ODAN·DETECH
CONSULTING ENGINEERS

The Odan/Detech Group Inc.
P: (905) 632-3811
F: (905) 632-3363
5230, SOUTH SERVICE ROAD, UNIT 107
BURLINGTON, ONTARIO, L7L 5K2
www.odandetech.com

PROPOSED TOWNHOUSE DEVELOPMENT
487 SHAVER ROAD
HAMILTON (ANCASTER), ONTARIO

PROJECT No. : 21203

FUNCTIONAL SERVICING REPORT

Prepared For:

ELITE M.D. DEVELOPMENTS

Prepared By:

The Odan/Detech Group Inc.

Original:	September 10, 2021	Issued for ZBA
Revision 1:	August 12, 2022	Reissued for ZBA
Revision 2:	November 25, 2022	Reissued for ZBA

TABLE OF CONTENTS

DESCRIPTION page

LIST OF FIGURES

LIST OF TABLES

APPENDIX A

Existing Site	Aerial view of Site and surrounding areas
Site Plan Concept	by KNYMH Inc.
Topographic Survey	by Barich Grenkie Surveying Ltd.
City Engineering Criteria	

APPENDIX B

Shaver Estates Sanitary Tributary Plan

APPENDIX C

Cultec Stormwater Sizing Sheets
Jellyfish Filter Sizing Report
Shaver Estates Stormwater Tributary Plan
Shaver Estates SWM Pond Excerpt from SWM Report

APPENDIX D

Functional Servicing Plan
Functional Grading Plan
Functional Section Plan

1.0 INTRODUCTION

The property under study is a 0.452 ha site located at 487 Shaver Road in the City of Hamilton (Ancaster). The site is bounded by a residential subdivision to the north, Shaver Road to the west, and a City of Hamilton Works Yard to the south and east. Presently, the site contains a 1-storey house and detached garage with a gravel driveway and sodded yard. Refer to the Aerial Photo of the Existing Site in Appendix A for additional details.

The parcel falls within the area of the *Shaver Estates* residential subdivision (City of Hamilton File No. 25T-97002) which was designed by A.J. Clarke and Associates Ltd. The lands were slated for future medium density development and were thus accounted for in the design of the entire subdivision. Engineering drawings for the *Shaver Estates* residential subdivision were retrieved by Odan/Detech through the City of Hamilton Spatially Indexed Engineering Records (SPIDER) website.

It is proposed to construct a residential townhouse development comprising three blocks of stacked townhouses with rooftop amenities. Driveway and pedestrian access is proposed from Shaver Road on the site's west property line. The remainder of the site includes surface parking and sodded areas. Refer to the Site Plan Concept by KNYMH Inc. in Appendix A for more information regarding the proposed layout of the site.

For detailed topography of the existing site conditions, as of November 17, 2020, refer to the topographic survey prepared by Barich Grenkie Surveying Ltd. in Appendix A.

This report will evaluate the serviceability of the site with respect to sanitary waste water, water and storm water management (SWM) and will implement the SWM criteria identified by City staff in prior correspondence.

Criteria for the site engineering was provided by Himanshi Juneja of the City of Hamilton in a memo to Yvette Rybensky (Development Planning) dated February 2, 2021. The memo is provided here in Appendix A.

2.0 SCOPE OF WORK

THE ODAN/DETECH GROUP INC. was retained by **Elite M.D. Developments** to review the Site, collect data, evaluate the Site for the proposed use and present the findings in a Functional Servicing and Storm Water Management Report in support of a Rezoning Application and Site Plan Application. The scope of work in brief involves the following:

a) Collecting existing servicing drawings from the CITY in order to establish availability and feasibility of Site servicing;
b) Meetings/conversations with CITY Engineers and Design Team.
c) Evaluation of the data and presentation of the findings in a FSR and Storm Water Management Report in support of the Rezoning and Site Plan Application.

3.0 SANITARY SEWERS

i) Available Infrastructure

There is a 300mm diameter municipal sanitary sewer flowing southerly beneath Shaver Road, adjacent to the site's west boundary.

ii) Proposed Sanitary Servicing

The proposed development comprises 36 residential units, each with 2 bedrooms. Refer to the architectural statistics in Appendix A.

The following City standards for calculating the site's inflow/infiltration and peaking factor are provided in the City of Hamilton *Comprehensive Development Guidelines and Financial Policies Manual* (2019), Section E.1. *Design Guidelines*.

Inflow/Infiltration

- For areas where there are no storm sewers, or shallow storm sewers which require the weeping tiles of the dwelling to be drained by sump pump, the infiltration factor shall be 0.6 L/s per hectare

Peaking Factor

$$M = \frac{5}{p^{0.2}}$$

Where *p* is population in thousands and 2<M<5

The following is the expected sanitary flow from the proposed development, calculated using the Ontario Building Code, Section 8.2.1.3 (refer to Table 2 on page 4 for calculation details).

Total development area of Site:	0.452 ha
Peak Infiltration flow rate:	0.6 L/sec/ha
Peaking Factor (Babbitt Peaking Factor): $M = 5 \div (P/1000)^{0.2}$ (2 < M < 5)	5 (max)
Total average daily flow: (from OBC calc in Table 2)	48,400 L/day
Total average flow:	0.460 L/sec
Population, peak flow:	Average flow x PF = 2.30 L/sec
Total extraneous flow:	0.452 x 0.6 = 0.271 L/sec
Total Peak Flow: (Peak Flow + Extraneous) = (2.30 + 0.271) =	**2.57 L/sec.**

The following is the expected sanitary flow from the proposed development, calculated using the City's design criteria of 3.67 persons/unit and 360 L/person/day.

Design flow = 3.67 (p/u) x 36 (units) x 360 (L/sec/day) + 0.6 L/sec/ha x 0.452 (ha)
=47,563.2 L/day + 0.271 L/s
=0.55 L/sec + 0.271 L/s
Peak flow = 0.55 L/sec x PF + 0.271 L/s
=0.55 L/sec X 5 + 0.271
=**3.02 L/sec**

The allocated sanitary flow rate will also be calculated, using the population density. The subject property is located in a catchment with a designed population density of 110 ppha (refer to the Shaver Estates Sanitary Drainage Plan by A.J. Clarke and Associates Ltd. In Appendix B). The City standard for flow rate (360 L/person/day) will be used along with the designed population density in order to calculate the population increases for the site.

Thus, the allocated sanitary flow from the subject site by A.J. Clarke and Associates Ltd. is calculated as follows:

Design Flow = Average Dry Weather Flow x Peak Factor + Infiltration allowance
= 110 (ppha) x 0.452 (ha) x 360 (L/cap/day) x 5 + 0.6 (L/sec/ha) x 0.452 (ha)
= 89,496 L/day + 0.271 L/s
= 1.036 L/s + 0.271 L/s
= **1.31 L/sec**

See Table 1 below for a comparison of the proposed sanitary flow rate calculated using the Ontario Building Code, Section 8.2.1.3., versus the allocated flow rate calculated based on the designed population density of 110 ppha.

Table 1 – Proposed vs Allocated Sanitary Flows

	Proposed Flow Rate (L/sec) (based on OBC calculation)	Proposed Flow Rate (L/sec) (based on City Criteria)	Allocated Flow Rate (L/sec) (based on population density)
Proposed Development	2.57	**3.02**	1.31

As seen above, the proposed development will contribute 1.71 L/s more flow into the existing sanitary sewer when compared to A.J. Clarke and Associates Ltd.'s design of the same area (0.452 ha).

Furthermore, the proposed 200mm @ 2.0% sanitary sewer connection for the site has a capacity of 46 L/s, which is adequate to convey the post-development sanitary flows from the site (3.02 L/s). See site servicing drawings by ODAN/DETECH for further details.

As per the City's request, a downstream sanitary analysis has been completed using a population density of 3.67 people/per unit for the newer developments within this sanitary sewer shed. Refer to section 3.0 iii) for a detailed discussion of the downstream sanitary analysis.

Table 2 – OBC Sanitary Flow Calculation for the Development

ODAN·DETECH
CONSULTING ENGINEERS

The Odan/Detech Group Inc.
P: (905) 632-3811
F: (905) 632-3363
5230, SOUTH SERVICE ROAD, UNIT 107
BURLINGTON, ONTARIO, L7L 5K2
www.odandetech.com

PROJECT: ***Proposed Townhouse Development***
487 Shaver Road
Hamilton (Ancaster), Ontario

CLIENT: Elite M.D. Developments
DATE: 22-Jul-22
PROJECT No.: 21203
DRAWING REF.: Rev 1

	A	B	C	D	E	F	G	H	I	J
	Floor Area (sq.ft.)	**Floor Area (sq.m.)**	**Establishment Type (OBC 8.2.1.3.B.)**	**Based on Floor Area**	**Volume (litres)**	**Total Volume (litres) (B/DxE)**	**Volume (litres)**	**Establishment Type (OBC 8.2.1.3.B.)**	**Based on Number of Beds or Units (ea.)**	**Volume (litres) (G x I)**
Proposed 2-Bedroom Townhouse							1100	2 Bedroom Dwelling	36	*39600*
Total Floor Area	***0***	***0***	***Total Based on Floor Area***			**0**	***Total Based on Number of Beds/Units***			**39600**
Total Volume (Average per day)										***39600***
Total (l/sec)										***0.46***

iii) Downstream Sanitary Analysis

An original downstream sanitary sewer analysis is provided as follows, given that the proposed development poses additional flows to the sanitary network.

The methodology used to prepare the downstream sanitary sewer analysis is as follows.

1) Tributary unit statistics, floor areas, etc., were found through an analysis of existing land uses via google maps and the Shaver Estates Sanitary Analysis by A.J. Clarke & Associates.

2) Odan/Detech has coordinated with the City of Hamilton to ensure accurate unit counts and population densities were used in the analysis.

3) The resulting tributary statistics were inputted into the downstream sanitary sewer analysis sheets on the following pages.

4) The following unit populations, flows, etc. were applied in the following sewer analysis sheets, as per the *Comprehensive Development Guidelines and Financial Policies* (City of Hamilton, 2019).

    a. Townhouse – 3.67 Person/unit
    b. Other – as noted on the Shaver Estates Sanitary Analysis
    c. Average flows – 350 L/cap/d
    d. Infiltration allowance – 0.60 L/s/Ha

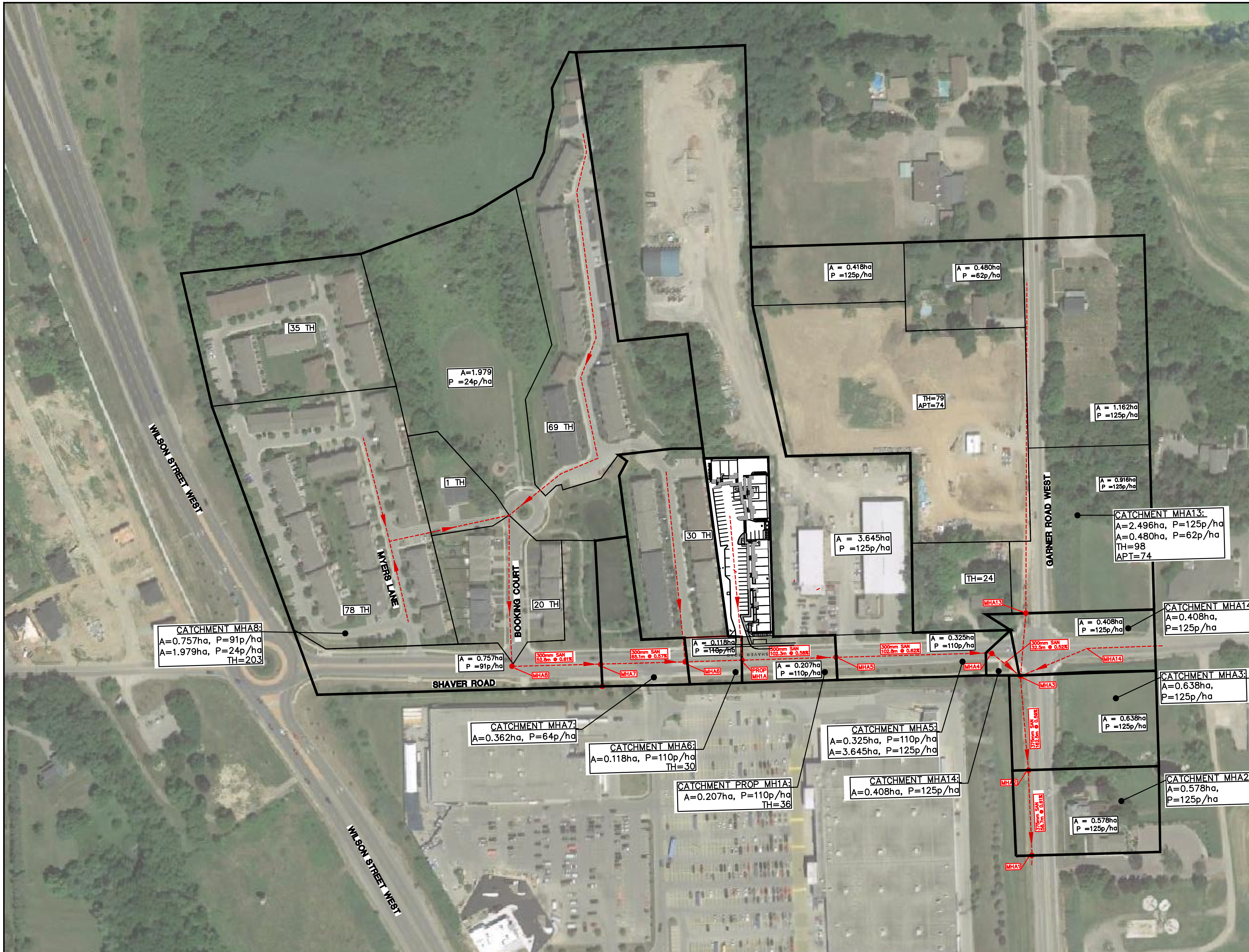
Conventional gravity sanitary sewer analysis sheets and catchment plans are provided on the following pages for two scenarios, the pre and post-development.

The following conclusions and discussion are drawn from the following conventional sewer analysis sheets.

- In the pre-development, all sewers are flowing well below capacity, at a maximum of 55.61% full.

- In the post-development, all sewers are flowing well below capacity, at a maximum of 58.47% full.

- ***Therefore, it follows that the existing downstream sanitary sewer network has available capacity to service the subject development and no sanitary sewer infrastructure upgrades are required.***



CONSTRUCTION NORTH

LEGEND

OVERALL CATCHMENT AREA (FOR I/I)

PROPERTY LINE

EX SAN SEWER

DRAWING :

POST-DEV SANITARY SEWER
DOWNSTREAM CATCHMENT PLAN

DATE:	PROJ. NO.:	SCALE:
NOV 2022	21203	1:2500

PROJECT :

PROPOSED RESIDENTIAL DEVELOPMENT
487 SHAVER ROAD
ANCASTER, ON

ODAN·DETECH CONSULTING ENGINEERS
The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

PROPOSED DOWNSTREAM SANITARY SEWER ANALYSIS SHEET - PRE-DEVELOPMENT

Site location: 487 Shaver Road, Ancaster

Ref# PN 21203

q = average daily per capita flow = 360 (L/cap/d)
I = Unit of peak extraneous flow = 0.6
Q(p) = peak population flow (L/s)
Q(I) = peak extraneous flow (L/s)
Q(d) = peak design flow (L/s)

Mannings Equation:
Qcap=(D/1000)^2.667*(S/100)^0.5/(3.211*n)*1000(L/s)
D: pipe size (mm)
S: slope (grade) of pipe (%)
n = Manning roughness coefficient = 0.013

Location					Inlet Flow: Population/Area						Population/Unit				Accumulative Tributary	Inflow/ Infiltration	Residential P/F	Average Residential Sanitary	Peak Residential Sanitary	Unit Inflow/ Infiltration	Segment Inflow/ Infiltration	Accumulative Inflow/ Infiltration	Accumulative Sanitary Flow	Pipe: Length	Size	Slope	Shape	Full Flow Capacity	% Full
Sanitary Trib ID	Street Name	Pipe No. Main or Trib Branch	US MH	DS MH	Area 1 (ha)	Pop Density 1 (p/ha)	Area 2 (ha)	Pop Density 2 (p/ha)	Population (Person)	Acc've Pop'n (Person)	High Density APT (Units)	Townhome (Units)	Population (Person)	Acc've Pop'n (Person)	Population (Person)	Area (ha)	M	Q (360 L/c/d) (L/s)	Q(p) (360 L/c/d) (L/s)	I/I (L/Sec/ha)	Q(i) (L/s)	Q(i) (L/s)	Q(d) (L/s)	L (m)	(mm)	S (%)		Qcap (L/s)	Q(d)/Qcap
MH A8	Shaver Road	main	MH A8	MH A7	0.76	91.00	1.98	24.00	116.38	116.38		203.00	744.33	744.33	860.72	8.52	5.00	3.59	17.93	0.60	5.11	5.11	23.04	52.80	300	0.61	Circle	75.53	30.51%
MH A7	Shaver Road	main	MH A7	MH A6	0.36	64.00			23.17	139.55			-	744.33	883.88	0.36	5.00	0.10	0.48	0.60	0.21	5.33	23.74	65.10	300	0.57	Circle	73.01	32.52%
MH A6	Shaver Road	main	MH A6	Prop MH1A	0.12	110.00			12.98	152.53		30.00	110.00	854.33	1,006.86	0.87	4.99	0.51	2.56	0.60	0.52	5.85	26.79	39.00	300	0.58	Circle	73.65	36.38%
PROP MH1A	Shaver Road	main	Prop MH1A	MH A5	0.21	110.00			22.77	175.30			-	854.33	1,029.63	0.65	4.97	0.09	0.47	0.60	0.39	6.24	27.56	63.30	300	0.58	Circle	73.65	37.43%
MH A5	Shaver Road	main	MH A5	MH A4	0.33	110.00	3.65	125.00	491.38	666.68			-	854.33	1,521.01	3.96	4.60	2.05	9.41	0.60	2.38	8.61	37.75	102.80	300	0.62	Circle	76.14	49.58%
MH A4	Shaver Road	main	MH A4	MH A3	0.41	125.00			51.00	717.68			-	854.33	1,572.01	0.41	4.57	0.21	0.97	0.60	0.24	8.86	38.78	32.50	300	0.52	Circle	69.73	55.61%
MH A13	Garner Road West	Branch	MH A13	MH A3	2.50	125.00	0.48	62.00	341.76	341.76	74.00	98.00	544.33	544.33	886.09	5.60	5.00	3.69	18.46	0.60	3.36	3.36	21.82						
MH A14	Shaver Road	Branch	MHA14	MH A3	0.41	125.00			51.00	51.00			-	-	51.00	0.41	5.00	0.21	1.06	0.60	0.24	0.24	1.31						
MH A3	Garner Road West	main	MH A3	MH A2	0.64	125.00			79.75	1,190.19			-	1,398.67	2,588.85	0.64	4.13	0.33	1.37	0.60	0.38	12.85	57.44	162.50	375	0.59	Circle	134.67	42.65%
MH A2	Garner Road West	main	MH A2	MH A1	0.58	125.00			72.25	1,262.44			-	1,398.67	2,661.10	0.58	4.11	0.30	1.24	0.60	0.35	13.19	58.78	58.70	375	0.61	Circle	136.94	42.92%

Notes:

PEAKING FACTOR, M =5/(P^0.2) P in thousands
AVERAGE DAILY PER CAPITA FLOW q = 360 L/c/day

Townhouse 3.67person/unit
High Density Apt 2.5person/unit

UNIT OF PEAK EXTRANEOUS FLOW, 0.6 L/s/ha
PEAK POPULATION FLOW, Q (p) = q*P*M / 86400 L / Sec.
PEAK EXTRANEOUS FLOW, Q(i) = I*A L / Sec.
PEAK DESIGN FLOW, Q(d) = Q(p) + Q(i) L / Sec.
PIPE ROUGHGNESS, n = 0.013 For Manning's Equation

Vmin. = 0.75m/s and Vmax. = 2.75m/s

PROPOSED DOWNSTREAM SANITARY SEWER ANALYSIS SHEET - POST-DEVELOPMENT

ODAN·DETECH CONSULTING ENGINEERS

Site location: 487 Shaver Road, Ancaster

Ref# PN 21203

q = average daily per capita flow = 360 (L/cap/d)
I = Unit of peak extraneous flow = 0.6
Q(p) = peak population flow (L/s)
Q(I) = peak extraneous flow (L/s)
Q(d) = peak design flow (L/s)

Mannings Equation:
Qcap=(D/1000)^2.667*(S/100)^0.5/(3.211*n)*1000(L/s)
D: pipe size (mm)
S: slope (grade) of pipe (%)
n = Manning roughness coefficient = 0.013

Location					Inlet Flow: Population/Area						Population/Unit			
Sanitary Trib ID	Street Name	Pipe No. Main or Trib Branch	US MH	DS MH	Area 1 (ha)	Pop Density 1 (p/ha)	Area 2 (ha)	Pop Density 2 (p/ha)	Population (Person)	Acc've Pop'n (Person)	High Density APT (Units)	Townhome (Units)	Population (Person)	Acc've Pop'n (Person)
MH A8	Shaver Road	main	MH A8	MH A7	0.76	91.00	1.98	24.00	116.38	116.38		203.00	744.33	744.33
MH A7	Shaver Road	main	MH A7	MH A6	0.36	64.00			23.17	139.55			-	744.33
MH A6	Shaver Road	main	MH A6	Prop MH1A	0.12	110.00			12.98	152.53		30.00	110.00	854.33
PROP MH1A	Shaver Road	main	Prop MH1A	MH A5	0.21	110.00			22.77	175.30		36.00	132.00	986.33
MH A5	Shaver Road	main	MH A5	MH A4	0.33	110.00	3.65	125.00	491.38	666.68			-	986.33
MH A4	Shaver Road	main	MH A4	MH A3	0.41	125.00			51.00	717.68			-	986.33
MH A13	Gamer Road West	Branch	MH A13	MH A3	2.50	125.00	0.48	62.00	341.76	341.76	74.00	98.00	544.33	544.33
MH A14	Shaver Road	Branch	MHA14	MH A3	0.41	125.00			51.00	51.00			-	-
MH A3	Gamer Road West	main	MH A3	MH A2	0.64	125.00			79.75	1,190.19			-	1,530.67
MH A2	Gamer Road West	main	MH A2	MH A1	0.58	125.00			72.25	1,262.44			-	1,530.67

Sanitary Trib ID	Accumulative Tributary Population (Person)	Inflow/ Infiltration Area (ha)	Residential P/F M	Average Residential Sanitary Q (360 L/c/d) (L/s)	Peak Residential Sanitary Q(p) (360 L/c/d) (L/s)	Unit Inflow/ Infiltration I/I (L/Sec/ha)	Segment Inflow/ Infiltration Q(i) (L/s)	Accumulative Inflow/ Infiltration Q(i) (L/s)	Accumulative Sanitary Flow Q(d) (L/s)	Pipe: Length L (m)	Size (mm)	Slope S (%)	Shape	Full Flow Capacity Qcap (L/s)	% Full Q(d)/Qcap
MH A8	860.72	8.52	5.00	3.59	17.93	0.60	5.11	5.11	23.04	52.80	300	0.61	Circle	75.53	30.51%
MH A7	883.88	0.36	5.00	0.10	0.48	0.60	0.21	5.33	23.74	65.10	300	0.57	Circle	73.01	32.52%
MH A6	1,006.86	0.87	4.99	0.51	2.56	0.60	0.52	5.85	26.79	39.00	300	0.58	Circle	73.65	36.38%
PROP MH1A	1,161.63	0.65	4.85	0.64	3.13	0.60	0.39	6.24	29.72	63.30	300	0.58	Circle	73.65	40.36%
MH A5	1,653.01	3.96	4.52	2.05	9.26	0.60	2.38	8.61	39.76	102.80	300	0.62	Circle	76.14	52.22%
MH A4	1,704.01	0.41	4.49	0.21	0.96	0.60	0.24	8.86	40.77	32.50	300	0.52	Circle	69.73	58.47%
MH A13	886.09	5.60	5.00	3.69	18.46	0.60	3.36	3.36	21.82						
MH A14	51.00	0.41	5.00	0.21	1.06	0.60	0.24	0.24	1.31						
MH A3	2,720.85	0.64	4.09	0.33	1.36	0.60	0.38	12.85	59.25	162.50	375	0.59	Circle	134.67	43.99%
MH A2	2,793.10	0.58	4.07	0.30	1.23	0.60	0.35	13.19	60.58	58.70	375	0.61	Circle	136.94	44.24%

Notes:

PEAKING FACTOR, M =5/(P^0.2) P in thousands
AVERAGE DAILY PER CAPITA FLOW q = 360 L/c/day

Townhouse 3.67person/unit
High Density Apt 2.5person/unit

UNIT OF PEAK EXTRANEOUS FLOW, 0.6 L/s/ha
PEAK POPULATION FLOW, Q (p) = q*P*M / 86400 L / Sec.
PEAK EXTRANEOUS FLOW, Q(i) = I*A L / Sec.
PEAK DESIGN FLOW, Q(d) = Q(p) + Q(i) L / Sec.
PIPE ROUGHGNESS, n = 0.013 For Manning's Equation

Vmin. = 0.75m/s and Vmax. = 2.75m/s

4.0 WATER DISTRIBUTION

Design Considerations

There is an existing 300mm diameter municipal water main on the east side of Shaver Road adjacent to the site's west boundary which is available to service the subject site.

It is proposed to provide a 150mm diameter water service connection to this main for the proposed townhouses' domestic water supply and fire protection. The townhouses will be served for fire protection by two hydrants which are located within 90m of all units: one hydrant is an existing hydrant which is located in the municipal right-of-way on the east side of Shaver Road, adjacent to the subject site's west property line, and the other hydrant is a proposed private hydrant located within the subject site. See servicing drawings by ODAN/DETECH for details and locations of the above.

The proposed development is located within Pressure Zone 18. Hydrant test data for the existing hydrant noted above was provided by Udo Ehrenberg of the City of Hamilton Public Works Department in an email dated February 22, 2021 – see Table 3 below.

Table 3 – Hydrant Test Data Provided by the City of Hamilton

Hydrant ID	Address	Pressure Zone	Date of Most Recent HFI2	Static Pressure (psi)	Residual Pressure (psi)	Test Flow (Imp Gal/min)	DSR	DSR2	FAR20 (Imp Gal/min)
AN16H014	487 Shaver Road	18	6/20/19 3:20:00 PM	86	74	1110	12	66	2787

The hydrant test data shows a flow of 2787 imp gal/min @ 20 psi, which converts to a flow rate of 3358 USGM at 20 psi.

The required domestic water demand for the site is calculated using the AWWA Manual M22 Modified Fixture Value Method. A domestic peak hour demand of 3.66 L/s was calculated as per the AWWA method as shown in Table 4 and Figure 1 on page 9. Please note that the fixture count was determined using the latest architectural floor plans for the proposed building (refer to Appendix A for a breakdown of the development's fixture counts). The fixture values were obtained from Table 4-2 of the aforementioned manual.

