PROPOSED RESIDENTIAL DEVELOPMENT
ELM STREET & STEELE STREET, PORT COLBORNE

FUNCTIONAL SERVICING DESIGN BRIEF
NEW STORM, SANITARY AND WATER SERVICES

REV 1 – November 13, 2024

PREPARED BY:

HALLEX ENGINEERING LTD.

HALLEX PROJECT #230919

HALLEX NIAGARA
4999 VICTORIA AVENUE
NIAGARA FALLS, ON L2E 4C9

HALLEX HAMILTON
745 SOUTH SERVICE ROAD, UNIT 205
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1. INTRODUCTION

The proposed Elm & Steele Street residential development consists of the demolition of the existing agricultural field and the construction of twenty single family dwellings, forty-three townhouse / semi units, twenty-two three-storey triplex townhouse lots (66 units), sixteen two-storey duplex townhouse / semi lots (32 units) and a ten-storey mixed-use apartment building (200 units) complete with public and private roads, asphalt driveways and parking areas and grass areas. This development is located south of Barrick Road, west of Elm Street and east of Steele Street in the City of Port Colborne, ON.

The purpose of the service assessment is to determine the functional sizing of the proposed storm, sanitary and water services in addition to the post-development flows from the site to determine the impact on the existing municipal infrastructure.

2. EXISTING MUNICIPAL INFRASTRUCTURE

2.1 EXISTING SITE DRAINAGE

The existing site currently drains from west to the east side of the property via overland flow as per the Topographic Survey completed by Chambers & Associates Surveying Ltd. under file number 23-01, dated March 26, 2024. This overland flow drains to the roadside drainage ditches at Elm Street and ultimately discharges to the existing storm sewer at Elm Street.

2.2 STORM SEWER

The existing site is not currently serviced as it consists of an agricultural field. The existing drainage infrastructure at Elm Street consists of a 975mm concrete municipal storm sewer which drains southerly towards Borden Avenue. The existing drainage infrastructure at Steele Street consists of an 825mm concrete municipal storm sewer which drains southerly towards Northland Avenue.

2.3 SANITARY SEWER

The existing site is not currently serviced as it consists of an agricultural field. The existing sanitary infrastructure at Elm Street consists of a 350mm municipal sanitary forcemain and a 375mm concrete municipal sanitary sewer which drains southerly towards Borden Avenue. The existing sanitary infrastructure at Steele Street consists of 250mm municipal sanitary sewer which drains southerly towards Northland Avenue.

2.4 WATERMAIN

The existing site is not currently serviced as it consists of an agricultural field. The existing watermain infrastructure at Elm Street consists of a 400mm PVC municipal watermain and 450mm PVC regional watermain. The existing watermain infrastructure at Steele Street consists of 200mm PVC municipal watermain.

3. STORM SEWER SYSTEM

3.1 PRE-DEVELOPMENT SITE FLOW

The total drainage area for the subject development, including the existing fields and residential properties north and west of the development which drain through the site, is 12.109 hectares. This area has an existing runoff coefficient of 0.25 based on the existing agricultural field, grass surfaces and developed single-family dwellings. The catchment area plan for the pre-development site condition is provided on Hallex Sketch CSK1, attached. Due to the significant size of the drainage area, the airport formula is used to determine the time of concentration as per the following formula:

Airport Formula
Tc= (3.26* (1.1-C) *(L^0.5))/(Sw^0.33)

Tc= Time of Concentration (minutes)
C=Runoff Coefficient
L= Watershed Length (metres)
Sw = Watershed Slope (%)

Utilizing the rationale method (Q = CiA/360) and the calculated time of concentration, the allowable peak flow for the pre-development site is as follows:

Storm Event	Pre-Development Storm Flow
5-year Storm	239.0 L/s
100-year Storm	367.6 L/s

These flows are calculated using the City of Welland intensity-duration-frequency curves given IDF curves are not available from the City of Port Colborne. The pre-development flows for the subject development are provided in Exhibit #1 for the five-year storm and Exhibit #2 for the one-hundred-year storm at the end of the design brief.

3.2 POST-DEVELOPMENT SITE FLOW

The proposed residential development includes the twenty single family dwellings, forty-three townhouse / semi units, twenty-two three-storey triplex townhouse lots (66 units), sixteen two-storey duplex townhouse / semi lots (32 units) and a ten-storey mixed-use apartment building (200 units), public and private roads, asphalt driveways and parking areas and grass areas. The grading for the site will ensure drainage through the proposed storm sewer system for storm water quantity and quality controls.

The total drainage area for the subject development, including the existing fields and residential properties north and west of the development which drain through the site, is 12.109 hectares. This area has a calculated runoff coefficient of 0.43 based on the existing agricultural field, single-family dwellings and grass surfaces and the proposed roof, asphalt, concrete, and grass surfaces. The proposed storm sewer for the site will then discharge to the existing 975mm municipal storm sewer at Elm Street. The catchment area plan for the post-development site condition is provided on Hallex Sketch CSK2, attached.

Utilizing the rationale method (Q = CiA/360), the minimum recommended time of concentration of 10 minutes for the proposed development and the airport formula for the existing fields and residential properties north and west of the development, the calculated peak flow for the post-development site is as follows:

Storm Event	Post-Development Storm Flow
5-year Storm	938.3 L/s
100-year Storm	1,464.2 L/s

These flows are calculated using the City of Welland intensity-duration-frequency curves given IDF curves are not available from the City of Port Colborne. The post-development flows for the proposed development are provided in Exhibit #3 for the five-year storm and Exhibit #4 for the one-hundred-year storm at the end of the design brief.

3.3 STORMWATER QUANTITY CONTROL

The post-development storm water runoff for the subject site will increase by 699.4 L/s for the five-year storm and 1,096.6 L/s for the one-hundred-year storm from the maximum allowable flow from the site. As such, storm water detention will be required for the proposed development.

Stormwater quantity controls for the site can be achieved by utilizing an orifice pipe prior to discharging to the existing 975mm municipal storm sewer at Elm Street. The orifice pipe will ensure the post-development runoff is controlled to the pre-development runoff rate for the five-year and one-hundred-year storm events. The resulting 1,167.0 m^3 volume generated for the five-year storm event and 1,886.0 m^3 volume generated for the one-hundred-year storm event can be stored within a proposed underground storage chamber system below the proposed park area prior to discharging to the existing 975mm municipal storm sewer at Elm Street.

3.4 STORMWATER QUALITY CONTROL

Stormwater quality controls for the site can be achieved by utilizing an ETV certified oil / grit separator prior to draining to the existing 975mm municipal storm sewer at Elm Street. The OGS unit will be sized to achieve a total suspended solids removal of at least 80% based on the above post-development site conditions in order to achieve the required 'Enhanced' treatment of 80% as indicated in the MOE Stormwater Management Planning and Design Manual, dated March 2003 (refer to Chapter 3: Environmental Design Criteria, Section 3.3.1.1. Level of Protection).

Additionally, the proposed underground storage chamber system will aid to further improve the water quality from the site as stormwater drains through the chambers and the clear stone base prior to draining to the oil / grit separator.

4. SANITARY SEWER SYSTEM

Given the site is to be completely developed for the proposed residential development, a new sanitary sewer system shall be proposed within the public and private roads and shall discharge to the existing 375mm concrete municipal sanitary sewer at Elm Street.

The residential development is currently in the concept phase; therefore, the following assumptions based on the architectural drawings are made in carrying out the calculations:

- The domestic sewage design flow is based on the recommendation in Section 5.5.2.1 – Domestic Sewage Flows of the Ministry of the Environment Design Guidelines for Sewage Works 2008.
- The average commercial daily design flow is based on the recommendation in Section 5.5.2.2 Commercial and Institutional Sewage Flows of the Ministry of the Environment Design Guidelines for Sewage Works 2008 assuming the flow is distributed over 8 hours.
- The twenty single-family dwellings are assumed to consist of three-bedrooms in each dwelling. The bedrooms are assumed to have a maximum of 2 persons in the master bedroom and 1 person in each of the remaining bedrooms.
- The forty-three townhouse / semi units are assumed to consist of three bedrooms in each unit. The bedrooms are assumed to have a maximum of 2 persons in the master bedroom and 1 person in each of the remaining bedrooms.
- The twenty-two triplex townhouse lots (66 units) are assumed to consist of three bedrooms in each unit. The bedrooms are assumed to have a maximum of 2 persons in the master bedroom and 1 person in each of the remaining bedrooms.
- The sixteen duplex townhouse / semi lots (32 units) are assumed to consist of three bedrooms in each unit. The bedrooms are assumed to have a maximum of 2 persons in the master bedroom and 1 person in each of the remaining bedrooms.

