STORMWATER MANAGEMENT
AND
FUNCTIONAL SERVICING REPORT

FOR

VIC II - 150 RUTLEDGE ROAD

CITY OF MISSISSAUGA

UEL PROJECT NO. 19013.102

January 26, 2023
Revised April 25, 2024

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APPENDIX 2- Storm Drainage Area Plan G-7 - Land-Pro Engineering Consultants Inc. dated April 2012.

APPENDIX 3- Municipal Servicing Study - Land-Pro Engineering Consultants Inc dated Revised Nov 1, 2012

APPENDIX 4- Mullet Creek Erosion Assessment report prepared by Aquafor Beech Limited dated Feb 25, 2010

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1.0 INTRODUCTION

The Kings Mill site, is a residential development project which has proceeded to development, under a number of phases, since year 2004.

The Kings Mill site is located at the north side of Tannery Street and west of Queen Street South in the City of Mississauga, as illustrated on the Key Plan **Figure 1** provided in this Report.

The Kings Mill Site generally consists of 3 development blocks, a municipal road allowance and valley lands associated with Mullet Creek.

The Kings Mill development was initially identified as proceeding in two phases.

Phase 1 would consist of a retirement building on the east side and a residential condo building at the west side of the property.

Phase 2 would consist of a future residential development at the north side of the property.

A number of reports and studies were prepared, submitted and accepted by the Approving Authorities allowing development of the Kings Mill lands to proceed.

Rutledge Road extension to Tannery Road was completed in year 2013.

The valley lands associated with Mullet Creek were deeded to TRCA/City for the environmental protection as Open Space.

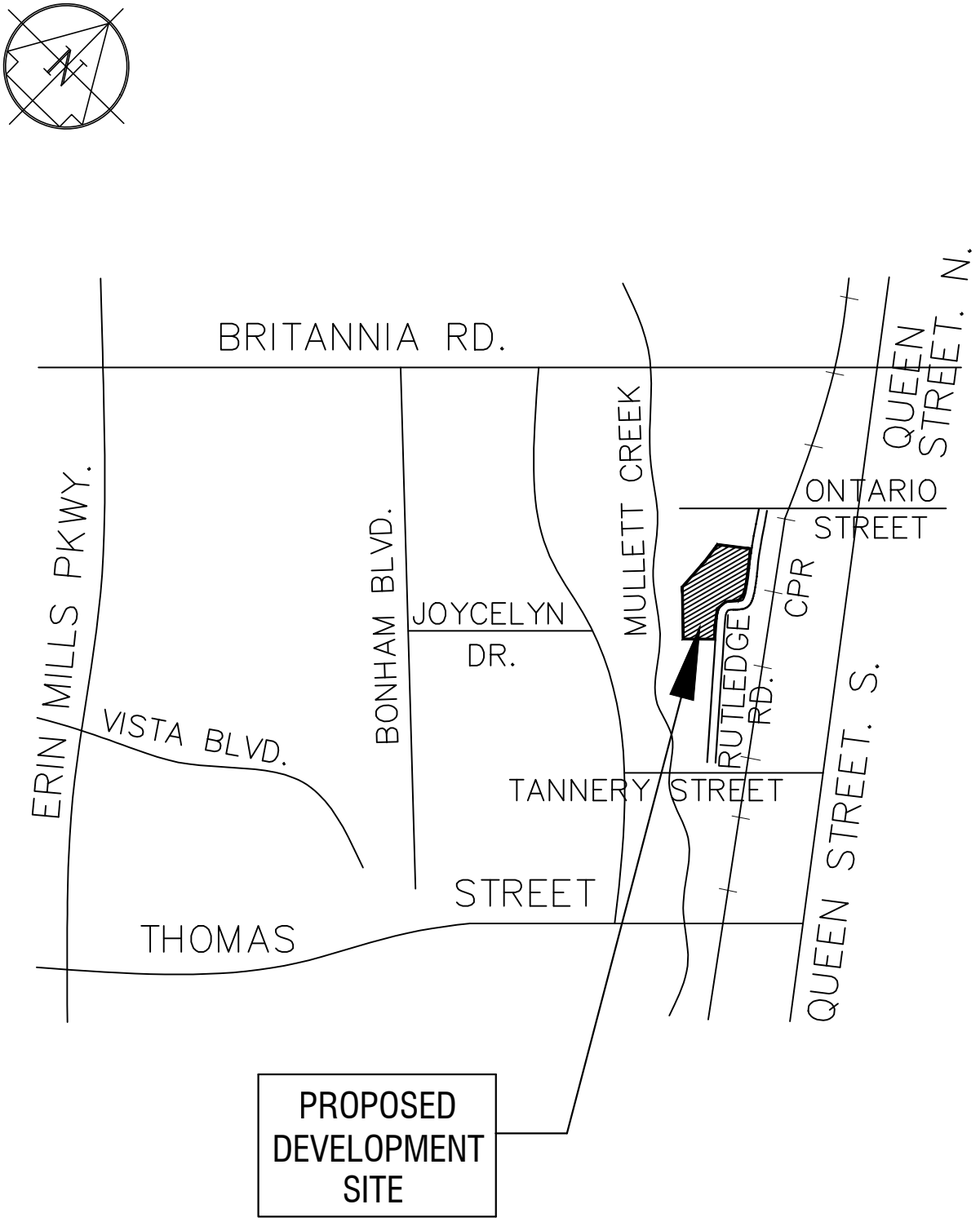
Phase 1A Development "referred to as Credit River Retirement Residence" is currently completed and occupied.

Phase 1B Development "referred to as Vic I -180 Rutledge Residential Condo Building"" is currently approved and under construction.

Phase 2 Development "referred to as Vic II -150 Rutledge Residential Condo Building"" is currently under submission to the City of Mississauga for development approval. A copy of the Vic II -150 Rutledge Residential Condo Building Site Plan drawing A101 prepared by Global Architect Inc **Figure 2** is provided in this Report.

The Development reports, Studies and the Municipal Servicing Feasibility reports prepared for the original 3.4 hectare site, including all phases, was found acceptable by the City, TRCA and the Region, and served as the basis for City issuance of approvals for Credit River Retirement Residence and the Vic I -180 Rutledge Residential Condo Building sites.

This Stormwater Management and Functional Site Servicing Report has been prepared in support of the proposed Vic II -150 Rutledge Road site, which is the final phase of the Kings Mill development project.



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UEL

150 RUTLEDGE ROAD
KEY PLAN

DATE	SCALE	PROJECT No.	FIGURE
JAN 2023	N.T.S.	19013	FIGURE 1

LEGAL INFORMATION TAKEN FROM:

TOPOGRAPHY OF
PART OF LOT 4
CONCESSION 5
WEST OF HURONTARIO STREET
(GEOGRAPHIC TOWNSHIP OF TORONTO)
CITY OF MISSISSAUGA
REGIONAL MUNICIPALITY OF PEEL

SURVEY PREPARED BY:
KRCMAR SURVEYORS LTD.
1137 CENTRE STREENT
THORNHILL, ON, L4HJ 3M5
DATED: MAY 2, 2022

THE ARCHITECT IS NOT RESPONSIBLE FOR ERRORS OR OMISSIONS IN THIS RESPECT.

NOTE:

Refer to the Site Grading Plan prepared by Urban Ecosystems, Drawing (Title and/or Number), for the purposes of obtaining site grading information.

1. "I HEREBY CERTIFY THAT THIS DRAWING CONFORMS IN ALL RESPECTS TO THE SITE DEVELOPMENT PLANS AS APPROVED BY THE CITY OF MISSISSAUGA UNDER FILE NUMBER SP XXXXXX"
   a. ARCHITECT OR ENGINEER'S SIGNATURE (IF APPLICABLE) AND PROFESSIONAL SEAL ________________
2. THE CITY OF MISSISSAUGA REQUIRES THAT ALL WORKING DRAWINGS SUBMITTED TO THE BUILDING DIVISION AS PART OF AN APPLICATION FOR THE ISSUANCE OF A BUILDING PERMIT SHALL BE CERTIFIED BY THE ARCHITECT OR ENGINEER AS BEING IN CONFORMITY WITH THE SITE DEVELOPMENT PLAN AS APPROVED BY THE CITY OF MISSISSAUGA.
3. ALL EXTERIOR LIGHTING WILL BE DIRECTED ONTO THE SITE AND WILL NOT INFRINGE UPON THE ADJACENT PROPERTIES.
4. ALL ROOF TOP MECHANICAL UNITS SHALL BE SCREENED FROM VIEW BY THE APPLICANT.
5. PARKING SPACES RESERVED FOR PEOPLE WITH DISABILITIES MUST BE IDENTIFIED BY A SIGN, INSTALLED AT THE APPLICANT'S EXPENSE, *IN ACCORDANCE WITH THE BY-LAW REQUIREMENTS AND BUILDING CODE REQUIREMENTS*
6. THE APPLICANT WILL BE RESPONSIBLE FOR ENSURING THAT ALL PLANS CONFORM TO TRANSPORT CANADA'S RESTRICTIONS.
7. ALL DAMAGED AREAS ARE TO BE REINSTATED WITH TOPSOIL AND SOD PRIOR TO THE RELEASE OF SECURITIES.
8. SIGNAGE SHOWN ON THE SITE DEVELOPMENT PLANS IS FOR INFORMATION PURPOSES ONLY. ALL SIGNS WILL BE SUBJECT TO THE PROVISIONS OF SIGN BY-LAW 0054-2002, AS AMENDED, AND A SEPARATE SIGN APPLICATION WILL BE REQUIRED THROUGH THE BUILDING DIVISION.
9. ANY FENCING ADJACENT TO MUNICIPAL LANDS IS TO BE LOCATED 15 CM (6.0 IN.) INSIDE THE PROPERTY LINE.
10. ONLY SHIELDED LIGHTING FIXTURES ARE PERMITTED FOR ALL DEVELOPMENT, EXCEPT FOR DETACHED AND SEMI-DETACHED DWELLINGS WITHIN 60 M (196.8 FT.) OF A RESIDENTIALLY ZONED PROPERTY AND MUST CONFORM TO THE ENGINEER CERTIFIED LIGHTING PLAN.
11. WHERE PLANTING IS TO BE LOCATED IN LANDSCAPED AREAS ON TOP OF AN UNDERGROUND PARKING STRUCTURE, IT IS THE RESPONSIBILITY OF THE APPLICANT TO ARRANGE THE COORDINATION OF THE DESIGN OF THE UNDERGROUND PARKING STRUCTURE WITH THE LANDSCAPE ARCHITECT AND THE CONSULTING ENGINEERING. UNDERGROUND PARKING STRUCTURES WITH LANDSCAPING AREA TO BE CAPABLE OF SUPPORTING THE FOLLOWING LOADS:- 15 CM OF DRAINAGE GRAVEL PLUS 40 CM TOPSOIL FOR SOD- 15 CM OF DRAINAGE GRAVEL PLUS 60 CM TOPSOIL FOR SHRUBS- 15 CM OF DRAINAGE GRAVEL PLUS 90 CM FOR TREES OR- PREFABRICATED SHEET DRAIN SYSTEM* WITH A COMPRESSIVE STRENGTH OF 1003 KPA PLUS 40 CM TOPSOIL FOR SOD- PREFABRICATED SHEET DRAIN SYSTEM* WITH A COMPRESSIVE STRENGTH OF 1003 KPA PLUS 60 CM TOPSOIL FOR SHRUBS- PREFABRICATED SHEET DRAIN SYSTEM* WITH A COMPRESSIVE STRENGTH OF 1003 KPA PLUS 90 CM TOPSOIL FOR TREES *TERRADRAIN 900 OR APPROVED EQUAL
12. THE STRUCTURAL DESIGN OF ANY RETAINING WALL OVER 0.6 M IN HEIGHT OR ANY RETAINING WALL LOCATED ON A PROPERTY LINE IS TO BE SHOWN ON THE SITE GRADING PLAN FOR THIS PROJECT AND IS TO BE APPROVED BY THE CONSULTING ENGINEER FOR THE PROJECT.
13. CONTINUOUS 15 CM HIGH BARRIER TYPE POURED CONCRETE CURBING WILL BE PROVIDED BETWEEN ALL ASPHALT AND LANDSCAPED AREAS THROUGHOUT THE SITE.
14. TREE PROTECTION NOTE:
   a. THE APPLICANT IS RESPONSIBLE FOR ENSURING THAT TREE PROTECTION HOARDING (SECTION 4.8.2) IS MAINTAINED THROUGHOUT ALL PHASES OF DEMOLITION AND CONSTRUCTION IN THE LOCATION AND CONDITION AS APPROVED BY THE PLANNING AND BUILDING DEPARTMENT. NO MATERIALS (BUILDING MATERIALS, SOIL, ETC.) MAY BE STOCKPILED WITHIN THE AREA OF HOARDING. FAILURE TO MAINTAIN THE HOARDING AS ORIGINALLY APPROVED OR THE STORAGE OF MATERIALS WITHIN THE HOARDING WILL BE CAUSE FOR THE LETTER OF CREDIT TO BE HELD FOR TWO (2)YEARS FOLLOWING COMPLETION OF ALL SITE WORKS. HOARDING MUST BE INSPECTED PRIOR TO THE REMOVAL OF ANY TREE HOARDING FROM THE SITE.
   b. OWNER'S SIGNATURE: ________________
   c. DATE: ________________
15. ALL EXCESS EXCAVATED MATERIALS WILL BE REMOVED FROM THE SITE.
16. AT THE ENTRANCES TO THE SITE, THE MUNICIPAL CURB AND SIDEWALK WILL BE CONTINUOUS THROUGH THE DRIVEWAY AND A CURB DEPRESSION WILL BE PROVIDED FOR EACH ENTRANCE.
17. ALL PROPOSED CURBING AT THE ENTRANCES TO THE SITE IS TO STOP AT THE PROPERTY LINE OR AT THE MUNICIPAL SIDEWALK.
18. THE PORTIONS OF THE DRIVEWAY WITHIN THE MUNICIPAL BOULEVARD WILL BE PAVED BY THE APPLICANT.
19. THE EXISTING DRAINAGE PATTERN WILL BE MAINTAINED EXCEPT WHERE NOTED.
20. ALL UTILITY COMPANIES WILL BE NOTIFIED FOR LOCATES PRIOR TO THE INSTALLATION OF THE HOARDING THAT LIES WITHIN THE LIMITS OF THE CITY BOULEVARD AREA.
21. THE APPLICANT WILL BE RESPONSIBLE FOR THE COST OF ANY UTILITIES RELOCATIONS NECESSITATED BY THE SITE PLAN.
22. SHOULD THE INSTALLATION OF BELOW GROUND SERVICES REQUIRE HOARDING TO BE REMOVED, PLANNING AND BUILDING STAFF ARE TO BE CONTACTED PRIOR TO THE COMMENCEMENT OF SUCH WORK. SHOULD AN ALTERNATIVE SERVICE ROUTE NOT BE POSSIBLE, STAFF WILL INSPECT AND DOCUMENT THE CONDITION OF THE VEGETATION AND SERVICING INSTALLATION IN ORDER TO MINIMIZE DAMAGE TO THE VEGETATION.
23. IF A WELL IS DISCOVERED IT WILL BE DECOMMISSIONED BY A LICENSED WELL CONTRACTOR OR TECHNICIAN IN ACCORDANCE WITH THE ONTARIO WATER RESOURCES ACT REGULATION 903 (FORMERLY 612/84) AND ANY OTHER APPLICABLE REGULATIONS AND GUIDELINES
24. ALL SURFACE DRAINAGE WILL BE SELF CONTAINED, COLLECTED AND DISCHARGED AT A LOCATION TO BE APPROVED PRIOR TO THE ISSUANCE OF A BUILDING PERMIT
25. ALL PROPOSED CURBING WITHIN THE MUNICIPAL BOULEVARD AREA FOR THE SITE IS TO SUIT AS FOLLOWS:
   a. FOR ALL SINGLE FAMILY RESIDENTIAL PROPERTIES INCLUDING ON STREET TOWNHOUSES, ALL CURBING IS TO STOP AT THE PROPERTY LIMIT OR THE BACK OF THE MUNICIPAL SIDEWALK, WHICHEVER IS APPLICABLE, OR,
   b. FOR ALL OTHER PROPOSALS INCLUDING INDUSTRIAL, COMMERCIAL AND CONDOMINIUM DEVELOPMENTS, ALL ENTRANCES TO THE SITE ARE TO BE IN ACCORDANCE WITH O.P.S.D. 350.010
26. ALL INTERNAL CURBS ARE TO BE STANDARD 2 STAGE CURB AND GUTTER AS PER O.P.S.D 600.070.
27. PRIOR TO CONSTRUCTION TAKING PLACE, ALL REQUIRED HOARDING IN ACCORDANCE WITH THE ONTARIO OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS MUST BE ERECTED AND THEN MAINTAINED THROUGHOUT ALL PHASES OF CONSTRUCTION
28. CONFIRMATION MUST BE RECEIVED FROM THE DEVELOPMENT CONSTRUCTION SECTION THAT THEY HAVE MADE ARRANGEMENTS FOR A PRECONSTRUCTION MEETING.
29. FIRE ACCESS ROUTE WILL BE DESIGNED TO SUPPORT LOAD OF NOT LESS THAN 11,363KG. PER AXLE AND HAVE A CHANGE IN GRADIENT OR MORE THAN 1 IN 12.5 OVER 15M
30. FIRE ROUTE WILL BE DESIGNATED AS PER BYLAW 1036-81
31. DESIGN OF UPPER SUSPENDED SLAB FOR THE UNDERGROUND PARKING GARAGE PREPARED BY PROJECT STRUCTURAL CONSULTANT (P.ENG. OF ONTARIO) IN CONFORMANCE WITH PART 4 OF THE 2012 ONTARIO BUILDING CODE. WASTE COLLECTION VEHICLES WILL NOT TRAVEL ON ACCESS DRIVEWAY ON TOP OF THE SUSPENDED SLAB.
32. PRIOR TO THE ISSUANCE OF OCCUPANCY PERMITS FOR THIS DEVELOPMENT A PROFESSIONAL ENGINEER QUALIFIED TO PROVIDE ACOUSTICAL ENGINEERING SERVICES IN ONTARIO SHALL CERTIFY THAT THE NOISE MEASURES FOR THE RESIDENTIAL DWELLINGS HAVE BEEN PROPERLY INSTALLED AND CONSTRUCTED.
33. WITHIN THE VICINITY OF THE DRIVEWAY, ALL ASPHALT AND BASE MATERIALS OF THE EXISTING DRIVEWAY TO BE REMOVED ARE TO BE REINSTATED WITH TOPSOIL AND SOD.
34. NOISE WARNING CLAUSES
   a. PURCHASERS/TENANTS ARE ADVISED THAT DESPITE THE INCLUSION OF NOISE CONTROL FEATURES IN THE DEVELOPMENT AND WITHIN THE BUILDING UNITS, SOUND LEVELS DUE TO INCREASING ROAD AND AIR TRAFFIC MAY OCCASIONALLY INTERFERE WITH SOME ACTIVITIES OF THE DWELLING OCCUPANTS AS THE SOUND LEVELS EXCEED THE MUNICIPALITY'S AND THE MINISTRY OF THE ENVIRONMENT, CONSERVATION AND PARKS NOISE CRITERIA
   b. THIS DWELLING UNIT HAS BEEN SUPPLIED WITH A CENTRAL AIR CONDITIONING SYSTEM WHICH WILL ALLOW WINDOWS AND EXTERIOR DOORS TO REMAIN CLOSED, THEREBY ENSURING THAT THE INDOOR SOUND LEVELS ARE WITHIN THE SOUND LEVEL LIMITS OF THE MUNICIPALITY AND THE MINISTRY OF THE ENVIRONMENT, CONSERVATION AND PARKS.
   c. PURCHASERS ARE ADVISED THAT DUE TO THE PROXIMITY OF THE EXISTING COMMERCIAL AND INSTITUTUIONAL BUILDINGS, SOUND LEVELS FROM THE FACILITIES MAY AT SOME TIMES BE AUDIBLE
35. GRADES WILL BE MET WITH A 33% MAXIMUM SLOPE AT THE PROPERTY LINES AND WITHIN THE SITE
36. THE ENGINEER CERTIFIED LIGHTING PLAN MUST BE SIGNED BY THE CONSULTING ENGINEER
37. THE OWNER COVENANTS AND AGREES TO CONSTRUCT AND INSTALL SHIELDED LIGHTING FIXTURES ON THE SUBJECT LANDS, IN CONFORMITY WITH THE SITE PLAN AND ENGINEER CERTIFIED LIGHTING PLAN TO THE SATISFACTION OF THE CITY OF MISSISSAUGA
38. THE ACOUSTICAL CONSULTANT SHALL CERTIFY TO THE PLANNING AND BUILDING DEPARTMENT THAT THE AS CONSTRUCTED BUILDINGS, MECHANICAL EQUIPMENT AND VENTILATION SYSTEMS FOR THE BUILDINGS ON THE SITE AND THE OFF-SITE STATIONARY NOISE SOURCES ARE IN COMPLIANCE WITH THE ACOUSTICAL REPORT AS PREPARED FOR THE PARTICULAR BUILDING AND IN COMPLIANCE WITH THE MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE (MOECC) GUIDELINE FOR STATIONARY NOISE SOURCES.
39. TRAFFIC NOTES
   a. ALL DAMAGED OR DISTURBED AREAS WITHIN THE MUNICIPAL RIGHT-OF-WAY ARE TO BE REINSTATED AT THE OWNER'S EXPENSE
   b. ALL LANDSCAPING AND GRADING WITHIN CLOSE PROXIMITY TO THE PROPOSED ACCESS POINTS IS TO BE DESIGNED TO ENSURE THAT ADEQUATE SIGHT DISTANCES ARE AVAILABLE FOR ALL APPROACHING AND EXITING MOTORISTS AND PEDESTRIANS
   c. THE PORTION OF THE DRIVEWAY WITHIN THE MUNICIPAL BOULEVARD IS TO BE PAVED BY THE OWNER
   d. DRIVEWAY ACCESSES SHALL MAINTAIN A 1.5M SETBACK FROM ABOVEGROUND FEATURES SUCH AS UTILITIES AND TREES
   e. ANY ABOVE GROUND UTILITIES LOCATED WITHIN 1.5M OF A PROPOSED ACCESS ARE TO BE RELOCATED AT THE OWNER'S EXPENSE
   f. THE COST FOR ANY/ALL ROAD IMPROVEMENTS REQUIRED IN SUPPORT OF THIS DEVELOPMENT APPLICATION WILL BE BORNE BY THE OWNER
   g. THE OWNER SHALL MAKE SATISFACTORY ARRANGEMENTS WITH THE TRANSPORTATION AND WORKS DEPARTMENTS FOR THE DESIGN, CONSTRUCTION AND PAYMENT OF ALL COSTS ASSOCIATED WITH WORKS NECESSARY TO SUPPORT ACCESS TO THIS SITE.
   h. ANY ACCESS TO INTERNAL SERVICING SHALL BE PROVIDED INTERNALLY THROUGH THE SITE
40. ONLY SHIELDED EXTERIOR LIGHTING FIXTURES WILL BE USED EXCEPT AS REQUIRED FOR COMPLIANCE WITH THE ONTARIO BUILDING CODE AND/OR THE RECOMMENDATIONS OF THE ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA) LIGHTING HANDBOOK FOR USES AND/OR ACTIVITIES. EXTERIOR LIGHTING IS DARK SKY COMPLIANT.
41. IF THE FINAL COURSE OF ASPHALT PAVING IS DELAYED, INSTALL A TEMPORARY LIFT OF ASPHALT AT RAMPS OR CURB CUTS TO PROVIDE BARRIER-FREE ACCESS
42. OPEN TRENCHING - NO OPEN TRENCHING IS PERMITTED IN THE MUNICIPAL BOULEVARD WHERE ADJACENT TO CITY TREES.
43. BIRD-FRIENDLY GLAZING PROVIDED ON THE GROUND FLOOR.

KEY PLAN

PARKING - PRECINCT 2

BASED ON PARKING STUDY BY WSP, MARCH 24, 2022

CONDO UNITS	REQUIRED	PROVIDED
RESIDENT VISITOR	301 UNITS x 0.9sp = 271 301 UNITS x 0.2sp = 60	275 60
TOWNHOUSES		
RESIDENT VISITOR	4 UNITS x 2.0 sp = 8 4 UNITS x 0.25 sp = 1	8 1
TOTAL	340	344

EV PARKING SPACES

CONDO UNITS	REQUIRED	PROVIDED
RESIDENT VISITOR	20% OF TOTAL RESIDENT PARKING SPACES = 54 10% OF TOTAL VISITOR PARKING SPACES = 6	54 6

BICYCLE PARKING SPACES

CONDO/APARTMENT & TOWNS	REQUIRED	PROVIDED
CLASS A (INDOOR) 0.6/UNIT CLASS B (OUTDOOR) 0.05/UNIT	305 UNITS x 0.6 = 183 305 UNITS x 0.05 = 15	184 15

TH Areas

Level	Area	Area (SF)
TH1		
P2	63 m²	681 ft²
P1	63 m²	681 ft²
Level 01 - Ground	39 m²	416 ft²
	165 m²	1777 ft²
TH2		
P2	61 m²	657 ft²
P1	61 m²	657 ft²
Level 01 - Ground	30 m²	325 ft²
	152 m²	1638 ft²
TH3		
P2	61 m²	654 ft²
P1	61 m²	654 ft²
Level 01 - Ground	30 m²	322 ft²
	151 m²	1629 ft²
TH4		
P2	62 m²	666 ft²
P1	62 m²	666 ft²
Level 01 - Ground	30 m²	328 ft²
	154 m²	1660 ft²

SITE COVERAGE

Name	Area	Percent Coverage
BUILDING COVERAGE		
BUILDING COVERAGE	2725 m²	44%
	2725 m²	44%
LANDSCAPE AREA		
LANDSCAPE AREA	29 m²	0%
LANDSCAPE AREA	44 m²	1%
LANDSCAPE AREA	3032 m²	49%
	3105 m²	50%
PAVEMENT COVERAGE		
PAVEMENT COVERAGE	403 m²	6%
	403 m²	6%
PROPERTY AREA	6232 m²	100%
FSI	3.61	

GFA

Name	Area	Area (SF)
GFA P1	280 m²	3010 ft²
GFA 1st	2526 m²	27193 ft²
GFA 2nd	2526 m²	27193 ft²
GFA 3rd	2526 m²	27193 ft²
GFA 4th	2526 m²	27193 ft²
GFA 5th	2526 m²	27193 ft²
GFA 6th	2526 m²	27193 ft²
GFA 7th	2394 m²	25765 ft²
GFA 8th	2274 m²	24477 ft²
GFA 9th	1999 m²	21513 ft²
GFA 10th	1760 m²	18941 ft²
TOTAL	23863 m²	256861 ft²

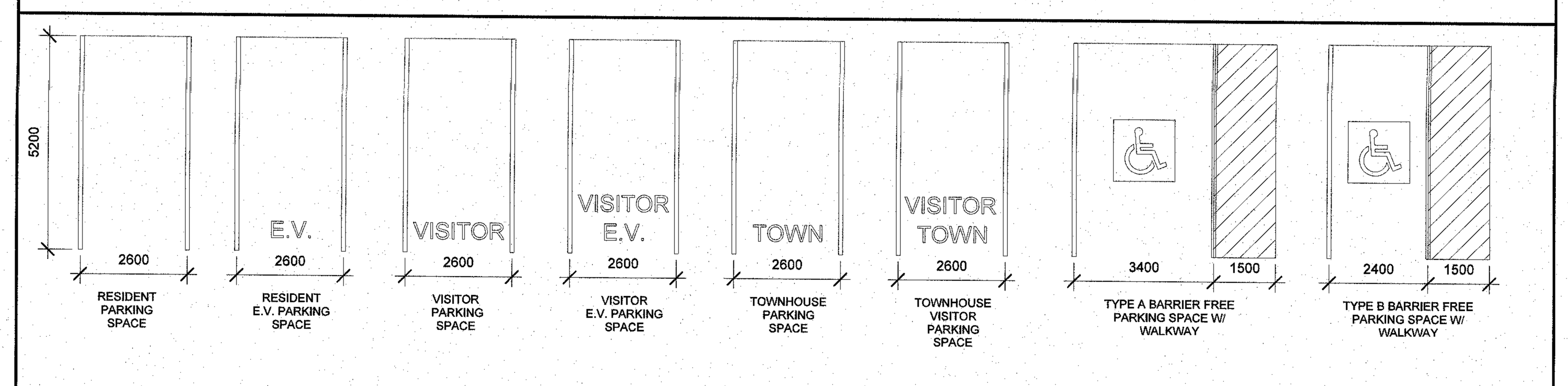
Suite Types

Unit Type	Count
P1	
TOWNHOUSE	4
	4
Level 01 - Ground	
1B	6
1B+D	3
2B	7
2B+D	4
2BI	8
	28
Level 02	
1B	6
1B+D	5
2B	9
2B+D	4
2BI	9
	33
Level 03	
1B	6
1B+D	5
2B	9
2B+D	4
2BI	9
	33
Level 04	
1B	6
1B+D	5
2B	9
2B+D	4
2BI	9
	33
Level 05	
1B	6
1B+D	5
2B	9
2B+D	4
2BI	9

Suite Types

Unit Type	Count
	33
Level 06	
1B	6
1B+D	5
2B	9
2B+D	4
2BI	9
	33
Level 07	
1B	8
1B+D	4
2B	5
2B+D	5
2BI	9
	31
Level 08	
1B	5
1B+D	5
2B	4
2B+D	6
2BI	9
	29
Level 09	
1B	4
1B+D	4
2B	7
2B+D	2
2BI	9
	26
Level 10	
1B	3
1B+D	3
2B	5
2B+D	3
2BI	8
	22
Grand total	305

PARKING LEGEND



Parking

Mark	Type	Provided	Required
	<varies>	29	<varies>
Resident	5200 x 2600	183	217
Resident - 1 Side Obstructed	5200 x 2750	10	
Resident - 2 side Obstruction	5200 x 2900	3	
Resident EV	5200 x 2600	54	54
Townhome	5200 x 2600	8	8
Townhome Visitor	5200 x 2600	1	1
Type A - BF	5200 x 3400	3	
Type B - BF	5200 x 2400	1	
Visitor	5200 x 2600	50	54
Visitor - 1 Side obstructed	5200 x 2750	3	
Visitor EV	5200 x 2600	6	6
Grand total		351	

GFA - APT DWELL ZONE

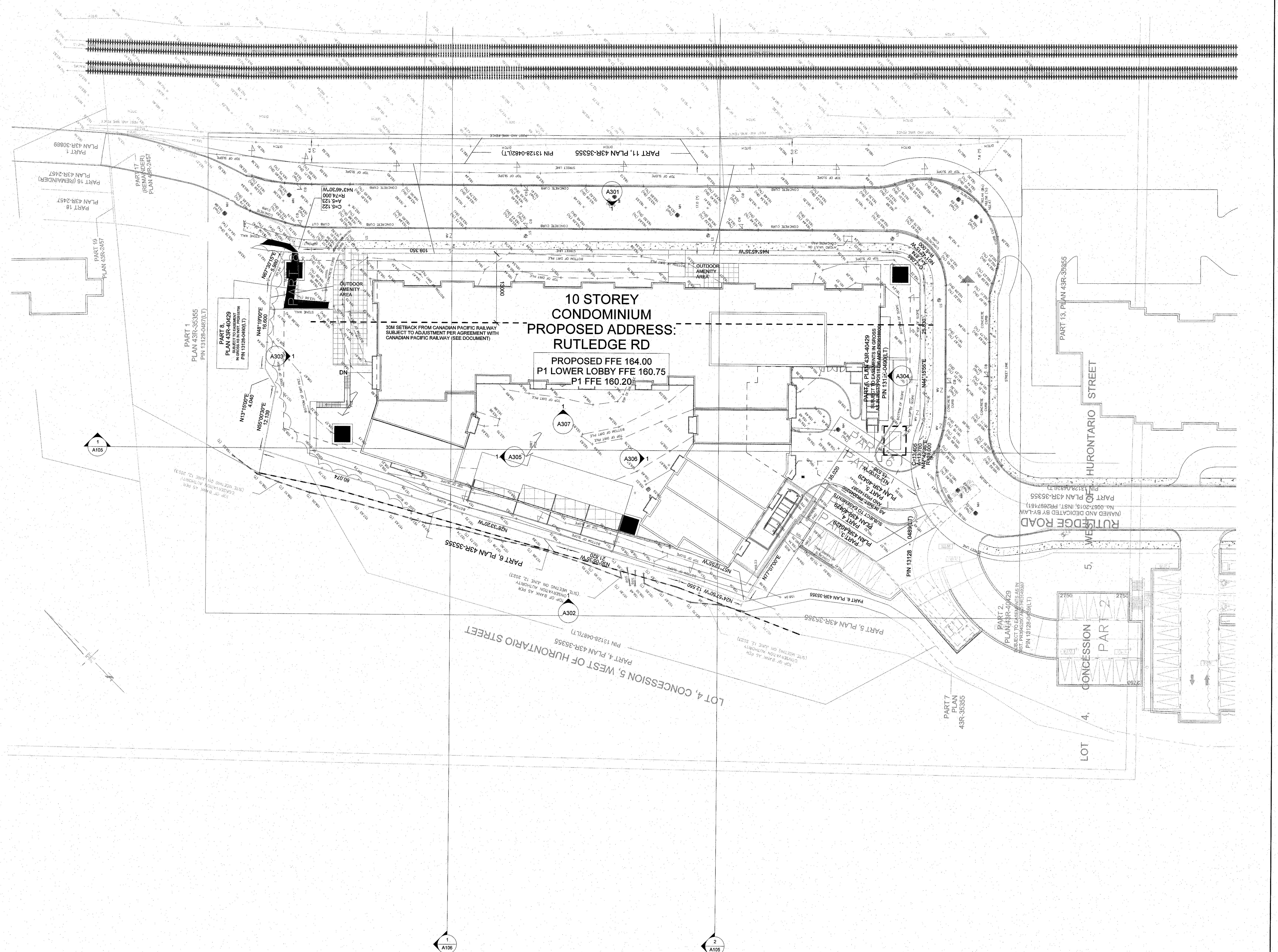
Level	Area	Area (SF)
Level 01 - Ground	2114 m²	22759 ft²
Level 02	2448 m²	26355 ft²
Level 03	2448 m²	26355 ft²
Level 04	2448 m²	26355 ft²
Level 05	2448 m²	26355 ft²
Level 06	2448 m²	26355 ft²
Level 07	2316 m²	24928 ft²
Level 08	2195 m²	23628 ft²
Level 09	1902 m²	20470 ft²
Level 10	1666 m²	17933 ft²
TOTAL	22435 m²	241494 ft²

Amenity Areas

Name	Area	Area (SF)
Indoor		
Amenity	114 m²	1224 ft²
Great Room	54 m²	584 ft²
Lobby/Lounge	55 m²	596 ft²
Lobby/Lounge	94 m²	1009 ft²
Rec	32 m²	342 ft²
Outdoor		
Courtyard	751 m²	8084 ft²
Great Room Terrace	41 m²	444 ft²
Street	132 m²	1423 ft²
Total	1273 m²	13705 ft²

SUITE AREA RANGE

Unit Type	Count	Area
1B	56	41 m² ... 61 m²
1B+D	44	53 m² ... 81 m²
2B	73	53 m² ... 102 m²
2B+D	40	80 m² ... 114 m²
2BI	88	54 m² ... 70 m²
Grand total: 301		



1 Site Context
1 : 300

DATE	ISSUED FOR
2023/01/27	ISSUED FOR REZONING

LEGEND

- PRIMARY BUILDING ENTRANCE
- SECONDARY BUILDING ENTRANCE
- CENTERLINE
- Room name 101 150 m2 — ROOM NAME, NUMBER, AREA
- PROPOSED ELEVATION (M)
- 1t — WALL TAG
- 1t — WINDOW TAG
- 101 — DOOR TAG
- 1 Ref A101 — ELEVATION TAG
- ACCESSIBLE PARKING
- FIRE HYDRANT
- CATCH BASIN
- LIGHT BOLLARD
- LIGHT POST
- WALL LIGHT
- BIKE RACK
- INTAKE/EXHAUST VENT
- EASEMENT
- EXTENT OF UNDERGROUND
- SEVERANCE LINE
- PROPERTY LINE
- TOP OF BANK
- LONG TERM STABLE SLOPE

NO.	DATE	DESCRIPTION
1	2023/01/27	ISSUED FOR REZONING

REVISIONS

Contractor must check and verify all dimensions and be responsible for same; reporting any discrepancies to the Architect before commencing work.

All drawings, prints and specifications are the property of the Architect and must be returned to him on completion of work. Latest drawings only to be used for construction.

Prints are not to be scaled.

ONTARIO ASSOCIATION OF ARCHITECTS — LICENCE 5061

GLOBAL ARCHITECT INC.
6 Leswyn Road, Toronto, Ontario M6A 1K2
ph: 416 256 4440 fx: 416 256 4449

FOREST GREEN HOMES

CLIENT	Forest Green Homes 5332 Highway 7 Woodbridge ON L4L 1T3 Phone: 905.850.8500 Fax: 905.850.8503 Email:info@forestgreenhomes.com
PROJECT NAME	Vic 2 150 RUTLEDGE RD. Mississauga (Streetsville) Ont.
DRAWN BY	CM, DQ
CHECKED BY	RP, PP
DATE	06/29/21
SCALE	As indicated
DWG. TITLE	SITE PLAN
PROJECT NO.	22-03
	A101

FIGURE 2

2.0 SANITARY SEWERAGE

A sanitary sewerage system was constructed on Rutledge Road to accommodate for the sewage from the proposed The Vic II -150 Rutledge Residential Condo Building, as well as the existing Credit River Retirement Residence and the Vic I -180 Rutledge Residential Condo Building, as illustrated in the Sanitary Drainage Area Plan G-8 prepared by Land-Pro Engineering Consultants Inc. dated April 2012 and included in the **Appendix 1** of this Report

The sewers at Rutledge Road were in fact provided with extra depth, at the Region of Peel request, to allow for drainage from existing houses on Ontario Street and Rutledge Road, north of the Kings Mill site, as additional sanitary drainage areas.

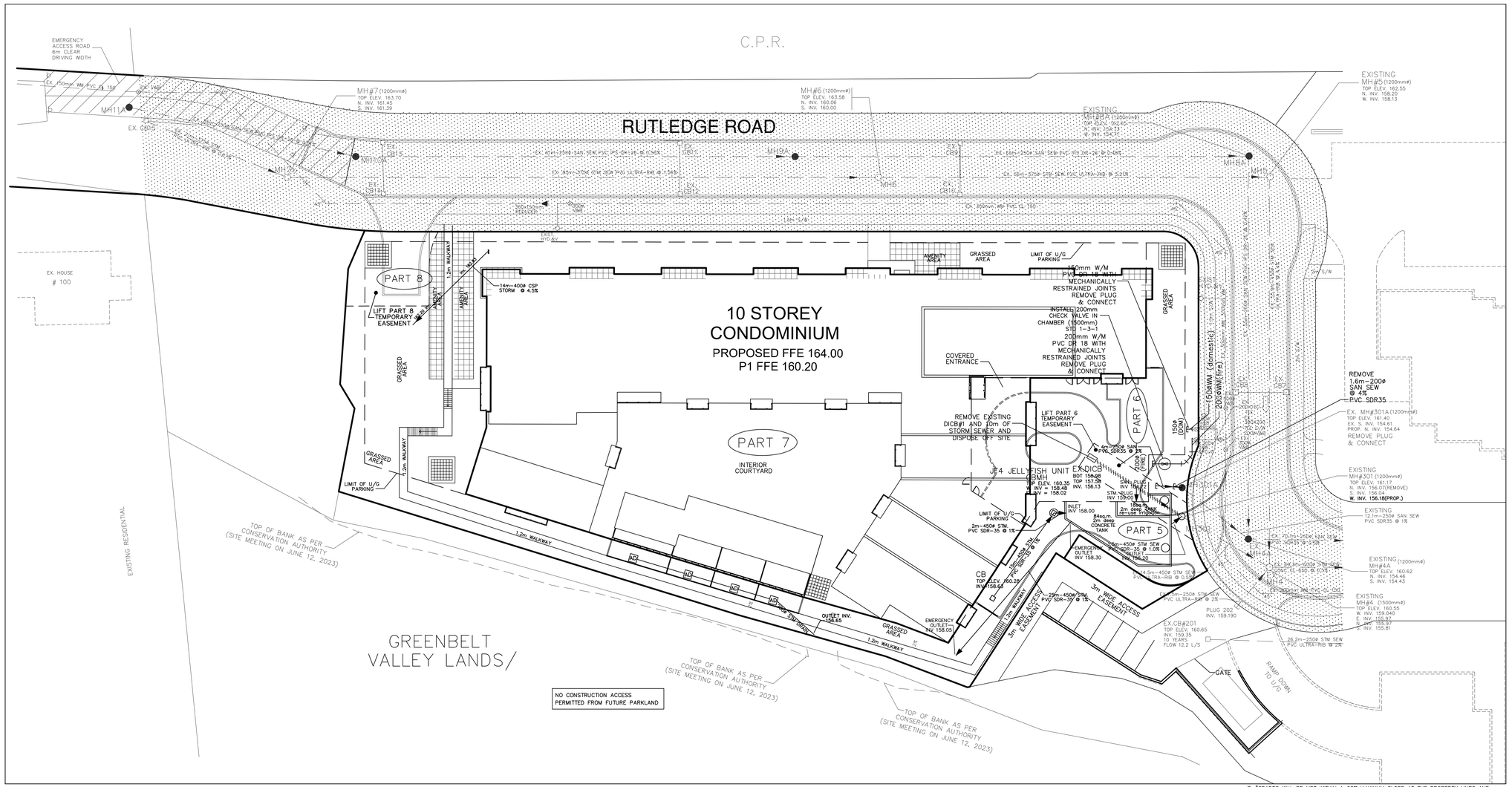
The Rutledge Road extension to Tannery Road, including sanitary sewers, were completed in year 2013, based on detailed engineering drawings dated April 2012 and per Municipal Servicing Study prepared by Land-Pro Engineering Consultants Inc dated Revised Nov 1, 2012.

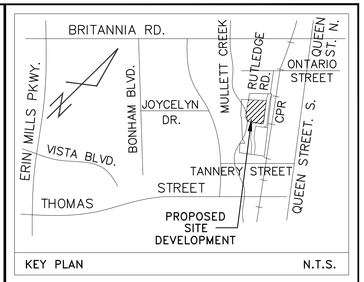
The Land-Pro detailed engineering drawings and Municipal Servicing Study included the sanitary servicing of the Vic II -150 Rutledge Residential Condo Building.

A sanitary sewer connection to Manhole 4A currently exists, at the bend of Rutledge Road, to service the proposed Vic II -150 Rutledge Residential Condo Building site.

A copy of the Vic II -150 Rutledge Residential Condo Building Site Servicing Plan **Figure 3** prepared by Urban Ecosystems limited dated April 9, 2024 is provided in this Report.

A copy of the Municipal Servicing Study prepared by Land-Pro Engineering Consultants Inc dated Revised Nov 1, 2012 is also provided in the **Appendix 3** of this Report.





KEY PLAN N.T.S.