Table 4 – Required Domestic Water Demand for the Development

Fixture	Fixture Value (GPM) at 60 psi	Number of Fxitures	Fixture Value (GPM)
Fixture count as per latest arch. floor plans. Fixture values as per Table 4-2 of AWWA Manual M22.			
Toilets (Tank)	4	36	144
Faucets (Lavatory)	1.5	36	54
Bath Tubs	8	36	288
Faucets (Kitchen Sink)	2.2	36	79.2
Dishwashers	2	36	72
Clothes Washers	6	36	216
Faucets (Laundry Tub)	4	0	0
Hose Bibs	6	0	0
Total Fixture Value			**853**
Demand (gpm) from Fig 4.2 of AWWA Manual M22 Second Editon			**58**
Total Domestic Demand (l/s)			**3.66**

Figure 1 – AWWA M22 Figure 4-2 Excerpt showing Domestic Water Demand

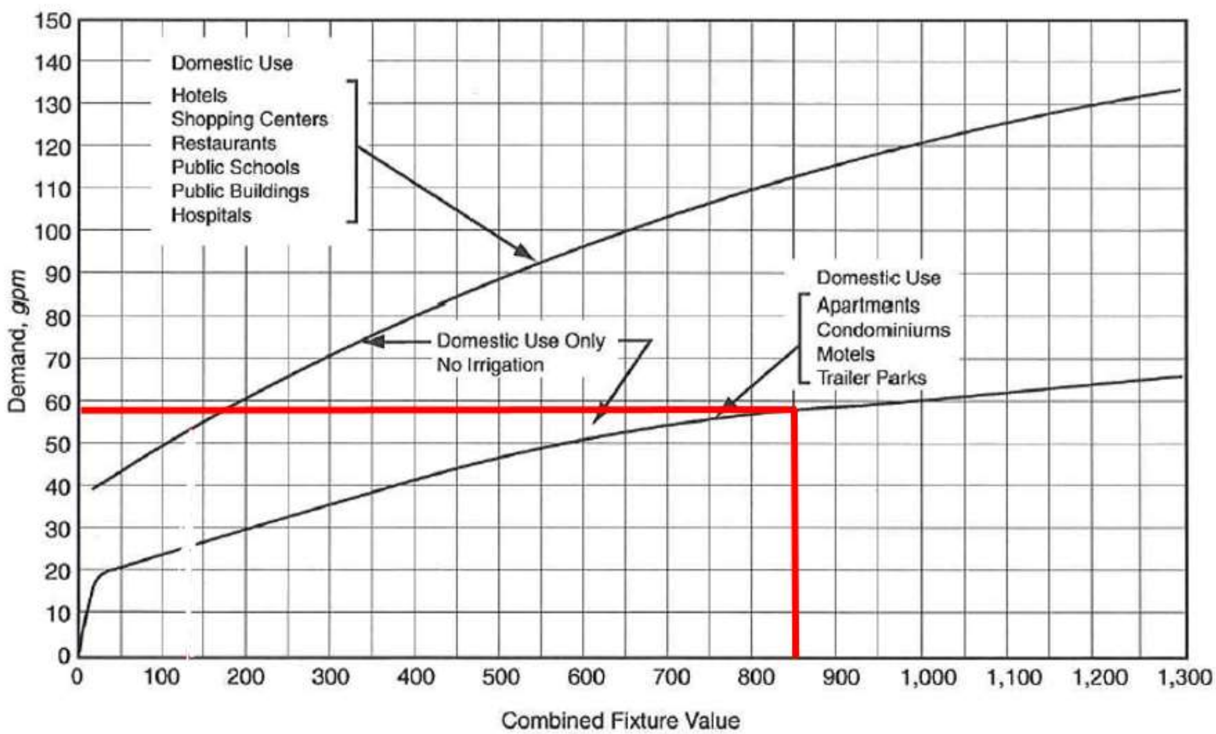


Figure 4-2 Water flow demand per fixture value—low range

The fire flow demands for this development will follow the target available fire flow (AFF) for the proposed land use, as per Table 5 below, which was provided by the City in their memorandum dated February 2, 2021 in Appendix A. The proposed townhouse development will have 44 residential units; therefore, the target AFF will be 150 L/s, as highlighted below.

Table 5 – Target AFF for Various Land Uses Provided by the City of Hamilton

Land Use	**Target AFF (L/s)**
Commercial	150
Small ICI (<1800 m^3)	100
Industrial	250
Institutional	150
Residential Multi (greater than three units) *	150
Residential Medium (three or less units)	125
Residential Single	75
Residential Single (dead end)	50

* Land Use for Proposed development

A summary of the total water demands for the site and available flow in the vicinity of the development is presented in Table 6 below.

As shown, the existing watermain is sufficient to provide fire and domestic service for the proposed development because the available flow (as per hydrant test data from the City of Hamilton and/or the recent flow test) is greater than the total water demand.

Table 6 – Summary of Water Demand for the Site and Available Flow

	L/sec	USGPM
Domestic Flow Demand (peak hour)	3.66	58
Domestic Flow Demand (peak day)	2.31	37
Fire Flow Demand	150	2378
Total Water Demand	152.3	2415
Available Flow at 20 PSI Residual Pressure (Hydrant AM13H030)	196.7 (City Data)	2787 (City Data)

As can be seen above the Available Fire Flow is greater than the Required Fire Flow for the proposed development.

5.0 STORM WATER MANAGEMENT

i) Background & Available Infrastructure

The Shaver Estates subdivision was originally designed to divert any storm flows from the subject property to a stub manhole to the north west of the site, which would fall into the catchment area of the stormwater management and conveyance system for the *Shaver Estates* residential subdivision (City of Hamilton File No. 25T-97002), designed by A.J. Clarke and Associates Ltd. The A.J. Clarke and Associates Ltd. design had 0.452 ha flowing to the existing SWM pond from the Subject Site for the 2-year storm (see the Shaver Estates Stormwater Tributary Plan in Appendix C).

However, as the Stub Manhole was not built during the construction stage of the aforementioned project, the storm flows will have to be discharged directly into the Municipal sewers beneath Shaver Road.

At present there is an existing catch basin on-site in the centre of the northern driveway.
The existing catch basin has a PVC lead of 13.98m @4.01% to an existing 450mm PVC storm sewer beneath Shaver Road which flows north. This sewer provides minor system storm conveyance to an existing pond on the northeast corner of the intersection of Garner Road West and McClure Road.

The roofs for the existing buildings on the subject property and the adjacent property drain via downspouts to the aforementioned catch basin – this is designated as Catchment Area EX-1 on the Pre-Development Drainage Plan (see Figure 1 on page 14).

Stormwater management for the proposed development will follow the stormwater management criteria set out by the City of Hamilton, Ontario Ministry of the Environment, Conservation and Parks and the Hamilton Conservation Authority. A summary of the stormwater management criteria applicable to the site are as follows:

Quantity Control: Quantity control measures are to be designed to ensure that 100 year post-development flows from site are equal to or less than the pre-development 2 year flow.

Quality Control: Quality control measures are to be designed to provide Enhanced Protection - long term average removal of 80% of Total Suspended Solids (TSS) on an annual loading basis from all runoff leaving the proposed development site based on the post-development level of imperviousness.

ii) Allowable (Pre-Development) Discharge Rate

The 100-year post development flow from the site will be controlled to the pre-development 2-year level. Design storm data for the Hamilton Mount Hope 2 and 100-year storm events are shown below.

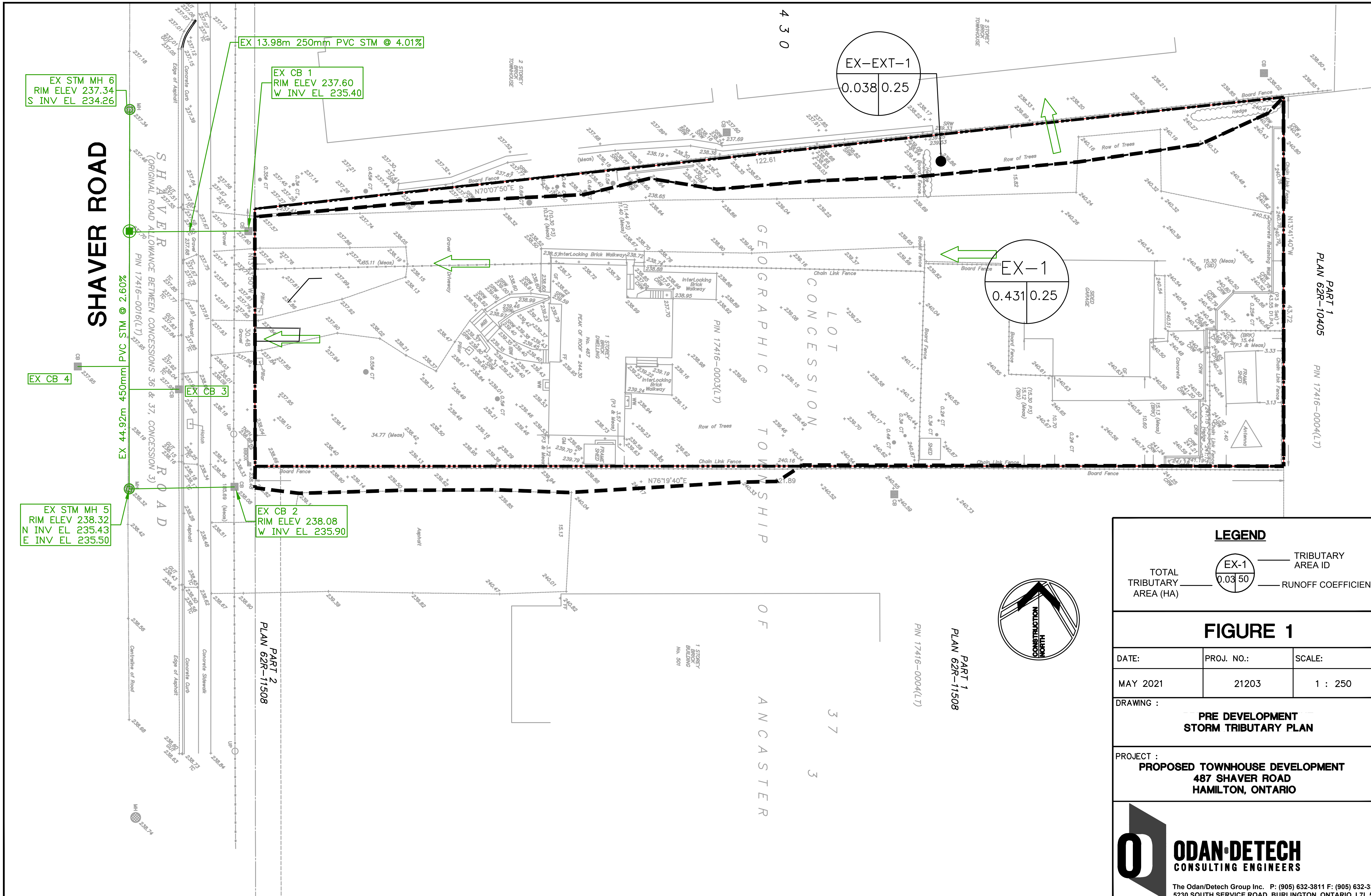
2 Year Storm: $I_2 = 646.0 / (T + 6)^{0.781}$ where: I = intensity (mm/hr)
$I_2 = 74.10$ mm/hr T = time of concentration (10min)

100 Year Storm: $I_{100} = 2317.4 / (T + 11)^{0.836}$
$I_{100}=181.81$ mm/hr

In pre-development conditions, a 0.431 Ha area consisting of lands within the existing site, as well as lands off-site to the south, drain uncontrolled via overland sheet flow easterly towards the existing site catch basin. A portion of the site, 0.038 Ha, drains off-site to the property to the north. Refer to the Pre-Development Drainage Plan on the following page. The pre-development runoff flow rate, calculated using Rational Method, in 2-year and 100-year storms from this area are as follows.

TABLE 7 – Pre Development Flows

Location	Run-off Coefficient	Rainfall Intensity (mm/hr)	Area of Region (ha)	Site Discharge (L/s)
On-Site Flow (EX-1)	0.25	2Y: 74.10	0.431	**22.20**
	0.25	100Y: 181.81		**54.46**
Off-site Flow (EX-EXT-1)	-	-	0.038	**-**
	-	-		**-**



LEGEND

TOTAL TRIBUTARY AREA (HA) — TRIBUTARY AREA ID — RUNOFF COEFFICIENT

EX-1 / 0.03 / 50

FIGURE 1

DATE:	PROJ. NO.:	SCALE:
MAY 2021	21203	1 : 250

DRAWING :

PRE DEVELOPMENT STORM TRIBUTARY PLAN

PROJECT :

PROPOSED TOWNHOUSE DEVELOPMENT
487 SHAVER ROAD
HAMILTON, ONTARIO

ODAN·DETECH CONSULTING ENGINEERS

The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

iii) Proposed Conditions & Post-Development Flow Analysis

In the post-development condition, the 100-year flow is to be equal to or less than the 2-year flow in the pre-development condition. This will ensure that the existing storm water infrastructure will be sufficient for the proposed development and no off-site upgrades will be required.

To control post development flows a 375mm PVC pipe will be installed on site. The proposed building's rooftops will be drain via a downspout to the surface and flow to the proposed 375mm storm sewer. Area drains will be provided at the entrance of each building unit and will drain to the storm system via mechanical.

The computer hydraulic and hydrologic modelling software XPSWMM 2023.1 by Innovyze is used as follows to model the runoff flow rates and hydraulics of the proposed storm sewer system. This is necessary to accurately model the backflow effect on the site from the existing Shaver Road storm sewers. Two Shaver Road storm sewer segments, totaling a distance of 109m were included in the model, with the outlet at Ex STM MH 7 being free-flow. This outlet has been considered free flow as the catch basin rim elevation near Ex STM MH 7 is at 236.20, which is substantially lower than the 487 Shaver Road's spill elevation at the rim of Prop CBMH 1 of 237.82m. Therefore, in an extremely large storm event, water would spill out the catch basins on Shaver Road rather than the subject site's catch basin manhole (which is at a lower elevation than the proposed basement floor elevations on site). XPSWMM is also utilized to plot the 100-year water level within the site to ensure the unit patios maintain a reasonable freeboard from the 100-year water level in a large storm event.

The hydrology parameters used in the post-development XPSWMM model are as follows. The post-development tributary plan can be found on page 17. In the post-development, 0.012ha of storm runoff will free flow onto the neighbouring property to the north (EXT-2), which is less than the 0.038ha in existing conditions (see Table 7).

Name	Subcatchment	Impervious Area depression storage (mm)	Pervious Area depression storage (mm)	Area ha	Width m	Slope	Impervious Percentage %
EX MH5	1	2	5	0.28	17.5	0.020	71
	2	2	5	1.476	40.5	0.02	93
Ex MH6	1	2	5	0.23	16.1	0.020	72
Prop MH3	1	2	5	0.09	9.8	0.02	90
Prop MH5	1	2	5	0.09	10.2	0.020	90
Prop MH6	2	2	5	0.15	12.8	0.02	90
Prop MH7	1	2	5	0.07	9.1	0.01	50
Patio A	1	2	5	0.01	2.6	0.01	99
Patio B	1	2	5	0.01	3.0	0.01	99
Patio C	1	2	5	0.01	3.0	0.01	99
Patio D	1	2	5	0.01	2.4	0.01	99

Table 8 – Horton's Equation Parameters (Soil Type C)	
Maximum Initial Infiltration Rate	75.0 mm/hr
Minimum Initial Infiltration Rate	5.0 mm/hr
Decay rate of infiltration	2.0 /hr
Accumulated soil moisture at Beginning of Storm	0.0 mm
Previous Area Depression Storage	5.0 mm

The design storm used in the XPSWMM model was the Hamilton Mount Hope storm. The IDF parameters used for the 100-year storm can be seen below.

TABLE 2.1 IDF PARAMETERS - MOUNT HOPE						
Parameter	**2**	**5**	**10**	**25**	**50**	**100**
A	646.0	1049.5	1343.7	1719.5	1954.8	2317.4
B	6.0	8.0	9.0	10.0	10.0	11.0
C	0.781	0.803	0.814	0.823	0.826	0.836

In order to control the post-development flows to the allowable flow rate, a Cultec system is proposed along with an 85mm diameter orifice plate at Prop STM CBMH 1. The Cultec system will be located within the groundwater table and will therefore be constructed in a water-tight manner. Schematic figures of the XPSWMM model can be found on the following pages and the results are summarized as follows:

Table 9 – Summary of Stormwater Flows to Shaver Road		
Storm Event	**Allowable Flow (L/s)**	**Proposed Flow (L/s)**
5 Year Storm	-	15*
100 Year Storm	22	21

*5-year release rate used for Downstream Storm Sewer Analysis in Section 5 iv).

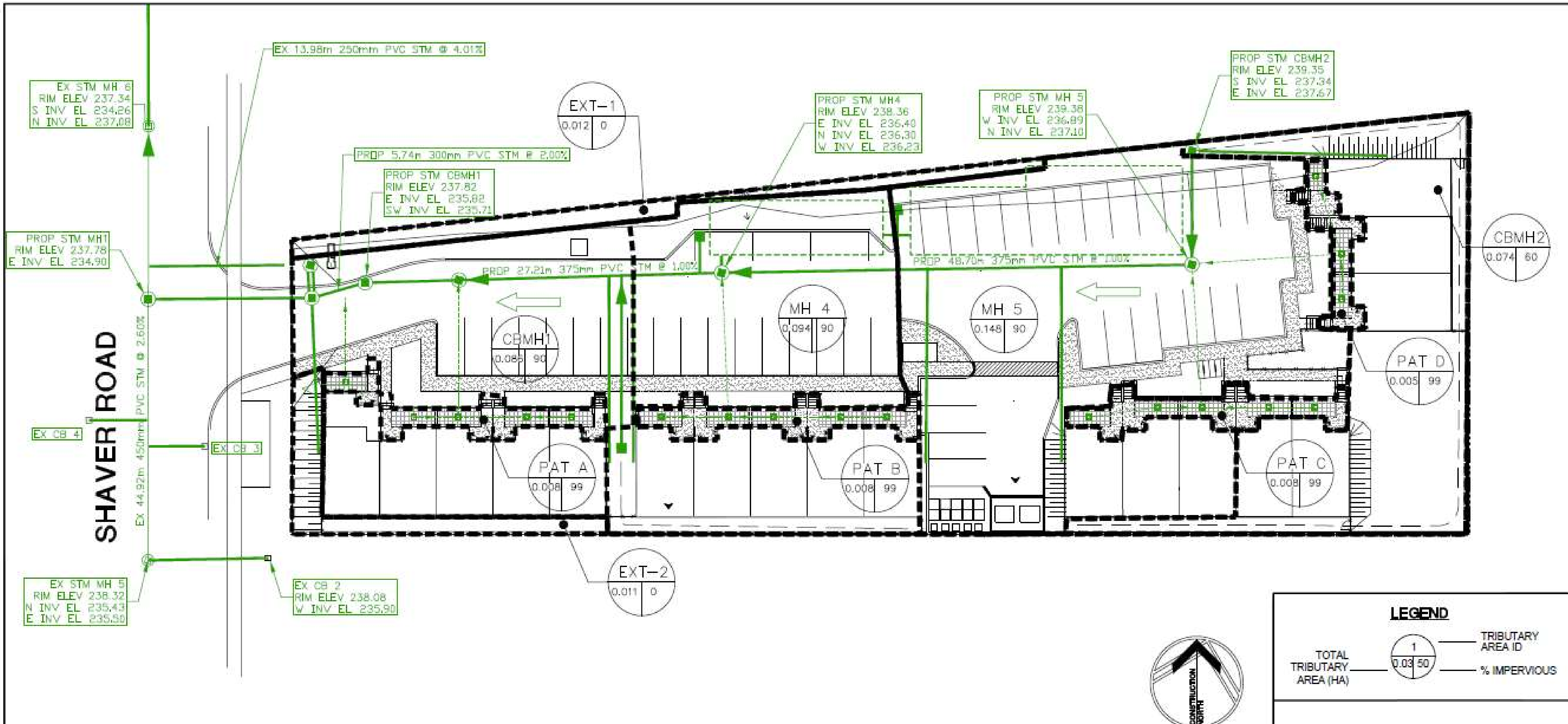
Table 10 – Summary of Cultec Chamber Stormwater Volumes		
Storm Event	**Volume Required (m3)**	**Volume Provided (m3)**
100 Year	202	208

A 208m^3 Cultec system is proposed to store the required volumes for the site. Refer to Appendix C for the Cultec Sizing/Design Sheets. Being that the Cultec system will be constructed as water-tight, the volume provided by the stone beneath the chamber is not included in the total storage volume.

A plot of the 100-year HGL through the site is shown on page 20. It can be seen that the maximum 100-year water level in the proposed stormwater system is at an elevation of 237.235m. This is 0.54m below the lowest patio elevation of 237.78m, which is a sufficient freeboard in case of an emergency situation. The XPSWMM output file is available upon request.

A storm sewer analysis has been completed on the site's proposed storm system, along with a proposed storm drainage plan. All proposed sewers are flowing well below 85% during the 5-year storm event, with the highest percent full being 54.2% within the 375mm pipe from STM MH 4 to STM MH 3.

As per the City's request, a downstream storm analysis has been completed for the storm sewers beneath Shaver Road. Refer to section 5.0 iv) for a detailed discussion of the downstream storm analysis.



LEGEND

TOTAL TRIBUTARY AREA (HA) — 0.03
TRIBUTARY AREA ID — 1
% IMPERVIOUS — 50

LEGEND

CATCHMENT BOUNDARY

DATE:	PROJ. NO.:	SCALE:
MAY 2021	21203	1 : 250

DRAWING :

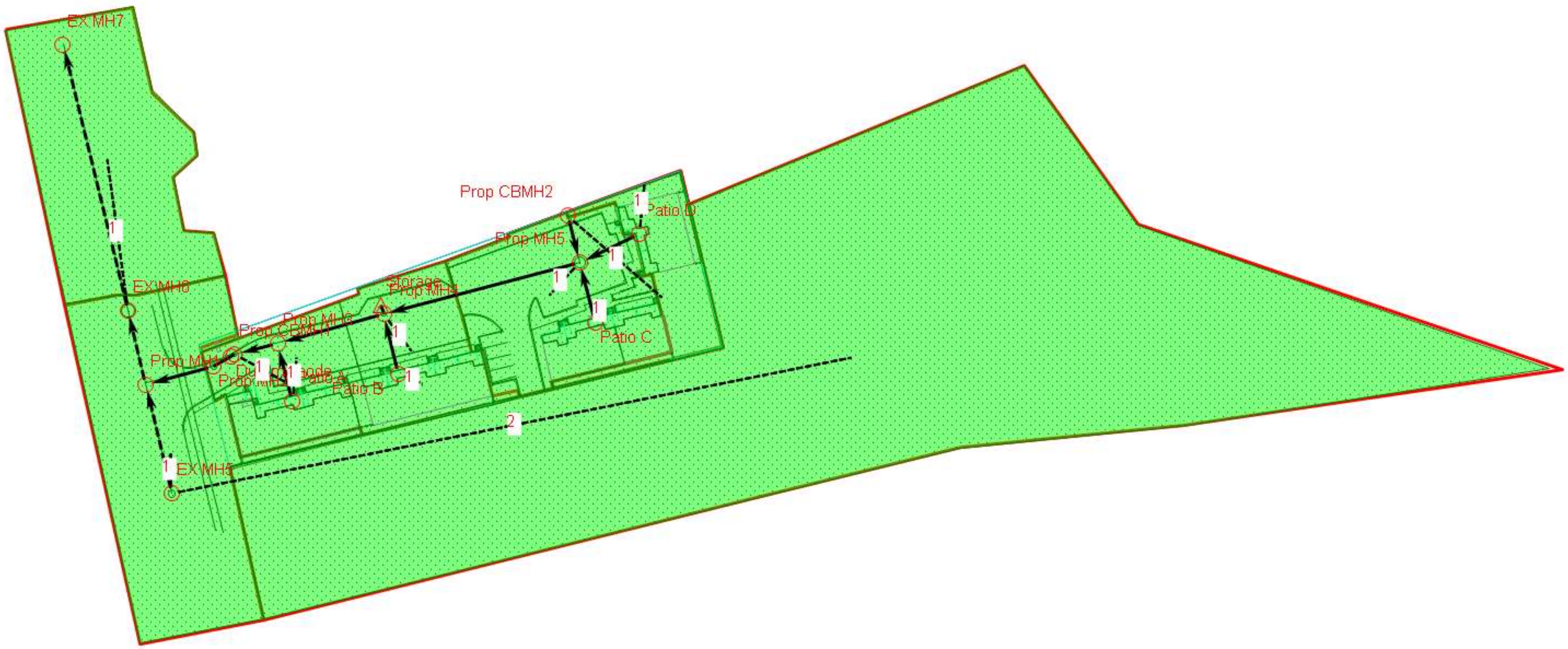
POST DEVELOPMENT STORM TRIBUTARY PLAN

PROJECT :

PROPOSED TOWNHOUSE DEVELOPMENT
487 SHAVER ROAD
HAMILTON, ONTARIO

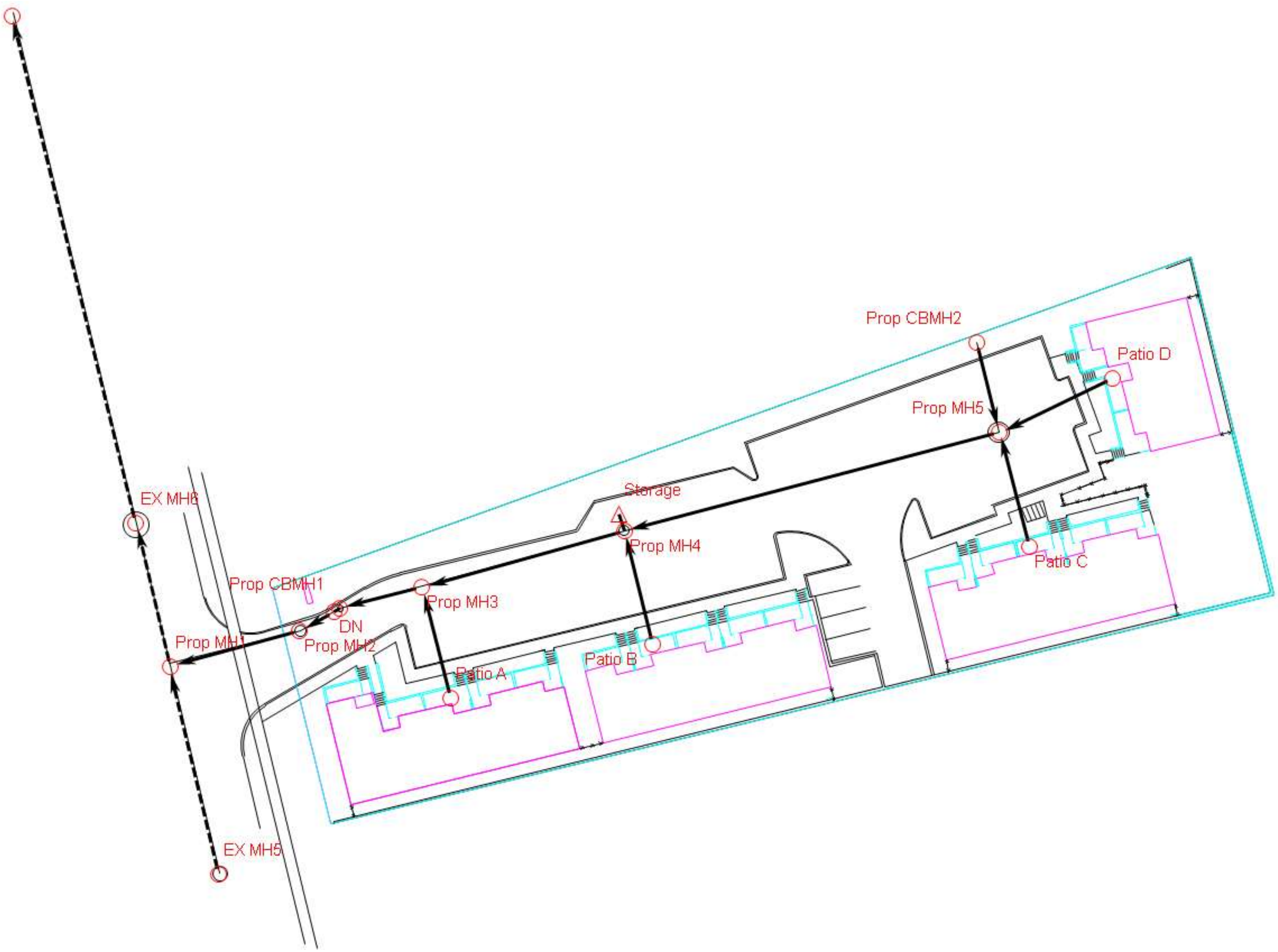
ODAN·DETECH CONSULTING ENGINEERS
The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

Figure 2 - Post-Development XPSWMM Model with Tributaries



Legend: Δ - storage node, o –node/MH,
Link (pipe or open channel) **Tan colour** shows a channel
Parallel Pipe or Link with pipe and channel above or orifice