- The ten-storey mixed-use apartment building is assumed to have 10 floors consisting of 200 two-bedroom units. Each apartment is assumed to have a maximum of 2 persons per bedroom.

The peak dry weather design flow for the proposed residential development is determined to be 28.161 L/s the peak wet weather design flow is determined to be 29.626 L/s. These calculations are based on the Sanitary Catchment Area Plan CSK3 and the Sanitary Sewer Design Sheet provided in Exhibit #5, attached.

Based on the above, Hallex recommends a minimum 200mm sanitary sewer @ 0.4% to be installed to convey sanitary flows throughout the site. Sanitary lateral connections shall be designed for each dwelling, townhouse / semi unit, stack of townhouse / semi units and the mixed-use apartment building. The final section of the proposed sanitary sewer is to be increased to a 250mm sewer due to the additional flows received from the mixed-use apartment building. The proposed sanitary sewer system shall discharge to the existing 375mm concrete municipal sanitary sewer at Elm Street.

The installation of the proposed sanitary sewer will require crossing the existing 975mm concrete municipal storm sewer, the 350mm municipal sanitary forcemain, the 400mm PVC municipal watermain and the 450mm PVC regional watermain at Elm Street. Given the existing 375mm concrete municipal sanitary sewer is located at a similar elevation to this infrastructure, it is recommended the proposed sanitary sewer be installed to pass over the existing infrastructure in the street. This will require a significant amount of fill to be imported to raise the grade of the site and ensure the proposed sanitary sewer can service the development upstream.

5. WATER DISTRIBUTION SYSTEM

Given the site is to be completely developed for the proposed residential development, a new watermain system shall be proposed within the public and private roads and shall be looped through the development and connect to the existing 400mm PVC municipal watermain at Elm Street and the 200mm PVC municipal watermain at Steele Street.

The residential development is currently in the concept phase; therefore, the following assumptions based on the architectural drawings are made in carrying out the calculations:

- The plumbing fixtures and the number of plumbing fixtures indicated in Exhibit #6 are assumed and may not represent the final building plumbing designs for each building.
- The single-family dwellings, townhouse / semi blocks, duplex townhouse / semi blocks and triplex townhouse blocks are assumed to be of wood-frame construction and will not have sprinklers installed throughout the buildings.
- The ten-storey apartment building is assumed to be fire protected vertically between floors (including the protection of vertical openings between floors), of non-combustible construction and will have sprinklers and hose cabinets installed throughout the buildings as per applicable standards.

The domestic water demand for the proposed development is determined to be as follows:

Single-Family Dwelling	110.8 L/min (Each Dwelling)
Townhouse / Semi Blocks	110.8 L/min (Each Unit)
Duplex Townhouse / Semi Blocks	133.8 L/min (Each Unit Stack)
Triplex Townhouse Blocks	163.8 L/min (Each Unit Stack)
Ten-Storey Apartment Building	1,352.3 L/min

These calculations are based on the fixtures and fixture units shown in Exhibit #6 attached. Table 7.4.10.5 in the Ontario Building Code is used to determine water demands for the total fixture units.

Using the calculations provided in the Fire Underwriters Survey – 2020 Water Supply for Public Fire Protection, the minimum water supply flow rate for fire protection is determined to be as follows:

Single-Family Dwellings	9,000 L/min
Townhouse / Semi Blocks	11,000 L/min
Duplex Townhouse / Semi Blocks	13,000 L/min
Triplex Townhouse Blocks	13,000 L/min
Ten-Storey Apartment Building	7,000 L/min

These calculations are based on the above assumptions as shown in Exhibits #7-11, attached. There are four existing municipal fire hydrants located near the development. The first is located adjacent to the north end of the development in the street island at the Elm Street and Barrick Road intersection. The second is located adjacent to the proposed entrance to the development on the west side of Elm Street. The third is approximately 62.2m south of the property on the west side of Elm Street. The fourth is approximately 63.2m north of the property on the west side of Steele Street.

Based on the above, Hallex recommends a minimum 200mm diameter watermain to be installed within the public and private roads to provide water supply throughout the site. Water service connections shall be designed for each dwelling, townhouse / semi unit, stack of townhouse / semi units and apartment building. Each dwelling, townhouse / semi unit and apartment building is also proposed to be metered individually complete with a remote reader on the face of the building to monitor individual water usage. The proposed watermain system shall be looped through the development and connect to the existing 400mm PVC municipal watermain at Elm Street and the 200mm PVC municipal watermain at Steele Street. Additionally, five fire hydrants are proposed for the development in accordance with Ontario Building Code requirements.

The installation of the proposed watermain will require crossing the existing 975mm concrete municipal storm sewer, the 350mm municipal sanitary forcemain and the 450mm PVC regional watermain at Elm Street. As such, protection of the municipal and regional infrastructure during the installation of the new watermain shall be completed in accordance with City of Port Colborne and Region of Niagara requirements.

6. CONCLUSION

The aforementioned calculations and recommendations for the storm, sanitary and water services are based on the current design for the site as of writing this report. A final sealed report, complete with updates to the recommendations made in this report, may be required based on the final site design.

We trust this report meets your approval. Please contact the undersigned should you have any questions or comments.

Yours truly,
HALLEX ENGINEERING LTD

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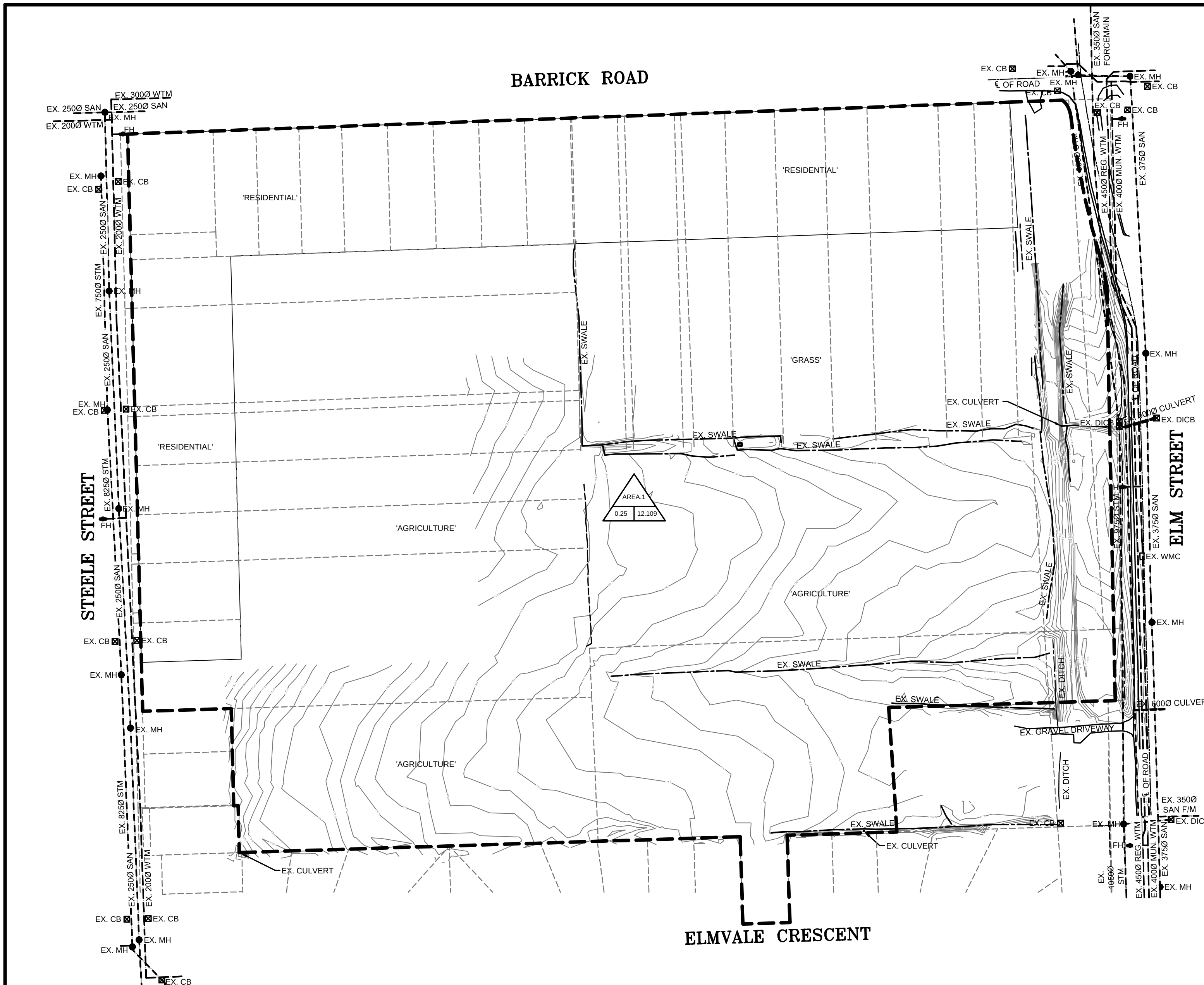

