourg: Plumbing Design

Hello Ken,

Can you provide your responses as per below and attached. Refer to pages 7 to 10.

Thank you

Pankaj Verma | Manager, International Services
K Paul Architect Inc.
2660 Sherwood Heights Drive, Suite 200 | Oakville, ON | L6J 7Y8
☎(289) 644-2543 | 🖷 (905) 337-1986
C (416) 200-7161 | pverma@kpaularchitect.com

From: Stevens, Bob @ CBRE GCS Canada [mailto:bob.stevens@cbre.com]
Sent: August-27-20 9:27 AM
To: Pankaj Verma
Cc: Aaron Gold; Abu Ziauddin | nEngineering Inc.; Mina Ghasemi | nArchitecture Inc; Nitin Malhotra | nArchitecture Inc
Subject: FW: 428-432 King St East, Cobourg: Plumbing Design

Hi Pankaj,
Please see below. Can you have BnZ Engineers help out as required?
Please work directly with the LL to resolve/ complete.
Thanks,

Bob Stevens, CET | Senior Project Manager
CBRE | Global Workplace Solutions | Project Management Canada
18 King Street East, Suite 1100 | Toronto, ON M5C 1C4
T +1 289 259 9916
Bob.Stevens@cbre.com | www.cbre.ca

From: Aaron Gold <agold@plazacorp.com>
Sent: Wednesday, August 26, 2020 3:58 PM
To: Stevens, Bob @ CBRE GCS Canada <bob.stevens@cbre.com>
Cc: Abu Ziauddin | nEngineering Inc. <az@nengineering.com>; Mina Ghasemi | nArchitecture Inc <mg2@narchitecture.com>; Nitin Malhotra | nArchitecture Inc <nm@narchitecture.com>
Subject: RE: 428-432 King St East, Cobourg: Plumbing Design

Hi Bob,

Northumberland County, which is involved in our SPA review and approval ; instituted a new requirement a couple years ago that for applicants (i.e. us) to get approved for SPA drawings, we need to satisfy permit plumbing design elements now as well.

It allows the County to issue the SPA approval and permit approval at the same time, but adds a layer of complexity to the SPA process.

If you look at our 2nd SPA feedback (attached PDF), and scroll to page 7-10 ; you'll see a Building Inspection Report table provided by Northumberland County.

Some of the items our Civil Engineer (Abu, CCd) will resolve, but Abu will require Tim's Plumbing Engineer to assist with the 3 items related to Part 7 of OBC for the Tim's building.

From Tim's - Abu will need sizing of sanitary sewer & water pipes based on Part 7 to justify proposed sanitary sewer and water pipe sizing.

Here are the 3 Tim's related items copy-pasted from the feedback table. Can Tim's Plumbing Engineer assist?

Table 7.4.10.8.							
Maximum Permitted Hydraulic Load Drained to a Horizontal Sanitary Drainage Pipe							
Forming Part of Sentences 7.4.10.6.(2) and 7.4.10.8.(1)							
Item	COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4	COLUMN 5	COLUMN 6	COLUMN 7
	Drain Size, Nominal in.	Maximum Hydraulic Load, IN FIXTURE UNITS (FU)					
		Slope[1]					
		1 in 400	1 in 200	1 in 133	1 in 100	1 in 50	1 in 25
		0.25%	0.50%	0.75%	1.00%	2.00%	4.00%
1.	3					27	36
2.	4				180	240	300
3.	5			380	390	480	670
4.	6			600	700	840	1,300
5.	8		1,400	1,500	1,600	2,250	3,370
6.	10		2,500	2,700	3,000	4,500	6,500
7.	12	2,240	3,900	4,500	5,400	8,300	13,000
8.	15	4,800	7,000	9,300	10,400	16,300	22,500
Notes to Table 7.4.10.8.:							
(1) Slope is the ratio of rise to run, in whatever measurement units are chosen.							

Rejected

Provide sanitary sewage hydraulic loading for the building sewer **SITE CIVIL**

Please provide for Phase 1 buildings
7/21/2020 sizing for sanitary drainage piping to be done in accordance with OBC 7.4.10 for horizontal piping. Part 8 calculations are for onsite septic systems.

I am assuming here that any reference to Building Sewer applies only to the section of piping more than 1M outside the building footprint per the definitions in the Ontario Building Code and therefore are handled by the site civil engineer.

With regard to the TDL drawings, the maximum loading on a 3" sanitary pipe is 27 fixture units which is the maximum for the lowest permitted slope of 2% on a 3" sanitary pipe, and then we transition to 4". A 4" at minimum slope of 1% is capable of 180 Sanitary Fixture Units and our total sanitary load is 74 Fixture Units, therefore we are in compliance with table 7.4.10.8.

Rejected

Provide slope, sizing, lengths and cleanouts/ manholes for the sanitary building sewer **SITE CIVIL**

Sizing to be determined by hydraulic load and slope as per OBC 7/21/2020 use OBC 7.4.10 **BnZ comments above**

Grease interceptor details to be provided 7/21/2020 to be provided with plumbing permit application. **BnZ comments below**

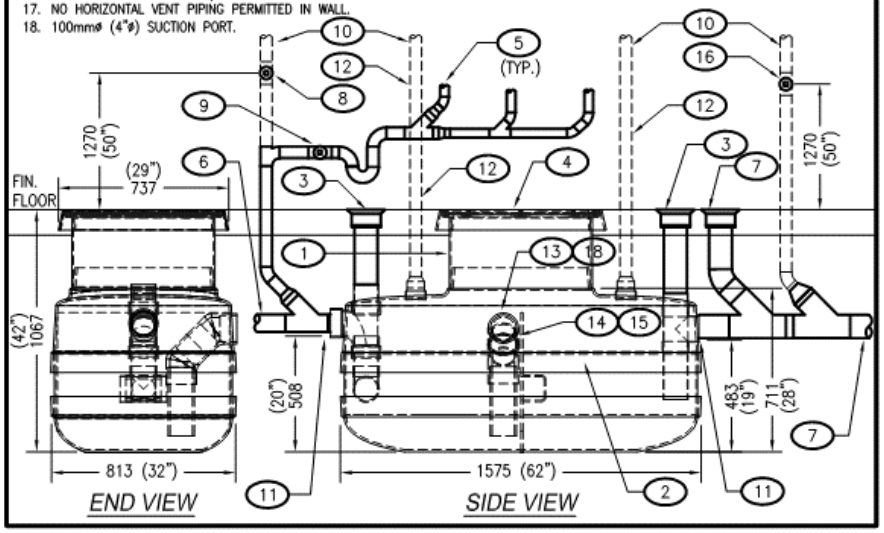
Sanitary building sewer from Tim Hortons cannot flow through the interceptor from sanitary units. Please revise drawing 7/21/2020 correction made **SITE CIVIL**

I am assuming here that any reference to Building Sewer applies only to the section of piping more than 1M outside the building footprint per the definitions in the Ontario Building Code and therefore are handled by the site civil engineer.

Grease interceptor details for the TDL GI are included on BnZ drawings. From our Drawing M8:

1. 1ft HIGH 600mmø (24"ø) EXTENSION COLLAR NOT BONDED TO TANK. TRIM COLLAR AS REQUIRED TO SUIT FINISHED FLOOR.
2. THE FRP SEAM LOCATED AROUND THE TANK PERIMETER TO BE EMBEDDED IN 350mm (14") HIGH ANTI-BOUYANCY CONCRETE SLAB WHERE WATER TABLE RISES ABOVE TANK BOTTOM.
3. EXTEND 100mmø (4"ø) SAMPLE PORT / C.O. (2) FLUSH WITH FINISHED FLOOR.
4. TOP OF ACCESS COVER SHALL BE FLUSH WITH TOP OF FINISHED FLOOR.
5. SANITARY LINE FROM TRIPLE SINK. ENSURE ACCESS TO GREASE INTERCEPTOR ACCESS COVER IS MAINTAINED FOR SERVICING.
6. 75mmø (3"ø) SANITARY LINE FROM DISHTABLING SINK, RATIONAL OVEN(S) & DISHWASHER. (CONNECTION TO DISHWASHER ONLY WHERE NOTED ON DRAWINGS AND AS REQUIRED BY LOCAL MUNICIPALITY).
7. LEAVING SANITARY LINE & CLEANOUT. REFER TO PLANS FOR LINE & CLEANOUT SIZES.
8. LINE CLEANOUT IN WALL C/W CHROME COVER PLATE LOCATED ABOVE Y-T DRAINAGE CONNECTION FROM TRIPLE SINK.
9. LINE CLEANOUT WHERE SANITARY LINE FROM TRIPLE SINKS PENETRATES WALL CAVITY.
10. 50mmø (2"ø) SANITARY VENT LINE IN WALL UP TO MAIN SANITARY VENT EXITING BUILDING THROUGH ROOF.
11. 100mmø (4"ø) INLET AND OUTLET. 75mmø (3"ø) CONCENTRIC REDUCER SUPPLIED LOOSE WITH UNIT.
12. 50mmø (2"ø) SANITARY VENT FROM INTERCEPTOR UP WALL TO MAIN VENT SYSTEM.
13. EXTEND SUCTION LINE TO OUTSIDE WALL USING SCH. 40 PVC PIPE, SLOPED BACK TOWARD INTERCEPTOR, AND CAP WITH TYPE 'D' CAMLOCK FITTING.
14. MAXIMUM VERTICAL DISTANCE FROM BOTTOM OF TANK TO END OF REMOTE SUCTION PIPE IS 9.15m (30'). MAXIMUM HORIZONTAL DISTANCE FROM TANK TO END OF REMOTE SUCTION PIPE IS 91.5m (300").
15. MAXIMUM TOTAL COMBINED CHANGE IN DIRECTION IS 360° (IE. 4 x 90° BENDS OR 8 x 45° BENDS). USE 45° BENDS AS MUCH AS POSSIBLE.
16. LINE CLEANOUT IN WALL C/W CHROME COVER PLATE.
17. NO HORIZONTAL VENT PIPING PERMITTED IN WALL.
18. 100mmø (4"ø) SUCTION PORT.

