KALAR ROAD APARTMENTS

7302 KALAR ROAD, NIAGARA FALLS

FUNCTIONAL SERVICING DESIGN BRIEF
NEW STORM, SANITARY AND WATER SERVICES

REV 1 – January 08, 2024

PREPARED BY:

HALLEX PROJECT #230611

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

HALLEX HAMILTON
745 SOUTH SERVICE ROAD, UNIT 205
STONEY CREEK, ON L8E 5Z2

TABLE OF CONTENTS

1. INTRODUCTION

The proposed Kalar Road Apartments development consists of the demolition of the existing industrial building complete with a concrete pad and gravel laneway & parking areas and the construction of two residential apartment buildings (a north 13-storey building and a south 15-storey building) with connected underground parking, asphalt laneway & parking areas and grass areas. This development is located at 7302 Kalar Road which is south of the Kalar Road and McLeod Road intersection in the City of Niagara Falls, 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 the west to the east side of the property via overland flow storm sewers as per the Existing Conditions Plan by Upper Canada Consultants, Dwg No. 2197-ECP, dated June 12, 2023. This sewer and overland flow ultimately drain to the existing Chippawa Power Canal adjacent the east property line.

2.2 STORM SEWER/CANAL

The existing site is currently serviced with a 450mm storm lateral connection to the Chippawa Power Canal as the site consisted of the existing industrial building. The Chippawa Power Canal drains southerly along the east property line. Furthermore, the existing storm infrastructure at Kalar Road consists of a 375mm municipal storm sewer which drains southerly towards Elderberry Drive.

2.3 SANITARY SEWER

The existing site is currently serviced as it consisted of the existing industrial building, however the size of the existing sanitary lateral is unknown. The existing sanitary infrastructure at Kalar Road consists of a 250mm municipal sanitary sewer which drains northerly towards McLeod Road and a 250mm municipal sanitary sewer which drains southerly towards Elderberry Drive.

2.4 WATERMAIN

The existing site is currently serviced as it consisted of the existing industrial building, however the size of the existing water service is unknown. The existing watermain infrastructure at Kalar Road consists of a 300mm municipal watermain.

3. STORM DRAINAGE SYSTEM

3.1 PRE-DEVELOPMENT SITE FLOW

The total drainage area for the subject development is 1.286 hectares with an existing runoff coefficient of 0.65 based on the existing roof, concrete and gravel surfaces. The catchment area plan for the pre-development site condition is provided on Hallex Sketch CSK1, attached.

Utilizing the rationale method (Q = CiA/360) and the minimum recommended time of concentration of 10 minutes, the allowable peak flow for the pre-development site is as follows:

Storm Event	Pre-Development Storm Flow
2-year Storm	151.7 L/s
5-year Storm	193.5 L/s
10-year Storm	245.8 L/s
25-year Storm	256.6 L/s
100-year Storm	308.0 L/s

These flows are calculated using the City of Niagara intensity-duration-frequency curves. The pre-development flows for the subject site are provided in Exhibit #1 for the two-year storm, Exhibit #2 for the five-year storm, Exhibit #3 for the ten-year storm, Exhibit #4 for the twenty-five-year storm and Exhibit #5 for the one-hundred-year storm at the end of the design brief.

3.2 POST-DEVELOPMENT SITE FLOW

The proposed development includes two residential apartment buildings, asphalt laneway and parking areas, parking structure below grade 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 for the site consists of 1.286 hectares with a calculated runoff coefficient of 0.68 based on the proposed roof, asphalt and grass surfaces. The catchment area plan for the post-development site condition is provided on Hallex Sketch CSK2, attached.

Utilizing the rationale method (Q = CiA/360) and the minimum recommended time of concentration of 10 minutes, the calculated peak flow for the post-development site is as follows:

Storm Event	Post-Development Storm Flow
2-year Storm	159.5 L/s
5-year Storm	203.3 L/s
10-year Storm	258.4 L/s
25-year Storm	269.7 L/s
100-year Storm	323.7 L/s

These flows are calculated using the City of Niagara intensity-duration-frequency curves. The post-development flows for the proposed development are provided in Exhibit #6 for the two-year storm, Exhibit #7 for the five-year storm, Exhibit #8 for the ten-year storm, Exhibit #9 for the twenty-five-year storm and Exhibit #10 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 7.7 L/s for the two-year storm, 9.9 L/s for the five-year storm, 12.5 L/s for the ten-year storm 13.1 L/s for the twenty-five-year storm and 15.7 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 plate within a cast-in-place stormwater management tank prior to discharging to the existing Chippawa Power Canal adjacent the east property line. The orifice plate will ensure the post development runoff for the storm is controlled to the pre-development runoff rate for the two-year, five-year, ten-year, twenty-five-year and one-hundred-year storm events. The resulting 4.6 m^3 volume generated for the two-year storm event, 5.9 m^3 volume generated for the five-year storm event, 7.5 m^3 volume generated for the ten-year storm event, 7.8 m^3 volume generated for the twenty-five-year storm event and 9.4 m^3 volume generated for the one-hundred-year storm event could then be stored within the cast-in-place stormwater management tank.