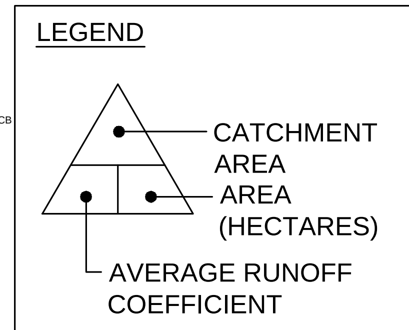

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PROJECT:
ELM & STEELE RESIDENTIAL DEVELOPMENT
ELM & STEELE STREET, PORT COLBORNE, ON

SHEET TITLE:
PRE-DEVELOPMENT CATCHMENT AREA PLAN

DATE: 11/13/2024

SCALE: 1:2500

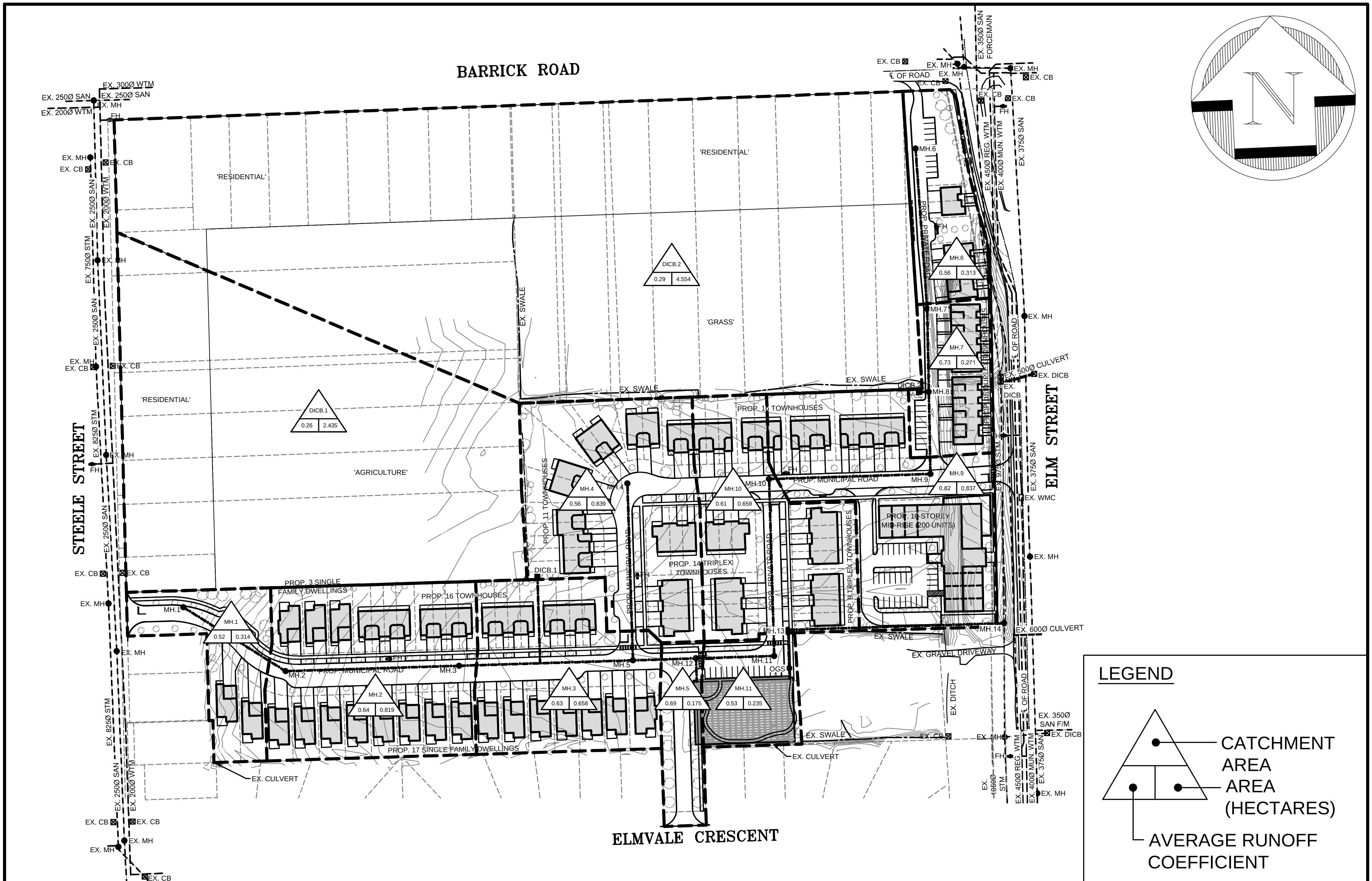
DR. BY: JF

CH. BY: JS/JH

JOB No.: 230919

DWG. CSK1

REV. 1



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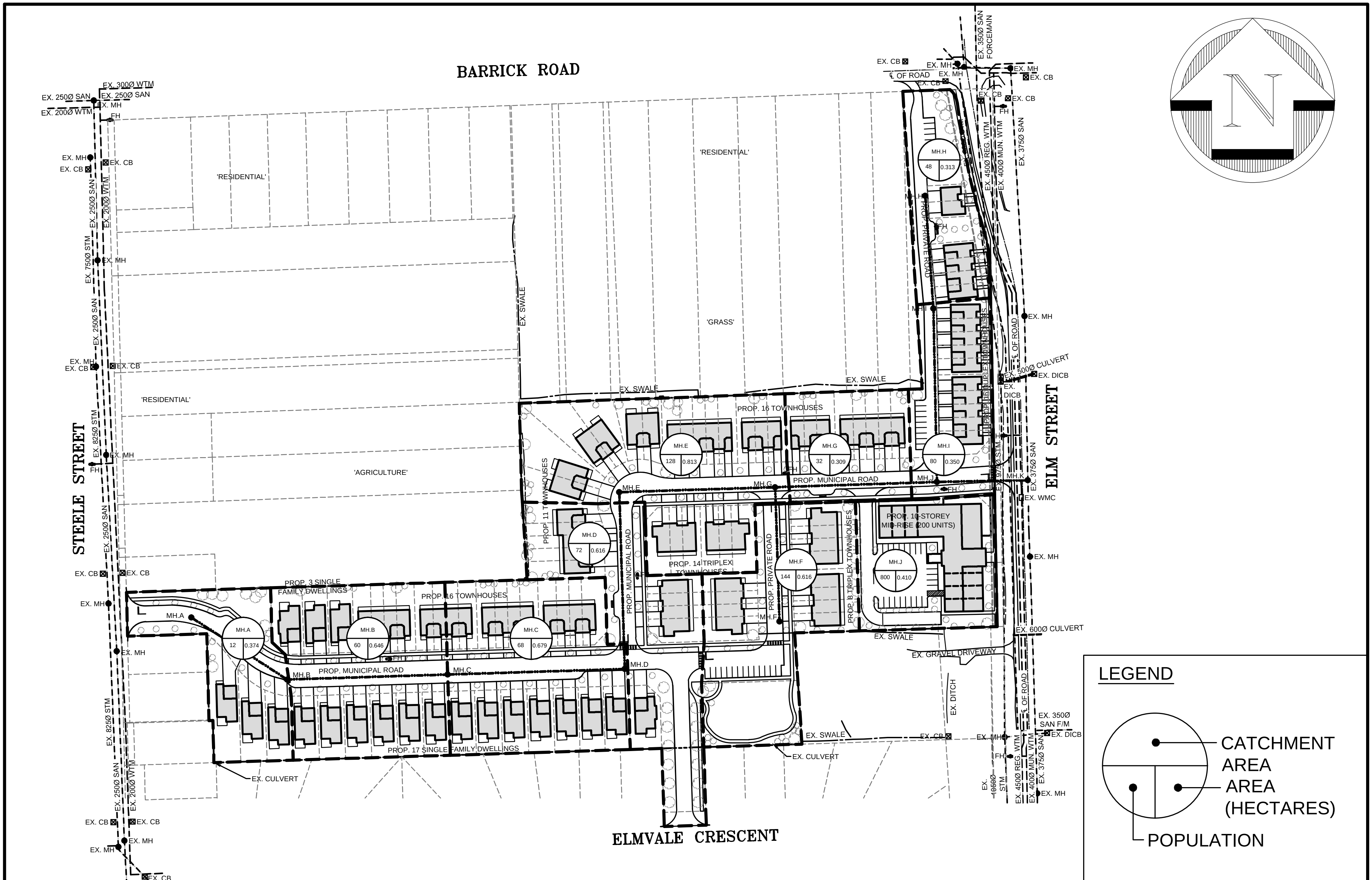
PROJECT:
ELM & STEELE RESIDENTIAL DEVELOPMENT
ELM & STEELE STREET, PORT COLBORNE, ON

