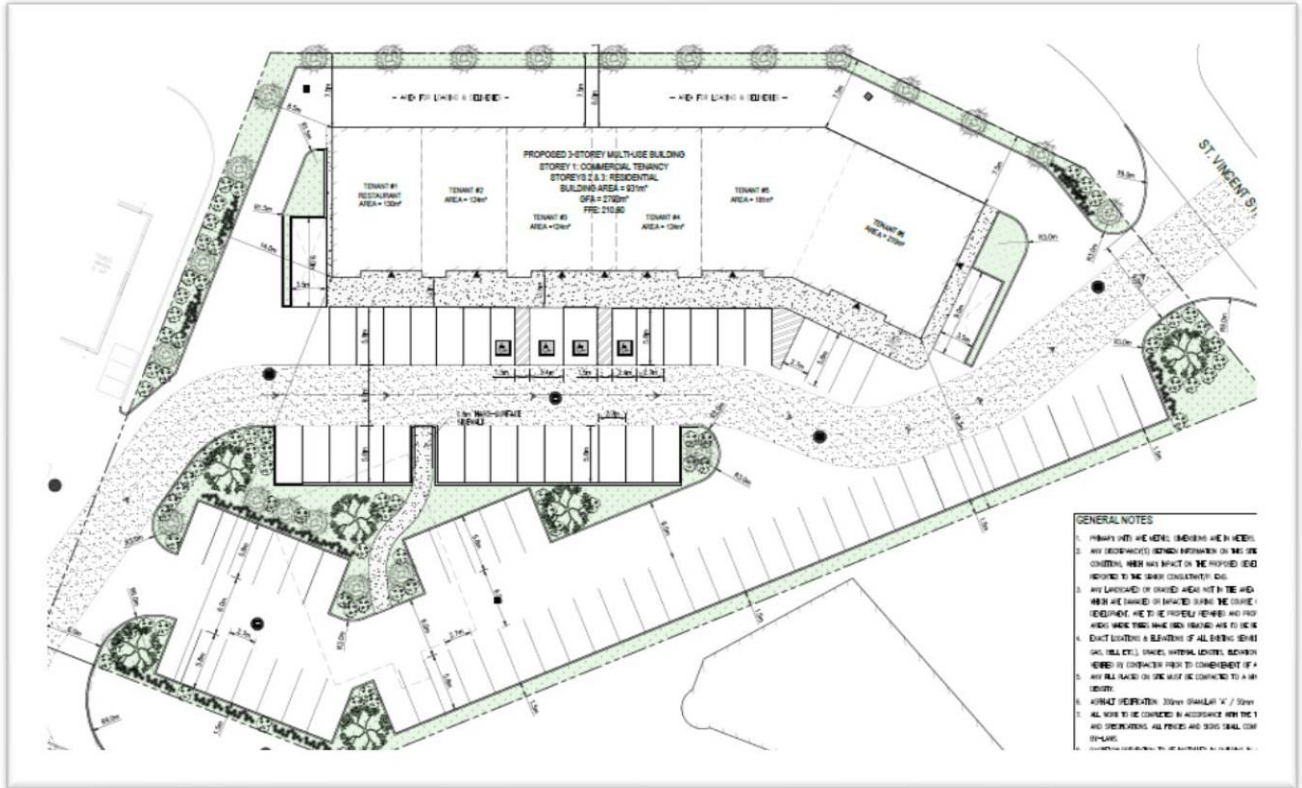


ZOLTAN ENGINEERING

Stormwater Management Brief



To be read in conjunction with site plan documents:

Project 19-116 – Proposed Mixed-Use Building
337 Sykes Street South, Meaford

Zoltan Lakatos, P. Eng.

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Introduction:

This report is to be read in conjunction with the Site Plan Drawings SP1, SP2, SS1 and SG1 prepared by Zoltan Engineering Inc..

The subject property located at 337 Sykes Street, Meaford, Ontario. Currently the site is partially developed and includes a 300m² building as well as asphalt and granular vehicle access and parking areas covering most of the lot. The proposed development is to demolish the existing building and construct a new 933m² commercial multi-tenant building with an asphalt parking area and landscaped space.

Stormwater Management

Design Criteria:

The following documents have been referenced and reviewed in the preparation of this report:

- Ministry of the Environment – Stormwater Management Planning and Design Manual, 2003.
- Municipality of Meaford - Engineering Standards, 2019.

The IDF curves for the city of Owen Sound have been used for the calculations required in this report, see Table 1 below.

