Memo

TO	**:**	Municipality of Clarington
COPY TO	**:**	Ryan Cressman, Project Engineer
FROM	**:**	Kevin Lukawiecki, Engineering Intern
DATE	**:**	March 19, 2019
SUBJECT	**:**	Storm Water Management of Grady Drive Extension Municipal Class Environmental Assessment (MCEA)

1. Background

The Municipality of Clarington retained CIMA Canada Inc. (CIMA+) to undertake a MCEA for the extension of Grady Drive from Whitehand Drive to Remi Court in the Town of Newcastle. The study area is located on Foster Creek within the jurisdiction of the Ganaraska Region Conservation Authority. A map of the study area can be found in Appendix A. The current landuse is low density residential. The proposed roadway will be approximately 180 m long. This memo outlines the assessment of the stormwater management impacts of the proposed extension including preliminary design of the stormsewer, as well as both an existing and proposed storm sewer design sheets, including all assumptions and calculations.

2. Assumptions

The following assumptions were applied:

- 15 min time of concentration;
- Runoff coefficients, Appendix B;
    - 0.45 for low density residential;
    - 0.25 for existing valley;
    - 0.85 for proposed roadway.

3. Existing Conditions

The Grady Drive Right of Way is a 30 m wide unopened easement through the Foster Creek Valley.

4. Proposed Conditions

Stormwater for the proposed roadway will be collected by CB's and storm sewers and directed to the low point on the proposed roadway at proposed MH-2.

To merge the existing and proposed storm sewers the existing outfall will be relocated to the Grady ROW. Existing MH-5 would have its outflow redirected to the west, conveying flows to proposed MH-2.

The storm sewers would then outlet to the south, where it will enter a proposed Oil and Grit Separator (OGS), outlet into the existing channel and eventually flow into Foster Creek.

The proposed Drainage Mosaic can be seen in Appendix A.

5. Stormwater Assessment

The storm sewers were analyzed using a storm sewer design sheet. A 5-year Yarnell storm was used for the analysis, as per Municipality of Clarington guidelines. The design sheets can be seen in Appendix C. The Yarnell Storm intensities were calculated using the parameters which can be found in Appendix B. The drainage areas, as well as the runoff coefficients used for existing and proposed can be seen in Appendix A.

The study area calculations and change in runoff from existing conditions to proposed is summarized in Table 1 below:

Table 1: Changes in Peak Flow Due to Proposed Roadway Extension

	Area (ha)	Runoff Coefficient	2.78AR	Time of Concentration (min)	Rainfall Intensity (mm/hr)	Peak Flow (l/s)
Existing	0.44	0.25	0.308	15.00	79.48	25
Proposed	0.44	0.85	1.040	15.00	79.48	82
Difference						57

The flow in Foster Creek at Grady Drive during a 5-year storm is 2.89 m^3/s. This proposed increase in flow due to the proposed roadway represents a 2% change in flow. Therefore, no quantity control measures are recommended.

6. Water Quality

It is recommended that an OGS unit be installed to provide enhanced (80% TSS removal) water quality treatment. The drainage area to the OGS unit will be 2.39 ha, with a weighted runoff coefficient of 0.52. Preliminary sizing recommends Hydroworks Hydroguard 5. OGS sizing report is attached in Appendix D. The existing swale will provide treatment train

Appendix A: Figures

Figure 1: Study Area & Drainage Mosaics

CLIENT: Clarington

SCALE: 10 5 0 10 20 30 40 50 meters — 1:2,000

PROJECT NAME: GRADY DRIVE EA

SHEET TITLE: STUDY AREA

PROJECT No: C14-0162	CLIENT FILE No: ---
DRAFTER: S. ELLIOTT / DESIGNER: ---	DRAWING No: FIG. 1
APPROVER: R. CRESSMAN / APPROVER: ---	
DATE: 11/8/2017	SHEET No: 1 of 1

CLIENT: Clarington

SCALE: 10 5 0 10 20 30 40 50 meters
1:750
(1:1,500 on 11x17)