SHEET TITLE:
POST-DEVELOPMENT CATCHMENT AREA PLAN

DATE: 11/13/2024
SCALE: 1:2500
DR. BY: JF/CA
CH. BY: JS/JH
JOB No.: 230919
DWG. CSK2
REV. 1



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PROJECT:
ELM & STEELE RESIDENTIAL DEVELOPMENT
ELM & STEELE STREET, PORT COLBORNE, ON

SHEET TITLE:
POST-DEVELOPMENT SANITARY CATCHMENT AREA PLAN

DATE: 11/13/2024
SCALE: 1:2500
DR. BY: JF/CA
CH. BY: JS/JH
JOB No.: 230919
DWG. CSK3
REV. 1

Elm & Steele Residential Development
Exhibit #1 - 5 Year Pre - Development Calculations

MUNICIPALITY: **Welland**

manning's n = 0.013 Conc Pipe
0.013 PVC Pipe
0.024 Corr. Stl Pipe

Rainfall Intensity Values = A= 830.000
B= 7.300
C= 0.777

Location			Length of Pipe	Area		Flow Time		Rainfall Intensity	Unit rate of Runoff	Design Flows	
Pipe	From Node	To Node		Incre-ment	Cum Total	To Upper	In Sectio			Cum Flow	Cum Flow
			(m)	(ha)	(ha)	(min)	(min)	mm/hr	m^3/ha*day	(m^3/d)	(m^3/s)
1	**Area.1**	**Street**	**N/A**	**12.109**	**12.109**	**67.89**	**N/A**	**29**	**21175**	**20647.6**	**0.2390**
Avg. Res.	-	-	-	2.761	-	-	-	-	2777.1	7667.5	-
Grass	-	-	-	9.348	-	-	-	-	1388.5	12980.1	-

Run-off Coefficients Used:

Avg Residential C = 0.40
Field / Grass C = 0.20

Velocity Range:

Minimum Velocity = 0.75 m/s
Maximum Velocity = 6.00 m/s

Time of Concentration = 10 min

Elm & Steele Residential Development
Exhibit #2 - 100 Year Pre - Development Calculations

MUNICIPALITY: **Welland**

manning's n =	0.013	Conc Pipe	Rainfall Intensity Values =	A=	1020.000
	0.013	PVC Pipe		B=	4.700
	0.024	Corr. Stl Pipe		C=	0.731

Location			Length of Pipe	Area		Flow Time		Rainfall Intensity	Unit rate of Runoff	Design Flows	
Pipe	From Node	To Node		Incre-ment	Cum Total	To Upper	In Sectio			Cum Flow	Cum Flow
			(m)	(ha)	(ha)	(min)	(min)	mm/hr	m^3/ha*day	(m^3/d)	(m^3/s)
1	**Area.1**	**Street**	**N/A**	**12.109**	**12.109**	**67.89**	**N/A**	**44**	**32571**	**31759.0**	**0.3676**
Avg. Res.	-	-	-	2.761	-	-	-	-	4271.5	11793.7	-
Grass	-	-	-	9.348	-	-	-	-	2135.8	19965.2	-

<u>Run-off Coefficients Used:</u>

Avg Residential C = 0.40
Field / Grass C = 0.20

<u>Velocity Range:</u>

Minimum Velocity = 0.75 m/s
Maximum Velocity = 6.00 m/s

<u>Time of Concentration =</u> 10 min

HALLEX ENGINEERING LTD.

Elm & Steele Residential Development
Exhibit #3 - 5 Year Post - Development Calculations

MUNICIPALITY: **Welland**

Rainfall Intensity Values = A= 830.000, B= 7.300, C= 0.777

manning's n = 0.013 PVC Pipe; 0.013 Conc Pipe; 0.024 Corr. Stl Pipe; 0.035 Grass Swale