The resulting 221.3m^3 volume generated from the 25mm Chicago storm will be completely contained within the cast-in-place stormwater management tank below the orifice plate and outlet pipe. This storm volume will be slowly pumped from the tank over a 24-hour period to mitigate the erosion impacts on the downstream watercourse in accordance with the Niagara Regions requirements.

3.4 STORMWATER QUALITY CONTROL

Stormwater quality controls for the site can be achieved by utilizing a Hydrodome HD12 prior to draining to the existing Chippawa Power Canal adjacent the east property line. This will achieve a total suspended solids removal of at least 81% based on the above post-development site conditions. This value is greater than 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).

4. SANITARY SEWER SYSTEM

Given the site is to be completely redeveloped for the proposed residential apartment buildings with connected underground parking, all existing sanitary laterals are to be capped and abandoned as required at the municipal sanitary sewer. A new sanitary lateral shall be proposed from the building to the existing 250mm diameter municipal sanitary sewer at Kalar Road.

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

- The north 13-storey apartment building is assumed to have 13 floors consisting of 52 one-bedroom apartment units and 127 two-bedroom apartment units.
- The south 15-storey apartment building is assumed to have 15 floors consisting of 58 one-bedroom apartment units and 175 two-bedroom apartment units.
- Each apartment is assumed to have a maximum of 2 persons per bedroom.

The peak dry weather design flow for the proposed development is determined to be 34.998 L/s, or 0.025 L/s per person. The peak wet weather design flow for the proposed development is determined to be 35.361 L/s, or 0.025 L/s per person. These calculations are based on the Sanitary Catchment Area Plan CSK3 and the Sanitary Sewer Design Sheet provided in Exhibit #11, attached.

Based on the above, Hallex recommends a minimum 250mm diameter sanitary sewer @ 0.5% to be installed to convey sanitary flows from the proposed building to the existing 250mm @ 0.74% municipal sanitary sewer at Kalar Road.

5. WATER DISTRIBUTION SYSTEM

Given the site is to be completely redeveloped for the proposed residential apartment buildings with connected underground parking, all existing water services are to be located, capped and abandoned as required at the municipal watermain. A new water service shall be proposed from the building to the existing 300mm diameter municipal watermain at Kalar Road.

The building 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 #12 are assumed and may not represent the final building plumbing design.
- Each 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 building as per applicable standards.

The domestic water demand for the proposed development is determined to be 2043.6 L/min based on the fixtures and fixture units shown in Exhibit #12 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 7,000 L/min for the north 13-storey apartment building and 7,000 L/min for the south 15-storey apartment building based on the above assumptions as shown in Exhibits #13 and 14, attached. There are 3 existing municipal fire hydrants located near the site. The first is adjacent the west property line on the east side of Kalar Road. The second is approximately 31m south of the property on the west side of Kalar Road. The third is approximately 80.5m north of the property on the southeast side of the Kalar Road and McLeod Road intersection.

Based on the above, Hallex recommends a minimum 200mm diameter domestic water service and a 200mm diameter fire protection services to be installed to provide water supply to the proposed building from the existing 300mm diameter municipal watermain at Kalar Road.