TOTAL WET VOLUME:	378.5 L	(100 GAL)
MAX. GREASE CAPACITY:	136.3 L	(36 GAL)
MAX SOLIDS CAPACITY:	109.8 L	(29 GAL)
PEAK FLOW RATES		
PDI PERFORMANCE:	6.3 L/s	(100 GPM)



31 TDLGMC100 SSU "PROCEPTOR" GREASE INT. DETAIL
N.T.S.

From our drawing M6:

GREASE INTERCEPTER					CODE REFERENCE
SINK 1	3 COMPARTMENT SINK (S-1)				
WIDTH	533.40	MM	21.00	INCH	
LENGTH	431.80	MM	17.00	INCH	
DEPTH	330.20	MM	13.00	INCH	
QTY OF TUBS	3.00				
CAPACITY (TOTAL)	228.16	LITRES	60.27	US GAL.	
DIVERSITY FACTOR	0.75				
USEABLE VOLUME	171.12	LITRES	45.20	US GAL.	
SINK 2	PRE-RINSE SINK (S-3)				
WIDTH	508.00	MM	20.00	INCH	
LENGTH	508.00	MM	20.00	INCH	
DEPTH	127.00	MM	5.00	INCH	
QTY OF TUBS	1.00				
CAPACITY (TOTAL)	32.77	LITRES	8.66	US GAL.	
DIVERSITY FACTOR	0.75				
USEABLE VOLUME	24.58	LITRES	6.49	US GAL.	
MISC.					
FLOOR DRAIN FLOW	0.25	L/SEC	3.96	USGPM	
FUNNEL FLOOR DRAIN FLOW	0.67	L/SEC	10.60	USGPM	
DESIGN CALCULATION					
TOTAL DRAIN DOWN VOLUME	195.70	LITRES	51.70	US GAL.	
PUMPED FLOW	0.06	L/SEC	0.95	USGPM	
DRAIN DOWN TIME	60.00	SEC			
DESIGN FLOW RATE	4.24	L/SEC	67.22	USGPM	
NOTE THAT 120 SECOND DRAIN DOWN TIME REQUIRES FLOW RESTRICTION BE INCORPORATED INTO SYSTEM TO PREVENT FLOODING OF OTHER DEVICES SUCH AS FLOOR DRAINS AS WELL AS WASH THROUGH OF THE GREASE INTERCEPTER.					

Provide water service calculations in accordance with Part 7 of the OBC

Please provide
7/21/2020 still to be provided, see OBC 7.6.3.2

We are in compliance with the noted code references. BnZ Hydraulic Calculations comply with Part 7, Table A-7.6.3.1. 100mm domestic water service to building with 2" distribution piping. Per our calculation we have a hydraulic load of 163.5 fixture units. From our Drawing M6:

Rejected

FIXTURE AND WATER CALCULATION

ITEM	QTY	WATER		WASTE		
		F.U. PER ITEM	TOTAL FIXTURE UNITS	TRAP SIZE	F.U. PER ITEM	TOTAL FIXTURE UNITS
W.C. (FLUSH VALVE - PUBLIC USE)	3		90.0	3"	6.0	18.0
FLOOR/HUB DRAIN	13			3"	3.0	39.0
3 COMPARTMENT SINK	1	4.0	4.0	2"	2.0	2.0
HAND SINK	4	2.0	8.0	1 1/4"	1.0	4.0
SERVICE SINK	4	2.0	8.0	1 1/2"	1.5	6.0
MOP SINK (RECESSED)	1	3.0	3.0	2"	2.0	2.0
DISHWASHER	1	6.0	6.0	2"	3.0	3.0
DISHWASHER QUENCH	1	4.0	4.0			
WALL HYDRANT	1	2.5	2.5			
ITEM 62.18 ICE MACHINE	1	2.0	2.0			
ITEM 67 HOT POWDERED DRINK	2	2.0	4.0			
ITEM 68 COFFEE BREWER	6	2.0	12.0			
ITEM 99.1 TEA BREWER	2	2.0	4.0			
ITEM 136.5 ESPRESSO MACHINE	1	2.0	2.0			
ITEM 203 RATIONAL OVEN	2	4.0	8.0			
ITEM 208.3 RINSER	1	2.0	2.0			
ITEM 208.4 GLASS FILLER WATER STATION	2	2.0	4.0	1 1/2"	1.5	3.0
TOTAL FIXTURE UNITS			163.5			77.0
MAXIMUM GPM			-			49.0
MIN. SERVICE SIZE			2"			4"
BUILDING WATER SERVICE * WITH ALL PRESSURE REDUCING AND BACKFLOW PREVENTOR EQUIPMENT IN MECHANICAL ROOM			T.B.D.			

LOSSES	QTY	UNIT	LOSS / UNIT	LOSS	PRESSURE	
STREET STATIC PRESSURE RANGE ASSUMED	50				50.00	
SERVICE PIPE LOSS (6 LBS/100FT)	100	FT	0.06	6.00	44.00	
STATIC HEIGHT (FTx.43)	10	FT	0.43	4.30	39.70	
WATER METER	1		5	5.00	34.70	
					34.70	
TOTAL				15.30	34.70	PSI

* CALCULATIONS PER 2012 ONTARIO BUILDING CODE

TABLE A-7.6.3.1
PIPE SIZE BASED ON THE NUMBER OF FIXTURES UNITS SERVED

Water Service Pipe, inches	Water Distribution System, inches	Maximum Allowable Length, m														
		12	18	24	30	46	61	76	91	122	152	183	213	244	274	305
		Number of Fixture Units Served														
		Flow Velocity, m/s						3.0	2	1.5						
Pressure Range 200 to 310 kPa																
¾	½	6	5	4	3	2	1	1	1	0	0	0				
¾	⅝	12	10	9	7	5	3	3	3	2	2	1	1	1	1	0
¾	¾	18	16	14	12	9	6	5	5	4	4	3	2	2	2	1
1	1	36	31	27	25	20	17	15	13	12	10	8	6	6	6	6
1½	1¼	83	68	57	48	38	32	28	25	21	18	15	12	12	11	11
1½	1½	151	124	105	91	70	57	49	45	36	31	26	23	21	20	20
2	1½	151	151	132	110	80	64	53	46	38	32	27	23	21	20	20
2	2	359	329	292	265	217	185	164	147	124	96	70	61	57	54	51
2½	2½	445	418	390	370	330	300	280	265	240	220	198	175	158	143	133
Pressure Range 311 to 413 kPa																
¾	½	8	7	6	5	4	3	2	2	1	1	1	0	0	0	0
¾	⅝	13	13	12	11	9	7	5	5	3	3	2	2	1	1	1
¾	¾	21	21	19	17	14	11	9	8	6	5	4	4	3	3	3
1	1	42	42	41	36	30	25	23	20	18	15	12	10	9	8	8
1½	1¼	83	83	83	83	66	52	44	39	33	29	24	20	19	17	16
1½	1½	151	151	151	151	128	105	90	78	62	52	42	38	35	32	30
2	1½	151	151	151	151	150	117	98	84	67	55	42	38	35	32	30
2	2	359	359	359	359	359	318	280	250	205	165	142	123	110	102	94
2½	2½	611	611	610	580	535	500	470	440	400	365	335	315	285	267	250
Pressure Over 413 kPa																
¾	½	8	8	7	6	5	4	3	3	2	1	1	1	1	1	0
¾	⅝	13	13	13	13	11	8	7	6	5	4	3	3	3	2	2
¾	¾	21	21	21	21	17	13	11	10	8	7	6	6	5	4	4
1	1	42	42	42	42	38	32	29	26	22	18	14	13	12	12	11
1½	1¼	83	83	83	83	83	74	62	54	43	34	26	25	23	22	21
1½	1½	151	151	151	151	151	151	130	113	88	73	51	51	46	43	40
2	1½	151	151	151	151	151	151	142	122	98	82	64	51	46	43	40
2	2	359	359	359	359	359	359	359	340	288	245	204	172	153	141	129
2½	2½	611	611	611	611	611	611	610	570	510	460	430	404	380	356	329

Regards,
Aaron

AARON GOLD
VICE PRESIDENT, OPERATIONS

PLAZACOMM

10 Wanless Avenue, Suite 201, Toronto, ON M4N1V6
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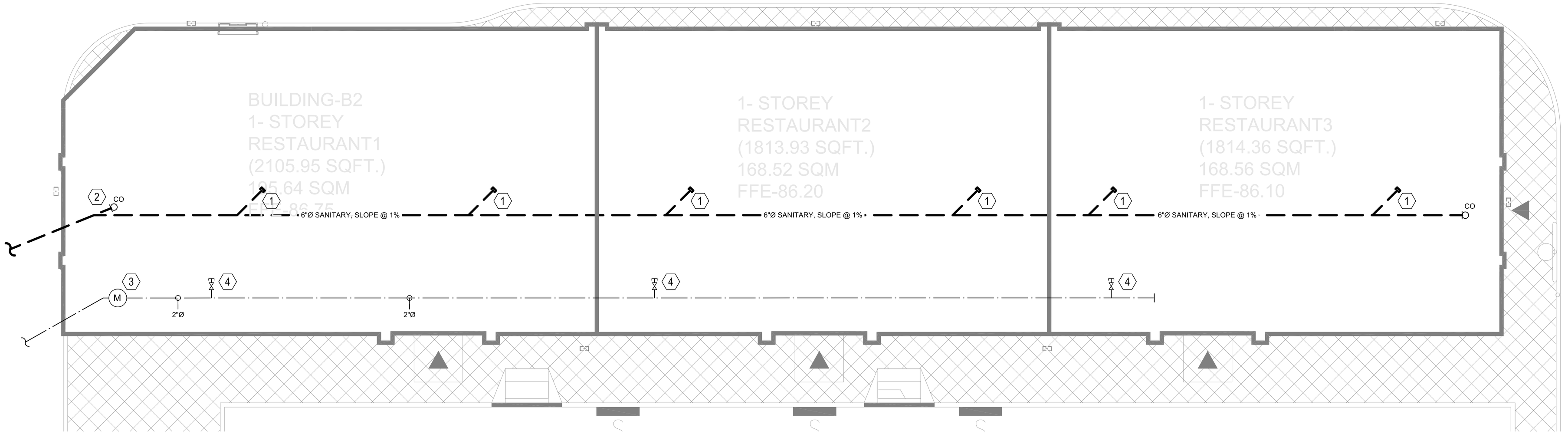


