665 James Street Apartments

Preliminary

Servicing Report

Project Location:
665 James Street North, St. Mary's, ON

Prepared for:
Heritage Homes
2749 Perth Road, Fullerton, ON

Prepared by:
MTE Consultants
123 St George Street
London, ON N6A 3A1

December 12, 2018
Revised: December 03, 2019

MTE File No.: 46140-100

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1.0 Introduction

MTE Consultants Inc. was retained by Heritage Homes to complete a Preliminary Servicing Report in support of an Official Plan Amendment application, Zoning By-law Amendment application, and Site Plan approval for their lands known as 665 James St N, located in the Town of St. Mary's. The subject site consists of approximately 0.42 ha generally bounded by the North Ridge Subdivision to the east, Glass St. to the south, James St. N. to the west and North Ridge Condominiums to the north, as shown on Figure 1.

It is proposed to develop the property as a multi-story apartment building with the potential of mixed commercial and residential use . A Site Plan application for the proposed development will be prepared by Zelinka Priamo Ltd. and forms the basis for the proposed servicing concepts. Figure 1 outlines a general concept plan for the proposed development. The building and parking layout will be subject to change; however, the general lot coverage and servicing scheme will be maintained.

2.0 Municipal Servicing

2.1 Sanitary Servicing

The sanitary sewage from the proposed development will outlet to the existing 200mm diameter sanitary sewer on Glass St. via a 200mm service that currently terminates at the south-east property line. The service was extended to the proposed site during construction of the North Ridge Subdivision in anticipation of future development.

The existing downstream outletting sewer along Glass St. has been sized to accommodate the proposed development. A sanitary design sheet has been prepared based on the existing flow rates per the Town of St. Mary's pipe capacity model received by MTE Consultants on Oct 17, 2018. The design sheet includes the expected flows from the proposed Thamescrest developments to the West with an allocated flow for an estimated 46 residential units. The resulting flows do not exceed any downstream pipe capacities. Refer to Appendix A for the sanitary design sheet.

2.2 Water Distribution

The 665 James St. development is located within the Town of St. Marys water distribution system. The development has water servicing options from the existing 200mm dia. watermain on Glass St. and the 150mm dia. watermain on James St. To assess any capacity constraints in these servicing options, a water distribution analysis was conducted using the Town of St. Mary's distribution model.

The proposed apartment was added into the water distribution model at junction J-845 which represents the intersection of Glass and James St. The following assumptions were used to assess the available pressure in the main:

No. of Units	46
Population per Unit	1.56
Total Population	72
Demand	280 L/cap/day (0.00324 L/cap/sec)
Total Demand	0.233 L/s

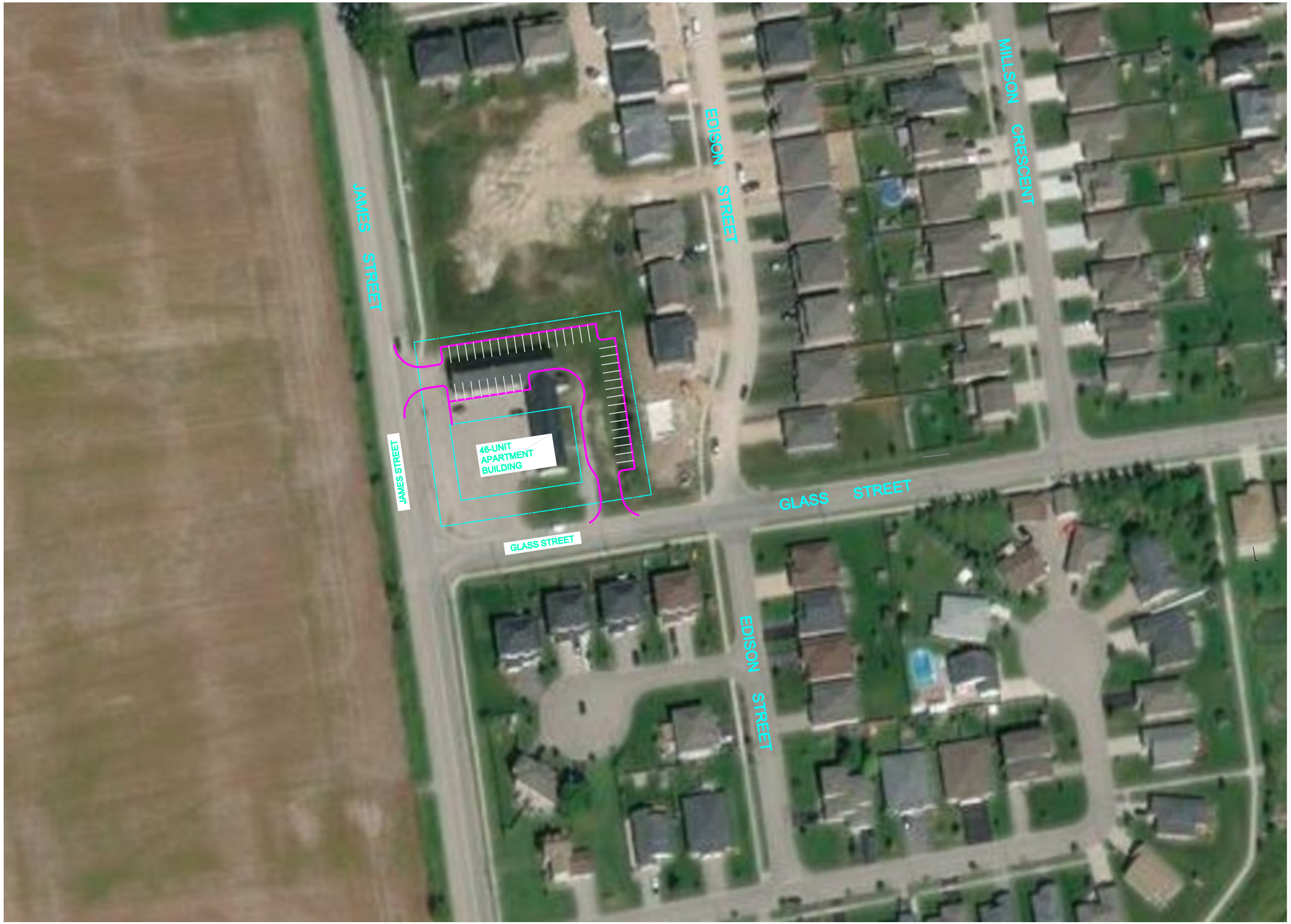
The model was run for the average day scenario and reported a pressure of 355 kPa (51.5 psi) which meets the Town's pressure criteria. The existing demand from the commercial building of 0.011 L/s was deleted from the James St. watermain as the existing commercial building would be disbanded during construction.

