COUNTERPOINT LAND DEVELOPMENT BY | DILLON CONSULTING

HOME OPPORTUNITIES

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

280 Clair Road West, Guelph, Ontario

ZONING BY-LAW AMENDMENT APPLICATION

Version: 1st Submission

November 20, 2024

EXECUTIVE SUMMARY

This Functional Servicing and Stormwater Management Report ('FSSR') has been prepared in support of Zoning Bylaw Amendment ('ZBA') application for the site municipally known as 280 Clair Road West, Guelph, Ontario, N1L 1G1 (referred to as 'the site'). The report has been prepared on behalf of the applicant, Home Opportunities (or 'client'). The legal description is as follows: PART OF LOT 11 CONCESSION 7, GEOGRAPHIC TOWNSHIP OF PUSLINCH NOW CITY OF GUELPH COUNTY OF WELLINGTON

The existing 8.56 ha site is entirely greenfield. A 60m wide, 2.45 ha environmental linkage consideration exists to the east of the site and will remain in the existing condition with minor site grading to utilize the area and its porous soils for drainage basin and infiltration purposes.

As the 60m wide environmental linkage is maintained, only 6.11 ha of the 8.56 ha site is developable area. The proposed development for the site comprises 31 townhouse blocks, a 14-story residential building, a 16-storey residential building, at-grade parking, and a 5-storey parking structure. The site will include several private roads for vehicles. No basements are proposed. The re-development will provide 314 new residential units and 642 new residential apartments over the proposed buildings.

The servicing strategy for the proposed development is summarized as follows:

Water Servicing:

The adjacent municipal roadways contain watermains that are of a typical size to service the proposed development. There exists 2 – 400mm watermains on Clair Road West, one is in Pressure District ("PD") 3 while the other is in PD1. The subject site will be serviced off the existing 400 mm diameter watermain in PD3 on Clair Road West as coordinated with municipal staff. The domestic and fire flow water demands were calculated in accordance with City of Guelph design criteria and FUS guidelines (2020).

Sanitary Servicing:

The adjacent municipal roadways contain sanitary sewers however they are not directly within the site frontage. Additionally, there is an existing abandoned 200mm forcemain, this will not be used for connection purposes. As coordinated with City of Guelph staff, a sanitary sewer extension from the existing 300mm sanitary sewer in Clair Road West is proposed to provide a new sanitary connection to the subject site. The development proposed will result in an increase in the equivalent population and peak flow, calculated as per City of Guelph Sanitary Design Criteria, to the municipal sewer system.

Stormwater Management:

In accordance with the requirements outlined in consultation with City of Guelph staff, the subject site is considered to be isolated from a direct stormwater outlet and will therefore rely on infiltration and evaporation for stormwater management. The Hydrogeological Investigation Report delineated an infiltration design rate of 36 mm/hour, which is deemed sufficient to manage all design storm events, including the 100-year storm event. As a result, on-site stormwater management (SWM) infrastructure has been designed to meet the City's criteria for the Hanlon Creek Sub-watershed for quantity control, water quality treatment, and water balance, in alignment with the discussions held with City staff. Detailed calculations supporting the proposed design have been included as part of the development application.

TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

1.0 INTRODUCTION

1.1 BACKGROUND

This Functional Servicing and Stormwater Management Report ('FSSR') has been prepared in support of Zoning Bylaw Amendment ('ZBA') application for the site municipally known as 280 Clair Road West, Guelph, Ontario, N1L 1G1 (referred to as 'the site'). The report has been prepared on behalf of the applicant, Home Opportunities (or 'client'). The legal description is as follows: PART OF LOT 11 CONCESSION 7, GEOGRAPHIC TOWNSHIP OF PUSLINCH NOW CITY OF GUELPH COUNTY OF WELLINGTON

The existing 8.56 ha site is entirely greenfield. A 60m wide, 2.45 ha environmental linkage consideration exists to the south of the site and will remain in the proposed condition. This will be achieved through site grading and drainage basin provision.

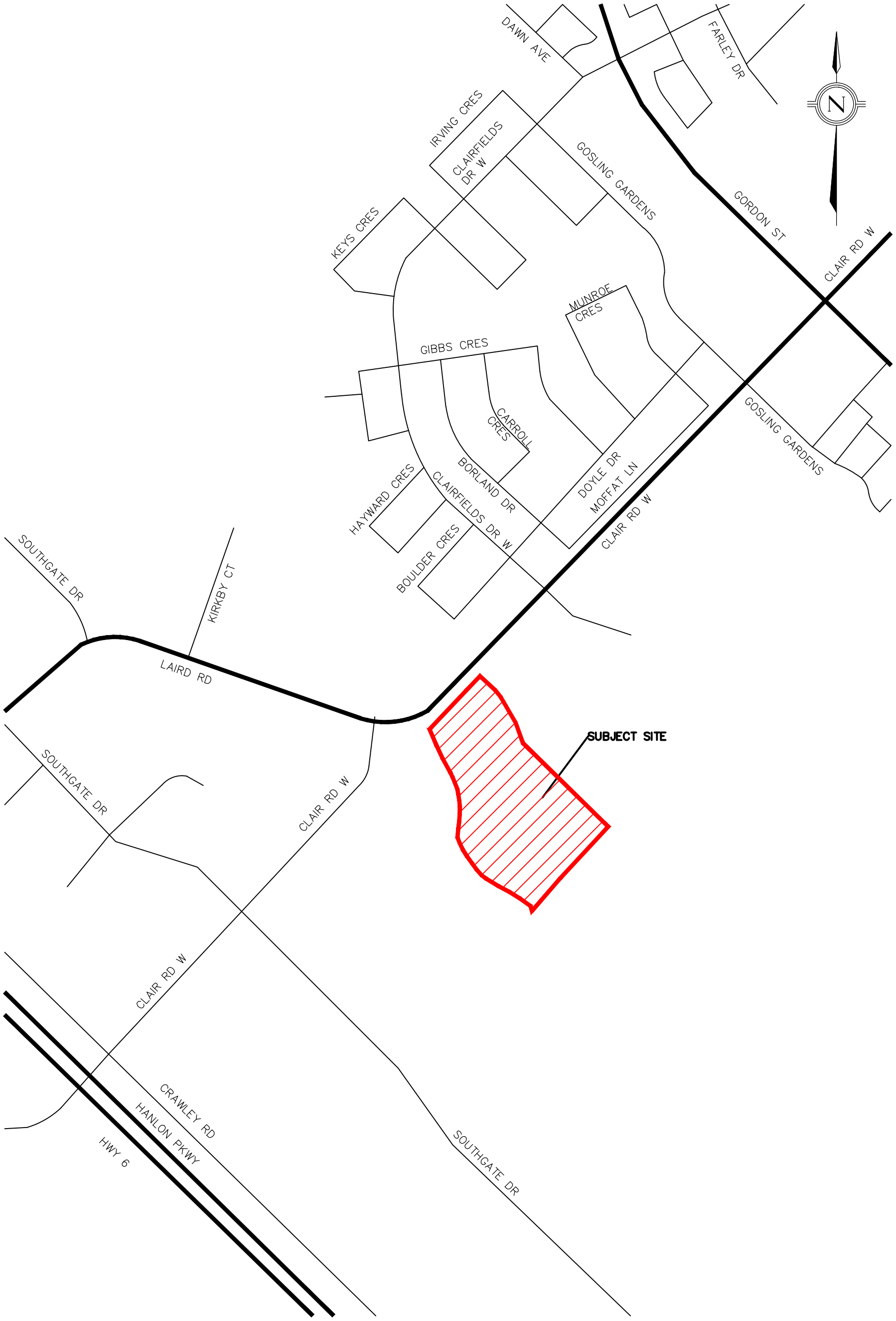
As the 60m wide environmental linkage is maintained, only 6.11 ha of the 8.56 ha site is developable area. The proposed development for the site comprises 31 townhouse blocks, a 14-story residential building, a 16-storey residential building, at-grade parking, and a 5-storey parking structure. The site will include several private roads for vehicles. No basements are proposed. The re-development will provide 314 new residential units and 642 new residential apartments over the proposed buildings.

The proposed development is bound by Clair Rd W to the north, a high school to the east, and Industrial, Commercial, Institutional ('ICI') lands to the west and south. Refer to Figure 1 – Site Location for an illustration of the subject site within the context of its surroundings.

1.2 STUDY PARAMETERS

This servicing assessment was based on:

- Architectural Plans, prepared by architectureunfolded.
- Plan and Profile Z-067 of Clair Road West, dated January 2016, by City of Guelph
- Plan and Profile 2D-086 of Clair Road West, dated January 2016, by City of Guelph
- Development Engineering Manual, dated October 2023, prepared by The City of Guelph.
- Stormwater Management Master Plan Appendix F, dated December 2022, prepared by City of Guelph
- Stormwater Management Master Plan Appendix E, dated November 2022, prepared by City of Guelph
- Water and Wastewater Servicing Master Plan Volume II – Technical Memorandum 5, dated February 2023, prepared by City of Guelph
- Final Water Supply Master Plan Update, dated July 2022, prepared by City of Guelph
- Water Supply for Public Fire Protection, dated 2020, by Fire Underwriters Survey
- Geotechnical Investigation, dated July 15, 2024, prepared by JLP Services Inc.;
- Hydrogeological Investigation Report, dated September 4, 2024, prepared by JLP Services Inc.;
- Buried Utility Map, dated September 27, 2024, prepared by Onsite Locates Inc.
- Topographical Survey, dated January 24, 2024, prepared by J.D. Barnes Limited.



SITE LOCATION PLAN

counterpoint ENGINEERING
A SUBSIDIARY OF DILLON CONSULTING LIMITED
8395 Jane St., Suite 100, Vaughan, ON L4K 5Y2 Phone 905.326.1404 Fax 905.326.1405

RESIDENTIAL DEVELOPMENT
280 CLAIR ROAD
GUELPH, ON

DESIGNED BY: TZ	DATE: MARCH, 2024
CHECKED BY: JH	PROJECT No. 24010
DRAWING BY: TZ	
CHECKED BY: JH	FIGURE No. 1
SCALE: NTS	

2.0 WATER SUPPLY

2.1 EXISTING WATER SUPPLY

The adjacent municipal roadways contain available existing watermains, as follows:

- Clair Road West:
  - North 400mm diameter watermain (Pressure District 1)
  - South 400mm diameter watermain (Pressure District 3)

A number of existing municipal fire hydrants are located on Clair Road West.

2.2 PROPOSED WATER SUPPLY

The proposed development is to be serviced from the existing 400mm diameter watermain on the south side of Clair Road West in PD3. The 400mm diameter watermain on the north side of Clair Road West in PD1 shall remain as is. Refer to Appendix A for reference Plan and Profiles.

The site shall have one (1) independent 250mm diameter PVC watermain connection to the municipal system complete with valve and box. Prior to distribution to site elements, the service connection will be routed to a water chamber located within 5m adjacent to the property line. This water chamber shall be

outfitted with a Protectus III Meter complete with pedestal and meter reader as per City of Guelph Drawing A2/A3. The private site watermain system shall be looped internally. Proposed fire hydrants shall be provisioned within the private site as required. Refer to Site Servicing Plan, SW-S for the existing and proposed watermain layout.

Domestic water demands were calculated using a per capita rate of 167 litres/person/day and peaked using a factor of 1.34 in accordance with the City of Guelph Water Master Plan. The proposed development will contain 314 townhouse units and 642 apartment units, generating an equivalent residential population of 1963 persons.

Fire flows for proposed Towers A/B, the 5-storey parking garage, and the townhome complexes were completed. Townhome Back-to-Back – 12 units was calculated having the highest required fire flow demand. Fire Under Survey (FUS) parameters were determined based on the 2020 Water Supply for Public Fire Protection guidelines as presented in Table 1 below. Please note that per code, wood frame town houses require fire walls should the effected floor area pass a specific threshold. This has not been considered in the calculations provided as the Architect is in the preliminary stages of design, but the introduction of the fire walls would reduce the required fire demand presented below.

Table 1: FUS Parameters

ELEMENT	CONSTRUCTION TYPE	CONTENTS FACTOR	EFFECTIVE AREA (M^2)	SYSTEM TYPE REDUCTIONS
Back-to-Back – 12 units	Type V – Wood Frame Construction	Limited Combustible	1469	NO – all

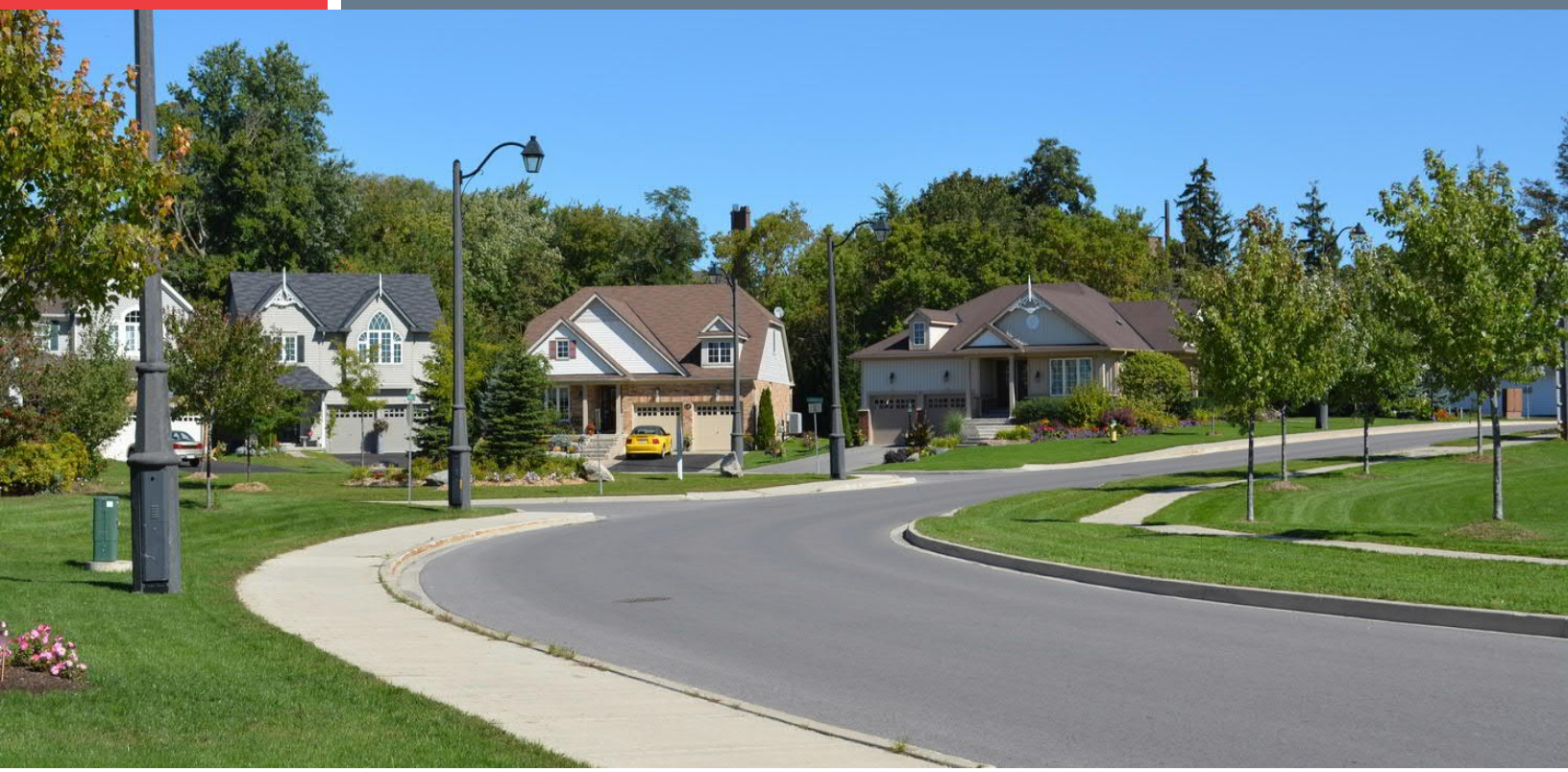
The resulting domestic and fire flow demands are presented in Table 2:

Table 2: Summary of Water Demands

AVG. DAY (L/S)	MAX. DAY (L/S)	FIRE FLOW (L/S)*	FIRE FLOW DURATION (HRS)	MAX. DAY + FF (L/S)
3.8	5.1	283.3	3.75	288.4

* Back-to-Back – 12 units used to determine governing fire flow demand due to having largest floor area.

Refer to Appendix B for all water demand calculations. Discussions with City of Guelph staff back in June 2024 previously have indicated that the watermain system would have enough available flow to meet 272 L/s for MDD plus fire flow conditions The available flow at hydrants H80-013, and H80-034 surpassed the calculated fire flow of 266.7 L/s (provide in June 2024) and City's guidelines of 200 L/s. Given the marginal increase in the flows from June 2024 and the understanding that the required FUS fire flow will drop with the introduction of fire walls, the municipal system can accommodate the proposed development.



3.0 SANITARY SERVICING

3.1 EXISTING SANITARY SERVICING

The adjacent municipal roadways contain available existing sanitary servicing, as follows:

- Clair Road West:
  - 200mm diameter sanitary sewer flowing east. East of the subject site.
  - Abandoned 200mm diameter sanitary forcemain.
  - 300 mm diameter sanitary sewer flowing west towards Laird Road. West of the subject site.
- Laird Road:
  - 300mm diameter sanitary sewer flowing west.
  - 450mm diameter sanitary sewer flowing west.

Clair Road West does not contain a municipal gravity-fed sanitary sewer directly adjacent to the proposed site. Both the existing 200mm and 300mm sanitary are at the outside limits of the site. The existing abandoned 200mm diameter sanitary forcemain is not an option for connection. Refer to Site Servicing Plan, SW-S for the existing and proposed sanitary servicing layout. Refer to Appendix A for the Plan and Profile reference.

3.2 PROPOSED SANITARY SERVICING

A municipal sanitary sewer extension, from the existing 300mm diameter sanitary sewer west of the site on Clair Road West, is proposed in order to provide a new municipal sanitary service connection to the subject site. Private sanitary sewers will extend into the property to provide each townhouse and commercial unit with one service connection each. Refer to Site Servicing Plan – SW-S for the existing and proposed sanitary servicing layout.

The proposed development will contain 314 townhouse units and 642 apartment units, generating an equivalent residential population of 1963 persons. As per City of Guelph design specifications, an average flow of 300 L/p/day was used to calculate the peak flow generated by residential land use, while 0.25 L/s/ha was used to estimate flows generate from the commercial land use. A summary of generated sanitary flows from the subject development is shown in Table 3 below:

Table 3: Summary of Sanitary Flows

	CONNECTION	APARTMENT	TOWNHOME	EQUIV. POP	PEAK FLOW (L/S)
Residential	Clair Road West	642	314	1963	24.48
Infiltration	-	-	-	-	2.14
	TOTAL		-	1964	26.62

Refer to Appendix C for detailed sanitary demand calculations and downstream sanitary sewer capacity assessment. Discussions with City of Guelph staff back in June 2024 previously have indicated that the sanitary system would have a sufficient capacity to support the previously calculated sanitary flows of 27.62 L/s. As the revised site stats lead to a sanitary peak flow of 26.62 L/s, the conclusions remain the same. The existing municipal sanitary infrastructure can accommodate the proposed development.

4.0 STORMWATER SERVICING

4.1 EXISTING STORMWATER DRAINAGE

As mentioned above, the subject site is considered to be isolated from a direct stormwater outlet to the existing storm sewers. Given the site's hummocky topography all storm runoffs would be infiltrated within the site.

4.2 STORMWATER MANAGEMENT CRITERIA

The following stormwater management criteria was established for the subject site, as per feedback from the City of Guelph staff and per the criteria laid out in the municipal guidelines related to Hanlon Creek Sub-watershed:

- Quantity Control, Water Balance and Erosion Control: capture all storm events, up to the 100-year design storm event, to be infiltrated within the site.
- Quality Control: provide quality control on discharged stormwater such that 80% of total suspended solids ('TSS') are captured on an annual basis.

4.3 ALLOWABLE RELEASE RATE

As noted, the site's hummocky topography, combined with an acceptable infiltration rate of 36 mm/hour, allows for the infiltration of all storm events, up to the 100-year design storm event, within the site. According to the proposed drainage plan, runoff from 0.792 ha of the site will be directed to the 0.67 ha northern basin, while runoff from 4.856 ha will flow into the 2.149 ha southern basin for infiltration. The delineated infiltration rate of 36 mm/hour has been applied to both the northern and southern basins in order to calculate the infiltration flows boundary condition, including the bottom and maximum-water-level areas, as detailed in Table 4.

Table 4: Infiltration Rates from Northern and Southern Basins (L/s)

BASIN	INFILTRATION RATE FROM BOTTOM AREA	INFILTRATION RATE FROM MAXIMUM-WATER-LEVEL WET AREA
Northern	6	46
Southern	2.9	96.8

4.4 PROPOSED STORM SERVICING

As mentioned earlier, runoff from all storm events, including the 100-year design storm, will be fully retained, and infiltrated on-site through the northern and southern basins. Utilizing the site natural slopes and topography minimizes the extent of grading required to form the retention basins. Minimal fill is required around the north basin to create a berm that will be naturalized. The south basin will only require minor grading along its east edge to shape the retention basin. The remaining areas in the environmental linkage will remain untouched from construction activities.

The post-development drainage areas are as follows, per Post-Development Drainage Plan – SW-SWM:

- 0.792 ha of the site (Area 200) will be directed to the 0.67 ha northern basin (Basin 202), resulting in a total drainage area of 1.462 ha for the northern basin.
- 4.856 ha of the site (Area 201) will be directed to the 2.149 ha southern basin (Basin 203), resulting in a total drainage area of 7.005 ha for the southern basin.
- 0.092 ha of the sites landscape area will drain uncontrolled to the designated environmental lands to the south.

4.5 STORMWATER QUANTITY, WATER BALANCE AND EROSION CONTROL

Sufficient storages have been proposed in both the northern and southern basins to fully retain, and infiltrated runoff from all storm events, including the 100-year design storm on-site. Hydrologic model, VISUAL-OTTHYMO Version ('VO6'), has been employed to analyse the 100-year storm events for post-development conditions. The design storm events used in this analysis are based on the 24-hour Chicago storm distribution and a time step of 10 minutes, as per City of Guelph Development Engineering Manual, October 2023. The 100-year storm events were based on City of Guelph IDF curves. Refer also to Appendix D for rainfall information inputted into VO6.

The proposed site development drainage areas have been modelled in VO6 using the STANHYD commands with the Horton's Equation for areas with imperviousness. In the post-development conditions, flows from the development blocks have been routed through the northern and southern basins storages. The ROUTE RESERVOIR command has been used to model the SWM storage basins. Refer to Appendix D for post-development VO6 model calculations. A summary of quantity calculations is provided in Table 5.

Table 5: Quantity Control Summary

BASIN ID	TOTAL DRAINAGE AREA (HA)	IMP. %	MINIMUM INFILTRATION RATE (L/S)	MAXIMUM INFILTRATION RATE (L/S)	PROVIDED STORAGE (M^3)	UTILIZED STORAGE (M^3)
Northern 202	1.462	43	6	46	2,410	493
Southern 203	7.005	55	2.9	96.8	3,785	3,218
Total 202+203	-	-	8.9	142.8	6,195	3,751

Refer to Post-Development Drainage Plan – SW-SWM for the post-development drainage boundaries and Appendix D for details quality control calculations.

It should be noted that the measured infiltration rates on site for shallow soils in the location of the proposed basins ranged from 81 mm/hr to 101 mm/hr. Therefore, it is expected that the utilized storage will be less under true conditions (no safety factor applied). Based on the design infiltration rate of 36 mm/hr and the maximum basin depths of 1.6m and 1.5m for the north and south basins, respectively, the calculated drawdown times are 44.4 hrs for the north basin and 41.6 hrs for the south basin.

As the 100-year storm volumes are captured and retained on site (no designated storm outlet), all applicable water balance criteria are being achieved onsite through onsite infiltration and evapotranspiration.

4.6 PROPOSED QUALITY CONTROLS

The subject site must implement quality control measures for stormwater discharge to ensure that 80% of total suspended solids (TSS) are captured annually. To achieve this, two OGS (Oil-Grit Separator) units will be installed at each storm sewer connection to the basins, prior to discharge into the basins. Refer to Appendix D for detailed quality control calculations and OGS units' detail.

4.7 EXTERNAL DRAINAGE

Under existing conditions, a portion of the school property to the east of the subject site drains onto the proposed development. To eliminate the need for retaining walls and reduce the steep sloping on the school property, fill is prosed along the east property line and within the adjacent property. External flows will still be directed towards the site from the school in the post development condition. Taking advantage of the high infiltration rates, discussions with the school board will be had to instal bioswales/rain gardens (Low Impact Development or LIDs measures) along this property line to manage stormwater with emergency overflow directed towards Clair Road West ROW. Details of the proposed LIDs will be provided during detailed design.

5.0 EROSION AND SEDIMENT CONTROL

Erosion and sediment controls will be used on site during construction. These controls include various methods such as:

- Placement of silt fencing around the perimeter of the site.
- Installation of a mud mat at the site access point to the municipal roadway.
- Infiltration basins designed and provided to detain site runoff and promote infiltration of storm runoff into existing soils.
- Rip-rap treatment on all infiltration basin inlets to minimize scour and erosion.
- Use of inlet protection on all catchbasins in close proximity to the site.

All erosion and sediment control measures are to be designed, maintained and constructed in accordance with the GTA CA's Erosion and Sediment Control Guidelines for Urban Construction (2019) and the City of Guelph design standards. Refer to the Erosion and Sediment Control Plan – SW-ESC1 to 4 for the proposed erosion and sediment control layout.

6.0 CONCLUSION

This FSSR presents a site servicing strategy for the proposed development that addresses the requirements of all applicable regulatory agencies and provides the basis for detailed servicing design.

We trust this report sufficiently addresses the site servicing requirements and allows for approval of Zoning Bylaw Amendment ('ZBA') application. Should there be any questions or comments, please feel free to contact the undersigned.

Sincerely,

Counterpoint Land Development by Dillon Consulting Limited

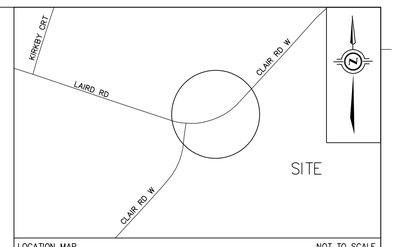
Jake Howkins, P.Eng
Project Manager, Associate
Direct: (416) 389 - 9135
Email: jhowkins@counterpointeng.com

Reza Kazemi, P.Eng.
Water Resources Manager
Direct: (416) 732 - 8504
Email: rkazemi@counterpointeng.com

Terms of Use

This Report was prepared by Counterpoint Engineering Inc. for the exclusive use of the 'Client' and in accordance with the Terms and Conditions set out in the Agreement between Counterpoint Engineering Inc. and said Client. The material contained in this Report and all information relating to this activity reflect Counterpoint Engineering's assessment based on the information made available at the time of preparation of this report and do not take into account any subsequent changes that may have occurred thereafter. It should be noted that the information included in this report and data provided to Counterpoint Engineering has not been independently verified. Counterpoint Engineering Inc. represents that it has performed services hereunder with a degree of care, skill, and diligence normally provided by similarly-situated professionals in the performance of such services in respect of projects of similar nature at the time and place those services were rendered. Counterpoint Engineering Inc. disclaims all warranties, or any other representations, or conditions, either expressed or implied. With the exception of any designated 'Approving Authorities' to whom this report was submitted to for approval by Counterpoint Engineering Inc., any reliance on this document by a third party is strictly prohibited without written permission from Counterpoint Engineering Inc.. Counterpoint Engineering Inc. accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions based on this Report.

APPENDIX A
Background Documents



LOCATION MAP NOT TO SCALE

SUBSURFACE UTILITY PLAN OF
280 CLAIR ROAD WEST
CITY OF GUELPH
WELLINGTON COUNTY

ONSITE LOCATES INC.

J.D. BARNES LIMITED

SCALE 1 : 500
10 0 10 20 30 metres

METRIC
DISTANCES AND/OR COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

COORDINATE SYSTEM
UTM ZONE 17, NAD83 (CSRS) (2010.0).

ELEVATION NOTES
ELEVATIONS SHOWN HEREON ARE GEODETIC (CGVD28-1978) AND ARE DERIVED FROM GNSS OBSERVATIONS USING NATURAL RESOURCES CANADA'S GEOID MODEL HTv2.0

INDEX CONTOURS ARE AT 1.00m INTERVALS.
INTERMEDIATE CONTOURS ARE AT 0.25m INTERVALS.

LEGEND

— SAN —	DENOTES UNDERGROUND SANITARY SEWER
— STM —	DENOTES UNDERGROUND STORM SEWER
— G —	DENOTES UNDERGROUND GAS LINE
— W —	DENOTES UNDERGROUND WATER LINE
— UE —	DENOTES UNDERGROUND HYDRO LINE
— E —	DENOTES OVERHEAD HYDRO
— UC —	DENOTES UNDERGROUND CABLE LINE
— UT —	DENOTES UNDERGROUND TELEPHONE LINE
— FO —	DENOTES UNDERGROUND FIBRE OPTIC LINE
SAN MH	DENOTES SANITARY MANHOLE
STM MH	DENOTES STORM MANHOLE
STM CEPTOR	DENOTES STORM CEPTOR
SICB	DENOTES SIDE INLET CATCHBASIN
CB	DENOTES CATCHBASIN
GV	DENOTES GAS VALVE
H	DENOTES FIRE HYDRANT
WV	DENOTES WATER VALVE
WK	DENOTES WATER KEY
WMH	DENOTES WATER MANHOLE
HP	DENOTES HYDRO POLE
HT	DENOTES HYDRO TRANSFORMER
HC	DENOTES HYDRO CHAMBER
CPED	DENOTES CABLE TV PEDESTAL
PED	DENOTES TELEPHONE PEDESTAL
GLB	DENOTES GROUND LEVEL BOX
OPI	DENOTES OUTSIDE PLANT INTERFACE
TMH	DENOTES TELEPHONE MANHOLE
	DENOTE ENDCAP
MW	DENOTES MONITORING WELL

■	DENOTES SURVEY MONUMENT FOUND (375 UNLESS NOTED OTHERWISE)
□	DENOTES SURVEY MONUMENT SET
SIB	DENOTES STANDARD IRON BAR
SSIB	DENOTES SHORT STANDARD IRON BAR
IB	DENOTES IRON BAR
PB	DENOTES PLASTIC BAR
RP	DENOTES REGISTERED PLAN
WIT	DENOTES WITNESS
MEAS	DENOTES MEASURED
375	DENOTES BLACK, SHOEMAKER, ROBINSON & DONALDSON LTD.
VH	DENOTES Van HARTEN SURVEYING INC.
P1	DENOTES PLAN 61R-20330
P2	DENOTES PLAN 61R-9756
P3	DENOTES PLAN 61R-8894
P4	DENOTES PLAN 61R-7455
P5	DENOTES PLAN 61R-194

NOTES
BEARINGS ARE UTM GRID, DERIVED FROM OBSERVED REFERENCE POINTS A AND B, BY REAL TIME NETWORK (RTN) OBSERVATIONS, UTM ZONE 17, NAD83 (CSRS) (2010.0).

DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.999604.

FOR BEARING COMPARISONS, A ROTATION OF 1°01'50" COUNTER-CLOCKWISE WAS APPLIED TO 61R-7455 & 61R-9756 TO CONVERT TO GRID BEARINGS.

FOR BEARING COMPARISONS, A ROTATION OF 1°02'50" COUNTER-CLOCKWISE WAS APPLIED TO 61R-194 TO CONVERT TO GRID BEARINGS.

INTEGRATION DATA		
OBSERVED REFERENCE POINTS (ORPs): UTM ZONE 17, NAD83 (CSRS) (2010.0).		
COORDINATES TO URBAN ACCURACY PER SECTION 14 (2) OF O.REG 216/10.		
POINT ID	EASTING	NORTHING
ORP (A)	564 758.70	4 815 832.14
ORP (B)	564 920.03	4 815 877.22
COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN.		

THE RESULTANT TIE BETWEEN ORP (A) AND ORP (B) IS 167.58 N74°23'25"E

SEWER INVERT DATA TABLE

MH/CB	DIRECTION	DIAMETER	INVERT	TOP OF LID/GRATE ELEVATION	NOTES
SICB#1	S	200	1.15	336.32	
SICB#2	W	250	1.20	336.31	
STM MH#1	NW *NW* *W* NE *E*	*600* *600* *200* *225* *250*	*4.50* *4.50* N/A *4.38* N/A	336.32	B.O.C. AT 4.54m
STM CEPT #2	NW SE SE	900 600 600	3.53 3.49 3.50	335.28	TO DEBRIS
SAN MH#1	NE	200	2.86	336.83	
SAN MH#2	E E W	200 200 300	2.86 4.10 4.21	334.87	DROP
SAN MH#3	E S W	300 300 300	4.13 3.67 4.15	334.36	
SAN MH#4	S W	450 450	3.15 3.57	333.75	

SEWER INVERT NOTE:
SEWER INVERT DEPTHS ARE MANUALLY MEASURED FROM THE LID/GRATE OF THE GIVEN FEATURE.

ANNOTATIONS DISPLAYED AS *ITALICIZED* WITH AN ASTERISK* HAVE BEEN INTERPOLATED FROM RECORDS AND WERE NOT FIELD VERIFIED BY ONSITE LOCATES LTD.

INVERT DEPTH MEASUREMENTS ARE FROM THE ASSUMED BOTTOM OF THE FACILITY STRUCTURE.

DEPTHS ARE NOT SUITABLE FOR EXCAVATION PURPOSES. SEWER NETWORK CONNECTIONS WERE COMPILED WHERE FIELD EVIDENCE COINCIDED WITH AS-BUILT RECORDS

WHERE NO DEPTH INFORMATION COULD BE OBTAINED, UTILITIES ARE ASSUMED TO BE AT STANDARD INSTALLATION DEPTH FOR THE SPECIFIC TYPE OF UTILITY.

THE MOST RELIABLE WAY TO PRECISELY DETERMINE THE HORIZONTAL AND VERTICAL LOCATION OF AN UNDERGROUND UTILITY IS THROUGH PHYSICAL EXPOSURE USING SAFE DIGGING TECHNIQUES (COMMONLY PERFORMED WITH HYDRO VACUUM EXCAVATION)

INVERT DEPTH MEASUREMENTS HEREON ARE PROVIDED IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

UNDERGROUND UTILITY NOTES
THE UTILITY DATA DEPICTED ON THIS DRAWING WERE ACQUIRED IN ACCORDANCE WITH ASCE STANDARD 38-02. THE INFORMATION IS SHOWN BY ATTRIBUTED QUALITY LEVELS WHICH ARE DEFINED AS FOLLOWS:

DATA QUALITY LEVEL

HIGHEST QUALITY
LOWEST QUALITY
QUALITY LEVEL A
QUALITY LEVEL B
QUALITY LEVEL C
QUALITY LEVEL D

QUALITY LEVEL "A" - INFORMATION OBTAINED BY ACTUAL PHYSICAL EXPOSURE OF TARGETED UTILITIES AND SUBSEQUENT MEASUREMENT OF THE EXPOSED PRECISE HORIZONTAL AND VERTICAL POSITION.

QUALITY LEVEL "B" - INFORMATION OBTAINED USING GEOPHYSICAL LOCATE TECHNIQUES TO IDENTIFY THE EXISTENCE AND APPROXIMATE HORIZONTAL POSITION OF THE DESIGNATED UTILITIES.

QUALITY LEVEL "C" - INFORMATION OBTAINED BY SURVEYING AND PLOTTING VISIBLE UTILITY FEATURES AND BY USING PROFESSIONAL JUDGMENT IN CORRELATING THIS INFORMATION TO THE QUALITY "D" INFORMATION OBTAINED.

QUALITY LEVEL "D" - INFORMATION DERIVED FROM UTILITY RECORDS OR VERBAL RECOLLECTIONS

ALL SERVICES ARE QUALITY "D" UNLESS NOTED OTHERWISE.
LEVEL "D" RECORD INFORMATION SHOWN ON THIS PLAN HAVE BEEN PLOTTED APPROXIMATELY AS PER THE RECORDS FOUND AND COULD NOT BE FIELD VERIFIED WITHIN THE SCOPE OF THIS PROJECT. IF FURTHER VERIFICATION IS REQUIRED, IT IS SUGGESTED THAT LEVEL "A" METHODOLOGIES BE EMPLOYED.

LOST SIGNAL- DENOTES/INDICATES A POINT WHERE QL-B METHODS COULD NO LONGER ASCERTAIN THE HORIZONTAL POSITION OF A FACILITY.

QUALITY LEVEL "D" INFORMATION COMPILED FROM RECORDS PROVIDED BY ALECTRA FILE NAME Clair Rd W and Laird Rd.pdf; CITY OF GUELPH; ENBRIDGE FILE NAME 20243213l0 As-Built.pdf; AND ROGERS FILE NAME G24B277.dwg

CAUTION: CALL BEFORE YOU DIG
THIS PLAN IS INTENDED FOR DESIGN PURPOSES ONLY. OTHER BURIED UTILITIES MAY EXIST WHICH ARE NOT SHOWN DUE TO INSUFFICIENT INFORMATION OR IMPROPER INSTALLATION. CONTACT ALL POTENTIAL OWNERS OF UNDERGROUND UTILITIES PRIOR TO CONSTRUCTION OR BREAKING GROUND.
IT IS THE RESPONSIBILITY OF THE CONTRACTOR/BUILDER TO ENSURE THE APPROPRIATE LEGAL REQUIREMENTS ARE MET.

SUBSURFACE UTILITY FIELD WORK WAS COMPLETED ON THE 5TH DAY OF SEPTEMBER, 2024

ONSITE LOCATES INC.
UTILITY LOCATE SERVICES
A wholly owned subsidiary of J.D. Barnes Ltd.
140 RENFREW DRIVE, SUITE 100, MARKHAM, ON L3R 6B3
T: 1-800-805-6155 www.onsitelocates.ca

DRAWN BY:	CHECKED BY:	REFERENCE NO.:
AB	ZW	24-46-40095

SUE DATED: SEPTEMBER 27, 2024

J.D.BARNES LIMITED SURVEYING MAPPING GIS
LAND INFORMATION SPECIALISTS
257 WOODLAWN ROAD WEST, UNIT 101, GUELPH, ON N1H 8J1
T: (519) 822-4031 F: (519) 822-1220 www.jdbarnes.com

DRAWN BY:	CHECKED BY:	REFERENCE NO.:
RPA	RJS	24-14-057-00-A
PLOTTED: 10/02/24		TOPO DATED: JANUARY 24, 2024

FILE: G:\24-14-057\00\Drawing\24-14-057-01 (24-46-40095).dgn

notes:

architecture unfolded

tel: (416) 601 5416 info@unfolded.ca

368 dufferin street. toronto, on. M6K 1Z8

revisions: dd-mm-yy

architectural team :

Eduardo Ortiz
Ihab Daakour

spa no. -

project:
280 Clair Rd W, Guelph, ON
xxxx

SITE PLAN

2024.09.18 — date:
1:750 — scale:
23-50 — project:
ID — drawn by:

true north / project north

drawning number:
A100

architectureunfolded

368 dufferin st., toronto, on, m6k 1Z8, tel. (416) 601-5416

PRELIMINARY STATISTICS - 280 CLAIR RD W - GUELPH

SITE INFORMATION		
SITE AREA	85,600	M²
NATURAL CORRIDOR	24,552	M²
EXISTING GROSS FLOOR AREA	-	M²
PROPOSED GROSS FLOOR AREA (EXCLUDING PARKING)	79,025	M²
FLOOR SPACE INDEX	0.92	
LOT COVERAGE	19,981	M²
	23%	
UNITS	956	
PARKING	919	

MINIMUM SETBACKS	TO PARKING		TO RESIDENTIAL	
EAST	1.0	M	7.5	M
WEST	1.0	M	6.0	M
NORTH	-	M	7.5	M
SOUTH	-	M	-	M

	TOTAL FLOOR AREA		GROSS FLOOR AREA		NET SALEABLE AREA	
BACK TO BACK - 6 UNITS	M²	FT²	M²	FT²	M²	FT²
GROUND FLOOR	262	2,822				
SECOND FLOOR	262	2,822				
THIRD FLOOR	210	2,260				
TOTAL	**734**	**7,905**	**-**	**-**	**-**	**-**

UNITS	BA	1B	1B+D	2B	3B	4B	TOTAL
	-	-	-	-	6	-	6
NUMER OF BLOCKS							3

	TOTAL FLOOR AREA		GROSS FLOOR AREA		NET SALEABLE AREA	
BACK TO BACK - 8 UNITS	M²	FT²	M²	FT²	M²	FT²
GROUND FLOOR	350	3,763				
SECOND FLOOR	350	3,763				
THIRD FLOOR	280	3,014				
TOTAL	**979**	**10,540**	**-**	**-**	**-**	**-**

UNITS	BA	1B	1B+D	2B	3B	4B	TOTAL
	-	-	-	-	8	-	8
NUMER OF BLOCKS							1

	TOTAL FLOOR AREA		GROSS FLOOR AREA		NET SALEABLE AREA	
BACK TO BACK - 10 UNITS	M²	FT²	M²	FT²	M²	FT²
GROUND FLOOR	437	4,704				
SECOND FLOOR	437	4,704				
THIRD FLOOR	350	3,767				
TOTAL	**1,224**	**13,175**	**-**	**-**	**-**	**-**

UNITS	BA	1B	1B+D	2B	3B	4B	TOTAL
	-	-	-	-	10	-	10
NUMER OF BLOCKS							11

	TOTAL FLOOR AREA		GROSS FLOOR AREA		NET SALEABLE AREA	
BACK TO BACK - 12 UNITS	M²	FT²	M²	FT²	M²	FT²
GROUND FLOOR	524	5,645				
SECOND FLOOR	524	5,645				
THIRD FLOOR	420	4,521				
TOTAL	**1,469**	**15,810**				

UNITS	BA	1B	1B+D	2B	3B	4B	TOTAL
	-	-	-	-	12	-	12
NUMER OF BLOCKS							1

	TOTAL FLOOR AREA		GROSS FLOOR AREA		NET SALEABLE AREA	
8-PLEX	M²	FT²	M²	FT²	M²	FT²
GROUND FLOOR	325	3,498				
SECOND FLOOR	320	3,444				
THIRD FLOOR	172	1,851				
TOTAL	**817**	**8,794**	**-**	**-**	**-**	**-**

UNITS	BA	1B	1B+D	2B	3B	4B	TOTAL
	-	-	2	2	-	4	8
NUMER OF BLOCKS							6

	TOTAL FLOOR AREA		GROSS FLOOR AREA		NET SALEABLE AREA	
9-PLEX W/BASMENT	M²	FT²	M²	FT²	M²	FT²
BASMENT	233	2,508				
GROUND FLOOR	242	2,605				
SECOND FLOOR	237	2,551				

THIRD FLOOR		89	958				
TOTAL		**801**	**8,622**	**-**	**-**	**-**	**-**
UNITS	**BA**	**1B**	**1B+D**	**2B**	**3B**	**4B**	**TOTAL**
	-	**-**	**4**	**3**	**-**	**2**	**9**
NUMER OF BLOCKS							**2**

12-PLEX W/BASEMENT		M²	FT²	M²	FT²	M²	FT²
BASMENT		316	3,401				
GROUND FLOOR		325	3,498				
SECOND FLOOR		320	3,444				
THIRD FLOOR		172	1,851				
TOTAL		**1,133**	**12,196**	**-**	**-**	**-**	**-**
UNITS	**BA**	**1B**	**1B+D**	**2B**	**3B**	**4B**	**TOTAL**
	-	**-**	**4**	**4**	**-**	**4**	**12**
NUMER OF BLOCKS							**7**

TOWER 'A'		M²	FT²	M²	FT²	M²	FT²
GROUND-8TH FLOOR (PER FLOOR)		1,750	18,837			1,488	16,011
TOTAL		14,000	150,695			11,900	128,091
9TH-16TH FLOOR (PER FLOOR)		1,215	13,078			1,033	11,116
TOTAL		9,720	104,625			8,262	88,931
TOTAL		**23,720**	**255,320**	**-**	**-**	**20,162**	**217,022**
UNITS	**BA**	**1B**	**1B+D**	**2B**	**3B**	**4B**	**TOTAL**
GROUND	1	3	9	2	2	-	17
2ND-8TH (PER FLOOR)	4	5	9	6	2	-	26
2ND-8TH (TOTAL)	28	35	63	42	14	-	182
9TH-16TH (PER FLOOR)	2	4	6	4	2	-	18
9ND-16TH (TOTAL)	16	32	48	32	16	-	144
TOTAL	**45**	**70**	**120**	**76**	**32**	**-**	**343**

TOWER 'B'		M²	FT²	M²	FT²	M²	FT²
GROUND-7TH FLOOR (PER FLOOR)		1,750	18,837			1,488	16,011
TOTAL		12,250	131,858			10,413	112,079
8TH-14TH FLOOR (PER FLOOR)		1,215	13,078			1,033	11,116
TOTAL		8,505	91,547			7,229	77,815
TOTAL		**20,755**	**223,405**	**-**	**-**	**17,642**	**189,894**
UNITS	**BA**	**1B**	**1B+D**	**2B**	**3B**	**4B**	**TOTAL**
GROUND	1	3	9	2	2	-	17
2ND-7TH (PER FLOOR)	4	5	9	6	2	-	26
2ND-7TH (TOTAL)	24	30	54	36	12	-	156
8TH-14TH (PER FLOOR)	2	4	6	4	2	-	18
8ND-14TH (TOTAL)	14	28	42	28	14	-	126
TOTAL	**39**	**61**	**105**	**66**	**28**	**-**	**299**

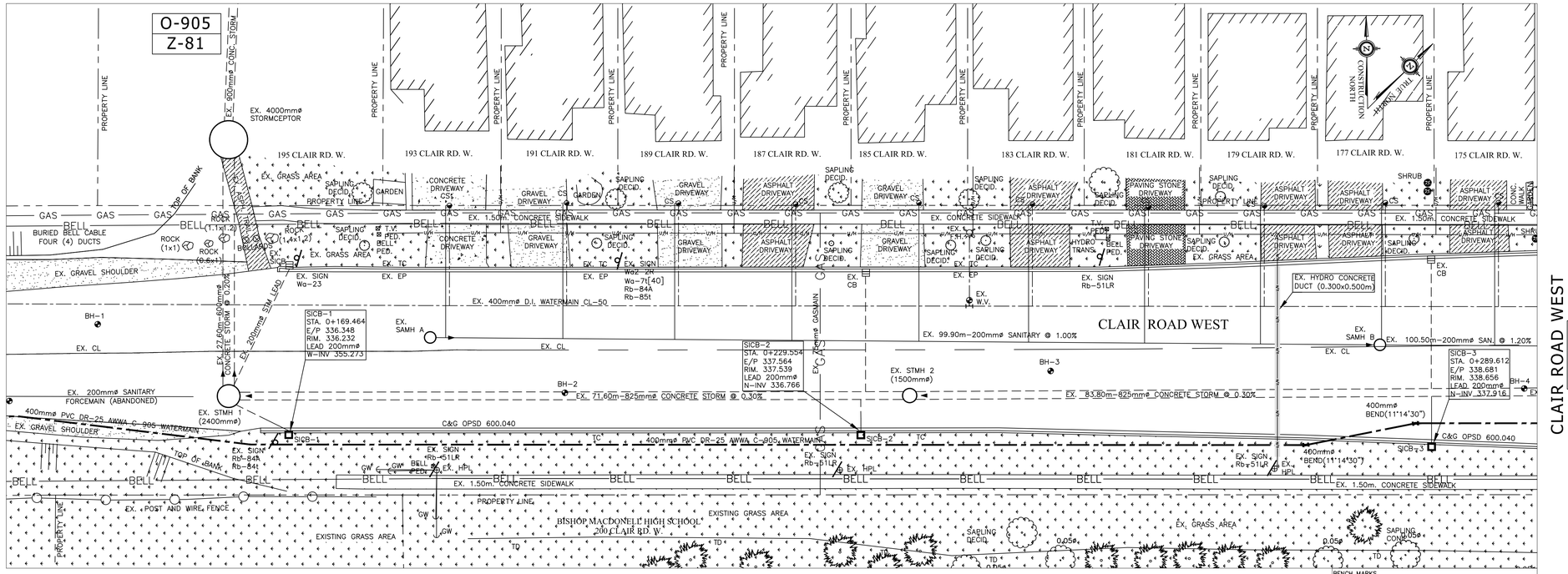
PARKING STRUCTURE		M²	FT²	M²	FT²	M²	FT²
PARKING PER FLOOR		4,624	49,772	-	-	-	-
TOTAL PARKING FLOORS		23,120	248,862				
TOTAL TOWNS (16)		2,000	21,528	-	-	-	-
TOTAL		**25,120**	**270,389**	**-**	**-**	**-**	**-**
UNITS	**BA**	**1B**	**1B+D**	**2B**	**3B**	**4B**	**TOTAL**
	-	**-**	**-**	**-**	**16**	**-**	**16**
PARKING SPACES							**800**

SURFACE PARKING	**90**
LAY-BY PARKING	**29**
TOTAL PARKING SPACES	**919**

AREA TOTAL	M²	FT²	M²	FT²	M²	FT²
TOTAL TOWNHOUSES	**34,550**	**371,895**				
TOTAL APARTMENTS	**44,475**	**478,725**				
GRAND TOTAL	**79,025**	**850,620**				

UNITS TOTAL	**BA**	**1B**	**1B+D**	**2B**	**3B**	**4B**	**TOTAL**
TOTAL TOWNHOUSES	**-**	**-**	**48**	**46**	**164**	**56**	**314**
TOTAL APARTMENTS	**84**	**131**	**225**	**142**	**60**	**-**	**642**
GRAND TOTAL	**84**	**131**	**273**	**188**	**224**	**56**	**956**

LOADING	
TYPE G LOADING	2
MOLOK GARBAGE PICKUP	3



KEY PLAN Scale : NOT TO SCALE

SHEET No. 12 19

CLAIR RD. WEST

NOTE:

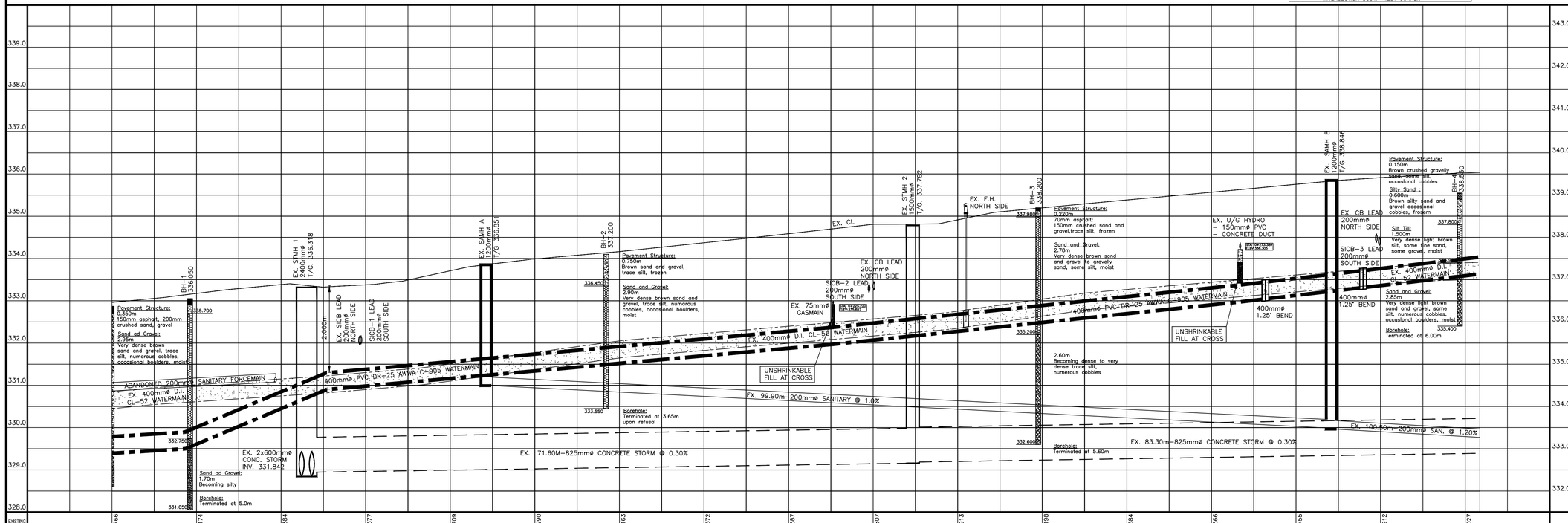
1. ALL WORK DONE IN ACCORDANCE WITH THE STANDARDS AND SPECIFICATIONS OF THE CITY OF GUELPH AND ONTARIO PROVINCIAL STANDARDS EXCEPT WHERE NOTED.
2. THE CONTRACTOR SHALL NOTIFY THE CITY OF GUELPH AND THE ENGINEER AT LEAST 48 HOURS PRIOR TO COMMENCING CONSTRUCTION.
3. PRIOR TO THE COMMENCEMENT OF CONSTRUCTION, ALL BENCH MARKS, ELEVATIONS, DIMENTIONS AND GRADES MUST BE CHECKED BY THE CONTRACTOR AND ANY DISCREPANCIES REPORTED TO THE ENGINEER. AT LEAST TWO DIFFERENT BENCH MARKS MUST BE REFERRED TO AT ALL TIMES.
4. ALL CONCRETE IS 32MPA IN 28 DAYS WITH 6±1% AIR ENTRAINMENT UNLESS OTHERWISE STATED.
5. CONTRACTOR TO SUPPORT AND PROTECT EXISTING UTILITIES DURING CONSTRUCTION TO THE SATISFACTION OF THE UTILITY COMPANY.

6. WATER MAIN SYSTEM
   - WATERMAIN CONSTRUCTION ADHERES TO THE C. OF G. PART "B" STANDARD CONTRACT SPECIFICATIONS SS-200 FOR WATER MAIN SPECIFICATIONS FOR CONSTRUCTION.
   - 100-300mmø PVC MIN. DR18 CONFORM AWWA C900 AND CERTIFIED TO CSA B137.3.
   - 350mmø AND LARGER SHALL BE MIN. DR25 CONFORM AWWA C905 AND CERTIFIED TO CSA B137.3.
   - 2.0m MINIMUM COVER
   - MINIMUM VERTICAL CLEARANCE BETWEEN WATER MAIN AND OTHER SERVICES IS 0.50m
   - MINIMUM HORIZONTAL CLEARANCE BETWEEN WATER MAIN AND OTHER SERVICES IS 2.50m.
   - PIPE BEDDING CLASS "B" AS PER SD-29
   - FITTINGS AND VALVES AS PER DGSSMS AND CITY OF GUELPH STANDARDS.
   - ALL EXISTING VALVES TO BE OPERATED BY CITY FORCES ONLY.
   - PROVIDE CATHODIC PROTECTION AS SPECIFIED IN DGSSMS AND CITY OF GUELPH STDS., OPSD 1109.18 & 1109.010
   - TESTING OF THE NEW WATERMAIN TO BE COMPLETED BEFORE LIVE CONNECTION TO EXISTING MAINS. SWABBING AND DISINFECTION OF THE MAINS MUST BE COMPLETED ALL IN ACCORDANCE WITH DGSSMS AND THE CITY OF GUELPH STANDARDS.

7. ROADWORKS
   - ROADWAY RESTORATION AS PER CITY OF GUELPH STANDARDS SD-50
   - SAW CUT EXISTING ASPHALT
     ASPHALT CONCRETE SURFACE COURSE HL3 45mm
     ASPHALT CONCRETE BASE COURSE(TWO LIFTS)HL8 90mm
     GRANULAR "A" 175mm
     GRANULAR "B" 450mm
   - PAVEMENT CONSTRUCTION - SEE DETAILS
   - RESTORE ALL DISTURBED GRASSED AREAS WITH 150mm TOPSOIL, SEED AND MULCH UNLESS OTHERWISE NOTED.
   - STRAW BALE BARRIER AS PER OPSD 219.100 OR SILT FANCE BARRIER AS PER OPSD 219.110 TO BE INSTALLED PRIOR ANY GRADING, EXCAVATING AS DIRECTED BY THE ENGINEER

BENCH MARKS

TBM-1 ELEV.=333.002 -SIB- LOCATION: ON PROPORTY LINE 266 CLAIR RD. W. STA. 0+082.662 OFFSET 14.88 m SOUTH 14.888m ON CLAIR RD W. ALIGNMENT.
BM 387 ELEV.=338.980 LOCATION: NORTH SIDE OF TRAFFIC CONTROL BASECLAIR DR. WEST @ POPPY DR. INTERSECTION SOUTH WEST CORNER



CHAINAGE	0+140	0+150	0+160	0+170	0+180	0+190	0+200	0+210	0+220	0+230	0+240	0+250	0+260	0+270	0+280	0+290	0+300
EXISTING CENTRE-LINE	335.766	336.174	336.384	336.377	336.709	336.990	337.163	337.372	337.587	337.807	337.913	338.198	338.384	338.566	338.755	338.912	339.027
PROP. GRADE																	
STORM SEWER			331.947	EX. 71.60m-825mmø CONCRETE STORM @ 030%						332.167 332.167	EX. 83.80m-825mmø CONCRETE STORM @ 030%						
SANIT. SEWER	ABANDONED 200mmø SANITARY FORCEMAIN					333.994	EX. 99.90m-200mmø SANITARY @ 1.0%								328.690 333.550	EX. 100.50m-200mmø SANITARY @ 1.20%	

THE POSITION OF POLES, LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES, AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	DATE	DESCRIPTION	BY:	CHKD.
1	Jan/2016	AS-BUILT	C.M.C.	

ISSUES/REVISIONS

CITY OF Guelph — Making a Difference

ENGINEERING SERVICES

CLAIR ROAD WATERMAIN REPLACEMENT PHASE 1 (WATER TOWER TO SOUTH END OF POPPY DR.)

CLAIR ROAD W. STA. 0+140 to STA.0+300

LICENSED PROFESSIONAL ENGINEER M. QAQISH PROVINCE OF ONTARIO

EXISTING CENTRELINE	SCALES: HOR: 1:250 VER: 1:50
PROPOSED GRADE	DATE DRAWN: SEPT. 2011
STORM SEWER	DRAWN BY: S.B. CHECKED BY: M.Q.
SANITARY SEWER	CONSULTANT DRAWING No.
CHAINAGE	CITY CONTRACT No. 2-1203
	CITY REFERENCE No. Z-67 REV.