PROJECT NAME: **GRADY DRIVE EA**

SHEET TITLE: **EXISTING CONDITIONS DRAINAGE MOSAIC**

PROJECT No: C14-0162		CLIENT FILE No: --
DRAFTER: S. ELLIOTT	DESIGNER: --	DRAWING No: --
APPROVER: R. CRESSMAN	APPROVER: --	
DATE: 2/11/2019		SHEET No: 1 of 1

Canadian Pacific Railway

MH 1

0.512 ha
0.45

300 @ 0.75%

MH 2

0.071 ha
0.45

300 @ 0.63%

MH 3

0.182 ha
0.45

300 @ 0.56%

Remi Court

MH 4

0.918 ha
0.45

450 @ 0.56%

Whitehand Drive

Grady Drive

0.222 ha
0.85

0.221 ha
0.85

300 @ 1%

450 @ 2%

MH 5

300 @ 1.9%

CBMH 7

0.266 ha
0.45

450 @ 4.76%

450 @ 6%

MH 6

450 @ 1%

Foster Creek

Monroe Street

Manvers Road

North Street

Allens Lane

Donald Powell Crescent

Foster Creek Community
SWM Pond

LEGEND

PROPOSED STORM INFRASTRUCTURE

- CATCHBASIN
- CATCHBASIN MAINT. HOLE
- DOUBLE CATCHBASIN
- DOUBLE CATCHBASIN MAINT. HOLE
- MAINT. HOLE
- OUTFALL
- OIL GRIT SEPARATOR
- SEWER
- SWALE
- HIGH POINT
- LOW POINT
- SIDEWALK
- GRADY DRIVE EXTENSION

EXISTING STORM INFRASTRUCTURE

- CATCHBASIN
- CATCHBASIN MAINT. HOLE
- DCB
- MAINT. HOLE
- OUTFALL
- SEWER
- SWALE
- EXISTING DRAINAGE CATCHMENTS

OTHER FEATURES

- RAILWAY
- WATERCOURSE
- PROPOSED GRADY DR. EXTENSION
- FLOODPLAIN
- ASSESSMENT PARCEL

CLIENT: Clarington

SCALE: 10 5 0 10 20 30 40 50 meters
1:750
(1:1,500 for 11 x 17)

PROJECT NAME: **GRADY DRIVE EA**

SHEET TITLE: **PROPOSED CONDITIONS DRAINAGE MOSAIC**

PROJECT No: **C14-0162**
CLIENT FILE No: ---
DRAFTER: S. ELLIOTT
DESIGNER: ---
DRAWING No: --
APPROVER: R. CRESSMAN
APPROVER: ---
DATE: 2/12/2019
SHEET No: 1 of 1

Appendix B: Runoff Coefficient and Yarnell Parameters

Ground Cover	Runoff Coefficient, c	Average
Lawns	0.05 - 0.35	0.2
Forest	0.05 - 0.25	0.15
Cultivated land	0.08-0.41	0.245
Meadow	0.1 - 0.5	0.3
Parks, cemeteries	0.1 - 0.25	0.175
Unimproved areas	0.1 - 0.3	0.2
Pasture	0.12 - 0.62	0.37
Residential areas	0.3 - 0.75	0.525
Business areas	0.5 - 0.95	0.725
Industrial areas	0.5 - 0.9	0.7
Asphalt streets	0.7 - 0.95	0.825
Brick streets	0.7 - 0.85	0.775
Roofs	0.75 - 0.95	0.85
Concrete streets	0.7 - 0.95	0.825

Chin, David A. 2000. Water-Resources Engineering.

Intensity Calculation Yarnell		
I = a/(b+Tc)	a	b
"1:2"	1778	13
"1:5"	2464	16
"1:10"	2819	16
"1:25"	4318	27
"1:50"	4750	24
"1:100"	5588	28

Technical and Engineering Guidelines for Stormwater Management Submissions, Ganaraska Region Conservation Authority, 2014

Appendix C: Storm Sewer Design Sheets

Storm Sewer Design Sheet

Project : Grady Drive EA
Project No. : C14-0162

Prepared by: KL
Checked by:
Date: 12-Feb-19
n = 0.013 Yarnell Storm Event

File:
Submission:

Street	From MH	To MH	A Area (ha)	R Runoff Coeff.	2.78AR	Accum. 2.78AR	Time of Conc. (min)	Design Return Period	Rainfall (mm/hr)	Q Peak Flow (l/s)	Pipe Diam. (mm)	Slope (%)	Length (m)	Capacity (l/s)	Capacity at Critical Slope	Capacity Problem	Velocity (m/s)	Time in Section (min)	Total Time (min)	Remarks
Remi Court & Grady Drive																				
																			15.00	
Remi Court	MH 1	MH-2	0.51	0.45	0.641	0.641	15.00	"1:5"	79.48	51	300	0.75	61.8	87	103	No	1.20	0.86	15.86	58%
	MH-2	MH-3	0.07	0.45	0.089	0.729	15.86	"1:5"	77.34	56	300	0.63	7.6	80	103	No	1.10	0.12	15.98	70%
	MH-3	MH-4	0.18	0.45	0.228	0.957	15.98	"1:5"	77.06	74	300	0.58	72.5	77	103	No	1.05	1.15	17.12	96%
	MH-4	MH-5	0.92	0.45	1.151	2.108	17.12	"1:5"	74.39	157	450	0.56	81.7	223	292	No	1.36	1.00	18.13	70%
																			15.00	
Grady Drive	CBMH-7	MH-5	0.27	0.45	0.333	0.333	15.00	"1:5"	79.48	26	300	1.90	62.0	139	103	No	1.91	0.54	15.54	19%
Right of Way	MH-5	MH-6	0.00	0.45	0	2.441	18.13	"1:5"	72.20	176	450	4.76	50.0	649	292	No	3.95	0.21	18.34	27%
	MH-6	Outlet	0.00	0.45	0	2.441	18.34	"1:5"	71.76	175	450	1.00	5.0	297	292	No	1.81	0.05	18.38	59%
Grady Drive (Proposed)			0.44	0.20	0.246															

Runoff Coefficients

0.20	Parks-Cemeteries-Playground	0.70	Schools & Churches
0.50	Single Family Residential	0.80	Industrial Areas
0.55	Semi-Detached Residential	0.90	Commercial Areas
0.65	Townhouses		

0.0

Storm Sewer Design Sheet

Date	Submission

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	MH-2	MH-3	0.07	0.45	0.089	0.729	15.86	"1:5"	77.34	56	300	0.63	7.6	80	103	No	1.10	0.12	15.98	70%
	MH-3	MH-4	0.18	0.45	0.228	0.957	15.98	"1:5"	77.06	74	300	0.58	72.5	77	103	No	1.05	1.15	17.12	96%
	MH-4	MH-5	0.92	0.45	0.918	1.875	17.12	"1:5"	74.39	139	450	0.56	81.7	223	292	No	1.36	1.00	18.13	63%
																			15.00	
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Grady Drive (Proposed)	MH-5	Pro MH-2	0.00	0.45		2.208	18.13	"1:5"	72.20	159	450	2.00	50.0	421	292	No	2.56	0.33	18.45	38%
Grady Drive (Proposed)	Pro MH-1	Pro-MH2	0.22	0.85	0.520	0.520	15.00	"1:5"	79.48	41	300	1.00	50.0	101	103	No	1.38	0.60	15.60	41%
Right of Way (Proposed)	Pro MH-2	OGS	0.22	0.85	0.522	3.250	18.45	"1:5"	71.52	232	450	5.00	23.0	665	292	No	4.05	0.09	18.55	35%

Runoff Coefficients 0.0

0.20	Parks-Cemeteries-Playground	0.70	Schools & Churches
0.50	Single Family Residential	0.80	Industrial Areas
0.55	Semi-Detached Residential	0.90	Commercial Areas
0.65	Townhouses		

Storm Sewer Design Sheet

Date	Submission

Storm Sewer Design Sheet: Existing Conditions

Project : Grady Drive EA
Project No. : C14-0162

Prepared by: KL
Checked by:
Date: 6-Mar-19
n = 0.013 Yarnell Storm Event

File:
Submission:

Street	From MH	To MH	A Area (ha)	R Runoff Coeff.	2.78AR	Accum. 2.78AR	Time of Conc. (min)	Design Return Period	Rainfall (mm/hr)	Q Peak Flow (l/s)	Pipe Diam. (mm)	Slope (%)	Length (m)	Capacity (l/s)	Capacity at Critical Slope	Capacity Problem	Velocity (m/s)	Time in Section (min)	Total Time (min)	Remarks
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Grady Drive (Proposed)			0.44	0.20	0.246	0.246	15.00	"1:5"	79.48	20										
		Total	2.39	0.40																

Runoff Coefficients					
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	0.65	Townhouses		

Storm Sewer Design Sheet

Date	Submission

Storm Sewer Design Sheet: Proposed Conditions

Project : Grady Drive EA
Project No. : C14-0162

Prepared by: KL
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n = 0.013 Yarnell Storm Event

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	OGS	Out	0.00	0.25		3.250	18.55	"1:5"	71.32	232	450	1.00	13.5	297	292	No	1.81	0.12	18.67	78%
		Total	2.39	0.52																

Runoff Coefficients

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Storm Sewer Design Sheet

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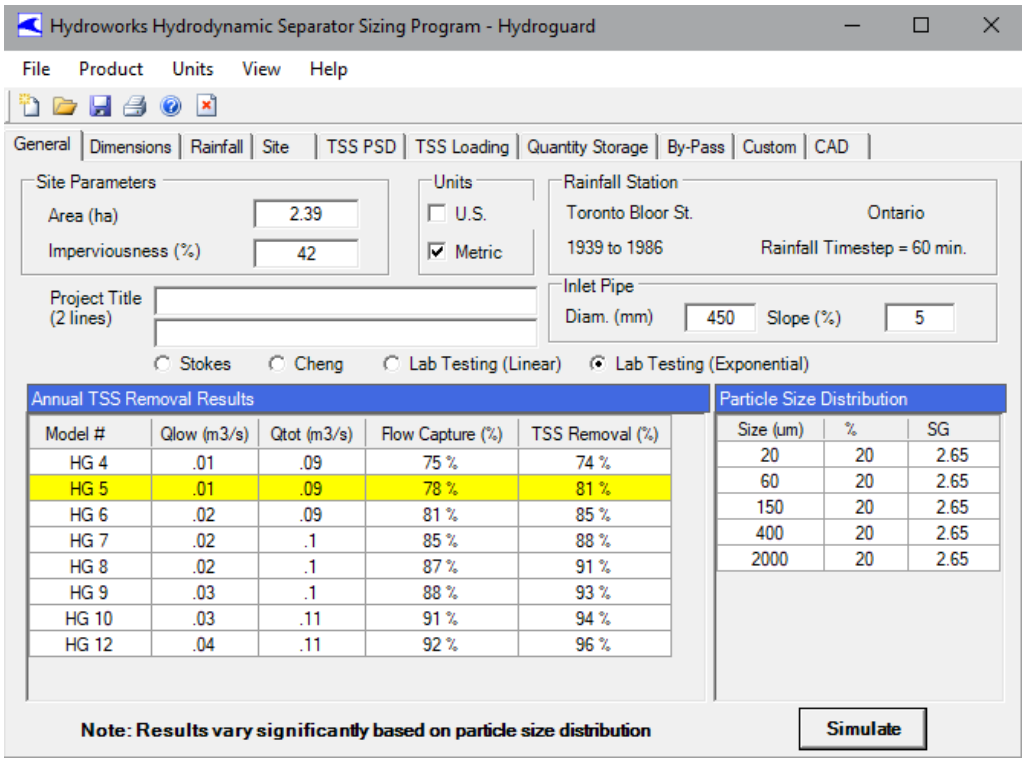
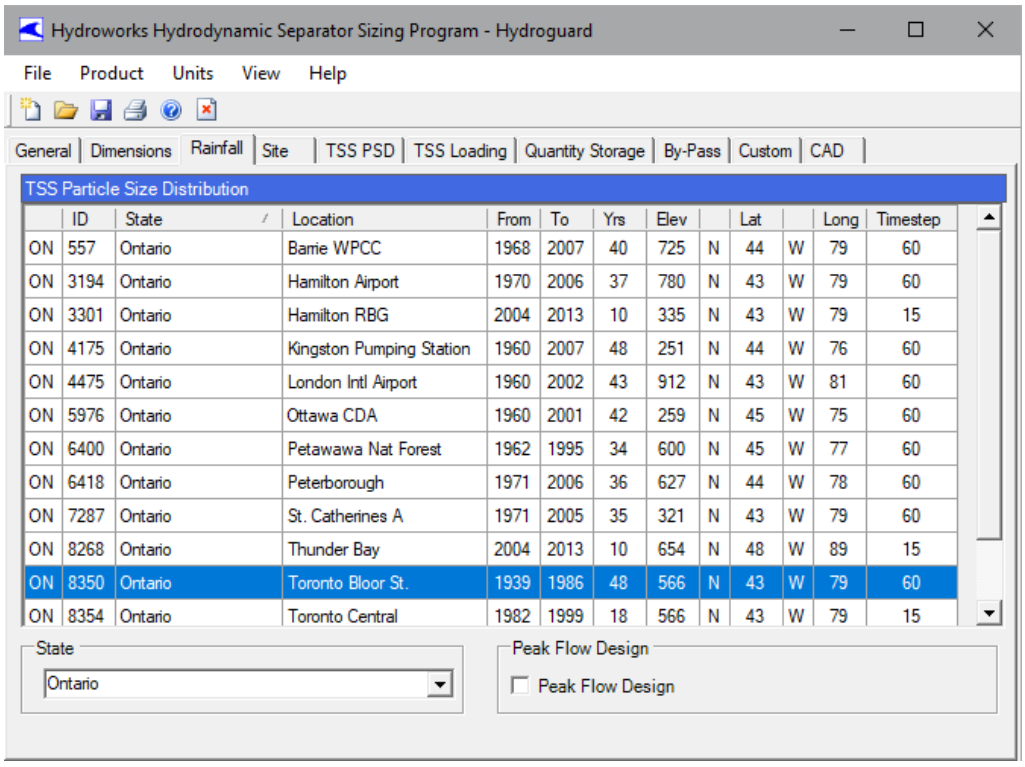
Appendix D: OGS Sizing