For the max day scenario, a peaking factor of 1.75 was used for all demands. The model showed that the pressure at Junction J-845 dropped slightly to 352 kPa (51.1 psi) but remained above the Town's preferred minimum operating pressure of 350 kPa during the max day demand scenario.

For the peak hour scenario, a peaking factor of 2.62 was used for the existing St. Mary's demands while a factor of 3.5 was applied to the apartment demand for conservatism. The model showed the pressure at Junction 845 dropped to 349 kPa (50.7 psi). Under this demand scenario, the supply pressure meets the Town's preferred minimum of 275 kPa at peak hour demands.

A fire flow analysis was performed to determine what flow would be available for fire suppression during a max day demand scenario. The model showed that at the minimum pressure of 140 kPa (20 psi), a flow of 98 L/s can be provided by the system. This flow falls short of the 200 L/s recommended by the FUS. If required, fire flow can be addressed during the design of the structure through options like fire proof building materials and on-site fire storage reservoirs.

It should be noted that the development of the neighbouring Thames Crest subdivision is expected to lower pressures in the area by approximately 2 kPa and 4 kPa during average day and peak hour scenarios.



Scale: 1:1250 Date: Dec.03/19

OWNER: KATHY CARRADINE
APPLICANT: ZELINKA PRIAMO

Client Address Client City

665 JAMES ST.
NORTH
ST. MARY'S, ON

Project Address Project City

LOCATION MAP

MTE
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Project No.: 46140-100

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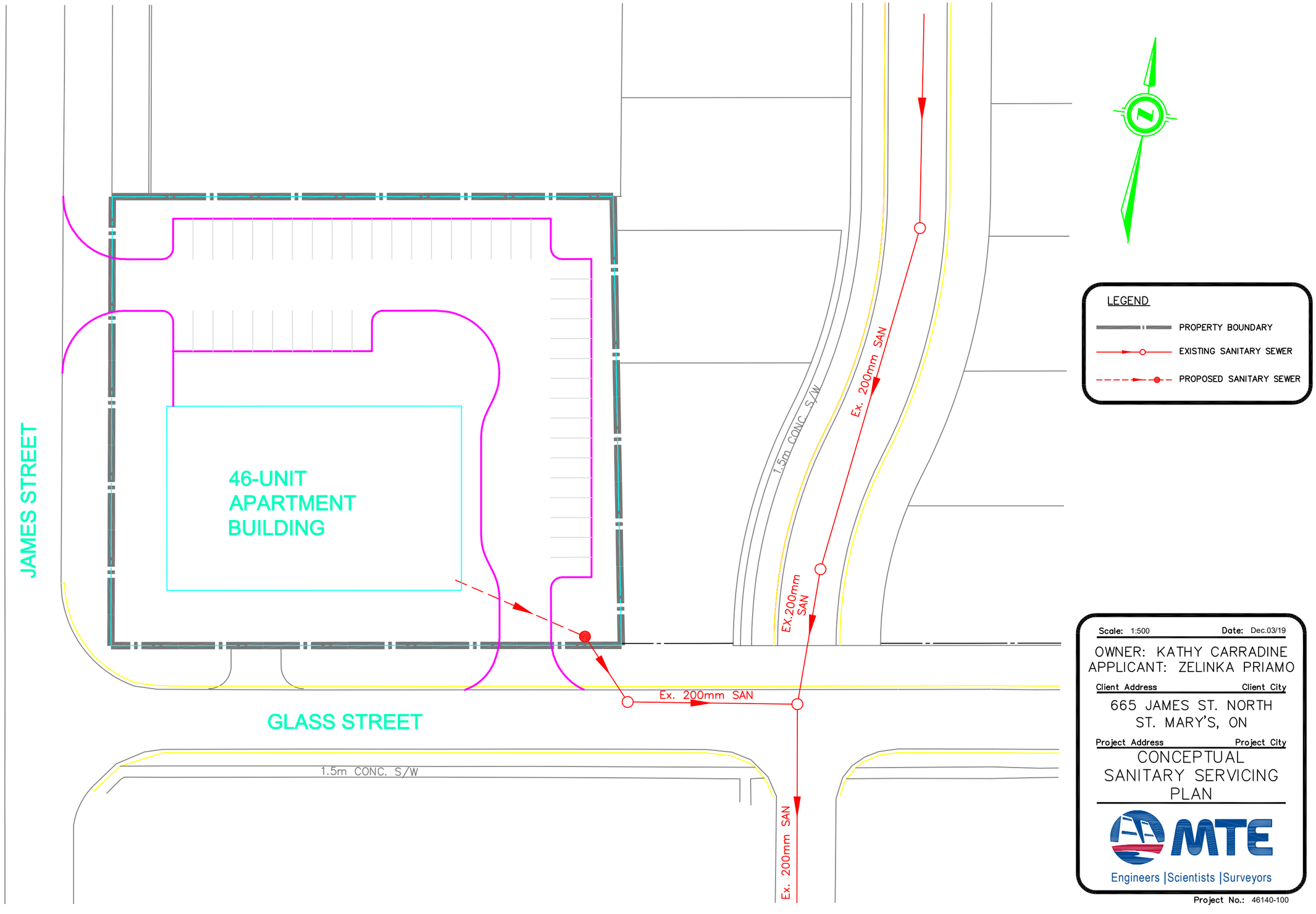