6. CONCLUSION

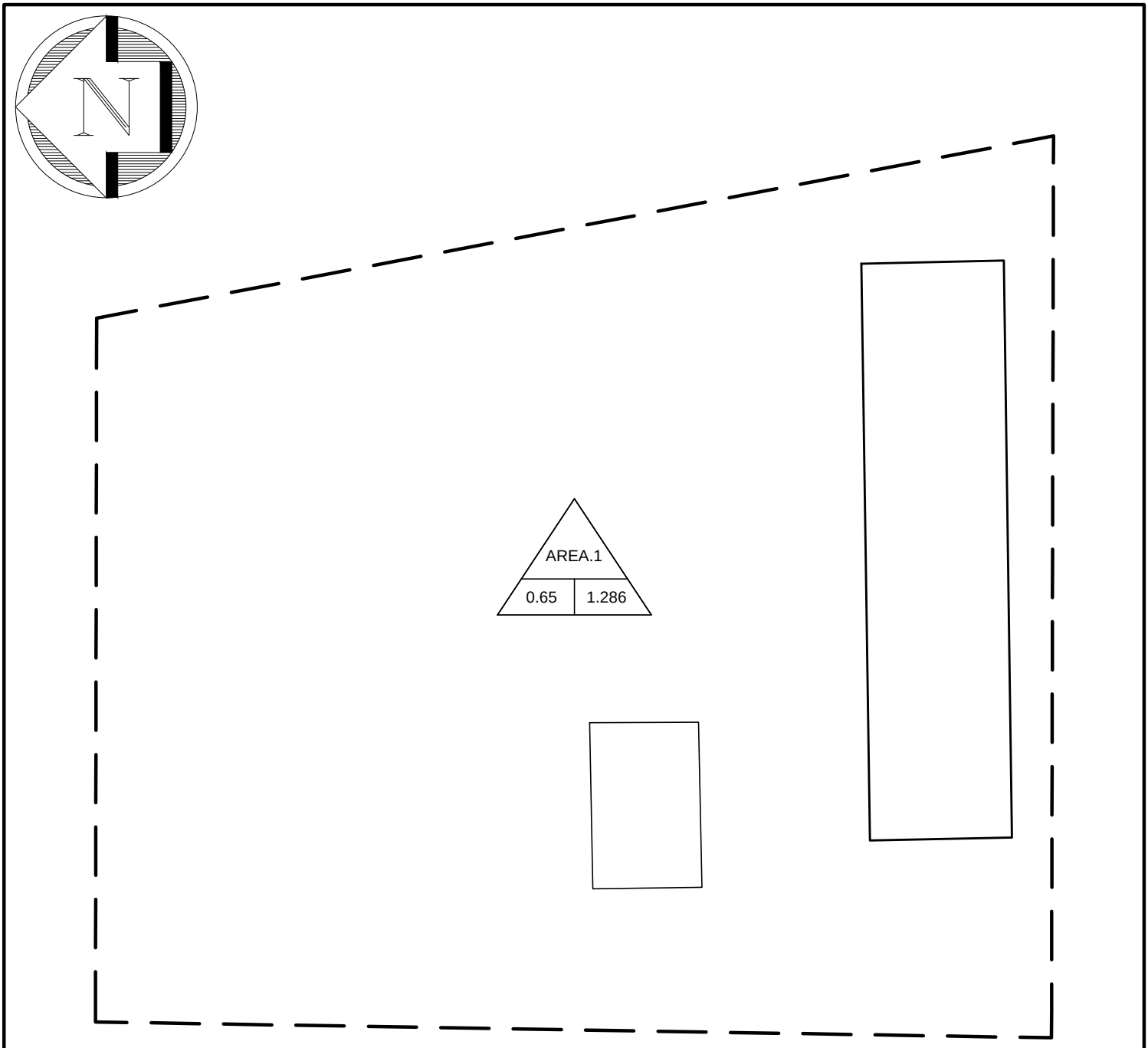
The aforementioned calculations and recommendations for the storm, sanitary and water services are based on the current design for the site as of writing this report. A final sealed report, complete with updates to the recommendations made in this report, may be required based on the final site design.

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

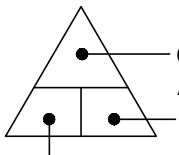
Yours truly,
HALLEX ENGINEERING LTD

Jim Halucha P.Eng
Civil/Structural Engineer

Jonathan Skinner, C.E.T., B.Tech
Civil Technologist



LEGEND



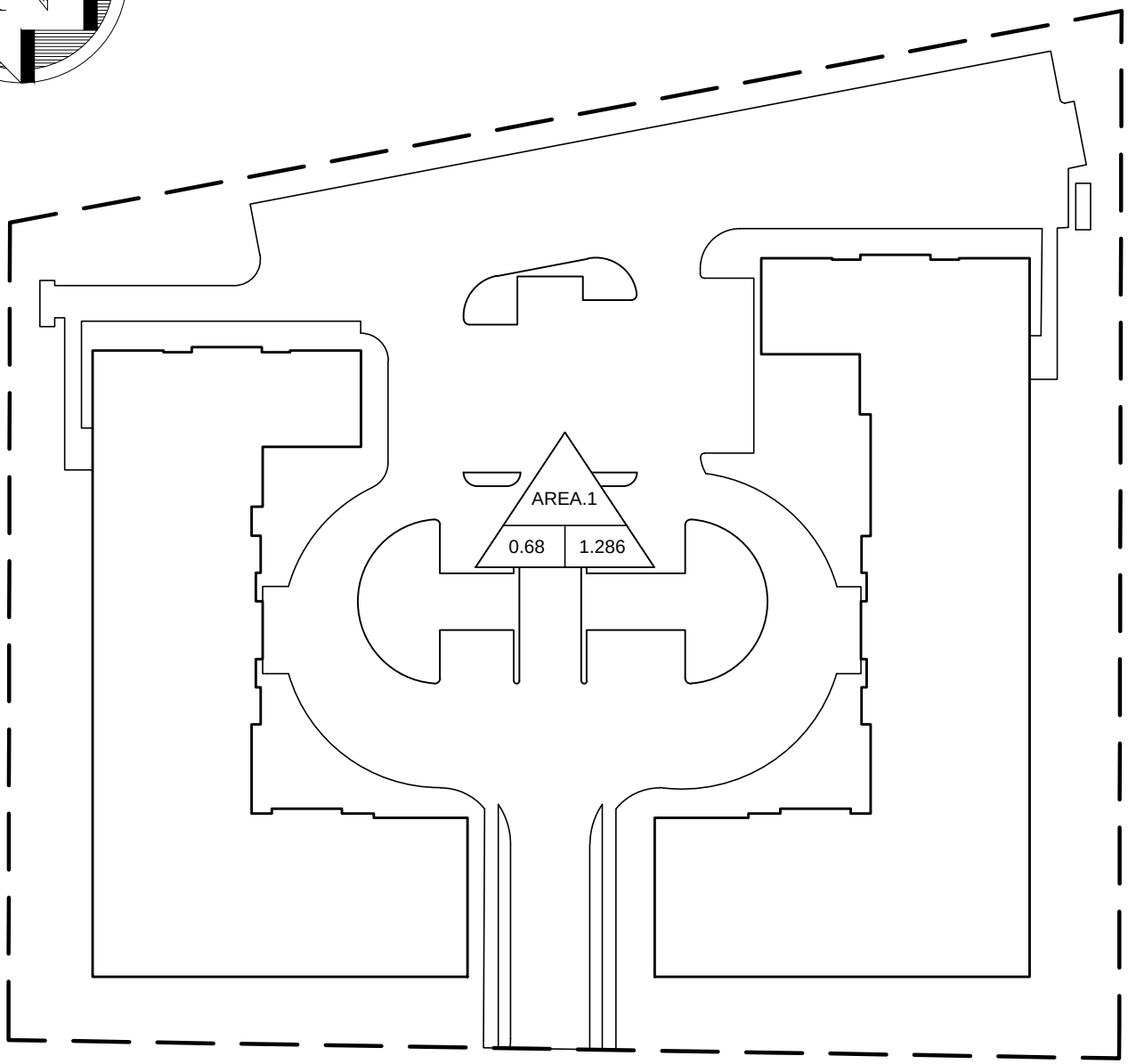
HALLEX ENGINEERING LTD.
4999 Victoria Avenue, Niagara Falls, ON L2E 4C9
Tel: 905-357-4015 Fax: 905-353-1105
745 South Service Rd. Unit 205, Stoney Creek, ON L8E 5Z2
Tel: 905-561-4016 Fax: 905-561-1105