Hydroworks Hydrodynamic Separator Sizing Program - Hydroguard
File Product Units View Help
General Dimensions Rainfall Site TSS PSD TSS Loading Quantity Storage By-Pass Custom CAD
Site Parameters
Area (ha) 2.39
Imperviousness (%) 42
Units
U.S.
Metric
Rainfall Station
Toronto Bloor St. Ontario
1939 to 1986 Rainfall Timestep = 60 min.
Project Title (2 lines)
Inlet Pipe
Diam. (mm) 450 Slope (%) 5
Stokes Cheng Lab Testing (Linear) Lab Testing (Exponential)
Annual TSS Removal Results
Model # Qlow (m3/s) Qtot (m3/s) Flow Capture (%) TSS Removal (%)
HG 4 .01 .09 75 % 74 %
HG 5 .01 .09 78 % 81 %
HG 6 .02 .09 81 % 85 %
HG 7 .02 .1 85 % 88 %
HG 8 .02 .1 87 % 91 %
HG 9 .03 .1 88 % 93 %
HG 10 .03 .11 91 % 94 %
HG 12 .04 .11 92 % 96 %
Particle Size Distribution
Size (um) % SG
20 20 2.65
60 20 2.65
150 20 2.65
400 20 2.65
2000 20 2.65
Note: Results vary significantly based on particle size distribution
Simulate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TSS Particle Size Distribution
ID State Location From To Yrs Elev Lat Long Timestep
ON 557 Ontario Barrie WPCC 1968 2007 40 725 N 44 W 79 60
ON 3194 Ontario Hamilton Airport 1970 2006 37 780 N 43 W 79 60
ON 3301 Ontario Hamilton RBG 2004 2013 10 335 N 43 W 79 15