Scale: 1:500 Date: Dec.03/19

OWNER: KATHY CARRADINE
APPLICANT: ZELINKA PRIAMO

Client Address Client City

665 JAMES ST. NORTH
ST. MARY'S, ON

Project Address Project City

CONCEPTUAL SANITARY SERVICING PLAN

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Project No.: 46140-100

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2.3 Stormwater Management

Post-development minor flows will be conveyed through a proposed service connection to the existing storm sewer on James St at the west limit of the property. Major flows exceeding the 100 year storm event will be conveyed through overland flow routes generally flowing south on James St.

A stormwater management analysis was conducted based on the proposed development layout comparing pre and post development runoff flows. Although the site layout is subject to change, the lot coverage and impervious surface area will generally remain the same. The composite runoff coefficients for pre and post development conditions were 0.59 and 0.70 respectively. City of Stratford rainfall intensity data was used as the input parameters for the 2 to 100 year design storms. The analysis resulted in an on-site storage requirement of 39 m^3.

On-site storage will be addressed through parking lot ponding storage. The proposed parking layout provides adequate grading and surface area to meet the storage requirements of the 100 year storm event. An orifice plate will be utilized on the outlet structure to control the flows to the municipal storm sewer.

With much of the building's parking needs being serviced by the perimeter asphalt parking area, quality control of the stormwater runoff must be addressed. An oil-grit separator will be utilized at the outlet point to the municipal storm sewer. Proper sizing will allow for adequate hydrocarbon and suspended solid removal to meet the requirements of the Town of St. Marys.

In conclusion; the proposed stormwater management system will provide adequate quantity and quality control for stormwater runoff from the site. The existing site conditions do not provide any quality or quantity control at this time, thus the proposed development will improve the overall efficacy of the property's storm water management system.

3.0 Roadworks

The proposed development will not involve any municipal road extensions or improvements. Sections will need to be cut to allow access for servicing and will be replaced with the existing granular and asphalt makeup.

The proposed apartment parking area is roughly 1500 m2 with grades of roughly 0.5 to 4%. A pavement structure detail will be designed during the site plan application process once soil conditions are documented by a geotechnical engineer.