Location			Length of Pipe	Area		Flow Time		Rainfall Intensity	Unit rate of Runoff	Design Flows		Flow Control	Sewer/Channel Design				Invert Elevations	
Pipe	From Node	To Node		Incre-ment	Cum Total	To Upper	In Section			Cum Flow	Cum Flow		Slope	Capacity Full	Velocity Full	*Dia/ Depth	Up-stream	Down-stream
			(m)	(ha)	(ha)	(min)	(min)	mm/hr	m^3/ha*day	(m^3/d)	(m^3/s)	(m^3/s)	(m/m)	(m^3/s)	(m/s)	(m)	(m)	(m)
1	**MH. 1**	**MH. 2**	**57.5**	**0.314**	**0.314**	**10.00**	**1.11**	**91**	**44574**	**3514.8**	**0.0407**	**0.0407**	**0.0040**	**0.0612**	**0.8652**	**0.300**	**177.43**	**177.20**
Roof	-	-	-	0.031	-	-	-	-	20656.2	640.3	-	-	-	-	-	-	-	-
Paved	-	-	-	0.108	-	-	-	-	19569.1	2113.5	-	-	-	-	-	-	-	-
Grass	-	-	-	0.175	-	-	-	-	4348.7	761.0	-	-	-	-	-	-	-	-
2	**MH. 2**	**MH. 3**	**82.9**	**0.819**	**1.133**	**11.11**	**1.22**	**86**	**42471**	**14287.0**	**0.1654**	**0.1654**	**0.0040**	**0.1803**	**1.1338**	**0.450**	**177.17**	**176.83**
Roof	-	-	-	0.235	-	-	-	-	19681.9	4625.2	-	-	-	-	-	-	-	-
Paved	-	-	-	0.257	-	-	-	-	18646.0	4792.0	-	-	-	-	-	-	-	-
Grass	-	-	-	0.327	-	-	-	-	4143.5	1354.9	-	-	-	-	-	-	-	-
3	**DICB. 1**	**MH. 3**	**41.5**	**2.435**	**2.435**	**47.61**	**0.51**	**37**	**5318**	**5541.4**	**0.0641**	**0.0641**	**0.0100**	**0.0967**	**1.3680**	**0.300**	**177.70**	**177.28**
Avg. Res.	-	-	-	0.691	-	-	-	-	3545.4	2449.9	-	-	-	-	-	-	-	-
Grass	-	-	-	1.744	-	-	-	-	1772.7	3091.6	-	-	-	-	-	-	-	-
4	**MH. 3**	**MH. 5**	**82.9**	**0.658**	**4.226**	**12.33**	**1.17**	**82**	**40406**	**27946.1**	**0.3234**	**0.3234**	**0.0030**	**0.3363**	**1.1894**	**0.600**	**176.80**	**176.55**
Roof	-	-	-	0.173	-	-	-	-	18724.7	3239.4	-	-	-	-	-	-	-	-
Paved	-	-	-	0.215	-	-	-	-	17739.1	3813.9	-	-	-	-	-	-	-	-
Grass	-	-	-	0.270	-	-	-	-	3942.0	1064.3	-	-	-	-	-	-	-	-
5	**MH. 4**	**MH. 5**	**84.4**	**0.839**	**0.839**	**10.00**	**1.76**	**91**	**44574**	**10134.6**	**0.1173**	**0.1173**	**0.0020**	**0.1275**	**0.8017**	**0.450**	**176.75**	**176.58**
Roof	-	-	-	0.184	-	-	-	-	20656.2	3800.7	-	-	-	-	-	-	-	-
Paved	-	-	-	0.229	-	-	-	-	19569.1	4481.3	-	-	-	-	-	-	-	-
Grass	-	-	-	0.426	-	-	-	-	4348.7	1852.5	-	-	-	-	-	-	-	-
6	**MH. 5**	**MH. 12**	**30.2**	**0.175**	**5.240**	**13.50**	**0.34**	**79**	**38629**	**40359.8**	**0.4671**	**0.4671**	**0.0040**	**0.5316**	**1.4856**	**0.675**	**176.52**	**176.39**
Roof	-	-	-	0.025	-	-	-	-	17901.0	447.5	-	-	-	-	-	-	-	-
Paved	-	-	-	0.096	-	-	-	-	16958.9	1628.1	-	-	-	-	-	-	-	-
Grass	-	-	-	0.054	-	-	-	-	3768.6	203.5	-	-	-	-	-	-	-	-
7	**MH. 6**	**MH. 7**	**76.6**	**0.313**	**0.313**	**10.00**	**1.48**	**91**	**44574**	**3801.8**	**0.0440**	**0.0440**	**0.0040**	**0.0612**	**0.8652**	**0.300**	**177.71**	**177.40**
Roof	-	-	-	0.047	-	-	-	-	20656.2	970.8	-	-	-	-	-	-	-	-
Paved	-	-	-	0.110	-	-	-	-	19569.1	2152.6	-	-	-	-	-	-	-	-
Grass	-	-	-	0.156	-	-	-	-	4348.7	678.4	-	-	-	-	-	-	-	-
8	**MH. 7**	**MH. 8**	**39.7**	**0.271**	**0.584**	**11.48**	**0.77**	**85**	**41820**	**7807.4**	**0.0904**	**0.0904**	**0.0030**	**0.0960**	**0.8695**	**0.375**	**177.37**	**177.25**
Roof	-	-	-	0.085	-	-	-	-	19379.9	1647.3	-	-	-	-	-	-	-	-
Paved	-	-	-	0.112	-	-	-	-	18359.9	2056.3	-	-	-	-	-	-	-	-
Grass	-	-	-	0.074	-	-	-	-	4080.0	301.9	-	-	-	-	-	-	-	-

Elm & Steele Residential Development
Exhibit #3 - 5 Year Post - Development Calculations

11/13/2024
Job: 230919

Location			Length of Pipe	Area		Flow Time		Rainfall Intensity	Unit rate of Runoff	Design Flows		Flow Control	Sewer/Channel Design				Invert Elevations	
Pipe	From Node	To Node		Incre-ment	Cum Total	To Upper	In Section			Cum Flow	Cum Flow		Slope	Capacity Full	Velocity Full	*Dia/ Depth	Up-stream	Down-stream
			(m)	(ha)	(ha)	(min)	(min)	mm/hr	m^3/ha*day	(m^3/d)	(m^3/s)	(m^3/s)	(m/m)	(m^3/s)	(m/s)	(m)	(m)	(m)
9	**DICB. 2**	**MH. 8**	**4.7**	**4.554**	**4.554**	**60.00**	**0.05**	**32**	**4540**	**10025.2**	**0.1160**	**0.1160**	**0.0100**	**0.1753**	**1.5875**	**0.375**	**177.33**	**177.28**
Avg. Res.	-	-	-	2.070	-	-	-	-	3026.9	6265.7	-	-	-	-	-	-	-	-
Grass	-	-	-	2.484	-	-	-	-	1513.5	3759.4	-	-	-	-	-	-	-	-
10	**MH. 8**	**MH. 9**	**35.5**	**0.000**	**5.138**	**12.25**	**0.61**	**82**	**0**	**17832.5**	**0.2064**	**0.2064**	**0.0020**	**0.2746**	**0.9712**	**0.600**	**177.22**	**177.14**
11	**MH. 9**	**MH. 10**	**77.1**	**0.837**	**5.975**	**12.86**	**1.23**	**80**	**39578**	**31084.4**	**0.3598**	**0.3598**	**0.0020**	**0.3759**	**1.0505**	**0.675**	**177.08**	**176.92**
Roof	-	-	-	0.230	-	-	-	-	18341.0	4218.4	-	-	-	-	-	-	-	-
Paved	-	-	-	0.495	-	-	-	-	17375.7	8601.0	-	-	-	-	-	-	-	-
Grass	-	-	-	0.112	-	-	-	-	3861.3	432.5	-	-	-	-	-	-	-	-
12	**MH. 10**	**MH. 11**	**84.4**	**0.659**	**6.634**	**14.09**	**1.10**	**77**	**37798**	**38491.9**	**0.4455**	**0.4455**	**0.0030**	**0.4604**	**1.2866**	**0.675**	**176.86**	**176.60**
Roof	-	-	-	0.163	-	-	-	-	17516.2	2855.1	-	-	-	-	-	-	-	-
Paved	-	-	-	0.211	-	-	-	-	16594.3	3501.4	-	-	-	-	-	-	-	-
Grass	-	-	-	0.285	-	-	-	-	3687.6	1051.0	-	-	-	-	-	-	-	-
13	**MH. 11**	**MH. 12**	**37.4**	**0.235**	**6.869**	**15.19**	**0.42**	**74**	**36354**	**40713.0**	**0.4712**	**0.4712**	**0.0040**	**0.5316**	**1.4856**	**0.675**	**176.54**	**176.39**
Roof	-	-	-	0.025	-	-	-	-	16846.8	421.2	-	-	-	-	-	-	-	-
Paved	-	-	-	0.085	-	-	-	-	15960.1	1356.6	-	-	-	-	-	-	-	-
Grass	-	-	-	0.125	-	-	-	-	3546.7	443.3	-	-	-	-	-	-	-	-
14	**MH. 12**	**CHMBR**	**11.1**	**0.000**	**12.109**	**15.61**	**0.09**	**73**	**0**	**81072.8**	**0.9383**	**0.9383**	**0.0075**	**0.9641**	**2.1823**	**0.750**	**176.33**	**176.24**
15	**CHMBR**	**OGS**	**5**	**0.000**	**12.109**	**15.70**	**0.07**	**73**	**0**	**81072.8**	**0.9383**	**0.1861**	**0.0100**	**0.0595**	**1.2115**	**0.250**	**176.18**	**176.13**
16	**OGS**	**MH. 13**	**18.3**	**0.000**	**12.109**	**15.77**	**0.20**	**72**	**0**	**81072.8**	**0.9383**	**0.1861**	**0.0030**	**0.9915**	**1.5586**	**0.900**	**176.07**	**176.01**
17	**MH. 13**	**MH. 14**	**100**	**0.000**	**12.109**	**15.97**	**1.07**	**72**	**0**	**81072.8**	**0.9383**	**0.1861**	**0.0030**	**0.9915**	**1.5586**	**0.900**	**175.95**	**175.65**

Run-off Coefficients Used:

Roof Structure	C =	0.95
Paved Surface	C =	0.90
Avg Residential	C =	0.40
Field / Grass	C =	0.20

Velocity Range:

Minimum Velocity = 0.75 m/s
Maximum Velocity = 6.00 m/s

Time of Concentration:

Time of Concentration = 10 min

4999 Victoria Avenue
Niagara Falls, ON L2E 4C9

745 South Service Road, Unit 205
Stoney Creek, ON L8E 5Z2

HALLEX ENGINEERING LTD.

