FUNCTIONAL SERVICING REPORT & DESIGN BRIEF
SETTLERS RIDGE EAST PHASE 3 & TOWNCENTRE PLACE

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EXECUTIVE SUMMARY

This functional servicing report is prepared to support draft plan of subdivision and zoning by-law amendment applications for two developments west of Towncentre Drive. The first development is called Settlers Ridge East Phase 3 owned by 2215100 Ontario Inc and 2380416 Ontario Inc. The second development is called Towncentre Place and is owned by 2398513 Ontario Inc. The Towncentre Place development is situated south of SRE Ph 3 and the Raycroft Drive extension.

Servicing for water, sanitary and storm sewer are discussed. Both developments will tie into the existing 300mm watermain and the 375mm diameter sanitary sewer. Sufficient water pressure is available to meet the peak hour demand and the fire flow requirements.

The stormwater management system has already been put in place for the quantity controls required for Norbelle Creek. Storm sewer design and the individual oil-grit separator (OGS) designs are discussed. Storm sewers will meet the design requirements and three new OGS units are needed to achieve the water quality criteria.

As part of the new CLI process for the City of Belleville, the functional servicing report is expanded to include a design brief summarizing the design requirements for a CLI approval.

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1 Background

Jewell Engineering (Jewell) was engaged to prepare a functional servicing report for two developments west of Towncentre Drive. The first development is called Settlers Ridge East Phase 3 owned by 2215100 Ontario Inc and 2380416 Ontario Inc. The second development is called Towncentre Place and is owned by 2398513 Ontario Inc. The Towncentre Place development is situated south of SRE and the Raycroft Drive extension (see Figure 1). It is expected Towncentre Place will not precede SRE.

A. Settlers Ridge East Phase 3 (SRE Ph 3) – red outline
B. Towncentre Place (Towncentre) – blue outline

Both developments are seeking draft plan of subdivision approval and a zoning by-law amendment.

Settlers Ridge East is a wholly residential development with a mix of single-family dwellings and townhouses. The Towncentre Place development is mostly residential with a good mix of housing types, but also will include some component of commercial.

Figure 1: Site Location

The following services have been reviewed as part of this application:

- Water Distribution System
- Sanitary Sewer System

- Storm Sewer System
- Stormwater Management (separate cover)
- Traffic Impact (separate cover)

1.1 Site Description

1.1.1 Settlers Ridge East Phase 3

The SRE Ph 3 development is immediately east of Ph 2 and abuts existing commercial lands along Hwy 62. The site is approximately 5.8 hectares (ha) in area and slope gently to the south.

1.1.2 Towncentre Place

The site is approximately 2.6 hectares (ha) in area. The lands also slope gently to the south. The Norbelle SWM facilities abut Towncentre Place on the south (Cell 1) and west (Cell 2).

1.2 Development

1.2.1 Settlers Ridge East Phase 3

The proposed development includes 109 residential dwelling units. See Figure 2.

Single Family Dwellings	50
Townhouse Units	59
Total Dwelling Units	**109**

Access will be gained from Raycroft Drive, which will be extended to connect to the intersection of Roy Boulevard and Towncentre Drive.

1.2.2 Towncentre Place

The proposed development includes 93 residential lots and 4 commercial units. The side development plan is shown in Figure 3.

Bungalow Townhouse Units	12
2 Storey Townhouse Units	9
Back-to-Back Townhouse Units	26
2-Unit Dwellings	6
Semi-Detached with A.D.U. (#families)	20
Mixed Use Bldg	20
Total Dwelling Units	**93**

The access will be gained from the extension of Raycroft Drive and Towncentre Drive.

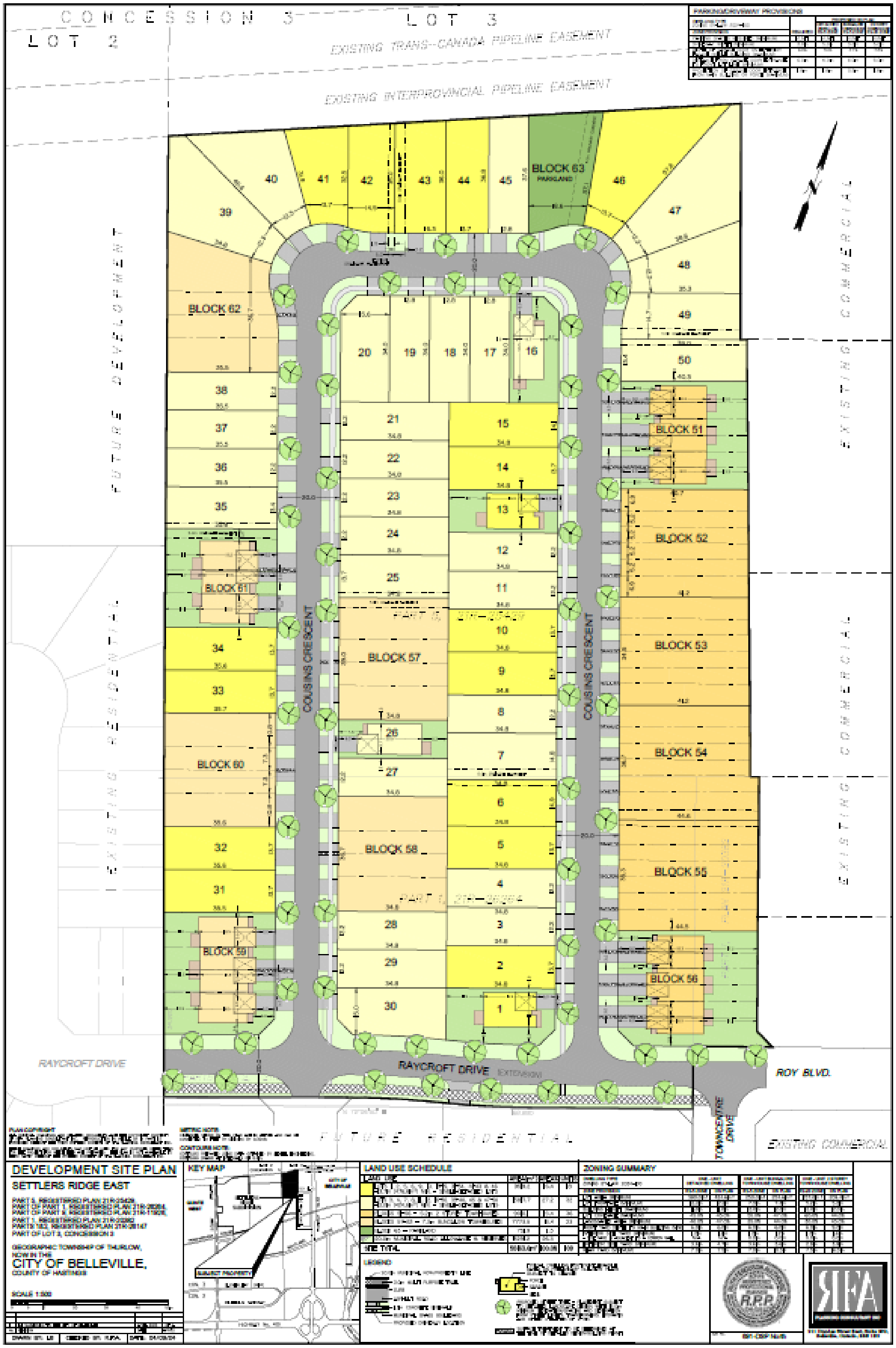

Figure 2: Settlers Ridge East – Phase 3 Concept Plan

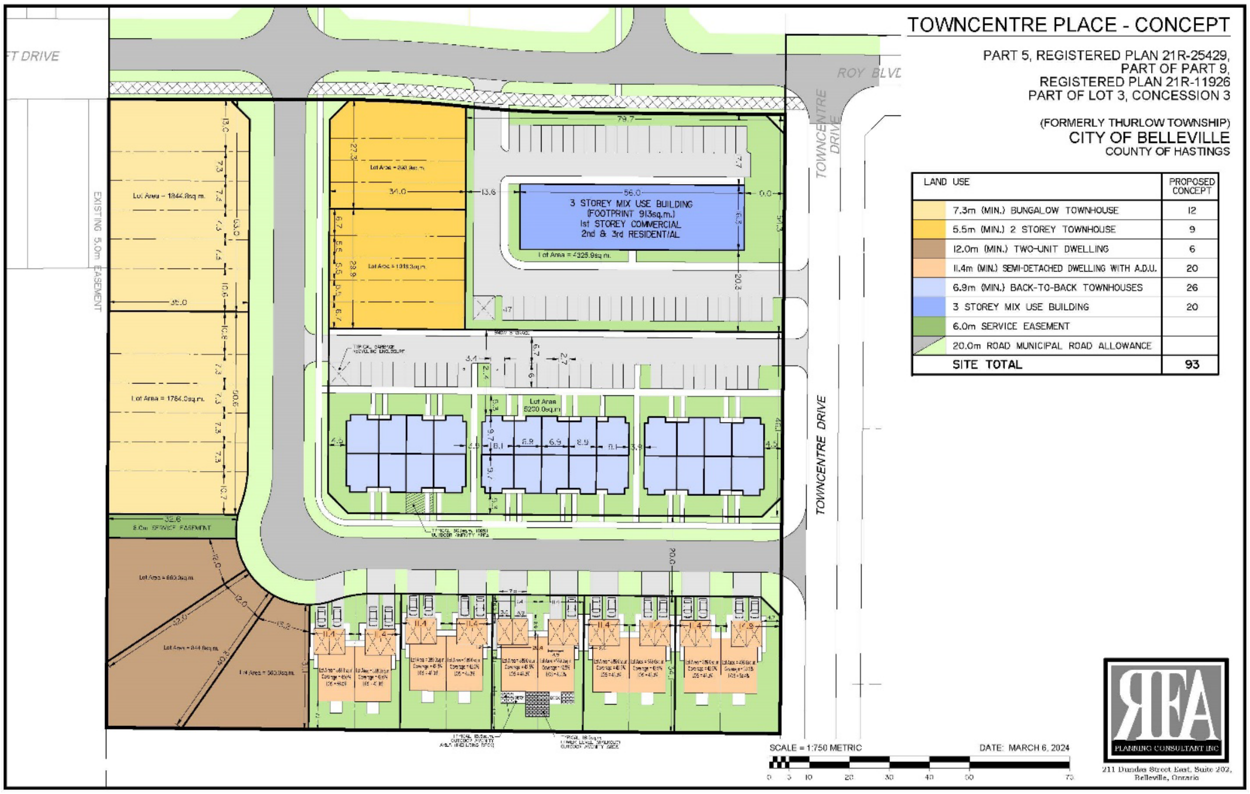

Figure 3: Towncentre Place Concept Plan

1.3 Soils and Hydrogeology

A hydrogeological study was conducted by Cambium between 2020 and 2022. They advanced 16 test pits and 16 boreholes to understand the groundwater, soils and bedrock conditions. Automated loggers were outfitted into three monitoring wells for a period of one year to supplement field observations of groundwater conditions. Cambium determined that the water table elevations fluctuated 1.5m to 2m during the season and reached as high as 0.25m from ground surface in one location.

Bedrock was encountered in all boreholes between 1 and 4 metres below ground surface.

Soils were generally silty sands. These are generally well-drained soils that do not present any particular design concerns for the construction, operation and maintenance of underground municipal infrastructure.

During the construction season, low groundwater conditions are expected and no dewatering will be required. Design of sewers has considered the high ground water conditions. The soils report did not indicate the presence of any highly frost susceptible soils. Reference was also made to Climate Atlas and the Freezing Degree Days for Belleville is at 500 and trending downward, indicating frost straps will not be needed.

2 Water Distribution System

New PVC watermains are proposed to service SRE Ph 3 and Towncentre. The watermains will be constructed within new 20 m rights-of-way that will be deeded to the City.

Jewell received the EPAnet water model from the City for use in this design. The model was recently updated by GHD in 2019. The updated model contains all watermains constructed up to and including 2018. For the complete update, see GHD's memorandum *EPANET 2.0 Water Model Update for 2016, 2017, and 2018*, dated May 13, 2020 (2020 EPAnet Memo). **Base demand** in the GHD Model A is understood as the Maximum Day Demand.

Jewell updated the model to reflect all completed construction within Settlers Ridge.

2.1 Existing Conditions

A 300 mm watermain along Raycroft Drive/Roy Boulevard to Highway 62 was constructed during SRE Ph 2. Two hundred (200 mm) stubs for SRE Ph 3 and Towncentre were included.

2.2 Design Criteria

The watermain design criteria used are based on the City of Belleville and MECP guidelines, which are summarized below:

- Minimum Watermain Diameter Size: 200 mm
- Average Residential Daily Demand: 350 L/d*cap
- Average Commercial Daily Demand: 2,500 L/d*sq. m
- Maximum Day plus Fire Flow Demand Pressure Minimum: 20 psi
- Peak Hour Demand Pressure Minimum: 50 psi
- Peak Hour Demand Pressure Maximum: 80 psi
- Maximum Pressure: 100 psi
- Test Pressure: 200 psi
- Maximum Velocity: 3.0 m/s
- Friction Factor: 110 (200mm-250mm)
- Minimum Depth of Watermain: 1.8 m
- Maximum Depth of Watermain: 2.5 m
- Minimum Horizontal Separation: 3.0 m
- Minimum Vertical Separation: 0.5 m
- Fire Hydrant Spacing: 90 m – 180 m

2.3 Scenarios

Jewell completed a model evaluation for two development scenarios and reported the results for Peak Hour and Max Day + Fire Flow calculations during the hour specified in the 2020 EPAnet Memo, see Table 1.

Table 1: Table 10 City Models and Hours to Use for Each Demand Scenario Excerpt (2020 EPAnet Memo, pg. 29)

Flow Scenario to be Evaluated	City Model	Hour to be Analyzed
Peak Hour Flow (PHF)	Model A	11:00 AM – 12:00 PM
Max Day Flow + Fire Demand (MDF + Fire)	Model A	7:00 AM – 8:00 AM

The development scenarios are as follows (Figure 4):

1. Existing Conditions + Settlers Ridge East Phase 3
2. Existing Conditions + Settlers Ridge East Phase 3 + Towncentre Place

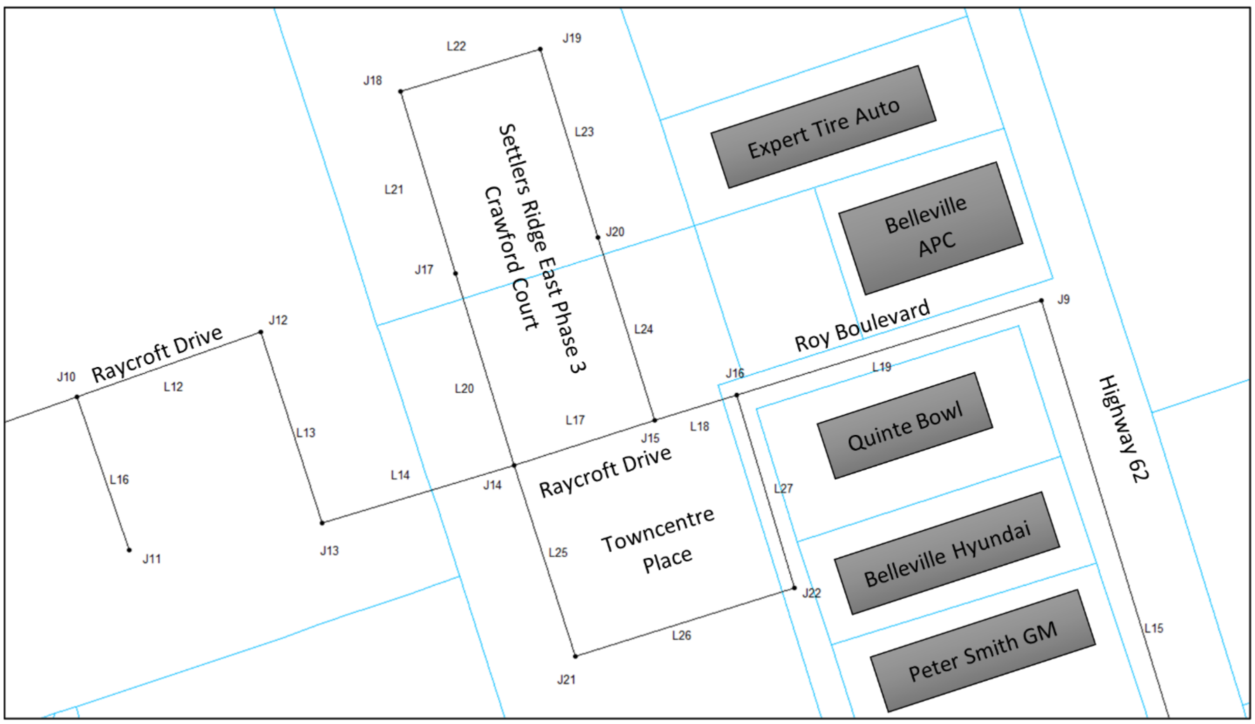

Figure 4: Settlers Ridge East Phase 3 + Towncentre Place – Water Model Layout

2.4 Water Demand Calculations

2.4.1 Settlers Ridge East Phase 3

Base demand for SRE Ph 3 was calculated using the method described in the 2020 EPAnet Memo. Jewell applied a conservative assumption of 3 persons per proposed dwelling unit.

The average residential daily demand (350 L/d*cap) was multiplied by the number of people per unit (3 people/unit) and the number of units. The resulting demand was then multiplied by a factor of 1.8 (this is equivalent to Table 3-1, Design Guidelines for Drinking-Water Systems, MOE) system-wide maximum day peaking factor. The maximum day demand was then multiplied by a 0.955 system-wide correction factor to calculate the development's base demand. The base demand is then divided equally amongst all the nodes within the development. See Table 2 below for the calculations.

Table 2: Settlers Ridge East Phase 3 – Residential Demand Calculations

Population	System-wide Maximum Day Factor
$109\,units * 3\,persons/unit$ $= 327\,persons$	$1.32\,L/s * 1.8$ $= 2.38\,L/s$
Average Demand	**System-wide Correction Factor**
$350\,L/d \cdot cap * 327\,persons$ $= 114{,}450\,L/d$ $= 1.32\,L/s$	$2.38\,L/s * 0.955$ $= 2.28\,L/s$
Base Demand Applied to Junction	
$\frac{2.28\,L/s}{6\,junctions}$ $= 0.38\,L/s \cdot junction$	

All junctions analyzed within the development use Demand Pattern 2 (medium density residential, 13 units/ha), see Figure 5. Time 0 hour (h) is 12:00 AM.

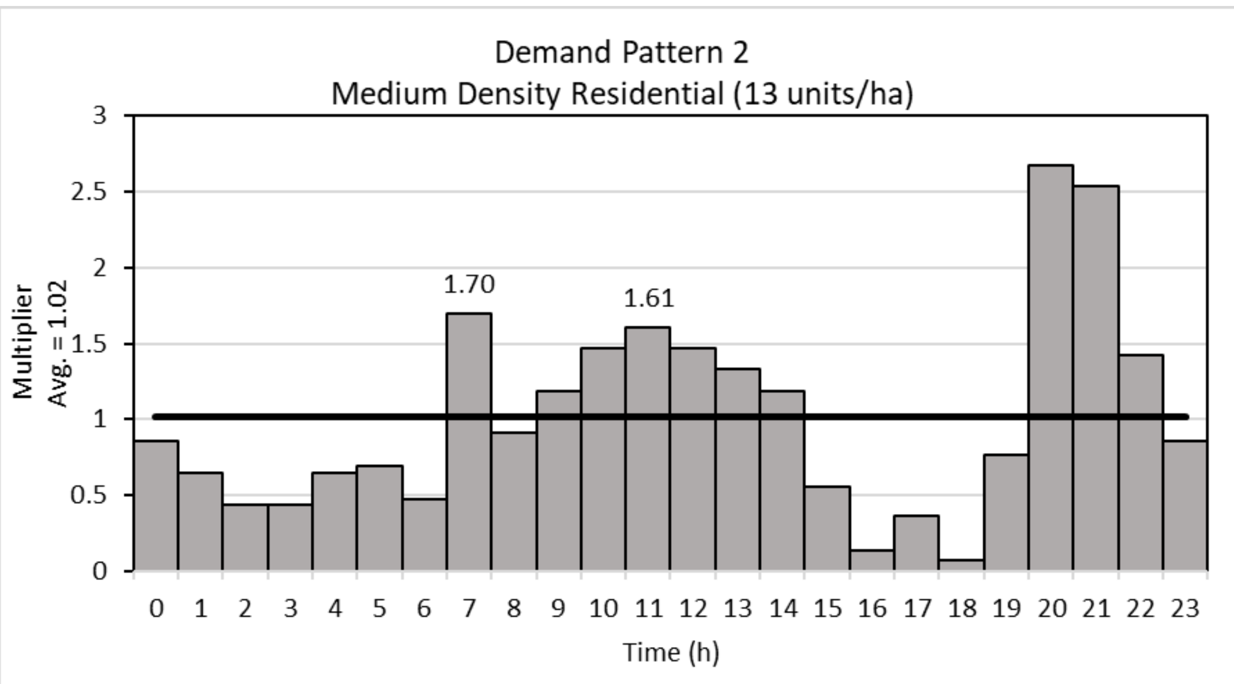

Figure 5: Settlers Ridge East Phase 3 – Design Pattern 2

2.4.2 Towncentre Place

Base demand for Towncentre was calculated using the method described in the 2020 EPAnet Memo.

The average residential daily demand (350 L/d*cap) was multiplied by the number of people per unit (3 people/unit) and the number of units. The resulting demand was then multiplied by a factor of 1.8 (this is equivalent to Table 3-1, Design Guidelines for Drinking-Water Systems, MOE) system-wide maximum day peaking factor. The maximum day demand was then multiplied by a 0.955 system-wide correction factor to calculate the development's residential base demand. The base demand is then divided equally amongst all the nodes within the development. See Table 3 below for the calculations.

Table 3: Towncentre Place – Residential Demand Calculations

Population	**System-wide Maximum Day Factor**
$93\,units * 3\,persons/unit$ $= 279\,persons$	$1.13\,L/s * 1.8$ $= 2.03\,L/s$
Average Demand	**System-wide Correction Factor**
$350\,L/d \cdot cap * 279\,persons$ $= 97{,}650\,L/d$ $= 1.13\,L/s$	$2.03\,L/s * 0.955$ $= 1.94\,L/s$
Base Demand Applied to Junction	
$\frac{1.94\,L/s}{5\,junctions}$ $= 0.40\,L/s \cdot junction$	

The average commercial daily demand (19 cu. m/d*ha) was multiplied by the floor area. The resulting demand was then multiplied by a factor of 1.8 (this is equivalent to Table 3-1, Design Guidelines for Drinking-Water Systems, MOE) system-wide maximum day peaking factor. The maximum day demand was then multiplied by a 0.955 system-wide correction factor to calculate the development's commercial base demand. The base demand is then applied to the nearest junction. See Table 4 below for the calculations.

Table 4: Towncentre Place – Commercial Demand Calculations

Floor Area	**System-wide Maximum Day Factor**
$4\,units * 228.25\,sq.m$ $= 913\,sq.m$ $= 0.09\,ha$	$0.02\,L/s * 1.8$ $= 0.04\,L/s$
Average Demand	**System-wide Correction Factor**
$19\,cu.m/d \cdot ha * 0.09\,ha$ $= 1.71\,cu.m/d$ $= 0.02\,L/s$	$0.04\,L/s * 0.955$ $= 0.03\,L/s$
Base Demand Applied to Junction J15	
$0.03\,L/s$	

All residential junctions analyzed within the development use Demand Pattern 2 (medium density residential, 13 units/ha), see Figure 6. Time 0 hour (h) is 12:00 AM.

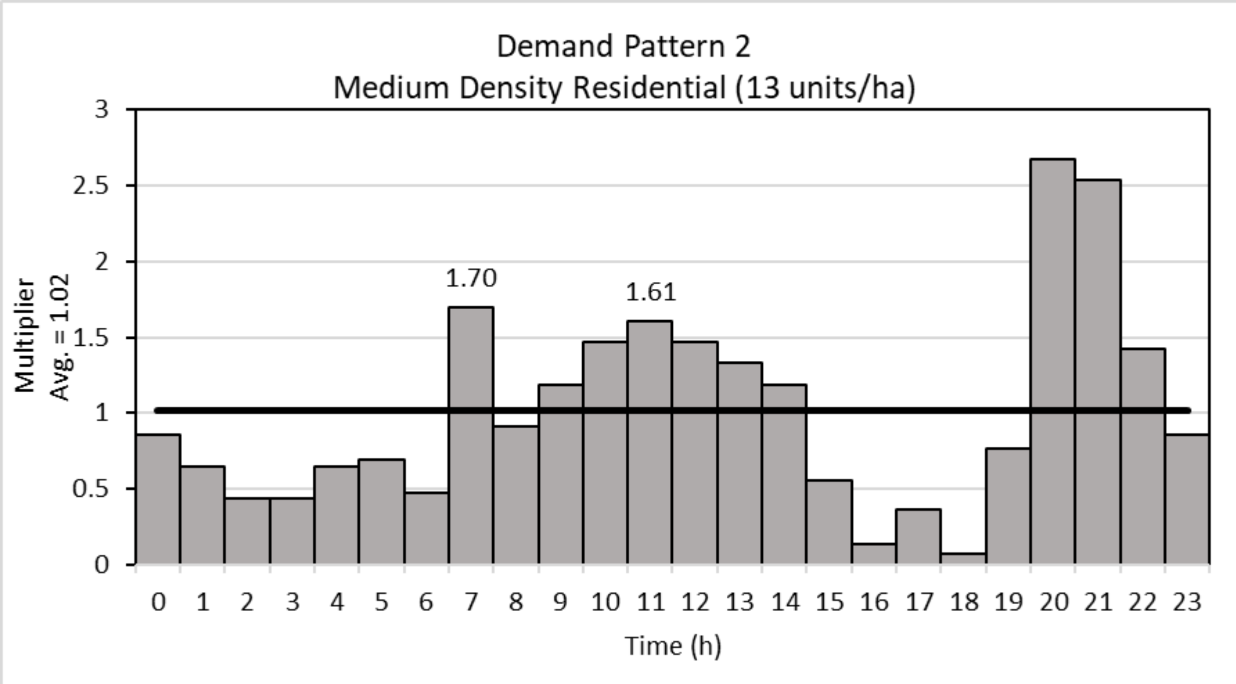

Figure 6: Towncentre Place – Design Pattern 2

The commercial junction analyzed within the development use Demand Pattern 4 (commercial), see Figure 7. Time 0 hour (h) is 12:00 AM.

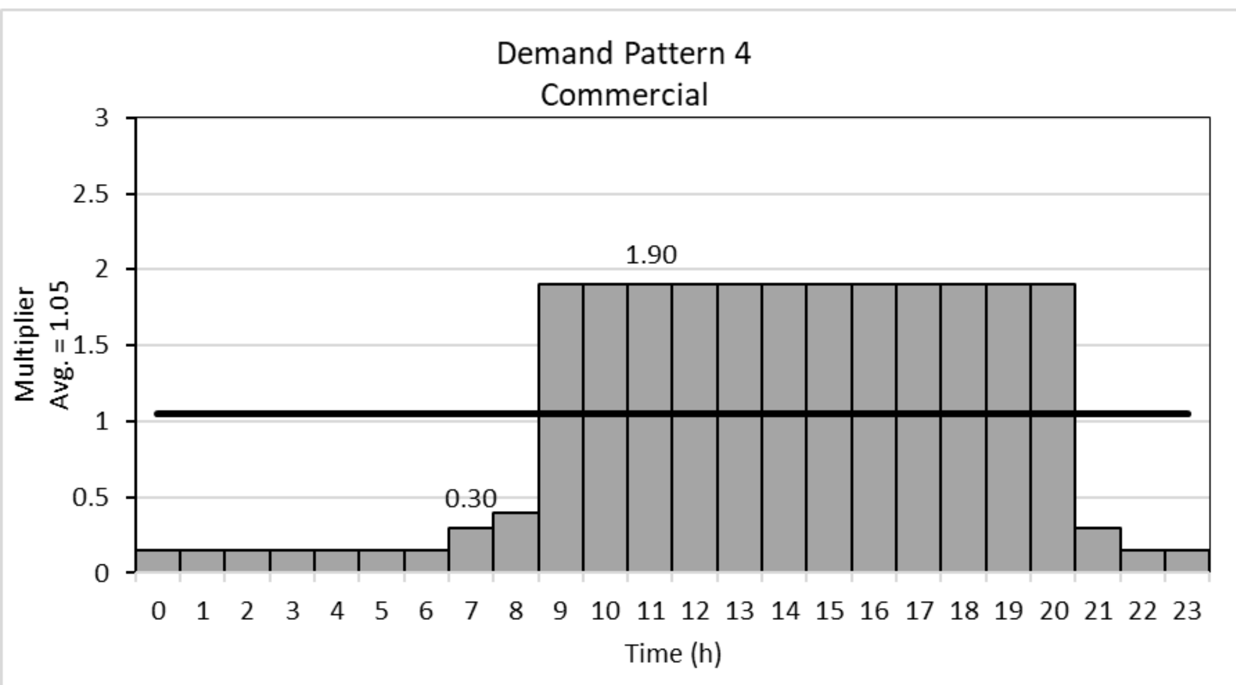

Figure 7: Towncentre Place – Design Pattern 4

2.5 Peak Hour Flow

Peak Hour is reported at the 11:00 AM time step.

Jewell reviewed the modelled representation of Peak Hour Demand. The Peak Hour demand is calculated by multiplying the Base Demand, as calculated previously, by the peaking factor for the 11:00 AM to 12:00 PM period, which is 1.61 for residential and 1.90 for commercial.

The resulting peak hour factors are as follows:

Residential	$1.8 * 0.955 * 1.61 = \mathbf{2.77}$
Commercial	$1.8 * 0.955 * 1.90 = \mathbf{3.27}$

The peak hour factor recommended by MOE is 2.70; therefore, the modelled peak hour demand is remarkably close to the demand that would be calculated using the MOE Table 3-1.

2.6 Max Day Flow

Max Day is reported at the 7:00 AM time step.

Jewell reviewed the modelled representation of Max Day Demand. The Max Day demand is calculated by multiplying the Base Demand, as calculated previously, by the peaking factor for the 7:00 AM to 8:00 AM period, which is 1.70 for residential and 0.30 for commercial.

The resulting max day factors are as follows:

Residential	$1.8 * 0.955 * 1.70 = \mathbf{2.92}$
Commercial	$1.8 * 0.955 * 0.30 = \mathbf{0.52}$

The maximum day factor recommended by MOE is 1.80; therefore, the modelled Max Day flow is conservative.

2.7 Fire Flow

A fire flow of 167 L/s (10,000 L/min) was calculated as the residential and commercial fire flow requirement for both developments, taken from GHD's memorandum *Barkema Subdivision Water Network Modelling*, dated February 21, 2018 (2018 EPAnet Memo). However, the 2020 EPAnet Memo states the following:

- "Model A (MDF) may underestimate flow distributed to Pressure Zone 2 by 30% (7.5 L/s). Modelled results in Pressure Zone 2 should consider this uncertainty. At minimum, 7.5 L/s should be added to any fire flow requirements in Pressure Zone 2 to evaluate the fire flow protection capacity of the system." (2020 EPAnet Memo, pg. 29)

Therefore, a total residential fire flow requirement of **174.5 L/s** (10,470 L/min) is applied.

Also, to ensure the proper pumps at the Adam Street BPS were on during a fire flow event, Jewell changed Rules 29 and 30 to a clock hour-based trigger per the recommendations in the 2020 EPAnet Memo. The 2020 EPAnet Memo notes that “in some instances, the lag pump and the duty pump may need to be opened and closed respectively using rule-based controls (by clock hour) during emergency flow conditions to simulate the most probable operating conditions.”

2.8 Hydraulic Evaluation

2.8.1 Settlers Ridge East Phase 3

The results for SRE Ph 3 can be found in Table 5. The new pipes are to be 250 mm diameter.

Table 5: Settlers Ridge East Phase 3 – Water Model Results

Junction Properties - Settlers Ridge East Phase 3									
Junction ID	Elevation (m)	Base Demand (L/s)	Peaking Pattern	Peak Hour Demand (L/s)	Peak Hour Pressure (m)	Peak Hour Pressure (psi)	Max Day + Fire Flow @ J19 Demand (L/s)	Max Day + Fire Flow @ J19 Pressure (m)	Max Day + Fire Flow @ J19 Pressure (psi)
J9	111.0	0.00	N/A	0.00	31.94	45.4	0.00	23.06	32.8
J13	111.7	0.36	2	0.57	31.22	44.4	0.60	19.90	28.3
J14	111.7	0.38	2	0.61	31.22	44.4	0.65	19.62	27.9
J15	111.3	0.38	2	0.61	31.65	45.0	0.65	20.07	28.5
J16	110.2	0.00	N/A	0.00	32.72	46.5	0.00	21.53	30.6
J17	111.7	0.38	2	0.61	31.22	44.4	0.65	17.51	24.9
J18	112.0	0.38	2	0.61	30.88	43.9	0.65	15.24	21.7
J19	111.8	0.38	2	0.61	31.10	44.2	175.15	14.43	20.5
J20	111.6	0.38	2	0.61	31.32	44.5	0.65	17.09	24.3

The resultant pressures are greater than the minimum requirement; therefore, **there is sufficient pressure and flow for SRE Phase 3 with a 250 mm loop from Raycroft Drive.**

2.8.2 Towncentre Place

The results for Towncentre can be found in Table 6. The new pipes are to be 250 mm diameter.

A dead-end service from Raycroft Drive was initially investigated, but there was insufficient pressure during Max Day + Fire Flow scenario. With a 250 mm loop through Red Fox Lane and Towncentre Drive the resultant pressures are greater than the minimum requirement; therefore, **there is sufficient pressure and flow for Towncentre with a 250 mm loop from Raycroft Drive.** Refer to Table 6 for scenario results.

Table 6: Towncentre Place – Water Model Results

Junction Properties - Towncentre Place									
Junction ID	Elevation (m)	Base Demand (L/s)	Peaking Pattern	Peak Hour			Max Day + Fire Flow @ J21		
				Demand (L/s)	Pressure (m)	Pressure (psi)	Demand (L/s)	Pressure (m)	Pressure (psi)
J9	111.0	0.00	N/A	0.00	30.59	43.5	0.00	22.69	32.3
J13	111.7	0.36	2	0.57	29.87	42.5	0.60	19.67	28.0
J14	111.7	0.78	2	1.26	29.87	42.5	1.33	19.40	27.6
J15	111.3	0.78	2	1.26	30.30	43.1	1.33	19.89	28.3
J16	110.2	0.03	4	0.06	31.37	44.6	0.01	21.02	29.9
J17	111.7	0.38	2	0.61	29.87	42.5	0.65	19.40	27.6
J18	112.0	0.38	2	0.61	29.53	42.0	0.65	19.07	27.1
J19	111.8	0.38	2	0.61	29.75	42.3	0.65	19.30	27.4
J20	111.6	0.38	2	0.61	29.97	42.6	0.65	19.54	27.8
J21	110.9	0.40	2	0.64	30.65	43.6	175.18	17.30	24.6
J22	109.5	0.40	2	0.64	32.10	45.6	0.68	20.30	28.9

2.9 Transient Pressure

The transient pressure is checked assuming a column of water flowing at 0.6 m/s is abruptly stopped. Transient flows are estimated using the water hammer equation:

$$P_{additional} = \frac{aV}{2.31g}$$

Where:

$a = speed\ of\ pressure\ wave = 4860\ ft/s$
$V = velocity\ in\ pipe(ft/s)$
$g = acceleration\ due\ to\ gravity = 32\ ft/s^2$

Given that velocity equals 0.6 m/s (1.97 ft/s), the additional pressure equals 129.5 psi. Total pressure is the additional pressure due to water hammer plus the static pressure, which is 50 psi. This is less than the 235-psi maximum rated pressure of the DR18 pipes. Therefore, the 250 mm DR18 pipes are sufficient for the application. See below for full calculations.

Additional Pressure	Total Pressure
$P_{additional} = \frac{aV}{2.31g}$ $P_{additional} = \frac{(4860\ ft/s)(1.97\ ft/s)}{2.31(32\ ft/s^2)} = 129.5\ psi$	$P_{total} = P_{additional} + P_{static}$ $P_{total} = 129.5\ psi + 50\ psi$ $P_{total} = 179.5\ psi$
Conclusion	
$P_{total} < 235\ psi\ (maximum\ rated\ pressure, DR18\ pipe)$ $P_{total} = 179.5\ psi < 235\ psi$ $\therefore 250mm\ DR18\ pipes\ are\ sufficient$	

Restraints must be provided per the manufacturers and the City's specifications.

2.10 Watermain Items

The City of Belleville standard watermain notes are included on the engineering drawings and will be carried through to the Approved for Construction drawings. A summary of item specifications is listed below.

2.10.1 Pipe Material

All watermain pipe 100 mm to 300 mm in diameter shall be PVC DR18 (or lower) and be manufactured in accordance with AWWA C900 and certified to NSF/ANSI 61 and to CSA B137.3.

The pressure class of all pipes shall be a minimum of 235 psi.

2.10.2 Water Services

Water services should be installed at locations shown on the engineering drawings. They shall terminate 0.15 m outside the property line within the right-of-way. The service is to be controlled by a curb stop that shall be installed a minimum of 500 mm away from the driveway location. All water services conform to the city standards.

Per the City of Belleville standards, each dwelling unit shall have a minimum equivalent service size of 19mm. A 2-unit dwelling must have a 25mm service. Multi-unit dwellings must be sized to convey the water flow of a 19mm service. Since there is a provincial directive to increase opportunities for second units, **all service sets will be increased in size to a minimum of 25mm**.

Water service minimum sizes shall be as follows:

- Single Family Dwelling: 25 mm (1”)
- Semi-detached Dwelling (per unit): 25 mm (1”)
- Townhouse Dwelling (per unit): 25 mm (1”)
- 2-Unit Dwelling: 25 mm (1”)
- 8-Unit Dwelling: 30mm
- 10-Unit Dwelling: 30mm

2.10.3 Fire Hydrants

Hydrants should be installed at locations agreed through consultation with the City during the review process. The City of Belleville standard for fire hydrant spacing requires no greater separation between hydrants than 180m for single family residential developments and 90m for towns and multi-units. There is no gradation when a mix of unit types is provided. Therefore, all hydrants are spaced no greater than 90m apart.

Hydrants shall conform to AWWA Standard C502: Dry Barrrel Fire Hydrants.

If the drain hole is within or below the ground water table, the hole is to be plugged. High water table is expected at the two sites and therefore the holes will be plugged.

2.10.4 Valves

Valves shall be installed at each intersection (2 at a 'T', 3 at a 'X') and at minimum separations as requested by the City during detailed design. This standard has been applied.

All valves conform to AWWA standards.

2.10.5 Chambers

There are no chambers proposed in this development.

2.10.6 Depth

All watermain shall be a minimum of 1.8 m in depth. Watermains will all be placed 1.8m below top of road.

2.10.7 Dead Ends

All locations where a watermain terminates (temporary or permanent) a plug and blow off shall be installed.

No watermain dead ends are proposed. All mains will be looped.

2.10.8 Restraints

All joints (at fittings, hydrants, valves and bends greater than 11.25°) shall be mechanically restrained.

2.10.9 Nitrile Gasket Seals

Nitrile gaskets shall be used for watermains buried in soil with or with the potential for hydrocarbon contamination. Nitrile gaskets shall conform to AWWA standards.

There is no known soil contamination on the subject lands and nitrile gaskets are not proposed.

3 Sanitary Sewer System

The sanitary sewer system for the two developments will be constructed as an **extension** to the existing 375mm sewer provided in Phase 2 of SRE. The 375 mm PVC gravity sewer in Ph 2 will be extended along Raycroft Drive and will be reduced to 300mm at the east intersection of Cousins Crescent. Also, two new 200 mm PVC sewer mains are proposed to service SRE Ph 3 and Towncentre. The sewer mains will be constructed within new 20 m rights-of-way that will be deeded to the City. See Figure 8 for the sanitary sewer network.

None of the works discussed below are located within a source protection area and do not pose a significant drinking water threat and require no mitigation measures. The entirety of the Belleville serviced area is within a highly vulnerable aquifer. No specific policies require any additional protective measures to be employed.

The site is not flood susceptible.

Due to the high water table conditions, care should be taken during construction such that all connections are well sealed. A product such as Riser Wrap will be placed around all manhole joints. Pipe connections to the manholes will be made using boot connections.

Since the area will be filled to bring the lands well above the groundwater table and no special measures are required to resist uplift pressures.

The project is not subject to Section 16 of the EAA.

3.1 Existing Conditions

A 375 mm gravity sewer exists on Raycroft Drive with a 300 mm stub going east and two 200 mm stubs going north and south to service SRE Ph 3 and Towncentre. This maintenance hole needs to be relocated to the west by about 2 m to align with the centreline of the new road connections.

The gravity sewer throughout the Settlers Ridge development ultimately drains to the syphon that crosses Highway 401, which conveys sewage to the wastewater treatment plant that outlets into the Bay of Quinte.

The gravity system north of the Highway 401 has been studied by GGG in 2015 for the City and also by Jewell in 2022[1] for the Black Bear Ridge Development. Capacity exists to the Hwy 401 crossing.

[1] Servicing Feasibility Review, Black Bear Ridge Development February 28, 2022

3.2 Design Criteria

The sanitary design criteria used are based on the City of Belleville ECA design criteria, engineering standards, MECP guidelines, and MECP F-6-1, which are summarized below.

• Minimum Sewer Diameter:	200 mm
• Pipe Capacity Equation:	Manning's
• Minimum Roughness Coefficient (Manning's n):	0.013
• Minimum Full Flow Velocity:	0.6 m/s
• Maximum Full Flow Velocity:	3.0 m/s
• Extraneous Flow Allowance:	0.28 L/s*ha
• Average Daily Residential Flow:	350 L/d*cap
• Population Factors:	
○ Single Family:	3.0 persons/unit
○ Townhome:	3.0 persons/unit
○ Apartment:	3.0 persons/unit
• Peak Flows:	
○ Commercial:	1.05 L/s*ha
• Residential Peak Factor:	Harmon Formula
○ Minimum:	2.00
• Maximum Pipe Usage	80%
• Horizontal Separation from Watermain	2.5m (minimum)
• Vertical Separation from Watermain	0.5m (minimum)

The **rationale** for the selection of the above factors is they are all **either municipally or provincially specified**.

3.3 Pipe Design

Pipes are sized using the standard Sanitary Sewer Design Sheet enclosed as Table 7.

Residential flows are determined by multiplying the number of residential units by number of residents per unit and the per capita daily flow. Peak flows are found using the Harmon Peaking Formula (see Table 7). The Harmon Peaking formula adjusts the peak flow factor based on population served at each pipe length. Extraneous flows (I&I) are calculated by multiplying the City's standard rate of 0.28L/s/ha by the contributing area.

Commercial flows are determined using the standard flow rate of 1.05L/s/ha including extraneous flows. The total peak flow is found by an arithmetic sum:

Equation 1: Calculation of Peak Sanitary Flows

$$\text{Peak Design Flow } (Q_d) = \text{Peak Population Flow } (Q_p) + \text{Peak Extraneous Flow } (Q_i)$$

Pipe capacity is solved using Manning's Equation (see Section 4.4).

For pipes flowing partially full, flow depths and pipe capacities are resolved using MTO Chart 2.30.

Greater detail for the calculations can be found directly on the Sanitary Sewer Design Sheet (Table 7).

3.3.1 Settlers Ridge East Phase 3

SRE Ph 3 will drain to a 375 mm PVC gravity sanitary sewer on Raycroft Drive.

Sewers on the east side of the development have been designed to accommodate future commercial development to the north along Highway 62. Therefore, the sewer main on the east side of Cousins Crescent are 300 mm with a minimum slope of 0.4% and all other sewer mains are 200 mm with a minimum slope of 0.4%. On Raycroft Drive, a 375 mm sewer main is to be extended to the east Cousins Crescent intersection where it will decrease to a 300 mm sewer main that continues 19m to the east.

3.3.2 Towncentre Place

A gravity system has been designed through the development draining to the existing 375mm PVC sewer main on Raycroft Drive.

The new sewer mains are to be 250 mm with a minimum slope of 0.28% to allow for maximum available cover.

3.3.3 Pipe Materials

All sanitary sewer pipes will be PVC DR35. This conforms with OPSS 1841. Pipe Joints will be bell and spigot style with a PVC compression gasket. No restraints are required.

The Manning's n for PVC is published by manufacturers as 0.10. As required by the Design Guidelines, a value of 0.013 was used that is representative of a rougher surface, which adds conservatism to the calculations.

3.3.4 Bury Depth

The maximum bury depth for DR35 PVC is 10.8m for trench installation and 6.5m for embankment installation per OPSD 806.040 and all pipes will conform.

DR35 PVC is the industry standard and conforms to the pipe strength requirements and safety factors for OPSS 1841. Minimum depth of cover for frost protection would be 1.2m for the Quinte Region (O.B.C.). OPSD 3090.010 indicates the frost depth for Quinte Region is 1.4m to 1.5m. Pipes should then have a minimum cover of 1.5m before requiring additional frost protection measures. Sanitary sewers at SA14 will require additional frost protection per OPSD 1109.030 at a rate of 50mm per 300mm of cover deficit.

Sewer mains are buried to a depth that allows for laterals to be positioned with inverts a minimum of 2.2m at the property line.

3.3.5 Syphon

No syphons are proposed.

3.3.6 Foundation Drainage

Foundation drains will not be connected to the sanitary system.

3.3.7 Pipe Size

The minimum allowable sewer size is 200mm. All sewers will be 200mm or greater. Sewers discharge into downstream sewer pipes that are equal or larger in size. At changes in pipe sizes, obverts were matched or at a minimum the 80% diameters were matched.

3.3.8 Flow Velocity

All velocities are within 0.6m/s and 3m/s and there is no concern for deposition, scour or long residence times.

3.3.9 Alignment

Sewers connect at maintenance hole with right or obtuse angles thereby satisfying the design requirements.

3.3.10 By-Pass / Surcharge

No by-pass is required. The system is designed using the maximum expected peak flows and retains a minimum 20% reserve capacity. Surcharge of the system is not likely and impacts to basements are not expected.

3.3.11 Separation from Drinking Water

No sewers are proposed within 15m of a drinking water facility. There are no drinking water facilities within 60m of the development area. Sewers are separated from watermains by 2.5m horizontal separation of outside edge of pipes and 0.5m separation vertically.

3.3.12 Laterals

Laterals will be 125mm or 150mm PVC DR28 as described in the engineering drawings. Connections will be made using a manufactured Tee. Risers for sewers greater than 4m bury depth will use long sweep elbows connecting to the main at an angle no greater than 45 degrees. Lateral slopes are set to 2%.

3.4 Sanitary Trunk Sewer

The Greer Galloway Group (GGG) completed a servicing study of the area north of Highway 401 in February 2014. This study shows a 375 mm sanitary sewer crossing Highway 62 from a future extension of Mineral Road. However, Settlers Ridge constructed a trunk sewer along Hampton Ridge Drive that continues along Maitland Drive and Millennium Parkway to service the lands west of Highway 62. A 375 mm sewer was extended from this trunk sewer through SRE Ph 1 & 2, which will be extended further to service SRE Ph 3 and Towncentre. The GGG study can be found in Appendix A.

3.5 Water Pollution Control Plant Capacity

The City provided the preliminary uncommitted capacity of the pollution control plant. There is an approximate capacity of 13,250 m^3/d available and the two developments would create volume of 355 m^3/d; therefore, there is capacity for the developments. The expansion to the Belleville sanitary sewer system is anticipated by the City and by the allocation of the uncommitted capacity the City anticipates no by-pass concerns.

A full breakdown of the plant capacity can be found in Appendix B.

3.6 Maintenance Holes

All maintenance holes are to be designed per the latest OPSDs and conform to all required guidelines, such as: Occupational Health and Safety Act, MOL Confined Space Guidelines, Fire Protection and Prevention Act.

3.6.1 Size

Sanitary maintenance holes are 1200 mm in diameter. This is the minimum size for the pipe 375mm maximum pipe sizes and connection geometry. Maximum hole sizes were selected with reference to OPSD 701.021 and Forterra drawing C1.

3.6.2 Access and Safety

Maintenance holes access steps will conform to OPSD 405.010, which will facilitate safe access for operational maintenance.

No safety platforms are required since all structure heights are less than 5m (refer to the structure tables in the Pipe and Structure drawings).

3.6.3 Sealing

Maintenance hole seals will conform to OPSS 1351. Additional seals are specified using Blue Skin or Riser Wrap.

3.6.4 Flow Accommodation

No drop structures are needed at any of the maintenance holes for either development.

All sanitary maintenance holes are to be benched. Benching will conform to OPSD 701.021.

Inverts are calculated such that all outgoing pipes are 3cm lower than incoming pipes when pipes are 180 degrees apart and 6cm lower than incoming pipes when pipes are 90 degrees apart.

3.6.5 Spacing

Maintenance hole spacing is specified by MECP 2008 Design Guidelines which require spacing to be no greater than 120m for pipes sizes up to 375mm, 150m for pipes from 450mm to 750mm and up to 185m spacing for pipes larger than 750mm. All pipes are 375 mm or less and therefore maximum allowable spacing is 120m. Maintenance hole spacing is interpreted on the Pipe and Structure drawings for the pipe lengths. All pipe lengths are measured centre to centre of maintenance holes and the pipe lengths are all below the 120m maximum permissible.

3.6.6 Accommodation for Phasing

Phase 3 is the last sanitary sewer extension planned for the subdivision. SA3 is placed for possible future extension by others. For the Towncentre Development, SA14 has been placed at the intersection of Red Fox Lane and Towncentre Drive for potential connection for existing commercial developments.

Connection to the previous phase was planned with the standard pipe invert differences ensuring smooth flow transition to the existing system.

3.6.7 Grading

Sanitary maintenance holes are typically placed at the centreline of the road, which is the high point of the cross-section. This will reduce surface infiltration into the maintenance holes.

3.6.8 Corrosion Protection

There is no indication of the presence of contaminated soils or groundwater and therefore no corrosion protection measures are required.

3.6.9 Rehabilitation

Not required.

3.6.10 Stream Crossing

Not required.

3.6.11 Aerial Crossing

Not required.

3.6.12 Alternative Sewer Systems

Not required.

3.6.13 Challenging Conditions

The sewers follow typical installations procedures and standard installations.

3.7 Testing

Low pressure testing of the pipes and maintenance holes will be completed according to OPSS.MUNI 410. CCTV inspections will be completed according to OPSS 409.

3.8 Sanitary Sewer Summary

The sewer design satisfies the MECP Design Criteria and guidelines and City of Belleville standards and will not cause any adverse effects.

Design flow calculations and pipe sizing are provided in the sanitary sewer design sheet, Table 7. According to the sanitary sewer design sheet, the following conclusions were made:

- Maximum q/Q ratio within the developments was found to be 62.4%.
- Peak design flow was found to be 45.6 L/s.
- Maximum full flow velocity was found to be 0.87 m/s, which is less than the maximum allowable of 3.00 m/s.
- Minimum full flow velocity of 0.6 m/s was achieved in all proposed sections.
- Sewer laterals will be 125mm or 150mm DR28, and the mains will be DR35.

The following sanitary sewer mains are proposed to be constructed:

- Raycroft Drive (Settlers Ridge East Phase 3)
    - 88.5 metres of 375 mm diameter DR35 PVC
    - 19.0 metres of 300 mm diameter DR35 PVC
- Cousins Crescent (Settlers Ridge East Phase 3)
    - 327.6 metres of 200 mm diameter DR35 PVC
    - 267.5 metres of 300 mm diameter DR35 PVC
- Red Fox Lane (Towncentre Place)
    - 251.7 metres of 250 mm diameter DR35 PVC

The following sanitary sewer laterals are proposed to be constructed:

- Raycroft Drive
  - 150 mm diameter DR28 PVC (commercial/residential)
- Cousins Crescent (Settlers Ridge East Phase 3)
  - 125 mm diameter DR28 PVC
- Red Fox Lane
  - 125 mm diameter DR28 PVC
  - 150 mm diameter DR28 PVC (2 family dwellings, stacked townhomes)

Pipe joints to be bell and spigot. Maintenance holes to be outfitted with boot gaskets for PVC pipes.

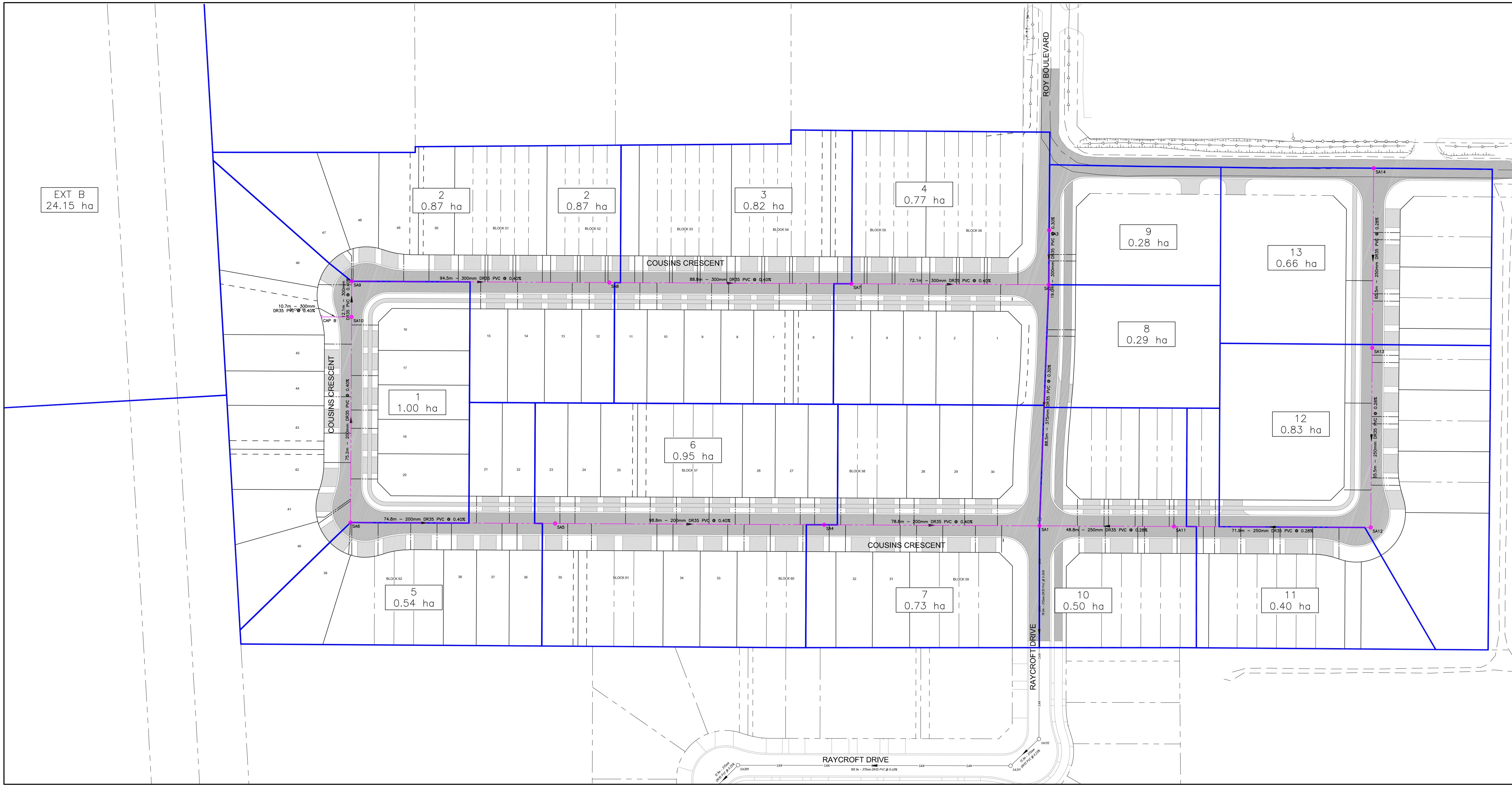

Figure 8: Sanitary Sewer Catchment

Table 7: Sanitary Sewer Design Sheet

SANITARY SEWER DESIGN SHEET

Peak Design Flow Calculation

Peak Design Flow (Q_d) = Peak Population Flow (Q_p) + Peak Extraneous Flow (Q_i)

$Q_d = Q_p + Q_i$

$Q_p = \frac{PqM}{86.4}$

$Q_i = IA$

$M = 1 + \frac{14}{4+\sqrt{P}}$

Where:

q	Average daily per capita flow	**350** L/d*cap
I	Unit of peak extraneous flow	**0.28** L/s*ha
M	Harmon peaking factor (min = 2)	
P	Population in 1000's	
A	Area in hectares (ha)	

Commercial Flows

Commercial Flows	**1.05** L/s*ha
Peaking Factor	**Included**

Residential Flows

Population Density	**3.0** cap/unit

Pipe Capacity by Manning's Equation

$Q = \frac{1}{n} A R^{2/3} S^{1/2}$

Where:

A	Area of pipe in m^2
R	Hydraulic radius = a/p
P	Wetted perimeter
S	Slope (m/m)
n	Manning's friction coef.

Check

$Q_d \leq 0.8 \cdot (Pipe\ Capacity)$

$0.6 \leq V \leq 3.0$

use Actual V if d:D < **0.3**

LOCATION				PEAK FLOW CALCULATION												SEWER DATA									
				RESIDENTIAL					RESID. PEAKING FACTOR	COMMERCIAL		POP. FLOW	COMM. FLOW	PEAK EX.	DESIGN FLOW									VELOCITY & CAPACITY CHECK	
				INDIVIDUAL			CUMULATIVE			INDIVIDUAL	CUMULATIVE														
CATCHMENT	STREET	UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	UNITS	POP.	AREA (A) (ha)	POP.	AREA (A) (ha)	(M)	AREA (A) (ha)	AREA (A) (ha)	Q_p (L/s)	Q_c (L/s)	Q_i (L/s)	Q_d (L/s)	LENGTH (m)	PIPE SIZE (mm)	PIPE MATERIAL	GRADE USE m/m (%)	CAPACITY n = 0.013 (L/s)	FULL FLOW VELOCITY (m/s)	RATIO d:D	ACTUAL VELOCITY AT Qd (m/s)		% FULL q/Q
13	Red Fox Ln	SA14	SA13	16	48.0	0.66	48.0	0.66	4.32		0.00	0.8	0.0	0.2	1.0	65.5	250	PVC	0.28%	31.47	0.64	0.12	0.64	OK	3.3%
12	Red Fox Ln	SA13	SA12	30	90.0	0.83	138.0	1.49	4.20		0.00	2.3	0.0	0.4	2.8	65.5	250	PVC	0.28%	31.47	0.64	0.20	0.64	OK	8.8%
11	Red Fox Ln	SA12	SA11	11	33.0	0.40	171.0	1.89	4.17		0.00	2.9	0.0	0.5	3.4	71.9	250	PVC	0.28%	31.47	0.64	0.22	0.64	OK	10.9%
10	Red Fox Ln	SA11	SA1	12	36.0	0.50	207.0	2.39	4.14		0.00	3.5	0.0	0.7	4.1	48.8	250	PVC	0.28%	31.47	0.64	0.24	0.64	OK	13.2%
EXT B	Park	CAP B	SA10		0.0		0.0	0.00	4.50	32.22	32.22	0.0	33.8	0.0	33.8	10.7	300	PVC	0.40%	61.16	0.87	0.53	0.87	OK	55.3%
1	Cousins Cres	SA6-E	SA10	12	36.0	1.00	36.0	1.00	4.34		0.00	0.6	0.0	0.3	0.9	75.2	200	PVC	0.40%	20.74	0.66	0.14	0.66	OK	4.4%
	Cousins Cres	SA10	SA9		0.0		36.0	1.00	4.34		32.22	0.6	33.8	0.3	34.7	12.1	300	PVC	0.40%	61.16	0.87	0.54	0.87	OK	56.8%
2	Cousins Cres	SA9	SA8	19	57.0	0.87	93.0	1.87	4.25		32.22	1.6	33.8	0.5	36.0	94.5	300	PVC	0.40%	61.16	0.87	0.55	0.87	OK	58.8%
3	Cousins Cres	SA8	SA7	20	60.0	0.82	153.0	2.69	4.19		32.22	2.6	33.8	0.8	37.2	88.8	300	PVC	0.40%	61.16	0.87	0.56	0.87	OK	60.8%
4	Cousins Cres	SA7	SA2	16	48.0	0.77	201.0	3.46	4.15		32.22	3.4	33.8	1.0	38.2	72.1	300	PVC	0.40%	61.16	0.87	0.57	0.87	OK	62.4%
5	Cousins Cres	SA6-S	SA5	10	30.0	0.54	30.0	0.54	4.35		0.00	0.5	0.0	0.2	0.7	74.8	200	PVC	0.40%	20.74	0.66	0.12	0.66	OK	3.3%
6	Cousins Cres	SA5	SA4	19	57.0	0.95	87.0	1.49	4.26		0.00	1.5	0.0	0.4	1.9	98.8	200	PVC	0.40%	20.74	0.66	0.20	0.66	OK	9.2%
7	Cousins Cres	SA4	SA1	13	39.0	0.73	126.0	2.22	4.21		0.00	2.2	0.0	0.6	2.8	78.8	200	PVC	0.40%	20.74	0.66	0.24	0.66	OK	13.4%
9	Raycroft Dr	SA3	SA2	8	24.0	0.28	24.0	0.28	4.37	0.05	0.05	0.4	0.1	0.1	0.6	39.0	300	PVC	0.30%	52.97	0.75	0.06	0.75	OK	1.0%
8	Raycroft Dr	SA2	SA1	8	24.0	0.29	249.0	4.03	4.11	0.05	32.32	4.1	33.9	1.1	39.2	88.5	375	PVC	0.30%	96.03	0.87	0.44	0.87	OK	40.8%
	Raycroft Dr	SA1	*SA312*		0.0		582.0	8.64	3.94		32.32	9.3	33.9	2.4	45.6	*78.0*	*375*	*PVC*	*0.26%*	89.40	0.81	0.51	0.81	OK	51.1%
	Stacked Towns	Service	Lateral	10	30.0	0.25	30.0	0.25	4.35		0.00	0.5	0.0	0.1	0.6	10.0	150	PVC	2.00%	21.54	1.22	0.11	1.22	OK	2.8%

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Belleville, ON K8P 4Z5
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Note:
All peaking factors are above the minimum of 2.00

Designed: Julie Humphries, C.E.T.
Checked: Bryon Keene P.Eng
Date: April 11, 2024

Project: Settlers Ridge East Phase 3 & Towncentre Place

4 Storm Sewer System

New storm sewers will be installed throughout the developments as extensions to the existing storm sewer system. Stormwater from the developments will be directed to either Cell 2 or the ditch along the east side of Towncentre Drive.