PROJECT:
KALAR ROAD APARTMENTS
7302 KALAR ROAD, NIAGARA FALLS

SHEET TITLE:
PRE-DEVELOPMENT CATCHMENT AREAS

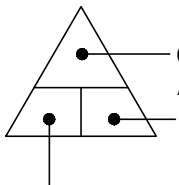
DATE: 01/08/2024
SCALE: 1:750
DR. BY: JS
CH. BY: JH

JOB No.: 230611
DWG. CSK1
REV. 1



KALAR ROAD

LEGEND



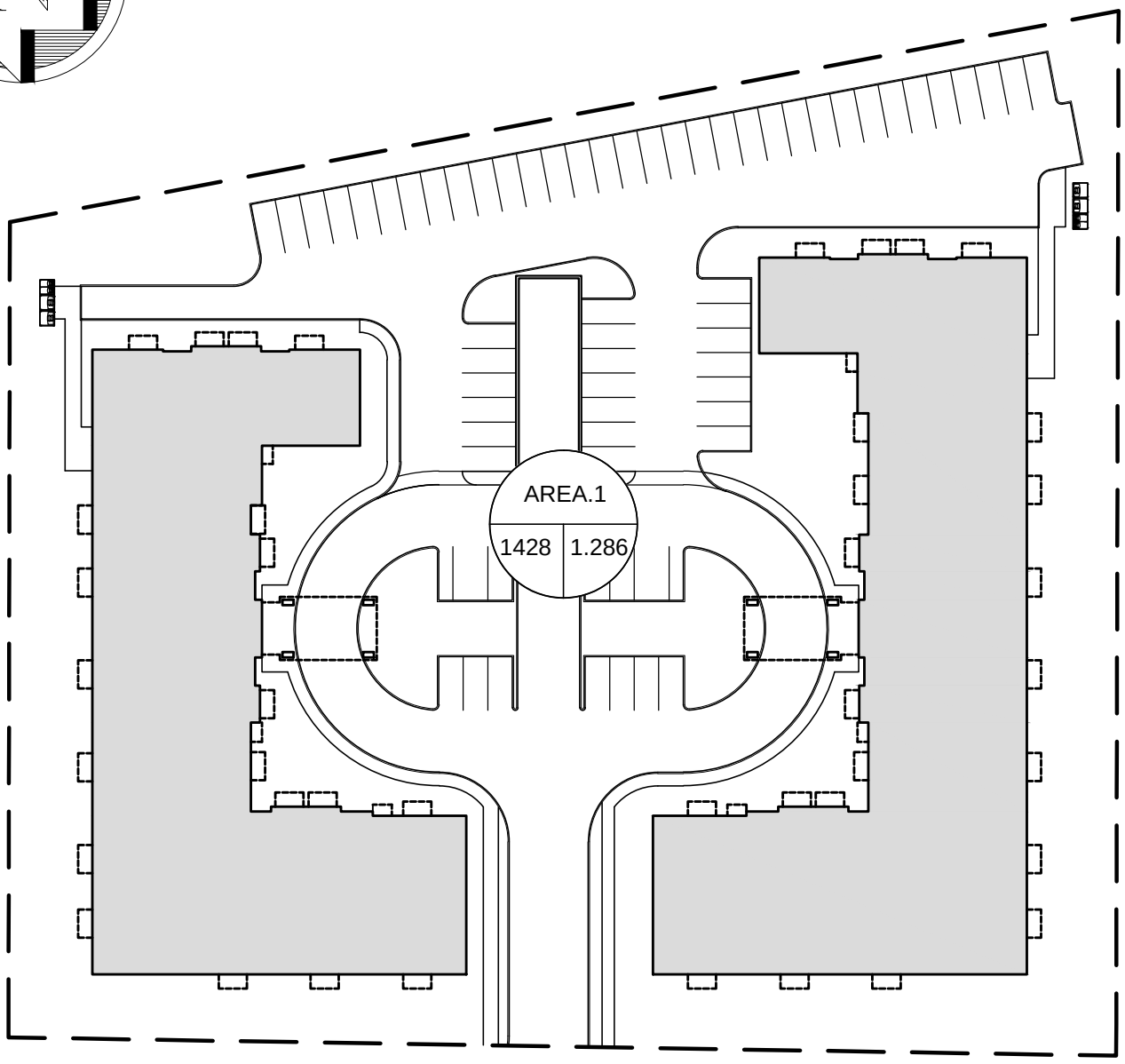
HALLEX ENGINEERING LTD.
4999 Victoria Avenue, Niagara Falls, ON L2E 4C9
Tel: 905-357-4015 Fax: 905-353-1105
745 South Service Rd. Unit 205, Stoney Creek, ON L8E 5Z2
Tel: 905-561-4016 Fax: 905-561-1105