4.0 Utility Servicing

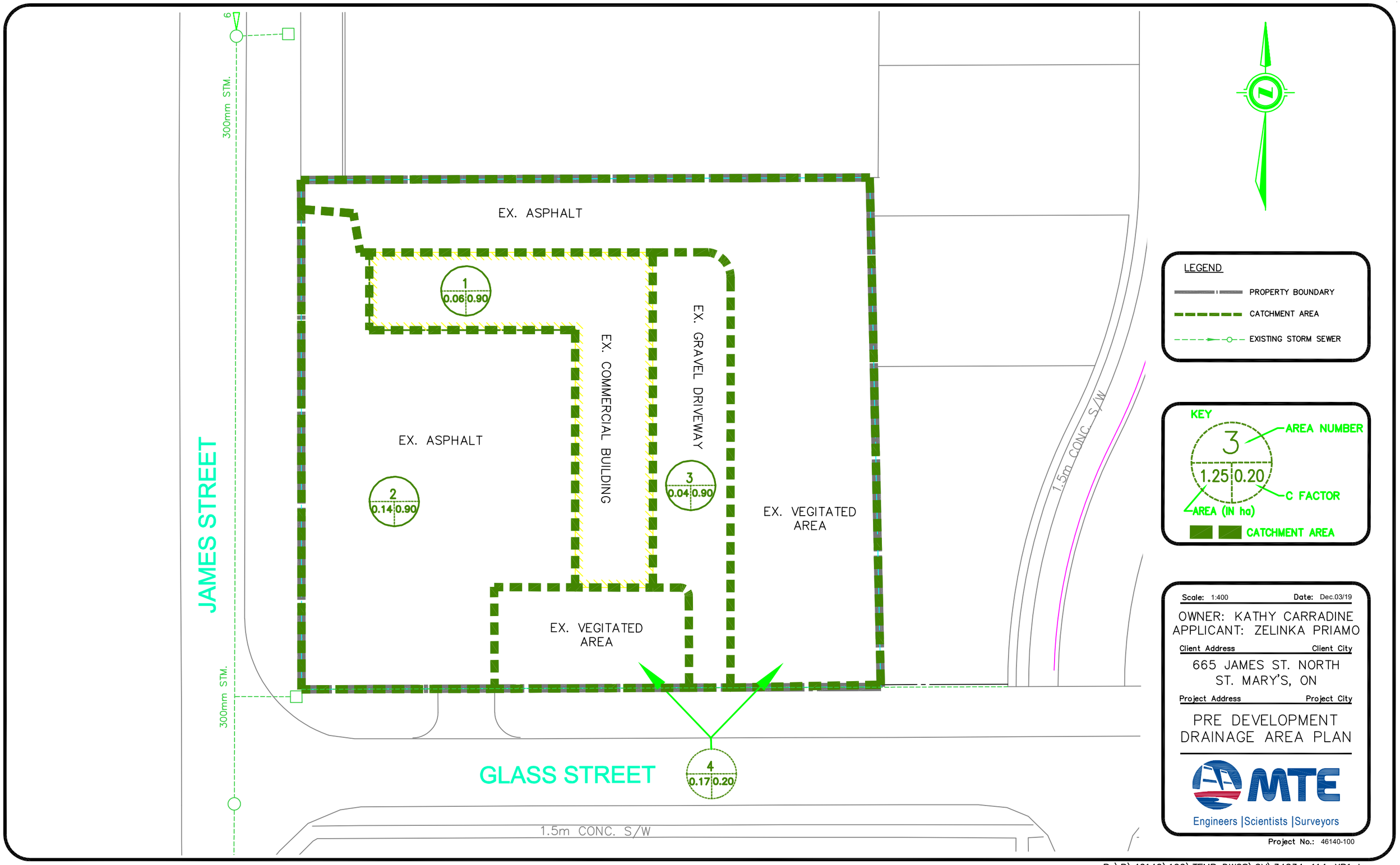
Utility servicing of the proposed development will be through the connection to existing services along James St and Glass St. The existing commercial building is currently serviced with hydro, communications, and gas. It is assumed that the following utilities will be available to the proposed development, and will be confirmed during the site plan application process.

Festival Hydro (electrical)

Bell Canada (telephone)

Union Gas (gas)

Rogers Cable (cable TV)