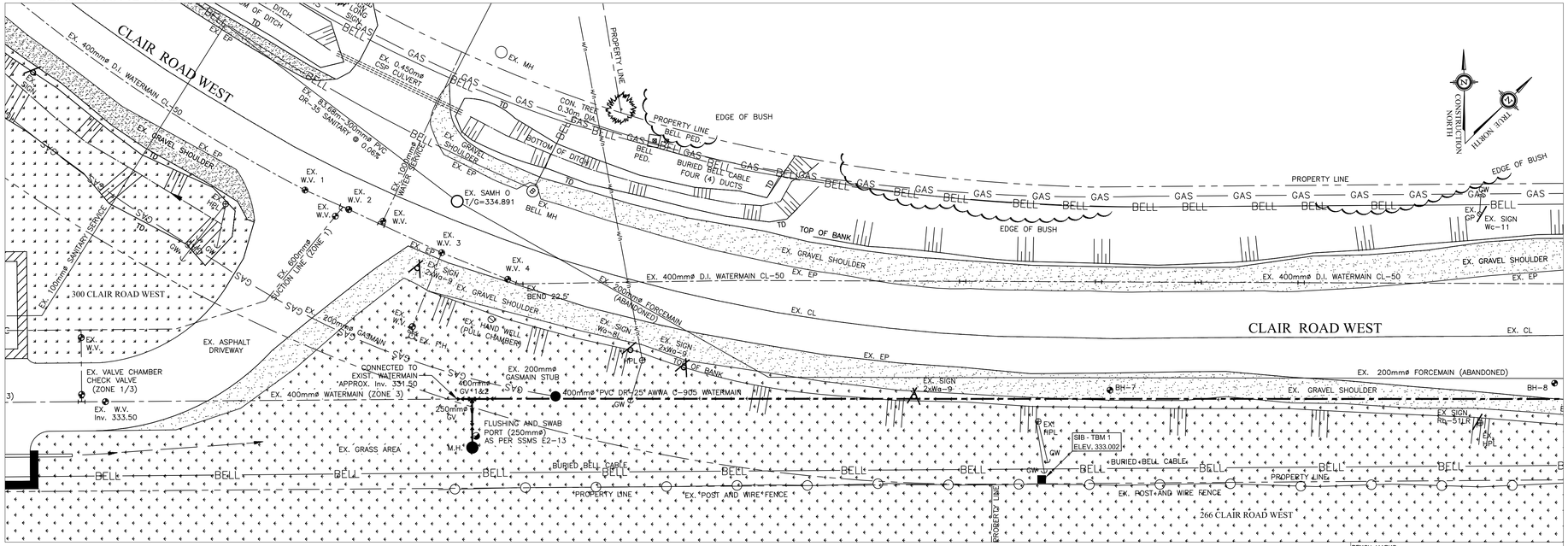
16.212.1203

2F-40

CLAIR ROAD WEST

CLAIR ROAD WEST
WATER TOWER

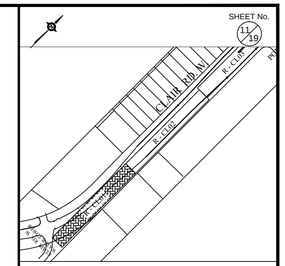
CLAIR ROAD WEST
Z-67



CLAIR ROAD WEST

BENCH MARKS

TBM-1 ELEV.=333.002 -SIB- LOCATION: ON PROPERTY LINE 266 CLAIR RD. W. STA. 0+082.662 OFFSET 14.88 m SOUTH 14.888m ON CLAIR RD W. ALIGNMENT.
BM 387 ELEV.=338.980 LOCATION: NORTH SIDE OF TRAFFIC CONTROL BASECLAIR DR. WEST @ POPPY DR. INTERSECTION SOUTH WEST CORNER

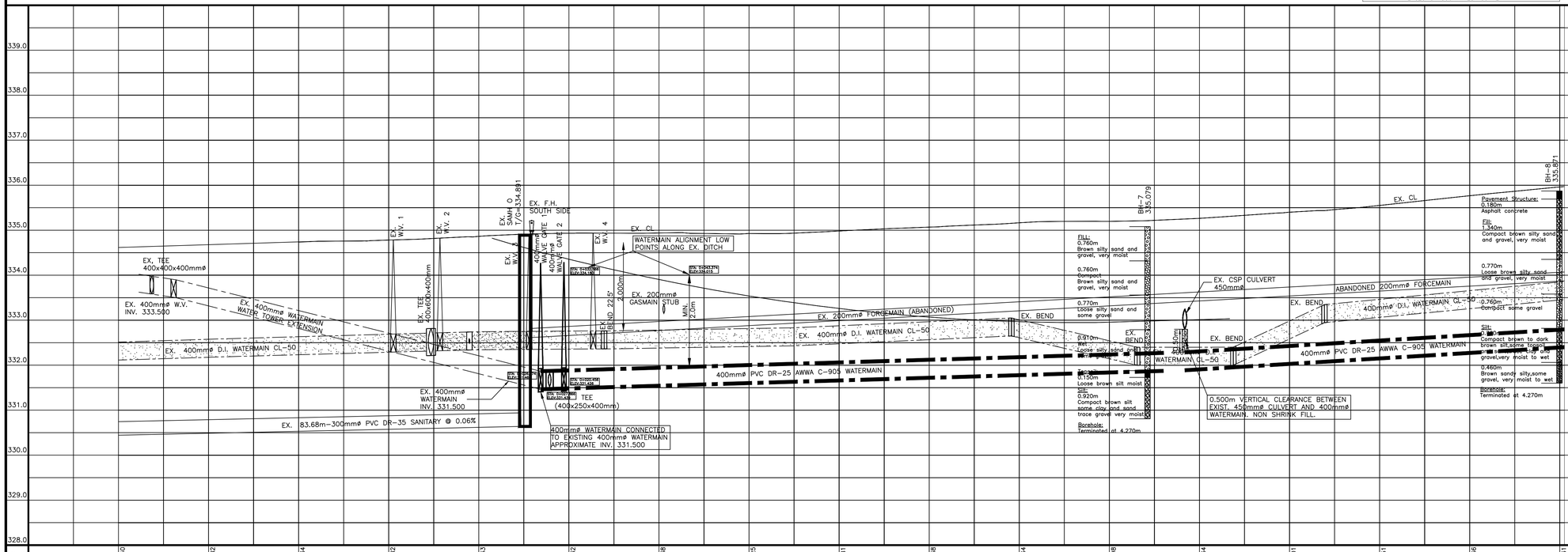


SHEET No. 11 19

KEY PLAN Scale : NOT TO SCALE

NOTE:

1. ALL WORK DONE IN ACCORDANCE WITH THE STANDARDS AND SPECIFICATIONS OF THE CITY OF GUELPH AND ONTARIO PROVINCIAL STANDARDS EXCEPT WHERE NOTED.
2. THE CONTRACTOR SHALL NOTIFY THE CITY OF GUELPH AND THE ENGINEER AT LEAST 48 HOURS PRIOR TO COMMENCING CONSTRUCTION.
3. PRIOR TO THE COMMENCEMENT OF CONSTRUCTION, ALL BENCH MARKS, ELEVATIONS, DIMENTIONS AND GRADES MUST BE CHECKED BY THE CONTRACTOR AND ANY DISCREPANCIES REPORTED TO THE ENGINEER. AT LEAST TWO DIFFERENT BENCH MARKS MUST BE REFERRED TO AT ALL TIMES.
4. ALL CONCRETE IS 32MPA IN 28 DAYS WITH 6±1% AIR ENTRAINMENT UNLESS OTHERWISE STATED.
5. CONTRACTOR TO SUPPORT AND PROTECT EXISTING UTILITIES DURING CONSTRUCTION TO THE SATISFACTION OF THE UTILITY COMPANY.
6. WATER MAIN SYSTEM
   - WATERMAIN CONSTRUCTION ADHERES TO THE C. OF G. PART "B" STANDARD CONTRACT SPECIFICATIONS SS-200 FOR WATER MAIN SPECIFICATIONS FOR CONSTRUCTION.
   - 100-300mmø PVC MIN. DR18 CONFORM AWWA C900 AND CERTIFIED TO CSA B137.3.
   - 350mmø AND LARGER SHALL BE MIN. DR25 CONFORM AWWA C905 AND CERTIFIED TO CSA B137.3.
   - 2.0m MINIMUM COVER
   - MINIMUM VERTICAL CLEARANCE BETWEEN WATER MAIN AND OTHER SERVICES IS 0.50m
   - MINIMUM HORIZONTAL CLEARANCE BETWEEN WATER MAIN AND OTHER SERVICES IS 2.50m.
   - PIPE BEDDING CLASS "B" AS PER SD-29
   - FITTINGS AND VALVES AS PER DGSSMS AND CITY OF GUELPH STANDARDS.
   - ALL EXISTING VALVES TO BE OPERATED BY CITY FORCES ONLY.
   - PROVIDE CATHODIC PROTECTION AS SPECIFIED IN DGSSMS AND CITY OF GUELPH STDS., OPSD 1109.18 & 1109.010
   - TESTING OF THE NEW WATERMAIN TO BE COMPLETED BEFORE LIVE CONNECTION TO EXISTING MAINS. SWABBING AND DISINFECTION OF THE MAINS MUST BE COMPLETED ALL IN ACCORDANCE WITH DGSSMS AND THE CITY OF GUELPH STANDARDS.
7. ROADWORKS
   - ROADWAY RESTORATION AS PER CITY OF GUELPH STANDARDS SD-50
   - SAW CUT EXISTING ASPHALT
     ASPHALT CONCRETE SURFACE COURSE HL3 45mm
     ASPHALT CONCRETE BASE COURSE(TWO LIFTS)HL8 90mm
     GRANULAR "A" 175mm
     GRANULAR "B" 450mm
   - PAVEMENT CONSTRUCTION - SEE DETAILS
   - RESTORE ALL DISTURBED GRASSED AREAS WITH 150mm TOPSOIL, SEED AND MULCH UNLESS OTHERWISE NOTED.
   - STRAW BALE BARRIER AS PER OPSD 219.100 OR SILT FANCE BARRIER AS PER OPSD 219.110 TO BE INSTALLED PRIOR ANY GRADING, EXCAVATING AS DIRECTED BY THE ENGINEER



EXISTING CENTRE-LINE	337.940	338.182	334.734	334.782	334.863	334.932	334.938	334.925	334.981	335.088	335.164	335.198	335.264	335.401	335.551	335.766	335.961
PROP. GRADE																	
STORM SEWER																	
SANIT. SEWER	EX. 83.68m-300mmø PVC DR-35 SANITARY @ 0.06%					334.880 333.880	ABANDONED 200mmø SANITARY FORCEMAIN										
CHAINAGE	0+020	0+010	0+000	0+010	0+020	0+030	0+040	0+050	0+060	0+070	0+080	0+090	0+100	0+110	0+120	0+130	0+140

THE POSITION OF POLES, LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES, AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	DATE	DESCRIPTION	BY:	CHKD.
1	Jan 2016	AS-BUILT	C.M.C.	

ISSUES/REVISIONS

CITY OF Guelph
Making a Difference

ENGINEERING SERVICES

CLAIR ROAD WATERMAIN REPLACEMENT PHASE 1 (WATER TOWER TO SOUTH END OF POPPY DR.)

CLAIR ROAD W. STA. - 0+020 to STA.0+140

LICENSED PROFESSIONAL ENGINEER M. QAQISH PROVINCE OF ONTARIO

EXISTING CENTRELINE	SCALES: HOR: 1:250 VER: 1:50
PROPOSED GRADE	DATE DRAWN: SEPT. 2011
STORM SEWER	DRAWN BY: S.B. CHECKED BY: M.Q.
SANITARY SEWER	CONSULTANT DRAWING No.
CHAINAGE	CITY CONTRACT No. 2-1203
	CITY REFERENCE No. 2D-86 REV.

16.212.1203

APPENDIX B
Water Calculations

Counterpoint Engineering Inc.

Water Demand Design Calculations

Project: **280 Clair Road**
Project No: **24010**
Location: **Guelph**
Site Area: 8.56 ha

Population		
Apartment	1.86	ppu
Single/Semi Detached	3.4	ppu
Townhouse	2.45	ppu
ICI	30	ppu/ha

	Residential Units		
	Apartment Units	Townhouse Units	Total Units
Townhouses	0	**314**	314
Tower A	343	**0**	343
Tower B	299	**0**	299
TOTAL	**642**	**314**	**956**

Daily Average Flow
Residential 167 **L/persons/day**

City of Gueloh Watermain Guidelines

MDD Peaking Factors **1.34 x ADD**

Water Demand based on Equivalent Population

Land Use		Population	Average Day (L/s)	Maximum Day (L/s)	Fire Flow Required (L/s)	Fire Flow Duration (hr)*	Max Day + Fire Flow (L/s)
Residential		1963	3.8	5.1	283.3	3.75	288.4
Totals		1963	3.8	5.1	283.3	3.75	288.4

counterpoint engineering

Fire Underwriter Survey (2020) Fire Flow Calculation - High Rise

Project: 280 Clair Road
Project No: 24010
Location: Guelph

$$F = 220C\sqrt{A}$$

Where:

RFF = the Required Fire Flow in litres per minutes (LPM)
C = the Construction Coefficient is related to the type of construction of the building
A = the Total Effective Floor Area (effective building area) in square metres of the building

C = 1.5 for **Type V** Wood Frame Construction
= 0.8 for **Type IV-A** Mass Timber Construction
= 0.9 for **Type IV-B** Mass Timber Construction
= 1.0 for **Type IV-C** Mass Timber Construction
= 1.5 for **Type IV-D** Mass Timber Construction
= 1.0 for **Type III** Ordinary Construction
= 0.8 for **Type II** Noncombustible Construction
= 0.6 for **Type I** Fire Resistive Construction

A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Legend

Construction Class		Contents Factor	
WF	wood frame construction	NC	non-combustible
OC	ordinary construction	LC	limited combustible
NC	non-combustible construction	C	combustible
FC	fire-resistive construction	FB	free burning
		RB	rapid burning

Contents Factor:

Non-Combustible	-25%	Free Burning	+15%
Limited Combustible	-15%	Rapid Burning	+25%
Combustible	No Charge		

Separation	Charge	Separation	Charge
0 to 3m	25%	20.1 to 30 m	10%
3.1 to 10m	20%	30.1 to 45m	5%
10.1 to 20m	15%		

1) Fire Flow
Tower A / B - both have same floor areas

	NC	<-- Type II
C =	0.8	
A =	2625	m^2
F =	**10,000 L/min**	

<--- per FUS 2020, Type II buildings with protected openings, Effective Area is equal to the largest single floor area plus 25% of each of the next two adjoining floors.
as Total Effective Area

2) Occupancy Reduction

Contents Factor:	LC
Occupancy Charge =	-15%

-15% of 10,000 L/min = -1,500 L/min
F = = **8,500 L/min**

3) System Type Reduction (to be reduced from result of Step 2)

NFPA 13 Sprinkler:	30%			Yes
Standard Water Supply:	10%			Yes
Fully Supervised:	10%			Yes
Total System Type Reduction =	**50%**			

50% of **8,500 L/min** = **4,250 L/min**
(to be reduced from result of Step 2)

4) Separation Charge (to be added to result of Step 2)
Tower B has shorter distances

Building Face	Distance (m)	Length-Height Factor	Bldg Type	Auto Sprinkler Protection Reduction		Charge	
North	12	93	Type V	0%	=	0%	Townhomes
East	>30	n/a	n/a	0%	=	0%	n/a
South	17	Over 100	Type II (2)	100%	=	0%	Parking Structure
West	19	Over 100	Type V	0%	=	0%	Townhomes
Total						**0%**	(max exposure charge can be 75%)

*Dependant on whether Site building and exposed building have automatic sprinkler systems

0% of **8,500 L/min** = **0 L/min**
(to be added to result of Step 2)

F = 5,000 L/min (round to the nearest 1,000 L/min) (2,000 L/min < F < 45,000 L/min)
F = 1,321 GPM
F = 83.3 L/s

counterpoint engineering

Fire Underwriter Survey (2020) Fire Flow Calculation - Parking

Project: 280 Clair Road
Project No: 24010
Location: Guelph

$$F = 220C\sqrt{A}$$

Where:

RFF = the Required Fire Flow in litres per minutes (LPM)
C = the Construction Coefficient is related to the type of construction of the building
A = the Total Effective Floor Area (effective building area) in square metres of the building

C = 1.5 for **Type V** Wood Frame Construction
= 0.8 for **Type IV-A** Mass Timber Construction
= 0.9 for **Type IV-B** Mass Timber Construction
= 1.0 for **Type IV-C** Mass Timber Construction
= 1.5 for **Type IV-D** Mass Timber Construction
= 1.0 for **Type III** Ordinary Construction
= 0.8 for **Type II** Noncombustible Construction
= 0.6 for **Type I** Fire Resistive Construction

A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Legend

Construction Class		Contents Factor	
WF	wood frame construction	NC	non-combustible
OC	ordinary construction	LC	limited combustible
NC	non-combustible construction	C	combustible
FC	fire-resistive construction	FB	free burning
		RB	rapid burning

Contents Factor:

Non-Combustible	-25%	Free Burning	+15%
Limited Combustible	-15%	Rapid Burning	+25%
Combustible	No Charge		

Separation	Charge	Separation	Charge
0 to 3m	25%	20.1 to 30 m	10%
3.1 to 10m	20%	30.1 to 45m	5%
10.1 to 20m	15%		

1) Fire Flow
Open Parking Garage

	NC	<-- Type II
C =	0.8	
A =	4624	m^2
F =	**12,000 L/min**	

<--- per FUS 2020, For open parking garage use area of largest floor for Total Effective Area

as Total Effective Area

2) Occupancy Reduction

Contents Factor:	LC
Occupancy Charge =	0%

0% of 12,000 L/min = 0 L/min
F = = **12,000 L/min**

3) System Type Reduction (to be reduced from result of Step 2)

NFPA 13 Sprinkler:	30%			Yes
Standard Water Supply:	10%			Yes
Fully Supervised:	10%			Yes
Total System Type Reduction =	**50%**			

50% of **12,000 L/min** = **6,000 L/min**
(to be reduced from result of Step 2)

4) Separation Charge (to be added to result of Step 2)

Building Face	Distance (m)	Length-Height Factor	Bldg Type	Auto Sprinkler Protection Reduction*		Charge	
North	17	Over 100	Type II (3)	100%	=	0%	Tower B (without unprotected openings)
East	>30	n/a	n/a	0%	=	0%	n/a
South	>30	n/a	n/a	0%	=	0%	n/a
West	26	Over 100	Type II (3)	100%	=	0%	Tower A (without unprotected openings)
Total						**0%**	(max exposure charge can be 75%)

*Dependant on whether Site building and exposed building have automatic sprinkler systems

0% of **12,000 L/min** = **0 L/min**
(to be added to result of Step 2)

F = 6,000 L/min (round to the nearest 1,000 L/min) (2,000 L/min < F < 45,000 L/min)
F = 1,585 GPM
F = 100.0 L/s

counterpoint engineering

Fire Underwriter Survey (2020) Fire Flow Calculation - Townhome

Project: 280 Clair Road
Project No: 24010
Location: Guelph

$$F = 220C\sqrt{A}$$

Where:

RFF = the Required Fire Flow in litres per minutes (LPM)
C = the Construction Coefficient is related to the type of construction of the building
A = the Total Effective Floor Area (effective building area) in square metres of the building

C = 1.5 for **Type V** Wood Frame Construction
= 0.8 for **Type IV-A** Mass Timber Construction
= 0.9 for **Type IV-B** Mass Timber Construction
= 1.0 for **Type IV-C** Mass Timber Construction
= 1.5 for **Type IV-D** Mass Timber Construction
= 1.0 for **Type III** Ordinary Construction
= 0.8 for **Type II** Noncombustible Construction
= 0.6 for **Type I** Fire Resistive Construction

A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Legend

Construction Class		Contents Factor	
WF	wood frame construction	NC	non-combustible
OC	ordinary construction	LC	limited combustible
NC	non-combustible construction	C	combustible
FC	fire-resistive construction	FB	free burning
		RB	rapid burning

Contents Factor:

Non-Combustible	-25%	Free Burning	+15%
Limited Combustible	-15%	Rapid Burning	+25%
Combustible	No Charge		

Separation	Charge	Separation	Charge
0 to 3m	25%	20.1 to 30 m	10%
3.1 to 10m	20%	30.1 to 45m	5%
10.1 to 20m	15%		

1) Fire Flow
Back to Back -12 Units (largest TH building)

	WF	<-- Type II
C =	1.5	
A =	1469	m^2
F =	**13,000 L/min**	

<--- per FUS 2020, for Type V buildings, Effective Area is equal to 100% of all floor areas

as Total Effective Area

2) Occupancy Reduction

Contents Factor:	LC
Occupancy Charge =	-15%

-15% of 13,000 L/min = -1,950 L/min
F = = **11,050 L/min**

3) System Type Reduction (to be reduced from result of Step 2)

NFPA 13 Sprinkler:	0%			No
Standard Water Supply:	0%			No
Fully Supervised:	0%			No
Total System Type Reduction =	**0%**			

0% of **11,050 L/min** = **0 L/min**
(to be reduced from result of Step 2)

4) Separation Charge (to be added to result of Step 2)
Tower B has shorter distances

Building Face	Distance (m)	Length-Height Factor	Bldg Type	Auto Sprinkler Protection Reduction		Charge	
North	15	Over 100	Type V	0%	=	15%	Townhomes
East	7	36	Type V	0%	=	16%	Townhomes
South	17	96	Type V	0%	=	14%	Townhomes
West	27	81	Type V	0%	=	8%	Townhomes
Total						**53%**	(max exposure charge can be 75%)

*Dependant on whether Site building and exposed building have automatic sprinkler systems

53% of **11,050 L/min** = **5,857 L/min**
(to be added to result of Step 2)

F = 17,000 L/min (round to the nearest 1,000 L/min) (2,000 L/min < F < 45,000 L/min)
F = 4,491 GPM
F = 283.3 L/s

DILLON CONSULTING

Howkins, Jake <jhowkins@counterpointeng.com>

RE: 280 Clair Road West - Engineering Q & A

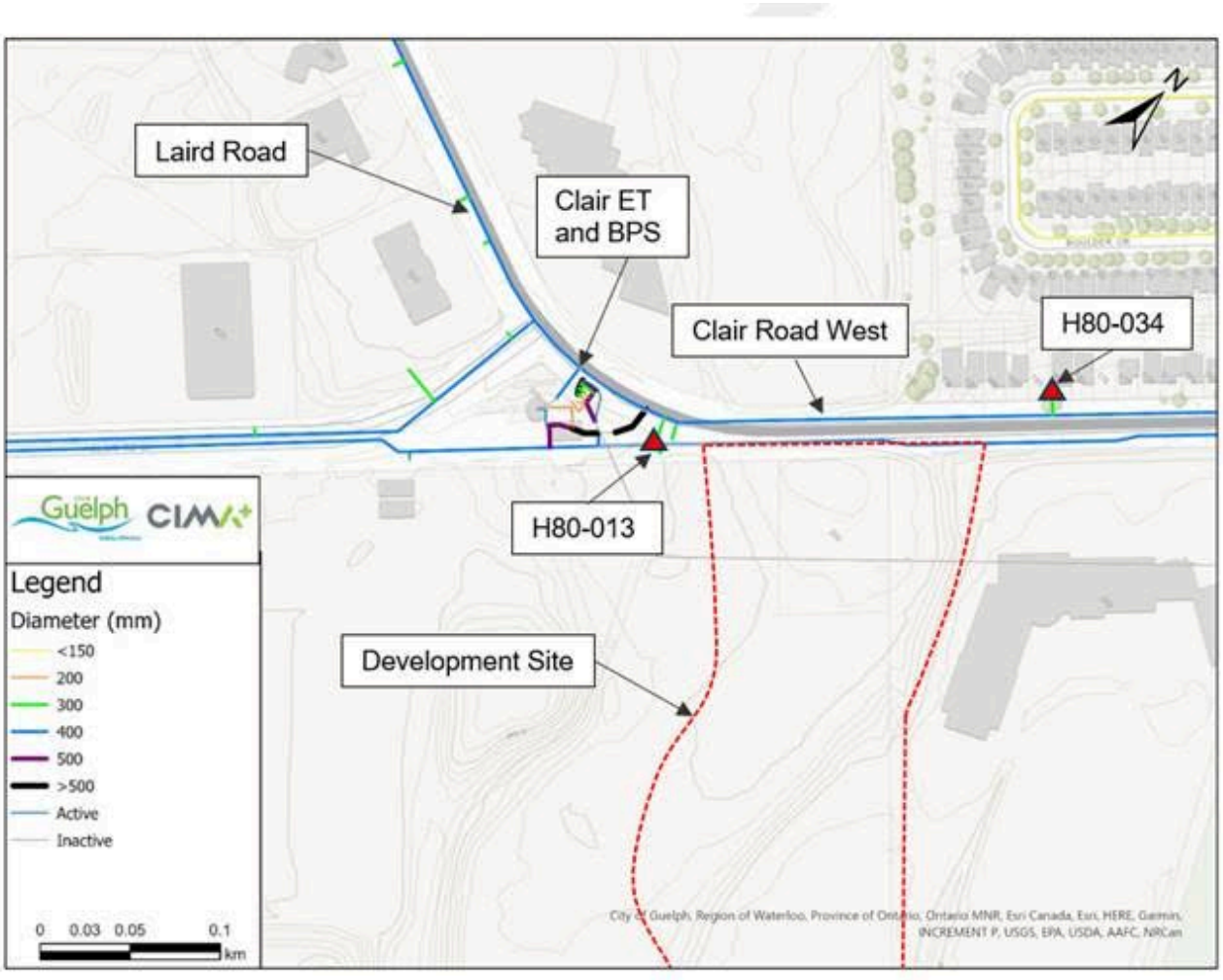
1 message

Michelle Thalen <Michelle.Thalen@guelph.ca> Thu, Jun 27, 2024 at 4:46 PM
To: "Howkins, Jake" <jhowkins@counterpointeng.com>, John Farley <jdfarley@gmail.com>
Cc: Mary Angelo <Mary.Angelo@guelph.ca>

Hi Jake and John,

The results from the water and waste water capacity analysis have been completed and are as follows:

Water



- Please note that the fire flow proposed by Counterpoint for the site was defined to be 266.7 L/s which is the commercial rate whereas high density residential is 200 L/s. The higher fire flow was used within the model as per the request.
- Based on the model results, the water system at the proposed development provided a pressure of 82 psi under both ADD and MDD conditions which slightly exceeds the City's preferred operating range of

50 – 80 psi but is still below the maximum allowable pressure of 100 psi. The available fire flow at hydrants H80-013, and H80-034 surpassed the calculated FUS fire flow requirement of 266.7 L/s and the City's guideline of 200 L/s.

Sanitary

- The model shows there is no surcharging between the subject site and the WWTP. Along the flow path from the local receiving sewer to the WWTP, there are 4 MHs with a HGL freeboard less than 1.8 m. For all 4 MHs, the HGL freeboard is also less than 1.8 m under existing conditions. 3 junctions with a HGL freeboard less than 1.8 m are located between the siphon and the WWTP, and all 4 are associated with shallow sewers. The fact that there is no surcharging from the subject site to the WWTP and the maximum decrease in HGL freeboard in MHs with an HGL freeboard less than 1.8 m is 2 cm suggests the existing network has sufficient capacity to manage the existing flows, as well as the additional flows from the proposed development.

Trusting the above information will assist you with detailed design.

Should you have any questions, feel free to contact me at your convenience.

Best regards,

Michelle Thalen, C.Tech, Engineering Technologist III

Engineering and Transportation Services
City of Guelph

T 519-822-1260 x 2333 | F 519-822-6194
E michelle.thalen@guelph.ca

guelph.ca

From: Howkins, Jake <jhowkins@counterpointeng.com>
Sent: Monday, June 3, 2024 4:35 PM
To: Michelle Thalen <Michelle.Thalen@guelph.ca>
Cc: Mary Angelo <Mary.Angelo@guelph.ca>
Subject: Re: 280 Clair Road West - Engineering Q & A

Hi Michelle,

Counterpoint Engineering Inc.
Water Demand Design Calculations

Previous Calculations Coordinated with Municipal Staff for Modeling

Project: **280 Clair Road**
Project No: **24010**
Location: **Guelph**
Site Area: 8.56 ha

Population		
Apartment	1.86	ppu
Single/Semi Detached	3.4	ppu
Townhouse	2.45	ppu
ICI	30	ppu/ha

	Residential Units		
	Apartment Units	Townhouse Units	Total Units
Townhouses	0	**339**	339
Tower A	328	**0**	328
Tower B	328	**0**	328
TOTAL	**656**	**339**	**995**

Daily Average Flow
Residential 167 **L/persons/day**

City of Gueloh Watermain Guidelines

MDD Peaking Factors **1.34 x ADD**

Water Demand based on Equivalent Population

Land Use		Population	Average Day (L/s)	Maximum Day (L/s)	Fire Flow Required (L/s)	Fire Flow Duration (hr)*	Max Day + Fire Flow (L/s)
Residential		2051	4.0	5.3	266.7	3.5	272.0
Totals		2051	4.0	5.3	266.7	3.5	272.0

counterpoint engineering

Fire Underwriter Survey (2020) Fire Flow Calculation - Proposed Building

Project: 280 Clair Road
Project No: 24010
Location: Guelph

Previous Calculations Coordinated with Municipal Staff for Modeling

$$F = 220C\sqrt{A}$$

Where:

RFF = the Required Fire Flow in litres per minutes (LPM)
C = the Construction Coefficient is related to the type of construction of the building
A = the Total Effective Floor Area (effective building area) in square metres of the building

C = 1.5 for **Type V** Wood Frame Construction
= 0.8 for **Type IV-A** Mass Timber Construction
= 0.9 for **Type IV-B** Mass Timber Construction
= 1.0 for **Type IV-C** Mass Timber Construction
= 1.5 for **Type IV-D** Mass Timber Construction
= 1.0 for **Type III** Ordinary Construction
= 0.8 for **Type II** Noncombustible Construction
= 0.6 for **Type I** Fire Resistive Construction

A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Legend

Construction Class
- WF wood frame construction
- OC ordinary construction
- NC non-combustible construction
- FC fire-resistive construction

Contents Factor
- NC non-combustible
- LC limited combustible
- C combustible
- FB free burning
- RB rapid burning

Contents Factor:

Non-Combustible	-25%	Free Burning	+15%
Limited Combustible	-15%	Rapid Burning	+25%
Combustible	No Charge		

Separation	Charge	Separation	Charge
0 to 3m	25%	20.1 to 30 m	10%
3.1 to 10m	20%	30.1 to 45m	5%
10.1 to 20m	15%		

1) Fire Flow
Tower A

	NC	<-- Type II
C =	0.8	
A =	2625	m^2
F =	10,000	L/min

<--- per FUS 2020, Type II buildings with protected openings, Effective Area is equal to the largest single floor area plus 25% of each of the next two adjoining floors.
as Total Effective Area

2) Occupancy Reduction

Contents Factor:	LC
Occupancy Charge =	-15%

-15% of 10,000 L/min = -1,500 L/min
F = = 8,500 L/min

3) System Type Reduction (to be reduced from result of Step 2)

NFPA 13 Sprinkler:	30%			Yes
Standard Water Supply:	10%			Yes
Fully Supervised:	10%			Yes
Total System Type Reduction =	50%			

50% of 8,500 L/min = 4,250 L/min
(to be reduced from result of Step 2)

4) Separation Charge (to be added to result of Step 2)

Building Face	Distance (m)	Length-Height Factor	Bldg Type	Auto Sprinkler Protection Reduction: Exposed BLDG (50% factor), Exposed & Subject Bldg (0% factor)		Charge	
North	24	111	Type V	0%	=	10%	Residential House
East	24	164	Type V	0%	=	10%	Institutional
South	18	215	Type III-IV²	0%	=	10%	Industrial
West	>30	-	Type III-IV²	0%	=	0%	Convenience Store
Total						30%	(max exposure charge can be 75%)

30% of 8,500 L/min = 2,550 L/min
(to be added to result of Step 2)

F = 7,000 L/min (round to the nearest 1,000 L/min) (2,000 L/min < F < 45,000 L/min)
F = 1,849 GPM
F = 116.7 L/s

counterpoint engineering

Fire Underwriter Survey (2020) Fire Flow Calculation - Proposed Building

Project: 280 Clair Road
Project No: 24010
Location: Guelph

Previous Calculations Coordinated with Municipal Staff for Modeling

Where:

$$F = 220C\sqrt{A}$$

RFF = the Required Fire Flow in litres per minutes (LPM)
C = the Construction Coefficient is related to the type of construction of the building
A = the Total Effective Floor Area (effective building area) in square metres of the building

C = 1.5 for **Type V** Wood Frame Construction
= 0.8 for **Type IV-A** Mass Timber Construction
= 0.9 for **Type IV-B** Mass Timber Construction
= 1.0 for **Type IV-C** Mass Timber Construction
= 1.5 for **Type IV-D** Mass Timber Construction
= 1.0 for **Type III** Ordinary Construction
= 0.8 for **Type II** Noncombustible Construction
= 0.6 for **Type I** Fire Resistive Construction

A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Legend

Construction Class

WF	wood frame construction
OC	ordinary construction
NC	non-combustible construction
FC	fire-resistive construction

Contents Factor

NC	non-combustible
LC	limited combustible
C	combustible
FB	free burning
RB	rapid burning

Contents Factor:

Non-Combustible	-25%	Free Burning	+15%
Limited Combustible	-15%	Rapid Burning	+25%
Combustible	No Charge		

Separation	Charge	Separation	Charge
0 to 3m	25%	20.1 to 30 m	10%
3.1 to 10m	20%	30.1 to 45m	5%
10.1 to 20m	15%		

1) Fire Flow

Back to Back -12 Units (largest TH building)

	WF	<-- Type V
C =	1.5	
A =	1469	m^2
F =	13,000	L/min

<--- per FUS 2020, for Type V buildings, Effective Area is equal to 100% of all floor areas

2) Occupancy Reduction

Contents Factor:	LC
Occupancy Charge =	-15%

-15% of 13,000 L/min = -1,950 L/min
F = = 11,050 L/min

3) System Type Reduction (to be reduced from result of Step 2)

NFPA 13 Sprinkler:	0%			No
Standard Water Supply:	10%			Yes
Fully Supervised:	0%			No
Total System Type Reduction =	10%			

10% of 11,050 L/min = 1,105 L/min
(to be reduced from result of Step 2)

4) Separation Charge (to be added to result of Step 2)

Building Face	Distance (m)	Length-Height Factor	Bldg Type	Auto Sprinkler Protection Reduction: Exposed BLDG (50% factor), Exposed & Subject Bldg (0% factor)		Charge	
North	5.5	33	Type V	0%	=	16%	Residential House
East	12	36	Type V	0%	=	11%	Institutional
South	2	36	Type V	0%	=	21%	Industrial
West	>30	-	Type III-IV²	0%	=	0%	Convenience Store
Total						48%	(max exposure charge can be 75%)

48% of 11,050 L/min = 5,304 L/min
(to be added to result of Step 2)

F = 16,000 L/min (round to the nearest 1,000 L/min) (2,000 L/min < F < 45,000 L/min)
F = 4,227 GPM
F = 266.7 L/s

APPENDIX C
Sanitary Calculations

Counterpoint Engineering Inc.