Rainfall intensity has been calculated with the following formula:

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

Where i = Intensity (mm/hr), t = Time of Concentration / Time of Storm (mins)

Table 1 – Owen Sound IDF Data

Return Period (Years)	Parameters		
	a	b	c
2	807	6.75	0.828
5	1,135	7.5	0.841
10	1,387	7.97	0.852
25	1,676	8.3	0.858
50	1,973	9	0.868
100	2,193	9.04	0.871

Quantity Control:

The objective is to control flows for the entire site. Stormwater runoff from the developed area will be controlled and discharged at the 5-year, 10 minute pre-development rate for up to the 100-year storm. On site retention capacity will be provided to store the 100-year storm until it can be released at the pre-development rate.

Erosion and Sediment Control:

Erosion and sediment control measures must be in place during the entire course of construction works and maintained to the satisfaction of the Municipality of Meaford.

Existing Conditions:

The property previously contained a small commercial building containing a restaurant and a dance studio. There was an asphalt parking lot at the front of the building and gravel parking lot at the rear as well as a large grassed area with some small trees. The pre-development drainage conditions are shown in Table 2.

Table 2 - Pre-Development Conditions

Catchment Area Number	Area (ha)					Weighted C
	Building	Grass	Gravel	Pavement	Total	
Total	0.027	0.329	0.120	0.092	0.5682	0.49

Table 3 - Runoff Coefficients

Material	Runoff Coefficient, C
Building	0.90
Grass	0.25
Gravel	0.75
Pavement	0.90

Proposed Works:

The proposed development will construct a new 3-storey multi-use residential and commercial building. The new building will be 931m² and positioned near the rear of the lot. The remainder of the lot will be an asphalt parking lot with some small landscaped areas containing sod, small trees, and plants. The stormwater will be collected by catch basins on the site and discharged through the onsite sewer system into the municipal storm sewer system on Sykes Street. The proposed stormwater management system can be seen on drawing SS1. The post-development drainage conditions are shown in Table 4.

Table 4 - Post-Development Conditions

Catchment Area Number	Area (ha)					Weighted C
	Building	Grass	Gravel	Pavement	Total	
Total	0.093	0.110	0	0.365	0.5682	0.77

Servicing Assessment:

Quantity Control – Overall Site:

The rational method has been used to determine pre-development and post-development peak flow rates. Storage calculations have been conducted using the rational method, as shown at the back of this report. The post-development average runoff coefficient is approximately 0.77. Please see the Appendix.

The storm sewer will function as the outlet for the subject catchment area, discharging into the municipal storm sewer in Sykes Street. Quantity control measures will be provided by means of an orifice plate over the south outlet of CB/MH#1. Stormwater outflow will be controlled by a 170mm diameter orifice. The designed orifice size will control the outflow to the 5-year, 10 minute event ($<0.079\text{m}^3/\text{sec}$). Detailed information is provided at the back of this report. The total storage provided by the catch basins and parking lot area around them is approximately 192m^3 which is more than the amount required to maintain an outflow of $0.079\text{m}^3/\text{sec}$ for the 100-year storm.

Erosion and Sediment Control:

Erosion and sediment control measures must be in place during the entire course of construction works and maintained to the satisfaction of the Municipality of Meaford and the Conservation Authority. The following elements are required to be considered:

- Silt Fencing according to OPSD 219.130
- Hard features installed to reduce erosion.

Overall System

The quantity control provided in this report and on the final design drawings will sufficiently meet the design objectives of this report, as well as the standards outlined by the Municipality of Meaford.

No impact from stormwater on the road allowance from the proposed development is anticipated.

Quantity Control - Overall Lot

Zoltan Engineering Inc.

Project # 19-116
Project Name: Abdul Merchant
Location: 337 Sykes Street, Meaford

Date: 16-Mar-20
Revision: 1

IDF Location: Owen Sound

Table 1

Storm (yrs)	a	b	c
2	807	6.75	0.828
5	1,135	7.5	0.841
10	1,387	7.97	0.852
25	1,676	8.3	0.858
50	1,973	9	0.868
100	2,193	9.04	0.871

Table 2

Material	Runoff Coefficient, C
Building	0.90
Grass	0.25
Gravel	0.75
Pavement	0.90

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

Design Storm (Pre-Development) 5 Year
Time of Concentration, Tc (Overall Site) 10 minutes
Intensity, I 102.27 mm/hr

Table 3 - PreDevelopment Drainage Conditions

Catchment Area Number	Area (ha)					Weighted C
	Building	Grass	Gravel	Pavement	Total	
1	0.027	0.329	0.120	0.092	0.5682	0.49
Total:	0.027	0.329	0.120	0.092	0.568	0.49