The development contributes directly to the Norbelle Creek system for which an overall stormwater management concept has been developed in the early 2000s and amended from time to time. The most current stormwater management report was prepared for Norbelle Creek in 2017 (Jewell Engineering, April 17, 2017). This report supported a small expansion to Cell 2 and considered the stormwater management impacts for the two subject areas (SRE Ph3 and Towncentre).

The Norbelle Creek stormwater management system includes:

- Pond 110 Quality and Quantity Control (off-line pond)
- Cell 1 Quantity Control Only (on-line pond)
- Cell 2 Quantity Control Only (on-line pond)
- Various OGS units for Quality Control

Jewell has also authored under a separate cover a stormwater management design brief that contains a review of the performance of the Norbelle ponds (Cells 1 and 2) that considers no development outside of the existing urban area. This scenario includes an analysis with no development outside of the urban area and Ponds 104 and 107 would not be constructed. Jewell also reviewed the impact of the east portion of the storm sewer (discussed below) that will drain to Norbelle Creek after the confluence of the SWM facilities.

The Norbelle Creek stormwater management targets are:

- Quality treatment target is Enhanced
- Quantity control target 2.8 cms at Hwy 62

The stormwater management design brief concluded that the peak flows at Hwy 62 will be less than the 2.8cms limit and therefore the quantity control targets are achieved.

Quality controls follow the stormwater management plan and will be provided via oil grit separator (OGS) units.

In this section, the storm sewer design and the OGS design are discussed. The storm sewer network can be found in Figure 9.

None of the works discussed below are located within a source protection area and do not pose a significant drinking water threat and require no mitigation measures. The entirety of the

Belleville serviced area is within a highly vulnerable aquifer. No specific policies require any additional protective measures to be employed.

The site is not flood susceptible.

There are no known CSOs or SSOs in the study area. There are no known contaminated sites within the project area.

Due to the high water table conditions, care should be taken during construction such that all connections are well sealed. A product such as Riser Wrap will be placed around all manhole joints. Pipe connections to the manholes will be made using boot connections.

Since the area will be filled to bring the lands well above the groundwater table and no special measures are required to resist uplift pressures.

The project is not subject to Section 16 of the EAA.

The project does not outlet into a Municipal Drain.

4.1 Existing Conditions

A 750 mm gravity storm sewer exists on Raycroft Drive and ends at a maintenance hole at the west Cousins Crescent intersection. This maintenance hole needs to be relocated to the west by about 2 m to align with the centreline of the new road connections.

4.2 Design Criteria

The sanitary design criteria used are based on the City of Belleville ECA design criteria, engineering standards, MECP guidelines, and MECP F-6-1, which are summarized below.

- Minimum storm sewer diameter: 300 mm
- Roughness Coefficient (n):
  - Polyvinyl Chloride Pipes (PVC): 0.013
  - Reinforced Concrete Pipe (RCP): 0.013
- Minimum Full Flow Velocity: 0.75 m/s
- Maximum Full Flow Velocity: 6 m/s
  Horizontal Separation from Watermain 2.5m (minimum)
- Vertical Separation from Watermain 0.5m (minimum)

In particular, the City of Belleville storm sewer design standards F.2.4.1.3 were followed.

Pipes were designed to convey the 5-yr peak flows as calculated using the Rational Method and the standard storm sewer design sheets. Larger events will flow overland through the rights of way. This follows the minor/major design approach.

4.2.1 Calculation of Peak Flows – 5 Yr

The storm sewer calculations follow the Rational Method with peak flows found by solving:

$$Q = \frac{CiA}{360}$$

Where:

Q = Peak flow in m^3/s
C = Runoff coefficient (dimensionless)
i = Intensity of rainfall (mm/hr)
A = Catchment Area (ha)

4.2.1.1 Precipitation

The IDF curves from Environment Canada at Belleville station 6150689 v3.3 were used.

4.2.1.2 Runoff Coefficient

Runoff coefficients were selected from the City of Belleville's design standards (F.2.4.1.3.1) and follow the MTO Drainage Manual guidelines Design Chart 1.07. Individual runoff coefficients are shown on the catchment drawing in Figure 9 and identified on the storm sewer design sheet in Table 8.

4.2.1.3 Time of Concentration

The time of concentration is established starting with the first inlet time for the most upstream catch basin. The time of concentration is calculated using the Airport Method. The Airport Method uses site topography and soil conditions to estimate time of concentration, as follows:

$$T_c = \frac{3.26 * (1.1 - C) * \sqrt{L}}{S_w^{0.33}}$$

Where

T_c = Time of concentration
C = Runoff Coefficient
L = watershed length, m
S_w = slope of watershed, %

The times of concentration for the two larger catchments were derived to be 20 minutes.

4.2.1.4 Inlet Time

The inlet time is a minimum of 15 minutes per the City of Belleville standards (F.2.4.1.3.1). This was adjusted to 20 minutes using the Airport Formula for the two larger catchments north side of SRE where ditch inlets temporarily intercept the undeveloped lands. The future development conditions will also have an approximate time of pipe of 20 minutes.

4.3 Storm Sewer Network Design

In this section, the storm sewers and OGS units for each development is discussed. Three new OGS units in total are proposed; one for SRE and two for Towncentre.

The proposed storm sewers contribute to an existing system stormwater management system wholly within the City of Belleville. Some drainage will directly discharge into the Norbelle Creek SWMFs. Some drainage will discharge into the municipal ditch on Towncentre Drive.

The developments were foreseen in the original design and accommodations were made to receive the storm discharge.

4.3.1 Settlers Ridge East Phase 3

This development will have two separate storm sewer systems. The **west** system will connect to the existing storm sewer system that outlets into Cell 2. The **east** system will outlet to the existing ditch on the east side of Towncentre Drive.

West

The storm sewer system on the west leg of Cousins Crescent is to be connected to the existing 750 mm storm sewer on Raycroft Drive and ultimately outlet into Cell 2. The quality control for this portion of the development is provided by the existing OGS unit installed during SRE Ph 2.

East

The storm sewer system on the east leg of Cousins Crescent is to outlet into the existing ditch on the east side of Towncentre Drive. The quality control for this portion of the development is provided by a new OGS unit. Jewell sized the OGS unit using the design sheet provided by Hydro International, see Section 5.

4.3.2 Towncentre Place

This development will have two separate storm sewer systems. The west system will outlet into Cell 2. The east system will outlet into the existing ditch on the east side of Towncentre Drive. Along with the development, the west ditch of Towncentre Drive will be upgraded to an urban section from Roy Boulevard to the south limit of the development for a total distance of 150m.

West

The storm sewer system on the west leg of Red Fox Lane is to outlet through a service easement into Cell 2. The quality control for this portion of the development is provided by a new OGS unit. Jewell sized the OGS unit using the design sheet provided by Hydro International, see Section 5 Table 12.

East

The storm sewer system on the south leg of Red Fox Lane is to outlet to the existing ditch on the east side of Towncentre Drive. The quality control for this portion of the development is provided by a new OGS unit. Jewell sized the OGS unit using the design sheet provided by Hydro International, see Section 5 Table 11.

4.4 Pipe Design

Storm sewer pipes include Ribbed PVC and RCP pipes. No culverts and no municipal ditches are proposed.

Pipe design follow the Manning's equation and the continuity equation. The Manning's equation is originally solved for velocity, but is converted to flow by multiplying by the flow area. The equation below is thus derived from the two.

Equation 2: Manning's Equation

$$Q = \frac{1}{n} A\, R^{2/3}\; S^{1/2}$$

Where:

- Q = Flow capacity (m^3/s)
- A = Area of pipe (m^2)
- R = Hydraulic radius = A / P
- P = Wetter perimeter (m)
- S = Slope (m/m)
- n = Manning's friction coefficient (dimensionless)

Equation 3: Continuity Equation

$$Q = VA$$

Where:

Q = Flow (m^3/s)
V = Velocity (m/s)
A = Cross-sectional are of pipe (m^2)

Pipe capacities are determined using Equation 2. Pipe sizes and slopes were adjusted to ensure that pipe capacities are greater than the expected peak flows using the storm sewer design sheet. Additionally, a velocity check is included to ensure that minimum velocities of 0.75m/s are attained to reduce the opportunity for deposition. Further, a third check is performed to ensure that peak flows do not exceed 6m/s.

4.4.1 Pipe Materials

Storm sewer pipes 600mm or smaller will be Ribbed PVC which conform with OPSS 1841. Concrete pipes are 65-D RCP and conform with OPSS 1820. All pipes will be installed following the Ontario provincial standards. By conforming to the standards, the installation achieves the safety factors of the pipe design requirements. Pipe Joints will be bell and spigot style with a PVC compression gasket. No restraints are required.

4.4.2 Bury Depth

The maximum bury depth for 65D class concrete pipe for trench installation is 4.1m per OPSD 807.010 and all concrete pipes will conform.

The maximum bury depth of Ribbed PVC pipes is 10.8m for trench installation per OPSD 806.040 and all Ribbed PVC pipes will conform.

Floatation of the pipes is not expected since the storm sewer systems will generally have 1.5m or more of cover and the majority of the pipes will be above the seasonal high groundwater table.

Minimum depth of cover for frost protection would be 1.2m for the Quinte Region (O.B.C.). OPSD 3090.010 indicates the frost depth for Quinte Region is 1.4m to 1.5m. Pipes should then have a minimum cover of 1.5m before requiring additional frost protection measures. Storm sewers will require no additional frost protection.

4.4.3 Syphon

No syphons are proposed.

4.4.4 Foundation Drainage

Foundation drains will not be connected to the storm sewer system. Instead, foundation drains will discharge to rear yards.

4.4.5 Pipe Size

The minimum allowable storm sewer size is 300mm. All sewers will be 300mm or greater. A listing of pipe sizes is contained in Section 0 and in the pipe data form. Sewers discharge into downstream sewer pipes that are equal or larger in size. At changes in pipe sizes, obverts were matched or at a minimum the 80% diameters were matched.

All pipes convey the maximum expected peak flows during the 5-yr event without surcharge.

4.4.6 Flow Velocity

The City of Belleville's draft standards require flow velocities to be between 0.75m/s and 4.6m/s. MOE Design Guidelines require velocities to be between 0.6m/s to 6m/s. Pipe velocities are between 0.98m/s and 2.35m/s. Pipe slopes were adjusted during design to ensure velocities were achieved. There is no need for any additional pipe slope adjustment.

Flow velocities are within the allowable limits and there is no concern for deposition or scour.

4.4.7 Pipe Slope

Minimum pipe slopes are governed by MOE 2008 Design Guidelines Table 5-4. The ministry also defers to local municipalities for minimum slopes. City of Belleville requires slopes to be minimum 0.5% for 300mm and 375mm pipes and 0.3% for 450mm to 525mm pipes per F.2.4.1.3.1. RY307 have slopes of 0.3% which are less than the City's new criteria, but well above the MOE 2008 criterion of 0.22% slope for a 300mm pipe.

All slopes are less than 20% and require no steep slope protection.

4.4.8 Alignment

Sewers connect at maintenance hole with right or obtuse angles thereby satisfying the design requirements.

4.4.9 By-Pass / Surcharge

No by-pass is required. The system is designed using the maximum expected peak flows. Surcharge of the system is not likely and impacts to basements are not expected.

4.4.10 Separation from Drinking Water

No sewers are proposed within 15m of a drinking water facility. There are no drinking water facilities within 60m of the development area. Sewers are separated from watermains by 2.5m horizontal separation of outside edge of pipes and 0.5m separation vertically.

No special source protection policies are required for SGRAs or HVAs.

4.4.11 Outlets

Storm outfalls discharge to established municipal infrastructure. The TRCA SWM Criteria, 2012 publication, Schedule E provides helpful guidance on locating outfalls such that the likelihood of downstream impacts will be diminished. The ultimate receiver of the stormwater is Norbelle Creek, which is highly urbanized in the lower reaches. Norbelle Creek is not an eroding creek and it will not be affected by the proposed development. This is due largely in part by the extensive storage provided by the SWMFs.

A portion of the drainage will contribute to the existing Outlet A. Three new outlets (A, B and C) are proposed and are discussed in Section 5. Discharges are to grade with no grade separations. The outlets are comparatively small and do not pose erosion risks. The soils have low susceptibility to erosion.

- Outlet A is 675mm and will discharge to the municipal ditch along Towncentre Drive at Roy Boulevard. This outlet will require rip-rap protection per OPSD 810.010.
- Outlet B is 300mm and will discharge to the same municipal ditch. It has little erosion risk and requires no special protection.
- Outlet C is 300mm and will discharge to Cell 2 (SWMF). This discharge is to a well-established and vegetated area, well removed from the creek. This outlet requires no special protection.

4.5 Maintenance Holes

All maintenance holes are to be designed per the latest OPSDs and conform to all required guidelines, such as: Occupational Health and Safety Act, MOL Confined Space Guidelines, Fire Protection and Prevention Act.

4.5.1 Size

Storm maintenance holes vary in diameter from 1200mm to 1800mm. The specific sizes are listed on Drawing ND-3 for SRE and ND-4 for Towncentre. Maintenance hole sizes were selected with reference to OPSD 701.021 and Forterra drawing C1.

4.5.2 Access and Safety

Maintenance holes access steps will conform to OPSD 405.010, which will facilitate safe access for operational maintenance.

No safety platforms are required since all structure heights are less than 5m (refer to the structure tables in the Pipe and Structure drawings).

4.5.3 Sealing

Maintenance hole seals will conform to OPSS 1351.

4.5.4 Flow Accommodation

No drop structures are needed at any of the maintenance holes for either development.

No benching is provided for storm maintenance holes.

Inverts are calculated such that all outgoing pipes are 3cm lower than incoming pipes when pipes are 180 degrees apart and 6cm lower than incoming pipes when pipes are 90 degrees apart.

4.5.5 Spacing

Maintenance hole spacing is specified by MECP 2008 Design Guidelines which require spacing to be no greater than 120m for pipes sizes up to 375mm, 150m for pipes from 450mm to 750mm and up to 185m spacing for pipes larger than 750mm. All pipes are 375 mm or less and therefore maximum allowable spacing is 120m. Maintenance hole spacing is interpreted on the Pipe and Structure drawings for the pipe lengths. All pipe lengths are measured centre to centre of maintenance holes and the pipe lengths are all below the 120m maximum permissible.

4.5.6 Accommodation for Phasing

Lands along the north limit of SRE drain to SRE storm sewer system and have been accommodated for future development in the pipe sizing. This is shown in the Storm Sewer Design Sheet in Figure 9 and Table 8. External flows are picked up in RY304 and RY308 catch basins. Storm sewers from the CBs are 450mm and 525mm respectively and discharge to maintenance holes ST 105 and 112 positioned on Cousins Crescent to receive the external flows.

Connection to the previous phase was planned with the standard pipe invert differences ensuring smooth flow transition to the existing system.

4.5.7 Grading

Storm maintenance holes are positioned typically 3m offset from the sanitary, which places them about 1m from the curbline. The storm sewer system requires no special protection to prevent surface drainage from entering the maintenance holes.

4.5.8 Corrosion Protection

There is no indication of the presence of contaminated soils or groundwater and therefore no corrosion protection measures are required.

4.5.9 Rehabilitation

Not required.

4.5.10 Stream Crossing

Not required.

4.5.11 Aerial Crossing

Not required.

4.5.12 Alternative Sewer Systems

No alternative sewer systems are proposed.

4.5.13 Challenging Conditions

The sewers follow typical installations procedures and standard installations.

4.6 Catch Basins

Catch basins will be installed in accordance with the provincial OPSDs with a cast iron frame and grate per OPSD 400.010. Catch basin manholes are identified on drawings ND-3 and ND-4 in Appendix F under the Storm Structures (Round) table with OPSD 400.010 grates.

Locations of catch basins were positioned upstream of pedestrian crossings, at intersections, and out of driveway locations and walkways. Double catch basins were positioned at low points.

Catch basin spacing conforms with the City standard of 75m for slopes between 0.6% and 5% and 60m for slopes greater than 5%. No road slopes are proposed below 0.6%.

Catch basin laterals are 300mm for a single catch basin or ditch inlet and are 375mm for double catch basins or for the second catch basin when they are daisy chained together. Laterals have a minimum slope of 1% in the ROW and lesser slopes are used for longer runs from rear yard catch basins. In these cases, the slopes conform to the MOE 2008 slope requirements in their Table 5-4.

Catch basin specifications are summarized in the engineering design drawings in Appendix F on Drawing ND-3 for SRE and ND-4 for Towncentre.

4.7 Testing

Low pressure testing of the pipes and maintenance holes will be completed according to OPSS.MUNI 410. CCTV inspections will be completed according to OPSS 409.

4.8 Storm Sewer Summary

The sewer design satisfies the MECP Design Criteria and guidelines and City of Belleville standards and will not cause any adverse effects.

Design flow calculations and pipe sizing are provided in the storm sewer design sheet, Table 8.

- Storm design flows were calculated using the Rational Method.
- Runoff Coefficients applied ranged from 0.45 to 0.6.
- Rainfall intensities were calculated using the Environment Canada IDF curve for Belleville station 6150689.
- Storm pipe capacities were calculated using Mannings Equation.
- Manning's n value of 0.13 was used for all pipes.

According to the storm sewer design sheet, the following conclusions are made:

- Maximum q/Q ratio within the developments was found to be 84.8%.
- Maximum full flow velocity was found to be 2.35 m/s.
- Minimum full flow velocity of 0.75 m/s was achieved in all proposed sections.

The following storm sewer mains are proposed to be constructed:

- Raycroft Drive (Settlers Ridge East Phase 3)
    - 40.3 metres of 300 mm diameter RIBBED PVC
    - 55.4 metres of 675 mm diameter 65-D RCP
- Cousins Crescent (Settlers Ridge East Phase 3)
    - 29.4 metres of 450 mm diameter RIBBED PVC
    - 122.2 metres of 525 mm diameter RIBBED PVC
    - 297.1 metres of 600 mm diameter RIBBED PVC
    - 96.8 metres of 675 mm diameter 65-D RCP
- Red Fox Lane (Towncentre Place)
    - 143.8 metres of 300 mm diameter RIBBED PVC
- Service Easement (Towncentre Place)
    - 55.4 metres of 300 mm diameter RIBBED PVC
- Towncentre Drive (Towncentre Place)
    - 25.4 metres of 300 mm diameter HDPE

All maintenance holes are to be designed per the latest OPSDs and conform to all required guidelines, such as: Occupational Health and Safety Act, MOL Confined Space Guidelines, Fire Protection and Prevention Act. All catch basins are to be designed per the latest OPSDs.

The SRE and Towncentre designs adhere to the City standards and the Ontario provincial standards. All flow calculations were completed using gravity flow conditions and there are no expected adverse impacts.

4.9 Swales

Rear yard swales are designed to the City standards. Standard swales must have a slope of 2% or greater. Swale grades may be reduced to 1%, but must include a subdrain. All swales are 1% or greater and all are proposed with subdrains regardless of slope.

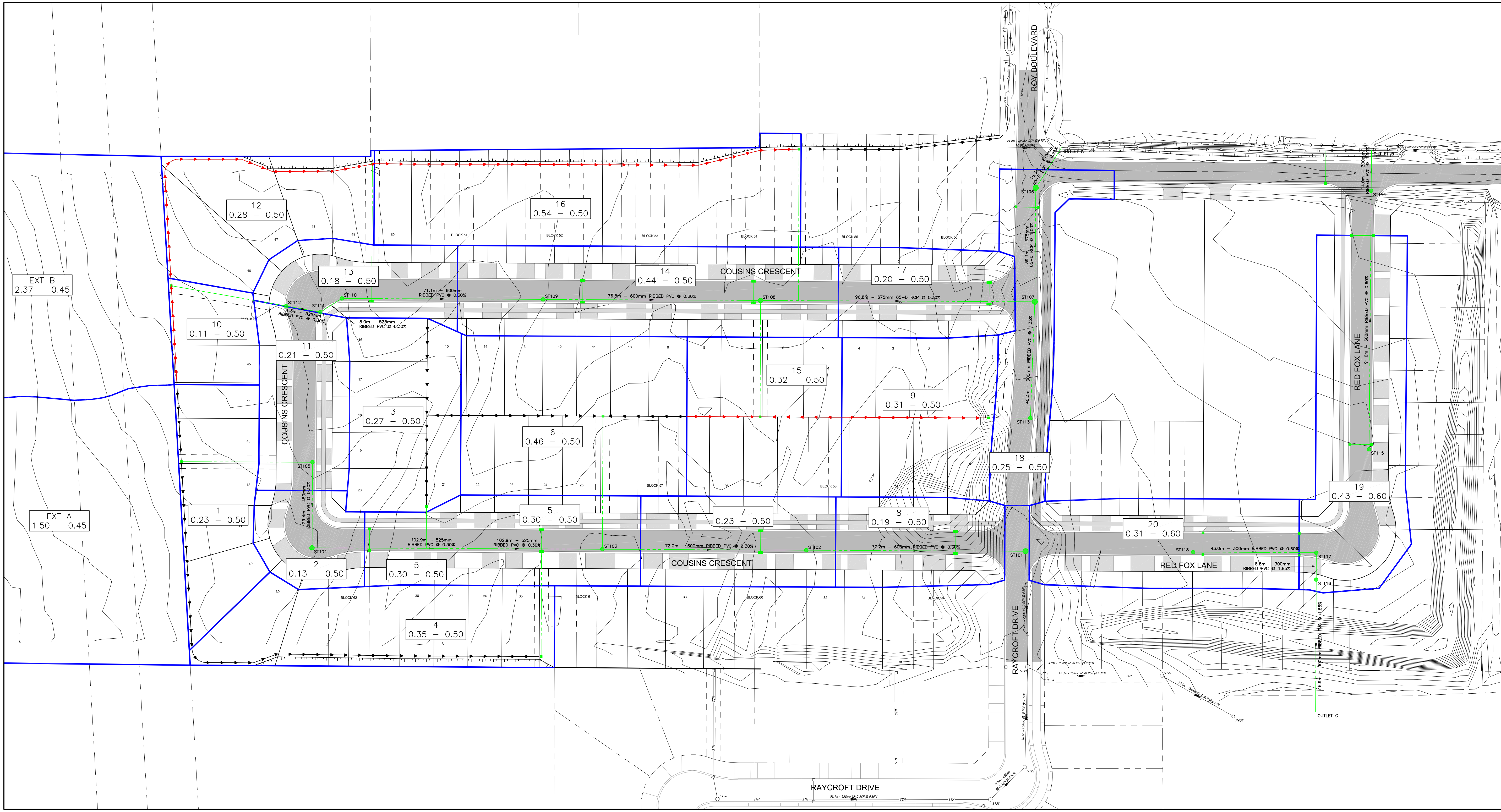

Figure 9: Storm Sewer Catchment

Table 8: Storm Sewer Design Sheet

STORM SEWER DESIGN SHEET

Peak Runoff Estimate by Rational Method

$$Q = \frac{1}{360} C\, i\, A$$

Where:
- Q = Peak Flow in cms
- C = Runoff Coefficient
- i = Rainfall Intensity in mm/hr
- A = Area in hectares

Intensity Equation: **Belleville**

$$i = A * T_c^{\,B}$$

Where:
- i = Rainfall Intensity in mm/hr
- T_c = Time of Concentration in hours

5-Year Parameters
- A = 26.4
- B = -0.677

Manning's Coef
- CSP 0.024
- RCP/PVC 0.013

Pipe Capacity by Manning's Equation

$$Q = \frac{1}{n} A\, R^{2/3}\, S^{1/2}$$

Where:
- A = area of pipe in m^2
- R = Hydraulic radius = A / P
- P = Wetted perimeter
- S = Slope (m/m)
- n = Manning's friction coef.

Check
- $q \leq Q$
- $V \leq 6\ m/s$

LOCATION				PEAK FLOW CALCULATION									PROPOSED SEWER									
STREET	CATCHMENT	FROM	TO	CATCHMENT AREAS / RUNOFF COEFFICIENT 0.25	0.45	0.50	0.60	R.C. x A (ha)	CUM. R.C x A (ha)	TIME OF CONCENTRATION (min)	INTENSITY (mm/hr)	PEAK FLOW (m^3/s)	DIAMETER (mm)	LENGTH (m)	TYPE OF PIPE	GRADE (m/m) (%)	CAPACITY (m^3/s)	FULL FLOW VELOCITY (m/s)	TIME OF FLOW (min)	ACTUAL VELOCITY AT Q_d (m/s)	q/Q (%)	CHECK CAPACITY
Cousins Cres	Ext A, 1	ST105	ST104		1.50	0.23		0.79	0.79	20.00	55.5	0.12	450	29.5	RCP	0.30%	0.16	0.98	0.50	1.09	78.1%	OK
	2, 3, 4, 5	ST104	ST103			1.05		0.53	1.32	20.50	54.6	0.20	525	103.9	RCP	0.30%	0.24	1.09	1.59	1.22	84.8%	OK
	6, 7	ST103	ST102			0.69		0.35	1.66	22.09	51.9	0.24	600	71.1	RCP	0.30%	0.34	1.19	1.00	1.29	71.2%	OK
	8	ST102	ST101			0.19		0.10	1.76	23.09	50.4	0.25	600	77.2	RCP	0.30%	0.34	1.19	1.08	1.30	73.1%	OK
Raycroft Dr		ST101	ST21					0.00	1.76	24.17	48.9	0.24	*750*	39.9	*RCP*	*0.30%*	0.61	1.38	0.48	1.29	39.1%	OK
Easement	*116,117,118,119*	ST21	OGS4			1.80		0.90	2.66	24.65	48.2	0.36	*750*	*4.9*	*RCP*	*0.30%*	0.61	1.38	0.06	1.43	58.4%	OK
		OGS4	ST20					0.00	2.66	24.71	48.1	0.36	*750*	*40.3*	*RCP*	*0.30%*	0.61	1.38	0.49	1.43	58.3%	OK
		ST20	HW57					0.00	2.66	25.20	47.5	0.35	*750*	*28.9*	*RCP*	*0.30%*	0.61	1.38	0.35	1.42	57.5%	OK
Raycroft Dr	9	ST113	ST107			0.31		0.16	0.16	15.00	67.5	0.03	300	40.3	PVC	1.35%	0.11	1.59	0.42	1.33	25.9%	OK
Cousins Cres	Ext B, 10, 11	ST112	ST111		2.37	0.32		1.23	1.23	20.00	55.5	0.19	525	11.3	PVC	0.30%	0.24	1.09	0.17	1.22	80.4%	OK
		ST111	ST110					0.00	1.23	20.17	55.2	0.19	525	8.0	PVC	0.30%	0.24	1.09	0.12	1.22	79.9%	OK
	12, 13	ST110	ST109			0.46		0.23	1.46	20.30	55.0	0.22	600	71.1	PVC	0.30%	0.34	1.19	1.00	1.27	66.2%	OK
	14	ST109	ST108			0.44		0.22	1.68	21.29	53.2	0.25	600	76.8	PVC	0.30%	0.34	1.19	1.08	1.30	73.8%	OK
	15, 16, 17	ST108	ST107			1.06		0.53	2.21	22.37	51.5	0.32	675	96.8	RCP	0.30%	0.46	1.29	1.25	1.38	68.6%	OK
Raycroft Dr	18	ST107	ST106			0.25		0.13	2.49	23.62	49.6	0.34	675	38.1	RCP	1.00%	0.84	2.35	0.27	2.22	40.8%	OK
Raycroft Dr		ST106	OUTLET A					0.00	2.49	23.89	49.2	0.34	675	54.3	RCP	0.25%	0.42	1.17	0.77	1.32	81.0%	OK
Red Fox Ln	19	ST115	ST114				0.43	0.26	0.26	15.00	67.5	0.05	300	91.6	PVC	0.60%	0.07	1.06	1.44	1.12	64.6%	OK
		ST114	OUTLET B					0.00	0.26	16.44	63.4	0.05	300	14.0	PVC	1.90%	0.13	1.89	0.12	1.70	34.1%	OK
Red Fox Ln	20	ST118	ST117				0.31	0.19	0.19	15.00	67.5	0.03	300	52.2	PVC	0.60%	0.07	1.06	0.82	1.04	46.6%	OK
Service Route		ST117	ST116					0.00	0.19	15.82	65.1	0.03	300	8.5	PVC	1.30%	0.11	1.56	0.09	1.37	30.5%	OK
		ST116	OUTLET C					0.00	0.19	15.82	65.1	0.03	300	46.9	PVC	1.80%	0.13	1.84	0.43	1.54	25.9%	OK

JEWELL ENGINEERING

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Designed: Julie Humphries, C.E.T.
Checked: Bryon Keene, P.Eng.
Date: April 11, 2024

Project: Settlers Ridge Phase 3 & Towncentre Place

5 Water Quality Treatment

The Norbelle Creek stormwater management system has been established with on-line quantity control in a 2-celled dry pond. However, quality controls must be provided off-line. The Norbelle Creek SWM plan is for quality treatment to be provided off-line using Oil-Grit Separators (OGS units) to remove sediment. In previous phases, units from Hydro International have been employed. For the current developments (SRE Ph3 and Towncentre) the First Defence units from Hydro International are proposed. These units are ETV verified.

Three OGS units are proposed. The three OGS units can each effectively treat 100% of all incoming flows, and all but unit A can achieve the 80% TSS removal target (*Enhanced*). The treatment summary is provided in Table 9. This means some additional treatment will be required for Unit A.

Table 9: OGS Treatment Summary

Unit	Treatment Area (ha)	Runoff Coefficient	TSS Removal (%)	Treatment Volume (%)
OGS A – FD-8HC	5.21	0.39	69.2	100
OGS B – FD-4HC	0.43	0.60	80.3	100
OGS C	0.31	0.60	84.3	100
Total	5.95		70.8*	100

** Weighted Average TSS Removal Efficiency from OGS units alone*

5.1 OGS Unit Sizing

Oil-Grit Separator sizing was completed using the proprietary sizing sheets from Hydro International. The summary of the results was shown in Table 9 and the individual calculations are reported in the follow three tables for each of the three units. The full sizing reports can be found in Appendix C.

Table 10: Settlers Ridge East Phase 3 – OGS A Sizing

Hydro First Defense® - HC

Net Annual Water Quality Worksheet

Rev. 9.6

Hydro International

Project Name:	**Settlers Ridge East Phase 3**	*Report Date:*	**2024-03-01**
Street:	**Raycroft Drive**	*City:*	**Belleville**
Province:	**Ontario**	*Country:*	**Canada**
Designer:	**Julie Humphries**	*email:*	

Teatment Parameters:

Structure ID:	ST106
TSS Goal:	80 % Removal
TSS Particle Size:	NJDEP / ETV
Area:	5.21 ha
Percent Impervious:	45%
Rational C value:	0.39 (Calc. Cn)
Rainfall Station:	Belleville, ONT (MAP)
Peak Storm Flow:	340 L/s

RESULTS SUMMARY

Model	TSS	Volume
FD-3HC	40.8%	89.0%
FD-4HC	50.2%	96.4%
FD-5HC	58.5%	99.2%
FD-6HC	62.8%	99.7%
FD-8HC	**69.2%**	**100.0%**

Model Specification:

Model:	**FD-8HC**
Diameter:	2400 mm
No Bypass Flow:	142.00 L/s
Peak Flow Capacity:	1416.00 L/s
Sediment Storage:	2.14 m^3
Oil Storage:	4240.00 L

Installation Configuration:

Placement:	Online	
Outlet Pipe Size:	675 mm	*OK*
Inlet Pipe 1 Size:	675 mm	*OK*
Inlet Pipe 2 Size:	mm	*OK*
Inlet Pipe 3 Size:	mm	*OK*
Rim Level:	110.327 m	Calc Invs.
Outlet Pipe Invert:	108.723 m	*Additional cover may be required*
Invert Pipe 1:	108.750 m	*Check cover*
Invert Pipe 2:	m	
Invert Pipe 3:	m	

Net Annual Removal Model: FD-8HC

Intensity[1] (mm/hr)	Fraction of Rainfall[1] (%)	FD-8HC Removal Efficiency[2] (%)	Weighted Net Annual Efficiency (%)
0.50	0.4%	91.0%	0.4%
1.00	13.2%	83.5%	11.0%
1.50	14.0%	79.1%	11.0%
2.00	14.0%	76.0%	10.6%
2.50	3.6%	73.6%	2.6%
3.00	2.5%	71.6%	1.8%
3.50	8.4%	69.9%	5.9%
4.00	5.1%	68.5%	3.5%
4.50	1.6%	67.2%	1.1%
5.00	5.1%	66.1%	3.3%
6.00	4.8%	64.1%	3.1%
7.00	4.5%	62.5%	2.8%
8.00	3.5%	61.0%	2.1%
9.00	2.4%	59.7%	1.5%
10.00	2.5%	58.6%	1.5%
20.00	9.7%	51.1%	4.9%
30.00	2.8%	46.7%	1.3%
40.00	0.9%	43.6%	0.4%
50.00	0.4%	41.2%	0.2%
100.00	0.6%	33.7%	0.2%
150.00	0.1%	0.0%	0.0%
200.00	0.0%	0.0%	0.0%
Total Net Annual Removal Efficiency:			**69.2%**
Total Annual Runoff Volume Treated:			**100.0%**

1. Rainfall Data: 1960:2007, HLY03, Belleville, ONT, 6150700 & 6150689.

#N/A

3. Rainfall adjusted to 5 min peak intensity based on hourly average.

Designer Notes

The total contributing area to OGS A is 5.21 ha. This includes 2.37 ha of external undeveloped lands. A weighted runoff coefficient of 0.39 was calculated and provided to the model to determine a projected TSS removal rate of 69.2% and a total treatment volume of 100%.

This treatment rate would not be sufficient to achieve the Enhanced target and additional treatment is needed. This is discussed further in Section 5.2.

Table 11: Towncentre Place – OGS B Sizing

Hydro First Defense® - HC

Net Annual Water Quality Worksheet

Hydro International

Rev. 9.6

Project Name:	Towncentre Place	Report Date:	2024-03-01
Street:	Red Fox Lane	City:	Belleville
Province:	Ontario	Country:	Canada
Designer:	Julie Humphries	email:	

Teatment Parameters:

Structure ID:	ST114
TSS Goal:	80 % Removal
TSS Particle Size:	NJDEP / ETV
Area:	0.43 ha
Percent Impervious:	60%
Rational C value:	0.60
Rainfall Station:	Belleville, ONT
Peak Storm Flow:	340 L/s

RESULTS SUMMARY

Model	TSS	Volume
FD-3HC	70.1%	99.7%
FD-4HC	**80.3%**	**100.0%**
FD-5HC	81.3%	99.9%
FD-6HC	85.3%	99.9%
FD-8HC	90.5%	99.9%

Model Specification:

Model:	FD-4HC
Diameter:	1200 mm
No Bypass Flow:	20.00 L/s
Peak Flow Capacity:	510.00 L/s
Sediment Storage:	0.54 m^3
Oil Storage:	723.00 L

Installation Configuration:

Placement:	Online	
Outlet Pipe Size:	300 mm	OK
Inlet Pipe 1 Size:	300 mm	OK
Inlet Pipe 2 Size:	mm	OK
Inlet Pipe 3 Size:	mm	OK
Rim Level:	109.617 m	
Outlet Pipe Invert:	108.526 m	OK
Invert Pipe 1:	108.556 m	OK
Invert Pipe 2:	m	
Invert Pipe 3:	m	

Net Annual Removal Model: FD-4HC

Intensity[1] (mm/hr)	Fraction of Rainfall[1] (%)	FD-4HC Removal Efficiency[2] (%)	Weighted Net Annual Efficiency (%)
0.50	0.4%	105.2%	0.4%
1.00	13.2%	96.6%	12.8%
1.50	14.0%	91.6%	12.8%
2.00	14.0%	88.0%	12.3%
2.50	3.6%	85.3%	3.0%
3.00	2.5%	83.0%	2.1%
3.50	8.4%	81.1%	6.8%
4.00	5.1%	79.4%	4.0%
4.50	1.6%	78.0%	1.2%
5.00	5.1%	76.7%	3.9%
6.00	4.8%	74.4%	3.6%
7.00	4.5%	72.5%	3.3%
8.00	3.5%	70.8%	2.5%
9.00	2.4%	69.4%	1.7%
10.00	2.5%	68.1%	1.7%
20.00	9.7%	59.5%	5.7%
30.00	2.8%	54.4%	1.5%
40.00	0.9%	50.9%	0.5%
50.00	0.4%	48.1%	0.2%
100.00	0.6%	39.5%	0.2%
150.00	0.1%	0.0%	0.0%
200.00	0.0%	0.0%	0.0%
Total Net Annual Removal Efficiency:			**80.3%**
Total Annual Runoff Volume Treated:			**100.0%**

1. Rainfall Data: 1960:2007, HLY03, Belleville, ONT, 6150700 & 6150689.

#N/A

3. Rainfall adjusted to 5 min peak intensity based on hourly average.

Designer Notes

OGS B meets the 80% TSS removal target for Enhanced treatment.

Table 12: Towncentre Place – OGS C Sizing

Hydro First Defense® - HC
Net Annual Water Quality Worksheet
Rev. 9.6

Project Name:	**Towncentre Place**	*Report Date:*	**2024-03-01**
Street:	**Red Fox Lane**	*City:*	**Belleville**
Province:	**Ontario**	*Country:*	**Canada**
Designer:	**Julie Humphries**	*email:*	

Teatment Parameters:

Structure ID:	ST116
TSS Goal:	80 % Removal
TSS Particle Size:	NJDEP / ETV
Area:	0.31 ha
Percent Impervious:	60%
Rational C value:	0.60
Rainfall Station:	Belleville, ONT
Peak Storm Flow:	340 L/s

RESULTS SUMMARY

Model	TSS	Volume
FD-3HC	73.6%	99.9%
FD-4HC	**84.3%**	**100.0%**
FD-5HC	84.9%	99.9%
FD-6HC	88.4%	99.9%
FD-8HC	92.8%	99.9%

Model Specification:

Model:	FD-4HC
Diameter:	1200 mm
No Bypass Flow:	20.00 L/s
Peak Flow Capacity:	510.00 L/s
Sediment Storage:	0.54 m^3
Oil Storage:	723.00 L

Installation Configuration:

Placement:	Online	
Outlet Pipe Size:	300 mm	OK
Inlet Pipe 1 Size:	300 mm	OK
Inlet Pipe 2 Size:	mm	OK
Inlet Pipe 3 Size:	mm	OK
Rim Level:	111.207 m	
Outlet Pipe Invert:	109.096 m	OK
Invert Pipe 1:	109.096 m	OK
Invert Pipe 2:	m	
Invert Pipe 3:	m	

Net Annual Removal Model: FD-4HC

Intensity(1) (mm/hr)	Fraction of Rainfall(1) (%)	FD-4HC Removal Efficiency(2) (%)	Weighted Net Annual Efficiency (%)
0.50	0.4%	100.0%	0.4%
1.00	13.2%	100.7%	13.3%
1.50	14.0%	95.7%	13.4%
2.00	14.0%	92.1%	12.9%
2.50	3.6%	89.3%	3.2%
3.00	2.5%	87.1%	2.2%
3.50	8.4%	85.1%	7.2%
4.00	5.1%	83.5%	4.2%
4.50	1.6%	82.0%	1.3%
5.00	5.1%	80.7%	4.1%
6.00	4.8%	78.5%	3.7%
7.00	4.5%	76.6%	3.4%
8.00	3.5%	74.9%	2.6%
9.00	2.4%	73.4%	1.8%
10.00	2.5%	72.1%	1.8%
20.00	9.7%	63.5%	6.1%
30.00	2.8%	58.5%	1.6%
40.00	0.9%	54.9%	0.5%
50.00	0.4%	52.2%	0.2%
100.00	0.6%	43.6%	0.2%
150.00	0.1%	38.5%	0.0%
200.00	0.0%	0.0%	0.0%
Total Net Annual Removal Efficiency:			**84.3%**
Total Annual Runoff Volume Treated:			**100.0%**

1. Rainfall Data: 1960:2007, HLY03, Belleville, ONT, 6150700 & 6150689.

#N/A

3. Rainfall adjusted to 5 min peak intensity based on hourly average.

Designer Notes

OGS C meets the 80% TSS removal target for Enhanced treatment.

5.2 Combination of Technologies Approach

As per the previous section, the performance of OGS A is insufficient on its own to meet the quality target. Therefore, some additional treatment is required. The treatment for the catchment contributing to OGS A will be augmented through a combination of technologies approach. This is often referred to as the treatment train approach [2]. The treatment train strategy combines lot level, conveyance, and end of pipe controls. This is considered to be preferable to a single end of pipe solution (ibid, p2-17).

Per the new CLI for Belleville, the ministry will no longer accept the combined benefits of mechanical treatment devices (such as OGS units and CB Shields) that are positioned in series

[2] Low Impact Development Stormwater Management Planning and Design Guide, TRCA & CVC, 2010

but will only acknowledge the TSS removal benefit of one device. Therefore, the proposed additional technology will be enhanced grassed swales that are not mechanical treatment devices. This follows the recommendations of the LID Design Manual for a treatment train approach and the new ministry criteria for calculation of TSS removal efficiency.

To assist with additional sediment removal, the grassed swales will be set to 1% slopes for most locations and will be improved with subdrains and additional topsoil. The locations of these swales are depicted as red in Figure 9.

Using the combined technologies method, Jewell determined the quality treatment to be about 80.2%. This is calculated using the following formula (*source: NCDENR Stormwater BMP Manual, p3-20*):

$$E = A + B - \left\lfloor \frac{AxB}{100} \right\rfloor$$

Where:

E = Total pollutant removal efficiency (%)
A = Removal efficiency of Technology 1 (upstream position) 80%
B = Removal efficiency of Technology 2 (downstream position) 50%

In this case, Technology 1 is represented by the grassed swales and Technology 2 is represented by OGS units. The treatment effectiveness of the OGS unit has been discounted to just 50% for OGS A to account for a reduced capture success rate given that it will be positioned second in the series. This assumption is conservative.

Grassed swales are typically assigned a removal rate of approximately 80% TSS. There are several sources for TSS removal effectiveness, see Appendix D.

- LID Design Manual (referenced earlier) – 76%
- Lucke et al[3], – 80%

An example calculation of the combination of technologies approach is shown below.

$$E = 80\% + 50\% - \left\lfloor \frac{80\% x 50\%}{100} \right\rfloor = 90\%$$

This calculation was completed for each of the catchments contributing to the enhanced grassed swales and the results are presented in Table 13. The overall removal rate of TSS is calculated to be 80.2% using a weighted average of each contributing area and the target is expected to be achieved.

[3]Lucke, T. (2014). *Pollutant Removal and Hydraulic Reduction Performance of Field Grassed Swales during Runoff Simulation Experiments.* Water

Table 13: Summary of Quality Treatment Using Enhanced Grassed Swales and OGS A in Series

Ctch ID	Area (ha)	Technology 1 (Grass Swale - 80%)	Technology 2 (OGS Unit - 50%)	Combined Technologies
9	0.31	✓	✓	90.0%
10	0.11	✓	✓	90.0%
11	0.21	✗	✓	50.0%
12	0.28	✓	✓	90.0%
13	0.18	✗	✓	50.0%
14	0.44	✗	✓	50.0%
15	0.32	✓	✓	90.0%
16	0.54	✓	✓	90.0%
17	0.20	✗	✓	50.0%
18	0.25	✗	✓	50.0%
Ext B	2.37	✓	✓	90.0%
Total	**5.21**			**80.2%**

6 Operation and Maintenance

The two technologies proposed for stormwater quality control include enhanced grassed swales and OGS units. The operation and maintenance for these devices are commonly known to the City and will be familiar to maintenance staff.

6.1 Enhanced Grassed Swales

Slight enhancements are proposed to grassed swales to increase the infiltration and filtration effects. These include the following:

- Reduced slopes
- Subdrains
- Supplemental topsoil

Rear yard swales are difficult for the City to control and once constructed and turned over to private homeowners, the operation and maintenance of the swales is no longer the City responsibility. Given, that the water quality improvement success is dependent in part on the effectiveness of the swales, we have selected techniques that require no participation from the private landowners. The subdrains are placed within a stone trench under the swales and will be covered with a greater depth of topsoil. Other techniques such as extending the stone trenches to the surface require more understanding on the part of the landowner to maintain. Such enhancements are avoided in favour of the ones listed above.

Grassed swales need only to be mowed along with the rear yards.

6.2 OGS Units

OGS units have proprietary operation and maintenance manuals that are prepared by the manufacturer. Their maintenance manual is included in Appendix E. This manual describes the maintenance procedures, how to access the unit and remove accumulated sediment and floatables and also includes an operation log.

OGS units will accumulate sediment and should be checked annually. Accumulated sediment can be removed with standard vacuum equipment. Floatable materials include not only oils, but debris. This can also be removed with the same equipment.

Removed material must be deposited at an approved site.

7 Conclusion

The proposed Settlers Ridge East – Phase 3 and Towncentre Place developments were reviewed for the potential for extension of municipal water, sanitary and storm sewers to provide full municipal services.

Jewell found that watermain extensions using 200mm and 250mm pipes with looping will adequately meet pressure requirements for domestic and fire fighting purposes.

The existing 375mm sanitary trunk sewer has sufficient capacity for the two developments and the sewer extension provides future connection opportunities. The trunk will be reduced to 300mm at the east intersection of Cousins Crescent. A 300mm trunk sewer will be extended along the east leg of Cousins Crescent and a 200mm sewer along the west leg. A local 250mm sewer is provided for Towncentre Place.

Storm sewers range in size from 300mm to 675mm. Three new outlets are proposed to the existing Norbelle Creek stormwater management system. Quantity control has been demonstrated in a separate report by Jewell Engineering in 2017 and in a Design Brief April 11, 2024 submitted under separate cover.

Stormwater quality treatment is addressed using a combination of technologies approach including OGS units and grassed swales. The water quality treatment target of *Enhanced* is achieved.

The water, sanitary and storm sewer systems proposed for SRE Ph 3 and Towncentre developments have been designed following the most current ministry and City of Belleville design standards.

Prepared by:

Submitted by:

Julie Humphries, C.E.T.
Jewell Engineering Inc.

Bryon Keene, P.Eng.
Jewell Engineering Inc.

8 References and Specifications

8.1 Watermain

The information used to prepare this report is based on the following documents and information provided as noted below:

- City of Belleville Standard Specifications
  - 1010 Watermain Distribution – General
  - 1020 Watermain Distribution Design – General
  - 1030 Watermain Distribution Construction – General
  - 1110 Watermain Pipe
  - 1120 Watermain Flow Control Valves
  - 1130 Fire Hydrants
  - 1140 Service Pipes
  - 1150 Meters
  - 1160 Corrosion Protection
  - 1170 Temporary Watermains
  - 1190 Commissioning New Watermains
  - SD-WD-1001 Pipe Embedment
  - SD-WD-1002 Mechanical Joint Restraint
  - SD-WD-1010 Deflection of Watermain Under New Sewer
  - SD-WD-1011 Deflection of Watermain Under Existing Sewer
  - SD-WD-1020 Watermain Pipe Installed in Encasement (Trenchless)
  - SD-WD-1021 Watermain Pipe Installed in Encasement (Open Trench)
  - SD-WD-1030 Styrofoam Insulation for Existing Shallow Watermains
  - SD-WD-1031 Placement of Watermain Adjacent to Catch Basin
  - SD-WD-1040 Blow-off Assembly
  - SD-WD-1041 Temporary Bacteriological Test Sampling Assembly
  - SD-WD-1101 Fire Hydrant Installation
  - SD-WD-1201 Copper Water Service
  - SD-WD-1202 Polyethylene Water Service
  - SD-WD-1210 Styrofoam Insulation for Existing Shallow Water Services
  - SD-WD-1301 Valve Bypass Assembly
  - SD-WD-1901 Terminology Used for Drinking Water Systems Servicing Buildings
- Ontario Ministry of Environment
  - Design Guidelines for Drinking-Water Systems, 2008
- Fire Underwriters Survey
  - Water Supply for Public Fire Protection, 2020

8.2 Sanitary Sewer

The information used to prepare this report is based on the following documents and information provided as noted below:

- Ontario Ministry of Environment
  - Design Guidelines for Sewage Works, 2008
  - Design Criteria for Sanitary Sewers, Storm Sewers, and Forcemains for Alterations Authorized under an Environmental Compliance Approval, v2.0, 2023
- Climate Atlas (www.climateatlas.ca)

8.3 Storm Sewer

The information used to prepare this report is based on the following documents and information provided as noted below:

- Ontario Ministry of Environment
  - Stormwater Management Planning and Design Manual, 2003
  - Design Guidelines for Sewage Works, 2008
  - Design Criteria for Sanitary Sewers, Storm Sewers, and Forcemains for Alterations Authorized under an Environmental Compliance Approval, v2.0, 2023
- Articles
  - Pollutant Removal and Hydraulic Reduction Performance of Field Grassed Swales during Runoff Simulation Experiments, Terry Lucke et al, Water, 2014

APPENDIX A:
MUNICIPAL SERVICING REVIEW AND STUDY UPDATE
CANNIFTON SECONDARY PLAN

BELLEVILLE
on the Bay of Quinte

MUNICIPAL SERVICING REVIEW AND STUDY UPDATE

CANNIFTON SECONDARY PLAN

Prepared for:
The City of Belleville
City Hall
169 Front Street
Belleville, ON
K8N 2Y8

Prepared by:
The Greer Galloway Group Inc.
1620 Wallbridge-Loyalist Road
Belleville, ON, K8N 4Z5
File No. 1337538

Revised - Final Report Dated: February 3rd, 2014

City of Belleville

MEMORANDUM

TO: File

FROM: Barry Simpson, Senior Project Manager
Engineering and Development Services Department

DATE: November 3, 2014

RE: City of Belleville Memo Amendment to Report

On January 14, 2014 the following staff of the Engineering and Development Services Department met to discuss the Municipal Servicing Review and Study Update for the Cannifton Secondary Plan report (hereafter referred to as the report) and the servicing of the Heritage Park Subdivision: Rod Bovay, Ray Ford, Spencer Hutchison, Art MacKay, Phil Cantelo and Barry Simpson.

At the conclusion of the meeting it was the consensus of the group that the preferred solution for the servicing of Mineral Road and Maitland Drive and the Heritage Park Subdivision development was to extend the trunk sewer up Mineral Road to Maitland Drive with only a local sewer being installed on Maitland Drive while maintaining the Canniff Mills pumping station in operation. Until such time as the sewer is installed on Maitland Drive the Developer of the Heritage Park Subdivision would be permitted to construct a portion of the local sewer on Maitland Drive outletting into the Canniff Mills sewage pumping station to service their development. Upon the completion of the local sewer on Maitland Drive outletting into the Mineral Road sewer the Heritage Park Subdivision sewer flows would be redirected into this new sewer. The sewer installed for the temporary servicing of the subdivision directing flows to the sewage pumping station would remain in place and would be used to service the Maitland Drive properties fronting onto this sewer. While this option requires the Canniff Mills pumping station to remain in operation the potential for decommissioning the station at some point in the future still remains. To decommission the pumping station in the future a trunk sewer along the Moira River and down Parks Drive outletting into either the Mineral Road or Millennium Parkway trunk sewers as identified in the report would be required.

With the decision to keep the Canniff Mills pumping station in operation it was agreed that the upgrades recommended in the report need to be undertaken. Particular emphasis was placed on the need to upgrade the existing 10 HP pump #1 to a 20 HP capable of delivering a flow of 80 L/s at 7.5 m TDH the same as pump #2 to bring the stations firm pumping capacity into compliance with the MOE Certificate of Approval for the station.

The general consensus regarding the two 600mm segments on Millennium Parkway that were identified and recommended in the report to be upsized to 750 mm pipes was that they would not be upsized as part of the Mineral Road / Maitland Drive project. It was decided that these segments should be monitored in the future as more development occurs to determine if and when these pipe segments would require upgrading.

Yours Truly,

Barry Simpson

Barry Simpson

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List of Tables

1.0 Introduction

The City of Belleville retained the Greer Galloway Group to undertake an assessment and comprehensive review and update of the Cannifton Secondary Plan Sanitary Sewer Servicing Study from January 2001. As part of the exercise the siphon capacity was reviewed and the possibility of eliminating the Moira Lea/ Canniff Mills Pumping Station was considered. This study focused on the evaluation of the sanitary sewer collection system.

An inventory of the existing development within the Cannifton Study area was undertaken, and an assessment was made in consultation with City Planning staff concerning the probable ultimate growth based on the existing zoning and probable redevelopment of the study area.

The goal of this assignment was to determine the capacity of the sanitary sewer system within the Cannifton area, its ability to meet current and projected demands for future growth, determine the capacity and limitations of the siphon, and determine the feasibility of eliminating the Moira Lea/Canniff Mills pumping station.

The City is planning to extend the sanitary sewer to Mineral Road, and requested GGG to look at the possibilities of providing services to Maitland Drive, Farnham Road, Bird Crescent, Thurlow Drive, Oakwood Lane, Scott Drive and Towncentre Drive.

This report includes recommendations regarding the upgrade of the sanitary network that has reached or exceeded their service life/capacity, documents the deficiencies and bottlenecks in the system and provides justification of the need for upgrades, improvements or expansion. It identifies solutions to provide the immediate and long-term needs of the wastewater services to the Cannifton Area and the Moira Lea/ Canniff Mills Pumping Station.

2.0 Existing Conditions

Since the initial report done in 2000, growth in the Cannifton Planning Area has advanced at a quick pace and the sanitary sewer servicing conceptual plan has been updated along the way to accommodate development and growth as it occurred.

There are a number of developments within the service area that are currently not connected to the sanitary system at this time, but will be in the future. Currently the Moira Lea/Canniff Mills pumping station only services the Moira Lea/Canniff Mills subdivision and pumps across the river into the Cannifton Road North gravity system. The siphon currently receives flows from the west side of the Cannifton Study area and also ties into the Cannifton Road North gravity system further down. As part of the study the City would like to determine if the siphon and downstream system have the capacity to eliminate the pumping station and re-direct all flows through the siphon.

3.0 Planning Review

3.1 Cannifton Secondary Plan and Industrial Land Study Areas: Assessment of Growth Potential for Upgrading of Municipal Services

This assessment presents growth scenarios for the Cannifton Secondary Plan area and the adjacent Industrial lands located north of Highway 401 in the City of Belleville. Growth potential is based upon an estimate of the total future commercial floor area as well as estimated total number of residential units.

The Study Area includes properties within the Cannifton Secondary Plan (shown in red) and the Industrial Lands to the east of this area (shown in yellow), see Study Area and Land Use Map provided in Appendix A. An inventory of the existing property characteristics has been prepared for each lot along these streets within the Study Area. These characteristics include:

a) Street Address
b) Building Name
c) Existing Land Use
d) Zoning
e) Estimated Number of Storeys
f) Lot Area (m^2)
g) Zoning Lot Coverage (%)

The following sources of information were used in the evaluation of the estimated total commercial and industrial floor area as well as the total number of estimated residential units for each scenario:

a) Key Map, Cannifton Secondary Plan (Revised Dec. 1999) Sanitary Sewer Servicing Study, City of Belleville
b) Land Use Map provided by the City of Belleville Engineering and Development Services Department
c) Vacant Land Use Map provided by the City of Belleville Engineering and Development Services Department
d) City of Belleville Official Plan, Schedule 'B' Land Use Plan-Urban Service Area
e) Subdivision Plans for the Cannifton area provided by the Greer Galloway Group Inc.
f) Property Information (Area, Location, and Zoning for each property) provided by the City of Belleville Engineering and Development Services Department
g) Schedule A1, A2 and A4 to the Township of Thurlow Zoning By-law No. 3014

The existing land use has been classified into the following categories:

a) Residential
b) Commercial
c) Industrial

Two (2) growth scenarios are presented for the Cannifton Secondary Plan Study Area. Scenario 1: "Maximum Theoretical Capacity: 3 Storeys" assumes the maximum development potential of the Cannifton Secondary Plan Study Area by assuming that every lot designated Commercial or Industrial under the Official Plan can have a building on it that is 3 storeys, in accordance with the maximum building height of the 'M' zones of the Thurlow Zoning By-law. Scenario 2: "Maximum Theoretical Capacity: 1 Storey" generally assumes a lower development potential of the Cannifton Secondary Plan Study Area by assuming that every lot designated Commercial or Industrial under the Official Plan can have a building on it that is only 1 storey. The assumptions for residential development are the same for both scenarios. The following assumptions were also incorporated into the calculations:

- Where land is zoned for a purpose which does not comply with the Official Plan designation, then zoning for uses permitted by the Official Plan will apply.
- Non-parkland related lands zoned for Community Facility (CF) uses are considered in accordance with the use of land designated under the Official Plan.
- Properties that are designated for Commercial and Industrial uses in the Official Plan have a 30% lot coverage and are all fully serviced.
- Commercial and Industrial floor area calculations are determined by total lot area x 30% lot coverage x the number of storeys.
- Two (2) Residential density calculations have been used depending on the following scenarios:
  - For properties that are designated for Residential uses in the Official Plan but have lands zoned for non-residential uses, including C1, C2, C3, M1, M2, M3, CF, D, D-r, CF, PA, or RU zones, the following calculation has been used: total lot area x 4.5 units/acre or 1 unit/900m^2 which was used as the residential density factor. An actual residential density factor of 1 unit/922m^2 was determined by obtaining the average density of the Settlers Ridge, Canniff Mill Estates and Deerfield Park subdivisions. This value has been rounded down to 900m^2 for estimate purposes.
  - Where properties are designated for Residential uses in the Official Plan and zoned for residential uses in the Zoning By-law and have a lot area greater than 1000m^2 then the number of units/acre have been applied. If the lot area is less than 1000m^2 then the number of residential units/lot have been applied.
    - Residential (R1) zones have 1 residential unit/lot or 5 units/acre.
    - Residential (R2) zones have 2 residential units/lot or 7 units/acre.

        - Residential (R3) zones have 4 residential units/lot or 9 units/acre.
        - Residential (R4) zones have 1 unit/freehold lot or 11 units/acre.
        - Rural Residential (RR) zones have 1 unit/lot or 4.5 units/acre.
        - Estate Residential (ER) zones have 1 unit/lot or 4.5 units/acre.
        - Hazard (H) zones have no development potential.
- Where more than 2 Official Plan designations are located on a property, a visual estimate of each designation was determined and then incorporated into the following calculations depending on the scenario:
    - Mix of Commercial and Industrial designations: % of property under each designation x total lot area x estimated lot coverage x number of storeys
    - Mix of Commercial and/or Industrial with Residential:
        - For Commercial and/or Industrial portions of the property: same as the calculations for Mix of Commercial and Industrial designations: % of property under each designation x total lot area x estimated lot coverage x number of storeys.
        - For Residential portions of the property: % of property under residential designation x total lot area x by number of units/acre for each zone as listed above for residential designations.
- St. Marks Church is 1 storey.
- The Christian Belleville School is 1 storey.
- It is assumed that the property owned by the Trust Cannifton Board is a cemetery and therefore has no development potential.