KEY NOTES

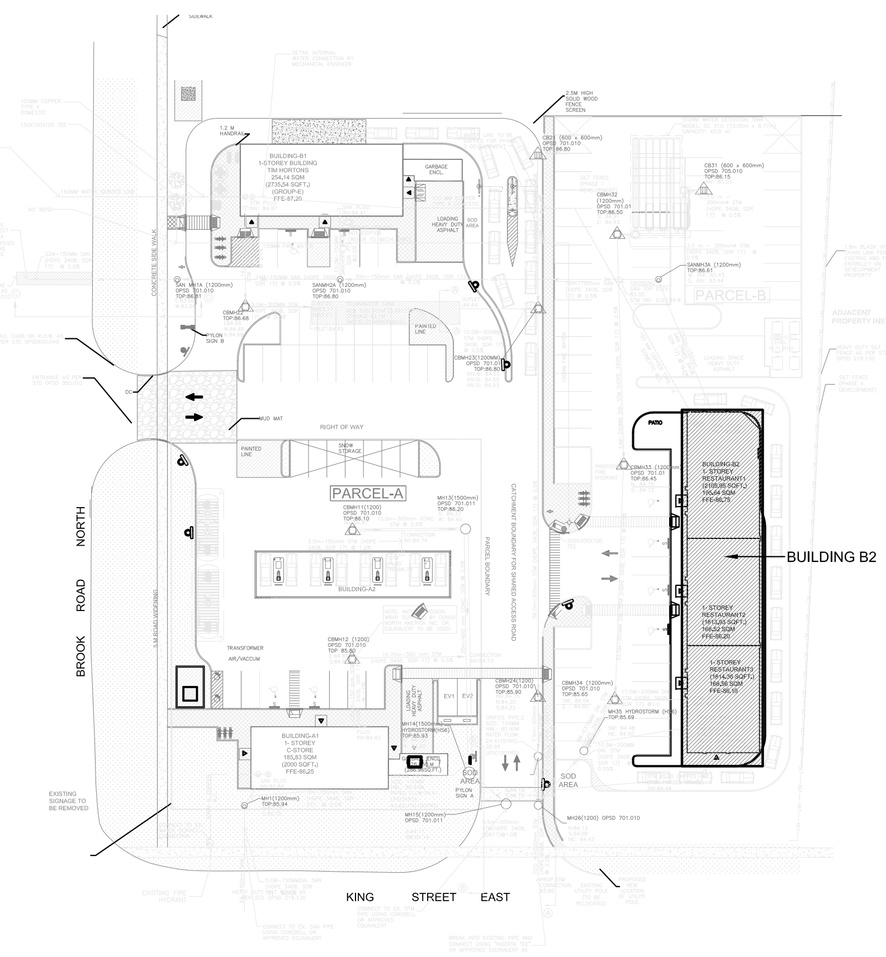
1	PROVIDE CAPPED 4"Ø SANITARY CONNECTION BELOW FINISHED FLOOR, TERMINATED FOR FUTURE TIE IN
2	REFER TO SITE SERVICES PLAN FOR INVERT DEPTH & CONTINUATION.
3	WATER METER INSTALLED IN ACCORDANCE WITH REGION STANDARDS C/W DOUBLE CHECK VALVE.
4	TERMINATE 38mmØ INCOMING WATER SERVICE C.W VALVED CONNECTION FOR FUTURE TIE-IN. FUTURE WATER ASSEMBLE TO BE PROVIDED BY OTHERS UNDER SEPARATE PERMIT & CONTRACT.

PLUMBING LEGEND

SYMBOL	DESCRIPTION
	COLD WATER LINE
	HOT WATER LINE
	SANITARY OVERHEAD
	SANITARY UNDERGROUND
	PIPE DOWN
	DRAIN
HD	HUB DRAIN
FD	FLOOR DRAIN
CO	FLOOR CLEAN OUT
CO	ABOVE FLOOR CLEAN OUT

PLUMBING, PIPING, & FIXTURES

1. GENERAL
 1.1. MATERIAL AS INDICATED ON DRAWINGS. IF MATERIALS HAVE NOT BEEN INDICATED ON DRAWINGS, THEN INSTALLATION SHALL ADHERE TO THIS SECTION.
 1.2. CONTRACTOR SHALL BE RESPONSIBLE FOR CONFIRMING EXACT LOCATIONS OF EXISTING PIPING. APPROXIMATE DISTANCES ARE INDICATED ON DRAWINGS AS REQUIRED.
 1.3. PROVIDE MATERIALS IN ACCORDANCE WITH THIS SECTION UNLESS OTHERWISE SPECIFIED.
 1.4. PROVIDE ALL MATERIALS AS REQUIRED INCLUDING PIPING, VALVES, FITTINGS, TRAPS, HANGERS, SUPPORTS AND THERMAL INSULATION FOR COMPLETE SYSTEM INSTALLATION AND OPERATION.
 1.5. PROVIDE MINIMUM PIPE INSULATION THICKNESS IN ACCORDANCE WITH LATEST EDITION OF ASHRAE STANDARD 90.1 UNLESS OTHERWISE INDICATED.
 1.6. PROVIDE ALL PLUMBING SYSTEMS, FIXTURES AND ACCESSORIES IN ACCORDANCE WITH OBC AND LOCAL AUTHORITIES HAVING JURISDICTION.
2. THERMAL INSULATION
 2.1. ALL OTHER PROCESSES AND PLUMBING PIPES: UNLESS OTHERWISE INDICATED, PROVIDE AND INSTALL FIBERGLASS INSULATION WITH REINFORCED VAPOUR RETARDER FACING AND FACTORY APPLIED ADHESIVE CLOSURE SYSTEM. INSULATION SHALL BE JOHNS MANVILLE MICRO-LOK AP-T PLUS OR EQUIVALENT.
 2.2. MINIMUM PIPE THICKNESS SHALL BE IN ACCORDANCE WITH LATEST EDITION OF ASHRAE STD. 90.1.
 2.3. MINIMUM PIPE INSULATION SHALL BE 1" FOR ALL CONDENSATE LINE, DOMESTIC HOT AND COLD WATER PIPES, AND RAIN WATER LEADERS UNLESS OTHERWISE INDICATED.
 2.4. DOMESTIC HOT WATER PIPES GREATER THAN 2" SHALL HAVE 1-1/2" THICK INSULATION.
 2.5. INSULATION FOR CONDENSATE SHALL BE RIGID MOULDED MINERAL FIBRE WITHOUT FACTORY APPLIED VAPOUR RETARDER.
 2.6. THICKNESS FOR CONDENSATE SHALL BE AS FOLLOWS:
  2.6.1. RUN OUTS (<13FT LONG): 1";
  2.6.2. ALL OTHER PIPE SIZES: 1-1/2"
 2.7. PROVIDE AND INSTALL PVC JACKET [AND VAPOUR RETARDER](IF NOT PROVIDED ELSEWHERE) FOR INDOOR INSULATED PIPE APPLICATIONS. JACKETING SHALL BE JOHNS MANVILLE ZESTON 300 SERIES OR EQUIVALENT.)(NOT NECESSARY FOR USE WITH MICRO-LOK AP-T PLUS)
 2.8. PROVIDE AND INSTALL ALUMINUM JACKET WITH A LAMINATED MOISTURE RETARDER FOR OUTDOOR INSULATED PIPE APPLICATIONS. SECURE JACKET USING METAL BANDS AT BUTT JOINT OVERLAPS AND BETWEEN JOINTS.
 2.9. INSTALL ALL INSULATION AND JACKETS AS PER MANUFACTURER RECOMMENDATIONS.
 2.10. PROVIDE CANVAS JACKET WITH LAGGING ADHESIVE ON ALL CONDENSATE PIPE APPLICATIONS.
 2.11. MAINTAIN UNINTERRUPTED CONTINUITY AND INTEGRITY OF VAPOUR RETARDER AND FINISHES. HANGERS AND SUPPORTS TO BE OUTSIDE VAPOUR OF RETARDER.
 2.12. APPLY HIGH COMPRESSIVE STRENGTH INSULATION, SUITABLE FOR SERVICE, AT OVERSIZED SADDLES AND SHOES WHERE INSULATION SADDLES HAVE NOT BEEN PROVIDED
 2.13. INSULATION SHALL BE FOIL FACED.
 2.14. INSULATION SHALL HAVE A FLAME SPREAD RATING OF 25 OR LESS AND A SMOKE DEVELOPMENT CLASSIFICATION OF 50 OR LESS.
3. PIPE HANGERS AND SUPPORTS
 3.1. PIPING HANGERS AND SUPPORTS SHALL BE SPACED IN ACCORDANCE WITH APPLICABLE CODES AND AUTHORITIES HAVING JURISDICTION.
 3.2. PIPE HANGERS SHALL BE GRINNELL ADJUSTABLE CLEVIS TYPE OR EQUIVALENT.
 3.3. EXTERIOR SUPPORTS SHALL BE S.S. GRINNELL OR EQUIVALENT
4. DRAINAGE WASTE AND VENT PIPING
 4.1. ABOVE GROUND SANITARY, STORM AND VENT LINES LESS THAN 3" SHALL BE TYPE DWV TO ASTM B306 WITH CAST BRASS OR WROUGHT COPPER FITTINGS TO CAN/CSA B125.
 4.2. JOINTS FOR COPPER TUBE/ PIPE SHALL BE TIN/ANTIMONY (95%/5%) SOLDER.
 4.3. PROVIDE TRAP PRIMERS WHERE REQUIRED.
 4.4. ABOVE GROUND SANITARY, STORM AND VENT LINES 3" AND LARGER SHALL BE CAST IRON HUB AND SPIGOT PIPE IN ACCORDANCE WITH THE LATEST EDITION OF THE OBC FOR SOIL AND WASTE. JOINTS SHALL BE CAULKED WITH WHITE OAKUM AND SECURED WITH MOLTEN LEAD NOT LESS THEN 1" DEEP.
 4.5. BURIED SANITARY, STORM AND VENT SHALL BE MINIMUM 3" CAST IRON TO CAN/CSA-B70, JOINTS FOR CAST IRON SHALL BE HUB AND SPIGOT.
 4.6. BURIED SANITARY, STORM AND VENT SHALL BE MINIMUM 3" PVC OR ABS PIPE AND FITTINGS TO CSA CAN 3-B181.1-M85 (ABS), CAN 3-B181.2-M85 (PVC) B182.1-M1983, B182.2-M1983, (LARGE DIAMETER PSM PVC), B182.3-M1983 (LARGE DIAMETER IPS PVC).
 4.7. PROVIDE AND INSTALL BACK WATER VALVE ON ALL FLOOR DRAIN.
5. DOMESTIC COLD AND HOT WATER PIPE
 5.7. TYPE L COPPER TO ASTM B88M.
 5.8. JOINTS SHALL BE TIN/SILVER OR TIN/ANTIMONY (95%/5%) SOLDER AND NON-CORROSIVE FLUX. ALL SOLDER SHALL BE LEAD FREE.
 5.9. PROVIDE ISOLATION VALVES FOR EACH NEW FIXTURE. VALVES SHALL BE BY-PASS BALL VALVES WITH THREADED/SOLDERED ENDS, RATED FOR 400 CWP.
 5.10. TYPE K COPPER PIPE TO ASTM B88M SHALL BE USED FOR BURIED DCW PIPE.
6. LARGE SANITARY AND VENT
 6.1. SHALL BE MINIMUM 3" CAST IRON TO CAN/CSA-B70.
 6.2. JOINTS FOR CAST IRON SHALL BE HUB AND SPIGOT
7. VALVES (CW)
 7.1. NEW VALVES 2"Ø OR LESS SHALL BE BRASS BALL VALVES WITH THREADED ENDS, FULL PORT, 600 CWP, ULC LISTED AND FM APPROVED.
 7.2. ALL VALVES 2-1/2"Ø OR GREATER SHALL HAVE FLANGE CONNECTIONS.
 7.3. ACCEPTABLE MANUFACTURER: JENKINS OR APPROVED EQUAL.
8. BURIED SANITARY, STORM AND VENT
 8.1. SHALL BE MINIMUM 3" CAST IRON TO CAN/CSA-B70.
 8.2. JOINTS FOR CAST IRON SHALL BE HUB AND SPIGOT
 8.3. PROVIDE TRAP PRIMERS WHERE REQUIRED.
 8.4. PROVIDE BACKWATER VALVE ON ALL FLOOR DRAINS AND WHERE INDICATED ON DRAWINGS.
9. FLOOR DRAINS
 9.1. DUCO CAST IRON BODY, FLASHING COLLAR AND 12.7MM THICK NICKEL BRONZE ADJUSTABLE STRAINER HEAD.
 9.2. DRAIN SHALL BE JAY R.SMITH OR EQUIVALENT.
 9.3. PROVIDE PRIMING AT EACH FLOOR DRAIN FROM NEAREST LAVATORY OR WATER CLOSET.
10. ROOF DRAINS
 10.1. RD-1, RD-2: DUCO CAST IRON BODY AND FLASHING CLAMP, PERFORATED STAINLESS STEEL EXTENSION, GRAVEL STOP AND POLYETHYLENE DOME WITH WIDE FLANGE BODY.
 10.2. DRAIN SHALL BE JAY R.SMITH OR EQUIVALENT.
11. SCUPPER DRAINS
 11.1. COMPLETE WITH DUCO CAST IRON BODY, FLASHING CLAMP AND LOOSE SET GRATE WITH 45 DEG THREADED OUTLET.
 11.2. DRAIN SHALL BE JAY R.SMITH OR EQUIVALENT.
12. FUNNEL FLOOR DRAIN
 12.1. ROUND TOP OVAL INTEGRAL FUNNEL TO A DUCO CAST IRON BODY AND FLASHING COLLAR AND NICKEL BRONZE STRAINER HEAD.
 12.2. DRAIN SHALL BE JAY R.SMITH OR EQUIVALENT.
13. CLEAN-OUTS AND VENTING
 13.1. PROVIDE IN ACCORDANCE WITH OBC CHAPTER 7 AND AS INDICATED ON DRAWINGS.
14. FIXTURES:
 14.1. PROVIDE ALL NEW FIXTURES (AS INDICATED).
 14.2. NEW FIXTURES SHALL BE BARRIER FREE AND CSA APPROVED.
 14.3. FIXTURES SHALL MEET WATER EFFICIENCY REQUIREMENTS AS INDICATED IN OBC CHAPTER 7