LEGEND

- SAN. SEW — MH — SANITARY SEWER AND MANHOLE
- STM. SEW — MH — STORM SEWER AND MANHOLE
- W/M — WATERMAIN
- HYD&V — VALVED HYDRANT
- V&B — VALVE AND BOX
- ROADSIDE C.B. SEDIMENT PROTECTION (STD. 2930.04)
- FILTER CLOTH WRAP AROUND CATCHBASIN (STD. 2930.03)
- OVERLAND FLOW DIRECTION
- AD#1 — AREA DRAINS BY MECH. ENG.
- PART 7 — PARCEL PART NUMBER PER PLAN 43R-40429
- AMENITY AREA
- EXISTING AS-BUILT RUTLEDGE ROAD RIGHT OF WAY

4.	REVISED TO ADDRESS CITY APRIL 19, 2024 COMMENTS	APRIL 25, 2024	R.S.	
3.	REVISED TO ADDRESS CITY FEB. 26, 2024 COMMENTS	MARCH 7, 2024	R.S.	
2.	COORDINATE WITH ARCHITECTURAL SITE PLAN	JAN 17, 2024	R.S.	
1.	ADDED TOP OF BANK	JULY 4, 2023	R.S.	
	Revision	Date	By	Appr'd

CITY OF MISSISSAUGA BENCHMARK No. 1080

BENCHMARK IS SET VERTICALLY ON THE SOUTH FACE OF THE SOUTH-WEST END OF THE SOUTH-WEST END OF THE CONCRETE BRIDGE ON TANNERY STREET

ELEVATION = 157.018

CONSULTANT

REGISTERED PROFESSIONAL ENGINEER ROSARIO.SACCO APRIL 25, 2024 PROVINCE OF ONTARIO

CITY OF MISSISSAUGA
REGIONAL MUNICIPALITY OF PEEL

URBAN ECOSYSTEMS LIMITED
7050 WESTON ROAD, SUITE 600
WOODBRIDGE, ONTARIO L4L 8G7
uel@urbanecosystems.com
t. (905)856-0629
f. (905)856-0698

THE VIC 2
150 RUTLEDGE ROAD
SITE SERVICING PLAN

Designed By	D.J.S.	Checked by	R.S.
Drawn By	V.T.	Approved by	R.S.
		Date	DEC. 2022
Scale	1 : 300		

Project No. 19013

Drawing No. SS-1

Sheet No. – OF –

P:\2019\19013 Rutledge Rd\19013-150 RUTLEDGE-VIC 2-BASE

NOTES

1. SANITARY

A. PIPES
SHALL BE CONCRETE UP TO AND INCLUDING 900mm DIAMETER CONFORMING TO C.S.A. STANDARDS FOR CONCRETE PIPE, A251.1 OR A257.2 (WHICHEVER APPLIES) AND A257.3 AND RELATED APPENDICES;
OR
SHALL BE POLYVINYL CHLORIDE (PVC) 250mm TO 375mm INCLUSIVE CONFORMING TO THE LATEST EDITION OF C.S.A. STANDARD B182.2 (A.S.T.M. SPECIFICATION D3034) WITH RUBBER GASKETED BELL AND SPIGOT JOINTS;
PIPE AND FITTINGS SHALL HAVE A MAXIMUM STANDARD DIMENSION RATIO OF 35 (SDR 35) AND A MINIMUM PIPE STIFFNESS OF 320 kPa, OR HIGHER STRENGTH AS MAY BE REQUIRED BY THE DESIGN.

B. MANHOLES
SHALL BE AS PER STANDARD DRAWINGS (STD. DWGS.) 2-1-1, 2-1-2, 2-1-4, 2-1-5, 2-1-6, 2-2-1, 2-2-2, 2-2-3 & 2-2-4 OF THE REGION OF PEEL.

C. BENCHING
SHALL BE AS PER STD. DWG. 2-1-4 OF THE REGION.

D. BEDDINGS
SHALL BE AS PER STD. DWG. 2-3-1 (CLASS "B") OF THE REGION UNLESS THE FIELD CONDITIONS REQUIRE OTHERWISE.

E. SAFETY GRATING
SHALL BE AS PER STD. DWG. 2-2-1 OF THE REGION.

F. SERVICE CONNECTIONS
SHALL BE MINIMUM 125mm DIAMETER AS PER STD. DWGS. 2-4-1, 2-4-2, 2-4-3 & 2-4-4 OF THE REGION AND/OR AS SHOWN ON THE DRAWING.

G. CONFORMANCE
THE CONTRACTOR SHALL ENSURE THAT THEIR CONSTRUCTION PRACTICES CONFORMS TO THE LATEST REGION OF PEEL STANDARDS, SPECIFICATIONS AND DESIGN CRITERIA, POSTED ON THE REGION OF PEEL'S WEBSITE (www.peelregion.ca/pw/standards).

2. STORM SEWERS

A. PIPES
SHALL BE CONCRETE, RUBBER GASKET, EXTRA STRENGTH NON-REINFORCED CONFORMING TO CSA SPECIFICATIONS A257.1 AND REINFORCED CONFORMING TO CSA SPECIFICATION A257.2, LATEST AMENDMENT(S), CLASS AS SHOWN ON DRAWINGS, OR
SHALL BE POLYVINYL CHLORIDE (PVC) (ULTRA-RIB) UP TO AND INCLUDING 450mm DIAMETER CONFORMING TO CSA SPECIFICATION B182.2 AND B182.4 LATEST AMENDMENT(S).

B. MANHOLES
SHALL BE AS PER ONTARIO PROVINCIAL STANDARD DRAWING (OPSD) No. 401.010 (TYPE"A"), 404.020, 405.010, 405.020, 701.010, 701.011, 701.012, 701.030, 701.040, 701.050, 701.060, 705.010 & 708.020 AND STD. DWG. 2113.010 OF THE CITY OF MISSISSAUGA.

C. CATCHBASIN & DITCHINLET CATCHBASINS
SHALL BE PER OPSD No. 400.010, 400.100, 403.010, 705.010, 705.020, 705.030, 705.040, 706.010, 706.020, 706.030, 708.01 & 708.020 AND STD. DWGS. 2114.010 & 2114.020 OF THE CITY. ALL CATCHBASINS CONSTRUCTED IN FILL AREA TO BE SUPPORTED ON 15 MPa CONCRETE TO SOLID GROUND UNLESS NOTES OTHERWISE.

D. BEDDINGS
SHALL BE AS PER STD. DWGS. 2112.080 (CLASS "B"), 2112.090, 2112.100, 2112.110 (CLASS "B" & 2112.140 OF THE CITY UNLESS THE FIELD CONDITIONS REQUIRE OTHERWISE.

E. SERVICE CONNECTIONS
SHALL BE AS PER STD. DWGS. 2115.010, 2115.020, 2115.030, 2115.040 & 2115.050 OF THE CITY AND/ OR AS SHOWN ON THE DRAWING. PREFABRICATED TEES SHALL UTILIZED FOR THE SEWER SIZES 600 mm AND SMALLER.

F. CONFORMANCE
ALL WORKS SHALL CONFORM TO THE REQUIREMENTS OF THE CITY.

3. WATERMAINS

A. PIPES
SHALL BE TO THE REGION OF PEEL SPECIFICATIONS AND
SHALL BE P.V.C. CONFORMING TO (CSA SPEC. B137.0 & B137.3) AWWA C-900-81 & C-901-78 FOR WATERMAINS 100 mm TO 300 mm IN DIAMETER AND SHALL BE COPPER TYPE 'K' FOR WATERMAINS 50mm AND SMALLER INCLUDING APPROVED FITTINGS COMPATIBLE WITH DUCTILE IRON PIPE IN ACCORDANCE WITH NFPA 24-1997. ALL WATERMAIN JOINTS TO BE APPROVED PUSH ON, MECHANICAL OR FLANGE TYPE AS REQUIRED FOR A 1000 KPa RATED PRESSURE.
CONDUCTIVITY STRAPS AND WEDGES AS PER THE REQUIREMENTS OF THE REGION.
WATERMAINS TO BE INSTALLED TO GRADES AS SHOWN ON APPROVED PLAN, COPY OF GRADE SHEET MUST BE SUPPLIED TO INSPECTOR PRIOR TO COMMENCEMENT OF WORK, WHERE REQUESTED BY INSPECTOR.

B. HYDRANTS
SHALL BE DARLING "MUELLER CENTURY" OR CLOW/McCAVITY M67B OR CONCORD D67-M OR APPROVED EQUAL WITH PUMPER NOZZLES AND SHALL BE SET AS PER STD. DWGS. 3-1-1, 3-6-2 & 1-6-3 CONFORMING TO THE REGION OF PEEL REQUIREMENTS, DIMENSION A AND B, 0.7 m AND 0.9 m.

C. COVER
WATERMAINS SHALL HAVE A MINIMUM COVER OF 1.7m FROM FINISH GRADE (1-6-1).

D. CLEARANCE
MINIMUM CLEARANCE BETWEEN WATERMAINS AND SEWERS SHALL BE 2.5m HORIZONTAL, 0.15m VERTICAL WHEN WATERMAINS ARE ABOVE SEWERS AND 0.5m VERTICAL WHEN WATERMAINS ARE BELOW SEWERS AND 1.2m FROM THEMSELVES AND ALL OTHER UTILITIES.

E. BEDDING
SHALL BE AS PER STD. DWG. 1-5-1 OF THE REGION.

F. WATERMAIN CONSTRUCTION IN FILL AREAS
NO WATERMAIN SHALL BE LAID ON FILL UNTIL THE DENSITY TEST REPORTS HAVE BEEN SUBMITTED TO AND APPROVED BY REGION. FILL SHALL BE PLACED TO A MINIMUM ABOVE THE TOP OF THE WATERMAIN GRADES AND COMPACTED TO THE MINIMUM OF 100% STANDARD PROCTOR DENSITY IN 0.3m LIFTS. TESTS SHALL BE TAKEN ALONG THE CENTERLINE OF THE WATERMAIN, ALL FITTINGS AND BRANCH VALVES IN FILL AREAS SHALL BE MECHANICALLY RESTRAINED WITH TIE RODS IN ADDITION TO CONCRETE BLOCKING.

G. VALVE AND BOXES
SHALL BE CAST IRON SLIDING TYPE, COMPLETED WITH VALVE GUIDE PLATES.
VALVE AND BOXES SHALL BE INSTALLED AS PER REGION STANDARD 1-3-8.
MAINLINE VALVES TO BE RESTRAINED AS PER REGION STD. 1-3-3A.

H. THRUST BLOCKING
SHALL BE AS PER STD. DWG. 1-5-4, 1-5-5, 1-5-6 & 1-5-7 OF THE REGION.

I. SERVICE CONNECTIONS
SHALL BE AS PER STD. DWG. 1-6-4, 1-7-1 & 1-7-3 OF THE REGION. PROVISIONS FOR FLUSHING WATER LINE PRIOR TO TESTING, ETC. SHALL BE PROVIDED.

J. CATHODIC PROTECTION
ARE REQUIRED ON ALL METALLIC FITTINGS, STAINLESS STEEL NUTS AND BOLTS ARE TO BE USED ON ALL FITTINGS AND JOIN RESTRAINTS AS PER THE LATEST REGION OF PEEL MATERIAL STANDARDS.

K. WATER METER SERVICES
SHALL BE MINIMUM 19mm OR AS INDICATED ON THE ENGINEERING DRAWINGS. FOR NON METALLIC APPROVED MATERIALS, WATER SERVICES SHALL BE AS PER LATEST REGIONAL STANDARDS, COMPLETE WITH A 12 GAUGE TWU STRANDED COPPER, LIGHT COLOURED, PLASTIC COATED TRACER WIRE INSTALLED WITH AND ALONG THE SERVICE PIPE AND BROUGHT TO THE SURFACE AT EACH SERVICE BOX AND ATTACHED TO THE PIPE AND OUTSIDE OF EACH SERVICE BOX BY MEANS OF TAPE OR RUBBER GROMMET.

L. CONFORMANCE
THE CONTRACTOR SHALL ENSURE THAT THEIR CONSTRUCTION PRACTICES CONFORMS TO THE LATEST REGION OF PEEL STANDARDS, SPECIFICATIONS AND DESIGN CRITERIA, POSTED ON THE REGION OF PEEL'S WEBSITE (www.peelregion.ca/pw/standards).

4. MATERIALS SPECIFICATIONS & CONSTRUCTION

SHALL BE (WHEREVER NOT SPECIFIED) IN ACCORDANCE WITH THE APPLICABLE ONTARIO PROVINCIAL STANDARD SPECIFICATIONS (OPSS), LATEST AMENDMENTS.

5. OCCUPATIONAL HEALTH AND SAFETY

A. SAFETY ACT
THE CONTRACTOR AND ITS SUBCONTRACTORS SHALL BE RESPONSIBLE FOR CONSTRUCTION SAFETY AND FOR COMPLIANCE WITH THE RULES, REGULATIONS AND PRACTICES REQUIRED BY THE APPLICABLE FEDERAL AND PROVINCIAL CONSTRUCTION SAFETY LEGISLATION.

B. LOCAL REQUIREMENTS
ALL SERVICES AND UTILITIES TO BE SUPPORTED AS PER THE REQUIREMENTS OF THE REGION OF PEEL, CITY OF MISSISSAUGA AND THE CORRESPONDING UTILITY COMPANIES.

6. DIMENSIONS

ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS NOTED OTHERWISE.
ALL PIPE SIZES ARE IN MILLIMETRES.

7. BENCH MARK

A. CITY OF MISSISSAUGA
BENCH MARK No. 393 ELEVATION 157.323 m

B. DESCRIPTION
ON THE SOUTH FACE OF THE N/W CONCRETE END POST
OF BRIDGE ON TANNERY STREET, 61 METRES EAST OF JOYMAR DRIVE.

8. EROSION AND SEDIMENT CONTROL

A. PROTECT ALL EXPOSED SURFACE AND CONTROL ALL RUNOFF DURING CONSTRUCTION.
B. ALL EROSION CONTROL MEASURES TO BE IN PLACE BEFORE STARTING CONSTRUCTION AND MAINTAIN IN GOOD CONDITION DURING CONSTRUCTION UNTIL COMPLETE.
C. MAINTAIN EROSION CONTROL MEASURES DURING CONSTRUCTION IN GOOD ORDER.
D. MINIMIZE AREA DISTURBED DURING CONSTRUCTION.
E. PROTECT ALL CATCHBASINS, MANHOLES AND PIPE ENDS FROM SEDIMENT INTRUSION.
F. KEEP ALL SUMPS CLEAN DURING CONSTRUCTION.
G. PREVENT AND BLOWN DUST BY WATERING, SEEDING DISTURBED AREAS AS REQUIRED.
H. SILT CONTROL AS PER STD. DRWS. 2930.010, 2930.020, 2930.030 & 2930.040 OF THE CITY SHALL BE USED IN LOCALISED AREAS IF REQUIRED AND AS DIRECTED BY THE ENGINEER DURING CONSTRUCTION.
I. GRAVEL ENTRANCE SHALL BE PROVIDED WHEREVER EQUIPMENT LEAVES THE SITE TO PREVENT MUD TRACKING ONTO PAVED SURFACES. GRAVEL BED SHALL BE A MINIMUM OF 15m LONG, 6m WIDE AND 0.3m DEEP AND SHALL CONSIST OF COARSE (50mm CRUSHER-RUN LIMESTONE) MATERIAL. GRAVEL ENTRANCE SHALL BE MAINTENED IN CLEAN CONDITION.
J. TEMPORARY PARKING DURING THE CONSTRUCTION ACTIVITY SHOULD BE LOCATED ON FLAT AREAS AS MUCH AS POSSIBLE.

9. ROADWORKS

A. EXISTING PAVEMENT
ANY SECTION OF PAVEMENT DISTURBED WITHIN THE EXISTING RIGHT-OF-WAY SHALL BE RESTORED AS PER THE ORIGINAL PAVEMENT DESIGN AND AS PER THE REQUIREMENTS OF THE CITY AND THE REGION.

B. TRENCH RESTORATION FOR OPEN CUT
SHALL BE AS PER STD. DWG. 2220.030, 2220.031 AND 2220.032 OF THE CITY.

C. PAVEMENT DESIGN FOR THE SITE.(REFER TO THE SOILS REPORT WHICH SHALL SUPERCEDE) SHALL BE AS PER STD. DWGS. 2211.240 & 2211.270 OF THE CITY.

	PARKING AREA (MINIMUM)
ASPHALT HL3	40 mm
ASPHALT HLB	65 mm
19mm CRUSHER RUN/(GRANULAR "A")	200 mm
50mm CRUSHER RUN/(GRANULAR "B")	250 mm

IN FILL AREAS THE LAST 1 METER FILL BELOW SUBGRADE SHALL BE COMPACTED TO 100% STANDARD PROCTOR DENSITY AND BELOW THIS 98% COMPACTION IS ACCEPTABLE UNLESS NOTED OTHERWISE IN THE SOILS REPORT.

D. CONCRETE SIDEWALK
SHALL BE AS PER STD.DWGS. 2240.010, 2240.020, 2240.030 & 2240.040 OF THE CITY.

E. CONCRETE CURB
SHALL BE AS PER OPSD 600.040, 600.070 & 600.110.

F. CONCRETE WALKWAY
SHALL BE AS PER STD.DWG. 2240.050 OF THE CITY.

G. STREET SIGN
SHALL BE AS PER THE CITY REQUIREMENTS.(STD.DWGS. SERIES 2430)

H. SUBDRAINS
SHALL BE AS PER STD. DWG. 2220.040 & 2220.050 OF THE CITY.

I. FENCE
SHALL BE AS PER STD. 2850.010 & 2850.020 OF THE CITY.

J. EROSION AND SEDIMENT CONTROL
SHALL BE AS PER STD.DWGS. 2930.010, 2930.020, 2930.030, 2030.040 & 2940.010 OF THE CITY.

K. CONFORMANCE
ALL WORKS SHALL CONFORM TO THE REQUIREMENTS OF THE CITY.

10. GENERAL

A. WHENEVER PIPES ARE PASSING THROUGH UNCOMPACTED FILL AREA, THE BEDDING TRENCH SHALL BE EXCAVATED TO THE UNDISTURBED GROUND LEVEL AND BACKFILLED WITH GRANULAR MATERIAL COMPACTED TO A MINIMUM OF 95% STANDARD PROCTOR DENSITY.
B. FOR DIMENSIONS AND DETAILS NOT SHOWN ON THE PLAN, REFER TO THE STD. DWGS.
C. ANY WORK OUTSIDE OF THE DEVELOPMENT PLAN LIMITS, SHALL BE RESTORED TO THE ORIGINALS CONDITIONS TO THE SATISFACTION OF THE CITY OF MISSISSAUGA AND THE REGION OF PEEL.
D. ALL TRAFFIC CONTROLS AND SIGNING DURING CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF MTO, THE REGION, AND THE CITY.
E. BEFORE ANY DIGGING, ALL UTILITIES MUST BE CONTACTED BY THE CONTRACTOR ON BEHALF OF THE DEVELOPER FOR EXACT LOCATION OF THEIR PLANTS. THE CONTRACTOR ON BEHALF OF THE DEVELOPER MUST PROTECT THE EXISTING PLANTS AS PER THE REQUIREMENTS OF THE CORRESPONDING UTILITY COMPANIES. SHOULD RELOCATION OF UTILITIES BE REQUIRED IT WOULD BE THE RESPONSABILITY OF THE DEVELOPER.
F. EXISTING ELEVATIONS HAVE BEEN PROVIDED BY THE O.L.S., C.E. DOTTERILL LTD.
G. ALL SURFACE DRAINAGE SHALL BE SELF CONTAINED AND COLLECTED AND DISCHARGED AT AN APPROVED LOCATION.
H. THE CONTRACTOR ON BEHALF OF THE DEVELOPER SHALL OBTAIN ALL NECESSARY PERMITS (LIKE – DEMOLISHION OF STRUCTURES, REMOVAL OF TREES, FOUNDATION INSTALLATION, ROAD ENCROACHMENT, WORK WITHIN FLOOD PLAIN AREA ETC.) PRIOR TO COMMENCEMENT OF CONSTRUCTION.
I. GRADES WILL BE MET WITHIN A 33% MAXIMUM SLOPE AT THE PROPERTY LINES AND WITHIN THE DEVELOPMENT SITE.
J. ALL RECOMMENDATIONS OF THE SOILS REPORT SHALL BE STRICTLY FOLLOWED AND ANY DISCREPENCY BETWEEN THESE PLANS AND THE SOILS REPORT SHALL BE REPORTED BY THE CONTRACTOR ON BEHALF OF THE DEVELOPER TO THE ENGINEER PRIOR TO THE TENDERING OF THE PRICES FOR THIS PROJECT.
K. INFORMATION ON EXISTING SANITARY AND STORM SEWERS AND WATERMAINS HAS BEEN OBTAINED FROM THE CITY OF MISSISSAUGA AND THE REGION OF PEEL.
L. THE BUILDING AND THE SITE BOUNDARIES HAVE BEEN LOCATED BASED ON INFORMATION OBTAINED FROM GRAZIANI+CORAZZA ARCHITECTS INC. AND SMV ARCHITECTS.
M. FOR LOCATION OF CONCRETE CURBS IN THE ASPHALT LIMITS, REFER TO THE ARCHITECTS DRAWINGS.
N. NO BLASTING OR HAMMERING WILL TAKE PLACE WITHOUT THE WRITTEN APPROVAL OF THE COMMISSIONER OF ENGINEERING.
O. ROAD CLOSURE AND OPEN CUT PERMITS MUST BE OBTAINED BY THE CONTRACTOR ON BEHALF OF THE DEVELOPER PRIOR TO UNDERTAKING WORK ON AN EXISTING ROAD ALLOWANCE.
P. CONSTRUCTION ACCESS SHALL BE RUTLEDGE ROAD AND PRIOR APPROVAL FOR THE SAME SHALL BE OBTAINED FROM THE CITY AND THE REGION BY THE CONTRACTOR ON BEHALF OF THE DEVELOPER.

"THIS IS TO CERTIFY THAT ALL PROPOSED DRAINAGE PIPING (SANITARY & STORM) WILL BE INSTALLED TO A MIN. DEPTH OF 1.2m & ANY WATERSERVICE PIPING (WATER & FIRE) TO A MIN. 1.7m OR PROVIDED A FROST PROTECTION FOR ANY LESSER DEPTHS"

THERE ARE NO EXTERNAL ROOF DRAINS FOR THE BUILDING

WEEPING TILES SHALL BE DRAINED USING A SUMP PUMP

COMMUNITY SERVICES NOTES

A. 1. NO GRADING, STRUCTURES, RETAINING WALLS, CONSTRUCTION OR SITE/ CONSTRUCTION ACCESS ARE PERMITTED ON OR FROM THE MUNICIPAL PARKLAND.
A. 2. NO CONSTRUCTION ACCESS PERMITTED FROM FUTURE PARKLAND.

B. THE PLACEMENT OF UNAPPROVED MATERIALS OR STRUCTURES WITHIN FUTURE MUNICIPAL GREENBELT/WOODLOT BLOCKS IS NOT PERMITTED BY COMMUNITY SERVICES AT ANY STAGE OF DEVELOPMENT. THIS INCLUDES, BUT IS NOT LIMITED TO, TOPSOIL STOCKPILING, CONSTRUCTION TRAILERS AND VEHICLES, CONSTRUCTION MATERIALS AND DEBRIS, SALES/ PROMOTIONAL TRAILERS AND SIGNAGE.

C. THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING PARK AND TREE PRESERVATION HOARDING IN AN APPROVED AND FUNCTIONING CONDITION AS REQUIRED BY THE COMMUNITY SERVICES DEPARTMENT THROUGH ALL PHASES OF CONSTRUCTION.

D. INFORM THE COMMUNITY SERVICES DEPARTMENT OF THE CONSTRUCTION SCHEDULE AS IT PERTAINS TO THE MUNICIPALLY OWNED PARKLAND, ITS PROTECTIVE HOARDING, CLEAN UPS, REINSTATEMENT AND ISSUES AFFECTING PARKLAND USE, CONSTRUCTION AND MAINTENANCE. IT IS THE RESPONSIBILITY OF THE APPLICANT TO ARRANGE FOR COMMUNITY SERVICES – PARK PLANNING SECTION INSPECTIONS AND APPROVALS AS REQUIRED.

E. REMOVE CONSTRUCTION RELATED DEBRIS OR LITTER THAT HAS MIGRATED OR HAS THE POTENTIAL TO MIGRATE INTO THE ADJUCENT FUTURE MUNICIPALLY OWNED GREENBELT/WOODLAND. SHOULD THE CONTRACTOR/ APPLICANT FAIL TO DO SO, ARRANGEMENTS WILL BE MADE TO DRAW ON THE SUBMITTED PARK PROTECTION AND REINSTATEMENT SECURITIES TO FUND PARK CLEAN ACTIVITIES.

F. PRIOR TO THE RELEASE OF SECURITIES, THE COMMUNITY SERVICES DEPARTMENT IS TO INSPECT AND APPROVE ANY REQUIRED RESTORATION, REINSTATEMENT AND/OR CLEAN UP WORKS INCLUDING HOARDING REMOVAL AND OFF-SITE DISPOSAL, CONDUCTED AT THE SHARED PROPERTY LINE AND WITHIN THE FUTURE GREENBELT/WOODLANDS.

SITE PLAN STANDARD NOTES

1. "I HEREBY CERTIFY THAT THIS DRAWING CONFORMS IN ALL RESPECTS TO THE SITE DEVELOPMENT PLANS AS APPROVED BY THE CITY OF MISSISSAUGA UNDER FILE NUMBER SP 12/144 W11"
2. "THE CITY OF MISSISSAUGA REQUIRES THAT ALL WORKING DRAWINGS SUBMITTED TO THE BUILDING DIVISION AS PART OF AN APPLICATION FOR THE ISSUANCE OF A BUILDING PERMIT SHALL BE CERTIFIED BY THE ARCHITECT OR THE ENGINEER AS BEING IN CONFORMITY WITH THE SITE DEVELOPMENT PLAN AS APPROVED BY THE CITY OF MISSISSAUGA."
3. "ALL EXTERIOR LIGHTING WILL BE DIRECTED ON TO THE SITE AND WILL NOT INFRINGE UPON THE ADJACENT PROPERTIES."
4. "ALL ROOF TOP MECHANICAL UNITS SHALL BE SCREENED FROM VIEW BY THE APPLICANT."
5. "PARKING SPACES RESERVED FOR PEOPLE WITH DISABILITIES MUST BE IDENTIFIED BY A SIGN, INSTALLED AT THE APPLICANT'S EXPENSE, IN ACCORDANCE WITH THE DESIGN SPECIFICATIONS OF SCHEDULE 2 & 3 OF BY-LAW 001-2009."
6. "THE APPLICANT WILL BE RESPONSIBLE FOR ENSURING THAT ALL PLANS CONFORM TO TRANSPORT CANADA'S RESTRICTIONS."
7. "GRADES WILL BE MET WITHIN A 33% MAXIMUM SLOPE AT THE PROPERTY LINES AND WITHIN THE SITE."
8. "ALL DAMAGED AREAS ARE TO BE REINSTATED WITH TOPSOIL AND SOD PRIOR TO THE RELEASE OF SECURITIES."
9. "SIGNAGE SHOWN ON THE SITE DEVELOPMENT PLANS IS FOR INFORMATION PURPOSES ONLY. ALL SIGNS WILL BE SUBJECT TO THE PROVISIONS OF SIGN BY-LAW 0054-2002, AS AMMENDED, AND A SEPARATE SIGN APPLICATION WILL BE REQUIRED THROUGH THE BUILDING DIVISION."
10. "ANY FENCING ADJACENT TO MUNICIPAL LANDS IS TO BE LOCATED 15 CM (6.0 INC.) INSIDE THE PROPERTY LINE."

REGION OF PEEL CONSTRUCTION STANDARDS

1. ALL MATERIALS AND CONSTRUCTION METHODS MUST CORRESPOND TO THE CURRENT PEEL PUBLIC WORKS STANDARDS AND SPECIFICATIONS.
2. WATERMAIN AND/OR WATER SERVICE MATERIALS 100mm(4") AND LARGER MUST BE PVC DR18. (REFER TO CURRENT MATERIAL SPECS AND INDICATE THE PIPE TO BE USED.)
3. WATERMAIN AND/OR WATER SERVICES ARE TO HAVE A MINIMUM COVER OF 1.7m(5'6") WITH A MINIMUM HORIZONTAL SPACING OF 1.2m(4') FROM THEMSELVES AND ALL OTHER UTILITIES.
4. PROVISIONS FOR FLUSHING WATER LINE PRIOR TO TESTING, ETC. MUST BE PROVIDED WITH AT LEAST A 50mm(2") OUTLET ON 100mm(4") AND LARGER LINES. COPPER LINES ARE TO HAVE FLUSHING POINTS AT THE END, THE SAME SIZE AS THE LINE. THEY MUST ALSO BE HOSED OR PIPED TO ALLOW THE WATER TO DRAIN ONTO A PARKING LOT OR DOWN A DRAIN, ON FIRE LINES, FLUSHING OUTLET TO BE 100mm(4") DIAMETER MINIMUM ON A HYDRANT.
5. ALL CURB STOP TO BE 3.0m(10') OFF THE FACE OF THE BUILDING UNLESS OTHERWISE NOTED.
6. HYDRANT AND VALVE SET TO REGION STANDARD 1-6-1 DIMENSION A AND B, 0.7m(2') AND 0.9m(3') AND TO HAVE PUMPER NOZZLE.
7. WATERMAINS TO BE INSTALLED TO GRADES AS SHOWN ON APPROVED SITE PLAN. COPY OF GRADE SHEET MUST BE SUPPLIED TO INSPECTOR PRIOR TO COMMENCEMENT OF WORK, WHERE REQUESTED BY INSPECTOR.
8. WATERMAINS MUST HAVE A MINIMUM VERTICAL CLEARANCE OF 0.3m(12") OVER/0.5m (20") UNDER SEWERS AND ALL OTHER UTILITIES WHEN CROSSING.
9. ALL PROPOSED WATER PIPING MUST BE ISOLATED FROM EXISTING LINES IN ORDER TO ALLOW INDEPENDENT PRESSURE TESTING AND CHLORINATING FROM EXISTING SYSTEMS.
10. ALL LIVE TAPPING AND OPERATION OF REGION WATER VALVES SHALL BE ARRANGED THOUGH THE REGIONAL INSPECTOR ASSIGNED OR BY CONTACTING THE OPERATIONS AND MAINTENANCE DIVISION.
11. LOCATION OF ALL EXISTING UTILITIES IN THE FIELD TO BE ESTABLISHED BY THE CONTRACTOR.
12. THE CONTRACTOR(S) SHALL BE SOLELY RESPONSIBLE FOR LOCATES, EXPOSING, SUPPORTING AND PROTECTING OF ALL UNDERGROUND AND OVERHEAD UTILITIES AND STRUCTURES EXISTING AT THE TIME OF CONSTRUCTION IN THE AREA OF THEIR WORK WHETHER SHOWN ON THE PLANS OR NOT AND FOR ALL REPAIRS AND CONSEQUENCES RESULTING FROM DAMAGE TO SAME.
13. THE CONTRACTOR(S) SHALL BE SOLELY RESPONSIBLE TO GIVE 72 HOURS WRITTEN NOTICE TO THE UTILITIES PRIOR TO CROSSING SUCH UTILITIES, FOR THE PURPOSE OF INSPECTION BY THE CONCERNED UTILITY. THIS INSPECTION WILL BE FOR THE DURATION OF THE CONSTRUCTION, WITH THE CONTRACTOR RESPONSIBLE FOR ALL COSTS ARISING FROM SUCH INSPECTION.
14. ALL PROPOSED WATER PIPING MUST BE ISOLATED THROUGH A TEMPORARY CONNECTION THAT SHALL INCLUDE AN APPROPRIATE CROSS-CONNECTION CONTROL DEVICE, CONSISTENT WITH THE DEGREE OF HAZARD, FOR BACKFLOW PREVENTION OF THE ACTIVE DISTRIBUTION SYSTEM, CONFORMING TO REGION OF PEEL STANDARDS 1-7-7 OR 1-7-8.

FIGURE 3

3.0 STORM SEWERAGE

A storm sewerage system was constructed on Rutledge Road to accommodate drainage flows from the proposed Vic II -150 Rutledge Residential Condo Building, as well as the existing Credit River Retirement Residence and the Vic I -180 Rutledge Residential Condo Building, as illustrated in the Storm Drainage Area Plan G-7 prepared by Land-Pro Engineering Consultants Inc. dated April 2012 and included in the **Appendix 2** of this Report.

The Rutledge Road extension to Tannery Road, including storm sewers, were completed in year 2013, based on detailed engineering drawings dated April 2012 and per Municipal Servicing Study prepared by Land-Pro Engineering Consultants Inc dated Revised Nov 1, 2012.

The Land-Pro detailed engineering drawings and Municipal Servicing Study included the storm servicing of the Vic II -150 Rutledge Residential Condo Building.

A storm sewer connection to Manhole 4 currently exists, at the bend of Rutledge Road, to service the proposed Vic II -150 Rutledge Residential Condo Building site.

A copy of the Vic II -150 Rutledge Residential Condo Building Site Servicing Plan **Figure 3** prepared by Urban Ecosystems limited dated April 9, 2024 is provided in this Report.

A copy of the Municipal Servicing Study prepared by Land-Pro Engineering Consultants Inc dated Revised Nov 1, 2012 is provided in the **Appendix 3** of this Report.

4.0 PRIOR STORMWATER MANAGEMENT

Aquafor Beech Limited was retained by the developer of the subject property to prepare a stormwater management/erosion assessment report.

The Acquafor Beech Limited Mullet Creek Erosion Assement Report dated Feb 25, 2010 concluded that an onsite stormwater management facility would not be required for the subject development lands since the impact on the Mullet Creek flows upon development of this infill site, would be insignificant.

A copy of the Mullet Creek Erosion Assessment report prepared by Aquafor Beech Limited dated Feb 25, 2010 is provided in the **Appendix 4** of this Report.

While the impact from the proposed flows was not considered excessive, the Report recommended that it would be prudent to incorporate some stormwater source and/or conveyance controls to minimize impacts to the creek, as much as possible.

Due to site constraints, it was concluded that conveyance controls at the storm outlet to the creek would be utilized.

In addition to the above, a cash contribution from the developer was also provided to the City for this storm sewer installation.

As part of the Rutledge Road construction contract, an outlet energy dissipating channel feature was added to the storm sewer outlet structure to reduce the velocity and minimize erosion of the stormwater flow to the creek.

The above stormwater management strategy served as the basis for the issuance of approvals for Credit River Retirement Residence and the Vic I -180 Rutledge Residential Condo Building, without any requirement for quality and/or quantity controls.

Although the existing storm sewer conveyance system was also designed to accommodate the proposed Vic II - 150 Rutledge Residential Condo Building site, without any requirement for quality or quantity controls, an updated stormwater management plan is proposed for this development site.

5.0 PROPOSED STORMWATER MANAGEMENT

5.1 Design Criteria

The design criteria for the stormwater management plan for Vic II -150 Rutledge Residential Condo Building site development is as follows:

- Water quality treatment to Level 1 Enhanced Protection as per MOE Stormwater Management Practices Planning and Design Manual (2003).
- Water quantity control to limit post-development peak flows to pre-development peak flows for the 2-year to 100-year storm events.
- Volume retention through capturing post-construction runoff volume and retaining on-site from a 5 mm rainfall event from the total site area.

5.2 Existing Condition

The project site, with an area of 6233sm, was previously graded in conjunction with the Phase1 development lands and Rutledge Road construction activity.

5.3 Proposed Development

The proposed development consists of a proposed 10 storey condo building with associated underground parking, and an access driveway to existing Rutledge Road.

5.4 Hydrological Modeling

The Modified Rational method will be used to estimate existing and proposed flows from the site, utilizing City of Mississauga standard Intensity-Duration-Frequency- Rainfall Curve data for each storm event.

5.5 Pre-Development Condition

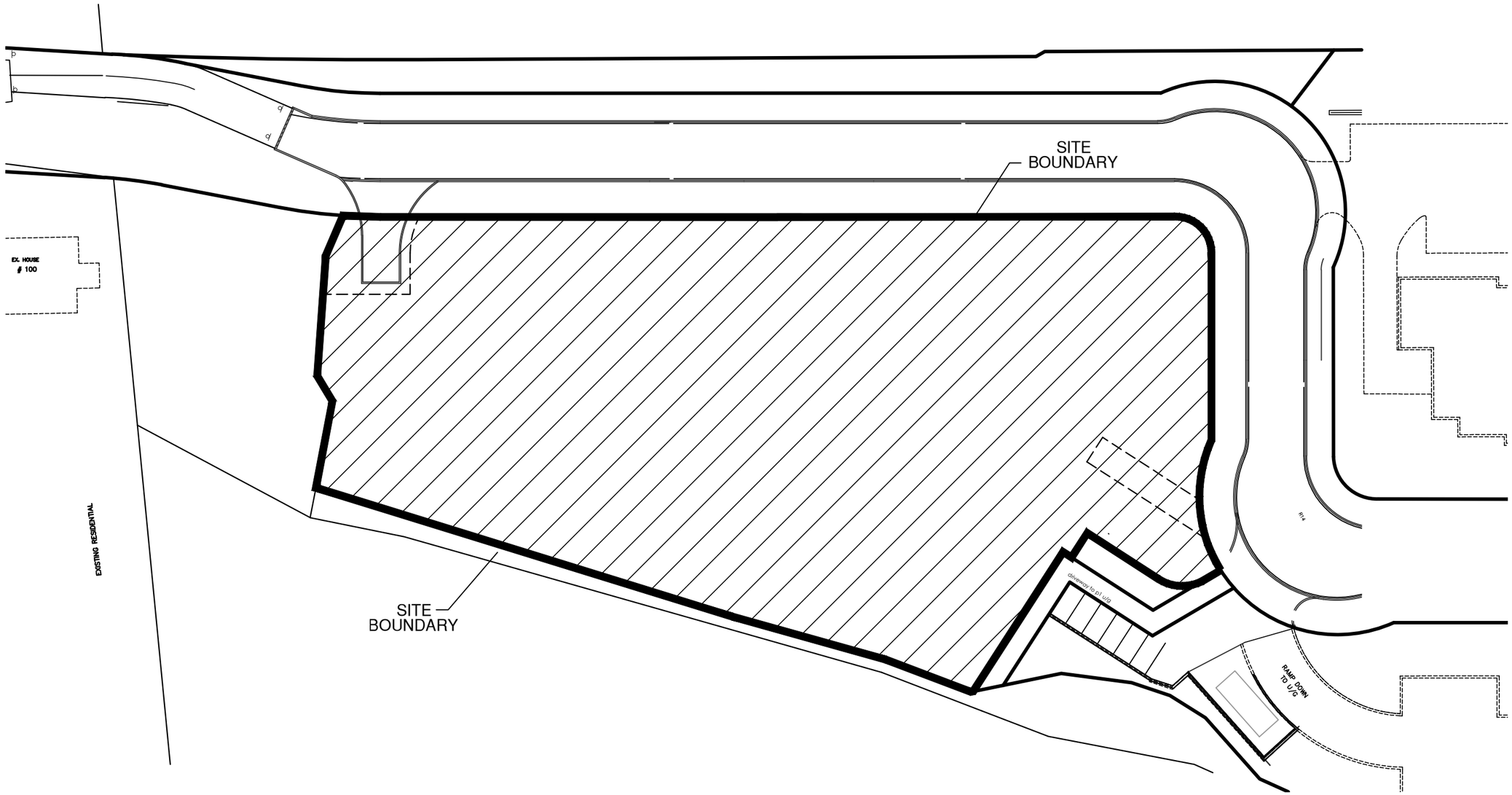
Although the site presently exists without topsoil or vegetation cover, for calculation purposes it is being considered as grass area with a runoff coefficient of 0.25.

The pre-development site area is identified in **Figure 4**.

The City of Mississauga Intensity-Duration-Frequency (IDF) curves will be used to determine the flow rates per the following equations:

City of Mississauga Intensity Equation	Coefficient Adjustment Factor
Rainfall intensity (mm/hr) : I(2yr) = 610 x (t +4.6) ^-.78 =	C = 1.0
Rainfall intensity (mm/hr) : I(5yr) = 820 x (t +4.6) ^-.78 =	C = 1.0
Rainfall intensity (mm/hr) : I(10yr) = 1010 x (t +4.6) ^-.78 =	C = 1.0
Rainfall intensity (mm/hr) : I(25yr) = 1160 x (t +4.6) ^-.78 =	C = 1.1
Rainfall intensity (mm/hr) : I(50yr) = 1300 x (t +4.7) ^-.78 =	C = 1.2
Rainfall intensity (mm/hr) : I(100yr) = 1450 x (t +4.9) ^-.78 =	C = 1.25

T= 15 time of concentration in minutes



PRE-DEVELOPMENT
GRASSED AREA

	sq.m.
PRE-DEVELOPMENT GRASSED AREA	6233

THE VIC 2
150 RUTLEDGE ROAD

URBAN ECOSYSTEMS LIMITED
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PERVIOUS-IMPERVIOUS
PRE-DEVELOPMENT PLAN

SCALE	DATE	PROJECT No.	FIGURE
N.T.S.	APRIL 2024	19013	4

5.0 PROPOSED STORMWATER MANAGEMENT CONT'D

5.5 Pre-Development Condition Cont'd

Using a runoff coefficient of 0.25 for the existing areas of 6233 sm and an inlet time of 15 minutes, the following flow rates were obtained as shown in **Table 5. 5.** Detailed calculations are provided in **Appendix 5** to this Report.

TABLE 5.5 PRE-DEVELOPMENT ALLOWABLE RELEASE RATES

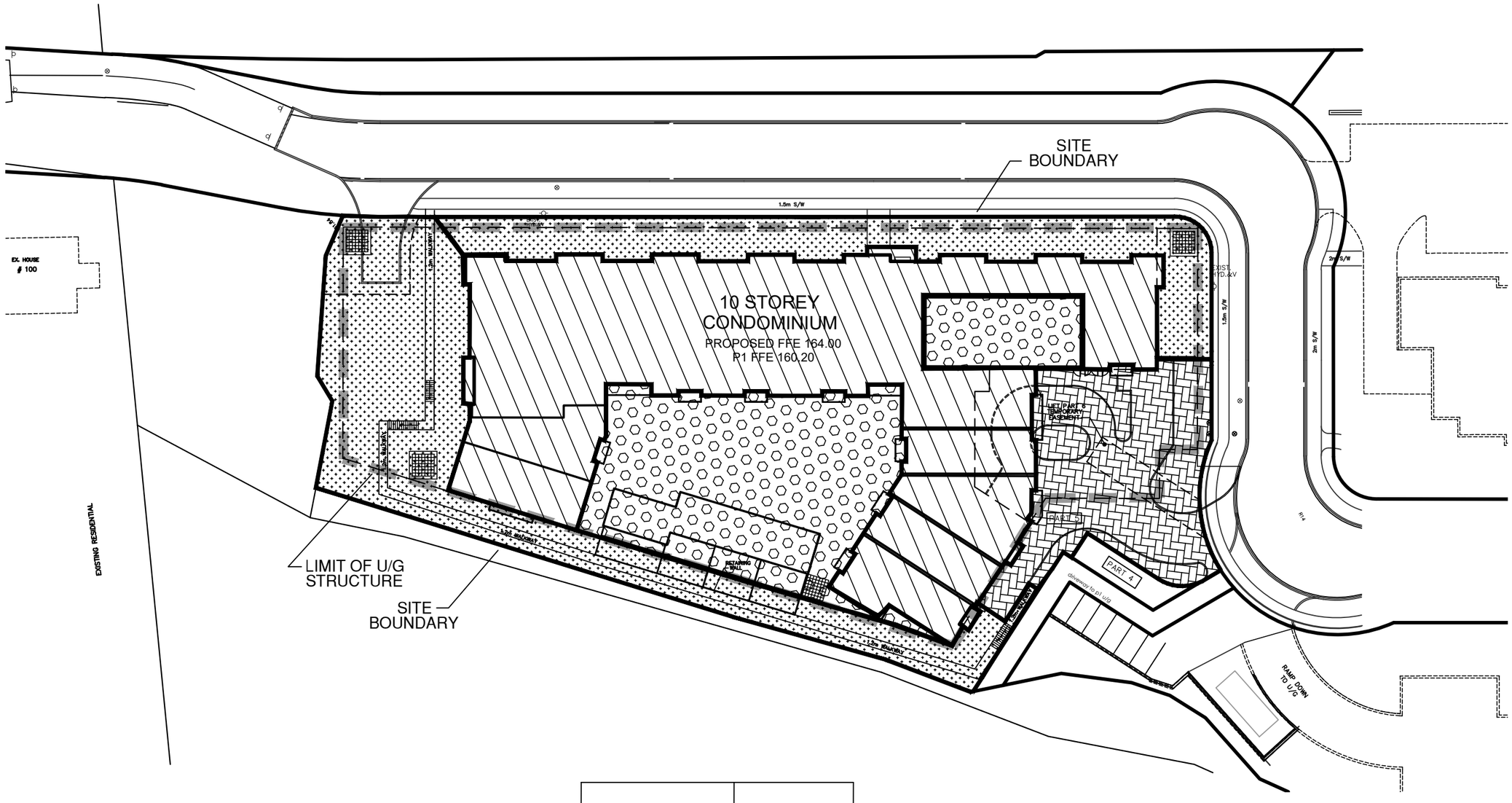
Return Period (years)	Runoff Coefficient	Intensity (mm/hr) (TC=15min)	Peak Flow (L/s)	Allowable Release Rate (L/s)
2	0.25	59.89	25.9	25.9
5	0.25	80.51	34.9	34.9
10	0.25	99.17	42.9	42.9
25	0.28	113.89	54.2	54.2
50	0.30	127.13	66.0	66.0
100	0.31	140.69	75.5	75.5

5.6 Proposed Condition

The proposed development area will comprise of 4 drainage areas. There will be an uncontrolled landscape area of 1,887 m2, a controlled hard surface of 705 m2, a controlled roof area of 2,418 m2 and an uncontrolled roof area of 1,223 m2.