Two (2) growth scenarios are presented for the Industrial Lands Study Area to the East of the Cannifton Secondary Plan Study Area. Scenario 1: "Maximum Theoretical Capacity: 3 Storeys" assumes the maximum development potential of the Industrial Lands Study Area by assuming that every lot designated Commercial or Industrial under the Official Plan can have a building on it that is 3 storeys, in accordance with the maximum building height of the 'M' zones of the Thurlow Zoning By-law. Scenario 2: "Maximum Theoretical Capacity: 1 Storey" generally assumes a lower development potential of the Industrial Lands Study Area by assuming that every lot designated Commercial or Industrial under the Official Plan can have a building on it that is only 1 storey. The above assumptions were also incorporated into the calculations.

Based on the above assumptions, the total floor area for commercial and industrial lands as well as the estimated number of residential units for all scenarios was calculated in Table 1. The results are summarized as follows:

Table 1 – Cannifton Secondary Plan Study Area

	Estimated Floor Area Commercial (m^2)	Estimated Floor Area Industrial (m^2)	Estimated Units Residential
Scenario 1	1,864,000	2,179,186	4,451
Scenario 2	626,421	726,395	4,451

*Due to properties such as churches and schools which will have the same floor areas in each scenario, scenario 1's floor areas will not be exactly three times that of scenario 2.

Table 2 - Industrial Lands Study Area to the East of the Cannifton Secondary Plan Study Area

	Estimated Floor Area Commercial (m^2)	Estimated Floor Area Industrial (m^2)	Estimated Units Residential
Scenario 1	n/a	2,913,127	n/a
Scenario 2	n/a	971,042	n/a

4.0 Sanitary Sewer Servicing

The existing and proposed sanitary sewer pipes were designed based on the City's and MOE criteria as shown in Table 3.

Table 3 – Sanitary Sewer Design Criteria for Commercial, Industrial and Residential Development

Category	**Sewage Flow**
Existing Commercial/Industrial	1.05 l/s/ha (includes allowance for infiltration)
Proposed Commercial/Industrial (Study Area)	5000 l/1000m^2/day (based on total floor area)
Residential	350 l/cap/day infiltration rate = 0.28 l/s/ha 3.0 persons/unit

Where there was information provided on existing sewers the size and material of the pipe was included within the breakdown. Where no information was provided or where new sewer was proposed, theoretical pipe sizes that can handle the capacity was provided.

The Cannifton Study area was evaluated based on three options, each with two scenarios as described below.

Option A – Scenario 1: This option considered the removal of the Moira Lea/Canniff Mills pumping station and assumed a maximum capacity of 3 storeys for all commercial and industrial properties. Although the siphon had capacity, the two sections of pipe upstream of the siphon were over capacity as well as multiple sections downstream of the siphon, these pipes have been highlighted in both the sanitary sizing table and correlating sanitary sewer drawing in Appendix B. It should be noted that to provide the required capacity for the proposed sanitary sewer, tying drainage area 7F into the existing pipes in area 7G, that it would be tying a larger diameter pipe (675mm) into the existing 600mm diameter pipe. It is usually not recommended to downsize pipe sizes in a system, and thus replacing/upsizing these two pipe sections (MH 29 to MH 28 and MH 28 to Siphon) should be done.

Option A – Scenario 2: This option considered the removal of the Moira Lea/Canniff Mills pumping station and assumed a maximum build out of 1 storey for all commercial and industrial properties. Although the siphon had capacity, the two sections of pipe upstream of the siphon were over capacity as well as multiple sections downstream of the siphon, these pipes have been highlighted in both the sanitary sizing table and correlating sanitary sewer drawing in Appendix B. It should be noted that to provide the required capacity for the proposed sanitary sewer, tying drainage area 7F into the existing pipes in area 7G, that it would be tying a larger diameter pipe (675mm) into the existing 600mm diameter pipe. It is usually not recommended to downsize pipe sizes in a system, and thus replacing/upsizing these two pipe sections (MH 29 to MH 28 and MH 28 to Siphon) should be done.

Option B – Scenario 1: This option left the Moira Lea/Canniff Mills pumping station in service and assumed a maximum capacity of 3 storeys for all commercial and industrial properties. The Cannifton Road sanitary pipe downstream of the pumping station did not have capacity for the full build out of the Moira Lea Canniff Mills subdivision. The siphon had capacity however the two sections of pipe upstream of the siphon were over capacity as well as multiple sections downstream of the siphon, these pipes have been highlighted in both the sanitary sizing table and correlating sanitary sewer drawing in Appendix B.

Option B – Scenario 2: This option left the Moira Lea/Canniff Mills pumping station in service and assumed a maximum capacity of 1 storey for all commercial and industrial properties. The Cannifton Road sanitary pipe downstream of the pumping station did not have capacity for the full build out of the Moira Lea Canniff Mills subdivision. The sanitary sewers upstream of the siphon as well as the siphon had capacity however the sewer at the end of the system prior to crossing the 401 did not have capacity; these pipes have been highlighted in both the sanitary sizing table and correlating sanitary sewer drawing in Appendix B.

For all of the above options, one pipe that was severely under capacity was the 200mm pipe from MH 7B to MH 7 servicing drainage area 10B. This pipe was shown as a 675mm on the original sewer servicing study drawing; however in the background information provided to us by the City, the plan and profiles sized it as a 200mm. The actual size of this pipe has been confirmed as 200mm and as such results in capacity issues.

It should also be noted that in most of the options to provide the required capacity for the proposed sanitary sewer tying into the pipes upstream of the siphon (MH 29A to MH 29), that a larger diameter pipe (675mm) then what it is tying into (600mm) is required. It is usually not recommended to downsize pipe sizes in a system. If the two sections of pipe before the siphon (MH 29 to MH 28 and MH 28 to Siphon) were replaced/upsized to 750mm, the entire system upstream of the siphon in all options would have capacity and it would eliminate the problem of downsizing within the system.

Since both options A and B above resulted in capacity issues within the system with the main concern being the pipe that passes under the 401, a third and fourth option was considered. Option C and Option D look at the impact on the system if we consider not servicing the commercial/industrial areas to the east (Areas 10A, 10B, 10C). For both these options only scenario 1 (Maximum capacity of 3 storeys for all commercial and industrial properties) was considered as it results in the worst case scenario.

> **Option C – Scenario 1:** This option considered the removal of the Moira Lea/Canniff Mills pumping station, assumed a maximum capacity of 3 storeys for all commercial and industrial properties, and did not service the commercial/industrial properties to the East (Areas 10A, 10B, 10C). This option showed the two pipe sections immediately upstream of the siphon did not have capacity (MH29 to MH 28 and MH 28 to Siphon), as well as a good portion of the Cannifton Road pipes. These pipes have been highlighted in both the sanitary sizing table and correlating sanitary sewer drawing in Appendix B. This option still resulted in the sanitary pipe passing under the 401 to be over capacity.

> **Option D – Scenario 1:** This option left the Moira Lea/Canniff Mills pumping station in service, assumed a maximum capacity of 3 storeys for all commercial and industrial properties, and did not service the commercial/industrial properties to the East(Areas 10A, 10B, 10C). This option resulted in only the Cannifton Road sanitary pipes to have capacity issues, these pipes have been highlighted in both the sanitary sizing table and correlating sanitary sewer drawing in Appendix B. This option still resulted in the sanitary pipe passing under the 401 to be over capacity.

Sanitary sewer design sheets and corresponding drawings highlighting the over capacity pipe sections for all options are provided in Appendix B. The correlating Sanitary Drainage Area Drawing is provided in Appendix C.

Overall all options showed common problem areas; the Cannifton Road sanitary sewers, the two pipe sections directly upstream of the siphon (MH 29 to MH 28 and MH 28 to Siphon), and the pipes passing under the 401. Of these over capacity pipes the most costly ones to replace would be the pipes running under the 401.

4.1 Sewer Extension Cost Estimate

We have considered the preliminary costs associated with extending the proposed sewer services within the existing road allowances, and have summarized them below in Table 4.

Table 4 – Sanitary Sewer Extension Cost Summary

Road Allowance	Sanitary Sewer Diameter (mm)	Length (m)	Cost/m	Total
West of Highway 62				
Thurlow Dr.	200	175	$ 550.00	$ 96,250.00
Bird Cres.	200	280	$ 550.00	$ 154,000.00
Maitland Dr.	200	565	$ 550.00	$ 310,750.00
East of Highway 62				
Farnham Rd.	200	2060	$ 650.00	$ 1,339,000.00
Oakwood Ln.	200	300	$ 670.00	$ 201,000.00
Maitland Dr.	250	260	$ 670.00	$ 174,200.00
Maitland Dr.	350	440	$ 670.00	$ 294,800.00
Parks Dr.	250	1140	$ 670.00	$ 763,800.00
Mineral Road	450	354	$ 700.00	$ 247,800.00
Mineral Road	675	296	$ 750.00	$ 222,000.00
Upsize Existing Sewer				
MH 29 - MH 28	750	128	$ 920.00	$ 117,760.00
MH 28 - Siphon	750	130	$ 920.00	$ 119,600.00

Cost estimates were determined per meter of sanitary sewer to be installed. These per meter costs include sanitary sewer, sanitary services, sanitary maintenance holes, and replacement for the width of the trench with 300mm granular "B", 150mm granular "A", 50mm HL8 and 40mm HL3. Installation costs have also considered rock removal. For streets West of Highway 62 we have assumed rock to be 2m below ground level, and for streets East of Highway 62 we have assumed rock to be 1m below ground level.

5.0 Siphon Capacity Review

As part of the Cannifton Secondary Plan study and update, determining the capacity of the siphon was tasked to XCG Environmental Engineers and Scientist. XCG reviewed the details and drawings provided by the City and were able to determine the current capacity of the siphon to be 464 l/s. XCG's final report has been attached in Appendix D. This capacity was entered into the sanitary sizing tables and showed that in both scenarios, with or without the pumping station, the siphon has the capacity to handle the entire sanitary flows in future build out conditions. However parts of the upstream and downstream pipe network do not have the capacity for full future build out.

6.0 Moira Lea / Canniff Mills Pumping Station

A site visit was made to the Moira Lea/Canniff Mills pumping station to perform a detailed assessment. The following is a list of observations and recommendations;

- Sewage pump #1 has been re-built and the impeller was changed to an "N" style however it is still only a 10 HP pump. Since the rated capacity is defined as the pumping capacity with the largest pump out of service, the firm capacity of this station is limited by the 10 HP pump. If there are ever issues with insufficient flow capacity of the station than sewage pump #1 should be upgraded to one that is of equal size/capacity to sewage pump #2. If this is done the overload protection should be upgraded to meet the new pump capacity and leak protection should be added for the larger pump;

- One section of the wet well ladder access handrail should be re-installed;
- Consideration should be given to removable handrail around the wet well hatches; and,
- A flow meter controller needs to be reinstated;

The existing Amended Certificate of Approval (Number 3-0887-96-007), was for the construction of this pumping station to be equipped with two sewage submersible pumps each capable of delivering 80 litres per second at 7.5 meters TDH. From XCG's inspection report and confirmed by our site visit, the current pumping station does not conform to the current C of A. This leaves the City with two options if they choose to have the pumping station remain in operation;

a) Upgrade pump #1 to a 20 HP pump so that both pumps are capable of delivering the same flow; or,
b) Amend the certificate of approval and reduce the pumping capacity of the station accordingly.

7.0 Life Cycle Cost Analysis

A cost analysis was done to compare the following three options;

1) Demolish the Moira Lea/Canniff Mills pumping station and direct all sanitary flows down Maitland Drive and Mineral Road to tie into the existing system on Millenium Parkway;
2) Demolish the Moira Lea/Canniff Mills pumping station and direct all sanitary flows down Parks Drive and Mineral Road to tie into the existing system on Millenium Parkway; and,
3) Leave the Moira Lea/Canniff Mills pumping station operational.

For the above, options 1 and 2 pipe capacity was checked using Option A Scenario 1 to accommodate the worst case scenario. This revised sanitary sizing table has been attached in Appendix B.

The City of Belleville uses a life cycle of 60 years for their pumping stations and 100 years for their sanitary sewer networks. For this life cycle cost analysis we have used a life cycle of 102 years (to allow for two replacements of the pumping station) and for a more accurate comparison between the pumping station and sanitary sewers.

The following equation was used to calculate present value for an annually recurring fixed cost;

$$PV = TV(UPW)$$
where
$$UPW = \frac{(1+d)^n-1}{d(1+d)^n}$$

PV = Present Value
TV = Todays Value
UPW = Uniform Present Worth factor of fixed recurring costs
d = real discount rate
  = interest rate – inflation rate
n = analysis period (years)

The following equation was used to calculate present value for a future investment/one time investment;

$$PV = TV\ \frac{(1+e)^n}{(1+d)^n}$$

PV = Present Value
TV = Todays Value
d = real discount rate
  = interest rate – inflation rate
n = analysis period (years)
e = real growth escalation rate

Option 1: Sanitary System down Maitland Drive

Should the City choose to demolish the pumping station and run all sanitary flows down Maitland Drive, the proposed sanitary system would need to be significantly deeper to allow for a gravity fed system. The cost to demolish the pumping station and install deeper sanitary sewers down Maitland Drive to tie into the Mineral Road trunk is as follows;

Table 5 – Sanitary Sewer Maitland Drive Cost Summary

Road Allowance	Sanitary Sewer Diameter (mm)	Length (m)	Cost/m	Total
SA1 (Moira Lea) to SA23 - East of Highway 62				
Maitland Dr.	450	60	$ 700.00	$ 42,000.00
Maitland Dr.	525	700	$ 1,300.00	$ 910,000.00
			Demolish Pumping Station	$ 100,000.00
			Total =	**$ 1,052,000.00**

The costs for the above sanitary sewer were based on the same assumptions stated in Section 4.1 with the exception of rock depth. For this option, to allow for a gravity fed system, the new pipes on Maitland drive would need to be 5-6 meters deeper than the existing sanitary sewer leaving Heritage Park Subdivision.

This would also affect the cost of the Mineral Road sanitary system as it would also need to be installed deeper to accommodate the Maitland Drive sewers (compared to the costs shown in Section 4.1 - $469,800). It would also require an increase in pipe size to accommodate increased flows from the Moira Lea/Caniff Mills Subdivision. These costs would be as follows;

Table 6 – Sanitary Sewer Mineral Road Cost Summary

Road Allowance	Sanitary Sewer Diameter (mm)	Length (m)	Cost/m	Total
SA23 to MH 29 - East of Highway 62 (To accommodate Deeper Sanitary)				
Mineral Road	675	650	$ 780.00	$ 507,000.00
			Total =	**$ 507,000.00**

Option 1 would result in a total construction cost of approximately $1.65 million.

Option 2: Sanitary System down Parks Road

Should the City choose to eliminate the pumping station, the cost to demolish the building and install new sanitary sewers down Parks Drive to tie into the proposed Mineral Road trunk is as follows;

Table 7 – Sanitary Sewer Parks Road Cost Summary

Road Allowance	Sanitary Sewer Diameter (mm)	Length (m)	Cost/m	Total
SA1 (Moira Lea) to MH 29A - East of Highway 62				
Parks Drive	450	400	$ 750.00	$ 300,000.00
Parks Drive	525	740	$ 865.00	$ 640,100.00
			Demolish Pumping Station	$ 100,000.00
			Total =	**$ 1,040,100.00**

The costs for the above sanitary sewer were based on the same assumptions stated in Section 4.1.

Option 2 would result in a total construction cost of approximately $1.1 million.

Option 3: Leaving the pumping station operational:

The existing Moira Lea/Canniff Mills pumping station (Thurlow Bridge Station) was built in 1996. XCG performed their inspection in 2010 when the pumping station was 14 years old. At the time of inspection the station was anticipated to have a remaining service life of 46 years and would need to be replaced in 2056 at an anticipated cost of $950,000. Since we are comparing the pumping station life cycle costs to that of a sanitary sewer system we have considered a 102 year life cycle.

Currently the average annual operating expenses to run the Moira Lea/Canniff Mills pumping station is approximately $20,000 (based on the past four years 2010-2013). It has been assumed that the City will need to have a capital improvement reserve of $5,000 per year for upgrades or repairs above the operating costs. The following assumptions were used to calculate present value for annual operating costs;

TV = $25,000
d = 3% - 2%
  = 1%
n = 102 years
Thus UPW = 13.5903

PV_{annual} = $25,000 (63.7574)
PV_{annual} = $1,593,935.00

The estimated cost to replace the pumping station is $950,000 of which is going to be applied to the life cycle analysis in 42 years (2056). The following assumptions were used to calculate present value for future investments/replacement cost;

TV = $950,000
d = 3%-2%
  = 1%
n = 42 years
e = 0 (we have assumed that the their will be no escalation rate outside of inflation for construction costs).
Thus
$PV_{n=42}$ = $625,497.97

Therefore the total present worth of the pumping station is;

PV_{total} = PVannual + $PVn_{=42}$
= $1,593,935.00 + $625,497.97
= $2,219,432.97

To leave the pumping station in operation and have sanitary flows from Moira Lea/Caniff Mills subdivision continue as is the present value over a 102 year life cycle would be approximately $2.2 million.

8.0 Conclusions and Recommendations

The Greer Galloway Group has evaluated the existing sanitary sewer infrastructure within the Cannifton Area and has come to the following conclusions;

- In all scenarios the main concern or bottleneck within the Cannifton study area, is the Cannifton trunk that passes under Highway 401. Whether the pumping station is eliminated or not, the existing pipe size (675mm in diameter), does not have the capacity to handle the full servicing and build out of the Cannifton study area.

- In all scenarios the Cannifton Road sanitary sewer has capacity issues.
- In most of the scenarios the two 600mm sections of pipe upstream of the siphon (MH 29 to MH 28 and MH 28 to Siphon) are over capacity. Increasing these to 750mm diameter pipes would remove this capacity issue.
- The siphon has ample capacity to handle the elimination of the pumping station, however as mentioned above, the system downstream of the siphon does not have the capacity for future build out.
- By not servicing the commercial/industrial areas to the East (Areas 10A, 10B, 10C), the trunk passing under the 401 still does not have capacity to service the build out of the remaining areas of the Cannifton Study area.
- The Moira Lea/Canniff Mills pumping does not currently conform to the certificate of approval and as such if the City chooses to keep the pumping station operational should either amend the C of A or upgrade pump #1 to 20 HP.
- Based on the life cycle analysis comparing the options of 1) removing the pumping station and directing flows down Maitland Drive, 2) removing the pumping station and directing flows down Parks Drive, and 3) leaving the pumping station in operation, option 2 is the least costly.

If the city intends to fully develop the entire Cannifton area several upgrades to existing sanitary pipes would need to be done, including what could be a costly upgrade to the sewer crossing under Highway 401. With or without the Moira Lea/Canniff Mills pumping station, the siphon has sufficient capacity.

Yours truly,
THE GREER GALLOWAY GROUP INC.
ENGINEERS AND PLANNERS

LICENSED PROFESSIONAL ENGINEER
J. BLAKEY
Feb /14
PROVINCE OF ONTARIO

S. Blakey, P.Eng.
Sr. Engineer

Adele Voldock, P.Eng.

Appendix A – Jp2g Report and Study Area and Land Use Map

Cannifton Secondary Plan and Industrial Land Study Areas: Assessment of Growth Potential for Upgrading of Municipal Services

This assessment presents growth scenarios for the Cannifton Secondary Plan area and the adjacent Industrial lands located north of Highway 401 in the City of Belleville. Growth potential is based upon an estimate of the total future commercial floor area as well as estimated total number of residential units.

The Study Area includes properties within the Cannifton Secondary Plan (shown in red) and the Industrial Lands to the east of this area (shown in yellow) on the attached Study Area and Land Use Map. An inventory of the existing property characteristics has been prepared for each lot along these streets within the Study Area. These characteristics include:

a) Street Address
b) Building Name
c) Existing Land Use
d) Zoning
e) Estimated Number of Storeys
f) Lot Area (m^2)
g) Zoning Lot Coverage (%)

The following sources of information were used in the evaluation of the estimated total commercial and industrial floor area as well as the total number of estimated residential units for each scenario:

a) Key Map, Cannifton Secondary Plan (Revised Dec. 1999) Sanitary Sewer Servicing Study, City of Belleville
b) Land Use Map provided by the City of Belleville Engineering and Development Services Department
c) Vacant Land Use Map provided by the City of Belleville Engineering and Development Services Department
d) City of Belleville Official Plan, Schedule 'B' Land Use Plan-Urban Service Area
e) Subdivision Plans for the Cannifton area provided by the Greer Galloway Group Inc.
f) Property Information (Area, Location, and Zoning for each property) provided by the City of Belleville Engineering and Development Services Department
g) Schedule A1, A2 and A4 to the Township of Thurlow Zoning By-law No. 3014

The existing land use has been classified into the following categories:

a) Residential
b) Commercial
c) Industrial

Two (2) growth scenarios are presented for the Cannifton Secondary Plan Study Area. Scenario 1: "Maximum Theoretical Capacity: 3 Storeys" assumes the maximum development potential of the Cannifton Secondary Plan Study Area by assuming that every lot designated Commercial or Industrial under the Official Plan can have a building on it that is 3 storeys, in accordance with the maximum building height of the 'M' zones of the Thurlow Zoning By-law. Scenario 2: "Maximum Theoretical Capacity: 1 Storey" generally assumes a lower development potential of the Cannifton Secondary Plan Study Area by assuming that every lot designated Commercial or Industrial under the Official Plan can have a building on it that is only 1 storey. The assumptions for residential development are the same for both scenarios. The following assumptions were also incorporated into the calculations:

- Where land is zoned for a purpose which does not comply with the Official Plan designation, then zoning for uses permitted by the Official Plan will apply.
- Non-parkland related lands zoned for Community Facility (CF) uses are considered in accordance with the use of land designated under the Official Plan.
- Properties that are designated for Commercial and Industrial uses in the Official Plan have a 30% lot coverage and are all fully serviced.
- Commercial and Industrial floor area calculations are determined by total lot area x 30% lot coverage x the number of storeys.
- Two (2) Residential density calculations have been used depending on the following scenarios:
  - For properties that are designated for Residential uses in the Official Plan but have lands zoned for non-residential uses, including C1, C2, C3, M1, M2, M3, CF, D, D-r, CF, PA, or RU zones, the following calculation has been used: total lot area x 4.5 units/acre or 1 unit/900m^2 which was used as the residential density factor. An actual residential density factor of 1 unit/922m^2 was determined by obtaining the average density of the Settlers Ridge, Canniff Mill Estates and Deerfield Park subdivisions. This value has been rounded down to 900m^2 for estimate purposes.
  - Where properties are designated for Residential uses in the Official Plan and zoned for residential uses in the Zoning By-law and have a lot area greater than 1000m^2 then the number of units/acre have been applied. If the lot area is less than 1000m^2 then the number of residential units/lot have been applied.
    - Residential (R1) zones have 1 residential unit/lot or 5 units/acre.
    - Residential (R2) zones have 2 residential units/lot or 7 units/acre.
    - Residential (R3) zones have 4 residential units/lot or 9 units/acre.
    - Residential (R4) zones have 1 unit/freehold lot or 11 units/acre.
    - Rural Residential (RR) zones have 1 unit/lot or 4.5 units/acre.
    - Estate Residential (ER) zones have 1 unit/lot or 4.5 units/acre.
    - Hazard (H) zones have no development potential.
- Where more than 2 Official Plan designations are located on a property, a visual estimate of each designation was determined and then incorporated into the following calculations depending on the scenario:
  - Mix of Commercial and Industrial designations: % of property under each designation x total lot area x estimated lot coverage x number of storeys
  - Mix of Commercial and/or Industrial with Residential:
    - For Commercial and/or Industrial portions of the property: same as the calculations for Mix of Commercial and Industrial designations: % of property

under each designation x total lot area x estimated lot coverage x number of storeys.
  - For Residential portions of the property: % of property under residential designation x total lot area x by number of units/acre for each zone as listed above for residential designations.
- St. Marks Church is 1 storey.
- The Christian Belleville School is 1 storey.
- It is assumed that the property owned by the Trust Cannifton Board is a cemetery and therefore has no development potential.

Two (2) growth scenarios are presented for the Industrial Lands Study Area to the East of the Cannifton Secondary Plan Study Area. Scenario 1: "Maximum Theoretical Capacity: 3 Storeys" assumes the maximum development potential of the Industrial Lands Study Area by assuming that every lot designated Commercial or Industrial under the Official Plan can have a building on it that is 3 storeys, in accordance with the maximum building height of the 'M' zones of the Thurlow Zoning By-law. Scenario 2: "Maximum Theoretical Capacity: 1 Storey" generally assumes a lower development potential of the Industrial Lands Study Area by assuming that every lot designated Commercial or Industrial under the Official Plan can have a building on it that is only 1 storey. The above assumptions were also incorporated into the calculations.

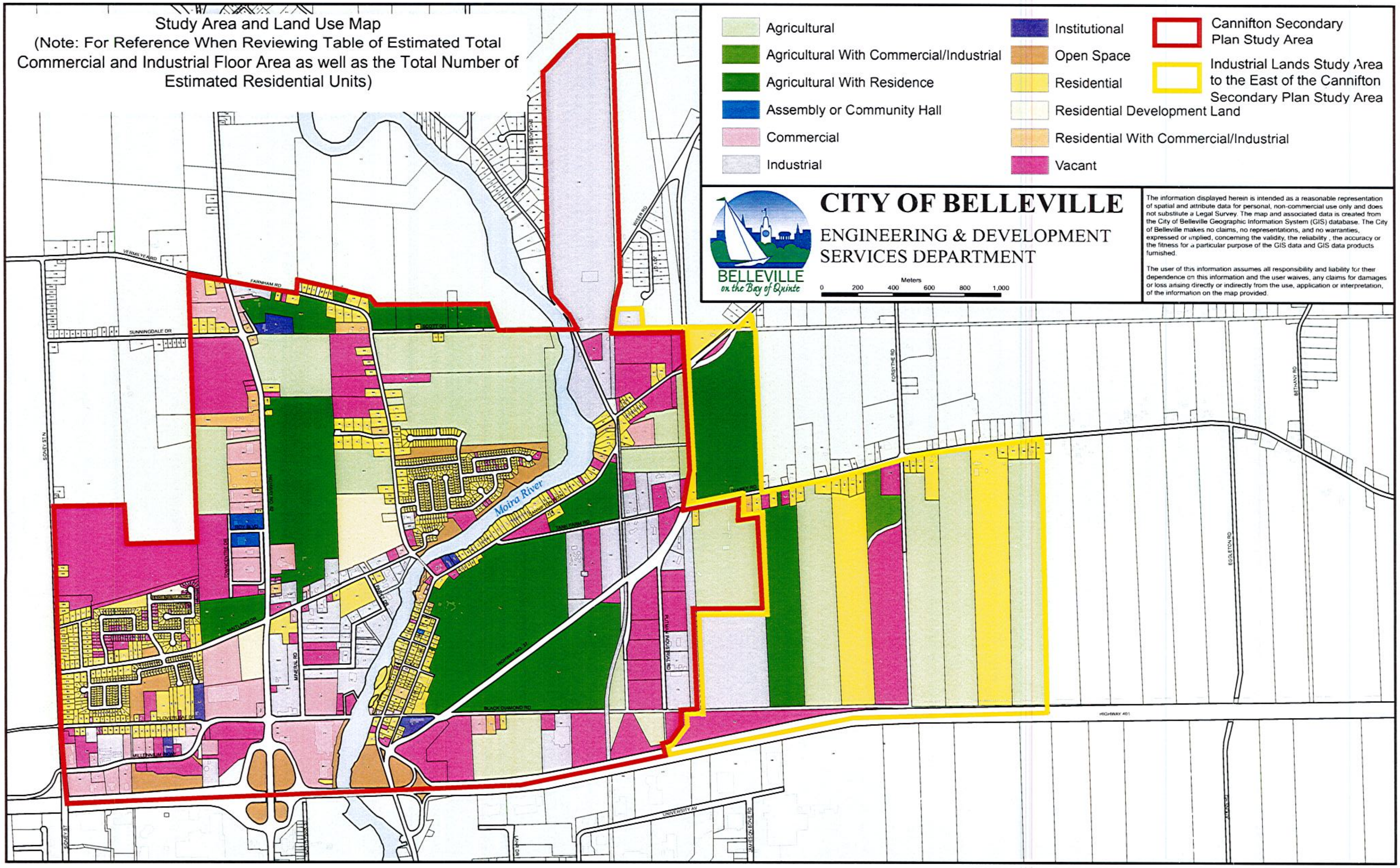
Based on the above assumptions, the total floor area for commercial and industrial lands as well as the estimated number of residential units for all scenarios was calculated in Table 1. The results are summarized as follows:

Cannifton Secondary Plan Study Area

	Estimated Floor Area Commercial (m^2)	Estimated Floor Area Industrial (m^2)	Estimated Units Residential
Scenario 1	1,864,000	2,179,186	4,451
Scenario 2	626,421	726,395	4,451

Industrial Lands Study Area to the East of the Cannifton Secondary Plan Study Area

	Estimated Floor Area Commercial (m^2)	Estimated Floor Area Industrial (m^2)	Estimated Units Residential
Scenario 1	n/a	2,913,127	n/a
Scenario 2	n/a	971,042	n/a


Study Area and Land Use Map
(Note: For Reference When Reviewing Table of Estimated Total Commercial and Industrial Floor Area as well as the Total Number of Estimated Residential Units)
Agricultural
Agricultural With Commercial/Industrial
Agricultural With Residence
Assembly or Community Hall
Commercial
Industrial
Institutional
Open Space
Residential
Residential Development Land
Residential With Commercial/Industrial
Vacant
Cannifton Secondary Plan Study Area
Industrial Lands Study Area to the East of the Cannifton Secondary Plan Study Area
CITY OF BELLEVILLE
ENGINEERING & DEVELOPMENT SERVICES DEPARTMENT
BELLEVILLE on the Bay of Quinte
Meters
0 200 400 600 800 1,000
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The user of this information assumes all responsibility and liability for their dependence on this information and the user waives, any claims for damages or loss arising directly or indirectly from the use, application or interpretation, of the information on the map provided.
Moira River
HIGHWAY 401
FARNHAM RD
VERMILYEA RD
SUNNINGDALE DR
SIDNEY ST N
FORSYTHE RD
BETHANY RD
EGGLESTON RD
BLACK DIAMOND RD
HIGHWAY NO 37
MINERAL RD
UNIVERSITY AV
JAMIESON BONE RD

Table 1: Estimated Total Commercial and Industrial Floor Area as well as the Total Number of Estimated Residential Units

Cannifton Secondary Plan Study Area

Address (Millennium Pkwy.) S. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Scenario 1 Estimated Floor Area Commercial (m2)	Scenario 1 Estimated Floor Area Industrial (m2)	Scenario 1 Estimated Units Residential	Scenario 2 Estimated Floor Area Commercial (m2)	Scenario 2 Estimated Floor Area Industrial (m2)	Scenario 2 Estimated Units Residential
-		Open Space	OS & H	-	10058	10058	-	-	-	-	-	-	-	-
274	Wal-Mart	Commercial	C1	3/1	98854	98854	50	30	88969	-	-	29656	-	-
264														
264A														
262														
260														
-		Residential	C1	3/1	1960	1960	50	30	1764	-	-	588	-	-
-		Vacant-Commercial	C1	3/1	29544	29544	50	30	26590	-	-	8863	-	-
-		Vacant-Commercial	R1	3/1	1752	1752	35	30	1577	-	-	526	-	-
-		Vacant-Commercial	M1	3/1	470	470	50	30	423	-	-	141	-	-
-		Commercial	M1	3/1	7933	7933	50	30	7140	-	-	2380	-	-
-		Vacant-Commercial	S1-2	3/1	741	741	50	30	667	-	-	222	-	-
-		Open Space	S1-1-h & S1-2	3/1	1400	1400	50	30	1260	-	-	420	-	-
-		Vacant-Commercial	S1-1-h & H	3/1	23635	23635	50	30	21272	-	-	7091	-	-
-		Vacant-Commercial	S1-5-h	3/1	2983	2983	50	30	2685	-	-	895	-	-
-		Open Space	S1-5-h & H &D	3/1	39432	39432	50	30	35489	-	-	11830	-	-
60		Commercial	D & C1	3/1	11869	11869	50	30	10682	-	-	3561	-	-
-		Commercial	S1-2	3/1	11775	11775	50	30	10598	-	-	3533	-	-
32		Commercial	S1-2	3/1	4579	4579	50	30	4121	-	-	1374	-	-
146		Commercial	S1-2	3/1	23409	23409	50	30	21068	-	-	7023	-	-

Address (Millennium Pkwy.) N. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Scenario 1 Estimated Floor Area Commercial (m2)	Scenario 1 Estimated Floor Area Industrial (m2)	Scenario 1 Estimated Units Residential	Scenario 2 Estimated Floor Area Commercial (m2)	Scenario 2 Estimated Floor Area Industrial (m2)	Scenario 2 Estimated Units Residential
-		Vacant-Residential	M1 & H & OS	3/1	5108	5108	50	30	-	4597	-	-	1532	-
-		Vacant-Industrial	M1	3/1	3575	3575	50	30	-	3218	-	-	1073	-
-		Vacant-Residential	M1	3/1	1029	1029	50	30	-	926	-	-	309	-
219	Lowes	Commercial	C1-7	3/1	65102	65102	50	30	58592	-	-	19531	-	-
-		Industrial	S1-2	3/1	9061	9061	50	30	8155	-	-	2718	-	-
-		Vacant-Commercial	S1-3	3/1	3027	3027	50	30	2724	-	-	908	-	-
111		Institutional	S1-2-h	3/1	6265	6265	50	30	5639	-	-	1880	-	-
-		Vacant	S1-2-h	3/1	6232	6232	50	30	5609	-	-	1870	-	-
91	Plainfield Community Homes	Commercial	S1-2-h	3/1	5347	5347	50	30	4812	-	-	1604	-	-
81		Commercial	S1-2	3/1	8316	8316	50	30	7484	-	-	2495	-	-
-		Commercial	S1-7	3/1	6223	6223	50	30	5601	-	-	1867	-	-
49		Industrial	S1-2-h	3/1	24141	24141	50	30	21727	-	-	7242	-	-
31	Hosers Car Wash Ltd.	Commercial	S1-2-h	3/1	3607	3607	50	30	3246	-	-	1082	-	-
146		Vacant-Commercial	S1-2-h	3/1	15760	15760	50	30	14184	-	-	4728	-	-
1		Commercial	C1	3/1	9273	9273	50	30	8346	-	-	2782	-	-

Address (Cloverleaf Dr.) S. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Scenario 1 Estimated Floor Area Commercial (m2)	Scenario 1 Estimated Floor Area Industrial (m2)	Scenario 1 Estimated Units Residential	Scenario 2 Estimated Floor Area Commercial (m2)	Scenario 2 Estimated Floor Area Industrial (m2)	Scenario 2 Estimated Units Residential
148		Commercial	M1-2	3/1	5664	5664	50	30	5098	-	-	1699	-	-
138		Residential	R1	3/1	2704	2704	35	30	-	-	3	-	-	3
128		Residential	R1	3/1	2699	2699	35	30	-	-	3	-	-	3
120		Residential	R1	3/1	2246	2246	35	30	-	-	2	-	-	2
114		Residential	R1	3/1	2242	2242	35	-	-	-	2	-	-	2
108		Residential	R1	3/1	2238	2238	35	-	-	-	2	-	-	2
102		Residential	R1	3/1	2234	2234	35	-	-	-	2	-	-	2
96		Residential	R1	3/1	2229	2229	35	-	-	-	2	-	-	2
94		Residential	M1	3/1	2224	2224	50	30	-	-	2	-	-	2
86		Residential	R1	3/1	2712	2712	35	-	-	-	3	-	-	3
72		Residential	R1	3/1	1389	1389	35	-	-	-	1	-	-	1
68		Residential	R1	3/1	1384	1384	35	-	-	-	1	-	-	1
60		Residential With Commercial/ Industrial	PA	3/1	1533	1533	20	-	-	-	1	-	-	1
56		Residential	R1	3/1	1358	1358	35	-	-	-	1	-	-	1
52		Residential	R1	3/1	1362	1362	35	-	-	-	1	-	-	1
46		Vacant-Residential	R1	3/1	668	668	35	-	-	-	1	-	-	1

44		Vacant-Residential	R1	3/1	679	679	35	-	-	-	1	-	-	1
-		Industrial	M1-1	3/1	5541	5541	50	30	-	-	1	-	-	1
26		Residential	R1	3/1	1468	1468	35	-	-	-	1	-	-	1
20		Residential	R1	3/1	1393	1393	35	-	-	-	1	-	-	1
-		Vacant-Residential	C1-8	3/1	1976	1976	50	30	1778	-	-	593	-	-

									Scenario 1			Scenario 2		
Address (Cloverleaf Dr.) N. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
151	Canadian Conference of the B...	Institutional	CF	3/1	11993	11993	-	30	-	-	13	-	-	13
145		Residential	R1 & R1-h	3/1	3956	3956	35	-	-	-	4	-	-	4
143		Residential	R1 & R1-h	3/1	5979	5979	35	-	-	-	7	-	-	7
137		Residential	R1 & R1-h	3/1	7527	7527	35	-	-	-	9	-	-	9
-		Vacant-Residential	R1 & R1-h	3/1	1012	1012	35	-	-	-	1	-	-	1
129		Residential	R1 & R1-h	3/1	4275	4275	35	-	-	-	5	-	-	5
123		Residential	R1 & R1-h	3/1	4300	4300	35	-	-	-	5	-	-	5
119		Residential	R1 & R1-h	3/1	12545	12545	35	-	-	-	15	-	-	15
107		Residential	R1 & R1-h	3/1	2018	2018	35	-	-	-	2	-	-	2
-		Vacant-Residential	R1 & R1-h	3/1	9749	9749	35	-	-	-	12	-	-	12
93		Vacant-Residential	M1-3	3/1	1291	1291	50	30	-	-	1	-	-	1
83		Residential	R1	3/1	1167	1167	35	-	-	-	1	-	-	1
77		Residential	R1	3/1	789	789	35	-	-	-	1	-	-	1
69		Residential	M1-5	3/1	1250	1250	50	30	-	-	2	-	-	2
65		Residential	R1	3/1	1191	1191	35	-	-	-	1	-	-	1
59		Residential	R1	3/1	1090	1090	35	-	-	-	1	-	-	1
51		Residential	R1	3/1	1173	1173	35	-	-	-	1	-	-	1
45		Residential	R1	3/1	747	747	35	-	-	-	1	-	-	1
39		Residential	R1	3/1	1340	1340	35	-	-	-	1	-	-	1
33		Vacant-Residential	R1-h 05	3/1	605	605	35	-	-	-	1	-	-	1
29		Residential	R1	3/1	1735	1735	35	-	-	-	2	-	-	2
25		Residential	R1	3/1	1750	1750	35	-	-	-	2	-	-	2
15		Residential	R1	3/1	2258	2258	35	-	-	-	2	-	-	2
11		Residential	R1	3/1	1585	1585	35	-	-	-	1	-	-	1

									Scenario 1			Scenario 2		
Address (Parks Dr.) S. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
131		Industrial	M1	3/1	22384	22384	50	30	-	20146	-	-	6715	-
121		Industrial	M1	3/1	8417	8417	50	30	-	7575	-	-	2525	-
109		Industrial	M1	3/1	7529	7529	50	30	-	6776	-	-	2259	-

99		Industrial	M1 & OS & H	3/1	3060	3060	50	30	-	2754	-	-	918	-
71		Industrial	M1-17	3/1	5921	5921	50	30	-	5329	-	-	1776	-
51		Industrial	M1	3/1	16060	16060	50	30	-	14454	-	-	4818	-
-		Industrial	M1	3/1	12223	12223	50	30	-	11001	-	-	3667	-

									Scenario 1			Scenario 2		
Address (Parks Dr.) N. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
146		Vacant-Industrial	M1	3/1	17424	17424	50	30	-	15682	-	-	5227	-
122		Industrial	M1	3/1	6407	6407	50	30	-	5766	-	-	1922	-
102		Industrial	M1-20	3/1	2745	2745	50	30	-	2471	-	-	824	-
98		Industrial	M1	3/1	3253	3253	50	30	-	2928	-	-	976	-
88		Industrial	M1	3/1	5751	5751	50	30	-	5176	-	-	1725	-
80		Industrial	M1	3/1	3861	3861	50	30	-	3475	-	-	1158	-
52		Industrial	M1	3/1	7521	7521	50	30	-	6769	-	-	2256	-

									Scenario 1			Scenario 2		
Address (Maitland Dr.) S. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
410		Industrial	M1	3/1	2562	2562	50	30	-	2306	-	-	769	-
404		Industrial	M1-17	3/1	5641	5641	50	30	-	5077	-	-	1692	-
-		Industrial	M1	3/1	10949	10949	50	30	-	9854	-	-	3285	-
374		Residential	RR	3/1	2893	2893	20	30	-	2604	-	-	868	-
366		Residential	RR	3/1	1620	1620	20	30	-	1458	-	-	486	-
342		Residential	M1	3/1	27915	27915	50	30	-	25124	-	-	8375	-
322		Residential	RR	3/1	2272	2272	20	30	-	2045	-	-	682	-
320		Vacant-Residential	M1	3/1	1538	1538	50	30	-	1384	-	-	461	-
300		Industrial	M1	3/1	5010	5010	50	30	-	4509	-	-	1503	-
286		Industrial	M1	3/1	21170	21170	50	30	-	19053	-	-	6351	-
284		Vacant-Residential	RR	3/1	1503	1503	20	30	-	1353	-	-	451	-
-		Residential Development Land	D	3/1	37610	37610	100	30	33849	-	-	11283	-	-
174		Commercial	D	3/1	49713	49713	100	30	44742	-	-	14914	-	-
156		Residential	R1	3/1	1680	1680	35	-	-	-	2	-	-	2
154		Residential	R1	3/1	1501	1501	35	-	-	-	1	-	-	1
74		Residential	R1	3/1	2685	2685	35	-	-	-	3	-	-	3
68		Residential	R1	3/1	1675	1675	35	-	-	-	2	-	-	2
62		Residential	R1	3/1	1624	1624	35	-	-	-	2	-	-	2
56		Residential	R1	3/1	1575	1575	35	-	-	-	1	-	-	1
48		Residential	R1	3/1	1528	1528	35	-	-	-	1	-	-	1
42		Residential	R1	3/1	1477	1477	35	-	-	-	1	-	-	1
36		Residential	R1	3/1	1347	1347	35	-	-	-	1	-	-	1
26		Residential	R1	3/1	2189	2189	35	-	-	-	2	-	-	2
18		Residential	R1	3/1	2013	2013	35	-	-	-	2	-	-	2
12		Residential	R1	3/1	2171	2171	35	-	-	-	2	-	-	2
						11911								

									Scenario 1			Scenario 2		
Address (Maitland Dr.) N. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
415		Commercial	C3	3/1	3342	3342	50	30	-	3008	-	-	1003	-
-		Vacant-Industrial	M1	3/1	3529	3529	50	30	-	3176	-	-	1059	-
381	A & B Precast Manufacturing Ltd.	Industrial	M1	3/1	7049	7049	50	30	-	6344	-	-	2115	-
365		Industrial	M1	3/1	2252	2252	50	30	-	2027	-	-	676	-
347	Separate School Bd. Algonquin	Industrial	M1	3/1	5114	5114	50	30	-	4603	-	-	1534	-
341		Industrial	M1	3/1	4024	4024	50	30	-	3622	-	-	1207	-
325		Industrial	M1	3/1	13848	13848	50	30	-	12463	-	-	4154	-
303		Industrial	M1	3/1	6406	6406	50	30	-	5765	-	-	1922	-
291		Commercial	M1-25	3/1	2055	2055	50	30	-	1850	-	-	617	-
-		Industrial	M1	3/1	1044	1044	50	30	-	940	-	-	313	-
285		Agricultural With Residence	D & D-r	3/1	372648	372648	100	30	142538	50307	176	47513	16769	176
269		Vacant-Residential	RR	3/1	5504	5504	20	30	4954	-	-	1651	-	-
187		Agricultural With Residence	D & D-r	3/1	71170	71170	-	30	64053	-	-	21351	-	-
161		Residential	R1	3/1	4376	4376	35	-	-	-	5	-	-	5
149		Residential	RR	3/1	4019	4019	20	-	-	-	4	-	-	4
-		Vacant-Residential	R1-22	3/1	890	890	35	-	-	-	1	-	-	1
143		Residential	R1	3/1	1488	1488	35	-	-	-	1	-	-	1
89		Residential	R1	3/1	2490	2490	35	-	-	-	3	-	-	3
85		Residential	R1	3/1	2583	2583	35	-	-	-	3	-	-	3
81		Residential	R1	3/1	2709	2709	35	-	-	-	3	-	-	3
71		Residential	R1	3/1	3963	3963	35	-	-	-	4	-	-	4
69		Residential	R1-2	3/1	1829	1829	35	-	-	-	2	-	-	2
67		Vacant-Residential	R1-3	3/1	4452	4452	35	-	-	-	5	-	-	5
59		Residential	R1	3/1	1756	1756	35	-	-	-	2	-	-	2
47		Residential	R1	3/1	2853	2853	35	-	-	-	3	-	-	3
35		Residential	R1	3/1	1412	1412	35	-	-	-	1	-	-	1
29		Residential	R1	3/1	1414	1414	35	-	-	-	1	-	-	1
23		Residential	R1	3/1	1419	1419	35	-	-	-	1	-	-	1
15		Residential	R1	3/1	1409	1409	35	-	-	-	1	-	-	1
9		Residential	R1	3/1	1410	1410	35	-	-	-	1	-	-	1
3		Residential	R1	3/1	1600	1600	35	-	-	-	1	-	-	1

									Scenario 1			Scenario 2		
Address	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
-	Deerfield Park Subdivision	Mostly Residential	-	3/1	-	113197	35	-	-	-	250	-	-	250

									Scenario 1			Scenario 2		
Address (Bird Cr.) W. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
41		Residential	R1	3/1	1491	1491	35	-	-	-	1	-	-	1
37		Residential	R1	3/1	1436	1436	35	-	-	-	1	-	-	1
29		Residential	R1	3/1	1433	1433	35	-	-	-	1	-	-	1
27		Residential	R1	3/1	1429	1429	35	-	-	-	1	-	-	1
21		Residential	R1	3/1	1426	1426	35	-	-	-	1	-	-	1
11		Residential	R1	3/1	1500	1500	35	-	-	-	1	-	-	1

									Scenario 1			Scenario 2		
Address (Bird Cr.) E. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
52		Residential	R1	3/1	1920	1920	35	-	-	-	2	-	-	2
50		Residential	R1	3/1	1429	1429	35	-	-	-	1	-	-	1
40		Residential	R1	3/1	1429	1429	35	-	-	-	1	-	-	1
38		Residential	R1	3/1	1429	1429	35	-	-	-	1	-	-	1
30		Residential	R1	3/1	1429	1429	35	-	-	-	1	-	-	1
28		Residential	R1	3/1	1428	1428	35	-	-	-	1	-	-	1
20		Residential	R1	3/1	1429	1429	35	-	-	-	1	-	-	1
18		Residential	R1	3/1	1379	1379	35	-	-	-	1	-	-	1

									Scenario 1			Scenario 2		
Address (Sidney St.) E. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
1104		Residential	R1	3/1	2340	2340	35	-	-	-	2	-	-	2
1098		Residential	R1	3/1	2405	2405	35	-	-	-	2	-	-	2
1058		Residential	R1	3/1	2452	2452	35	-	-	-	3	-	-	3
1056		Residential	R1	3/1	2371	2371	35	-	-	-	2	-	-	2
1044		Residential	R1	3/1	1635	1635	35	-	-	-	2	-	-	2
1032		Residential	R1	3/1	1838	1838	35	-	-	-	2	-	-	2
1028		Residential	R1	3/1	1556	1556	35	-	-	-	1	-	-	1
1018		Residential	R1	3/1	1511	1511	35	-	-	-	1	-	-	1
1016		Residential	R1	3/1	1511	1511	35	-	-	-	1	-	-	1
1010		Residential	R1	3/1	1511	1511	35	-	-	-	1	-	-	1
1000		Residential	R1	3/1	2128	2128	35	-	-	-	2	-	-	2
974		Residential	R1	3/1	2225	2225	35	-	-	-	2	-	-	2
970		Residential	R1	3/1	2225	2225	35	-	-	-	2	-	-	2
964		Residential	R1	3/1	2224	2224	35	-	-	-	2	-	-	2
954		Residential	R1	3/1	2040	2040	35	-	-	-	2	-	-	2
950		Residential	R1	3/1	1784	1784	35	-	-	-	2	-	-	2
944		Residential	R1	3/1	2672	2672	35	-	-	-	3	-	-	3
936		Residential	R1	3/1	1618	1618	35	-	-	-	1	-	-	1
930		Residential	R1	3/1	1981	1981	35	-	-	-	2	-	-	2
-		Vacant-Residential	C1-8	3/1	3932	3932	50	30	3539	-	-	1180	-	-

									Scenario 1			Scenario 2		
Address (Thurlow Dr.) S. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
24		Residential	R1	3/1	1587	1587	35	-	-	-	1	-	-	1
16		Residential	R1	3/1	1504	1504	35	-	-	-	1	-	-	1

Address (Thurlow Dr.) N. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Scenario 1 Estimated Floor Area Commercial (m2)	Scenario 1 Estimated Floor Area Industrial (m2)	Scenario 1 Estimated Units Residential	Scenario 2 Estimated Floor Area Commercial (m2)	Scenario 2 Estimated Floor Area Industrial (m2)	Scenario 2 Estimated Units Residential
37		Residential	R1	3/1	1623	1623	35	-	-	-	2	-	-	2
31		Residential	R1	3/1	1835	1835	35	-	-	-	2	-	-	2
27		Residential	R1	3/1	1779	1779	35	-	-	-	2	-	-	2
23		Residential	R1	3/1	2122	2122	35	-	-	-	2	-	-	2
15		Residential	R1	3/1	1976	1976	35	-	-	-	2	-	-	2

Address	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Scenario 1 Estimated Floor Area Commercial (m2)	Scenario 1 Estimated Floor Area Industrial (m2)	Scenario 1 Estimated Units Residential	Scenario 2 Estimated Floor Area Commercial (m2)	Scenario 2 Estimated Floor Area Industrial (m2)	Scenario 2 Estimated Units Residential
-	Settlers Ridge Subdivision Phase 1&2	-	-	3/1	-	826526	-	-	-	-	540	-	-	540

Address (Roy Blvd.) S. & N. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Scenario 1 Estimated Floor Area Commercial (m2)	Scenario 1 Estimated Floor Area Industrial (m2)	Scenario 1 Estimated Units Residential	Scenario 2 Estimated Floor Area Commercial (m2)	Scenario 2 Estimated Floor Area Industrial (m2)	Scenario 2 Estimated Units Residential
28		Assembly or Community Hall	C1	3/1	16692	16692	50	30	15023	-	-	5008	-	-
18		Assembly or Community Hall	C1	3/1	12349	12349	50	30	11114	-	-	3705	-	-

Address (Towncentre Dr.) W. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Scenario 1 Estimated Floor Area Commercial (m2)	Scenario 1 Estimated Floor Area Industrial (m2)	Scenario 1 Estimated Units Residential	Scenario 2 Estimated Floor Area Commercial (m2)	Scenario 2 Estimated Floor Area Industrial (m2)	Scenario 2 Estimated Units Residential
-		Vacant-Commercial	D	3/1	83440	83440	-	30	75096	-	-	25032	-	-

Address (Towncentre Dr.) E. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Scenario 1 Estimated Floor Area Commercial (m2)	Scenario 1 Estimated Floor Area Industrial (m2)	Scenario 1 Estimated Units Residential	Scenario 2 Estimated Floor Area Commercial (m2)	Scenario 2 Estimated Floor Area Industrial (m2)	Scenario 2 Estimated Units Residential
-		Vacant-Commercial	C1	3/1	8739	8739	50	30	7865	-	-	2622	-	-
42		Commercial	C1	3/1	22635	22635	50	30	20372	-	-	6791	-	-
22		Commercial	C1	3/1	9963	9963	50	30	8967	-	-	2989	-	-

Address (Oakwood Ln.) S. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Scenario 1 Estimated Floor Area Commercial (m2)	Scenario 1 Estimated Floor Area Industrial (m2)	Scenario 1 Estimated Units Residential	Scenario 2 Estimated Floor Area Commercial (m2)	Scenario 2 Estimated Floor Area Industrial (m2)	Scenario 2 Estimated Units Residential
55		Residential	RR	3/1	4039	4039	20	-	-	-	4	-	-	4
47		Residential	RR	3/1	3987	3987	20	-	-	-	4	-	-	4
33		Residential	RR	3/1	4172	4172	20	-	-	-	4	-	-	4
25		Residential	RR	3/1	4481	4481	20	-	-	-	4	-	-	4

Address (Oakwood Ln.) N. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Scenario 1 Estimated Floor Area Commercial (m2)	Scenario 1 Estimated Floor Area Industrial (m2)	Scenario 1 Estimated Units Residential	Scenario 2 Estimated Floor Area Commercial (m2)	Scenario 2 Estimated Floor Area Industrial (m2)	Scenario 2 Estimated Units Residential
56		Residential	RR	3/1	4133	4133	20	-	-	-	4	-	-	4
46		Residential	RR	3/1	4044	4044	20	-	-	-	4	-	-	4
36		Residential	RR	3/1	4123	4123	20	-	-	-	4	-	-	4
24		Residential	RR	3/1	4209	4209	20	-	-	-	4	-	-	4
						33188			0	0	32	0	0	32

Address (Scott Dr.) S. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Scenario 1 Estimated Floor Area Commercial (m2)	Scenario 1 Estimated Floor Area Industrial (m2)	Scenario 1 Estimated Units Residential	Scenario 2 Estimated Floor Area Commercial (m2)	Scenario 2 Estimated Floor Area Industrial (m2)	Scenario 2 Estimated Units Residential
-		Agricultural	D-r & H	3/1	218176	218176	-	30	-	-	242	-	-	242
82		Residential	RR	3/1	1388	1388	20	30	-	-	1	-	-	1
72		Residential	RR	3/1	1387	1387	20	30	-	-	1	-	-	1

									Scenario 1			Scenario 2		
Address (Scott Dr.) N. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
109		Agriculture With Residence	PA & H & ER	3/1	69845	69845	-	30	-	-	77	-	-	77
87		Agriculture With Residence	PA	3/1	11458	11458	-	30	-	-	12	-	-	12
55		Residential	RR	3/1	868	868	20	30	-	-	1	-	-	1

									Scenario 1			Scenario 2		
Address (Sunningdale Dr.) N. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
205		Residential	C1-3-h	3/1	1655	1655	50	30	1490	-	-	497	-	-
193		Residential	RR	3/1	4298	4298	20	30	3868	-	-	1289	-	-
179		Residential	RR	3/1	4177	4177	20	30	3759	-	-	1253	-	-
169		Residential	RR	3/1	4178	4178	20	30	3760	-	-	1253	-	-
157		Residential	RR	3/1	4333	4333	20	30	3900	-	-	1300	-	-

									Scenario 1			Scenario 2		
Address (Highway No. 62) W. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
-		Commercial	C1-3-h & C1-6	3/1	24681	24681	50	30	22213	-	-	7404	-	-
-		Vacant-Portion Farmed	D	3/1	213458	213458	-	30	192112	-	-	64037	-	-
-		Vacant-Residential	D	3/1	1878	1878	-	30	1690	-	-	563	-	-
-		Vacant-Residential	D	3/1	1879	1879	-	30	1691	-	-	564	-	-
6863		Residential With Commercial/ Industrial	C1	3/1	7250	7250	50	30	6525	-	-	2175	-	-
6845		Residential With Commercial/ Industrial	C1 & D	3/1	61156	61156	50	30	55040	-	-	18347	-	-
6835		Commercial	C1	3/1	11892	11892	50	30	10703	-	-	3568	-	-
-		Agricultural	C1 & D	3/1	99784	99784	50	30	89806	-	-	29935	-	-
6833		Commercial	C1	3/1	24164	24164	50	30	21748	-	-	7249	-	-
6775		Residential With Commercial/ Industrial	C1	3/1	26635	26635	50	30	23972	-	-	7991	-	-
6769		Residential With Commercial/ Industrial	C1	3/1	1523	1523	50	30	1371	-	-	457	-	-
6759		Commercial	C1	3/1	12843	12843	50	30	11559	-	-	3853	-	-
6749	Tyrex Corporation	Commercial	C1	3/1	10979	10979	50	30	9881	-	-	3294	-	-
6745	Tyrex Corporation	Residential	RR	3/1	1017	1017	20	30	915	-	-	305	-	-
6663		Vacant-Residential	C1	3/1	1034	1034	50	30	931	-	-	310	-	-
6521	Petro-Canada	Commercial	C1	3/1	3671	3671	50	30	3304	-	-	1101	-	-
-		Vacant-Commercial	C1-h	3/1	27562	27562	50	30	24806	-	-	8269	-	-

									Scenario 1			Scenario 2		
Address (Highway No. 62) E. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
6984		Agricultural With Residence	D-r & D	3/1	70670	70670	-	30	15901	-	58	5300	-	58
6992	Direct Realty Ltd.	Commercial	C1 & D	3/1	5501	5501	50	30	4951	-	-	1650	-	-
-		Commercial	C1	3/1	2401	2401	50	30	2161	-	-	720	-	-
-		Agricultural	D & D-r	3/1	139178	139178	-	30	62630	-	77	20877	-	77
6892		Residential	RR	3/1	4439	4439	20	30	3995	-	-	1332	-	-
-		Vacant-Commercial	C1	3/1	2789	2789	50	30	2510	-	-	837	-	-
6874		Residential	RR	3/1	1618	1618	20	30	1456	-	-	485	-	-
-		Residential	RR	3/1	1418	1418	20	30	1276	-	-	425	-	-
6692		Commercial	C1	3/1	22446	22446	50	30	20201	-	-	6734	-	-
6668		Vacant-Residential	RR	3/1	1189	1189	20	30	1070	-	-	357	-	-
6662		Commercial	C1	3/1	1129	1129	50	30	1016	-	-	339	-	-
6658		Residential With Commercial/ Industrial	C1	3/1	3152	3152	50	30	2837	-	-	946	-	-
6648	A & B Precast Manufacturing	Commercial	C1	3/1	981	981	50	30	883	-	-	294	-	-
6638	A & B Precast Manufacturing	Industrial	M1	3/1	13405	13405	50	30	2413	9652	-	804	3217	-
6612		Residential	M1	3/1	16595	16595	50	30	14936	-	-	4979	-	-
6542	St. Mary's Cement Inc.	Industrial	M1	3/1	28860	28860	50	30	25974	-	-	8658	-	-
-		Vacant-Industrial	M1	3/1	1504	1504	50	30	1354	-	-	451	-	-
6520	Coco Paving Inc.	Industrial	M1 & H	3/1	42392	42392	50	30	38153	-	-	12718	-	-

									Scenario 1			Scenario 2		
Address (Christian School Rd.) W. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
27		Residential With Commercial/ Industrial	C1	3/1	2174	2174	50	30	1957	-	-	652	-	-
18	Christian School Belleville	Institutional	CF	3/1	19505	19505	-	30	5852	-	-	5852	-	-
12		Residential With Commercial/ Industrial	C1	3/1	2708	2708	50	30	2437	-	-	812	-	-

									Scenario 1			Scenario 2		
Address (Mineral Rd.) W. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
117		Commercial	M1-12	3/1	2723	2723	50	30	2451	-	-	817	-	-
-		Vacant-Industrial	M1	3/1	3068	3068	50	30	2761	-	-	920	-	-

									Scenario 1			Scenario 2		
Address (Mineral Rd.) E. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
104		Industrial	M1	3/1	12647	12647	50	30	-	11382	-	-	3794	-
94		Industrial	C2	3/1	10238	10238	50	30	-	9214	-	-	3071	-
-		Vacant-Industrial	M1	3/1	8398	8398	50	30	-	7558	-	-	2519	-
50		Industrial	M1	3/1	9911	9911	50	30	-	8920	-	-	2973	-
28	Bell Canada	Commercial	M1	3/1	38930	38930	50	30	-	35037	-	-	11679	-