KEY PLAN

NO.	DATE	DESCRIPTION	BY
1	09/16/20	ISSUED FOR PERMIT	M.S.B.

MARK VOID ALL PRINTS DATED PREVIOUS TO FINAL DATE ABOVE

REVISIONS

ARCHITECT:

PROJECT NAME:
COMMERCIAL PLAZA

PROJECT ADDRESS:
428–432 KING STREET EAST, BUILDING B2, COBOURG, ON

MAGH ENGINEERING INC
6033 Shawson Drive, Unit 23, Mississauga, ON-L5T 1 H8
Tel: 905 564 1112 | msbharaj@magh.ca| www.magh.ca

PROJECT TITLE:
PLUMBING LAYOUT

LICENSED PROFESSIONAL ENGINEER 09/16/20 MS BHARAJ 100088853 PROVINCE OF ONTARIO

DESIGN: M.S.B.	PROJECT NUMBER: 2009078
DRAWN BY: K.S.G	SCALE: 3/16"=1'-0"
CHECKED BY: M.S.B.	
DATE: AUGUST, 2020	DRAWING NUMBER: M–01

Appendix I

Storm Sewer Hydraulic Load analysis

OBC Calculations

The following calculations review the capacity of the proposed 300 mm storm sewer between MH1 and the ex. MH southwest of the existing A&W. The upstream stormwater contributions to this pipe consist of tributary areas to CB1, CB2, CB3, CBMH4 and roof area of proposed building D (including vertical projection of the building walls).

7.4.10.4

1) Except as provided in sentence (2), the hydraulic load from a roof or paved surface is the maximum 15 min rainfall determined in conformance with MMAH Supplementary Standard SB-1, "Climatic Seismic Data", Multiplied by the sum of,

a) the area in square metres of the horizontal projection of the surface drained, and

b) one-half the area in square metres of the largest adjoining vertical surface

15 min Rainfall for Cobourg: 23 mm

Area of horizontal surface draining to sewer: 2200 m^2 (includes roof of Building D, assumed no controlled roof drains for the purpose of these calculations)

Area of Building D vertical surface: 288 m^2

$$Load = 23mm \times \left(2200 + \frac{288}{2}\right)$$

$$Load = 53{,}912mm \cdot m^2$$

$$\boldsymbol{Load = 53{,}912\ litres}$$

As per Table 7.4.10.9, the maximum permitted hydraulic load drained to a horizontal storm drainage pipe is **78,700L** based on a 12-inch sewer at a slope of 1 in 100.

Since the load of 53,912 litres is less than the maximum permitted flow of 78,700 litres, the proposed sewer is acceptable.

Appendix J

Sanitary Sewer Capacity Analysis

Sanitary Capacity Analysis

Proposed Commercial 428 & 432 Street East, Cobourg, ON

May 25, 2020

Prepared by:

n Architecture Inc
9120 Leslie Street, Suite-208,
Richmond Hill, Ontario.
L4B3J9.
Tel: 416-303-4821
http://narchitecture.com/
https://www.facebook.com/nArchitectureInc

Table of Content

List of Appendix

1.0 Introduction

The proposed development of a gas station and seating/drive through restaurants on 428 King Street East requires the assessment of existing sanitary sewer on Brook Road North and south from upstream at Railway truck up to the sanitary pumping station at Lakeshore Drive.

The site location and catchment area is shown in Figure 1.

Figure 1 – Sanitary Sewer Capacity Study Area

2.0 Capacity Assessment

Capacity analysis conducted based on population of the catchment area. Catchment area determined as per sanitary sewer network contributing to the main pipes on Brook Road. Information about the network obtained from City of Cobourg. The sewer network map attached in Appendix A.

2.1 Waste water flow generation Criteria and Scenario

Design Parameters of the sanitary sewage flows are calculated for the capacity analysis are based on the following Town of Cobourg design guidelines:

Domestic Waste Water Flow:

1. Sanitary flow r rate of 364 L/person/day for new residential development;
2. Population densities of 1.62 person/unit for apartment;
3. Population densities of 3.23 person/unit for Single Family/Semi detach;
4. Population densities of 2.68 person/unit for Town house;
5. Infiltration Allowance of 22.5 m3/Gross ha./day
6. Peaking Factor based on the Harmon Equation.

$$K_H = 1 + \frac{14}{4 + P^{0.5}}$$

Where:
KH = Peaking factor
P = Population in Thousands
KH - Maximum 3.8, Minimum 1.5

Commercial Waste Water Flow:

1. Population density for commercial development of 1.1 person/100m^2 of floor space ;
2. Floor Space Index: 0.50 of gross lot area unless designated otherwise in the secondary plan

Pre-development Flows:

Currently there is no sanitary service connection servicing the site – therefore there is no flows contributing to the existing network under assessment.

Post-development Flows:

Post development waste water flows calculated based on proposed development according to Ontario Building Code and presented below. Development proposal presented in Site Plan prepared by n Architecture Inc. (Refer: Site Plan A1.0, Appendix 1).

2.2 Sanitary wastewater Generation from the Site

Pre development and post development waste water flows calculated based on existing condition and proposed development.

PARCEL A:

Convenient Store plus Food Services:

Floor Area: 185.85 m^2
No of washroom: 1
Food service: Take out

1) Flow from Convenient store:

   No of washroom: 1
   Sewage flow rate: 950 L/day *(OBC 8.2.1.3.12)*
   Total Flow: 950 x 1 = **950 L/day**

2) Flow from Convenient store (Food Service):

   Flow per 9.25 m^2 Floor Area = 190 L/Day *(OBC 8.2.1.3 (B).12.J)*
   Floor Area: 185.85 m^2
   Flow per Employee = 75 L/day
   No. of Employee: 1
   Total Flow = (185.85/9.25) x 190 + 75 x 1 = 3,844 L/day

3) Flow from Gas Station:

   No of fuel outlet (Nozzle): 8
   Flow per nozzle: 560 L/day *(OBC 8.2.1.3.B)*
   Total sewage flow: 560 x 8 = 4,480 L/day

Total Flow from Parcel A = 950 + 3,844 + 4,480 = **9,274 L/day**

Infiltration Allowance (IA) = 22.5 m^3/Gross ha. /day
Gross area of parcel A = 3,282.18 m^2
IA for Parcel A = 22.5 x (3,282.18/10,000) = 7.38 m^3/day = 7,380 **L/day**

Parcel A - Design Flow = 9,274 + 7,380 = 16, 654 **L/day = 0.193 L/sec**

PARCEL B:

Development of the proposed to be done in two phases – however waste water discharge calculation is done for the whole site for both phases to get the optimal result of impact on the existing network.