Elm & Steele Residential Development
Exhibit #4 - 100 Year Post - Development Calculations

11/13/2024
Job: 230919

MUNICIPALITY: **Welland**

Rainfall Intensity Values = A= 1020.000; B= 4.700; C= 0.731

manning's n = 0.013 PVC Pipe; 0.013 Conc Pipe; 0.024 Corr. Stl Pipe; 0.035 Grass Swale

Location			Length of Pipe	Area		Flow Time		Rainfall Intensity	Unit rate of Runoff	Design Flows		Flow Control	Sewer/Channel Design				Invert Elevations	
Pipe	From Node	To Node		Incre-ment	Cum Total	To Upper	In Section			Cum Flow	Cum Flow		Slope	Capacity Full	Velocity Full	*Dia/ Depth	Up-stream	Down-stream
			(m)	(ha)	(ha)	(min)	(min)	mm/hr	m^3/ha*day	(m^3/d)	(m^3/s)	(m^3/s)	(m/m)	(m^3/s)	(m/s)	(m)	(m)	(m)
1	**MH. 1**	**MH. 2**	**57.5**	**0.314**	**0.314**	**10.00**	**1.11**	**143**	**70349**	**5547.3**	**0.0642**	**0.0642**	**0.0040**	**0.0612**	**0.8652**	**0.300**	**177.43**	**177.20**
Roof	-	-	-	0.031	-	-	-	-	32600.6	1010.6	-	-	-	-	-	-	-	-
Paved	-	-	-	0.108	-	-	-	-	30884.8	3335.6	-	-	-	-	-	-	-	-
Grass	-	-	-	0.175	-	-	-	-	6863.3	1201.1	-	-	-	-	-	-	-	-
2	**MH. 2**	**MH. 3**	**82.9**	**0.819**	**1.133**	**11.11**	**1.22**	**136**	**66703**	**22465.4**	**0.2600**	**0.2600**	**0.0040**	**0.1803**	**1.1338**	**0.450**	**177.17**	**176.83**
Roof	-	-	-	0.235	-	-	-	-	30911.2	7264.1	-	-	-	-	-	-	-	-
Paved	-	-	-	0.257	-	-	-	-	29284.3	7526.1	-	-	-	-	-	-	-	-
Grass	-	-	-	0.327	-	-	-	-	6507.6	2128.0	-	-	-	-	-	-	-	-
3	**DICB. 1**	**MH. 3**	**41.5**	**2.435**	**2.435**	**47.61**	**0.51**	**57**	**8141**	**8483.3**	**0.0982**	**0.0982**	**0.0100**	**0.0967**	**1.3680**	**0.300**	**177.70**	**177.28**
Avg. Res.	-	-	-	0.691	-	-	-	-	5427.6	3750.5	-	-	-	-	-	-	-	-
Grass	-	-	-	1.744	-	-	-	-	2713.8	4732.9	-	-	-	-	-	-	-	-
4	**MH. 3**	**MH. 5**	**82.9**	**0.658**	**4.226**	**12.33**	**1.17**	**128**	**63175**	**43640.9**	**0.5051**	**0.5051**	**0.0030**	**0.3363**	**1.1894**	**0.600**	**176.80**	**176.55**
Roof	-	-	-	0.173	-	-	-	-	29276.4	5064.8	-	-	-	-	-	-	-	-
Paved	-	-	-	0.215	-	-	-	-	27735.5	5963.1	-	-	-	-	-	-	-	-
Grass	-	-	-	0.270	-	-	-	-	6163.4	1664.1	-	-	-	-	-	-	-	-
5	**MH. 4**	**MH. 5**	**84.4**	**0.839**	**0.839**	**10.00**	**1.76**	**143**	**70349**	**15994.9**	**0.1851**	**0.1851**	**0.0020**	**0.1275**	**0.8017**	**0.450**	**176.75**	**176.58**
Roof	-	-	-	0.184	-	-	-	-	32600.6	5998.5	-	-	-	-	-	-	-	-
Paved	-	-	-	0.229	-	-	-	-	30884.8	7072.6	-	-	-	-	-	-	-	-
Grass	-	-	-	0.426	-	-	-	-	6863.3	2923.8	-	-	-	-	-	-	-	-
6	**MH. 5**	**MH. 12**	**30.2**	**0.175**	**5.240**	**13.50**	**0.34**	**122**	**60180**	**63186.4**	**0.7313**	**0.7313**	**0.0040**	**0.5316**	**1.4856**	**0.675**	**176.52**	**176.39**
Roof	-	-	-	0.025	-	-	-	-	27888.4	697.2	-	-	-	-	-	-	-	-
Paved	-	-	-	0.096	-	-	-	-	26420.5	2536.4	-	-	-	-	-	-	-	-
Grass	-	-	-	0.054	-	-	-	-	5871.2	317.0	-	-	-	-	-	-	-	-
7	**MH. 6**	**MH. 7**	**76.6**	**0.313**	**0.313**	**10.00**	**1.48**	**143**	**70349**	**6000.2**	**0.0694**	**0.0694**	**0.0040**	**0.0612**	**0.8652**	**0.300**	**177.71**	**177.40**
Roof	-	-	-	0.047	-	-	-	-	32600.6	1532.2	-	-	-	-	-	-	-	-
Paved	-	-	-	0.110	-	-	-	-	30884.8	3397.3	-	-	-	-	-	-	-	-
Grass	-	-	-	0.156	-	-	-	-	6863.3	1070.7	-	-	-	-	-	-	-	-
8	**MH. 7**	**MH. 8**	**39.7**	**0.271**	**0.584**	**11.48**	**0.77**	**133**	**65585**	**12282.0**	**0.1422**	**0.1422**	**0.0030**	**0.0960**	**0.8695**	**0.375**	**177.37**	**177.25**
Roof	-	-	-	0.085	-	-	-	-	30392.9	2583.4	-	-	-	-	-	-	-	-
Paved	-	-	-	0.112	-	-	-	-	28793.2	3224.8	-	-	-	-	-	-	-	-
Grass	-	-	-	0.074	-	-	-	-	6398.5	473.5	-	-	-	-	-	-	-	-

4999 Victoria Avenue
Niagara Falls, ON L2E 4C9

745 South Service Road, Unit 205
Stoney Creek, ON L8E 5Z2

Elm & Steele Residential Development
Exhibit #4 - 100 Year Post - Development Calculations