Catchment Area Number	5-year Outflow (m ³ /s)
1	0.079
Total:	0.079

Table 4 - PostDevelopment Drainage Conditions

Catchment Area Number	Area (ha)					Weighted C
	Building	Grass	Gravel	Pavement	Total	
1	0.093	0.110		0.365	0.568	0.77
Total:	0.093	0.110	0.000	0.365	0.568	0.77

Catchment Area Number	5-year Outflow (m ³ /s)
1	0.125
Total:	0.125

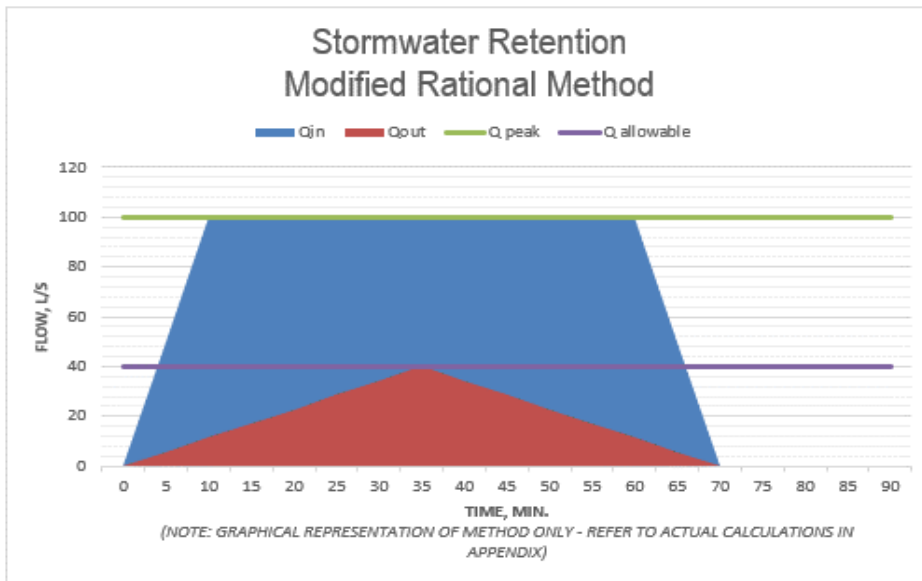
Rational Method - Storage

Rainfall Station	Owen Sound
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Storm (yrs)	A	B	C
2	807.44	6.75	0.828
5	1135.4	7.5	0.841
10	1387	7.97	0.852
25	1676.2	8.3	0.858
50	1973.1	9	0.868
100	2193.1	9.04	0.871

Area (ha)	Time of Concentration (min)	Time Increments (min)	Allowable Outflow (m3/s)	Post Development Runoff Coefficient
0.5682	10	5	0.079	0.77

Results		
Storm	Storage (m3)	Time (min)
2	9.7	10
5	31.4	15
10	47.4	20
25	68.1	25
50	85.7	25
100	102.5	30