									Scenario 1			Scenario 2		
Address (Farnham Rd.) SW. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
456	Conservation Authority Moira	Open Space	H	3/1	2946	2946	-	-	-	-	-	-	-	-
-	Heritage Park	Residential Development Land	-	3/1	121505	198914	-	30	-	-	221	-	-	221
-		Residential Development Land			3737									
424		Agricultural			73673									
382		Residential	RR	3/1	1736	1736	20	-	-	-	1	-	-	1
374		Residential	CF2	3/1	4487	4487	-	-	-	-	4	-	-	4
324		Residential	RR	3/1	4063	4063	20	-	-	-	4	-	-	4
374		Residential	CF2	3/1	1738	1738	-	-	-	-	1	-	-	1
310		Residential	RR	3/1	5628	5628	20	30	-	-	6	-	-	6
300		Residential With Commercial/ Industrial	RR	3/1	4286	4286	20	-	-	-	4	-	-	4
286		Residential	RR	3/1	4821	4821	20	-	-	-	5	-	-	5
254		Residential	RR	3/1	4199	4199	20	-	-	-	4	-	-	4
-		Vacant-Residential	D-r	3/1	30761	30761	-	30	-	-	34	-	-	34
254		Residential	RR	3/1	4142	4142	20	-	-	-	4	-	-	4
-		Vacant-Residential	D-r	3/1	27305	27305	-	30	-	-	30	-	-	30
232		Residential	RR	3/1	2054	2054	20	-	-	-	2	-	-	2
220		Residential	RR	3/1	1803	1803	20	-	-	-	2	-	-	2
208		Residential	RR	3/1	4059	4059	20	-	-	-	4	-	-	4
-		Vacant-Residential	D-r	3/1	48985	48985	-	30	-	-	54	-	-	54
176		Residential With Commercial/ Industrial	RR	3/1	11724	11724	20	30	-	-	13	-	-	13
158		Residential	RR	3/1	4757	4757	20	-	-	-	5	-	-	5
140		Residential	RR	3/1	3868	3868	20	-	-	-	4	-	-	4
130		Residential	RR	3/1	4500	4500	20	-	-	-	5	-	-	5
118		Residential	RR	3/1	4136	4136	20	-	-	-	4	-	-	4
80		Residential	D-r	3/1	4372	4372	-	-	-	-	4	-	-	4
-		Vacant-Residential	D-r	3/1	1409	1409	-	-	-	-	1	-	-	1
62		Residential	RR	3/1	1761	1761	20	-	-	-	1	-	-	1
28		Industrial	M1-29	3/1	13046	13046	50	30	11741	-	-	3914	-	-

									Scenario 1			Scenario 2		
Address (Farnham Rd.) NE. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
-		Open Space	CF-5 & H	3/1	14993	14993	-	-	-	-	-	-	-	-
-		Open Space	CF-5	3/1	1085	1085	-	-	-	-	-	-	-	-
427		Vacant-Residential	M1	3/1	4280	4280	50	30	3852	-	-	1284	-	-
407		Industrial	M1	3/1	2303	2303	50	30	2073	-	-	691	-	-
407		Industrial	M1	3/1	4635	4635	50	30	4172	-	-	1391	-	-
373		Residential	RR	3/1	1556	1556	20	-	-	-	1	-	-	1
369		Residential	RR-66	3/1	2580	2580	20	-	-	-	2	-	-	2
361		Residential	RR	3/1	2730	2730	20	-	-	-	3	-	-	3
347		Residential	RR	3/1	2717	2717	20	-	-	-	3	-	-	3
-		Open Space	CF-4	3/1	17154	17154	-	-	-	-	19	-	-	19
319		Residential	RR	3/1	3997	3997	20	-	-	-	4	-	-	4
311		Residential	RR	3/1	1458	1458	20	-	-	-	1	-	-	1
317		Residential	RR	3/1	1440	1440	20	-	-	-	1	-	-	1
305		Residential	RR	3/1	1427	1427	20	-	-	-	1	-	-	1
299		Residential	RR	3/1	1414	1414	20	-	-	-	1	-	-	1
281		Residential	RR	3/1	4084	4084	20	-	-	-	4	-	-	4
273		Residential	RR	3/1	4342	4342	20	-	-	-	4	-	-	4
-		Agricultural	RR	3/1	4151	4151	20	-	-	-	4	-	-	4
257		Residential	RR	3/1	4312	4312	20	-	-	-	4	-	-	4
233		Vacant-Residential	RR	3/1	13751	13751	20	-	-	-	15	-	-	15
155		Residential	RR	3/1	4527	4527	20	-	-	-	5	-	-	5
139		Residential	RR	3/1	6021	6021	20	-	-	-	6	-	-	6
125		Agriculture With Residence	D, PA & RR	3/1	27122	27122	-	30	-	-	30	-	-	30
119		Residential	RR	3/1	1626	1626	20	-	-	-	1	-	-	1
115		Residential	RR	3/1	1532	1532	20	-	-	-	1	-	-	1
105		Residential	RR	3/1	1599	1599	20	-	-	-	1	-	-	1
101		Residential	RR	3/1	1565	1565	20	-	-	-	1	-	-	1
95		Residential	RR	3/1	1544	1544	20	-	-	-	1	-	-	1
89		Residential	RR	3/1	1861	1861	20	-	-	-	2	-	-	2

									Scenario 1			Scenario 2		
Address (Vermilyea Rd.) S. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
5		Residential With Commercial/ Industrial	RR	3/1	2101	2101	20	30	1891	-	-	630	-	-
19		Residential	RR & D	3/1	5091	5091	-	30	4582	-	-	1527	-	-
33		Commercial	C1-6	3/1	21575	21575	50	30	19418	-	-	6473	-	-

									Scenario 1			Scenario 2		
Address	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
-	Canniff Mill Estates	Mostly Residential	-	3/1	-	611595	35	-	-	-	909	-	-	909

									Scenario 1			Scenario 2		
Address (Highway 401) N. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
-		Industrial	M1	3/1	14748	14748	50	30	13273	-	-	4424	-	-
-		Vacant-Residential	M1-28-h	3/1	13833	13833	50	30	-	12450	-	-	4150	-
-		Agricultural	M1-28-h	3/1	23849	23849	50	30	-	21464	-	-	7155	-
-		Vacant-Residential	D	3/1	38647	28647	-	30	-	25782	-	-	8594	-
-		Agricultural	D	3/1	9540	9540	-	30	-	8586	-	-	2862	-
-		Vacant-Residential	M1	3/1	56080	56080	50	30	-	50472	-	-	16824	-

									Scenario 1			Scenario 2		
Address (Black Diamond Rd.) S. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
184	Parmalat Black Diamond Cheese	Industrial	M1	3/1	48193	48193	50	30	-	43374	-	-	14458	-
-		Vacant-Residential	M1	3/1	7046	7046	50	30	-	6341	-	-	2114	-
-		Agricultural	D	3/1	120367	120367	-	30	-	108330	-	-	36110	-

136		Residential	RR	3/1	2920	2920	20	30	-	2628	-	-	876	-
-		Vacant-Residential	RR	3/1	2130	2130	20	30	-	1917	-	-	639	-
122		Residential With Commercial/ Industrial	RR & M1-8	3/1	5679	5679	-	30	-	5111	-	-	1704	-
112		Commercial	C2	3/1	9155	9155	50	30	-	8240	-	-	2747	-
-		Vacant-Residential	C1	3/1	67625	67625	50	30	60863	-	-	20288	-	-
-		Vacant-Commercial	C1	3/1	46733	46733	50	30	42060	-	-	14020	-	-
38	Keay Nursing Homes Inc.	Institutional	CF	3/1	13370	13370	-	30	-	-	22	-	-	22
12		Residential	R1	3/1	2386	2386	35	30	2147	-	-	716	-	-
6		Residential	R1	3/1	1262	1262	35	30	1136	-	-	379	-	-

									Scenario 1			Scenario 2		
Address (Black Diamond Rd.) N. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
-		Residential	R1 & R3	3/1	7111	7111	35	30	640	-	7	213	-	7
-		Residential	H	-	1602	1602	-	-	-	-	-	-	-	-
-		Residential	H	-	17007	17007	-	-	-	-	-	-	-	-
-		Commercial	H	-	1018	1018	-	-	-	-	-	-	-	-

									Scenario 1			Scenario 2		
Address (Latchford St.) N. & S. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
27		Residential	R1	3/1	1319	1319	35	-	-	-	1	-	-	1
15		Residential	R1	3/1	578	578	35	-	-	-	1	-	-	1
14		Residential	R1	3/1	1257	1257	35	30	1131	-	-	377	-	-
11		Residential	R1	3/1	307	307	35	-	-	-	1	-	-	1
9		Residential	R1	3/1	454	454	35	-	-	-	1	-	-	1

									Scenario 1			Scenario 2		
Address (McCall St.) N. & S. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
17		Residential	R1	3/1	1034	1034	35	-	-	-	1	-	-	1
16		Residential	R1	3/1	796	796	35	-	-	-	1	-	-	1
11		Residential	R1	3/1	808	808	35	-	-	-	1	-	-	1

									Scenario 1			Scenario 2		
Address (Canniff St.) N. & S. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
10		Residential With Commercial/ Industrial	R1	3/1	399	399	35	-	-	-	1	-	-	1

									Scenario 1			Scenario 2		
Address (Tank Farm Rd.) S. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
121		Industrial	M1	3/1	36750	36750	50	30	-	33075	-	-	11025	-
-		Industrial	M1	3/1	2655	2655	50	30	-	2390	-	-	797	-
107	Shell Canada Products Ltd.	Vacant-Industrial	M1	3/1	37617	37617	50	30	-	33855	-	-	11285	-
101	Petro-Canada	Industrial	M1	3/1	40758	40758	50	30	-	36682	-	-	12227	-
61	Northumberland Grain Inc.	Industrial	M1	3/1	33884	33884	50	30	-	30496	-	-	10165	-

50		Industrial	M1	3/1	14917	14917	50	30	-	13425	-	-	4475	-
43	Harwood Structures Corp.	Vacant-Industrial	M1	3/1	14202	14202	50	30	-	12782	-	-	4261	-

									Scenario 1			Scenario 2		

Address (Tank Farm Rd.) N. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
-		Vacant-Commercial	CF & C3-7	3/1	20691	20691	50	30	6316	-	15	2105	-	15
62	Dewal Paving Ltd.	Industrial	M1	3/1	11184	11184	50	30	-	10066	-	-	3355	-
50		Industrial	M1	3/1	16743	16743	50	30	-	15069	-	-	5023	-
40	Noronco Sheet Metal Ltd.	Industrial	M1-13 & M1-14	3/1	14378	14378	50	30	-	12940	-	-	4313	-
28		Vacant-Industrial	M1	3/1	12478	12478	50	30	-	11230	-	-	3743	-
18		Industrial	M1	3/1	10569	10569	50	30	-	9512	-	-	3171	-

									Scenario 1			Scenario 2		
Address (Casey Rd.) S. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
-		Agricultural	D	3/1	230515	230515	-	30	-	207464	-	-	69155	-
10		Residential	RR	3/1	4260	4260	20	30	-	3834	-	-	1278	-

									Scenario 1			Scenario 2		
Address (Cannifton Rd. N.) W. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
-		Vacant-Commercial	RU	3/1	15587	15587	-	30	-	-	17	-	-	17
-		Vacant-Commercial	D	3/1	63153	63153	-	30	-	-	70	-	-	70
579		Residential	RR	3/1	4475	4475	20	-	-	-	4	-	-	4
571		Residential	RR	3/1	4596	4596	20	-	-	-	5	-	-	5
-		Vacant-Commercial	D	3/1	35463	35463	-	30	-	-	39	-	-	39
533		Residential	RR	3/1	2008	2008	20	-	-	-	2	-	-	2
529		Residential	RR	3/1	1068	1068	20	-	-	-	1	-	-	1
525		Residential	RR	3/1	978	978	20	-	-	-	1	-	-	1
521		Residential	RR	3/1	1028	1028	20	-	-	-	1	-	-	1
-		Vacant-Residential	D	3/1	3427	3427	-	-	-	-	3	-	-	3
507		Residential	RR & H	3/1	2847	2847	20	-	-	-	3	-	-	3
501		Residential With Commercial/ Industrial	H	3/1	3421	3421	-	-	-	-	-	-	-	-
491		Residential	RR & H	3/1	2223	2223	20	-	-	-	2	-	-	2
487		Residential	RR & H	3/1	4707	4707	20	-	-	-	5	-	-	5
479		Residential	R1 & H	3/1	4075	4075	35	-	-	-	5	-	-	5
465		Residential	R1 & H	3/1	3948	3948	35	-	-	-	4	-	-	4
455		Residential With Commercial/ Industrial	C3-1 & H	3/1	3370	3370	50	30	-	-	3	-	-	3
-		Vacant-Residential	R1 & H	3/1	3447	3447	35	-	-	-	4	-	-	4
435		Residential	R1 & H	3/1	2005	2005	35	-	-	-	2	-	-	2
429		Residential	R1 & H	3/1	2285	2285	35	-	-	-	2	-	-	2
421		Residential	R1 & H	3/1	1824	1824	35	-	-	-	2	-	-	2
-		Vacant-Residential	R1 & H	3/1	1137	1137	35	-	-	-	1	-	-	1
413		Residential	R1 & H	3/1	1601	1601	35	-	-	-	1	-	-	1
405		Residential	R1 & H	3/1	2567	2567	35	-	-	-	3	-	-	3
397		Residential	R2-7 & H	3/1	1168	1168	35	-	-	-	2	-	-	2
393		Residential	R1 & H	3/1	2632	2632	35	-	-	-	3	-	-	3
385		Residential	R1 & H	3/1	2411	2411	35	-	-	-	2	-	-	2
379		Residential	R1 & H	3/1	2007	2007	35	-	-	-	2	-	-	2

-		Vacant-Residential	R1 & H	3/1	1548	1548	35	-	-	-	1	-	-	1
369		Residential	R1 & H	3/1	2593	2593	35	-	-	-	3	-	-	3
365		Residential	R1 & H	3/1	1870	1870	35	-	-	-	2	-	-	2
351		Residential	R1 & H	3/1	7426	7426	35	-	-	-	20	-	-	20
345		Residential	R1 R4H	3/1	1703	1703	35	-	-	-	2	-	-	2
341		Residential	R1 & H	3/1	1311	1311	35	-	-	-	1	-	-	1
337		Residential	R1 & H	3/1	1462	1462	35	-	-	-	1	-	-	1
331		Residential	R1 & H	3/1	1323	1323	35	-	-	-	1	-	-	1
325		Residential	R1 & H	3/1	1089	1089	35	-	-	-	1	-	-	1
323		Residential	R1 & H	3/1	1176	1176	35	-	-	-	1	-	-	1
321		Residential	R1 & H	3/1	1390	1390	35	-	-	-	1	-	-	1
319		Residential	R1-18 & H	3/1	3589	3589	35	-	-	-	4	-	-	4
313		Residential	R1 & H	3/1	2311	2311	35	-	-	-	2	-	-	2
303		Residential	R1 & H	3/1	2153	2153	35	-	-	-	2	-	-	2
297		Residential	R1 & H	3/1	2394	2394	35	-	-	-	2	-	-	2
295		Residential	R1 & H	3/1	1819	1819	35	-	-	-	2	-	-	2
289		Residential	R1 & H	3/1	1156	1156	35	-	-	-	1	-	-	1

287		Residential	R1 & H	3/1	1042	1042	35	-	-	-	1	-	-	1
283		Residential	R1 & H	3/1	1009	1009	35	-	-	-	1	-	-	1
275		Residential	R1 & H	3/1	1729	1729	35	-	-	-	2	-	-	2
271		Residential	R1 & H	3/1	955	955	35	-	-	-	1	-	-	1
269		Residential	R1 & H	3/1	883	883	35	-	-	-	1	-	-	1
265		Residential	R1 & H	3/1	1404	1404	35	-	-	-	1	-	-	1
261		Residential	R1 & H	3/1	1889	1889	35	-	-	-	2	-	-	2
257		Residential	R1 & H	3/1	898	898	35	-	-	-	1	-	-	1
237	St. Marks Church	Institutional	CF	3/1	2306 3629	5935	-	30	1781	-	-	1781	-	-
223		Vacant-Commercial	C3-5	3/1	7221	7221	50	30	6499	-	-	2166	-	-
209		Vacant-Residential	R1	3/1	1346	1346	35	30	1211	-	-	404	-	-
201		Commercial	C3	3/1	987	987	50	30	888	-	-	296	-	-
-		Residential With Commercial/ Industrial	C3	3/1	5812	5812	50	30	5231	-	-	1744	-	-
179		Residential	R1	3/1	1401	1401	35	-	-	-	1	-	-	1
175		Residential	R1	3/1	1085	1085	35	-	-	-	1	-	-	1
173		Residential	R1	3/1	1117	1117	35	-	-	-	1	-	-	1
161		Residential	R1	3/1	684	684	35	-	-	-	1	-	-	1
-		Vacant-Residential	R1	3/1	729	729	35	-	-	-	1	-	-	1
157		Residential	R1	3/1	1537	1537	35	-	-	-	1	-	-	1
155		Residential	R1	3/1	755	755	35	-	-	-	1	-	-	1
151		Residential	R1	3/1	818	818	35	-	-	-	1	-	-	1
145		Residential	R1	3/1	1753	1753	35	-	-	-	2	-	-	2
135		Residential	R1	3/1	1222	1222	35	-	-	-	1	-	-	1
129		Residential	R1-7	3/1	2262	2262	35	-	-	-	2	-	-	2
125		Residential	R1-7	3/1	1235	1235	35	-	-	-	1	-	-	1
121		Residential	R1	3/1	1551	1551	35	-	-	-	1	-	-	1
119		Residential	R1	3/1	1335	1335	35	-	-	-	1	-	-	1
113	Macpherson Motors Ltd.	Residential With Commercial/ Industrial	C3	3/1	946	946	50	30	-	-	1	-	-	1
111		Residential	R1	3/1	641	641	35	-	-	-	1	-	-	1
105		Vacant-Residential	R1	3/1	591	591	35	-	-	-	1	-	-	1
97		Residential	R1	3/1	1072	1072	35	-	-	-	1	-	-	1
93		Residential	R1	3/1	889	889	35	-	-	-	1	-	-	1
85		Residential	R1	3/1	1070	1070	35	-	-	-	1	-	-	1
81		Residential	R1	3/1	484	484	35	-	-	-	1	-	-	1
73		Residential	R1	3/1	1098	1098	35	-	-	-	1	-	-	1
65		Residential	R1	3/1	1392	1392	35	-	-	-	1	-	-	1
59		Residential	R1	3/1	1124	1124	35	-	-	-	1	-	-	1
53		Residential	R1	3/1	1062	1062	35	-	-	-	1	-	-	1
51		Commercial	C3	3/1	1018	1018	50	30	-	-	1	-	-	1
						37015			7330	0	28	2443	0	28
37		Residential	R1	3/1	1854	1854	35	30	1669	-	-	556	-	-
-		Vacant-Residential	R1-21	3/1	1342	1342	35	30	1208	-	-	403	-	-
23		Residential	R1-21	3/1	3424	3424	35	30	3082	-	-	1027	-	-
3		Open Space	-	3/1	38820	38820	-	-	-	-	-	-	-	-

									Scenario 1			Scenario 2		
Address (Cannifton Rd. N.) E. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
-		Vacant-Residential	D	3/1	5089	5089	-	30	-	4580	-	-	1527	-
-		Industrial	D	3/1	24309	24309	-	30	-	21878	-	-	7293	-
542		Residential	RR	3/1	1104	1104	20	-	-	-	1	-	-	1
536		Residential	RR	3/1	1281	1281	20	-	-	-	1	-	-	1
534		Residential	RR	3/1	1027	1027	20	-	-	-	1	-	-	1
530		Residential	RR	3/1	1199	1199	20	-	-	-	1	-	-	1
526		Residential	RR	3/1	948	948	20	-	-	-	1	-	-	1
522		Residential	RR	3/1	1205	1205	20	-	-	-	1	-	-	1
518		Residential	RR	3/1	862	862	20	-	-	-	1	-	-	1
514		Residential	RR	3/1	4536	4536	20	-	-	-	5	-	-	5
480		Residential	R1	3/1	4290	4290	35	30	-	3861	-	-	1287	-
					298082	298082			-	268274	-	-	89425	-
194		Agricultural With Residence	D-r, PA & RU	3/1	504051	504051	-	30	90729	181458	224	30243	60486	224
					78822	78822			-	56752	17	-	18917	17
376		Residential	D-r	3/1	4409	4409	-	30	-	-	4	-	-	4
366		Residential	R1	3/1	649	649	35	-	-	-	1	-	-	1
364		Residential	R1	3/1	924	924	35	-	-	-	1	-	-	1
272		Residential	R1	3/1	1810	1810	35	30	-	652	-	-	217	-

264		Residential	R1	3/1	947	947	35	-	-	-	1	-	-	1
258		Residential	R1	3/1	1133	1133	35	-	-	-	1	-	-	1
256		Residential	R1	3/1	774	774	35	-	-	-	1	-	-	1
254		Residential	R1	3/1	758	758	35	-	-	-	1	-	-	1
252		Residential	R1	3/1	724	724	35	-	-	-	1	-	-	1
240	Trust Cannifton Cemetary Boa	Vacant-Residential	CF	3/1	2450	2450	-	30	-	-	-	-	-	-
210		Residential	R1	3/1	3463	3463	35	30	1247	-	2	416	-	2
184		Residential With Commercial/ Industrial	C3	3/1	1073	1073	50	30	966	-	-	322	-	-
180		Residential	R1	3/1	784	784	35	30	706	-	-	235	-	-
178		Residential	C1	3/1	837	837	50	30	753	-	-	251	-	-
166		Residential	RR	3/1	1994	1994	20	-	-	-	2	-	-	2
162		Residential	R1	3/1	627	627	35	-	-	-	1	-	-	1
154		Assembly or Community Hall	CF	3/1	1010	1010	-	30	-	-	1	-	-	1
152		Residential	R2	3/1	434	1090	35	-	-	-	2	-	-	2
150		Residential	R2	3/1	472	474	35	-	-	-	2	-	-	2
138		Residential	R2-9 & R2-10	3/1	843	843	35	-	-	-	2	-	-	2
128		Residential	R2-8	3/1	1785	1785	35	-	-	-	3	-	-	3
124		Residential	R2-10	3/1	799	799	35	-	-	-	2	-	-	2
-		Residential	R1	3/1	703	703	35	-	-	-	1	-	-	1
120		Residential	R1	3/1	636	636	35	-	-	-	1	-	-	1
108		Commercial	C1	3/1	1123	1123	50	30	1011	-	-	337	-	-
104		Residential	R1	3/1	1072	1072	35	30	965	-	-	322	-	-
96		Residential	R1	3/1	929	929	35	30	836	-	-	279	-	-
94		Residential	R1	3/1	940	940	35	30	846	-	-	282	-	-
88		Residential	R1	3/1	971	971	35	30	874	-	-	291	-	-
84		Residential With Commercial/ Industrial	C3	3/1	5068	5068	50	30	4561	-	-	1520	-	-
68		Residential	C3	3/1	1917	1917	50	30	1725	-	-	575	-	-

66		Residential	R1 & C3	3/1	1113	1113	-	30	1002	-	-	334	-	-
60		Residential	R1	3/1	1027	1027	35	30	924	-	-	308	-	-
58		Residential	RR	3/1	667	667	20	30	600	-	-	200	-	-
54		Commercial	C3	3/1	2232	2232	50	30	2009	-	-	670	-	-
44		Residential	R1	3/1	759	759	35	30	683	-	-	228	-	-
-		Vacant-Residential	R1	3/1	828	828	35	30	745	-	-	248	-	-
38		Residential	R1	3/1	2587	2587	35	30	2328	-	-	776	-	-
24		Residential	R1	3/1	1372	1372	35	30	1235	-	-	412	-	-
20		Vacant-Residential	R1	3/1	2614	2614	35	30	2353	-	-	784	-	-

									Scenario 1			Scenario 2		
Address (Lywood St.) W. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
134		Residential	R1	3/1	751	751	35	30	676	-	-	225	-	-
110		Residential	R1	3/1	744	744	35	30	670	-	-	223	-	-
96		Residential	R1	3/1	1313	1313	35	30	1182	-	-	394	-	-
84		Residential	RR	3/1	699	699	20	30	629	-	-	210	-	-
80		Residential	R1	3/1	677	677	35	30	609	-	-	203	-	-
78		Residential	R1	3/1	718	718	35	30	646	-	-	215	-	-
76		Residential	R1	3/1	758	758	35	30	682	-	-	227	-	-
72		Residential	R1	3/1	1070	1070	35	30	963	-	-	321	-	-
52		Residential	R1	3/1	840	840	35	-	-	-	1	-	-	1
50		Residential	R1	3/1	1003	1003	35	-	-	-	1	-	-	1
46		Residential	R1	3/1	1000	1000	35	-	-	-	1	-	-	1
44		Residential	R2-2	3/1	402	402	35	-	-	-	2	-	-	2
42		Residential	R2-2	3/1	396	396	35	-	-	-	2	-	-	2
152		Residential	R1	3/1	1090	1090	35	-	-	-	1	-	-	1
18		Residential	R1	3/1	982	982	35	-	-	-	1	-	-	1
12		Residential	R1	3/1	2313	2313	35	-	-	-	2	-	-	2
6		Residential	R1	3/1	456	456	35	-	-	-	1	-	-	1
4		Residential	R1	3/1	720	720	35	-	-	-	1	-	-	1

Address (Lywood St.) E. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Scenario 1			Scenario 2		
									Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
143		Residential	RR	3/1	1455	1455	20	30	1310	-	-	437	-	-
135		Residential	R1	3/1	962	962	35	30	866	-	-	289	-	-
131		Residential	R1	3/1	950	950	35	30	855	-	-	285	-	-
105		Residential	R1	3/1	1142	1142	35	-	-	-	1	-	-	1
97		Residential	R1	3/1	955	955	35	-	-	-	1	-	-	1
93		Residential	R1	3/1	787	787	35	-	-	-	1	-	-	1
91		Residential	R1	3/1	781	781	35	-	-	-	1	-	-	1
89		Residential	R1	3/1	436	436	35	-	-	-	1	-	-	1
43		Residential	R1	3/1	1630	1630	35	-	-	-	2	-	-	2
83		Residential	R1	3/1	1076	1076	35	-	-	-	1	-	-	1
79		Residential	C3-2	3/1	1026	1026	50	30	-	-	1	-	-	1
73		Residential	R4	3/1	5873	5873	35	-	-	-	15	-	-	15
39		Residential	R1	3/1	2370	2370	35	-	-	-	2	-	-	2
37		Residential	R1	3/1	1072	1072	35	-	-	-	1	-	-	1
39		Residential	R1	3/1	738	738	35	-	-	-	1	-	-	1
27		Residential	R2	3/1	987	987	35	-	-	-	2	-	-	2
17		Residential	R2	3/1	987	987	35	-	-	-	2	-	-	2
15		Residential	R1	3/1	1010	1010	35	-	-	-	1	-	-	1

Address (River Rd.) W. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Scenario 1			Scenario 2		
									Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
-		Industrial	M1 & H	3/1	50880	50880	-	30	-	-	56	-	-	56
7		Residential	M1 & H	3/1	3287	3287	-	30	-	-	3	-	-	3

Address (River Rd.) E. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Scenario 1			Scenario 2		
									Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
134		Industrial	PA	3/1	576590	576590	-	30	-	103786	512	-	34595	512
134		Industrial	PA	3/1	18263	18263	-	30	-	-	-	-	-	-
134		Industrial	PA	3/1	28357	28357	-	30	-	2552	28	-	851	28
84		Vacant-Commercial	CF	3/1	12760	12760	-	30	-	-	14	-	-	14

Address (Short St.) W. & E. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Scenario 1			Scenario 2		
									Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
-		Vacant-Industrial	M1	3/1	7362	7362	50	30	-	6626	-	-	2209	-
-		Agricultural	D-1	3/1	45158	45158	-	30	-	40642	-	-	13547	-
86		Residential	R1	3/1	983	983	35	30	-	885	-	-	295	-
67	Trans Canada Pipelines Ltd.	Vacant-Residential	D-r	3/1	1294	1294	20	-	-	-	1	-	-	1

Address (Highway No. 37) W.Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Scenario 1			Scenario 2		
									Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
-		Industrial	RU	3/1	8285	8285	-	30	-	7457	-	-	2486	-
-		Vacant-Commercial	RU	3/1	3580	3580	-	30	-	3222	-	-	1074	-
-		Agricultural	RU	3/1	9630	9630	-	30	-	8667	-	-	2889	-
-		Agricultural	D	3/1	20045	20045	-	30	-	18041	-	-	6014	-
-		Agricultural	D	3/1	28692	28692	-	30		25823	-		8608	-
-		Commercial	D	3/1	18780	18780	-	30	-	16902	-	-	5634	-

Address (Highway No. 37) E.Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Scenario 1			Scenario 2		
									Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
-		Vacant-Residential	RU	3/1	4981	4981	-	30	-	4483	-	-	1494	-

									Scenario 1			Scenario 2		
Address (Putman Industrial Rd.) W.Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
-		Vacant-Industrial	M1	3/1	36651	36651	50	30	-	32986	-	-	10995	-
-		Vacant-Industrial	M1	3/1	18615	18615	50	30	-	16754	-	-	5585	-
-		Vacant-Industrial	M1	3/1	20935	20935	50	30	-	18842	-	-	6281	-
-		Vacant-Industrial	M1	3/1	21223	21223	50	30	-	19101	-	-	6367	-
-		Vacant-Industrial	M1	3/1	31955	31955	50	30	-	28760	-	-	9587	-
-		Agricultural	D	3/1	23817	23817	-	30	-	21435	-	-	7145	-

									Scenario 1			Scenario 2		
Address (Putman Industrial Rd.) E. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
209		Industrial	M1	3/1	29022	29022	50	30	-	26120	-	-	8707	-
197		Industrial	M1	3/1	15076	15076	50	30	-	13568	-	-	4523	-
-		Industrial	M1	3/1	15097	15097	50	30	-	13587	-	-	4529	-
-		Vacant-Industrial	M1	3/1	30392	30392	50	30	-	27353	-	-	9118	-
-		Vacant-Industrial	M1	3/1	16402	16402	50	30	-	14762	-	-	4921	-
61		Industrial	M1	3/1	11830	11830	50	30	-	10647	-	-	3549	-
43		Industrial	M1	3/1	6905	6905	50	30	-	6215	-	-	2072	-
-		Industrial	D	3/1	61478	61478	-	30	-	55330	-	-	18443	-
								Total	1864000	2179186	4451	626421	726395	4451

Industrial Lands Study Area to the East of the Cannifton Secondary Plan Study Area

									Scenario 1			Scenario 2		
Address (Casey Rd.) S. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
402		Residential	RR	3/1	3513	3513	20	30	-	3162	-	-	1054	-
394		Residential	C2	3/1	4892	4892	50	30	-	4403	-	-	1468	-
386		Residential	RR	3/1	5257	5257	20	30	-	4731	-	-	1577	-
372		Residential	RR	3/1	6333	6333	20	30	-	5700	-	-	1900	-
360		Residential	RR	3/1	4983	4983	20	30	-	4485	-	-	1495	-
341		Residential	PA & RU	3/1	294100	294100	-	30	-	264690	-	-	88230	-
282		Residential	RR	3/1	20735	20735	20	30	-	18662	-	-	6221	-
268		Residential	RR	3/1	4476	4476	20	30	-	4028	-	-	1343	-
262		Residential	RR-26	3/1	3260	3260	20	30	-	2934	-	-	978	-
256		Residential	RR-25	3/1	2985	2985	20	30	-	2687	-	-	896	-
246		Vacant-Commercial	C2	3/1	188661 20581	209242	50	30	-	188318	-	-	62773	-
-		Agricultural With Commercial/Industrial	RU	3/1	51187	51187	-	30	-	46069	-	-	15356	-
202		Residential	RR	3/1	5540 228748	234288	20	30	-	210859	-	-	70286	-
194		Residential	RR	3/1	5877	5877	20	30	-	5289	-	-	1763	-
182		Residential	RR	3/1	4924	4924	20	30	-	4432	-	-	1477	-
176		Residential	RR	3/1	4675	4675	20	30	-	4208	-	-	1403	-
158		Residential	RU	3/1	7088	7088	-	30	-	6379	-	-	2126	-
-		Agricultural	RU	3/1	247110	247110	-	30	-	222399	-	-	74133	-
136		Residential	RR	3/1	4234	4234	20	30	-	3811	-	-	1270	-
126		Residential	RR	3/1	4095	4095	20	30	-	3686	-	-	1229	-
112	Doug Winstanley Builder Ltd.	Vacant-Residential	PA	3/1	4169	4169	-	30	-	3752	-	-	1251	-
-		Agricultural With Residence	PA	3/1	226943	226943	-	30	-	204249	-	-	68083	-
102		Residential	PA	3/1	4218	4218	-	30	-	3796	-	-	1265	-

-		Vacant-Residential	RR	3/1	4228	4228	20	30	-	3805	-	-	1268	-
82		Residential	RR	3/1	5791	5791	20	30	-	5212	-	-	1737	-
72		Residential With Commercial/Industrial	RR	3/1	4962	4962	20	30	-	4466	-	-	1489	-

									Scenario 1			Scenario 2		
Address (Casey Rd.) N. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
41		Agricultural With Residence	PA	3/1	309869	309869	-	30	-	278882	-	-	92961	-
10		Residential	PA	3/1	5751	5751	-	30	-	5176	-	-	1725	-

									Scenario 1			Scenario 2		
Address (Highway 401) N. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
-		Agricultural	PA	3/1	267682	267682	-	30	-	240914	-	-	80305	-
-		Agricultural	PA, RU & H	3/1	267989	267989	-	30	-	241190	-	-	80397	-
-		Agricultural	PA, RU & H	3/1	244755	244755	-	30	-	220280	-	-	73427	-
-		Vacant-Commercial	RU & D	3/1	188661	188661	-	30	-	169795	-	-	56598	-
-		Residential	RU & D	3/1	228748	228748	-	30	-	205873	-	-	68624	-
-		Industrial	M2-1	3/1	218912	218912	50	30	-	197021	-	-	65674	-
1103		Vacant-Residential	H & D	3/1	96844	96844	-	30	-	87160	-	-	29053	-
						3105932			0	2795339	0	0	931780	0

									Scenario 1			Scenario 2		
Address (Blessington Rd.) N. & S. Side	Building Name	Existing Land Use	Zoning	Proposed/ Estimated # of Storeys	Lot Area (m2)	Total Lot Area (m2)	Zoning Lot Coverage (%)	Estimated Lot Coverage (%)	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential	Estimated Floor Area Commercial (m2)	Estimated Floor Area Industrial (m2)	Estimated Units Residential
86		Residential	PA	3/1	3277	3277	-	30	-	2949	-	-	983	-
25		Residential	PA	3/1	25854	25854	-	30	-	23269	-	-	7756	-
-		Vacant-Residential	M1-21	3/1	4900	4900	50	30	-	4410	-	-	1470	-
								Total	-	2913127	-	-	971042	-

Appendix B – Sanitary Sewer Sizing Design Sheets and Drawings

SANITARY SEWER DESIGN SHEET - PROPOSED SYSTEM

Option A - Scenario 1 (Without Pumping Station - Maximum Capacity of 3 Storeys for Commercial/Industrial)

Commercial/Institutional average daily flow (c): 5000 L/1000m2.d (2500-5000 L/1000m2.d)
Residential Unit average daily flow (p): 350 L/cap/d (225~450 L/cap.d)
Unit extraneous flow (E): 0.28 L/s/ha (0.1-0.28L.s.ha)

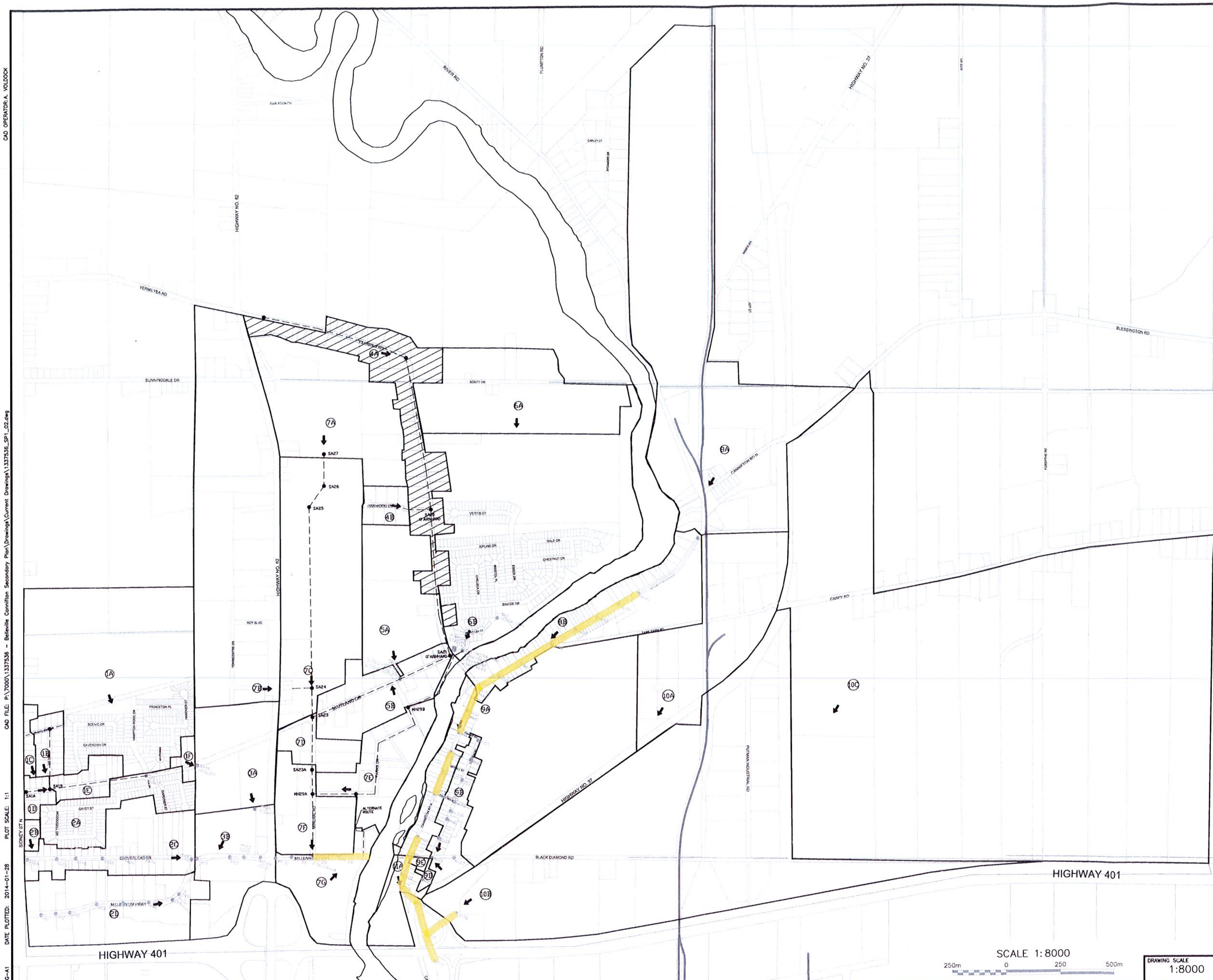
Residential: 3.0 persons/unit
Potential Connections to be reviewed:
Over Capacity:

q = average daily per capita flow (L/cap.d)
I = Unit of peak extraneous flow (L/s/ha)
Q(p) = peak population flow (L/s)
Q(c) = peak commercial/industrial flow (L/s)
Q(e) = peak extraneous flow (L/s)
Q(d) = peak design flow (L/s)

Peaking Factor:
M =1+14/(4+(P/1000)^0.5)
Q(p) = (P/1000)qM/86.4 (L/s)
Q(e) =IA (L/s); where A = Area in hectares
Q(d) = Q(p) + Q(c) + Q(e) (L/s)

Manning Equation:
Qcap. = (D/1000)^2.667*(S/100)^0.5/(3.211*n)*1000 (L/s)
D: pipe size (mm)
S: slope (grade) of pipe (%)
n: roughness coefficient n= 0.013

Location				Inlet Flow											Pipe						Q(d)/Qcap
				Commercial			Residential														
				Individual	Accumulative		Individual		Accumulative		Peaking	Pop.	Extran.	Design	Length	Size	Type	Slope	Capacity	Velocity	
Street Name	Area	From	To	Floor Area	Floor Area	Q(c)	Pop.	Area	Pop.	Area	Factor	Q(p)	Q(e)	Q(d)	L	D		S	Qcap.	V	
		MH	MH	(m2)	(m2)	(L/s)	(person)	(ha)	(person)	(ha)	M	(L/s)	(L/s)	(L/s)	(m)	(mm)		(%)	(L/s)	(m/s)	(%)
Settlers Ridge Subdivision	1A	-	SA1 (Ainley)	0	0	0.000	1632	83.13	1632	83.13	3.65	24.15	23.28	47.42		525	PVC	0.20	192.13	0.89	24.68%
Thurlow Dr & Bird Cr	1B	-	SA1B	0	0	0.000	81	3.30	81	3.30	4.27	1.40	0.92	2.32		200		0.40	20.72	0.66	11.22%
Maitland	1C	-	SA1A	0	0	0.000	45	1.65	45	1.65	4.32	0.79	0.46	1.25		200		0.40	20.72	0.66	6.04%
Maitland	1D	SA1A	SA1B	0	0	0.000	48	1.89	93	3.54	4.25	1.60	0.99	2.59		200		0.40	20.72	0.66	12.52%
Maitland	1E	SA1B	SA1 (Ainley)	0	0	0.000	114	3.74	288	10.58	4.09	4.77	2.96	7.73		200		0.40	20.72	0.66	37.31%
		SA1 (Ainley)	SA4A	0	0	0.000	0	0.00	1920	93.71	3.60	28.00	26.24	54.23		525	SDR35	0.40	271.71	1.26	19.96%
	1F	SA4A	SA10	0	0	0.000	42	1.40	1962	95.10	3.59	28.55	26.63	55.18		525	SDR35	0.40	271.71	1.26	20.31%
Deerfield Subdivision	2A	-	SA10	0	0	0.000	642	8.38	642	8.38	3.92	10.18	2.35	12.53		250	PVC	2.40	92.01	1.87	13.62%
Sidney	2B	SA2A	SA3A	0	0	0.000	30	1.01	30	1.01	4.35	0.53	0.28	0.81		200	PVC	1.60	41.43	1.32	1.96%
Cloverleaf Dr.	2C	SA3A	SA4A	10415	10415	0.603	474	16.06	504	17.07	3.97	8.11	4.78	13.49		200	PVC	0.92	31.42	1.00	42.95%
Cloverleaf Dr.		SA4A	SA5A	0	10415	0.603	0	0.00	504	17.07	3.97	8.11	4.78	13.49		200	PVC	0.40	20.72	0.66	65.13%
Cloverleaf Dr.		SA5A	SA6A	0	10415	0.603	0	0.00	504	17.07	3.97	8.11	4.78	13.49		200	PVC	0.44	21.73	0.69	62.10%
Cloverleaf Dr.		SA6A	SA7A	0	10415	0.603	0	0.00	504	17.07	3.97	8.11	4.78	13.49		200	PVC	0.53	23.85	0.76	56.59%
Cloverleaf Dr.		SA7A	SA10	0	10415	0.603	0	0.00	504	17.07	3.97	8.11	4.78	13.49		200	PVC	1.31	37.49	1.19	35.99%
Millennium Pkwy	2D	MH7	MH8	204507	204507	11.835	0	22.72	0	22.72	4.50	0.00	6.36	18.20		250	SDR35	0.40	37.56	0.77	48.45%
Millennium Pkwy		MH8	Pumping Sta.	0	204507	11.835	0	0.00	0	22.72	4.50	0.00	6.36	18.20		250	SDR35	0.64	47.51	0.97	38.30%
Millennium Pkwy		Pumping Sta.	SA10	0	204507	11.835	0	0.00	0	22.72	4.50	0.00	6.36	18.20							
Lowes	3A	-	MH8A	142644	142644	8.255	0	15.85	0	15.85	4.50	0.00	4.44	12.69		250	PVC	1.00	59.39	1.21	21.37%
Lowes	3B	MH8A	MH32	128329	270973	15.681	0	14.26	0	30.11	4.50	0.00	8.43	24.11		250	PVC	1.00	59.39	1.21	40.60%
Millennium Pkwy		SA10	SA11	0	214922	12.438	0	0	3108	143.27	3.43	43.18	40.12	95.73		600	SDR35	0.20	274.32	0.97	34.90%
Millennium Pkwy		SA11	MH33	0	214922	12.438	0	0	3108	143.27	3.43	43.18	40.12	95.73		600	SDR35	0.55	454.91	1.61	21.04%
Millennium Pkwy		MH33	MH32	0	214922	12.438	0	0	3108	143.27	3.43	43.18	40.12	95.73		600	SDR35	0.20	274.32	0.97	34.90%
Millennium Pkwy		MH32	MH31	0	485895	28.119	0	0	3108	173.38	3.43	43.18	48.55	119.84		600	SDR35	0.20	274.32	0.97	43.69%
Millennium Pkwy		MH31	MH30	0	485895	28.119	0	0	3108	173.38	3.43	43.18	48.55	119.84		600	SDR35	0.20	274.32	0.97	43.69%
Millennium Pkwy		MH30	MH29	0	485895	28.119	0	0	3108	173.38	3.43	43.18	48.55	119.84		600	SDR35	0.20	274.32	0.97	43.69%
Farnham Rd.	4A	-	SA21 (Farnham)	20118	20118	1.164	555	21.10	555	21.10	3.95	8.88	5.91	15.95		200		0.40	20.72	0.66	77.02%
Oakwood Lane	4B	SA20 (Farnham)	SA21 (Farnham)	0	0	0.000	96	3.32	96	3.32	4.25	1.65	0.93	2.58		200		0.40	20.72	0.66	12.46%
Maitland Dr.		SA21 (Farnham)	SA22	0	20118	1.164	0	0	651	24.42	3.91	10.32	6.84	18.32		250		0.28	31.43	0.64	58.29%
Maitland Dr	5A	-	SA22	0	0	0.000	663	19.89	663	19.89	3.91	10.50	5.57	16.07		200	PVC	0.50	23.16	0.74	69.37%
Maitland Dr	5B	-	SA22	118563	118563	6.861	0	13.17	0	13.17	4.50	0.00	3.69	10.55		250		0.28	31.43	0.64	33.57%
Maitland Dr		SA22	SA23	0	138681	8.026	0	0	1314	57.48	3.72	19.80	16.10	43.92		350		0.20	65.16	0.68	67.41%
Scotts Dr	6A	-	SA5 (Moira Lea)	0	0	0.000	1002	30.31	1002	30.31	3.80	15.42	8.49	23.91		450		0.25	142.40	0.90	16.79%
Moira Lea/Cannif Mills Sub.	6B	SA5 (Moira Lea)	SA1 (Moira Lea)	3852	3852	0.223	2829	66.29	3831	96.60	3.35	51.99	27.05	79.26		450	SDR35	0.25	142.40	0.90	55.66%
		SA1 (Moira Lea)	MH29B	0	3852	0.223	0	0.00	3831	96.60	3.35	51.99	27.05	79.26		450		0.20	127.36	0.80	62.23%
East of Highway 62	7A	SA27	SA26	100261	100261	5.802	681	32.85	681	32.85	3.90	10.76	9.20	25.76		300		0.22	45.30	0.64	56.87%
East of Highway 62		SA26	SA25	0	100261	5.802	0	0.00	681	32.85	3.90	10.76	9.20	25.76		300		0.22	45.30	0.64	56.87%
East of Highway 62		SA25	SA24	0	100261	5.802	0	0.00	681	32.85	3.90	10.76	9.20	25.76		300		0.39	60.32	0.85	42.72%
West of Highway 62 / Towncentre Dr.	7B	-	SA24	631259	631259	36.531	0	70.14	0	70.14	4.50	0.00	19.64	56.17		350		0.20	65.16	0.68	86.21%
East of Highway 62	7C	SA24	SA23	238603	970123	56.141	528	42.35	1209	145.34	3.75	18.34	40.70	115.18		450		0.20	127.36	0.80	90.43%
Mineral Rd	7D	SA23	SA23A	48302	1157106	66.962	0	5.37	2523	208.19	3.51	35.82	58.29	161.08		450		2.40	441.20	2.77	36.51%
Mineral Rd		SA23A	MH29A	0	1157106	66.962	0	0.00	2523	208.19	3.51	35.82	58.29	161.08		450		1.00	284.80	1.79	56.56%
Parks Dr	7E	MH29B	MH29A	110300	114152	6.606	0	12.26	3831	108.85	3.35	51.99	30.48	89.07		525		0.20	192.13	0.89	46.36%
Mineral Rd	7F	MH29A	MH29	109438	1380696	79.901	0	12.16	6354	329.21	3.15	81.00	92.18	253.08		675		0.15	325.25	0.91	77.81%
Millennium Pkwy		MH29	MH28	0	1866591	108.020	0	0.00	9462	502.59	2.98	114.17	140.72	362.91		600	SDR35	0.22	287.71	1.02	126.14%
Millennium Pkwy	7G	MH28	Siphon	97710	1964301	113.675	0	11.86	9462	514.45	2.98	114.17	144.05	371.89		600	SDR35	0.22	287.71	1.02	129.26%
Siphon		Siphon	MH11	0	1964301	113.675	0	0.00	9462	514.45	2.98	114.17	144.05	371.89		600	SDR35	0.16	464.00	1.64	80.15%
Cannifton Rd	8A	-	MH40	225987	225987	13.078	2349	98.43	2349	98.43	3.53	33.59	27.56	74.23		300	-	0.16	38.63	0.55	192.15%
Cannifton Rd	8B	MH40	MH39	66929	292916	16.951	357	18.78	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.21	43.73	0.62	201.05%
		MH39	MH38	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.23	46.32	0.66	189.81%
		MH38	MH37	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.19	42.21	0.60	208.29%
		MH37	MH36	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.23	46.32	0.66	189.81%
		MH36	MH35	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.23	46.32	0.66	189.81%
		MH35	MH34	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.23	46.32	0.66	189.81%
		MH34	MH33	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.22	45.30	0.64	194.08%
Cannifton Rd	9A	MH33	MH32	297295	590211	34.156	816	59.50	3522	176.71	3.38	48.26	49.48	131.89		450	S.S	0.18	120.49	0.76	109.46%
		MH32	MH17	0	590211	34.156	0	0.00	3522	176.71	3.38	48.26	49.48	131.89		450	S.S	0.19	122.83	0.77	107.38%
		MH17	MH16	0	590211	34.156	0	0.00	3522	176.71	3.38	48.26	49.48	131.89		450	S.S	0.45	191.05	1.20	69.04%
		MH16	MH15	0	590211	34.156	0	0.00	3522	176.71	3.38	48.26	49.48	131.89		450	S.S	0.20	128.63	0.81	102.53%
		MH15	MH14	0	590211	34.156	0	0.00	3522	176.71	3.38	48.26	49.48	131.89		450	S.S	0.20	128.32	0.81	102.79%
		MH14	MH13	0	590211	34.156	0	0.00	3522	176.71	3.38	48.26	49.48	131.89		450	S.S	0.40	181.00	1.14	72.87%
		MH13	MH12	0	590211	34.156	0	0.00	3522	176.71	3.38	48.26	49.48	131.89		450	S.S	0.20	127.68	0.80	103.30%
		MH12	MH11	0	590211	34.156	0	0.00	3522	176.71	3.38	48.26	49.48	131.89		450	S.S	0.50	202.19	1.27	65.23%
Lywood St	9B	MH25	MH19	6512	6512	0.377	153	4.13	153	4.13	4.19	2.60	1.16	4.13		200	-	0.40	20.72	0.66	19.94%
Black Diamond Rd	9C	MH27	MH19	640	640	0.037	87	2.05	87	2.05	4.26	1.50	0.57	2.11		200	-	0.40	20.72	0.66	10.19%
Lywood St	9D	MH18	MH19	3707	3707	0.215	0	0.41	0	0.41	4.50	0.00	0.12	0.33		200	-	0.40	20.72	0.66	1.59%
Black Diamond Rd	9E	MH19	MH11	3283	14142	0.818	0	0.36	240	6.96	4.12	4.00	1.95	6.77		200	-	0.40	20.72	0.66	32.68%
Highway 37	10A	-	MH7B	298935	298935	17.299	45	34.58	45	34.58	4.32	0.79	9.68	27.77		300		0.20	43.19	0.61	64.29%
South Industrial Park Area	10B	-	MH7B	1058509	1058509	61.256	0	117.61	0	117.61	4.50	0.00	32.93	94.19		600		0.20	274.32	0.97	34.33%
North Industrial Park Area	10C	-	MH7B	3009586	3009586	174.166	0	334.40	0	334.40	4.50	0.00	93.63	267.80		525		0.20	192.13	0.89	139.38%
		MH7B	MH7	0	4367030	252.722	0	0.00	45	486.59	4.32	0.79	136.25	389.76		200	Concrete	1.09	34.20	1.09	1139.77%
Cannifton Rd	11A	MH11	MH7	13302	2581956	149.419	0	5.36	13224	703.48	2.83	151.78	196.98	498.17		675	Concrete	0.35	496.83	1.39	100.27%
Cannifton Rd		MH7	401	0	6948986	402.140	0	0.00	13269	1190.08	2.83	152.22	333.22	887.58		675	Concrete	0.35	496.83	1.39	178.65%



SCALE 1:8000

250m 0 250 500m

(METRIC SCALE - ALL DIMS IN MILLIMETERS)

CAD OPERATOR: A. VOLDOCK

CAD FILE: P:\7000\1337536 - Belleville Cannifton Secondary Plan\Drawings\Current Drawings\1337536_SP1_02.dwg

PLOT SCALE: 1:1

DATE PLOTTED: 2014-01-28

GGG-A1

THE GREER GALLOWAY GROUP INC.
ENGINEERS & PLANNERS
PETERBOROUGH
BELLEVILLE
KINGSTON
1620 WALLBRIDGE LOYALIST ROAD
BELLEVILLE, ONTARIO, K8N 4Z5
PHONE: 613-966-3068
FAX: 613-966-3087

NOTES:

1. ALL WORK SHALL BE IN ACCORDANCE WITH RELEVANT CODES AND GUIDELINES.

2. ALL DRAWINGS AND ADDENDA ARE TO BE READ AS, AND IN CONJUNCTION WITH THE SPECIFICATIONS.

3. ALL EQUIPMENT SHALL BE INSTALLED AS SPECIFIED OR APPROVED EQUIVALENT.

4. CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS BEFORE PROCEEDING WITH WORK AND BE RESPONSIBLE FOR SAME.

5. CONTRACTOR MUST REPORT ANY DISCREPANCIES TO ENGINEER FOR RESOLUTION BEFORE COMMENCING THE WORK.

6. ANY CHANGES MUST BE APPROVED BY THE ENGINEER.

A — A DETAIL NO.
B — B DRAWING NO. - WHERE DETAILED

LEGEND

PROPOSED SANITARY SEWER

SA24 PROPOSED SANITARY MAINTENANCE HOLE

DRAINAGE AREA BOUNDARY

6C DRAINAGE AREA

EXISTING SANITARY SEWER

EXISTING SANITARY MAINTENANCE HOLE

OVER CAPACITY

NORTH

STAMP

PROJECT
CANNIFTON SERVICING STUDY
OPTION A - SCENARIO 1

BELLEVILLE, ONTARIO

DRAWING TITLE
SANITARY DRAINAGE AREAS

05		
04		
03		
02		
01		
REVISION		DATE

DESIGNED BY: A. VOLDOCK

DRAWN BY: A. VOLDOCK

REVIEWED BY: S. BLAKEY

APPROVED BY: S. BLAKEY

PROJECT DATE: 28/01/2014 (DD/MM/YYYY)

PROJECT #: 13-3-7536

DRAWING SCALE: 1:8000

DRAWING #: DA-1

SANITARY SEWER DESIGN SHEET - PROPOSED SYSTEM

Option A - Scenario 2 (Without Pumping Station - Maximum Capacity of 1 Storey for Commercial/Industrial)

Commercial/Institutional average daily flow (p): 5000 L/1000m2.d (2500-5000 L/1000m2.d)

Residential Unit average daily flow (q): 350 L/cap/d (225~450 L/cap.d)

Unit extraneous flow (E): 0.28 L/s/ha (0.1-0.28L.s.ha)

Residential: 3.0 persons/unit

Potential Connections to be reviewed:

Over Capacity:

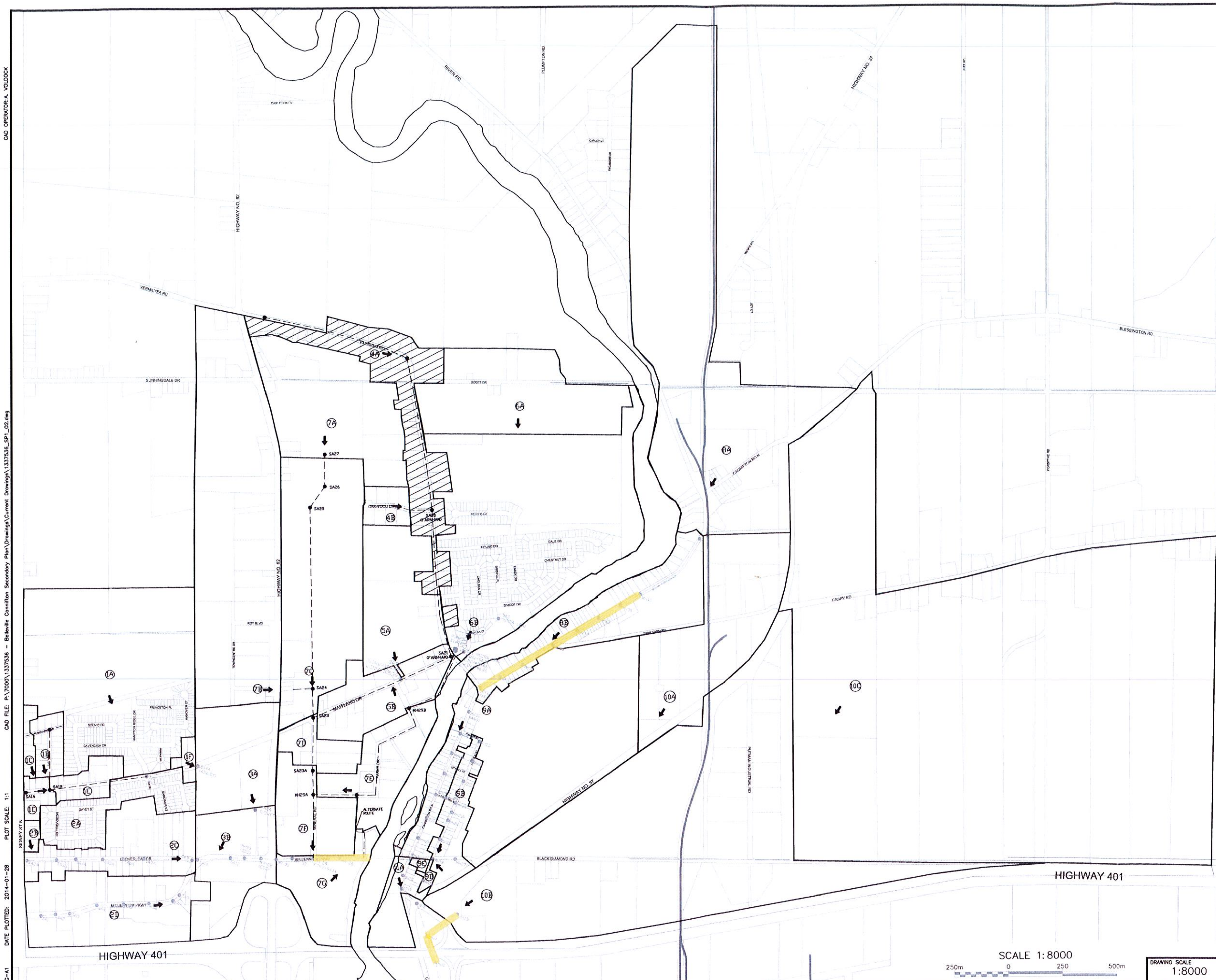
q = average daily per capita flow (L/cap.d)
I = Unit of peak extraneous flow (L/s/ha)
Q(p) = peak population flow (L/s)
Q(c) = peak commercial/industrial flow (L/s)
Q(e) = peak extraneous flow (L/s)
Q(d) = peak design flow (L/s)

Peaking Factor:
M =1+14/(4+(P/1000)^0.5)
Q(p) = (P/1000)qM/86.4 (L/s)
Q(e) =IA (L/s); where A = Area in hectares
Q(d) = Q(p) + Q(c) + Q(e) (L/s)

Manning Equation:
Qcap. = (D/1000)^2.667*(S/100)^0.5/(3.211*n)*1000 (L/s)
D: pipe size (mm)
S: slope (grade) of pipe (%)
n: roughness coefficient n= 0.013