Scale: 1:400 Date: Dec.03/19

OWNER: KATHY CARRADINE
APPLICANT: ZELINKA PRIAMO

Client Address Client City

665 JAMES ST. NORTH
ST. MARY'S, ON

Project Address Project City

PRE DEVELOPMENT DRAINAGE AREA PLAN

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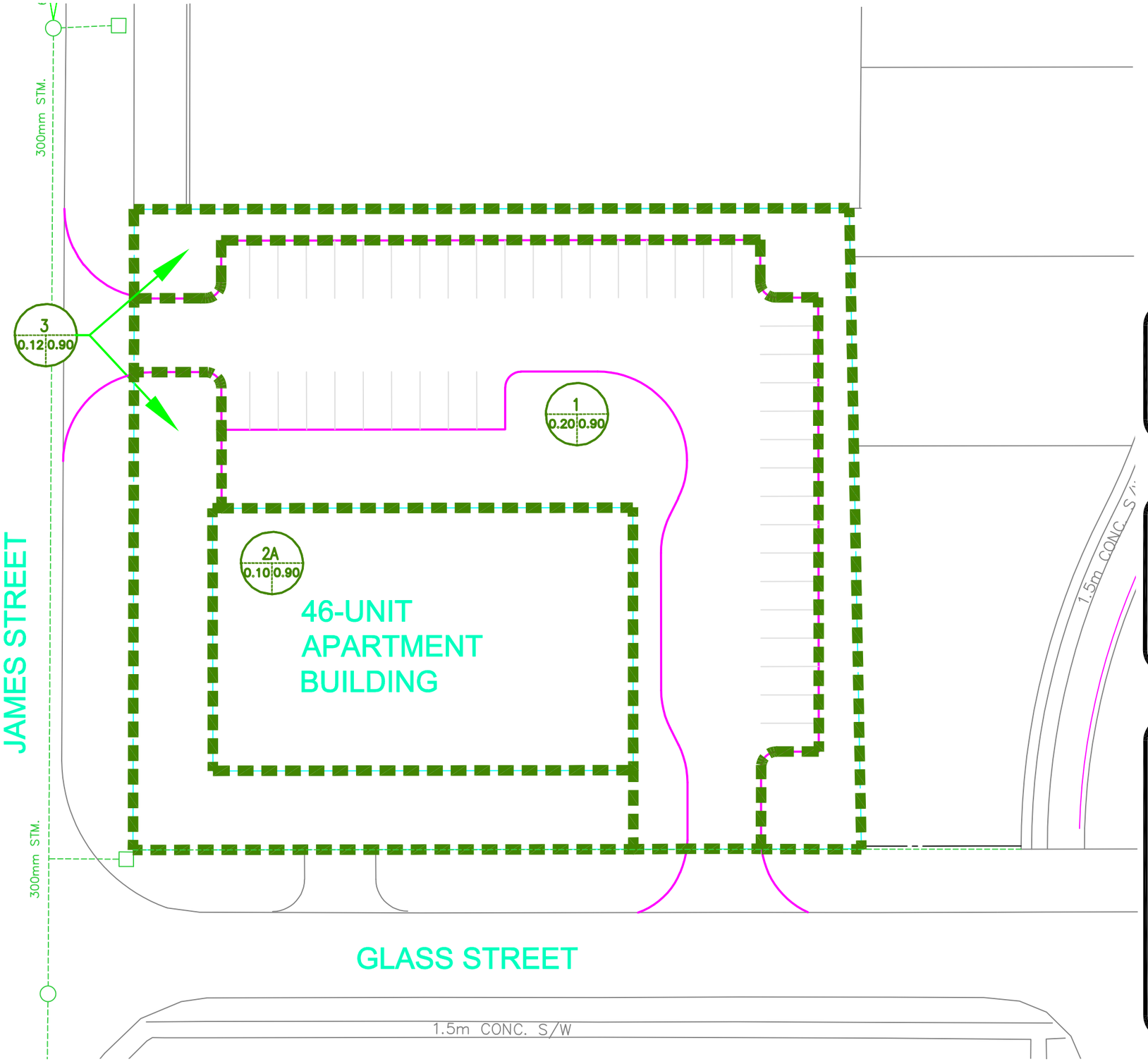

LEGEND

- PROPERTY BOUNDARY
- CATCHMENT AREA
- EXISTING STORM SEWER

KEY

CATCHMENT AREA

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OWNER: KATHY CARRADINE
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665 JAMES ST. NORTH
ST. MARY'S, ON

Project Address Project City

POST DEVELOPMENT DRAINAGE AREA PLAN

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5.0 Summary

The main findings of the preliminary servicing report for the proposed 665 James St Apartments are:

1. The proposed development can be adequately serviced through the extension of existing gravity sanitary sewers and municipal watermains.

2. The sanitary outlet connection is available at the south-east property line. Downstream sewers are constructed with adequate capacity.

3. Water supply for the proposed development will be provided by a single connection point to the existing municipal water distribution system at:
   - James St 150mm dia. Watermain.

4. Stormwater management for the development can be accommodated in the proposed storm sewer servicing and oil-grit separator

5. Overall site grading will provide for "major" overland flow conveyance to the James St right-of-way, provide adequate cover over municipal services and generally match existing road and boundary grades with appropriate slopes or retaining walls.

6. The proposed development can be adequately serviced through the extension of exiting utilities including hydro, gas, cable TV and telephone.

All of which is respectfully submitted,

MTE Consultants Inc.

Dec 4/19

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Appendix A

SANITARY DESIGN SHEET

665 James St Apartments
TOWN OF ST. MARYS

Project No.: 46140-100
Date: 3-Dec-19
Designed By: JMG
Checked By: JJM
File: Q:\46140\100\Preliminary (From Thames Crest)\SAN\46140-100 Sanitary Sewer Design Sheet 665 James St_Rev1.xls

SANITARY SEWER DESIGN SHEET

ENGINEERING SERVICES

ULTIMATE DEVELOPMENT CONDITION

Design Parameters

Average Daily Flow

Residential:	0.004 L/s/p	n =	0.013	Population Densities (ppu)	
Commercial:	0.32 L/s/ha	Vmax =	3.00 m/s	Singles	2.84
Institutional:	0.32 L/s/ha	Vmin =	0.60 m/s	Semis	2.84
Industrial:	0.41 L/s/ha			Townhomes	2.10
Infiltration:	0.20 L/s/ha	Residentail Harmon Peaking Factor		Appartments	1.56
		$M = 1 + 14/(4 + P^{0.5})$			