Proposed Conditions - Sanitary

Project: 280 Clair Road
Project No: 24010
Location: Guelph
Site Area: 8.56 ha

City of Guelph Sanitary Guidelines

Average Flow		
Residential	300	litres/person/day
ICI	300	litres/person/day
Inflow and Infiltration	0.25	litres/second/ha

Retail/Residential Population Criteria		
Apartment	1.86	ppu
Single/Semi Detached	3.4	ppu
Townhouse	2.45	ppu
ICI	30	ppu/ha

	Residential Units			Commercial	Office
	Apartment Units	Townhouse Units	Total Units	Area (m^2)*	Area (m^2)
Townhouses	0	**314**	314		
Tower A	343	**0**	343		
Tower B	299	**0**	299		
TOTAL	**642**	**314**	**956**		

** Note: GFA used for retail calculation. Represents YMCA space.*

	Population Apartment Units	Population Townhouse Units	TOTAL POPULATION	Average Flow (l/day)	l/s
Residential	1194	769	1963	588900	6.82

	Area (m^2)	Average Flow (l/day)	l/s
Commercial Area	0.00	0	0.00

Harmon Peaking Factor

Total Population	Harmon Peak Factor
1963	**3.59**

Commercial Peak Sanitary Flow	0.00	**l/s**	
Residential Peak Sanitary Flow	24.48	**l/s**	
Total Sanitary Flow	24.48	**l/s**	
Infiltration	2.14	**l/s**	
Groundwater Rate	0.00	**l/s**	*No LT GW discharge.*
Total Peak Flow	**26.62**	**l/s**	
Net Increase from Existing	**26.62**	**l/s**	

DILLON CONSULTING

Howkins, Jake <jhowkins@counterpointeng.com>

RE: 280 Clair Road West - Engineering Q & A

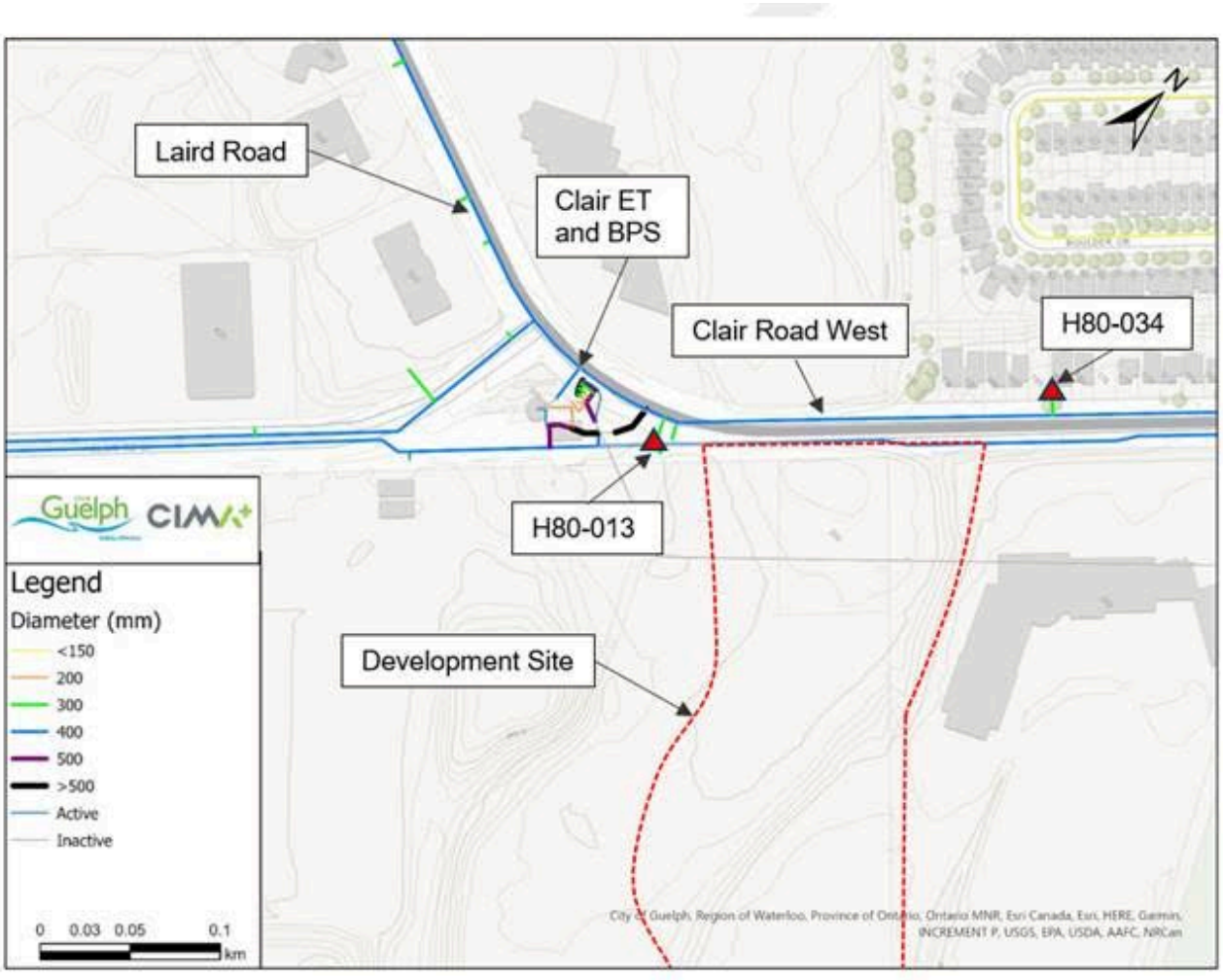
1 message

Michelle Thalen <Michelle.Thalen@guelph.ca> Thu, Jun 27, 2024 at 4:46 PM
To: "Howkins, Jake" <jhowkins@counterpointeng.com>, John Farley <jdfarley@gmail.com>
Cc: Mary Angelo <Mary.Angelo@guelph.ca>

Hi Jake and John,

The results from the water and waste water capacity analysis have been completed and are as follows:

Water



- Please note that the fire flow proposed by Counterpoint for the site was defined to be 266.7 L/s which is the commercial rate whereas high density residential is 200 L/s. The higher fire flow was used within the model as per the request.
- Based on the model results, the water system at the proposed development provided a pressure of 82 psi under both ADD and MDD conditions which slightly exceeds the City's preferred operating range of

50 – 80 psi but is still below the maximum allowable pressure of 100 psi. The available fire flow at hydrants H80-013, and H80-034 surpassed the calculated FUS fire flow requirement of 266.7 L/s and the City's guideline of 200 L/s.

Sanitary

- The model shows there is no surcharging between the subject site and the WWTP. Along the flow path from the local receiving sewer to the WWTP, there are 4 MHs with a HGL freeboard less than 1.8 m. For all 4 MHs, the HGL freeboard is also less than 1.8 m under existing conditions. 3 junctions with a HGL freeboard less than 1.8 m are located between the siphon and the WWTP, and all 4 are associated with shallow sewers. The fact that there is no surcharging from the subject site to the WWTP and the maximum decrease in HGL freeboard in MHs with an HGL freeboard less than 1.8 m is 2 cm suggests the existing network has sufficient capacity to manage the existing flows, as well as the additional flows from the proposed development.

Trusting the above information will assist you with detailed design.

Should you have any questions, feel free to contact me at your convenience.

Best regards,

Michelle Thalen, C.Tech, Engineering Technologist III

Engineering and Transportation Services
City of Guelph

T 519-822-1260 x 2333 | F 519-822-6194
E michelle.thalen@guelph.ca

guelph.ca

From: Howkins, Jake <jhowkins@counterpointeng.com>
Sent: Monday, June 3, 2024 4:35 PM
To: Michelle Thalen <Michelle.Thalen@guelph.ca>
Cc: Mary Angelo <Mary.Angelo@guelph.ca>
Subject: Re: 280 Clair Road West - Engineering Q & A

Hi Michelle,

Counterpoint Engineering Inc.

Proposed Conditions - Sanitary

Previous Calculations Coordinated with Municipal Staff for Modeling

Project: 280 Clair Road
Project No: 24010
Location: Guelph
Site Area: 8.56 ha

City of Guelph Sanitary Guidelines

Average Flow		
Residential	300	litres/person/day
ICI	300	litres/person/day
Inflow and Infiltration	0.25	litres/second/ha

Retail/Residential Population Criteria		
Apartment	1.86	ppu
Single/Semi Detached	3.4	ppu
Townhouse	2.45	ppu
ICI	30	ppu/ha

	Residential Units			Commercial	Office
	Apartment Units	Townhouse Units	Total Units	Area (m^2)*	Area (m^2)
Townhouses	0	**339**	339		
Tower A	328	**0**	328		
Tower B	328	**0**	328		
TOTAL	**656**	**339**	**995**		

** Note: GFA used for retail calculation. Represents YMCA space.*

	Population Apartment Units	Population Townhouse Units	TOTAL POPULATION	Average Flow (l/day)	l/s
Residential	1220	831	2051	615300	7.12

	Area (m^2)	Average Flow (l/day)	l/s
Commercial Area	0.00	0	0.00

Harmon Peaking Factor

Total Population	Harmon Peak Factor
2051	**3.58**

Commercial Peak Sanitary Flow	0.00	**l/s**	
Residential Peak Sanitary Flow	25.48	**l/s**	
Total Sanitary Flow	25.48	**l/s**	
Infiltration	2.14	**l/s**	
Groundwater Rate	0.00	**l/s**	*No LT GW discharge.*
Total Peak Flow	**27.62**	**l/s**	
Net Increase from Existing	**27.62**	**l/s**	

APPENDIX D

SWM Calculations

SWM DESIGN CALCULATIONS
RIPRAP Sizing for Outlet 1 (Area 5.4ha)

Project Name: 280 Clair Road
Municipality: Guelph
Project No.: 24010
Date: 8-Nov-24

Prepared by: R.K.
Checked by:
Last Revised: 8-Nov-24

Pipe Input Parameters:

Pipe Manning Roughness, n	**0.013**	
Pipe Outlet Slope, S	**0.0050**	m / m
Pipe Diameter	**0.825**	m
Pipe Diameter	33	inch

Pipe Computed Values

Pipe Area, A	0.53	m^2
Wetted Perimeter, P	2.59	m
Hydraulic Radius, R	0.206	m
Velocity, V	**1.9**	m / s
Full flow	1.02	m^3 / s
Full flow	36	ft^3 / s)

RIPRAP Calculations:

D_{50} (From USDA Table)	**160**	mm		<-- Looked up on table using computed velocity
D_{50} (USDA Chart)	160	mm	**0.5** ft	<-- Look up on chart using flow and diameter
Average	160	mm		
Max Size (1.5 x D_{50})	240	mm		
Blanket Thickness (2.25 x D_{50})	360	mm		

Assumed minimum tailwater conditions (i.e. discharge to open area)

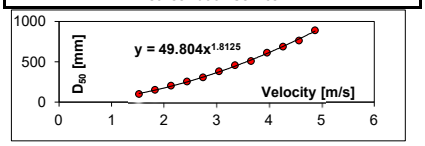
Apron Length (minimum)	4.9	m	**16** ft	<-- Look up on chart using flow and diameter
Apron width at outlet (minimum)	2.5	m		
Apron width at length "L"	5.7	m		

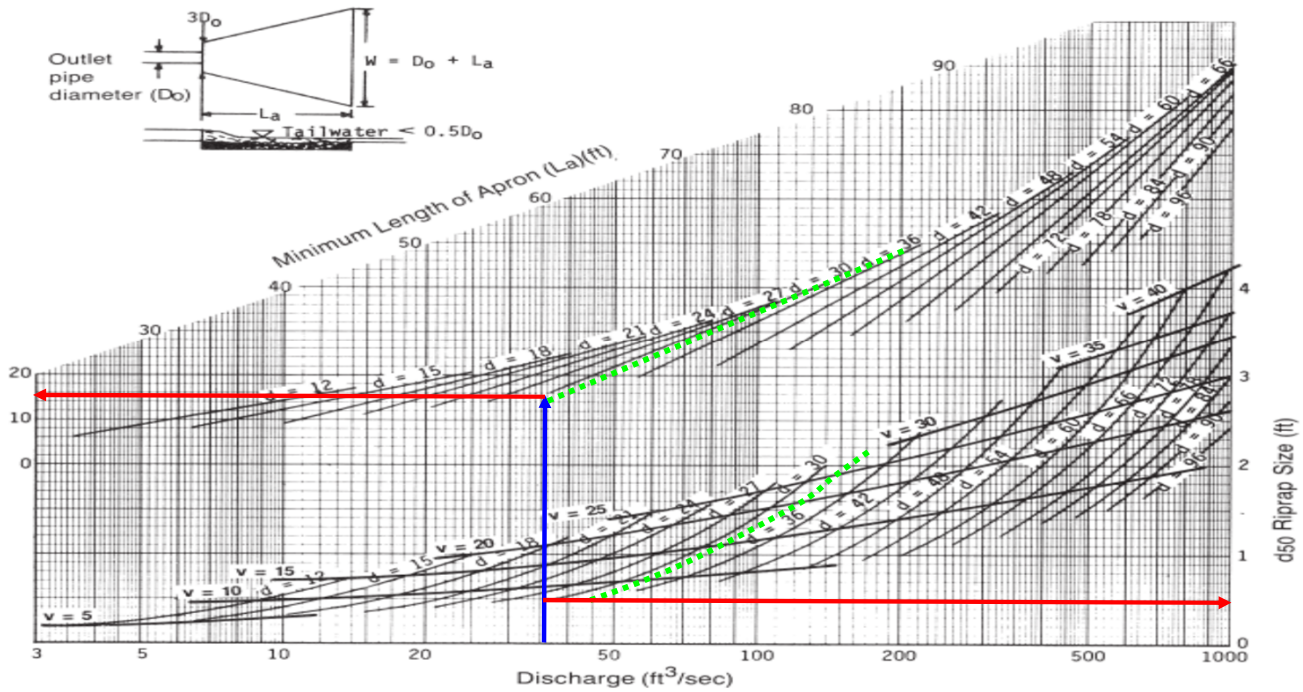
Provided size: **200-300mm RIP-RAP**

Source: USDA / SCS & MTO Drainage Manual

Velocity		Minimum D_{50}		Rock Weight
m / s	ft / s	mm	inches	pounds
1.5	5	102	4	3
1.8	6	152	6	10
2.1	7	203	8	24
2.4	8	254	10	47
2.7	9	305	12	81
3.0	10	381	15	158
3.4	11	457	18	273
3.7	12	508	20	375
4.0	13	610	24	650
4.3	14	686	27	925
4.6	15	762	30	1268
4.9	16	889	35	2013

Source: US Environmental Protection Agency / USDA Soil Conservation Service





Counterpoint Engineering Inc.
8395 Jane Street, Suite 100 Vaughan, Ontario L4K 5Y2
TEL: (905) 326-1404 FAX: (905) 326-1405
www.counterpointeng.com

SWM DESIGN CALCULATIONS
RIPRAP Sizing for Outlet 2 (Area 0.43ha)

Project Name: 280 Clair Road
Municipality: Guelph
Project No.: 24010
Date: 8-Nov-24

Prepared by: R.K.
Checked by:
Last Revised: 8-Nov-24

Pipe Input Parameters:

Pipe Manning Roughness, n	**0.013**	
Pipe Outlet Slope, S	**0.0050**	m / m
Pipe Diameter	**0.675**	m
Pipe Diameter	27	inch

Pipe Computed Values

Pipe Area, A	0.36	m^2
Wetted Perimeter, P	2.12	m
Hydraulic Radius, R	0.169	m
Velocity, V	**1.7**	m / s
Full flow	0.59	m^3 / s
Full flow	21	ft^3 / s)

RIPRAP Calculations:

D_{50} (From USDA Table)	**130**	mm		<-- Looked up on table using computed velocity
D_{50} (USDA Chart)	130	mm	**0.4** ft	<-- Look up on chart using flow and diameter
Average	130	mm		
Max Size (1.5 x D_{50})	195	mm		
Blanket Thickness (2.25 x D_{50})	293	mm		

Assumed minimum tailwater conditions (i.e. discharge to open area)

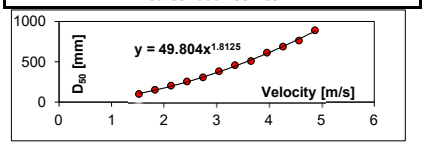
Apron Length (minimum)	3.0	m	**10** ft	<-- Look up on chart using flow and diameter
Apron width at outlet (minimum)	2.0	m		
Apron width at length "L"	3.7	m		

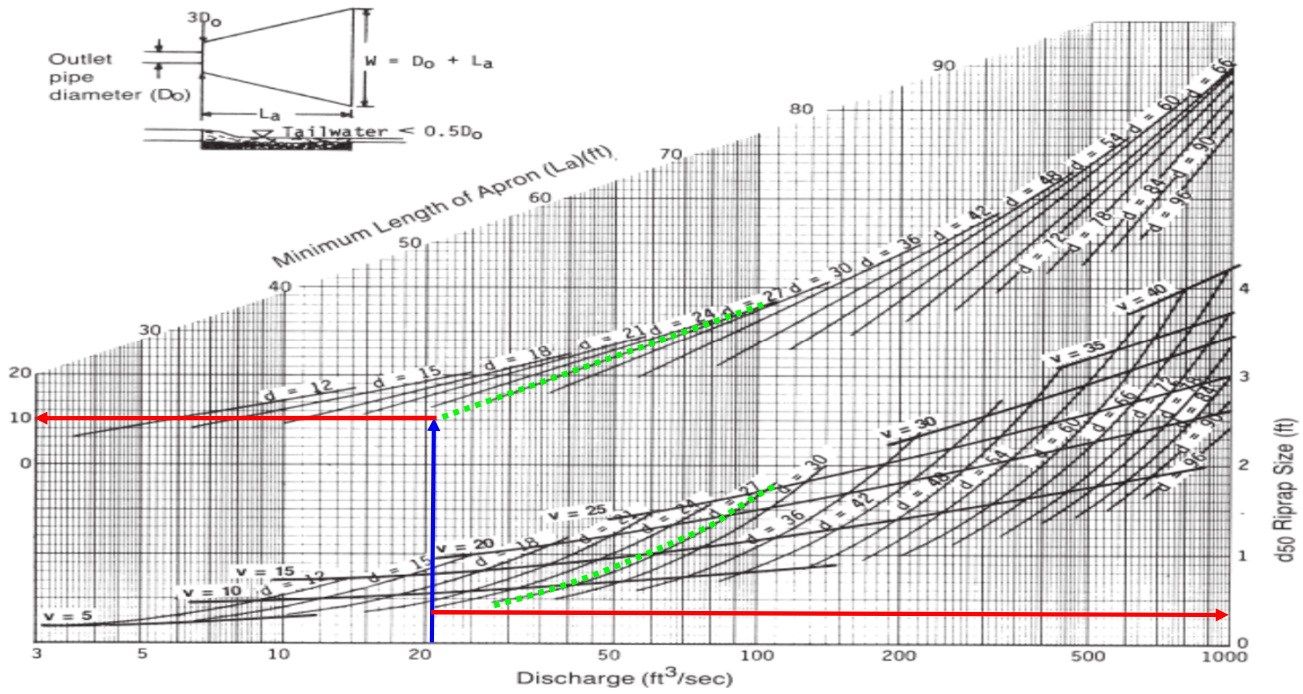
Provided size: **150-250mm RIP-RAP**

Source: USDA / SCS & MTO Drainage Manual

Velocity		Minimum D_{50}		Rock Weight
m / s	ft / s	mm	inches	pounds
1.5	5	102	4	3
1.8	6	152	6	10
2.1	7	203	8	24
2.4	8	254	10	47
2.7	9	305	12	81
3.0	10	381	15	158
3.4	11	457	18	273
3.7	12	508	20	375
4.0	13	610	24	650
4.3	14	686	27	925
4.6	15	762	30	1268
4.9	16	889	35	2013

Source: US Environmental Protection Agency / USDA Soil Conservation Service





Counterpoint Engineering Inc.
8395 Jane Street, Suite 100 Vaughan, Ontario L4K 5Y2
TEL: (905) 326-1404 FAX: (905) 326-1405
www.counterpointeng.com

5.5.1 Storm Sewer Flows

The designed flow shall be computed on the standard City of Guelph design sheet according to the Rational Method equation as follows:

$Q = KCIA$

Where:

Q = Design flow (m3/sec)

K = Conversion factor (0.00278)

C = Runoff Coefficient

I = Rainfall intensity (mm/hour)

A = Contributing drainage area (ha)

Storm sewers shall be designed to flow at a maximum of 95% full flow design capacity of the pipe size, while trunk sewers (1200mm diameter and larger) are to be designed to 85% of full flow design capacity.

Note: when calculating capacity, a roughness coefficient of 0.013 is to be used for all smooth-walled pipes, and roughness coefficient of 0.024 is to be used for all corrugated pipe.

5.5.1.1 Rainfall Intensity

The intensity of rainfall shall be determined based on City of Guelph IDF data has been updated in accordance with the City's Stormwater Management Master Plan using the following rainfall intensity equation and parameters:

$I = A(tc)^B$

Where:

I = Rainfall Intensity (mm/hr)

A & B = Parameters as per Table 1

tc = Initial time of concentration (min)

Table 5-2 Rainfall Intensity Parameters

Return Period	A	B
2-year	475.61	-0.738
5-year	632.75	-0.741
10-year	721.92	-0.736
25-year	822.74	-0.725
50-year	893.80	-0.719
100-year	953.29	-0.711

Table 5-3 Rainfall Distribution for Regional Storm (Hurricane Hazel 1954)

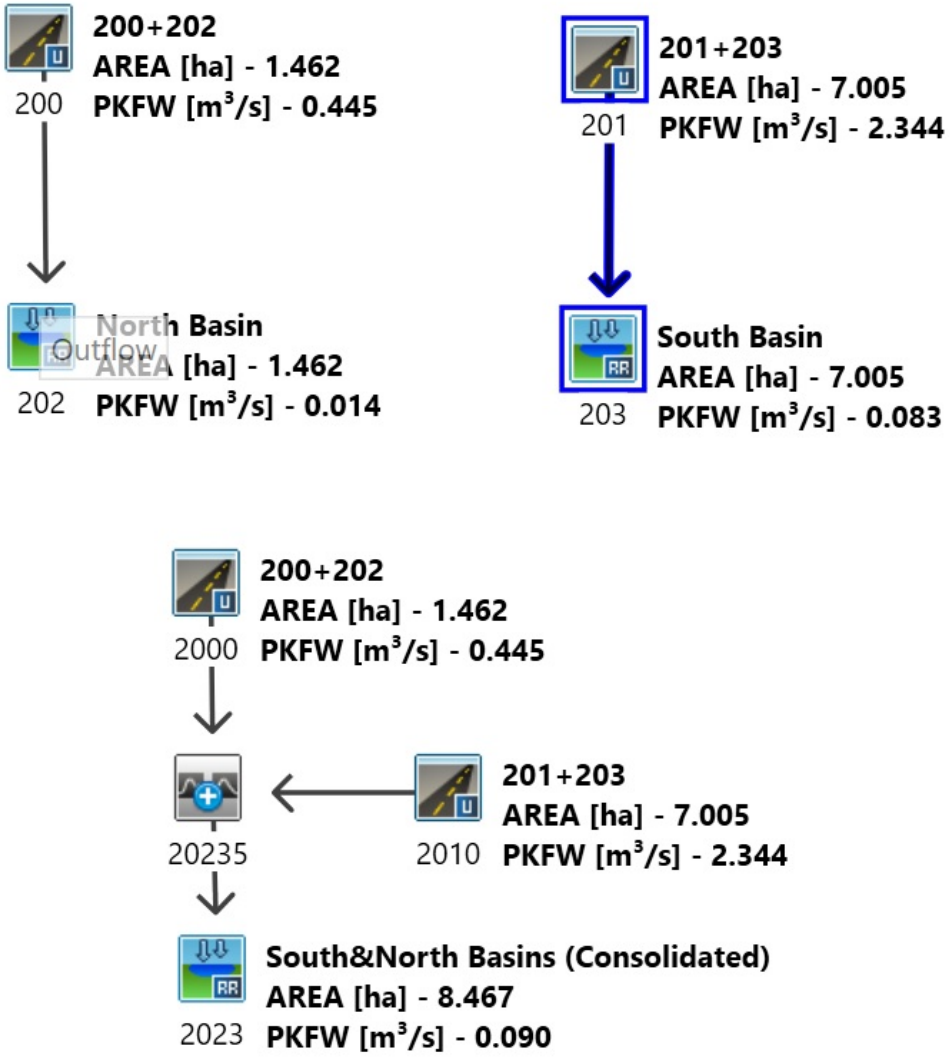
Regional Storm Rainfall Distribution

DT (min)	60	120	180	240	300	360	420	480	540	600
600	2.028	2.028	2.028	2.028	2.028	2.028	2.028	2.028	2.028	2.028
1200	2.028	2.028	2.028	2.028	2.028	2.028	2.028	2.028	2.028	2.028
1800	2.028	2.028	2.028	2.028	2.028	2.028	2.028	2.028	2.028	2.028
2400	2.028	2.026	2.026	2.026	2.028	2.026	6.000	4.000	6.000	13.000
	17.000	13.000	23.000	13.000	13.000	53.000	38.000	13.000	Depth = 285.0mm	

5.5.1.2 Runoff Coefficients

Runoff Coefficients shall be determined from the following types of land uses within the drainage area:

VO6 Model Schematic Post-development Condition



```
================================================================================
========================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.


                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\21nk\AppData\Local\Civica\VH5\3a96e338-2316-473b-9cca-f5ecb795c5b4\72f8cc5
6-c285-4583-b3c1-2f80d40ba2b1\scenari
  Summary filename:
C:\Users\21nk\AppData\Local\Civica\VH5\3a96e338-2316-473b-9cca-f5ecb795c5b4\72f8cc5
6-c285-4583-b3c1-2f80d40ba2b1\scenari


DATE: 11-07-2024                          TIME: 07:29:47

USER: Reza Kazemi



COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
------------------------
  ********************************************
  ** SIMULATION : 100-year 24hr Chicago Design  **
  ********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 953.290
| Ptotal=129.97 mm |                          B=   0.000
--------------------                          C=   0.711
```

used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	1.59	6.00	4.51	12.00	4.06	18.00	2.16
0.17	1.62	6.17	4.83	12.17	3.95	18.17	2.13
0.33	1.64	6.33	5.21	12.33	3.84	18.33	2.11
0.50	1.67	6.50	5.68	12.50	3.74	18.50	2.08
0.67	1.70	6.67	6.26	12.67	3.65	18.67	2.06
0.83	1.72	6.83	7.01	12.83	3.57	18.83	2.04
1.00	1.75	7.00	8.02	13.00	3.48	19.00	2.02
1.17	1.79	7.17	9.47	13.17	3.41	19.17	2.00
1.33	1.82	7.33	11.77	13.33	3.33	19.33	1.98
1.50	1.85	7.50	16.19	13.50	3.26	19.50	1.96
1.67	1.89	7.67	30.45	13.67	3.20	19.67	1.94
1.83	1.93	7.83	185.45	13.83	3.13	19.83	1.92
2.00	1.96	8.00	37.49	14.00	3.07	20.00	1.90
2.17	2.01	8.17	23.45	14.17	3.02	20.17	1.88
2.33	2.05	8.33	17.80	14.33	2.96	20.33	1.86
2.50	2.09	8.50	14.61	14.50	2.91	20.50	1.85
2.67	2.14	8.67	12.53	14.67	2.86	20.67	1.83
2.83	2.19	8.83	11.04	14.83	2.81	20.83	1.81
3.00	2.25	9.00	9.92	15.00	2.76	21.00	1.80
3.17	2.30	9.17	9.04	15.17	2.72	21.17	1.78
3.33	2.36	9.33	8.32	15.33	2.68	21.33	1.76
3.50	2.43	9.50	7.73	15.50	2.63	21.50	1.75
3.67	2.50	9.67	7.23	15.67	2.59	21.67	1.73
3.83	2.57	9.83	6.80	15.83	2.56	21.83	1.72
4.00	2.65	10.00	6.43	16.00	2.52	22.00	1.70
4.17	2.74	10.17	6.10	16.17	2.48	22.17	1.69
4.33	2.83	10.33	5.82	16.33	2.45	22.33	1.68
4.50	2.93	10.50	5.56	16.50	2.42	22.50	1.66
4.67	3.04	10.67	5.32	16.67	2.38	22.67	1.65
4.83	3.16	10.83	5.11	16.83	2.35	22.83	1.64
5.00	3.30	11.00	4.92	17.00	2.32	23.00	1.62
5.17	3.44	11.17	4.75	17.17	2.29	23.17	1.61
5.33	3.61	11.33	4.59	17.33	2.26	23.33	1.60
5.50	3.79	11.50	4.44	17.50	2.24	23.50	1.59
5.67	4.00	11.67	4.30	17.67	2.21	23.67	1.58
5.83	4.23	11.83	4.17	17.83	2.18	23.83	1.56

CALIB STANDHYD (0200)	Area (ha)= 1.46

|ID= 1 DT= 5.0 min | Total Imp(%)= 43.00 Dir. Conn.(%)= 43.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.63	0.83
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	98.73	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.59	6.083	4.51	12.083	4.06	18.08	2.16
0.167	1.59	6.167	4.51	12.167	4.06	18.17	2.16
0.250	1.62	6.250	4.83	12.250	3.95	18.25	2.13
0.333	1.62	6.333	4.83	12.333	3.95	18.33	2.13
0.417	1.64	6.417	5.21	12.417	3.84	18.42	2.11
0.500	1.64	6.500	5.21	12.500	3.84	18.50	2.11
0.583	1.67	6.583	5.68	12.583	3.74	18.58	2.08
0.667	1.67	6.667	5.68	12.667	3.74	18.67	2.08
0.750	1.70	6.750	6.26	12.750	3.65	18.75	2.06
0.833	1.70	6.833	6.26	12.833	3.65	18.83	2.06
0.917	1.72	6.917	7.01	12.917	3.57	18.92	2.04
1.000	1.72	7.000	7.01	13.000	3.57	19.00	2.04
1.083	1.75	7.083	8.02	13.083	3.48	19.08	2.02
1.167	1.75	7.167	8.02	13.167	3.48	19.17	2.02
1.250	1.79	7.250	9.47	13.250	3.41	19.25	2.00
1.333	1.79	7.333	9.47	13.333	3.41	19.33	2.00
1.417	1.82	7.417	11.77	13.417	3.33	19.42	1.98
1.500	1.82	7.500	11.77	13.500	3.33	19.50	1.98
1.583	1.85	7.583	16.19	13.583	3.26	19.58	1.96
1.667	1.85	7.667	16.19	13.667	3.26	19.67	1.96
1.750	1.89	7.750	30.45	13.750	3.20	19.75	1.94
1.833	1.89	7.833	30.46	13.833	3.20	19.83	1.94
1.917	1.93	7.917	185.45	13.917	3.13	19.92	1.92
2.000	1.93	8.000	185.44	14.000	3.13	20.00	1.92
2.083	1.96	8.083	37.49	14.083	3.07	20.08	1.90
2.167	1.96	8.167	37.49	14.167	3.07	20.17	1.90
2.250	2.01	8.250	23.45	14.250	3.02	20.25	1.88
2.333	2.01	8.333	23.45	14.333	3.02	20.33	1.88
2.417	2.05	8.417	17.80	14.417	2.96	20.42	1.86
2.500	2.05	8.500	17.80	14.500	2.96	20.50	1.86
2.583	2.09	8.583	14.61	14.583	2.91	20.58	1.85
2.667	2.09	8.667	14.61	14.667	2.91	20.67	1.85
2.750	2.14	8.750	12.53	14.750	2.86	20.75	1.83
2.833	2.14	8.833	12.53	14.833	2.86	20.83	1.83
2.917	2.19	8.917	11.04	14.917	2.81	20.92	1.81

3.000	2.19	9.000	11.04	15.000	2.81	21.00	1.81
3.083	2.25	9.083	9.92	15.083	2.76	21.08	1.80
3.167	2.25	9.167	9.92	15.167	2.76	21.17	1.80
3.250	2.30	9.250	9.04	15.250	2.72	21.25	1.78
3.333	2.30	9.333	9.04	15.333	2.72	21.33	1.78
3.417	2.36	9.417	8.32	15.417	2.68	21.42	1.76
3.500	2.36	9.500	8.32	15.500	2.68	21.50	1.76
3.583	2.43	9.583	7.73	15.583	2.63	21.58	1.75
3.667	2.43	9.667	7.73	15.667	2.63	21.67	1.75
3.750	2.50	9.750	7.23	15.750	2.59	21.75	1.73
3.833	2.50	9.833	7.23	15.833	2.59	21.83	1.73
3.917	2.57	9.917	6.80	15.917	2.56	21.92	1.72
4.000	2.57	10.000	6.80	16.000	2.56	22.00	1.72
4.083	2.65	10.083	6.43	16.083	2.52	22.08	1.70
4.167	2.65	10.167	6.43	16.167	2.52	22.17	1.70
4.250	2.74	10.250	6.10	16.250	2.48	22.25	1.69
4.333	2.74	10.333	6.10	16.333	2.48	22.33	1.69
4.417	2.83	10.417	5.82	16.417	2.45	22.42	1.68
4.500	2.83	10.500	5.82	16.500	2.45	22.50	1.68
4.583	2.93	10.583	5.56	16.583	2.42	22.58	1.66
4.667	2.93	10.667	5.56	16.667	2.42	22.67	1.66
4.750	3.04	10.750	5.32	16.750	2.38	22.75	1.65
4.833	3.04	10.833	5.32	16.833	2.38	22.83	1.65
4.917	3.16	10.917	5.11	16.917	2.35	22.92	1.64
5.000	3.16	11.000	5.11	17.000	2.35	23.00	1.64
5.083	3.30	11.083	4.92	17.083	2.32	23.08	1.62
5.167	3.30	11.167	4.92	17.167	2.32	23.17	1.62
5.250	3.44	11.250	4.75	17.250	2.29	23.25	1.61
5.333	3.44	11.333	4.75	17.333	2.29	23.33	1.61
5.417	3.61	11.417	4.59	17.417	2.26	23.42	1.60
5.500	3.61	11.500	4.59	17.500	2.26	23.50	1.60
5.583	3.79	11.583	4.44	17.583	2.24	23.58	1.59
5.667	3.79	11.667	4.44	17.667	2.24	23.67	1.59
5.750	4.00	11.750	4.30	17.750	2.21	23.75	1.58
5.833	4.00	11.833	4.30	17.833	2.21	23.83	1.58
5.917	4.23	11.917	4.17	17.917	2.18	23.92	1.56
6.000	4.23	12.000	4.17	18.000	2.18	24.00	1.56

Max.Eff.Inten.(mm/hr)=	185.45	109.68	
over (min)	5.00	10.00	
Storage Coeff. (min)=	1.98 (ii)	8.78 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00	
Unit Hyd. peak (cms)=	0.31	0.12	
			TOTALS
PEAK FLOW (cms)=	0.32	0.15	0.445 (iii)
TIME TO PEAK (hrs)=	8.00	8.08	8.00
RUNOFF VOLUME (mm)=	128.97	18.28	65.88
TOTAL RAINFALL (mm)=	129.97	129.97	129.97
RUNOFF COEFFICIENT =	0.99	0.14	0.51

```
       (i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
            Fo   (mm/hr)= 72.00          K  (1/hr)=  2.00
            Fc   (mm/hr)= 36.00     Cum.Inf.   (mm)=  0.00
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0202)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)    |   (cms)     (ha.m.)

                           0.0060     0.0000    |   0.0460      0.2410

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0200)      1.462      0.445      8.00      65.88
   OUTFLOW: ID= 1 (  0202)      1.462      0.014      9.50      65.92

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.18
                  TIME SHIFT OF PEAK FLOW         (min)= 90.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0493

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   7.01
|ID= 1 DT= 5.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  55.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       3.85         3.15
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     216.10        40.00
     Mannings n             =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    1.59 | 6.083    4.51 |12.083    4.06 | 18.08    2.16
              0.167    1.59 | 6.167    4.51 |12.167    4.06 | 18.17    2.16
              0.250    1.62 | 6.250    4.83 |12.250    3.95 | 18.25    2.13
              0.333    1.62 | 6.333    4.83 |12.333    3.95 | 18.33    2.13
```

0.417	1.64	6.417	5.21	12.417	3.84	18.42	2.11
0.500	1.64	6.500	5.21	12.500	3.84	18.50	2.11
0.583	1.67	6.583	5.68	12.583	3.74	18.58	2.08
0.667	1.67	6.667	5.68	12.667	3.74	18.67	2.08
0.750	1.70	6.750	6.26	12.750	3.65	18.75	2.06
0.833	1.70	6.833	6.26	12.833	3.65	18.83	2.06
0.917	1.72	6.917	7.01	12.917	3.57	18.92	2.04
1.000	1.72	7.000	7.01	13.000	3.57	19.00	2.04
1.083	1.75	7.083	8.02	13.083	3.48	19.08	2.02
1.167	1.75	7.167	8.02	13.167	3.48	19.17	2.02
1.250	1.79	7.250	9.47	13.250	3.41	19.25	2.00
1.333	1.79	7.333	9.47	13.333	3.41	19.33	2.00
1.417	1.82	7.417	11.77	13.417	3.33	19.42	1.98
1.500	1.82	7.500	11.77	13.500	3.33	19.50	1.98
1.583	1.85	7.583	16.19	13.583	3.26	19.58	1.96
1.667	1.85	7.667	16.19	13.667	3.26	19.67	1.96
1.750	1.89	7.750	30.45	13.750	3.20	19.75	1.94
1.833	1.89	7.833	30.46	13.833	3.20	19.83	1.94
1.917	1.93	7.917	185.45	13.917	3.13	19.92	1.92
2.000	1.93	8.000	185.44	14.000	3.13	20.00	1.92
2.083	1.96	8.083	37.49	14.083	3.07	20.08	1.90
2.167	1.96	8.167	37.49	14.167	3.07	20.17	1.90
2.250	2.01	8.250	23.45	14.250	3.02	20.25	1.88
2.333	2.01	8.333	23.45	14.333	3.02	20.33	1.88
2.417	2.05	8.417	17.80	14.417	2.96	20.42	1.86
2.500	2.05	8.500	17.80	14.500	2.96	20.50	1.86
2.583	2.09	8.583	14.61	14.583	2.91	20.58	1.85
2.667	2.09	8.667	14.61	14.667	2.91	20.67	1.85
2.750	2.14	8.750	12.53	14.750	2.86	20.75	1.83
2.833	2.14	8.833	12.53	14.833	2.86	20.83	1.83
2.917	2.19	8.917	11.04	14.917	2.81	20.92	1.81
3.000	2.19	9.000	11.04	15.000	2.81	21.00	1.81
3.083	2.25	9.083	9.92	15.083	2.76	21.08	1.80
3.167	2.25	9.167	9.92	15.167	2.76	21.17	1.80
3.250	2.30	9.250	9.04	15.250	2.72	21.25	1.78
3.333	2.30	9.333	9.04	15.333	2.72	21.33	1.78
3.417	2.36	9.417	8.32	15.417	2.68	21.42	1.76
3.500	2.36	9.500	8.32	15.500	2.68	21.50	1.76
3.583	2.43	9.583	7.73	15.583	2.63	21.58	1.75
3.667	2.43	9.667	7.73	15.667	2.63	21.67	1.75
3.750	2.50	9.750	7.23	15.750	2.59	21.75	1.73
3.833	2.50	9.833	7.23	15.833	2.59	21.83	1.73
3.917	2.57	9.917	6.80	15.917	2.56	21.92	1.72
4.000	2.57	10.000	6.80	16.000	2.56	22.00	1.72
4.083	2.65	10.083	6.43	16.083	2.52	22.08	1.70
4.167	2.65	10.167	6.43	16.167	2.52	22.17	1.70
4.250	2.74	10.250	6.10	16.250	2.48	22.25	1.69
4.333	2.74	10.333	6.10	16.333	2.48	22.33	1.69
4.417	2.83	10.417	5.82	16.417	2.45	22.42	1.68
4.500	2.83	10.500	5.82	16.500	2.45	22.50	1.68

4.583	2.93	10.583	5.56	16.583	2.42	22.58	1.66
4.667	2.93	10.667	5.56	16.667	2.42	22.67	1.66
4.750	3.04	10.750	5.32	16.750	2.38	22.75	1.65
4.833	3.04	10.833	5.32	16.833	2.38	22.83	1.65
4.917	3.16	10.917	5.11	16.917	2.35	22.92	1.64
5.000	3.16	11.000	5.11	17.000	2.35	23.00	1.64
5.083	3.30	11.083	4.92	17.083	2.32	23.08	1.62
5.167	3.30	11.167	4.92	17.167	2.32	23.17	1.62
5.250	3.44	11.250	4.75	17.250	2.29	23.25	1.61
5.333	3.44	11.333	4.75	17.333	2.29	23.33	1.61
5.417	3.61	11.417	4.59	17.417	2.26	23.42	1.60
5.500	3.61	11.500	4.59	17.500	2.26	23.50	1.60
5.583	3.79	11.583	4.44	17.583	2.24	23.58	1.59
5.667	3.79	11.667	4.44	17.667	2.24	23.67	1.59
5.750	4.00	11.750	4.30	17.750	2.21	23.75	1.58
5.833	4.00	11.833	4.30	17.833	2.21	23.83	1.58
5.917	4.23	11.917	4.17	17.917	2.18	23.92	1.56
6.000	4.23	12.000	4.17	18.000	2.18	24.00	1.56

Max.Eff.Inten.(mm/hr)=	185.45	109.68	
over (min)	5.00	10.00	
Storage Coeff. (min)=	3.17 (ii)	9.97 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00	
Unit Hyd. peak (cms)=	0.27	0.11	
			TOTALS
PEAK FLOW (cms)=	1.91	0.54	2.344 (iii)
TIME TO PEAK (hrs)=	8.00	8.08	8.00
RUNOFF VOLUME (mm)=	128.97	18.28	79.16
TOTAL RAINFALL (mm)=	129.97	129.97	129.97
RUNOFF COEFFICIENT =	0.99	0.14	0.61

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 72.00 K (1/hr)= 2.00
Fc (mm/hr)= 36.00 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(0203) / IN= 2---> OUT= 1 / DT= 5.0 min	OVERFLOW IS OFF			
	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0029	0.0000	0.0968	0.3785

AREA	QPEAK	TPEAK	R.V.

	(ha)	(cms)	(hrs)	(mm)
INFLOW : ID= 2 (0201)	7.005	2.344	8.00	79.16
OUTFLOW: ID= 1 (0203)	7.005	0.083	9.67	79.16

PEAK FLOW REDUCTION [Qout/Qin](%)= 3.53
TIME SHIFT OF PEAK FLOW (min)=100.00
MAXIMUM STORAGE USED (ha.m.)= 0.3218

CALIB STANDHYD (2000) ID= 1 DT= 5.0 min	Area (ha)= 1.46 Total Imp(%)= 43.00 Dir. Conn.(%)= 43.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.63	0.83
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	98.73	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.59	6.083	4.51	12.083	4.06	18.08	2.16
0.167	1.59	6.167	4.51	12.167	4.06	18.17	2.16
0.250	1.62	6.250	4.83	12.250	3.95	18.25	2.13
0.333	1.62	6.333	4.83	12.333	3.95	18.33	2.13
0.417	1.64	6.417	5.21	12.417	3.84	18.42	2.11
0.500	1.64	6.500	5.21	12.500	3.84	18.50	2.11
0.583	1.67	6.583	5.68	12.583	3.74	18.58	2.08
0.667	1.67	6.667	5.68	12.667	3.74	18.67	2.08
0.750	1.70	6.750	6.26	12.750	3.65	18.75	2.06
0.833	1.70	6.833	6.26	12.833	3.65	18.83	2.06
0.917	1.72	6.917	7.01	12.917	3.57	18.92	2.04
1.000	1.72	7.000	7.01	13.000	3.57	19.00	2.04
1.083	1.75	7.083	8.02	13.083	3.48	19.08	2.02
1.167	1.75	7.167	8.02	13.167	3.48	19.17	2.02
1.250	1.79	7.250	9.47	13.250	3.41	19.25	2.00
1.333	1.79	7.333	9.47	13.333	3.41	19.33	2.00
1.417	1.82	7.417	11.77	13.417	3.33	19.42	1.98
1.500	1.82	7.500	11.77	13.500	3.33	19.50	1.98
1.583	1.85	7.583	16.19	13.583	3.26	19.58	1.96
1.667	1.85	7.667	16.19	13.667	3.26	19.67	1.96
1.750	1.89	7.750	30.45	13.750	3.20	19.75	1.94
1.833	1.89	7.833	30.46	13.833	3.20	19.83	1.94
1.917	1.93	7.917	185.45	13.917	3.13	19.92	1.92

2.000	1.93	8.000	185.44	14.000	3.13	20.00	1.92
2.083	1.96	8.083	37.49	14.083	3.07	20.08	1.90
2.167	1.96	8.167	37.49	14.167	3.07	20.17	1.90
2.250	2.01	8.250	23.45	14.250	3.02	20.25	1.88
2.333	2.01	8.333	23.45	14.333	3.02	20.33	1.88
2.417	2.05	8.417	17.80	14.417	2.96	20.42	1.86
2.500	2.05	8.500	17.80	14.500	2.96	20.50	1.86
2.583	2.09	8.583	14.61	14.583	2.91	20.58	1.85
2.667	2.09	8.667	14.61	14.667	2.91	20.67	1.85
2.750	2.14	8.750	12.53	14.750	2.86	20.75	1.83
2.833	2.14	8.833	12.53	14.833	2.86	20.83	1.83
2.917	2.19	8.917	11.04	14.917	2.81	20.92	1.81
3.000	2.19	9.000	11.04	15.000	2.81	21.00	1.81
3.083	2.25	9.083	9.92	15.083	2.76	21.08	1.80
3.167	2.25	9.167	9.92	15.167	2.76	21.17	1.80
3.250	2.30	9.250	9.04	15.250	2.72	21.25	1.78
3.333	2.30	9.333	9.04	15.333	2.72	21.33	1.78
3.417	2.36	9.417	8.32	15.417	2.68	21.42	1.76
3.500	2.36	9.500	8.32	15.500	2.68	21.50	1.76
3.583	2.43	9.583	7.73	15.583	2.63	21.58	1.75
3.667	2.43	9.667	7.73	15.667	2.63	21.67	1.75
3.750	2.50	9.750	7.23	15.750	2.59	21.75	1.73
3.833	2.50	9.833	7.23	15.833	2.59	21.83	1.73
3.917	2.57	9.917	6.80	15.917	2.56	21.92	1.72
4.000	2.57	10.000	6.80	16.000	2.56	22.00	1.72
4.083	2.65	10.083	6.43	16.083	2.52	22.08	1.70
4.167	2.65	10.167	6.43	16.167	2.52	22.17	1.70
4.250	2.74	10.250	6.10	16.250	2.48	22.25	1.69
4.333	2.74	10.333	6.10	16.333	2.48	22.33	1.69
4.417	2.83	10.417	5.82	16.417	2.45	22.42	1.68
4.500	2.83	10.500	5.82	16.500	2.45	22.50	1.68
4.583	2.93	10.583	5.56	16.583	2.42	22.58	1.66
4.667	2.93	10.667	5.56	16.667	2.42	22.67	1.66
4.750	3.04	10.750	5.32	16.750	2.38	22.75	1.65
4.833	3.04	10.833	5.32	16.833	2.38	22.83	1.65
4.917	3.16	10.917	5.11	16.917	2.35	22.92	1.64
5.000	3.16	11.000	5.11	17.000	2.35	23.00	1.64
5.083	3.30	11.083	4.92	17.083	2.32	23.08	1.62
5.167	3.30	11.167	4.92	17.167	2.32	23.17	1.62
5.250	3.44	11.250	4.75	17.250	2.29	23.25	1.61
5.333	3.44	11.333	4.75	17.333	2.29	23.33	1.61
5.417	3.61	11.417	4.59	17.417	2.26	23.42	1.60
5.500	3.61	11.500	4.59	17.500	2.26	23.50	1.60
5.583	3.79	11.583	4.44	17.583	2.24	23.58	1.59
5.667	3.79	11.667	4.44	17.667	2.24	23.67	1.59
5.750	4.00	11.750	4.30	17.750	2.21	23.75	1.58
5.833	4.00	11.833	4.30	17.833	2.21	23.83	1.58
5.917	4.23	11.917	4.17	17.917	2.18	23.92	1.56
6.000	4.23	12.000	4.17	18.000	2.18	24.00	1.56

Max.Eff.Inten.(mm/hr)=	185.45	109.68	
over (min)	5.00	10.00	
Storage Coeff. (min)=	1.98 (ii)	8.78 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00	
Unit Hyd. peak (cms)=	0.31	0.12	
			TOTALS
PEAK FLOW (cms)=	0.32	0.15	0.445 (iii)
TIME TO PEAK (hrs)=	8.00	8.08	8.00
RUNOFF VOLUME (mm)=	128.97	18.28	65.88
TOTAL RAINFALL (mm)=	129.97	129.97	129.97
RUNOFF COEFFICIENT =	0.99	0.14	0.51

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 72.00 K (1/hr)= 2.00
Fc (mm/hr)= 36.00 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (2010) ID= 1 DT= 5.0 min	Area (ha)= 7.01 Total Imp(%)= 55.00 Dir. Conn.(%)= 55.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	3.85	3.15
Dep. Storage	(mm)=	1.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	216.10	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.59	6.083	4.51	12.083	4.06	18.08	2.16
0.167	1.59	6.167	4.51	12.167	4.06	18.17	2.16
0.250	1.62	6.250	4.83	12.250	3.95	18.25	2.13
0.333	1.62	6.333	4.83	12.333	3.95	18.33	2.13
0.417	1.64	6.417	5.21	12.417	3.84	18.42	2.11
0.500	1.64	6.500	5.21	12.500	3.84	18.50	2.11
0.583	1.67	6.583	5.68	12.583	3.74	18.58	2.08
0.667	1.67	6.667	5.68	12.667	3.74	18.67	2.08
0.750	1.70	6.750	6.26	12.750	3.65	18.75	2.06
0.833	1.70	6.833	6.26	12.833	3.65	18.83	2.06

0.917	1.72	6.917	7.01	12.917	3.57	18.92	2.04
1.000	1.72	7.000	7.01	13.000	3.57	19.00	2.04
1.083	1.75	7.083	8.02	13.083	3.48	19.08	2.02
1.167	1.75	7.167	8.02	13.167	3.48	19.17	2.02
1.250	1.79	7.250	9.47	13.250	3.41	19.25	2.00
1.333	1.79	7.333	9.47	13.333	3.41	19.33	2.00
1.417	1.82	7.417	11.77	13.417	3.33	19.42	1.98
1.500	1.82	7.500	11.77	13.500	3.33	19.50	1.98
1.583	1.85	7.583	16.19	13.583	3.26	19.58	1.96
1.667	1.85	7.667	16.19	13.667	3.26	19.67	1.96
1.750	1.89	7.750	30.45	13.750	3.20	19.75	1.94
1.833	1.89	7.833	30.46	13.833	3.20	19.83	1.94
1.917	1.93	7.917	185.45	13.917	3.13	19.92	1.92
2.000	1.93	8.000	185.44	14.000	3.13	20.00	1.92
2.083	1.96	8.083	37.49	14.083	3.07	20.08	1.90
2.167	1.96	8.167	37.49	14.167	3.07	20.17	1.90
2.250	2.01	8.250	23.45	14.250	3.02	20.25	1.88
2.333	2.01	8.333	23.45	14.333	3.02	20.33	1.88
2.417	2.05	8.417	17.80	14.417	2.96	20.42	1.86
2.500	2.05	8.500	17.80	14.500	2.96	20.50	1.86
2.583	2.09	8.583	14.61	14.583	2.91	20.58	1.85
2.667	2.09	8.667	14.61	14.667	2.91	20.67	1.85
2.750	2.14	8.750	12.53	14.750	2.86	20.75	1.83
2.833	2.14	8.833	12.53	14.833	2.86	20.83	1.83
2.917	2.19	8.917	11.04	14.917	2.81	20.92	1.81
3.000	2.19	9.000	11.04	15.000	2.81	21.00	1.81
3.083	2.25	9.083	9.92	15.083	2.76	21.08	1.80
3.167	2.25	9.167	9.92	15.167	2.76	21.17	1.80
3.250	2.30	9.250	9.04	15.250	2.72	21.25	1.78
3.333	2.30	9.333	9.04	15.333	2.72	21.33	1.78
3.417	2.36	9.417	8.32	15.417	2.68	21.42	1.76
3.500	2.36	9.500	8.32	15.500	2.68	21.50	1.76
3.583	2.43	9.583	7.73	15.583	2.63	21.58	1.75
3.667	2.43	9.667	7.73	15.667	2.63	21.67	1.75
3.750	2.50	9.750	7.23	15.750	2.59	21.75	1.73
3.833	2.50	9.833	7.23	15.833	2.59	21.83	1.73
3.917	2.57	9.917	6.80	15.917	2.56	21.92	1.72
4.000	2.57	10.000	6.80	16.000	2.56	22.00	1.72
4.083	2.65	10.083	6.43	16.083	2.52	22.08	1.70
4.167	2.65	10.167	6.43	16.167	2.52	22.17	1.70
4.250	2.74	10.250	6.10	16.250	2.48	22.25	1.69
4.333	2.74	10.333	6.10	16.333	2.48	22.33	1.69
4.417	2.83	10.417	5.82	16.417	2.45	22.42	1.68
4.500	2.83	10.500	5.82	16.500	2.45	22.50	1.68
4.583	2.93	10.583	5.56	16.583	2.42	22.58	1.66
4.667	2.93	10.667	5.56	16.667	2.42	22.67	1.66
4.750	3.04	10.750	5.32	16.750	2.38	22.75	1.65
4.833	3.04	10.833	5.32	16.833	2.38	22.83	1.65
4.917	3.16	10.917	5.11	16.917	2.35	22.92	1.64
5.000	3.16	11.000	5.11	17.000	2.35	23.00	1.64

5.083	3.30	11.083	4.92	17.083	2.32	23.08	1.62
5.167	3.30	11.167	4.92	17.167	2.32	23.17	1.62
5.250	3.44	11.250	4.75	17.250	2.29	23.25	1.61
5.333	3.44	11.333	4.75	17.333	2.29	23.33	1.61
5.417	3.61	11.417	4.59	17.417	2.26	23.42	1.60
5.500	3.61	11.500	4.59	17.500	2.26	23.50	1.60
5.583	3.79	11.583	4.44	17.583	2.24	23.58	1.59
5.667	3.79	11.667	4.44	17.667	2.24	23.67	1.59
5.750	4.00	11.750	4.30	17.750	2.21	23.75	1.58
5.833	4.00	11.833	4.30	17.833	2.21	23.83	1.58
5.917	4.23	11.917	4.17	17.917	2.18	23.92	1.56
6.000	4.23	12.000	4.17	18.000	2.18	24.00	1.56

			TOTALS
Max.Eff.Inten.(mm/hr)=	185.45	109.68	
over (min)	5.00	10.00	
Storage Coeff. (min)=	3.17 (ii)	9.97 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00	
Unit Hyd. peak (cms)=	0.27	0.11	
PEAK FLOW (cms)=	1.91	0.54	2.344 (iii)
TIME TO PEAK (hrs)=	8.00	8.08	8.00
RUNOFF VOLUME (mm)=	128.97	18.28	79.16
TOTAL RAINFALL (mm)=	129.97	129.97	129.97
RUNOFF COEFFICIENT =	0.99	0.14	0.61

(i) HORTONS EQUATION SELECTED FOR PERVIOUS LOSSES:
Fo (mm/hr)= 72.00 K (1/hr)= 2.00
Fc (mm/hr)= 36.00 Cum.Inf. (mm)= 0.00
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (20235)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (2000):	1.46	0.445	8.00	65.88
+	ID2= 2 (2010):	7.01	2.344	8.00	79.16
	ID = 3 (20235):	8.47	2.789	8.00	76.86

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(2023)	OVERFLOW IS OFF
IN= 2---> OUT= 1	

```
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)

                          0.0089     0.0000   |   0.1428      0.6195

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 ( 20235)      8.467      2.789      8.00       76.86
   OUTFLOW: ID= 1 (  2023)      8.467      0.090      9.83       76.87

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.23
                  TIME SHIFT OF PEAK FLOW         (min)=110.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.3751

--------------------------------------------------------------------------------

 FINISH
================================================================================
========================
```

Hydroworks Sizing Summary

24010 Clair Rd - OGS1

Guelph, Ontario

10-31-2024

Recommended Size: HydroDome HD 12

Hydroworks Sizing Program Version 5.8.5

A HydroDome HD 12 is recommended to provide 80 % annual TSS removal based on a drainage area of 4.86 (ha) with an imperviousness of 78 % and Kitchener / Waterloo, Ontario rainfall for the User defined particle size distribution.

The recommended HydroDome HD 12 treats 100 % of the annual runoff and provides 81 % annual TSS removal for the Kitchener / Waterloo rainfall records and User defined particle size distribution.