ON 4175 Ontario Kingston Pumping Station 1960 2007 48 251 N 44 W 76 60
ON 4475 Ontario London Intl Airport 1960 2002 43 912 N 43 W 81 60
ON 5976 Ontario Ottawa CDA 1960 2001 42 259 N 45 W 75 60
ON 6400 Ontario Petawawa Nat Forest 1962 1995 34 600 N 45 W 77 60
ON 6418 Ontario Peterborough 1971 2006 36 627 N 44 W 78 60
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ON 8268 Ontario Thunder Bay 2004 2013 10 654 N 48 W 89 15
ON 8350 Ontario Toronto Bloor St. 1939 1986 48 566 N 43 W 79 60
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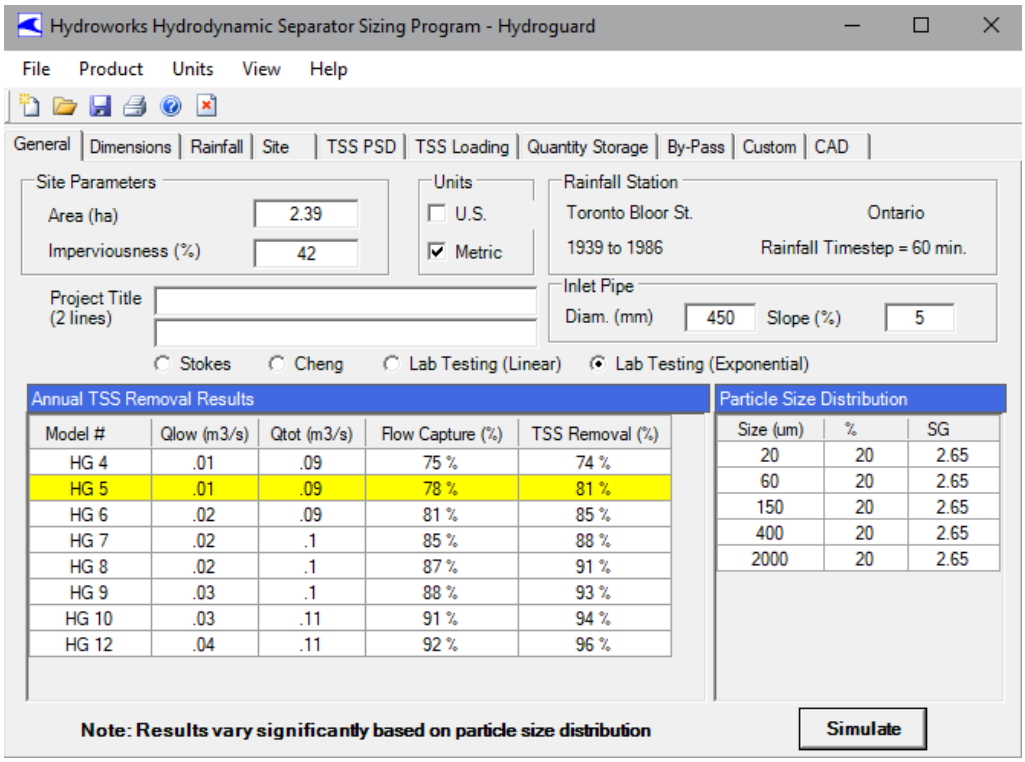
State
Ontario
Peak Flow Design
Peak Flow Design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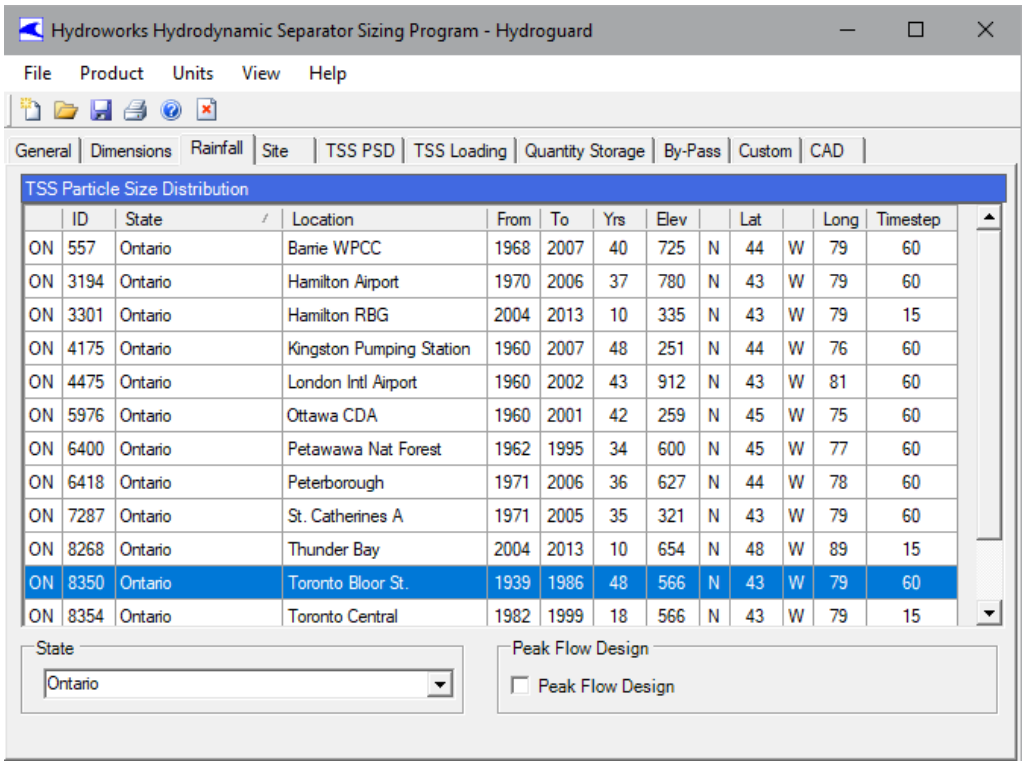
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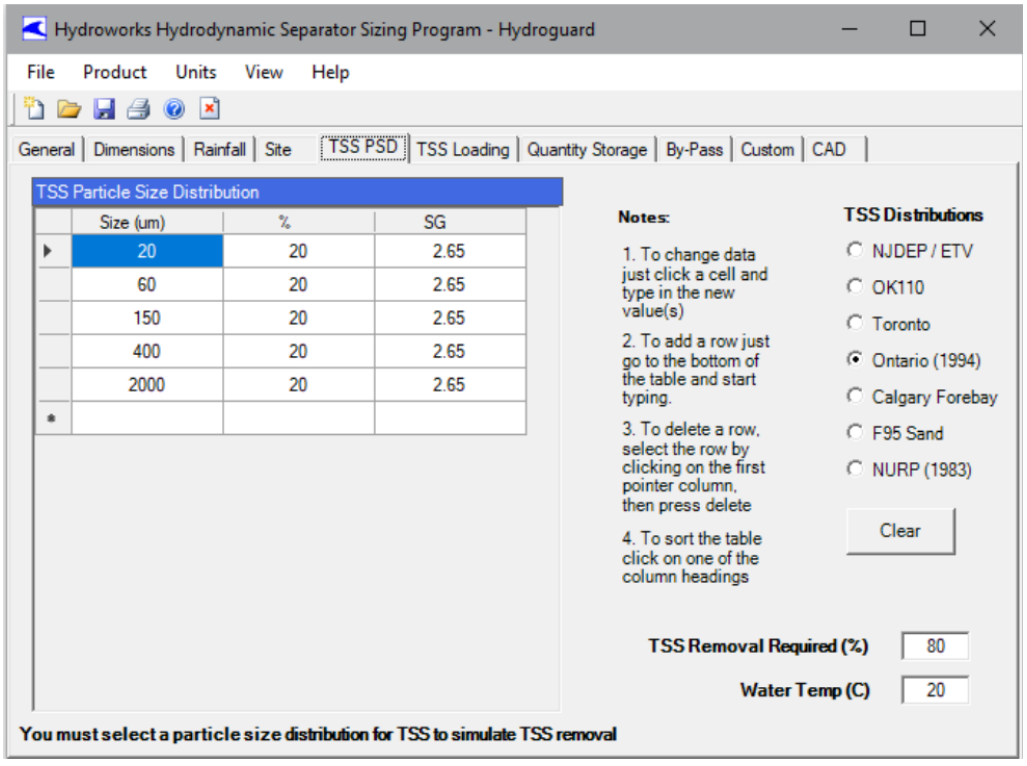
Peak Flow Design
Peak Flow Design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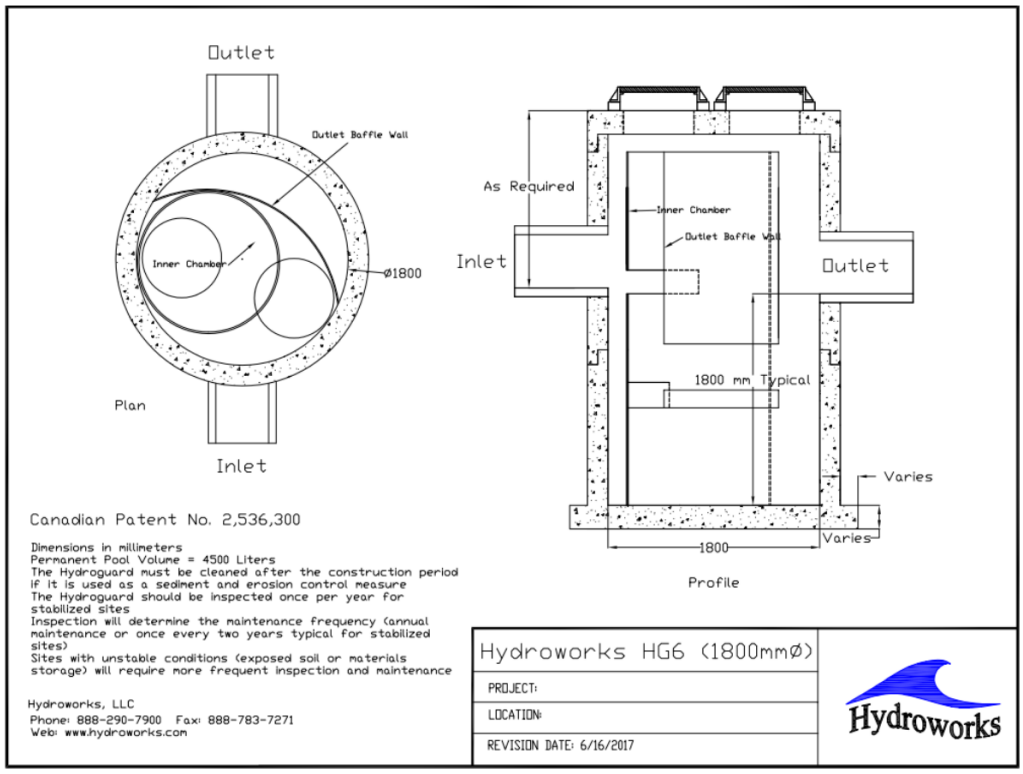
File
Product
Units
View
Help
General
Dimensions
Rainfall
Site
TSS PSD
TSS Loading
Quantity Storage
By-Pass
Custom
CAD
TSS Particle Size Distribution
Size (um)
%
SG
20
20
2.65
60
20
2.65
150
20
2.65
400
20
2.65
2000
20
2.65
Notes:
1. To change data just click a cell and type in the new value(s)
2. To add a row just go to the bottom of the table and start typing.