Although the total site area is 6,233sm, due to the limited landscaped (non-underground garage) area, runoff control and retention will be limited, with all storage and retention requirements being addressed utilizing underground storage tanks.

The post-development site area is identified in **Figure 5**.



CONTROLLED HARD SURFACE (IMPERVIOUS)

UNCONTROLLED ROOF

CONTROLLED ROOF

UNCONTROLLED LANDSCAPE (INCLUDING PERMABLE WALKWAY)

	sq.m.
CONTROLLED ROOF	2418
CONTROLLED HARD SURFACE	705
UNCONTROLLED ROOF	1223
UNCONTROLLED LANDSCAPE	1887
TOTAL	6233

THE VIC 2
150 RUTLEDGE ROAD

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PERVIOUS-IMPERVIOUS POST-DEVELOPMENT PLAN

SCALE	DATE	PROJECT No.	FIGURE
N.T.S.	APRIL 2024	19013	5

5.6 Proposed Condition Cont'd

5.6.1 Quantity Control

Runoff from the roof areas and all paved area are proposed to be collected and drained to a quantity control storage chamber, where flows will be controlled and allowed to drain out via an orifice controlled outlet to the existing storm service connection manhole and ultimately to the Rutledge Road storm sewer. Within this chamber will be storage set aside for 5 mm of rainfall from the site.

The Quantity Control Chamber Design Parameters and Site Release rates are identified in **Table 4.6.1.**

Detailed calculations are provided in **Appendix 5** to this Report.

TABLE 5.6.1 POST-DEVELOPMENT SITE RELEASE RATES and STORAGE REQUIREMENTS

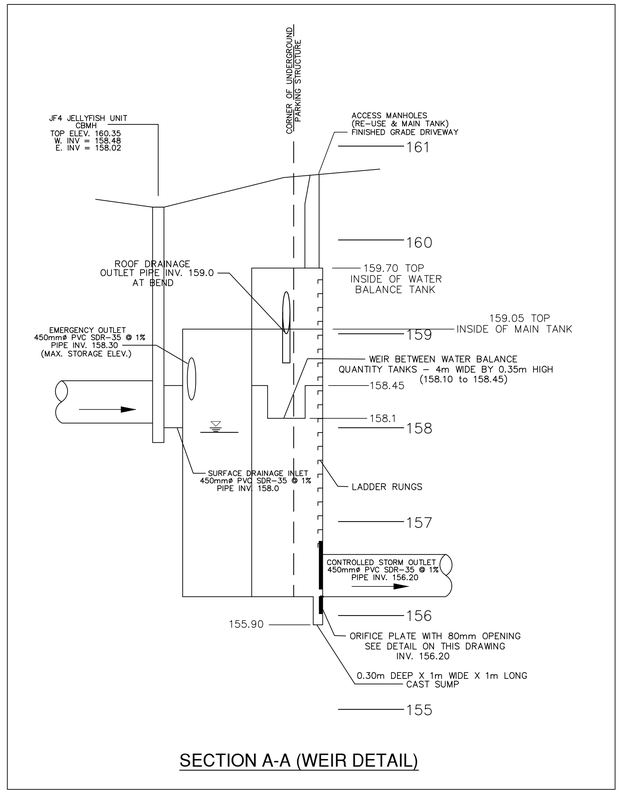
POST-DEVELOPMENT SITE RELEASE RATES					
Orifice Control Opening mm	Controlled Peak Flow (L/s)	Uncontrolled Peak Flow (L/s)	Total Site Release Rate (L/s)	Req'd Storage Volume (m3)	Allowable Release Rate (L/s)
80	18.1	7.8	25.9	31	25.9
	18.1	10.6	28.6	46	34.9
	18.1	13.0	31.0	61	42.9
	18.1	16.4	34.5	79	54.2
	18.1	20.0	38.0	92	66.0
	18.1	22.9	40.9	106	75.5

5.6 Proposed Condition Cont'd

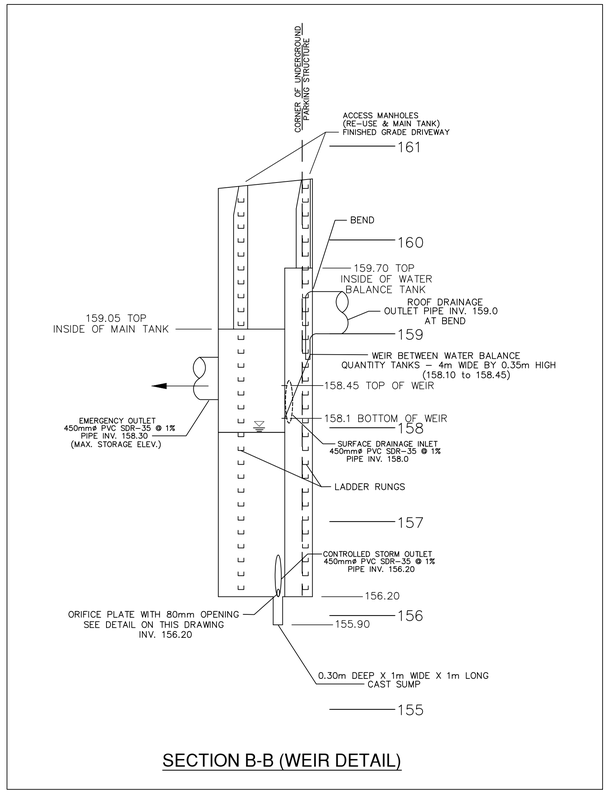
Orifice Plate diameter opening	=	80 mm
Orifice Control Invert	=	156.20
Maximum Ponding / Storage Elevation	=	157.95
Minimum Storage Tank Footprint	=	72 sm
Minimum Quantity Control Storage Tank Volume	=	126cu.m

The details of the storage chamber are provided in Detail Drawing DET-1 **Figure 6**. The location of the quantity storage chamber, length, width height and relationship with the Jellyfish filter system is outlined in Drawing SP-1 **Figure 3**. The 5 mm water balance runoff storage chamber details are also provided in Detail Drawing DET-1 **Figure 6.**

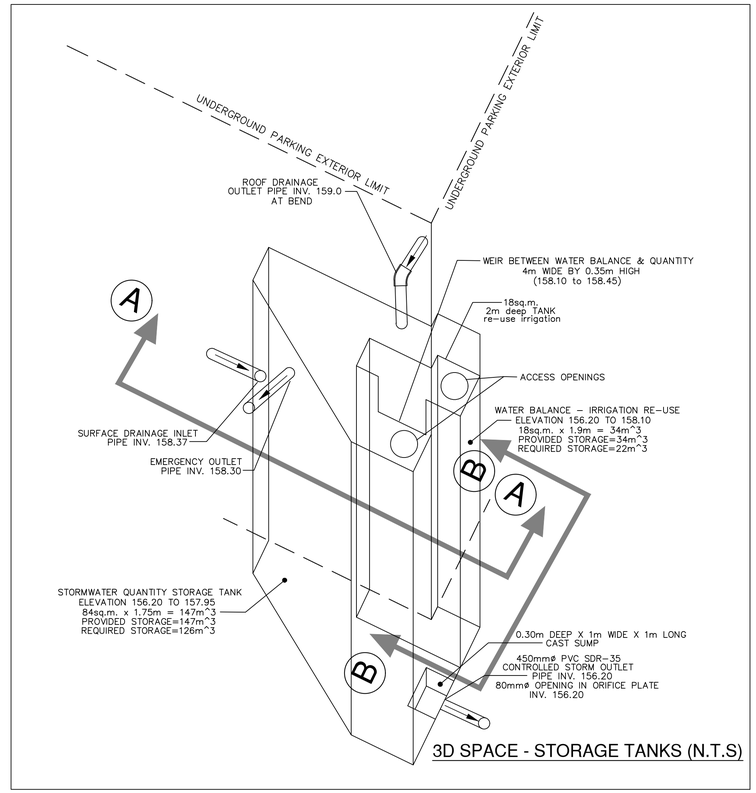
An emergency spillway will be placed at an elevation of 158.30 m to allow spilling into the valleyland such that flows do not spill into the underground parking garage. The emergency spillway is provided for runoff greater than the 100-year storm and in the unlikely situation that orifice outlet may be blocked. The emergency spillway will have a flow capacity to accommodate the 100-year uncontrolled flow rate.



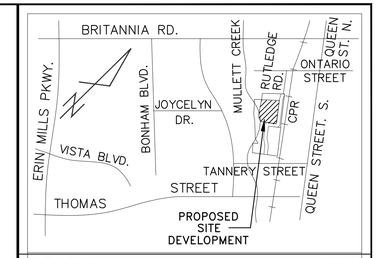
SECTION A-A (WEIR DETAIL)



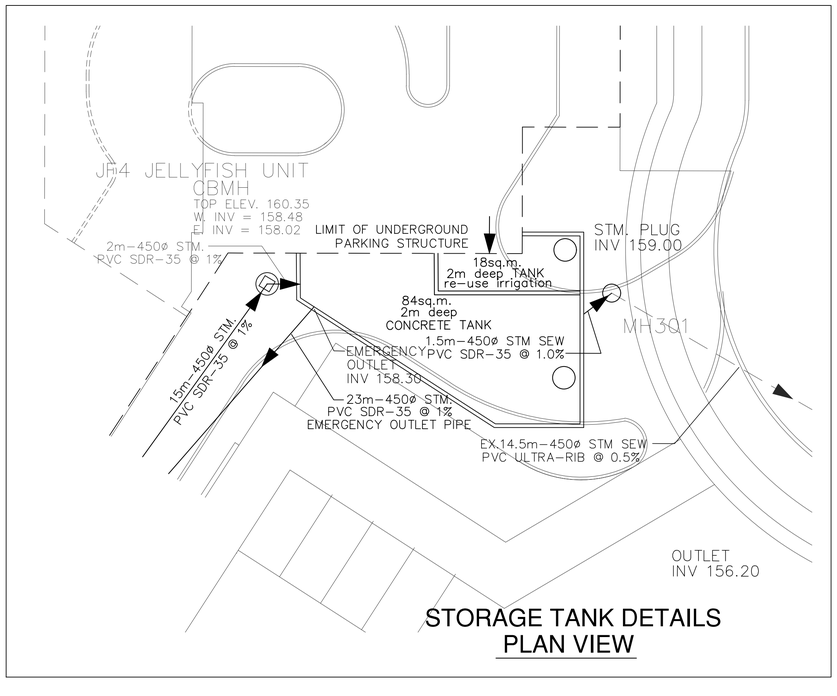
SECTION B-B (WEIR DETAIL)



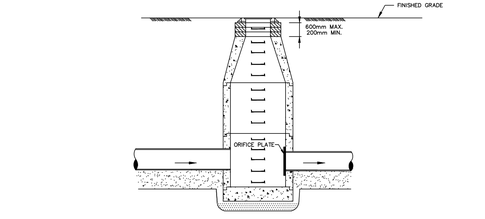
3D SPACE - STORAGE TANKS (N.T.S)



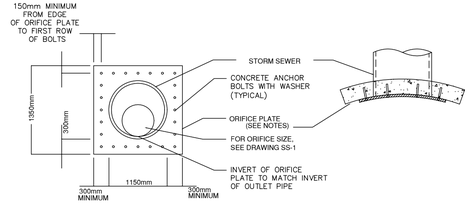
KEY PLAN N.T.S.



STORAGE TANK DETAILS
PLAN VIEW



CONTROL MANHOLE 01
ORIFICE CONNECTION DETAIL
N. T. S.



Notes:

1. ORIFICE PLATE SHALL BE INSTALLED ON DOWNSTREAM SIDE OF MANHOLE (OUTLET PIPE)
2. MANHOLE CONTAINING ORIFICE PLATE SHALL HAVE A 0.30m SUMP
3. ORIFICE PLATE TO BE 6mm STAINLESS OR GALVANIZED STEEL OR 25mm STRUCTURAL POLYETHYLENE
4. ORIFICE PLATE TO BE ATTACHED WITH 9mm CONCRETE ANCHOR BOLTS OR APPROVED EQUIVALENT
5. BOLTS NOT TO PROTRUDE GREATER THAN 25mm FROM FACE OF ORIFICE PLATE
6. ONE WASHER MAXIMUM TO BE INSTALLED ON EACH BOLT UNLESS INSTRUCTED OTHERWISE

DETAIL OF ORIFICE PLATE
AT CONTROL MH (typical)
N.T.S.

1.	REVISED TO ADDRESS CITY APRIL 19, 2024 COMMENTS	APRIL 25, 2024	R.S.	
	Revision	Date	By	Appr'd

CITY OF MISSISSAUGA BENCHMARK No. 1080

BENCHMARK IS SET VERTICALLY ON THE SOUTH FACE OF THE SOUTH-WEST END OF THE SOUTH-WEST END OF THE CONCRETE BRIDGE ON TANNERY STREET

ELEVATION = 157.018

CONSULTANT

REGISTERED PROFESSIONAL ENGINEER
ROSARIO.SACCO
APRIL 25, 2024
PROVINCE OF ONTARIO

CITY OF MISSISSAUGA
REGIONAL MUNICIPALITY OF PEEL

URBAN ECOSYSTEMS LIMITED
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t. (905)856-0629
f. (905)856-0698

THE VIC 2
150 RUTLEDGE ROAD
DETAILS

Designed By	D.J.S.	Checked by	R.S.
Drawn By	V.T.	Approved by	R.S.
		Date	MARCH 2022
Scale	1 : 300	Project No.	19013
		Drawing No.	DET-1
		Sheet No.	– OF –

P:\2019\19013 Rutledge Rd\19013-150 RUTLEDGE-VIC 2-BASE

5.6 Proposed Condition Cont'd

5.6.2 Water Balance – 5mm Retention

Water retention, through capturing post-construction runoff volume and retaining on-site from a 5 mm rainfall event from the total impervious site area, will be provided as follows:.

Landscaped area	1,887 sm
Roof Podium Area	1,223 sm
Roof Area	2,418 sm
Asphalt/Paved Area	705 sm
Total Site area	6,233 sm
Less : Landscaped area	1,887 sm
Total Site Impervious area	4,346 sm

5mm Water Retention Requirement = 4,346sm x .005m = 22 cu.m

As the 5 mm runoff from the landscaped area will naturally infiltrate into the grassed areas, we proposing that the 5 mm rainfall from the entire impervious site area will be stored in a second quantity chamber.

A second quantity chamber is proposed to store 34 cu.m of water to be reused for irrigation or other uses within the site.

5.0 PROPOSED STORMWATER MANAGEMENT CONT'D

5.6 Proposed Condition Cont'd

5.6.3 Quality Control

Due to the compact development with underground parking, it will not be possible to install a standard stormwater management (SWM) facility. For sites of this size (<5.0 hectares), manhole separators are typically used to attain the 80% TSS removal. However, in recent past, both the City of Mississauga and Conservation Authority will only provide credit of 50% TSS removal for manhole separators. To achieve 80% TSS removal, a treatment train approach will be used for this site. Initial runoff from the paved area of the site will be directed through a Jellyfish unit before entering an underground storage facility. The Jellyfish unit has been sized to provide 80% TSS removal from the site. The underground storage facility will be sized to provide the required water quantity control. The initial runoff from the building roof and podium area, which are considered to be clean water, will be outletted directly into the underground storage facility. In addition to the above, the underground storage facility will include a second compartment to store enough water to meet the runoff volume control criteria of 5mm from the site. This stored water will be used for reuse within the site.

This facility will act as part of the treatment train line of defence for water quality. This chamber would hold back suspended solids that may pass through or by-pass the Jellyfish unit as water is stored in the tank and slowly pump out over time. Any removal of TSS within the unit will be in addition to the Jellyfish unit.

It should be noted that all site runoff, including roof, paved areas and rood podium areas, with the exception of the uncontrolled landscape runoff area, will enter the quantity storage chamber. As such, its actual efficiency would be much greater as TSS from Roof area is very negligible and the roof area accounts for approx. 84 percent of the drainage area entering the quantity storage chamber.

Quality Treatment is therefore primarily required to address the paved driveway access area at the south east quadrant of the site.

Based on the hard surface area of 705sm, a Jellyfish Model JF4 was selected to provide 80% TSS removal. This combined with the storage chamber would provide the required 80% TSS removal. Details of the Jellyfish Quality Unit is proved in **Appendix 6** of this Report.

6.0 WATER DISTRIBUTION SYSTEM

A water distribution system was constructed on Rutledge Road to address water requirements for the proposed Vic II -150 Rutledge Residential Condo Building, as well as the existing Credit River Retirement Residence and the Vic I -180 Rutledge Residential Condo Building sites.

The Rutledge Road extension to Tannery Road, including watermain, was completed in year 2013, based on detailed engineering drawings dated April 2012 and per Municipal Servicing Study dated Feb 26, 2010 prepared by Land-Pro Engineering Consultants Inc.

The Land-Pro detailed engineering drawings and Municipal Servicing Study included the watermain servicing of the Vic II -150 Rutledge Residential Condo Building Site.

The water distribution system for The Kings Mill site, was connected to the existing 300mm diameter watermain at Tannery Street.

The general pressure at Tannery Street was noted to be approx.. 70 psi, therefore, a proposed 300mm diameter watermain was determined to be adequate for the present and the future phases of the proposed Kings Mill development.

The water distribution system in this neighbourhood, is appropriately networked to provide adequate water requirements, as watermains are existing at Tannery, Joymar, Queen St. South, Rutledge Road and Ontario Street.

These watermains are all interconnected and provide adequate water pressures for the entire Kings Mill development site, including the Vic II -150 Rutledge Residential Condo Building site.

A water connection to the 300mm diameter watermain currently exists, at the bend of Rutledge Road, to service the proposed Vic II -150 Rutledge Residential Condo Building site.

6.0 ROADWORKS AND SITE GRADING

The proposed Vic II -150 Rutledge Residential Condo Building fronts Rutledge Road on the east and the south sides, Mullet Creek on the west and open space on the north side.

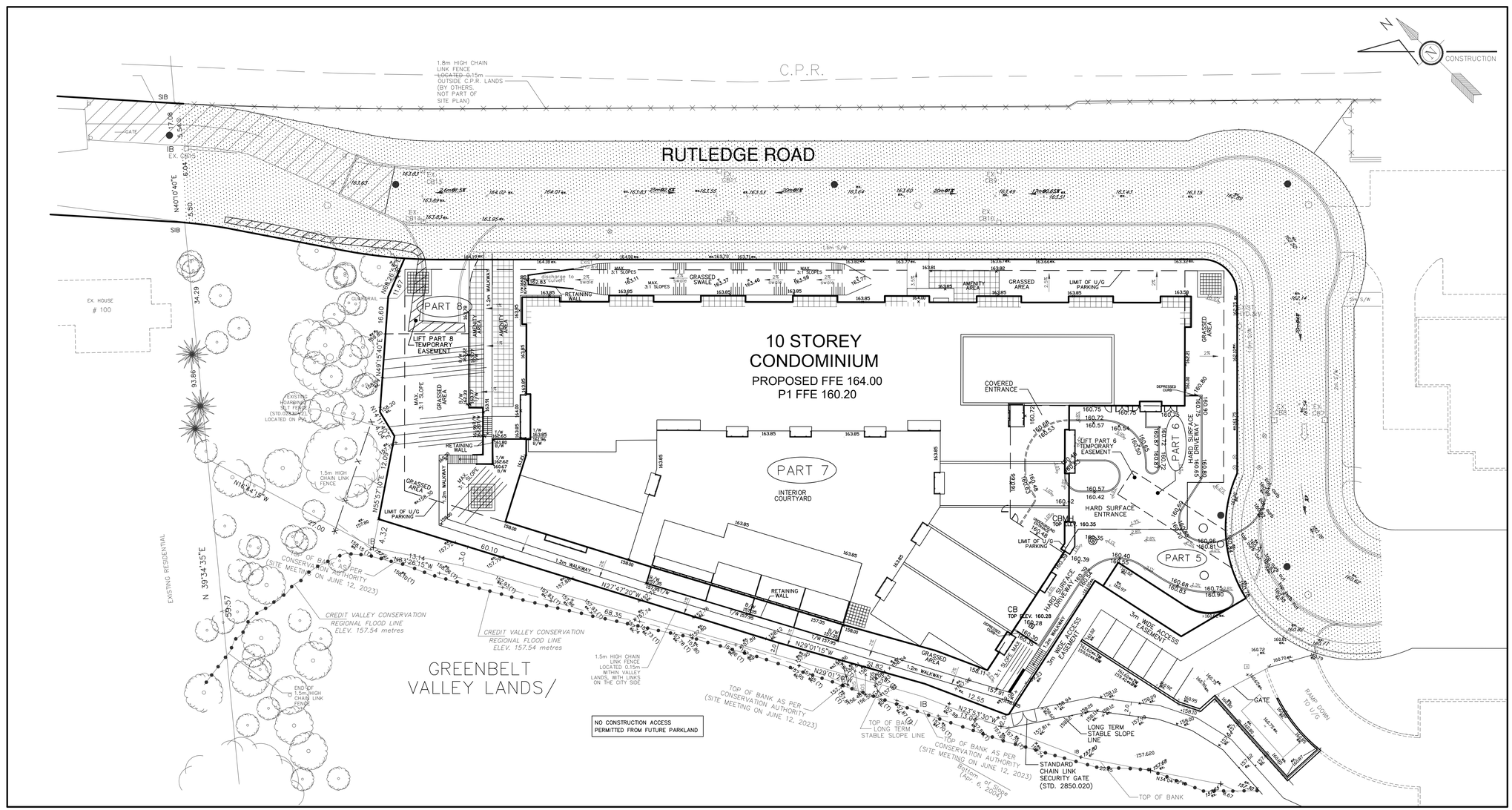
Rutledge Road currently exists as noted previously in this report.

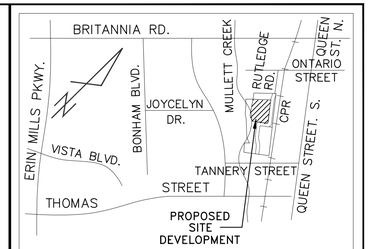
Rutledge Road, the open space to the north and Mullet Creek bank shall be maintained in the "as-is" condition and shall be protected.

The site grading has, therefore, been proposed to provide due regard to these boundary conditions.

The parameters of the site grading, established by CVC and the City for Kings Mill Development including the proposed Vic II -150 Rutledge Residential Condo Building site have been addressed accordingly.

A copy of the Vic II -150 Rutledge Residential Condo Building Site Grading Plan **Figure 7** prepared by Urban Ecosystems limited dated Dec 2022 is provided in this Report.





KEY PLAN N.T.S.

LEGEND

- CB — CATCHBASIN
- e.+163.00 / ×163.00 — EXISTING ELEVATION
- 159.28 × — PROPOSED ELEVATION
- 1.5% — DRAINAGE DIRECTION AND SLOPE
- EXISTING OVERLAND FLOW ROUTE
- DRAINAGE DIRECTION AND SLOPE
- PART 7 — PARCEL PART NUMBER PER PLAN 43R–40429
- AMENITY AREA
- EXISTING AS–BUILT RUTLEDGE ROAD RIGHT OF WAY

GRADING PLAN STANDARD NOTES (the following notes are to be included on all grading plans)

1) "Elevations are referred to the City of Mississauga Benchmark No. 1080, located VERTICALLY ON THE SOUTH FACE OF THE SOUTH–WEST END OF THE SOUTH–WEST END OF THE CONCRETE BRIDGE ON TANNERY STREET , having a published elevation of 157.018 meters".

2) "I have reviewed the plans for the construction of a Condo building site located at 150 Rutledge Road and have prepared this plan to indicate the compatibility of the proposal to existing adjacent properties and municipal services. It is my belief that adherence to the proposed grades as shown will produce adequate surface drainage and proper facility of the municipal services without any detrimental effect to the existing drainage patterns or adjacent properties"

3)
a) "All surface drainage will be self–contained, collected and discharged at a location to be approved prior to the issuance of a building permit.

(b) "The portions of the driveway within the municipal boulevard will be paved by the applicant."

(c) "At the entrances to the site, the municipal curb and sidewalk will be continuous through the driveway and a curb depression will be provided for each entrance."

(d) "All proposed curbing within the municipal boulevard area for the site is to suit as follows:
i) For all single family residential properties including on street townhouses, all curbing is to stop at the property limit or the back of the municipal sidewalk, whichever is applicable; or

ii) For all other proposals including Industrial, Commercial and Multi–Unit Residential developments, all entrances to the site are to be in accordance with City of Mississauga Standards 2240.030/2240.031, (as applicable) and 2230.20. Driveway and entrance curb radii dimensions shall be in accordance with OSPD 350.010."

(e) "All excess excavated material will be removed from the site."

(f) "The existing drainage pattern will be maintained except where noted."

(g) "The applicant will be required to contact all utility companies to obtain all required locates prior to the installation of hoarding within the municipal right–of–way."

(h) "The applicant will be responsible for the cost of any utility relocations necessitated by the site plan."

(i) "Prior to commencing construction, all required hoarding in accordance with the Ontario Occupational Health & Safety Act and regulations for construction projects, must be erected and then maintained throughout all phases of construction."

(j) "Should any works be required within the municipal right–of–way, a Road Occupancy Permit will be required. PUCC approval will be required. For further information, please contact the PUCC/Permit Technologist, at 905–615–4950 or by email at tw.counter@mississauga.ca or see the website link below.?
https: //www.mississauga.ca/services–and–programs/transportation–and–streets/roads–and–sidewalks/apply–for–a–road–occupancy–permit/

CONSULTANT
REGISTERED PROFESSIONAL ENGINEER
ROSARIO.SACCO
APRIL 25, 2024
PROVINCE OF ONTARIO

EROSION AND SEDIMENT CONTROL

A. PROTECT ALL EXPOSED SURFACE AND CONTROL ALL RUNOFF DURING CONSTRUCTION.
B. ALL EROSION CONTROL MEASURES TO BE IN PLACE BEFORE STARTING CONSTRUCTION AND REMAIN IN PLACE UNTIL RESTORATION/CONSTRUCTION IS COMPLETE.
C. MAINTAIN EROSION CONTROL MEASURES DURING CONSTRUCTION IN GOOD ORDER.
D. MINIMIZE AREA DISTURBED DURING CONSTRUCTION.
E. PROTECT ALL CATCHBASINS, MANHOLES AND PIPE ENDS FROM SEDIMENT INTRUSION.
F. KEEP ALL SUMPS CLEAN DURING CONSTRUCTION.
G. PREVENT WIND BLOWN DUST BY WATERING, SEEDING DISTURBED AREAS AS REQUIRED.
H. SILT CONTROL AS PER STD. DRWS. 2930.010, 2930.020, 2930.030 & 2930.040 OF THE CITY SHALL BE USED IN LOCALISED AREAS IF REQUIRED AND AS DIRECTED BY THE ENGINEER DURING CONSTRUCTION.
I. GRAVEL ENTRANCE SHALL BE PROVIDED WHEREVER EQUIPMENT LEAVES THE SITE TO PREVENT MUD TRACKING ONTO PAVED SURFACES. GRAVEL BED SHALL BE A MINIMUM OF 15m LONG, 6m WIDE AND 0.3m DEEP AND SHALL CONSIST OF COARSE (50mm CRUSHER–RUN LIMESTONE) MATERIAL. GRAVEL ENTRANCE SHALL BE MAINTENED IN CLEAN CONDITION.
J.TEMPORARY PARKING DURING THE CONSTRUCTION ACTIVITY SHOULD BE LOCATED ON FLAT AREAS AS MUCH AS POSSIBLE.

SITE PLAN STANDARD NOTES

1. "I HEREBY CERTIFY THAT THIS DRAWING CONFORMS IN ALL RESPECTS TO THE SITE DEVELOPMENT PLANS AS APPROVED BY THE CITY OF MISSISSAUGA UNDER FILE NUMBER SP 12/144 W11"
2. "THE CITY OF MISSISSAUGA REQUIRES THAT ALL WORKING DRAWINGS SUBMITTED TO THE BUILDING DIVISION AS PART OF AN APPLICATION FOR THE ISSUANCE OF A BUILDING PERMIT SHALL BE CERTIFIED BY THE ARCHITECT OR THE ENGINEER AS BEING IN CONFORMITY WITH THE SITE DEVELOPMENT PLAN AS APPROVED BY THE CITY OF MISSISSAUGA."
3. "ALL EXTERIOR LIGHTING WILL BE DIRECTED ON TO THE SITE AND WILL NOT INFRINGE UPON THE ADJACENT PROPERTIES."
4. "ALL ROOF TOP MECHANICAL UNITS SHALL BE SCREENED FROM VIEW BY THE APPLICANT."
5. "PARKING SPACES RESERVED FOR PEOPLE WITH DISABILITIES MUST BE IDENTIFIED BY A SIGN, INSTALLED AT THE APPLICANT'S EXPENSE, IN ACCORDANCE WITH THE DESIGN SPECIFICATIONS OF SCHEDULE 2 & 3 OF BY–LAW 001–2009."
6. "THE APPLICANT WILL BE RESPONSIBLE FOR ENSURING THAT ALL PLANS CONFORM TO TRANSPORT CANADA'S RESTRICTIONS."
7. "GRADES WILL BE MET WITHIN A 33% MAXIMUM SLOPE AT THE PROPERTY LINES AND WITHIN THE SITE ".
8. "ALL DAMAGED AREAS ARE TO BE REINSTATED WITH TOPSOIL AND SOD PRIOR TO THE RELEASE OF SECURITIES."
9. "SIGNAGE SHOWN ON THE SITE DEVELOPMENT PLANS IS FOR INFORMATION PURPOSES ONLY. ALL SIGNS WILL BE SUBJECT TO THE PROVISIONS OF SIGN BY–LAW 0054–2002, AS AMMENDED, AND A SEPARATE SIGN APPLICATION WILL BE REQUIRED THROUGH THE BUILDING DIVISION."
10. "ANY FENCING ADJACENT TO MUNICIPAL LANDS IS TO BE LOCATED 15 CM (6.0 INC,) INSIDE THE PROPERTY LINE."

4.	REVISED TO ADDRESS CITY APRIL 19, 2024 COMMENTS	APRIL 25, 2024	R.S.	
3.	REVISED TO ADDRESS CITY FEB. 26, 2024 COMMENTS	MARCH 7, 2024	R.S.	
2.	COORDINATE WITH ARCHITECTURAL SITE PLAN	JAN 17, 2024	R.S.	
1.	ADDED TOP OF BANK	JULY 4, 2023	R.S.	
	Revision	Date	By	Appr'd

CITY OF MISSISSAUGA BENCHMARK No. 1080

BENCHMARK IS SET VERTICALLY ON THE SOUTH FACE OF THE SOUTH–WEST END OF THE SOUTH–WEST END OF THE CONCRETE BRIDGE ON TANNERY STREET

ELEVATION = 157.018

CONSULTANT
REGISTERED PROFESSIONAL ENGINEER
ROSARIO.SACCO
APRIL 25, 2024
PROVINCE OF ONTARIO

CITY OF MISSISSAUGA
REGIONAL MUNICIPALITY OF PEEL

URBAN ECOSYSTEMS LIMITED
7050 WESTON ROAD, SUITE 600
WOODBRIDGE, ONTARIO L4L 8G7
uel@urbanecosystems.com
t. (905)856–0629
f. (905)856–0698

THE VIC 2
150 RUTLEDGE ROAD
SITE GRADING PLAN

Designed By	D.J.S.	Checked by	R.S.	Project No.	19013
Drawn By	V.T.	Approved by	R.S.		
		Date	DEC. 2022	Drawing No.	SG–1
Scale	1 : 300			Sheet No.	– OF –

P:\2019\19013 Rutledge Rd\19013–150 RUTLEDGE–VIC 2–BASE

FIGURE 7

7.0 CONCLUSION

The proposed Vic II -150 Rutledge Residential Condo Building site represents the final phase of the Kings Mill development project.

All reports and approvals for Kings Mill development have anticipated the future development of the proposed Vic II -150 Rutledge Residential Condo Building site.

This Stormwater Management and Functional Site Servicing Report confirms that existing services are currently available, to within the property limits, to allow the development of the Vic II -150 Rutledge Road site.
The following conclusions and recommendations can be made for the Phase 1 of Site Plan Application SPA-2021-0268 lands:

- The use of a storage chamber SWM facility and the use of orifice plate would provide control of post development flows to pre development levels as required by Conservation Authority and the City of Mississauga
- Within the Quantity storage chamber 34 m^3 of volume will be set aside for runoff volume control of the first 5 mm of rainfall.
- For the SWM portion of the chamber at least 126 m3 of volume in addition to the runoff volume control will be provided for quantity control.
- Water quality control will be via the Jellyfish Filter Model JF4 to provide 80% TSS removal. Additional water quality will be provided with the quantity storage chamber before outletting the storm sewer system.

Based on the preceding analysis, we recommend that the City, Region and CVC approve the Proposed Vic II -150 Rutledge Residential Condo Building site development.

Respectfully Submitted,

LICENSED PROFESSIONAL ENGINEER
R. SACCO
40295305
Apr 27, 2024
PROVINCE OF ONTARIO

Rosario Sacco, P.Eng

APPENDICIES

APPENDIX 1- Sanitary Drainage Area Plan G-8 - Land-Pro Engineering Consultants Inc.

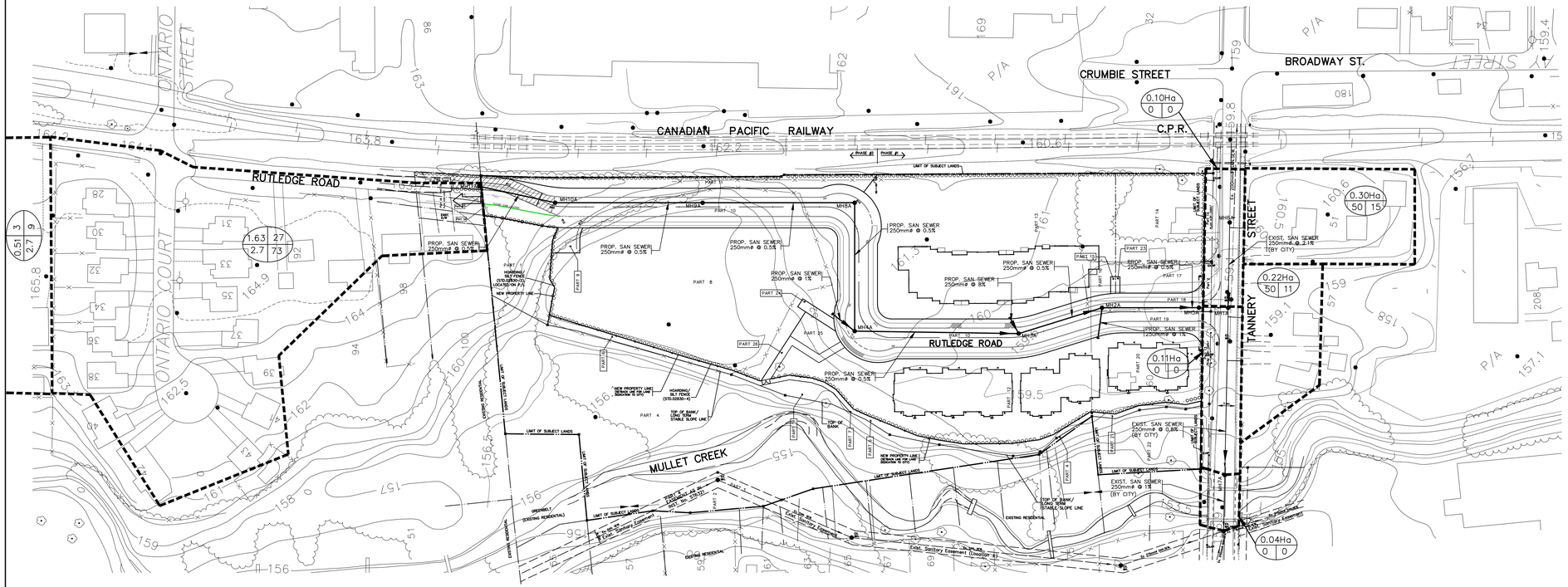
APPENDIX 2- Storm Drainage Area Plan G-7 - Land-Pro Engineering Consultants Inc.

APPENDIX 3- Municipal Servicing Study - Land-Pro Engineering Consultants Inc

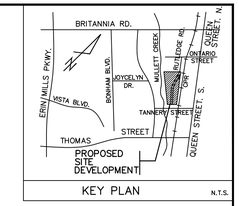
APPENDIX 4- Mullet Creek Erosion Assessment report prepared by Aquafor Beech Limited

APPENDIX 5- Stormwater Management Calculations

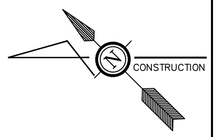
APPENDIX 6- Jelly Fish Quality Unit Details

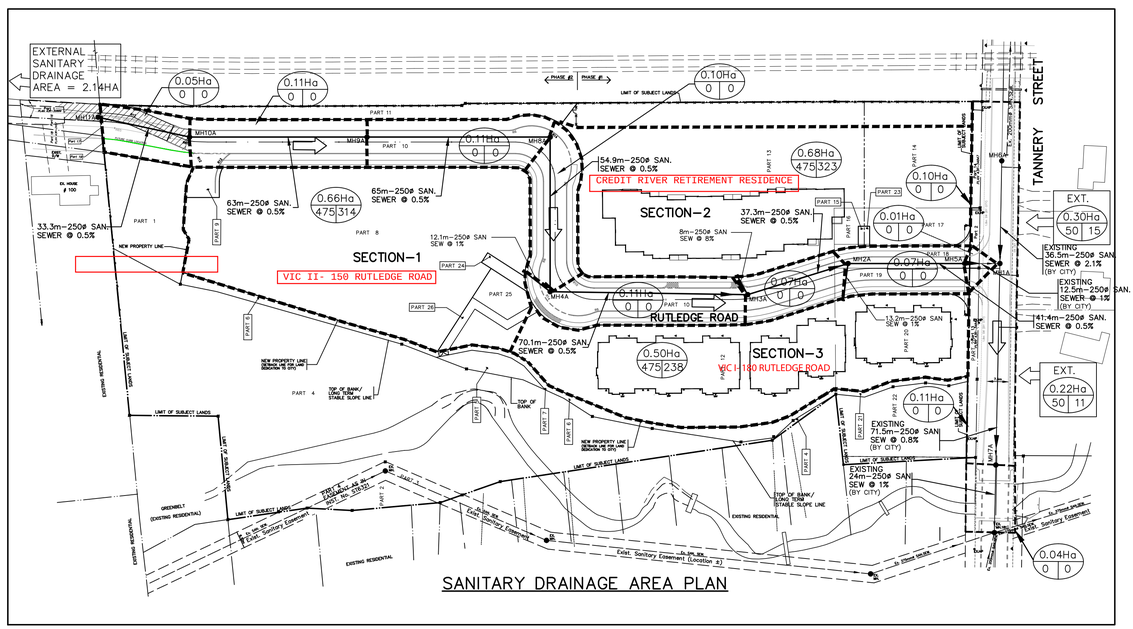


EXTERNAL SANITARY DRAINAGE AREAS



KEY PLAN N.T.S.





SANITARY DRAINAGE AREA PLAN

LEGEND:

- 0.44Ha / 475 / 209 — DRAINAGE AREA IN HECTARES; POPULATION; PERSONS PER HECTAR
- 1.63 / 27 / 2.7 / 73 — DRAINAGE AREA IN HECTARES; NUMBER OF UNITS; POPULATION; NUMBER OF PERSON PER UNIT

NOTE

FOR GENERAL NOTES AND LEGEND REFER TO DWG. No. 08014G–1

No.	Date	By	Description
1	Aug. 25, 15	V.G.	AS–BUILT U/G STORM, SANITARY AND WATERMAIN

REVISIONS

UNAUTHORIZED USE OR REUSE OF THIS DRAWING IS NOT PERMITTED

SUBMISSIONS

1st.	✓	Date July 18, 12	interim	✓	Date Apr. 12, 13
2nd.	✓	Date Oct 16, 12	interim	✓	Date June 3, 13
		Date	final	✓	Date Mar. 14, 14

Municipality:

CITY OF MISSISSAUGA
REGIONAL MUNICIPALITY OF PEEL
Z39.307

RUTLEDGE ROAD EXTENSION
'MUNICIPAL WORKS'
SP 12/143
KINGS MILL DEVELOPMENT INC.