Time (min)	2 Year				5 Year				10 Year			
	Intensity mm/hr	Inflow m ³ /s	Outflow m ³ /s	Storage m ³	Intensity mm/hr	Inflow m ³ /s	Outflow m ³ /s	Storage m ³	Intensity mm/hr	Inflow m ³ /s	Outflow m ³ /s	Storage m ³
10	78.28	0.095	0.0790	9.72	102.27	0.124	0.0790	27.23	118.36	0.144	0.0790	38.98
15	63.05	0.077	0.0790	0.00	82.79	0.101	0.0790	31.37	96.02	0.117	0.0790	45.86
20	53.12	0.065	0.0790	0.00	69.93	0.085	0.0790	30.97	81.19	0.099	0.0790	47.40
25	46.10	0.056	0.0790	0.00	60.77	0.074	0.0790	0.00	70.57	0.086	0.0790	45.81
30	40.84	0.050	0.0790	0.00	53.88	0.066	0.0790	0.00	62.57	0.076	0.0790	0.00
35	36.75	0.045	0.0790	0.00	48.49	0.059	0.0790	0.00	56.31	0.068	0.0790	0.00
40	33.46	0.041	0.0790	0.00	44.16	0.054	0.0790	0.00	51.27	0.062	0.0790	0.00
45	30.76	0.037	0.0790	0.00	40.60	0.049	0.0790	0.00	47.12	0.057	0.0790	0.00
50	28.50	0.035	0.0790	0.00	37.61	0.046	0.0790	0.00	43.63	0.053	0.0790	0.00
55	26.57	0.032	0.0790	0.00	35.06	0.043	0.0790	0.00	40.66	0.049	0.0790	0.00
60	24.92	0.030	0.0790	0.00	32.86	0.040	0.0790	0.00	38.10	0.046	0.0790	0.00
65	23.47	0.029	0.0790	0.00	30.95	0.038	0.0790	0.00	35.87	0.044	0.0790	0.00
70	22.20	0.027	0.0790	0.00	29.26	0.036	0.0790	0.00	33.90	0.041	0.0790	0.00
75	21.07	0.026	0.0790	0.00	27.76	0.034	0.0790	0.00	32.15	0.039	0.0790	0.00
80	20.06	0.024	0.0790	0.00	26.42	0.032	0.0790	0.00	30.58	0.037	0.0790	0.00
85	19.15	0.023	0.0790	0.00	25.21	0.031	0.0790	0.00	29.18	0.035	0.0790	0.00
90	18.32	0.022	0.0790	0.00	24.12	0.029	0.0790	0.00	27.90	0.034	0.0790	0.00
95	17.57	0.021	0.0790	0.00	23.13	0.028	0.0790	0.00	26.75	0.033	0.0790	0.00
100	16.89	0.021	0.0790	0.00	22.22	0.027	0.0790	0.00	25.69	0.031	0.0790	0.00
105	16.26	0.020	0.0790	0.00	21.39	0.026	0.0790	0.00	24.71	0.030	0.0790	0.00
110	15.68	0.019	0.0790	0.00	20.62	0.025	0.0790	0.00	23.82	0.029	0.0790	0.00
115	15.15	0.018	0.0790	0.00	19.91	0.024	0.0790	0.00	22.99	0.028	0.0790	0.00
120	14.65	0.018	0.0790	0.00	19.25	0.023	0.0790	0.00	22.22	0.027	0.0790	0.00
125	14.19	0.017	0.0790	0.00	18.64	0.023	0.0790	0.00	21.51	0.026	0.0790	0.00
130	13.76	0.017	0.0790	0.00	18.06	0.022	0.0790	0.00	20.84	0.025	0.0790	0.00
135	13.36	0.016	0.0790	0.00	17.53	0.021	0.0790	0.00	20.22	0.025	0.0790	0.00
140	12.98	0.016	0.0790	0.00	17.03	0.021	0.0790	0.00	19.64	0.024	0.0790	0.00
145	12.62	0.015	0.0790	0.00	16.56	0.020	0.0790	0.00	19.09	0.023	0.0790	0.00
150	12.29	0.015	0.0790	0.00	16.12	0.020	0.0790	0.00	18.57	0.023	0.0790	0.00
155	11.97	0.015	0.0790	0.00	15.70	0.019	0.0790	0.00	18.09	0.022	0.0790	0.00
160	11.67	0.014	0.0790	0.00	15.30	0.019	0.0790	0.00	17.63	0.021	0.0790	0.00
165	11.39	0.014	0.0790	0.00	14.93	0.018	0.0790	0.00	17.19	0.021	0.0790	0.00
170	11.12	0.014	0.0790	0.00	14.57	0.018	0.0790	0.00	16.78	0.020	0.0790	0.00
175	10.87	0.013	0.0790	0.00	14.24	0.017	0.0790	0.00	16.39	0.020	0.0790	0.00
180	10.63	0.013	0.0790	0.00	13.92	0.017	0.0790	0.00	16.02	0.019	0.0790	0.00
185	10.40	0.013	0.0790	0.00	13.61	0.017	0.0790	0.00	15.66	0.019	0.0790	0.00