Location			Length of Pipe	Area		Flow Time		Rainfall Intensity	Unit rate of Runoff	Design Flows		Flow Control	Sewer/Channel Design				Invert Elevations	
Pipe	From Node	To Node		Incre-ment	Cum Total	To Upper	In Section			Cum Flow	Cum Flow		Slope	Capacity Full	Velocity Full	*Dia/ Depth	Up-stream	Down-stream
			(m)	(ha)	(ha)	(min)	(min)	mm/hr	m^3/ha*day	(m^3/d)	(m^3/s)	(m^3/s)	(m/m)	(m^3/s)	(m/s)	(m)	(m)	(m)
9	**DICB. 2**	**MH. 8**	**4.7**	**4.554**	**4.554**	**60.00**	**0.05**	**48**	**6970**	**15389.0**	**0.1781**	**0.1781**	**0.0100**	**0.1753**	**1.5875**	**0.375**	**177.33**	**177.28**
Avg. Res.	-	-	-	2.070	-	-	-	-	4646.4	9618.1	-	-	-	-	-	-	-	-
Grass	-	-	-	2.484	-	-	-	-	2323.2	5770.9	-	-	-	-	-	-	-	-
10	**MH. 8**	**MH. 9**	**35.5**	**0.000**	**5.138**	**12.25**	**0.61**	**129**	**0**	**27671.0**	**0.3203**	**0.3203**	**0.0020**	**0.2746**	**0.9712**	**0.600**	**177.22**	**177.14**
11	**MH. 9**	**MH. 10**	**77.1**	**0.837**	**5.975**	**12.86**	**1.23**	**126**	**61776**	**48355.3**	**0.5597**	**0.5597**	**0.0020**	**0.3759**	**1.0505**	**0.675**	**177.08**	**176.92**
Roof	-	-	-	0.230	-	-	-	-	28627.8	6584.4	-	-	-	-	-	-	-	-
Paved	-	-	-	0.495	-	-	-	-	27121.1	13424.9	-	-	-	-	-	-	-	-
Grass	-	-	-	0.112	-	-	-	-	6026.9	675.0	-	-	-	-	-	-	-	-
12	**MH. 10**	**MH. 11**	**84.4**	**0.659**	**6.634**	**14.09**	**1.10**	**119**	**58793**	**59877.3**	**0.6930**	**0.6930**	**0.0030**	**0.4604**	**1.2866**	**0.675**	**176.86**	**176.60**
Roof	-	-	-	0.163	-	-	-	-	27245.5	4441.0	-	-	-	-	-	-	-	-
Paved	-	-	-	0.211	-	-	-	-	25811.5	5446.2	-	-	-	-	-	-	-	-
Grass	-	-	-	0.285	-	-	-	-	5735.9	1634.7	-	-	-	-	-	-	-	-
13	**MH. 11**	**MH. 12**	**37.4**	**0.235**	**6.869**	**15.19**	**0.42**	**115**	**56398**	**63323.0**	**0.7329**	**0.7329**	**0.0040**	**0.5316**	**1.4856**	**0.675**	**176.54**	**176.39**
Roof	-	-	-	0.025	-	-	-	-	26135.6	653.4	-	-	-	-	-	-	-	-
Paved	-	-	-	0.085	-	-	-	-	24760.1	2104.6	-	-	-	-	-	-	-	-
Grass	-	-	-	0.125	-	-	-	-	5502.2	687.8	-	-	-	-	-	-	-	-
14	**MH. 12**	**CHMBR**	**11.1**	**0.000**	**12.109**	**15.61**	**0.09**	**113**	**0**	**126509.4**	**1.4642**	**1.4642**	**0.0075**	**0.9641**	**2.1823**	**0.750**	**176.33**	**176.24**
15	**CHMBR**	**OGS**	**5**	**0.000**	**12.109**	**15.70**	**0.07**	**113**	**0**	**126509.4**	**1.4642**	**0.2494**	**0.0100**	**0.0595**	**1.2115**	**0.250**	**176.18**	**176.13**
16	**OGS**	**MH. 13**	**18.3**	**0.000**	**12.109**	**15.77**	**0.20**	**112**	**0**	**126509.4**	**1.4642**	**0.2494**	**0.0030**	**0.9915**	**1.5586**	**0.900**	**176.07**	**176.01**
17	**MH. 13**	**MH. 14**	**100**	**0.000**	**12.109**	**15.97**	**1.07**	**111**	**0**	**126509.4**	**1.4642**	**0.2494**	**0.0030**	**0.9915**	**1.5586**	**0.900**	**175.95**	**175.65**

Run-off Coefficients Used:

Roof Structure	C =	0.95
Paved Surface	C =	0.90
Avg Residential	C =	0.40
Field / Grass	C =	0.20

Velocity Range:

Minimum Velocity = 0.75 m/s
Maximum Velocity = 6.00 m/s

Time of Concentration:

Time of Concentration = 10 min

Elm & Steele Residential Development
Exhibit #5 - Post-Development Sanitary Sewer Design

11/13/2024
Job: 230919

Niagara Region

manning's n = 0.013 PVC Pipe
0.013 Conc Pipe
0.024 Corr. Stl Pipe

Location			Length	INDIVIDUAL			CUMULATIVE			M	Q (p)	Q (i)	Q	Sewer Design				Invert Elevations	
Pipe	From Node	To Node	(m)	Resid'l Populat'n	Comrc'l Area (ha)	Resid'l Area (ha)	Resid'l Populat'n	Comrc'l Area (ha)	Resid'l Area (ha)		(L/s)	(L/s)	(L/s)	Slope (m/m)	Capacity Full (L/s)	Velocity Full (m/s)	Dia-meter (m)	Up-stream (m)	Down-stream (m)
1	MH. A	MH. B	54.5	12	0.000	0.374	12	0.000	0.374	4.41	0.275	0.107	0.382	0.0040	20.744	0.660	0.200	179.48	179.26
2	MH. B	MH. C	76.7	60	0.000	0.646	72	0.000	1.020	4.28	1.605	0.292	1.897	0.0040	20.744	0.660	0.200	179.23	178.92
3	MH. C	MH. D	84.6	68	0.000	0.679	140	0.000	1.699	4.20	3.063	0.486	3.549	0.0040	20.744	0.660	0.200	178.91	178.57
4	MH. D	MH. E	84.4	72	0.000	0.610	212	0.000	2.309	4.14	4.570	0.660	5.230	0.0040	20.744	0.660	0.200	178.51	178.17
5	MH. E	MH. G	74.5	128	0.000	0.813	340	0.000	3.122	4.05	7.180	0.893	8.073	0.0040	20.744	0.660	0.200	178.11	177.81
6	MH. F	MH. G	64.1	144	0.000	0.616	144	0.000	0.616	4.20	3.148	0.176	3.324	0.0040	20.744	0.660	0.200	178.12	177.86
7	MH. G	MH. J	77.3	32	0.000	0.309	516	0.000	4.047	3.97	10.662	1.157	11.819	0.0040	20.744	0.660	0.200	177.80	177.49
8	MH. H	MH. I	53.9	48	0.000	0.313	48	0.000	0.313	4.32	1.080	0.090	1.169	0.0040	20.744	0.660	0.200	178.13	177.91
9	MH. I	MH. J	82.8	80	0.000	0.350	128	0.000	0.663	4.21	2.808	0.190	2.998	0.0040	20.744	0.660	0.200	177.88	177.54
10	MH. J	MH. K	43.4	800	0.410	0.000	1444	0.410	4.710	3.69	28.161	1.464	29.626	0.0040	37.611	0.766	0.250	177.48	177.30

Calculations:

M = domestic peaking factor — $M = 1 + \frac{14}{4 + \sqrt{P_r}}$ where P=population in 1000's

Q (p) = peak population flow (L/s) — $Q(p) = \frac{P_r * q_r * M}{86.4} + \frac{A_c * q_c}{28.8}$ where P=population and A=area in 1000's

Q (i) = peak extraneous flow (L/s) — $Q(i) = I * (A_r + A_c)$ (L/s) where A = area in hectares

Q = peak design flow (L/s) — Q = Q(p)+Q(i) (L/s)

q_d = domestic sewage flow 450 L/cap.d — P_r = residential population

q_c = commercial daily flow 28000 L/ha.d — A_c = commercial area (hectares)

I = infiltration allowance 0.286 L/ha.s — A_r = residential area (hectares)

Velocity Range:

Minimum Velocity = 0.60 m/s

Maximum Velocity = 3.00 m/s

Elm & Steele Residential Development
Exhibit #6 - Water Demand

DOMESTIC WATER SUPPLY

Fixture	# of Units	# of Plumbing Fixtures	Fixture Units (Table 7.6.3.2.A.)	Total Water Fixture Units
Single Family Dwellings				
Bathroom group with flush tank	1	3 fixtures	3.6 FUs	10.8 FUs
Clothes washer (private, domestic)	1	1 fixture	1.4 FUs	1.4 FUs
Dishwasher (domestic)	1	1 fixture	1.4 FUs	1.4 FUs
Sink (domestic)	1	1 fixture	2 FUs	2 FUs
			Total =	15.6 FUs
			Total Flow =	110.8 L/min

Therefore the maximum domestic water demand at each single family dwelling is determined to be 110.8 L/min.

Fixture	# of Units	# of Plumbing Fixtures	Fixture Units	Total Water Fixture Units
Townhouses / Semis				
Bathroom group with flush tank	1	3 fixtures	3.6 FUs	10.8 FUs
Clothes washer (private, domestic)	1	1 fixture	1.4 FUs	1.4 FUs
Dishwasher (domestic)	1	1 fixture	1.4 FUs	1.4 FUs
Sink (domestic)	1	1 fixture	2 FUs	2 FUs
			Total =	15.6 FUs
			Total Flow =	110.8 L/min

Therefore the maximum domestic water demand at each townhouse / semi unit is determined to be 110.8 L/min.

Fixture	# of Units	# of Plumbing Fixtures	Fixture Units	Total Water Fixture Units
Duplex Stacked Townhouses / Semis				
Bathroom group with flush tank	2	2 fixtures	3.6 FUs	14.4 FUs
Clothes washer (private, domestic)	2	1 fixture	1.4 FUs	2.8 FUs
Dishwasher (domestic)	2	1 fixture	1.4 FUs	2.8 FUs
Sink (domestic)	2	1 fixture	2 FUs	4 FUs
			Total =	24.0 FUs
			Total Flow =	133.8 L/min

Therefore the maximum domestic water demand at each duplex stack of townhouse / semi units is determined to be 133.8 L/min.