LOCATION					RESIDENTIAL AREAS							INSTITUIONAL				COMMERCIAL				INDUSTRIAL					INFILTRATION			DESIGN					
STREET	AREA NO.	MANHOLE LOCATION		Existing Flow Rates As Per Town of St. Marys Pipe Capacity Model (Received Oct 17, 2018)	POPULATION DENSITY			POPUL.	ACCUM. POPUL.	PEAK FACTOR "PF"	PEAK RES. FLOW	HECTARES AND FLOW OF EACH ZONING												TOTALS-C-I FLOW	AREA	ACCUM. AREA	INFIL FLOW	TOTAL VOLUME FLOW	LENGTH	SLOPE	PIPE SIZE	CAPACITY	FULL FLOW VELOCITY	ACTUAL VELOCITY
												0.32 *L/s/ha*				0.32 *L/s/ha*				0.41 *L/s/ha*												
		FROM MH	TO MH		Area (ha)	No. of Units						AREA	ACCUM. AREA	PF	PEAK FLOW	AREA	ACCUM. AREA	PF	PEAK FLOW	AREA	ACCUM AREA	PF	PEAK FLOW										
						Singles/ Semis	*Towns* *Appts*																											
				L/s				*1000s*	*1000s*		m^3/s	*ha*	*ha*		m^3/s	*ha*	*ha*		m^3/s	*ha*	*ha*		m^3/s	m^3/s	*ha*	*ha*	m^3/s	m^3/s	*m*	%	*mm*	m^3/s	*m/s*	*m/s*
Thamescrest PH2			147		45.70	595.00		1.690	1.690	3.6	0.0249		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	45.70	45.70	0.0091	0.0341						
Emily Street		147	146	0				0.000	1.690	3.6	0.0249		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	45.70	0.0091	0.0341	2.99	300	0.1671	2.366	1.856
		146	145	0.3				0.000	1.690	3.6	0.0249		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	45.70	0.0091	0.0344	0.37	300	0.0588	0.832	0.861
		145	141	0.3				0.000	1.690	3.6	0.0249		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	45.70	0.0091	0.0344	0.42	300	0.0626	0.887	0.901
		141	140	0.6				0.000	1.690	3.6	0.0249		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	45.70	0.0091	0.0347	3.37	300	0.1774	2.511	1.948
		140	139	1.2				0.000	1.690	3.6	0.0249		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	45.70	0.0091	0.0353	8.17	300	0.2763	3.910	2.682
		139	138	1.3				0.000	1.690	3.6	0.0249		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	45.70	0.0091	0.0354	0.51	300	0.0690	0.977	0.975
		138	137	1.6				0.000	1.690	3.6	0.0249		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	45.70	0.0091	0.0357	0.56	300	0.0723	1.024	1.012
665 James St		194	193	1.8	1.00		46.00	0.072	0.072	4.3	0.0012		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	1.00	1.00	0.0002	0.0032	0.51	200	0.0234	0.746	0.524
Apartments		195	193	3.7	2.90	48.00	12.00	0.162	0.233	4.1	0.0039		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	2.90	3.90	0.0008	0.0084	0.74	200	0.0282	0.898	0.783
		193	192	5.5				0.000	0.233	4.1	0.0039		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	3.90	0.0008	0.0102	0.54	200	0.0241	0.767	0.731
		192	191	6.0				0.000	0.233	4.1	0.0039		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	3.90	0.0008	0.0107	0.56	200	0.0245	0.781	0.749
Thamescrest PH2			191		9.31	122.00		0.346	0.580	3.9	0.0093		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	9.31	13.21	0.0026	0.0119						
James Street North		191	190	6.3				0.000	0.580	3.9	0.0093		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	13.21	0.0026	0.0182	0.49	200	0.0229	0.731	0.811
		190	189	6.4				0.000	0.580	3.9	0.0093		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	13.21	0.0026	0.0183	0.60	200	0.0254	0.809	0.880
		189	188	7.2				0.000	0.580	3.9	0.0093		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	13.21	0.0026	0.0191	2.10	200	0.0475	1.513	1.425
		188	187	8.1				0.000	0.580	3.9	0.0093		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	13.21	0.0026	0.0200	3.28	200	0.0594	1.891	1.706
		187	186	8.1				0.000	0.580	3.9	0.0093		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	13.21	0.0026	0.0200	0.75	200	0.0284	0.904	0.979
		186	185	9.1				0.000	0.580	3.9	0.0093		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	13.21	0.0026	0.0210	0.93	200	0.0316	1.007	1.077
		185	184	9.4				0.000	0.580	3.9	0.0093		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	13.21	0.0026	0.0213	9.30	200	0.1000	3.184	2.529
		184	183	13.6				0.000	0.580	3.9	0.0093		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	13.21	0.0026	0.0255	1.82	300	0.1304	1.846	1.432