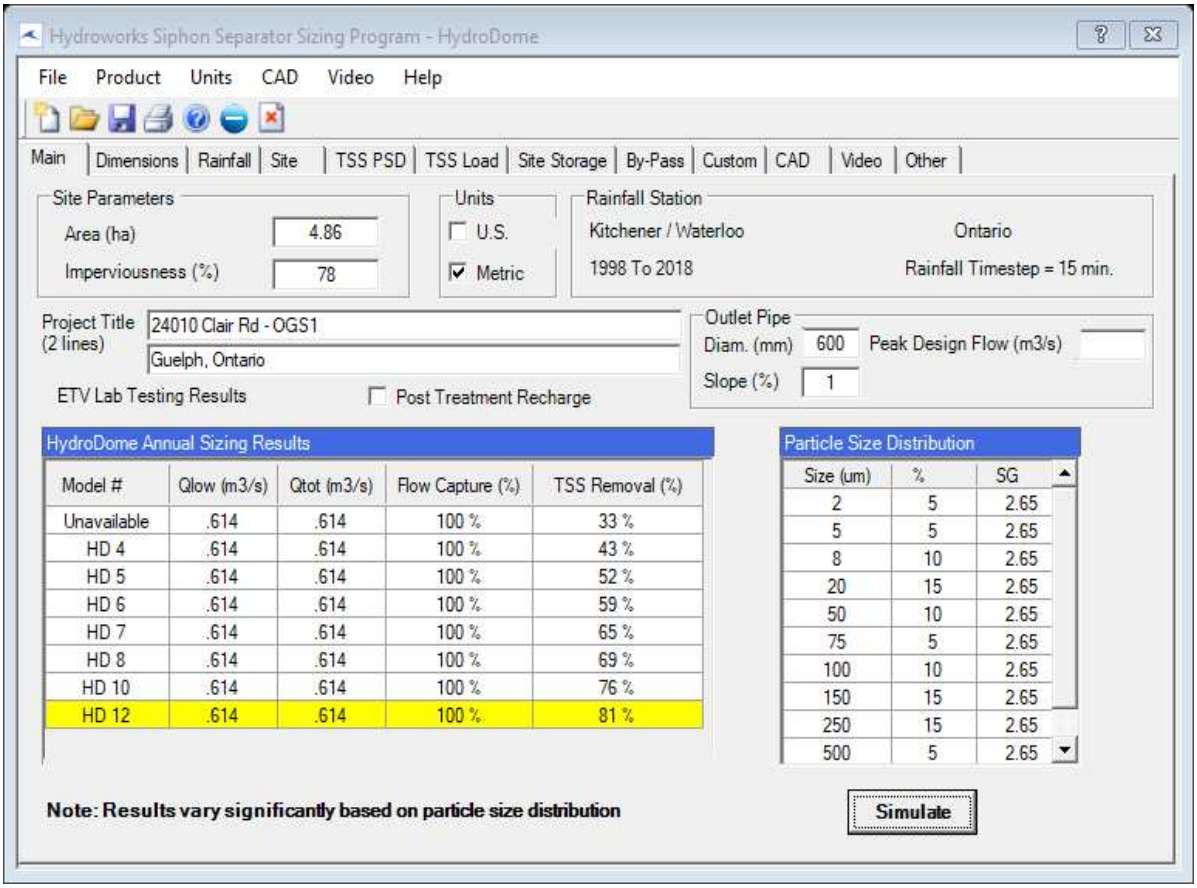
The HydroDome has a siphon which creates a discontinuity in headloss. Since a peak flow was not specified, headloss was calculated using the full pipe flow of .61 (m3/s) for the given 600 (mm) pipe diameter at 1% slope. The headloss was calculated to be 427 (mm) above the crown of the 600 (mm) outlet pipe.

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.

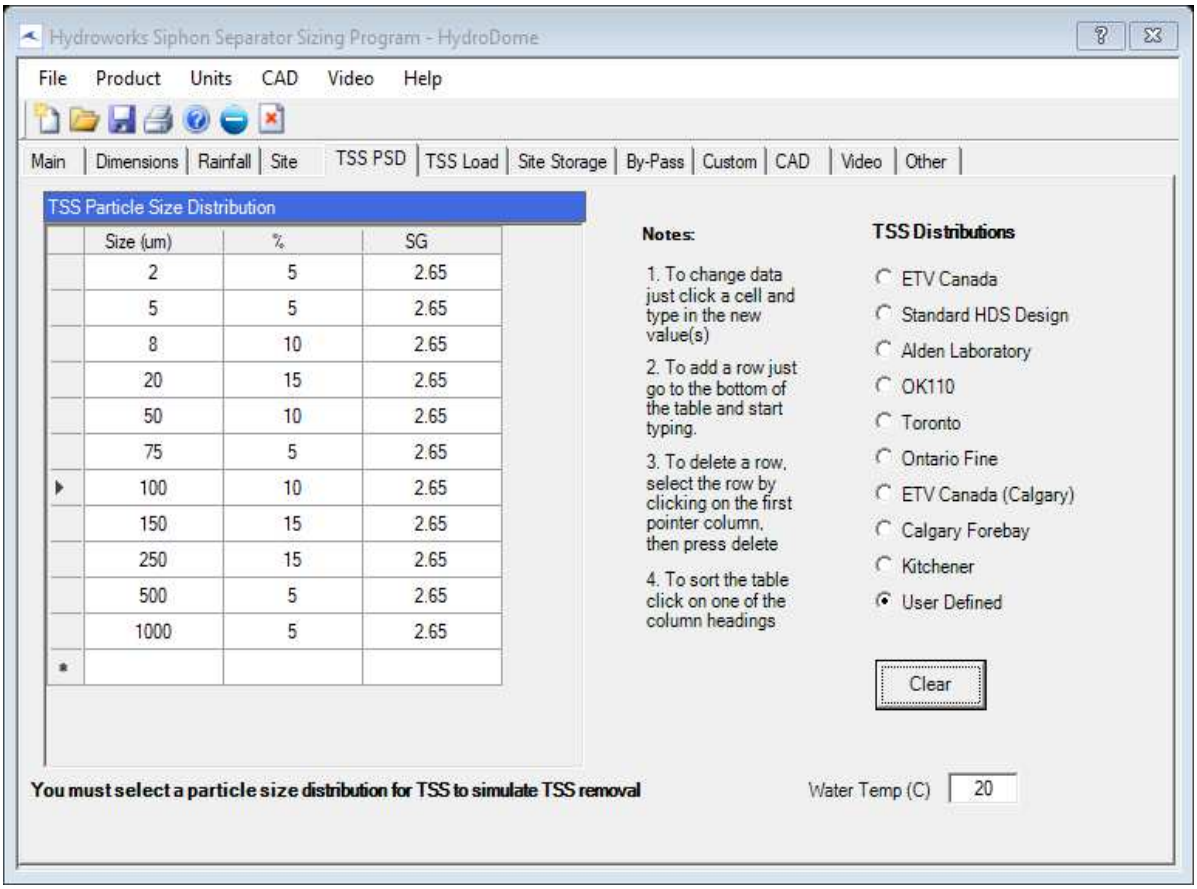
If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.

The sizing program is for sizing purposes only and does not address any site specific parameters such as hydraulic gradeline, tailwater submergence, groundwater, soils bearing capacity, etc. Headloss calculations are not a hydraulic gradeline calculation since this requires a starting water level and an analysis of the entire system downstream of the HydroDome .

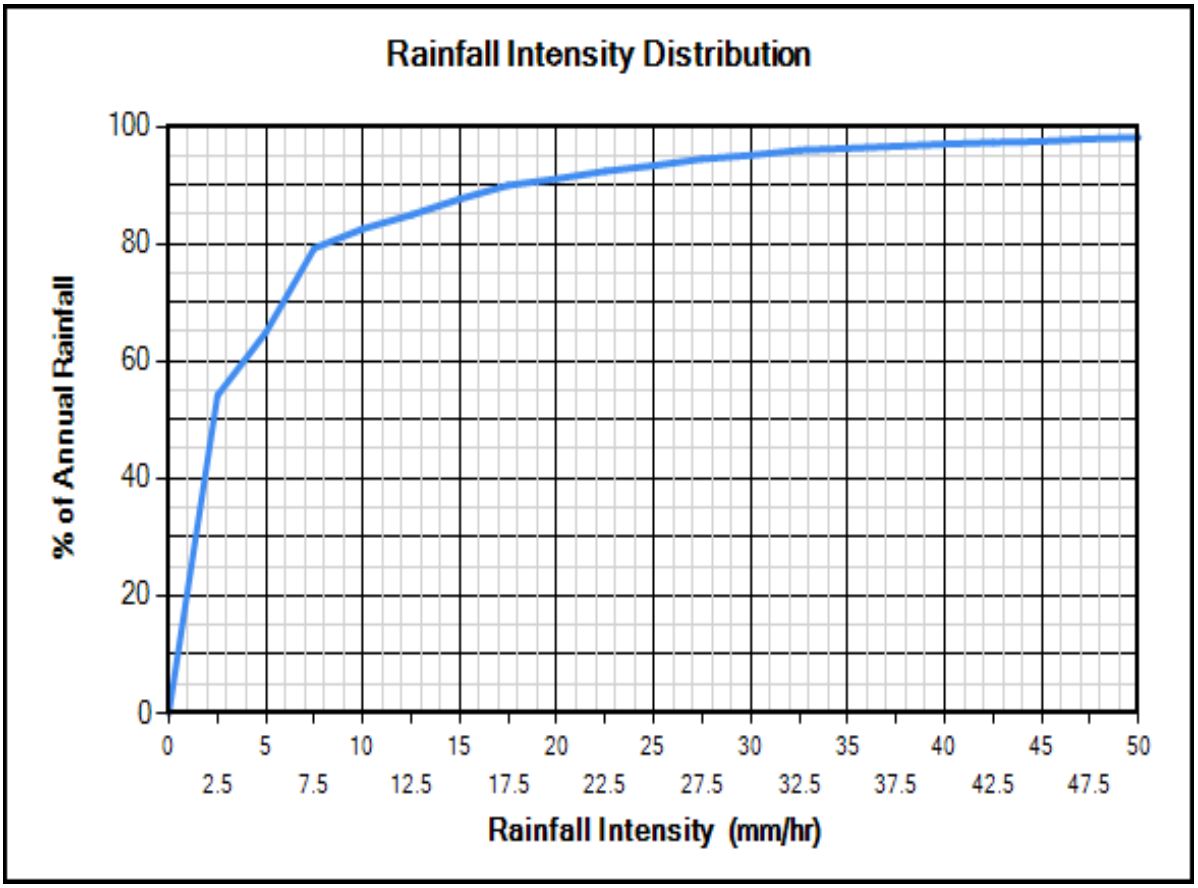
TSS Removal Sizing Summary



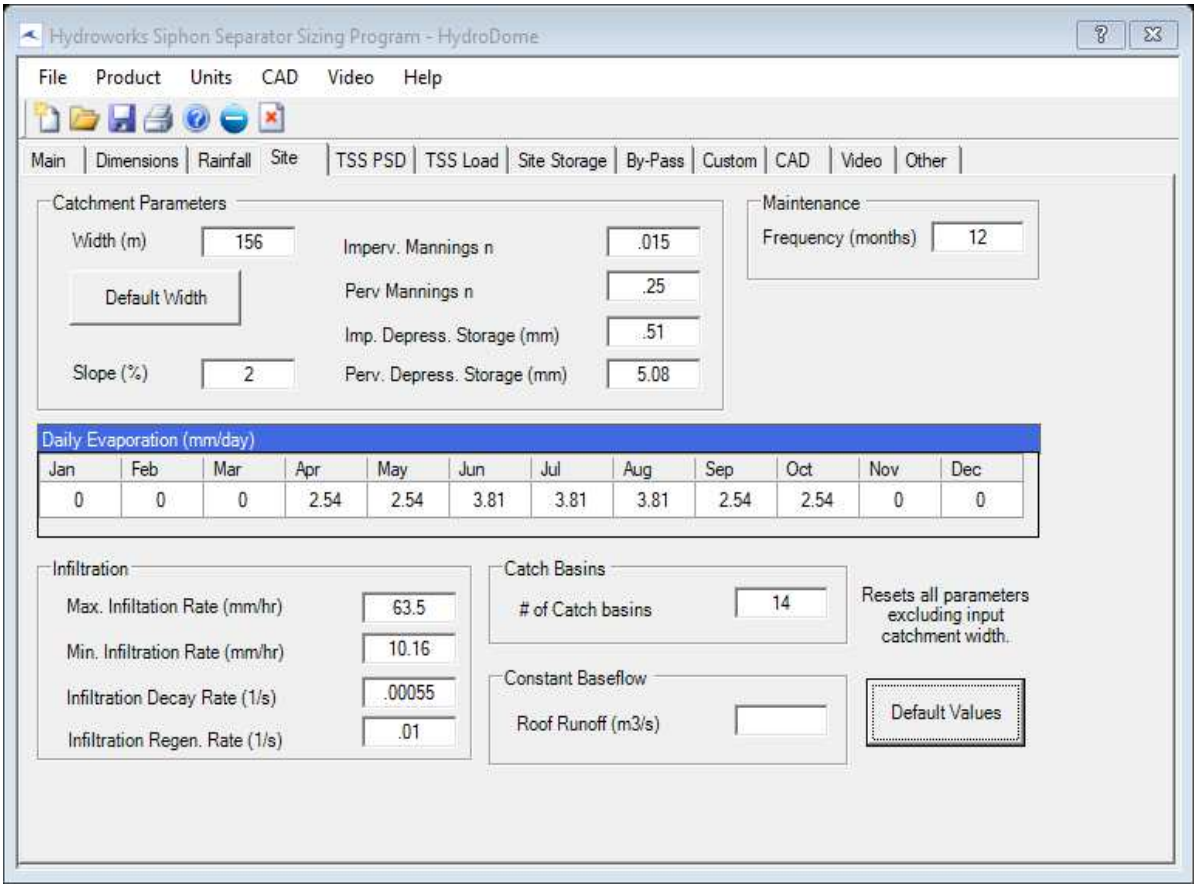
TSS Particle Size Distribution



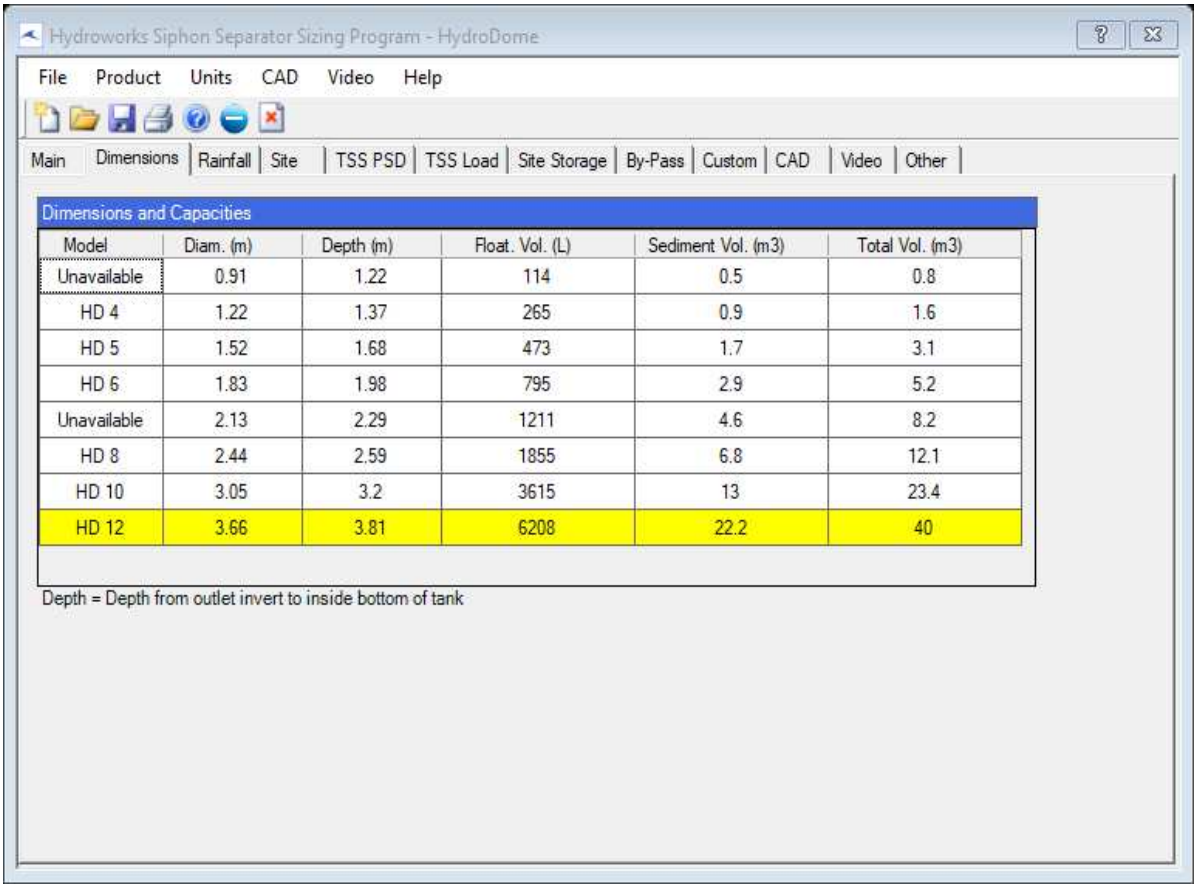
Rainfall Station - Kitchener / Waterloo, Ontario(1998 To 2018)



Site Physical Characteristics



Dimensions And Capacities

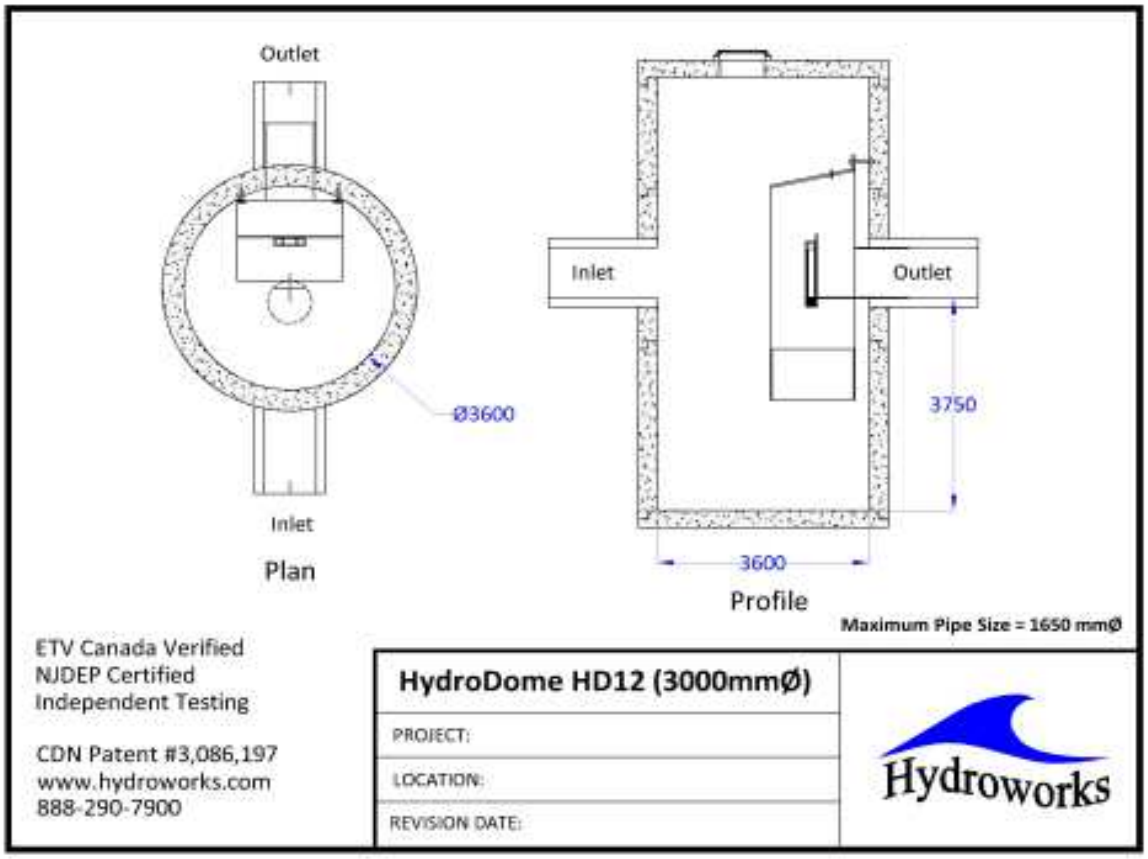


Dimensions and Capacities

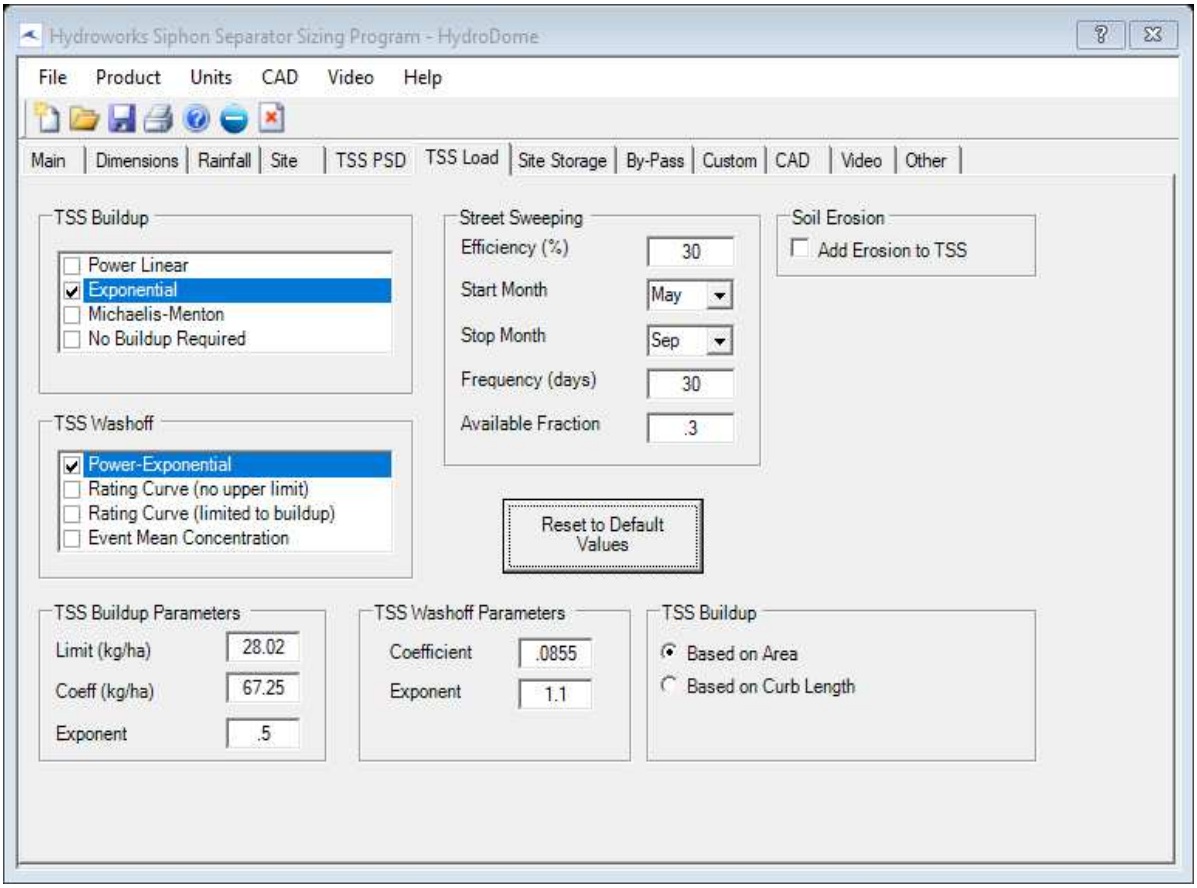
Model	Diam. (m)	Depth (m)	Float. Vol. (L)	Sediment Vol. (m3)	Total Vol. (m3)
Unavailable	0.91	1.22	114	0.5	0.8
HD 4	1.22	1.37	265	0.9	1.6
HD 5	1.52	1.68	473	1.7	3.1
HD 6	1.83	1.98	795	2.9	5.2
Unavailable	2.13	2.29	1211	4.6	8.2
HD 8	2.44	2.59	1855	6.8	12.1
HD 10	3.05	3.2	3615	13	23.4
HD 12	3.66	3.81	6208	22.2	40

Depth = Depth from outlet invert to inside bottom of tank

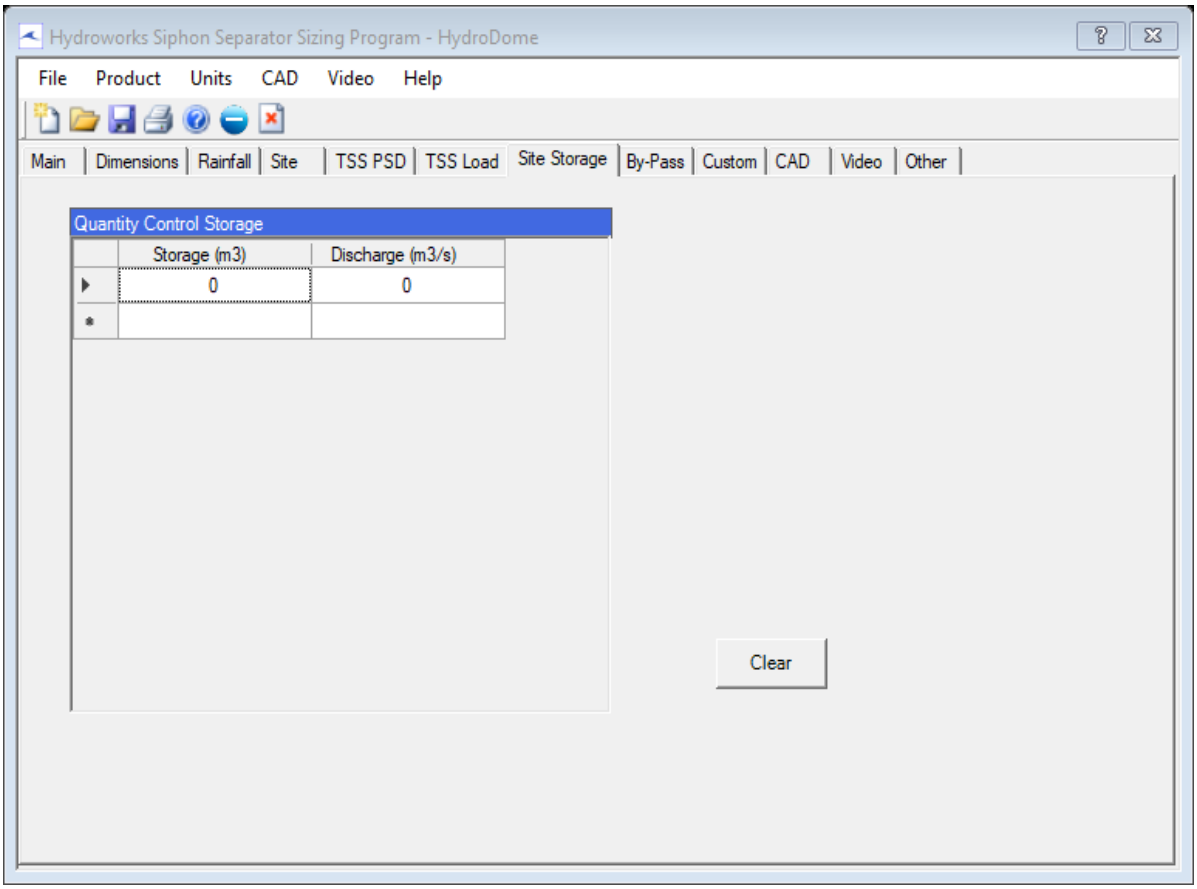
Generic HD 12 CAD Drawing



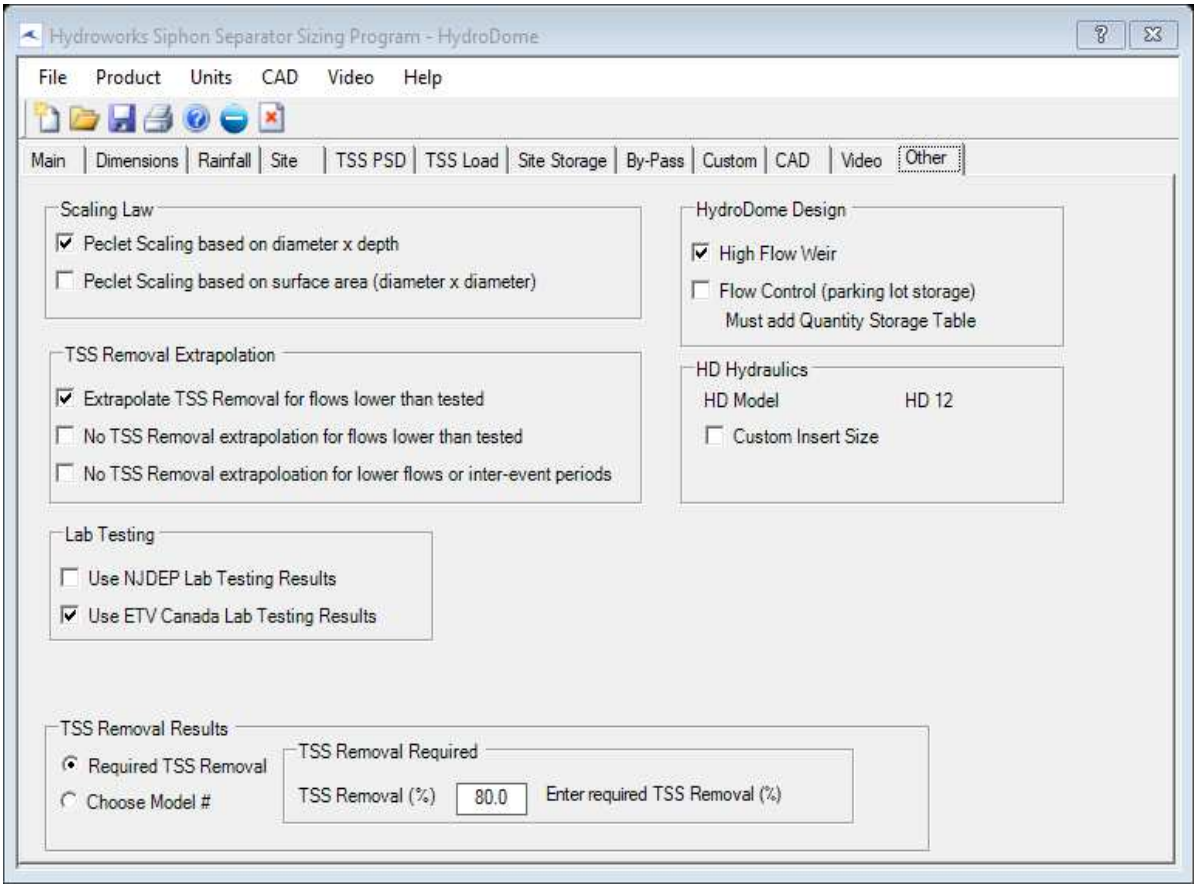
TSS Buildup And Washoff



Upstream Quantity Storage



Other Parameters



Flagged Issues

If there is underground detention storage upstream of the HydroDome please contact Hydroworks to ensure it has been modeled correctly.