Fixture	# of Units	# of Plumbing Fixtures	Fixture Units	Total Water Fixture Units
Triplex Stacked Townhouses				
Bathroom group with flush tank	3	2 fixtures	3.6 FUs	21.6 FUs
Clothes washer (private, domestic)	3	1 fixture	1.4 FUs	4.2 FUs
Dishwasher (domestic)	3	1 fixture	1.4 FUs	4.2 FUs
Sink (domestic)	3	1 fixture	2 FUs	6 FUs
			Total =	36.0 FUs
			Total Flow =	163.8 L/min

Therefore the maximum domestic water demand at each triplex stack of townhouse units is determined to be 163.8 L/min.

Fixture	# of Units	# of Plumbing Fixtures	Fixture Units	Total Water Fixture Units
10-Storey Mid Rise Apartment				
Bathroom group with flush tank	200	2 fixtures	3.6 FUs	1440 FUs
Clothes washer (private, domestic)	200	1 fixture	1.4 FUs	280 FUs
Dishwasher (domestic)	200	1 fixture	1.4 FUs	280 FUs
Sink (domestic)	200	1 fixture	2 FUs	400 FUs
			Total =	2400.0 FUs
			Total Flow =	1352.3 L/min

Therefore the maximum domestic water demand at ten-storey apartment building is determined to be 1352.3 L/min.

4999 Victoria Avenue
Niagara Falls, ON L2E 4C9

745 South Service Road, Unit 205
Stoney Creek, ON L8E 5Z2

Elm & Steele Residential Development
Exhibit #7 - Fire Water Demand
Single-Family Dwellings

FIRE WATER SUPPLY

Building Type: No Fire Protection

Floor Area		Reduct.	
First Floor	155.4 m^2	1.00	155.4 m^2
Second Floor	155.4 m^2	1.00	155.4 m^2
			310.8 m^2

Construction Type: Wood Frame Construction — Construction Coefficient: 1.5

1st Preliminary Fire Flow = 6000 L/min

Fire Hazard: Limited Combustible — Fire Hazard Factor: -0.15

Net Decrease = -900 L/min

2nd Preliminary Fire Flow = 5100 L/min

Sprinkler System: No System — Sprinkler System Factor: 0.0

No Change = 0 L/min

Separation Factor

North	31.1 m	0.05
South	17.5 m	0.15
West	2.6 m	0.25
East	2.6 m	0.25
		0.70

Net Increase = 3570 L/min

FINAL FIRE FLOW = 9000.0 L/min

Minimum Water Supply Flow Rate for Fire Protection as determined by the Water Supply For Public Fire Protection, dated 1999, by the Fire Underwriter's Survey

Elm & Steele Residential Development
Exhibit #8 - Fire Water Demand
Townhouse / Semi Blocks

FIRE WATER SUPPLY

Building Type: No Fire Protection

Floor Area		Reduct.	
First Floor	398.6 m^2	1.00	398.6 m^2
Second Floor	398.6 m^2	1.00	398.6 m^2
			797.2 m^2

Construction Type: Wood Frame Construction — Construction Coefficient: 1.5

1st Preliminary Fire Flow = 9000 L/min

Fire Hazard: Limited Combustible — Fire Hazard Factor: -0.15

Net Decrease = -1350 L/min

2nd Preliminary Fire Flow = 7650 L/min

Sprinkler System: No System — Sprinkler System Factor: 0.0

No Change = 0 L/min

Separation Factor

North	45+ m	0.00
South	28.4 m	0.10
West	5.0 m	0.20
East	4.0 m	0.20
		0.50

Net Increase = 3825 L/min

FINAL FIRE FLOW = 11000.0 L/min

Minimum Water Supply Flow Rate for Fire Protection as determined by the Water Supply For Public Fire Protection, dated 1999, by the Fire Underwriter's Survey

Elm & Steele Residential Development
Exhibit #9 - Fire Water Demand
Duplex Townhouse / Semi Blocks

FIRE WATER SUPPLY

Building Type: No Fire Protection

Floor Area		Reduct.	
First Floor	425 m^2	1.00	425 m^2
Second Floor	425 m^2	1.00	425 m^2
			850 m^2

Construction Type: Wood Frame Construction — Construction Coefficient: 1.5

1st Preliminary Fire Flow = 10000 L/min

Fire Hazard: Limited Combustible — Fire Hazard Factor: -0.15

Net Decrease = -1500 L/min

2nd Preliminary Fire Flow = 8500 L/min

Sprinkler System: No System — Sprinkler System Factor: 0.0

No Change = 0 L/min

Separation Factor

North	2.7 m	0.25
South	2.4 m	0.25
West	45+ m	0.00
East	45+ m	0.00
		0.50

Net Increase = 4250 L/min

FINAL FIRE FLOW = 13000.0 L/min

Minimum Water Supply Flow Rate for Fire Protection as determined by the Water Supply For Public Fire Protection, dated 1999, by the Fire Underwriter's Survey

HALLEX ENGINEERING LTD.

Elm & Steele Residential Development
Exhibit #10 - Fire Water Demand
Triplex Townhouse Blocks

FIRE WATER SUPPLY

Building Type: No Fire Protection

Floor Area		Reduct.	
First Floor	330.2 m^2	1.00	330.2 m^2
Second Floor	330.2 m^2	1.00	330.2 m^2
Third Floor	330.2 m^2	1.00	330.2 m^2
			990.6 m^2

Construction Type: Wood Frame Construction — Construction Coefficient: 1.5

1st Preliminary Fire Flow = 10000 L/min

Fire Hazard: Limited Combustible — Fire Hazard Factor: -0.15

Net Decrease = -1500 L/min

2nd Preliminary Fire Flow = 8500 L/min

Sprinkler System: No System — Sprinkler System Factor: 0.0

No Change = 0 L/min

Separation Factor

North	28.6 m	0.10
South	5.0 m	0.20
West	28.7 m	0.10
East	19.9 m	0.15
		0.55

Net Increase = 4675 L/min

FINAL FIRE FLOW = 13000.0 L/min

Minimum Water Supply Flow Rate for Fire Protection as determined by the Water Supply For Public Fire Protection, dated 1999, by the Fire Underwriter's Survey

Elm & Steele Residential Development
Exhibit #11 - Fire Water Demand
Ten-Storey Apartment Building

FIRE WATER SUPPLY

Building Type: Fire Protected (Vertically)

Floor Area		Reduct.	
First Floor	1423.7 m^2	1.00	1423.7 m^2
Second Floor	1400.3 m^2	0.25	350.1 m^2
Third Floor	1400.3 m^2	0.25	350.1 m^2
Fourth Floor	1400.3 m^2	0.00	0.0 m^2
Fifth Floor	1400.3 m^2	0.00	0.0 m^2
Sixth Floor	1195.9 m^2	0.00	0.0 m^2
Seventh Floor	991.5 m^2	0.00	0.0 m^2
Eighth Floor	991.5 m^2	0.00	0.0 m^2
Ninth Floor	787.1 m^2	0.00	0.0 m^2
Tenth Floor	787.1 m^2	0.00	0.0 m^2
			2123.9 m^2

Construction Type: Non-Combustible Const. — Construction Coefficient: 0.8

1st Preliminary Fire Flow = 8000 L/min

Fire Hazard: Limited Combustible — Fire Hazard Factor: -0.15
Net Decrease = -1200 L/min

2nd Preliminary Fire Flow = 6800 L/min

Sprinkler System: Sprinkler & Hose Lines — Sprinkler System Factor: -0.4
Net Decrease = -2720 L/min

Separation Factor

North	28.2 m	0.10
South	26.0 m	0.10
West	19.9 m	0.15
East	39.5 m	0.05
		0.40

Net Increase = 2720 L/min

FINAL FIRE FLOW = 7000.0 L/min

Minimum Water Supply Flow Rate for Fire Protection as determined by the Water Supply For Public Fire Protection, dated 2020, by the Fire Underwriter's Survey