Figure 3 - Post-Development XPSWMM Model with Node Labels

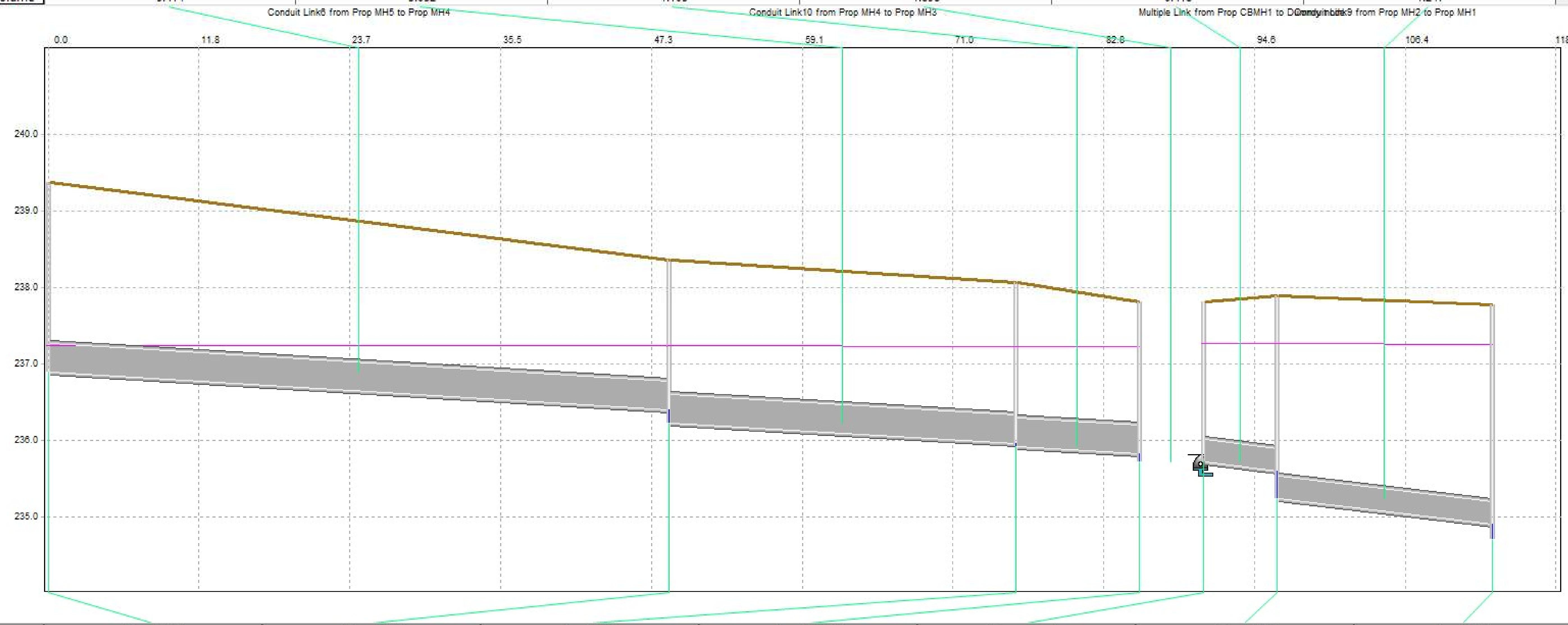


Legend: ∆ - storage node, o –node/MH,
Link (pipe or open channel) **Tan colour** shows a channel
Parallel Pipe or Link with pipe and channel above or orific

Figure 4 – Proposed Storm System 100-Year Hydraulic Grade Line

Pipes

	Link6	Link10	Link11	orifice plate	Link17	Link9
Storm	100yr3hrChicago-HamM	100yr3hrChicago-HamM	100yr3hrChicago-HamM	100yr3hrChicago-HamM	100yr3hrChicago-HamM	100yr3hrChicago-HamM
Max Flow	0.105	-0.049	-0.047	0.021	0.026	0.054
Design Full Flo	0.175	0.175	0.175	0.005	0.137	0.137
Diameter (Hei	0.375	0.375	0.375		0.300	0.300
Max Velocity	1.601	0.741	0.669	3.323	1.395	1.394
Max Volume	5.414	3.052	1.105	1.898	0.418	1.247



	Prop MH5	Prop MH4	Prop MH3	Prop CBMH1	Dummy node	Prop MH2	Prop MH1
Storm	100yr3hrChicago-HamM	100yr3hrChicago-HamM	100yr3hrChicago-HamM	100yr3hrChicago-HamM	100yr3hrChicago-HamM	100yr3hrChicago-HamM	100yr3hrChicago-HamM
Ground Elevati	239.380	238.360	238.070	237.820	237.820	237.900	237.780
Freeboard	2.145	1.127	0.840	0.590	0.556	0.637	0.525
Max Water Ele	237.235	237.233	237.230	237.230	237.264	237.263	237.255
Invert Elevatio	236.887	236.228	235.920	235.710	235.710	235.240	234.700
Max Volume	0.425	1.226	1.599	1.854	1.900	2.468	3.117

ODAN·DETECH
CONSULTING ENGINEERS

PROJECT: **PROPOSED TOWNHOUSE DEVELOPMENT**
PROJECT No.: **21203**
LOCATION: **487 SHAVER ROAD**
MUNICIPALITY: **HAMILTON**
DESIGNED BY: **MLB**
CHECKED BY: **JK**
DATE: Nov 21 **2022**

DESIGN PARAMETERS:

Min. Pipe Size=	300	mm
Mannings, n=	0.013	
Minimum Tc =	10	min
Max. Percent Full=	85	%
Min. Pipe Cover=	1.22	m
Min. Full Flow Velocity=	0.8	m/s
Max. Full Flow Velocity=	3.65	m/s

RAINFALL DATA:

	LOCATION	FORMULA
5 Yr Storm:	Mount Hope	i=A/(B+Tc)^C
Yr Storm:	Mount Hope	i=A/(B+Tc)^C

5 Yr IDF		100 Yr IDF	
A=	1049.5	A=	2317.4
B=	8	B=	11
C=	0.803	C=	0.836

TRIBUTARY ID #	STREET NAME	UPPER MANHOLE	LOWER MANHOLE	AREA (ha)	RUNOFF COEFFICIENT (C)	A*C	ACCUMULATED A*C	INITIAL TIME OF CONCENTRATION (min)	5 YR RAINFALL INTENSITY (mm/hr)	5 YR PEAK FLOW (L/s)	TOTAL 5YR PEAK FLOW (L/s)	TOTAL 5Y PEAK FLOW From OTTHYMO (L/s)	LENGTH (m)	HEIGHT/ DIAMETER (mm)	SLOPE (%)	FULL FLOW CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)	PERCENT FULL (%)
CBMH 2	On-Site	CBMH 2	MH 5	0.074	0.5	0.037	0.037	10	103.0383	10.59852	10.59852	-	11.8	200	2	46.38	1.48	22.8%
MH 5	On-Site	MH 5	MH 4	0.161	0.9	0.1449	0.1819	10	103.0383	41.50609	52.10461	-	48.7	375	1	175.33	1.59	29.7%
MH 4	On-Site	MH 4	MH 3	0.102	0.9	0.0918	0.2737	10	103.0383	26.29578	78.40039	-	27.2	375	1	175.33	1.59	44.7%
MH 3	On-Site	MH 3	CBMH 1	0.094	0.90	0.0846	0.3583	10	103.0383	24.23337	102.6338		9.7	375	1	175.33	1.59	58.5%
MH 3	On-Site	CBMH 1	MH 2	0	0	0	0.2737	10	103.0383	0	0	15	5.7	250	2	84.10	1.71	17.8%

iv) Downstream Storm Sewer Analysis

As per the Shaver Estates Storm Drainage Area Plan in Appendix C, the subject development's storm runoff was allocated towards the Shaver Estates SWM Pond rather than the Shaver Road storm sewers that is currently being proposed. A downstream storm sewer analysis is therefore proposed to confirm the existing storm sewers beneath Shaver Road have available capacity to accept stormwater runoff from the subject development

The methodology used to prepare the downstream storm sewer analysis is as follows.

1) The 5-year Mount Hope storm has been modelled in the following downstream storm sewer analysis.

2) Tributary areas and runoff coefficients have been obtained from the Shaver Estates Stormwater Management Report and Catchment Plan, provided in Appendix C.

3) The Shaver Estate SWM report states the 2-year and 10-year stormwater release rate from the Shaver Estates SWM pond. The 10-year release rate of 600 L/s has been used in this analysis.

4) The 5-year stormwater release rate for the subject site of 15 L/s, calculated using XPSWMM and is being used in this analysis.

Conventional gravity storm sewer analysis sheets and catchment plans are provided on the following pages for the post-development storm sewer analysis.

The following conclusions and discussion are drawn from the following conventional sewer analysis sheets.

- All storm sewers downstream of the subject site are flowing well below capacity, at a maximum of 66.6% full (5-year).

- One branch storm sewer segment is flowing above 100% in the existing condition, and the subject development adds no additional flow to this sewer.

- ***Therefore, it follows that the existing downstream storm sewer network has available capacity to service the subject development and no storm sewer infrastructure upgrades are required.***

LEGEND

OVERALL CATCHMENT AREA (FOR I/I)

PROPERTY LINE

EX STM SEWER

DRAWING :

POST-DEV STORM SEWER
DOWNSTREAM CATCHMENT PLAN

DATE:	PROJ. NO.:	SCALE:
NOV 2022	21203	1:2000

PROJECT :

PROPOSED RESIDENTIAL DEVELOPMENT
487 SHAVER ROAD
ANCASTER, ON

ODAN-DETECH
CONSULTING ENGINEERS
The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

ODAN·DETECH CONSULTING ENGINEERS

PROJECT: **PROPOSED TOWNHOUSE DEVELOPMENT**
PROJECT No.: **21203**
LOCATION: **487 SHAVER ROAD**
MUNICIPALITY: **HAMILTON**
DESIGNED BY: **MLB**
CHECKED BY: **JK**
DATE: **November 20 2022**

DESIGN PARAMETERS:

Min. Pipe Size=	300	mm
Mannings, n=	0.013	
Minimum Tc =	10	min
Max. Percent Full=	85	%
Min. Pipe Cover=	1.22	m
Min. Full Flow Velocity=	0.8	m/s
Max. Full Flow Velocity=	3.65	m/s

RAINFALL DATA:

	LOCATION	FORMULA
5 Yr Storm:	Mount Hope	i=A/(B+Tc)^C
Yr Storm:	Mount Hope	i=A/(B+Tc)^C

5 Yr IDF		100 Yr IDF	
A=	1049.5	A=	2317.4
B=	8	B=	11
C=	0.803	C=	0.836

TRIBUTARY ID #	STREET NAME	UPPER MANHOLE	LOWER MANHOLE	AREA (ha)	RUNOFF COEFFICIENT (C)	A*C	ACCUMULATED A*C	INITIAL TIME OF CONCENTRATION (min)	5 YR RAINFALL INTENSITY (mm/hr)	5 YR PEAK FLOW (L/s)	5Y PEAK FLOW From XPSWMM/OTTHYMO (L/s)	TOTAL 5Y PEAK FLOW	LENGTH (m)	HEIGHT/ DIAMETER (mm)	SLOPE (%)	FULL FLOW CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)	PERCENT FULL (%)
Ex MH5	SITE	Ex MH5	Ex MH6	0.431						0	15.00	15.00	45.2	450	2.52	452.59	2.85	3.3%
Ex MH5	Shaver Road	Ex MH5	Ex MH6	1.476	0.66	0.97416	0.97416	15	84.63	229.19		244.19	45.2	450	2.52	452.59	2.85	54.0%
Ex MH5	Shaver Road	Ex MH5	Ex MH6	0.285	0.7	0.1995	1.17366	10	103.04	57.15		301.33	45.2	450	2.52	452.59	2.85	66.6%
Ex MH6	Shaver Road	Ex MH6	Ex MH7	0.232	0.7	0.1624	1.33606	10	103.04	46.52		347.85	66.1	525	2	608.20	2.81	57.2%
Ex MH9	Shaver Road	Ex MH9	Ex MH8	0.638	0.7	0.4466	0.4466	10	103.04	127.93		127.93	82.5	300	4.47	204.45	2.89	62.6%
Ex MH8	Shaver Road	Ex MH8	Ex MH7	0.247	0.7	0.1729	0.6195	10	103.04	49.53		177.45	66.1	375	0.57	132.37	1.20	134.1%
Pond	Shaver Road	Pond	Ex MH7	11.96						0	600.00	600.00	66.1	900	5	4047.98	6.36	14.8%
Ex MH7	Shaver Road	Ex MH7	Ex MH1	15.269								1125.31	66.1	900	5	4047.98	6.36	27.8%

v) Stormwater Quality Control

Hamilton City staff identified the stormwater quality control criteria applying to the runoff from this site to be Level 1 quality control considering treatment train design principles in accordance with City of Hamilton and MECP's standards. Proposed OGS unit should be designed to capture and treat at least 90% of the runoff volume that occurs for a site on a long-term average basis using ETV Canada particle size distribution

Water quality for the site will be accomplished via a JF4-2-1 unit (or an approved alternative). The total upstream area contributing flow to the proposed OGS has been considered. Refer to the sizing report in Appendix B.

vi) Erosion Control

Erosion and sediment control will be implemented on-site prior to construction and be maintained through the entire duration of construction. Erosion control measures to be implemented are:

- silt fence around the entire site
- sediment socks within existing and proposed catchbasins
- an entrance mud mat for trucks
- daily cleaning and weekly washing of roads

6.0 CONCLUSIONS

From the foregoing investigation, the site is serviceable utilizing existing sanitary, storm and water main infrastructure within and adjacent to the site. Storm water management for the proposed development will match existing conditions as described in this report.

The following table summarizes the SWM and Servicing components of the proposed development.

TABLE 11 – Summary	
Sanitary Peak Flow Rate (L/s)	3.02
Proposed Sanitary Service	200mm @ 1.0%
Receiving Sanitary Sewer	Shaver Road – 300mm @ 0.6%
Required Fire Flow Development Water Demand (Fire + Domestic)	152.3 L/sec (2415 USGPM)
Available Flow Rate	196.7 l/sec (2787 USGPM)
Allowable release rate from site (2 year storm)	22
Proposed release rate from site (100 year storm)	21
Total Storm Water Storage Required (m3)	202
Total Storm Water Storage Required (m3)	208
Quantity Control	85mm Dia. Orifice Plate
Water Quality	JF4-2-1

7.0 REFERENCES

1. City of Hamilton *Development Engineering Guidelines and Financial Policies* (2019)

2. Storm water Management Planning and Design Manual, Ontario Ministry of the Environment, March 2003

3. Visual OTTHYMO v2.0 Reference Manual, July 2002

Respectfully Submitted;
The Odan Detech Group Inc.

REGISTERED PROFESSIONAL ENGINEER
Nov 25/2022
I. KRPAN
PROVINCE OF ONTARIO

John Krpan, M.S.C.E., P.Eng.	Mitchell Bufalino, Civil EIT

APPENDIX A

Existing Site	Aerial view of Site and surrounding areas
Site Plan Concept	by KNYMH Inc.
Topographic Survey	by Barich Grenkie Surveying Ltd.
City Engineering Criteria	

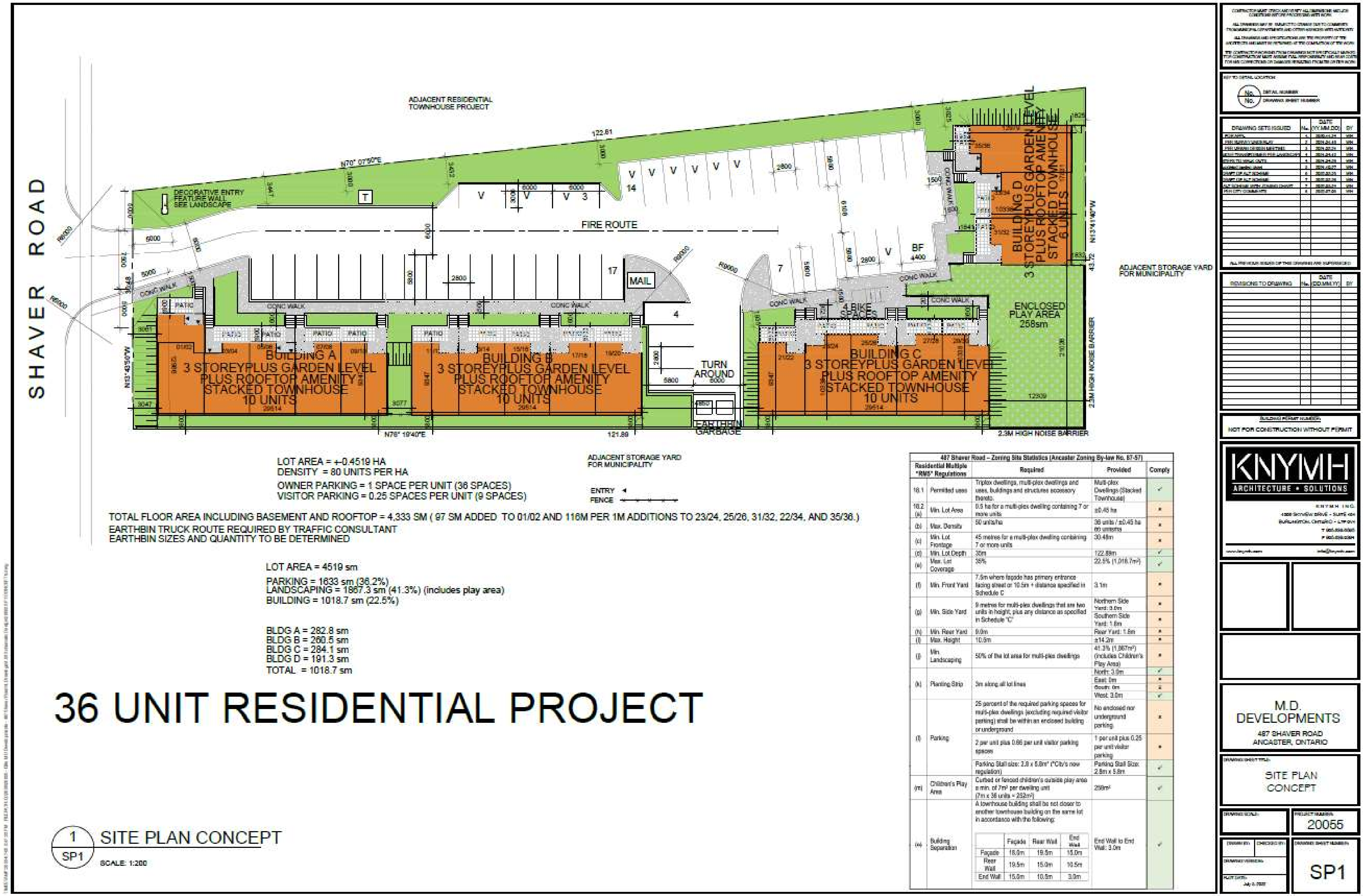
Property Boundary

DRAWING :		
KEY PLAN		
DATE:	PROJ. NO.:	SCALE:
FEBRUARY 2021	21203	NTS

PROJECT :

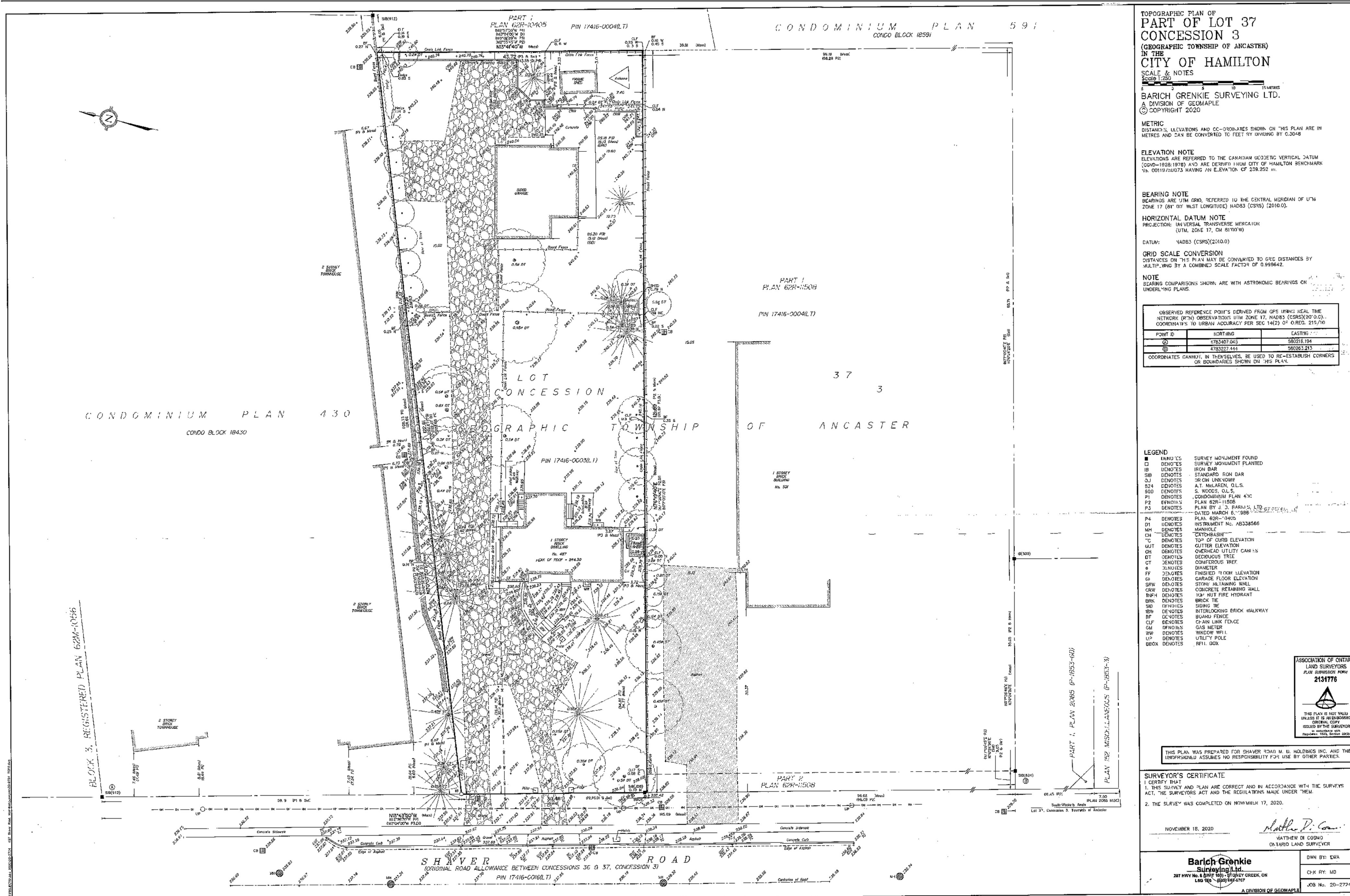
PROPOSED TOWNHOUSE DEVELOPMENT
487 SHAVER ROAD
ANCASTER, ON

ODAN·DETECH
CONSULTING ENGINEERS
The Odan/Detech Group Inc.
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2



487 Shaver Road – Zoning Site Statistics (Ancaster Zoning By-law No. 87-57)				
Residential Multiple "RM5" Regulations		Required	Provided	Comply
18.1	Permitted uses	Triplex dwellings, multi-plex dwellings and uses, buildings and structures accessory thereto.	Multi-plex Dwellings (Stacked Townhouse)	✓
18.2 (a)	Min. Lot Area	0.5 ha for a multi-plex dwelling containing 7 or more units	±0.45 ha	▪
(b)	Max. Density	50 units/ha	36 units / ±0.45 ha 80 units/ha	▪
(c)	Min. Lot Frontage	45 metres for a multi-plex dwelling containing 7 or more units	30.48m	▪
(d)	Min. Lot Depth	30m	122.89m	✓
(e)	Max. Lot Coverage	35%	22.5% (1,018.7m²)	✓
(f)	Min. Front Yard	7.5m where façade has primary entrance facing street or 10.5m + distance specified in Schedule C	3.1m	▪
(g)	Min. Side Yard	9 metres for multi-plex dwellings that are two units in height, plus any distance as specified in Schedule "C"	Northern Side Yard: 3.0m	▪
			Southern Side Yard: 1.6m	▪
(h)	Min. Rear Yard	9.0m	Rear Yard: 1.6m	▪
(i)	Max. Height	10.5m	±14.2m	▪
(j)	Min. Landscaping	50% of the lot area for multi-plex dwellings	41.3% (1,867m²) (includes Children's Play Area)	▪
(k)	Planting Strip	3m along all lot lines	North: 3.9m	✓
			East: 0m	▪
			South: 0m	▪
			West: 3.0m	✓
(l)	Parking	25 percent of the required parking spaces for multi-plex dwellings (excluding required visitor parking) shall be within an enclosed building or underground	No enclosed nor underground parking	▪
		2 per unit plus 0.66 per unit visitor parking spaces	1 per unit plus 0.25 per unit visitor parking	▪
		Parking Stall size: 2.8 x 5.8m* (*City's new regulation)	Parking Stall Size: 2.8m x 5.8m	✓
(m)	Children's Play Area	Curbed or fenced children's outside play area a min. of 7m² per dwelling unit (7m x 36 units = 252m²)	258m²	✓
(n)	Building Separation	A townhouse building shall be not closer to another townhouse building on the same lot in accordance with the following:	End Wall to End Wall: 3.0m	✓

	Façade	Rear Wall	End Wall
Façade	18.0m	19.5m	15.0m
Rear Wall	19.5m	15.0m	10.5m
End Wall	15.0m	10.5m	3.0m


CONDOMINIUM PLAN 591
CONDO BLOCK 18591
CONDOMINIUM PLAN 430
CONDO BLOCK 18430
PART 1 PLAN 62R-10405
PIN 17416-0004(LT)
PART 1 PLAN 62R-11508
PIN 17416-0004(LT)
LOT 37 CONCESSION 3
GEOGRAPHIC TOWNSHIP OF ANCASTER
PIN 17416-0003(LT)
1 STOREY BRICK DWELLING No. 487
PART 2 PLAN 62R-11508
BLOCK 3, REGISTERED PLAN 62M-1066
PART 1, PLAN 2085 (P-1853-68)
PLAN 152 MISCELLANEOUS (P-1853-3)
SHAVER ROAD
(ORIGINAL ROAD ALLOWANCE BETWEEN CONCESSIONS 36 & 37, CONCESSION 3)
PIN 17416-0016(LT)
TOPOGRAPHIC PLAN OF
PART OF LOT 37
CONCESSION 3
(GEOGRAPHIC TOWNSHIP OF ANCASTER)
IN THE
CITY OF HAMILTON
SCALE & NOTES
Scale 1:250
5 0 5 10 15 METRES
BARICH GRENKIE SURVEYING LTD.
A DIVISION OF GEOMAPLE
© COPYRIGHT 2020
METRIC
DISTANCES, ELEVATIONS AND CO-ORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048
ELEVATION NOTE
ELEVATIONS ARE REFERRED TO THE CANADIAN GEODETIC VERTICAL DATUM (CGVD-1928:1978) AND ARE DERIVED FROM CITY OF HAMILTON BENCHMARK No. 00119750073 HAVING AN ELEVATION OF 239.252 m.
BEARING NOTE
BEARINGS ARE UTM GRID, REFERRED TO THE CENTRAL MERIDIAN OF UTM ZONE 17 (81° 00' WEST LONGITUDE) NAD83 (CSRS) (2010.0).
HORIZONTAL DATUM NOTE
PROJECTION: UNIVERSAL TRANSVERSE MERCATOR (UTM, ZONE 17, CM 81°00'W)
DATUM: NAD83 (CSRS)(2010.0)
GRID SCALE CONVERSION
DISTANCES ON THIS PLAN MAY BE CONVERTED TO GRID DISTANCES BY MULTIPLYING BY A COMBINED SCALE FACTOR OF 0.999642.
NOTE
BEARING COMPARISONS SHOWN ARE WITH ASTRONOMIC BEARINGS ON UNDERLYING PLANS.
OBSERVED REFERENCE POINTS DERIVED FROM GPS USING REAL TIME NETWORK (RTN) OBSERVATIONS UTM ZONE 17, NAD83 (CSRS)(2010.0). COORDINATES TO URBAN ACCURACY PER SEC 14(2) OF O.REG. 216/10
POINT ID | NORTHING | EASTING
A | 4783407.045 | 580216.194
B | 4783227.444 | 580263.213
COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN.
LEGEND
■ DENOTES SURVEY MONUMENT FOUND
□ DENOTES SURVEY MONUMENT PLANTED
IB DENOTES IRON BAR
SIB DENOTES STANDARD IRON BAR
OU DENOTES ORIGIN UNKNOWN
824 DENOTES A.T. McLAREN, O.L.S.
600 DENOTES S. WOODS, O.L.S.
P1 DENOTES CONDOMINIUM PLAN 430
P2 DENOTES PLAN 62R-11508
P3 DENOTES PLAN BY J. D. BARNES, LTD. DATED MARCH 6, 1986
P4 DENOTES PLAN 62R-10405
D1 DENOTES INSTRUMENT No. AB338566
MH DENOTES MANHOLE
CB DENOTES CATCHBASIN
TC DENOTES TOP OF CURB ELEVATION
GUT DENOTES GUTTER ELEVATION
OH DENOTES OVERHEAD UTILITY CABLES
DT DENOTES DECIDUOUS TREE
CT DENOTES CONIFEROUS TREE
Ø DENOTES DIAMETER
FF DENOTES FINISHED FLOOR ELEVATION
GF DENOTES GARAGE FLOOR ELEVATION
SRW DENOTES STONE RETAINING WALL
CRW DENOTES CONCRETE RETAINING WALL
TNFH DENOTES TOP NUT FIRE HYDRANT
BRK DENOTES BRICK TIE
SID DENOTES SIDING TIE
IBW DENOTES INTERLOCKING BRICK WALKWAY
BF DENOTES BOARD FENCE
CLF DENOTES CHAIN LINK FENCE
GM DENOTES GAS METER
WW DENOTES WINDOW WELL
UP DENOTES UTILITY POLE
BBOX DENOTES BELL BOX
ASSOCIATION OF ONTARIO LAND SURVEYORS
PLAN SUBMISSION FORM
2131776
THIS PLAN IS NOT VALID UNLESS IT IS AN EMBOSSED ORIGINAL COPY ISSUED BY THE SURVEYOR in accordance with Regulation 1026, Section 29(3)
THIS PLAN WAS PREPARED FOR SHAVER ROAD M. D. HOLDINGS INC. AND THE UNDERSIGNED ASSUMES NO RESPONSIBILITY FOR USE BY OTHER PARTIES.
SURVEYOR'S CERTIFICATE
I CERTIFY THAT
1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE REGULATIONS MADE UNDER THEM.
2. THE SURVEY WAS COMPLETED ON NOVEMBER 17, 2020.
NOVEMBER 18, 2020
MATTHEW DI COSMO
ONTARIO LAND SURVEYOR
Barich Grenkie Surveying Ltd.
297 HWY No. 8 (UNIT 101) - STONEY CREEK, ON L8G 1E6 (905) 662-6767
A DIVISION OF GEOMAPLE
DWN BY: EWA
CHK BY: MD
JOB No. 20-2724

City Formal Consultation Engineering Criteria

Planning and Economic Development Department, Development Engineering Division

Memorandum

To: Yvette Rybensky
Development Planning

From: Himanshi Juneja
Development Engineering Approvals

Phone: 905-546-2424 X 4351 **Fax:** 905-546-4202

Date: February 2, 2021 **File:** FC-20-146

Subject: Formal Consultation Meeting – Application by GSP Group Inc. C/O Brenda Khes for Lands Located at 487 Shaver Road, Ancaster (Ward 12)

The applicant proposes to proposal to redevelop into 44 stacked townhouse units within 3 buildings. An Official Plan Amendment, Zoning By-law Amendment and Site Plan Control Application are required to facilitate the proposal.