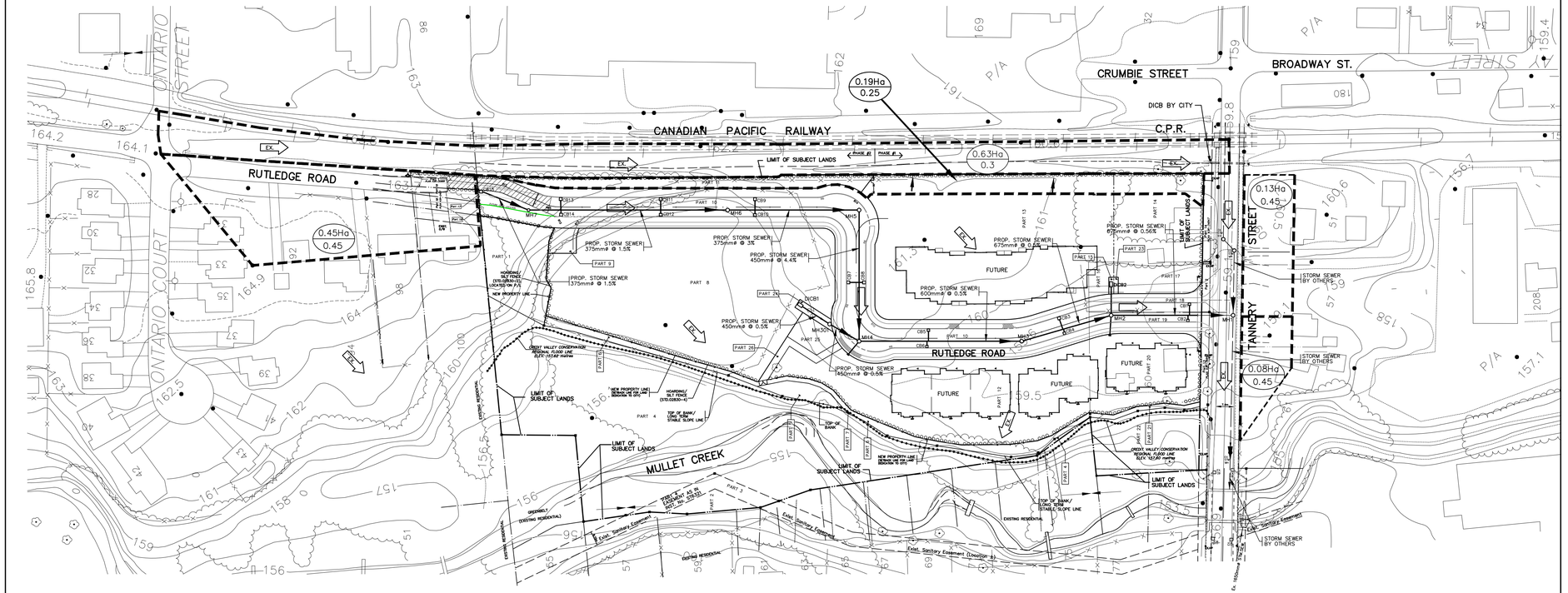
Title:

EXTERNAL SANITARY DRAINAGE AREAS & SANITARY DRAINAGE AREA PLAN

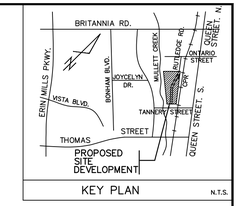
REGISTERED PROFESSIONAL ENGINEER — Aug. 25, 2015 — V.GUPTA — PROVINCE OF ONTARIO

LAND–PRO
ENGINEERING CONSULTANTS INC.
2601 MATHESON BLVD. EAST
SUITE 206, MISSISSAUGA
ONTARIO, L4W 5A8
TEL: (905) 625–7666
FAX: (905) 625–1985

DESIGN BY: V.G.	ELECTRONIC FILE: 08014G8	DATE: APRIL 2012
DRAWN BY: IP/BM	PROJECT No. 08014	DRAWING No. G–8
SCALE: HORI. 1:1000		

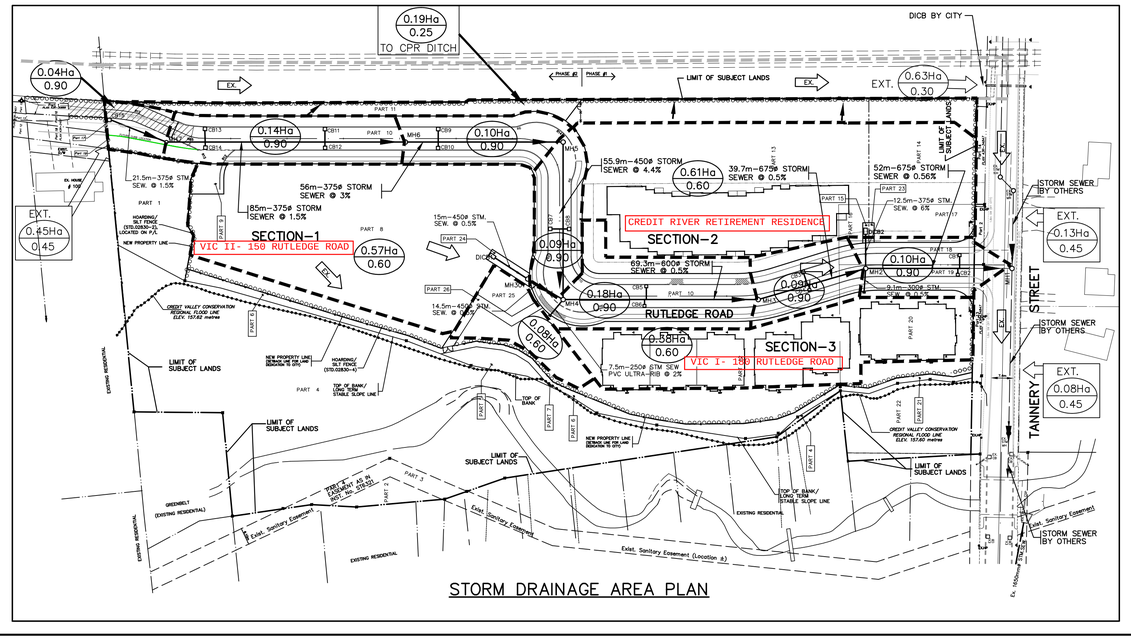


EXTERNAL STORM DRAINAGE AREAS



KEY PLAN N.T.S.

CONSTRUCTION



STORM DRAINAGE AREA PLAN

NOTE

FOR GENERAL NOTES AND LEGEND REFER TO DWG. No. 08014G-1

LEGEND:

- 0.40Ha / 0.60 — DRAINAGE AREA IN HECTARES / RUNOFF COEFFICIENT
- PROPOSED OVERLAND FLOW ROUTE
- EXISTING OVERLAND FLOW ROUTE

No.	Date	By	Description
1	Aug. 25, 15	V.G.	AS-BUILT U/G STORM, SANITARY AND WATERMAIN

REVISIONS

UNAUTHORIZED USE OR REUSE OF THIS DRAWING IS NOT PERMITTED

SUBMISSIONS

1st.	✓	Date	July 18, 12	interim	✓	Date	June 3, 13
2nd.	✓	Date	Oct 16, 12	final	✓	Date	Mar. 14, 14
interim	✓	Date	Apr. 12, 13	final	✓	Date	Apr. 25, 14

Municipality:

CITY OF MISSISSAUGA

REGIONAL MUNICIPALITY OF PEEL

Z39.307

RUTLEDGE ROAD EXTENSION 'MUNICIPAL WORKS'

SP 12/143

KINGS MILL DEVELOPMENT INC.

Title:

EXTERNAL STORM DRAINAGE AREAS & STORM DRAINAGE AREA PLAN

REGISTERED PROFESSIONAL ENGINEER — Aug. 25, 2015 — V. GUPTA — PROVINCE OF ONTARIO

LAND-PRO
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DESIGN BY: V.G.	ELECTRONIC FILE: 08014G7	DATE: APRIL 2012	
DRAWN BY: I.P./B.M.	PROJECT No. 08014	DRAWING No. G-7	
SCALE: HORI. 1:1000			

LAND-PRO
ENGINEERING CONSULTANTS INC.

FEASIBILITY STUDY
FOR MUNICIPAL SERVICING
RUTLEDGE ROAD EXTENSION
'MUNICIPAL WORKS'
56/60 TANNERY STREET
CITY OF MISSISSAUGA

FILE NO 2008-014

Revised November 1, 2012
Revised February 26, 2010
July 14, 2009

LAND-PRO ENGINEERING CONSULTANTS INC.
2601 MATHESON BLVD. EAST
SUITE 206, MISSISSAUGA,
ONTARIO, L4W 5A8
TEL (905) 625-7666
FAX (905) 625-1985

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2.0	SANITARY SEWERAGE SYSTEM	2
3.0	STORM SEWERAGE SYSTEM	2
4.0	WATER DISTRIBUTION SYSTEM	3
5.0	SITE GRADING AND ROADWORKS	4
6.0	CONCLUSION	5

DRAWINGS

DCP-1	DETAILED CONCEPT PLAN	rear pocket
G-3	BELOW GROUND GENERAL PLAN	rear pocket
G-4-A	LOT GRADING PLAN	rear pocket
G-5	EROSION CONTROL PLAN	rear pocket

APPENDICES

APPENDIX-1 REDUCED SANITARY DRAINAGE AREAS PLAN & DESIGN SHEET
APPENDIX-2 REDUCED STORM DRAINAGE AREAS PLAN & DESIGN SHEET
APPENDIX-3 BERM & NOISE FENCE SECTIONS

1.0 INTRODUCTION

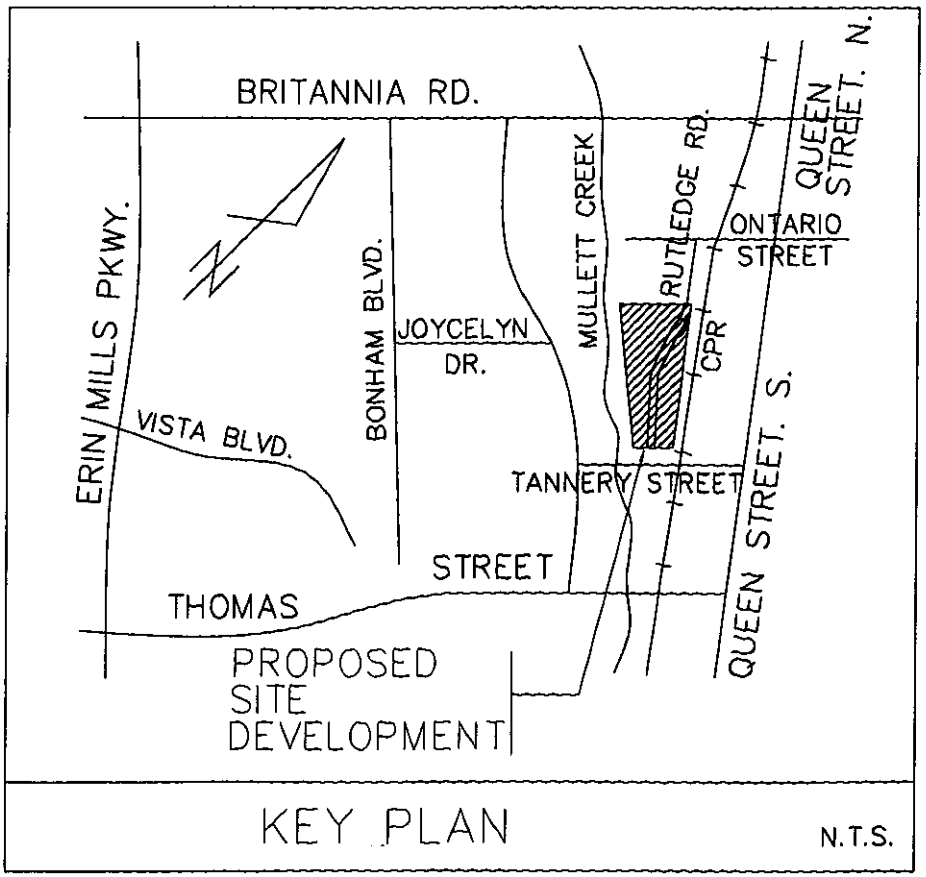
The RUTLEDGE ROAD EXTENSION 'MUNICIPAL WORKS' site is a proposed residential development. It is located on the north side of Tannery Street and west of Queen Street South, in the City of Mississauga, as shown in the Key Plan below.

The proposed development would be in two Phases. Phase-I would consists of a Retirement Residential Building on the east side (Diversicare) and Residential Appartment Buildings at the west side of the property. Phase-II would be a future residential development at the north side of the property (refer to the Detailed Concept Plan DCP-1, rear pocket).

The above noted site is approximately 3.9 hectares in area which extends into the Mullet Creek valley lands and therefore, part of the site shall be deeded to Credit Valley Conservation Authority (CVC)/City of Mississauga, for environmental protection as Open Space. Therefore, the development section of the site shall be approximately 2.6 hectares.

A Municipal Servicing Feasibility report was prepared for this site earlier in 2004 by Land-Pro Engineering Consultants for a different development layout and was found acceptable by the City, CVC and the Region. This report was again revised in 2010 and is now revised in 2012.

Due to the market conditions, the present development proposal has been revised substantially from the 2004 scenario and therefore, this feasibility report has been prepared to address the functioning of the municipal services for the latest scenario.



.....2

2.0 SANITARY SEWERAGE SYSTEM

The proposed site would consists of a present Phase-I development with a 6 storey Retirement Building on the east side, and Appartment Buildings of 56 units on the west side of the property, and a future Phase –II development block on the north side (refer to dwg. DCP-1, rear pocket).

Sanitary sewers are proposed within this site to service the Phase-I and Phase-II developments. Sanitary sewer diameter of 250mm would be adequate to service these developments (refer to the sanitary sewer design sheet, Appendix-1).

Sanitary sewers from this proposed Phase-I and Phase-II site shall drain to the proposed sanitary sewers at Tannery Street which would be constructed by the City of Mississauga in the immediate future.

The Below Ground General Plan G-3 and Reduced Drainage Areas Plan (Appendix-1) indicate the functionality of the sanitary sewerage system.

The sanitary peak flows from the site and the existing pipe capacity are as follows;

The Region of Peel Criteria;

- Maximum sewage flow rate up to 1000 persons 0.013 cu.m/s ,
- Total expected population 874,
- Infiltration allowance of (0.0002/ha + 0.00028/MH) cu.m/s ,
- Total site area 2.6 hectares,

Peak flow from the site upon development = 0.0152 cu.m/s (see design sheet, Appendix-1)
Proposed pipe capacity (250mmΦ @ 1.0%) = 0.0595 cu.m/s

3.0 STORM SEWERAGE SYSTEM

The proposed Rutledge Road Extension shall be connected to the existing Rutledge Road at the north end of this property through a 6 metre paved emergency access, (see dwg. G-3, DCP-1, rear pocket).

Storm sewers shall be placed within this roadway to drain the Phase-I and the Phase-II of the development section to the storm sewers on Tannery Street. However, the backyards of the units backing onto Mullet Creek shall drain overland to the creek as sheet drainage.

The storm sewers from this site shall drain to Mullet Creek through the proposed storm sewer system at Tannery Street which would be constructed by the City of Mississauga in the immediate future.

The Below Ground General Plan G-3 and Rduced Drainage Areas Plan (Appendix-2) indicate the functionality of the storm sewer system.

STORMWATER MANAGEMENT

Aquafor Beech Limited had been retained by the developer of the subject property to prepare a Mullet Creek Erosion Assessment report. This report of February 10, 2009 indicates that an onsite quantity control stormwater management facility would not be required for this site since the impact on the Mullet Creek flows upon development of this infill site, would be insignificant.

SILTATION CONTROLS

An Erosion Control Plan (DWG. No. G-5, rear pocket) has been prepared to identify the erosion and siltation control requirements.

Furthermore, the following principles of silt control features shall be adopted during construction to ensure reasonable stormwater quality, downstream of the proposed development.

a. Protect all exposed surfaces and control all runoff during construction;
b. All erosion control measures to be in place before starting construction and remain in place until restoration/construction is completed;
c. Maintain erosion control measures during construction in good working order;
d. Minimize area disturbed during construction;
e. Protect all catchbasins, manholes and pipes ends from sediment intrusions;
f. Keep all sumps clean during and after construction;
g. Silt fence to be used as specified and as directed by the engineer during construction;
h. Gravel entrance shall be provided wherever equipment leaves the site to prevent mud tracking onto paved surface. Gravel entrance shall be maintained in clean condition.

4.0 WATER DISTRIBUTION SYSTEM

The water distribution system on the Rutledge Road Extension 'Municipal Works' site, shall be connected to the existing 300mm diameter watermain at Tannery Street. The general pressure at Tannery Street is about 70 psi, therefore, a proposed 300mm diameter watermain shall be more than adequate for the present and the future phases of the proposed development.

In reviewing the overall servicing of the general area around the subject site, it is noted that a 150mm diameter watermain exists on Rutledge Road on the north side of the proposed development. The proposed watermain shall be connected to this existing 150mm watermain on Rutledge Road through the 6m wide City lands, on the north side of the development limits, to provide looping of the watermain system. The Below Ground General Plan (see Dwg. No. G-3, rear pocket) indicates the general layout of the proposed watermains.

5.0 SITE GRADING AND ROADWORKS

The Lot Grading Plan and Conceptual Overall Road Gradients (see Dwg. No. G-4-A, rear pocket) have been prepared to indicate that the proposed Rutledge Road Extension 'Municipal Works' development can be graded to provide positive drainage and the major flood routing. A noise berm and fence shall be placed along the east side of the development to address the C.P. Railways concerns. Some sections along the noise berm have been prepared and appended in Appendix-3 as additional details.

The concerns of CVC in respect to the top-of-bank, have also been maintained by establishing the existing top of bank, stable top-of-bank and an additional set-back from the top-of-bank, for conservation. The additional set-back strip of land shall be cleaned up and utilized for grading purposes prior to its dedication for conservation.

Rutledge Road is a 17m Right-of- Way road based on the modified City standard 2211.240 and 2211.270. It has sidewalks on both sides of the pavement for Phase-1 to allow for the seniors walkway system around the retirement home.

6.0 CONCLUSION

The Rutledge Road Extension 'Municipal Works' (Phase-I and Phase-II) proposed by the Kings Mill Development Inc., can be provided with municipal services with little or no constraints.

The preceding sections appended herewith indicate that the proposed municipal services meet with City of Mississauga, Credit Valley Conservation Authority and Region of Peel requirements.

Additionally, as requested by the Region, it is recommended that the watermain on proposed Street 'A" be connected with the existing 150mm watermain on Rutledge Road.

It is also recommended that this report be adopted for detailed design if the City, the Conservation Authority and the Region find the analysis noted herein, acceptable.

Prepared by
Land-Pro Engineering
Consultants Inc.

Baskar Maniccam, P.Eng.

Vijay Gupta, P.Eng.

APPENDICES

APPENDIX 1

REDUCED SANITARY
DRAINAGE AREAS PLAN
& DESIGN SHEET

SANITARY SEWER DESIGN SHEET

Infiltration = (0.0002/Ha + 0.00028/MH) cu.m/s

LOCATION	FROM MH	TO MH	AREA (ha)	DENSITY (ppha)	POPULATION	CUMULATIVE AREA (ha)	CUMULATIVE POPULATION	SEWAGE FLOW 1 (cu.m/s)	INFILTRATION FLOW 2 (cu.m/s)	FOUNDATION DRAIN 3 (cu.m/s)	TOTAL FLOW 1+2+3 (cu.m/s)	LENGTH (m)	PIPE DIA (mm)	GRADIENT (%)	CAPACITY (cu.m/s)	VELOCITY (m/s)	DROP IN MH LOWER (m)
RUTLEDGE ROAD																	
SECTION-1	plug	4A	0.66	475	314	0.66	314	0.0130	0.0004	0	**0.0134**	15.8	250	1	**0.0595**	1.21	0.158
Road section	4A	3A	0.37	0	0	1.03	314	0.0130	0.0008	0	**0.0138**	66.4	250	1	**0.0595**	1.21	0.664
SECTION-2	plug	3A	0.68	475	323	1.71	637	0.0130	0.0006	0	**0.0136**	8.6	250	1	**0.0595**	1.21	0.086
Road section	3A	2A	0.11	0	0	1.82	637	0.0130	0.0015	0	**0.0145**	37.3	250	1	**0.0595**	1.21	0.373
SECTION-3	plug	2A	0.50	475	238	2.32	874	0.0130	0.0007	0	**0.0137**	13.2	250	1	**0.0595**	1.21	0.132
Road section	2A	1A	0.07	0	0	2.39	874	0.0130	0.0022	0	**0.0152**	53.9	250	1	**0.0595**	1.21	0.539
Tannery Rd/Ext. Area	6A		0.30	50	15	0.30	15										
Tannery Road section		1A	0.10	0	0	0.40	15	0.0130	0.0006	0	**0.0136**	36.5	250	2.2	**0.0882**	1.80	0.803
Tannery Road section	1A		0.11	0	0	0.11	0										
External Area			0.22	50	11	0.33	11										
Rutledge Road		7A	2.39	475	874	3.12	900	0.0130	0.0034	0	**0.0164**	71.5	250	1	**0.0595**	1.21	0.715
Tannery Rd/Outfall	7A	181	0.04	0	0	3.16	900	0.0130	0.0034	0	**0.0164**	24.0	250	1	**0.0595**	1.21	0.240

DRAINAGE AREA PLAN No: G-8
CONSULTANT: LAND-PRO ENGINEERING
DEVELOPMENT: RUTLEDGE ROAD EXTENSION AND MULLET CREEK VALLEYLANDS
SHEET: 1 OF 1
PROJ. No: 2008-014
DATE: September 19, 2012

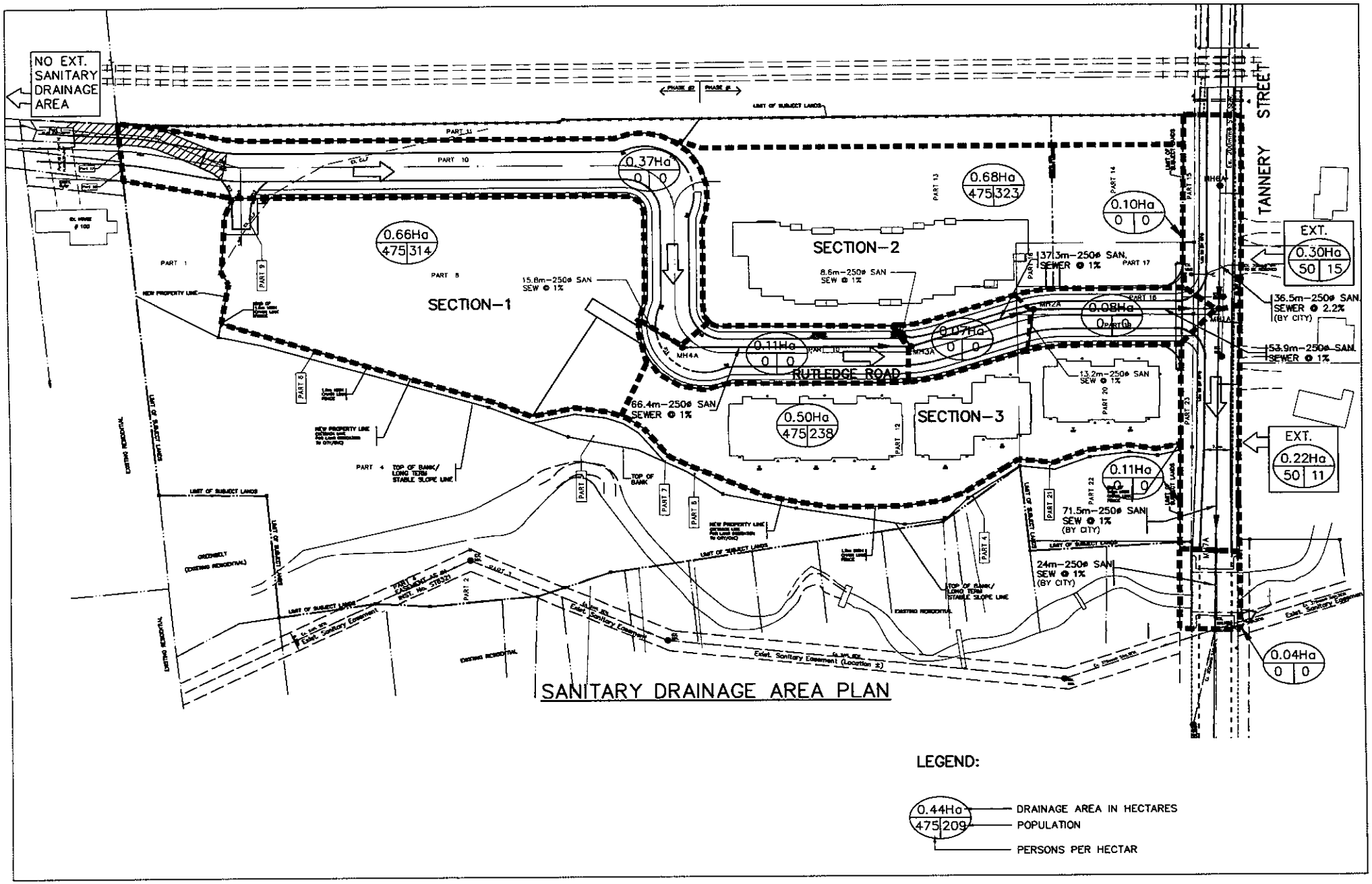
The Regional Municipality of Peel
Department of Public Works

STANDARD DRAWING

Date:

Approved

STD.DWG. 2-5-1

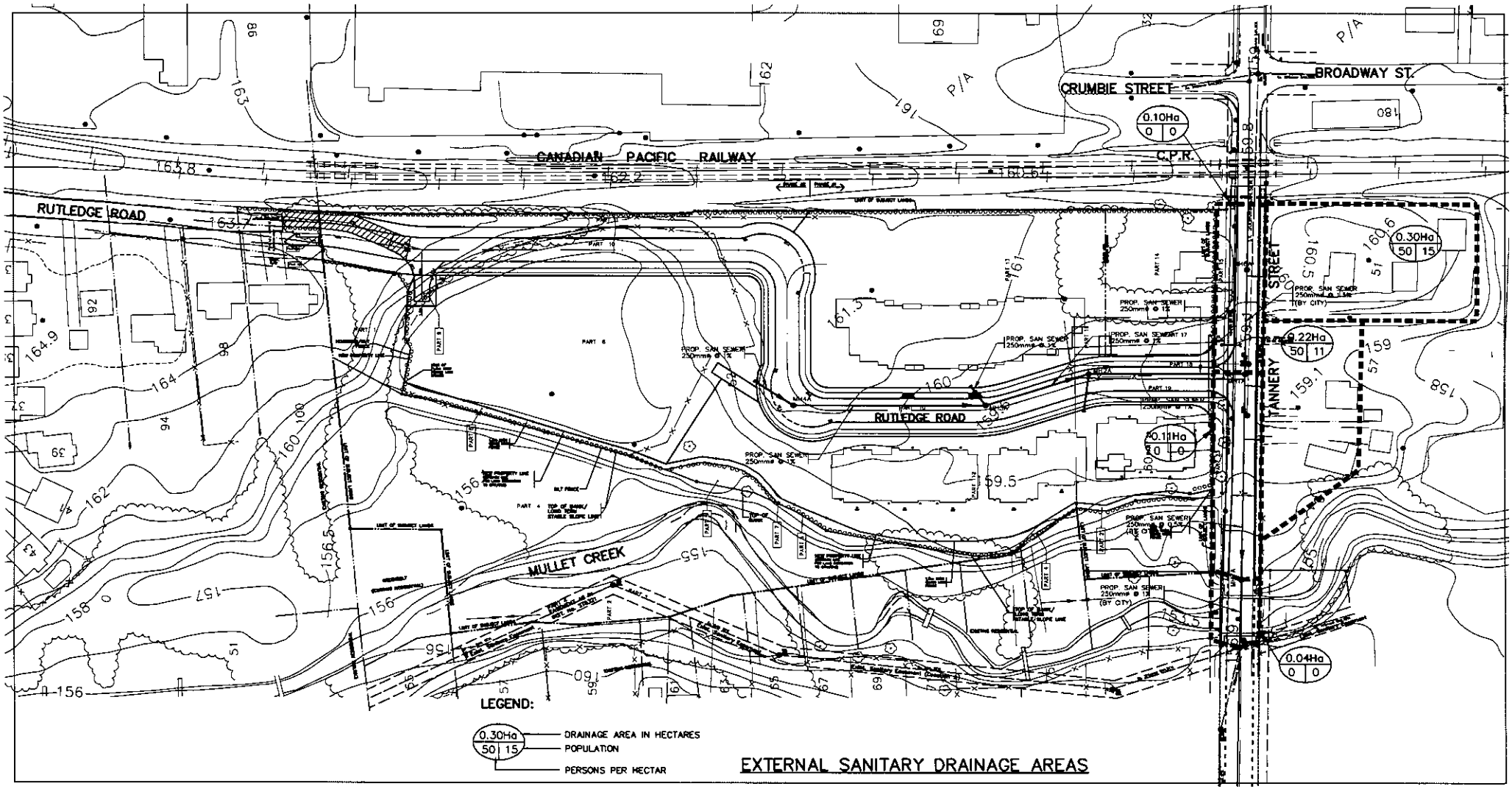


SANITARY DRAINAGE AREA PLAN

LEGEND:

0.44Ha / 475 / 209

- DRAINAGE AREA IN HECTARES
- POPULATION
- PERSONS PER HECTAR



EXTERNAL SANITARY DRAINAGE AREAS

APPENDIX 2

REDUCED STORM
DRAINAGE AREAS PLAN
& DESIGN SHEET

CITY OF MISSISSAUGA

DEVELOPMENT : RUTLEDGE ROAD EXTENSION AND MULLET CREEK VALLEYLANDS

DATE: September 19, 2012

TRANSPORTATION AND WORKS

CONSULTANT : LAND-PRO ENGINEERING CONSULTANTS INC.

SHEET NO. 1 OF 1

STORM DRAINAGE DESIGN CHART

DESIGNED BY BM

CHECKED BY V.G.

I = 1010/(Tc +4.6)^0.78

FOR CIRCULAR DRAINS FLOWING FULL

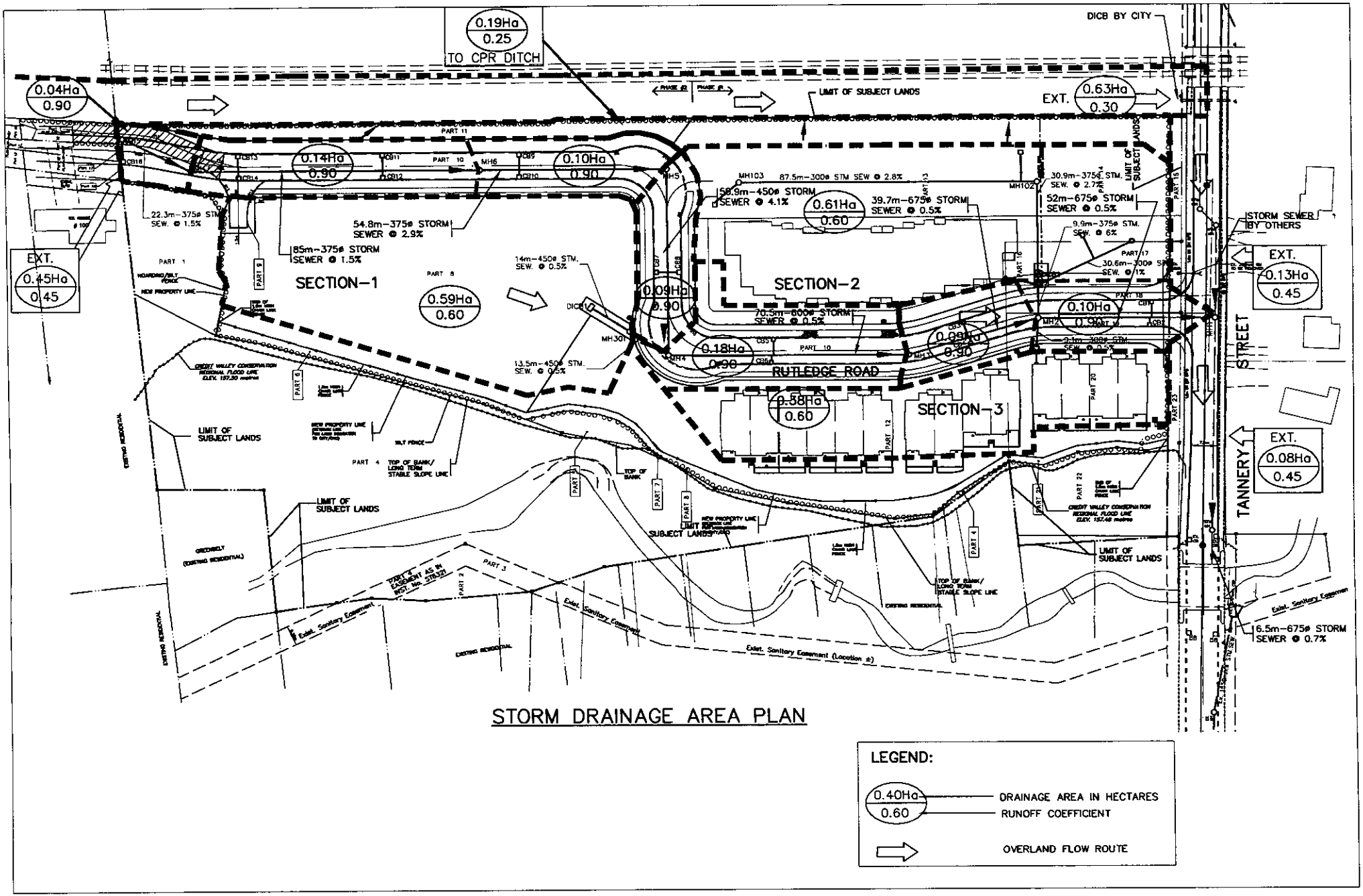
LOCATION OF SITE	FROM UPSTREAM	TO UPSTREAM	ADJACENT CONTRIBUTARY AREA	RUNOFF COEFFICIENT	AREA TIMES RUNOFF COEFFICIENT	ACCUMULATIVE AREA DRAINED BY SECTION	ACCUMULATIVE AREA TIMES RUNOFF COEFFICIENT FOR SECTION	FLOW TIME TO SECTION FROM EXTREME UPSTREAM INLET	INITIAL TIME OF CONCENTRATION AT EXTREME UPSTREAM INLET	TIME OF CONCENTRATION UPSTREAM END OF SECTION	INTENSITY OF RAINFALL (10 yr.)	QUANTITY OF FLOW TO BE ACCOMODATED IN SECTION	TYPE OF PIPE	MANNINGS ROUGHNESS COEFFICIENT	SLOPE	DIAMETER	LENGTH OF SECTION	VELOCITY OF FLOW WITH PIPE FLOWING FULL	CAPACITY OF PIPE FLOWING FULL	PIPE INVERT AT UPSTREAM M.H.	PIPE INVERT AT DOWNSTREAM M.H.	TIME OF FLOW IN SECTION
	MH #	MH #	Aa	Ca	AaxCa	sum Aa	sum AaxCa	TC f	TC i	TC=TCf+TCi	i	Q=iAC/360		n	s	D	r	V	Q			T=L/(Vx60)
			ha		ha			min	min	min	mm/hr	m3/sec			%	mm	m	m/s	m3/sec	m	m	min
EXTERNAL AREA NORTH	MH7	MH6	0.45	0.45	0.203	0.450	**0.203**	1.90														
RUTLEDGE ROAD	CB16	MH7	0.04	0.90	0.036	0.490	**0.239**	1.90	15.0	16.90	92.26	**0.061**	PVC	0.013	1.50	375	22.30	1.94	**0.215**	161.720	161.390	**0.19**
RUTLEDGE ROAD	MH7	MH6	0.14	0.90	0.126	0.590	**0.329**	2.09	15.0	17.09	91.63	**0.084**	PVC	0.013	1.50	375	85.00	1.94	**0.215**	161.380	160.090	**0.73**
RUTLEDGE ROAD	MH6	MH5	0.10	0.90	0.090	0.69	**0.419**	2.82	15.0	17.82	89.30	**0.104**	PVC	0.013	2.90	375	54.80	2.70	**0.299**	160.070	158.470	**0.34**
RUTLEDGE ROAD	MH5	MH4	0.09	0.90	0.081	0.780	**0.500**	3.16	15.0	18.16	88.26	**0.122**	PVC	0.013	4.10	450	55.90	3.63	**0.577**	158.390	156.100	**0.26**
SECTION-1	DICB1	MH301	0.59	0.60	0.354	0.590	**0.354**	0.75	15.0	15.75	96.30	**0.095**	PVC	0.013	0.50	450	14.00	1.27	**0.202**	156.260	156.190	**0.18**
	MH301	MH4	0.00	0.00	0.000	0.590	**0.354**	0.93	15.0	15.93	95.63	**0.094**	PVC	0.013	0.50	450	13.50	1.27	**0.202**	156.170	156.100	**0.18**
RUTLEDGE ROAD	MH4	MH3	0.18	0.90	0.162	1.55	**1.016**	3.41	15.0	18.41	87.49	**0.247**	CON	0.013	0.50	600	70.50	1.54	**0.434**	155.940	155.590	**0.77**
RUTLEDGE ROAD	MH3	MH2	0.09	0.90	0.081	1.640	**1.097**	4.18	15.0	19.18	85.29	**0.260**	CON	0.013	0.50	675	39.70	1.66	**0.594**	155.520	155.320	**0.40**
SECTION-2	DICB2	MH2	0.61	0.60	0.366	0.610	**0.366**	0.00	15.0	15.00	99.17	**0.101**	PVC	0.013	6.00	375	9.90	3.89	**0.429**	156.190	155.600	**0.04**
SECTION-3	PLUG	MH2	0.38	0.60	0.228	0.380	**0.228**	0.00	15.0	15.00	99.17	**0.063**	PVC	0.013	0.50	300	9.10	0.97	**0.068**	155.720	155.670	**0.16**
RUTLEDGE ROAD	MH2	MH1	0.10	0.90	0.090	2.730	**1.781**	4.58	15.0	19.58	84.19	**0.416**	CON	0.013	0.50	675	52.00	1.66	**0.594**	155.300	155.040	**0.52**

PROJECT : RUTLEDGE ROAD EXTENSION AND MULLET CREEK VALLEYLANDS

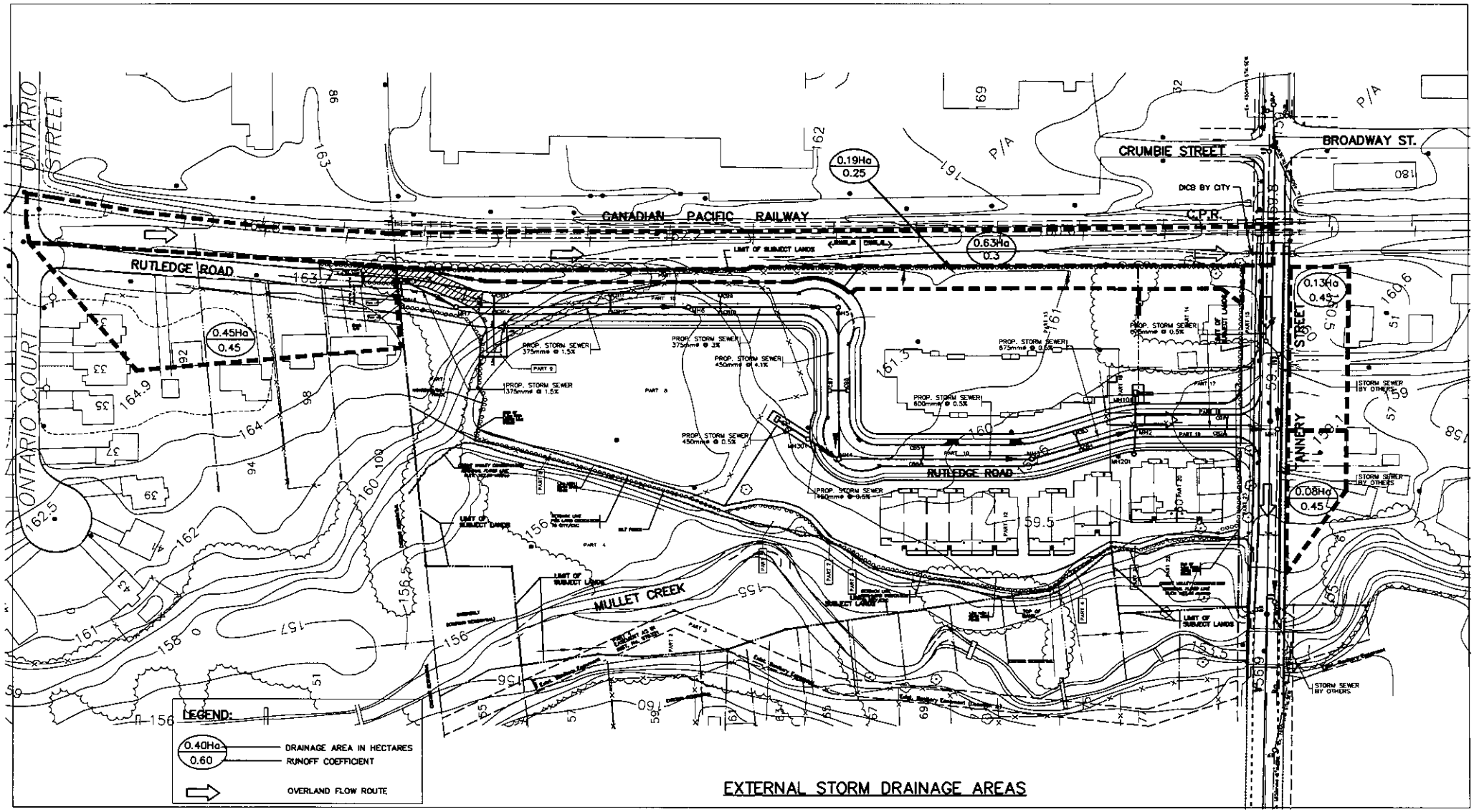
PROJECT No. : 2008-014

Future MH connection (north end) t = 145/(1.27 x 60) = 1.90 min

Tc for DICB1 = 15 + 90/(2 x 60) = 15.75 min



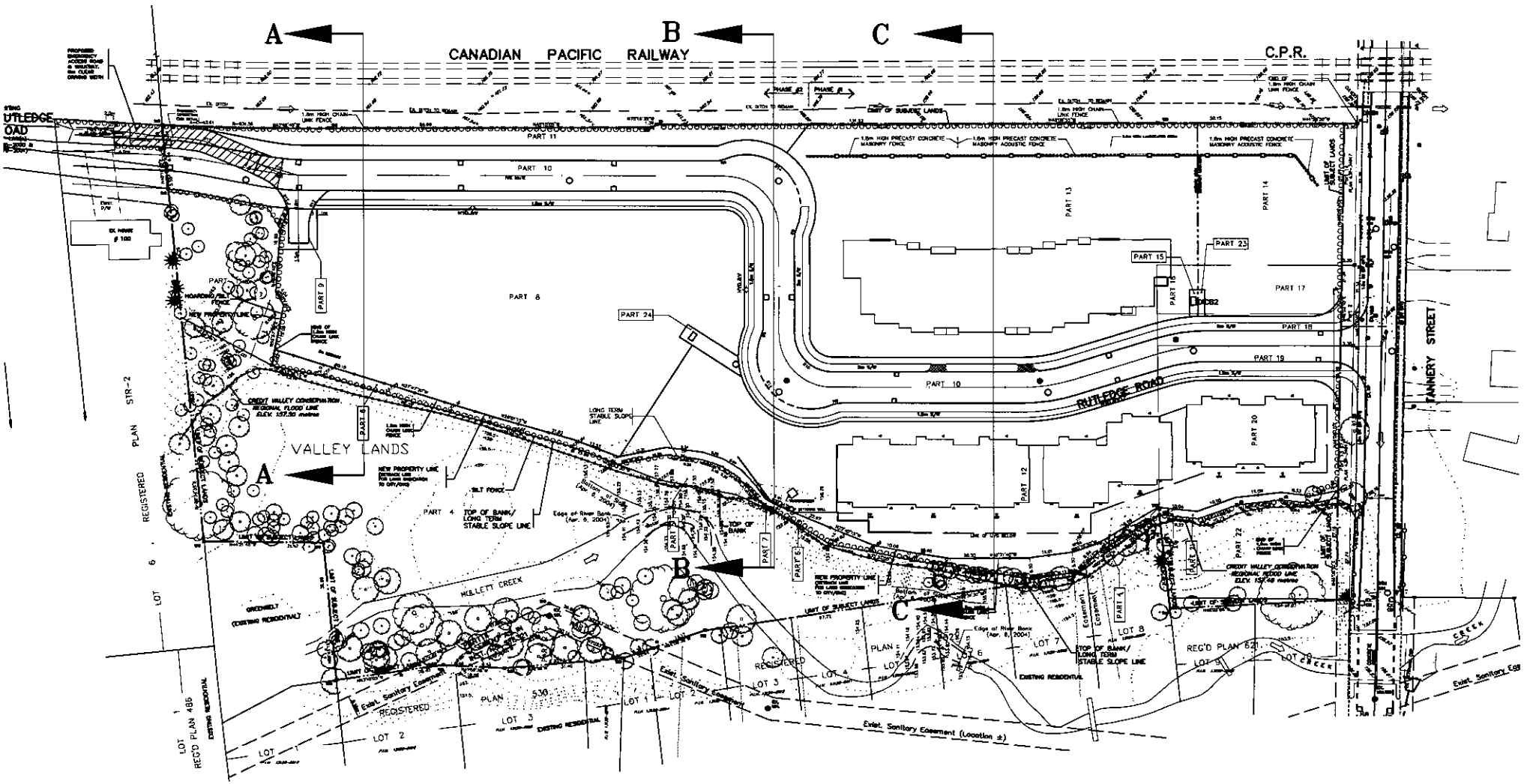
STORM DRAINAGE AREA PLAN

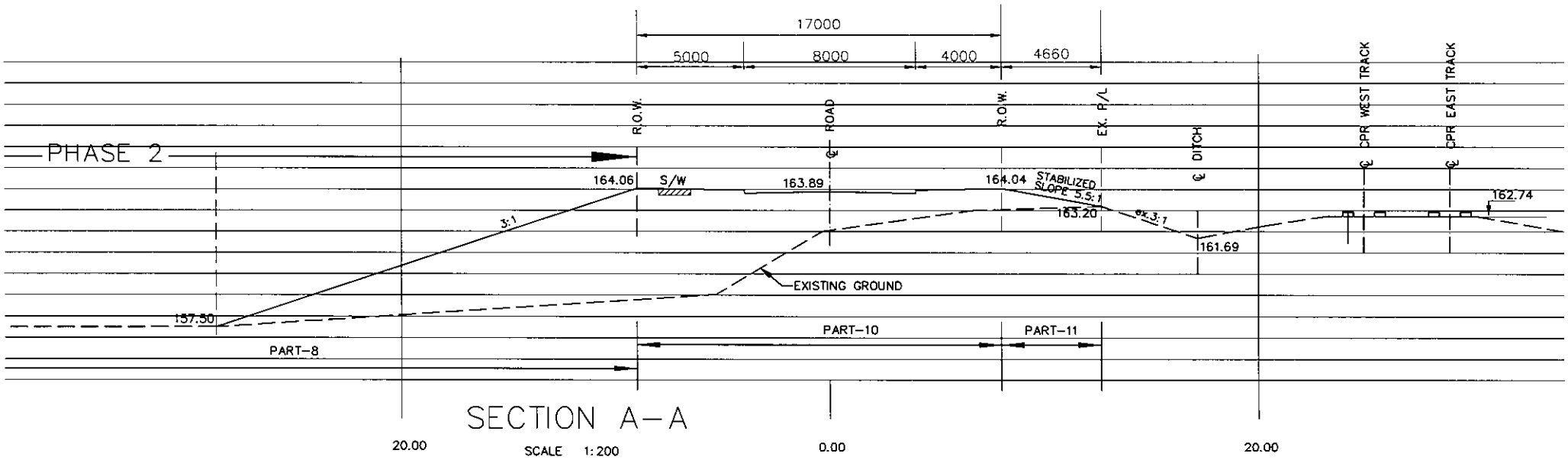


EXTERNAL STORM DRAINAGE AREAS

APPENDIX 3

BERM & NOISE FENCE
SECTIONS


A
B
C
CANADIAN PACIFIC RAILWAY
C.P.R.
RUTLEDGE ROAD
FANNERY STREET
VALLEY LANDS
HOLLETT CREEK
PART 1
PART 2
PART 3
PART 4
PART 5
PART 6
PART 7
PART 8
PART 9
PART 10
PART 11
PART 12
PART 13
PART 14
PART 15
PART 16
PART 17
PART 18
PART 19
PART 20
PART 21
PART 22
PART 23
PART 24
LOT 1
LOT 2
LOT 3
LOT 4
LOT 5
LOT 6
LOT 7
LOT 8
LOT 9
REGISTERED PLAN 530
REG'D PLAN 621
REGISTERED PLAN 486
EXISTING RESIDENTIAL
Exist. Sanitary Easement (Location ±)
SCALE 1:1000