Building B1: (Tim Horton's)

Flow from restaurant (Seating):

No of Seat: 24
Flow per seat: 125 L/day (OBC 8.2.1.3.B (12 .a))
Total Flow from restaurant: 125 x 24 = 3,000 L/day

Flow from restaurant (Drive Through)

Flow per 9.25 m^2 Floor Area = 190 L/Day (OBC 8.2.1.3 (B).12.h .i)
Floor Area: 254.14 m^2
Flow per Employee = 75 L/day (OBC 8.2.1.3 (B).12.h.j)
No. of Employee: 4

Total Flow from Building B1 = (254.14/9.25) x 190 + 75 x 4 = **5,520 L/day**

Building B2:

Restaurant # 1 (Seating):

No of Seat: 30
Flow per seat: 125 L/day (OBC 8.2.1.3.B (12 .a))
Total Flow from restaurant: 125 x 30 = 3,750 L/day

Restaurant # 1 (Drive Through):

Flow per 9.25 m^2 Floor Area = 190 L/Day (OBC 8.2.1.3 (B).12.h .i)
Floor Area: 168.58m^2
Flow per Employee = 75 L/day (OBC 8.2.1.3 (B).12.h.j)
No. of Employee: 4
Total Flow = (168.58/9.25) x 190 + 75 x 4 = 3,763 L/day

Restaurant # 2 (Seating):

No of Seat: 30
Flow per seat: 125 L/day (OBC 8.2.1.3.B (12 .a))
Total Flow from restaurant: 125 x 30 = 3,750 L/day

Restaurant # 3 (Seating):

No of Seat: 30
Flow per seat: 125 L/day (OBC 8.2.1.3.B (12 .a))
Total Flow from restaurant: 125 x 30 = 3,570 L/day

Total Flow from Building B2 = 3,570 + 3,763 + 3,570 + 3,570 =**15,013 L/day**

Infiltration Allowance = 22.5 m^3/Gross ha. /day

Gross area of parcel B – Phase 1 = 3201 m^2
IA for Parcel B Phase 1 = 22.5 x (3201/10,000) = 7.2 m^3/day **= 7,200 L/day**

Gross area of parcel B – Phase 2 = 4213 m^2
IA for Parcel B Phase 2 = 22.5 x (4213 x10,000) = 9.5 m^3/day **= 9,500 L/day**

Parcel B Phase 1: Design Flow = 5,520 + 7,200 = 12,720 L/day

Parcel B Phase 2: Design Flow = 15,013 + 9,500 = 24,513 L/day

Parcel B: Design Flow = 12,720 + 24,513 = 37,233 L/day = 0.431 L/sec

Waste Water Flow from the site = Flow from Parcel A + Flow from Parcel B

= 0.193 L/sec + 0.431 L/sec

= 0.624 L/sec

2.3 Capacity Analysis Findings:

Capacity analysis was done following above described criteria and findings are summarized below:

1) Existing sanitary sewer on Brook Road from Railway Truck up to Acadia Drive consists of 300 mm diameter concrete and PVC pipes with slope varies from 1.08% to 0.12%;

2) From Acadia Drive to Lakeshore Drive diameter of existing sewer is 450 mm PVC pipes with slope varies from 0.69% to 0.23%;

3) Existing flow at pre-development condition ranges from 7.46% to 0.33%v of the existing capacity of the pipe;

4) Pre-development flow at Lakeshore Drive calculated as 9.94 L/sec

5) Post-development flow from the site calculated as 0.62 L/sec, that is 5.9% of post-development flow of 10.52 L/sec at Lakeshore Drive.

3.0 Summary

Based on information of existing sanitary sewer obtained from City of Cobourg and proposed development of the site the sanitary capacity analysis was carried out. As per the calculation based on available information the existing flow is well below the capacity. Adding waste water flow from proposed development will increase 5.9% on existing pre-development flow.

We trust you will find this submission complete and in order. Should you have any questions, please contact the undersigned.

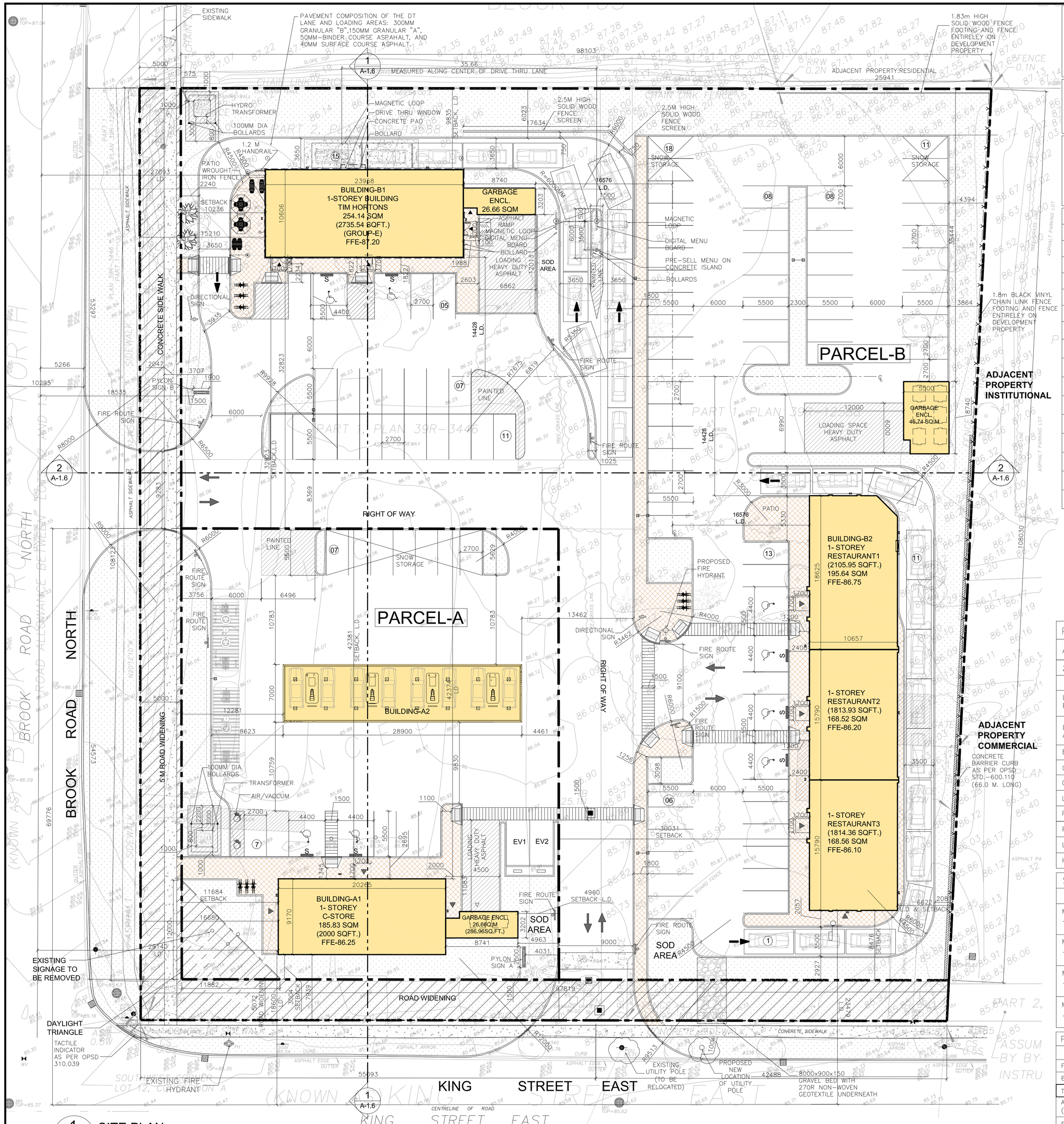
Respectfully submitted.

Abu S Ziauddin P. Eng. M.Eng
PROJECT MANAGER
(Municipal Engineering)