Information:

1. The property is not subject to a Right-of-Way Widening on Shaver Road as described below:

   Existing Right-of-Way Width
   - Shaver Road–Collector Road – 30.1 metres approx.

   Future Right-of-Way Width (per Urban Official Plan Schedule C-2)
   - Shaver Road–Collector Road – 30.1 metres approx.

2. Please be advised that there are outstanding cost recoveries associated with this property (sanitary sewer and sanitary drain) that will require to be paid as development approvals advance.

3. Currently, the following municipal servicing infrastructure exists in the vicinity of the site:

   Shaver Road
   - 300 mm dia. watermain flanking the property.
   - 300 mm dia. sanitary sewer flanking the property.
   - 450 mm dia. storm sewers flanking the property.

4. In regard to water servicing, water service for the proposed development can be connected to the existing 300 mm diameter municipal watermain on Shaver Road. For the future Site Plan Control Application, please demonstrate that the fire hydrant in the municipal ROW can provide for sufficient fire flow protection. If not, a fire hydrant on the private property may be required. Please see Public Works comments for further requirements.

5. There is a 300 mm sanitary sewer fronting the property on Shaver Rd (drawing 05-S-51_06), which ultimately drains to HC014 pumping station. The designed population density for this catchment is 110 ppHa (GISNET and drawing 05-S-51_12R). According to the proposed Site Concept Plan, a density of 98 units/ha is provided which, using a population density of 3.5 persons/unit results in approx. 343 people/ha. This is above the designed population density. Kindly see Public Works comments below for further details.

6. There is a 450 mm storm sewer fronting the property on Shaver Rd (drawing 05-S-51_06), which drains to a wet pond on the northeast corner of Garner Rd W and McClure Rd. Storm drainage area – 05-S-51_13R. Please show compliance with the Storm drainage plans prepared that account for the site.

7. A Functional Servicing and SWM Report (FSR & SWM) c/w preliminary Grading and Site Servicing Plan will be required to demonstrate the adequate sanitary and storm sewer outlet and overall servicing strategy for the site at the OPA / ZBA Stage followed by detailed Servicing and Stormwater Management Report and engineering drawings at the SPA stage.

8. The info in our GIS system suggests that in the existing conditions of the site, runoff from the site is directed towards Shaver Road. The proponent will be required to provide a SWM Report to clarify how the existing drainage pattern from the subject lands and external lands is going to be maintained to pre-development levels. Please see Infrastructure Planning's comments for more details.

<u>Public Works Section</u>

The following comments were provided from Public Works:

<u>Water</u>

Regarding the proposal to construct 44 stacked townhouse units in three buildings, on the subject lands at 487 Shaver Road in Ancaster:

- Water service for the proposed development can be connected to the existing 300 mm diameter municipal watermain on Shaver Road.

- To determine the approximate static pressure of the watermain and collect calibration data for hydraulic modelling if needed, it is recommended that two-hydrant flow tests be conducted at the closest municipal hydrants by the proponent through a licensed private contractor.
- The City of Hamilton undertakes a hydrant testing program for the purposes of colour coding hydrants as a requirement under the Ontario Fire Code. City hydrant testing data can be provided if required by contacting Udo Ehrenberg at udo.ehrenberg@hamilton.ca with carbon copy (cc) to hwapprovals@hamilton.ca.
- With the applications for Official Plan Amendment, Zoning Bylaw Amendment and Site Plan Control (updated as necessary to reflect the final design of the buildings), the proponent is required to provide a servicing report, prepared by a licensed Professional Engineer, addressing:
    - How the proponent intends to provide water servicing for the new development.
    - Intended occupancy, intended land use from the table below, and the anticipated water demands.
    - The required fire flow (RFF) for the buildings calculated per the Ontario Building Code (OBC) Water Supply Flow Rate Method (OBC section A-3.2.5.7) falling under Part 3 and Part 9 of the OBC (sections 1.1.2.2 and 1.1.2.4). Details to support the RFF calculation (e.g. building volumes, types of construction, major occupancy classifications and property line exposures) shall be clearly identified and properly documented.
    - If the proponent intends to install sprinkler systems to ensure fire protection of the proposed buildings, the hydraulic parameters (flow and pressure) required by this system will need to be provided during the building permit application stage.
    - Summary of the available fire flow in the area, based on two-hydrant flow tests, and a conclusion as to the adequacy of available flow from the municipal system for the proposal. The municipal system as is or with enhancement must be able to provide the greater of the RFF calculated using the OBC methodology, or the target available fire flow (AFF) for the proposed land use, as per the table below.

Land Use	**Target AFF (L/s)**
Commercial	150
Small ICI (<1800 m^3)	100
Industrial	250
Institutional	150
Residential Multi (greater than three units)	150
Residential Medium (three or less units)	125
Residential Single	75
Residential Single (dead end)	50

- The attached Adequate Water Services – Required Fire Flow-RFF and Available Fire Flow-AFF Form should be completed and submitted for the proposed development.
- A watermain hydraulic analysis (WHA), identifying the modelled system pressures at pressure district (PD18) level under various boundary conditions and demand scenarios, will be required to support the Official Plan Amendment, Zoning Bylaw Amendment and Site Plan Control applications. Please note that the requirement for a WHA may be waived following review of the water demand and fire flow requirements if it can be demonstrated that there is adequate service for the proposed development within the existing municipal system based on hydrant tests.
- It will be the responsibility of the proponent to ensure that any unique hydraulic requirements to support private site appurtenances (such as process equipment, domestic/fire booster pumps, minimum suction side pressure, large volumes, etc.) have been accounted for.

Sanitary Sewer

There is a 300 mm sanitary sewer fronting the property on Shaver Rd (drawing 05-S-51_06), which ultimately drains to HC014 pumping station. The designed population density for this catchment is 110 ppHa (GISNET and drawing 05-S-51_12R). It is anticipated that the proposed development will exceed this density.

For future Zoning application, the applicant is required to provide the following:

- Calculations/analysis to demonstrate that flows generated from the proposed development will not adversely impact the sewer capacity and hydraulic performance of the City's sanitary sewer system

For future Site Plan Control application, the applicant is required to provide the following:

- A servicing plan showing the sanitary connection to the municipal sewer
- A wastewater generation calculation based on Part 8 of the latest edition of the Code and Guide for Sewage Systems in order to establish an equivalent population density

Storm Sewer

There is a 450 mm storm sewer fronting the property on Shaver Rd (drawing 05-S-51_06), which drains to a wet pond on the northeast corner of Garner Rd W and McClure Rd. Storm drainage area – 05-S-51_13R.

The applicant is required to provide the following:

- Storm drainage plans for pre- and post-development conditions. The plans shall include:
    - Appropriate runoff coefficients,
    - Location of outlet points to the City's receiving system(s),
    - Controlled runoff release rate(s), and
    - Illustration and/or details of runoff control measures.

Infrastructure Planning Section

Infrastructure Planning section reviewed the above noted application which proposes to redevelop into 44 stacked townhouse units within 3 buildings.at the subject site.

Infrastructure Planning staff would like to provide following comments from stormwater management perspective:

1. A 'Stormwater Management Brief (SWM Brief)' is required for this development proposal. The SWM Brief should be prepared in accordance with City's current Comprehensive Development Guidelines and Financial Policies Manual.

2. The SWM Brief should demonstrate the followings:

Storm water quantity control criteria:

The proponent should demonstrate existing drainage conditions including existing storm outlets and provide suitable storm outlet (s) for the proposed development.

There is a 450 mm storm sewer available on Shaver Road fronting the subject site.

100-year post development flow at the subject site should be controlled to the lesser of 2-year pre development level based on the contributing drainage areas under existing conditions at each proposed storm outlet or allowable flow from the subject site considered in the original design of the existing storm sewer on shaver road.

Storm water quality control criteria:

'Level 1' stormwater quality control should be provided considering treatment train design principles in accordance with the City standards.

Source Water Protection Planning Section

Given that the development is on the edge of the urban boundary and a small number of nearby properties rely on private water servicing, if dewatering is anticipated for construction activities we would require a water well survey to be conducted for the development, to the satisfaction of Director, Hamilton Water. Dewatering has the potential to impact nearby private well owners.

This water well survey would include a door-to-door survey of wells within a 500 m radius of the site perimeter or the proposed area of influence from dewatering (whichever is greater) and should determine the condition and details of local wells, including the method of construction, static water level, pump intake, well depths, and water use. The result of this survey will determine the number of wells which could be impacted by construction activities and propose mitigation strategies in case impacts arise.

The proponent is reminded that dewatering discharge must comply with City of Hamilton Sewer Use Bylaw standards and Temporary Sewer Discharge Permit requirements. It is recommended to consult with the Superintendent of Environmental Monitoring and Enforcement Group within Hamilton Water as early as possible in the approval process, given that additional review may be required by Hamilton Water to verify the wastewater system could accept the quantity and/or quality of the discharge. Email sewerusebylaw@hamilton.ca to better understand water discharges to City infrastructure. If dewatering is expected to exceed 50,000 L/day, registration with the Environmental Activity Sector Registry or a Permit to Take Water from the Ministry of Environment and Climate Change may be required.

If dewatering is not anticipated, as a condition of approval to the satisfaction of Director, Hamilton Water, the applicant shall provide a technical memorandum from a qualified professional (P.Eng, P.Geo) which provides justification as to why dewatering is not required, and in the event that dewatering is in fact required due to unforeseen circumstances, the applicant should provide a written record of their proposed Monitoring and Contingency plan that outlines their protocol for action. This contingency plan would include identification and monitoring of potential impacts, triggers, and mitigation plans in case impacts arise.

Recommendation

Development Engineering has no issues with this application.

The following reports are requested for further review:

1. Survey and Topographic Plan

   ZBA/OPA Stage
2. Functional Servicing and SWM Brief (FSR & SWM) c/w Grading and Site Servicing Plan to demonstrate adequate storm and sanitary outlet for the site;
3. Storm drainage plans for pre- and post-development conditions. The plans shall include
4. Calculations/analysis to demonstrate that flows generated from the proposed development will not adversely impact the sewer capacity and hydraulic performance of the City's sanitary sewer system
5. The attached Adequate Water Services – Required Fire Flow-RFF and Available Fire Flow-AFF Form should be completed and submitted for the proposed development
6. A watermain hydraulic analysis (WHA), identifying the modelled system pressures at pressure district (PD18) level under various boundary conditions and demand scenarios, will be required to support the Official Plan Amendment,

Zoning Bylaw Amendment and Site Plan Control applications, if required based on the RFF described above.

SPA Stage

7. Erosion and Sediment Control Plan
8. Geotechnical and/or Hydrogeological Reporting will need to discuss soil/groundwater conditions onsite and ground water elevations.
9. Servicing and SWM Implementation Brief (SR & SWM) c/w Grading and Site Servicing Plan
10. A wastewater generation calculation based on Part 8 of the latest edition of the Code and Guide for Sewage Systems in order to establish an equivalent population density

Special Condition

11. Please be advised that there are outstanding cost recoveries associated with this property (sanitary sewer and sanitary drain) that will require to be paid as development approvals advance

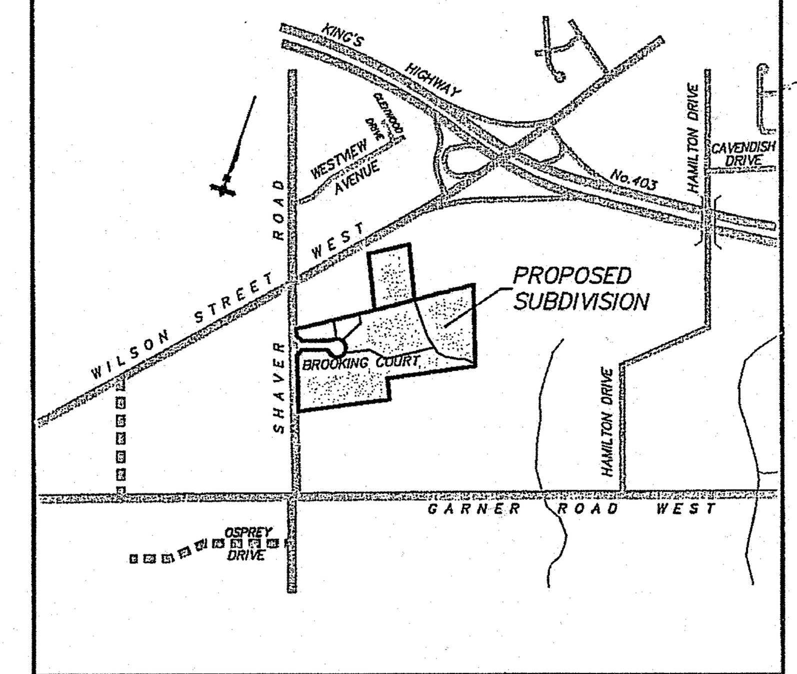
Should you require clarification please email me at Himanshi.juneja@hamilton.ca or contact me at 905 546-2424 X 4351.

HJ:hj

APPENDIX B

Shaver Estates Sanitary Tributary Plan

SHAVER ESTATES (AS CONSTRUCTED)



KEY PLAN N.T.S.

SITE BENCH MARK

Elevation: 237.31m (778.58 ft.)

Description: Top of southeast corner of concrete wall surrounding Bell kiosk located on the west side of Shaver Road at the intersection of Brooking Court and Shaver Road.

BENCH MARK

MTO BM. No. 758009

Elevation: 231.570m (759.74 ft.)

Description: One and a half-storey frame house along Hwy. No. 53, at east intersection Hwy's No. 2 & 53, tablet in west foundation, 34.7m south of centre line, 3.60m from northwest corner, 0.3m below aluminum siding.

No.	Revision	Date	By
3.	AS CONSTRUCTED FINAL SUBMISSION	FEB. 28, '13	A.J.I.
2.	AS CONSTRUCTED FIRST SUBMISSION	JAN. 23, '12	A.J.I.
1.	ISSUED FOR CONSTRUCTION	N/A	

REVISIONS

CERTIFICATION OF COMPLETION

IT IS HEREBY DECLARED THAT THE WORKS SHOWN ON THIS DRAWING RELATED TO UNDERGROUND WORKS REQUIRED BY THE CITY OF HAMILTON HAVE BEEN COMPLETED IN THE FIELD AS PER THE SUBDIVISION AGREEMENTS. ALL SERVICES ARE AS CONSTRUCTED.

A. J. IRANI, P.Eng. — FEBRUARY 28, 2013 (Date)

ORIGINAL DESIGN SIGNED BY C. GIAMMARCO, P. ENG. DATED FEBRUARY 26, 2007

ENGINEER

PROJECT OWNER: 1315596 ONTARIO INC.

AS CONSTRUCTED

MUNICIPALITY: CITY OF HAMILTON (ANCASTER)

PROJECT NAME: SHAVER ESTATES FILE No. 25T-97002

A. J. Clarke and Associates Ltd.
SURVEYORS • PLANNERS • ENGINEERS
25 MAIN STREET WEST, SUITE 300
HAMILTON, ONTARIO L8P 1H1
Tel: 905 528-8761 Fax: 905 528-2289
email: ajc@ajclarke.com

TITLE: SANITARY DRAINAGE AREA PLAN

SCALE:	1:1000	DATE:	NOVEMBER 2003
DESIGN:	C. GIAMMARCO	DRAWN:	M.P./D.M./T.L.
DWG:	K-03-011	SHT:	12

SHAVER ESTATES (AS CONSTRUCTED)

APPENDIX C

Cultec Stormwater Sizing Sheets

Jellyfish Filter Sizing Report

Shaver Estates Stormwater Tributary Plan

Shaver Estates SWM Pond Excerpt from SWM Report

CULTEC Stormwater Design Calculator

Date:	November 21, 2022

Project Number:	21203

Project Information:
CULTEC 1

Calculations Performed By:

RECHARGER 330XLHD

Recharger 330XLHD Chamber Specifications		
Height	**775**	mm
Width	**1321**	mm
Length	**2.59**	meters
Installed Length	**2.13**	meters
Bare Chamber Volume	**1.48**	cu. meters
Installed Chamber Volume	**2.38**	cu. meters

Breakdown of Storage Provided by Recharger 330XLHD Stormwater System		
Within Chambers	**134.02**	cu. meters
Within Feed Connectors	**-**	cu. meters
Within Stone	**94.36**	cu. meters
Total Storage Provided	**228.4**	**cu. meters**
Total Storage Required	221.00	cu. meters

Materials List

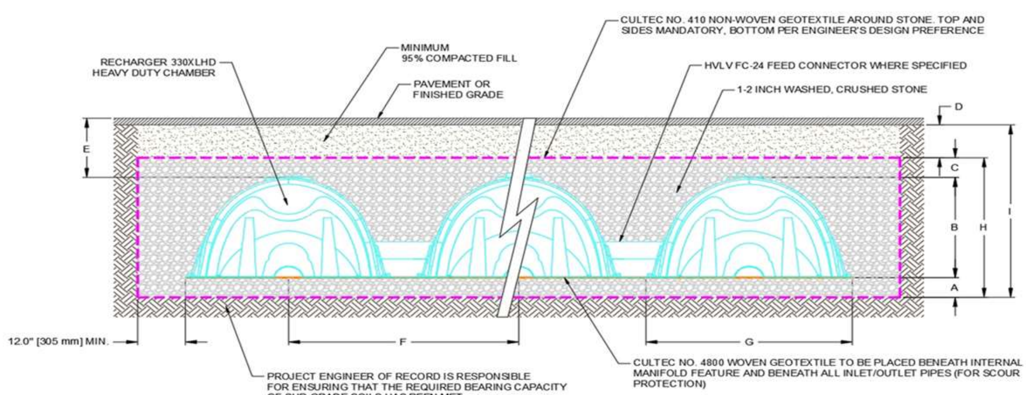
Recharger 330XLHD		
Total Number of Chambers Required	**90**	**pieces**
Starter Chambers	**3**	pieces
Intermediate Chambers	**84**	pieces
End Chambers	**3**	pieces
HVLV FC-24 Feed Connectors	**4**	pieces
CULTEC No. 410 Non-Woven Geotextile	**1016**	sq. meters
CULTEC No. 4800 Woven Geotextile	**10**	meters
Stone	**236**	cu. meters

Based on 2 Internal Manifolds

Bed Detail

Bed Layout Information		
Number of Rows Wide	**3**	pieces
Number of Chambers Long	**30**	pieces
Chamber Row Width	**4.42**	meters
Chamber Row Length	**64.47**	meters
Bed Width	**5.03**	meters
Bed Length	**65.07**	meters
Bed Area Required	**327.27**	sq. meters
Length of Separator Row	**N/A**	meters

Bed detail for reference only. Not project specific. Not to scale.



Conceptual graphic only. Not job specific.

Cross Section Table Reference			
A	Depth of Stone Base	**180**	mm
B	Chamber Height	**775**	mm
C	Depth of Stone Above Units	**180**	mm
D	Depth of 95% Compacted Fill	**254**	mm
E	Max. Depth Allowed Above the Chamber	**3.66**	meters
F	Chamber Width	**1321**	mm
G	Center to Center Spacing	**1.55**	meters
H	Effective Depth	**1.13**	meters
I	Bed Depth	**1.38**	meters

CULTEC Stage-Storage Calculations

CULTEC

Date:	November 21, 2022

Project Information:
CULTEC 1

Project Number:
21203

Chamber Model -	**Recharger 330XLHD**	
Number of Rows-	3	units
Total Number of Chambers -	90	units
HVLV FC-24 Feed Connectors-	4	units
Stone Void -	40	%
Stone Base -	180	mm
Stone Above Units -	180	mm
Area -	327.27	m2
Base of Stone Elevation -	236.14	

Recharger 330XLHD Incremental Storage Volumes

Height of System		Chamber Volume		HVLV Feed Connector Volume		Stone Volume		Cumulative Storage Volume		Total Cumulative Storage Volume		Elevation		
in	mm	ft^3	m^3	ft3	m3	ft^3	m^3	ft^3	m^3	ft^3	m^3	ft	m	
44.5	1130	0.0	0.0	0.0	0.0	117.4	3.3	117.425	3.3	8066.73	228.42	239.850	237.27	Top of Stone Elevation
43.5	1105	0.0	0.0	0.0	0.0	117.4	3.3	117.425	3.3	7949.30	225.10	239.770	237.25	
42.5	1080	0.0	0.0	0.0	0.0	117.4	3.3	117.425	3.3	7831.88	221.77	239.680	237.22	
41.5	1054	0.0	0.0	0.0	0.0	117.4	3.3	117.425	3.3	7714.45	218.45	239.600	237.20	
40.5	1029	0.0	0.0	0.0	0.0	117.4	3.3	117.425	3.3	7597.03	215.12	239.520	237.17	
39.5	1003	0.0	0.0	0.0	0.0	117.4	3.3	117.425	3.3	7479.60	211.80	239.430	237.15	
38.5	978	0.0	0.0	0.0	0.0	117.4	3.3	117.425	3.3	7362.18	208.47	239.350	237.12	
37.5	953	0.1	0.0	0.0	0.0	58.7	1.7	58.751	1.7	7244.75	205.15	239.270	237.09	Top of Chamber Elevation
37.0	940	12.1	0.3	0.0	0.0	112.6	3.2	124.658	3.5	7186.00	203.48	239.230	237.08	
36.0	914	32.4	0.9	0.0	0.0	104.5	3.0	136.841	3.9	7061.35	199.95	239.140	237.06	
35.0	889	53.3	1.5	0.0	0.0	96.1	2.7	149.404	4.2	6924.51	196.08	239.060	237.03	
34.0	864	78.7	2.2	0.0	0.0	86.0	2.4	164.632	4.7	6775.10	191.85	238.980	237.01	
33.0	838	95.2	2.7	0.0	0.0	79.4	2.2	174.530	4.9	6610.47	187.19	238.890	236.98	
32.0	813	109.8	3.1	0.0	0.0	73.5	2.1	183.286	5.2	6435.94	182.25	238.810	236.95	
31.0	787	121.2	3.4	0.0	0.0	68.9	2.0	190.139	5.4	6252.65	177.06	238.730	236.93	
30.0	762	131.3	3.7	0.0	0.0	64.9	1.8	196.230	5.6	6062.51	171.67	238.640	236.90	
29.0	737	140.2	4.0	0.0	0.0	61.3	1.7	201.560	5.7	5866.29	166.11	238.560	236.88	
28.0	711	147.8	4.2	0.0	0.0	58.3	1.7	206.128	5.8	5664.73	160.41	238.480	236.85	
27.0	686	154.8	4.4	0.0	0.0	55.5	1.6	210.316	6.0	5458.60	154.57	238.390	236.83	
26.0	660	161.2	4.6	0.0	0.0	53.0	1.5	214.123	6.1	5248.28	148.61	238.310	236.80	
25.0	635	167.5	4.7	0.0	0.0	50.4	1.4	217.930	6.2	5034.16	142.55	238.230	236.78	
24.0	610	171.9	4.9	0.0	0.0	48.6	1.4	220.595	6.2	4816.23	136.38	238.140	236.75	
23.0	584	179.6	5.1	0.0	0.0	45.6	1.3	225.163	6.4	4595.63	130.13	238.060	236.73	
22.0	559	186.5	5.3	0.0	0.0	42.8	1.2	229.351	6.5	4370.47	123.76	237.980	236.70	
21.0	533	187.8	5.3	0.0	0.0	42.3	1.2	230.112	6.5	4141.12	117.26	237.890	236.68	
20.0	508	189.7	5.4	0.0	0.0	41.5	1.2	231.254	6.5	3911.01	110.75	237.810	236.65	
19.0	483	191.0	5.4	0.2	0.0	41.0	1.2	232.236	6.6	3679.75	104.20	237.730	236.62	
18.0	457	192.3	5.4	0.2	0.0	40.5	1.1	232.957	6.6	3447.52	97.62	237.640	236.60	
17.0	432	192.9	5.5	0.2	0.0	40.3	1.1	233.330	6.6	3214.56	91.03	237.560	236.57	
16.0	406	194.2	5.5	0.2	0.0	39.8	1.1	234.089	6.6	2981.23	84.42	237.480	236.55	
15.0	381	198.6	5.6	0.2	0.0	38.0	1.1	236.750	6.7	2747.14	77.79	237.390	236.52	
14.0	356	203.7	5.8	0.2	0.0	36.0	1.0	239.788	6.8	2510.39	71.09	237.310	236.50	
13.0	330	204.3	5.8	0.1	0.0	35.7	1.0	240.158	6.8	2270.60	64.30	237.230	236.47	
12.0	305	204.9	5.8	0.1	0.0	35.4	1.0	240.533	6.8	2030.45	57.50	237.140	236.45	
11.0	279	205.6	5.8	0.1	0.0	35.2	1.0	240.896	6.8	1789.91	50.68	237.060	236.42	
10.0	254	206.2	5.8	0.1	0.0	34.9	1.0	241.245	6.8	1549.02	43.86	236.980	236.40	
9.0	229	207.5	5.9	0.0	0.0	34.4	1.0	241.954	6.9	1307.77	37.03	236.890	236.37	
8.0	203	210.7	6.0	0.0	0.0	33.2	0.9	243.843	6.9	1065.82	30.18	236.810	236.35	
7.0	178	0.0	0.0	0.0	0.0	117.4	3.3	117.425	3.3	821.98	23.28	236.730	236.32	Bottom of Chamber Elevation
6.0	152	0.0	0.0	0.0	0.0	117.4	3.3	117.425	3.3	704.55	19.95	236.640	236.29	
5.0	127	0.0	0.0	0.0	0.0	117.4	3.3	117.425	3.3	587.13	16.63	236.560	236.27	
4.0	102	0.0	0.0	0.0	0.0	117.4	3.3	117.425	3.3	469.70	13.30	236.480	236.24	
3.0	76	0.0	0.0	0.0	0.0	117.4	3.3	117.425	3.3	352.28	9.98	236.390	236.22	
2.0	51	0.0	0.0	0.0	0.0	117.4	3.3	117.425	3.3	234.85	6.65	236.310	236.19	
1.0	25	0.0	0.0	0.0	0.0	117.4	3.3	117.425	3.3	117.43	3.33	236.230	236.17	
0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.000	0.0	0.00	0.00	236.140	236.14	Bottom of Stone Elevation
-1.0														
-2.0														
-3.0														
-4.0														
-5.0														
-6.0														
-7.0														
-8.0														
-9.0														
-10.0														
-11.0														
-12.0														
-13.0														
-14.0														
-15.0														
-16.0														
-17.0														
-18.0														
-19.0														
-20.0														
-21.0														
-22.0														
-23.0														
-24.0														
-25.0														
-26.0														
-27.0														
-28.0														
-29.0														
-30.0														
-31.0														
-32.0														
-33.0														
-34.0														
-35.0														

CULTEC, Inc.
P.O. Box 280
Brookfield, CT 06804

Phone: 203-775-4416
www.cultec.com
tech@cultec.com

STANDARD OFFLINE
Jellyfish Filter Sizing Report

Project Information

Date	Tuesday, July 26, 2022
Project Name	48 Shaver Rd.
Project Number	21203
Location	Hamilton

Jellyfish Filter Design Overview

This report provides information for the sizing and specification of the Jellyfish Filter. When designed properly in accordance to the guidelines detailed in the Jellyfish Filter Technical Manual, the Jellyfish Filter will exceed the performance and longevity of conventional horizontal bed and granular media filters.