Location				Inlet Flow: Commercial			Inlet Flow: Residential								Pipe						Q(d)/Qcap
				Individual	Accumulative		Individual		Accumulative		Peaking	Pop.	Extran.	Design	Length	Size	Type	Slope	Capacity	Velocity	
Street Name	Area	From MH	To MH	Floor Area (m2)	Floor Area (m2)	Q(c) (L/s)	Pop. (person)	Area (ha)	Pop. (person)	Area (ha)	Factor M	Q(p) (L/s)	Q(e) (L/s)	Q(d) (L/s)	L (m)	D (mm)		S (%)	Qcap. (L/s)	V (m/s)	(%)
Settlers Ridge Subdivision	1A	-	SA1 (Ainley)	0	0	0.000	1632	83.13	1632	83.13	3.65	24.15	23.28	47.42		525	PVC	0.20	192.13	0.89	24.68%
Thurlow Dr & Bird Cr	1B	-	SA1B	0	0	0.000	81	3.30	81	3.30	4.27	1.40	0.92	2.32		200		0.40	20.72	0.66	11.22%
Maitland	1C	-	SA1A	0	0	0.000	45	1.65	45	1.65	4.32	0.79	0.46	1.25		200		0.40	20.72	0.66	6.04%
Maitland	1D	SA1A	SA1B	0	0	0.000	48	1.89	93	3.54	4.25	1.60	0.99	2.59		200		0.40	20.72	0.66	12.52%
Maitland	1E	SA1B	SA1 (Ainley)	0	0	0.000	114	3.74	288	10.58	4.09	4.77	2.96	7.73		200		0.40	20.72	0.66	37.31%
		SA1 (Ainley)	SA4A	0	0	0.000	0	0.00	1920	93.71	3.60	28.00	26.24	54.23		525	SDR35	0.40	271.71	1.26	19.96%
	1F	SA4A	SA10	0	0	0.000	42	1.40	1962	95.10	3.59	28.55	26.63	55.18		525	SDR35	0.40	271.71	1.26	20.31%
Deerfield Subdivision	2A	-	SA10	0	0	0.000	642	8.38	642	8.38	3.92	10.18	2.35	12.53		250	PVC	2.40	92.01	1.87	13.62%
Sidney	2B	SA2A	SA3A	0	0	0.000	30	1.01	30	1.01	4.35	0.53	0.28	0.81		200	PVC	1.60	41.43	1.32	1.96%
Cloverleaf Dr.	2C	SA3A	SA4A	3472	3472	0.201	474	16.06	504	17.07	3.97	8.11	4.78	13.09		200	PVC	0.92	31.42	1.00	41.67%
Cloverleaf Dr.		SA4A	SA5A	0	0	0.000	0	0.00	504	17.07	3.97	8.11	4.78	12.89		200	PVC	0.40	20.72	0.66	62.23%
Cloverleaf Dr.		SA5A	SA6A	0	0	0.000	0	0.00	504	17.07	3.97	8.11	4.78	12.89		200	PVC	0.44	21.73	0.69	59.33%
Cloverleaf Dr.		SA6A	SA7A	0	0	0.000	0	0.00	504	17.07	3.97	8.11	4.78	12.89		200	PVC	0.53	23.85	0.76	54.06%
Cloverleaf Dr.		SA7A	SA10	0	0	0.000	0	0.00	504	17.07	3.97	8.11	4.78	12.89		200	PVC	1.31	37.49	1.19	34.38%
Millennium Pkwy	2D	MH7	MH8	68169	68169	3.945	0	22.72	0	22.72	4.50	0.00	6.36	10.31		250	SDR35	0.40	37.56	0.77	27.44%
Millennium Pkwy		MH8	Pumping Sta.	0	68169	3.945	0	0.00	0	22.72	4.50	0.00	6.36	10.31		250	SDR35	0.64	47.51	0.97	21.69%
Millennium Pkwy		Pumping Sta.	SA10	0	68169	3.945	0	0.00	0	22.72	4.50	0.00	6.36	10.31							
Lowes	3A	-	MH8A	47548	47548	2.752	0	15.85	0	15.85	4.50	0.00	4.44	7.19		250	PVC	1.00	59.39	1.21	12.11%
Lowes	3B	MH8A	MH32	42776	90324	5.227	0	14.26	0	30.1	4.50	0.00	8.43	13.66		250	PVC	1.00	59.39	1.21	23.00%
Millennium Pkwy		SA10	SA11	0	68169	3.945	0	0.00	3108	143.27	3.43	43.18	40.12	87.24		600	SDR35	0.20	274.32	0.97	31.80%
Millennium Pkwy		SA11	MH33	0	68169	3.945	0	0.00	3108	143.27	3.43	43.18	40.12	87.24		600	SDR35	0.55	454.91	1.61	19.18%
Millennium Pkwy		MH33	MH32	0	68169	3.945	0	0.00	3108	143.27	3.43	43.18	40.12	87.24		600	SDR35	0.20	274.32	0.97	31.80%
Millennium Pkwy		MH32	MH31	0	158493	9.172	0	0.00	3108	173.38	3.43	43.18	48.55	100.89		600	SDR35	0.20	274.32	0.97	36.78%
Millennium Pkwy		MH31	MH30	0	158493	9.172	0	0.00	3108	173.38	3.43	43.18	48.55	100.89		600	SDR35	0.20	274.32	0.97	36.78%
Millennium Pkwy		MH30	MH29	0	158493	9.172	0	0.00	3108	173.38	3.43	43.18	48.55	100.89		600	SDR35	0.20	274.32	0.97	36.78%
Farnham Rd.	4A	-	SA21 (Farnham)	6707	6707	0.388	555	21.10	555	21.1	3.95	8.88	5.91	15.18		200		0.40	20.72	0.66	73.27%
Oakwood Lane	4B	SA20 (Farnham)	SA21 (Farnham)	0	0	0.000	96	3.32	96	3.32	4.25	1.65	0.93	2.58		200		0.40	20.72	0.66	12.46%
Maitland Dr.		SA21 (Farnham)	SA22	0	6707	0.388	0	0.00	651	24.42	3.91	10.32	6.84	17.54		250		0.28	31.43	0.64	55.82%
Maitland Dr	5A	-	SA22	0	0	0.000	663	19.89	663	19.89	3.91	10.50	5.57	16.07		200	PVC	0.50	23.16	0.74	69.37%
Maitland Dr	5B	-	SA22	39521	39521	2.287	0	13.17	0	13.17	4.50	0.00	3.69	5.98		250		0.28	31.43	0.64	19.01%
Maitland Dr		SA22	SA23	0	46228	2.675	0	0.00	1314	57.48	3.72	19.80	16.10	38.57		350		0.20	65.16	0.68	59.20%
Scotts Dr	6A	-	SA5 (Moira Lea)	0	0	0.000	1002	30.31	1002	30.31	3.80	15.42	8.49	23.91		450		0.25	142.40	0.90	16.79%
Moira Lea/Cannif Mills Sub.	6B	SA5 (Moira Lea)	SA1 (Moira Lea)	1284	1284	0.074	2829	66.29	3831	96.60	3.35	51.99	27.05	79.11		450	SDR35	0.25	142.40	0.90	55.56%
		SA1 (Moira Lea)	MH29B	0	1284	0.074	0	0.00	3831	96.60	3.35	51.99	27.05	79.11		450		0.20	127.36	0.80	62.11%
East of Highway 62	7A	SA27	SA26	37321	37321	2.160	681	32.85	681	32.85	3.90	10.76	9.20	22.12		300		0.22	45.30	0.64	48.83%
East of Highway 62		SA26	SA25	0	37321	2.160	0	0.00	681	32.85	3.90	10.76	9.20	22.12		300		0.22	45.30	0.64	48.83%
East of Highway 62		SA25	SA24	0	37321	2.160	0	0.00	681	32.85	3.90	10.76	9.20	22.12		300		0.39	60.32	0.85	36.68%
West of Highway 62 / Towncentre Dr.	7B	-	SA24	210419	210419	12.177	0	70.14	0	70.14	4.50	0.00	19.64	31.82		300		0.20	43.19	0.61	73.66%
East of Highway 62	7C	SA24	SA23	79534	327274	18.939	528	42.35	1209	145.34	3.75	18.34	40.70	77.98		400		0.20	93.03	0.74	83.82%
Mineral Rd	7D	SA23	SA23A	16100	389602	22.546	0	5.37	2523	208.19	3.51	35.82	58.29	116.67		450		2.40	441.20	2.77	26.44%
Mineral Rd		SA23A	MH29A	0	389602	22.546	0	0.00	2523	208.19	3.51	35.82	58.29	116.67		450		1.00	284.80	1.79	40.96%
Parks Dr	7E	MH29B	MH29A	36767	38051	2.202	0	12.26	3831	108.85	3.35	51.99	30.48	84.67		525		0.20	192.13	0.89	44.07%
Mineral Rd	7F	MH29A	MH29	36479	464132	26.859	0	12.16	6354	329.21	3.15	81.00	92.18	200.04		675		0.15	325.25	0.91	61.50%
Millennium Pkwy		MH29	MH28	0	622625	36.032	0	0.00	9462	502.59	2.98	114.17	140.72	290.92		600	SDR35	0.22	287.71	1.02	101.12%
Millennium Pkwy	7G	MH28	Siphon	32570	655195	37.916	0	11.86	9462	514.45	2.98	114.17	144.05	296.13		600	SDR35	0.22	287.71	1.02	102.93%
Siphon		Siphon	MH11	0	655195	37.916	0	0.00	9462	514.45	2.98	114.17	144.05	296.13		600	SDR35	0.16	464.00	1.64	63.82%
Canniffon Rd	8A	-	MH40	75329	75329	4.359	2349	98.43	2349	98.43	3.53	33.59	27.56	65.51		300	-	0.16	38.63	0.55	169.58%
Canniffon Rd	8B	MH40	MH39	23497	98826	5.719	357	18.78	2706	117.21	3.48	38.15	32.82	76.69		300	S.S	0.21	43.73	0.62	175.37%
		MH39	MH38	0	98826	5.719	0	0.00	2706	117.21	3.48	38.15	32.82	76.69		300	S.S	0.23	46.32	0.66	165.56%
		MH38	MH37	0	98826	5.719	0	0.00	2706	117.21	3.48	38.15	32.82	76.69		300	S.S	0.19	42.21	0.60	181.68%
		MH37	MH36	0	98826	5.719	0	0.00	2706	117.21	3.48	38.15	32.82	76.69		300	S.S	0.23	46.32	0.66	165.56%
		MH36	MH35	0	98826	5.719	0	0.00	2706	117.21	3.48	38.15	32.82	76.69		300	S.S	0.23	46.32	0.66	165.56%
		MH35	MH34	0	98826	5.719	0	0.00	2706	117.21	3.48	38.15	32.82	76.69		300	S.S	0.23	46.32	0.66	165.56%
		MH34	MH33	0	98826	5.719	0	0.00	2706	117.21	3.48	38.15	32.82	76.69		300	S.S	0.22	45.30	0.64	169.28%
Canniffon Rd	9A	MH33	MH32	99098	197924	11.454	816	59.50	3522	176.71	3.38	48.26	49.48	109.19		450	S.S	0.18	120.49	0.76	90.62%
		MH32	MH17	0	197924	11.454	0	0.00	3522	176.71	3.38	48.26	49.48	109.19		450	S.S	0.19	122.83	0.77	88.90%
		MH17	MH16	0	197924	11.454	0	0.00	3522	176.71	3.38	48.26	49.48	109.19		450	S.S	0.45	191.05	1.20	57.15%
		MH16	MH15	0	197924	11.454	0	0.00	3522	176.71	3.38	48.26	49.48	109.19		450	S.S	0.20	128.63	0.81	84.89%
		MH15	MH14	0	197924	11.454	0	0.00	3522	176.71	3.38	48.26	49.48	109.19		450	S.S	0.20	128.32	0.81	85.09%
		MH14	MH13	0	197924	11.454	0	0.00	3522	176.71	3.38	48.26	49.48	109.19		450	S.S	0.40	181.00	1.14	60.33%
		MH13	MH12	0	197924	11.454	0	0.00	3522	176.71	3.38	48.26	49.48	109.19		450	S.S	0.20	127.68	0.80	85.52%
		MH12	MH11	0	197924	11.454	0	0.00	3522	176.71	3.38	48.26	49.48	109.19		450	S.S	0.50	202.19	1.27	54.01%
Lywood St	9B	MH25	MH19	2171	2171	0.126	153	4.13	153	4.13	4.19	2.60	1.16	3.88		200	-	0.40	20.72	0.66	18.73%
Black Diamond Rd	9C	MH27	MH19	213	213	0.012	87	2.05	87	2.05	4.26	1.50	0.57	2.09		200	-	0.40	20.72	0.66	10.07%
Lywood St	9D	MH18	MH19	1236	1236	0.072	0	0.41	0	0.41	4.50	0.00	0.12	0.19		200	-	0.40	20.72	0.66	0.90%
Black Diamond Rd	9E	MH19	MH11	1095	4715	0.273	0	0.36	240	6.96	4.12	4.00	1.95	6.23		200	-	0.40	20.72	0.66	30.05%
Highway 37	10A	-	MH7B	99645	99645	5.766	45	34.58	45	34.58	4.32	0.79	9.68	16.24		300		0.20	43.19	0.61	37.59%
South Industrial Park Area	10B	-	MH7B	352836	352836	20.419	0	117.61	0	117.61	4.50	0.00	32.93	53.35		450		0.20	127.36	0.80	41.89%
North Industrial Park Area	10C	-	MH7B	1003196	1003196	58.055	0	334.40	0	334.40	4.50	0.00	93.63	151.69		450		0.20	127.36	0.80	119.10%
		MH7B	MH7	0	1455677	84.241	0	0.00	45	486.59	4.32	0.79	136.25	221.27		200	Concrete	1.09	34.20	1.09	647.08%
Canniffon Rd	11A	MH11	MH7	4434	862268	49.900	0	5.36	13224	703.48	2.83	151.78	196.98	398.65		675	Concrete	0.35	406.83	1.39	80.24%
Canniffon Rd		MH7	401	0	2317945	134.140	0	0.00	13269	1190.08	2.83	152.22	333.22	619.58		675	Concrete	0.35	496.83	1.39	124.71%

CAD OPERATOR: A. VOLDOCK
CAD FILE: P:\7000\1337536 - Belleville Cannifton Secondary Plan\Drawings\Current Drawings\1337536_SP1_02.dwg
PLOT SCALE: 1:1
DATE PLOTTED: 2014-01-28
GGG-A1



THE GREER GALLOWAY GROUP INC.
ENGINEERS & PLANNERS

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NOTES:

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A — A DETAIL NO.
B — B DRAWING NO. - WHERE DETAILED

LEGEND

- PROPOSED SANITARY SEWER
- SA24 PROPOSED SANITARY MAINTENANCE HOLE
- DRAINAGE AREA BOUNDARY
- 6C DRAINAGE AREA
- EXISTING SANITARY SEWER
- EXISTING SANITARY MAINTENANCE HOLE
- OVER CAPACITY

NORTH | STAMP

PROJECT
CANNIFTON SERVICING STUDY
OPTION A - SCENARIO 2

BELLEVILLE, ONTARIO

DRAWING TITLE
SANITARY DRAINAGE AREAS

REVISION		DATE
05		
04		
03		
02		
01		

DESIGNED BY: A. VOLDOCK
DRAWN BY: A. VOLDOCK
REVIEWED BY: S. BLAKEY
APPROVED BY: S. BLAKEY
PROJECT DATE: 28/01/2014 (DD/MM/YYYY)
PROJECT #: 13-3-7536
DRAWING SCALE: 1:8000
DRAWING #: DA-1

(METRIC SCALE - ALL DIMS IN MILLIMETERS)

SANITARY SEWER DESIGN SHEET - PROPOSED SYSTEM

Option B - Scenario 1 (With Pumping Station - Maximum Capacity of 3 Storeys for Commercial/Industrial)

Commercial/Institutional average daily flow (p): 5000 L/1000m2.d (2500-5000 L/1000m2.d)

Residential Unit average daily flow (q): 350 L/cap/d (225~450 L/cap.d)

Unit extraneous flow (E): 0.28 L/s/ha (0.1-0.28L.s.ha)

Residential: 3.0 persons/unit

Potential Connections to be reviewed:

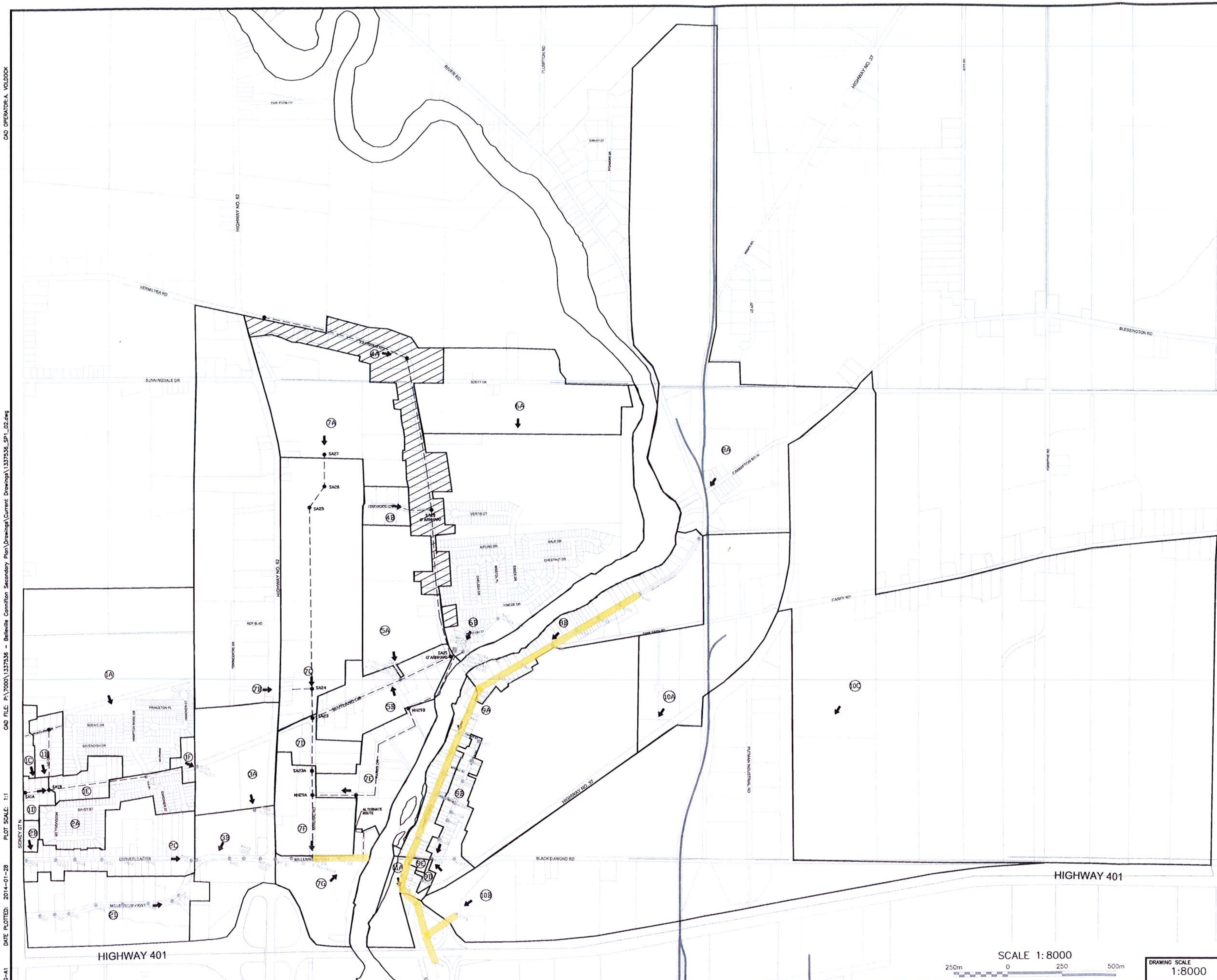
Over Capacity:

q = average daily per capita flow (L/cap.d)
I = Unit of peak extraneous flow (L/s/ha)
Q(p) = peak population flow (L/s)
Q(c) = peak commercial/industrial flow (L/s)
Q(e) = peak extraneous flow (L/s)
Q(d) = peak design flow (L/s)

Peaking Factor:
M =1+14/(4+(P/1000)^0.5)
Q(p) = (P/1000)qM/86.4 (L/s)
Q(e) =IA (L/s); where A = Area in hectares
Q(d) = Q(p) + Q(c) + Q(e) (L/s)

Manning Equation:
Qcap. = (D/1000)^2.667*(S/100)^0.5/(3.211*n)*1000 (L/s)
D: pipe size (mm)
S: slope (grade) of pipe (%)
n: roughness coefficient n= 0.013

Location				Inlet Flow: Commercial			Inlet Flow: Residential								Pipe						Q(d)/Qcap
				Individual	Accumulative		Individual		Accumulative		Peaking	Pop.	Extran.	Design	Length	Size	Type	Slope	Capacity	Velocity	
Street Name	Area	From MH	To MH	Floor Area (m2)	Floor Area (m2)	Q(c) (L/s)	Pop. (person)	Area (ha)	Pop. (person)	Area (ha)	Factor M	Q(p) (L/s)	Q(e) (L/s)	Q(d) (L/s)	L (m)	D (mm)		S (%)	Qcap. (L/s)	V (m/s)	(%)
Settlers Ridge Subdivision	1A	-	SA1 (Ainley)	0	0	0.000	1632	83.13	1632	83.13	3.65	24.15	23.28	47.42		525	PVC	0.20	192.13	0.89	24.68%
Thurlow Dr & Bird Cr	1B	-	SA1B	0	0	0.000	81	3.30	81	3.30	4.27	1.40	0.92	2.32		200		0.40	20.72	0.66	11.22%
Maitland Dr.	1C	-	SA1A	0	0	0.000	45	1.65	45	1.65	4.32	0.79	0.46	1.25		200		0.40	20.72	0.66	6.04%
Maitland Dr.	1D	SA1A	SA1B	0	0	0.000	48	1.89	93	3.54	4.25	1.60	0.99	2.59		200		0.40	20.72	0.66	12.52%
Maitland Dr.	1E	SA1B	SA1 (Ainley)	0	0	0.000	114	3.74	288	10.58	4.09	4.77	2.96	7.73		200		0.40	20.72	0.66	37.31%
		SA1 (Ainley)	SA4A	0	0	0.000	0	0.00	1920	93.71	3.60	28.00	26.24	54.23		525	SDR35	0.40	271.71	1.26	19.96%
	1F	SA4A	SA10	0	0	0.000	42	1.40	1962	95.10	3.59	28.55	26.63	55.18		525	SDR35	0.40	271.71	1.26	20.31%
Deerfield Subdivision	2A	-	SA10	0	0	0.000	642	8.38	642	8.38	3.92	10.18	2.35	12.53		250	PVC	2.40	92.01	1.87	13.62%
Sidney	2B	SA2A	SA3A	0	0	0.000	30	1.01	30	1.01	4.35	0.53	0.28	0.81		200	PVC	1.60	41.43	1.32	1.96%
Cloverleaf Dr.	2C	SA3A	SA4A	10415	10415	0.603	474	16.06	504	17.07	3.97	8.11	4.78	13.49		200	PVC	0.92	31.42	1.00	42.95%
Cloverleaf Dr.		SA4A	SA5A	0	10415	0.603	0	0.00	504	17.07	3.97	8.11	4.78	13.49		200	PVC	0.40	20.72	0.66	65.13%
Cloverleaf Dr.		SA5A	SA6A	0	10415	0.603	0	0.00	504	17.07	3.97	8.11	4.78	13.49		200	PVC	0.44	21.73	0.69	62.10%
Cloverleaf Dr.		SA6A	SA7A	0	10415	0.603	0	0.00	504	17.07	3.97	8.11	4.78	13.49		200	PVC	0.53	23.85	0.76	56.59%
Cloverleaf Dr.		SA7A	SA10	0	10415	0.603	0	0.00	504	17.07	3.97	8.11	4.78	13.49		200	PVC	1.31	37.49	1.19	35.99%
Millennium Pkwy	2D	MH7	MH8	204507	204507	11.835	0	22.72	0	22.72	4.50	0.00	6.36	18.20		250	SDR35	0.40	37.56	0.77	48.45%
Millennium Pkwy		MH8	Pumping Sta.	0	204507	11.835	0	0.00	0	22.72	4.50	0.00	6.36	18.20		250	SDR35	0.64	47.51	0.97	38.30%
Millennium Pkwy		Pumping Sta.	SA10	0	204507	11.835	0	0.00	0	22.72	4.50	0.00	6.36	18.20							
Lowes	3A	-	MH8A	142644	142644	8.255	0	15.85	0	15.85	4.50	0.00	4.44	12.69		250	PVC	1.00	59.39	1.21	21.37%
Lowes	3B	MH8A	MH32	128329	270973	15.681	0	14.26	0	30.11	4.50	0.00	8.43	24.11		250	PVC	1.00	59.39	1.21	40.60%
Millennium Pkwy		SA10	SA11	0	214922	12.438	0	0	3108	143.27	3.43	43.18	40.12	95.73		600	SDR35	0.20	274.32	0.97	34.90%
Millennium Pkwy		SA11	MH33	0	214922	12.438	0	0.00	3108	143.27	3.43	43.18	40.12	95.73		600	SDR35	0.55	454.91	1.61	21.04%
Millennium Pkwy		MH33	MH32	0	214922	12.438	0	0.00	3108	143.27	3.43	43.18	40.12	95.73		600	SDR35	0.20	274.32	0.97	34.90%
Millennium Pkwy		MH32	MH31	0	485895	28.119	0	0.00	3108	173.38	3.43	43.18	48.55	119.84		600	SDR35	0.20	274.32	0.97	43.69%
Millennium Pkwy		MH31	MH30	0	485895	28.119	0	0.00	3108	173.38	3.43	43.18	48.55	119.84		600	SDR35	0.20	274.32	0.97	43.69%
Millennium Pkwy		MH30	MH29	0	485895	28.119	0	0.00	3108	173.38	3.43	43.18	48.55	119.84		600	SDR35	0.20	274.32	0.97	43.69%
Farnham Rd.	4A	-	SA21 (Farnham)	20118	20118	1.164	555	21.10	555	21.10	3.95	8.88	5.91	15.95		200		0.40	20.72	0.66	77.02%
Oakwood Lane	4B	SA20 (Farnham)	SA21 (Farnham)	0	0	0.000	96	3.32	96	3.32	4.25	1.65	0.93	2.58		200		0.40	20.72	0.66	12.46%
Maitland Dr.		SA21 (Farnham)	SA22	0	20118	1.164	0	0	651	24.42	3.91	10.32	6.84	18.32		250		0.28	31.43	0.64	58.29%
Maitland Dr	5A	-	SA22	0	0	0.000	663	19.89	663	19.89	3.91	10.50	5.57	16.07		200	PVC	0.50	23.16	0.74	69.37%
Maitland Dr	5B	-	SA22	118563	118563	6.861	0	13.17	0	13.17	4.50	0.00	3.69	10.55		250		0.28	31.43	0.64	33.57%
Maitland Dr		SA22	SA23	0	138681	8.026	0	0.00	1314	57.48	3.72	19.80	16.10	43.92		350		0.20	65.16	0.68	67.41%
Scotts Dr	6A	-	SA5 (Moira Lea)	0	0	0.000	1002	30.31	1002	30.31	3.80	15.42	8.49	23.91		450		0.25	142.40	0.90	16.79%
Moira Lea/Cannif Mills Sub.	6B	SA5 (Moira Lea)	SA1 (Moira Lea)	3852	3852	0.223	2829	66.29	3831	96.60	3.35	51.99	27.05	79.26		450	SDR35	0.25	142.40	0.90	55.66%
Pumping Station		SA1 (Moira Lea)	MH33	0	3852	0.223	0	0.00	3831	96.60	3.35	51.99	27.05	79.26		450		0.20	127.36	0.80	62.23%
East of Highway 62	7A	SA27	SA26	100261	100261	5.802	681	32.85	681	32.85	3.90	10.76	9.20	25.76		300		0.22	45.30	0.64	56.87%
East of Highway 62		SA26	SA25	0	100261	5.802	0	0.00	681	32.85	3.90	10.76	9.20	25.76		300		0.22	45.30	0.64	56.87%
East of Highway 62		SA25	SA24	0	100261	5.802	0	0.00	681	32.85	3.90	10.76	9.20	25.76		300		0.39	60.32	0.85	42.72%
West of Highway 62 / Towncentre Dr.	7B	-	SA24	631259	631259	36.531	0	70.14	0	70.14	4.50	0.00	19.64	56.17		350		0.20	65.16	0.68	86.21%
East of Highway 62	7C	SA24	SA23	238603	970123	56.141	528	42.35	1209	145.34	3.75	18.34	40.70	115.18		450		0.20	127.36	0.80	90.43%
Mineral Rd	7D	SA23	SA23A	48302	1157106	66.962	0	5.37	2523	208.19	3.51	35.82	58.29	161.08		450		2.40	441.20	2.77	36.51%
Mineral Rd		SA23A	MH29A	0	1157106	66.962	0	0.00	2523	208.19	3.51	35.82	58.29	161.08		450		1.00	284.80	1.79	56.56%
Parks Dr	7E	-	MH29A	110300	110300	6.383	0	12.26	0	12.26	4.50	0.00	3.43	9.81		200		0.20	14.65	0.47	67.00%
Mineral Rd	7F	MH29A	MH29	109438	1376844	79.678	0	12.16	2523	232.61	3.51	35.82	65.13	180.63		600		0.15	237.57	0.84	76.03%
Millennium Pkwy		MH29	MH28	0	1862739	107.797	0	0.00	5631	405.99	3.20	72.92	113.68	294.40		600	SDR35	0.22	287.71	1.02	102.32%
Millennium Pkwy	7G	MH28	Siphon	97710	1960449	113.452	0	11.86	5631	417.85	3.20	72.92	117.00	303.37		600	SDR35	0.22	287.71	1.02	105.44%
Siphon		Siphon	MH11	0	1960449	113.452	0	0.00	5631	417.85	3.20	72.92	117.00	303.37		600	SDR35	0.16	464.00	1.64	65.38%
Cannifton Rd	8A	-	MH40	225987	225987	13.078	2349	98.43	2349	98.43	3.53	33.59	27.56	74.23		300	-	0.16	38.63	0.55	192.15%
Cannifton Rd	8B	MH40	MH39	66929	292916	16.951	357	18.78	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.21	43.73	0.62	201.05%
		MH39	MH38	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.23	46.32	0.66	189.81%
		MH38	MH37	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.19	42.21	0.60	208.29%
		MH37	MH36	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.23	46.32	0.66	189.81%
		MH36	MH35	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.23	46.32	0.66	189.81%
		MH35	MH34	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.23	46.32	0.66	189.81%
		MH34	MH33	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.22	45.30	0.64	194.08%
Cannifton Rd	9A	MH33	MH32	297295	594063	34.379	816	59.50	7353	273.31	3.09	91.92	76.53	202.83		450	S.S	0.18	120.49	0.76	168.33%
		MH32	MH17	0	594063	34.379	0	0.00	7353	273.31	3.09	91.92	76.53	202.83		450	S.S	0.19	122.83	0.77	165.13%
		MH17	MH16	0	594063	34.379	0	0.00	7353	273.31	3.09	91.92	76.53	202.83		450	S.S	0.45	191.05	1.20	106.17%
		MH16	MH15	0	594063	34.379	0	0.00	7353	273.31	3.09	91.92	76.53	202.83		450	S.S	0.20	128.63	0.81	157.68%
		MH15	MH14	0	594063	34.379	0	0.00	7353	273.31	3.09	91.92	76.53	202.83		450	S.S	0.20	128.32	0.81	158.07%
		MH14	MH13	0	594063	34.379	0	0.00	7353	273.31	3.09	91.92	76.53	202.83		450	S.S	0.40	181.00	1.14	112.06%
		MH13	MH12	0	594063	34.379	0	0.00	7353	273.31	3.09	91.92	76.53	202.83		450	S.S	0.20	127.68	0.80	158.85%
		MH12	MH11	0	594063	34.379	0	0.00	7353	273.31	3.09	91.92	76.53	202.83		450	S.S	0.50	202.19	1.27	100.32%
Lywood St	9B	MH25	MH19	6512	6512	0.377	153	4.13	153	4.13	4.19	2.60	1.16	4.13		200	-	0.40	20.72	0.66	19.94%
Black Diamond Rd	9C	MH27	MH19	640	640	0.037	87	2.05	87	2.05	4.26	1.50	0.57	2.11		200	-	0.40	20.72	0.66	10.19%
Lywood St	9D	MH18	MH19	3707	3707	0.215	0	0.41	0	0.41	4.50	0.00	0.12	0.33		200	-	0.40	20.72	0.66	1.59%
Black Diamond Rd	9E	MH19	MH11	3283	14142	0.818	0	0.36	240	6.96	4.12	4.00	1.95	6.77		200	-	0.40	20.72	0.66	32.68%
Highway 37	10A	-	MH7B	298935	298935	17.299	45	34.58	45	34.58	4.32	0.79	9.68	27.77		300		0.20	43.19	0.61	64.29%
South Industrial Park Area	10B	-	MH7B	1058509	1058509	61.256	0	117.61	0	117.61	4.50	0.00	32.93	94.19		600		0.20	274.32	0.97	34.33%
North Industrial Park Area	10C	-	MH7B	3009586	3009586	174.166	0	334.40	0	334.40	4.50	0.00	93.63	267.80		525		0.20	192.13	0.89	139.38%
		MH7B	MH7	0	4367030	252.722	0	0.00	45	486.59	4.32	0.79	136.25	389.76		200	Concrete	1.09	34.20	1.09	1139.77%
Cannifton Rd	11A	MH11	MH7	13302	2581956	149.419	0	5.36	13224	703.48	2.83	151.78	196.98	498.17		675	Concrete	0.35	496.83	1.39	100.27%
Cannifton Rd		MH7	401	0	6948986	402.140	0	0.00	13269	1190.08	2.83	152.22	333.22	887.58		675	Concrete	0.35	496.83	1.39	178.65%



THE GREER GALLOWAY GROUP INC.
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FAX: 613-966-3087

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5. CONTRACTOR MUST REPORT ANY DISCREPANCIES TO ENGINEER FOR RESOLUTION BEFORE COMMENCING THE WORK.
6. ANY CHANGES MUST BE APPROVED BY THE ENGINEER.

A — DETAIL NO.
B — DRAWING NO. – WHERE DETAILED

LEGEND

- PROPOSED SANITARY SEWER
- SA24 PROPOSED SANITARY MAINTENANCE HOLE
- DRAINAGE AREA BOUNDARY
- 6C DRAINAGE AREA
- EXISTING SANITARY SEWER
- EXISTING SANITARY MAINTENANCE HOLE
- OVER CAPACITY

NORTH

STAMP

PROJECT

CANNIFTON SERVICING STUDY

OPTION B - SCENARIO 1

BELLEVILLE, ONTARIO

DRAWING TITLE

SANITARY DRAINAGE AREAS

REVISION		DATE
05		
04		
03		
02		
01		

DESIGNED BY: A. VOLDOCK

DRAWN BY: A. VOLDOCK

REVIEWED BY: S. BLAKEY

APPROVED BY: S. BLAKEY

PROJECT DATE: 28/01/2014 (DD/MM/YYYY)

PROJECT #: 13-3-7536

DRAWING SCALE: 1:8000

DRAWING #: DA-1

CAD OPERATOR: A. VOLDOCK

CAD FILE: P:\7000\1337536 - Belleville Cannifton Secondary Plan\Drawings\Current Drawings\1337536_SP1_02.dwg

PLOT SCALE: 1:1

DATE PLOTTED: 2014-01-28

GGG-A1

(METRIC SCALE – ALL DIMS IN MILLIMETERS)

SANITARY SEWER DESIGN SHEET - PROPOSED SYSTEM

Option B - Scenario 2 (With Pumping Station - Maximum Capacity of 1 Storey for Commercial/Industrial)

Commercial/Institutional average daily flow (p): 5000 L/1000m2.d (2500-5000 L/1000m2.d)

Residential Unit average daily flow (q): 350 L/cap/d (225~450 L/cap.d)

Unit extraneous flow (E): 0.28 L/s/ha (0.1-0.28L.s.ha)

Residential: 3.0 persons/unit

Potential Connections to be reviewed:

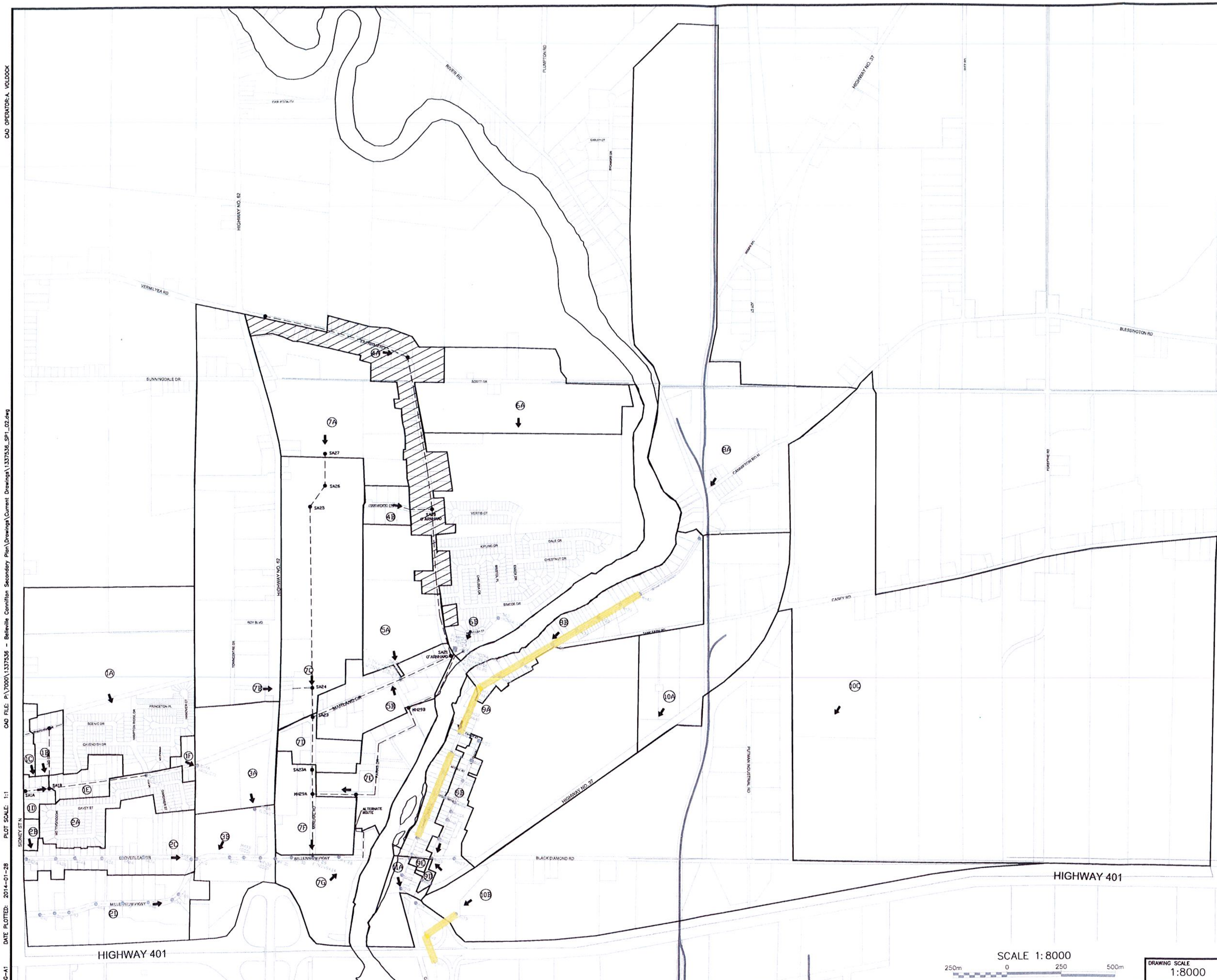
Over Capacity:

q = average daily per capita flow (L/cap.d)
I = Unit of peak extraneous flow (L/s/ha)
Q(p) = peak population flow (L/s)
Q(c) = peak commercial/industrial flow (L/s)
Q(e) = peak extraneous flow (L/s)
Q(d) = peak design flow (L/s)

Peaking Factor:
M =1+14/(4+(P/1000)^0.5)
Q(p) = (P/1000)qM/86.4 (L/s)
Q(e) =IA (L/s); where A = Area in hectares
Q(d) = Q(p) + Q(c) + Q(e) (L/s)

Manning Equation:
Qcap. = (D/1000)^2.667*(S/100)^0.5/(3.211*n)*1000 (L/s)
D: pipe size (mm)
S: slope (grade) of pipe (%)
n: roughness coefficient n= 0.013

Location				Inlet Flow											Pipe						Q(d)/Qcap
				Commercial			Residential														
				Individual	Accumulative		Individual		Accumulative		Peaking	Pop.	Extran.	Design	Length	Size	Type	Slope	Capacity	Velocity	
Street Name	Area	From	To	Floor Area	Floor Area	Q(c)	Pop.	Area	Pop.	Area	Factor	Q(p)	Q(e)	Q(d)	L	D		S	Qcap.	V	
		MH	MH	(m2)	(m2)	(L/s)	(person)	(ha)	(person)	(ha)	M	(L/s)	(L/s)	(L/s)	(m)	(mm)		(%)	(L/s)	(m/s)	(%)
Settlers Ridge Subdivision	1A	-	SA1 (Ainley)	0	0	0.000	1632	83.13	1632	83.13	3.65	24.15	23.28	47.42		525	PVC	0.20	192.13	0.89	24.68%
Thurlow Dr & Bird Cr	**1B**	**-**	**SA1B**	**0**	**0**	**0.000**	**81**	**3.30**	**81**	**3.30**	**4.27**	**1.40**	**0.92**	**2.32**		**200**		**0.40**	**20.72**	**0.66**	**11.22%**
Maitland Dr.	**1C**	**-**	**SA1A**	**0**	**0**	**0.000**	**45**	**1.65**	**45**	**1.65**	**4.32**	**0.79**	**0.46**	**1.25**		**200**		**0.40**	**20.72**	**0.66**	**6.04%**
Maitland Dr.	**1D**	**SA1A**	**SA1B**	**0**	**0**	**0.000**	**48**	**1.89**	**93**	**3.54**	**4.25**	**1.60**	**0.99**	**2.59**		**200**		**0.40**	**20.72**	**0.66**	**12.52%**
Maitland Dr.	**1E**	**SA1B**	**SA1 (Ainley)**	**0**	**0**	**0.000**	**114**	**3.74**	**288**	**10.58**	**4.09**	**4.77**	**2.96**	**7.73**		**200**		**0.40**	**20.72**	**0.66**	**37.31%**
		SA1 (Ainley)	SA4A	0	0	0.000	0	0.00	1920	93.71	3.60	28.00	26.24	54.23		525	SDR35	0.40	271.71	1.26	19.96%
		SA4A	SA10	0	0	0.000	42	1.40	1962	95.10	3.59	28.55	26.63	55.18		525	SDR35	0.40	271.71	1.26	20.31%
Deerfield Subdivision	2A	-	SA10	0	0	0.000	642	8.38	642	8.38	3.92	10.18	2.35	12.53		250	PVC	2.40	92.01	1.87	13.62%
Sidney	2B	SA2A	SA3A	0	0	0.000	30	1.01	30	1.01	4.35	0.53	0.28	0.81		200	PVC	1.60	41.43	1.32	1.96%
Cloverleaf Dr.	2C	SA3A	SA4A	3472	3472	0.201	474	16.06	504	17.07	3.97	8.11	4.78	13.09		200	PVC	0.92	31.42	1.00	41.67%
Cloverleaf Dr.		SA4A	SA5A	0	0	0.000	0	0.00	504	17.07	3.97	8.11	4.78	12.89		200	PVC	0.40	20.72	0.66	62.23%
Cloverleaf Dr.		SA5A	SA6A	0	0	0.000	0	0.00	504	17.07	3.97	8.11	4.78	12.89		200	PVC	0.44	21.73	0.69	59.33%
Cloverleaf Dr.		SA6A	SA7A	0	0	0.000	0	0.00	504	17.07	3.97	8.11	4.78	12.89		200	PVC	0.53	23.85	0.76	54.06%
Cloverleaf Dr.		SA7A	SA10	0	0	0.000	0	0.00	504	17.07	3.97	8.11	4.78	12.89		200	PVC	1.31	37.49	1.19	34.38%
Millennium Pkwy	2D	MH7	MH8	68169	68169	3.945	0	22.72	0	22.72	4.50	0.00	6.36	10.31		250	SDR35	0.40	37.56	0.77	27.44%
Millennium Pkwy		MH8	Pumping Sta.	0	68169	3.945	0	0.00	0	22.72	4.50	0.00	6.36	10.31		250	SDR35	0.64	47.51	0.97	21.69%
Millennium Pkwy		Pumping Sta.	SA10	0	68169	3.945	0	0.00	0	22.72	4.50	0.00	6.36	10.31							
Lowes	3A	-	MH8A	47548	47548	2.752	0	15.85	0	15.85	4.50	0.00	4.44	7.19		250	PVC	1.00	59.39	1.21	12.11%
Lowes	3B	MH8A	MH32	42776	90324	5.227	0	14.26	0	30.11	4.50	0.00	8.43	13.66		250	PVC	1.00	59.39	1.21	23.00%
Millennium Pkwy		SA10	SA11	0	68169	3.945	0	0	3108	143.27	3.43	43.18	40.12	87.24		600	SDR35	0.20	274.32	0.97	31.80%
Millennium Pkwy		SA11	MH33	0	68169	3.945	0	0.00	3108	143.27	3.43	43.18	40.12	87.24		600	SDR35	0.55	454.91	1.61	19.18%
Millennium Pkwy		MH33	MH32	0	68169	3.945	0	0.00	3108	143.27	3.43	43.18	40.12	87.24		600	SDR35	0.20	274.32	0.97	31.80%
Millennium Pkwy		MH32	MH31	0	158493	9.172	0	0.00	3108	173.38	3.43	43.18	48.55	100.89		600	SDR35	0.20	274.32	0.97	36.78%
Millennium Pkwy		MH31	MH30	0	158493	9.172	0	0.00	3108	173.38	3.43	43.18	48.55	100.89		600	SDR35	0.20	274.32	0.97	36.78%
Millennium Pkwy		MH30	MH29	0	158493	9.172	0	0.00	3108	173.38	3.43	43.18	48.55	100.89		600	SDR35	0.20	274.32	0.97	36.78%
Farnham Rd.	**4A**	**-**	**SA21 (Farnham)**	**6707**	**6707**	**0.388**	**555**	**21.10**	**555**	**21.10**	**3.95**	**8.88**	**5.91**	**15.18**		**200**		**0.40**	**20.72**	**0.66**	**73.27%**
Oakwood Lane	**4B**	**SA20 (Farnham)**	**SA21 (Farnham)**	**0**	**0**	**0.000**	**96**	**3.32**	**96**	**3.32**	**4.25**	**1.65**	**0.93**	**2.58**		**200**		**0.40**	**20.72**	**0.66**	**12.46%**
Maitland Dr.		**SA21 (Farnham)**	**SA22**	**0**	**6707**	**0.388**	**0**	**0**	**651**	**24.42**	**3.91**	**10.32**	**6.84**	**17.54**		**250**		**0.28**	**31.43**	**0.64**	**55.82%**
Maitland Dr	**5A**	**-**	**SA22**	**0**	**0**	**0.000**	**663**	**19.89**	**663**	**19.89**	**3.91**	**10.50**	**5.57**	**16.07**		**200**	**PVC**	**0.50**	**23.16**	**0.74**	**69.37%**
Maitland Dr	**5B**	**-**	**SA22**	**39521**	**39521**	**2.287**	**0**	**13.17**	**0**	**13.17**	**4.50**	**0.00**	**3.69**	**5.98**		**250**		**0.28**	**31.43**	**0.64**	**19.01%**
Maitland Dr		**SA22**	**SA23**	**0**	**46228**	**2.675**	**0**	**0.00**	**1314**	**57.48**	**3.72**	**19.80**	**16.10**	**38.57**		**350**		**0.20**	**65.16**	**0.68**	**59.20%**
Scotts Dr	**6A**	**-**	**SA5 (Moira Lea)**	**0**	**0**	**0.000**	**1002**	**30.31**	**1002**	**30.31**	**3.80**	**15.42**	**8.49**	**23.91**		**450**		**0.25**	**142.40**	**0.90**	**16.79%**
Moira Lea/Cannif Mills Sub.	6B	SA5 (Moira Lea)	SA1 (Moira Lea)	1284	1284	0.074	2829	66.29	3831	96.60	3.35	51.99	27.05	79.11		450	SDR35	0.25	142.40	0.90	55.56%
Pumping Station		SA1 (Moira Lea)	MH33	0	1284	0.074	0	0.00	3831	96.60	3.35	51.99	27.05	79.11		450		0.20	127.36	0.80	62.11%
East of Highway 62	7A	SA27	SA26	37321	37321	2.160	681	32.85	681	32.85	3.90	10.76	9.20	22.12		300		0.22	45.30	0.64	48.83%
East of Highway 62		SA26	SA25	0	0	0.000	0	0.00	681	32.85	3.90	10.76	9.20	19.96		300		0.22	45.30	0.64	44.06%
East of Highway 62		SA25	SA24	0	0	0.000	0	0.00	681	32.85	3.90	10.76	9.20	19.96		300		0.39	60.32	0.85	33.10%
West of Highway 62 / Towncentre Dr.	**7B**	**-**	**SA24**	**210419**	**210419**	**12.177**	**0**	**70.14**	**0**	**70.14**	**4.50**	**0.00**	**19.64**	**31.82**		**300**		**0.20**	**43.19**	**0.61**	**73.66%**
East of Highway 62	7C	SA24	SA23	79534	327274	18.939	528	42.35	1209	145.34	3.75	18.34	40.70	77.98		400		0.20	93.03	0.74	83.82%
Mineral Rd	7D	SA23	SA23A	16100	389602	22.546	0	5.37	2523	208.19	3.51	35.82	58.29	116.67		450		2.40	441.20	2.77	26.44%
Mineral Rd		SA23A	MH29A	0	389602	22.546	0	0.00	2523	208.19	3.51	35.82	58.29	116.67		450		1.00	284.80	1.79	40.96%
Parks Dr	7E	-	MH29A	36767	36767	2.128	0	12.26	0	12.26	4.50	0.00	3.43	5.56		200		0.20	14.65	0.47	37.95%
Mineral Rd	7F	MH29A	MH29	36479	462848	26.785	0	12.16	2523	232.61	3.51	35.82	65.13	127.74		525		0.15	166.39	0.77	76.77%
Millennium Pkwy		MH29	MH28	0	621341	35.957	0	0.00	5631	405.99	3.20	72.92	113.68	222.56		600	SDR35	0.22	287.71	1.02	77.35%
Millennium Pkwy	7G	MH28	Siphon	32570	653911	37.842	0	11.86	5631	417.85	3.20	72.92	117.00	227.76		600	SDR35	0.22	287.71	1.02	79.16%
Siphon		Siphon	MH11	0	653911	37.842	0	0.00	5631	417.85	3.20	72.92	117.00	227.76		600	SDR35	0.16	464.00	1.64	49.09%
Cannifton Rd	8A	-	MH40	75329	75329	4.359	2349	98.43	2349	98.43	3.53	33.59	27.56	65.51		300	-	0.16	39.11	0.55	167.50%
Cannifton Rd	8B	MH40	MH39	23497	98826	5.719	357	18.78	2706	117.21	3.48	38.15	32.82	76.69		300	S.S	0.21	43.73	0.62	175.37%
		MH39	MH38	0	98826	5.719	0	0.00	2706	117.21	3.48	38.15	32.82	76.69		300	S.S	0.23	46.32	0.66	165.56%
		MH38	MH37	0	98826	5.719	0	0.00	2706	117.21	3.48	38.15	32.82	76.69		300	S.S	0.19	42.21	0.60	181.68%
		MH37	MH36	0	98826	5.719	0	0.00	2706	117.21	3.48	38.15	32.82	76.69		300	S.S	0.23	46.32	0.66	165.56%
		MH36	MH35	0	98826	5.719	0	0.00	2706	117.21	3.48	38.15	32.82	76.69		300	S.S	0.23	46.32	0.66	165.56%
		MH35	MH34	0	98826	5.719	0	0.00	2706	117.21	3.48	38.15	32.82	76.69		300	S.S	0.23	46.32	0.66	165.56%
		MH34	MH33	0	98826	5.719	0	0.00	2706	117.21	3.48	38.15	32.82	76.69		300	S.S	0.22	45.30	0.64	169.28%
Cannifton Rd	9A	MH33	MH32	99098	199208	11.528	816	59.50	7353	273.31	3.09	91.92	76.53	179.97		450	S.S	0.18	120.49	0.76	149.37%
		MH32	MH17	0	199208	11.528	0	0.00	7353	273.31	3.09	91.92	76.53	179.97		450	S.S	0.19	122.83	0.77	146.53%
		MH17	MH16	0	199208	11.528	0	0.00	7353	273.31	3.09	91.92	76.53	179.97		450	S.S	0.45	191.05	1.20	94.20%
		MH16	MH15	0	199208	11.528	0	0.00	7353	273.31	3.09	91.92	76.53	179.97		450	S.S	0.20	128.63	0.81	139.91%
		MH15	MH14	0	199208	11.528	0	0.00	7353	273.31	3.09	91.92	76.53	179.97		450	S.S	0.20	128.32	0.81	140.26%
		MH14	MH13	0	199208	11.528	0	0.00	7353	273.31	3.09	91.92	76.53	179.97		450	S.S	0.40	181.00	1.14	99.44%
		MH13	MH12	0	199208	11.528	0	0.00	7353	273.31	3.09	91.92	76.53	179.97		450	S.S	0.20	127.68	0.80	140.95%
		MH12	MH11	0	199208	11.528	0	0.00	7353	273.31	3.09	91.92	76.53	179.97		450	S.S	0.50	202.19	1.27	89.01%
Lywood St	9B	MH25	MH19	2171	2171	0.126	153	4.13	153	4.13	4.19	2.60	1.16	3.88		200	-	0.40	20.72	0.66	18.73%
Black Diamond Rd	9C	MH27	MH19	213	213	0.012	87	2.05	87	2.05	4.26	1.50	0.57	2.09		200	-	0.40	20.72	0.66	10.07%
Lywood St	9D	MH18	MH19	1236	1236	0.072	0	0.41	0	0.41	4.50	0.00	0.12	0.19		200	-	0.40	20.72	0.66	0.90%
Black Diamond Rd	9E	MH19	MH11	1095	4715	0.273	0	0.36	240	6.96	4.12	4.00	1.95	6.23		200	-	0.40	20.72	0.66	30.05%
Highway 37	10A	-	MH7B	99645	99645	5.766	45	34.58	45	34.58	4.32	0.79	9.68	16.24		300		0.20	43.19	0.61	37.59%
South Industrial Park Area	10B	-	MH7B	352836	352836	20.419	0	117.61	0	117.61	4.50	0.00	32.93	53.35		450		0.20	127.36	0.80	41.89%
North Industrial Park Area	10C	-	MH7B	1003196	1003196	58.055	0	334.40	0	334.40	4.50	0.00	93.63	151.69		450		0.20	127.36	0.80	119.10%
		MH7B	MH7	0	1455677	84.241	0	0.00	45	486.59	4.32	0.79	136.25	221.27		200	Concrete	1.09	34.20	1.09	647.08%
Cannifton Rd	11A	MH11	MH7	4434	862268	49.900	0	5.36	13224	703.48	2.83	151.78	196.98	398.65		675	Concrete	0.35	496.83	1.39	80.24%
Cannifton Rd		MH7	401	0	2317945	134.140	0	0.00	13269	1190.08	2.83	152.22	333.22	619.58		675	Concrete	0.35	496.83	1.39	124.71%



THE GREER GALLOWAY GROUP INC.
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NOTES:

1. ALL WORK SHALL BE IN ACCORDANCE WITH RELEVANT CODES AND GUIDELINES.
2. ALL DRAWINGS AND ADDENDA ARE TO BE READ AS, AND IN CONJUNCTION WITH THE SPECIFICATIONS.
3. ALL EQUIPMENT SHALL BE INSTALLED AS SPECIFIED OR APPROVED EQUIVALENT.
4. CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS BEFORE PROCEEDING WITH WORK AND BE RESPONSIBLE FOR SAME.
5. CONTRACTOR MUST REPORT ANY DISCREPANCIES TO ENGINEER FOR RESOLUTION BEFORE COMMENCING THE WORK.
6. ANY CHANGES MUST BE APPROVED BY THE ENGINEER.