SECTION A–A

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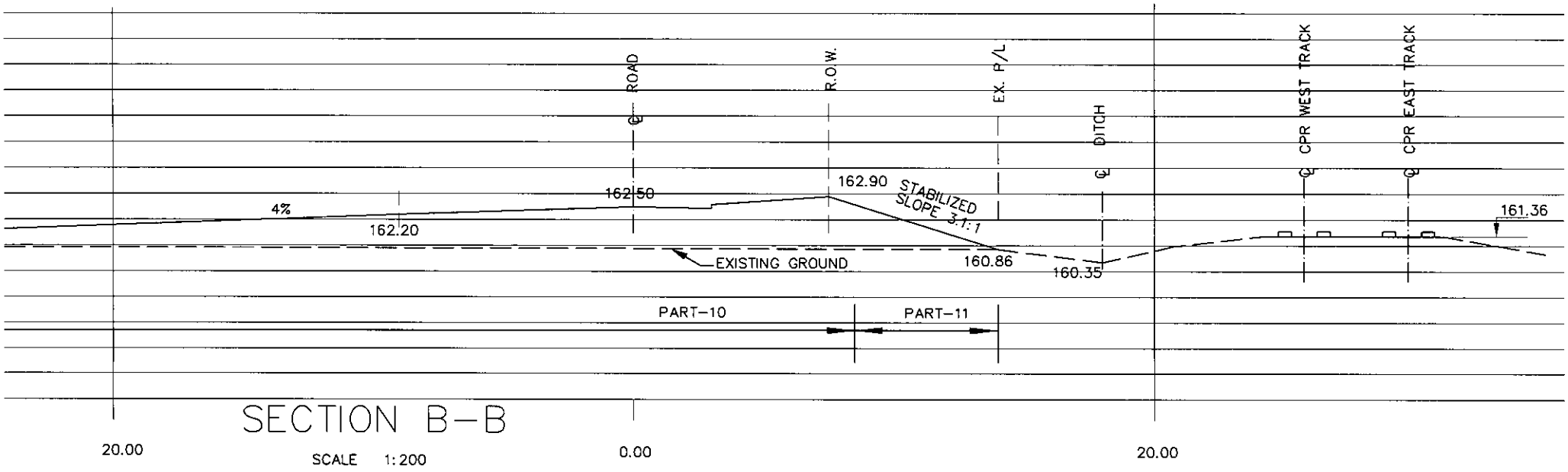

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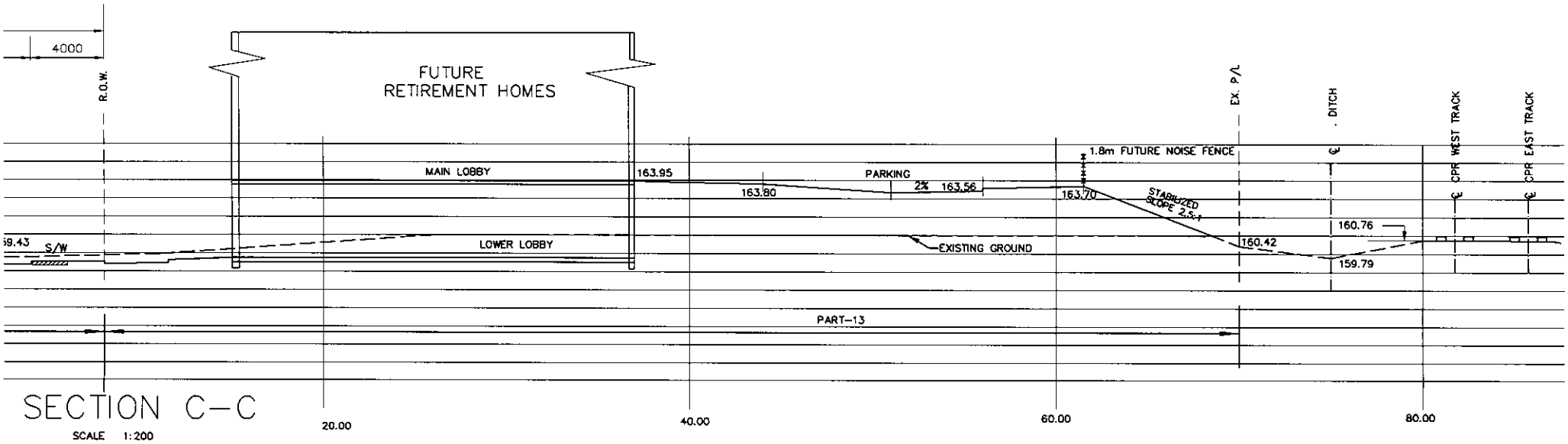

SECTION C–C

SCALE 1:200

KINGSMILL

MULLET CREEK EROSION ASSESSMENT

Report Prepared for:

Forest Green Homes

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Project No.: 64494.10

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1.0_INTRODUCTION

Kingsmill, a 3.84 ha proposed development within the City of Mississauga is situated adjacent to Mullet Creek **(Figure 1)**. Stormwater from the subject property is proposed to be discharged into Mullet Creek through a storm outfall channel upstream of Tannery Street. Whenever runoff is proposed to be directed into a watercourse, then an assessment is required to be completed to determine the effects of this discharge and, wherever appropriate, to recommend mitigation options.

Aquafor Beech Limited was retained by Forest Green Homes in collaboration with LandPro Engineering to conduct an erosion assessment of Mullet Creek in the vicinity of the proposed KINGSMILL. The assessment was completed in two phases:

Phase 1: preliminary assessment to determine if a stormwater management facility would be required on the subject property (see April 2004 correspondence from Aquafor to CVC); (see attached).

Phase 2: conduct a detailed geomorphic assessment of existing channel conditions to identify impact of increasing flows on entrainment and transport of boundary materials; examine nature of storm hydrograph immediately downstream of proposed Kingsmill; where appropriate recommend mitigation options to reduce impact of proposed stormwater outflow.

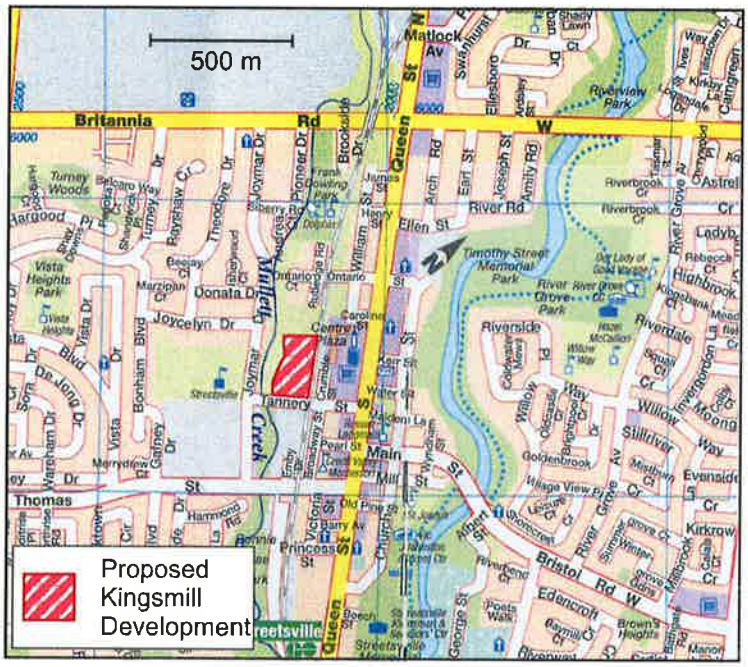

Figure 1. Study Area.

2.0 SCOPE OF WORK

The following tasks were completed as part of this investigation:

- Preliminary site visit and background information review,
- Detailed field investigation to collect data pertaining to cross-sectional shape, substrate and bank materials,
- Detailed geomorphic analyses to identify sensitivities of bank material and substrate and to determine critical flow stresses and velocities required to erode the materials,
- Review storm water plan prepared by Land Pro Engineering,
- Identify storm flows for varying rainfall events,
- Review pipe size, manhole location and storm sewer alignment,
- Review of flow data for the site (i.e., before the Kingsmill development),
- Compare predicted flow events from storm sewer to the Mullet Creek flow regime,
- Determination of effect of flow from storm sewer to erodibility of bank and bed materials and any other geomorphic processes,
- If required, recommend mitigation solutions to reduce impact of additional flows to Mullet Creek,
- Report outlining findings from study which may be submitted to regulatory agencies.

3.0 EXISTING CONDITIONS

Mullet Creek was the subject of a detailed geomorphic assessment as part of the Mullet Creek Rehabilitation Study (Aquafor, 2001). Several years have passed since that investigation was undertaken and hence a unique opportunity is provided to re-assess local site conditions along Mullet Creek, downstream of Tannery Street. For the purpose of this study, both a synoptic and scoped detailed assessment of Mullet Creek, within the study area, was completed.

Upstream of Tannery Street

Adjacent to the proposed Kingsmill development area (i.e., upstream of Tannery Street), Mullet Creek is a meandering watercourse with well defined banks that are well-connected to the adjacent floodplain (**Figure 2**). Vegetation within the floodplain consisted primarily of manicured grasses where residential property boundaries envelope the floodplain, and wooded areas beyond. Within the channel, fine sediment had accumulated in pools and contributed to the embeddedness of riffles. Backwater conditions seemed to exist from Tannery Street to upstream of a small bridge crossing.

Examination of the banks revealed stone lining in several locations (e.g., at small bridge crossing, at toe of slope). Although some erosion was observed leading to an irregular bank line (e.g., which may be due to water level fluctuations and hydration of bank

materials) none of this was considered to be excessive.

Application of rapid assessment tools indicated that the reach upstream of Tannery Street is in a state of transition but was considered to be stable. Key processes occurring within the channel were:

- Accumulation of fine sediment
- Backwater influence
- Minor adjustments of channel width

Tannery Street Crossing

A large medial bar was found under Tannery Street which was also observed during the 1999 field investigation for the Mullet Creek Rehabilitation Study (Aquafor, 2001) (see **Figure 3** – comparison of 1999 and 2005 photos). During both the 2005 and 1999 field visits, the bar was well vegetated and extended both upstream and downstream of the crossing.

Under the crossing, the bar occupied most of the area under the bridge with the exception of a 4 m wide low-flow channel that was present along the west bridge abutment. The bar consisted of gravel and cobble materials that was overlain with a layer of fine sediment **(Figure 3).**

Downstream of Tannery Street

Immediately downstream of Tannery Street, along the west embankment, a 1.8 m diameter storm sewer discharges water into Mullet Creek **(see Figure 4 for site photos).** Coincident with the storm sewer was gabion basket bank and bed protection that encompasses the cross-section of the channel in this location. It is likely that the gabion exerts a low-flow backwater influence extending upstream of Tannery Street which would contribute to the observed accumulation of fine sediment, as described above.

The setting downstream of Tannery Street is markedly different from that which was observed upstream. Here, Mullet Creek is confined within a relatively narrow valley (valley wall ~ 5 m high) with slopes that are well vegetated by trees (some leaning) and shrubs or vegetative cover. The only exception occurs in an area of recent fill placement (note CVC is aware of this issue as part of another file). Indeed, most of the valley wall appeared to consist of fill materials.

There were two bends along the channel, the abrupt nature of these bends and the extensive length of straight channel downstream of the 2nd bend suggests that previous channel modifications have occurred. Erosion was observed along the outside bank of the second meander bend which was expected given its planform position. A narrow floodplain flanked the channel downstream of this second bend.

The channel bed contained a subtle pool-riffle morphology that was not well-developed.

Accumulations of sand and small gravel occurred within the channel as point bars (2nd bend) and lateral bar. Bed materials consisted of gravel and cobble but also of concrete rubble in a sandy matrix. Some large woody debris had accumulated in the channel.

Application of rapid assessment tools indicated that the reach downstream of Tannery Street is in a state of adjustment. Key processes operative within the channel were:

- Aggradation of fine sediment in channel
- Some channel widening

4.0 MULLET CREEK REHABILITATION PLAN

As part of the Mullet Creek Rehabilitation Study (Aquafor 2001), a comprehensive assessment of Mullet Creek was undertaken which encompassed the hydrology, geomorphology, hydrogeology, water quality, aquatic and riparian resources of the channel and watershed. From the Mullet Creek Rehabilitation Plan, the following information regarding this section of Mullet Creek was found:

- The proposed Kingsmill is situated along Reach 6b of Mullet Creek.
- Reach 6 is predominantly alluvial and may be characterized as a Rosgen C type channel.
- Between Bellvue St and Thomas Rd, a large portion of Mullet Creek has been straightened and the floodplain was infilled.
- The dominant process observed during the field investigation for the MCRS was determined to be ENLARGING With some lateral migration.
- The enlargement process is due to previous upstream urbanization.
- Valley wall erosion was observed as a consequence of high flow velocities.
- Restoration works were identified for the medium term to long term (5 – 10 years).

Erosion Downstream of Proposed Kingsmill

Since the intent of the Mullet Creek Rehabilitation Study (Aquafor 2001) was to identify opportunities for, and recommend, restoration strategies, the entire length of the watercourse was walked and all erosion areas were identified. The erosion sites were then ranked to prioritize them for future potential restoration works. The *erosion ranking* method used in the Mullet Creek Rehabilitation Study (Aquafor 2001) combines three weighted indices including:

1. *Erosion Index* - The erosion index employed in the Cooksville Creek Rehabilitation Study (50 %);
2. *Site Activity Index* - An index based on Stream Power (25 %); and,
3. *Potential Change Index* - An index based on channel enlargement and ratio of future to pre development stream power (25 %).

Technical details regarding each index used in the determination of the erosion ranking are provided in **Appendix A**. In summary, the *erosion ranking* was calculated by standardizing the indices such that the *erosion index*, the *activity index* and the *change potential index* were weighted as shown below:

Erosion Ranking = Erosion Index (50 %) + Activity Index (25 %) + Change Potential Index (25 %)

The three indices were added together to yield an erosion ranking value. A maximum score of 100 indicates that the site has the highest erosion hazard. The erosion ranking values for Mullet Creek range from 12 to 87.

The standardized indices for Reach 6b (upstream Thomas St.) and 6a (downstream of Thomas St.) along Mullet Creek were:

	Reach 6b: Upstream Thomas	**Reach 6a: Downstream of Thomas**	**Range**	**Median**
Erosion index	43	30	4 – 50	31
Activity index	5	2	0 – 25	8
Potential change	4.3	4.2	3.7 - 25	7.3
Erosion Ranking	52	36	12 - 87	51

(NOTE: detailed descriptions of each index are provided below)

The *erosion ranking* values for Reach 6b and 6a were slightly above and well below, respectively, of the median value of the erosion ranking for Mullet Creek (51). Values for each of the indices that are used to quantify the erosion ranking were all under the median values for site 6a. For site 6b, all indices except for the erosion index value was under the median value. The erosion index, which is described in detail below, is most affected by the proximity of the erosion site to property within reach 6b. Key factors that are included within the erosion index, and which directly affect erosion at the site, are 'susceptibility to erosion' and 'severity of flows'. Index values for these factors were both < 50% of the maximum potential score value allocated to these categories within the erosion index calculation. Hence, **it is apparent that under existing conditions, the existing and anticipated processes of enlargement and meander development due to increasing flow on reaches 6a and 6b of Mullet Creek is expected to be low to moderate**.

5.0 MULLET CREEK LAND USE AND HYDROLOGY

The Mullet Creek watershed begins within the City of Brampton where it flows through fields, and enters the City of Mississauga which is primarily urbanized. The dominant urban nodes within the Mullet Creek watershed are Streetsville and Meadowvale. Commercial development occurred north of Streetsville in the 1960s and early 1970s. Approximately half of the watershed was developed in the 1980s. Commercial/industrial development occurs primarily between Hwy 401 and Brittannia Rd; Residential development occurs primarily between Eglinton Road and Burnhamthorpe Road. The

Wabukayne and Aquitane tributaries were developed out by the 1990s. By 1999, the entire portion of Mullet Creek was developed within the City of Mississauga urban limits with the exception of some parcels of land. Most of the channelization/relocation works occurred in the early 1970s. (note: all information from 2001 Mullet Creek Rehabilitation Plan)

Modeling of the hydrology along Mullet Creek was completed for the 2001 Rehabilitation Plan **(Table 1).** The proposed Tannery Street development was not included in the scope of that project. Runoff from this site for the 2yr and 25yr return period rainfall events (Chicago storm) were estimated using SWMHYMO with parameters set according to CVC guidelines. The resulting values, 0.5 m^3/s and 1.2 m^3/s respectively, represent approximately 4% of the comparable flow in Mullet Creek (2 yr flow – 15.6 m^3/s, 25 yr flow – 27.4 m^3/s as documented in the 2001 Mullet Creek Rehabilitation Plan report). Since the estimated change in flow regime is small, the above conclusion that the risk of erosion is low in reach 6a and low to moderate in reach 6b in the two reaches below Tannery Street does not change, all other things being equal. Thus, based on this assessment, **a stormwater management facility will not be required within the proposed Kingsmill development. This does not preclude the need for stormwater control and/or erosion protection as discussed in the following section.**

In the proposed study area, it is important to focus not only on erodibility of the boundary materials, but also to examine how discharge from the proposed Kingsmill impacts the local hydrograph. It is possible that the addition of a hydrograph from a stormwater outfall to a storm hydrograph of a receiver like Mullet Creek may be sufficient to alter the entrainment and transport processes of boundary materials. Either the magnitude of the peak of the resulting event hydrograph may be large enough to cause sediment entrainment or the duration of the event, over a critical threshold, may cause entrainment/transport. Since, as shown in Table 1, the increase in creek flows below the culvert is less than five percent, the impact of the cumulative hydrograph on the boundary materials of Mullet Creek is negligible.

Table 1. Overview of site hydrology

	2 year	25 year
Mullet Creek (cms)[1]	15.6	27.4
From Kingsmill (cms)[2]	0.5	1.2
Proportional increase	3%	4%

[1] Mullet Creek Rehabilitation Study (2001)
[2] SWMHYMO (2006)

6.0 DETAILED GEOMORPHIC ASSESSMENT

As outlined above, the purpose of this study is to evaluate the impact of drainage from the proposed residential development on flows within Mullet Creek in the context of determining whether an on-site stormwater management facility is likely to be

recommended and/or what mitigation may need to be done to minimize impact. For this purpose, a scoped field program was created in which detailed cross-section profiles and characterization of bank and substrate material was undertaken at five locations within the study area. This information was compiled and assessed to gain insight into existing geomorphic conditions and to determine sensitivity to erosion. A summary of site characteristics is presented in **Table 1**. These data were used to identify thresholds of erosion for boundary materials and to examine how an increase in flows will affect the erodibility.

As noted above, the setting immediately downstream of Tannery Street has been highly modified including previous channel straightening and realignment. In conjunction with the channel realignment, fill was used to increase the elevation of adjacent table lands, resulting in an entrenched channel condition. Within this corridor, delineation of a 'bankfull' stage was not always possible. Nevertheless, an indication of active flow stage could be identified at some cross-section locations.

The elevation corresponding to the 'bankfull' or channel forming flow was not always apparent during the field investigation due to the nature of the setting. Where there were field indicators (i.e., mainly change in vegetation and lower limit of tree growth on slope) of this stage, completion of geomorphic and hydraulic analyses indicated that the capacity of the 'bankfull' channel was much lower than the modeled 2 year flow (**Table 1**) event which may be expected given the increased frequency of channel forming flows in urban settings. The poor definition of 'bankfull stage' in the field may also reflect the dynamic nature of urban runoff.

6.1 Bed Materials

Thresholds for substrate material entrainment and transport were quantified based on pebble count data collected at each cross-section (**Table 2**). Review of existing conditions revealed that the D50 of channel bed material may begin to move during the 'bankfull flow' but would not be actively transported (note: this is based on the best estimate of 'bankfull' flow given the limited field indicators available). The D84 of the channel bed would remain immobile during this flow.

Under the 'worst case scenario' where the flow of Kingsmill would be added to the 'bankful' rather than the 2 year flow, then an increase in bed material mobility would be expected. Comparison of the shear stress exerted on the channel bed under existing and proposed conditions was completed following the methodology provided by Johnson, Gleason, and Hey (1999). Results suggest that more of the D50 particles may begin to move under the proposed flow conditions but these particles would not be fully in motion (i.e., bed is only partly in motion); the amount of movement varies spatially. The D84 particles of the channel bed would remain immobile under the 'worst case scenario'.

Evaluation of the flow velocities associated with the bankfull flows and future augmented flows **(Tables 2 and 3)** reveals that the flow velocity is slightly below the threshold for transport of the D50 grain size. This result, in conjunction with the shear stress analyses

suggests that while some movement of substrate materials occurs under existing conditions, this is primarily limited to bedload (i.e., the velocity is not competent enough to transport the D50 within the water column). This condition essentially does not change under the proposed flow regime.

In summary, the increase in flow due to contributions by Kingsmill would be expected to contribute to flushing of fine sediment and some movement of the D50. Neither of these processes is considered to be detrimental. Indeed, given the volume of fine sediment that was observed within the watercourse (which may be from road wash), flushing of the sediment may be beneficial from an aquatic habitat perspective. Further, it is important to note that the analyses completed here were under the 'worst case scenario'. In actual fact, the peak flow from Kingsmill is likely to pass through Mullet Creek prior to the hydrograph peak from the upstream drainage area. This would reduce the effect of increasing flows on substrate material mobility and would also reduce the flushing effect.

Table 2. Summary of Mullet Creek Site Characteristics

Variable	**Dimension**	**Hydraulic parameters**	**Value**
Average grade (%)	0.60	Average bankfull flow (cms)	5.04
Width (m)	5.14	Average bankfull flow velocity (m/s)	0.91
Avg. depth (m)	0.27	Average boundary shear (N/m^2)	33.97
Max. depth (m)	0.38	Boundary shear with increase in flows (N/m^2)	34.91
Cross-section area (m^2)	1.233		
Wetted width (m)	4.12		
Wetted depth (m)	0.1		
Substrate (cm) D84 D50 D16	 8.5 4 2		
Bank materials	Silty clay Other areas: fill with sandy gravelly content		

Table 3. Results from Analyses for Bed Material Entrainment and Transport.

Parameter	Value
Critical shear (N/m^2)	
D84	61.88
D50	29.12
Bank material	
Critical transport velocity (m/s):	
D84	1.53
D50	1.08
Fine sand	0.75
Shear Ratio at bankfull (existing)	
D50	1.16 (some movement on bed)
D84	0.55 (immobile on bed)
Shear Ratio (future = bankfull + 0.5 cms)	
D50	1.20 (some movement on bed)
D84	0.56 (immobile on bed)
Flow velocity at future flow (m/s)	0.94

Note: Shear Ratios of >1 = some particles begin to move; > 2 = most of bed in motion; >3 entire bed in motion (Johnson, Gleason, Hey, 1999)

6.2 Bank Materials

In addition to examining the potential for bed material movement, it is perhaps more important to examine the potential for increased bank erosion under the proposed flow conditions. Bank erosion is considered to be important since the channel downstream of Tannery Street is confined within a corridor which is flanked by private properties and existing erosion concerns. The erosion assessment that was undertaken for the study area acknowledges that existing processes are operative and seeks to determine whether the additional flow from Kingsmill would aggravate these processes, leading to exacerbated erosion conditions.

Thresholds for bank erosion require consideration of a range of techniques and considerations including a field evaluation of soil materials. Field testing of the channel bank materials was conducted through soil consistency tests, penetrometer and torvane readings as well as field characterization. Through these field based analyses, it was determined that most channel banks consisted of a cohesive silty clay loam or clay loam. This characterization and measurement of a plasticity index of 14.8 suggests that the bank materials are a cohesive and clayey (fine-grained soil) that is typically erosion resistant. Application of penetrometer and torvane apparatus confirm that the material is cohesive and displays resistance to erosion.

In addition to considering the shear velocity conditions within the channel which will be discussed momentarily, it is important to identify the erosion processes that would induce erosion. Cohesive materials are influenced by hydration processes in which the chemical bonds between clay and silt particles are weakened due to the absorption of water by the materials. Thus, the longer that a cohesive material is in contact with water, the more

likely that the surface layer of the material (e.g., bank face) will begin to erode. From a water management perspective then, reducing the amount of time that water remains in the channel is beneficial so that the time for hydration processes is reduced.

Permissible velocities associated with erosion of typical soils having similar characteristics as those found in the field were quantified in reference to established tables of thresholds for varying soil materials (Fischenich, 2001; FISRWG, 1998; PADEP, 1996) (**Table 4**). Comparison of flow velocities associated with the bankfull flow under existing conditions reveals that they are close to or below the threshold of bank material erosion as represented in **Table 4**. It is important to note that the thresholds do not account for vegetative influences and hence the actual permissible velocity would be higher than reported in **Table 4**. Under the proposed flow condition, the flow velocity increases marginally compared to existing conditions (**Tables 2 and 3**). This increase enables flows to remain under thresholds established by Fischenich (2001) and is slightly more than that by PADEP (1996). As such, any increase in erosion potential from the proposed flow condition is expected to be marginal.

Table 4. Bank Material Erosion Assessment

Bank Materials	Silty clay, fill (sandy, gravelly, concrete blocks)
Vegetation	Variable shrub, herbaceous, trees; root protection is variable along lower bank
Field Characterization	Silty clay loam or clay loam Plasticity index: 14.80
Critical shear velocity (m/s) (Fischenich, 2001; does not account for rooting strength): Firm loam Alluvial silt	 0.762 – 1.07 m/s 1.14 m/s
Recommended maximum permissible velocity for sparse vegetation cover (e.g., due to shade, soil or climate) (PADEP, 1996)	0.91 m/s

6.3 Overview of Erosion Assessment

The erosion assessment for this investigation was conducted in two parts to enable examination of both bank and bed material erodibility. Analyses were completed for the bankfull flow event since it is at this flow stage that most impact can be detected. That is, an increase in flow at bankfull stage is typically proportionally higher than at larger flows (e.g., 25 year). Typically, any increase in higher flows does not cause as much of an increase in boundary shear stresses than when smaller flows such as the bankfull are increased. Furthermore, the low flows occur more frequently and therefore require more attention.

Results have shown that under existing conditions, for the bankfull flow event, the finer sediment on the channel bed (e.g., D50 and smaller) may be subject to some movement as bedload; larger particles (D84) are considered to be immobile. Entrainment and transport of sand sized sediment occurs. Under the proposed flow conditions in which 0.500 cms would be discharged into Mullet Creek for the 2 year flow event, bed material mobility can be expected to increase somewhat for the D50 and smaller materials, but would not affect the larger materials.

Examination of bank material erodibility revealed that, under existing conditions, flow conditions are in proximity to erosion thresholds presented in published tables. Alteration of flow conditions due to Kingsmill will increase existing flow velocities slightly but are not expected to aggravate existing erosion processes. Given existing bank erosion that was observed at the second bend that is downstream of Tannery Street, it is recommended that these impacts be mitigated as much as possible through the use of stormwater source and conveyance controls.

7.0 MITIGATION RECOMMENDATIONS FOR PROPOSED STORMWATER INLET

Whenever additional water is discharged into a watercourse, some impact may be expected. Results of the erosion assessment that has been completed for this study have demonstrated that the proposed discharge from the proposed Kingsmill would be expected to contribute to a slight increase in bed mobility and sand transport in the adjacent downstream channel. While the impact from the proposed flows is not considered excessive, it is nevertheless prudent to incorporate some stormwater source and/or conveyance controls to minimize impacts to the creek as much as possible. To this end, several recommendations are made below that would reduce impact of the stormwater discharge from the proposed Kingsmill to Mullet Creek and adjacent downstream watercourse.

1. Source/Conveyance Controls

Additional erosion protection may be achieved by delaying the volume of stormwater discharge to Mullet Creek by ensuring that the down spouts are disconnected from the storm sewer system and that flow occurs over vegetated surfaces, creating depression storage wherever possible, and minimizing the amount of impervious surface connected to each catch basin. Credit Valley Conservation Authority has also recommended that consideration be given to the following:

- enhance infiltration on-site (e.g., soak away pit, infiltration trench);
- enabling overland flow from the property into the valley through lot grading (i.e., enable flow attenuation on the grass on the valley slope and valley bottom, thereby allowing for some infiltration);

One common practice for source control, especially on private property, is to install an appropriately sized underground storage tank on-site with appropriate controls (e.g., 25 mm, 48 hr). Such storage would reduce the rate of stormwater flow from entering Mullet Creek. Incorporating such a storage tank was determined to be infeasible for the study area as determined by Land Pro Engineering.

A second practice that may be useful on this site is the construction of a bulkhead in the manhole at the upstream end of the pipe discharging to the Creek. This practice is sometimes referred to as "inlet control". There are a few different elements to this practice, namely;

- a sump at the bottom of the manhole to act as a "plunge pool" to dissipate flow energy
- a bulkhead controlling the discharge (acting as a sharp crested weir) from the manhole that would "store" stormwater in the manhole and upstream pipe before overtopping the weir, further reducing flow energy.
- a drain in the bulkhead to allow the stormwater pipes (upstream and downstream) to drain between storm events.

Since this manhole is accessible and the contributing area is small, maintenance of the "inlet control" should not be a problem. Aquafor has provided details of such construction to LandPro.

2. Location of Proposed Outfall and Stormwater Drainage Channel

The vicinity and alignment of the proposed stormwater outfall and drainage channel looks appropriate. The location is upstream of the Tannery St crossing of Mullet Creek, as illustrated in **Figure 5.**

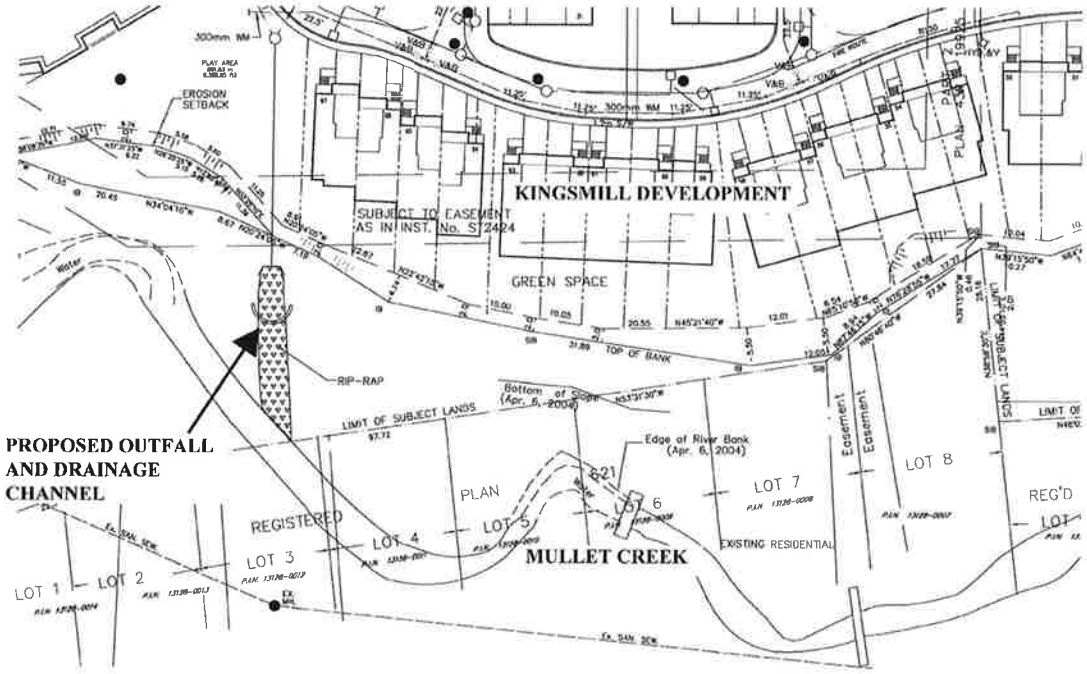

Figure 5. Proposed location and alignment of storm outfall from Kingsmill.

The outlet design is set back from the Creek at the edge of the floodplain, in order to provide necessary energy dissipation prior to entering Mullet Creek. The energy dissipation at the storm outlet should be provided by creating a scour pool at the upstream end of the stormwater channel, with the flow leaving the scour pool as shallow and broad as possible. The relatively flat, wooded floodplain and low channel banks are ideal to keep the gradient of the stormwater channel low, approaching zero as it approaches the confluence. This will create a backwater effect in the stormwater channel, and will cause a bar to form across the mouth, which in turn will reduce the primary flow into the opposite bank. The planform alignment is set to be oblique to the main channel so that the angle formed at the confluence will be between 33 to 45 degrees.

A secondary field investigation was recently undertaken to assess the existing geomorphic conditions of Mullet Creek in the area of the proposed confluence with the drainage channel and Mullet Creek, with representative photos presented in **Figure 6**. Within the vicinity of the proposed confluence, Mullet Creek has good access to the floodplain, with a stable riffle feature to tie into. Representative channel measurements of the riffle characterized the channel at 4.6m : 0.75m (W:D). This high width to depth ratio will help protect the opposite bank, and should not likely need artificial protection. The floodplain where the stormwater channel is proposed is well vegetated, with intermediate aged trees spaced approximately 5m apart. Any trees affected by the stormwater channel will be replaced at a minimum of 3:1, however, the proposed channel alignment will likely affect less than 10 trees.

Looking at Mullet Creek right bank and floodplain where stormwater outfall and channel are proposed.

Looking upstream where Mullet Creek impinges upon the valley toe.

Looking downstream the proposed confluence at stable riffle feature.

identifying downstream manicured section within residential properties upstream of Tannery St.

Figure 6. Site photos identifying specific conditions within the vicinity of the proposed stormwater outfall and channel.

Mullet Creek impinges upon the valley toe approximately 13m upstream of the proposed outfall location at a relatively sharp bend. In cases where the apex of a bend is in contact with a valley slope, downvalley migration of the bend will often become the dominant mode of planform adjustment. The 13m spacing is likely appropriate based upon the erosion index in the area, and the increased strength of the bank material provided by the

binding strength of the mature vegetation between the bend and the outfall. It is recommended any vegetation restoration be strategically placed to ensure stability of the bank and floodplain connecting the bend to the outfall. Presently, a small drainage feature is conveying overland flow from the tablelands into Mullet Creek in the vicinity of the proposed channel.

Downstream of the wooded floodplain area, existing residential lots envelop Mullet Creek and floodplain for approximately 100 metres upstream of Tannery Street. Within this section there are 4 private pedestrian crossings, and intermittent areas of bank hardening, consisting primarily of rip-rap.

The section of Mullet Creek is classified within the Cooperative Management Planning Initiative for the Credit River Fishery (2002) as a mixed cool / warmwater community. Further, it notes that small warmwater communities best represent species favourable to Mullet Creek, where dominant species include creek chub and blacknose dace. Consultation with Aquafor's fisheries biologist indicated a warmwater construction window between June 30 to March 30 would likely be most beneficial to the aquatic community.

4. Monitoring

The proposed construction of Kingsmill will result in some increase in flows within Mullet Creek and, while attempts will be made to minimize this impact, Credit Valley Conservation has suggested that some monitoring should occur to evaluate the impact. That is, the monitoring is intended to confirm results from this study and evaluate whether flows from the proposed development compromise natural erosion rates and sediment transport in the area downstream of the stormwater outfall. To this end, the following monitoring program is recommended:

Install and monitor erosion pins in several locations downstream of the outfall. Installation and preliminary monitoring should occur prior to construction of the development to enable baseline data collection. It is recommended that the erosion pins be monitored on an annual basis.

Examination of bed material characteristics is also recommended to be undertaken in the riffle section that is immediately downstream of the proposed outfall. The work would include general characterization of sediment size (100 pebbles), embedding and imbrication of a riffle feature. This characterization could occur on an annual basis. Interpretation of results will need to consider seasonal effects and variability associated with technique.

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APPENDIX

Photo A - Manicured lawns to water's edge and low banks are a common feature of Mullett Creek in this area. Backwater influence extends upstream of this crossing.

Photo B. The channel meanders through its floodplain, to which it is well-connected.

Photo C. Some banks have been hardened with stone.

Figure 2. Photographs of Mullett Creek upstream of Tannery Street.

Photo A - Bar feature viewed from approximately 10 m downstream of bridge.

Photo B. Vantage approximately 15 m downstream of bridge. The vegetated bar has increased in length.

Photo C. Steep embankment on the right (east) bank, approximately 100 m downstream of Tannery Street.

Figure 3a. Photographs of Mullett Creek downstream of Tannery Street, 1996 and 2005

Aquafor Beech

Photo A - View upstream toward left (west) bank. Low flow channel at left of photo against west bridge abutment.

Photo B. View upstream toward right (east) bank. A large bar is exposed along the right side, consisting of gravels that are covered with a veneer or silty clay. This bar has increased in extent since 1996.

Photo C. View downstream along low flow channel (right of photo). Bar is visible at left.

Figure 3b. Photographs of Mullett Creek at the Tannery Street bridge.

Aquafor Beech

Photo A - Stormwater outfall downstream of Tannery Street.

Photo B - Gabion structure downstream of stormwater outfall extends along channel bed and induces a backwater effect.

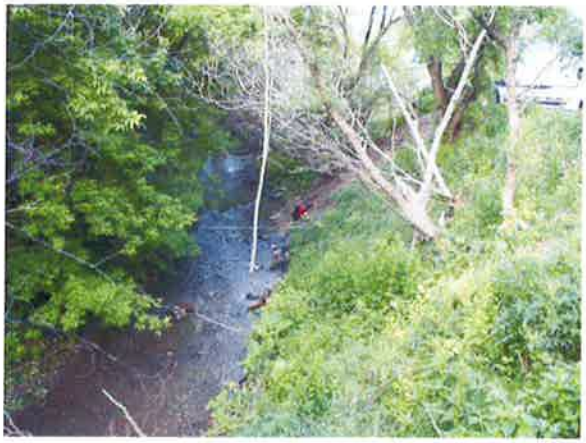

Photo C. Confined channel setting downstream of Tannery Street.

Photo D. Narrow floodplain evident in the vicinity of the second channel bend downstream of Tannery Street.

Photo E. Rubble and other debris observed on the channel bed and banks.

Photo F. A wooded riparian zone contributes some large woody debris.

Figure 4. Photographs of Mullett Creek downstream of the Tannery Street bridge.

Aquator Beech

Aquafor Beech Limited

TRANSMITTAL

Date: April 4, 2005

To: Jeff Wong, CVC

RE: Tannery Village outlet to Mullet Creek

From: Mark Hartley P.Eng. and Mariëtte Prent, M.Sc.

As previously discussed, we have reviewed findings from the Mullet Creek Rehabilitation Study (Aquafor, 2001) for the section of Mullet Creek that is in vicinity of the proposed Tannery Village. We have also completed preliminary analyses to evaluate the impact of drainage from the proposed residential development on flows within Mullet Creek in the context of determining whether an on-site stormwater management facility is likely to be recommended.

As part of the Mullet Creek Rehabilitation Study (Aquafor 2001), the entire length of the watercourse was walked and all erosion areas were identified. The erosion sites were then ranked to prioritize them for future potential restoration works. The *erosion ranking* method used in the Mullet Creek Rehabilitation Study (Aquafor 2001) combines three weighted indices including:

1. *Erosion Index* - The erosion index employed in the Cooksville Creek Rehabilitation Study (50 %);
2. *Site Activity Index* - An index based on Stream Power (25 %); and,
3. *Potential Change Index* - An index based on channel enlargement and ratio of future to pre development stream power (25 %).

Technical details regarding each index used in the determination of the erosion ranking are provided in the last section of this document. In summary, the *erosion ranking* was calculated by standardizing the indices such that the *erosion index*, the *activity index* and the *change potential index* were weighted as shown below:

Erosion Ranking = Erosion Index (50 %) + Activity Index (25 %) + Change Potential Index (25 %)

The three indices were added together to yield an erosion ranking value. A maximum score of 100 indicates that the site has the highest erosion hazard. The erosion ranking values for Mullet Creek range from 12 to 87.

Aquafor Beech Limited

Results for Study Area

The standardized indices for Reach 6b (Tannery to Thomas St.) and 6a (downstream of Thomas St.) along Mullet Creek were:

	6b	6a	Range	Median
Erosion index	43	30	4 – 50	31
Activity index	5	2	0 – 25	8
Potential change	4.3	4.2	3.7 - 25	7.3
Erosion Ranking	52	36	12 - 87	51

(NOTE: detailed descriptions of each index are provided below)

The *erosion ranking* values for Reach 6b and 6a were slightly above and well below, respectively, of the median value of the erosion ranking for Mullet Creek (51). Values for each of the indices that are used to quantify the erosion ranking were all under the median values for site 6a. For site 6b, all indices except for the erosion index value was under the median value. The erosion index, which is described in detail below, is most affected by the proximity of the erosion site to property within reach 6b. Key factors that are included within the erosion index, and which directly affect erosion at the site, include 'susceptibility to erosion' and 'severity of flows'. Index values for these factors were both < 50% of the maximum potential score value allocated to these categories within the erosion index calculation. Hence, it is apparent that under existing conditions, the existing and anticipated processes of enlargement and meander development due to increasing flow on reaches 6a and 6b of Mullet Creek is expected to be low to moderate.

The proposed Tannery Street development was not included in the scope of the 2001 Rehabilitation Plan. Runoff from this site for the 2yr and 25yr return period rainfall events (Chicago storm) were estimated using SWMHYMO with parameters set according to CVC guidelines. The resulting values, 0.5 m^3/s and 1.2 m^3/s respectively, represent approximately 4% of the comparable flow in Mullet Creek (2yr flow – 15.6 m^3/s, 25yr flow – 27.4 m^3/s). Since the estimated change in flow regime is small, the above conclusion that the risk of erosion is low in reach 6a and low to moderate in reach 6b in the two reaches below Tannery Street does not change, all other things being equal.

Based on the preliminary assessment, it is unlikely that a stormwater management facility will be required within the proposed Tannery Village development. Additional erosion protection may be achieved by constructing a stormwater inflow channel transition. Sediment has been accumulating on the same side of the Tannery Street culvert as the location of the proposed stormwater outfall. This accumulated sediment could be re-graded to work in conjunction with the transition to further reduce any potential impacts of the outfall on Mullet Creek. These, and other options, will be identified upon completion of the detailed geomorphic assessment for this site which will be completed once site conditions are suitable for field investigations.