n Architecture Inc

Appendix K

Site Plan

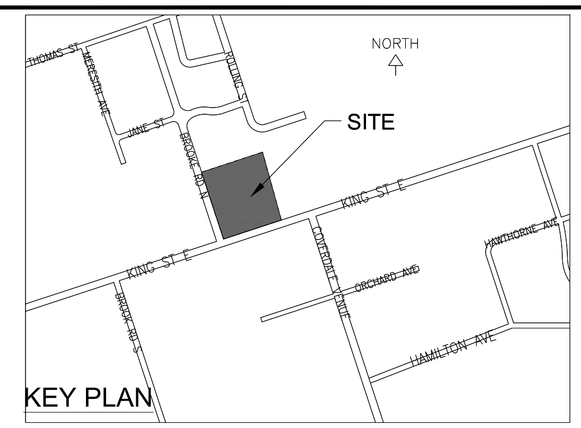


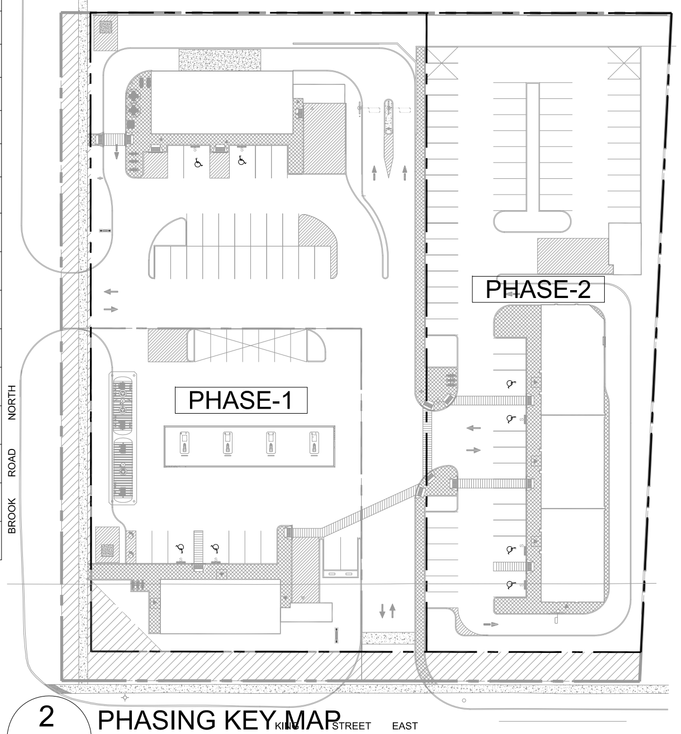
1 SITE PLAN
A-1.0 SCALE 1:250

SCALE 1:250
0 1 2 3 4 5 10 15 20 25 metres

APPLICANT:	n Architecture Inc 9120 LESLIE STREET, SUITE-208,RICHMOND HILL, ONTARIO L4B 3J9 T: 416.303.4821 F:1.866.340.5265 E: Info@narchitecture.com www.narchitecture.com
OWNER INFO:	KING AND BROOK INC. 10 Wanless Avenue, Suite 201, Toronto, ON M4N1V6 T. 416.481.2222 x 253 | F. 647.789.5189 | E. agold@plazacorp.com
MUNICIPAL ADDRESS & LEGAL DESCRIPTION:	428-432 KING STREET EAST, TOWN OF COBOURG PART OF LOT 12, CONCESSION A, GEOGRAPHIC TOWNSHIP OF HAMILTON, TOWN OF COBOURG, COUNTY OF NORTHUMBERLAND

INDEX	
	NEW BUILDING
	OVERHEAD DOOR
	MAN DOOR
	ASPHALT
	CONCRETE PAVEMENT
	LANDSCAPING
	SIDEWALK
	PROPERTY LINE
	EXISTING CITY TREE
	EXISTING FIRE HYDRANT
	EXISTING UTILITY POLE
EX.CB	EXISTING CATCH BASIN
PH	PROPOSED FIRE HYDRANT
DC	DEPRESSED CURB
	ACCESSIBLE PARKING SIGN
	SOLID FENCE





2 PHASING KEY MAP
A-1.0 NTS

PROJECT STATISTICS FOR PARCEL A		
ADDRESS: 428-432 KING STREET EAST, COBOURG, ON		
ZONING: DC	DISTRICT COMMERCIAL	
	REQUIRED	PROPOSED
LOT(SITE) AREA (m^2) BEFORE ROAD WIDENING		3012.97 SQ.M. (0.74 ACRES)
LOT(SITE) AREA (m^2) AFTER ROAD WIDENING		2491.49 SQ.M. (0.61 ACRES)
BUILDING-A1,(C-STORE)- GFA		185.83 SQ.M.
GARBAGE ENCLOSURE		26.66 SQ.M.
COVERAGE	MAX. 30%	212.49 SQ.M.(8.52%)
LANDSCAPED AREA	MIN. 15%	441.45 SQ.M.(17.71%)
PAVED AREA + ASPHALT AREA		1837.55 SQ.M.(73.75%)
PARKING	18	14+2HC=16
LOT FRONTAGE	MIN. 25M	55.09 M
HEIGHT OF BUILDING	4 STOREY MAX.	5.8 M

SETBACK		
	REQUIRED	PROPOSED
MINIMUM SETBACK (NORTH) -REAR YARD	7.5M (INCLUDING 3M STRIP LANDSCAPE)	42.38M
MINIMUM SETBACK (SOUTH) -FRONT YARD	3M(MIN.)-15M(MAX.) (INCLUDING 3M STRIP LANDSCAPE)	3.00M
MINIMUM SETBACK (EAST) -INTERIOR SIDE YARD	---	4.96M
MINIMUM SETBACK (WEST) -EXTERIOR SIDE YARD	3M(MIN.)-15M(MAX.)	11.68M

PARKING CALCULATIONS		
	REQUIRED	PROVIDED
FUELING STATION (2 per PUMP)	8	8
BUILDING #A1- C-Store (1 per 18SQM)	10	14
TOTAL PARKING	18	22
ACCESSIBLE PARKING SPACES (1 per 20 PARKING)	1	2 (4400W X 5500)
EV PARKING SPACE	-	2
BICYCLE PARKING	-	6
LOADING STATISTICS UPTO 25,300 SQF GFA SPACE	1 SPACE	1

PROJECT STATISTICS FOR PARCEL B		
ADDRESS: 428-432 KING STREET EAST, COBOURG, ON		
ZONING: DC	DISTRICT COMMERCIAL	
	REQUIRED	PROPOSED
LOT(SITE) AREA (m^2) BEFORE ROAD WIDENING	MIN. 740 SQM	8307.78 SQ.M. (2.05 ACRES)
LOT(SITE) AREA (m^2) AFTER ROAD WIDENING		7809.72 SQ.M. (1.92 ACRES)
BUILDING-B1 (TIM HORTONS)		254.14 SQ.M.
BUILDING-B2 QSR		532.72 SQ.M.
GARBAGE ENCLOSURE		73.40 SQ.M.
TOTAL GFA		786.86 SQ.M.
COVERAGE	MAX. 30%	860.26 SQ.M.(11.01%)
LANDSCAPED AREA	MIN. 15%	1376.38 SQ.M.(17.62%)
PAVED AREA+ASPHALT AREA		5576.39 SQ.M.(71.40%)
PARKING		82 CARS + 5 HC
LOT FRONTAGE	MIN. 25M	42.48 M
HEIGHT OF BUILDING	4 STOREY MAX.	5.8 M
FLOOR SPACE INDEX	1.0 TIMES	

SETBACK		
	REQUIRED	PROPOSED
MINIMUM SETBACK (NORTH) -REAR YARD	7.5M (INCLUDING 3M STRIP LANDSCAPE)	9.83M
MINIMUM SETBACK (SOUTH) -FRONT YARD	3M(MIN.)-15M(MAX.) (INCLUDING 3M STRIP LANDSCAPE)	8.47M
MINIMUM SETBACK (EAST) -INTERIOR SIDE YARD	6M	6.62M
MINIMUM SETBACK (WEST) -EXTERIOR SIDE YARD	3M(MIN.)-15M(MAX.)	10.23M

PARKING CALCULATIONS		
	REQUIRED	PROVIDED
BUILDING #B1 (1 per 9SQM)	28	28
BUILDING #B2 (1 per 9SQM)	59	59
TOTAL PARKING	87	87
ACCESSIBLE PARKING SPACES (1 per 20 PARKING)	5	5 (4400W X 5500)
BICYCLE PARKING	-	06
LOADING STATISTICS UPTO 25,300 SQF GFA SPACE	1 SPACE	2

22 SEP. 2020

N (GEODETIC NORTH)
PROJECT NORTH

30th SEP. 2020
ISSUED FOR SPA III
NOT FOR CONSTRUCTION

No.	Date	Version	Dwn.
3.	22 SEP. 2020	ISSUED FOR SPA III	MG
2.	08 JULY 2020	ISSUED FOR SPA II	MG
1.	25 FEB. 2020	ISSUED FOR SPA I	MG

PROJECT:

COMMERCIAL DEVELOPMENT 428-432 KING STREET EAST, COBOURG, ON

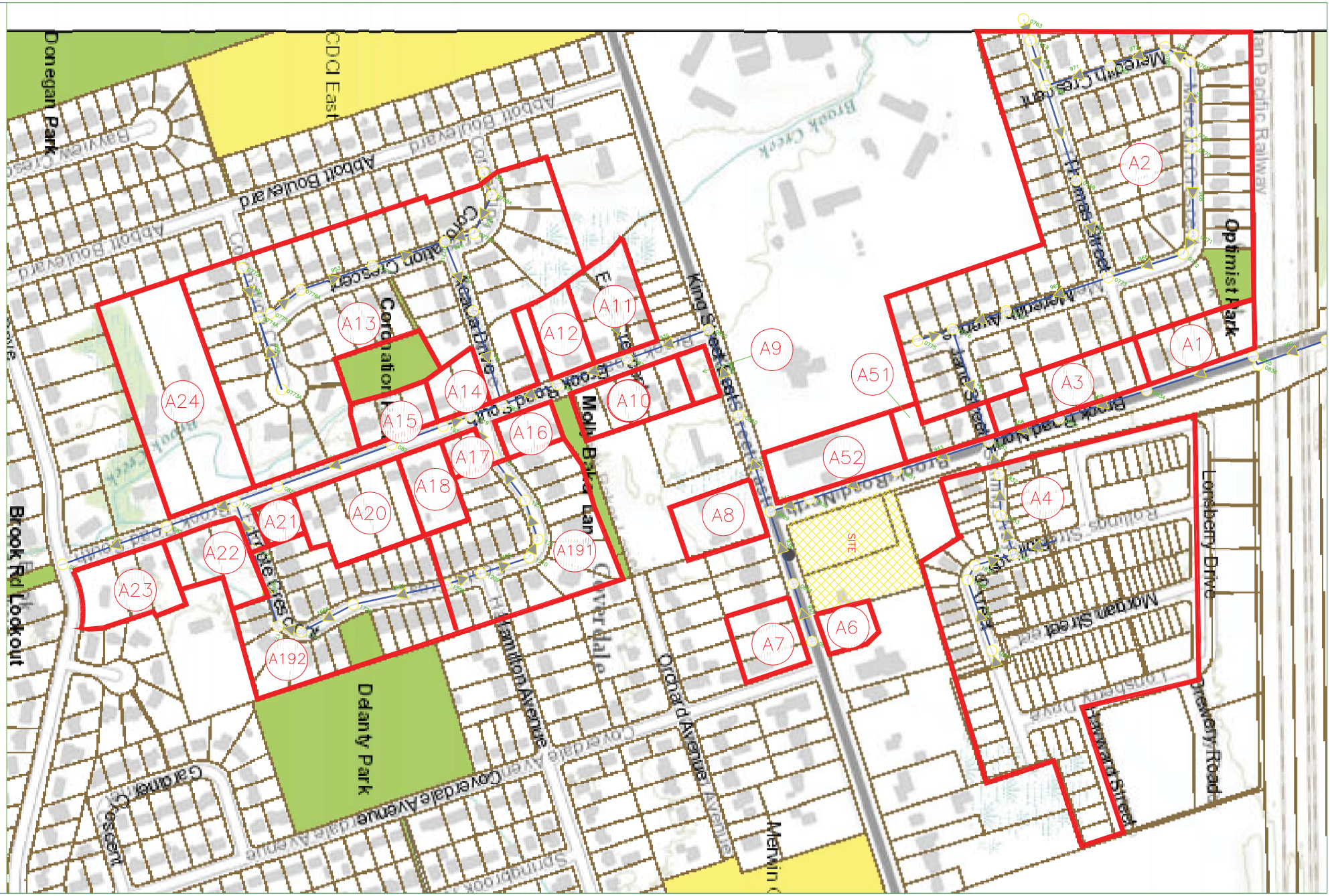
DRAWING TITLE:

OVERALL SITE PLAN

DRAWN BY: MG	DATE: 25TH FEB. 2020
CHECKED BY: NM	SCALE: AS NOTED
PROJECT NO.: 19-43	DRAWING NO.: A-1.0

Appendix L

Sanitary Map



n Architecture Inc
PRINCIPAL: NITIN MALHOTRA, ARCHITECT.
9120 Leslie Street, Suite-208
Richmond Hill, Ontario, L4B 3J9
T: 416.303.4821
E: info@narchitecture.com
www.narchitecture.com

PROJECT:

COMMERCIAL DEVELOPMENT
428 AND 432
KING STREET EAST, COBOURG, ON

DRAWING TITLE:

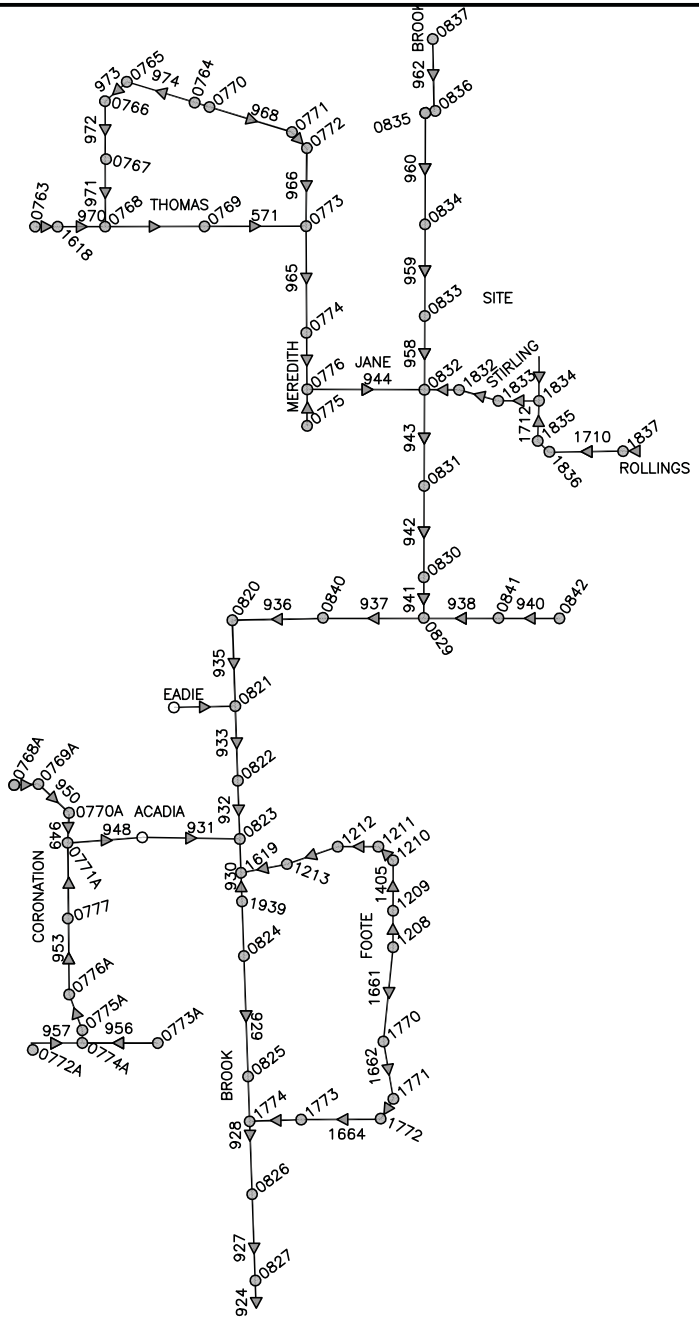
SANITARY SEWER STUDY MAP

DRAWN BY: AZ	DATE: 21 OCTOBER 2019
CHECKED BY: AZ	SCALE: NTS
PROJECT NO.: **n 1943**	DRAWING NO.: **S-01**

N
(GEODETIC NORTH)
PROJECT NORTH

Appendix M

Sanitary Analysis Sheet



CATCHMENT ID	AREA (Ha)	EQUIVALENT POPULATION
A1	0.55	19
A2	8.68	242
A3	0.70	16
A4	2.96	145
A51	0.36	10
A52	0.68	38
A6	0.21	3
A7	0.43	6
A8	0.46	3
A9	0.15	2
A10	0.56	19
A11	0.62	13
A12	0.34	6
A13	6.38	165
A14	0.27	10
A15	0.34	16
A16	0.22	6
A17	0.14	6
A18	0.37	3
A191	2.26	61
A192	2.21	78
A20	0.84	13
A21	0.15	6
A22	0.51	6
A23	0.61	6
A24	1.93	6

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PROJECT:

COMMERCIAL DEVELOPMENT
428 AND 432
KING STREET EAST, COBOURG, ON

DRAWING TITLE:

MAIN SEWER MAP

DRAWN BY: AZ	DATE: 21 OCTOBER 2019
CHECKED BY: AZ	SCALE: NTS
PROJECT NO.: n 1943	DRAWING NO.: S-02

N
(GEODETIC NORTH)
PROJECT NORTH

PROJECT 428 King Street East, Cobourg
CONSULTANT **n Architecture Inc.**
PROJECT NO. n 1943

CITY OF COBOURG

DESIGN CHART S01: SANITARY SEWER - PRE- DEVELOPMENT CONDITION

AREA (ID)	AREA (Land Use Type)	UPSTREAM MH	DOWNSTREAM MH	FLOW				DESIGN FLOW		CUM. FLOW (L/s)	PIPE					
				Area (ha.)	EQUIV. POP. (Table S01)	PEAK FACT.	AVG. FLOW (L/s)	INFILTRATION FLOW (L/s)	TOTAL FLOW (L/s)		LENGTH	SIZE	GRADE	CAP. FULL	(DES.)CAP. (%)	DES. VEL.FULL
A1	Residential	SA-0835	SA-0834	0.550	19	4.382	0.08	0.143	0.22	**0.22**	*120.0*	*300*	*0.49*	67.7	0.33%	0.33
A3	Residential	SA-0834	SA-0833	0.700	16	4.392	0.07	0.182	0.25	**0.48**	*89.1*	*300*	*0.55*	71.7	0.66%	0.36
		SA-0833	SA-0832					0.000	0.00	**0.48**	*82.9*	*300*	*1.08*	100.5	0.47%	0.56
A2	Residential			8.680	242	4.117	1.02	2.260	3.28	**3.76**						
A4	Residential			2.960	145	4.196	0.61	0.771	1.38	**5.14**						
A51	Residential	SA-0832	SA-0831	0.368	10	4.416	0.04	0.096	0.14	**5.27**	*106.2*	*300*	*0.73*	82.6	6.38%	0.43
A52	Commercial	SA-0831	SA-0830	0.683	38	4.338	0.16	0.178	0.34	**5.61**	*93.8*	*300*	*0.68*	79.7	7.04%	0.41
		SA-0830	SA-0829							**5.61**	*23.6*	*300*	*0.60*	74.9	7.49%	0.38
A6	Residential	SA-0842	SA-0841	0.210	3	4.451	0.01	0.055	0.07	**0.07**	*65.5*	*200*	*1.00*	32.8	0.21%	0.46
A7	Residential	SA-0841	SA-0829	0.429	6	4.431	0.03	0.112	0.14	0.21	*60.2*	*200*	*0.60*	25.4	0.82%	0.33
A8	Residential	SA-0829	SA-0840	0.047	3	4.451	0.01	0.012	0.03	5.84	*96..18*	*300*	*0.70*	80.9	7.22%	0.42
		SA-0840	SA-0820							5.84	*99.0*	*300*	*0.70*	80.9	7.22%	0.42
A9	Commercial	SA-0820	SA-0821	0.147	2	4.461	0.01	0.038	0.05	5.89	*112.1*	*300*	*0.74*	83.2	7.08%	0.44
A10	Residential			0.559	19	4.382	0.08	0.146	0.23	6.12						
A11	Residential			0.620	13	4.403	0.05	0.161	0.22	6.33						
A12	Residential	SA-0821	SA-0822	0.340	6	4.431	0.03	0.089	0.12	6.45	*68.6*	*300*	*0.80*	86.5	7.46%	0.46
A16	Residential	SA-0822	SA-0823	0.220	6	4.431	0.03	0.057	0.08	6.53	*44.1*	*300*	*0.83*	88.1	7.42%	0.47
A14	Residential	SA-0823	*SA-1619*	0.270	10	4.416	0.04	0.070	0.11	6.64	*23.0*	*450*	*0.14*	106.7	6.23%	0.18
A17	Residential			0.140	6	4.431	0.03	0.036	0.06	6.71						
A191	Residential	*SA-1619*	*SA-1939*	2.264	61	4.296	0.26	0.590	0.85	7.56	*22.0*	*450*	*0.14*	106.7	7.08%	0.18
A15	Residential			0.340	16	4.392	0.07	0.089	0.16	7.71						
A18	Residential	*SA-1939*	SA-0824	0.370	3	4.451	0.01	0.096	0.11	7.82	*44.0*	*450*	*0.14*	106.7	7.33%	0.18
A20	Residential	SA-0824	SA-0825	0.840	13	4.403	0.05	0.219	0.27	8.10	*93.7*	*450*	*0.23*	136.7	5.92%	0.25
A21	Residential	SA-0825	*SA-1774*	0.150	6	4.431	0.03	0.039	0.07	8.16	*80.0*	*450*	0.4	180.3	4.53%	0.35
A192	Residential			2.209	78	4.272	0.33	0.575	0.90	9.06						
A22	Residential			0.510	6	4.431	0.03	0.133	0.16	9.22						
A24	Residential	*SA-1774*	SA-0826	1.930	6	4.431	0.03	0.503	0.53	9.75	*82.5*	*450*	0.4	180.3	5.41%	0.35
A23	Residential	SA-0826	SA-0827	0.610	6	4.431	0.03	0.159	0.19	9.94	*107.2*	*450*	*0.69*	236.8	4.20%	0.51