A — A DETAIL NO.
B — B DRAWING NO. - WHERE DETAILED

LEGEND

- PROPOSED SANITARY SEWER
- SA24 PROPOSED SANITARY MAINTENANCE HOLE
- DRAINAGE AREA BOUNDARY
- 6C DRAINAGE AREA
- EXISTING SANITARY SEWER
- EXISTING SANITARY MAINTENANCE HOLE
- OVER CAPACITY

NORTH

STAMP

PROJECT

CANNIFTON SERVICING STUDY

OPTION B - SCENARIO 2

BELLEVILLE, ONTARIO

DRAWING TITLE

SANITARY DRAINAGE AREAS

REVISION		DATE
05		
04		
03		
02		
01		

DESIGNED BY A. VOLDOCK

DRAWN BY A. VOLDOCK

REVIEWED BY S. BLAKEY

APPROVED BY S. BLAKEY

PROJECT DATE 28/01/2014 (DD/MM/YYYY)

PROJECT # 13-3-7536

DRAWING SCALE 1:8000

DRAWING # DA-1

(METRIC SCALE - ALL DIMS IN MILLIMETERS)

CAD OPERATOR: A. VOLDOCK

CAD FILE: P:\70001\1337536 - Belleville Cannifton Secondary Plan\Drawings\Current Drawings\1337536_SP1_02.dwg

PLOT SCALE: 1:1

DATE PLOTTED: 2014-01-28

GGG-A1

SANITARY SEWER DESIGN SHEET - PROPOSED SYSTEM

Option C - Scenario 1 (Without Pumping Station and Without Commercial/Industrial to East - Maximum Capacity of 3 Storeys for Commercial/Industrial)

Commercial/Institutional average daily flow (c): 5000 L/1000m2.d (2500-5000 L/1000m2.d)

Residential Unit average daily flow (p): 350 L/cap/d (225~450 L/cap.d)

Unit extraneous flow (E): 0.28 L/s/ha (0.1-0.28L.s.ha)

Residential: 3.0 persons/unit

Potential Connections to be reviewed:

Over Capacity:

q = average daily per capita flow (L/cap.d)
I = Unit of peak extraneous flow (L/s/ha)
Q(p) = peak population flow (L/s)
Q(c) = peak commercial/industrial flow (L/s)
Q(e) = peak extraneous flow (L/s)
Q(d) = peak design flow (L/s)

Peaking Factor:
M =1+14/(4+(P/1000)^0.5)
Q(p) = (P/1000)qM/86.4 (L/s)
Q(e) =IA (L/s); where A = Area in hectares
Q(d) = Q(p) + Q(c) + Q(e) (L/s)

Manning Equation:
Qcap. = (D/1000)^2.667*(S/100)^0.5/(3.211*n)*1000 (L/s)
D: pipe size (mm)
S: slope (grade) of pipe (%)
n: roughness coefficient n= 0.013

Location				Inlet Flow											Pipe						Q(d)/Qcap
				Commercial			Residential														
				Individual	Accumulative		Individual		Accumulative		Peaking	Pop.	Extran.	Design	Length	Size	Type	Slope	Capacity	Velocity	
Street Name	Area	From	To	Floor Area	Floor Area	Q(c)	Pop.	Area	Pop.	Area	Factor	Q(p)	Q(e)	Q(d)	L	D		S	Qcap.	V	
		MH	MH	(m2)	(m2)	(L/s)	(person)	(ha)	(person)	(ha)	M	(L/s)	(L/s)	(L/s)	(m)	(mm)		(%)	(L/s)	(m/s)	(%)
Settlers Ridge Subdivision	1A	-	SA1 (Ainley)	0	0	0.000	1632	83.13	1632	83.13	3.65	24.15	23.28	47.42		525	PVC	0.20	192.13	0.89	24.68%
Thurlow Dr & Bird Cr	**1B**	**-**	**SA1B**	**0**	**0**	**0.000**	**81**	**3.30**	**81**	**3.30**	**4.27**	**1.40**	**0.92**	**2.32**		**200**		**0.40**	**20.72**	**0.66**	**11.22%**
Maitland	**1C**	**-**	**SA1A**	**0**	**0**	**0.000**	**45**	**1.65**	**45**	**1.65**	**4.32**	**0.79**	**0.46**	**1.25**		**200**		**0.40**	**20.72**	**0.66**	**6.04%**
Maitland	**1D**	**SA1A**	**SA1B**	**0**	**0**	**0.000**	**48**	**1.89**	**93**	**3.54**	**4.25**	**1.60**	**0.99**	**2.59**		**200**		**0.40**	**20.72**	**0.66**	**12.52%**
Maitland	**1E**	**SA1B**	**SA1 (Ainley)**	**0**	**0**	**0.000**	**114**	**3.74**	**288**	**10.58**	**4.09**	**4.77**	**2.96**	**7.73**		**200**		**0.40**	**20.72**	**0.66**	**37.31%**
		SA1 (Ainley)	SA4A	0	0	0.000	0	0.00	1920	93.71	3.60	28.00	26.24	54.23		525	SDR35	0.40	271.71	1.26	19.96%
	1F	SA4A	SA10	0	0	0.000	42	1.40	1962	95.10	3.59	28.55	26.63	55.18		525	SDR35	0.40	271.71	1.26	20.31%
Deerfield Subdivision	2A	-	SA10	0	0	0.000	642	8.38	642	8.38	3.92	10.18	2.35	12.53		250	PVC	2.40	92.01	1.87	13.62%
Sidney	2B	SA2A	SA3A	0	0	0.000	30	1.01	30	1.01	4.35	0.53	0.28	0.81		200	PVC	1.60	41.43	1.32	1.96%
Cloverleaf Dr.	2C	SA3A	SA4A	10415	10415	0.603	474	16.06	504	17.07	3.97	8.11	4.78	13.49		200	PVC	0.92	31.42	1.00	42.95%
Cloverleaf Dr.		SA4A	SA5A	0	10415	0.603	0	0.00	504	17.07	3.97	8.11	4.78	13.49		200	PVC	0.40	20.72	0.66	65.13%
Cloverleaf Dr.		SA5A	SA6A	0	10415	0.603	0	0.00	504	17.07	3.97	8.11	4.78	13.49		200	PVC	0.44	21.73	0.69	62.10%
Cloverleaf Dr.		SA6A	SA7A	0	10415	0.603	0	0.00	504	17.07	3.97	8.11	4.78	13.49		200	PVC	0.53	23.85	0.76	56.59%
Cloverleaf Dr.		SA7A	SA10	0	10415	0.603	0	0.00	504	17.07	3.97	8.11	4.78	13.49		200	PVC	1.31	37.49	1.19	35.99%
Millennium Pkwy	2D	MH7	MH8	204507	204507	11.835	0	22.72	0	22.72	4.50	0.00	6.36	18.20		250	SDR35	0.40	37.56	0.77	48.45%
Millennium Pkwy		MH8	Pumping Sta.	0	204507	11.835	0	0.00	0	22.72	4.50	0.00	6.36	18.20		250	SDR35	0.64	47.51	0.97	38.30%
Millennium Pkwy		Pumping Sta.	SA10		204507	11.835	0	0.00	0	22.72	4.50	0.00	6.36	18.20							
Lowes	3A	-	MH8A	142644	142644	8.255	0	15.85	0	15.85	4.50	0.00	4.44	12.69		250	PVC	1.00	59.39	1.21	21.37%
Lowes	3B	MH8A	MH32	128329	270973	15.681	0	14.26	0	30.11	4.50	0.00	8.43	24.11		250	PVC	1.00	59.39	1.21	40.60%
Millennium Pkwy		SA10	SA11	0	214922	12.438	0	0	3108	143.27	3.43	43.18	40.12	95.73		600	SDR35	0.20	274.32	0.97	34.90%
Millennium Pkwy		SA11	MH33	0	214922	12.438	0	0	3108	143.27	3.43	43.18	40.12	95.73		600	SDR35	0.55	454.91	1.61	21.04%
Millennium Pkwy		MH33	MH32	0	214922	12.438	0	0	3108	143.27	3.43	43.18	40.12	95.73		600	SDR35	0.20	274.32	0.97	34.90%
Millennium Pkwy		MH32	MH31	0	485895	28.119	0	0	3108	173.38	3.43	43.18	48.55	119.84		600	SDR35	0.20	274.32	0.97	43.69%
Millennium Pkwy		MH31	MH30	0	485895	28.119	0	0	3108	173.38	3.43	43.18	48.55	119.84		600	SDR35	0.20	274.32	0.97	43.69%
Millennium Pkwy		MH30	MH29	0	485895	28.119	0	0.00	3108	173.38	3.43	43.18	48.55	119.84		600	SDR35	0.20	274.32	0.97	43.69%
Farnham Rd.	**4A**	**-**	**SA21 (Farnham)**	**20118**	**20118**	**1.164**	**555**	**21.10**	**555**	**21.10**	**3.95**	**8.88**	**5.91**	**15.95**		**200**		**0.40**	**20.72**	**0.66**	**77.02%**
Oakwood Lane	**4B**	**SA20 (Farnham)**	**SA21 (Farnham)**	**0**	**0**	**0.000**	**96**	**3.32**	**96**	**3.32**	**4.25**	**1.65**	**0.93**	**2.58**		**200**		**0.40**	**20.72**	**0.66**	**12.46%**
Maitland Dr.		**SA21 (Farnham)**	**SA22**	**0**	**20118**	**1.164**	**0**	**0**	**651**	**24.42**	**3.91**	**10.32**	**6.84**	**18.32**		**250**		**0.28**	**31.43**	**0.64**	**58.29%**
Maitland Dr	**5A**	**-**	**SA22**	**0**	**0**	**0.000**	**663**	**19.89**	**663**	**19.89**	**3.91**	**10.50**	**5.57**	**16.07**		**200**	**PVC**	**0.50**	**23.16**	**0.74**	**69.37%**
Maitland Dr	**5B**	**-**	**SA22**	**118563**	**118563**	**6.861**	**0**	**13.17**	**0**	**13.17**	**4.50**	**0.00**	**3.69**	**10.55**		**250**		**0.28**	**31.43**	**0.64**	**33.57%**
Maitland Dr		**SA22**	**SA23**	**0**	**138681**	**8.026**	**0**	**0.00**	**1314**	**57.48**	**3.72**	**19.80**	**16.10**	**43.92**		**350**		**0.20**	**65.16**	**0.68**	**67.41%**
Scotts Dr	**6A**	**-**	**SA5 (Moira Lea)**	**0**	**0**	**0.000**	**1002**	**30.31**	**1002**	**30.31**	**3.80**	**15.42**	**8.49**	**23.91**		**450**		**0.25**	**142.40**	**0.90**	**16.79%**
Moira Lea/Cannif Mills Sub.	6B	SA5 (Moira Lea)	SA1 (Moira Lea)	3852	3852	0.223	2829	66.29	3831	96.60	3.35	51.99	27.05	79.26		450	SDR35	0.25	142.40	0.90	55.66%
		SA1 (Moira Lea)	MH29B	0	3852	0.223	0	0.00	3831	96.60	3.35	51.99	27.05	79.26		450		0.20	127.36	0.80	62.23%
East of Highway 62	7A	SA27	SA26	100261	100261	5.802	681	32.85	681	32.85	3.90	10.76	9.20	25.76		300		0.22	45.30	0.64	56.87%
East of Highway 62		SA26	SA25	0	100261	5.802	0	0.00	681	32.85	3.90	10.76	9.20	25.76		300		0.22	45.30	0.64	56.87%
East of Highway 62		SA25	SA24	0	100261	5.802	0	0.00	681	32.85	3.90	10.76	9.20	25.76		300		0.39	60.32	0.85	42.72%
West of Highway 62 / Towncentre Dr.	**7B**	**-**	**SA24**	**631259**	**631259**	**36.531**	**0**	**70.14**	**0**	**70.14**	**4.50**	**0.00**	**19.64**	**56.17**		**350**		**0.20**	**65.18**	**0.68**	**86.21%**
East of Highway 62	7C	SA24	SA23	238603	970123	56.141	528	42.35	1209	145.34	3.75	18.34	40.70	115.18		450		0.20	127.36	0.80	90.43%
Mineral Rd	7D	SA23	SA23A	48302	1157106	66.962	0	5.37	2523	208.19	3.51	35.82	58.29	161.08		450		2.40	441.20	2.77	36.51%
Mineral Rd		SA23A	MH29A	0	1157106	66.962	0	0.00	2523	208.19	3.51	35.82	58.29	161.08		450		1.00	284.80	1.79	56.56%
Parks Dr	7E	MH29B	MH29A	110300	114152	6.606	0	12.26	3831	108.85	3.35	51.99	30.48	89.07		525		0.20	192.13	0.89	46.36%
Mineral Rd	7F	MH29A	MH29	109438	1380696	79.901	0	12.16	6354	329.21	3.15	81.00	92.18	253.08		675		0.15	325.25	0.91	77.81%
Millennium Pkwy		MH29	MH28	0	1866591	108.020	0	0.00	9462	502.59	2.98	114.17	140.72	362.91		600	SDR35	0.22	287.71	1.02	126.14%
Millennium Pkwy	7G	MH28	Siphon	97710	1964301	113.675	0	11.86	9462	514.45	2.98	114.17	144.05	371.89		600	SDR35	0.22	287.71	1.02	129.26%
Siphon		Siphon	MH11	0	1964301	113.675	0	0.00	9462	514.45	2.98	114.17	144.05	371.89		600	SDR35	0.16	464.00	1.64	80.15%
Cannifton Rd	8A	-	MH40	225987	225987	13.078	2349	98.43	2349	98.43	3.53	33.59	27.56	74.23		300	-	0.16	38.63	0.55	192.15%
Cannifton Rd	8B	MH40	MH39	66929	292916	16.951	357	18.78	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.21	43.73	0.62	201.05%
		MH39	MH38	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.23	46.32	0.66	189.81%
		MH38	MH37	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.19	42.21	0.60	208.29%
		MH37	MH36	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.23	46.32	0.66	189.81%
		MH36	MH35	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.23	46.32	0.66	189.81%
		MH35	MH34	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.23	46.32	0.66	189.81%
		MH34	MH33	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.22	45.30	0.64	194.08%
Cannifton Rd	9A	MH33	MH32	297295	590211	34.156	816	59.50	3522	176.71	3.38	48.26	49.48	131.89		450	S.S	0.18	120.49	0.76	109.46%
		MH32	MH17	0	590211	34.156	0	0.00	3522	176.71	3.38	48.26	49.48	131.89		450	S.S	0.19	122.83	0.77	107.38%
		MH17	MH16	0	590211	34.156	0	0.00	3522	176.71	3.38	48.26	49.48	131.89		450	S.S	0.45	191.05	1.20	69.04%
		MH16	MH15	0	590211	34.156	0	0.00	3522	176.71	3.38	48.26	49.48	131.89		450	S.S	0.20	128.63	0.81	102.53%
		MH15	MH14	0	590211	34.156	0	0.00	3522	176.71	3.38	48.26	49.48	131.89		450	S.S	0.20	128.32	0.81	102.79%
		MH14	MH13	0	590211	34.156	0	0.00	3522	176.71	3.38	48.26	49.48	131.89		450	S.S	0.40	181.00	1.14	72.87%
		MH13	MH12	0	590211	34.156	0	0.00	3522	176.71	3.38	48.26	49.48	131.89		450	S.S	0.20	127.68	0.80	103.30%
		MH12	MH11	0	590211	34.156	0	0.00	3522	176.71	3.38	48.26	49.48	131.89		450	S.S	0.50	202.19	1.27	65.23%
Lywood St	9B	MH25	MH19	6512	6512	0.377	153	4.13	153	4.13	4.19	2.60	1.16	4.13		200	-	0.40	20.72	0.66	19.94%
Black Diamond Rd	9C	MH27	MH19	640	640	0.037	87	2.05	87	2.05	4.26	1.50	0.57	2.11		200	-	0.40	20.72	0.66	10.19%
Lywood St	9D	MH18	MH19	3707	3707	0.215	0	0.41	0	0.41	4.50	0.00	0.12	0.33		200	-	0.40	20.72	0.66	1.59%
Black Diamond Rd	9E	MH19	MH11	3283	14142	0.818	0	0.36	240	6.96	4.12	4.00	1.95	6.77		200	-	0.40	20.72	0.66	32.68%
Highway 37	10A	-	MH7B	0	0	0.000	0	0.00	0	0.00	4.50	0.00	0.00	0.00		300		0.20	43.19	0.61	0.00%
South Industrial Park Area	10B	-	MH7B	0	0	0.000	0	0.00	0	0.00	4.50	0.00	0.00	0.00		600		0.20	274.32	0.97	0.00%
North Industrial Park Area	10C	-	MH7B	0	0	0.000	0	0.00	0	0.00	4.50	0.00	0.00	0.00		525		0.20	192.13	0.89	0.00%
		MH7B	MH7	0	0	0.000	0	0.00	0	0.00	4.50	0.00	0.00	0.00		200	Concrete	1.09	34.20	1.09	0.00%
Cannifton Rd	11A	MH11	MH7	13302	2581956	149.419	0	5.36	13224	703.48	2.83	151.78	196.98	498.17		675	Concrete	0.35	496.83	1.39	100.27%
Cannifton Rd		MH7	401	0	2581956	149.419	0	0.00	13224	703.48	2.83	151.78	196.98	498.17		675	Concrete	0.35	496.83	1.39	100.27%

THE GREER GALLOWAY GROUP INC.
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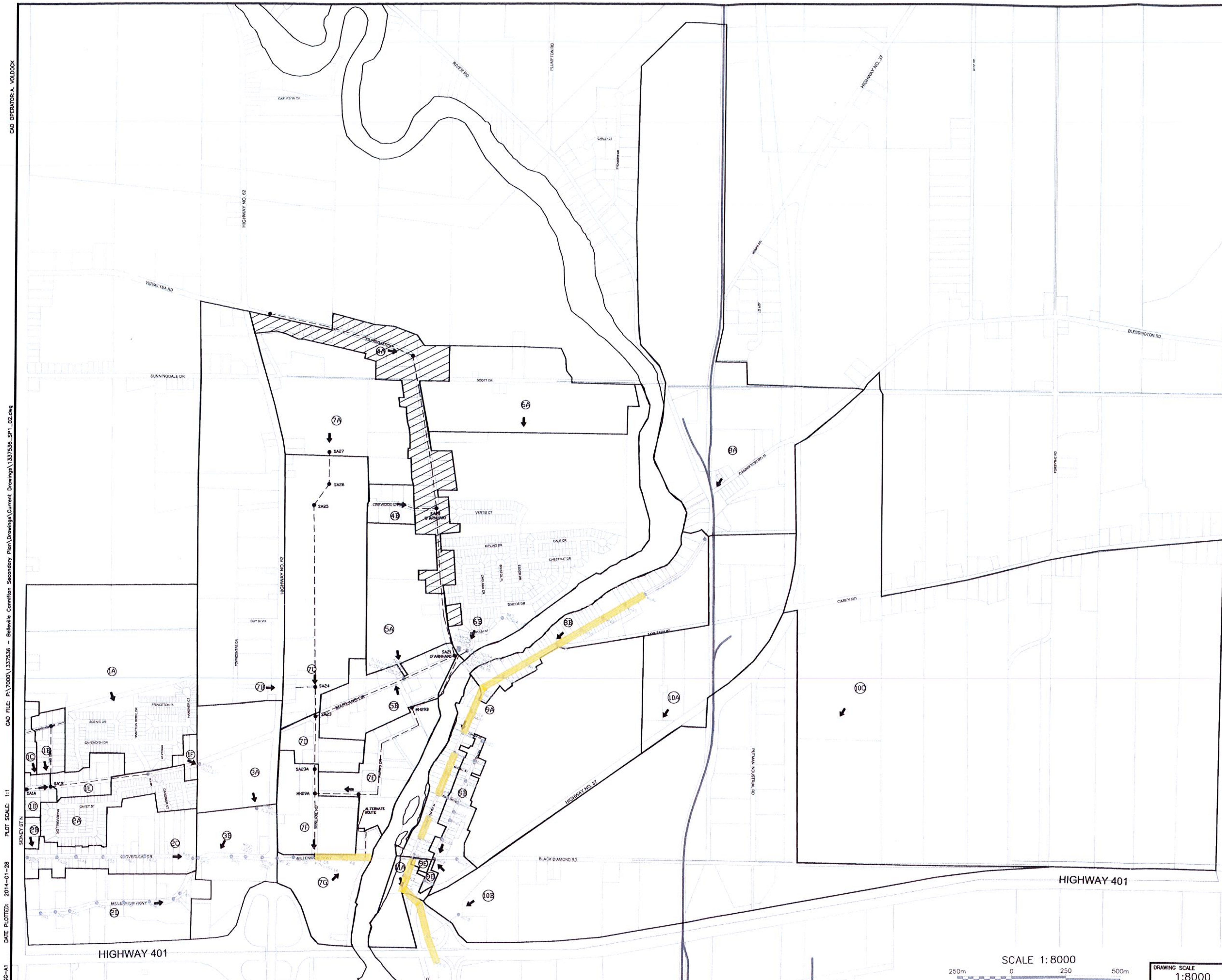


NOTES:

1. ALL WORK SHALL BE IN ACCORDANCE WITH RELEVANT CODES AND GUIDELINES.
2. ALL DRAWINGS AND ADDENDA ARE TO BE READ AS, AND IN CONJUNCTION WITH THE SPECIFICATIONS.
3. ALL EQUIPMENT SHALL BE INSTALLED AS SPECIFIED OR APPROVED EQUIVALENT.
4. CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS BEFORE PROCEEDING WITH WORK AND BE RESPONSIBLE FOR SAME.
5. CONTRACTOR MUST REPORT ANY DISCREPANCIES TO ENGINEER FOR RESOLUTION BEFORE COMMENCING THE WORK.
6. ANY CHANGES MUST BE APPROVED BY THE ENGINEER.

A — A DETAIL NO.
B — B DRAWING NO. - WHERE DETAILED

LEGEND

- PROPOSED SANITARY SEWER
- SA24 PROPOSED SANITARY MAINTENANCE HOLE
- DRAINAGE AREA BOUNDARY
- 6C DRAINAGE AREA
- EXISTING SANITARY SEWER
- EXISTING SANITARY MAINTENANCE HOLE
- OVER CAPACITY

NORTH

STAMP

PROJECT

CANNIFTON SERVICING STUDY

OPTION C - SCENARIO 1

BELLEVILLE, ONTARIO

DRAWING TITLE

SANITARY DRAINAGE AREAS

REVISION		DATE
05		
04		
03		
02		
01		

DESIGNED BY: A. VOLDOCK

DRAWN BY: A. VOLDOCK

REVIEWED BY: S. BLAKEY

APPROVED BY: S. BLAKEY

PROJECT DATE: 28/01/2014 (DD/MM/YYYY)

PROJECT #: 13-3-7536

DRAWING SCALE: 1:8000

DRAWING #: DA-1

CAD OPERATOR: A. VOLDOCK

CAD FILE: P:\7000\1337536 - Belleville Cannifton Secondary Plan\Drawings\Current Drawings\1337536_SP1_02.dwg

PLOT SCALE: 1:1

DATE PLOTTED: 2014-01-28

GGG-A1

(METRIC SCALE - ALL DIMS IN MILLIMETERS)

SANITARY SEWER DESIGN SHEET - PROPOSED SYSTEM

Option D - Scenario 1 (With Pumping Station and Without Commercial/Industrial to East - Maximum Capacity of 3 Storeys for Commercial/Industrial)

Commercial/Institutional average daily flow (p): 5000 L/1000m2.d (2500-5000 L/1000m2.d)

Residential Unit average daily flow (q): 350 L/cap/d (225~450 L/cap.d)

Unit extraneous flow (E): 0.28 L/s/ha (0.1-0.28L.s.ha)

Residential: 3.0 persons/unit

Potential Connections to be reviewed:

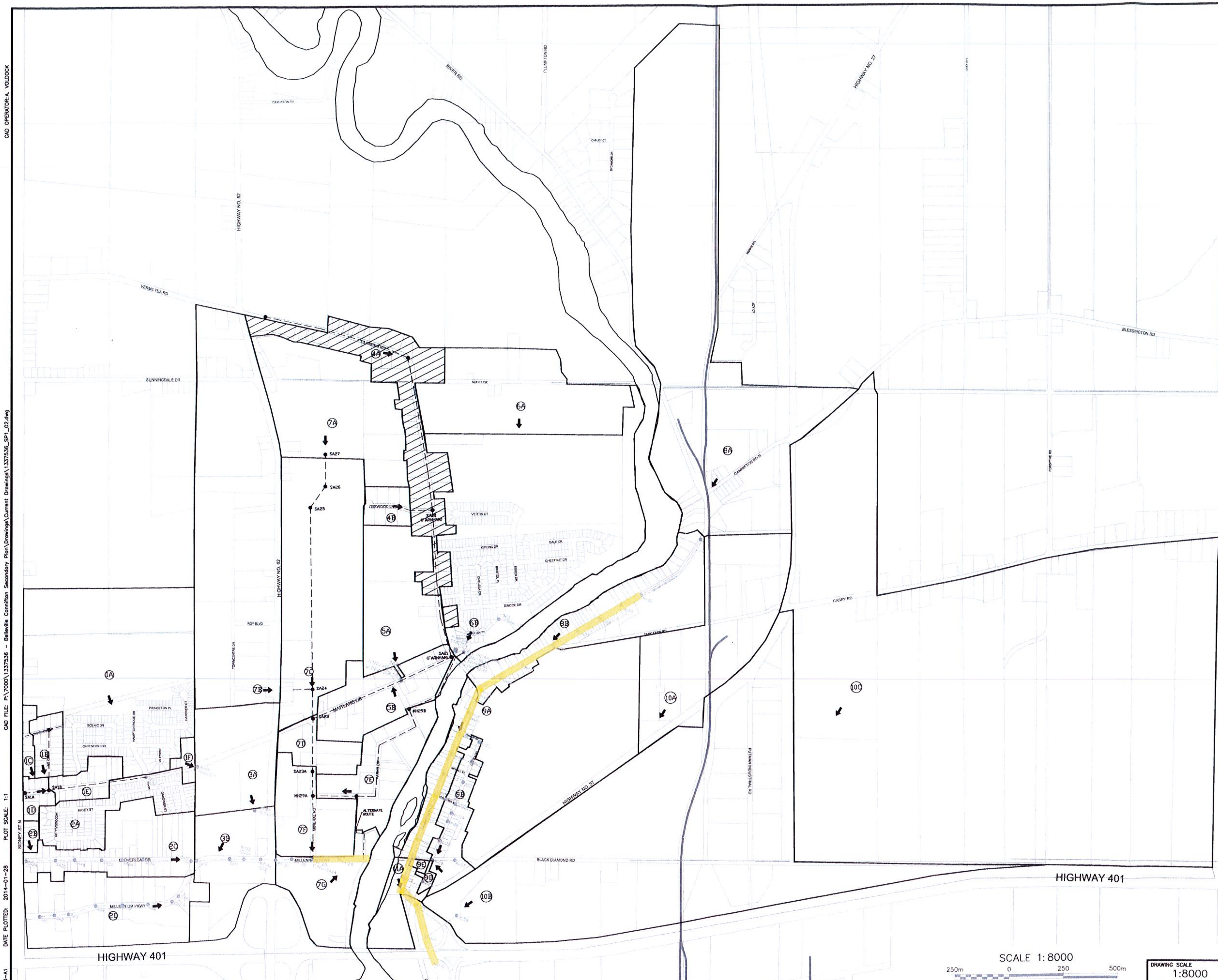
Over Capacity:

q = average daily per capita flow (L/cap.d)
I = Unit of peak extraneous flow (L/s/ha)
Q(p) = peak population flow (L/s)
Q(c) = peak commercial/industrial flow (L/s)
Q(e) = peak extraneous flow (L/s)
Q(d) = peak design flow (L/s)

Peaking Factor:
M =1+14/(4+(P/1000)^0.5)
Q(p) = (P/1000)qM/86.4 (L/s)
Q(e) =IA (L/s); where A = Area in hectares
Q(d) = Q(p) + Q(c) + Q(e) (L/s)

Manning Equation:
Qcap. = (D/1000)^2.667*(S/100)^0.5/(3.211*n)*1000 (L/s)
D: pipe size (mm)
S: slope (grade) of pipe (%)
n: roughness coefficient n= 0.013

Location: Street Name	Area	From MH	To MH	Inlet Flow: Commercial Individual Floor Area (m2)	Commercial Accumulative Floor Area (m2)	Commercial Accumulative Q(c) (L/s)	Residential Individual Pop. (person)	Residential Individual Area (ha)	Residential Accumulative Pop. (person)	Residential Accumulative Area (ha)	Peaking Factor M	Pop. Q(p) (L/s)	Extran. Q(e) (L/s)	Design Q(d) (L/s)	Pipe: Length L (m)	Size D (mm)	Type	Slope S (%)	Capacity Qcap. (L/s)	Velocity V (m/s)	Q(d)/Qcap (%)
Settlers Ridge Subdivision	1A	-	SA1 (Ainley)	0	0	0.000	1632	83.13	1632	83.13	3.65	24.15	23.28	47.42		525	PVC	0.20	192.13	0.89	24.68%
Thurlow Dr & Bird Cr	1B	-	SA1B	0	0	0.000	81	3.30	81	3.30	4.27	1.40	0.92	2.32		200		0.40	20.72	0.66	11.22%
Maitland Dr.	1C	-	SA1A	0	0	0.000	45	1.65	45	1.65	4.32	0.79	0.46	1.25		200		0.40	20.72	0.66	6.04%
Maitland Dr.	1D	SA1A	SA1B	0	0	0.000	48	1.89	93	3.54	4.25	1.60	0.99	2.59		200		0.40	20.72	0.66	12.52%
Maitland Dr.	1E	SA1B	SA1 (Ainley)	0	0	0.000	114	3.74	288	10.58	4.09	4.77	2.96	7.73		200		0.40	20.72	0.66	37.31%
		SA1 (Ainley)	SA4A	0	0	0.000	0	0.00	1920	93.71	3.60	28.00	26.24	54.23		525	SDR35	0.40	271.71	1.26	19.96%
	1F	SA4A	SA10	0	0	0.000	42	1.40	1962	95.10	3.59	28.55	26.63	55.18		525	SDR35	0.40	271.71	1.26	20.31%
Deerfield Subdivision	2A	-	SA10	0	0	0.000	642	8.38	642	8.38	3.92	10.18	2.35	12.53		250	PVC	2.40	92.01	1.87	13.62%
Sidney	2B	SA2A	SA3A	0	0	0.000	30	1.01	30	1.01	4.35	0.53	0.28	0.81		200	PVC	1.60	41.43	1.32	1.96%
Cloverleaf Dr.	2C	SA3A	SA4A	10415	10415	0.603	474	16.06	504	17.07	3.97	8.11	4.78	13.49		200	PVC	0.92	31.42	1.00	42.95%
Cloverleaf Dr.		SA4A	SA5A	0	10415	0.603	0	0.00	504	17.07	3.97	8.11	4.78	13.49		200	PVC	0.40	20.72	0.66	65.13%
Cloverleaf Dr.		SA5A	SA6A	0	10415	0.603	0	0.00	504	17.07	3.97	8.11	4.78	13.49		200	PVC	0.44	21.73	0.69	62.10%
Cloverleaf Dr.		SA6A	SA7A	0	10415	0.603	0	0.00	504	17.07	3.97	8.11	4.78	13.49		200	PVC	0.53	23.85	0.76	56.59%
Cloverleaf Dr.		SA7A	SA10	0	10415	0.603	0	0.00	504	17.07	3.97	8.11	4.78	13.49		200	PVC	1.31	37.49	1.19	35.99%
Millennium Pkwy	2D	MH7	MH8	204507	204507	11.835	0	22.72	0	22.72	4.50	0.00	6.36	18.20		250	SDR35	0.40	37.56	0.77	48.45%
Millennium Pkwy		MH8	Pumping Sta.	0	204507	11.835	0	0.00	0	22.72	4.50	0.00	6.36	18.20		250	SDR35	0.64	47.51	0.97	38.30%
Millennium Pkwy		Pumping Sta.	SA10	0	204507	11.835	0	0.00	0	22.72	4.50	0.00	6.36	18.20							
Lowes	3A	-	MH8A	142644	142644	8.255	0	15.85	0	15.85	4.50	0.00	4.44	12.69		250	PVC	1.00	59.39	1.21	21.37%
Lowes	3B	MH8A	MH32	128329	270973	15.681	0	14.26	0	30.11	4.50	0.00	8.43	24.11		250	PVC	1.00	59.39	1.21	40.60%
Millennium Pkwy		SA10	SA11	0	214922	12.438	0	0	3108	143.27	3.43	43.18	40.12	95.73		600	SDR35	0.20	274.32	0.97	34.90%
Millennium Pkwy		SA11	MH33	0	214922	12.438	0	0.00	3108	143.27	3.43	43.18	40.12	95.73		600	SDR35	0.55	454.91	1.61	21.04%
Millennium Pkwy		MH33	MH32	0	214922	12.438	0	0.00	3108	143.27	3.43	43.18	40.12	95.73		600	SDR35	0.20	274.32	0.97	34.90%
Millennium Pkwy		MH32	MH31	0	485895	28.119	0	0.00	3108	173.38	3.43	43.18	48.55	119.84		600	SDR35	0.20	274.32	0.97	43.69%
Millennium Pkwy		MH31	MH30	0	485895	28.119	0	0.00	3108	173.38	3.43	43.18	48.55	119.84		600	SDR35	0.20	274.32	0.97	43.69%
Millennium Pkwy		MH30	MH29	0	485895	28.119	0	0.00	3108	173.38	3.43	43.18	48.55	119.84		600	SDR35	0.20	274.32	0.97	43.69%
Farnham Rd.	4A	-	SA21 (Farnham)	20118	20118	1.164	555	21.10	555	21.10	3.95	8.88	5.91	15.95		200		0.40	20.72	0.66	77.02%
Oakwood Lane	4B	SA20 (Farnham)	SA21 (Farnham)	0	0	0.000	96	3.32	96	3.32	4.25	1.65	0.93	2.58		200		0.40	20.72	0.66	12.46%
Maitland Dr.		SA21 (Farnham)	SA22	0	20118	1.164	0	0	651	24.42	3.91	10.32	6.84	18.32		250		0.28	31.43	0.64	58.29%
Maitland Dr	5A	-	SA22	0	0	0.000	663	19.89	663	19.89	3.91	10.50	5.57	16.07		200	PVC	0.50	23.16	0.74	69.37%
Maitland Dr	5B	-	SA22	118563	118563	6.861	0	13.17	0	13.17	4.50	0.00	3.69	10.55		250		0.28	31.43	0.64	33.57%
Maitland Dr		SA22	SA23	0	138681	8.026	0	0.00	1314	57.48	3.72	19.80	16.10	43.92		350		0.20	65.16	0.68	67.41%
Scotts Dr	6A	-	SA5 (Moira Lea)	0	0	0.000	1002	30.31	1002	30.31	3.80	15.42	8.49	23.91		450		0.25	142.40	0.90	16.79%
Moira Lea/Cannif Mills Sub.	6B	SA5 (Moira Lea)	SA1 (Moira Lea)	3852	3852	0.223	2829	66.29	3831	96.60	3.35	51.99	27.05	79.26		450	SDR35	0.25	142.40	0.90	55.66%
Pumping Station		SA1 (Moira Lea)	MH33	0	3852	0.223	0	0.00	3831	96.60	3.35	51.99	27.05	79.26		450		0.20	127.36	0.80	62.23%
East of Highway 62	7A	SA27	SA26	100261	100261	5.802	681	32.85	681	32.85	3.90	10.76	9.20	25.76		300		0.22	45.30	0.64	56.87%
East of Highway 62		SA26	SA25	0	100261	5.802	0	0.00	681	32.85	3.90	10.76	9.20	25.76		300		0.22	45.30	0.64	56.87%
East of Highway 62		SA25	SA24	0	100261	5.802	0	0.00	681	32.85	3.90	10.76	9.20	25.76		300		0.39	60.32	0.85	42.72%
West of Highway 62 / Towncentre Dr.	7B	-	SA24	631259	631259	36.531	0	70.14	0	70.14	4.50	0.00	19.64	56.17		350		0.20	65.16	0.68	86.21%
East of Highway 62	7C	SA24	SA23	238603	970123	56.141	528	42.35	1209	145.34	3.75	18.34	40.70	115.18		450		0.20	127.36	0.80	90.43%
Mineral Rd	7D	SA23	SA23A	48302	1157106	66.962	0	5.37	2523	208.19	3.51	35.82	58.29	161.08		450		2.40	441.20	2.77	36.51%
Mineral Rd		SA23A	MH29A	0	1157106	66.962	0	0.00	2523	208.19	3.51	35.82	58.29	161.08		450		1.00	284.80	1.79	56.56%
Parks Dr	7E	-	MH29A	110300	110300	6.383	0	12.26	0	12.26	4.50	0.00	3.43	9.81		200		0.20	14.65	0.47	67.00%
Mineral Rd	7F	MH29A	MH29	109438	1376844	79.678	0	12.16	2523	232.61	3.51	35.82	65.13	180.63		600		0.15	237.57	0.84	76.03%
Millennium Pkwy		MH29	MH28	0	1862739	107.797	0	0.00	5631	405.99	3.20	72.92	113.68	294.40		600	SDR35	0.22	287.71	1.02	102.32%
Millennium Pkwy	7G	MH28	Siphon	97710	1960449	113.452	0	11.86	5631	417.85	3.20	72.92	117.00	303.37		600	SDR35	0.22	287.71	1.02	105.44%
Siphon		Siphon	MH11	0	1960449	113.452	0	0.00	5631	417.85	3.20	72.92	117.00	303.37		600	SDR35	0.16	464.00	1.64	65.38%
Cannifton Rd	8A	-	MH40	225987	225987	13.078	2349	98.43	2349	98.43	3.53	33.59	27.56	74.23		300	-	0.16	38.63	0.55	192.15%
Cannifton Rd	8B	MH40	MH39	66929	292916	16.951	357	18.78	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.21	43.73	0.62	201.05%
		MH39	MH38	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.23	46.32	0.66	189.81%
		MH38	MH37	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.19	42.21	0.60	208.29%
		MH37	MH36	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.23	46.32	0.66	189.81%
		MH36	MH35	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.23	46.32	0.66	189.81%
		MH35	MH34	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.23	46.32	0.66	189.81%
		MH34	MH33	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.22	45.30	0.64	194.08%
Cannifton Rd	9A	MH33	MH32	297295	594063	34.379	816	59.50	7353	273.31	3.09	91.92	76.53	202.83		450	S.S	0.18	120.49	0.76	168.33%
		MH32	MH17	0	594063	34.379	0	0.00	7353	273.31	3.09	91.92	76.53	202.83		450	S.S	0.19	122.83	0.77	165.13%
		MH17	MH16	0	594063	34.379	0	0.00	7353	273.31	3.09	91.92	76.53	202.83		450	S.S	0.45	191.05	1.20	106.17%
		MH16	MH15	0	594063	34.379	0	0.00	7353	273.31	3.09	91.92	76.53	202.83		450	S.S	0.20	128.63	0.81	157.68%
		MH15	MH14	0	594063	34.379	0	0.00	7353	273.31	3.09	91.92	76.53	202.83		450	S.S	0.20	128.32	0.81	158.07%
		MH14	MH13	0	594063	34.379	0	0.00	7353	273.31	3.09	91.92	76.53	202.83		450	S.S	0.40	181.00	1.14	112.06%
		MH13	MH12	0	594063	34.379	0	0.00	7353	273.31	3.09	91.92	76.53	202.83		450	S.S	0.20	127.68	0.80	158.85%
		MH12	MH11	0	594063	34.379	0	0.00	7353	273.31	3.09	91.92	76.53	202.83		450	S.S	0.50	202.19	1.27	100.32%
Lywood St	9B	MH25	MH19	6512	6512	0.377	153	4.13	153	4.13	4.19	2.60	1.16	4.13		200	-	0.40	20.72	0.66	19.94%
Black Diamond Rd	9C	MH27	MH19	640	640	0.037	87	2.05	87	2.05	4.26	1.50	0.57	2.11		200	-	0.40	20.72	0.66	10.19%
Lywood St	9D	MH18	MH19	3707	3707	0.215	0	0.41	0	0.41	4.50	0.00	0.12	0.33		200	-	0.40	20.72	0.66	1.59%
Black Diamond Rd	9E	MH19	MH11	3283	14142	0.818	0	0.36	240	6.96	4.12	4.00	1.95	6.77		200	-	0.40	20.72	0.66	32.68%
Highway 37	10A	-	MH7B	0	0	0.000	0	0.00	0	0.00	4.50	0.00	0.00	0.00		300		0.20	43.19	0.61	0.00%
South Industrial Park Area	10B	-	MH7B	0	0	0.000	0	0.00	0	0.00	4.50	0.00	0.00	0.00		600		0.20	274.32	0.97	0.00%
North Industrial Park Area	10C	-	MH7B	0	0	0.000	0	0.00	0	0.00	4.50	0.00	0.00	0.00		525		0.20	192.13	0.89	0.00%
		MH7B	MH7	0	0	0.000	0	0.00	0	0.00	4.50	0.00	0.00	0.00		200	Concrete	1.09	34.20	1.09	0.00%
Cannifton Rd	11A	MH11	MH7	13302	2581956	149.419	0	5.36	13224	703.48	2.83	151.78	196.98	498.17		675	Concrete	0.35	496.83	1.39	100.27%
Cannifton Rd		MH7	401	0	2581956	149.419	0	0.00	13224	703.48	2.83	151.78	196.98	498.17		675	Concrete	0.35	496.83	1.39	100.27%



CAD OPERATOR: A. VOLDOCK
CAD FILE: P:\7000\1337536 - Belleville Cannifton Secondary Plan\Drawings\Current Drawings\1337536_SP1_02.dwg
PLOT SCALE: 1:1
DATE PLOTTED: 2014-01-28
GGG-A1

(METRIC SCALE - ALL DIMS IN MILLIMETERS)

THE GREER GALLOWAY GROUP INC.
ENGINEERS & PLANNERS
PETERBOROUGH
BELLEVILLE
KINGSTON
1620 WALLBRIDGE LOYALIST ROAD
BELLEVILLE, ONTARIO, K8N 4Z5
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FAX: 613-966-3087

NOTES:

1. ALL WORK SHALL BE IN ACCORDANCE WITH RELEVANT CODES AND GUIDELINES.
2. ALL DRAWINGS AND ADDENDA ARE TO BE READ AS, AND IN CONJUNCTION WITH THE SPECIFICATIONS.
3. ALL EQUIPMENT SHALL BE INSTALLED AS SPECIFIED OR APPROVED EQUIVALENT.
4. CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS BEFORE PROCEEDING WITH WORK AND BE RESPONSIBLE FOR SAME.
5. CONTRACTOR MUST REPORT ANY DISCREPANCIES TO ENGINEER FOR RESOLUTION BEFORE COMMENCING THE WORK.
6. ANY CHANGES MUST BE APPROVED BY THE ENGINEER.

A — A DETAIL NO.
B — B DRAWING NO. - WHERE DETAILED

LEGEND

- PROPOSED SANITARY SEWER
- SA24 PROPOSED SANITARY MAINTENANCE HOLE
- DRAINAGE AREA BOUNDARY
- 6C DRAINAGE AREA
- EXISTING SANITARY SEWER
- EXISTING SANITARY MAINTENANCE HOLE
- OVER CAPACITY

NORTH

STAMP

PROJECT
CANNIFTON SERVICING STUDY
OPTION D - SCENARIO 1

BELLEVILLE, ONTARIO

DRAWING TITLE
SANITARY DRAINAGE AREAS

REVISION		DATE
05		
04		
03		
02		
01		

DESIGNED BY: A. VOLDOCK
DRAWN BY: A. VOLDOCK
REVIEWED BY: S. BLAKEY
APPROVED BY: S. BLAKEY
PROJECT DATE: 28/01/2014 (DD/MM/YYYY)
PROJECT #: 13-3-7536
DRAWING SCALE: 1:8000
DRAWING #: DA-1

SANITARY SEWER DESIGN SHEET - PROPOSED SYSTEM

Option A - Scenario 1 (Without Pumping Station - Maximum Capacity of 3 Storeys for Commercial/Industrial)

Alternative for Removing Pumping Station and directing all flows down Maitland Drive

Commercial/Institutional average daily flow (c): 5000 L/1000m2.d (2500-5000 L/1000m2.d)

Residential Unit average daily flow (p): 350 L/cap/d (225~450 L/cap.d)

Unit extraneous flow (E): 0.28 L/s/ha (0.1-0.28L.s.ha)

Residential: 3.0 persons/unit

Potential Connections to be reviewed:

Over Capacity:

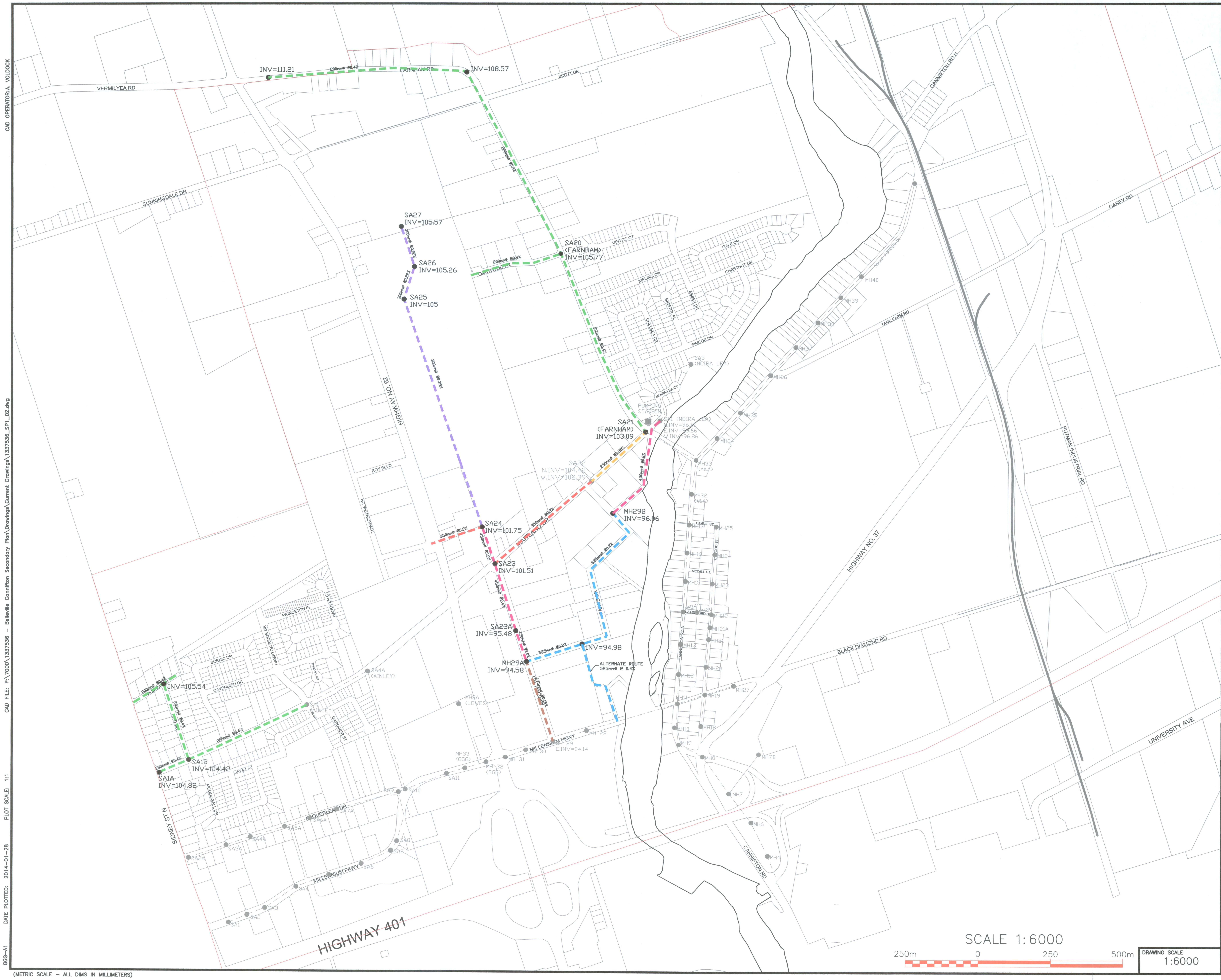
q = average daily per capita flow (L/cap.d)
I = Unit of peak extraneous flow (L/s/ha)
Q(p) = peak population flow (L/s)
Q(c) = peak commercial/industrial flow (L/s)
Q(e) = peak extraneous flow (L/s)
Q(d) = peak design flow (L/s)

Peaking Factor:
M =1+14/(4+(P/1000)^0.5)
Q(p) = (P/1000)qM/86.4 (L/s)
Q(e) =IA (L/s); where A = Area in hectares
Q(d) = Q(p) + Q(c) + Q(e) (L/s)

Manning Equation:
Qcap. = (D/1000)^2.667*(S/100)^0.5/(3.211*n)*1000 (L/s)
D: pipe size (mm)
S: slope (grade) of pipe (%)
n: roughness coefficient n= 0.013

Location				Inlet Flow											Pipe						Q(d)/Qcap
				Commercial			Residential														
				Individual	Accumulative		Individual		Accumulative		Peaking	Pop.	Extran.	Design	Length	Size	Type	Slope	Capacity	Velocity	
Street Name	Area	From	To	Floor Area	Floor Area	Q(c)	Pop.	Area	Pop.	Area	Factor	Q(p)	Q(e)	Q(d)	L	D		S	Qcap.	V	
		MH	MH	(m2)	(m2)	(L/s)	(person)	(ha)	(person)	(ha)	M	(L/s)	(L/s)	(L/s)	(m)	(mm)		(%)	(L/s)	(m/s)	(%)
Settlers Ridge Subdivision	1A	-	SA1 (Ainley)	0	0	0.000	1632	83.13	1632	83.13	3.65	24.15	23.28	47.42		525	PVC	0.20	192.13	0.89	24.68%
Thurlow Dr & Bird Cr	**1B**	**-**	**SA1B**	**0**	**0**	**0.000**	**81**	**3.30**	**81**	**3.30**	**4.27**	**1.40**	**0.92**	**2.32**		**200**		**0.40**	**20.72**	**0.66**	**11.22%**
Maitland	**1C**	**-**	**SA1A**	**0**	**0**	**0.000**	**45**	**1.65**	**45**	**1.65**	**4.32**	**0.79**	**0.46**	**1.25**		**200**		**0.40**	**20.72**	**0.66**	**6.04%**
Maitland	**1D**	**SA1A**	**SA1B**	**0**	**0**	**0.000**	**48**	**1.89**	**93**	**3.54**	**4.25**	**1.60**	**0.99**	**2.59**		**200**		**0.40**	**20.72**	**0.66**	**12.52%**
Maitland	**1E**	**SA1B**	**SA1 (Ainley)**	**0**	**0**	**0.000**	**114**	**3.74**	**288**	**10.58**	**4.09**	**4.77**	**2.96**	**7.73**		**200**		**0.40**	**20.72**	**0.66**	**37.31%**
		SA1 (Ainley)	SA4A	0	0	0.000	0	0.00	1920	93.71	3.60	28.00	26.24	54.23		525	SDR35	0.40	271.71	1.26	19.96%
	1F	SA4A	SA10	0	0	0.000	42	1.40	1962	95.10	3.59	28.55	26.63	55.18		525	SDR35	0.40	271.71	1.26	20.31%
Deerfield Subdivision	2A	-	SA10	0	0	0.000	642	8.38	642	8.38	3.92	10.18	2.35	12.53		250	PVC	2.40	92.01	1.87	13.62%
Sidney	2B	SA2A	SA3A	0	0	0.000	30	1.01	30	1.01	4.35	0.53	0.28	0.81		200	PVC	1.60	41.43	1.32	1.96%
Cloverleaf Dr.	2C	SA3A	SA4A	10415	10415	0.603	474	16.06	504	17.07	3.97	8.11	4.78	13.49		200	PVC	0.92	31.42	1.00	42.95%
Cloverleaf Dr.		SA4A	SA5A	0	10415	0.603	0	0.00	504	17.07	3.97	8.11	4.78	13.49		200	PVC	0.40	20.72	0.66	65.13%
Cloverleaf Dr.		SA5A	SA6A	0	10415	0.603	0	0.00	504	17.07	3.97	8.11	4.78	13.49		200	PVC	0.44	21.73	0.69	62.10%
Cloverleaf Dr.		SA6A	SA7A	0	10415	0.603	0	0.00	504	17.07	3.97	8.11	4.78	13.49		200	PVC	0.53	23.85	0.76	56.59%
Cloverleaf Dr.		SA7A	SA10	0	10415	0.603	0	0.00	504	17.07	3.97	8.11	4.78	13.49		200	PVC	1.31	37.49	1.19	35.99%
Millennium Pkwy	2D	MH7	MH8	204507	204507	11.835	0	22.72	0	22.72	4.50	0.00	6.36	18.20		250	SDR35	0.40	37.56	0.77	48.45%
Millennium Pkwy		MH8	Pumping Sta.	0	204507	11.835	0	0.00	0	22.72	4.50	0.00	6.36	18.20		250	SDR35	0.64	47.51	0.97	38.30%
Millennium Pkwy		Pumping Sta.	SA10	0	204507	11.835	0	0.00	0	22.72	4.50	0.00	6.36	18.20							
Lowes	3A	-	MH8A	142644	142644	8.255	0	15.85	0	15.85	4.50	0.00	4.44	12.69		250	PVC	1.00	59.39	1.21	21.37%
Lowes	3B	MH8A	MH32	128329	270973	15.681	0	14.26	0	30.11	4.50	0.00	8.43	24.11		250	PVC	1.00	59.39	1.21	40.60%
Millennium Pkwy		SA10	SA11	0	214922	12.438	0	0	3108	143.27	3.43	43.18	40.12	95.73		600	SDR35	0.20	274.32	0.97	34.90%
Millennium Pkwy		SA11	MH33	0	214922	12.438	0	0	3108	143.27	3.43	43.18	40.12	95.73		600	SDR35	0.55	454.91	1.61	21.04%
Millennium Pkwy		MH33	MH32	0	214922	12.438	0	0	3108	143.27	3.43	43.18	40.12	95.73		600	SDR35	0.20	274.32	0.97	34.90%
Millennium Pkwy		MH32	MH31	0	485895	28.119	0	0	3108	173.38	3.43	43.18	48.55	119.84		600	SDR35	0.20	274.32	0.97	43.69%
Millennium Pkwy		MH31	MH30	0	485895	28.119	0	0	3108	173.38	3.43	43.18	48.55	119.84		600	SDR35	0.20	274.32	0.97	43.69%
Millennium Pkwy		MH30	MH29	0	485895	28.119	0	0	3108	173.38	3.43	43.18	48.55	119.84		600	SDR35	0.20	274.32	0.97	43.69%
Farnham Rd.	**4A**	**-**	**SA21 (Farnham)**	**20118**	**20118**	**1.164**	**555**	**21.10**	**555**	**21.10**	**3.95**	**8.88**	**5.91**	**15.95**		**200**		**0.40**	**20.72**	**0.66**	**77.02%**
Oakwood Lane	**4B**	**SA20 (Farnham)**	**SA21 (Farnham)**	**0**	**0**	**0.000**	**96**	**3.32**	**96**	**3.32**	**4.25**	**1.65**	**0.93**	**2.58**		**200**		**0.40**	**20.72**	**0.66**	**12.46%**
Maitland Dr.		**SA21 (Farnham)**	**SA22**	**0**	**20118**	**1.164**	**0**	**0**	**4482**	**121.02**	**3.29**	**59.71**	**33.88**	**94.76**		**525**		**0.10**	**135.86**	**0.63**	**69.75%**
Maitland Dr	**5A**	**-**	**SA22**	**0**	**0**	**0.000**	**663**	**19.89**	**663**	**19.89**	**3.91**	**10.50**	**5.57**	**16.07**		**200**	**PVC**	**0.50**	**23.16**	**0.74**	**69.37%**
Maitland Dr	**5B**	**-**	**SA22**	**118563**	**118563**	**6.861**	**0**	**13.17**	**0**	**13.17**	**4.50**	**0.00**	**3.69**	**10.55**		**250**		**0.28**	**31.43**	**0.64**	**33.57%**
Maitland Dr		**SA22**	**SA23**	**0**	**138681**	**8.026**	**0**	**0**	**5145**	**154.08**	**3.23**	**67.39**	**43.14**	**118.56**		**525**		**0.10**	**135.86**	**0.63**	**87.27%**
Scotts Dr	**6A**	**-**	**SA5 (Moira Lea)**	**0**	**0**	**0.000**	**1002**	**30.31**	**1002**	**30.31**	**3.80**	**15.42**	**8.49**	**23.91**		**450**		**0.25**	**142.40**	**0.90**	**16.79%**
Moira Lea/Cannif Mills Sub.	6B	SA5 (Moira Lea)	SA1 (Moira Lea)	3852	3852	0.223	2829	66.29	3831	96.60	3.35	51.99	27.05	79.26		450	SDR35	0.25	142.40	0.90	55.66%
		SA1 (Moira Lea)	SA21(Farnham)	0	3852	0.223	0	0.00	3831	96.60	3.35	51.99	27.05	79.26		450		0.12	98.66	0.62	80.34%
East of Highway 62	7A	SA27	SA26	100261	100261	5.802	681	32.85	681	32.85	3.90	10.76	9.20	25.76		300		0.22	45.30	0.64	56.87%
East of Highway 62		SA26	SA25	0	100261	5.802	0	0.00	681	32.85	3.90	10.76	9.20	25.76		300		0.22	45.30	0.64	56.87%
East of Highway 62		SA25	SA24	0	100261	5.802	0	0.00	681	32.85	3.90	10.76	9.20	25.76		300		0.39	60.32	0.85	42.72%
West of Highway 62 / Towncentre Dr.	**7B**	**-**	**SA24**	**631259**	**631259**	**36.531**	**0**	**70.14**	**0**	**70.14**	**4.50**	**0.00**	**19.64**	**56.17**		**350**		**0.20**	**65.16**	**0.68**	**86.21%**
East of Highway 62	7C	SA24	SA23	238603	970123	56.141	528	42.35	1209	145.34	3.75	18.34	40.70	115.18		450		0.20	127.36	0.80	90.43%
Mineral Rd	7D	SA23	SA23A	48302	1157106	66.962	0	5.37	6354	304.79	3.15	81.00	85.34	233.31		675		0.10	265.56	0.74	87.85%
Mineral Rd		SA23A	MH29A	0	1157106	66.962	0	0.00	6354	304.79	3.15	81.00	85.34	233.31		675		0.10	265.56	0.74	87.85%
Parks Dr	7E	MH29B	MH29A	110300	114152	6.606	0	12.26	0	12.26	4.50	0.00	3.43	10.04		250		0.28	31.43	0.64	31.94%
Mineral Rd	7F	MH29A	MH29	109438	1380696	79.901	0	12.16	6354	329.21	3.15	81.00	92.18	253.08		675		0.12	290.91	0.81	87.00%
Millennium Pkwy		MH29	MH28	0	1866591	108.020	0	0.00	9462	502.59	2.98	114.17	140.72	362.91		600	SDR35	0.22	287.71	1.02	126.14%
Millennium Pkwy	7G	MH28	Siphon	97710	1964301	113.675	0	11.86	9462	514.45	2.98	114.17	144.05	371.89		600	SDR35	0.22	287.71	1.02	129.26%
Siphon		Siphon	MH11	0	1964301	113.675	0	0.00	9462	514.45	2.98	114.17	144.05	371.89		600	SDR35	0.16	464.00	1.64	80.15%
Cannifton Rd	8A	-	MH40	225987	225987	13.078	2349	98.43	2349	98.43	3.53	33.59	27.56	74.23		300	-	0.16	38.63	0.55	192.15%
Cannifton Rd	8B	MH40	MH39	66929	292916	16.951	357	18.78	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.21	43.73	0.62	201.05%
		MH39	MH38	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.23	46.32	0.66	189.81%
		MH38	MH37	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.19	42.21	0.60	208.29%
		MH37	MH36	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.23	46.32	0.66	189.81%
		MH36	MH35	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.23	46.32	0.66	189.81%
		MH35	MH34	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.23	46.32	0.66	189.81%
		MH34	MH33	0	292916	16.951	0	0.00	2706	117.21	3.48	38.15	32.82	87.92		300	S.S	0.22	45.30	0.64	194.08%
Cannifton Rd	9A	MH33	MH32	297295	590211	34.156	816	59.50	3522	176.71	3.38	48.26	49.48	131.89		450	S.S	0.18	120.49	0.76	109.46%
		MH32	MH17	0	590211	34.156	0	0.00	3522	176.71	3.38	48.26	49.48	131.89		450	S.S	0.19	122.83	0.77	107.38%
		MH17	MH16	0	590211	34.156	0	0.00	3522	176.71	3.38	48.26	49.48	131.89		450	S.S	0.45	191.05	1.20	69.04%
		MH16	MH15	0	590211	34.156	0	0.00	3522	176.71	3.38	48.26	49.48	131.89		450	S.S	0.20	128.63	0.81	102.53%
		MH15	MH14	0	590211	34.156	0	0.00	3522	176.71	3.38	48.26	49.48	131.89		450	S.S	0.20	128.32	0.81	102.79%
		MH14	MH13	0	590211	34.156	0	0.00	3522	176.71	3.38	48.26	49.48	131.89		450	S.S	0.40	181.00	1.14	72.87%
		MH13	MH12	0	590211	34.156	0	0.00	3522	176.71	3.38	48.26	49.48	131.89		450	S.S	0.20	127.79	0.80	103.30%
		MH12	MH11	0	590211	34.156	0	0.00	3522	176.71	3.38	48.26	49.48	131.89		450	S.S	0.50	202.19	1.27	65.23%
Lywood St	9B	MH25	MH19	6512	6512	0.377	153	4.13	153	4.13	4.19	2.60	1.16	4.13		200	-	0.40	20.72	0.66	19.94%
Black Diamond Rd	9C	MH27	MH19	640	640	0.037	87	2.05	87	2.05	4.26	1.50	0.57	2.11		200	-	0.40	20.72	0.66	10.19%
Lywood St	9D	MH18	MH19	3707	3707	0.215	0	0.41	0	0.41	4.50	0.00	0.12	0.33		200	-	0.40	20.72	0.66	1.59%
Black Diamond Rd	9E	MH19	MH11	3283	14142	0.818	0	0.36	240	6.96	4.12	4.00	1.95	6.77		200	-	0.40	20.72	0.66	32.68%
Highway 37	10A	-	MH7B	298935	298935	17.299	45	34.58	45	34.58	4.32	0.79	9.68	27.77		300		0.20	43.19	0.61	64.29%
South Industrial Park Area	10B	-	MH7B	1058509	1058509	61.256	0	117.61	0	117.61	4.50	0.00	32.93	94.19		600		0.20	274.32	0.97	34.33%
North Industrial Park Area	10C	-	MH7B	3009586	3009586	174.166	0	334.40	0	334.40	4.50	0.00	93.63	267.80		525		0.20	192.13	0.89	139.38%
		MH7B	MH7	0	4367030	252.722	0	0.00	45	486.59	4.32	0.79	136.25	389.76		200	Concrete	1.09	34.20	1.09	1139.77%
Cannifton Rd	11A	MH11	MH7	13302	2581956	149.419	0	5.36	13224	703.48	2.83	151.78	196.98	498.17		675	Concrete	0.35	496.83	1.39	100.27%
Cannifton Rd		MH7	401	0	6948986	402.140	0	0.00	13269	1190.08	2.83	152.22	333.22	887.58		675	Concrete	0.35	496.83	1.39	178.65%

THE GREER GALLOWAY GROUP INC.
ENGINEERS & PLANNERS
PETERBOROUGH
BELLEVILLE
KINGSTON
1620 WALLBRIDGE LOYALIST ROAD
BELLEVILLE, ONTARIO, K8N 4Z5
PHONE: 613-966-3068
FAX: 613-966-3087



NOTES:
1. ALL WORK SHALL BE IN ACCORDANCE WITH RELEVANT CODES AND GUIDELINES.
2. ALL DRAWINGS AND ADDENDA ARE TO BE READ AS, AND IN CONJUNCTION WITH THE SPECIFICATIONS.
3. ALL EQUIPMENT SHALL BE INSTALLED AS SPECIFIED OR APPROVED EQUIVALENT.
4. CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS BEFORE PROCEEDING WITH WORK AND BE RESPONSIBLE FOR SAME.
5. CONTRACTOR MUST REPORT ANY DISCREPANCIES TO ENGINEER FOR RESOLUTION BEFORE COMMENCING THE WORK.
6. ANY CHANGES MUST BE APPROVED BY THE ENGINEER.