Time (min)	25 Year				50 Year				100 Year			
	Intensity mm/hr	Inflow m ³ /s	Outflow m ³ /s	Storage m ³	Intensity mm/hr	Inflow m ³ /s	Outflow m ³ /s	Storage m ³	Intensity mm/hr	Inflow m ³ /s	Outflow m ³ /s	Storage m ³
10	138.40	0.168	0.0790	53.60	153.18	0.186	0.0790	64.38	168.45	0.205	0.0790	75.53
15	112.50	0.137	0.0790	63.89	125.06	0.152	0.0790	77.65	137.49	0.167	0.0790	91.25
20	95.21	0.116	0.0790	67.87	106.12	0.129	0.0790	83.78	116.62	0.142	0.0790	99.12
25	82.81	0.101	0.0790	68.13	92.43	0.112	0.0790	85.69	101.55	0.124	0.0790	102.33
30	73.44	0.089	0.0790	65.99	82.05	0.100	0.0790	84.84	90.13	0.110	0.0790	102.52
35	66.10	0.080	0.0790	62.19	73.90	0.090	0.0790	82.10	81.15	0.099	0.0790	100.61
40	60.19	0.073	0.0790	0.00	67.31	0.082	0.0790	77.97	73.89	0.090	0.0790	97.19
45	55.31	0.067	0.0790	0.00	61.86	0.075	0.0790	0.00	67.90	0.083	0.0790	92.63
50	51.21	0.062	0.0790	0.00	57.29	0.070	0.0790	0.00	62.86	0.076	0.0790	0.00
55	47.72	0.058	0.0790	0.00	53.38	0.065	0.0790	0.00	58.57	0.071	0.0790	0.00
60	44.71	0.054	0.0790	0.00	50.01	0.061	0.0790	0.00	54.85	0.067	0.0790	0.00
65	42.08	0.051	0.0790	0.00	47.06	0.057	0.0790	0.00	51.61	0.063	0.0790	0.00
70	39.76	0.048	0.0790	0.00	44.46	0.054	0.0790	0.00	48.76	0.059	0.0790	0.00
75	37.71	0.046	0.0790	0.00	42.16	0.051	0.0790	0.00	46.22	0.056	0.0790	0.00
80	35.87	0.044	0.0790	0.00	40.09	0.049	0.0790	0.00	43.95	0.053	0.0790	0.00
85	34.21	0.042	0.0790	0.00	38.24	0.047	0.0790	0.00	41.91	0.051	0.0790	0.00
90	32.71	0.040	0.0790	0.00	36.55	0.044	0.0790	0.00	40.06	0.049	0.0790	0.00
95	31.35	0.038	0.0790	0.00	35.02	0.043	0.0790	0.00	38.38	0.047	0.0790	0.00
100	30.10	0.037	0.0790	0.00	33.63	0.041	0.0790	0.00	36.84	0.045	0.0790	0.00
105	28.96	0.035	0.0790	0.00	32.34	0.039	0.0790	0.00	35.43	0.043	0.0790	0.00
110	27.91	0.034	0.0790	0.00	31.16	0.038	0.0790	0.00	34.13	0.042	0.0790	0.00
115	26.93	0.033	0.0790	0.00	30.06	0.037	0.0790	0.00	32.93	0.040	0.0790	0.00
120	26.03	0.032	0.0790	0.00	29.05	0.035	0.0790	0.00	31.81	0.039	0.0790	0.00
125	25.19	0.031	0.0790	0.00	28.11	0.034	0.0790	0.00	30.78	0.037	0.0790	0.00
130	24.41	0.030	0.0790	0.00	27.23	0.033	0.0790	0.00	29.81	0.036	0.0790	0.00
135	23.67	0.029	0.0790	0.00	26.41	0.032	0.0790	0.00	28.91	0.035	0.0790	0.00
140	22.99	0.028	0.0790	0.00	25.63	0.031	0.0790	0.00	28.06	0.034	0.0790	0.00
145	22.34	0.027	0.0790	0.00	24.91	0.030	0.0790	0.00	27.27	0.033	0.0790	0.00
150	21.74	0.026	0.0790	0.00	24.23	0.029	0.0790	0.00	26.52	0.032	0.0790	0.00
155	21.16	0.026	0.0790	0.00	23.59	0.029	0.0790	0.00	25.81	0.031	0.0790	0.00
160	20.62	0.025	0.0790	0.00	22.98	0.028	0.0790	0.00	25.15	0.031	0.0790	0.00
165	20.11	0.024	0.0790	0.00	22.41	0.027	0.0790	0.00	24.52	0.030	0.0790	0.00
170	19.63	0.024	0.0790	0.00	21.86	0.027	0.0790	0.00	23.92	0.029	0.0790	0.00
175	19.17	0.023	0.0790	0.00	21.34	0.026	0.0790	0.00	23.35	0.028	0.0790	0.00
180	18.73	0.023	0.0790	0.00	20.85	0.025	0.0790	0.00	22.81	0.028	0.0790	0.00
185	18.31	0.022	0.0790	0.00	20.39	0.025	0.0790	0.00	22.30	0.027	0.0790	0.00

Orifice Pipe - Flow Restrictor

Zoltan Engineering Inc.

Project # 19-116
Project Name: Abdul Merchant
Location: 337 Sykes Street, Meaford

$$Q = C_d A (2gH)^{0.5}$$

Size Based on Max. Flow		
Coefficient of Discharge	C_d	0.6
Gravity	g	9.81 m/s ²
Hydraulic Head	H	1.75 m
Max. Outflow	Q	0.079 m ³ /s
Orifice Area	A	0.02247 m ²
Orifice Diameter	D	169 mm
Velocity	V	3.52 m/s