PROJECT: KALAR ROAD APARTMENTS
7302 KALAR ROAD, NIAGARA FALLS

SHEET TITLE: POST-DEVELOPMENT CATCHMENT AREAS

DATE: 01/08/2024
SCALE: 1:750
DR. BY: JS
CH. BY: JH

JOB No.: 230611
DWG. CSK2
REV. 1



KALAR ROAD

LEGEND

MH.1 — CATCHMENT AREA

45 — POPULATION

0.123 — AREA (HECTARES)

HALLEX ENGINEERING LTD.

4999 Victoria Avenue,
Niagara Falls, ON L2E 4C9
Tel: 905-357-4015 Fax: 905-353-1105

745 South Service Rd. Unit 205,
Stoney Creek, ON L8E 5Z2
Tel: 905-561-4016 Fax: 905-561-1105

PROJECT:
KALAR ROAD APARTMENTS
7302 KALAR ROAD, NIAGARA FALLS

SHEET TITLE:
SANITARY CATCHMENT AREAS

DATE: 01/08/2024

SCALE: 1:750

DR. BY: JS

CH. BY: JH

JOB No.: 230611

DWG. CSK3

REV. 1

Kalar Road Apartments
Exhibit #1 - 2 Year Pre - Development Calculations

1/8/2024
Job: 230611

MUNICIPALITY: **Niagara Falls**

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

Rainfall Intensity Values = A= 521.910
B= 5.280
C= 0.759

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**	**Creek**	**N/A**	**1.286**	**1.286**	**10.00**	**N/A**	**66**	**47444**	**13108.7**	**0.1517**
Roof	-	-	-	0.138	-	-	-	-	15023.8	2073.3	-
Paved	-	-	-	0.030	-	-	-	-	14233.1	427.0	-
Gravel	-	-	-	1.118	-	-	-	-	9488.7	10608.4	-

Run-off Coefficients Used:

Roof Structure	C =	0.95
Paved Surface	C =	0.90
Gravel Surface	C =	0.60
Perm. Paver	C =	0.30
Grass Surface	C =	0.25

Velocity Range:

Minimum Velocity = 0.80 m/s
Maximum Velocity = 6.00 m/s

Time of Concentration = 10 min

4999 Victoria Avenue
Niagara Falls, ON L2E 4C9

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

Kalar Road Apartments
Exhibit #2 - 5 Year Pre - Development Calculations

1/8/2024
Job: 230611

MUNICIPALITY: **Niagara Falls**

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

Rainfall Intensity Values = A= 719.500
B= 6.340
C= 0.769

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**	**Creek**	**N/A**	**1.286**	**1.286**	**10.00**	**N/A**	**84**	**60497**	**16715.4**	**0.1935**
Roof	-	-	-	0.138	-	-	-	-	19157.5	2643.7	-
Paved	-	-	-	0.030	-	-	-	-	18149.2	544.5	-
Gravel	-	-	-	1.118	-	-	-	-	12099.5	13527.2	-

Run-off Coefficients Used:

Roof Structure	C =	0.95
Paved Surface	C =	0.90
Gravel Surface	C =	0.60
Perm. Paver	C =	0.30
Grass Surface	C =	0.25

Velocity Range:

Minimum Velocity = 0.80 m/s
Maximum Velocity = 6.00 m/s

Time of Concentration = 10 min

4999 Victoria Avenue
Niagara Falls, ON L2E 4C9

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

Kalar Road Apartments
Exhibit #3 - 10 Year Pre - Development Calculations

1/8/2024
Job: 230611

MUNICIPALITY: **Niagara Falls**

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

Rainfall Intensity Values = A= 577.930
B= 2.483
C= 0.669

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**	**Creek**	**N/A**	**1.286**	**1.286**	**10.00**	**N/A**	**107**	**76872**	**21239.8**	**0.2458**
Roof	-	-	-	0.138	-	-	-	-	24342.9	3359.3	-
Paved	-	-	-	0.030	-	-	-	-	23061.7	691.9	-
Gravel	-	-	-	1.118	-	-	-	-	15374.5	17188.7	-

Run-off Coefficients Used:

Roof Structure	C =	0.95
Paved Surface	C =	0.90
Gravel Surface	C =	0.60
Perm. Paver	C =	0.30
Grass Surface	C =	0.25

Velocity Range:

Minimum Velocity = 0.80 m/s
Maximum Velocity = 6.00 m/s

Time of Concentration = 10 min

4999 Victoria Avenue
Niagara Falls, ON L2E 4C9

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

Kalar Road Apartments
Exhibit #4 - 25 Year Pre - Development Calculations

1/8/2024
Job: 230611

MUNICIPALITY: **Niagara Falls**

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

Rainfall Intensity Values = A= 1020.690
B= 7.290
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**	**Creek**	**N/A**	**1.286**	**1.286**	**10.00**	**N/A**	**111**	**80253**	**22173.8**	**0.2566**
Roof	-	-	-	0.138	-	-	-	-	25413.4	3507.0	-
Paved	-	-	-	0.030	-	-	-	-	24075.8	722.3	-
Gravel	-	-	-	1.118	-	-	-	-	16050.5	17944.5	-

Run-off Coefficients Used:

Roof Structure	C =	0.95
Paved Surface	C =	0.90
Gravel Surface	C =	0.60
Perm. Paver	C =	0.30
Grass Surface	C =	0.25

Velocity Range:

Minimum Velocity = 0.80 m/s
Maximum Velocity = 6.00 m/s

Time of Concentration = 10 min

4999 Victoria Avenue
Niagara Falls, ON L2E 4C9

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

Kalar Road Apartments
Exhibit #5 - 100 Year Pre - Development Calculations

1/8/2024
Job: 230611

MUNICIPALITY: **Niagara Falls**

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

Rainfall Intensity Values = A= 1264.570
B= 7.720
C= 0.781

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**	**Creek**	**N/A**	**1.286**	**1.286**	**10.00**	**N/A**	**134**	**96322**	**26613.8**	**0.3080**
Roof	-	-	-	0.138	-	-	-	-	30502.0	4209.3	-
Paved	-	-	-	0.030	-	-	-	-	28896.6	866.9	-
Gravel	-	-	-	1.118	-	-	-	-	19264.4	21537.6	-

Run-off Coefficients Used:

Roof Structure	C =	0.95
Paved Surface	C =	0.90
Gravel Surface	C =	0.60
Perm. Paver	C =	0.30
Grass Surface	C =	0.25

Velocity Range:

Minimum Velocity = 0.80 m/s
Maximum Velocity = 6.00 m/s

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.

Kalar Road Apartments
Exhibit #6 - 2 Year Post - Development Calculations

1/8/2024
Job: 230611

MUNICIPALITY: **Niagara Falls**

Rainfall Intensity Values =

A=	521.910
B=	5.280
C=	0.759

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 Section			Cum Flow	Cum Flow
			(m)	(ha)	(ha)	(min)	(min)	mm/hr	m^3/ha*day	(m^3/d)	(m^3/s)
1	**Area 1**	**Creek**	**N/A**	**1.286**	**1.286**	**10.00**	**N/A**	**66**	**33211**	**13776.9**	**0.1595**
Roof	-	-	-	0.385	-	-	-	-	15023.8	5784.2	-
Paved	-	-	-	0.431	-	-	-	-	14233.1	6134.5	-
Grass	-	-	-	0.470	-	-	-	-	3953.6	1858.2	-

Run-off Coefficients Used:

Roof Structure	C =	0.95
Paved Surface	C =	0.90
Gravel Surface	C =	0.60
Perm. Paver	C =	0.30
Grass Surface	C =	0.25

Velocity Range:

Minimum Velocity =	0.80	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

Kalar Road Apartments
Exhibit #7 - 5 Year Post - Development Calculations

1/8/2024
Job: 230611

MUNICIPALITY: **Niagara Falls**

Rainfall Intensity Values =

A=	719.500
B=	6.340
C=	0.769

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 Section			Cum Flow	Cum Flow
			(m)	(ha)	(ha)	(min)	(min)	mm/hr	m^3/ha*day	(m^3/d)	(m^3/s)
1	**Area 1**	**Creek**	**N/A**	**1.286**	**1.286**	**10.00**	**N/A**	**84**	**42348**	**17567.4**	**0.2033**
Roof	-	-	-	0.385	-	-	-	-	19157.5	7375.6	-
Paved	-	-	-	0.431	-	-	-	-	18149.2	7822.3	-
Grass	-	-	-	0.470	-	-	-	-	5041.4	2369.5	-

Run-off Coefficients Used:

Roof Structure	C =	0.95
Paved Surface	C =	0.90
Gravel Surface	C =	0.60
Perm. Paver	C =	0.30
Grass Surface	C =	0.25

Velocity Range:

Minimum Velocity =	0.80	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.