A — A DETAIL NO.
B — B DRAWING NO. – WHERE DETAILED

LEGEND
- SA24 — PROPOSED SANITARY MAINTENANCE HOLE
- 200mmø PROPOSED SANITARY SEWER
- 250mmø PROPOSED SANITARY SEWER
- 300mmø PROPOSED SANITARY SEWER
- 350mmø PROPOSED SANITARY SEWER
- 450mmø PROPOSED SANITARY SEWER
- 525mmø PROPOSED SANITARY SEWER
- 675mmø PROPOSED SANITARY SEWER
- EXISTING SANITARY SEWER
- SA11 — EXISTING SANITARY MAINTENANCE HOLE

NORTH

STAMP

PROJECT
CANNIFTON SERVICING STUDY

BELLEVILLE, ONTARIO

DRAWING TITLE
PROPOSED SANITARY SEWERS AND INVERTS

REVISION		DATE
05		
04		
03		
02		
01		

DESIGNED BY A. VOLDOCK

DRAWN BY A. VOLDOCK

REVIEWED BY S. BLAKEY

APPROVED BY S. BLAKEY

PROJECT DATE 28/01/2014 (DD/MM/YYYY)

PROJECT # 13-3-7536

DRAWING SCALE 1:6000

DRAWING # SP-1

CAD OPERATOR: A. VOLDOCK

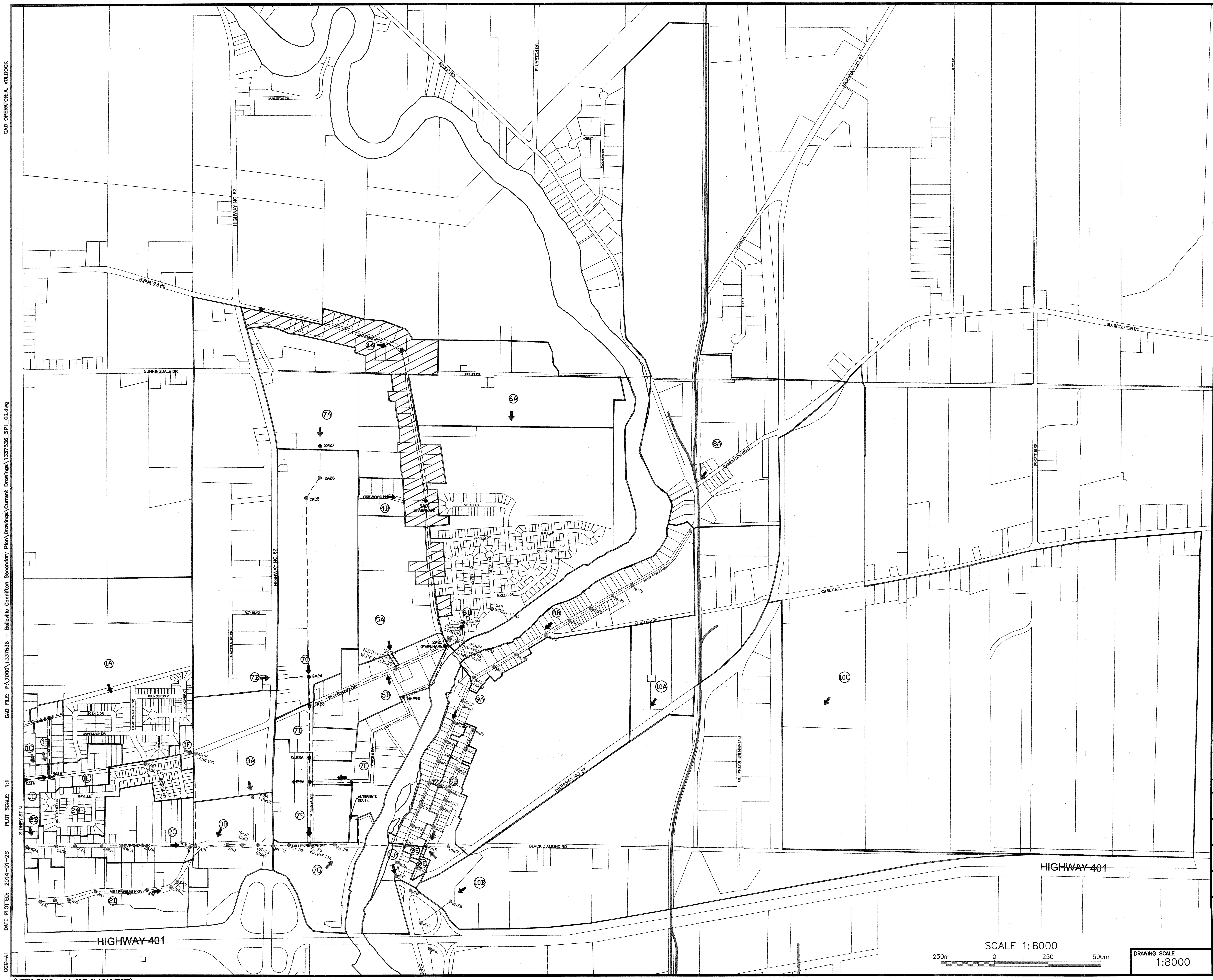
CAD FILE: P:\7000\1337536 - Belleville Cannifton Secondary Plan\Drawings\Current Drawings\1337536_SP1_02.dwg

PLOT SCALE: 1:1

DATE PLOTTED: 2014-01-28

GGG-A1

(METRIC SCALE – ALL DIMS IN MILLIMETERS)



THE GREER GALLOWAY GROUP INC.
ENGINEERS & PLANNERS
PETERBOROUGH
BELLEVILLE
KINGSTON
1620 WALLBRIDGE LOYALIST ROAD
BELLEVILLE, ONTARIO, K8N 4Z5
PHONE: 613-966-3068
FAX: 613-966-3087

NOTES:

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6. ANY CHANGES MUST BE APPROVED BY THE ENGINEER.

A — A DETAIL NO.
B — B DRAWING NO. – WHERE DETAILED

LEGEND

- PROPOSED SANITARY SEWER
- SA24 — PROPOSED SANITARY MAINTENANCE HOLE
- DRAINAGE AREA BOUNDARY
- 6C — DRAINAGE AREA
- EXISTING SANITARY SEWER
- SA11 — EXISTING SANITARY MAINTENANCE HOLE

NORTH

STAMP

PROJECT
CANNIFTON SERVICING STUDY

BELLEVILLE, ONTARIO

DRAWING TITLE
SANITARY DRAINAGE AREAS

05	
04	
03	
02	
01	
REVISION	DATE

DESIGNED BY: A. VOLDOCK

DRAWN BY: A. VOLDOCK

REVIEWED BY: S. BLAKEY

APPROVED BY: S. BLAKEY

PROJECT DATE: 28/01/2014 (DD/MM/YYYY)

PROJECT #: 13-3-7536

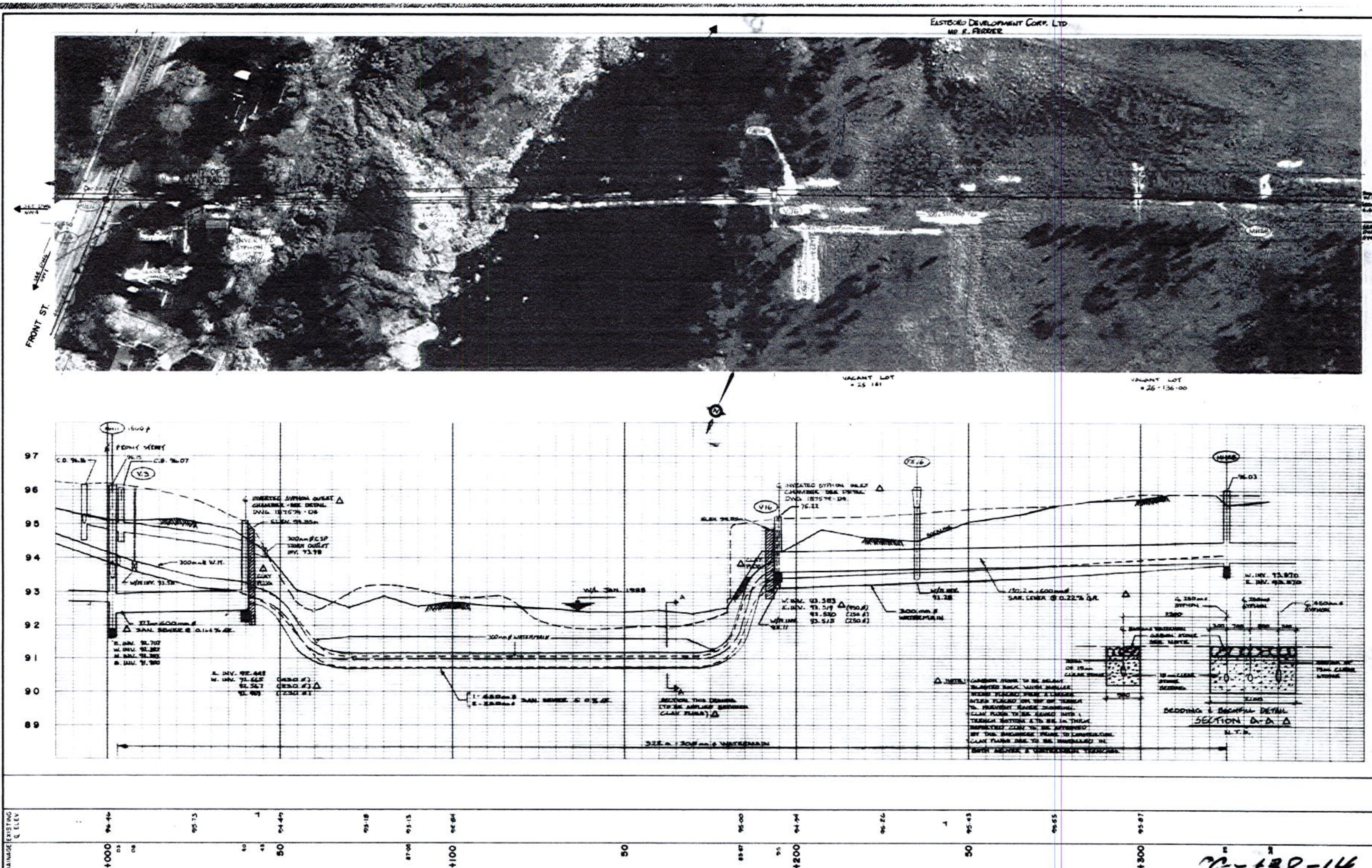
DRAWING SCALE: 1:8000

DRAWING #: DA-1

(METRIC SCALE – ALL DIMS IN MILLIMETERS)

Appendix C – Sanitary Sewer Drainage Area Drawing

Appendix D – XCG Report – Cannifton Siphon Capacity



XC-138-14

Notes

1) REFER TO SOILS REPORT FOR MORE INFORMATION ABOUT BOREHOLES AND AUGER HOLES.
2) EXACT LOCATION OF SERVICE CONNECTIONS TO BE DETERMINED IN THE FIELD.
3) LOCATION OF ALL UTILITIES ARE APPROXIMATE. CONTRACTOR TO OBTAIN UTILITY LOCATES AS REQUIRED.
4) ALL MANHOLES ARE 1200mm Ø UNLESS OTHERWISE NOTED.
5) ALL WATER SERVICE CONNECTIONS TO BE 19mm Ø UNLESS OTHERWISE NOTED.
6) ALL SANITARY SERVICE CONNECTIONS TO BE 125mm Ø UNLESS OTHERWISE NOTED.

LEGEND

——B——	BURIED BELL CABLE
——G——	GASMAIN
————	WATERMAIN
————	SANITARY SEWER
- - - - - -	EXISTING STORM SEWER
	BASEMENT TO RIGHT OF ℄
	BASEMENT TO LEFT OF ℄
●	BOREHOLE
◐	AUGER HOLE
GR 96.06	GROUND ELEVATION
BE 96.20	BASEMENT ELEVATION

NO.	REVISIONS	DATE	INITIAL
4	AS-CONSTRUCTED	JUN./90	C.C.
3	PRE-TENDER REVISIONS + TENDER	OCT./88	C.K.K.
2	MOE COMMENTS ADDED – ELEV. OF CLAY PLUGS & W.L. PITS	SEPT./88	C.C.
1	GENERAL REVISIONS IN RIVER CROSSING △	JUL./88	R.M.

Approved

C. K. KENT

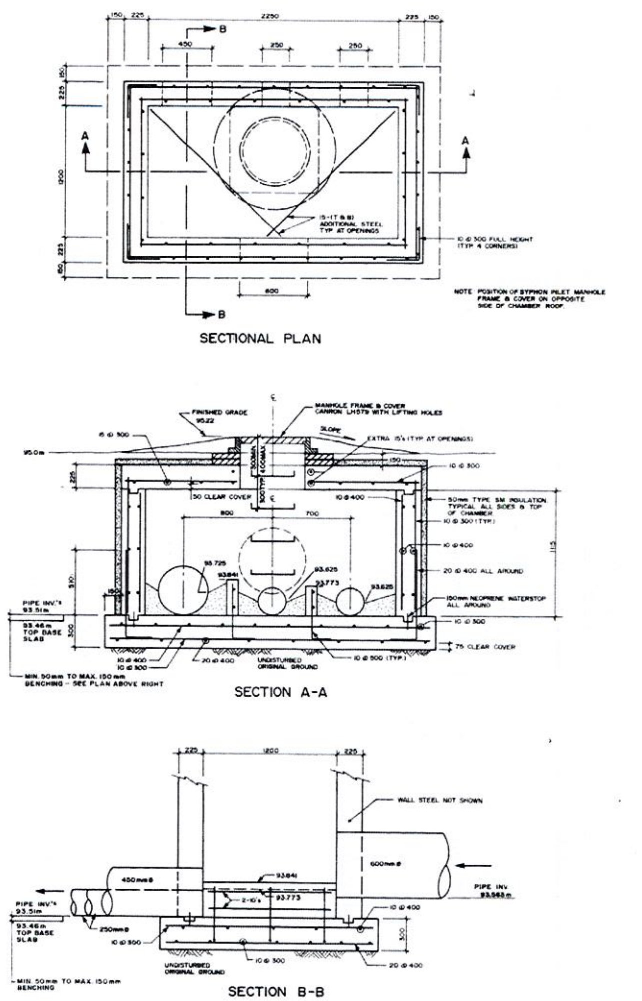
TOWNSHIP OF THURLOW
(CANNIFTON AREA)

ONTARIO MINISTRY OF THE ENVIRONMENT
DIRECT GRANT PROJECTS Nº 3-0176 & 7-0245

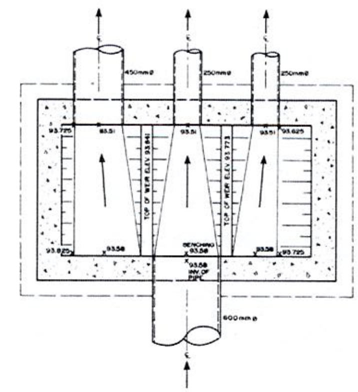
PLAN AND PROFILE
BLACK DIAMOND ROAD, RIVER CROSSING AND CLOVERLEAF DRIVE – FRONT ST. TO STA. 0+325

Ainley and Associates Ltd.
Consulting Engineers and Planners
Collingwood – Barrie – Belleville

SCALE: HORZ. 1:500 VERT. 1:50	METRIC		CONTRACT 3
DESIGN R.M.	CHECKED C.K.K.		DWG. Nº 187574-SWS
DRAWN S.W.	DATE MAY, 1988		



INVERTED SYPHON INLET CHAMBER



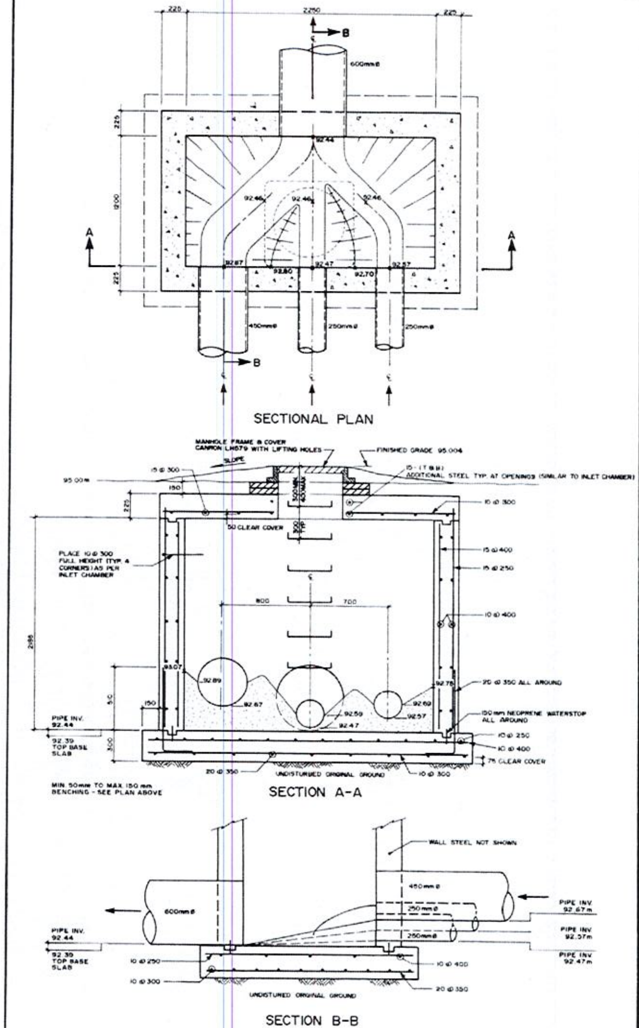
PIPING PLAN

GENERAL NOTES·

1. CONCRETE COVER FOR R/F STEEL SHALL BE MIN. 50 mm EXCEPT AS NOTED.
2. STRUCTURES TO BE BUILT ACCORDING TO CONTRACT SPECIFICATIONS.
3. SOILS REPORT IS AVAILABLE AT THE CONSULTING ENGINEER'S OFFICE
4. ALL EXPOSED CORNERS TO HAVE A 25 mm x 25 mm CHAMFER.
5. STRUCTURAL DRAWINGS TO BE READ IN CONJUNCTION WITH PROCESS AND ARCHITECTURAL DRAWINGS.
6. BACKFILL SHALL BE GRANULAR MATERIAL AS SPECIFIED COMPACTED TO 95% STANDARD PROCTOR MAXIMUM DRY DENSITY, EXCEPT WHERE NOTED.
7. BACKFILL MAY BE PLACED AGAINST WALLS AFTER CONCRETE COMPRESSIVE STRENGTH IN WALLS HAS REACHED 20 mPa. BACKFILL TO BE CARRIED UP EVENLY ON ALL SIDES OF STRUCTURES.
8. THE GROUND WATER TABLE SHALL BE CONTROLLED DURING CONSTRUCTION.
9. REINFORCING STEEL SHOP DRAWINGS SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL.

(N) DENOTES NEAR FACE
(F) DENOTES FAR FACE
(B) DENOTES BOTTOM FACE
(T) DENOTES TOP FACE
(E) DENOTES EACH FACE
ALT. DENOTES ALTERNATING
C.J. DENOTES CONSTRUCTION JOINT
EXP.J. DENOTES EXPANSION JOINT

1. MANHOLE FRAME AND COVER TO BE CANRON LH 579 WITH LIFTING HOLES.
2. STEPS TO BE ALUMINUM SAFETY RUNGS COATED WITH BITUMINOUS PAINT WHERE IN DIRECT CONTACT WITH CONCRETE.
3. STEPS TO BE LOCATED AT 300 CENTRES.
4. MANHOLE FRAME TO BE GROUTED TO BRICKWORK.
5. MANHOLE FRAME TO BE SET ON MIN. 3 COURSES, MAX. 6 COURSES, OF 200 TAPERED HARD BURNED SEWER CONING BRICK PARGED TO 6 mm MIN. THICKNESS.
6. MODULOC MANHOLE FRAME ADJUSTERS MAY BE USED INSTEAD OF SEWER BRICK.
7. PIPES TO BE CAST INTO WALLS.
8. BENCHING TO BE 25 MPa CONCRETE BENCHING TO HAVE WOOD FLOAT FINISH, CHANNELS TO HAVE STEEL TROWEL FINISH.



INVERTED SYPHON OUTLET CHAMBER

C-138-5

Notes:

NO.	REVISIONS	DATE	INITIAL
5	AS-CONSTRUCTED	JUN./90	C.G.
4	PRE-TENDER REVISIONS + TENDER	OCT./88	C.K.K.
3	PIPE INV'S & BASE SLAB ELEV'S REVISED	OCT./88	C.K.K.
2	EXTERNAL INSULATION ADDED TO INVERTED SYPHON INLET CHAMBER	SEPT./88	C.C.
1	GENERAL ELEVATION REVISIONS	JULY/88	E.M.

Approved

C. KENT

C. W. GRANT

TOWNSHIP OF THURLOW
(CANNIFTON AREA)
ONTARIO MINISTRY OF THE ENVIRONMENT
DIRECT GRANT PROJECTS Nº 3-0176 & 7-0245

INVERTED SYPHON CHAMBER DETAILS

Ainley and Associates Ltd.
Consulting Engineers and Planners
Collingwood — Barrie — Belleville

SCALE 1:20	METRIC	CONTRACT 3
DESIGN A.W.W.	CHECKED C.K.K.	DWG. Nº 187574-D4
DRAWN D.E.	DATE MAY, 1988	

APPENDIX B:
BELLEVILLE WATER POLLUTION CONTROL PLANT UNCOMMITTED RESERVE CAPACITY CALCULATION

UNCOMMITTED RESERVE CAPACITY CALCULATION
BELLEVILLE WATER POLLUTION CONTROL PLANT (2024 – PRELIMINARY)

Cu = Cr – ([L x F x P] ÷ H) – S

Cu = Uncommitted Reserve Capacity (m3/day)

Cr = Hydraulic Reserve Capacity (m3/day)

L = Number of Unconnected Lots/Units Committed

P = Existing Connected Population

H = Number of Households or Residential Connections

F = Average Daily Flow/Capita (m3/capita/day)

S = 5% Strategic Reserve Capacity, m3/day

Hydraulic Reserve Capacity, Cr:

WWTP Rated Capacity	54,500 m3/d	(a)
2020 Average Daily Flow	29,333 m3/d	
2021 Average Daily Flow	26,447 m3/d	
2022 Average Daily Flow	27,922 m3/d	
3-Year Rolling Average	27,901 m3/d	(b)
Hydraulic Reserve Capacity, Cr:	**26,599 m3/d**	**(c) = (a) – (b)**
Number of Unconnected Lots/Units, L:	**8,291**	**(d)**
Number of Residential Units, H:	**21,774**	**(e)**
Existing Connected Population, P:	**47,771**	**(f)**
Average Daily Flow/Capita, F:	**0.584 m3/cap/d**	**(g) = (b) ÷ (f)**
5% Strategic Reserve Capacity, S:	**2,725 m3/d**	**(h) = 0.05 * (a)**

Uncommitted Reserve Capacity, Cu:

Cu = 26,599 m3/d – ([8,291 x 0.584 m3/cap/d x 47,771] ÷ 21,774) – 2,725

Cu = 13,250 m3/d ≈ 24% of Plant Capacity Remaining

APPENDIX C:
HYDRO INTERNATIONAL – FIRST DEFENSE
OGS SIZING REPORTS

Hydro First Defense® - HC

Hydro International

Rev. 9.6

Project Name:	**Settlers Ridge East Phase 3**	*Report Date:*	**2024-03-01**
Street:	**Raycroft Drive**	*City:*	**Belleville**
Province:	**Ontario**	*Country:*	**Canada**
Designer:	**Julie Humphries**	*email:*	

Paste

Teatment Parameters:

Structure ID:	ST106
TSS Goal:	80 % Removal
TSS Particle Size:	NJDEP / ETV
Area:	5.21 ha
Percent Impervious:	45%
Rational C value:	0.39
Rainfall Station:	Belleville, ONT
Peak Storm Flow:	340 L/s

Calc. Cn

MAP

RESULTS SUMMARY

Model	TSS	Volume
FD-3HC	40.8%	89.0%
FD-4HC	50.2%	96.4%
FD-5HC	58.5%	99.2%
FD-6HC	62.8%	99.7%
FD-8HC	**69.2%**	**100.0%**

Model Specification:

Model:	**FD-8HC**
Diameter:	2400 mm
No Bypass Flow:	142.00 L/s
Peak Flow Capacity:	1416.00 L/s
Sediment Storage:	2.14 m^3
Oil Storage:	4240.00 L

Installation Configuration:

Placement:	Online	
Outlet Pipe Size:	675 mm	*OK*
Inlet Pipe 1 Size:	675 mm	*OK*
Inlet Pipe 2 Size:	mm	*OK*
Inlet Pipe 3 Size:	mm	*OK*

Calc Invs.

Rim Level:	110.327 m	
Outlet Pipe Invert:	108.723 m	*Additional cover may be required*
Invert Pipe 1:	108.750 m	*Check cover*
Invert Pipe 2:	m	
Invert Pipe 3:	m	

Designer Notes:

Net Annual Removal Model: FD-8HC

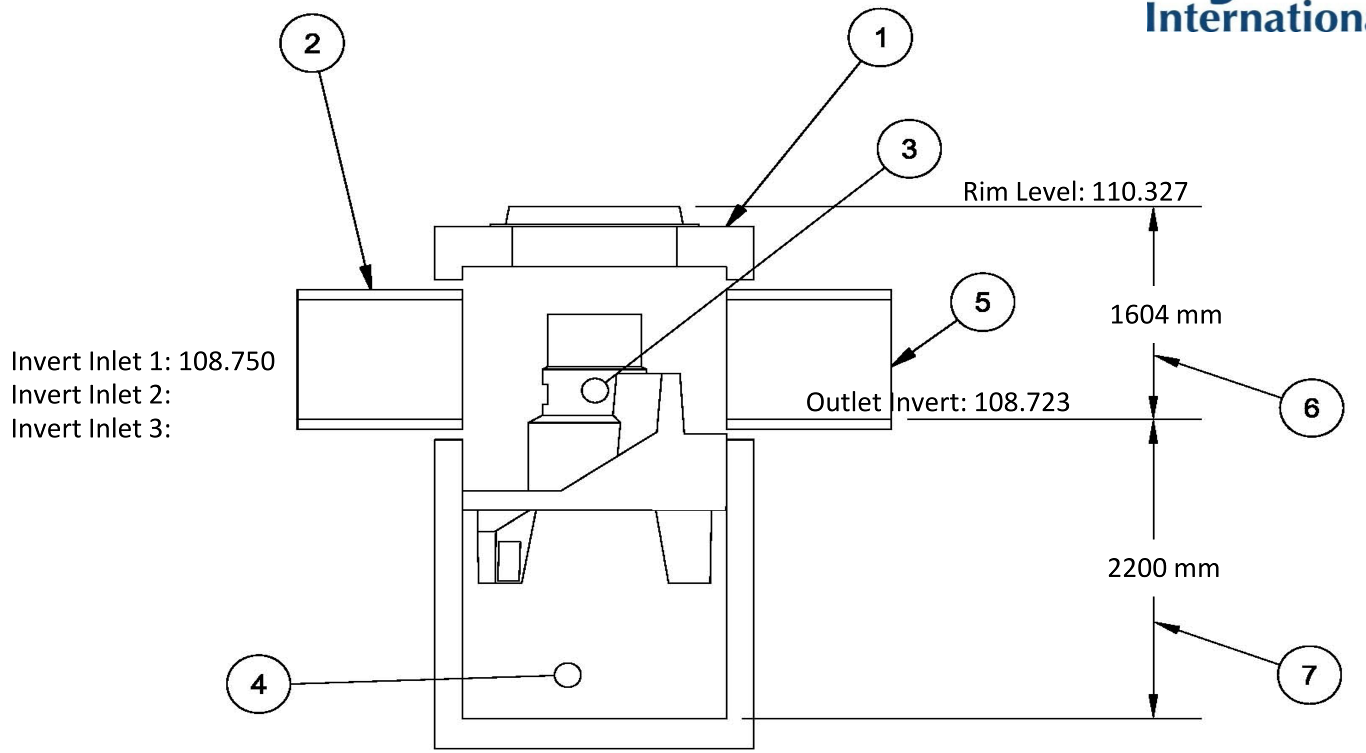
Intensity[1]	Fraction of Rainfall[1]	FD-8HC Removal Efficiency[2]	Weighted Net Annual Efficiency
(mm/hr)	(%)	(%)	(%)
0.50	0.4%	91.0%	0.4%
1.00	13.2%	83.5%	11.0%
1.50	14.0%	79.1%	11.0%
2.00	14.0%	76.0%	10.6%
2.50	3.6%	73.6%	2.6%
3.00	2.5%	71.6%	1.8%
3.50	8.4%	69.9%	5.9%
4.00	5.1%	68.5%	3.5%
4.50	1.6%	67.2%	1.1%
5.00	5.1%	66.1%	3.3%
6.00	4.8%	64.1%	3.1%
7.00	4.5%	62.5%	2.8%
8.00	3.5%	61.0%	2.1%
9.00	2.4%	59.7%	1.5%
10.00	2.5%	58.6%	1.5%
20.00	9.7%	51.1%	4.9%
30.00	2.8%	46.7%	1.3%
40.00	0.9%	43.6%	0.4%
50.00	0.4%	41.2%	0.2%
100.00	0.6%	33.7%	0.2%
150.00	0.1%	0.0%	0.0%
200.00	0.0%	0.0%	0.0%
Total Net Annual Removal Efficiency:			**69.2%**
Total Annual Runoff Volume Treated:			**100.0%**

1. Rainfall Data: 1960:2007, HLY03, Belleville, ONT, 6150700 & 6150689.

#N/A

3. Rainfall adjusted to 5 min peak intensity based on hourly average.

Hydro First Defense® - HC



All drawing elevations are metres.

FD-8HC Specification

1	Vortex Chamber Diameter	2400	mm
2	Inlet Pipe Diameter	675	mm
3	Oil Storage Capacity	4240.00	L
4	Min. Provided Sediment Storage Capacity	2.14	m^3
5	Outlet Pipe Diameter	675	mm
6	Height(Final Grade to Outlet Invert)	1604	mm
7	Sump Depth(Outlet Invert to Sump)	1130	mm
	Total Depth	**2734**	**mm**

Notes:

Hydro First Defense® - HC

Hydro International

Rev. 9.6

Project Name:	**Towncentre Place**	*Report Date:*	**2024-03-01**
Street:	**Red Fox Lane**	*City:*	**Belleville**
Province:	**Ontario**	*Country:*	**Canada**
Designer:	**Julie Humphries**	*email:*	

Paste

Teatment Parameters:

Structure ID:	ST114
TSS Goal:	80 % Removal
TSS Particle Size:	NJDEP / ETV
Area:	0.43 ha
Percent Impervious:	60%
Rational C value:	0.60
Rainfall Station:	Belleville, ONT
Peak Storm Flow:	340 L/s

Calc. Cn

MAP

RESULTS SUMMARY

Model	TSS	Volume
FD-3HC	70.1%	99.7%
FD-4HC	**80.3%**	**100.0%**
FD-5HC	81.3%	99.9%
FD-6HC	85.3%	99.9%
FD-8HC	90.5%	99.9%

Model Specification:

Model:	**FD-4HC**
Diameter:	1200 mm
No Bypass Flow:	20.00 L/s
Peak Flow Capacity:	510.00 L/s
Sediment Storage:	0.54 m^3
Oil Storage:	723.00 L

Installation Configuration:

Placement:	Online	
Outlet Pipe Size:	300 mm	*OK*
Inlet Pipe 1 Size:	300 mm	*OK*
Inlet Pipe 2 Size:	mm	*OK*
Inlet Pipe 3 Size:	mm	*OK*

Calc Invs.

Rim Level:	109.617 m	
Outlet Pipe Invert:	108.526 m	*OK*
Invert Pipe 1:	108.556 m	*OK*
Invert Pipe 2:	m	
Invert Pipe 3:	m	

Designer Notes:

Net Annual Removal Model: FD-4HC

Intensity[(1)]	Fraction of Rainfall[(1)]	FD-4HC Removal Efficiency[(2)]	Weighted Net Annual Efficiency
(mm/hr)	(%)	(%)	(%)
0.50	0.4%	105.2%	0.4%
1.00	13.2%	96.6%	12.8%
1.50	14.0%	91.6%	12.8%
2.00	14.0%	88.0%	12.3%
2.50	3.6%	85.3%	3.0%
3.00	2.5%	83.0%	2.1%
3.50	8.4%	81.1%	6.8%
4.00	5.1%	79.4%	4.0%
4.50	1.6%	78.0%	1.2%
5.00	5.1%	76.7%	3.9%
6.00	4.8%	74.4%	3.6%
7.00	4.5%	72.5%	3.3%
8.00	3.5%	70.8%	2.5%
9.00	2.4%	69.4%	1.7%
10.00	2.5%	68.1%	1.7%
20.00	9.7%	59.5%	5.7%
30.00	2.8%	54.4%	1.5%
40.00	0.9%	50.9%	0.5%
50.00	0.4%	48.1%	0.2%
100.00	0.6%	39.5%	0.2%
150.00	0.1%	0.0%	0.0%
200.00	0.0%	0.0%	0.0%
Total Net Annual Removal Efficiency:			**80.3%**
Total Annual Runoff Volume Treated:			**100.0%**

1. Rainfall Data: 1960:2007, HLY03, Belleville, ONT, 6150700 & 6150689.

#N/A

3. Rainfall adjusted to 5 min peak intensity based on hourly average.

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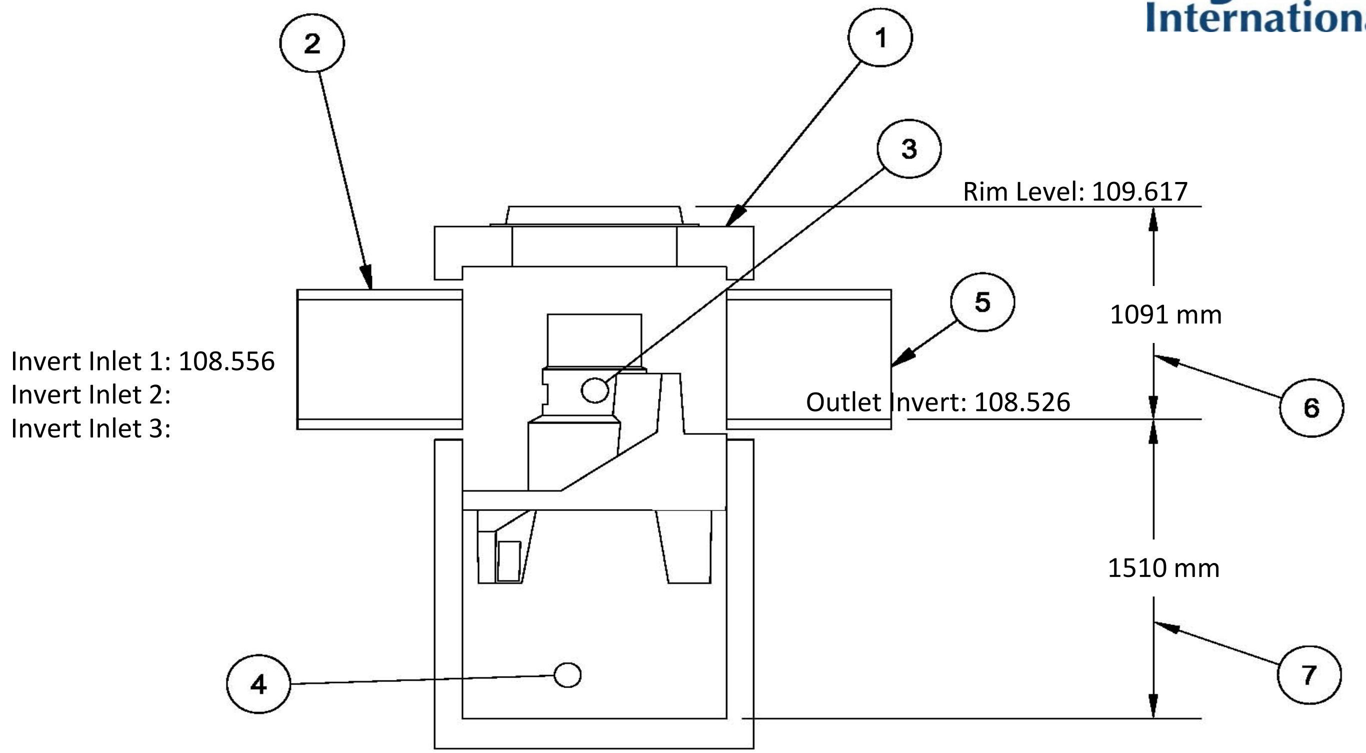


All drawing elevations are metres.

FD-4HC Specification

1	Vortex Chamber Diameter	1200	mm
2	Inlet Pipe Diameter	300	mm
3	Oil Storage Capacity	723.00	L
4	Min. Provided Sediment Storage Capacity	0.54	m^3
5	Outlet Pipe Diameter	300	mm
6	Height(Final Grade to Outlet Invert)	1091	mm
7	Sump Depth(Outlet Invert to Sump)	1130	mm
	Total Depth	**2221**	**mm**

Notes:

Hydro First Defense® - HC

Hydro International

Rev. 9.6

Project Name:	Towncentre Place	Report Date:	2024-03-01
Street:	Red Fox Lane	City:	Belleville
Province:	Ontario	Country:	Canada
Designer:	Julie Humphries	email:	

Teatment Parameters:

Structure ID:	ST116
TSS Goal:	80 % Removal
TSS Particle Size:	NJDEP / ETV
Area:	0.31 ha
Percent Impervious:	60%
Rational C value:	0.60
Rainfall Station:	Belleville, ONT
Peak Storm Flow:	340 L/s

Paste | Calc. Cn | MAP

RESULTS SUMMARY

Model	TSS	Volume
FD-3HC	73.6%	99.9%
FD-4HC	**84.3%**	**100.0%**
FD-5HC	84.9%	99.9%
FD-6HC	88.4%	99.9%
FD-8HC	92.8%	99.9%

Model Specification:

Model:	FD-4HC
Diameter:	1200 mm
No Bypass Flow:	20.00 L/s
Peak Flow Capacity:	510.00 L/s
Sediment Storage:	0.54 m^3
Oil Storage:	723.00 L

Installation Configuration:

Placement:	Online	
Outlet Pipe Size:	300 mm	OK
Inlet Pipe 1 Size:	300 mm	OK
Inlet Pipe 2 Size:	mm	OK
Inlet Pipe 3 Size:	mm	OK
Rim Level:	111.207 m	Calc Invs.
Outlet Pipe Invert:	109.096 m	OK
Invert Pipe 1:	109.096 m	OK
Invert Pipe 2:	m	
Invert Pipe 3:	m	

Net Annual Removal Model: FD-4HC

Intensity[1]	Fraction of Rainfall[1]	FD-4HC Removal Efficiency[2]	Weighted Net Annual Efficiency
(mm/hr)	(%)	(%)	(%)
0.50	0.4%	100.0%	0.4%
1.00	13.2%	100.7%	13.3%
1.50	14.0%	95.7%	13.4%
2.00	14.0%	92.1%	12.9%
2.50	3.6%	89.3%	3.2%
3.00	2.5%	87.1%	2.2%
3.50	8.4%	85.1%	7.2%
4.00	5.1%	83.5%	4.2%
4.50	1.6%	82.0%	1.3%
5.00	5.1%	80.7%	4.1%
6.00	4.8%	78.5%	3.7%
7.00	4.5%	76.6%	3.4%
8.00	3.5%	74.9%	2.6%
9.00	2.4%	73.4%	1.8%
10.00	2.5%	72.1%	1.8%
20.00	9.7%	63.5%	6.1%
30.00	2.8%	58.5%	1.6%
40.00	0.9%	54.9%	0.5%
50.00	0.4%	52.2%	0.2%
100.00	0.6%	43.6%	0.2%
150.00	0.1%	38.5%	0.0%
200.00	0.0%	0.0%	0.0%
Total Net Annual Removal Efficiency:			**84.3%**
Total Annual Runoff Volume Treated:			**100.0%**

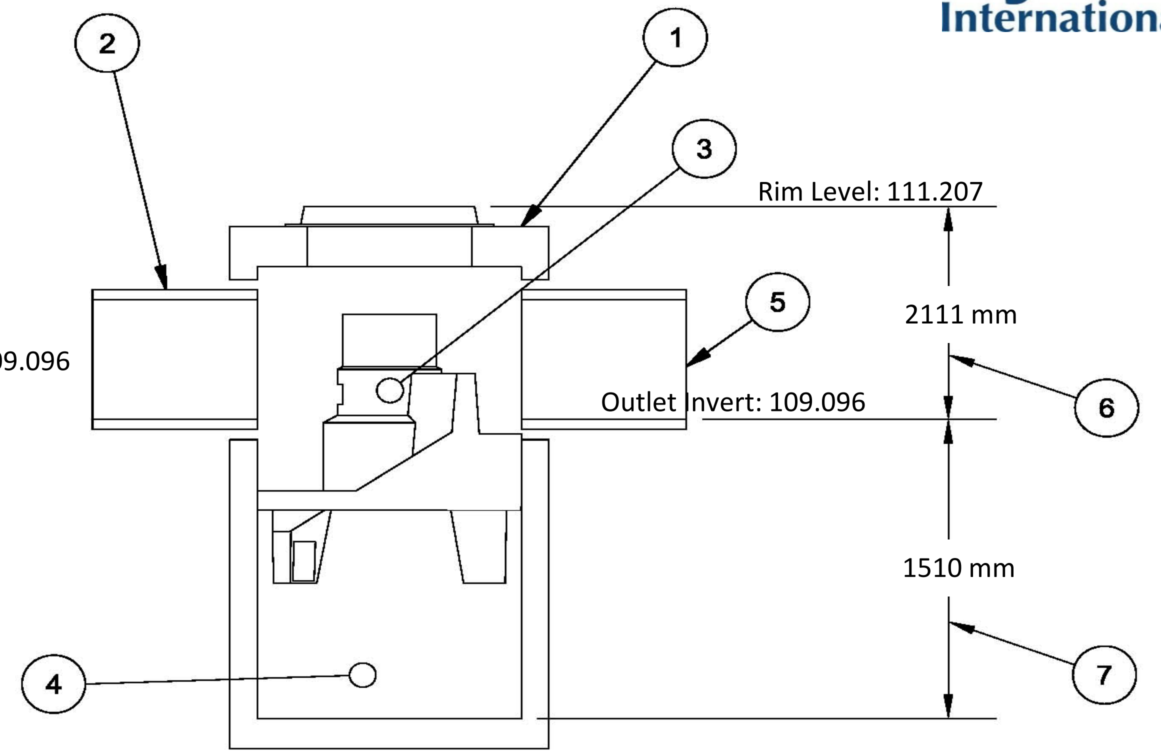
1. Rainfall Data: 1960:2007, HLY03, Belleville, ONT, 6150700 & 6150689.

#N/A

3. Rainfall adjusted to 5 min peak intensity based on hourly average.

Designer Notes:

Hydro First Defense® - HC



All drawing elevations are metres.

FD-4HC Specification

1	Vortex Chamber Diameter	1200	mm
2	Inlet Pipe Diameter	300	mm
3	Oil Storage Capacity	723.00	L
4	Min. Provided Sediment Storage Capacity	0.54	m^3
5	Outlet Pipe Diameter	300	mm
6	Height(Final Grade to Outlet Invert)	2111	mm
7	Sump Depth(Outlet Invert to Sump)	1130	mm
	Total Depth	**3241**	**mm**

Notes:

APPENDIX D:
POLLUTANT REMOVAL AND HYDRAULIC REDUCTION PERFORMANCE ARTICLE BY TERRY LUCKE ET AL

Water **2014**, *6*, 1887-1904; doi:10.3390/w6071887

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Article

Pollutant Removal and Hydraulic Reduction Performance of Field Grassed Swales during Runoff Simulation Experiments

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Abstract: Four different field swales were tested in this study, using 24 standardised synthetic runoff simulation experiments to evaluate their performance in removing Total Suspended Solids (TSS), Total Nitrogen (TN) and Total Phosphorous (TP) from stormwater runoff. Hydraulic reduction capability of the swales was also assessed. The study demonstrated that a swale's TSS removal performance is highly dependent on the inlet TSS concentrations. Results showed that between 50% and 80% of the TSS was generally removed within the first 10 m of the swale length. The study found no reduction in TN concentrations due to treatment by the swales. However, it did demonstrate a reduction in measured TP levels of between 20% and 23% between the inlet and the outlet. The study results demonstrated that swales can be successfully used to attenuate peak stormwater flow rates, reduce runoff volumes and to improve the quality of stormwater runoff, particularly in runoff with high concentrations of TSS and TP. The results from this study will assist designers to estimate the appropriate length of swale required to achieve specific TSS and TP pollution reductions in urban stormwater runoff and to reduce downstream runoff volumes.

Keywords: swales; stormwater pollution; total suspended solids (TSS); particle size distribution (PSD); stormwater treatment train

---

1. Introduction

Grassed swales are increasingly being used in a variety of engineering applications to transport polluted stormwater runoff to downstream catchments in an efficient, economic and aesthetically pleasing way. In addition, swales reduce runoff pollutants, require little maintenance, and can be easily incorporated in projects that require a cost-effective stormwater conveyance system. This can often make swales a better choice than traditional curb-and-gutter systems [1]. It has been demonstrated that grassed swales minimise stormwater runoff pollution levels [2] by reducing stormwater flow velocities, which decreases peak outlet discharges and allows filtering and sedimentation processes to occur within the swale.

Research has shown swales can be used as stormwater runoff pre-treatment systems which reduce the need for downstream treatment facilities [3]. Water Sensitive Urban Design (WSUD) guidelines recommend cost-effective and sustainable non-point-source stormwater pollution treatment options. These can include incorporating swales into urban catchments for treating polluted stormwater runoff prior to discharge into receiving waters [4]. WSUD is about integrating water cycle management into urban planning and design. The principles of WSUD are similar to those of Sustainable Urban Drainage System (SUDS) design in Europe and Low Impact Development (LID) in America [5].

Despite significant literature sources reporting the benefits of grassed swales to treat urban stormwater runoff, a fully comprehensive understanding of the design and performance characteristics of swales is still not apparent [6]. This investigation builds on previous swale research with a particular focus on swale length, and how it influences the stormwater attenuation and pollution removal capabilities of grassed swales.

2. Previous Research

Numerous researchers have reported that swales substantially reduce runoff volumes. Ackerman and Stein [7] demonstrated that grassed swales reduce mean runoff volume by approximately 52.5%. Barrett [8] reported that swales may have the potential to infiltrate up to 50% of the runoff volume, provided the soil is permeable and the initial moisture content of that soil is low. Fassman and Liao [3] monitored field swales in New Zealand under natural storm conditions and concluded that, on average, 73.6% of the peak flow discharge was dampened by swales, while 63.7% of the total volume was captured. Bäckström *et al.* [9], and Fassman and Liao [3] noted complete capture of runoff by swales when rainfall events of less than 2 mm occurred. Yousef *et al.* [10] and Deletic [11] also reported significant runoff reduction by swales. Barrett [8] concluded that the reduction in runoff volume also meant that the total pollutant constituent load was reduced, including nutrient loads, which generally exhibit little change in concentration due to treatment by swales. Increased stormwater retention time, and reduced peak flow rates by swales has the potential to significantly improve the quality of stormwater runoff [7,8].

Previous research agrees that swales remove pollutants through the processes of sedimentation, filtration by grass blades, infiltration into the subsurface zone and bio-chemical processes [2,6,12]. Previous research also reports that swale length, slope, vegetation cover and soil type, all factor into pollution removal performance. Pollutant properties, such as the sediment particle size distributions

(PSD) and concentrations, and the amount of particulate bound pollutants also directly affects the pollutant treatment efficiency of swales [1,13,14].

Due to their ability to trap sediments, and consequently pollutant constituents attached to particulate matter, many researchers have measured the pollution reducing efficiency of swales based on total suspended solids (TSS) removal. A summary of previous studies on the TSS removal performance of grassed swales is listed in Table 1.

Table 1. Previous studies on the Total Suspended Solids (TSS) removal performance of swales.

Literature Source	TSS Removal Performance of Grassed Swales (%)		Remarks
	Range	**Mean (Median)**	
Ackerman and Stein (2008) [7]	41–84	70.6 (72)	* Review of ten different swales studies
	80–99	89 (87)	* Review from five different peer reviewed swale study sources; ** TSS load reduction
Barrett *et al.* (1998) [2]	85–87	86	* Studied two field swales of 1055 m and 356 m long tested under real runoff events (n = 34); ** TSS concentration (EMC) reduction
Deletic and Fletcher (2006) [15] (review section)		72 (76)	* Review of 18 swale study sources
Deletic and Fletcher (2006) [15]	61–86		* A 6.2 m field grass channel studied with runoff simulation; ** TSS concentration (EMC) reduction
		69	* A 65 m long field swale with runoff simulation; ** TSS load reduction
Bäckström (2002) [13]	79–98		* Simulation study on nine different swales of 5–10 m long; ** TSS concentration (EMC) reduction
Yu *et al.* (2001) [12]	67.2–94		* From two field swale studies, one with a 30 m long swale using runoff simulation and other swale of 274.5 m with real time events (n = 4); ** mass sediment removal
Lloyd *et al.* (2001) [16]		74	* A 35 m long swale tested with runoff simulation; ** TSS load removal
Bäckström *et al.* (2006) [9]		15	* Field swale of 110 m long under real storm events (n = 7); ** TSS EMC removal; *** *few negative TSS removals were also observed in the study*
Kaighn and Yu (1996) [1]	29.7–49		* Results from two 30 m long field swales studied under real storm events (n = 8); ** TSS EMC removal
Scheuler (1994) [17]	65–98		* Results from three 61 m long field swales tested under real storm events; *** *one swale showed negative TSS removal due to erosion, which was not given in the range). This finding was verified by Winston et al. (2012) [18] who also found that erosion within a swale caused negative percent reductions for TSS.*
Stagge *et al.* (2012) [6]	44.1–82.7		* Two field swales of 198 m and 138 m long tested with different configurations under real events (n = 45); ** mass TSS removal
Mean	***61.3–86.4***	***67.9 (78.3)***	***Arithmetic mean of the listed literature performance data***

Notes: * type of swales used in the study and experimental method used and number of real storm events (n) sampled; ** TSS measurement method employed in the respective study; *** any specific observations noted; blank cells mean relevant data wasn't available; EMC—event mean concentration of pollutants.

Bäckström [13] found sedimentation of the coarse particles (>25 µm) within the first few metres of the swale length was the most significant factor in removing TSS from runoff, followed by filtration by grass blades predominantly in shallower flow regimes that often correspond to low to moderate intensity rainfall events. Bäckström [13] also reported that laboratory tests on swales generally performed better than field swale tests in sediment trapping. Five metre long field swales showed efficient removal of particles coarser than 25 µm. However, when the lengths of the swales were doubled, particles smaller than 25 µm were also trapped. Bäckström *et al.* [9] confirmed his earlier findings of sediment trapping using a 110 m long roadside grassed swale in Södra Hamnleden, Sweden, under different real rainfall and runoff events. This study revealed that particles larger than 25 µm were effectively trapped by the swale. However, this study found that sediments finer than 25 µm were not retained, and were transported out of the swale, which was in contrast to the earlier study results [13]. Bäckström *et al.* [9] attributed the export of finer sediment to higher flow rates that occurred under real runoff conditions. They concluded [9] that further studies are needed to improve the understanding of the capacity of swales to trap finer particles. Deletic's [14] experimental study on swales concluded that a substantial proportion of sediment particles larger than 57 µm in size were trapped by grassed swales. She also found that the removal efficiency of grassed swales was very low for particles smaller than 5.8 µm.

Previous studies have also looked into the nutrient removal performance by swales. Nutrients such as nitrogen and phosphorous were mostly considered in those studies due to their impact on urban waterways. Removal of total nitrogen (TN) in swales was found to be variable [15–17]. Other researchers reported that the removal of TSS particles finer than 150 µm would increase removal of total phosphorous (TP), because approximately 70% of the TP present in urban runoff is bound to particulates [6]. It has been suggested that relevant chemical or biological processes need to take place to significantly remove these nutrients, particularly the dissolved components [12]. However, it is unclear whether swale systems provide adequate Hydraulic Retention Time for these processes to occur [18]. Tables 2 and 3 list previous research results on the TN and TP removal performance by swales respectively.

It appears from the literature reviewed above that there are significant knowledge gaps relating to the ability of swales to remove pollutants from stormwater runoff. This study investigated the pollutant removal performances of field swales under simulated runoff conditions. As swales convey runoff to downstream water bodies, the main focus of the study was to investigate the level of pollution removal performance that can be expected from grass swales used to treat stormwater runoff before it reaches receiving waters. The study focussed on the three most common pollutants of concern to WSUD practitioners, namely: TSS, TN and TP. The particle size distributions (PSD) of the sediment trapped by the swales, runoff volume reduction, and peak discharge attenuation were also investigated in the study.

Table 2. Previous studies on the Total Nitrogen (TN) removal performance of swales.

Literature Source	**TN removal performance of grassed swales (%)**		**Remarks**
	Range	**Mean (Median)**	
Deletic and Fletcher's [15] review (2006)		45 (50)	* Review of 13 swale study sources
Deletic and Fletcher (2006) [15]		56	* A 65 m long field swale with runoff simulation; ** TN load reduction
Yu *et al.* (2001) [12]	13.8–23.1		* From two field swale studies, one with a 30 m long swale with runoff simulation and other swale of 274.5 m with real time events (n = 4); ** mass TN removal
Lloyd *et al.* (2001) [16]		Nil	* A 35 m long swale tested with runoff simulation; ** TN load removal
Scheuler (1994) [17]	(−X)–46.5		*Results from three 61 m long field swales tested under real storm events; (*** *one swale showed TN export of a certain negative percentage*)
Stagge *et al.* (2012) [6]	(−25.6)–85.6		* Two field swales of 198 m and 138 m long tested with different configurations under real events (n = 45); ** mass TN removal
Yousef *et al.* (1987) [10]	(−7)–11		* From two field swales of 53 m and 170 m long under simulated runoff events; ** EMC reduction
Mean	***−6.3–41.2***	***33.7 (50)***	***Arithmetic mean of the listed literature performance data***

Notes: * type of swales used in the study and experimental method used and number of real storm events (n) sampled; ** TN measurement method employed in the respective study; *** any specific observations noted; −X is an unknown negative value; blank cells mean relevant data wasn't available; EM—event mean concentration of pollutants.

Table 3. Previous studies on the Total Phosphorous (TP) removal performance of swales.

Literature Source	**TP removal performance of grassed swales (%)**		**Remarks**
	Range	**Mean (Median)**	
Barrett *et al.* (1998) [2]	34–44	39	* In two field swales of 1,055 m and 356 m long + tested under real runoff events (n = 34); ** TP concentration (EMC) reduction
Deletic and Fletcher's [15] review (2006)		52 (55)	* Review of 20 swale study sources
Deletic and Fletcher (2006) [15]		46	* A 65 m long field swale with runoff simulation; ** TP load reduction
Yu *et al.* (2001) [12]	28.8–98.6		* From two field swale studies, one with a 30 m long swale with runoff simulation and other swale of 274.5 m with real time events (n = 4); ** mass TP removal
Lloyd *et al.* (2001) [16]		55	* A 35 m long swale tested with runoff simulation; ** TP load removal
Kaighn and Yu (1996) [1]	(−0.4)–33		* Results from two 30 m long field swales tested under real storm events (n = 8); ** EMC removal
Scheuler (1994) [17]	18–41		* Results from three 61 m long field swales tested under real storm events
Stagge *et al.* (2012) [6]	(−49.6)–68.7		* Two field swales of 198 m and 138 m long tested with different configurations under real events (n = 45); ** mass TP removal
Yousef *et al.* (1987) [10]	3–25		* From two field swales of 53 m and 170 m long under simulated runoff events; ** EMC reduction
Mean	***5.6–51.7***	***48 (55)***	***Arithmetic mean of the listed literature performance data***

Notes: * type of swales used in the study and experimental method used and number of real storm events (n) sampled; ** TP measurement method employed in the respective study; *** any specific observations noted; blank cells mean relevant data wasn't available; EMC—event mean concentration of pollutants.

3. Study Objectives

The main goal of this study was to evaluate the overall performance of grass swales in improving urban stormwater runoff quality and mitigating runoff quantity. Four different grassed swales on the Sunshine Coast in Australia were studied using controlled stormwater runoff simulation experiments to evaluate their pollution removal performance. The specific objectives of this research project were to:

- Correlate the overall TSS removal efficiency of the swales to their length;
- Determine the relationship between the trapping efficiency of various sediment size fractions and swale length;
- Evaluate the nutrient removal performance of swales relative to their length;
- Understand the effects of varying influent pollutant concentrations on the swale pollution removal performance; and
- Evaluate the hydrological control characteristics of swales.

4. Experimental Methodology

The stormwater pollutant removal performance of four different field swale installations was monitored during 24 controlled field runoff simulation experiments. Controlled field runoff simulations were selected for the study because of their reliability and the difficulties in sampling real time precipitation runoff events. The experiments were designed to compare selected water quality parameters in the influent and effluent runoff. Three different pollutants were tested, namely: TSS, TN and TP. TSS was sampled every 5 m along the swale length and the nutrients TN and TP were tested every 10 m. Four different pollutant concentrations were used in the experiments as shown in Table 4. The reduction in flow rates due to infiltration along the swales was also measured. It must be noted that the pollution loads for the C and D tests are much higher than typical nutrient and sediment concentrations in stormwater runoff in Australia and these were included to ensure that differences in results could be measured.

Table 4. Synthetic runoff pollutant constituents and test types used in simulation experiments.

Pollutant constituents	Test types and design pollutant mix concentrations (mg/L)				Concentrations observed at swale inlets (mg/L)			
	Test A (TA)	Test B (TB)	Test C (TC)	Test D (TD)	Test A (TA)	Test B (TB)	Test C (TC)	Test D (TD)
Total suspended solid (TSS)–Silica	0	150	750	1500	0–19	67–96	283–451	511–1211
Total nitrogen (TN)–KNO_3	0	1.000	5.000	10.000	0.115–0.209	1.120–1.270	4.926–5.384	9.495–10.520
Total phosphorous (TP)–KH_2PO_4	0	1.000	5.000	10.000	0.088–0.261	0.947–1.245	3.868–5.145	8.570–11.650

Three of the swales tested were located on the campus of the University of the Sunshine Coast (identified as USC, IC, and CPB in Table 5). The fourth swale was located in Caloundra, Sunshine Coast (identified as SC in Table 5). The swale size, shape, length and slope are also given in Table 5.

The four swales were between 30 and 35 m in length. Figure 1 shows the CPB swale that was used in simulation experiments. All four study swales had similar characteristics with the grass type of kikuyu (*Pennisetum clandestinum*). Experiments were performed in swales within seven days of mowing, and the grass heights were varied between 10 and 60 mm.

Table 5. Study swale characteristics.

Swale Name	Swale characteristics				
	Length (m)	**Shape**	**Dimensions (m)**	**Slope (%)**	**Grass type and grass height (mm)**
USC Engineering (USC)	35	Triangular	b = 4.0, h = 0.16	<1	Kikuyu, 10–60
Sports Complex (SC)	35	Triangular	b = 6.1, h = 0.44	<1	Kikuyu, 10–60
Innovation Centre (IC)	35	Triangular	b = 3.0, h = 0.35	1	Kikuyu, 10–60
Car Park–B (CPB)	30	Triangular	b = 4.3, h = 0.49	1	Kikuyu, 10–60

Notes: * b—top width of swales in metres; h—mid height of swales in metres; all swales were tested under recently mowed conditions (within seven days of mowing) under which grass heights were varying between 10 and 60 mm.

Figure 1. Car Park-B (CPB) swale used in simulation experiments.

Experiments were conducted in 2012 and 2013, identified as R1 (Round 1) and R2 (Round 2) in Table 6. The experiments were conducted at least one day apart in order to allow the soil moisture to stabilise between tests. A runoff simulation approach similar to that used by Deletic and Fletcher [15] was employed in this field study. Each round (R1 and R2) had 12 individual experimental runs. To simulate the rainfall events, a 2000 L tank filled with clean water was used. The first set of experiments in 2012 (R1) were conducted using an average inflow rate of approximately 1.6 L/s for 21 min. The selected flow rate and the duration were limited by the capacity of the tank. However, this flow rate was considered to be appropriate to simulate a one year, 21 min, average recurrence interval (ARI), naturally occurring storm event (rainfall intensity = 29.3 mm/h) typically experienced on the Sunshine Coast.

Table 6. Experimental arrangements and tested parameters.

Test Name	Swale Name	Experiment	Inflow	IVMC (%)	Outflow (%)	WQ Tests
Round—R1 (Experiments performed in 2012)	USC Engineering (USC)	R1-USC-TA	2000 L of runoff delivered into the swales at an approximate average flow rate of 1.6 L/s (simulating 21 min runoff events)	NM	NM	TSS, TN & TP (Samples collected at every 5 m along swales and analysed for these WQ parameters)
		R1-USC-TB				
		R1-USC-TC				
		R1-USC-TD				
	Sports Complex (SC)	R1-SC-TA				
		R1-SC-TB				
		R1-SC-TC				
		R1-SC-TD				
	Innovation Centre (IC)	R1-IC-TA				
		R1-IC-TB				
		R1-IC-TC				
		R1-IC-TD				
Round—R2 (Experiments performed in 2013)	USC Engineering (USC)	R2-USC-TA	2000 L of runoff delivered into the swales under varying flow rates of 0.5–2.0 L/s (simulating 30 min runoff events)	39.5	NM	TSS, TN, TP & PSD (TSS and PSD analysis performed on samples collected at every 5 m along swales and nutrient tests were performed with every 10 m samples)
		R2-USC-TB		45.6	NM	
		R2-USC-TC		10.2	46.5	
		R2-USC-TD		34.3	53.5	
	Sports Complex (SC)	R2-SC-TA		47.2	NM	
		R2-SC-TB		27.6	NM	
		R2-SC-TC		11.3	0	
		R2-SC-TD		19.5	0	
	Car Park–B (CPB)	R2-CPB-TA		35.0	42.1	
		R2-CPB-TB		52.0	68.1	
		R2-CPB-TC		48.5	75.0	
		R2-CPB-TD		52.3	88.3	

Notes: * IVMC—initial volumetric moisture content of swales; Outflow—outflow measured as a percentage of inflow; NM—not measured; WQ tests—water quality tests performed in respective experiments; experiment names should be read as Round#-Swale name-Test type as shown in Table 5 (e.g., R1-USC-TA).