3. To delete a row, select the row by clicking on the first pointer column, then press delete
4. To sort the table click on one of the column headings
TSS Distributions
NJDEP / ETV
OK110
Toronto
Ontario (1994)
Calgary Forebay
F95 Sand
NURP (1983)
Clear
TSS Removal Required (%)
80
Water Temp (C)
20
You must select a particle size distribution for TSS to simulate TSS removal


Outlet
Outlet Baffle Wall
Inner Chamber
Ø1800
Plan
Inlet
As Required
Inner Chamber
Outlet Baffle Wall
Inlet
Outlet
1800 mm Typical
Varies
Varies
1800
Profile
Canadian Patent No. 2,536,300
Dimensions in millimeters
Permanent Pool Volume = 4500 Liters
The Hydroguard must be cleaned after the construction period if it is used as a sediment and erosion control measure
The Hydroguard should be inspected once per year for stabilized sites
Inspection will determine the maintenance frequency (annual maintenance or once every two years typical for stabilized sites)
Sites with unstable conditions (exposed soil or materials storage) will require more frequent inspection and maintenance
Hydroworks, LLC
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Web: www.hydroworks.com
Hydroworks HG6 (1800mmØ)
PROJECT:
LOCATION:
REVISION DATE: 6/16/2017
Hydroworks