Hydroworks Sizing Program - Version 5.8.5

1-800-290-7900
www.hydroworks.com

Hydroworks Sizing Summary

24010 Clair Rd - OGS2

Guelph, Ontario

10-31-2024

Recommended Size: HydroDome HD 6

Hydroworks Sizing Program Version 5.8.5

A HydroDome HD 6 is recommended to provide 80 % annual TSS removal based on a drainage area of .792 (ha) with an imperviousness of 78 % and Kitchener / Waterloo, Ontario rainfall for the User defined particle size distribution.

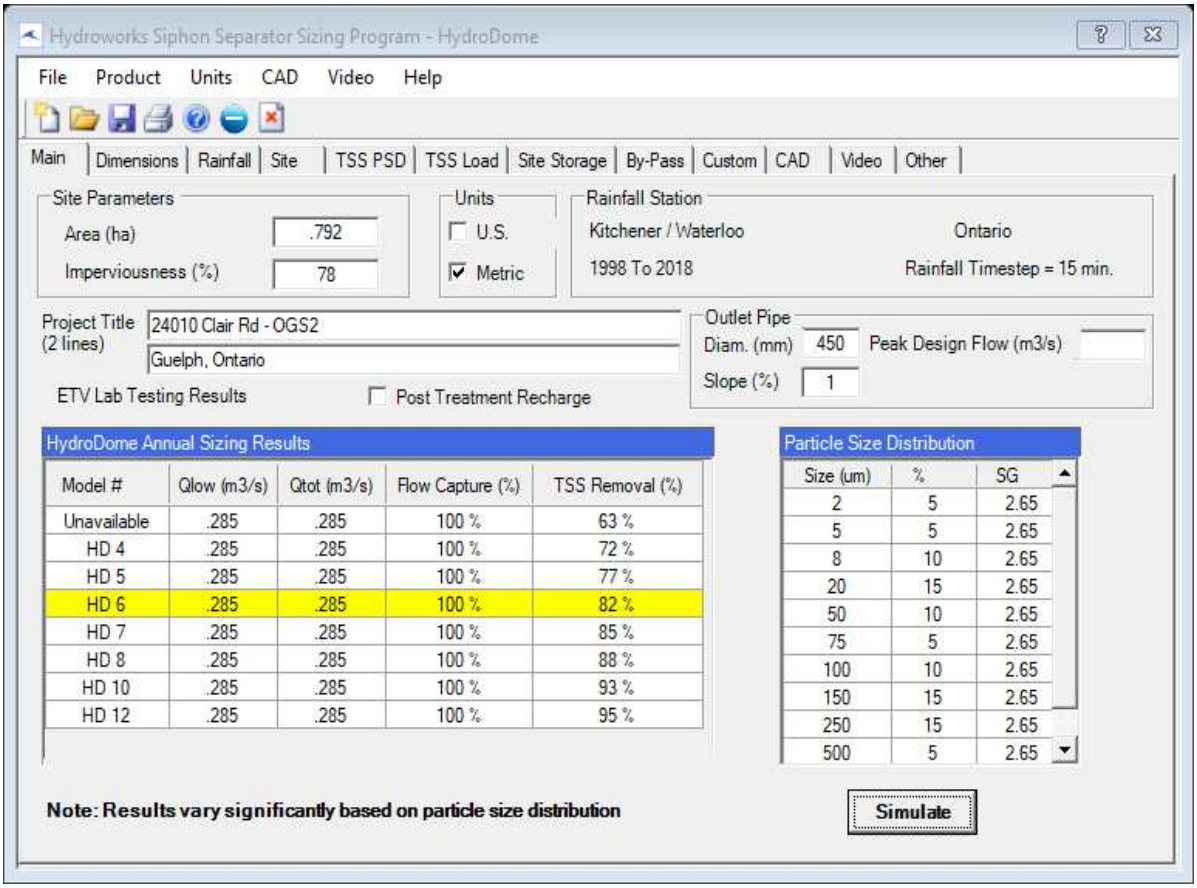
The recommended HydroDome HD 6 treats 100 % of the annual runoff and provides 82 % annual TSS removal for the Kitchener / Waterloo rainfall records and User defined particle size distribution.

The HydroDome has a siphon which creates a discontinuity in headloss. Since a peak flow was not specified, headloss was calculated using the full pipe flow of .29 (m3/s) for the given 450 (mm) pipe diameter at 1% slope. The headloss was calculated to be 402 (mm) above the crown of the 450 (mm) outlet pipe.

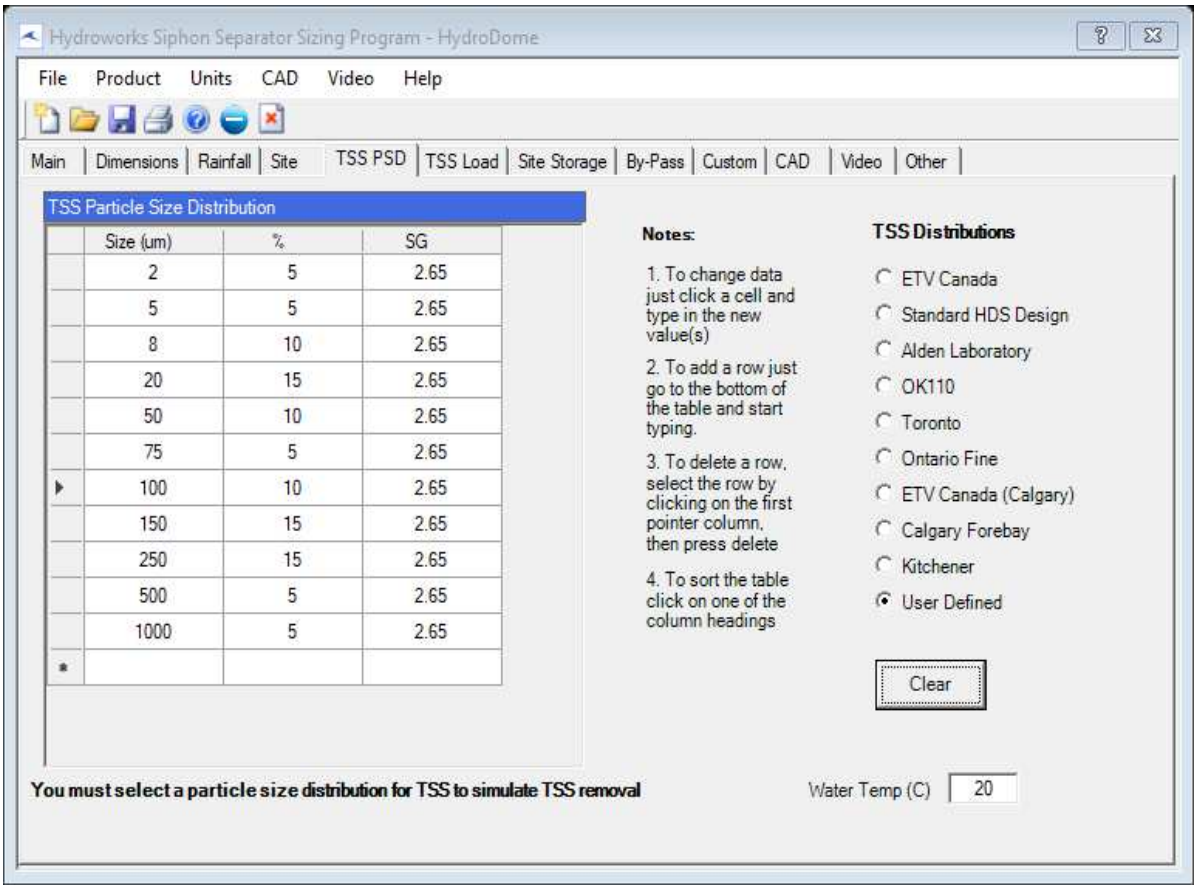
This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.

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.

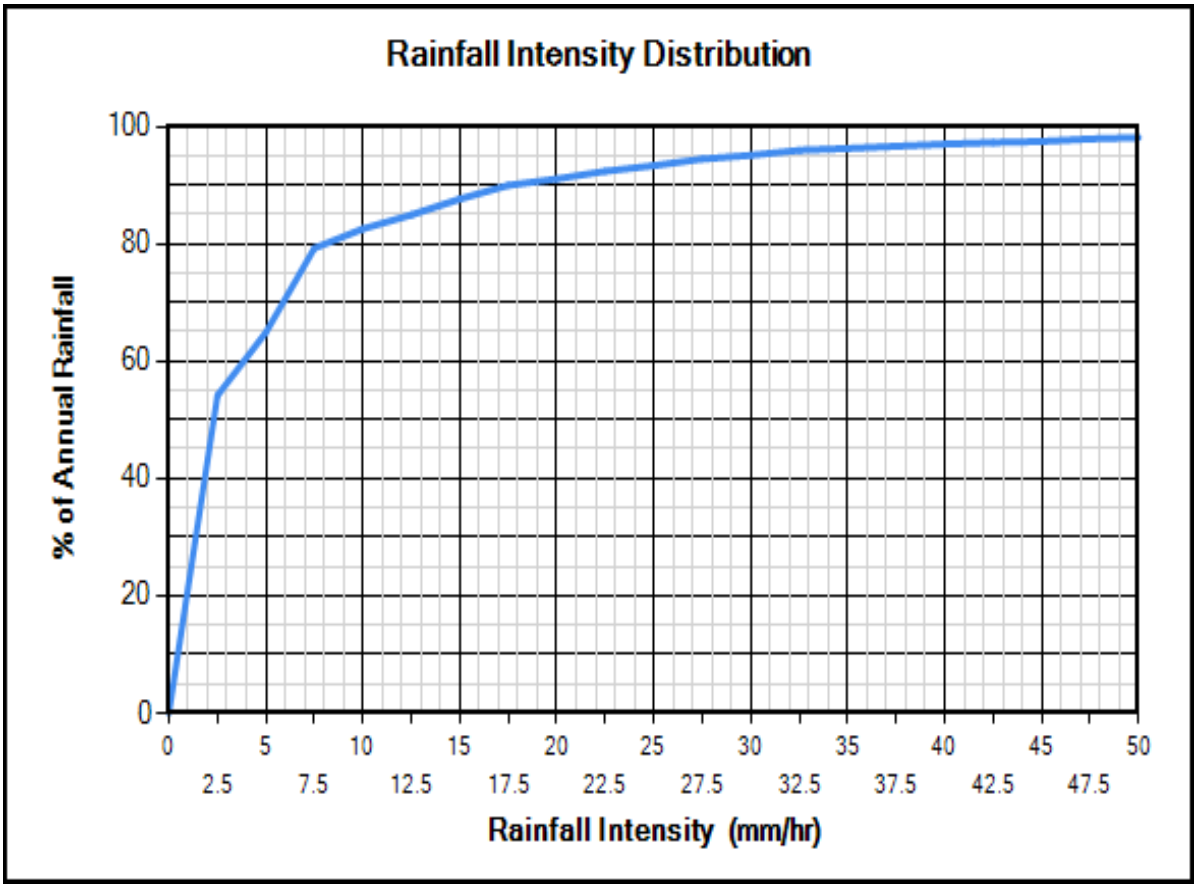
TSS Removal Sizing Summary



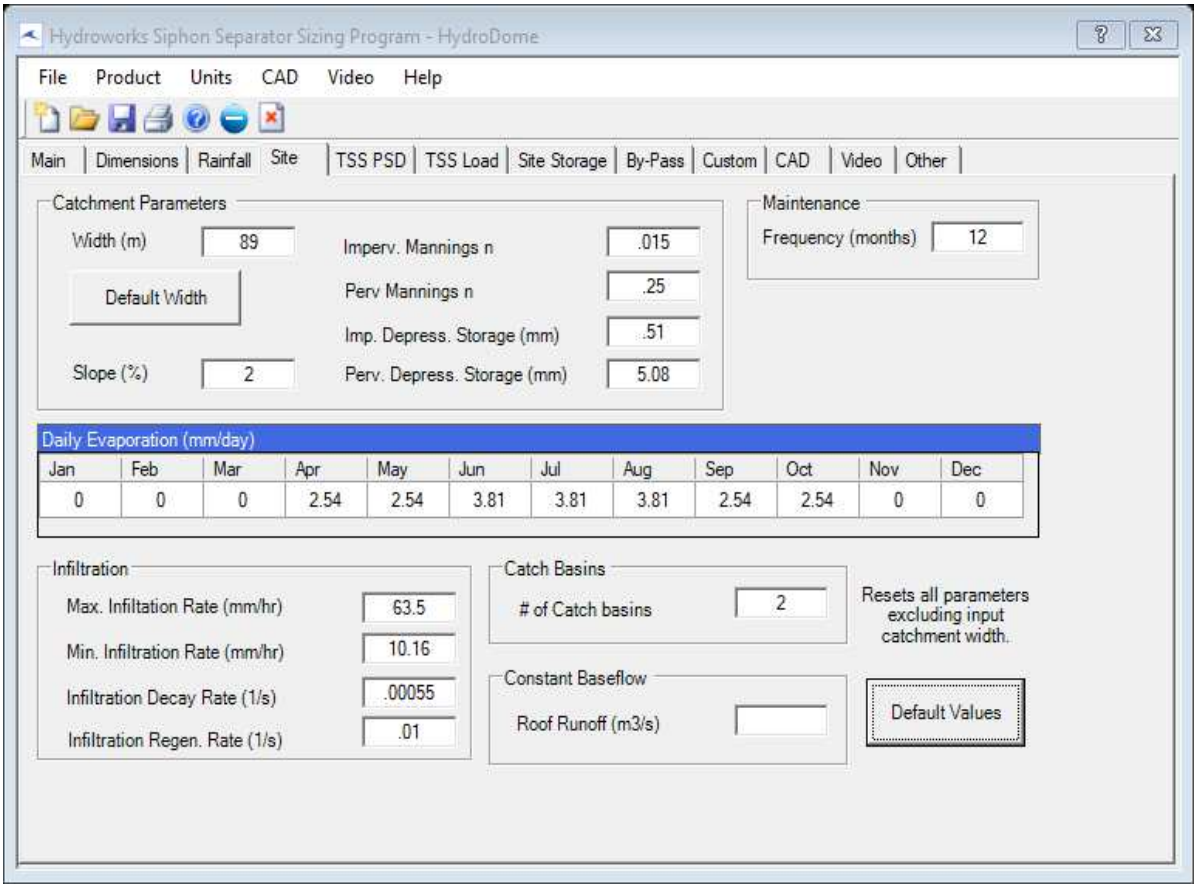
TSS Particle Size Distribution



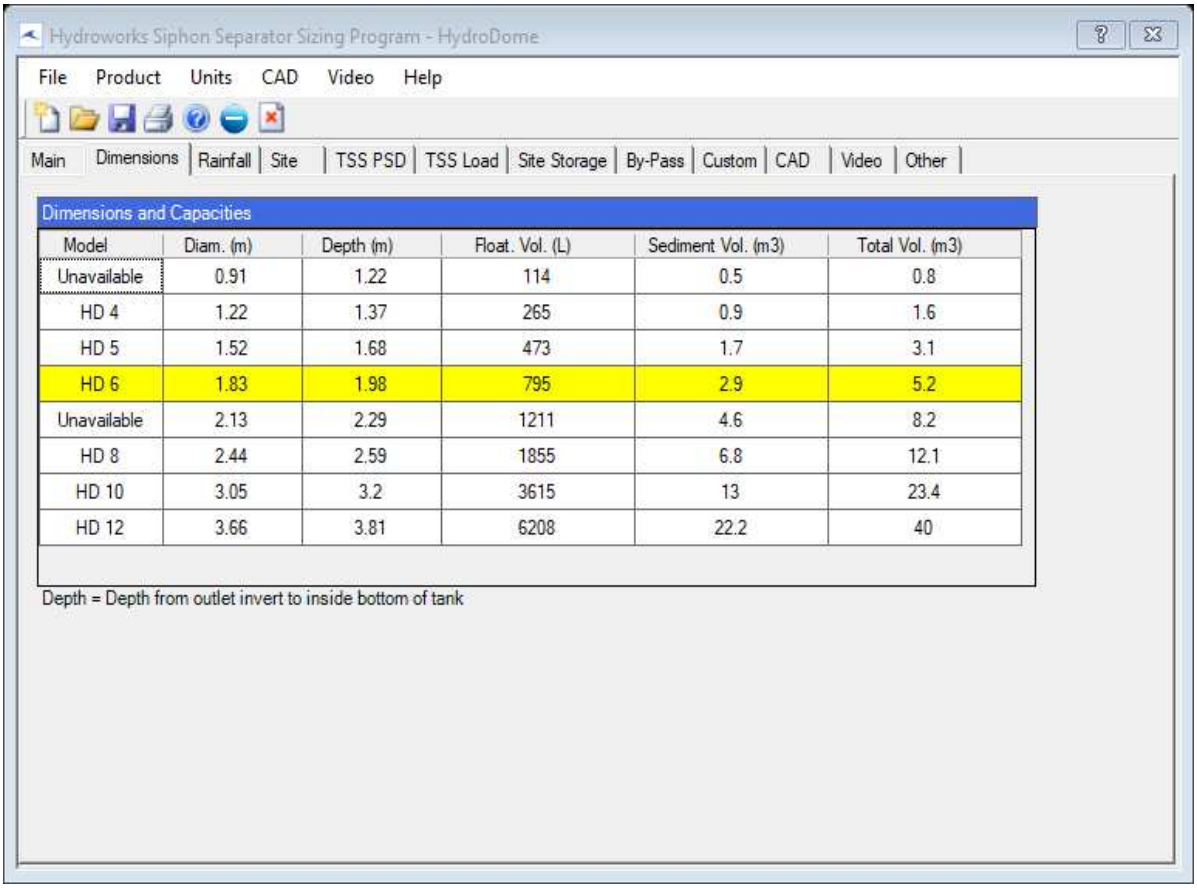
Rainfall Station - Kitchener / Waterloo, Ontario(1998 To 2018)



Site Physical Characteristics



Dimensions And Capacities

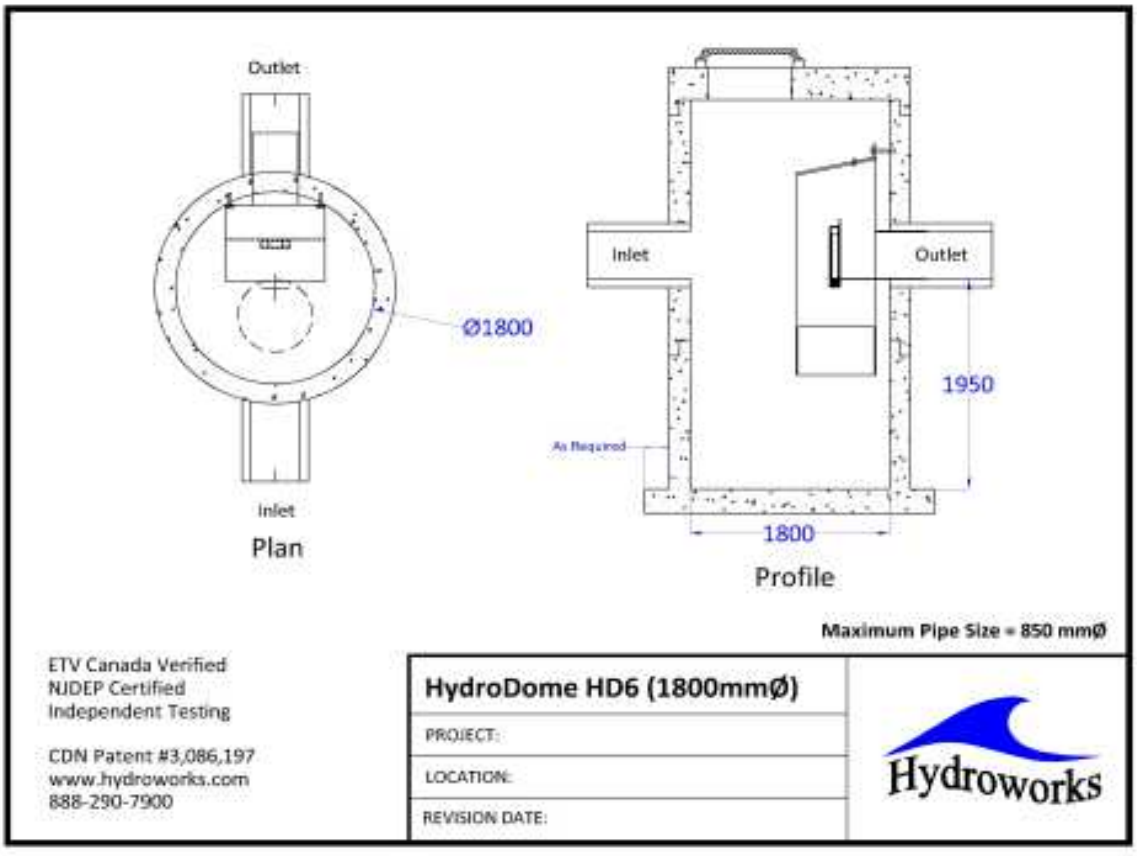


Dimensions and Capacities

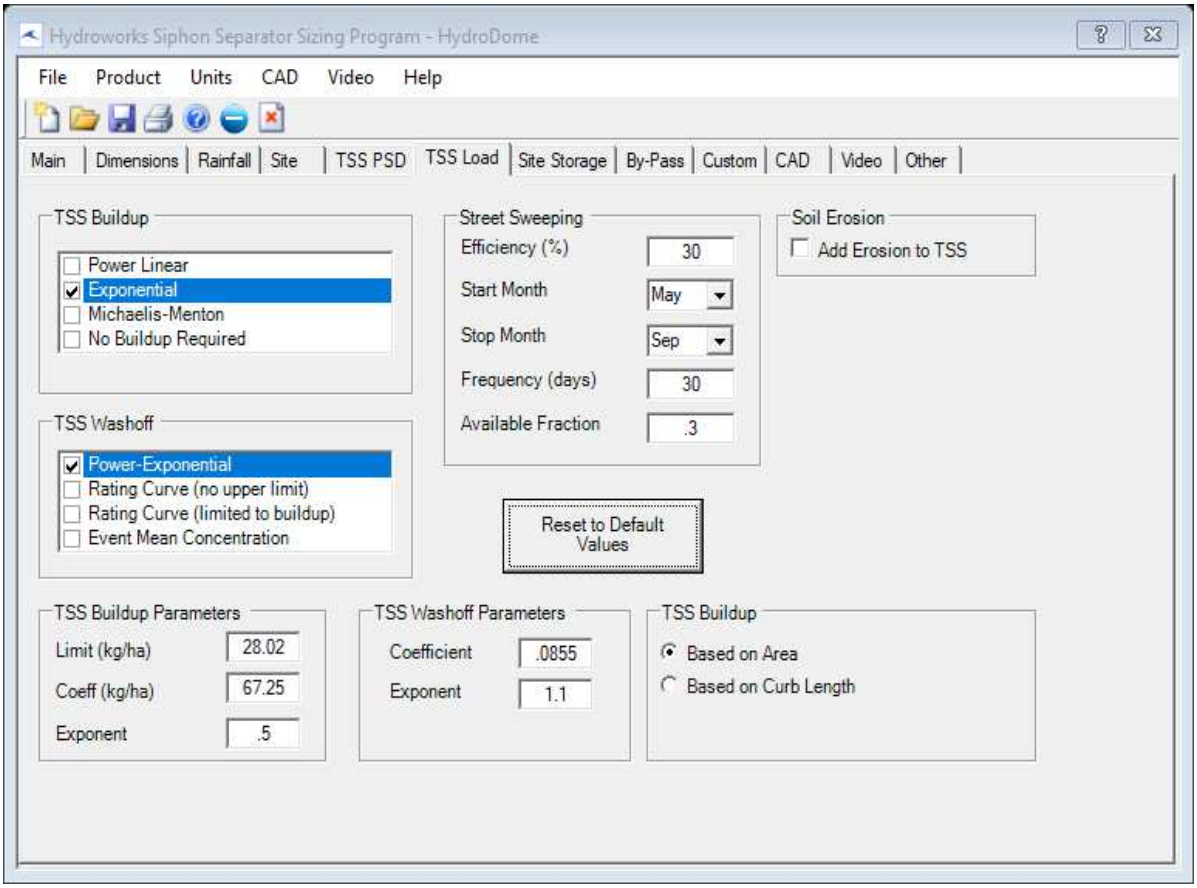
Model	Diam. (m)	Depth (m)	Float. Vol. (L)	Sediment Vol. (m3)	Total Vol. (m3)
Unavailable	0.91	1.22	114	0.5	0.8
HD 4	1.22	1.37	265	0.9	1.6
HD 5	1.52	1.68	473	1.7	3.1
HD 6	1.83	1.98	795	2.9	5.2
Unavailable	2.13	2.29	1211	4.6	8.2
HD 8	2.44	2.59	1855	6.8	12.1
HD 10	3.05	3.2	3615	13	23.4
HD 12	3.66	3.81	6208	22.2	40

Depth = Depth from outlet invert to inside bottom of tank

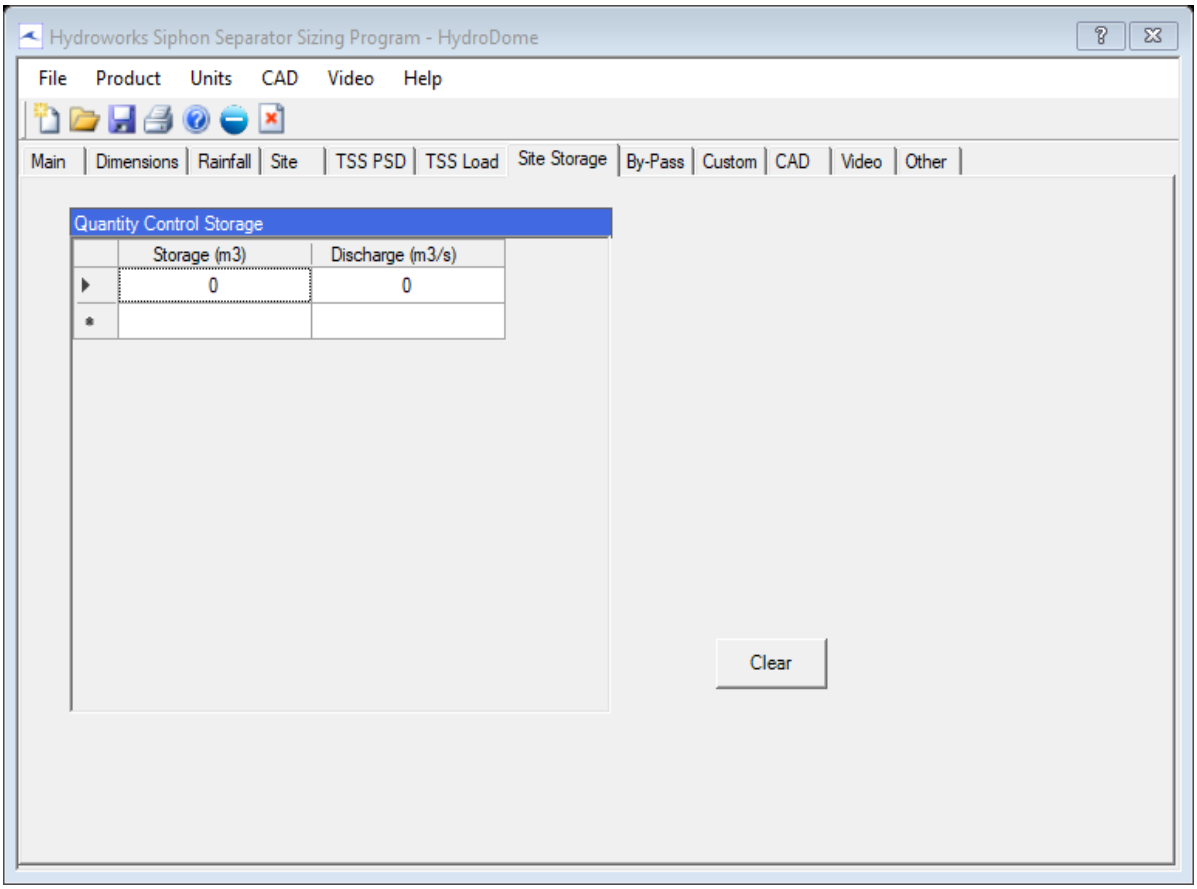
Generic HD 6 CAD Drawing



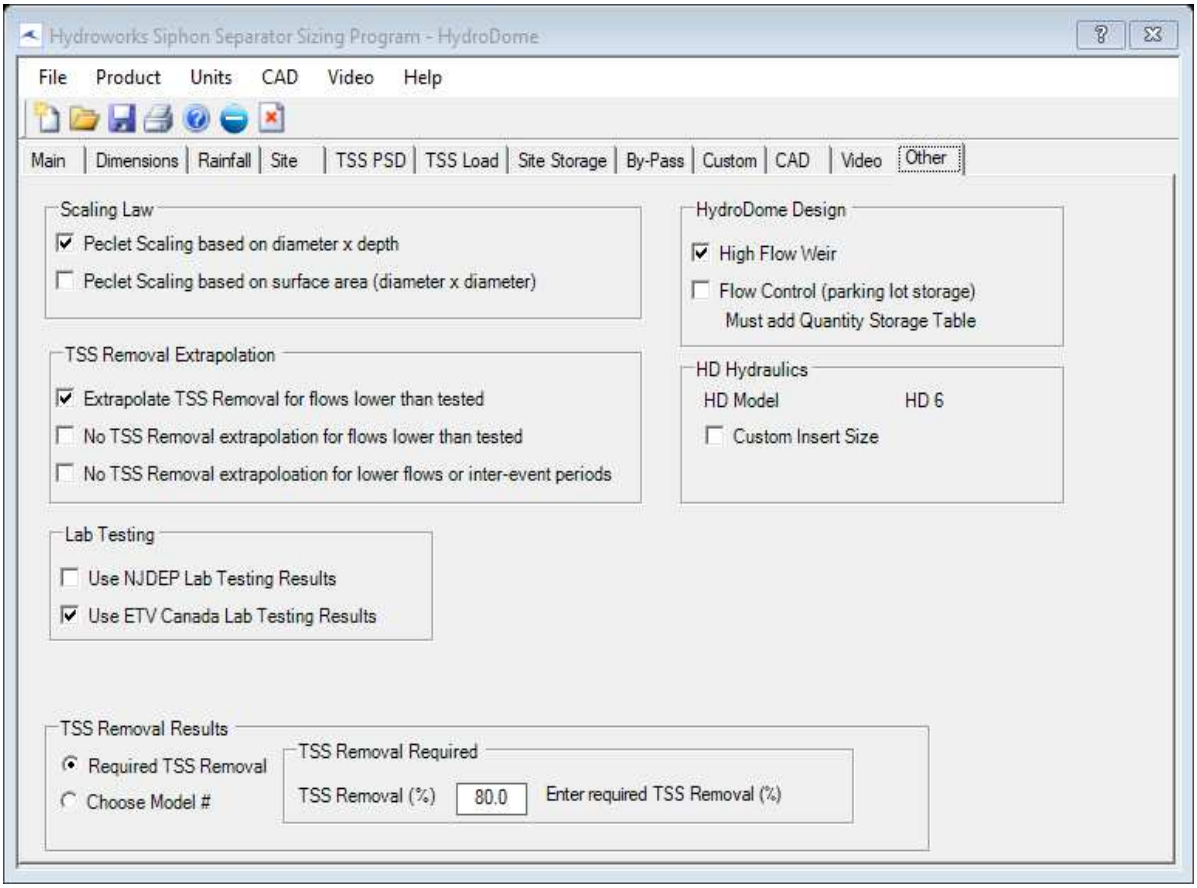
TSS Buildup And Washoff



Upstream Quantity Storage



Other Parameters



Flagged Issues

If there is underground detention storage upstream of the HydroDome please contact Hydroworks to ensure it has been modeled correctly.