Aquafor Beech Limited

Detailed Description of Erosion Ranking Methodology

The *erosion index* used was initially developed by L. Benson, P.Eng. of the Ganaraska Region Conservation Authority and modified for application on the Cooksville Creek Rehabilitation Study by Environmental Water Resources Group. The index considers the risk of erosion and significance of erosion. The risk of erosion component of the index is a function of the severity of erosive flows, the susceptibility of boundary to erosion and proximity to property. The significance of erosion component of the index is a function of the number of people at risk, the resource type being impacted and the extent of damage. The weighting of each factor is shown in Table 5.4 of the 2001 report. The erosion index ranges from low (e.g. 4) to high (e.g. 50) site severity (for comparison: Reach 6b=43; 6a=30).

The erosion index was calculated using data collected from the 157 erosion sites inventoried in the field. Since there were only sixteen management reaches in the Mullet Creek watershed, multiple sites were chosen within any given reach. Consequently, the average and maximum values were calculated for each reach. The erosion index was the sum of the average and maximum stream power for the sites contained within each reach. Inclusion of the maximum value in the index ensured that reaches with an extremely high erosion score were not under represented.

The *site activity index* was added to ensure that sites with the greatest ability to affect rapid morphological changes were adequately represented. The index was based on the amount of stream power per unit channel width. This quantity has been shown to be related to the amount of activity in the channel, the form of the channel and the potential mitigative solutions required (Brooks, 1996). The unit stream power was calculated for the two year return period future controlled flow conditions (e.g. M.O.E. stormwater management in new developments but no retrofitting) using HEC-RAS. The site activity index ranking for reach was the sum of the median and maximum stream power for the sites contained within each reach. Inclusion of the maximum value in the index ensures that reaches with an extremely active site were not under represented.

The *potential change index* was added to ensure that the dynamic nature of the river was taken into consideration. Areas that have experienced, or will experience, a significant change in the supply of water and sediment must be given greater consideration. The potential change index is the average of the channel enlargement ratio and the increase in stream power. The channel enlargement ratio was derived in the watershed analysis using sediment transport modeling. The enlargement ratio indicates the predicted increase in channel cross section from pre-development conditions to future controlled conditions. The increase in stream power was derived in the reach-specific analysis. The unit stream power was calculated for the two year return period for future controlled and pre-development flow conditions. The increase in stream power was represented by:

Future Unit Stream Power (2 year return period flow)
Pre Development Unit Stream Power (2 year return period flow)

The potential change index was represented by:

$$\frac{\text{Enlargement Ratio + Increase in Stream Power}}{2}$$

This notational index ranged from 3.7 to 25 and generally identified areas that have low to high increases in stream energy (For comparison: Reach 6b=4.3; 6a=4.2). This increase in energy represents the potential for change. The degree of response at each site depended on the resistance of the channel and time since the flow increases were experienced. The amount of cross-sectional change generally occurs relatively quickly (e.g. years, decades) but planform changes take much longer (decades, centuries). Since the majority of development within the Mullet Creek watershed was relatively recent, the potential change index should be representative of potentially problematic areas.

The *erosion ranking* was calculated by standardizing the indices such that the *erosion index*, the *activity index* and the *change potential index* were weighted as shown below:

Erosion Ranking = Erosion Index (50 %) + Activity Index (25 %) + Change Potential Index (25 %)

The three indices were added together to yield an erosion ranking value. A maximum score of 100 indicates that the site has the highest erosion hazard. The erosion ranking values for Mullet Creek range from 12 to 87.

PROJECT: 150 Rutledge
MUNICIPALITY: City of Mississauga
JOB NO.: 19013.102
DATE: April 8, 2024

URBAN ECOSYSTEMS
LIMITED

APPENDIX 5

SITE STORM WATER MANAGEMENT CALCULATIONS

PROJECT: 150 Rutledge
MUNICIPALITY: City of Mississauga
JOB NO.: 19013.102
DATE: April 8, 2024

URBAN ECOSYSTEMS LIMITED

SITE STORM WATER MANAGEMENT SUMMARY

PART A SITE AREAS AND CHARACTERISTICS

SITE COMPONENTS	Area (sm)	
Site area (sq.m) :	6233	
Controlled Pavement area (sq.m) :	1928	(Incl. Uncontrolled Roof Area)
Controlled Landscaped area (sq.m) :	0	
Proposed Roof area (sq.m) :	2418	
Uncontrolled Pave area (sq.m.) :		
Uncontrolled Landscaped area (sq.m.) :	1887	(Incl. Permeable Walkway Area)

Note: Controlled Roof Area =	2418 sm
UnControlled Roof Area=	1223 sm (Included in Pavement Area)
Total Roof Area=	3641 sm

Note: Controlled Pavement Area =	705 sm
UnControlled Roof Area=	1223 sm (Included in Pavement Area)
Total Controlled Pavement Area =	1928 sm

City of Mississauga Intensity Equation		Coefficient
Rainfall intensity (mm/hr) :	I(2yr) = 610 x (t +4.6) ^-.78 =	C = 1.0
Rainfall intensity (mm/hr) :	I(5yr) = 820 x (t +4.6) ^-.78 =	C = 1.0
Rainfall intensity (mm/hr) :	I(10yr) = 1010 x (t +4.6) ^-.78 =	C = 1.0
Rainfall intensity (mm/hr) :	I(25yr) = 1160 x (t +4.6) ^-.78 =	C = 1.1
Rainfall intensity (mm/hr) :	I(50yr) = 1300 x (t +4.7) ^-.78 =	C = 1.2
Rainfall intensity (mm/hr) :	I(100yr) = 1450 x (t +4.9) ^-.78 =	C = 1.25

T= 15 time of concentration in minutes

PART B DETERMINATION OF PRE-DEVELOPMENT ALLOWABLE RELEASE RATES

PRE-DEVELOPMENT ALLOWABLE RELEASE RATES

Return Period (years)	Runoff Coefficient	Intensity (mm/hr) (TC=15min)	Peak Flow (L/s)	Allowable Release Rate (L/s)
2	0.25	59.89	25.9	25.9
5	0.25	80.51	34.9	34.9
10	0.25	99.17	42.9	42.9
25	0.28	113.89	54.2	54.2
50	0.30	127.13	66.0	66.0
100	0.31	140.69	75.5	75.5

Runoff Coefficient
Landscape : 0.25

URBAN ECOSYSTEMS
LIMITED

PART C DETERMINATION OF PRE-DEVELOPMENT ALLOWABLE RELEASE RATES

Note: Based on providing On-Site Storage Tank with an Orifice plate Outlet

Orifice Plate diameter opening	=	80	mm
Orifice Control Invert	=	156.20	m
Maximum Ponding / Storage Elevation	=	157.95	m
Minimum Storage Tank Footprint	=	72	sm
Minimum Quantity Control Storage Tank Volume	=	126	m3

POST-DEVELOPMENT SITE RELEASE RATES

Orifice Control Opening mm	Controlled Peak Flow (L/s)	Uncontrolled Peak Flow (L/s)	Total Site Release Rate (L/s)	Req'd Storage Volume (m3)	Allowable Release Rate (L/s)
80	18.1	7.8	25.9	31	25.9
	18.1	10.6	28.6	46	34.9
	18.1	13.0	31.0	61	42.9
	18.1	16.4	34.5	79	54.2
	18.1	20.0	38.0	92	66.0
	18.1	22.9	40.9	106	75.5

Runoff Coefficient
Pavement : 0.9
Landscape : 0.25
Roof area : 0.9

PART D WATER BALANCE - 5mm RETENTION

Site area :	6233	sm
Less Landscaped area :	1887	sm
Total Impervious area :	**4346**	**sm**

Water Balance - 5mm Retention Calculations

Assuming 5mm across the Site,Require Retention Volume = 22 m3

THEREFORE,

Available Water Retention Storage Tank Volume = 34 m3

PROJECT: 150 Rutledge

MUNICIPALITY: City of Mississauga

JOB NO.: 19013.1

DATE: April 8, 2024

LOCATION:

URBAN ECOSYSTEMS
LIMITED

SITE STORM WATER MANAGEMENT

100 YR

SITE PLAN CHARACTERISTICS -

Site area (sq.m) :	6233	Pavement coefficient :	0.95	Total roof area (sq. m) :	2418	Weir rating (l/sec) :	0.15
Controlled Pavement area (sq.m) :	1928	Landscape coefficient :	0.31	Total number of roof hoppers :	10	Weir area rating (sq. m.) :	465
Controlled Landscaped area (sq.m) :	0	Roof area coefficient :	0.95	Total number of weirs :	10	Maximum head (cm) :	10.16
Proposed Roof area (sq.m) :	2418			Max. sloped roof depth (mm) :	50.8	Peak roof outflow rate (l/sec) :	15.2
Uncontrolled Pave area (sq.m.) :	0			Max. sloped roof storage (cu.m) :	40.94		
Uncontrolled Landscaped area (sq.m.) :	1887			Max. parapit roof storage (cu.m) :	122.83		
Note: Controlled Roof =	2418 sq.m			Rainfall intensity (mm/hr) :	I(100yr) = 1450 x (t +4.9) ^-.78 =		
UnControlled Roof =	1223 sq.m	(Included in Pavement Area)					

241.8

ROOF DRAINAGE CHARACTERISTICS

TABLE 1 - ROOF DRAINAGE SYSTEM

	1st ITERATION					2nd ITERATION						3rd ITERATION			
Time (min.)	Rainfall Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)	Peak Runoff volume (cu.m.)	Peak roof outflow volume (cu.m)	Required storage volume (cu.m)	Volume in sloped roof areas (cu.m)	Volume contained b roof parapi (cu.m)	Total head on roof hoppers (cm)	Roof outflow rate (l/sec)	Roof outflow volume (cu.m)	Required storage volume (cu.m)	Total head on roof hoppers (cm)	Roof outflow volume (cu.m)	Required storage volume (cu.m)	
10	176.31	112.51	67.51	9.14	58.36	40.94	17.42	5.80	8.70	5.22	62.29	5.96	5.37	62.14	
15	140.69	89.78	80.80	13.72	67.09	40.94	26.14	6.16	9.24	8.32	72.48	6.38	8.62	72.18	
20	118.12	75.38	90.45	18.29	72.17	40.94	31.22	6.37	9.56	11.47	78.99	6.65	11.98	78.48	
25	102.41	65.35	98.03	22.86	75.17	40.94	34.22	6.50	9.74	14.61	83.41	6.84	15.38	82.65	
30	90.77	57.93	104.27	27.43	76.84	40.94	35.89	6.56	9.85	17.72	86.54	6.97	18.81	85.46	
35	81.77	52.18	109.58	32.00	77.58	40.94	36.63	6.60	9.89	20.77	88.81	7.06	22.24	87.35	
40	74.58	47.59	114.22	36.58	77.64	40.94	36.70	6.60	9.90	23.75	90.47	7.13	25.66	88.56	
45	68.68	43.83	118.34	41.15	77.19	40.94	36.25	6.58	9.87	26.64	91.69	7.18	29.07	89.26	
50	63.75	40.68	122.05	45.72	76.33	40.94	35.38	6.54	9.82	29.45	92.60	7.22	32.47	89.58	<<------
55	59.56	38.01	125.43	50.29	75.14	40.94	34.19	6.49	9.74	32.15	93.28	7.24	35.86	89.57	
60	55.95	35.71	128.54	54.86	73.67	40.94	32.73	6.43	9.65	34.74	93.80	7.27	39.24	89.30	
65	52.81	33.70	131.42	59.44	71.98	40.94	31.04	6.36	9.55	37.23	94.19	7.28	42.60	88.82	
70	50.03	31.93	134.10	64.01	70.09	40.94	29.15	6.29	9.43	39.60	94.50	7.29	45.96	88.14	
75	47.58	30.36	136.62	68.58	68.04	40.94	27.09	6.20	9.30	41.85	94.76	7.31	49.31	87.30	
80	45.38	28.96	138.99	73.15	65.83	40.94	24.89	6.11	9.16	43.99	95.00	7.32	52.67	86.32	
85	43.39	27.69	141.23	77.72	63.50	40.94	22.56	6.01	9.02	46.00	95.23	7.32	56.04	85.19	
90	41.60	26.55	143.35	82.30	61.06	40.94	20.11	5.91	8.87	47.89	95.47	7.33	59.41	83.94	
95	39.97	25.50	145.38	86.87	58.51	40.94	17.56	5.81	8.71	49.64	95.73	7.35	62.81	82.57	
100	38.47	24.55	147.31	91.44	55.87	40.94	14.92	5.70	8.55	51.27	96.03	7.36	66.22	81.08	
105	37.10	23.68	149.16	96.01	53.14	40.94	12.20	5.58	8.38	52.77	96.38	7.37	69.67	79.48	
110	35.84	22.87	150.93	100.58	50.35	40.94	9.40	5.47	8.20	54.14	96.79	7.39	73.16	77.77	
115	34.66	22.12	152.63	105.16	47.48	40.94	6.53	5.35	8.03	55.37	97.26	7.41	76.68	75.95	
120	33.58	21.43	154.27	109.73	44.55	40.94	3.60	5.23	7.84	56.47	97.80	7.43	80.26	74.02	
125	32.57	20.78	155.86	114.30	41.56	40.94	0.61	5.11	7.66	57.43	98.42	7.46	83.89	71.97	
130	31.62	20.18	157.39	118.87	38.51	38.51	-2.43	4.68	7.02	54.73	102.66	7.63	89.30	68.09	
135	30.73	19.61	158.86	123.44	35.42	35.42	-5.52	4.17	6.25	50.62	108.25	7.86	95.54	63.33	

Qroof= R A I N
= 0.638 I (l / sec)

Peak roof outflow rate =
no. of hoppers x weir rating x max. head
= 15.2 l/sec

Peak roof outflow volume =
= 15.2 x time x 60/1000 cu. m.

Roof outflow rate =
head x weir rating x no. of weirs
= head x 1.50 l/sec

Required max. roof stotage (cu. m.) : 89.6
Available roof stotage (cu. m.) : 163.8

PROJECT: 150 Rutledge
MUNICIPALITY: City of Mississauga

SITE STORM WATER MANAGEMENT
100 YR

Rainfall intensity (mm/hr) : I(2yr) = 610 x (t +4.6) ^-.78 =
Rainfall intensity (mm/hr) : I(5yr) = 820 x (t +4.6) ^-.78 =
Rainfall intensity (mm/hr) : I(10yr) = 1010 x (t +4.6) ^-.78 =
Rainfall intensity (mm/hr) : I(25yr) = 1160 x (t +4.6) ^-.78 =
Rainfall intensity (mm/hr) : I(50yr) = 1300 x (t +4.7) ^-.78 =
Rainfall intensity (mm/hr) : I(100yr) = 1450 x (t +4.9) ^-.78 =
T= 15 time of concentration in minutes

SITE CHARACTERISTICS

Controlled Pavement area (sq.m) :	1928
Controlled Landscaped area (sq.m) :	0
Total area - excl. Bldg (sq.m) :	1928
Composite runoff coefficent :	0.95

OUTLET CHARACTERISTICS

Orifice diameter (mm) :	80
Area of orifice (sq.m) :	0.0050
Orifice coefficient :	0.62
Max. ponding elev. :	157.95
Catchbasin elev. :	157.95
Ponding depth. :	0.00
Orifice invert :	156.2
Orifice center line elev. :	156.240
Head (m) :	1.71
Orifice release rate (l/sec) :	18.1

TABLE 2 - System Storage

Time (min.)	Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)	Runoff volume (cu.m)	Orifice Outflow volume (cu.m)	Required storage volume (cu.m.)	
196	23.18	27.03	317.90	212.28	105.6	<-------
198	23.00	26.94	320.07	214.45	105.6	
200	22.82	26.85	322.23	216.62	105.6	
202	22.65	26.76	324.39	218.78	105.6	

Required site storage (cu. m) : 106
Available site storage (cu. m) : 126 72 sm footprint
SEE DRAWING SP-1

INCLUDES ROOF RELEASE RATE = 15.2 (l/sec)

TABLE 3 - Uncontrolled Runoff

Time (min.)	Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)	
15	140.69	22.9	<-------
20	118.12	19.2	
25	102.41	16.6	

Peak runoff (L/sec) : 22.9

UNCONTROLLED SITE CHARACTERISTICS

Uncontrolled Pavement area (sq.m.) :	0
Uncontrolled Landscaped area (sq.m.) :	1887
Total area (sq.m) :	1887
Composite runoff coefficent :	0.310

ALLOWABLE RELEASE RATE

Tc = 15 min
C = (1.25 x 0.25) = 0.3

Time (min.)	Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)
15	140.69	75.52

100 YR
SITE SUMMARY

Pipe release rate (l/sec) :	18.1
Uncontrolled release rate (l/sec) :	22.9
Total site release rate (l/sec) :	**40.9**
Total Allowable site release rate (l/sec) :	**75.5**

PROJECT: 150 Rutledge
MUNICIPALITY: City of Mississauga
JOB NO.: 19013.1
DATE: April 8, 2024
LOCATION:

URBAN ECOSYSTEMS
LIMITED

SITE STORM WATER MANAGEMENT
50 YR

SITE PLAN CHARACTERISTICS -

Site area (sq.m) :	6233	Pavement coefficient :	0.95		
Controlled Pavement area (sq.m) :	1928	Landscape coefficient :	0.30		
Controlled Landscaped area (sq.m) :	0	Roof area coefficient :	0.95		
Proposed Roof area (sq.m) :	2418				
Uncontrolled Pave area (sq.m.) :	0				
Uncontrolled Landscaped area (sq.m.) :	1887				

Note: Controlled Roof = 2386 sq.m
UnControlled Roof = 1239 sq.m (Included in Pavement Area)

ROOF DRAINAGE CHARACTERISTICS

Total roof area (sq. m) :	2418			Weir rating (l/sec) :	0.15
Total number of roof hoppers :	10			Weir area rating (sq. m.) :	465
Total number of weirs :	10			Maximum head (cm) :	10.16
Max. sloped roof depth (mm) :	50.8			Peak roof outflow rate (l/sec) :	15.2
Max. sloped roof storage (cu.m) :	40.94				
Max. parapit roof storage (cu.m) :	122.83				

Rainfall intensity (mm/hr) : I(50yr) = 1300 x (t +4.7) ^-.78 =

241.8

TABLE 1 - ROOF DRAINAGE SYSTEM

	1st ITERATION					2nd ITERATION						3rd ITERATION			
Time (min.)	Rainfall Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)	Peak Runoff volume (cu.m.)	Peak roof outflow volume (cu.m)	Required storage volume (cu.m)	Volume in sloped roof areas (cu.m)	Volume contained by roof parapit (cu.m)	Total head on roof hoppers (cm)	Roof outflow rate (l/sec)	Roof outflow volume (cu.m)	Required storage volume (cu.m)	Total head on roof hoppers (cm)	Roof outflow volume (cu.m)	Required storage volume (cu.m)	
10	159.75	101.94	61.16	9.14	52.02	40.94	11.08	5.54	8.31	4.98	56.18	5.71	5.14	56.03	
15	127.13	81.13	73.02	13.72	59.30	40.94	18.35	5.84	8.76	7.88	65.13	6.08	8.21	64.81	
20	106.57	68.01	81.61	18.29	63.32	40.94	22.38	6.01	9.01	10.81	70.80	6.31	11.37	70.24	
25	92.30	58.90	88.35	22.86	65.49	40.94	24.54	6.10	9.14	13.71	74.63	6.47	14.56	73.78	
30	81.75	52.17	93.90	27.43	66.47	40.94	25.52	6.14	9.20	16.57	77.34	6.58	17.78	76.12	
35	73.60	46.97	98.63	32.00	66.63	40.94	25.68	6.14	9.21	19.35	79.28	6.67	21.00	77.64	
40	67.10	42.82	102.76	36.58	66.18	40.94	25.24	6.12	9.19	22.05	80.71	6.72	24.21	78.55	
45	61.77	39.42	106.43	41.15	65.28	40.94	24.34	6.09	9.13	24.65	81.78	6.77	27.41	79.02	
50	57.32	36.58	109.74	45.72	64.02	40.94	23.07	6.03	9.05	27.15	82.58	6.80	30.61	79.13	<------
55	53.54	34.17	112.75	50.29	62.46	40.94	21.51	5.97	8.95	29.55	83.20	6.83	33.80	78.95	
60	50.28	32.09	115.52	54.86	60.65	40.94	19.71	5.90	8.84	31.83	83.69	6.85	36.98	78.54	
65	47.45	30.28	118.09	59.44	58.65	40.94	17.71	5.81	8.72	34.00	84.08	6.86	40.16	77.93	
70	44.95	28.69	120.48	64.01	56.47	40.94	15.53	5.72	8.58	36.05	84.43	6.88	43.33	77.15	
75	42.74	27.27	122.72	68.58	54.14	40.94	13.20	5.63	8.44	37.97	84.75	6.89	46.52	76.21	
80	40.76	26.01	124.84	73.15	51.69	40.94	10.74	5.52	8.29	39.77	85.06	6.90	49.71	75.13	
85	38.97	24.87	126.84	77.72	49.11	40.94	8.17	5.42	8.13	41.45	85.39	6.92	52.92	73.91	
90	37.36	23.84	128.73	82.30	46.44	40.94	5.49	5.31	7.96	42.99	85.75	6.93	56.16	72.58	
95	35.89	22.90	130.54	86.87	43.67	40.94	2.73	5.19	7.79	44.40	86.14	6.95	59.42	71.13	
100	34.54	22.04	132.27	91.44	40.83	40.83	-0.12	5.06	7.59	45.54	86.72	6.97	62.76	69.51	
105	33.31	21.26	133.92	96.01	37.90	37.90	-3.04	4.58	6.87	43.25	90.66	7.14	67.44	66.48	
110	32.17	20.53	135.50	100.58	34.92	34.92	-6.03	4.08	6.12	40.42	95.08	7.32	72.46	63.04	
115	31.12	19.86	137.02	105.16	31.87	31.87	-9.08	3.58	5.37	37.03	99.99	7.52	77.85	59.17	
120	30.14	19.23	138.49	109.73	28.76	28.76	-12.18	3.06	4.60	33.09	105.39	7.75	83.65	54.84	
125	29.23	18.65	139.90	114.30	25.60	25.60	-15.34	2.54	3.81	28.60	111.31	7.99	89.89	50.02	
130	28.38	18.11	141.27	118.87	22.40	22.40	-18.55	2.01	3.02	23.53	117.73	8.26	96.59	44.68	
135	27.59	17.60	142.59	123.44	19.15	19.15	-21.80	1.47	2.21	17.91	124.68	8.54	103.80	38.79	

Qroof= R A I N
= 0.638 I (l / sec)

Peak roof outflow rate =
no. of hoppers x weir rating x max. head
= 15.2 l/sec

Peak roof outflow volume =
= 15.2 x time x 60/1000 cu. m.

Roof outflow rate =
head x weir rating x no. of weirs
= head x 1.50 l/sec

Required max. roof storage (cu. m.) : 79.1
Available roof storage (cu. m.) : 163.8

PROJECT: 150 Rutledge
MUNICIPALITY: City of Mississauga

SITE STORM WATER MANAGEMENT
50 YR

Rainfall intensity (mm/hr) : I(2yr) = 610 x (t +4.6) ^-.78 =
Rainfall intensity (mm/hr) : I(5yr) = 820 x (t +4.6) ^-.78 =
Rainfall intensity (mm/hr) : I(10yr) = 1010 x (t +4.6) ^-.78 =
Rainfall intensity (mm/hr) : I(25yr) = 1160 x (t +4.6) ^-.78 =
Rainfall intensity (mm/hr) : I(50yr) = 1300 x (t +4.7) ^-.78 =
Rainfall intensity (mm/hr) : I(100yr) = 1450 x (t +4.9) ^-.78 =
T= 15 time of concentration in minutes

SITE CHARACTERISTICS

Controlled Pavement area (sq.m) : 1928
Controlled Landscaped area (sq.m) : 0
Total area - excl. Bldg (sq.m) : 1928
Composite runoff coefficent : 0.95

OUTLET CHARACTERISTICS

Orifice diameter (mm) : 80
Area of orifice (sq.m) : 0.0050
Orifice coefficient : 0.62
Max. ponding elev. : 157.95
Catchbasin elev. : 157.95
Ponding depth : 0.00
Orifice invert : 156.2
Orifice center line elev. : 156.240
Head (m) : 1.71
Orifice release rate (l/sec) : 18.1

TABLE 2 - System Storage

Time (min.)	Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)	Runoff volume (cu.m)	Orifice Outflow volume (cu.m)	Required storage volume (cu.m.)	
174	22.77	26.82	280.04	188.46	91.6	<------
176	22.57	26.72	282.20	190.62	91.6	
178	22.38	26.63	284.36	192.79	91.6	
180	22.19	26.53	286.52	194.95	91.6	

Required site storage (cu. m) : 92
Available site storage (cu. m) : 126
SEE DRAWING SP-1

INCLUDES ROOF RELEASE RATE = 15.2 (l/sec)

TABLE 3 - Uncontrolled Runoff

Time (min.)	Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)	
15	127.13	20.0	<------
20	106.57	16.8	
25	92.30	14.5	

Peak runoff (L/sec) : 20.0

UNCONTROLLED SITE CHARACTERISTICS

Uncontrolled Pavement area (sq.m.) : 0
Uncontrolled Landscaped area (sq.m.) : 1887
Total area (sq.m) : 1887
Composite runoff coefficent : 0.300

ALLOWABLE RELEASE RATE

Tc = 15 min
C = 0.30

Time (min.)	Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)
15	127.13	66.04

50 YR SITE SUMMARY

Pipe release rate (l/sec) : 18.1
Uncontrolled release rate (l/sec) : 20.0
Total site release rate (l/sec) : **38.0**

Total Allowable site release rate (l/sec) : **66.0**

PROJECT: 150 Rutledge

MUNICIPALITY: City of Mississauga

JOB NO.: 19013.1

DATE: April 8, 2024

LOCATION:

URBAN ECOSYSTEMS
LIMITED

SITE STORM WATER MANAGEMENT

25 YR

SITE PLAN CHARACTERISTICS -

Site area (sq.m) :	6233	Pavement coefficient :	0.95		
Controlled Pavement area (sq.m) :	1928	Landscape coefficient :	0.275		
Controlled Landscaped area (sq.m) :	0	Roof area coefficient :	0.95		
Proposed Roof area (sq.m) :	2418				
Uncontrolled Pave area (sq.m.) :	0				
Uncontrolled Landscaped area (sq.m.) :	1887				

Note: Controlled Roof = 2386 sq.m

UnControlled Roof = 1239 sq.m (Included in Pavement Area)

ROOF DRAINAGE CHARACTERISTICS

Total roof area (sq. m) :	2418			Weir rating (l/sec) :	0.15
Total number of roof hoppers :	10			Weir area rating (sq. m.) :	465
Total number of weirs :	10			Maximum head (cm) :	10.16
Max. sloped roof depth (mm) :	50.8			Peak roof outflow rate (l/sec) :	15.2
Max. sloped roof storage (cu.m) :	40.94				
Max. parapit roof storage (cu.m) :	122.83				

Rainfall intensity (mm/hr) : I(25yr) = 1160 x (t +4.6) ^-.78 =

TABLE 1 - ROOF DRAINAGE SYSTEM

	1st ITERATION					2nd ITERATION						3rd ITERATION			
Time (min.)	Rainfall Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)	Peak Runoff volume (cu.m.)	Peak roof outflow volume (cu.m)	Required storage volume (cu.m)	Volume in sloped roof areas (cu.m)	Volume contained by roof parapit (cu.m)	Total head on roof hoppers (cm)	Roof outflow rate (l/sec)	Roof outflow volume (cu.m)	Required storage volume (cu.m)	Total head on roof hoppers (cm)	Roof outflow volume (cu.m)	Required storage volume (cu.m)	
10	143.31	91.45	54.87	9.14	45.72	40.94	4.78	5.28	7.92	4.75	50.12	5.46	4.91	49.96	
15	113.89	72.68	65.41	13.72	51.70	40.94	10.75	5.52	8.29	7.46	57.95	5.78	7.81	57.60	
20	95.40	60.88	73.05	18.29	54.76	40.94	13.82	5.65	8.48	10.17	62.88	5.99	10.78	62.27	
25	82.58	52.69	79.04	22.86	56.18	40.94	15.24	5.71	8.57	12.85	66.19	6.12	13.78	65.26	
30	73.11	46.65	83.98	27.43	56.55	40.94	15.60	5.73	8.59	15.46	68.52	6.22	16.80	67.18	
35	65.80	41.99	88.18	32.00	56.18	40.94	15.23	5.71	8.57	17.99	70.20	6.29	19.81	68.37	
40	59.98	38.27	91.85	36.58	55.28	40.94	14.33	5.67	8.51	20.42	71.43	6.34	22.83	69.03	
45	55.21	35.23	95.12	41.15	53.97	40.94	13.02	5.62	8.43	22.76	72.36	6.38	25.84	69.28	<------
50	51.22	32.69	98.06	45.72	52.34	40.94	11.39	5.55	8.33	24.98	73.08	6.41	28.84	69.22	
55	47.84	30.53	100.74	50.29	50.45	40.94	9.50	5.47	8.21	27.09	73.65	6.43	31.84	68.90	
60	44.92	28.67	103.20	54.86	48.34	40.94	7.39	5.39	8.08	29.08	74.12	6.45	34.84	68.36	
65	42.39	27.05	105.49	59.44	46.05	40.94	5.11	5.29	7.94	30.95	74.53	6.47	37.84	67.64	
70	40.15	25.62	107.62	64.01	43.61	40.94	2.66	5.19	7.79	32.70	74.92	6.49	40.86	66.76	
75	38.17	24.36	109.62	68.58	41.04	40.94	0.09	5.08	7.63	34.32	75.30	6.50	43.88	65.73	
80	36.40	23.23	111.50	73.15	38.34	38.34	-2.60	4.65	6.97	33.48	78.02	6.61	47.62	63.88	
85	34.81	22.21	113.28	77.72	35.55	35.55	-5.39	4.19	6.28	32.04	81.24	6.75	51.61	61.67	
90	33.36	21.29	114.97	82.30	32.67	32.67	-8.27	3.71	5.57	30.06	84.91	6.90	55.87	59.09	
95	32.05	20.45	116.57	86.87	29.71	29.71	-11.24	3.22	4.83	27.54	89.04	7.07	60.44	56.14	
100	30.85	19.68	118.11	91.44	26.67	26.67	-14.27	2.72	4.08	24.47	93.64	7.26	65.33	52.78	
105	29.74	18.98	119.58	96.01	23.57	23.57	-17.38	2.21	3.31	20.84	98.74	7.47	70.59	48.99	
110	28.73	18.33	120.99	100.58	20.41	20.41	-20.54	1.68	2.52	16.66	104.33	7.70	76.25	44.74	
115	27.79	17.73	122.35	105.16	17.19	17.19	-23.76	1.15	1.73	11.91	110.44	7.95	82.32	40.02	
120	26.91	17.17	123.65	109.73	13.92	13.92	-27.02	0.61	0.91	6.59	117.06	8.23	88.86	34.79	
125	26.10	16.65	124.91	114.30	10.61	10.61	-30.33	0.06	0.09	0.70	124.21	8.52	95.89	29.02	
130	25.34	16.17	126.13	118.87	7.26	7.26	-33.69	-0.49	-0.74	-5.77	131.90	8.84	103.44	22.68	
135	24.63	15.72	127.30	123.44	3.86	3.86	-37.08	-1.05	-1.58	-12.81	140.12	9.18	111.56	15.75	

Qroof= R A I N
= 0.638 I (l / sec)

Peak roof outflow rate =
no. of hoppers x weir rating x max. head
= 15.2 l/sec

Peak roof outflow volume =
= 15.2 x time x 60/1000 cu. m.

Roof outflow rate =
head x weir rating x no. of weirs
= head x 1.50 l/sec

Required max. roof storage (cu. m.) : 69.3
Available roof storage (cu. m.) : 163.8

PROJECT: 150 Rutledge
MUNICIPALITY: City of Mississauga

SITE STORM WATER MANAGEMENT
25 YR

Rainfall intensity (mm/hr) : I(2yr) = 610 x (t +4.6) ^-.78 =
Rainfall intensity (mm/hr) : I(5yr) = 820 x (t +4.6) ^-.78 =
Rainfall intensity (mm/hr) : I(10yr) = 1010 x (t +4.6) ^-.78 =
Rainfall intensity (mm/hr) : I(25yr) = 1160 x (t +4.6) ^-.78 =
Rainfall intensity (mm/hr) : I(50yr) = 1300 x (t +4.7) ^-.78 =
Rainfall intensity (mm/hr) : I(100yr) = 1450 x (t +4.9) ^-.78 =
T= 15 time of concentration in minutes

SITE CHARACTERISTICS

Controlled Pavement area (sq.m) : 1928
Controlled Landscaped area (sq.m) : 0
Total area - excl. Bldg (sq.m) : 1928
Composite runoff coefficent : 0.95

OUTLET CHARACTERISTICS

Orifice diameter (mm) : 80
Area of orifice (sq.m) : 0.0050
Orifice coefficient : 0.62
Max. ponding elev. : 157.95
Catchbasin elev. : 157.95
Ponding depth. : 0.00
Orifice invert : 156.2
Orifice center line elev. : 156.240
Head (m) : 1.71
Orifice release rate (l/sec) : 18.1

TABLE 2 - System Storage

Time (min.)	Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)	Runoff volume (cu.m)	Orifice Outflow volume (cu.m)	Required storage volume (cu.m.)	
150	22.74	26.81	241.31	162.46	78.9	<<------
152	22.52	26.70	243.48	164.63	78.9	
154	22.30	26.58	245.64	166.79	78.8	
156	22.08	26.47	247.80	168.96	78.8	

Required site storage (cu. m) : 79
Available site storage (cu. m) : 126
SEE DRAWING SP-1

INCLUDES ROOF RELEASE RATE = 15.2 (l/sec)

TABLE 3 - Uncontrolled Runoff

Time (min.)	Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)	
15	113.89	16.4	<<------
20	95.40	13.8	
25	82.58	11.9	

Peak runoff (L/sec) : 16.4

UNCONTROLLED SITE CHARACTERISTICS

Uncontrolled Pavement area (sq.m.) : 0
Uncontrolled Landscaped area (sq.m.) : 1887
Total area (sq.m) : 1887
Composite runoff coefficent : 0.275

ALLOWABLE RELEASE RATE

Tc = 15 min
C = 0.275

Time (min.)	Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)
15	113.89	54.23

25 YR
SITE SUMMARY

Pipe release rate (l/sec) : 18.1
Uncontrolled release rate (l/sec) : 16.4
Total site release rate (l/sec) : **34.5**

Total Allowable site release rate (l/sec) : **54.2**

PROJECT: 150 Rutledge

MUNICIPALITY: City of Mississauga

JOB NO.: 19013.1

DATE: April 8, 2024

LOCATION:

URBAN ECOSYSTEMS
LIMITED

SITE STORM WATER MANAGEMENT

10 YR

SITE PLAN CHARACTERISTICS -

Site area (sq.m) :	6233	Pavement coefficient :	0.9		
Controlled Pavement area (sq.m) :	1928	Landscape coefficient :	0.25		
Controlled Landscaped area (sq.m) :	0	Roof area coefficient :	0.9		
Proposed Roof area (sq.m) :	2418				
Uncontrolled Pave area (sq.m.) :	0				
Uncontrolled Landscaped area (sq.m.) :	1887				

Note: Controlled Roof = 2386 sq.m

UnControlled Roof = 1239 sq.m (Included in Pavement Area)

ROOF DRAINAGE CHARACTERISTICS

Total roof area (sq. m) :	2418			Weir rating (l/sec) :	0.15
Total number of roof hoppers :	10			Weir area rating (sq. m.) :	465
Total number of weirs :	10			Maximum head (cm) :	10.16
Max. sloped roof depth (mm) :	50.8			Peak roof outflow rate (l/sec) :	15.2
Max. sloped roof storage (cu.m) :	40.94				
Max. parapit roof storage (cu.m) :	122.83				

Rainfall intensity (mm/hr) : I(10yr) = 1010 x (t +4.6) ^-.78 =

TABLE 1 - ROOF DRAINAGE SYSTEM

	1st ITERATION					2nd ITERATION						3rd ITERATION			
Time (min.)	Rainfall Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)	Peak Runoff volume (cu.m.)	Peak roof outflow volume (cu.m)	Required storage volume (cu.m)	Volume in sloped roof areas (cu.m)	Volume contained by roof parapit (cu.m)	Total head on roof hoppers (cm)	Roof outflow rate (l/sec)	Roof outflow volume (cu.m)	Required storage volume (cu.m)	Total head on roof hoppers (cm)	Roof outflow volume (cu.m)	Required storage volume (cu.m)	
10	124.77	75.43	45.26	9.14	36.12	36.12	-4.83	4.28	6.42	3.85	41.41	5.10	4.59	40.67	
15	99.17	59.95	53.96	13.72	40.24	40.24	-0.71	4.96	7.44	6.70	47.25	5.34	7.21	46.75	
20	83.06	50.21	60.26	18.29	41.97	40.94	1.02	5.12	7.68	9.22	51.04	5.50	9.90	50.36	
25	71.90	43.47	65.20	22.86	42.34	40.94	1.39	5.14	7.71	11.56	53.64	5.60	12.61	52.59	
30	63.66	38.48	69.27	27.43	41.84	40.94	0.89	5.12	7.68	13.82	55.45	5.68	15.34	53.93	
35	57.30	34.64	72.74	32.00	40.74	40.74	-0.21	5.05	7.57	15.89	56.85	5.74	18.07	54.67	
40	52.22	31.57	75.77	36.58	39.19	39.19	-1.75	4.79	7.18	17.24	58.52	5.81	20.91	54.86	<------
45	48.07	29.06	78.46	41.15	37.31	37.31	-3.63	4.48	6.72	18.14	60.32	5.88	23.82	54.64	
50	44.60	26.96	80.88	45.72	35.16	35.16	-5.78	4.12	6.19	18.56	62.33	5.96	26.84	54.04	
55	41.65	25.18	83.09	50.29	32.80	32.80	-8.14	3.73	5.60	18.48	64.62	6.06	29.99	53.10	
60	39.11	23.65	85.13	54.86	30.26	30.26	-10.68	3.31	4.97	17.89	67.24	6.17	33.30	51.82	
65	36.91	22.31	87.01	59.44	27.58	27.58	-13.37	2.87	4.30	16.78	70.23	6.29	36.80	50.21	
70	34.96	21.14	88.77	64.01	24.76	24.76	-16.18	2.40	3.60	15.14	73.63	6.43	40.52	48.25	
75	33.24	20.09	90.42	68.58	21.84	21.84	-19.11	1.92	2.88	12.95	77.46	6.59	44.48	45.93	
80	31.69	19.16	91.97	73.15	18.82	18.82	-22.13	1.42	2.13	10.22	81.75	6.77	48.73	43.24	
85	30.31	18.32	93.44	77.72	15.71	15.71	-25.23	0.91	1.36	6.93	86.51	6.96	53.28	40.16	
90	29.05	17.56	94.83	82.30	12.54	12.54	-28.41	0.38	0.57	3.08	91.75	7.18	58.17	36.66	
95	27.90	16.87	96.16	86.87	9.29	9.29	-31.65	-0.16	-0.23	-1.34	97.50	7.42	63.43	32.73	
100	26.86	16.24	97.42	91.44	5.98	5.98	-34.96	-0.70	-1.05	-6.33	103.75	7.68	69.10	28.33	
105	25.90	15.66	98.64	96.01	2.63	2.63	-38.32	-1.26	-1.89	-11.90	110.54	7.96	75.20	23.43	
110	25.01	15.12	99.80	100.58	-0.78	-0.78	-41.73	-1.82	-2.73	-18.05	117.85	8.26	81.78	18.02	
115	24.19	14.63	100.92	105.16	-4.24	-4.24	-45.18	-2.39	-3.59	-24.78	125.70	8.59	88.86	12.06	
120	23.43	14.17	102.00	109.73	-7.73	-7.73	-48.68	-2.97	-4.46	-32.10	134.10	8.93	96.47	5.52	
125	22.72	13.74	103.03	114.30	-11.27	-11.27	-52.21	-3.56	-5.34	-40.02	143.05	9.30	104.66	-1.62	
130	22.06	13.34	104.04	118.87	-14.83	-14.83	-55.78	-4.15	-6.22	-48.52	152.56	9.70	113.44	-9.41	
135	21.44	12.96	105.01	123.44	-18.43	-18.43	-59.38	-4.74	-7.11	-57.63	162.64	10.11	122.87	-17.86	

Qroof= R A I N
= 0.605 I (l / sec)

Peak roof outflow rate =
no. of hoppers x weir rating x max. head
= 15.2 l/sec

Peak roof outflow volume =
= 15.2 x time x 60/1000 cu. m.