MUNICIPALITY: **Niagara Falls**

Kalar Road Apartments
Exhibit #8 - 10 Year Post - Development Calculations

1/8/2024
Job: 230611

Rainfall Intensity Values =

A=	577.930
B=	2.483
C=	0.669

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 Section			Cum Flow	Cum Flow
			(m)	(ha)	(ha)	(min)	(min)	mm/hr	m^3/ha*day	(m^3/d)	(m^3/s)
1	**Area 1**	**Creek**	**N/A**	**1.286**	**1.286**	**10.00**	**N/A**	**107**	**53811**	**22322.5**	**0.2584**
Roof	-	-	-	0.385	-	-	-	-	24342.9	9372.0	-
Paved	-	-	-	0.431	-	-	-	-	23061.7	9939.6	-
Grass	-	-	-	0.470	-	-	-	-	6406.0	3010.8	-

Run-off Coefficients Used:

Roof Structure	C =	0.95
Paved Surface	C =	0.90
Gravel Surface	C =	0.60
Perm. Paver	C =	0.30
Grass Surface	C =	0.25

Velocity Range:

Minimum Velocity =	0.80	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

Kalar Road Apartments
Exhibit #9 - 25 Year Post - Development Calculations

MUNICIPALITY: **Niagara Falls**

Rainfall Intensity Values =

A=	1020.690
B=	7.290
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 Section			Cum Flow	Cum Flow
			(m)	(ha)	(ha)	(min)	(min)	mm/hr	m^3/ha*day	(m^3/d)	(m^3/s)
1	**Area 1**	**Creek**	**N/A**	**1.286**	**1.286**	**10.00**	**N/A**	**111**	**56177**	**23304.0**	**0.2697**
Roof	-	-	-	0.385	-	-	-	-	25413.4	9784.1	-
Paved	-	-	-	0.431	-	-	-	-	24075.8	10376.7	-
Grass	-	-	-	0.470	-	-	-	-	6687.7	3143.2	-

Run-off Coefficients Used:

Roof Structure	C =	0.95
Paved Surface	C =	0.90
Gravel Surface	C =	0.60
Perm. Paver	C =	0.30
Grass Surface	C =	0.25

Velocity Range:

Minimum Velocity =	0.80	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.

Kalar Road Apartments
Exhibit #10 - 100 Year Post - Development Calculations

1/8/2024
Job: 230611

MUNICIPALITY: **Niagara Falls**

Rainfall Intensity Values =

A= 1264.570
B= 7.720
C= 0.781

Location			Length of Pipe	Area		Flow Time		Rainfall Intensity	Unit rate of Runoff	Design Flows	
Pipe	From Node	To Node		Increment	Cum Total	To Upper	In Section			Cum Flow	Cum Flow
			(m)	(ha)	(ha)	(min)	(min)	mm/hr	m^3/ha*day	(m^3/d)	(m^3/s)
1	**Area 1**	**Creek**	**N/A**	**1.286**	**1.286**	**10.00**	**N/A**	**134**	**67425**	**27970.3**	**0.3237**
Roof	-	-	-	0.385	-	-	-	-	30502.0	11743.3	-
Paved	-	-	-	0.431	-	-	-	-	28896.6	12454.4	-
Grass	-	-	-	0.470	-	-	-	-	8026.8	3772.6	-

Run-off Coefficients Used:

Roof Structure	C =	0.95
Paved Surface	C =	0.90
Gravel Surface	C =	0.60
Perm. Paver	C =	0.30
Grass Surface	C =	0.25

Velocity Range:

Minimum Velocity = 0.80 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

Kalar Road Apartments
Exhibit #11 - Sanitary Sewer Design Sheet

1/8/2024
Job: 230611

Niagara Falls

manning's n = 0.013 PVC Pipe

Location			Length	INDIVIDUAL		CUMULATIVE		M	Q (p)	Q (i)	Q (I_1)	Q (I_2)	Q (I_3)	Q (I_m)	Q (d)	Q (w)	Sewer Design			
Pipe	From Node	To Node		Pop.	Area	Pop.	Area										Slope	Capacity Full	Velocity Full	Dia-meter
			(m)		(ha)		(ha)		(L/s)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)	(m/m)	(L/s)	(m/s)	(m)
1	Area. 1	Street	12.4	1428	1.286	1428	1.286	4.66	34.630	0.368	0.0129	0.3636	0.0006	0.364	34.998	35.361	0.0050	42.050	0.857	0.250

Estimated Dry Weather Flow per Person = 0.025 L/s
Estimated Wet Weather Flow per Person = 0.025 L/s