		183	178	13.6				0.000	0.580	3.9	0.0093		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	13.21	0.0026	0.0255	3.23	300	0.1737	2.459	1.756
		178	177	14.3				0.000	0.580	3.9	0.0093		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	13.21	0.0026	0.0262	0.64	300	0.0773	1.094	0.989
		177	171	14.5				0.000	0.580	3.9	0.0093		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	13.21	0.0026	0.0264	0.68	300	0.0797	1.128	1.013
		171	170	15.7				0.000	0.580	3.9	0.0093		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	13.21	0.0026	0.0276	0.36	350	0.0875	0.910	0.806
		170	163	15.9				0.000	0.580	3.9	0.0093		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	13.21	0.0026	0.0278	0.23	350	0.0699	0.727	0.683
		163	162	17.3				0.000	0.580	3.9	0.0093		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	13.21	0.0026	0.0292	0.30	350	0.0799	0.830	0.766
		162	156	17.5				0.000	0.580	3.9	0.0093		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	13.21	0.0026	0.0294	0.36	350	0.0875	0.910	0.820
		156	155	18.7				0.000	0.580	3.9	0.0093		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	13.21	0.0026	0.0306	0.36	350	0.0875	0.910	0.829
		155	154	18.7				0.000	0.580	3.9	0.0093		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	13.21	0.0026	0.0306	0.30	350	0.0799	0.830	0.774
		154	137	18.8				0.000	0.580	3.9	0.0093		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	13.21	0.0026	0.0307	0.41	350	0.0934	0.971	0.870
		137	136	20.4				0.000	2.270	3.5	0.0326		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	58.91	0.0118	0.0648	1.23	350	0.1617	1.681	1.583
		136	135	20.4				0.000	2.270	3.5	0.0326		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	58.91	0.0118	0.0648	0.30	350	0.0799	0.830	0.925
		135	134	20.5				0.000	2.270	3.5	0.0326		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	58.91	0.0118	0.0649	0.51	350	0.1041	1.083	1.141
		134	133	20.7				0.000	2.270	3.5	0.0326		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	58.91	0.0118	0.0651	0.22	350	0.0684	0.711	0.809
		133	132	27.1				0.000	2.270	3.5	0.0326		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	58.91	0.0118	0.0715	0.18	450	0.1209	0.761	0.789
		132	131	27.2				0.000	2.270	3.5	0.0326		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	58.91	0.0118	0.0716	0.20	450	0.1274	0.802	0.820
		131	130	29.7				0.000	2.270	3.5	0.0326		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	58.91	0.0118	0.0741	0.28	450	0.1508	0.949	0.936
		130	129	29.9				0.000	2.270	3.5	0.0326		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	58.91	0.0118	0.0743	0.17	450	0.1175	0.739	0.782
		129	128	30.6				0.000	2.270	3.5	0.0326		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	58.91	0.0118	0.0750	0.12	450	0.0987	0.621	0.683
		128	127	31				0.000	2.270	3.5	0.0326		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	58.91	0.0118	0.0754	0.09	450	0.0855	0.538	0.607
		127	126	31.4				0.000	2.270	3.5	0.0326		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	58.91	0.0118	0.0758	0.21	450	0.1306	0.821	0.848
		126	125B	87.9				0.000	2.270	3.5	0.0326		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	58.91	0.0118	0.1323	0.55	525	0.3188	1.473	1.398
		125B	105	88.3				0.000	2.270	3.5	0.0326		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	58.91	0.0118	0.1327	1.27	525	0.4844	2.239	1.908
		105	104	93.2				0.000	2.270	3.5	0.0326		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	58.91	0.0118	0.1376	0.37	500	0.2296	1.170	1.219
	**	104	103	93.2				0.000	2.270	3.5	0.0326		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	58.91	0.0118	0.1376	0.50	500	0.2669	1.360	1.359
		103	102	114.3				0.000	2.270	3.5	0.0326		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	58.91	0.0118	0.1587	0.79	675	0.7468	2.088	1.657
		102	101	114.3				0.000	2.270	3.5	0.0326		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	58.91	0.0118	0.1587	0.20	675	0.3757	1.051	1.000
		101	100	114.3				0.000	2.270	3.5	0.0326		0.00	3.0	0.0000		0.00	3.0	0.0000		0.00	3.0	0.0000	0.0000	0.00	58.91	0.0118	0.1587	0.28	675	0.4446	1.243	1.138