Roof outflow rate =
head x weir rating x no. of weirs
= head x 1.50 l/sec

Required max. roof storage (cu. m.) : 54.9
Available roof storage (cu. m.) : 163.8

PROJECT: 150 Rutledge
MUNICIPALITY: City of Mississauga

SITE STORM WATER MANAGEMENT
10 YR

Rainfall intensity (mm/hr) : I(2yr) = 610 x (t +4.6) ^-.78 =
Rainfall intensity (mm/hr) : I(5yr) = 820 x (t +4.6) ^-.78 =
Rainfall intensity (mm/hr) : I(10yr) = 1010 x (t +4.6) ^-.78 =
Rainfall intensity (mm/hr) : I(25yr) = 1160 x (t +4.6) ^-.78 =
Rainfall intensity (mm/hr) : I(50yr) = 1300 x (t +4.7) ^-.78 =
Rainfall intensity (mm/hr) : I(100yr) = 1450 x (t +4.9) ^-.78 =
T= 15 time of concentration in minutes

SITE CHARACTERISTICS

Controlled Pavement area (sq.m) : 1928
Controlled Landscaped area (sq.m) : 0
Total area - excl. Bldg (sq.m) : 1928
Composite runoff coefficent : 0.90

OUTLET CHARACTERISTICS

Orifice diameter (mm) : 80
Area of orifice (sq.m) : 0.0050
Orifice coefficient : 0.62
Max. ponding elev. : 157.95
Catchbasin elev. : 157.95
Ponding depth : 0.00
Orifice invert : 156.2
Orifice center line elev. : 156.240
Head (m) : 1.71
Orifice release rate (l/sec) : 18.1

TABLE 2 - System Storage

Time (min.)	Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)	Runoff volume (cu.m)	Orifice Outflow volume (cu.m)	Required storage volume (cu.m.)	
120	23.43	26.54	191.05	129.97	61.1	<------
122	23.14	26.40	193.22	132.14	61.1	
124	22.86	26.26	195.38	134.30	61.1	
126	22.59	26.13	197.53	136.47	61.1	

Required site storage (cu. m) : 61
Available site storage (cu. m) : 126
SEE DRAWING SP-1

INCLUDES ROOF RELEASE RATE = 15.2 (l/sec)

TABLE 3 - Uncontrolled Runoff

Time (min.)	Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)	
15	99.17	13.0	<------
20	83.06	10.9	
25	71.90	9.4	

Peak runoff (L/sec) : 13.0

UNCONTROLLED SITE CHARACTERISTICS

Uncontrolled Pavement area (sq.m.) : 0
Uncontrolled Landscaped area (sq.m.) : 1887
Total area (sq.m) : 1887
Composite runoff coefficent : 0.250

ALLOWABLE RELEASE RATE

Tc = 15 min
C = 0.25

Time (min.)	Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)
15	99.17	42.93

10 YR
SITE SUMMARY

Pipe release rate (l/sec) : 18.1
Uncontrolled release rate (l/sec) : 13.0
Total site release rate (l/sec) : **31.0**

Total Allowable site release rate (l/sec) : **42.9**

PROJECT: 150 Rutledge
MUNICIPALITY: City of Mississauga
JOB NO.: 19013.1
DATE: April 8, 2024
LOCATION:

URBAN ECOSYSTEMS
LIMITED

SITE STORM WATER MANAGEMENT
5 YR

SITE PLAN CHARACTERISTICS -

Site area (sq.m) :	6233	Pavement coefficient :	0.9		
Controlled Pavement area (sq.m) :	1928	Landscape coefficient :	0.25		
Controlled Landscaped area (sq.m) :	0	Roof area coefficient :	0.9		
Proposed Roof area (sq.m) :	2418				
Uncontrolled Pave area (sq.m.) :	0				
Uncontrolled Landscaped area (sq.m.) :	1887				

Note: Controlled Roof = 2418 sq.m
UnControlled Roof = 1223 sq.m (Included in Pavement Area)

ROOF DRAINAGE CHARACTERISTICS

Total roof area (sq. m) :	2418	Weir rating (l/sec) :	0.15
Total number of roof hoppers :	10	Weir area rating (sq. m.) :	465
Total number of weirs :	10	Maximum head (cm) :	10.16
Max. sloped roof depth (mm) :	50.8	Peak roof outflow rate (l/sec) :	15.2
Max. sloped roof storage (cu.m) :	40.94		
Max. parapit roof storage (cu.m) :	122.83		

Rainfall intensity (mm/hr) : I(5yr) = 820 x (t +4.6) ^-.78 =

TABLE 1 - ROOF DRAINAGE SYSTEM

	1st ITERATION					2nd ITERATION						3rd ITERATION			
Time (min.)	Rainfall Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)	Peak Runoff volume (cu.m.)	Peak roof outflow volume (cu.m)	Required storage volume (cu.m)	Volume in sloped roof areas (cu.m)	Volume contained by roof parapit (cu.m)	Total head on roof hoppers (cm)	Roof outflow rate (l/sec)	Roof outflow volume (cu.m)	Required storage volume (cu.m)	Total head on roof hoppers (cm)	Roof outflow volume (cu.m)	Required storage volume (cu.m)	
10	101.30	61.24	36.75	9.14	27.60	27.60	-13.34	2.87	4.31	2.59	34.16	3.96	3.56	33.18	
15	80.51	48.67	43.81	13.72	30.09	30.09	-10.86	3.28	4.93	4.43	39.37	4.82	6.51	37.30	
20	67.43	40.77	48.92	18.29	30.63	30.63	-10.31	3.37	5.06	6.07	42.85	5.16	9.29	39.64	
25	58.37	35.29	52.93	22.86	30.07	30.07	-10.87	3.28	4.92	7.38	45.55	5.27	11.86	41.07	
30	51.68	31.24	56.24	27.43	28.81	28.81	-12.14	3.07	4.61	8.29	47.94	5.37	14.50	41.74	
35	46.52	28.12	59.06	32.00	27.05	27.05	-13.89	2.78	4.17	8.76	50.29	5.47	17.22	41.84	<<------
40	42.40	25.63	61.51	36.58	24.94	24.94	-16.01	2.43	3.65	8.76	52.76	5.57	20.05	41.47	
45	39.02	23.59	63.70	41.15	22.55	22.55	-18.39	2.04	3.06	8.25	55.45	5.68	23.00	40.70	
50	36.21	21.89	65.67	45.72	19.95	19.95	-21.00	1.61	2.41	7.23	58.44	5.80	26.12	39.55	
55	33.82	20.44	67.46	50.29	17.17	17.17	-23.77	1.15	1.72	5.68	61.78	5.94	29.41	38.05	
60	31.76	19.20	69.11	54.86	14.25	14.25	-26.69	0.66	1.00	3.59	65.53	6.10	32.92	36.19	
65	29.96	18.11	70.64	59.44	11.21	11.21	-29.74	0.16	0.24	0.94	69.70	6.27	36.68	33.97	
70	28.38	17.16	72.07	64.01	8.06	8.06	-32.88	-0.36	-0.54	-2.27	74.34	6.46	40.70	31.37	
75	26.98	16.31	73.41	68.58	4.83	4.83	-36.12	-0.89	-1.34	-6.04	79.45	6.67	45.04	28.37	
80	25.73	15.56	74.67	73.15	1.52	1.52	-39.43	-1.44	-2.16	-10.39	85.05	6.90	49.71	24.96	
85	24.60	14.87	75.86	77.72	-1.86	-1.86	-42.81	-2.00	-3.00	-15.31	91.17	7.16	54.75	21.11	
90	23.58	14.26	76.99	82.30	-5.30	-5.30	-46.25	-2.57	-3.86	-20.82	97.82	7.43	60.20	16.79	
95	22.66	13.70	78.07	86.87	-8.80	-8.80	-49.74	-3.15	-4.72	-26.92	104.99	7.73	66.08	11.99	
100	21.81	13.18	79.10	91.44	-12.34	-12.34	-53.29	-3.74	-5.60	-33.62	112.71	8.05	72.43	6.66	
105	21.03	12.71	80.08	96.01	-15.93	-15.93	-56.88	-4.33	-6.49	-40.91	120.99	8.39	79.29	0.79	
110	20.31	12.28	81.03	100.58	-19.56	-19.56	-60.50	-4.93	-7.39	-48.79	129.82	8.76	86.68	-5.65	
115	19.64	11.87	81.93	105.16	-23.22	-23.22	-64.17	-5.53	-8.30	-57.29	139.22	9.14	94.64	-12.71	
120	19.02	11.50	82.81	109.73	-26.92	-26.92	-67.86	-6.15	-9.22	-66.38	149.19	9.56	103.21	-20.40	
125	18.45	11.15	83.65	114.30	-30.65	-30.65	-71.59	-6.76	-10.15	-76.09	159.74	9.99	112.42	-28.77	
130	17.91	10.83	84.47	118.87	-34.41	-34.41	-75.35	-7.38	-11.08	-86.40	170.87	10.45	122.30	-37.84	
135	17.41	10.53	85.25	123.44	-38.19	-38.19	-79.13	-8.01	-12.02	-97.33	182.59	10.94	132.89	-47.64	

Qroof= R A I N
= 0.605 I (l / sec)

Peak roof outflow rate =
no. of hoppers x weir rating x max. head
= 15.2 l/sec

Peak roof outflow volume =
= 15.2 x time x 60/1000 cu. m.

Roof outflow rate =
head x weir rating x no. of weirs
= head x 1.50 l/sec

Required max. roof storage (cu. m.) : 41.8
Available roof storage (cu. m.) : 163.8

PROJECT: 150 Rutledge
MUNICIPALITY: City of Mississauga

SITE STORM WATER MANAGEMENT
5 YR

Rainfall intensity (mm/hr) : I(2yr) = 610 x (t +4.6) ^-.78 =
Rainfall intensity (mm/hr) : I(5yr) = 820 x (t +4.6) ^-.78 =
Rainfall intensity (mm/hr) : I(10yr) = 1010 x (t +4.6) ^-.78 =
Rainfall intensity (mm/hr) : I(25yr) = 1160 x (t +4.6) ^-.78 =
Rainfall intensity (mm/hr) : I(50yr) = 1300 x (t +4.7) ^-.78 =
Rainfall intensity (mm/hr) : I(100yr) = 1450 x (t +4.9) ^-.78 =
T= 15 time of concentration in minutes

SITE CHARACTERISTICS

Controlled Pavement area (sq.m) : 1928
Controlled Landscaped area (sq.m) : 0
Total area - excl. Bldg (sq.m) : 1928
Composite runoff coefficent : 0.90

OUTLET CHARACTERISTICS

Orifice diameter (mm) : 80
Area of orifice (sq.m) : 0.0050
Orifice coefficient : 0.62
Max. ponding elev. : 157.95
Catchbasin elev. : 157.95
Ponding depth. : 0.00
Orifice invert : 156.2
Orifice center line elev. : 156.240
Head (m) : 1.71
Orifice release rate (l/sec) : 18.1

TABLE 2 - System Storage

Time (min.)	Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)	Runoff volume (cu.m)	Orifice Outflow volume (cu.m)	Required storage volume (cu.m.)	
94	22.83	26.25	148.03	101.81	46.2	<------
96	22.48	26.08	150.20	103.98	46.2	
98	22.14	25.91	152.36	106.14	46.2	
100	21.81	25.75	154.51	108.31	46.2	

Required site storage (cu. m) : 46
Available site storage (cu. m) : 126
SEE DRAWING SP-1

INCLUDES ROOF RELEASE RATE = 15.2 (l/sec)

TABLE 3 - Uncontrolled Runoff

Time (min.)	Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)	
15	80.51	10.6	<------
20	67.43	8.8	
25	58.37	7.6	

Peak runoff (L/sec) : 10.6

UNCONTROLLED SITE CHARACTERISTICS

Uncontrolled Pavement area (sq.m.) : 0
Uncontrolled Landscaped area (sq.m.) : 1887
Total area (sq.m) : 1887
Composite runoff coefficent : 0.250

ALLOWABLE RELEASE RATE

Tc = 15 min
C = 0.25

Time (min.)	Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)
15	80.51	34.85

5 YR

SITE SUMMARY

Pipe release rate (l/sec) : 18.1
Uncontrolled release rate (l/sec) : 10.6
Total site release rate (l/sec) : **28.6**

Total Allowable site release rate (l/sec) : **34.9**

PROJECT: 150 Rutledge
MUNICIPALITY: City of Mississauga
JOB NO.: 19013.1
DATE: April 8, 2024
LOCATION:

URBAN ECOSYSTEMS LIMITED

SITE STORM WATER MANAGEMENT
2 YR

SITE PLAN CHARACTERISTICS -

Site area (sq.m) :	6233	Pavement coefficient :	0.9
Controlled Pavement area (sq.m) :	1928	Landscape coefficient :	0.25
Controlled Landscaped area (sq.m) :	0	Roof area coefficient :	0.9
Proposed Roof area (sq.m) :	2418		
Uncontrolled Pave area (sq.m.) :	0		
Uncontrolled Landscaped area (sq.m.) :	1887		

Note: Controlled Roof = 2386 sq.m
UnControlled Roof = 1239 sq.m (Included in Pavement Area)

ROOF DRAINAGE CHARACTERISTICS

Total roof area (sq. m) :	2418	Weir rating (l/sec) :	0.15
Total number of roof hoppers :	10	Weir area rating (sq. m.) :	465
Total number of weirs :	10	Maximum head (cm) :	10.16
Max. sloped roof depth (mm) :	50.8	Peak roof outflow rate (l/sec) :	15.2
Max. sloped roof storage (cu.m) :	40.94		
Max. parapit roof storage (cu.m) :	122.83		

Rainfall intensity (mm/hr) : I(2yr) = 610 x (t +4.6) ^-.78 =

TABLE 1 - ROOF DRAINAGE SYSTEM

	1st ITERATION					2nd ITERATION						3rd ITERATION			
Time (min.)	Rainfall Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)	Peak Runoff volume (cu.m.)	Peak roof outflow volume (cu.m)	Required storage volume (cu.m)	Volume in sloped roof areas (cu.m)	Volume contained by roof parapit (cu.m)	Total head on roof hoppers (cm)	Roof outflow rate (l/sec)	Roof outflow volume (cu.m)	Required storage volume (cu.m)	Total head on roof hoppers (cm)	Roof outflow volume (cu.m)	Required storage volume (cu.m)	
10	75.36	45.56	27.33	9.14	18.19	18.19	-22.75	1.32	1.97	1.18	26.15	2.63	2.37	24.97	
15	59.89	36.21	32.59	13.72	18.87	18.87	-22.07	1.43	2.14	1.93	30.66	3.38	4.56	26.03	
20	50.16	30.33	36.39	18.29	18.10	18.10	-22.84	1.30	1.95	2.34	34.05	3.94	7.09	29.30	
25	43.42	26.25	39.38	22.86	16.52	16.52	-24.43	1.04	1.56	2.34	37.04	4.43	9.98	29.40	<<------
30	38.45	23.24	41.84	27.43	14.40	14.40	-26.54	0.69	1.03	1.86	39.97	4.92	13.28	28.55	
35	34.60	20.92	43.93	32.00	11.93	11.93	-29.02	0.28	0.42	0.88	43.05	5.17	16.28	27.66	
40	31.54	19.07	45.76	36.58	9.18	9.18	-31.76	-0.17	-0.26	-0.63	46.39	5.31	19.10	26.66	
45	29.03	17.55	47.39	41.15	6.24	6.24	-34.71	-0.66	-0.99	-2.68	50.06	5.46	22.10	25.28	
50	26.94	16.28	48.85	45.72	3.13	3.13	-37.81	-1.18	-1.76	-5.29	54.14	5.63	25.32	23.54	
55	25.16	15.21	50.19	50.29	-0.11	-0.11	-41.05	-1.71	-2.57	-8.47	58.65	5.81	28.77	21.41	
60	23.62	14.28	51.41	54.86	-3.45	-3.45	-44.39	-2.26	-3.40	-12.23	63.64	6.02	32.50	18.91	
65	22.29	13.47	52.55	59.44	-6.88	-6.88	-47.83	-2.83	-4.25	-16.57	69.12	6.25	36.53	16.02	
70	21.12	12.77	53.61	64.01	-10.39	-10.39	-51.34	-3.41	-5.12	-21.50	75.11	6.49	40.91	12.71	
75	20.07	12.14	54.61	68.58	-13.97	-13.97	-54.92	-4.00	-6.01	-27.03	81.64	6.76	45.65	8.96	
80	19.14	11.57	55.55	73.15	-17.61	-17.61	-58.55	-4.61	-6.91	-33.16	88.71	7.06	50.80	4.75	
85	18.30	11.07	56.43	77.72	-21.29	-21.29	-62.24	-5.22	-7.82	-39.90	96.33	7.37	56.38	0.05	
90	17.54	10.61	57.27	82.30	-25.02	-25.02	-65.97	-5.83	-8.75	-47.24	104.52	7.71	62.44	-5.17	
95	16.85	10.19	58.08	86.87	-28.79	-28.79	-69.74	-6.46	-9.68	-55.20	113.28	8.07	69.01	-10.94	
100	16.22	9.81	58.84	91.44	-32.60	-32.60	-73.54	-7.09	-10.63	-63.78	122.62	8.46	76.12	-17.28	
105	15.64	9.46	59.57	96.01	-36.44	-36.44	-77.38	-7.72	-11.58	-72.97	132.54	8.87	83.80	-24.23	
110	15.11	9.13	60.28	100.58	-40.31	-40.31	-81.25	-8.36	-12.54	-82.78	143.05	9.30	92.10	-31.82	
115	14.61	8.83	60.95	105.16	-44.21	-44.21	-85.15	-9.01	-13.51	-93.21	154.16	9.76	101.04	-40.09	
120	14.15	8.56	61.60	109.73	-48.13	-48.13	-89.07	-9.65	-14.48	-104.27	165.87	10.25	110.66	-49.06	
125	13.72	8.30	62.23	114.30	-52.07	-52.07	-93.02	-10.31	-15.46	-115.96	178.19	10.76	121.00	-58.77	
130	13.33	8.06	62.83	118.87	-56.04	-56.04	-96.98	-10.96	-16.45	-128.27	191.11	11.29	132.09	-69.26	
135	12.95	7.83	63.42	123.44	-60.02	-60.02	-100.97	-11.62	-17.43	-141.22	204.64	11.85	143.97	-80.55	

Qroof= R A I N
= 0.605 I (l / sec)

Peak roof outflow rate =
no. of hoppers x weir rating x max. head
= 15.2 l/sec

Peak roof outflow volume =
= 15.2 x time x 60/1000 cu. m.

Roof outflow rate =
head x weir rating x no. of weirs
= head x 1.50 l/sec

Required max. roof storage (cu. m.) : 29.4
Available roof storage (cu. m.) : 163.8

PROJECT: 150 Rutledge
MUNICIPALITY: City of Mississauga

SITE STORM WATER MANAGEMENT

2 YR

Rainfall intensity (mm/hr) : I(2yr) = 610 x (t +4.6) ^-.78 =
Rainfall intensity (mm/hr) : I(5yr) = 820 x (t +4.6) ^-.78 =
Rainfall intensity (mm/hr) : I(10yr) = 1010 x (t +4.6) ^-.78 =
Rainfall intensity (mm/hr) : I(25yr) = 1160 x (t +4.6) ^-.78 =
Rainfall intensity (mm/hr) : I(50yr) = 1300 x (t +4.7) ^-.78 =
Rainfall intensity (mm/hr) : I(100yr) = 1450 x (t +4.9) ^-.78 =
T= 15 time of concentration in minutes

SITE CHARACTERISTICS

Controlled Pavement area (sq.m) : 1928
Controlled Landscaped area (sq.m) : 0
Total area - excl. Bldg (sq.m) : 1928
Composite runoff coefficent : 0.90

OUTLET CHARACTERISTICS

Orifice diameter (mm) : 80
Area of orifice (sq.m) : 0.0050
Orifice coefficient : 0.62
Max. ponding elev. : 157.95
Catchbasin elev. : 157.95
Ponding depth : 0.00
Orifice invert : 156.2
Orifice center line elev. : 156.240
Head (m) : 1.71
Orifice release rate (l/sec) : 18.1

TABLE 2 - System Storage

Time (min.)	Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)	Runoff volume (cu.m)	Orifice Outflow volume (cu.m)	Required storage volume (cu.m.)	
66	22.04	25.87	102.43	71.48	30.9	
68	21.57	25.64	104.60	73.65	30.9	<-------
70	21.12	25.42	106.76	75.82	30.9	
72	20.68	25.21	108.91	77.98	30.9	

Required site storage (cu. m) : 31
Available site storage (cu. m) : 126
SEE DRAWING SP-1

INCLUDES ROOF RELEASE RATE = 15.2 (l/sec)

TABLE 3 - Uncontrolled Runoff

Time (min.)	Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)	
15	59.89	7.8	<-------
20	50.16	6.6	
25	43.42	5.7	

Peak runoff (L/sec) : 7.8

UNCONTROLLED SITE CHARACTERISTICS

Uncontrolled Pavement area (sq.m.) : 0
Uncontrolled Landscaped area (sq.m.) : 1887
Total area (sq.m) : 1887
Composite runoff coefficent : 0.250

ALLOWABLE RELEASE RATE

Tc = 15 min
C = 0.25

Time (min.)	Intensity I (mm/hr)	Peak rate of runoff Q (l/sec)
15	59.89	25.93

2 YR

SITE SUMMARY

Pipe release rate (l/sec) : 18.1
Uncontrolled release rate (l/sec) : 7.8
Total site release rate (l/sec) : **25.9**

Total Allowable site release rate (l/sec) : **25.9**

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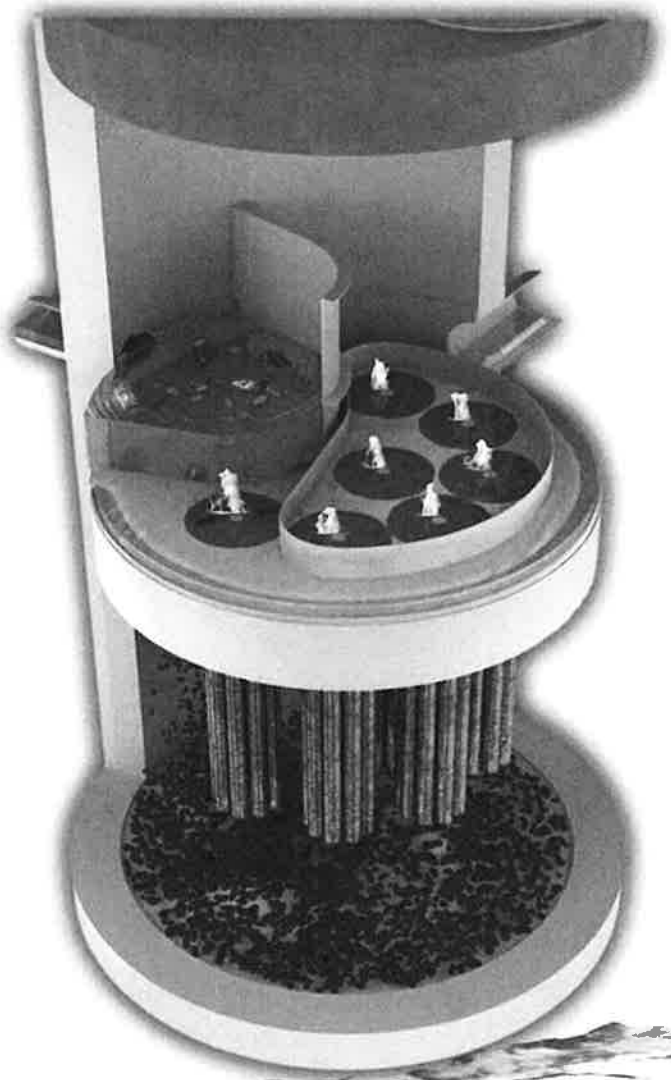
Technical Manual



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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.

PEAK DIVERSION JELLYFISH DESIGN NOTES:

1. STRUCTURE SHALL MEET AASHTO HS-20 OR PER APPROVING JURISDICTION REQUIREMENTS; WHICHEVER IS MORE STRINGENT, 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.
2. STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C-478 AND AASHTO LOAD FACTOR DESIGN METHOD.
3. INLET HGL NOT TO EXCEED 6" BELOW THE TOP OF THE M.A.W. DURING THE PEAK DESIGN STORM, OR 10-YEAR STORM (WHICHEVER IS GREATER).
4. INLET PIPE INVERT ELEVATION VARIES FROM 1" TO 6" MAXIMUM ABOVE THE OUTLET PIPE INVERT.
5. OUTLET PIPE INVERT IS EQUAL TO THE CARTRIDGE DECK ELEVATION.
6. THE OUTLET PIPE DIAMETER FOR NEW INSTALLATIONS IS TO BE ONE PIPE SIZE LARGER THAN THE INLET PIPE AT EQUAL OR GREATER SLOPE.
7. THE DIFFERENCE IN THE INLET AND OUTLET PIPE ELEVATIONS FOR RETROFIT INSTALLATIONS TO EXISTING STORM DRAIN PIPES SHALL BE EQUAL TO THE SLOPE OVER THE DIAMETER OF THE MANHOLE; NOT THE EXCEED 6" IN VERTICAL DIFFERENTIAL BETWEEN INLET AND OUTLET PIPES.

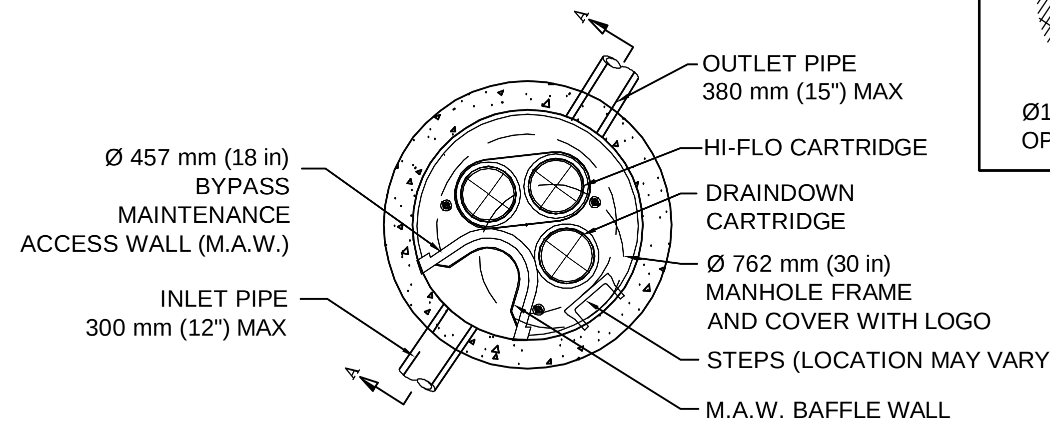
INSTALLATION NOTES

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.

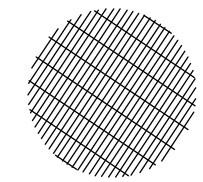
PEAK DIVERSION JELLYFISH RECOMMENDED PIPE DIAMETERS

MODEL DIAMETER (m)	MINIMUM ANGLE INLET/OUTLET PIPES	MINIMUM INLET PIPE DIAMETER (mm)	MAXIMUM INLET PIPE DIAMETER (mm)
1.2	62	150	300
1.8	59	200	300
2.4	52	250	375
3.0	48	300	450
3.6	40	300	450
CONTACT IMBRIUM SYSTEMS FOR ALTERNATE PIPE DIAMETERS			

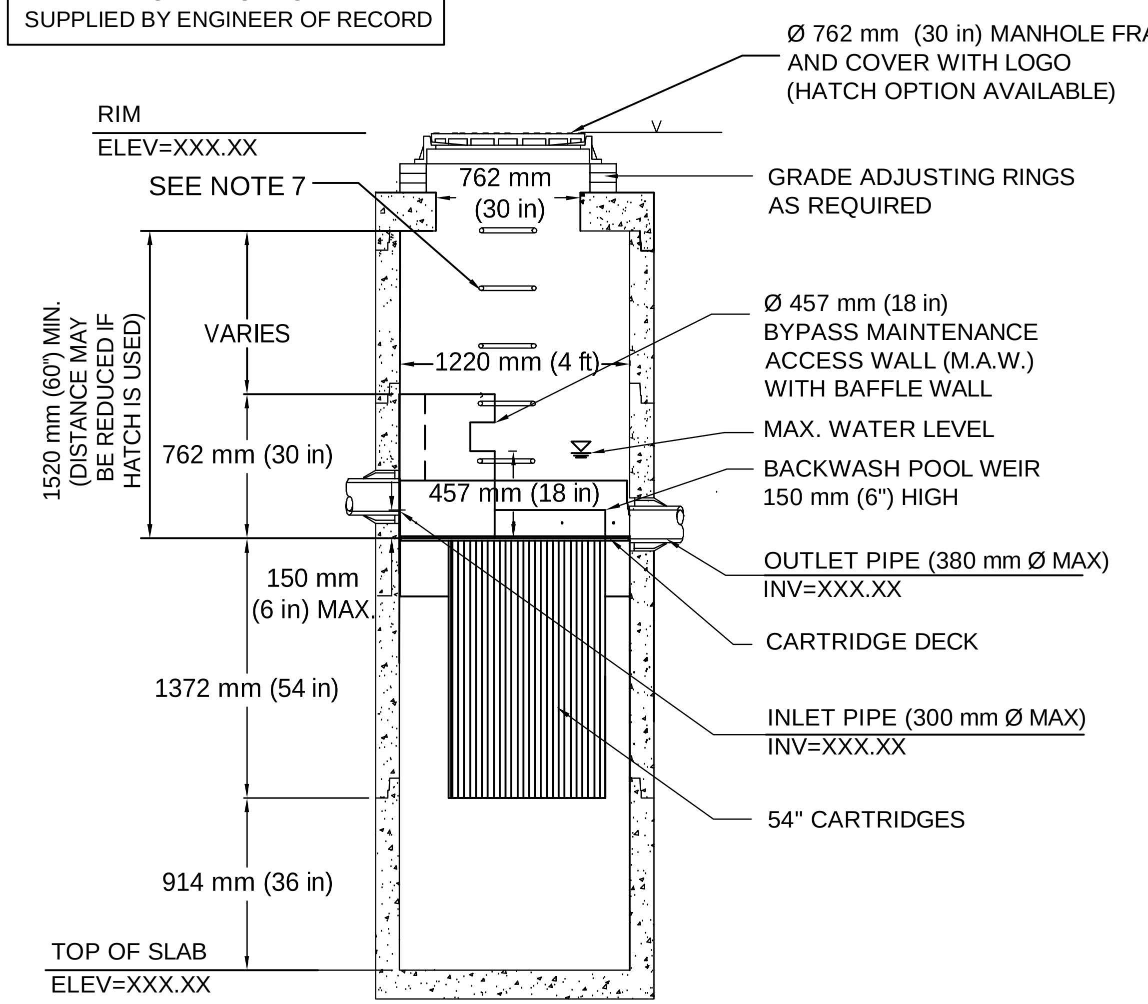
FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL JELLYFISH FILTER REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD REVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON AVAILABLE SPACE OR SITE CONFIGURATION REVISIONS.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



JF4 (PEAK DIVERSION) PLAN VIEW



XXX.XX INFORMATION TO BE SUPPLIED BY ENGINEER OF RECORD



JELLYFISH CROSS SECTION A-A

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), AND MAXIMUM BYPASS CAPACITY IS 70.8 L/s (2.50 CFS). IF THE SITE CONDITIONS EXCEED TOTAL CAPACITY, AN UPSTREAM BYPASS STRUCTURE IS REQUIRED. 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. BYPASS (L/s)	70.8			
MAX. SEDIMENT CAPACITY (kg)	142	105	70	40
MAX. TREATMENT (L/s)	12.7	9.3	6.2	3.4
MAX. TREATMENT AND BYPASS (L/s) (PEAK CAPACITY)	83.5	80.1	77.0	74.2

SITE SPECIFIC DATA REQUIREMENTS

JELLYFISH MODEL	*
STRUCTURE ID	*
WATER QUALITY FLOW RATE (L/s)	*
BYPASS FLOW RATE (L/s)	*
PEAK FLOW RATE (L/s)	*
RETURN PERIOD OF PEAK FLOW (yrs)	*
# OF CARTRIDGES REQUIRED (HF / DD)	*
CARTRIDGE SIZE (inches)	*
MAX ALLOWABLE BYPASS FLOW RATE (L/s)	70.8

PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

MARK	DATE	REVISION DESCRIPTION	BY
#	#	#	#
#	#	#	#
#	#	#	#
#	#	#	#
0	04/15/2015	INTIAL RELEASE	BSF

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JF4 PEAK DIVERSION

Scale = 1:50

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imbrium® Jellyfish® Filter

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

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
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JELLYFISH FILTER SPECIFICATIONS

Jellyfish®

JF4 ONLINE

Scale = 1:50

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Jellyfish® Filter

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

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Jellyfish® Filter Technical Manual

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Jellyfish® Filter Quick Glance

The Jellyfish Filter (patent pending) is an engineered stormwater quality treatment technology featuring unique membrane filtration in a compact standalone 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 suspended sediment removal capacity.

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

- Greater than 85! of the total suspended solids (TSS) load, including particles less than 5 microns
- Particulate bound pollutants such as nutrients, toxic metals, hydrocarbons, and bacteria
- Free oil
- Floatable trash and debris

Jellyfish cartridges are passively backwashed automatically after each storm event, which removes accumulated sediment from the membranes and significantly extends the service life of the cartridges and the maintenance interval. If required, the cartridges can be easily manually backwashed without removing the cartridges. Additionally, the lightweight cartridges can be removed by hand and externally rinsed, and rinsed cartridges then reinstalled. These simple maintenance options allow for cartridge regeneration, thereby minimizing cartridge replacement costs and lifecycle treatment costs while ensuring long term treatment performance.

Jellyfish® Filter Patent Information

Jellyfish Filter is protected by one or more of the following patents: Australian Patent No. 2008,286,748; US Patent Nos. 8,123,935, 8,287,726, US 8,221,618; Canadian Patent No. 2,696,482; Korean Patent No. 10-1287539; New Zealand Patent Nos. 583461, 604227; South African Patent No. 201,001,068; Other International Patents Pending.

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Chapter 1

1.0 Imbrium® Systems Contact Information

Imbrium® Systems is an engineered stormwater treatment company that designs, develops, manufactures, and distributes post-construction stormwater quality treatment technologies, to protect water resources from pollutants. Imbrium has a strong record of environmental innovation in the industry as the creator of the Stormceptor® oil and sediment separator, the Jellyfish® Filter, Sorbtive®MEDIA, Sorbtive®FILTER, and Sorbtive®VAULT.

Imbrium Systems is a global company with U.S. headquarters (Imbrium Systems Corporation) located in Rockville, Maryland and Canadian and International headquarters (Imbrium Systems Incorporated and Imbrium International Limited) located in Toronto, Ontario, Canada.

The Jellyfish® Filter is represented by a variety of licensees and organizations globally.

For assistance, please contact Imbrium Systems at:
United States: 888-279-8826 or 301-279-8827
Canada / International: 800-565-4801 or 416-960-9900

Chapter 2

2.0 Jellyfish Filter Design Overview

This technical manual provides information for design and installation of the Jellyfish Filter. When designed properly in accordance with this Technical Manual, the Jellyfish Filter will exceed the performance and longevity of conventional horizontal bed and granular media filters. Test data is available from Imbrium Systems upon request.

2.1 Jellyfish Filter Description

The Jellyfish Filter (patent pending) 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 consists of multiple membrane-encased filter elements ("filtration tentacles") attached to a cartridge head plate. The filtration tentacles provide an extraordinarily large amount of surface area, resulting in superior flow capacity and suspended sediment removal capacity.

Jellyfish efficiently captures a high level of stormwater pollutants, including:
- Greater than 85% of the total suspended solids (TSS) load, including particles less than 5 microns
- Particulate-bound pollutants such as nutrients, toxic metals, hydrocarbons, and bacteria
- Free oil
- Floatable trash and debris

Jellyfish cartridges are passively backwashed automatically after each storm event, which removes accumulated sediment from the membranes and significantly extends the service life of the cartridges and the maintenance interval. If required, the cartridges can be easily manually backwashed without removing the cartridges. Additionally, the lightweight cartridges can be removed by hand and externally rinsed, and rinsed cartridges then re-installed. These simple maintenance options allow for cartridge regeneration, thereby minimizing cartridge replacement costs and life-cycle treatment costs while ensuring long-term treatment performance. The Jellyfish Filter is comprised of several structural and functional components:

- A **cylindrical (manhole) or rectangular structure** constructed of either precast concrete or fiberglass, and available in a wide variety of sizes and configurations, serves as a vessel that provides long-lasting structural support for the system; provides hydraulic connections to the inlet and outlet pipes; provides surfaces for structural attachment of the cartridge deck and maintenance access wall; provides influent water storage and flow-through volume for pollutant separation and membrane filtration treatment; and provides a high-volume sump for storage of accumulated sediment.

- A rigid high-strength fiberglass **cartridge deck** separates the vessel into a lower chamber and upper chamber; houses the filter cartridges; provides a surface and flow path for treated water to the effluent pipe; provides doublewall containment of oil and other hydrocarbons below deck; and provides a platform for maintenance personnel to safely service the filter cartridges. The lower chamber provides influent water storage and flow-through volume for pollutant separation and membrane filtration treatment, and storage of accumulated sediment. The upper chamber provides above-deck clearance for inspection and maintenance service. The cartridge deck is securely attached to the vessel wall.

- A rigid high-strength fiberglass **maintenance access wall** attenuates influent water velocity; channels influent water into the lower chamber via a large opening in the cartridge deck; provides storage volume for floatable pollutants; and serves as a convenient inspection and maintenance access point for pollutant removal.

- **Cartridge receptacles** are secured to the cartridge deck and together with the cartridge lids, serve to securely anchor the filter cartridges into the cartridge deck.

- **Jellyfish membrane filtration cartridges** are inserted into the cartridge receptacles and secured with the cartridge lids. The filter cartridges treat the influent stormwater by filtering out fine suspended particulates (TSS) and particulate-bound pollutants on the membrane of each filtration tentacle. Filtered water passes through the membranes, flows up the center tube of each filtration tentacle and exits the top opening of each tentacle. Cartridges are available in various lengths and flow ratings. Filter cartridges are designated as either **hi-flo cartridges** or **draindown cartridges**, depending on their placement position within the cartridge deck. Cartridges placed within the backwash pool weir are automatically passively backwashed after each storm event, and are designated the hi-flo cartridges. Cartridges placed outside the backwash pool weir are not passively backwashed but facilitate the draindown of the backwash pool and these are designated the draindown cartridges. The design flow rate of a draindown cartridge is controlled by a cartridge lid orifice to one-half the design flow rate of a hi-flo car tridge of similar length. The lower design flow rate of the draindown cartridge reduces the likelihood of occlusion prior to scheduled maintenance.

- **Cartridge lids** are fastened onto the cartridge receptacles to securely anchor the filter cartridges into the cartridge deck. The lids are removable to allow manual backflushing or removal of the filter cartridges when required during maintenance service. Cartridge lids contain a **flow control orifice** that is specifically sized for use with hi-flo and draindown cartridges. **Blank lids** have no orifice and are used to cover unoccupied cartridge receptacles in systems that do not use the full rated flow capacity of the system.

- A **separator skirt** serves as a baffle that encloses the filtration tentacles and defines the filtration zone inside the separator skirt perimeter. The separator skirt extends the full length of the filtration tentacles and prevents contamination of the membranes with oil and floatable debris. The separator skirt has a large opening at the bottom that allows pre-treated water to enter the filtration zone under low velocity. The separator skirt is securely attached to the underside of the cartridge deck.

- A rigid fiberglass **backwash pool weir** extends 6 inches (150 mm) above the cartridge deck and encloses the hi-flo cartridges. During inflow, filtered water exiting the hi-flo cartridges forms a pool inside the weir. If sufficient driving head is available the pool overtops the weir and spills to the cartridge deck where it subsequently flows to the outlet pipe. As the inflow event subsides and forward driving head decreases, water in the backwash pool reverses flow direction and automatically passively backwashes the hi-flo cartridges, cleaning the membrane surfaces. Water in the lower chamber (below deck) is displaced through the draindown cartridges. This self-cleaning mechanism may occur multiple times during a single storm event as rainfall/runoff intensities rise and fall, thereby significantly extending the service life of the cartridges and the maintenance interval.

- **Optional internal bypass pressure relief pipe(s)** can be placed in one or multiple cartridge receptacles. The pressure relief pipe height and diameter can be varied to accommodate the design peak flow rate and system driving head requirements. When the internal bypass option is utilized, peak flow rates receive membrane filtration treatment up to the filtration design flow rate, with the balance of the peak flow receiving pre-treatment.

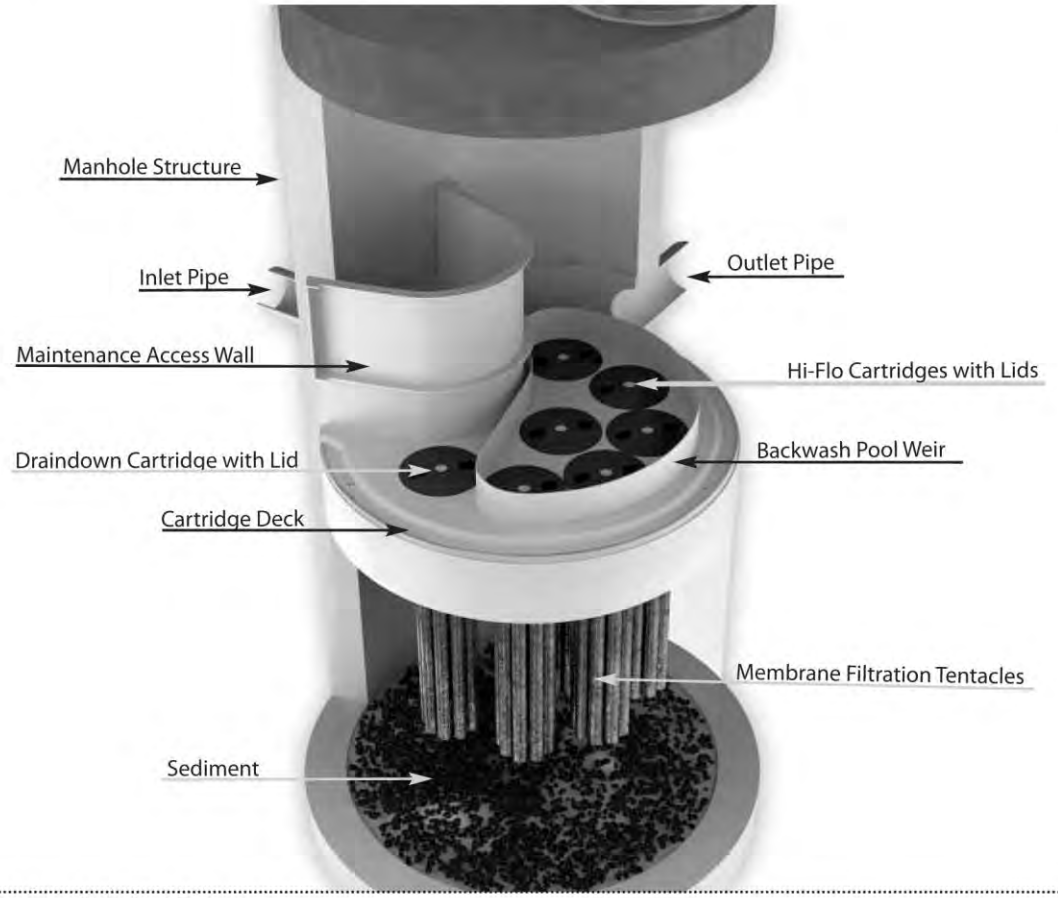
- A **deflector plate** (below-deck inlet pipe manhole configuration only) is installed across the below-deck inlet pipe opening to induce tangential water flow through the pre-treatment channel between the vessel wall and separator skirt.

- **Standard covers, rectangular hatches, or inlet grates** are installed at the surface and are removed to allow maintenance access to the system.

- **Built-in steps or ladder(s)** allow maintenance personnel to access the cartridge deck and filter cartridges. The Jellyfish Filter and components are depicted in **Figure 1.**

FIGURE 1

Jellyfish Filter and Components



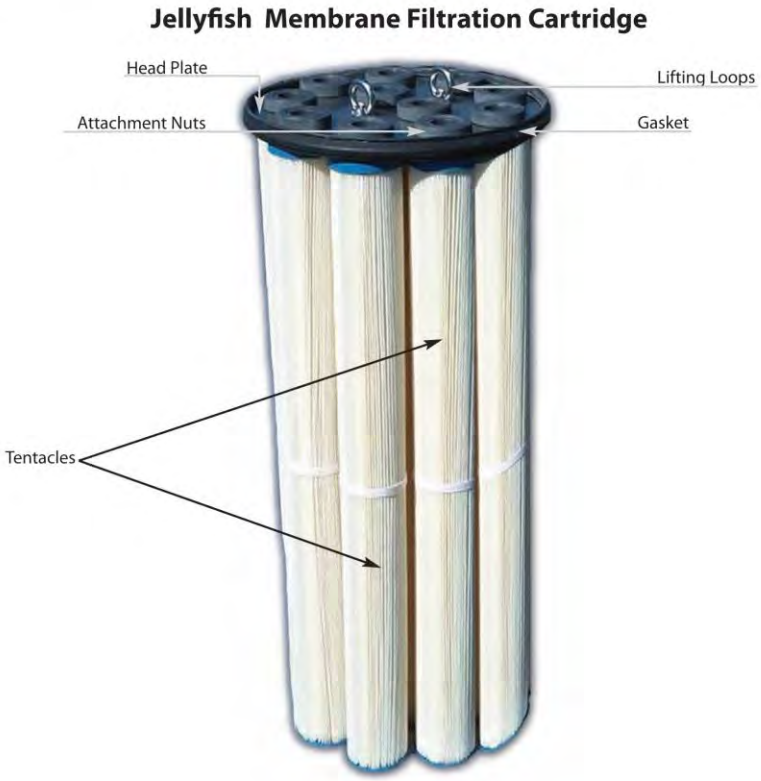
Note: Separator Skirt Not Shown

2.2 Jellyfish Membrane Filtration Cartridge

The Jellyfish Filter utilizes multiple lightweight membrane filtration cartridges. Each cartridge consists of multiple removable filter elements ("filtration tentacles") attached to a cartridge head plate. Each filtration tentacle consists of a central perforated tube surrounded by a specialized membrane. The cylindrical filtration tentacle has a threaded pipe nipple at the top and is sealed at the bottom with an end cap. A cluster of tentacles is attached to a stainless steel head plate by inserting the top pipe nipples through the head plate holes and securing with removable nuts. A removable oil-resistant polymeric rim gasket is attached to the head plate to impart a watertight seal when the cartridge is secured into the cartridge receptacle with the cartridge lid. A Jellyfish membrane filtration cartridge is depicted in **Figure 2**.

The cartridge length is typically either 27 inches (686 mm) or 54 inches (1372 mm), with options for custom lengths if required. The dry weight of a new cartridge is less than 20 pounds (9 kg), and the wet weight of a used cartridge is less than 50 pounds (23 kg), making a cartridge easy to install and remove by hand. No heavy lifting equipment is required.

FIGURE 2



The filtration tentacle membranes provide an extraordinarily large amount of surface area, resulting in superior flow capacity and suspended sediment removal capacity. A typical Jellyfish cartridge with eleven 54-inch (1372 mm) long filtration tentacles has 381 ft2 (35.4 m2) of membrane surface area. Hydraulic testing on a clean 54-inch (1372 mm) filter cartridge has demonstrated a flow rate of 180 gpm (11.3 L/s) at 18 inches (457 mm) of driving head.