Please see ***www.ImbriumSystems.com*** *for more information.*

Jellyfish Filter System Recommendation

The Jellyfish Filter model JF4-2-1 is recommended to meet the water quality objective by treating a flow of 12.6 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 34 years of HAMILTON A rainfall data for this site. This model has a sediment capacity of 142 kg, which meets or exceeds the estimated average annual sediment load.

Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF4-2-1	2	1	1.2	12.6	142

The Jellyfish Filter System

The patented Jellyfish Filter is an engineered stormwater quality treatment technology featuring unique membrane filtration in a compact stand-alone treatment system that removes a high level and wide variety of stormwater pollutants. Exceptional pollutant removal is achieved at high treatment flow rates with minimal head loss and low maintenance costs. Each lightweight Jellyfish Filter cartridge contains an extraordinarily large amount of membrane surface area, resulting in superior flow capacity and pollutant removal capacity.

Maintenance

Regular scheduled inspections and maintenance is necessary to assure proper functioning of the Jellyfish Filter. The maintenance interval is designed to be a minimum of 12 months, but this will vary depending on site loading conditions and upstream pretreatment measures. Quarterly inspections and inspections after all storms beyond the 5-year event are recommended until enough historical performance data has been logged to comfortably initiate an alternative inspection interval.

Please see ***www.ImbriumSystems.com*** *for more information.*

Thank you for the opportunity to present this information to you and your client.

Jellyfish® Filter

Performance

Jellyfish efficiently captures a high level of Stormwater pollutants, including:

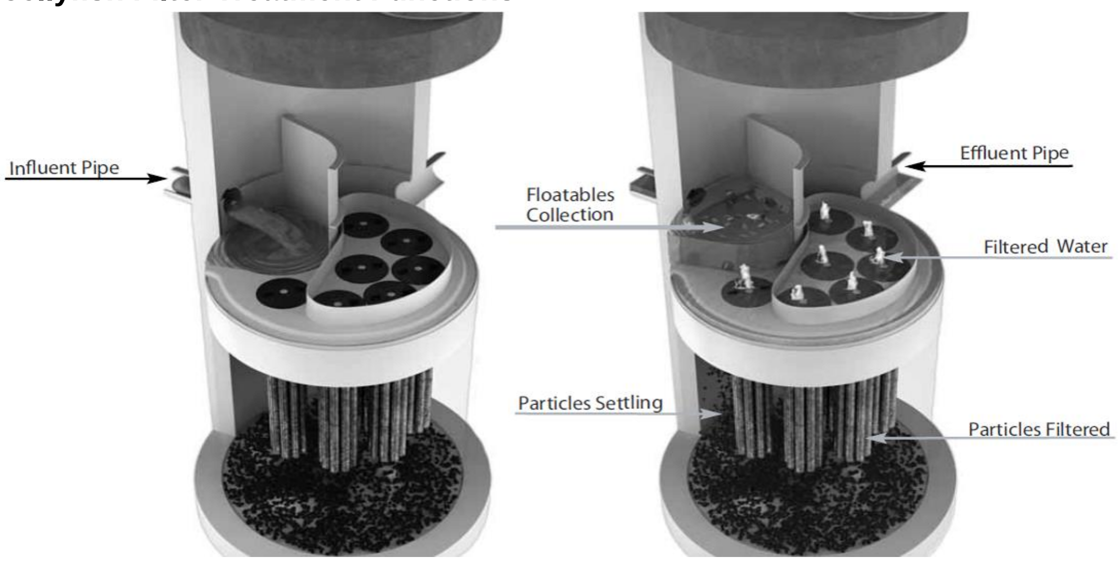
- ☑ 89% of the total suspended solids (TSS) load, including particles less than 5 microns
- ☑ 77% TP removal & 51% TN removal
- ☑ 90% Total Copper, 81% Total Lead, 70% Total Zinc
- ☑ Particulate-bound pollutants such as nutrients, toxic metals, hydrocarbons and bacteria
- ☑ Free oil, Floatable trash and debris

Field Proven Peformance

The Jellyfish filter has been field-tested on an urban site with 25 TARP qualifying rain events and field monitored according to the TARP field test protocol, demonstrating:

- A median TSS removal efficiency of 89%, and a median SSC removal of 99%;
- The ability to capture fine particles as indicated by an effluent d50 median of 3 microns for all monitotred storm events, and a median effluent turbidity of 5 NTUs;
- A median Total Phosphorus removal of 77%, and a median Total Nitrogen removal of 51%.

Jellyfish Filter Treatment Functions



Pre-treatment and Membrane Filtration

Jellyfish® Filter

Project Information

Date:	Tuesday, July 26, 2022
Project Name:	48 Shaver Rd.
Project Number:	21203
Location:	Hamilton

Designer Information

Company:	The Odan/Detech Group Inc.
Contact:	Mitchell Bufalino
Phone #:	

Notes

Rainfall

Name:	HAMILTON A
State:	ON
ID:	3194
Record:	1970 to 2003
Co-ords:	43°10.N'N, 79°56.W'N

Drainage Area

Total Area:	0.432 ha
Imperviousness:	82%

Upstream Detention

Peak Release Rate:	n/a
Pretreatment Credit:	n/a

Design System Requirements

Flow Loading	90% of the Average Annual Runoff based on 34 years of HAMILTON A rainfall data:	**8.7 L/s**
Sediment Loading	Treating 90% of the average annual runoff volume, 1802 m³, with a suspended sediment concentration of 60 mg/L.	**108 kg**

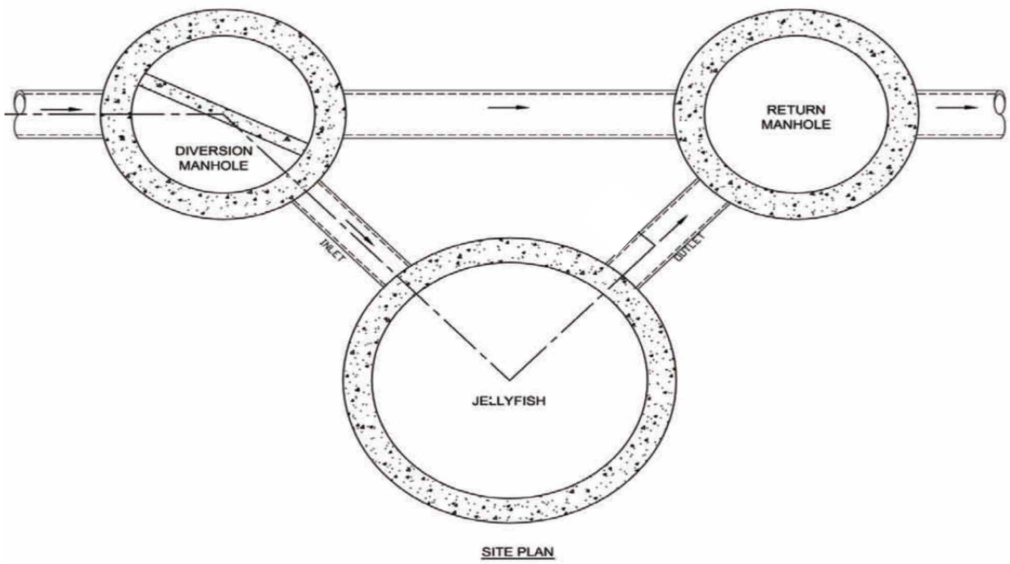
Recommendation

The Jellyfish Filter model JF4-2-1 is recommended to meet the water quality objective by treating a flow of 12.6 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 34 years of HAMILTON A rainfall data for this site. This model has a sediment capacity of 142 kg, which meets or exceeds the estimated average annual sediment load.

Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Wet Vol Below Deck (L)	Sump Storage (m³)	Oil Capacity (L)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF4-1-1	1	1	1.2	2313	0.34	379	7.6	85
JF4-2-1	**2**	**1**	**1.2**	**2313**	**0.34**	**379**	**12.6**	**142**
JF6-3-1	3	1	1.8	5205	0.79	848	17.7	199
JF6-4-1	4	1	1.8	5205	0.79	848	22.7	256
JF6-5-1	5	1	1.8	5205	0.79	848	27.8	313
JF6-6-1	6	1	1.8	5205	0.79	848	28.6	370
JF8-6-2	6	2	2.4	9252	1.42	1469	35.3	398
JF8-7-2	7	2	2.4	9252	1.42	1469	40.4	455
JF8-8-2	8	2	2.4	9252	1.42	1469	45.4	512
JF8-9-2	9	2	2.4	9252	1.42	1469	50.5	569
JF8-10-2	10	2	2.4	9252	1.42	1469	50.5	626
JF10-11-3	11	3	3.0	14456	2.21	2302	63.1	711
JF10-12-3	12	3	3.0	14456	2.21	2302	68.2	768
JF10-12-4	12	4	3.0	14456	2.21	2302	70.7	796
JF10-13-4	13	4	3.0	14456	2.21	2302	75.7	853
JF10-14-4	14	4	3.0	14456	2.21	2302	78.9	910
JF10-15-4	15	4	3.0	14456	2.21	2302	78.9	967
JF10-16-4	16	4	3.0	14456	2.21	2302	78.9	1024
JF10-17-4	17	4	3.0	14456	2.21	2302	78.9	1081
JF10-18-4	18	4	3.0	14456	2.21	2302	78.9	1138
JF10-19-4	19	4	3.0	14456	2.21	2302	78.9	1195
JF12-20-5	20	5	3.6	20820	3.2	2771	113.6	1280
JF12-21-5	21	5	3.6	20820	3.2	2771	113.7	1337
JF12-22-5	22	5	3.6	20820	3.2	2771	113.7	1394
JF12-23-5	23	5	3.6	20820	3.2	2771	113.7	1451
JF12-24-5	24	5	3.6	20820	3.2	2771	113.7	1508
JF12-25-5	25	5	3.6	20820	3.2	2771	113.7	1565
JF12-26-5	26	5	3.6	20820	3.2	2771	113.7	1622
JF12-27-5	27	5	3.6	20820	3.2	2771	113.7	1679

Jellyfish Filter Design Notes

- Typically the Jellyfish Filter is designed in an offline configuration, as all stormwater filter systems will perform for a longer duration between required maintenance services when designed and applied in off-line configurations. Depending on the design parameters, an optional internal bypass may be incorporated into the Jellyfish Filter, however note the inspection and maintenance frequency should be expected to increase above that of an off-line system. Speak to your local representative for more information.



Jellyfish Filter Typical Layout

- Typically, 18 inches (457 mm) of driving head is designed into the system, calculated as the difference in elevation between the top of the diversion structure weir and the invert of the Jellyfish Filter outlet pipe. Alternative driving head values can be designed as 12 to 24 inches (305 to 610mm) depending on specific site requirements, requiring additional sizing and design assistance.
- Typically, the Jellyfish Filter is designed with the inlet pipe configured 6 inches (150 mm) above the outlet invert elevation. However, depending on site parameters this can vary to an optional configuration of the inlet pipe entering the unit below the outlet invert elevation.
- The Jellyfish Filter can accommodate multiple inlet pipes within certain restrictions.
- While the optional inlet below deck configuration offers 0 to 360 degree flexibility between the inlet and outlet pipe, typical systems conform to the following:

Model Diameter (m)	Minimum Angle Inlet / Outlet Pipes	Minimum Inlet Pipe Diameter (mm)	Minimum Outlet Pipe Diameter (mm)
1.2	**62º**	**150**	**200**
1.8	59º	200	250
2.4	52º	250	300
3.0	48º	300	450
3.6	40º	300	450

- The Jellyfish Filter can be built at all depths of cover generally associated with conventional stormwater conveyance systems. For sites that require minimal depth of cover for the stormwater infrastructure, the Jellyfish Filter can be applied in a shallow application using a hatch cover. The general minimum depth of cover is 36 inches (915 mm) from top of the underslab to outlet invert.
- If driving head caclulations account for water elevation during submerged conditions the Jellyfish Filter will function effectively under submerged condtions.
- Jellyfish Filter systems may incorporate grated inlets depending on system configuration.
- For sites with water quality treatment flow rates or mass loadings that exceed the design flow rate of the largest standard Jellyfish Filter manhole models, systems can be designed that hydraulically connect multiple Jellyfish Filters in series or alternatively Jellyfish Vault units can be designed.

STANDARD SPECIFICATION
STORMWATER QUALITY – MEMBRANE FILTRATION TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

Specifies requirements for construction and performance of an underground stormwater quality membrane filtration treatment device that removes pollutants from stormwater runoff through the unit operations of sedimentation, floatation, and membrane filtration.

1.2 REFERENCE STANDARDS

ASTM C 891: Specification for Installation of Underground Precast Concrete Utility Structures
ASTM C 478: Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 443: Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM D 4101: Specification for Copolymer steps construction

CAN/CSA-A257.4-M92
Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections and Fittings Using Rubber Gaskets

CAN/CSA-A257.4-M92
Precast Reinforced Circular Concrete Manhole Sections, Catch Basins and Fittings

Canadian Highway Bridge Design Code

1.3 SHOP DRAWINGS

Shop drawings for the structure and performance are to be submitted with each order to the contractor. Contractor shall forward shop drawing submittal to the consulting engineer for approval. Shop drawings are to detail the structure's precast concrete and call out or note the fiberglass (FRP) internals/components.

1.4 PRODUCT SUBSTITUTIONS

No product substitutions shall be accepted unless submitted 10 days prior to project bid date, or as directed by the engineer of record. Submissions for substitutions require review and approval by the Engineer of Record, for hydraulic performance, impact to project designs, equivalent treatment performance, and any required project plan and report (hydrology/hydraulic, water quality, stormwater pollution) modifications that would be required by the approving jurisdictions/agencies. Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

1.5 HANDLING AND STORAGE

Prevent damage to materials during storage and handling.

PART 2 – PRODUCTS

2.1 GENERAL

2.1.1 The device shall be a cylindrical or rectangular, all concrete structure (including risers), constructed from precast concrete riser and slab components or monolithic precast structure(s), installed to conform to ASTM C 891 and to any required state highway, municipal or local specifications; whichever is more stringent. The device shall be watertight.

2.1.2 Cartridge Deck The cylindrical concrete device shall include a fiberglass deck. The rectangular concrete device shall include a coated aluminum deck. In either instance, the insert shall be bolted and sealed watertight inside the precast concrete chamber. The deck shall serve as: (a) a horizontal divider between the lower treatment zone and the upper treated effluent zone; (b) a deck for attachment of filter cartridges such that the membrane filter elements of each cartridge extend into the lower treatment zone; (c) a platform for maintenance workers to service the filter cartridges (maximum manned weight = 450 pounds (204 kg)); (d) a conduit for conveyance of treated water to the effluent pipe.

2.1.3 Membrane Filter Cartridges Filter cartridges shall be comprised of reusable cylindrical membrane filter elements connected to a perforated head plate. The number of membrane filter elements per cartridge shall be a minimum of eleven 2.75-inch (70-mm) diameter elements. The length of each filter element shall be a minimum 15 inches (381 mm). Each cartridge shall be fitted into the cartridge deck by insertion into a cartridge receptacle that is permanently mounted into the cartridge deck. Each cartridge shall be secured by a cartridge lid that is threaded onto the receptacle, or similar mechanism to secure the cartridge into the deck. The maximum treatment flow rate of a filter cartridge shall be controlled by an orifice in the cartridge lid, or on the individual cartridge itself, and based on a design flux rate (surface loading rate) determined by the maximum treatment flow rate per unit of filtration membrane surface area. The maximum design flux rate shall be 0.21 gpm/ft² (0.142 lps/m²).

Each membrane filter cartridge shall allow for manual installation and removal. Each filter cartridge shall have filtration membrane surface area and dry installation weight as follows (if length of filter cartridge is between those listed below, the surface area and weight shall be proportionate to the next length shorter and next length longer as shown below):

Filter Cartridge Length (in / mm)	Minimum Filtration Membrane Surface Area (ft2 / m2)	Maximum Filter Cartridge Dry Weight (lbs / kg)
15	106 / 9.8	10.5 / 4.8
27	190 / 17.7	15.0 / 6.8
40	282 / 26.2	20.5 / 9.3
54	381 / 35.4	25.5 / 11.6

2.1.4 Backwashing Cartridges The filter device shall have a weir extending above the cartridge deck, or other mechanism, that encloses the high flow rate filter cartridges when placed in their respective cartridge receptacles within the cartridge deck. The weir, or other mechanism, shall collect a pool of filtered water during inflow events that backwashes the high flow rate cartridges when the inflow event subsides. All filter cartridges and membranes shall be reusable and allow for the use of filtration membrane rinsing procedures to restore flow capacity and sediment capacity; extending cartridge service life.

2.1.5 Maintenance Access to Captured Pollutants The filter device shall contain an opening(s) that provides maintenance access for removal of accumulated floatable pollutants and sediment, removal of and replacement of filter cartridges, cleaning of the sump, and rinsing of the deck. Access shall have a minimum clear vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.

2.1.6 Bend Structure The device shall be able to be used as a bend structure with minimum angles between inlet and outlet pipes of 90-degrees or less in the stormwater conveyance system.

2.1.7 Double-Wall Containment of Hydrocarbons The cylindrical precast concrete device shall provide double-wall containment for hydrocarbon spill capture by a combined means of an inner wall of fiberglass, to a minimum depth of 12 inches (305 mm) below the cartridge deck, and the precast vessel wall.

2.1.8 Baffle The filter device shall provide a baffle that extends from the underside of the cartridge deck to a minimum length equal to the length of the membrane filter elements. The baffle shall serve to protect the membrane filter elements from contamination by floatables and coarse sediment. The baffle shall be flexible and continuous in cylindrical configurations, and shall be a straight concrete or aluminum wall in rectangular configurations.

2.1.9 Sump The device shall include a minimum 24 inches (610 mm) of sump below the bottom of the cartridges for sediment accumulation, unless otherwise specified by the design engineer. Depths less than 24 inches may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

2.2 PRECAST CONCRETE SECTIONS

All precast concrete components shall be manufactured to a minimum live load of HS-20 truck loading or greater based on local regulatory specifications, unless otherwise modified or specified by the design engineer, and shall be watertight.

2.3 JOINTS All precast concrete manhole configuration joints shall use nitrile rubber gaskets and shall meet the requirements of ASTM C443, Specification C1619, Class D or engineer approved equal to ensure oil resistance. Mastic sealants or butyl tape are not an acceptable alternative.

2.4 GASKETS Only profile neoprene or nitrile rubber gaskets in accordance to CSA A257.3-M92 will be accepted. Mastic sealants, butyl tape or Conseal CS-101 are not acceptable gasket materials.

2.5 FRAME AND COVER Frame and covers must be manufactured from cast-iron or other composite material tested to withstand H-20 or greater design loads, and as approved by the local regulatory body. Frames and covers must be embossed with the name of the device manufacturer or the device brand name.

2.6 DOORS AND HATCHES If provided shall meet designated loading requirements or at a minimum for incidental vehicular traffic.

2.7 CONCRETE All concrete components shall be manufactured according to local specifications and shall meet the requirements of ASTM C 478.

2.8 FIBERGLASS The fiberglass portion of the filter device shall be constructed in accordance with the following standard: ASTM D-4097: Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks.

2.9 STEPS Steps shall be constructed according to ASTM D4101 of copolymer polypropylene, and be driven into preformed or pre-drilled holes after the concrete has cured, installed to conform to applicable sections of state, provincial and municipal building codes, highway, municipal or local specifications for the construction of such devices.

2.10 INSPECTION All precast concrete sections shall be inspected to ensure that dimensions, appearance and quality of the product meet local municipal specifications and ASTM C 478.

PART 3 – PERFORMANCE

3.1 GENERAL

3.1.1 Verification – The stormwater quality filter must be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV).

3.1.2 Function - The stormwater quality filter treatment device shall function to remove pollutants by the following unit treatment processes; sedimentation, floatation, and membrane filtration.

3.1.3 Pollutants - The stormwater quality filter treatment device shall remove oil, debris, trash, coarse and fine particulates, particulate-bound pollutants, metals and nutrients from stormwater during runoff events.

3.1.4 Bypass - The stormwater quality filter treatment device shall typically utilize an external bypass to divert excessive flows. Internal bypass systems shall be equipped with a floatables baffle, and must avoid passage through the sump and/or cartridge filtration zone.

3.1.5 Treatment Flux Rate (Surface Loading Rate) – The stormwater quality filter treatment device shall treat 100% of the required water quality treatment flow based on a maximum design treatment flux rate (surface loading rate) across the membrane filter cartridges of 0.21 gpm/ft^2 (0.142 lps/m^2).

3.2 FIELD TEST PERFORMANCE

At a minimum, the stormwater quality filter device shall have been field tested and verified with a minimum 25 TARP qualifying storm events and field monitoring shall have been conducted according to the TARP 2009 NJDEP TARP field test protocol, and have received NJCAT verification.

3.2.1 Suspended Solids Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median TSS removal efficiency of 85% and a minimum median SSC removal efficiency of 95%.

3.2.2 Runoff Volume – The stormwater quality filter treatment device shall be engineered, designed, and sized to treat a minimum of 90 percent of the annual runoff volume determined from use of a minimum 15-year rainfall data set.

3.2.3 Fine Particle Removal - The stormwater quality filter treatment device shall have demonstrated the ability to capture fine particles as indicated by a minimum median removal efficiency of 75% for the particle fraction less than 25 microns, an effluent d_{50} of 15 microns or lower for all monitored storm events.

3.2.4 Turbidity Reduction - The stormwater quality filter treatment device shall have demonstrated the ability to reduce the turbidity from influent from a range of 5 to 171 NTU to an effluent turbidity of 15 NTU or lower.

3.2.5 Nutrient (Total Phosphorus & Total Nitrogen) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Phosphorus removal of 55%, and a minimum median Total Nitrogen removal of 50%.

3.2.6 Metals (Total Zinc & Total Copper) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Zinc removal of 55%, and a minimum median Total Copper removal of 85%.

3.3 INSPECTION and MAINTENANCE

The stormwater quality filter device shall have the following features:

3.3.1 Durability of membranes are subject to good handling practices during inspection and maintenance (removal, rinsing, and reinsertion) events, and site specific conditions that may have heavier or lighter loading onto the cartridges, and pollutant variability that may impact the membrane structural integrity. Membrane maintenance and replacement shall be in accordance with manufacturer's recommendations.

3.3.2 Inspection which includes trash and floatables collection, sediment depth determination, and visible determination of backwash pool depth shall be easily conducted from grade (outside the structure).

3.3.3 Manual rinsing of the reusable filter cartridges shall promote restoration of the flow capacity and sediment capacity of the filter cartridges, extending cartridge service life.

3.3.4 The filter device shall have a minimum 12 inches (305 mm) of sediment storage depth, and a minimum of 12 inches between the top of the sediment storage and bottom of the filter cartridge tentacles, unless otherwise specified by the design engineer. Variances may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

3.3.5 Sediment removal from the filter treatment device shall be able to be conducted using a standard maintenance truck and vacuum apparatus, and a minimum one point of entry to the sump that is unobstructed by filter cartridges.

3.3.6 Maintenance access shall have a minimum clear height that provides suitable vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.

3.3.7 Filter cartridges shall be able to be maintained without the requirement of additional lifting equipment.

PART 4 – EXECUTION

4.1 INSTALLATION

4.1.1 PRECAST DEVICE CONSTRUCTION SEQUENCE

The installation of a watertight precast concrete device should conform to ASTM C 891 and to any state highway, municipal or local specifications for the construction of manholes, whichever is more stringent. Selected sections of a general specification that are applicable are summarized below.

4.1.1.1 The watertight precast concrete device is installed in sections in the following sequence:

- aggregate base
- base slab
- treatment chamber and cartridge deck riser section(s)
- bypass section
- connect inlet and outlet pipes
- concrete riser section(s) and/or transition slab (if required)
- maintenance riser section(s) (if required)
- frame and access cover

4.1.2 The precast base should be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, should be installed in accordance with the precast concrete manufacturer's recommendations.

4.1.3 Adjustment of the stormwater quality treatment device can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary to restore original condition and watertight seals. Once the stormwater quality treatment device has been constructed, any/all lift holes must be plugged watertight with mortar or non-shrink grout.

4.1.4 Inlet and Outlet Pipes Inlet and outlet pipes should be securely set into the device using approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight, and such that any pipe intrusion into the device does not impact the device functionality.

4.1.5 Frame and Cover Installation Adjustment units (e.g. grade rings) should be installed to set the frame and cover at the required elevation. The adjustment units should be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover should be set in a full bed of mortar at the elevation specified.

4.2 MAINTENANCE ACCESS WALL
In some instances the Maintenance Access Wall, if provided, shall require an extension attachment and sealing to the precast wall and cartridge deck at the job site, rather than at the precast facility. In this instance, installation of these components shall be performed according to instructions provided by the manufacturer.

4.3 FILTER CARTRIDGE INSTALLATION Filter cartridges shall be installed in the cartridge deck only after the construction site is fully stabilized and in accordance with the manufacturer's guidelines and recommendations. Contractor to contact the manufacturer to schedule cartridge delivery and review procedures/requirements to be completed to the device prior to installation of the cartridges and activation of the system.

PART 5 – QUALITY ASSURANCE

5.1 FILTER CARTRIDGE INSTALLATION Manufacturer shall coordinate delivery of filter cartridges and other internal components with contractor. Filter cartridges shall be delivered and installed complete after site is stabilized and unit is ready to accept cartridges. Unit is ready to accept cartridges after is has been cleaned out and any standing water, debris, and other materials have been removed. Contractor shall take appropriate action to protect the filter cartridge receptacles and filter cartridges from damage during construction, and in accordance with the manufacturer's recommendations and guidance. For systems with cartridges installed prior to full site stabilization and prior to system activation, the contractor can plug inlet and outlet pipes to prevent stormwater and other influent from entering the device. Plugs must be removed during the activation process.

5.2 INSPECTION AND MAINTENANCE

5.2.1 The manufacturer shall provide an Owner's Manual upon request.

5.2.2 After construction and installation, and during operation, the device shall be inspected and cleaned as necessary based on the manufacturer's recommended inspection and maintenance guidelines and the local regulatory agency/body.