*Existing Flow Rates, Pipe Sizes, and Pipe Slopes Were Obtained From the Town of St. Marys Sanitary Pipe Capacity Model as Received Oct 17,2018
** The Slope of pipe 104-103 was modelled as 0.1% however the Town has advised that the slope is actually 0.5% (Per Jeff W. Feb. 2019)

Appendix B

SWM ANALYSIS

SWM Calculations

DATE:	December 3, 2019
JOB N0.:	46140-100

Client:	**Zelinka Priamo Ltd.**
Project:	**665 James St. Apartments**
Location:	**665 James St. North, St. Mary's ON**

PRE-DEVELOPMENT CONDITIONS

TOTAL PRE-DEVELOPMENT AREA (A1)

	Area (m^2)	C	A*C
Total Site Area:	4186.500		
Building Area:	600.70	0.9	540.63
Concrete/Asphalt:	1437.20	0.9	1293.48
Gravel:	430.50	0.7	301.35
Landscaped/Open:	1718.10	0.2	343.62
Totals:	4186.500		2479.08
C_{eq} = Sum(A*C)/Sum(A) =	0.59		
Imperviosness =			

CITY OF STRATFORD - 4 HOUR CHICAGO RAINFALL DISTRIBUTION PARAMETERS*

Return Period (years)	A,B,C Parameters A	B	C
2	601.090	4.922	0.767
5	875.105	7.641	0.762
10	1062.156	9.025	0.760
25	1319.273	10.500	0.762
50	1560.739	12.129	0.767
100	1821.990	13.507	0.773
250	2095.179	13.509	0.773

*Intensity i=A/(t+B)^C (mm/hr)

* Refer to the City of Stratford Infrastructure Standards and Specifications Manual 2018

5 Year Pre-Develeopment Area (A1) Flows

C =	0.59	
**Time to concentration t_c =	10.00	min
Intensity, i (@ t_c) =	98.22	mm/hr
Pre Development Flow, Q_r = 2.78*C*i*A =	67.69	l/s

POST-DEVELOPMENT CONDITIONS

POST-DEVELOPMENT CONTROLLED CATCHMENT A1

	Area (m^2)	C	A*C
Total Site Area:	4186.500		
Building Area:	1000.00	0.9	900
Concrete/Asphalt:	2000.00	0.9	1800
Landscaped/Open:	1186.50	0.2	237.3
Totals:	4186.50		2937.3
C_{eq} = Sum(A*C)/Sum(A) =	0.70		

FLOW RESTRICTOR CALCULATIONS

Orifice diameter is based on Bernoulli's equation, $Q=C_d*A*(2gH)^{0.5}$

Rearranging, $A= Q/[C_d*(2gH)^{0.5}]$, where:

Required Restriction Flow Rate, Q =	67.69	l/s
Orifice Coefficient, C_d =	0.63	
Gravitational Acceleration, g =	9.81	m/s^2
Top of Flooding =	329.00	m
Orifice Invert =	326.30	m
Hydralic Head on Orifice, H =	2.700	m
Required Cross-Sectional Area, A =	0.01480	m^2
Required Diameter, d = ((4*A)/pi)^0.5 =	0.137	m
Minimum orifice diameter =	**137**	**mm**
Therefore, Use Orfice Restrictor =	**137.00**	**mm**
Max Flow Rate, Q =	**67.59**	

RAINFALL DATA

Rainfall Data - Stratford Rainfall Intensity Duration

25YR Storm Event

Duration (min.)	Intensity "i" (mm/hr)
5	176.63
10	132.06
15	111.83
30	78.61
60	51.52
120	32.23
180	24.16

STORAGE CALCULATIONS

Inflow, Q_i 2.78*C*i*A (l/s)	Volume In Qt*t*60/1000 (m^3)	Orifice Restrictor Outflow, Q_o (l/s)	Surface Outflow Q_o (l/s)	Allowable Release, Q_o (l/s)	Volume Out Q_o*t*60/1000 (m^3)	Difference/ Storage (m^3)
143.90	43.17	67.69	0.00	67.69	20.31	22.86
107.59	64.55	67.69	0.00	67.69	40.62	23.94
91.11	82.00	67.69	0.00	67.69	60.92	21.07
64.04	115.27	67.69	0.00	67.69	121.85	-6.58
41.98	151.12	67.69	0.00	67.69	243.70	-92.58
26.26	189.05	67.69	0.00	67.69	487.39	-298.35
19.68	212.56	67.69	0.00	67.69	731.09	-518.53
					Max. Storage Volume (m^3) =	23.94

100 Yr Stm Event

Duration (min.)	Intensity "i" (mm/hr)
5	190.94
10	158.71
15	136.73
30	98.61
60	65.75
120	41.45
180	31.11

Inflow, Q_i 2.78*C*i*A (l/s)	Volume In Qt*t*60/1000 (m^3)	Orifice Restrictor Outflow, Q_o (l/s)	Surface Outflow Q_o (l/s)	Allowable Release, Q_o (l/s)	Volume Out Q_o*t*60/1000 (m^3)	Difference/ Storage (m^3)
155.56	46.67	67.69	0.00	67.69	20.31	26.36
129.30	77.58	67.69	0.00	67.69	40.62	36.97
111.39	100.25	67.69	0.00	67.69	60.92	39.33
80.34	144.61	67.69	0.00	67.69	121.85	22.76
53.56	192.83	67.69	0.00	67.69	243.70	-50.87
33.77	243.14	67.69	0.00	67.69	487.39	-244.25
25.35	273.75	67.69	0.00	67.69	731.09	-457.34
					Max. Storage Volume (m^3) =	39.33

AVAILABLE STORAGE CALCULATIONS

Available Surface Storage

Location	**Area (m^2)**	**Depth(m)**	**Volume (m^3)** (V=AxD/3)
CBMH8			
Total Ponding Area:		0.3	0.00
	Total Surface Storage Available (m3) =		**0.00**

Available Storage in StormTech SC-740 Chamber (Undrground Storage)

No. of Chambers (including endcaps):	0.00
Total Volume of Chamber System:	**0.00**

Total Underground Storage Available (m3) =	**0.00**

Total Storage Available On-Site (m^3) =	**0.00**
Required 100 Year Storage (m^3) =	**39.33**

Therefore, the sufficient storage is provided to attenuate the post-development 100-year storm flows to the 5-year storm pre-development level.