Extensive third-party field testing, including testing at an urban site with very high intensity rainfall and runoff, has demonstrated consistently high pollutant removal performance with a conservative design flow rate of 80 gpm (5.0 L/s) for the 54-inch (1372 mm) long hi-flo cartridge and 40 gpm (2.5 L/s) for the 54-inch (1372 mm) long draindown cartridge. These values translate to a conservative design membrane filtration flux rate (flow per unit surface area) of 0.21 gpm/ft_2 (0.14 Lps/m_2) for the hi-flo cartridge and 0.11 gpm/ft_2 (0.07 Lps/m_2) for the draindown cartridge.

The standard membrane demonstrates removal of >85% of fine sediment at a design flux rate of 0.21 gpm/ft_2, based on laboratory testing with Sil-Co-Sil™106 which has a median particle size (d50) of 22 microns. In addition, the filtration tentacle membrane has anti-microbial characteristics that inhibit the growth of bio-film that might otherwise prematurely occlude the pores of the membrane and restrict hydraulic conductivity.

Hydraulic and sediment loading testing has demonstrated scalability of the membrane filtration surface area such that increases in the number and/or length of filtration tentacles contribute a uniform increase in total filter surface area and therefore flow capacity and sediment removal capacity. The flow rating of a particular Jellyfish Filter cartridge is based on the membrane filtration surface area of the cartridge and data collected from both laboratory testing and field testing.

The cartridge deck contains a receptacle for each filter cartridge. The cartridge is lowered down into the receptacle such that the cartridge head plate and rim gasket rest on the lip of the receptacle. A cartridge lid is fastened onto the receptacle to anchor the cartridge. Each cartridge lid contains a flow control orifice. The orifice in the hi-flo cartridge lid is larger than the orifice in the draindown cartridge lid.

Jellyfish Filter cartridges are designated as either hi-flo cartridges or draindown cartridges, depending on their placement position within the cartridge deck. Cartridges placed within the 6-inch (150 mm) high backwash pool weir that extends above the deck are automatically passively backwashed after each storm event and are designated as the hi-flo cartridges. Cartridges placed outside the backwash pool weir are not passively backwashed but facilitate the draindown of the backwash pool, and these are designated as the draindown cartridges. The design flow rate of a draindown cartridge is controlled by a cartridge lid orifice to one-half the design flow rate of a hi-flo cartridge of similar length. The lower design flow rate of the draindown cartridge reduces the likelihood of occlusion prior to scheduled maintenance.

Inflow events with driving head ranging from less than 1 inch (25 mm) up to the maximum design driving head will cause continuous forward flow and filtration treatment through the draindown cartridges. Inflow events with driving head that exceeds the 6-inch (150 mm) height of the backwash pool weir will cause continuous forward flow and filtration treatment through the hi-flo cartridges.

2.3 Jellyfish Filter Operation – Driving Head Requirement

A differential in upstream and downstream water elevation during an inflow event provides the minimal driving head required to overcome the minor cumulative friction loss through the system, at which point flow-through operation of the Jellyfish Filter commences.

For systems using an external bypass with upstream diversion structure, the driving head is calculated as the difference in elevation between the top of the diversion structure weir and the invert of the Jellyfish Filter outlet pipe. For systems using an internal bypass, the driving head is calculated as the difference in elevation between the top of the pressure relief pipe(s) and the invert of the outlet pipe.

A minimum design driving head is selected to achieve design flow rates, while accounting for gradual increase in system head loss at the design flow rate due to long-term accumulation of sediment on the filtration membranes. A clean Jellyfish Filter cartridge has flow capacity far in excess of the cartridge design flow rate at the design driving head. This ensures that design flow capacity is maintained during the period between maintenance service operations. Typically, a minimum 18 inches (457 mm) of driving head is designed into the system but may vary from 12 to 24 inches (305 to 610 mm) depending on specific site requirements.

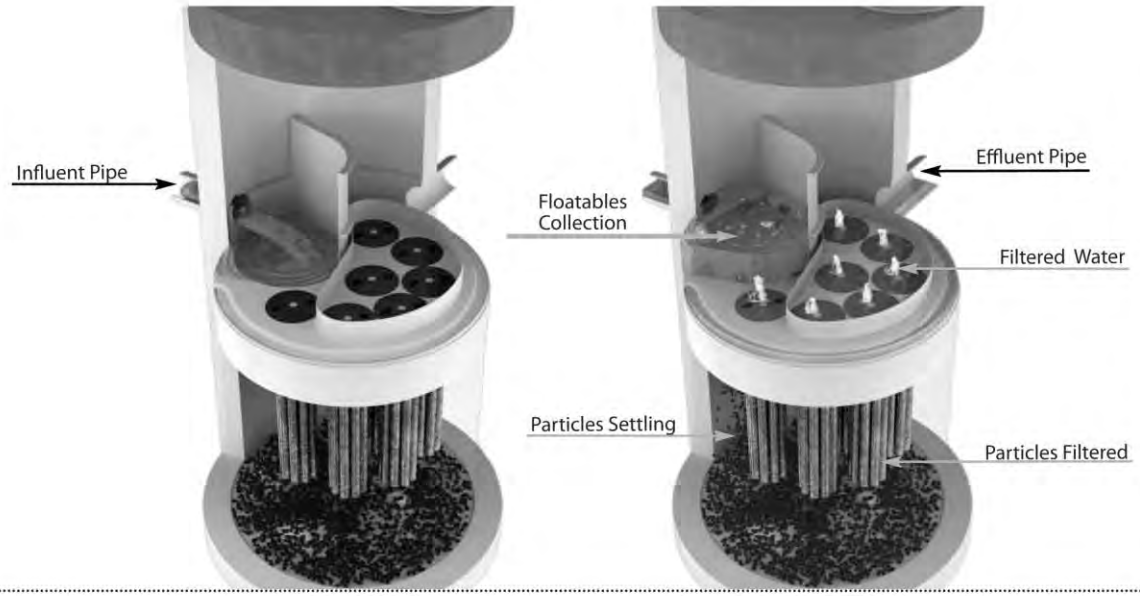
For systems that may experience submerged or backwater conditions due to dry weather base flow or tidal effects, driving head calculations must account for water elevation during the backwater condition. The Jellyfish Filter treatment functions will continue to operate during forward flow despite backwater conditions. An increase in the maintenance access wall height may be required to ensure floatables capture an increase in the height of the backwash pool weir may be required to ensure function of the automatic passive backwash feature.

2.4 Jellyfish Filter Operation – Treatment Functions

The Jellyfish Filter provides both **pre-treatment** and **membrane filtration** treatment to remove pollutants from stormwater runoff. These functions are depicted in **Figure 3** below.

FIGURE 3

Jellyfish Filter Treatment Functions
Pre-Treatment and Membrane Filtration
Section View with Maintenance Access Wall (MAW) Cutaway



Pre-treatment removes coarse sediment (generally > 50 microns), particulate-bound pollutants attached to coarse sediment (nutrients, toxic metals, hydrocarbons), free oil and floatable trash and debris. These pollutants are removed by gravity separation. Large, heavy particles fall to the sump (sedimentation) and low density pollutants rise to the surface (floatation) within the pre-treatment channel.

Pre-treatment begins when influent flow enters the system either through an above-deck inlet pipe (standard) or below-deck inlet pipe (optional). In the above-deck inlet pipe configuration, influent enters the maintenance access wall zone and is channeled through a large-diameter opening in the cartridge deck to the lower chamber. The large surface area of the deck opening and change in flow direction attenuate the influent flow velocity. Due to equalization of hydrostatic pressure and downstream pathway through the opening at the bottom of the separator skirt, influent flow spreads in lateral and downward directions throughout the pre-treatment channel between the vessel wall and the outer perimeter of the separator skirt. In the below-deck inlet pipe configuration, a deflector plate angled across the inlet pipe opening induces directional tangential flow in the pre-treatment channel. In either configuration, flow spreading throughout the pre-treatment channel serves to reduce the average flow velocity and enhance the separation of pollutants.

Pre-treatment for floatables occurs as buoyant pollutants rise toward the surface, with some of the floatables mass trapped beneath the cartridge deck in the pre-treatment channel. Most of the floatables mass accumulating in the maintenance access wall zone at the air-water interface. This feature allows convenient and easy inspection and maintenance for floatable contaminants. The separator skirt protects the filtration tentacles from contamination by oil and floatable debris.

Coarse sediment settles out of the pre-treatment channel to the sump. As water from the pre-treatment channel slowly flows downward and then laterally beneath the separator skirt, the combination of the large opening in the bottom of the separator skirt and a change in direction to an upward downstream flow path serves to further reduce average flow velocity and enhance particle separation. Sediment is stored in the sump until removed by vacuum during a maintenance service.

Membrane filtration treatment removes suspended particulates (generally < 50 microns) and particulate-bound pollutants (nutrients, toxic metals, hydrocarbons, and bacteria). Laboratory and field performance testing of the Jellyfish Filter have demonstrated capture of particulates as small as 2 microns.

Filtration treatment begins when pre-treated influent flows under the separator skirt and into the filtration zone through the large opening defined by the bottom edge of the separator skirt. Uniform hydraulic pressure gradient across the entire membrane surface area causes pre-treated water to penetrate the entire membrane surface area of each filtration tentacle. Water enters the membrane pores radically and deposits fine particulates on the exterior membrane surface. Filtered water flows into the perforated center drain tube of each filtration tentacle and then upward and out the top of each tentacle. Water exiting each of the tentacles of a single cartridge combines at the top of the cartridge under the cartridge lid. The combined flow then vertically exits the cartridge lid orifice with a pulsating fountain effect.

As a layer of sediment builds up on the external membrane surface, membrane pores are partially occluded which serves to reduce the effective pore size. This process, referred to as "filter ripening", significantly improves the removal efficiency of pollutants relative to a brand new or clean membrane of some nominal pore size. Filter ripening accounts for the ability of the Jellyfish Filter to remove particles finer than the nominal pore size rating of the membranes.

Jellyfish Filter operation and maintenance are depicted in an animation on Imbrium Systems website (www.imbriumsystems.com).

2.5 Jellyfish Filter Operation – Self- Cleaning Functions

The Jellyfish Filter utilizes several self-cleaning processes to remove accumulated sediment from the external surfaces of the filtration membranes, including **automatic passive backwash** of the h i-flo cartridges, **vibrational pulses**, and **gravity**. Combined, these processes significantly extend the cartridge service life, maintenance interval and reduce life-cycle costs.

Automatic passive backwash is performed on the hi-flo cartridge at the end of each runoff event and can also occur multiple times during a single storm event as intensity and driving head varies. During inflow, filtered water exiting the hi-flo cartridges forms a pool above the cartridge deck inside the backwash pool weir. The depth and volume of the back wash pool will vary with the available driving head, ranging from some minimal quantity up to a quantity sufficient to fill and overflow the backwash pool (typical weir height is 6 inches / 150 mm). As the inflow event subsides and forward driving head decreases, water in the backwash pool reverses flow direction and automatically passively backwashes the hi-flo cartridges, removing sediment from the membrane surfaces. Water in the lower chamber (below deck) is displaced through the draindown cartridges.

Vibrational pulses occur as a result of complex and variable pressure and f low direction conditions that a rise in the space between the top surface of the cartridge head plate and the underside of the cartridge lid. During forward flow a stream of filtered water exits the top of each filtration tentacle into this space and en counters resistance from the cartridge lid and turbulent pool of water within the space. Water is forced through the cartridge lid flow control orifice with a pulsating fountain effect. The variable localized pressure causes pulses that transmit vibrations to the membranes, thereby dislodging accumulated sediment. The effect appears more pronounced at higher flow rates, and applies to both hi-flo and draindown cartridges.

Gravity continuously applies a force to ac cumulate d sediment on the membranes, both during inflow events and inter-event dry periods. As fine particles agglomerate into larger masses on the membrane surface, adhesion to the membrane surface can lessen, and a peeling effect ensues which ultimately results in agglomerates falling away from the membrane. Complex chemical and biological effects may also play a role in this process.

Chapter 3

3.0 Jellyfish Filter Design Guidelines

The Jellyfish Filter has many flexible design features to accommodate a wide range of specific site requirements and constraints. For design assistance, please contact Imbrium Systems.

3.1 Configurations and Design Capacities

Design flow capacities and pollutant capacities for standard Jellyfish Filter manhole configurations are shown in **Tables 1** and **2**.

The Jellyfish Filter standard model numbers provide information about the manhole inside diameter (expressed in U.S. customary units) and cartridge counts for hi-flo and draindown cartridges. For example, Jellyfish Filter Model Number JF6-4-1 is a 6-ft (1.8 m) diameter manhole with four hi-flo cartridges and one draindown cartridge. Standard model numbers assume the use of 54-inch (1372 mm) long cartridges. Specific designations for non-standard structures or cartridge lengths are noted in the **Jellyfish Filter Owner's Manual**.

Table 1
Design Flow Capacities
Standard Jellyfish Filter Manhole Configurations

Manhole Diameter (ft / m) [1]	Model No.	Hi-Flo Cartridges [2] 54 in / 1372 mm	Draindown Cartridges [2] 54 in / 1372 mm	Treatment Flow Rate (gpm / cfs)	Treatment Flow Rate (L/S)
4 / 1.2	JF4-2-1	2	1	200 / 0.45	12.6
6 / 1.8	JF6-3-1	3	1	280 / 0.62	17.7
	JF6-4-1	4	1	360 / 0.80	22.7
	JF6-5-1	5	1	440 / 0.98	27.8
	JF6-6-1	6	1	520 / 1.16	32.8
8 / 2.4	JF8-6-2	6	2	560 / 1.25	35.3
	JF8-7-2	7	2	640 / 1.43	40.4
	JF8-8-2	8	2	720 / 1.60	45.4
	JF8-9-2	9	2	800 / 1.78	50.5
	JF8-10-2	10	2	880 / 1.96	55.5
10 / 3.0	JF10-11-3	11	3	1000 / 2.23	63.1
	JF10-12-3	12	3	1080 / 2.41	68.1
	JF10-12-4	12	4	1120 / 2.50	70.7
	JF10-13-4	13	4	1200 / 2.67	75.7
	JF10-14-4	14	4	1280 / 2.85	80.8
	JF10-15-4	15	4	1360 / 3.03	85.8
	JF10-16-4	16	4	1440 / 3.21	90.8
	JF10-17-4	17	4	1520 / 3.39	95.9
	JF10-18-4	18	4	1600 / 3.56	100.9
	JF10-19-4	19	4	1720 / 3.83	108.5
12 / 3.6	JF12-20-5	20	5	1800 / 4.01	113.6
	JF12-21-5	21	5	1880 / 4.19	118.6
	JF12-22-5	22	5	1960 / 4.37	123.7
	JF12-23-5	23	5	2040 / 4.54	128.7
	JF12-24-5	24	5	2120 / 4.72	133.8
	JF12-25-5	25	5	2200 / 4.90	138.8
	JF12-26-5	26	5	2280 / 5.08	143.8
	JF12-27-5	27	5	2360 / 5.26	148.9

[1] Smaller and larger systems may be custom designed
[2] Shorter length cartridge configurations are available

Table 2
Design Pollutant Capacities
Standard Jellyfish Filter Manhole Configurations

Model Diameter (ft / m)	Wet Volume Below Deck (ft^3 / L)	Sediment Capacity [1] (ft^3 / L)	Oil Capacity [2] (gal / L)
JF4 4 / 1.2	82 / 2313	12 / 0.34	100 / 379
JF6 6 / 1.8	184 / 5205	28 / 0.79	224 / 848
JF8 8 / 2.4	327 / 9252	50 / 1.42	388 / 1469
JF10 10 / 3.0	511 / 14,456	78 / 2.21	608 / 2302
JF12 12 / 3.6	735 / 20,820	113 / 3.20	732 / 2771

[1] Assumes 12 inches (305 mm) of sediment depth in sump.
Systems may be designed with increased sediment capacity.
[2] Assumes 24 inches (610 mm) of pre-treatment channel depth for oil storage

3.2 Inlet and Outlet Pipes

The Jellyfish Filter is available in both the standard **above-deck inlet pipe** configuration and optional **below-deck inlet** pipe configuration. Specific site requirements generally determine the configuration that is most favorable for the site. For both configurations, the invert elevation of the outlet pipe is identical to the cartridge deck elevation. Please refer to **Figures 4** and **5**.

FIGURE 4

Jellyfish Configuration with Below-Deck Inlet Pipe

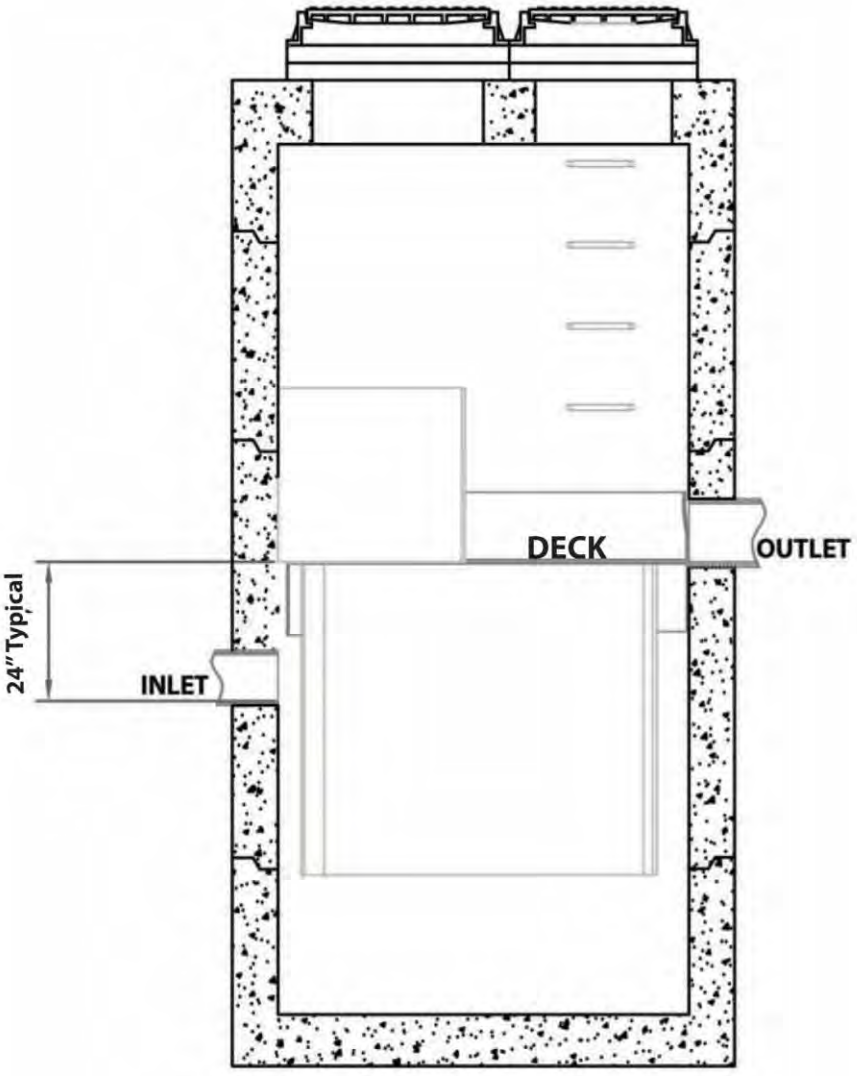
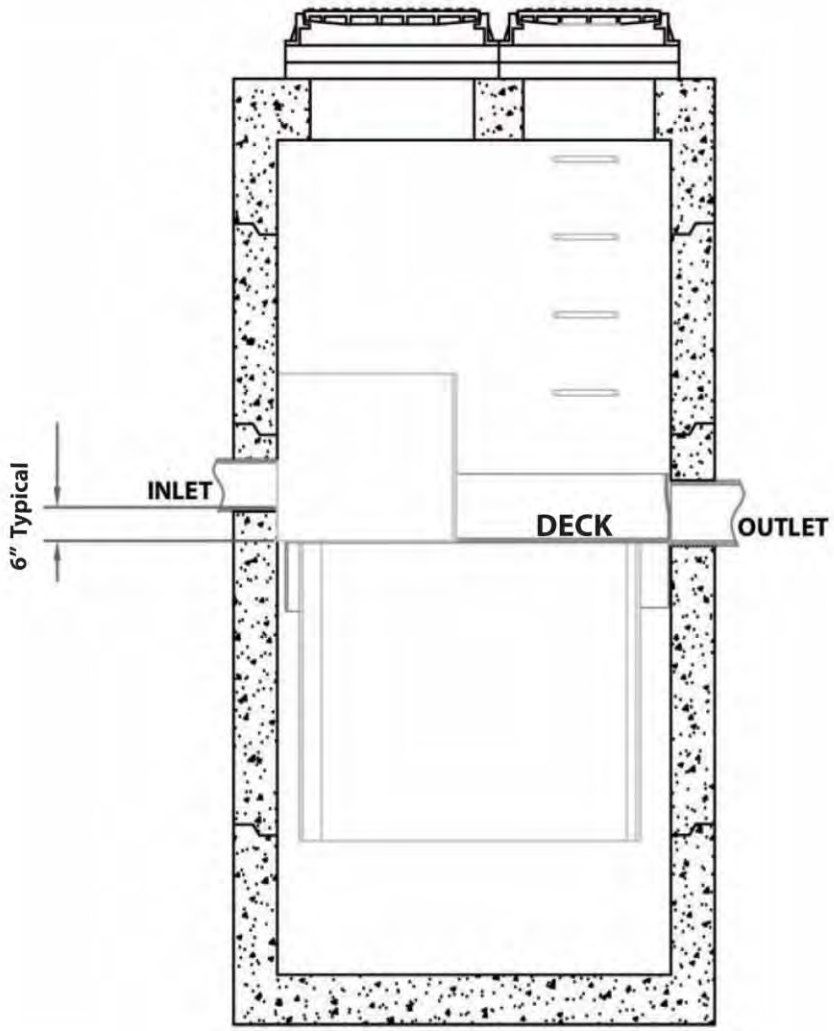


FIGURE 5

Jellyfish Configuration with Above-Deck Inlet Pipe



For the standard above-deck inlet pipe configuration, the invert elevation of the inlet pipe is typically set 6 inches (150 mm) higher than the invert elevation of the outlet pipe. This generally ensures that the inlet pipe will drain completely at the conclusion of each rainfall/runoff event, while providing sufficient volume within the maintenance access wall zone for surface accumulation of floatables below the inlet pipe. The elevation of the inlet pipe can be varied as required.

The Jellyfish Filter can accommodate a wide range of angles between the inlet and outlet pipes. The inlet pipe can be located anywhere about the circumference of the structure. The separation angle relationship of the inlet pipe to the outlet pipe can vary from 0 to 360 degrees to provide maximum design flexibility. Typical off-line layouts (external bypass using an upstream diversion structure) will have an inlet to outlet separation angle of 90 to 120 degrees. See **Table 3** below for the minimum separation angle for standard manhole configurations with an above-deck inlet pipe.

The Jellyfish Filter can accommodate **multiple inlet pipes** within certain restrictions.

The Jellyfish Filter can be built at all depths of cover generally associated with conventional stormwater conveyance systems.

Table 3
Minimum Inlet and Outlet Pipe Separation Angles and Diameters
(Jellyfish Filter Manhole Configurations with Above-Deck Inlet Pipe)

Model Diameter (ft / m)	Minimum Angle [1] Inlet / Outlet Pipes	Minimum Inlet Pipe Diameter (in / mm)	Minimum Outlet Pipe Diameter (in / mm)
JF4 4 / 1.2	62°	6 / 152	8 / 203
JF6 6 / 1.8	59°	8 / 203	10 / 254
JF8 8 / 2.4	52°	10 / 254	12 / 305
JF10 10 / 3.0	48°	12 / 305	18 / 457
JF12 12 / 3.6	40°	12 / 305	18 / 457

[1] Assumes off-line (external bypass) configuration

3.3 Bypass Design

The Jellyfish Filter can be designed with either an off-line or on-line configuration. All stormwater filter systems will perform for a longer duration between required maintenance services when designed and applied in off-line configurations.

A standard off-line configuration has an external bypass that uses an upstream diversion structure. The elevation difference between the top of the diversion structure weir and the Jellyfish Filter outlet pipe invert establishes the design driving head associated with the design flow rate. Excess flow that overtops the diversion weir bypasses the Jellyfish Filter and proceeds downstream. Drawings that illustrate relative system elevations are available by contacting Imbrium Systems.

For some sites an off-line configuration may not be practical and use of an on-line configuration is advantageous. In these cases, an optional internal bypass pressure relief pipe(s) can be placed in one or multiple cartridge receptacles within the Jellyfish Filter. The pressure relief pipe height and diameter can be varied to accommodate the design peak flow rate and system driving head requirements. For these systems the driving head is calculated as the difference in elevation between the top of the pressure relief pipe and the invert of the outlet pipe. When the internal bypass option is utilized, peak flow rates receive membrane filtration treatment up to the filtration design flow rate, with the balance of the peak flow receiving pre-treatment. Increased sump depth may be required to increase sediment storage capacity and to minimize re-suspension of previously captured sediment at peak flow rates. Please contact Imbrium Systems for design assistance.

3.4 Shallow or Low Cover Installations

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 to provide adequate access to all the cartridges within the unit. The general minimum depth of cover is 36 inches (915 mm) from the Jellyfish outlet pipe invert to the underside of the top slab. Further custom modifications may be possible. A typical drawing is included in **Appendix A** and **B**.

3.5 Submerged Installations

When properly designed, the Jellyfish Filter will function effectively under submerged conditions. For systems that may experience submerged or backwater conditions due to dry weather base flow or tidal effects, driving head calculations must account for water elevation during the backwater condition. The Jellyfish Filter treatment functions will continue to operate during forward flow despite backwater conditions. A customized increase to the maintenance access wall height may be required to ensure floatables capture and an increase in the height of the backwash pool weir may be required to ensure function of the automatic passive backwash feature.

3.6 Grated Inlet and Curb Inlet Jellyfish Filters

Existing drainage systems can be retrofitted by replacing conventional storm inlets with a Jellyfish Filter inlet. Imbrium Systems has two standard options, curb inlet and grated inlet configurations. Both configurations utilize the shorter 27-inch (686 mm) length Jellyfish filter cartridges and require minimal cover. Two typical drawings are included in **Appendix A** and **B**. Further custom modifications may be possible.

3.7 Series Jellyfish Filter

For sites with water quality treatment flow rates that exceed the design flow rate of the largest standard Jellyfish Filter model, custom systems can be designed that hydraulically connect multiple Jellyfish Filters in series. Please contact Imbrium Systems for assistance.

3.8 Jellyfish Filter with Sump Drain

The Jellyfish Filter is typically designed to maintain a pool of water in the lower chamber (below deck) between storms. However, certain sites or jurisdictions may require draindown of the sump between storms. To meet these requirements, a sump drain filter can be installed to slowly drain the lower chamber pool to the sub-grade for infiltration or to an alternate point of discharge. A typical drawing is included in **Appendix A** and **B**.

Chapter 4

4.0 Jellyfish Filter Sizing Guidelines

The Jellyfish Filter is sized based on considerations of the specified treatment flow rate, anticipated sediment mass load transported from the site and required pollutant storage capacities.

An optional software-based continuous simulation modeling tool, such as **PCSWMM for Stormceptor®**, can be utilized to determine site hydrology from local historical rainfall data and thereby assist in sizing a Jellyfish Filter. In general, such a tool is useful in deriving the water quality treatment flow rate associated with treatment of a high percentage of the average annual runoff volume.

4.1 Sizing for Water Quality Treatment Flow Rate

The Jellyfish Filter can be sized using a specified flow rate (i.e. "water quality flow rate" or "treatment flow rate"). The treatment flow rate is determined by the engineer in accordance with methods approved by the local jurisdiction. The appropriate Jellyfish Filter model number is then selected from **Table 1**. Custom systems can be designed for sites with water quality treatment flow rates that exceed the design flow rate of the largest standard Jellyfish Filter model. Please contact Imbrium Systems for assistance.

4.2 Sizing for Sediment Mass Loading

A second sizing consideration is the anticipated sediment load that will enter the Jellyfish Filter. For a stormwater filter system to have practical application in the field, it is important that the system's sediment mass loading and storage is recommended that a system be designed to accommodate a minimum one year interval between maintenance services for pollutant removal and filter cartridge flushing/rinsing.

Laboratory testing using a standard test sediment demonstrated sediment mass loading capacity of 125 pounds (57 kg) of sediment per 54-inch (1372 mm) long hi-flo cartridge at 18 inches (457 mm) of driving head (see **Table 4** below). Specific site conditions will influence the sediment mass loading capacity of the Jellyfish Filter due to the variable nature of sediment characteristics, rainfall intensity, time intervals between runoff events and frequency of automatic passive backwash.

The projected annual sediment load transported from the site should be determined by the engineer. Calculations can be performed for the projected annual runoff volume using an assumed event mean suspended solids concentration (typically 60 mg/L for urban sites). As a guideline, the U.S. EPA has determined typical annual sediment loads per acre for various sites by land use (see **Table 5**). Certain states and local jurisdictions have also established such guidelines.

For some sites the Jellyfish Filter is installed downstream of a detention facility. In these cases, the Jellyfish Filter will typically treat a relatively low flow rate (orifice-controlled release flow rate) from the detention facility compared to flow rates that would be treated if the Jellyfish Filter received the site runoff directly. In such cases, the size of the Jellyfish Filter and number of filter cartridges will typically be determined by the projected annual sediment mass load transported to the Jellyfish Filter, accounting for sediment mass that is expected to settle out in the upstream detention facility.

It is important for the engineer to confirm that the system design has adequate storage capacity for anticipated pollutant loads that will accumulate over the specified maintenance interval. The oil and sediment pollutant capacities for each standard Jellyfish Filter model are shown in **Table 2**.

Table 4
Sediment Mass Loading Capacity
Jellyfish Filter Hi-Flo and Draindown Cartridges

Cartridge Type	Cartridge Length (in / mm)	Driving Head (in / mm)	Sediment Mass Loading Capacity [1, 2] (lbs / kg)
Hi-Flo	27 / 686	18 / 457	63 / 28
Hi-Flo	54 / 1372	18 / 457	125 / 57
Draindown	27 / 686	18 / 457	32 / 15
Draindown	54 / 1372	18 / 457	63 / 28

[1] Based on laboratory testing using simulated storm events and Sil-Co-Sil™ 106 test sediment (d_{50} = 22 microns) at 40% of maximum cartridge flow rate

[2] Sediment Mass Loading Capacity expressed as pounds of NJPSD test sediment (1 – 1000 microns, d_{50} = 67 microns, characterized as 55% sand / 40% silt / 5% clay), using conversion factor of 1.66 from Sil-Co-Sil 106 to NJPSD

Note: Actual sediment mass loading capacity will vary depending on specific site characteristics

Table 5
Typical Urban Areas and Pollutant Yields (Sediment)
(Burton and Pitt, 2002)

Annual Total Suspended Solids Load by Land Use (lbs/acre/year) (kg/hectare/year)							
Commercial	Parking Lot	Residential Density			Highways	Industrial	Shopping Centers
		High	Med.	Low			
1000	400	400	250	10	880	500	440
1120	448	448	280	11	986	560	493

Source: U.S. EPA Stormwater Best Management Practice Design Guide, Volume 1, Appendix D, Table D-1, Burton and Pitt 2002

4.3 Continuous Simulation Sizing Tool

A software-based continuous simulation modeling tool such as **PCSWMM for Stormceptor®**, can be utilized to determined site hydrology from local historical rainfall data, thereby assist in sizing a Jellyfish Filter. In general, such a tool is useful in deriving the water quality treatment flow rate associated with treatment of a high percentage (typically 80 - 90%) of the average annual runoff volume. The appropriately sized Jellyfish Filter is then selected from **Table 1** based on the derived water quality treatment flow rate. Please contact Imbrium Systems for assistance with optional sizing methodology.

Chapter 5

5.0 Jellyfish Filter Installation

The installation of the precast concrete or fiberglass Jellyfish Filter structure should conform to state highway, provincial or local specifications for the installation of maintenance manholes. Selected sections of a general specification that are applicable are summarized in the following sections.

For more information, please refer to the Jellyfish Filter Performance Specification with document title **Standard Specification – Water Quality Filter Treatment Device**.

Excavation

- Excavation and general site preparation for the installation of the Jellyfish Filter structure should conform to state highway, provincial or local specifications.
- Topsoil removed during the excavation should be stockpiled in designated areas and should not be mixed with subsoil or other materials.
- The Jellyfish Filter structure should not be installed on frozen ground.
- Excavation should extend a minimum of 12 inches (300 mm) from the precast concrete surfaces plus an allowance for shoring and bracing where required.
- If the bottom of the excavation provides an unsuitable foundation additional excavation may be required. In areas with a high water table, continuous dewatering may be required to ensure that the excavation is stable and free of water.

- Level the sub-grade to the proper elevation. Verify the elevation against the structure dimensions, the invert elevations on the approved Jellyfish Filter drawing and the site plans. Adjust the base aggregate if necessary. Verify the soil bearing capacity is adequate for the required load.

Installation of Jellyfish Filter Structure

- Set the base section of the Jellyfish Filter structure on solid sub-grade.
- Verify the level and elevation of the base section before adding any riser sections.
- Add specified watertight seal to the base section. Set riser section(s) on the base section.
- Install the inlet and outlet pipes to the structure.
- Install the top slab and frames and covers.
- Do not install Jellyfish membrane filtration cartridges until the upstream catchment and site have been stabilized.

Installation of Jellyfish Membrane Filtration Cartridges

- After the upstream catchment and site have been stabilized, remove any accumulated sediment and debris from the structure.

- Safely descend to the cartridge deck using the ladder attached to the sidewall of the manhole. Confined space entry procedures are required.

- Carefully lower the Jellyfish membrane filtration cartridges into the cartridge receptacles within the cartridge deck. A filter cartridge should be placed into each of the draindown cartridge receptacles outside the backwash pool weir.

- Depending on the specific Jellyfish Filter model number, filter cartridges should be placed into most or all of the hi-flo cartridge receptacles within the backwash pool weir. If a membrane joint snags on the receptacle lip, use a slight twisting or sideways motion to clear the snag. Do not force the membranes down into the cartridge receptacle, as this may damage the membranes. Use a slight downward pressure on the cartridge head plate to seat the rim gasket (thick circular gasket on the stainless steel head plate) into the cartridge receptacle.

- Examine the cartridge lids to differentiate lids with a small orifice, a large orifice and no orifice. Lids with a small orifice are to be inserted into the draindown cartridge receptacles. Lids with a large orifice are to be inserted into the hi-flo cartridge receptacles. Lids with no orifice are to be inserted into unoccupied cartridge receptacles within the backwash pool weir.

- To install a cartridge lid, ensure the cartridge lid male threads are aligned properly with the cartridge receptacle female threads. Firmly twist the cartridge lid clockwise to seat the filter cartridge snugly in place.

Chapter 6

6.0 Jellyfish Filter Inspection and Maintenance

For inspection and maintenance information, please refer to the **Jellyfish® Filter Owner's Manual**. Jellyfish Filter operation and maintenance are depicted in an **animation** on Imbrium Systems website (**www.imbriumsystems.com**).

Chapter 7

7.0 Jellyfish Filter Replacement Parts

Replacement parts for the JellyfishFilter can be ordered by contacting Imbrium Systems at:

United States: 888-279-8826 or 301-279-8827
Canada / International: 800-565-4801 / 416-960-9900
www.imbriumsystems.com

Chapter 8

8.0 Jellyfish Filter Performance Specification

The Jellyfish Filter Performance Specification is contained in the document titled **Standard Specification – Water Quality Filter Treatment Device**, shown in **Appendix C** and available on Imbrium Systems website.

Jellyfish® Filter Standard Specifications
Water Quality Filter Treatment Device

Part 1- General

1.1 Work Included

Specifies requirements for construction and performance of an underground stormwater quality filter 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 D 4097: Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks
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

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 precast concrete and/or fiberglass (FRP) components.

1.4 Handling and Storage

Prevent damage to materials during storage and handling.

Part 2 - Products

2.1 General

2.1.1

The device shall be circular or rectangular and 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. Alternatively, the device shall be constructed of fiberglass (FRP), installed to conform to applicable sections of state, provincial and municipal building codes, highway, municipal or local specifications for the construction of such devices.

2.1.2 Fiberglass Insert (Cartridge Deck)

The concrete device shall include a fiberglass insert bolted and sealed watertight inside the precast concrete chamber. Alternatively, the fiberglass device shall include a fiberglass insert bolted and/or chemically welded watertight inside the fiberglass chamber. The fiberglass 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; (d) a conduit for conveyance of treated water to the effluent pipe.

2.1.3 Membrane Filter Cartridges

Filter cartridges shall be comprised of cylindrical membrane filter elements connected to a perforated head plate. The number of membrane filter elements per cartridge shall be eleven 2.75-inch (70-mm) diameter elements. The length of each filter element shall be a minimum 27 inches (690 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. The maximum treatment flow rate of a filter cartridge shall be controlled by an orifice in the cartridge lid and based on a design flux 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 lightweight membrane filter cartridge shall allow for manual installation and removal and shall have a dry installation weight not to exceed the following:

Cartridge Length		**Maximum Cartridge Dry Weight for Installation**	
27 inches	690 mm	20 pounds	9 kg
54 inches	1,370 mm	25 pounds	12 kg

2.1.4 Backwashing Cartridges

The filter device shall have a weir extending above the cartridge deck that encloses the high flow rate filter cartridges when placed in their respective cartridge receptacles within the cartridge deck. The weir shall collect a pool of water during inflow events that subsequently automatically backwashes the hi flo rate cartridges when the inflow event subsides. All filter cartridges shall allow for use of a manual backwashing or filtration membrane rinsing procedure to restore flow capacity and sediment capacity and extend cartridge service life.

2.1.5 Maintenance Access to Captured Pollutants

A Maintenance Access Wall shall enclose an opening in the cartridge deck that has minimum diameter of 18 inches (450 mm) and thereby provide suitable access for removal of accumulated floatable pollutants and sediment.

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 66-degrees or less in the stormwater conveyance system.

2.1.7 Double-Wall Containment of Hydrocarbons

The 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. Alternatively, a device constructed of fiberglass (FRP) does not require double-wall containment as fiberglass is resistant to hydrocarbon penetration.

2.1.8 Separator Skirt
The device shall provide a flexible separator skirt that extends from the underside of the cartridge deck to a minimum length equal to the length of the membrane filter elements. The separator skirt shall serve as a baffle to protect the membrane filter elements from contamination by floatables and coarse sediment.

2.1.9 Sump
The device must 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.

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.

2.3 Gaskets
All gaskets used for the concrete joints shall be manufactured using neoprene or nitrile rubber gaskets to prevent deterioration from presence of captured petroleum hydrocarbons. Mastic sealants or butyl tape are not an acceptable alternative as they are prone to leakage of petroleum hydrocarbons.

2.4 Frame and Cover
Frame and covers must be manufactured from cast-iron and embossed with the name of the device manufacturer or the device brand name.

2.5 Doors and Hatches
If provided shall meet designated loading requirements at a minimum for incidental traffic.

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

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

2.7 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.

2.8 Inspections
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 Function
The stormwater quality filter treatment device functions to remove pollutants by the following unit treatment processes; sedimentation, floatation and membrane filtration.

3.1.2 Pollutants
The stormwater quality filter treatment device removes oil, debris, trash, sediment, sediment-bound pollutants, metals and nutrients from stormwater during frequent wet weather events.

3.1.3 Bypass
The stormwater quality filter treatment device typically operates off-line.

3.1.4 Treatment Flux Rate
The stormwater quality filter treatment device shall treat 100% of the required water quality treatment flow based on a maximum treatment flux rate across the membrane filter cartridges of 0.21 gpm/ft2 (0.142 lps/m2).

3.2 Field Test Performance
At a minimum, the stormwater quality filter device shall have been field tested with a minimum 20 TARP qualifying rain events and field monitoring conducted according to the TARP or TAPE field test protocol.

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

3.2.2 Fine Particle Removal
The stormwater quality filter treatment device shall demonstrate the ability to capture fine particles as indicated by an effluent d50 of 15 microns or lower for all monitored storm events, and an effluent turbidity of 25 NTUs or lower.

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

3.3 Lab Test Performance

3.3.1 Suspended Solids Removal
The stormwater quality treatment device shall demonstrate the ability to remove a minimum of 85% of Sil-Co-Sil 106 (d50 = 22 microns), measured as SSC, with a 95% confidence interval at the system's 100% operating rate with influent sediment concentrations ranging from 100 to 300 mg/L.

3.4 Inspection and Maintenance

The stormwater quality filter device shall have the following features:

3.4.1 The membrane filter elements shall be designed to last three years prior to requiring replacement.

3.4.2 Inspection which includes trash and floatables collection, sediment depth determination, and visible determination of backwash pool depth shall be easily conducted from grade.

3.4.3 Manual backflushing of the filter cartridges shall be possible to restore the flow capacity and sediment capacity of the filter cartridges and therefore extend cartridge service life.

3.4.4 Filter treatment shall have a minimum 12 inches (610 mm) of sediment storage depth.

3.4.5 Sediment removal from the filter treatment device shall be conducted using a standard maintenance truck and vacuum apparatus, and a single point of entry through the cartridge deck that is unobstructed by filter cartridges.

3.4.6 Filter cartridges be easily maintained without the use of additional lifting equipment.

Part 4 – Execution

4.1 Precast & Installation

4.1.1 Construction Sequence

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

The 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
- riser section and/or transition slab (if required)
- maintenance riser section(s) (if required)
- frame and access cover

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.

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. Once the stormwater quality treatment device has been constructed, any lift holes must be plugged watertight with mortar or non-shrink grout.

4.1.2 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.

4.1.3 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 Fiberglass (FRP) Installation

4.2.1 Construction Sequence

The installation of the FRP device should conform to applicable sections of state, provincial and municipal building codes and highway, municipal or local specifications for the construction of such devices. Selected sections of a general specification that are applicable are summarized below. For detailed installation instructions refer to the submitted drawing and installation details.

Structural - Proposed installation details shall conform to all federal, provincial, state, municipal or other local specifications as may be applicable, including all building code requirements.

Water Quality Device Construction Sequence - The water quality FRP device is installed in the following sequence:

- Water quality device as delivered to site placed on prepared bedding or slab using spreader bars and the lifting lugs provided on the structure. Avoid lifting chains or cables from contacting sides of tank
- Do not drop, roll or slide vessel
- Backfill using approved back fill material
- Pour anti-buoyancy slab as required per the drawing
- Connect inlet and outlet pipes
- Riser sections and/or transitions (if required and if shipped separately)
- Frame and access cover

4.2.2 Frame and Cover Installation

No direct structural connection shall be permitted to any FRP maintenance access surface riser pipe. No vertical structural connection shall be permitted to any FRP component under any circumstances unless approved by the manufacturer.

A minimum 1-inch (25 mm) gap shall be left around and above any required FRP maintenance access surface risers (i.e. not a buried installation), with this gap filled with pea gravel or approved fill material against the surrounding structure that must support the frame and cover in its entirety.

4.3 Maintenance Access Wall
In some instances the Maintenance Access Wall will 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.

4.4 Filter Cartridge Installation
Filter cartridges shall be installed in the cartridge deck after the construction site is fully stabilized, unless otherwise specified by the design engineer.

4.5 Filter Cartridge Installation
Manufacturer shall coordinate delivery of filter cartridges and other internal components with contractor. Filter cartridges shall be delivered and installed after site is stabilized and unit is ready to accept cartridges. Contractor shall take appropriate action to protect the filter cartridge receptacles and filter cartridges from damage during construction. For systems with cartridges installed prior to full site stabilization and prior to system commissioning, the contractor can plug inlet and outlet pipes to prevent stormwater from entering the device. Plugs must be removed after the device has been commissioned.

Part 5 – Quality Assurance

5.1 Clean Up and Restoration
Each component of the water quality treatment device shall be inspected by the Owners Representative prior to final acceptance. The contractor shall remove soil and debris created by the storm drainage work from the structure. At the completion of all work, the structure and surrounding area shall be left in a neat, safe and orderly condition.

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.

5.2 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.