5.3 REPLACEMENT FILTER CARTRIDGES When replacement membrane filter elements and/or other parts are required, only membrane filter elements and parts approved by the manufacturer for use with the stormwater quality filter device shall be installed.

END OF SECTION

DRAWING NOT TO BE USED FOR CONSTRUCTION

GENERAL NOTES:

1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED.
2. JELLYFISH STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
3. UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES, OR PIPE CONDUITS CONNECTING TO COMPLETE THE JELLYFISH SYSTEM SHALL BE PROVIDED AND ADDRESSED SEPARATELY.
4. DRAWING FOR INFORMATION PURPOSES ONLY. REFER TO ENGINEER'S SITE/UTILITY PLAN FOR STRUCTURE ORIENTATION.
5. NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD.

JELLYFISH STRUCTURE & DESIGN NOTES:

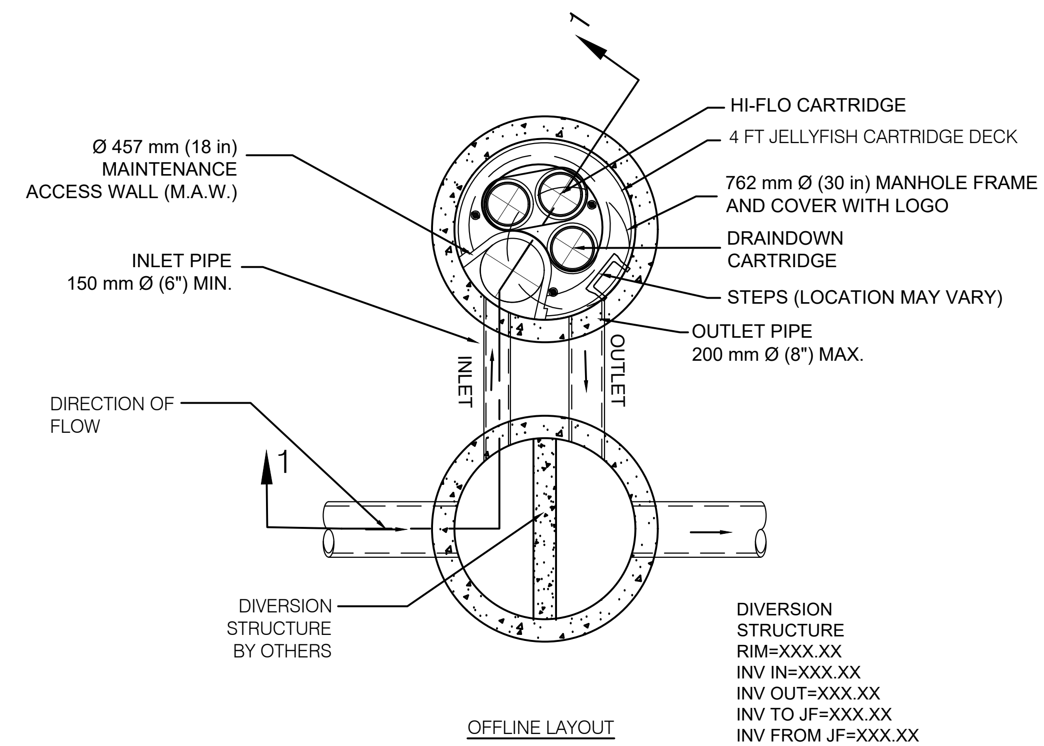
1. 457 MM Ø (18") MAINTENANCE ACCESS WALL TO BE USED FOR CLEANOUT AND ACCESS BELOW CARTRIDGE DECK.
2. CASTINGS OR DOORS OF THE JELLYFISH MANHOLE STRUCTURE TO EXTEND TO DESIGN FINISH GRADE. DEPTHS IN EXCESS OF 3.65 M (12') MAY REQUIRE THE DESIGN AND INSTALLATION OF INTERMEDIATE SAFETY GRATES OR OTHER STRUCTURAL ELEMENTS.
3. CASTINGS AND GRADE RINGS, OR DOORS AND DOOR RISERS, OR BOTH, SHALL BE GROUTED FOR WATERTIGHTNESS.
STRUCTURE SHALL MEET AASHTO HS-20, ASSUMING EARTH COVER OF 0' - 3', AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 LOAD RATING AND BE CAST WITH THE IMBRIUM LOGO.
4. ALL STRUCTURAL SECTIONS AND PARTS TO MEET OR EXCEED ASTM C-478, ASTM C-443, AND ASTM D-4097 CORRESPONDING TO AASHTO SPECIFICATIONS, AND ANY OTHER SITE OR LOCAL STANDARDS.
5. CONCRETE RISER SECTIONS FROM BOTTOM TO TOP WILL BE ADDED AS REQUIRED INCLUDING TRANSITION PIECES TO SMALLER DIAMETER RISERS FOR SURFACE ACCESSES WHERE WARRANTED BY SERVICING DEPTH.
6. IF MINIMUM DEPTH FROM TOP OF CARTRIDGE DECK TO BOTTOM OF STRUCTURAL TOP SLAB CANNOT BE ACHIEVED DUE TO PIPING INVERT ELEVATIONS OR OTHER SITE CONSTRAINTS. ALTERNATIVE HATCH CONFIGURATIONS MAY BE AVAILABLE. HATCH DOORS SHOULD BE SIZED TO PROVIDE FULL ACCESS ABOVE THE CARTRIDGES TO ACCOMMODATE MAINTENANCE.
7. STEPS TO BE APPROXIMATELY 330 MM (13") APART AND DIMENSIONS MUST MEET LOCAL STANDARDS. STEPS MUST BE INSTALLED AFTER CARTRIDGE DECK IS IN PLACE.
8. CONFIGURATION OF INLET AND OUTLET PIPE CAN VARY TO MEET SITE'S NEEDS.
9. IT IS THE RESPONSIBILITY OF OTHERS TO PROPERLY PROTECT THE TREATMENT DEVICE, AND KEEP THE DEVICE OFFLINE DURING CONSTRUCTION. FILTER CARTRIDGES SHALL NOT BE INSTALLED UNTIL THE PROJECT SITE IS CLEAN AND FREE OF DEBRIS, BY OTHERS. THE PROJECT SITE INCLUDES ANY SURFACE THAT CONTRIBUTES STORM DRAINAGE TO THE TREATMENT DEVICE. CARTRIDGES SHALL BE FURNISHED NEW, AT THE TIME OF FINAL ACCEPTANCE.
10. THIS DRAWING MUST BE VIEWED IN CONJUNCTION WITH THE STANDARD JELLYFISH SPECIFICATION, AND STORMWATER QUALITY FILTER TREATMENT JELLYFISH DOCUMENTS.

INSTALLATION NOTES

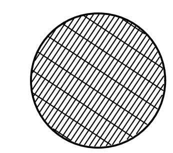
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
C. CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
D. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.
E. CARTRIDGE INSTALLATION, BY IMBRIUM, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE JELLYFISH UNIT IS CLEAN AND FREE OF DEBRIS. CONTACT IMBRIUM TO COORDINATE CARTRIDGE INSTALLATION WITH SITE STABILIZATION.

STANDARD OFFLINE JELLYFISH RECOMMENDED PIPE DIAMETERS			
MODEL DIAMETER (m)	MINIMUM ANGLE INLET/OUTLET PIPES	MINIMUM INLET PIPE DIAMETER (mm)	MINIMUM OULTET PIPE DIAMETER (mm)
1.2	62	150	200
1.8	59	200	250
2.4	52	250	300
3.0	48	300	450
3.6	40	300	450
CONTACT IMBRIUM SYSTEMS FOR ALTERNATE PIPE DIAMETERS			

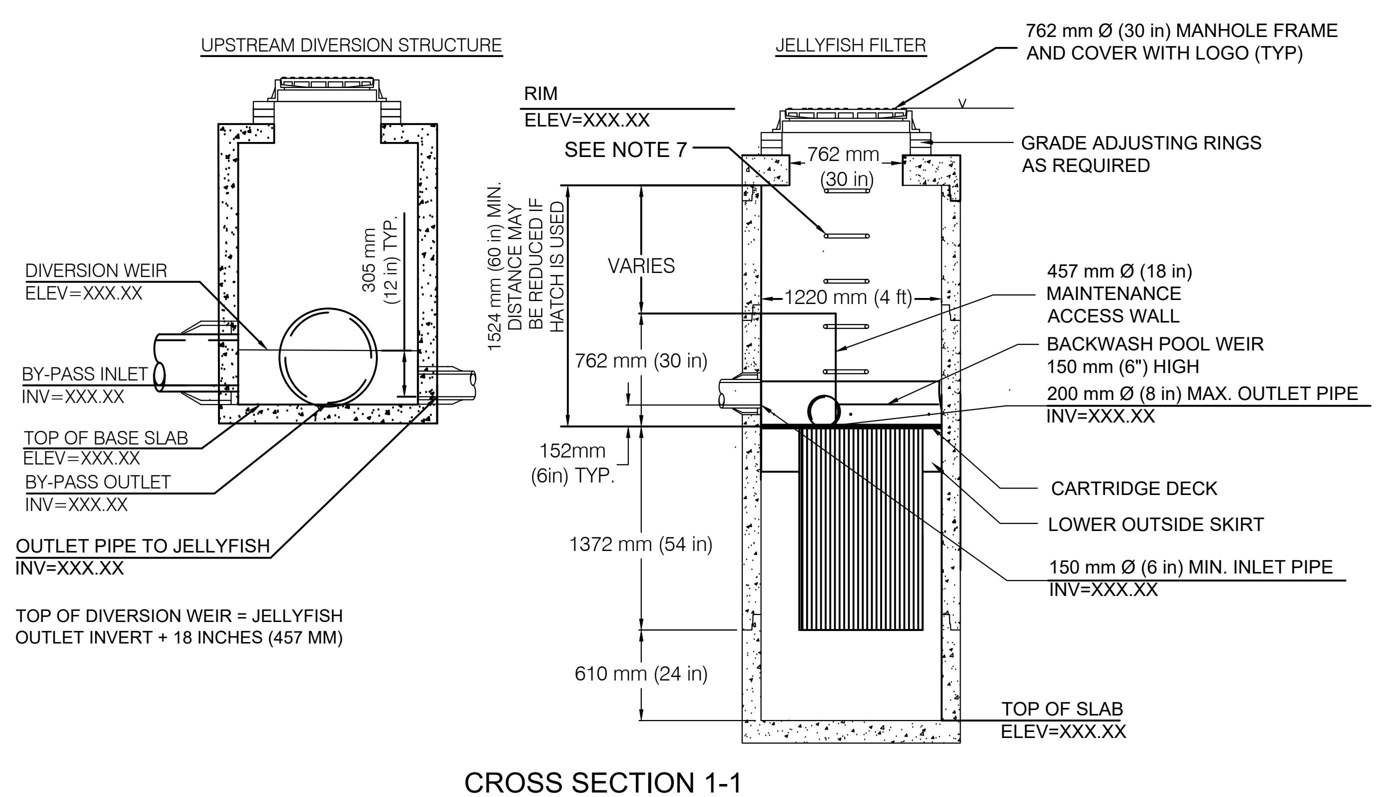
FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL JELLYFISH FILTER REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD REVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON AVAILABLE SPACE OR SITE CONFIGURATION REVISIONS. ELEVATIONS SHOULD BE MAINTAINED EXCEPT WHERE NOTED ON BYPASS STRUCTURE.



OFFLINE LAYOUT



XXX.XX INFORMATION TO BE SUPPLIED BY ENGINEER OF RECORD



TOP OF DIVERSION WEIR = JELLYFISH OUTLET INVERT + 18 INCHES (457 MM)

CROSS SECTION 1-1

JELLYFISH DESIGN NOTES

JELLYFISH TREATMENT CAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. THE STANDARD MANHOLE STYLE IS SHOWN. Ø1220 mm (48") MANHOLE JELLYFISH PEAK TREATMENT CAPACITY IS 12.7 L/s (0.54 CFS). TREATMENT FLOW RATE IS BASED ON 457 mm (18") OF HEAD PRESSURE.

CARTRIDGE SELECTION				
CARTRIDGE DEPTH	54"	40"	27"	15"
OUTLET INVERT TO STRUCTURE BASE SLAB	90"	76"	63"	51"
FLOW RATE HIGH-FLO / DRAINDOWN (L/s) (per cart)	5.09 / 2.55	3.68 / 1.84	2.55 / 1.27	1.41 / 0.71
SEDIMENT CAPACITY HIGH-FLO / DRAINDOWN (kg) (per cart)	57 / 28	42 / 21	28 / 14	16 / 8
MAX. CARTS HIGH-FLO/DRAINDOWN	2 / 1			
MAX. SEDIMENT CAPACITY (kg)	142	105	70	40
MAX. TREATMENT (L/s)	12.7	9.3	6.2	3.4

SITE SPECIFIC DATA REQUIREMENTS

JELLYFISH MODEL	*				
STRUCTURE ID					*
WATER QUALITY FLOW RATE (L/s)					*
PEAK FLOW RATE (L/s)					*
RETURN PERIOD OF PEAK FLOW (yrs)					*
# OF CARTRIDGES REQUIRED (HF / DD)					*
CARTRIDGE SIZE (inches)					*
PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

MARK	DATE	REVISION DESCRIPTION	BY
#	#	#	#
#	#	#	#
#	#	#	#
1	08/01/2015	NOTES	BSF
0	10/01/2014	INTIAL RELEASE	BSF

info@imbriumsystems.com

Jellyfish®

JF4 STANDARD

Scale = 1:50

www.imbriumsystems.com

imbrium®

7037 Ridge Road, Suite 350, Hanover, MD 21076

USA 888-279-8826 CA 800-565-4801 INTL +1-416-960-9900

Jellyfish® Filter

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING AUS NO. 2008/286748, U.S.A. NO. US 8,287,726, US 8,221,618, US 8,123,935, CA 2, 966,482, CA 2,834,542,CA 2,696,482, KR 10-1287539, NZ 583461, NZ 604227, ZA 2010/01068; OTHER INTERNATIONAL PATENTS PENDING

DATE: #####	
DESIGNED:	DRAWN: BSF
CHECKED: BSF	APPROVED: SP
PROJECT #: #####	PROJECT NAME: #####
SHEET: 1 OF 2	

I:\IMBRIUM\PRODUCTS\JELLYFISH FILTER\40 DRAWINGS & DETAILS\STANDARD DETAILS\JELLYFISH FILTER - OFFLINE\JELLYFISH FILTER JF4 - OFFLINE DIVERSION MANHOLE.DWG 5/17/2017 1:57 PM

JELLYFISH® FILTER - SPECIFICATIONS

GENERAL

A. WORK INCLUDED: SPECIFIES REQUIREMENTS FOR CONSTRUCTION AND PERFORMANCE OF AN UNDERGROUND STORMWATER QUALITY, MEMBRANE FILTRATION, AND TREATMENT DEVICE THAT REMOVES POLLUTANTS FROM STORMWATER RUNOFF THROUGH THE UNIT OPERATIONS OF SEDIMENTATION, FLOATATION, AND MEMBRANE FILTRATION.

B. REFERENCE STANDARDS:

ASTM C 891:	SPECIFICATION FOR INSTALLATION OF UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURES
ASTM C 478:	SPECIFICATION FOR PRECAST REINFORCED CONCRETE MANHOLE SECTIONS
ASTM C 990:	SPECIFICATION FOR JOINTS FOR CONCRETE MANHOLES USING PREFORMED FLEXIBLE JOINT SEALANTS
ASTM D 4101:	SPECIFICATION FOR COPOLYMER STEPS CONSTRUCTION

C. SHOP DRAWINGS: SHOP DRAWINGS FOR THE STRUCTURE AND PERFORMANCE ARE TO BE SUBMITTED WITH EACH ORDER TO THE CONTRACTOR. CONTRACTOR SHALL FORWARD SHOP DRAWING SUBMITTAL TO THE CONSULTING ENGINEER FOR APPROVAL. SHOP DRAWINGS ARE TO DETAIL THE STRUCTURE PRECAST CONCRETE AND CALL OUT OR NOTE THE FIBERGLASS (FRP) INTERNALS/COMPONENTS.

D. PRODUCT SUBSTITUTIONS: NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD. SUBMISSIONS FOR SUBSTITUTIONS REQUIRE REVIEW AND APPROVAL BY THE ENGINEER OF RECORD, FOR HYDRAULIC PERFORMANCE, IMPACT TO PROJECT DESIGNS, EQUIVALENT TREATMENT PERFORMANCE, AND ANY REQUIRED PROJECT PLAN AND REPORT (HYDROLOGY/HYDRAULIC, WATER QUALITY, STORMWATER POLLUTION) MODIFICATIONS THAT WOULD BE REQUIRED BY THE APPROVING JURISDICTIONS/AGENCIES. CONTRACTOR TO COORDINATE WITH THE ENGINEER OF RECORD ANY APPLICABLE MODIFICATIONS TO THE PROJECT ESTIMATES OF COST, BONDING AMOUNT DETERMINATIONS, PLAN CHECK FEES FOR CHANGES TO APPROVED DOCUMENTS, AND/OR ANY OTHER REGULATORY REQUIREMENTS RESULTING FROM THE PRODUCT SUBSTITUTION.

E. HANDLING AND STORAGE: PREVENT DAMAGE TO MATERIALS DURING STORAGE AND HANDLING.

PRODUCTS

A. THE DEVICE SHALL BE A CYLINDRICAL OR RECTANGULAR, ALL CONCRETE STRUCTURE (INCLUDING RISERS), CONSTRUCTED FROM PRECAST CONCRETE RISER AND SLAB COMPONENTS OR MONOLITHIC PRECAST STRUCTURE(S), INSTALLED TO CONFORM TO ASTM C 891 AND TO ANY REQUIRED STATE HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS; WHICHEVER IS MORE STRINGENT. THE DEVICE SHALL BE WATERTIGHT.

B. THE CYLINDRICAL CONCRETE DEVICE SHALL INCLUDE A FIBERGLASS CARTRIDGE DECK INSERT. THE RECTANGULAR CONCRETE DEVICE SHALL INCLUDE A COATED ALUMINUM INSERT. IN EITHER INSTANCE, THE INSERT SHALL BE BOLTED AND SEALED WATERTIGHT INSIDE THE PRECAST CONCRETE CHAMBER. THE INSERT SHALL SERVE AS: (A) A HORIZONTAL DIVIDER BETWEEN THE LOWER TREATMENT ZONE AND THE UPPER TREATED EFFLUENT ZONE; (B) A DECK FOR ATTACHMENT OF FILTER CARTRIDGES SUCH THAT THE MEMBRANE FILTER ELEMENTS OF EACH CARTRIDGE EXTEND INTO THE LOWER TREATMENT ZONE; (C) A PLATFORM FOR MAINTENANCE WORKERS TO SERVICE THE FILTER CARTRIDGES (MAXIMUM MANNED WEIGHT = 450 POUNDS); (D) A CONDUIT FOR CONVEYANCE OF TREATED WATER TO THE EFFLUENT PIPE.

C. MEMBRANE FILTER CARTRIDGES SHALL BE COMPRISED OF REUSABLE CYLINDRICAL MEMBRANE FILTER ELEMENTS CONNECTED TO A PERFORATED HEAD PLATE. THE NUMBER OF MEMBRANE FILTER ELEMENTS PER CARTRIDGE SHALL BE A MINIMUM OF ELEVEN 2.75-INCH (70-MM) OR GREATER DIAMETER ELEMENTS. THE LENGTH OF EACH FILTER ELEMENT SHALL BE A MINIMUM 15 INCHES (381 MM). EACH CARTRIDGE SHALL BE FITTED INTO THE CARTRIDGE DECK BY INSERTION INTO A CARTRIDGE RECEPTACLE THAT IS PERMANENTLY MOUNTED INTO THE CARTRIDGE DECK. EACH CARTRIDGE SHALL BE SECURED BY A CARTRIDGE LID THAT IS THREADED ONTO THE RECEPTACLE, OR SIMILAR MECHANISM TO SECURE THE CARTRIDGE INTO THE DECK. THE MAXIMUM TREATMENT FLOW RATE OF A FILTER CARTRIDGE SHALL BE CONTROLLED BY AN ORIFICE IN THE CARTRIDGE LID, OR ON THE INDIVIDUAL CARTRIDGE ITSELF, AND BASED ON A DESIGN FLUX RATE (SURFACE LOADING RATE) DETERMINED BY THE MAXIMUM TREATMENT FLOW RATE PER UNIT OF FILTRATION MEMBRANE SURFACE AREA. THE MAXIMUM FLUX RATE SHALL BE 0.21 GPM/FT2 (0.142 LPS/M2). EACH MEMBRANE FILTER CARTRIDGE SHALL ALLOW FOR MANUAL INSTALLATION AND REMOVAL.

D. ALL FILTER CARTRIDGES AND MEMBRANES SHALL BE REUSABLE AND ALLOW FOR THE USE OF FILTRATION MEMBRANE RINSING PROCEDURES TO RESTORE FLOW CAPACITY AND SEDIMENT CAPACITY; EXTENDING CARTRIDGE SERVICE LIFE.

E. ACCESS SHALL HAVE A MINIMUM CLEAR HEIGHT OF 60" OVER ALL OF THE FILTER CARTRIDGES, OR BE ACCESSIBLE BY A HATCH OR OTHER MECHANISM THAT PROVIDES MINIMUM 60" VERTICAL CLEAR SPACE OVER ALL OF THE FILTER CARTRIDGES. FILTER CARTRIDGES SHALL BE ABLE TO BE LIFTED STRAIGHT VERTICALLY OUT OF THE RECEPTACLES AND DECK FOR THE ENTIRE LENGTH OF THE CARTRIDGE.

F. THE DEVICE SHALL INCLUDE A MINIMUM 24 INCHES (610 MM) OF SUMP BELOW THE BOTTOM OF THE CARTRIDGES FOR SEDIMENT ACCUMULATION, UNLESS OTHERWISE SPECIFIED BY THE DESIGN ENGINEER. DEPTHS LESS THAN 24" MAY HAVE AN IMPACT ON THE TOTAL PERFORMANCE AND/OR LONGEVITY BETWEEN CARTRIDGE MAINTENANCE/REPLACEMENT OF THE DEVICE.

G. ALL PRECAST CONCRETE COMPONENTS SHALL BE MANUFACTURED TO A MINIMUM LIVE LOAD OF HS-20 TRUCK LOADING OR GREATER BASED ON LOCAL REGULATORY SPECIFICATIONS, UNLESS OTHERWISE MODIFIED OR SPECIFIED BY THE DESIGN ENGINEER, AND SHALL BE WATERTIGHT.

H. GASKETS AND/OR SEALANTS TO PROVIDE WATER TIGHT SEAL BETWEEN CONCRETE JOINTS. JOINTS SHALL BE SEALED WITH PREFORMED JOINT SEALING COMPOUND CONFORMING TO ASTM C 990.

I. FRAME AND COVERS MUST BE MANUFACTURED FROM CAST-IRON OR OTHER COMPOSITE MATERIAL TESTED TO WITHSTAND H-20 OR GREATER DESIGN LOADS, AND AS APPROVED BY THE LOCAL REGULATORY BODY. FRAMES AND COVERS MUST BE EMBOSSED WITH THE NAME OF THE DEVICE MANUFACTURER OR THE DEVICE BRAND NAME.

J. DOOR AND HATCHES, IF PROVIDED SHALL MEET DESIGNATED LOADING REQUIREMENTS OR AT A MINIMUM FOR INCIDENTAL VEHICULAR TRAFFIC.

K. ALL CONCRETE COMPONENTS SHALL BE MANUFACTURED ACCORDING TO LOCAL SPECIFICATIONS AND SHALL MEET THE REQUIREMENTS OF ASTM C 478.

L. THE FIBERGLASS PORTION OF THE FILTER DEVICE SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE FOLLOWING STANDARD: ASTM D-4097: CONTACT MOLDED GLASS FIBER REINFORCED CHEMICAL RESISTANT TANKS.

M. STEPS SHALL BE CONSTRUCTED ACCORDING TO ASTM D4101 OF COPOLYMER POLYPROPYLENE, AND BE DRIVEN INTO PREFORMED OR PRE-DRILLED HOLES AFTER THE CONCRETE HAS CURED, INSTALLED TO CONFORM TO APPLICABLE SECTIONS OF STATE, PROVINCIAL AND MUNICIPAL BUILDING CODES, HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS FOR THE CONSTRUCTION OF SUCH DEVICES.

N. ALL PRECAST CONCRETE SECTIONS SHALL BE INSPECTED TO ENSURE THAT DIMENSIONS, APPEARANCE AND QUALITY OF THE PRODUCT MEET LOCAL MUNICIPAL SPECIFICATIONS AND ASTM C 478.

PERFORMANCE

A. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL FUNCTION TO REMOVE POLLUTANTS BY THE FOLLOWING UNIT TREATMENT PROCESSES; SEDIMENTATION, FLOATATION, AND MEMBRANE FILTRATION.

B. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL REMOVE OIL, DEBRIS, TRASH, COARSE AND FINE PARTICULATES, PARTICULATE-BOUND POLLUTANTS, METALS AND NUTRIENTS FROM STORMWATER DURING RUNOFF EVENTS.

C. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL TYPICALLY UTILIZE AN EXTERNAL BYPASS TO DIVERT EXCESSIVE FLOWS. INTERNAL BYPASS SYSTEMS SHALL BE EQUIPPED WITH A FLOATABLES BAFFLE, AND MUST PASS WATER OVER THE CARTRIDGE DECK, AND AVOID PASSAGE THROUGH THE SUMP AND/OR CARTRIDGE FILTRATION ZONE.

D. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL TREAT 100% OF THE REQUIRED WATER QUALITY TREATMENT FLOW BASED ON A MAXIMUM TREATMENT FLUX RATE (SURFACE LOADING RATE) ACROSS THE MEMBRANE FILTER CARTRIDGES NOT TO EXCEED 0.21 GPM/FT2 (0.142 LPS/M2).

E. AT A MINIMUM, THE STORMWATER QUALITY FILTER DEVICE SHALL HAVE BEEN FIELD TESTED AND VERIFIED WITH A MINIMUM 25 QUALIFYING STORM EVENTS AND FIELD MONITORING CONDUCTED ACCORDING TO THE TARP TIER II OR TAPE FIELD TEST PROTOCOL, AND HAVE RECEIVED NJCAT VERIFICATION.

F. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TSS REMOVAL EFFICIENCY OF 85% AND A MINIMUM MEDIAN SSC REMOVAL EFFICIENCY OF 95%.

G. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED THE ABILITY TO CAPTURE FINE PARTICLES AS INDICATED BY A MINIMUM MEDIAN REMOVAL EFFICIENCY OF 75% FOR THE PARTICLE FRACTION LESS THAN 25 MICRONS, AN EFFLUENT D50 OF 15 MICRONS OR LOWER FOR ALL MONITORED STORM EVENTS, AND AN EFFLUENT TURBIDITY OF 15 NTUS OR LOWER.

H. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TOTAL PHOSPHORUS REMOVAL OF 55%, AND A MINIMUM MEDIAN TOTAL NITROGEN REMOVAL OF 50%.

I. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TOTAL ZINC REMOVAL OF 50%, AND A MINIMUM MEDIAN TOTAL COPPER REMOVAL OF 75%.

INSPECTION AND MAINTENANCE

A. DURABILITY OF MEMBRANES ARE SUBJECT TO GOOD HANDLING PRACTICES DURING INSPECTION AND MAINTENANCE (REMOVAL, RINSING, AND REINSERTION) EVENTS, AND SITE SPECIFIC CONDITIONS THAT MAY HAVE HEAVIER OR LIGHTER LOADING ONTO THE CARTRIDGES, AND POLLUTANT VARIABILITY THAT MAY IMPACT THE MEMBRANE STRUCTURAL INTEGRITY. MEMBRANE MAINTENANCE AND REPLACEMENT SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

B. INSPECTION WHICH INCLUDES TRASH AND FLOATABLES COLLECTION, SEDIMENT DEPTH DETERMINATION, AND VISIBLE DETERMINATION OF BACKWASH POOL DEPTH SHALL BE EASILY CONDUCTED FROM GRADE (OUTSIDE THE STRUCTURE).

C. MANUAL RINSING OF THE REUSABLE FILTER CARTRIDGES SHALL PROMOTE RESTORATION OF THE FLOW CAPACITY AND SEDIMENT CAPACITY OF THE FILTER CARTRIDGES, EXTENDING CARTRIDGE SERVICE LIFE.