Hydroworks Sizing Program - Version 5.8.5

1-800-290-7900
www.hydroworks.com

Verification Statement

Hydroworks HydroDome HD3 Oil-Grit Separator
Registration number: (V-2021-09-02)
Date of issue: 2021-October-04

Technology type	Oil-Grit Separator		
Application	Technology to remove oil, sediment, trash and debris from storm-water and snowmelt runoff as well as other pollutants that attach to sediment particles, such as nutrients and metals.		
Company	Hydroworks, LLC.		
Address	257 Cox St., Roselle, NJ 07203 USA	**Phone**	+1-888-290-7900
Website	https://hydroworks.com	**E-mail**	gbryant@hydroworks.com

Verified Performance Claims

The Hydroworks HydroDome HD3 Oil-Grit Separator (OGS) was tested by Alden Research Laboratory, Holden, Massachusetts, USA in 2021. The performance test results were verified by 'The Sir Sandford Fleming College of Applied Arts and Technology's Centre for Advancement of Water and Wastewater Technologies' (CAWT) following the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. The following performance claims were verified:

Sediment removal test: The Hydroworks HydroDome HD3 OGS device, with a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and a constant influent test sediment concentration of 200 mg/L and particle size distribution of 1-1000 µm, removed 83.9, 77.6, 68.4, 66.9, 59.4, 52.4, and 46.0 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 1000, and 1400 L/min/m^2 respectively.

Scour test: The Hydroworks HydroDome HD3 OGS device with 15.2 cm (6 inch) of test sediment preloaded onto a false floor reaching 50% of the manufacturer's recommended maximum sediment sump storage depth, generated corrected effluent sediment concentrations on average of 0.54, 0.70, 0.0, 0.0, and 0.11 mg/L at 5-min duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2, respectively.

Light liquid re-entrainment test: The Hydroworks HydroDome HD3 OGS with surrogate low-density polyethylene beads preloaded within the inner chamber, representing a floating light-liquid volume equal to a depth of 50.8 mm (2 inch) over the sedimentation area, retained 100, 100, 100, 100, and 99.7 percent of loaded beads by mass during the 5-minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2, respectively.

The above verified claims can be applied to other units smaller or larger than the tested unit, provided that the untested units meet the scaling rule specified in the Procedure for Laboratory Testing of Oil Grit Separators (Version 3.0, June 2014)

Technology Application

HydroDome is a hydrodynamic separator that provides benefits for both water quality and water quantity (i.e., flow control). HydroDome combines the function of separator, hood, and flow control with active storage to provide a multi-purpose stormwater management solution in one structure. HydroDome also functions as an oil separator due to the submerged inlet design and the fact that the design raises the water level with flow to maximize the distance between any floatables (oil, trash) and the discharge entrance to the HydroDome.

Technology Description

HydroDome comes complete and slides into the outlet pipe from a drainage structure and is secured to the wall with anchor bolts. It consists of a siphon with flow control, that regulates the water level in the structure and the flow rate in the outflow, and an optional high flow weir. A schematic of the Hydroworks HydroDone OGS is shown in Figure 1.

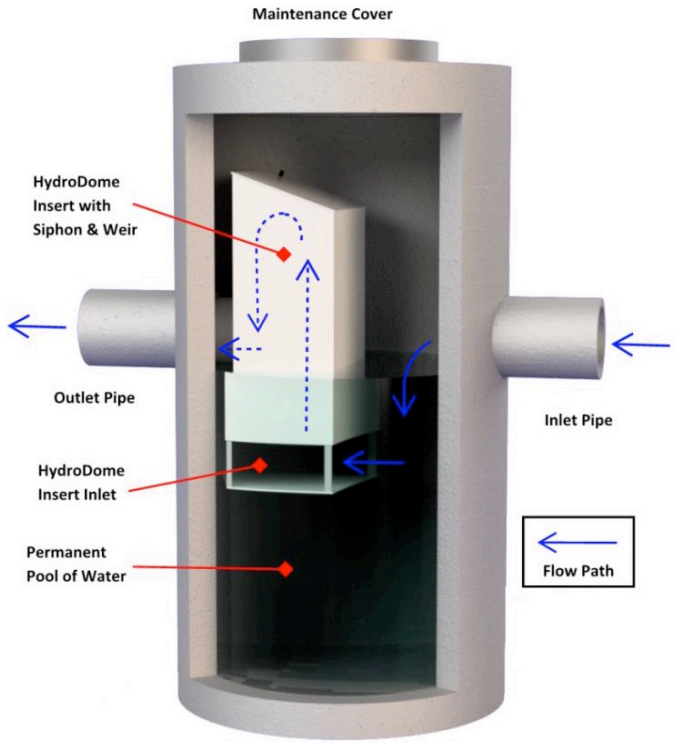


Figure 1: Schematic of the Hydroworks HydroDome Oil-Grit Separator

The siphon raises the water level to a pre-determined level without allowing water to exit the structure. The raised water level provides:
- Greater time for initial total suspended solids (TSS) removal and for floatables to prevent re-entrainment in the flow,
- Additional dilution to reduce effluent concentrations of any pollutants, and
- A greater volume, or buffer, of water to prevent scour of previously settled solids.

Water flows into the device through horizontal openings at the bottom of the HydroDome. Water then must travel upwards through the siphon. A foam filter is located at the entrance to the siphon inlet to provide secondary protection from its clogging (the outer housing of the HydroDome and submerged inlet provide primary protection). Once the water level reaches a pre-determined height, the siphon begins to engage, and water flows out of the structure downstream. The siphon flow is controlled by an orifice, whose size can be changed to provide the desired flow control. The water level continues to rise or begins to lower depending on the rate of flow from the orifice compared to the inflow of water to the structure.

An optional weir above the siphon provides a high flow path to prevent the system from surcharging. In cases where parking lot storage is desired, there would not be a high flow weir. A scour protection plate minimizes scour by preventing upward velocities/flow from the structure floor during periods of peak flow. Therefore, HydroDome combines the function of separator, hood, and flow control with active storage to provide a multi-purpose stormwater management solution in one structure.

Description of Test Procedure

For the purposes of this verification, a Hydroworks HydroDome 3-ft diameter (HD3) stormwater treatment unit was tested. The HD3 test unit was a full-scale 3 ft (0.91 m) diameter tank with an internal treatment hood that included a high flow weir. The test tank was fabricated from plastic and included 18-inch (457 mm) diameter inlet and outlet pipes, oriented along the center-line of the tank. The pipe inverts were located 48 inches (1.22 m) above the sump floor and were set with 1% slopes. The 100% and 50% sediment sump storage depths were 12 inches (0.305 m) and 6 inches (0.152 m), respectively. The effective treatment sedimentation area was 7.07 ft^2 (0.656 m^2).

The test data and results for this verification were obtained from independent testing conducted at Alden Research Laboratory in accordance with the *Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014)*[1]. Use of this procedure is intended to ensure that technologies in this category are subjected to stringent requirements in generating verifiable performance test data.

The verification plan was followed with one minor variance from the *Procedure*. This variance includes the required minimum amount of test sediment to be fed into the test unit for each tested surface loading rate (SLR). Although the *Procedure* requires a minimum of 11.3 kg of test sediment, during the 40 L/min/m^2 SLR test, only 6.45 kg was fed into the unit, which is 4.85 kg less than the specified minimum. This variance to the *Procedure* was agreed to by Toronto and Region Conservation Authority (TRCA), the author of the *Procedure*, based on previous conversations with Alden Labs, noting that the length of time to conduct the test with 11.3 kg of sediment at 40 L/min/m^2 would be over 36 hours.

Verification Results

CAWT verified the performance test data and other information pertaining to the HydroDome HD3 Oil-Grit Separator. A Verification Plan was prepared to guide the verification process based on the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol.

The test sediment consisted of ground silica (1 – 1000 micron) with a specific gravity of 2.65, uniformly mixed to meet the particle size distribution specified in the testing procedure.

The "*Procedure for Laboratory Testing of Oil Grit Separators"* (TRCA, 2014) requires that the three-sample average of the test sediment particle size distribution (PSD) meet the specified PSD. The allowable tolerance of 6% variation from the specified PSD curve was met at each discrete particle size tested and the d50 was finer than 75 µm.

Comparison of the individual sample and average test sediment PSD to the specified PSD is shown in Figure 2. This figure indicates that the test sediment used for the removal and scour tests met the above-mentioned criteria. The median particle size was 64 µm.

Samples from test sediment batches used for each run met the specified PSD within the required tolerance thresholds.

The capacity of the HydroDome HD3 device to retain sediment was determined at seven surface loading rates using the modified mass balance method. This method involved measuring the mass and particle size distribution of the injected and retained sediment for each test run.

[1] The *Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014)* was originally prepared by the Toronto and Region Conservation Authority (TRCA) in association with a 31 member advisory committee from various stakeholder groups.

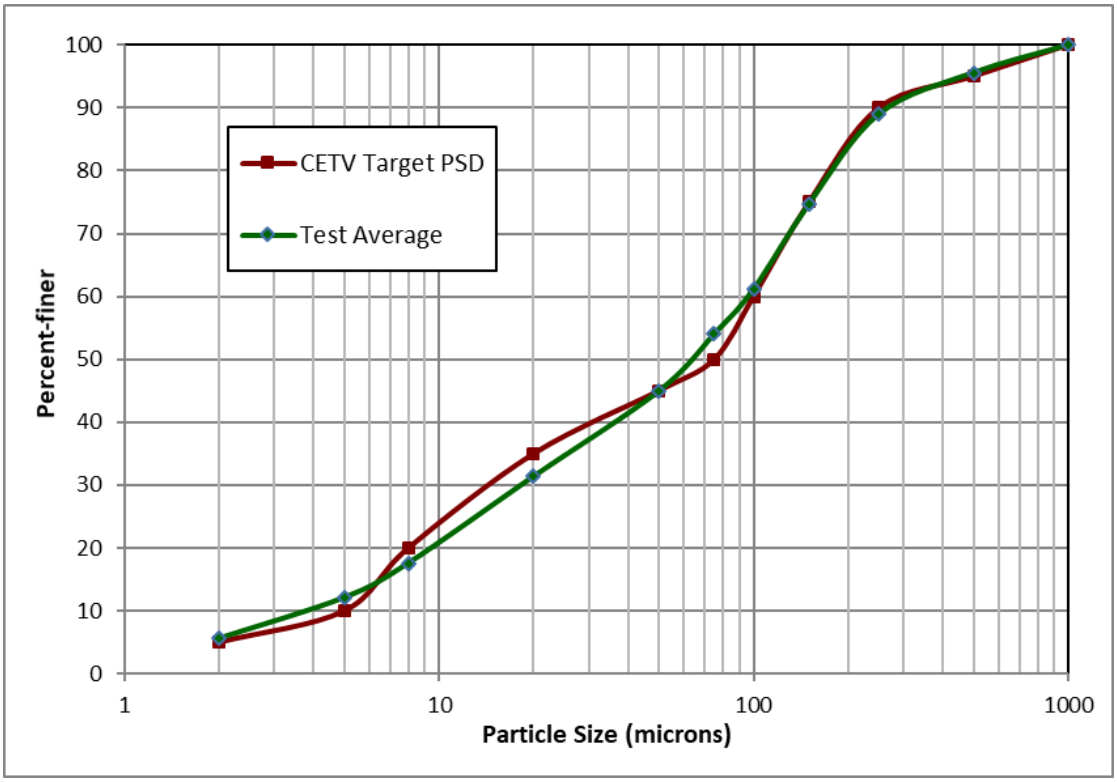


Figure 2 - Average particle size distribution (PSD) of the test sediment used for the sediment removal and scour test compared to the specified PSD

Performance was evaluated with a false floor simulating the technology filled to 50% of the manufacturer's recommended maximum sediment storage depth. The test was carried out with clean water that maintained a sediment concentration below 20 mg/L. Based on these conditions, removal efficiencies for individual particle size classes and for the test sediment, as a whole, were determined for each of the tested surface loading rates (Table 1).

In some instances, the removal efficiencies were above 100% for certain particle size fractions. These discrepancies are not unique to any one test laboratory and are attributed to errors relating to the blending of sediment, collection of representative samples for laboratory submission, and laboratory analysis of PSD. Due to these errors, caution should be exercised in applying the removal efficiencies by particle size fraction for the purposes of sizing the tested device (see Bulletin # CETV 2016-11-0001).

Particle Range (µm)	**40** L/min/m^2	**80** L/min/m^2	**200** L/min/m^2	**400** L/min/m^2	**600** L/min/m^2	**1000** L/min/m^2	**1400** L/min/m^2	**Average**
>500	100%	125%	140%	140%	200%	200%	180%	155%
250-500	114%	129%	150%	143%	143%	183%	217%	154%
150-250	150%	136%	157%	153%	179%	221%	220%	174%
100-150	116%	126%	129%	148%	157%	162%	139%	140%
75-100	136%	155%	178%	190%	180%	170%	133%	163%
50-75	91%	100%	128%	270%	126%	82%	75%	125%
20-50	111%	97%	93%	51%	58%	42%	73%	75%
8-20	75%	79%	38%	34%	29%	17%	26%	42%
5-8	53%	34%	16%	7%	0%	0%	23%	19%
2-5	37%	29%	14%	0%	0%	0%	1%	12%

Table 1 - Removal efficiencies (%) of the HydroDome HD3 Oil-Grit Separator for individual particle size classes at specified surface loading rates

Figure 3 compares the particle size distribution (PSD) of the three-sample average of the test sediment to the PSD of the sediment retained by the HydroDome HD3 OGS device at each of the tested surface loading rates. As expected, the capture efficiency for fine particles was generally found to decrease as surface loading rates increased, particularly in the 400 to 1400 L/min/m^2 range.

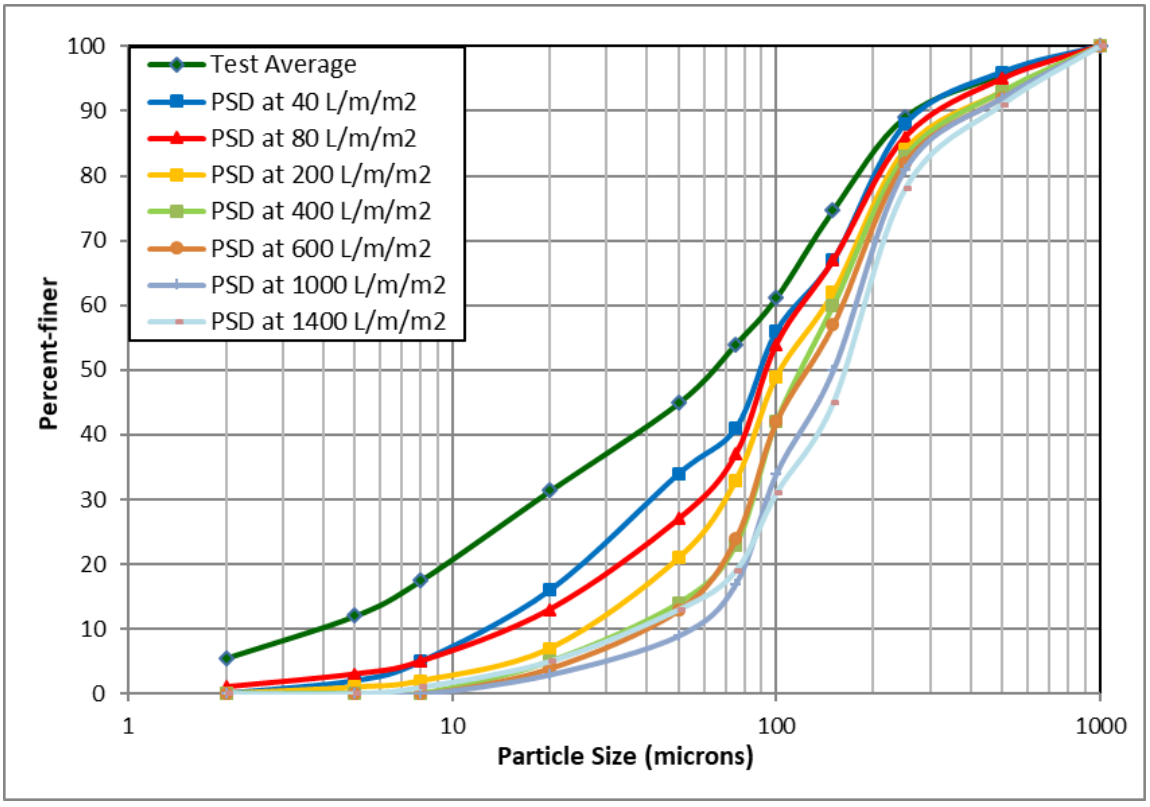


Figure 3 - Particle size distribution of sediment retained in the HydroDome HD3 Oil-Grit Separator in relation to the injected test sediment average

Table 2 shows the results of the sediment scour and re-suspension test for the HydroDome HD3 Oil-Grit Separator unit. The scour test involved preloading 15.2 cm (6 inches) of fresh test sediment into the sedimentation sump of the device. The sediment was placed on a false floor to mimic a device filled to 50% of the maximum recommended sediment storage depth.

Measured Concentration at Each surface Loading Rate					
Effluent Sample No.	200 L/min/m^2	800 L/min/m^2	1400 L/min/m^2	2000 L/min/m^2	2600 L/min/m^2
1	1.2	0.3	0.0	0.0	0.0
2	0.7	0.0	0.0	0.0	0.0
3	0.5	0.0	0.0	0.0	0.5
4	0.1	3.2	0.0	0.0	0.0
5	0.3	0.0	0.0	0.0	0.0
Average	**0.5**	**0.7**	**0.0**	**0.0**	**0.1**

Table 2 - Scour test adjusted effluent sediment concentration at each surface loading rate

Clean water was run through the device at five surface loading rates over a 30-minute period. Each flow rate was maintained for 5 minutes with a one-minute transition time between flow rates. Effluent samples were collected at one minute sampling intervals and analyzed for suspended solids concentration (SSC) and PSD by recognized methods. The effluent samples were subsequently adjusted based on the background concentration of the influent water.

Results showed average adjusted effluent sediment concentrations below 0.7 mg/L at all surface loading rates. The magnitude of scour is dependent on the internal flow patterns (velocity and turbulence) and water volume within the unit, which is related to the depth below the inlet and outlet. The HD3 possessed a large water volume in the sump and consequently, low velocity, which prevented incipient motion of the sediment of sufficient magnitude for scour to occur.

The average measured effluent scour sediment concentrations (adjusted for background) for each tested SLR were not adjusted for particle size based on the D5 of particles captured for the 40 L/min/m^2 removal efficiency test since there was negligible scour.

The capacity of the device to retain light liquid was determined at five surface loading rates in a range between 200 and 2600 L/min/m^2 using low-density polyethylene beads, Dow Chemical Dowlex^{tm} 2517, with a density of 0.917 g/cm^3. This material was specified as the acceptable surrogate to represent floating liquid for a qualitative assessment of liquid behaviour during operation.

Performance was evaluated with a total of 32.8 litres (18.94 kg) of pellets preloaded into the treatment vault by introducing them into the crown of the influent pipe, to a volume equal to a depth of 50.8 mm (2 inch) over the sedimentation area of 0.66 m^2. The effluent was collected in flow-designated nets to allow for quantification of any re-entrained pellets for each test SLR. The collected pellets were dried and the mass of collected pellets was quantified for each SLR, as well as the overall test.

The recorded average flow data, as well as quantified volume and mass of collected pellets for each target SLR and overall test, is shown in Table 3. The maximum re-entrainment of 0.3% occurred at 2600 L/min/m^2. The total retention rate was 99.7%.

Light-liquid Re-Suspension Data				**Starting Volume**	(Liters) **32.8**	**Starting Mass**	(grams) **18938**
Action	**Time Stamp** (minutes)	**Meter**	**Target Flow** (L/min/m^2)	**Recorded Flow** (L/min/m^2)	**COV**	**Collected Mass** (grams)	**Retained Mass**
Start D.A. Recording	0.0						
Flow set	1.0	4"	200	**207**	0.057	0	**100.0%**
Stop Collection	6.0			3.4%			
Flow set	7.0	4"	800	**826**	0.008	0	**100.0%**
Stop Collection	12.0			3.2%			
Flow set	13.0	6"	1400	**1407**	0.009	0	**100.0%**
Stop Collection	18.0			0.5%			
Flow set	19.0	6"	2000	**2022**	0.004	0.3	**100.0%**
Stop Collection	24.0			1.1%			
Flow set	25.0	6"	2600	**2599**	0.003	54.9	**99.7%**
Stop Collection	30.0			-0.1%			
Hydroworks HD 3				Interim Collection Net		1.3	
					Total	**56.5**	**99.7%**

Table 3 - Light-liquid recorded flow and re-entrainment data

Quality assurance

Performance testing and verification of the HydroDome HD3 Oil Grit Separator were performed in accordance with the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. The verifier, CAWT, has confirmed that quality assurance requirements were addressed throughout the performance testing process and in the generation of performance test results. This includes reviewing all data sheets and data downloads, as well as overall management of the test system, quality control and data integrity.

In addition, QA/QC measures are documented in the *"Procedure for Laboratory Testing of Oil-Grit Separators"* (TRCA, 2014) to ensure results are accurate and precise, and that testing conducted by multiple vendors of the same category of technology are employing the same test method. The QA/QC measures include the use of certified laboratories, established test methods, calibration of equipment, tolerance limits for results variation, data checks during testing, and stringent documentation requirements.

Table 4 provides a summary of the acceptance criteria for particle size distribution, solids concentration in test water, water temperature, flow measurement equipment, flow rate variation, sediment feed, sediment moisture content, and sample analysis.

QC Parameter	Acceptance Criteria
Particle Size Distribution	Analyzed by a certified laboratory in accordance with ASTM D422-63(2007)e1. Percentages for size ranges vary by <6%, median < 75 um. PSD in water determined by ASTM D422-63(2007)e1 upon prior drying in designated pre-weighed nonferrous trays in compliance with ASTM D4959-07.
Solids concentration in test water	Suspended solids concentration (SSC) concentration of test water of less than 20 mg/L.
Water temperature	Temperature of water less than 25ºC.
Flow measurement equipment	Equipment calibration reports submitted to confirm that reported flow rate match actual flow rate. Flow rates from calibrated flow instruments recorded at no longer than 30 second intervals over the duration of the test.
Flow rate variation	Flow rates have COV < 0.04; maintained with ±10% of target flow rate.
Sediment feed	TSS concentration target = 200 mg/L with a tolerance limit of ±25 mg/L. Injection location is 5 pipe diameters upstream of the inlet to the device, as per the *Procedure*. Six calibration samples taken over duration of each test run. The allowed Coefficient of Variance (COV) for the measured samples was 0.10.
Sediment moisture content	Determined by ASTM D4959-07 "Standard Test Method for Determination of Water (Moisture) Content of Soil By Direct Heating".
Sample analysis	Conducted by qualified laboratories using standard methods and meeting the requirements of ISO.

Table 4. Validation of QA/QC procedures

Summary of Verification Results and Verified Performance Claim for Hydroworks HydroDome HD3 Oil-Grit Separator (OGS)

In summary, the HydroDome HD3 Oil Grit Separator is designed to remove oil, sediment, trash and debris from stormwater and snowmelt runoff as well as other pollutants that attach to sediment particles, such as nutrients and metals. Verification of performance claims for the Hydroworks HydroDome HD3 Oil Grit Separator was conducted by CAWT based on independent third-party performance test results provided by Alden Research Laboratory, as well as additional information provided by Hydroworks.

Table 5 summarizes the verification results in relation to the technology performance parameters that were identified to determine the efficacy of the HydroDome HD3 Oil Grit Separator. The claims stated in Table 5 were verified using the modified mass balance method for sediment removal by measuring the total mass of sediment entering the unit and retained by the unit at prescribed surface loading rates. Effluent sampling was conducted every minute over a 30-minute duration for the scour test, using approved sampling methods as per the verification procedure. The light liquid re-entrainment test was conducted using a mass balance methodology which accounted for all the beads input, captured, and scoured from the separator.

Parameters	Verified Claims	Accuracy
Sediment Removal	During the sediment removal test, the Hydroworks HydroDome HD3 OGS device, with a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and a constant influent test sediment concentration of 200 mg/L and particle size distribution of 1-1000 µm, removed 83.9, 77.6, 68.4, 66.9, 59.4, 52.4, and 46.0 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 1000, and 1400 L/min/m^2 respectively	The sediment removal characteristics were quantified at various surface loading rates (SLRs), including particle size fractions, using a modified mass balance methodology. Performance results are presented as the true values.
Sediment Scour	During the scour test, the Hydroworks HydroDome HD3 OGS device with 15.2 cm (6 inch) of test sediment preloaded onto a false floor reaching 50% of the manufacturer's recommended maximum sediment sump storage depth, generated corrected effluent sediment concentrations on average of 0.54, 0.70, 0.0, 0.0, and 0.11 mg/L at 5-min duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m2, respectively.	5 samples analyzed for sediment (n=5) at each flow rate There was negligible scour once corrected for background concentrations.
Light Liquid Re-entrainment	During the light-liquid re-entrainment test, the Hydroworks HydroDome HD3 OGS with surrogate low-density polyethylene beads preloaded within the inner chamber, representing a floating light-liquid volume equal to a depth of 50.8 mm (2 inch) over the sedimentation area, retained 100, 100, 100, 100, and 99.7 percent of loaded beads by mass during the 5-minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2, respectively.	Performance results are presented as the true values. Under the "Procedure for Laboratory Testing of Oil-Grit Separators" (TRCA, 2014), the light-liquid re-entrainment test is also not amenable to statistical analysis as the tests were only conducted once at various flow rates following a mass balance procedure.

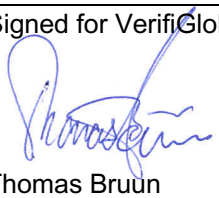
Table 5. Verified performance claims

What is ISO 14034?

The purpose of environmental technology verification is to provide a credible and impartial account of the performance of environmental technologies. Environmental technology verification is based on a number of principles to ensure that verifications are performed and reported accurately, clearly, unambiguously and objectively. The International Organization for Standardization (ISO) standard for environmental technology verification (ETV) is ISO 14034, which was published in November 2016.

Benefits of ETV

ETV contributes to protection and conservation of the environment by promoting and facilitating market uptake of innovative environmental technologies, especially those that perform better than relevant alternatives. ETV is particularly applicable to those environmental technologies whose innovative features or performance cannot be fully assessed using existing standards. Through the provision of objective evidence, ETV provides an independent and impartial confirmation of the performance of an environmental technology based on reliable test data. ETV aims to strengthen the credibility of new, innovative technologies by supporting informed decision-making among interested parties.

For more information on the HydroDome Oil Grit Separator, contact:	For more information on VerifiGlobal, contact:
Hydroworks LLC. 257 Cox St., Roselle, NJ 07203 USA T: +1-888-290-7900 E: gbryant@hydroworks.com W: https://hydroworks.com	VerifiGlobal c/o ETA-Danmark A/S Göteborg Plads 1, DK-2150 Nordhaven T: +45 7224 5900 E: info@verifiglobal.com W: www.verifiglobal.com
Signed for Hydroworks:  Graham Bryant Owner	Signed for VerifiGlobal:  Thomas Bruun Managing Director  John Neate Managing Director

NOTICE: Verifications are based on an evaluation of technology performance under specific, predetermined operational conditions and parameters and the appropriate quality assurance procedures. VerifiGlobal and the Verification Expert, CAWT, make no expressed or implied warranties as to the performance of the technology and do not certify that a technology will always operate as verified. The end user is solely responsible for complying with any and all applicable regulatory requirements. Mention of commercial product names does not imply endorsement.

VerifiGlobal and the Verification Expert, CAWT, provide the verification services solely on the basis of the information supplied by the applicant or vendor and assume no liability thereafter. The responsibility for the information supplied remains solely with the applicant or vendor and the liability for the purchase, installation, and operation (whether consequential or otherwise) is not transferred to any other party as a result of the verification.