Calculations:

q = avg. daily per capita flow 450 L/cap.d
I = unit of peak extraneous flo 0.286 L/ha.s
M= peaking factor
Q (p) = peak population flow (L/s)
Q (i) = peak extraneous flow (L/s)
L_1 = unit of allowable leakage 0.01 L/s/ha
L_2 = unit of allowable leakage 22 L/cap/d
L_3 = unit of allowable leakage 0.075 L/mm/100m/hr
Q (I_m) = peak allowable leakage (L/s)
Q (d) = peak dry weather design flow (L/s)
Q (w) = peak wet weather design flow (L/s)

$M = \frac{5}{P^{0.2}}$ where P=population in 100

$Q(p) = \frac{PqM}{86.4}$ (L/s)

$Q(i) = I * A$ (L/s) where A = area in hectares

$Q(I_1) = L_1 * A$ (L/s) where A = area in hectares

$Q(I_2) = \frac{L_2 * P}{86.4}$ (L/s) where P=population in 1000's

$Q(I_3) = \frac{L_3 * dia * Len}{360{,}000}$ (L/s) where dia = pipe diameter in mm and Len = pipe length in m

$Q(d) = Q(p)+Q(i)$ (L/s)

$Q(w) = Q(p)+Q(i)+Q(I_m)$ (L/s)

Velocity Range:

Minimum Velocity = 0.60 m/s
Maximum Velocity 3.00 m/s

4999 Victoria Avenue
Niagara Falls, ON L2E 4C9

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

Kalar Road Apartments
Exhibit #12 - Water Demand

1/8/2024
Job: 230611

DOMESTIC WATER SUPPLY

Fixture(building 1-2)	# of Units	# of Plumbing Fixtures	Fixture Units (Table 7.6.3.2.A.)	Total Water Fixture Units	
Bathroom group with flush tank	216	1 fixture	3.6 FUs	777.6 FUs	One Bathroom Units
Bathroom group with flush tank	196	2 fixtures	3.6 FUs	1411.2 FUs	Two Bathroom Units
Clothes washer (private, domestic)	412	1 fixture	1.4 FUs	576.8 FUs	
Dishwasher (domestic)	412	1 fixture	1.4 FUs	576.8 FUs	
Sink (domestic)	412	1 fixture	2 FUs	824 FUs	
			Total =	4166.4 FUs	
			Total Flow =	2043.6 L/min	

Therefore the maximum domestic water demand is determined to be 2043.6 L/min.

4999 Victoria Avenue
Niagara Falls, ON L2E 4C9

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

Kalar Road Apartments
Exhibit #13 - North Tower Fire Water Demand

1/8/2024
Job: 230611

FIRE WATER SUPPLY

Building Type: Fire Protected (Vertically)

Floor Area			Reduct.	
Second Floor	1863.14	m^2	1.00	1863.1 m^2
Third Floor	1863.14	m^2	1.00	1863.1 m^2
Fourth Floor	1086.61	m^2	0.25	271.7 m^2
Fifth Floor	1086.61	m^2	0.25	271.7 m^2
				4269.6 m^2

Construction Type: Non-Combustible Const.

Construction Coefficient: 0.8

1st Preliminary Fire Flow = 12000 L/min

Fire Hazard: Limited Combustible

Fire Hazard Factor: -0.15

Net Decrease = -1800 L/min

2nd Preliminary Fire Flow = 10200 L/min

Sprinkler System: Sprinkler & Hose Lines

Sprinkler System Factor: -0.4

Net Decrease = -4080 L/min

Separation Factor

North	45+	m	0.00
South	20.9	m	0.10
West	45+	m	0.00
East	45+	m	0.00
			0.10

Net Increase = 1020 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

4999 Victoria Avenue
Niagara Falls, ON L2E 4C9

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

Kalar Road Apartments
Exhibit #14 - South Tower Fire Water Demand

1/8/2024
Job: 230611

FIRE WATER SUPPLY

Building Type: Fire Protected (Vertically)

Floor Area			Reduct.	
Second Floor	2018.92	m^2	1.00	2018.9 m^2
Third Floor	2018.92	m^2	1.00	2018.9 m^2
Fourth Floor	1265.27	m^2	0.25	316.3 m^2
Fifth Floor	1265.27	m^2	0.25	316.3 m^2
				4670.5 m^2

Construction Type: Non-Combustible Const.

Construction Coefficient: 0.8

1st Preliminary Fire Flow = 12000 L/min

Fire Hazard: Limited Combustible

Fire Hazard Factor: -0.15

Net Decrease = -1800 L/min

2nd Preliminary Fire Flow = 10200 L/min

Sprinkler System: Sprinkler & Hose Lines

Sprinkler System Factor: -0.4

Net Decrease = -4080 L/min

Separation Factor

North	20.9	m	0.10
South	45+	m	0.00
West	45+	m	0.00
East	45+	m	0.00
			0.10

Net Increase = 1020 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

4999 Victoria Avenue
Niagara Falls, ON L2E 4C9

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