D. SEDIMENT REMOVAL FROM THE FILTER TREATMENT DEVICE SHALL BE ABLE TO BE CONDUCTED USING A STANDARD MAINTENANCE TRUCK AND VACUUM APPARATUS, AND A MINIMUM ONE POINT OF ENTRY TO THE SUMP THAT IS UNOBSTRUCTED BY FILTER CARTRIDGES.

E. MAINTENANCE ACCESS SHALL HAVE A MINIMUM CLEAR HEIGHT OF 60" OVER ALL OF THE FILTER CARTRIDGES, OR BE ACCESSIBLE BY A HATCH OR OTHER MECHANISM THAT PROVIDES MINIMUM 60" VERTICAL CLEAR SPACE OVER ALL OF THE FILTER CARTRIDGES. FILTER CARTRIDGES SHALL BE ABLE TO BE LIFTED STRAIGHT VERTICALLY OUT OF THE RECEPTACLES AND DECK FOR THE ENTIRE LENGTH OF THE CARTRIDGE.

F. FILTER CARTRIDGES SHALL BE ABLE TO BE MAINTAINED WITHOUT THE USE OF ADDITIONAL LIFTING EQUIPMENT.

EXECUTION

A. THE INSTALLATION OF A WATERTIGHT PRECAST CONCRETE DEVICE SHOULD CONFORM TO ASTM C 891 AND TO ANY STATE HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS FOR THE CONSTRUCTION OF MANHOLES, WHICHEVER IS MORE STRINGENT. SELECTED SECTIONS OF A GENERAL SPECIFICATION THAT ARE APPLICABLE ARE SUMMARIZED BELOW.

B. THE WATERTIGHT PRECAST CONCRETE DEVICE IS INSTALLED IN SECTIONS IN THE FOLLOWING SEQUENCE:
- AGGREGATE BASE
- BASE SLAB
- TREATMENT CHAMBER AND CARTRIDGE DECK RISER SECTION(S)
- BYPASS SECTION
- CONNECT INLET AND OUTLET PIPES
- CONCRETE RISER SECTION(S) AND/OR TRANSITION SLAB (IF REQUIRED)
- MAINTENANCE RISER SECTION(S) (IF REQUIRED)
- FRAME AND ACCESS COVER

C. INLET AND OUTLET PIPES SHOULD BE SECURELY SET INTO THE DEVICE USING APPROVED PIPE SEALS (FLEXIBLE BOOT CONNECTIONS, WHERE APPLICABLE) SO THAT THE STRUCTURE IS WATERTIGHT, AND SUCH THAT ANY PIPE INTRUSION INTO THE DEVICE DOES NOT IMPACT THE DEVICE FUNCTIONALITY.

D. ADJUSTMENT UNITS (E.G. GRADE RINGS) SHOULD BE INSTALLED TO SET THE FRAME AND COVER AT THE REQUIRED ELEVATION. THE ADJUSTMENT UNITS SHOULD BE LAID IN A FULL BED OF MORTAR WITH SUCCESSIVE UNITS BEING JOINED USING SEALANT RECOMMENDED BY THE MANUFACTURER. FRAMES FOR THE COVER SHOULD BE SET IN A FULL BED OF MORTAR AT THE ELEVATION SPECIFIED.

E. IN SOME INSTANCES THE MAINTENANCE ACCESS WALL, IF PROVIDED, SHALL REQUIRE AN EXTENSION ATTACHMENT AND SEALING TO THE PRECAST WALL AND CARTRIDGE DECK AT THE JOB SITE, RATHER THAN AT THE PRECAST FACILITY. IN THIS INSTANCE, INSTALLATION OF THESE COMPONENTS SHALL BE PERFORMED ACCORDING TO INSTRUCTIONS PROVIDED BY THE MANUFACTURER.

F. FILTER CARTRIDGES SHALL BE INSTALLED IN THE CARTRIDGE DECK AFTER THE CONSTRUCTION SITE IS FULLY STABILIZED AND IN ACCORDANCE WITH THE MANUFACTURERS GUIDELINES AND RECOMMENDATIONS. CONTRACTOR TO CONTACT THE MANUFACTURER TO SCHEDULE CARTRIDGE DELIVERY AND REVIEW PROCEDURES/REQUIREMENTS TO BE COMPLETED TO THE DEVICE PRIOR TO INSTALLATION OF THE CARTRIDGES AND ACTIVATION OF THE SYSTEM.

G. MANUFACTURER SHALL COORDINATE DELIVERY OF FILTER CARTRIDGES AND OTHER INTERNAL COMPONENTS WITH CONTRACTOR. FILTER CARTRIDGES SHALL BE DELIVERED AND INSTALLED COMPLETE AFTER SITE IS STABILIZED AND UNIT IS READY TO ACCEPT CARTRIDGES. UNIT IS READY TO ACCEPT CARTRIDGES AFTER IS HAS BEEN CLEANED OUT AND ANY STANDING WATER, DEBRIS, AND OTHER MATERIALS HAVE BEEN REMOVED. CONTRACTOR SHALL TAKE APPROPRIATE ACTION TO PROTECT THE FILTER CARTRIDGE RECEPTACLES AND FILTER CARTRIDGES FROM DAMAGE DURING CONSTRUCTION, AND IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AND GUIDANCE. FOR SYSTEMS WITH CARTRIDGES INSTALLED PRIOR TO FULL SITE STABILIZATION AND PRIOR TO SYSTEM ACTIVATION, THE CONTRACTOR CAN PLUG INLET AND OUTLET PIPES TO PREVENT STORMWATER AND OTHER INFLUENT FROM ENTERING THE DEVICE. PLUGS MUST BE REMOVED DURING THE ACTIVATION PROCESS.

H. THE MANUFACTURER SHALL PROVIDE AN OWNER'S MANUAL UPON REQUEST.

I. AFTER CONSTRUCTION AND INSTALLATION, AND DURING OPERATION, THE DEVICE SHALL BE INSPECTED AND CLEANED AS NECESSARY BASED ON THE MANUFACTURER'S RECOMMENDED INSPECTION AND MAINTENANCE GUIDELINES AND THE LOCAL REGULATORY AGENCY/BODY.

J. WHEN REPLACEMENT MEMBRANE FILTER ELEMENTS AND/OR OTHER PARTS ARE REQUIRED, ONLY MEMBRANE FILTER ELEMENTS AND PARTS APPROVED BY THE MANUFACTURER FOR USE WITH THE STORMWATER QUALITY FILTER DEVICE SHALL BE INSTALLED.

END OF SECTION

MARK	DATE	REVISION DESCRIPTION	BY
#	#	#	#
#	#	#	#
#	#	#	#
#	#	#	#
0	10/01/2014	INTIAL RELEASE	BSF

JELLYFISH FILTER SPECIFICATIONS

Jellyfish®

JF4 STANDARD

Scale = 1:50

www.imbriumsystems.com info@imbriumsystems.com

imbrium®
7037 Ridge Road, Suite 350, Hanover, MD 21076
USA 888-279-8826 CA 800-565-4801 INTL +1-416-960-9900

Jellyfish® Filter

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING AUS NO. 2008/286748, U.S.A. NO. US 8,287,726, US 8,221,618, US 8,123,935, CA 2, 966,482, CA 2,834,542,CA 2,696,482, KR 10-1287539, NZ 583461, NZ 604227, ZA 2010/01068; OTHER INTERNATIONAL PATENTS PENDING

DATE: #####	
DESIGNED:	DRAWN:
CHECKED: BSF	APPROVED: SP
PROJECT #: #####	PROJECT NAME: #####
SHEET: 2 OF 2	

I:\IMBRIUM\PRODUCTS\JELLYFISH FILTER\40 DRAWINGS & DETAILS\STANDARD DETAILS\JELLYFISH FILTER - OFFLINE\JELLYFISH FILTER JF4 - OFFLINE DIVERSION MANHOLE.DWG 5/17/2017 1:57 PM

SHAVER ESTATES (AS CONSTRUCTED)

KEY PLAN

N.T.S.

SITE BENCH MARK

Elevation: 237.31m (778.58 ft.)

Description: Top of southeast corner of concrete wall surrounding Bell kiosk located on the west side of Shaver Road at the intersection of Brooking Court and Shaver Road.

BENCH MARK

MTO BM. No. 758009

Elevation: 231.570m (759.74 ft.)

Description: One and a half-storey frame house along Hwy. No. 53, at east intersection Hwy's No. 2 & 53, tablet in west foundation, 34.7m south of centre line, 3.60m from northwest corner, 0.3m below aluminum siding.

No.	Revision	Date	By
3.	AS CONSTRUCTED FINAL SUBMISSION	FEB. 28, '13	A.J.I.
2.	AS CONSTRUCTED FIRST SUBMISSION	JAN. 23, '12	A.J.I.
1.	ISSUED FOR CONSTRUCTION	N/A	

REVISIONS

CERTIFICATION OF COMPLETION

IT IS HEREBY DECLARED THAT THE WORKS SHOWN ON THIS DRAWING RELATED TO UNDERGROUND WORKS REQUIRED BY THE CITY OF HAMILTON HAVE BEEN COMPLETED IN THE FIELD AS PER THE SUBDIVISION AGREEMENTS. ALL SERVICES ARE AS CONSTRUCTED.

FEBRUARY 28, 2013

P.Eng. Date

ORIGINAL DESIGN SIGNED BY C. GIAMMARCO, P. ENG. DATED SEPT. 13, 2005

ENGINEER

PROJECT OWNER:

1315596 ONTARIO INC.

AS CONSTRUCTED

MUNICIPALITY:

CITY OF HAMILTON (ANCASTER)

PROJECT NAME:

SHAVER ESTATES
FILE No. 25T-97002

A. J. Clarke and Associates Ltd.

SURVEYORS • PLANNERS • ENGINEERS
25 MAIN STREET WEST, SUITE 300
HAMILTON, ONTARIO L8P 1H1
Tel: 905 528-8761 Fax: 905 528-2289
email: ajc@ajclarke.com

TITLE:

STORM DRAINAGE AREA PLAN

SCALE:	1:1000	DATE:	NOVEMBER 2003
DESIGN:	C. GIAMMARCO	DRAWN:	M.P./D.M./T.L.
DWG:	K-03-011	SHT:	13

SHAVER ESTATES (AS CONSTRUCTED)

The evaluation shown in the above table demonstrates the relationship of a multi-component (i.e. stormwater quality treatment in series) approach to stormwater management. The combination of controls designed for site specific conditions will mitigate the impacts urbanization has on the existing hydrologic regime.

3.8.2 PROPOSED EXTENDED DETENTION WETLAND SYSTEM

It is proposed to provide an extended detention wetland system, which will provide quality and quantity control for the Shaver Estates development.

The following table shows the pre to post development peak flows, and the reduction of post development peak flows with stormwater management for the development.

Table 9 – Pre to Post Development Peak Flow Comparison

Design Storm Event	Pre-Development	Post Development (no controls)	Change (%)	Proposed Development (with controls)	Change (%)
2 Year	0.318	0.597	87.7%	0.280	-11.9%
10 Year	0.627	1.337	113.2%	0.600	-4.3%
25 Year	0.851	1.706	100.5%	0.840	-1.3%
100 Year	1.170	2.272	94.2%	0.980	-16.2%

It can be seen from the preceding table, without stormwater management, the post development peak flows would be much greater than those produced under pre-development conditions. The proposed stormwater management facility will reduce post development peak flows to pre-development levels.

The proposed wetland shall be 1.0m deep, with a total available storage volume of 0.269 ha.m. It has been designed to incorporate a sediment forebay which will remove larger sediment particles and facilitate maintenance near the inlet of the pond. The forebay berm extends into the permanent pool portion of the facility and is designed to prevent the conveyance of re-suspended material to the pond outlet.

The permanent pool is proposed to have a total volume of 470.34m^3. The permanent pool has a depth of 0.3m and 5:1 side slopes. A length to width ratio of >3:1 has been established with earthen berms (baffles) to ensure that short circuiting does not occur and that the flow path is maximized during low flow and frequent storm events.

The outlet structure consists of a 120mm diameter orifice for quality control and two 525mm diameter pipes with a grates situated 0.30m above the permanent pool for quantity control. This configuration ensures the "first flush" storm will be detained in the wetland for the minimum required time of 24 hours in accordance with 'Normal' protection guidelines and reduce post development peak flows to pre development levels.

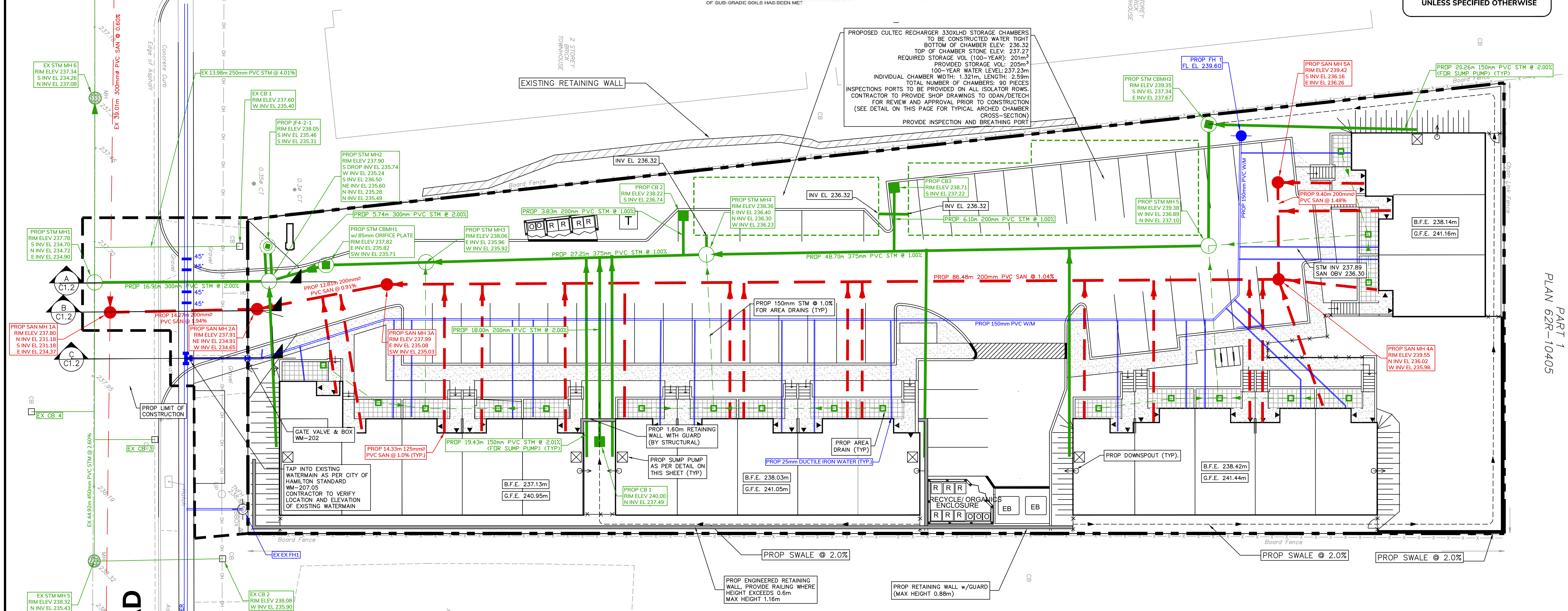
Refer to Appendix 'B' – Stormwater Management Design Information.
Refer to Appendix 'C' – Stormwater Management Facility Drawings.

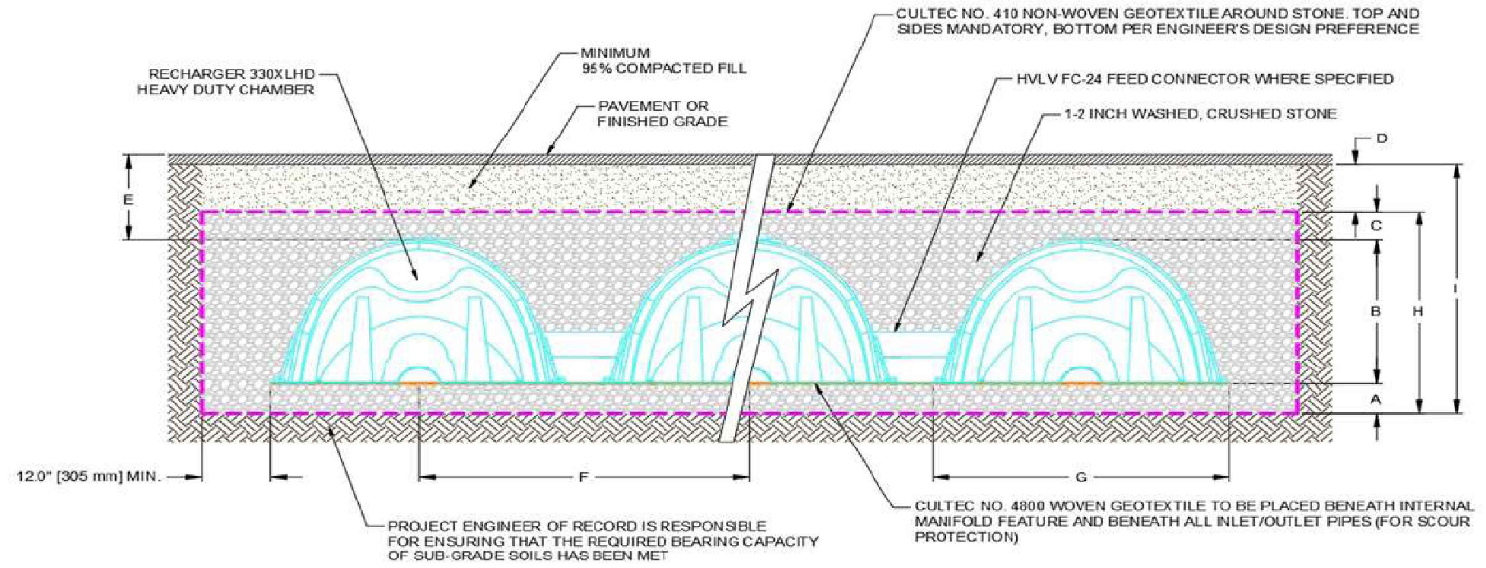
APPENDIX D

Functional Servicing Plan

Functional Grading Plan

Functional Section Plan



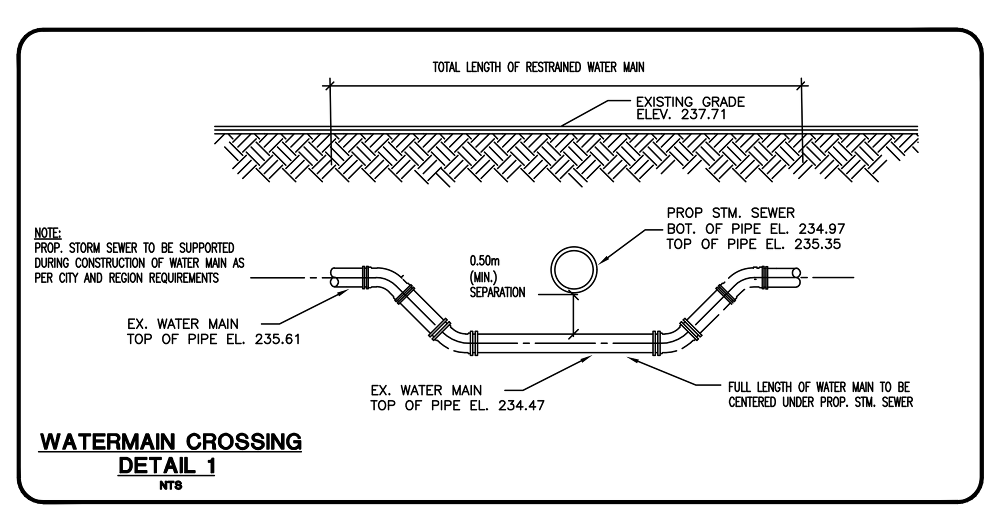


Cross Section Table Reference			
A	Depth of Stone Base	180	mm
B	Chamber Height	775	mm
C	Depth of Stone Above Units	180	mm
D	Depth of 95% Compacted Fill	254	mm
E	Max. Depth Allowed Above the Chamber	3.66	meters
F	Chamber Width	1321	mm
G	Center to Center Spacing	1.55	meters
H	Effective Depth	1.13	meters
I	Bed Depth	1.38	meters

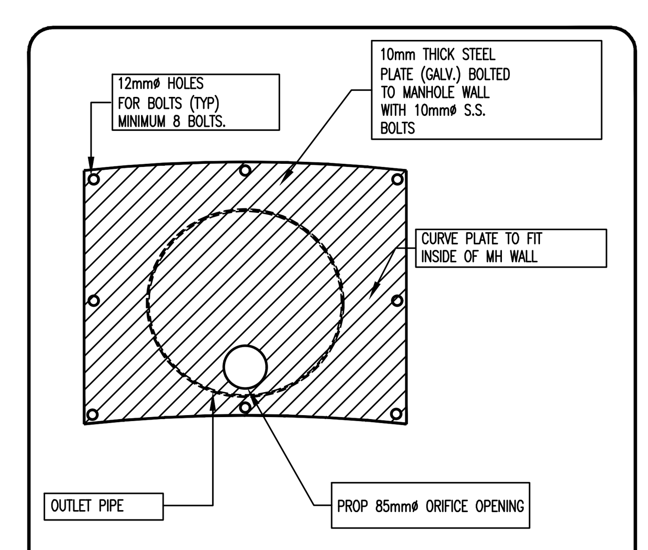
FURTHER DETAILS ON CULTEC CHAMBER TO BE PROVIDED AT SITE PLAN STAGE (SHOP DRAWINGS)

SERVICING LEGEND:

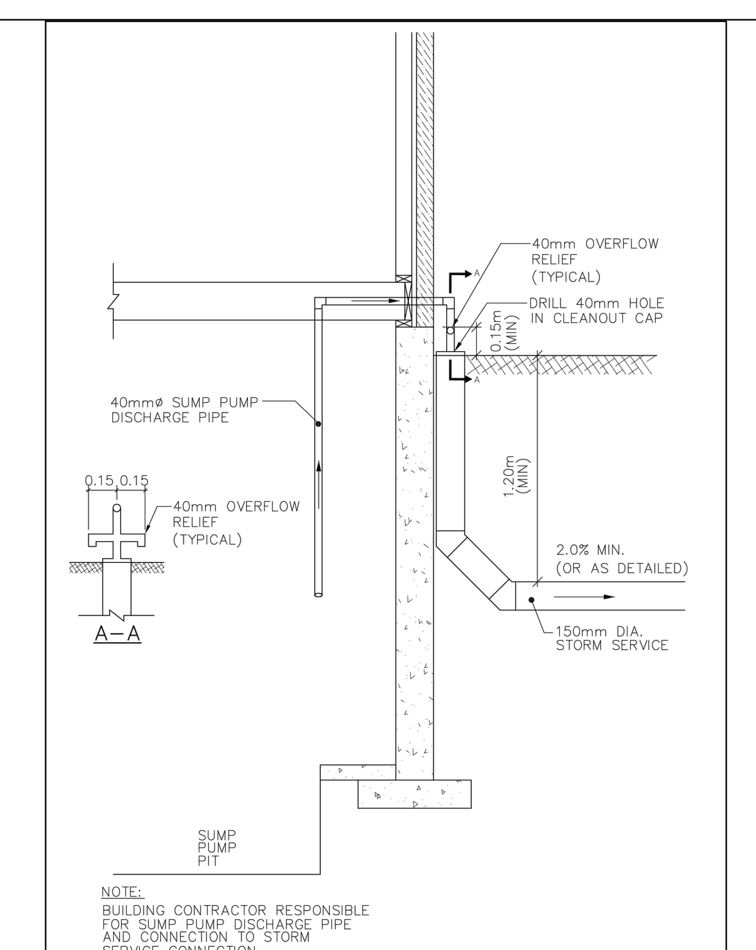
- DENOTES EXISTING STORM MANHOLE
- DENOTES PROPOSED STORM MANHOLE
- DENOTES EXISTING CATCH BASIN
- DENOTES PROPOSED CATCHBASIN
- DENOTES PROPOSED STORMCEPTOR
- DENOTES PROPOSED INLET CONTROL DEVICE (ICD)
- DENOTES EXISTING STORM SEWER
- DENOTES PROPOSED STORM SEWER
- DENOTES EXISTING SANITARY MANHOLE
- DENOTES PROPOSED SANITARY MANHOLE
- DENOTES PROPOSED SANITARY SEWER
- DENOTES EXISTING SANITARY SEWER
- DENOTES PROPOSED HYDRANT
- DENOTES EXISTING HYDRANT
- DENOTES PROPOSED WATER VALVE & BOX
- DENOTES EXISTING WATER VALVE & BOX
- DENOTES PROPOSED WATER METER
- DENOTES EXISTING WATER MAIN
- DENOTES PROPOSED WATER MAIN
- DENOTES PROPOSED SUMP PUMP
- DENOTES PROPOSED DOWN SPOUT
- DENOTES PROPOSED SIAMESE CONNECTION
- DENOTES PROPOSED CAP FOR SANITARY, STORM, AND/OR WATER AS NOTED
- DENOTES PROPOSED LIMIT OF CONSTRUCTION
- DENOTES PROPOSED HEAVY DUTY ASPHALT AREA
- B.F.E. 100.00m DENOTES BASEMENT FINSIHED FLOOR ELEVATION
- G.F.E. 100.00m DENOTES GROUND FINISHED FLOOR ELEVATION



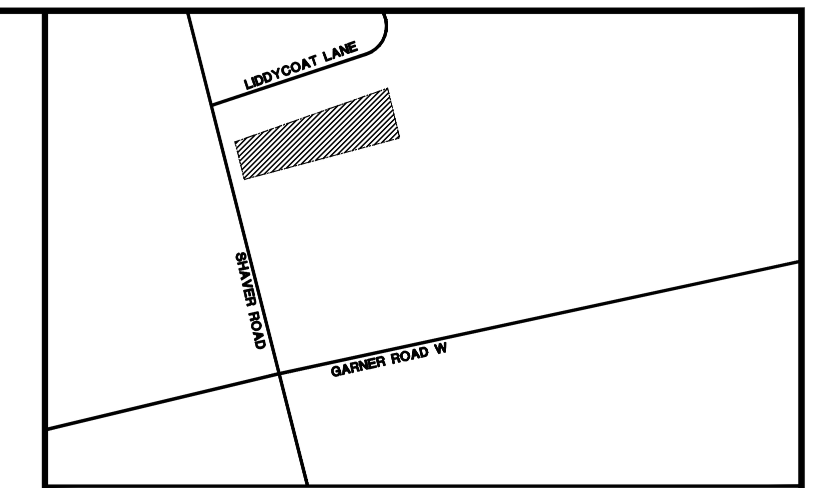
WATERMAIN CROSSING DETAIL 1
NTS



ORIFICE PLATE DETAIL
NTS



SUMP PUMP DETAIL
SCALE 1:25



KEY PLAN
Scale : N.T.S.

SUBJECT LANDS

NOTES:

THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND UNDERGROUND AND ABOVE GROUND UTILITIES 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 THE WORK THE CONTRACTOR SHALL CONFIRM OF THE EXACT LOCATION OF ALL UTILITIES AND STRUCTURES, AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

THE CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS ON THE JOB AND REPORT ANY DISCREPANCY TO THE ARCHITECTS/ENGINEERS BEFORE PROCEEDING WITH THE WORKS.

ALL DRAWINGS AND SPECIFICATIONS ARE INSTRUMENTS OF SERVICE AND THE PROPERTY OF THE ENGINEER WHICH MUST BE RETURNED AT THE COMPLETION OF WORK.

THIS DRAWING IS NOT TO BE SCALED. CONTRACTOR TO USE DIGITAL FILES FOR LAYOUT PROVIDED BY ENGINEER. THIS PLAN MUST NOT BE USED TO SITE THE PROPOSED BUILDINGS.

THE APPROVAL OF THIS PLAN DOES NOT EXEMPT THE OWNER'S CONTRACTOR FROM OBTAINING, BUT NOT LIMITED TO THE FOLLOWING PERMITS: ROAD CUT, SEWER PERMITS, RELOCATION OF SERVICES, ENCROACHMENT AGREEMENTS, APPROACH APPROVAL PERMITS, ETC..