Sanitary Demand = 364 L/day/cap, Max Peaking Factor: 3.8 used;

PROJECT 428 King Street East, Cobourg
CONSULT **n Architecture Inc.**
PROJECT n 1943

CITY OF COBOURG

DESIGN CHART S02: SANITARY SEWER - POST- DEVELOPMENT CONDITION

AREA (ID)	AREA (Land Use Type)	UPSTREAM MH	DOWNSTREAM MH	FLOW				DESIGN FLOW		CUM. FLOW (L/s)	PIPE					
				Area (ha.)	EQUIV. POP. (Table S01)	PEAK FACT.	AVG. FLOW (L/s)	INFILTRATION FLOW (L/s)	TOTAL FLOW (L/s)		LENGTH	SIZE	GRADE	CAP. FULL	(DES.)CAP. (%)	DES. VEL.FULL
A1	Residential	SA-0835	SA-0834	0.550	19	4.382	0.08	0.143	0.22	**0.22**	*120.0*	*300*	*0.49*	67.7	0.33%	0.33
A3	Residential	SA-0834	SA-0833	0.700	16	4.392	0.07	0.182	0.25	**0.48**	*89.1*	*300*	*0.55*	71.7	0.66%	0.36
		SA-0833	SA-0832					0.000	0.00	**0.48**	*82.9*	*300*	*1.08*	100.5	0.47%	0.56
A2	Residential			8.680	242	4.117	1.02	2.260	3.28	**3.76**						
A4	Residential			2.960	145	4.196	0.61	0.771	1.38	**5.14**						
A51	Residential	SA-0832	SA-0831	0.368	10	4.416	0.04	0.096	0.14	**5.27**	*106.2*	*300*	*0.73*	82.6	6.38%	0.43
A52	Commercial	SA-0831	SA-0830	0.683	38	4.338	0.16	0.178	0.34	**5.61**	*93.8*	*300*	*0.68*	79.7	7.04%	0.41
		SA-0830	SA-0829							**5.61**	*23.6*	*300*	*0.60*	74.9	7.49%	0.38
SITE	Flow from the site (Refer: Waste Water Flow Calculation)								0.58	**0.58**						
A6	Residential	SA-0842	SA-0841	0.210	3	4.451	0.01	0.055	0.07	**0.64**	*65.5*	*200*	*1.00*	32.8	1.96%	0.46
A7	Residential	SA-0841	SA-0829	0.429	6	4.431	0.03	0.112	0.14	0.78	*60.2*	*200*	*0.60*	25.4	3.08%	0.33
A8	Residential	SA-0829	SA-0840	0.047	3	4.451	0.01	0.012	0.03	6.42	*96..18*	*300*	*0.70*	80.9	7.93%	0.42
		SA-0840	SA-0820							6.42	*99.0*	*300*	*0.70*	80.9	7.93%	0.42
A9	Commercial	SA-0820	SA-0821	0.147	2	4.461	0.01	0.038	0.05	6.47	*112.1*	*300*	*0.74*	83.2	7.77%	0.44
A10	Residential			0.559	19	4.382	0.08	0.146	0.23	6.69						
A11	Residential			0.620	13	4.403	0.05	0.161	0.22	6.91						
A12	Residential	SA-0821	SA-0822	0.340	6	4.431	0.03	0.089	0.12	7.02	*68.6*	*300*	*0.80*	86.5	8.12%	0.46
A16	Residential	SA-0822	SA-0823	0.220	6	4.431	0.03	0.057	0.08	7.11	*44.1*	*300*	*0.83*	88.1	8.07%	0.47
A14	Residential	SA-0823	*SA-1619*	0.270	10	4.416	0.04	0.070	0.11	7.22	*23.0*	*450*	*0.14*	106.7	6.77%	0.18
A17	Residential			0.140	6	4.431	0.03	0.036	0.06	7.28						
A191	Residential	*SA-1619*	*SA-1939*	2.264	61	4.296	0.26	0.590	0.85	8.13	*22.0*	*450*	*0.14*	106.7	7.62%	0.18
A15	Residential			0.340	16	4.392	0.07	0.089	0.16	8.29						
A18	Residential	*SA-1939*	SA-0824	0.370	3	4.451	0.01	0.096	0.11	8.40	*44.0*	*450*	*0.14*	106.7	7.87%	0.18
A20	Residential	SA-0824	SA-0825	0.840	13	4.403	0.05	0.219	0.27	8.67	*93.7*	*450*	*0.23*	136.7	6.34%	0.25
A21	Residential	SA-0825	*SA-1774*	0.150	6	4.431	0.03	0.039	0.07	8.74	*80.0*	*450.00*	0.4	180.3	4.85%	0.35
A192	Residential			2.209	78	4.272	0.33	0.575	0.90	9.64						
A22	Residential			0.510	6	4.431	0.03	0.133	0.16	9.80						
A24	Residential	*SA-1774*	SA-0826	1.930	6	4.431	0.03	0.503	0.53	10.33	*82.5*	*450.00*	0.4	180.3	5.73%	0.35
A23	Residential	SA-0826	SA-0827	0.610	6	4.431	0.03	0.159	0.19	10.52	*107.2*	*450*	*0.69*	236.8	4.44%	0.51

Sanitary Demand = 364 L/day/cap, Max Peaking Factor: 3.8 used;

Equivalent Population Analysis
(Project: 428 King Street E, Cobourg)
Table S -01

Sub Catchment	Use Type	Number of Houses	Number Of Units	Building Area(ha.)	Equivalent Population	
A1	Residential	6	6		19	Single House
A2	Residential	75	75		242	Single House
A3	Residential	5	5		16	Single House
A4	Residential	52	54		145	Town House
A51	Residential	3	3		10	Single House
A52	Commercial	1		0.342	38	Motel
A6	Residential	1	1		3	Single House
A7	Residential	2	2		6	Single House
A8	Residential	1	1		3	Single House
A9	Commercial	1		0.015	2	Car Retail Shop
A10	Residential	6	6		19	Single House
A11	Residential	4	4		13	Single House
A12	Residential	2	2		6	Single House
A13	Residential	51	51		165	Single House
A14	Residential	3	3		10	Single House
A15	Residential	5	5		16	Single House
A16	Residential	2	2		6	Single House
A17	Residential	2	2		6	Single House
A18	Residential	1	1		3	Single House
A191	Residential	19	19		61	Single House
A192	Residential	24	24		78	Single House
A20	Residential	4	4		13	Single House
A21	Residential	2	2		6	Single House
A22	Residential	2	2		6	Single House
A23	Residential	2	2		6	Single House
A24	Residential	2	2		6	Single House

Population Equivalent:
Population densities of 1.62 person/unit for apartment;
Population densities of 3.23 person/unit for Single Family/Semi de
Population densities of 2.68 person/unit for Town house;
Commercial densities of 1.1 person/100m^2

Appendix N
Statement of Limiting Conditions and Assumptions

Statement of Limiting Conditions and Assumptions

1. This Report/Study (the "Work") has been prepared at the request of, and for the exclusive use of, the Owner, and its affiliates (the "Intended Users"). No one other then the intended users has the right to use and rely on the work without first obtaining the written authorization of n Engineering Inc. and its Owners.
2. The comments, recommendations and material in this report reflect n Engineering Inc. best judgment in light of the information available to it at the time of preparation of this report. It is not qualified to and is not providing legal or planning advice in this work.
3. n Engineering Inc. expressly excludes liability to any third party except the Intended Users for any use of, and/or reliance upon, the work.
4. n Engineering Inc. notes that the following assumptions were made in completing the work
   a) The land use description(s) supplied to n Engineer Inc. is correct;

   b) The surveys and other data supplied to n Engineering Inc. by the Owner are accurate;

   c) Market timing, approval delivery and secondary information are within the control of parties other then n Engineering Inc.;

   d) There are no encroachments, leases, covenants, binding agreements, restrictions, pledges, charges, liens or special assessments outstanding, or encumbrances, which would significantly affect the use or servicing;

   Investigations have not carried out to verify these assumptions. n Engineering deems the sources of data and statistical information contained herein to be reliable, but we extend no guarantee of accuracy in these respect.

5. All the plans, photographs, and sketches prepared and presented in this report/study are included solely to aid the visualizing the location of the property, the boundaries of the site, and the relative position of the improvements on the said lands are based on information provided by Owner
6. n Engineering Inc. accepts no responsibility for legal interpretations, questions of survey, opinion of title, hidden or inconspicuous conditions of the property, toxic wastes or contaminated materials, soil or sub soil conditions, environmental, engineering or other factual and technical matters disclosed by the owner, the clients, or any public agency, which by their nature, may change the outcome of the work.
7. In the preparation of this report, n Engineering Inc. have made investigations from secondary sources as documented in the work, but did not checked compliance with by laws, codes, agency and government regulations, etc., unless specifically noted in the work.
8. The value of proposed improvements should apply only with regard to the purpose and function of the work, as outlined in the body of this work. Any cost estimated set out in the work based on construction averages and subject to change.
9. Neither possession of Work, nor a copy of it, carries the right of publication. All copyright in the work reserved to n Engineering and considered confidential by n Engineering Inc. The Work shall not be disclosed, reproduced, quoted from, or referred to, in whole or in part, or published in any manner, without the express written consent of n Engineering and the Owner.
10. The work is only valid if it bears the Professional Engineer's seal and original signature of author, and if considered in its entity. Responsibility for unauthorized alteration to the Work is denied.

End of the Statement

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