EXISTING TOPOGRAPHICAL INFORMATION SUPPLIED BY J.D. BARNES LIMITED DATED NOVEMBER 8, 2019

EXISTING OFFSITE TOPOGRAPHICAL INFORMATION SUPPLIED BY A.T. MCLAREN LIMITED DATED MARCH 30, 2020

BENCH MARK:

ELEVATIONS ARE OF GEODETIC ORIGIN (CGVD-1928:78, ELEV 239.252), AND ARE DERIVED FROM GNSS OBSERVATIONS AND NATURAL RESOURCES CANADA'S GEOID MODEL HT2.0. STATION NO: 0011975U073
RIB WITH BRASS CAP, 30cm BELOW GROUND. LOCATED ON THE EAST SIDE OF HWY 6, 9m SOUTH OF PARKSIDE DR CENTRELINE, 1.2km NORTH OF DUNDAS RD.

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 Ⓐ	580 216.194	4 783 407.045
ORP Ⓑ	580 263.213	4 783 227.444

BEARING NOTE:

BEARINGS SHOWN HEREON ARE GRID BEARINGS AND ARE DERIVED FROM NETWORK REAL TIME GPS OBSERVATIONS AND REFERRED TO THE UTM PROJECTION ZONE 17, NAD83(CSRS 2010)

METRIC NOTE:

DISTANCES AND ELEVATIONS ON THIS PLAN ARE TYPICALLY SHOWN IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

NO.	REVISIONS	DATE	BY
5	ISSUED FOR ZBA	NOV 25/22	MLB
4	ISSUED FOR COORDINATION	OCT 21/22	MLB
3	REISSUED FOR ZBA	AUG 12/22	ZH
2	ISSUED FOR COORDINATION	JULY 26/22	MLB
1	ISSUED FOR ZBA	SEPT 10/21	MLB
0	INITIAL RELEASE	MAY 14/21	PJ

SCALE :
0 5 10 15 20

DRAWING :
FUNCTIONAL SERVICING PLAN

CLIENT :
ELITE M.D. DEVELOPMENTS
102-3410 SOUTH SERVICE ROAD
BURLINGTON, ONTARIO

PROJECT :
PROPOSED TOWNHOUSE DEVELOPMENT
487 SHAVER ROAD
HAMILTON, ONTARIO

ODAN·DETECH
CONSULTING ENGINEERS

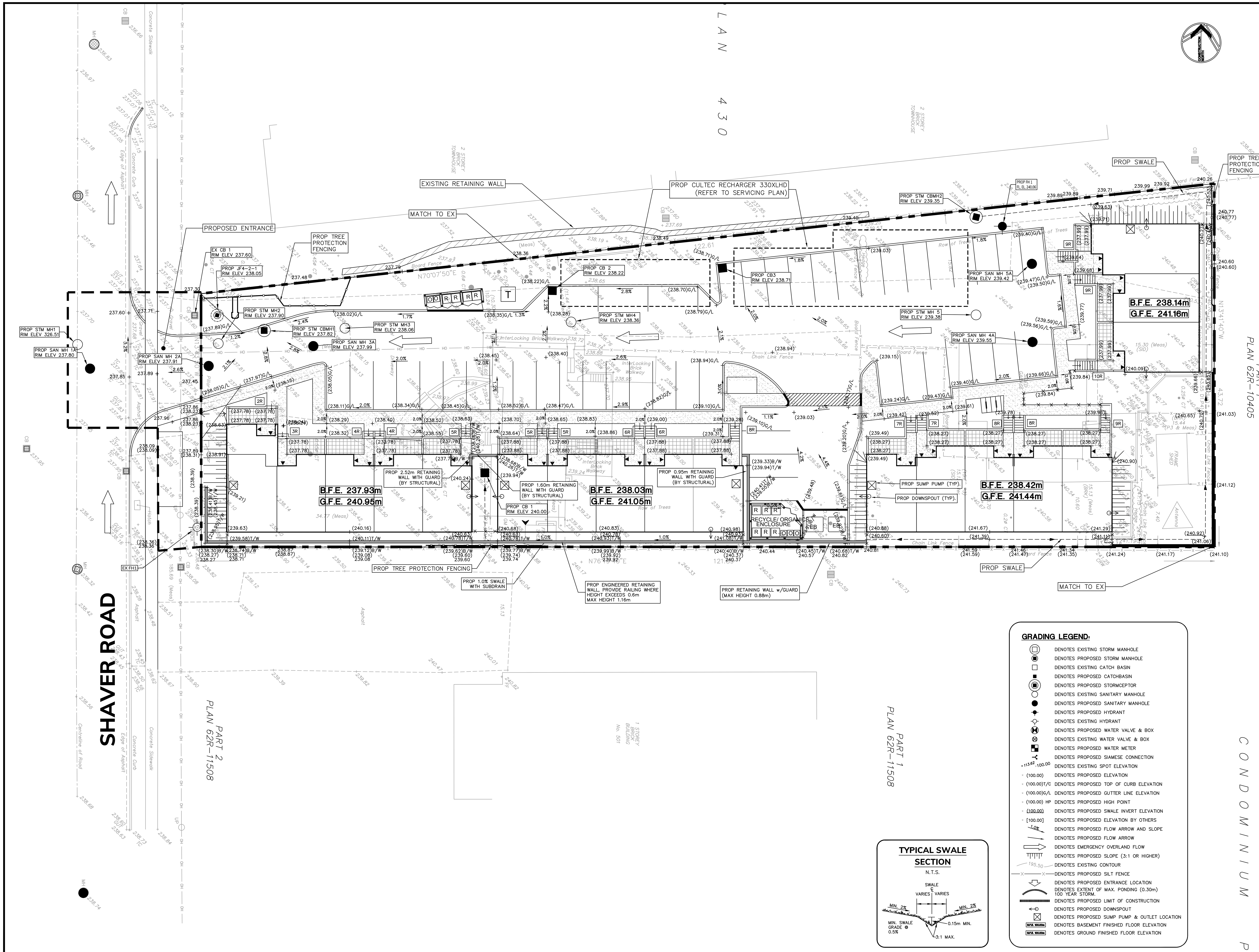
The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

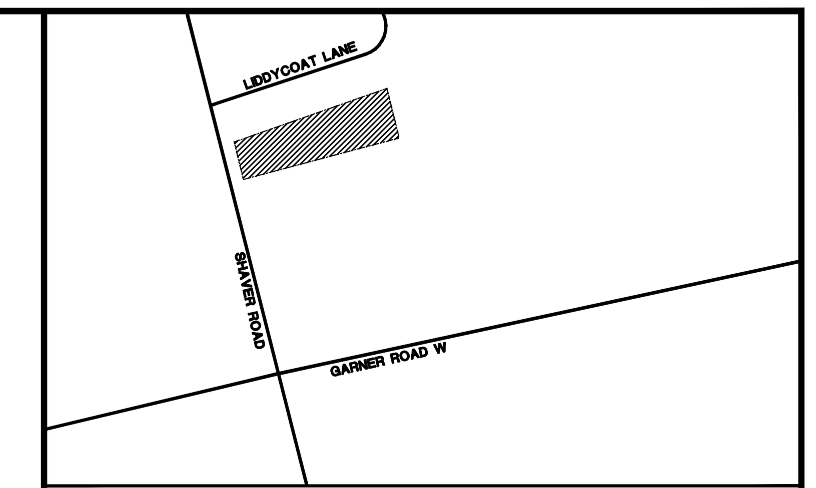
SCALE :	PROJ. NO.:	DATE STARTED:	DESIGN BY:
1:200	21203	APR 2021	J.K.

DRAWN BY: K.O.
CHECKED BY: D.C.S.
APPROVED BY: J.K.

REGISTERED PROFESSIONAL ENGINEER
NOV 25/22
I. KRPAN
PROVINCE OF ONTARIO
ENGINEER

DRWG. NO.: C1.0





KEY PLAN
Scale : N.T.S.

SUBJECT LANDS

NOTES:

THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND UNDERGROUND AND ABOVE GROUND UTILITIES 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 THE WORK THE CONTRACTOR SHALL CONFIRM OF THE EXACT LOCATION OF ALL UTILITIES AND STRUCTURES, AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

THE CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS ON THE JOB AND REPORT ANY DISCREPANCY TO THE ARCHITECTS/ENGINEERS BEFORE PROCEEDING WITH THE WORKS.

ALL DRAWINGS AND SPECIFICATIONS ARE INSTRUMENTS OF SERVICE AND THE PROPERTY OF THE ENGINEER WHICH MUST BE RETURNED AT THE COMPLETION OF WORK.

THIS DRAWING IS NOT TO BE SCALED. CONTRACTOR TO USE DIGITAL FILES FOR LAYOUT PROVIDED BY ENGINEER. THIS PLAN MUST NOT BE USED TO SITE THE PROPOSED BUILDINGS.

THE APPROVAL OF THIS PLAN DOES NOT EXEMPT THE OWNER'S CONTRACTOR FROM OBTAINING, BUT NOT LIMITED TO THE FOLLOWING PERMITS: ROAD CUT, SEWER PERMITS, RELOCATION OF SERVICES, ENCROACHMENT AGREEMENTS, APPROACH APPROVAL PERMITS, ETC..

EXISTING TOPOGRAPHICAL INFORMATION SUPPLIED BY J.D. BARNES LIMITED DATED NOVEMBER 8, 2019

EXISTING OFFSITE TOPOGRAPHICAL INFORMATION SUPPLIED BY A.T. MCLAREN LIMITED DATED MARCH 30, 2020

BENCH MARK:

ELEVATIONS ARE OF GEODETIC ORIGIN (CGVD-1928:78, ELEV 239.252), AND ARE DERIVED FROM GNSS OBSERVATIONS AND NATURAL RESOURCES CANADA'S GEOID MODEL HT2.0. STATION NO: 0011975U073
RIB WITH BRASS CAP, 30cm BELOW GROUND. LOCATED ON THE EAST SIDE OF HWY 6, 9m SOUTH OF PARKSIDE DR CENTRELINE, 1.2km NORTH OF DUNDAS RD.

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 Ⓐ	580 216.194	4 783 407.045
ORP Ⓑ	580 263.213	4 783 227.444

BEARING NOTE:

BEARINGS SHOWN HEREON ARE GRID BEARINGS AND ARE DERIVED FROM NETWORK REAL TIME GPS OBSERVATIONS AND REFERRED TO THE UTM PROJECTION ZONE 17, NAD83(CSRS 2010)

METRIC NOTE:

DISTANCES AND ELEVATIONS ON THIS PLAN ARE TYPICALLY SHOWN IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

NO.	REVISIONS	DATE	BY
5	ISSUED FOR ZBA	NOV 25/22	MLB
4	ISSUED FOR COORDINATION	OCT 21/22	MLB
3	REISSUED FOR ZBA	AUG 12/22	ZH
2	ISSUED FOR COORDINATION	JULY 26/22	MLB
1	ISSUED FOR ZBA	SEPT 10/21	MLB
0	INITIAL RELEASE	MAY 14/21	PJ

SCALE : 0 5 10 15 20

DRAWING :
FUNCTIONAL GRADING PLAN

CLIENT :
ELITE M.D. DEVELOPMENTS
102-3410 SOUTH SERVICE ROAD
BURLINGTON, ONTARIO

PROJECT :
PROPOSED TOWNHOUSE DEVELOPMENT
487 SHAVER ROAD
HAMILTON, ONTARIO

ODAN·DETECH CONSULTING ENGINEERS
The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

SCALE :	PROJ. NO.:	DATE STARTED:
1:200	21203	APR 2021

DESIGN BY: J.K.
DRAWN BY: K.O.
CHECKED BY: D.C.S.
APPROVED BY: J.K.
DRWG. NO.: C1.1

REGISTERED PROFESSIONAL ENGINEER
NOV 25/22
I. KRPAN
PROVINCE OF ONTARIO
ENGINEER

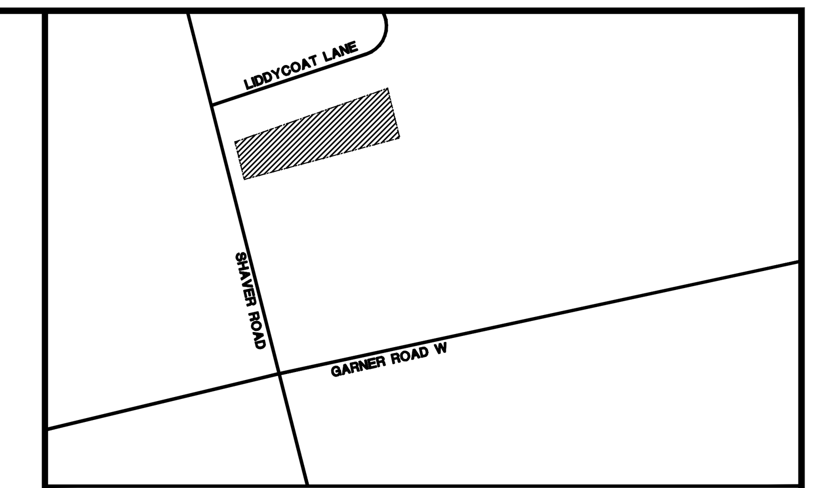
GRADING LEGEND:

- DENOTES EXISTING STORM MANHOLE
- DENOTES PROPOSED STORM MANHOLE
- DENOTES EXISTING CATCH BASIN
- DENOTES PROPOSED CATCHBASIN
- DENOTES PROPOSED STORMCEPTOR
- DENOTES EXISTING SANITARY MANHOLE
- DENOTES PROPOSED SANITARY MANHOLE
- DENOTES PROPOSED HYDRANT
- DENOTES EXISTING HYDRANT
- DENOTES PROPOSED WATER VALVE & BOX
- DENOTES EXISTING WATER VALVE & BOX
- DENOTES PROPOSED WATER METER
- DENOTES PROPOSED SIAMESE CONNECTION
- 113.62 ×100.00 DENOTES EXISTING SPOT ELEVATION
- (100.00) DENOTES PROPOSED ELEVATION
- (100.00)T/C DENOTES PROPOSED TOP OF CURB ELEVATION
- (100.00)G/L DENOTES PROPOSED GUTTER LINE ELEVATION
- (100.00) HP DENOTES PROPOSED HIGH POINT
- (100.00) DENOTES PROPOSED SWALE INVERT ELEVATION
- [100.00] DENOTES PROPOSED ELEVATION BY OTHERS
- 1.0% DENOTES PROPOSED FLOW ARROW AND SLOPE
- DENOTES PROPOSED FLOW ARROW
- DENOTES EMERGENCY OVERLAND FLOW
- DENOTES PROPOSED SLOPE (3:1 OR HIGHER)
- 195.50 DENOTES EXISTING CONTOUR
- DENOTES PROPOSED SILT FENCE
- DENOTES PROPOSED ENTRANCE LOCATION
- DENOTES EXTENT OF MAX. PONDING (0.30m) 100 YEAR STORM.
- DENOTES PROPOSED LIMIT OF CONSTRUCTION
- DENOTES PROPOSED DOWNSPOUT
- DENOTES PROPOSED SUMP PUMP & OUTLET LOCATION
- B.F.E. 100.00m DENOTES BASEMENT FINISHED FLOOR ELEVATION
- G.F.E. 100.00m DENOTES GROUND FINISHED FLOOR ELEVATION

TYPICAL SWALE SECTION

N.T.S.

SWALE
VARIES
VARIES
MIN. 2%
MIN. 2%
MIN. SWALE GRADE 0.5%
0.15m MIN.
3:1 MAX.



KEY PLAN
Scale : N.T.S.

SUBJECT LANDS

NOTES:

THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND UNDERGROUND AND ABOVE GROUND UTILITIES 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 THE WORK THE CONTRACTOR SHALL CONFIRM OF THE EXACT LOCATION OF ALL UTILITIES AND STRUCTURES, AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

THE CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS ON THE JOB AND REPORT ANY DISCREPANCY TO THE ARCHITECTS/ENGINEERS BEFORE PROCEEDING WITH THE WORKS.

ALL DRAWINGS AND SPECIFICATIONS ARE INSTRUMENTS OF SERVICE AND THE PROPERTY OF THE ENGINEER WHICH MUST BE RETURNED AT THE COMPLETION OF WORK.

THIS DRAWING IS NOT TO BE SCALED. CONTRACTOR TO USE DIGITAL FILES FOR LAYOUT PROVIDED BY ENGINEER. THIS PLAN MUST NOT BE USED TO SITE THE PROPOSED BUILDINGS.

THE APPROVAL OF THIS PLAN DOES NOT EXEMPT THE OWNER'S CONTRACTOR FROM OBTAINING, BUT NOT LIMITED TO THE FOLLOWING PERMITS: ROAD CUT, SEWER PERMITS, RELOCATION OF SERVICES, ENCROACHMENT AGREEMENTS, APPROACH APPROVAL PERMITS, ETC..

EXISTING TOPOGRAPHICAL INFORMATION SUPPLIED BY J.D. BARNES LIMITED DATED NOVEMBER 8, 2019

EXISTING OFFSITE TOPOGRAPHICAL INFORMATION SUPPLIED BY A.T. MCLAREN LIMITED DATED MARCH 30, 2020

BENCH MARK:

ELEVATIONS ARE OF GEODETIC ORIGIN (CGVD-1928:78, ELEV 239.252), AND ARE DERIVED FROM GNSS OBSERVATIONS AND NATURAL RESOURCES CANADA'S GEOID MODEL HT2.0. STATION NO: 0011975U073
RIB WITH BRASS CAP, 30cm BELOW GROUND. LOCATED ON THE EAST SIDE OF HWY 6, 9m SOUTH OF PARKSIDE DR CENTRELINE, 1.2km NORTH OF DUNDAS RD.

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 Ⓐ	580 216.194	4 783 407.045
ORP Ⓑ	580 263.213	4 783 227.444

BEARING NOTE:

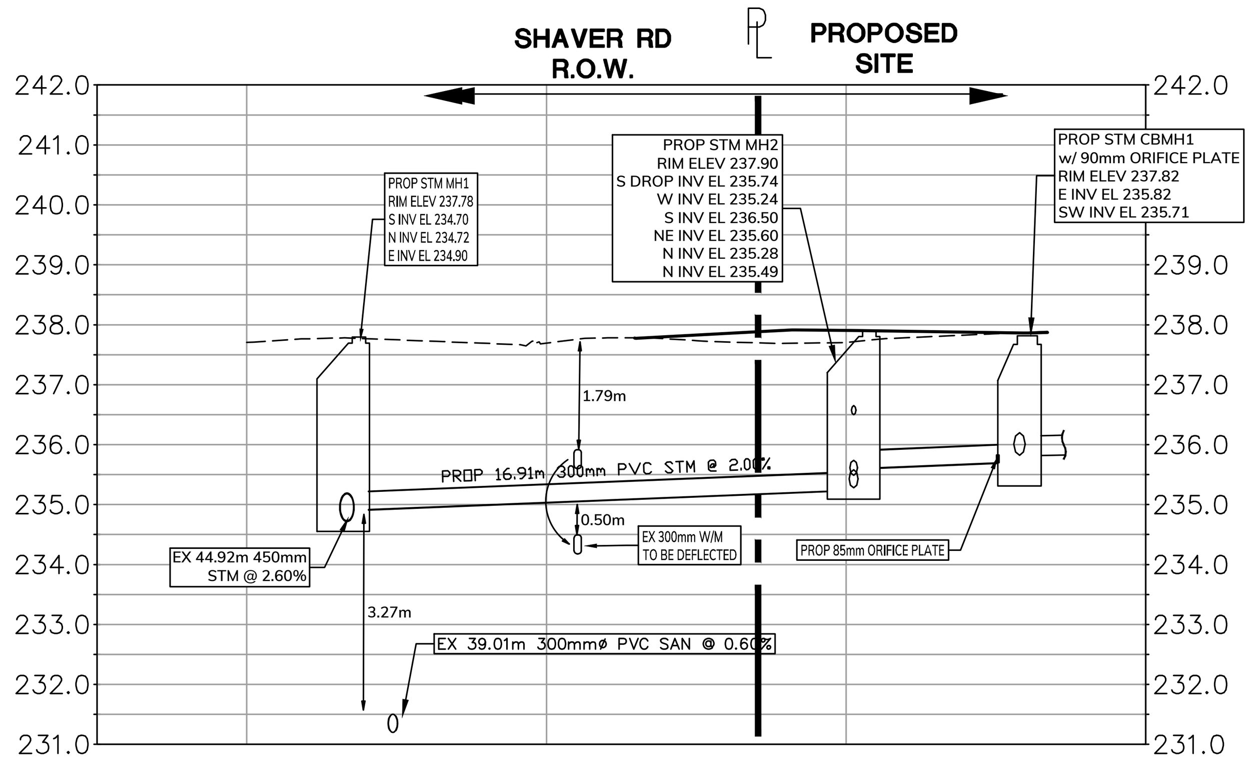
BEARINGS SHOWN HEREON ARE GRID BEARINGS AND ARE DERIVED FROM NETWORK REAL TIME GPS OBSERVATIONS AND REFERRED TO THE UTM PROJECTION ZONE 17, NAD83(CSRS 2010)

METRIC NOTE:

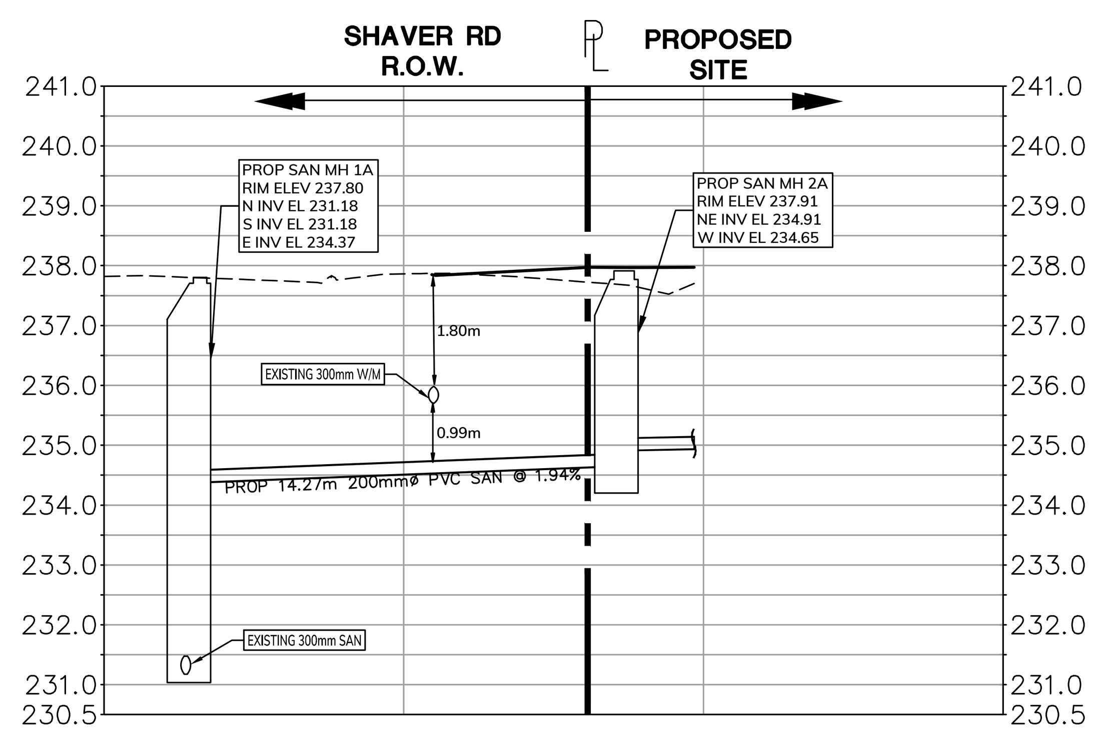
DISTANCES AND ELEVATIONS ON THIS PLAN ARE TYPICALLY SHOWN IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

NO.	REVISIONS	DATE	BY
5	ISSUED FOR ZBA	NOV 25/22	MLB
4	ISSUED FOR COORDINATION	OCT 21/22	MLB
3	REISSUED FOR ZBA	AUG 12/22	ZH
2	ISSUED FOR COORDINATION	JULY 26/22	MLB
1	ISSUED FOR ZBA	SEPT 10/21	MLB
0	INITIAL RELEASE	MAY 14/21	PJ

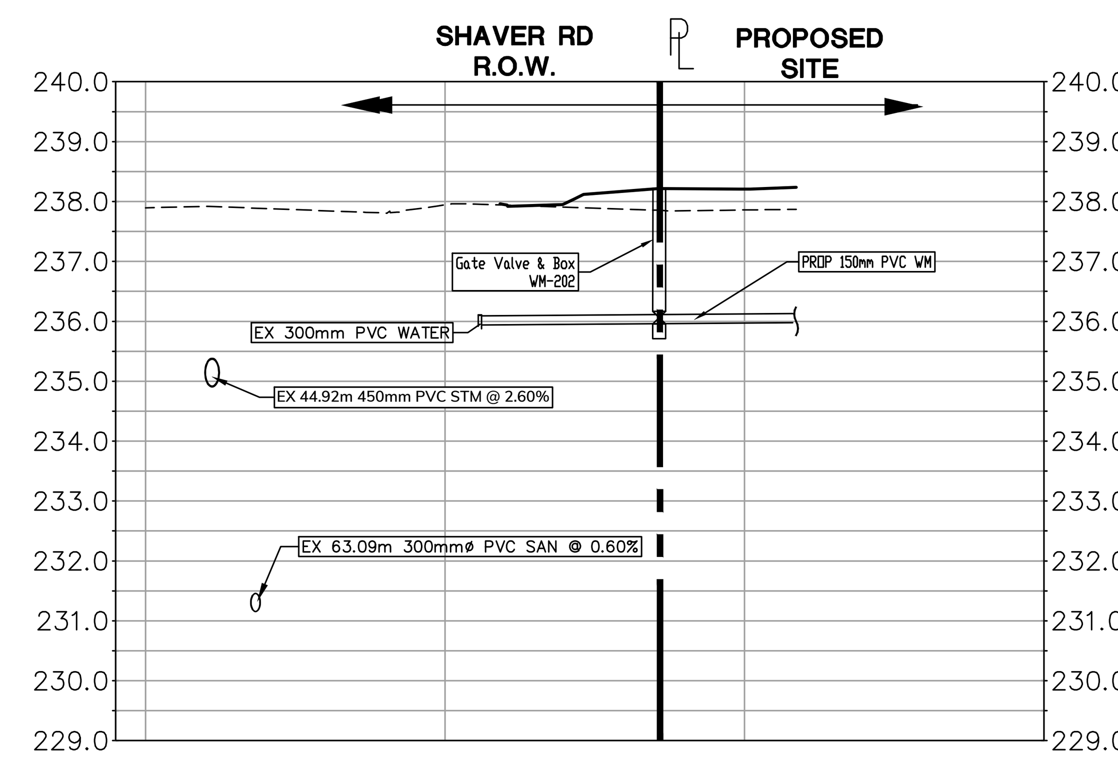
SCALE : 0 5 10 15 20



A: STORM CROSS SECTION
VERTICAL SCALE - 1:100
HORIZONTAL SCALE - 1:200



B: SANITARY CROSS SECTION
VERTICAL SCALE - 1:100
HORIZONTAL SCALE - 1:200



C: WATER CROSS SECTION
VERTICAL SCALE - 1:100
HORIZONTAL SCALE - 1:200

DRAWING :

FUNCTIONAL SECTION PLAN

CLIENT :

ELITE M.D. DEVELOPMENTS
102-3410 SOUTH SERVICE ROAD
BURLINGTON, ONTARIO

PROJECT :

PROPOSED TOWNHOUSE DEVELOPMENT
487 SHAVER ROAD
HAMILTON, ONTARIO

ODAN·DETECH
CONSULTING ENGINEERS
The Odan/Detech Group Inc. P: (905) 632-3811 F: (905) 632-3363
5230 SOUTH SERVICE ROAD, BURLINGTON, ONTARIO, L7L 5K2

SCALE :	PROJ. NO.:	DATE STARTED:	DESIGN BY:
1:200	21203	APR 2021	J.K.

DRAWN BY: K.O.
CHECKED BY: D.C.S.
APPROVED BY: J.K.
DRWG. NO.: C1.2

REGISTERED PROFESSIONAL ENGINEER
NOV 25/22
I. KRPAN
PROVINCE OF ONTARIO

ENGINEER