In 2013 (R2), the Innovation Centre (IC) swale was replaced by Car Park-B (CPB) swale for field simulation experiments due to non-accessibility to the IC swale. For the second set of experiments (R2) conducted in 2013, the swale inflow rates were varied from between 0.5 and 2.0 L/s based on the hydrograph from a one year, 30 min ARI rainfall event. Inflow rates were regulated using an electromagnetic flow meter to measure and a valve at the 2000 L tank outlet. The PSD of the water sample sediment was also analysed. In R2, initial swale moisture contents of swales were measured, and swale outflow measurements were also performed (Table 6). The moisture content of the swale soil profile was measured at different locations using a moisture probe that records volumetric moisture content of the soil matrix. The average measured moisture value can be seen in Table 6 in the

IVMC column. The flow rate at the outlet was measured continuously throughout the event using a sharp edged V-notch weir during R2 experiments.

Synthetic pollutant constituents were used in the experiments to simulate runoff pollutant levels, which allowed finer control of their concentration levels. Both R1 and R2 experiments were designed with different pollutant concentrations in order to help understand the performance of swales under varying pollutant discharges. This can be related to conditions occurring during the "first flush" phenomenon events, as well as typical pollutant loads. Each swale was tested under four different inlet pollutant loading conditions referred to as TA, TB, TC and TD as in Table 4.

Test-A (TA) was a control experiment, with no added pollutants, to determine the background concentration of the pollutant constituents in each swale tested. All other test runs were carried out with the addition of pollutants as shown in Table 4. Test-B (TB) was designed to simulate urban runoff pollutant concentrations typically found in Australian urban catchments [15,19]. Commercially available silica powder, which closely resembled the PSD of sediment found in urban runoff, was used as the synthetic TSS constituent in the simulated stormwater inside the tank. Chemical reagents KNO_3 and KH_2PO_4 were used to simulate the TN and TP loads respectively. Test-C (TC) and Test-D (TD) were comprised of pollutant concentrations five times and ten times higher than typical Australian urban stormwater pollutant concentrations.

To ensure a relatively homogeneous water column inside the tank, and to maintain constant concentrations of influent pollutant concentrations at the swale inlet, a stirring system using a submersible pump was used inside the 2000 L tank. Synthetic runoff water inside the tank was mixed for 30 min before each experiment, and during each runoff simulation.

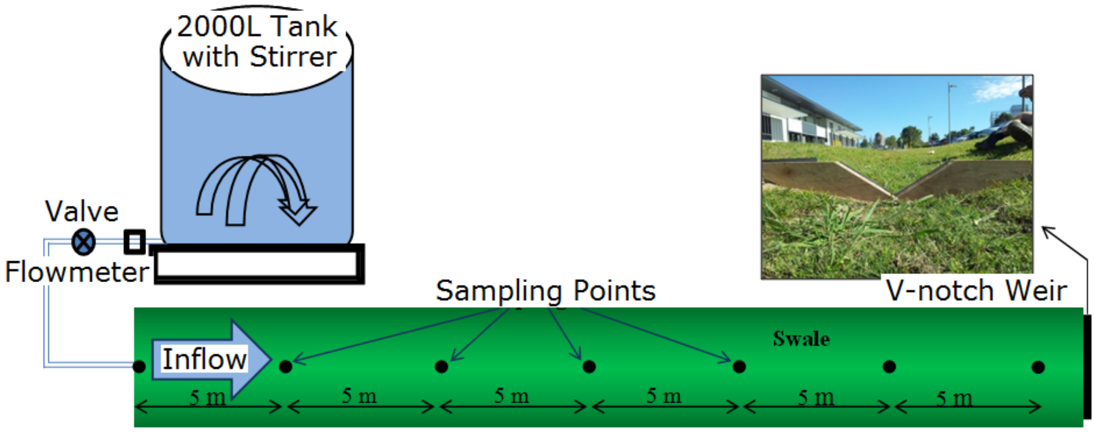
Marginal variations in the swale inlet TN and TP concentrations could be attributed to the compound effect of nutrients attached to settled sediments within the tank, and from residual nutrients inside the tank or water (Table 4). Swale inlet pollutant concentrations found during Test-A experiments represent the background pollutants present in the clean water. Samples from the tank outlet every five minutes revealed that outflow concentrations of TSS could vary by up to ±10% during simulations, possibly due to settling of larger particles in the tank.

The release of runoff into the swale was adjusted to different inflow hydrographs and took place for 21 min in R1 experiments and for 30 min in R2 experiments.

Manual grab samples were collected at selected sampling points located along the length of the swales. Figure 2 shows the conceptual swale testing setup and typical swale testing locations. Water samples were collected at the inlet, the outlet and at every either 5 m (for TSS, TN & TP in R1 and for TSS in R2) or 10 m (for TN & TP in R2) along the length of the swale (Table 5, Figure 2). Three individual samples of 300 mL were collected at each of the sampling locations at between 10 and 15 min intervals during the experiments. The three samples were later mixed together to form composite samples for each sampling point. Sampling was undertaken carefully to avoid disturbing the swale bed.

Collected samples were taken to the USC analytical lab within three hours of the field collection. Each water sample was preserved in accordance with the Standard Methods for the Examination of Water and Wastewater and then analysed for TSS, TN and TP according to APHA/AWWA/WEF [20]. Each sample was analysed for PSD of the suspended solid contents using a laser particle sizer—Malvern Mastersizer 3000 [21].

Figure 2. Conceptual swale testing setup.

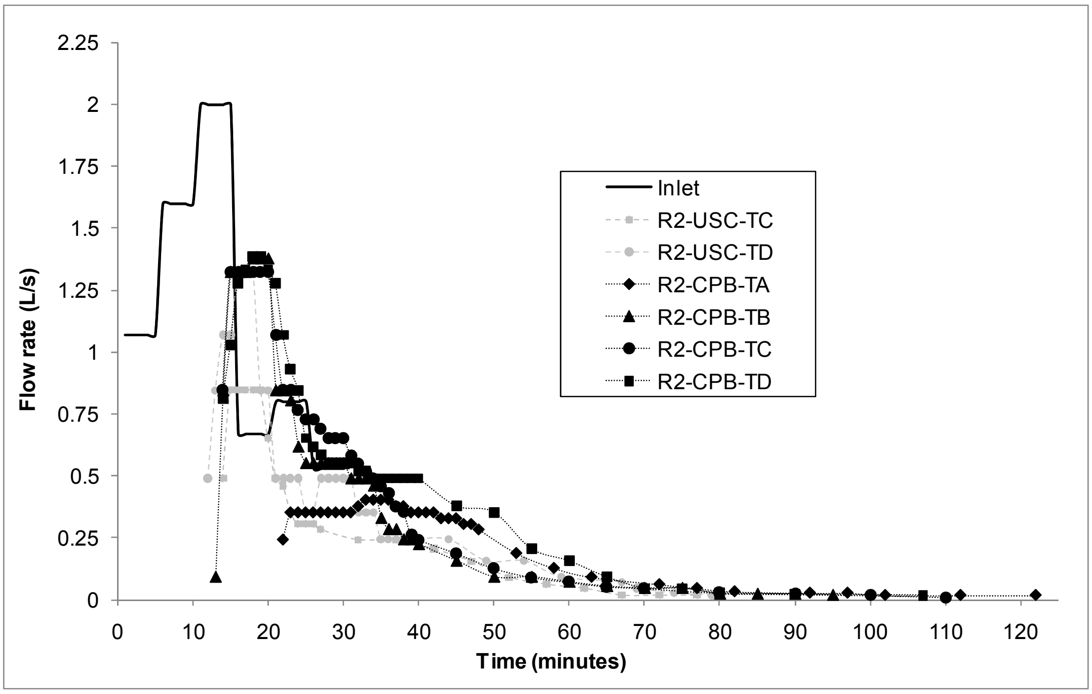


5. Results and Discussion

5.1. Hydraulic Performance of Swales

Figure 3 shows the swale inlet hydrograph, and the outflow hydrographs measured at the swale outlet during the different R2 experiments. Flow rates at the outlet reached a peak after approximately 20 min and then decreased exponentially to nearly zero flow after approximately 80 min. Figure 3 shows that a lag time of approximately 13 min was recorded after the start of the tests before any flow was measured at the outlet. While the flow into the swales ceased after 30 min, trickle flows were recorded at the outlet for up to 120 min after the start of the tests. Flow measurements demonstrated a mean total flow reduction of 52% in the 30 m long swales studied, with a peak flow reduction of 61% occurring in one of the study swales. As expected, more infiltration (and hence greater flow reduction) was observed in swales with low initial soil moisture contents.

Figure 3. Inlet and outlet hydrographs of flow measured experiments in R2.

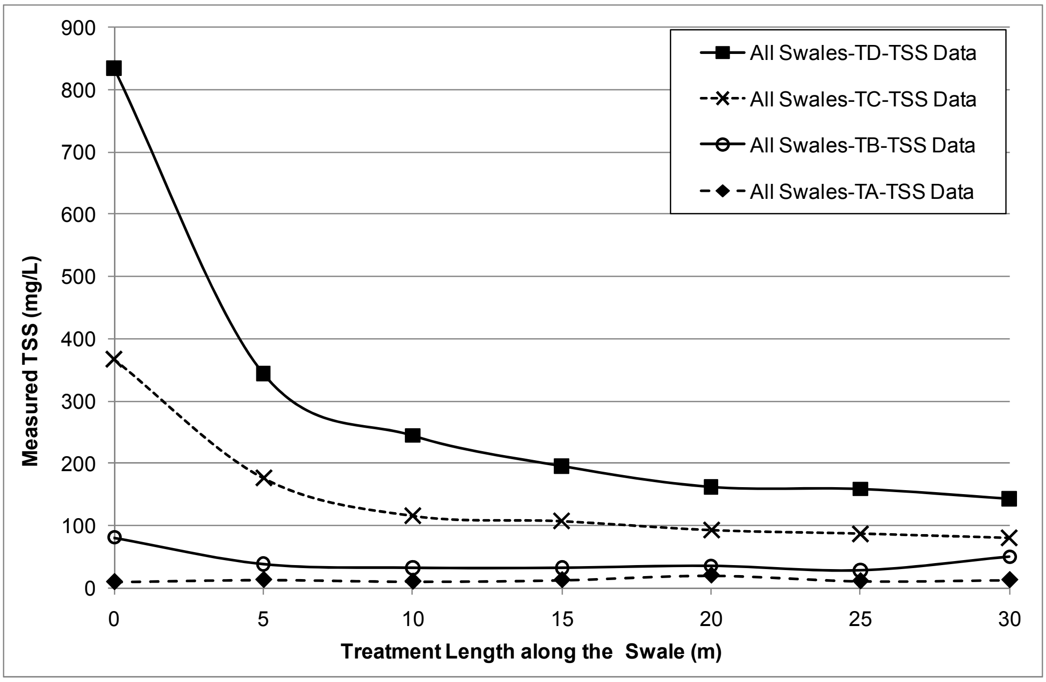


The results in Figure 3 demonstrate that swales can be used successfully to attenuate peak stormwater flow rates and to significantly reduce runoff volumes to downstream water courses. The increased runoff retention and peak flow reduction shown by the swales in this study have also suggested that they have the potential to significantly improve the quality of stormwater.

5.2. TSS Removal Performance of Swales

The average TSS concentrations measured at 5 m intervals for 30 m along the four study swales for tests TA, TB, TC & TD are shown in Figure 4. The figure clearly shows an exponential decay of TSS concentration along the swale, particularly at the higher pollutant loading tests, TC and TD. This trend agrees with previous research by Deletic [14] who reported an exponential decline of TSS concentration corresponding to swale length. Test-B data points also show an exponential decay of TSS concentration along the swale length, although this was less pronounced.

Figure 4. Measured TSS concentrations along the swale length.



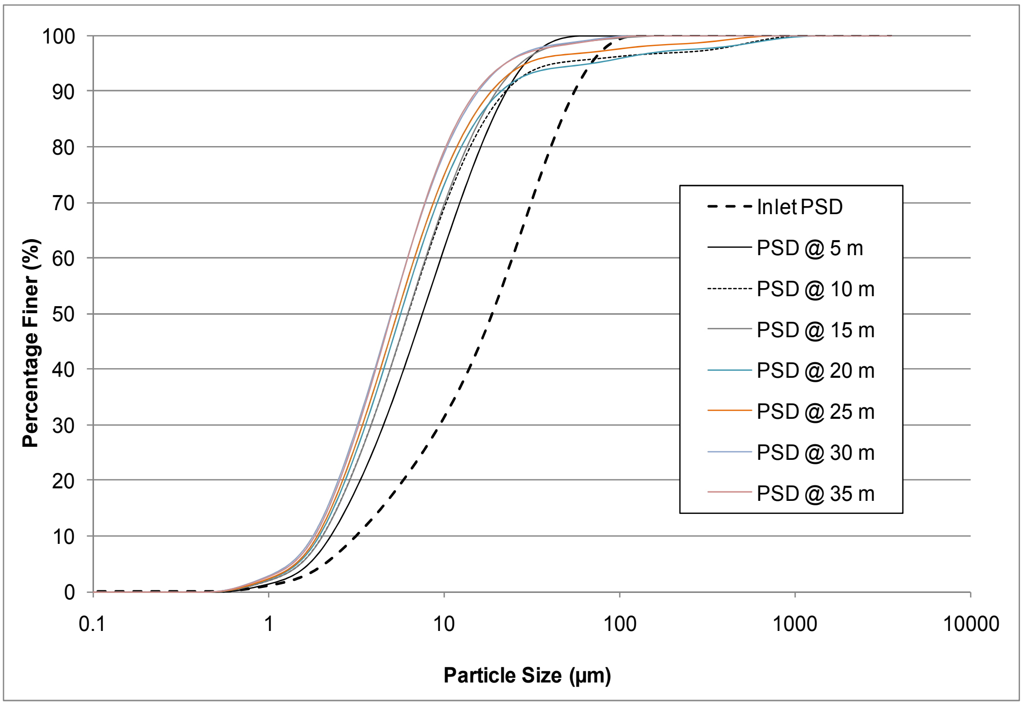
TSS concentrations measured during the TA tests showed that the swales had background TSS concentration values of between 0 and 40 mg/L. This agrees with pervious research finds [15,16,18]. It was hypothesised that these background TSS concentrations may have been due to disturbance of the swale bed during sampling or potential scouring of sediments by the runoff along the swale. Measured TSS concentrations below 40 mg/L for all other tests therefore led to variability in the results with some values showing slight increases along the swale length. The study results demonstrate that a swale's TSS removal performance is highly dependent on the inlet concentrations as was shown in previous research [15,16,18]. Results of TA and TB have demonstrated the difficulty in quantifying the efficiency of stormwater treatment devices with very low inlet pollutant concentrations (<40 mg/L).

Figure 4 demonstrates that the swales tested in the study were effective in reducing the higher TSS concentrations in the TC and TD tests. The results of the TC and TD tests also show that swales can treat higher pollution loads typically associated with the "first flush" phenomenon. Results showed that between 50% and 80% of the TSS was generally removed within the first 10 m of the swales. A further 10% to 20% reduction in TSS concentrations can be expected in swales up to 30 m long. Figure 4 also shows that there was a substantial decline in the TSS removal rate after the initial between 10 and 15 m length of the swales and the removal rate becomes very low from that point on. The results of TSS removal by swales in this study generally agreed with previous research results (Table 1).

5.3. Sediment Particle Size Removal Efficiency of Swales

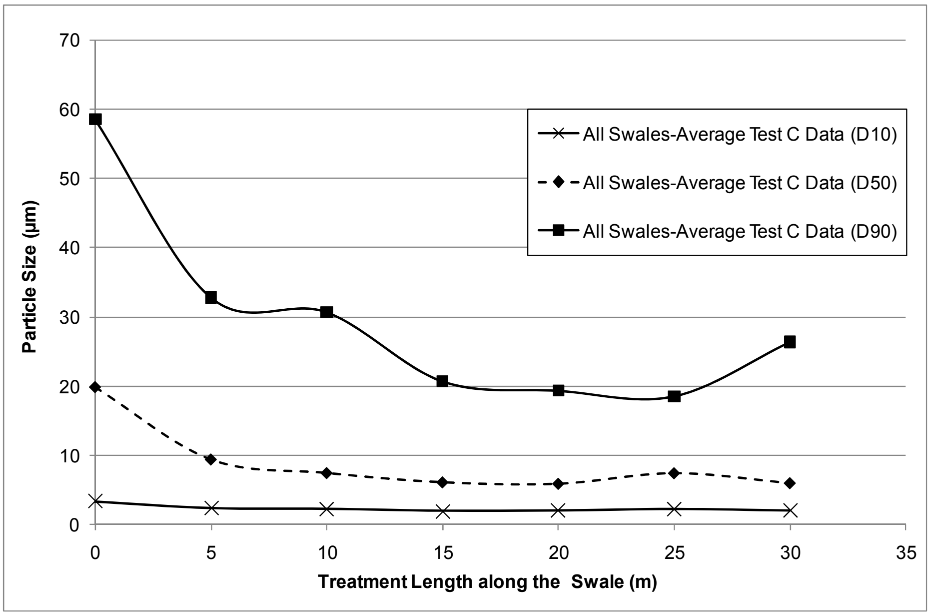
PSDs of the swale synthetic sediment (silica) inlet samples were relatively uniform for all the experiments. Figure 5 shows the variation in PSDs of the samples collected at 5 m intervals along the length of the swale for the R2-USC-TD experiment. There is a substantial difference between the PSD samples collected at the swale inlet and the samples collected within the first five to ten metres suggesting that the larger sediment particles were removed in this initial length. However the PSD of samples collected after 15 m show little difference in size. PSD curves followed a relatively similar pattern for the other R2 experimental runs performed under TB, TC and TD test conditions.

Figure 5. PSD0 of the samples collected during R2-USC-TD experiment.



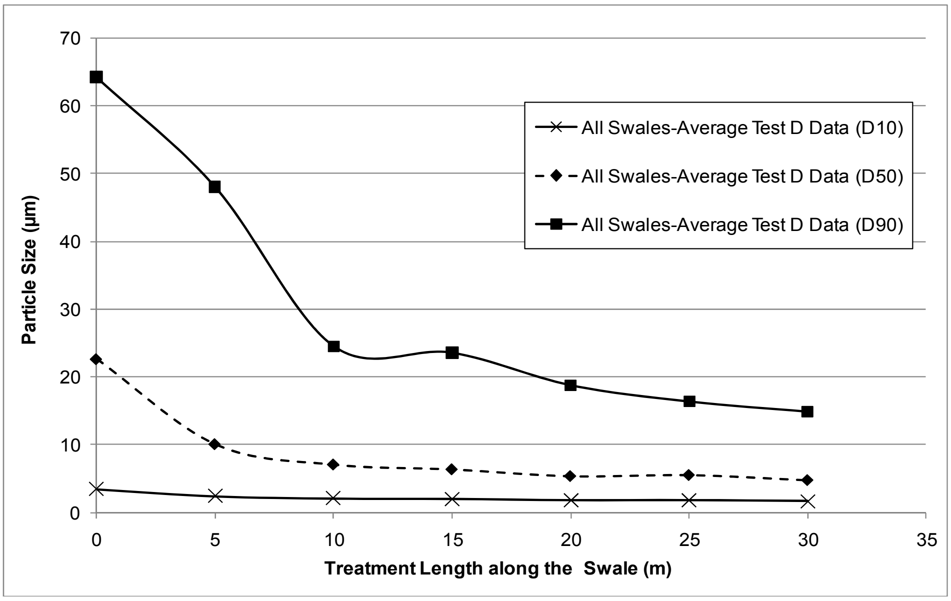
The variation in the D_{10}, D_{50} and D_{90} sediment sizes along the swales under TC conditions is shown in Figure 6. D_{50} and D_{90} values decreased rapidly within the first 10 m of the swale length and then continued to slowly decrease. D_{90} values declined steadily from approximately 58 µm at the inlet, to approximately 18 µm at the 25 m swale length point. It then increased slightly to approximately 27 µm at the 30 m point. The reason for the slight rise was not confirmed. However, it was hypothesised that it may have been due to the soil erosion occurring in the swale, or due to some minor disturbances potentially caused to the swale bed during sampling. No noticeable change was recorded in the D_{10} values along the length of the swale for the TC tests.

Figure 6. Average D_{10}, D_{50} and D_{90} values along the swale length during Test-C experiments.



The variation of the particle size parameters D_{10}, D_{50} and D_{90} along the swales under TD conditions is shown in Figure 7. D_{50} and D_{90} values decreased rapidly within the first 10 m of the swale length and then continued to slowly decrease. D_{90} values declined steadily from approximately 65 µm at the inlet, to approximately 24 µm at the 10 m swale length point. It then continued to decrease slightly along the rest of the swale length to a value of 15 µm at the 30 m point. A slight decrease in the D_{10} values from approximately 3 µm to 2 µm was measured after a length of 5 m, after which time the value remained relatively constant.

Figure 7. Average D_{10}, D_{50} and D_{90} values along the swale length during Test-D experiments.



The trends and variations of PSD along the swale suggested a clear relationship with the TSS removal (Figure 4). Sedimentation processes and removal of larger sediment particles may explain the higher TSS removal rates within the first 10–15 m of the swales (Figure 4). Similarly, the minimal changes in D_{50} and D_{90} after the first 15 m mirrored the TSS reduction occurring in the initial part of the swale. The results shown in Figure 7 also showed that swales evaluated in this study were not effective in capturing particles finer than 20 µm. However, potential scouring and minor disturbances to the soil during sampling may have led to the varying sediment performance shown in the TA and TB experiments.

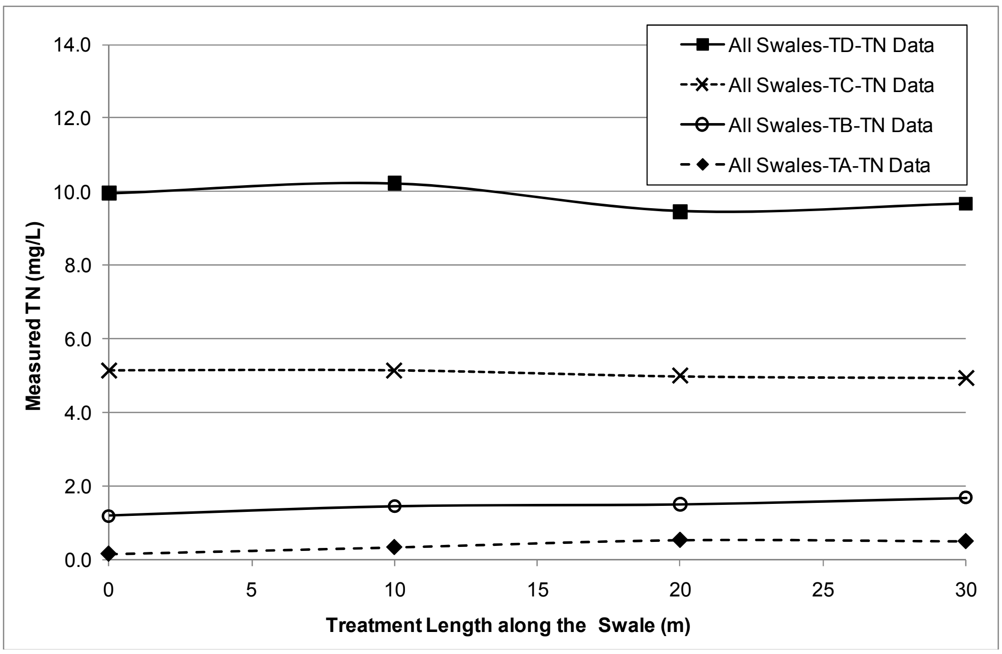
The study has found that swales can be used effectively as a primary treatment measure to remove larger sediment from stormwater runoff. The results showed that the first 15 m of the swale length is the most effective in treating the bulk of the TSS. This suggests that the installation of unnecessarily long swales to treat TSS pollutants may not be the optimal solution.

The selection of swales as a primary stormwater treatment measure could significantly affect the design requirements of downstream (or secondary) treatment systems. As the swales were generally shown to be successful in removing particles larger than 20 µm, this suggests that swales could be used in a stormwater treatment train as a pre-treatment to prevent clogging in downstream treatment systems. Results of this study also confirm that a comprehensive understanding of TSS removal and PSD reduction along the swale length is important in the design and sizing of swales, particularly when planning the construction of an urban stormwater runoff treatment train system.

5.4. Nutrient Removal Performance of Swales

The average TN concentrations measured at 10 m intervals along the four swales during the four tests (TA-TD) are shown in Figure 8. The results demonstrate that there was no reduction in TN levels measured along the length of the swales for any of the four tests. Indeed, for the TB and TA experiments, the TN concentrations appeared to increase. However, the measured TN levels were low in comparison to runoff from other sites such as highways and carparks and it was hypothesised that leaching of nitrogen components from the swales may have caused the TN increases measured during the TA and TB experiments.

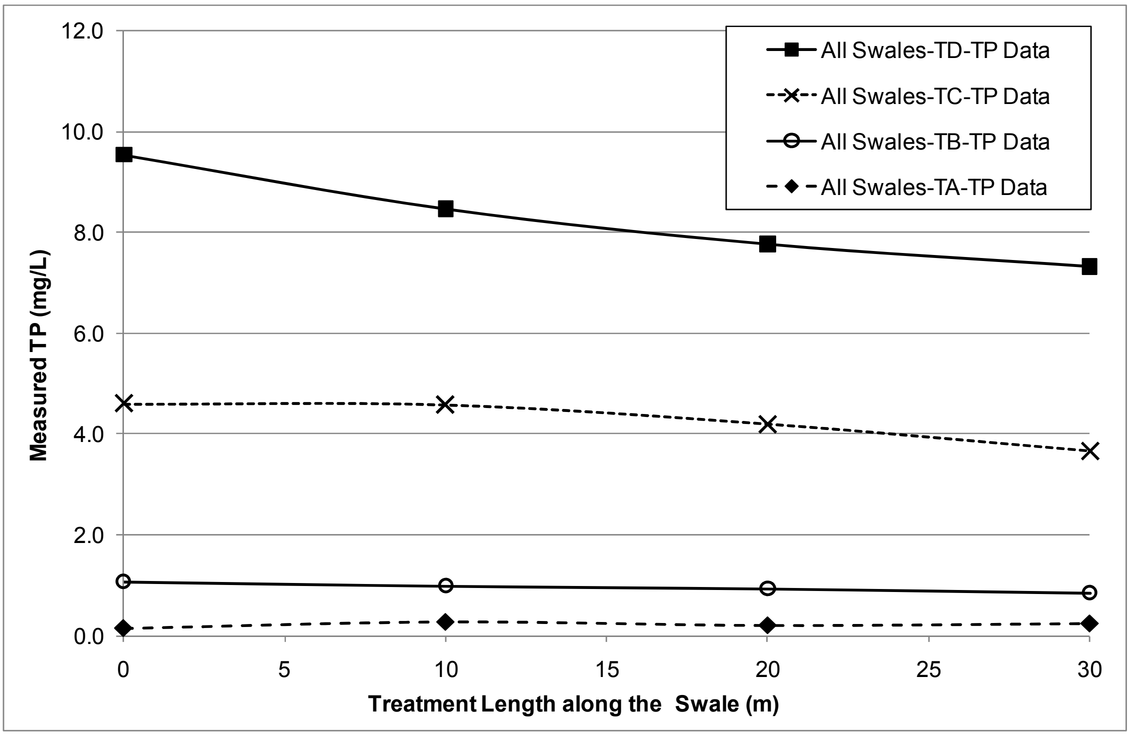
Figure 8. Average TN concentrations for all study swales measured at 10 m intervals.



The experimental results demonstrated that the swales were not effective in removing TN from the synthetic stormwater runoff used in the study. This result is in contrast to a number of previous study results (Table 3). However, the sediment reduction achieved in the swales may also result in a reduction in the overall amount of TN leaving the swales as nutrients are known to attach to sediment particles.

The average TP concentrations measured at 10 m intervals along the four swales during the four tests (TA-TD) are shown in Figure 9. The results show that there was between 20% and 23% reduction in measured TP levels between the inlet and the outlet for the TB, TC and TD tests. The uptake of TP along the swale during the simulation experiments may be attributed to several phosphorous trapping mechanisms that can occur when high TP concentrations are present. Other than direct removal of TP onto the surface of grass and soil within the swale, phosphorous from the simulated runoff may have been adsorbed by finer sediments that settled while flowing in the swales. In addition, the high TSS removal rates shown by swales (Figure 4) may have also assisted in the TP removal performance [6]. However, the results in Figure 9 show there was a substantial increase (61%) in the TP levels between the inlet and the outlet for the TA tests. This was presumably due to leaching of phosphorous components along the swales. The residual of the fertilizers that was used in the tested swales to maintain grass growth may have been contributed to this phosphorous leaching.

Figure 9. Average TP concentrations for all study swales measured at 10 m intervals.



Differences in the nutrient removal performance of the swales used in this study, compared to previous study results may be attributed to a number of causes, including the testing conditions under which the experiments were performed. For example, the synthetic nutrients (*i.e.*, chemical reagents) used in this study to replicate runoff nutrients were fully dissolved in the simulated stormwater. Real stormwater runoff also contains nutrients in particulate form and the methodology used in this study did not account for these pollutant types.

6. Conclusions

Four different field swales were tested during 24 standardised synthetic runoff simulation experiments under varying pollutant loading conditions to evaluate their performance in removing TSS, TN and TP from stormwater runoff. Hydraulic reduction capability of the swales was also assessed by flow measurements carried out at the outlet of the swale during some of the experiments.

Flow measurements demonstrated a mean total flow reduction of 52% in the 30 m long swales studied, with a peak flow reduction of 61%. The initial soil moisture content of a swale was shown to affect infiltration rates, total flow volumes and peak discharges. The study results have demonstrated that swales can be used successfully to attenuate peak stormwater flow rates and to substantially reduce runoff volumes to downstream water courses which can significantly improve the quality of stormwater runoff.

The study has shown that swales were effective in reducing the higher TSS concentrations used in the tests. However, the results demonstrate that a swale's TSS removal performance is highly dependent on the inlet concentrations. Results showed that between 50% and 80% of the TSS was generally removed within the first 10 m of the swales. A further 10% to 20% reduction in TSS concentrations can be expected in swales up to 30 m long. The study also demonstrated that swales can be used to treat higher pollution loads typically associated with the "first flush" phenomenon.

The study has found that swales can be used effectively as a primary treatment measure to remove larger sediment from stormwater runoff. The results showed that the first 15 m of the swale length is the most effective in treating the bulk of the TSS. This suggests that the installation of unnecessarily long swales to treat TSS pollutants may not be the optimal solution. The results suggest that swales could be used in a stormwater treatment train as a pre-treatment to prevent clogging in downstream treatment systems.

The study found no reduction in TN levels in any of the four tests that could be attributed to treatment by the swales. This was in contrast to previous study results. However, the study demonstrated a reduction in measured TP levels of between 20% and 23% between the inlet and the outlet for the TB, TC and TD tests. This reduction is within the range of TP removal reported in previous studies. Differences in nutrient removal performance by swales from this study and other studies may be attributed to the differences in testing conditions and pollutant constituents.

The overall study findings suggest that swales can be used effectively to reduce stormwater runoff pollution, particularly runoff with high concentrations of TSS and TP. Selection of swales as a primary stormwater treatment measure could significantly affect the design requirements of downstream treatment systems. The results from this study will assist designers to estimate the appropriate length of swale required to achieve specific TSS and TP pollution reductions in urban stormwater runoff.

Acknowledgments

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Author Contributions

This study was undertaken as a collaborative research project by the Stormwater Research Group of the University of the Sunshine Coast in Australia. The experimental design of the project was undertaken by Terry Lucke and Neil Tindale. The majority of the experimental field work was conducted by Mohamed Ansaf Kachchu Mohamed with assistance from Terry Lucke and Neil Tindale. The paper was written by all three authors equally.

Conflicts of Interest

The authors declare no conflict of interest.

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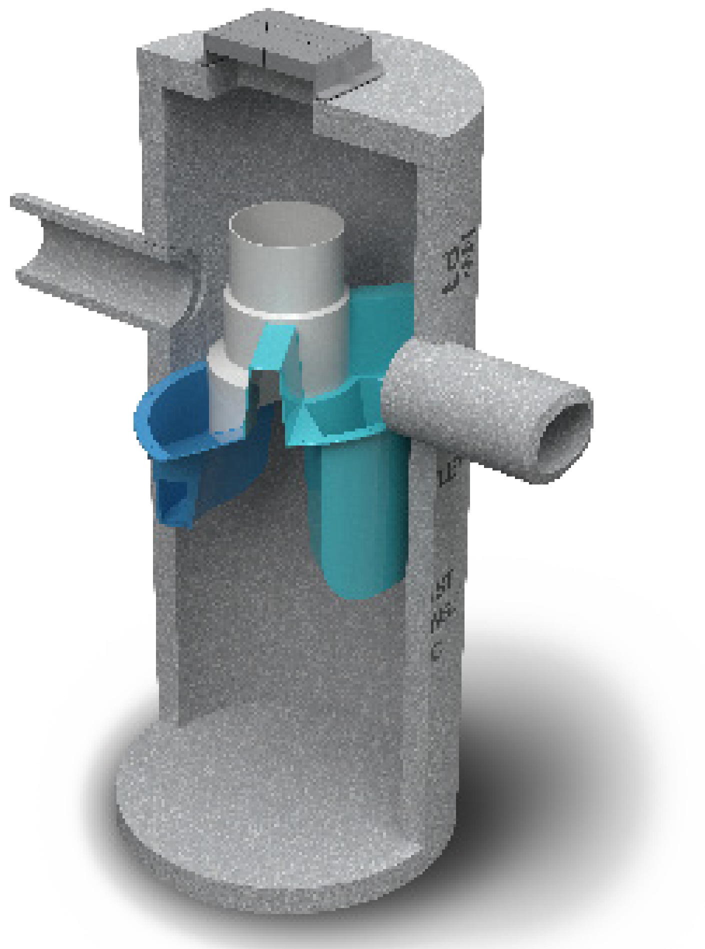
APPENDIX E:
HYDRO INTERNATIONAL – FIRST DEFENSE
OPERATION AND MAINTENANCE MANUAL



Operation and Maintenance Manual

First Defense® High Capacity and First Defense® Optimum

Vortex Separator for Stormwater Treatment

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Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

I. First Defense® by Hydro International

Introduction

The First Defense® is an enhanced vortex separator that combines an effective and economical stormwater treatment chamber with an integral peak flow bypass. It efficiently removes total suspended solids (TSS), trash and hydrocarbons from stormwater runoff without washing out previously captured pollutants. The First Defense® is available in several model configurations to accommodate a wide range of pipe sizes, peak flows and depth constraints.

The two product models described in this guide are the First Defense® High Capacity and the First Defense® Optimum; they are inspected and maintained identically.

Operation

The First Defense® operates on simple fluid hydraulics. It is self-activating, has no moving parts, no external power requirement and is fabricated with durable non-corrosive components. No manual procedures are required to operate the unit and maintenance is limited to monitoring accumulations of stored pollutants and periodic clean-outs. The First Defense® has been designed to allow for easy and safe access for inspection, monitoring and clean-out procedures. Neither entry into the unit nor removal of the internal components is necessary for maintenance, thus safety concerns related to confined-space-entry are avoided.

Pollutant Capture and Retention

The internal components of the First Defense® have been designed to optimize pollutant capture. Sediment is captured and retained in the base of the unit, while oil and floatables are stored on the water surface in the inner volume (Fig.1).

The pollutant storage volumes are isolated from the built-in bypass chamber to prevent washout during high-flow storm events. The sump of the First Defense® retains a standing water level between storm events. This ensures a quiescent flow regime at the onset of a storm, preventing resuspension and washout of pollutants captured during previous events.

Accessories such as oil absorbent pads are available for enhanced oil removal and storage. Due to the separation of the oil and floatable storage volume from the outlet, the potential for washout of stored pollutants between clean-outs is minimized.

Applications

- Stormwater treatment at the point of entry into the drainage line
- Sites constrained by space, topography or drainage profiles with limited slope and depth of cover
- Retrofit installations where stormwater treatment is placed on or tied into an existing storm drain line
- Pretreatment for filters, infiltration and storage

Advantages

- Inlet options include surface grate or multiple inlet pipes
- Integral high capacity bypass conveys large peak flows without the need for “offline” arrangements using separate junction manholes
- Long flow path through the device ensures a long residence time within the treatment chamber, enhancing pollutant settling
- Delivered to site pre-assembled and ready for installation

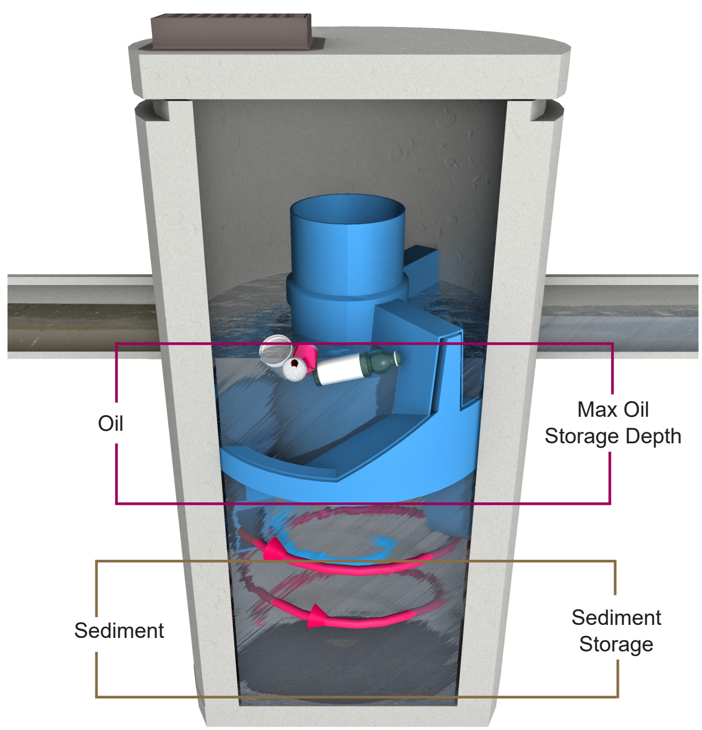


Fig.1 Pollutant storage volumes in the First Defense®.

II. Model Sizes & Configurations

The First Defense® inlet and internal bypass arrangements are available in several model sizes and configurations. The components have modified geometries allowing greater design flexibility to accommodate various site constraints.

All First Defense® models include the internal components that are designed to remove and retain total suspended solids (TSS), gross solids, floatable trash and hydrocarbons (Fig.2). First Defense® model sizes (diameter) are shown in Table 1.

III. Maintenance

First Defense® Components

1. **Built-In Bypass**
2. **Inlet Pipe**
3. **Inlet Chute**
4. **Floatables Draw-off Port**
5. **Outlet Pipe**
6. **Floatables Storage**
7. **Sediment Storage**
8. **Inlet Grate or Cover**

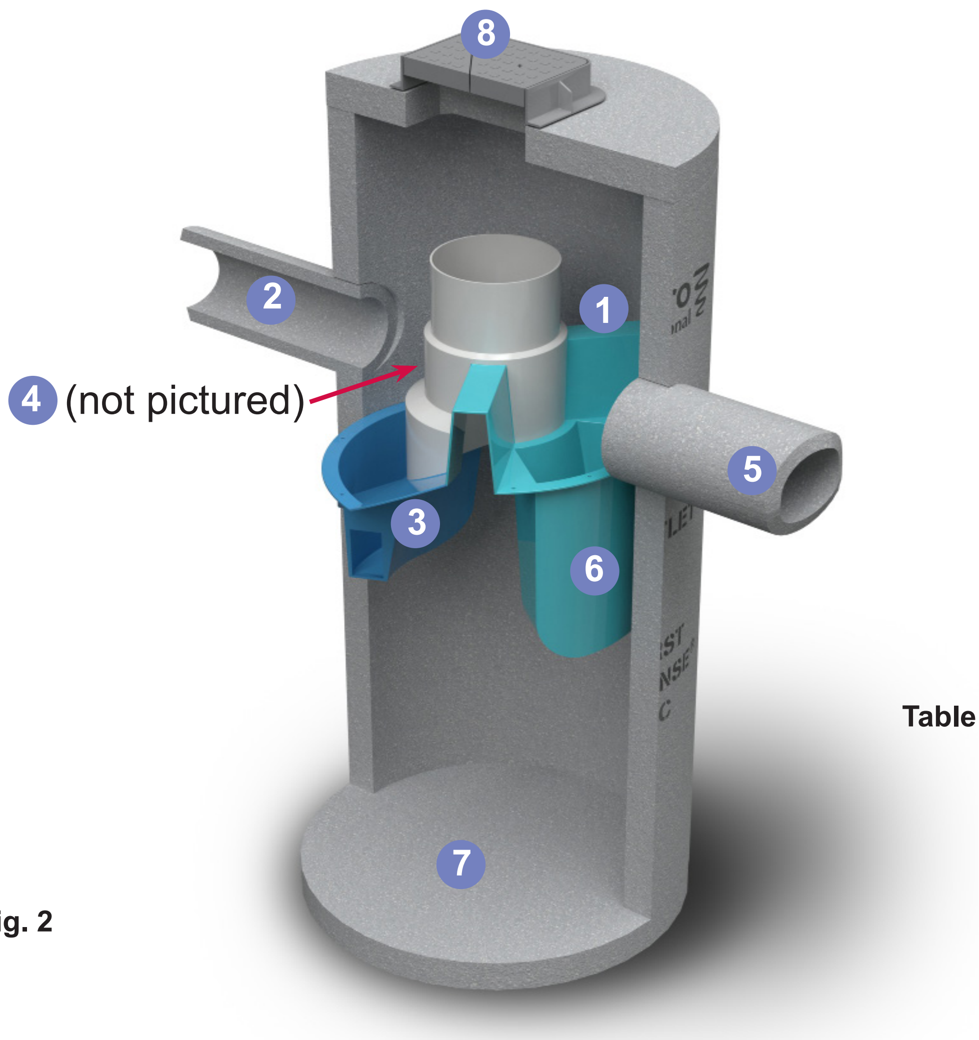


Fig. 2

Table 1

First Defense® Model Sizes
(ft / m) diameter
3 / 0.9
4 / 1.2
5 / 1.5
6 / 1.8
7 / 2.1
8 / 2.4
10 / 3.0

Overview

The First Defense® protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the continuous, long-term functioning of the First Defense®. The First Defense® will capture and retain sediment and oil until the sediment and oil storage volumes are full to capacity. When sediment and oil storage capacities are reached, the First Defense® will no longer be able to store removed sediment and oil.

The First Defense® allows for easy and safe inspection, monitoring and clean-out procedures. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables. Access ports are located in the top of the manhole.

Maintenance events may include Inspection, Oil & Floatables Removal, and Sediment Removal. Maintenance events do not require entry into the First Defense®, nor do they require the internal components of the First Defense® to be removed. In the case of inspection and floatables removal, a vactor truck is not required. However, a vactor truck is required if the maintenance event is to include oil removal and/or sediment removal.

Maintenance Equipment Considerations

The internal components of the First Defense® have a centrally located circular shaft through which the sediment storage sump can be accessed with a sump vac hose. The open diameter of this access shaft is 15 inches in diameter (Fig.3). Therefore, the nozzle fitting of any vactor hose used for maintenance should be less than 15 inches in diameter.

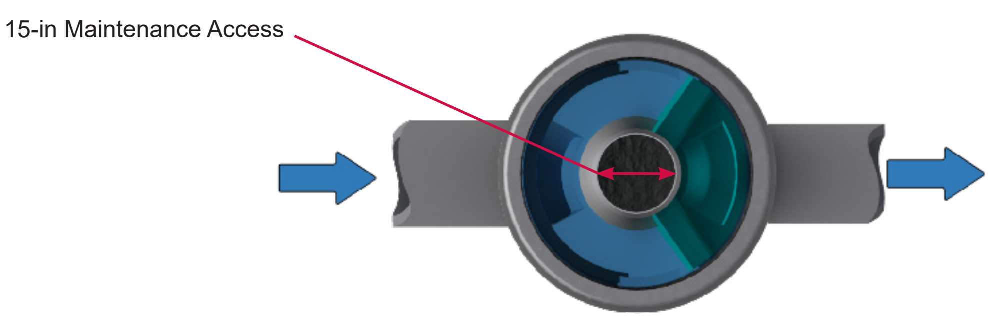


Fig.3 The central opening to the sump of the First Defense®is 15 inches in diameter.

Determining Your Maintenance Schedule

The frequency of clean out is determined in the field after installation. During the first year of operation, the unit should be inspected every six months to determine the rate of sediment and floatables accumulation. A simple probe such as a Sludge-Judge® can be used to determine the level of accumulated solids stored in the sump. This information can be recorded in the maintenance log (see page 9) to establish a routine maintenance schedule.

The vactor procedure, including both sediment and oil / flotables removal, for First Defense® typically takes less than 30 minutes and removes a combined water/oil volume of about 765 gallons.

Inspection Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove the grate or lid to the manhole.
3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities. Fig.4 shows the standing water level that should be observed.
4. Without entering the vessel, use the pole with the skimmer net to remove floatables and loose debris from the components and water surface.
5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel.
6. On the Maintenance Log (see page 9), record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.
7. Securely replace the grate or lid.
8. Take down safety equipment.
9. Notify Hydro International of any irregularities noted during inspection.

Fig.4 Floatables are removed with a vactor hose

Floatables and Sediment Clean Out

Floatables clean out is typically done in conjunction with sediment removal. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables (Fig.4).

Floatables and loose debris can also be netted with a skimmer and pole. The access port located at the top of the manhole provides unobstructed access for a vactor hose to be lowered to the base of the sump.

Scheduling

- Floatables and sump clean out are typically conducted once a year during any season.
- Floatables and sump clean out should occur as soon as possible following a spill in the contributing drainage area.

Recommended Equipment

- Safety Equipment (traffic cones, etc)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net (if only floatables are being removed)
- Sediment probe (such as a Sludge Judge®)
- Vactor truck (flexible hose recommended)
- First Defense® Maintenance Log

Floatables and Sediment Clean Out Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.

2. Remove the grate or lid to the manhole.

3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.

4. Remove oil and floatables stored on the surface of the water with the vactor hose or with the skimmer or net

5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel and record it in the Maintenance Log (page 9).

6. Once all floatables have been removed, drop the vactor hose to the base of the sump. Vactor out the sediment and gross debris off the sump floor

7. Retract the vactor hose from the vessel.

8. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components, blockages, or irregularly high or low water levels.

9. Securely replace the grate or lid.

Maintenance at a Glance

Inspection	- Regularly during first year of installation - Every 6 months after the first year of installation
Oil and Floatables Removal	- Once per year, with sediment removal - Following a spill in the drainage area
Sediment Removal	- Once per year or as needed - Following a spill in the drainage area
NOTE: For most clean outs the entire volume of liquid does not need to be removed from the manhole. Only remove the first few inches of oils and floatables from the water surface to reduce the total volume of liquid removed during a clean out.	

First Defense® Installation Log

HYDRO INTERNATIONAL REFERENCE NUMBER:	
SITE NAME:	
SITE LOCATION:	
OWNER:	CONTRACTOR:
CONTACT NAME:	CONTACT NAME:
COMPANY NAME:	COMPANY NAME:
ADDRESS:	ADDRESS:
TELEPHONE:	TELEPHONE:
FAX:	FAX:

INSTALLATION DATE: / /

MODEL SIZE (CIRCLE ONE): [3-FT] [4-FT] [5-FT] [6-FT] [7-FT] [8-FT] [10-FT]

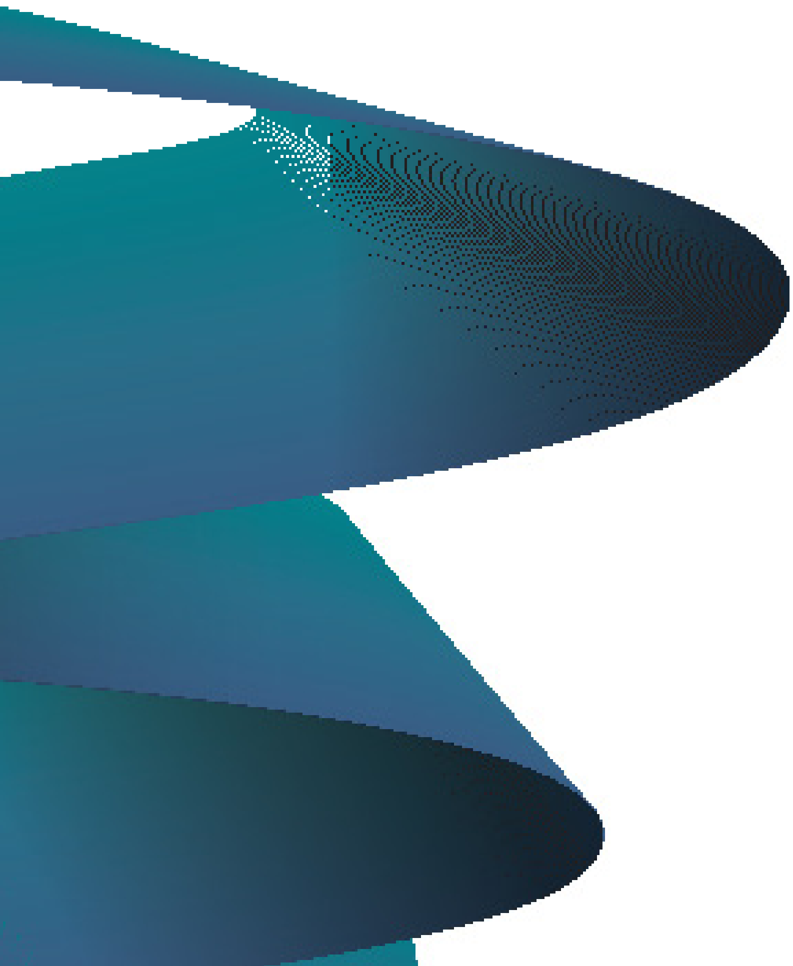
INLET (CIRCLE ALL THAT APPLY): GRATED INLET (CATCH BASIN) INLET PIPE (FLOW THROUGH)

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

First Defense® Inspection and Maintenance Log

Date	Initials	Depth of Floatables and Oils	Sediment Depth Measured	Volume of Sediment Removed	Site Activity and Comments

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com



Stormwater Solutions

94 Hutchins Drive
Portland, ME 04102

Tel: (207) 756-6200
Fax: (207) 756-6212
stormwaterinquiry@hydro-int.com

www.hydro-int.com

Turning Water Around...®

APPENDIX F:
ENGINEERING DESIGN DRAWINGS

SETTLERS RIDGE EAST
PHASE 3

CITY OF BELLEVILLE

DRAWING LIST

DRAWING NO.	DRAWING NAME
ND-1	GENERAL NOTES
ND-2	TYPICAL DETAILS
ND-3	PIPE AND STRUCTURE TABLES
ESC-1	EROSION AND SEDIMENT CONTROL PLAN
GS-1	GENERAL SERVICING PLAN - 1 of 3
GS-2	GENERAL SERVICING PLAN - 2 of 3
GG-1	GENERAL GRADING PLAN - 1 of 3
GG-2	GENERAL GRADING PLAN - 2 of 3
PP-RD-1	PLAN & PROFILE - RAYCROFT DRIVE - STA. 2+680 to 2+790
PP-RD-2	PLAN & PROFILE - RAYCROFT DRIVE - STA. 2+790 to 2+900
PP-CC-1	PLAN & PROFILE - COUSINS CRESCENT - STA. 6+000 to 6+140
PP-CC-2	PLAN & PROFILE - COUSINS CRESCENT - STA. 6+140 to 6+280
PP-CC-3	PLAN & PROFILE - COUSINS CRESCENT - STA. 6+280 to 6+350
PP-CC-4	PLAN & PROFILE - COUSINS CRESCENT - STA. 6+350 to 6+490
PP-CC-5	PLAN & PROFILE - COUSINS CRESCENT - STA. 6+490 to 6+630
SA-1	SANITARY SEWER NETWORK - CATCHMENT PLAN - 1 of 3
SA-2	SANITARY SEWER NETWORK - CATCHMENT PLAN - 2 of 3
SA-4	SANITARY SEWER NETWORK - DESIGN SHEET
ST-1	STORM SEWER NETWORK - CATCHMENT PLAN - 1 of 3
ST-2	STORM SEWER NETWORK - CATCHMENT PLAN - 2 of 3
ST-4	STORM SEWER NETWORK - DESIGN SHEET

BELLEVILLE SUBDIVISION NOTES:

1. THE OWNER COVENANTS AND AGREES NOT TO MAKE A MATERIAL CHANGE OR CAUSE A MATERIAL CHANGES TO BE MADE TO A PLAN, SPECIFICATION, DOCUMENT OR OTHER INFORMATION ON THE BASIS OF WHICH THESE DRAWINGS WERE APPROVED BY THE CITY, WITHOUT NOTIFYING, FILING DETAILS WITH AND OBTAINING THE WRITTEN AUTHORIZATION OF THE CITY.
2. ALL UNDERGROUND AND ABOVEGROUND WORK IS TO BE DONE IN ACCORDANCE WITH CURRENT CITY PLANS, STANDARDS AND SPECIFICATIONS INCLUDING THE FOLLOWING:
   - SPEC. M-9 URBAN LOCAL ROAD, 20m RIGHT-OF-WAY STANDARD UTILITY LOCATIONS
   - SPEC. M-111A STANDARD RESIDENTIAL ROAD (SUBDIVISIONS)
   - SPEC. M-118A CONCRETE HEADER
   - SPEC. M-120 TYPICAL 90° CRESCENT
   - SPEC. M-43B DEPRESSED CURB AND GUTTER AT SIDEWALK RAMPS
   - OPSD 219.110 LIGHT DUTY SILT FENCE BARRIER
   - OPSD 310.010 CONCRETE SIDEWALK
     - DELETE FIRST SENTENCE IN "NOTE 1"
     - DELETE "NOTE 2"
     - 50mm OF GRANULAR FILL TO BE PLACED UNDER THE SIDEWALK CROSSFALL SLOPE ON THE SIDEWALK IS TO BE 2% OR AS SPECIFIED ON THE GRADING PLAN OR AS DIRECTED BY THE CITY ENGINEER
   - OPSD 310.033 CONCRETE SIDEWALK RAMPS AT UNSIGNALIZED INTERSECTION
   - OPSD 310.039 CONCRETE SIDEWALK RAMPS TACTILE WALKING SURFACE
   - OPSD 400.010 CAST IRON, SQUARE FRAME WITH SQUARE OVERFLOW TYPE DISHED GRATE FOR CATCH BASINS, HERRING BONE OPENINGS
   - OPSD 401.010 CAST IRON, SQUARE FRAME WITH CIRCULAR CLOSED OR OPEN COVER FOR MAINTENANCE HOLES
     - DELETE "TYPE B" OPEN COVER
   - OPSD 403.010 GALVANIZED STEEL, HONEY COMB GRATING FOR DITCH INLET
   - OPSD 404.020 ALUMINUM SAFETY PLATFORM FOR CIRCULAR MAINTENANCE HOLE
   - OPSD 405.010 MAINTENANCE HOLE STEPS, HOLLOW
     - DELETE "RECTANGULAR STAINLESS STEEL" STEP DETAILS
   - OPSD 600.040 CONCRETE BARRIER CURB WITH STANDARD GUTTER
     - EXCEPT FOR MOUNTABLE CURB DROP BACK OF CURB 75mm, WITH NO ADDITIONAL DROP AT ENTRANCES
   - OPSD 701.010 PRECAST CONCRETE MAINTENANCE HOLE, 1200mm DIAMETER
     - EXCEPT USE PRECAST MONOLITHIC BASE ONLY
   - OPSD 701.011 PRECAST CONCRETE MAINTENANCE HOLE, 1500mm DIAMETER
     - EXCEPT USE PRECAST MONOLITHIC BASE ONLY
   - OPSD 701.012 PRECAST CONCRETE MAINTENANCE HOLE, 1800mm DIAMETER
   - OPSD 701.021 MAINTENANCE HOLE BENCHING AND PIPE OPENING DETAILS
     - EXCEPT ON THE "SECTION" DETAIL, THE BENCHING IS TO BE CONSTRUCTED TO THE OBVERT OF THE PIPE, I.E. D MAX
   - OPSD 704.010 PRECAST CONCRETE ADJUSTMENT UNITS FOR MAINTENANCE HOLES, CATCH BASINS, AND VALVE CHAMBERS
   - OPSD 704.011 HIGH DENSITY POLYETHYLENE ADJUSTMENT UNITS FOR MAINTENANCE HOLES, CATCH BASINS, AND VALVE CHAMBERS
   - OPSD 705.010 PRECAST CONCRETE CATCH BASIN, 600 x 600mm
   - OPSD 705.020 PRECAST CONCRETE TWIN INLET CATCH BASIN, 600 x 1450mm
   - OPSD 705.030 PRECAST CONCRETE DITCH INLET, 600 x 600mm
   - OPSD 708.010 CATCH BASIN CONNECTION FOR RIGID MAIN PIPE SEWER
   - OPSD 708.020 SUPPORT FOR PIPE AT CATCH BASIN OR MAINTENANCE HOLE
   - OPSD 708.030 CATCH BASIN CONNECTION FOR FLEXIBLE MAIN PIPE SEWER
   - OPSD 802.030 RIGID PIPE BEDDING, COVER AND BACKFILL
     - USE "CLASS B – BEDDING" DETAIL ONLY FOR ALL PIPE BEDDING
     - DELETE "CLASS C – BEDDING" DETAIL
     - "GRANULAR BEDDING MATERIAL" IS TO BE GRANULAR 'A'
     - "COVER MATERIAL" IS TO BE SAND FILL
     - DELETE "150mm" FROM "NOTE 2" AND INSERT 225mm FOR THE MINIMUM BEDDING DEPTH
     - FOR A "WET TRENCH" CONDITION AS DETERMINED BY THE CITY ENGINEER:
       - "GRANULAR BEDDING MATERIAL" IS TO BE AN "HL8 COURSE" GRADATION, CRUSHED LIMESTONE MATERIAL
       - "COVER MATERIAL" IS TO BE LIMESTONE SCREENINGS OR GRANULAR 'A' CRUSHED MATERIAL
   - OPSD 804.030 CONCRETE HEADWALL FOR PIPE LESS THAN 900mm DIAMETER
   - OPSD 804.050 GRATING FOR CONCRETE ENDWALL
   - OPSD 1003.010 CAST-IN-PLACE MAINTENANCE HOLE DROP STRUCTURE TEE
     - INVERT OF THE INLET END OF THE 90° BEND IS TO BE PLACED AT THE "SPRINGLINE" OF THE MAIN SEWER PIPE
   - OPSD 1006.010 SEWER SERVICE CONNECTIONS FOR RIGID MAIN PIPE SEWER
     - LATERAL IS TO BE 135mm PVC DR28 PIPE OR AS SPECIFIED
     - LATERAL IS TO BE 2.5m BELOW THE PROPOSED GRADE AT THE STREET LINE OR AS SPECIFIED
     - "MARKER" AT THE PROPERTY LINE IS TO BE A 2x4 BOARD EXTENDING FROM THE INVERT OF THE LATERAL TO 600mm ABOVE THE GROUND SURFACE, AND THE SECTION OF THE BOARD ABOVE THE GROUND IS TO BE PAINTED SEWER GREEN
     - BEDDING AND COVER MATERIALS ARE TO BE SUPPLIED AND INSTALLED IN ACCORDANCE WITH OPSD 802.030, AS REVISED BY THE CITY OF BELLEVILLE'S SPECIAL REVISIONS
3. THE CONTRACTOR IS REQUIRED TO OBTAIN A 'ROAD CUT PERMIT' FROM THE CITY BEFORE COMMENCING ANY WORK ON EXISTING CITY ROAD ALLOWANCES.
4. NO BLASTING IS PERMITTED ON CITY ROAD ALLOWANCES OR WITHIN THE SUBDIVISION.
5. ALL PVC PIPE, INCLUDING RIBBED PVC PIPE 320 KPa, IS TO HAVE A MINIMUM COVER OF 0.8m.
6. RE-BENCH EXISTING MAINTENANCE HOLES AS DIRECTED BY THE CITY ENGINEER.
7. WHEREVER THE COVER OVER A SANITARY SEWER IS 1.5m OR LESS, IT IS TO BE INSULATED WITH 100mm THICK x 1.2m WIDE INSULATION PLACED IN TWO (2) LAYERS WITH STAGGERED JOINTS, AND TO BE STYROFOAM BRAND H.I. TYPE IV.
8. ALL SANITARY SEWERS, STORM SEWERS AND WATERMAINS CONSTRUCTED ON PRIVATE PROPERTY ARE TO BE DONE IN ACCORDANCE WITH THE ONTARIO BUILDING CODE.
9. THE RE-INSTATEMENT OF ASPHALT ROADWAYS, CONCRETE SIDEWALKS AND CURBS ON THE CITY ROAD ALLOWANCE IS TO BE DONE BY THE OWNER IN ACCORDANCE WITH CITY SPECIFICATIONS AT THE OWNER'S EXPENSE.
10. INTERNAL ROAD PAVEMENT IS TO BE CONSTRUCTED AS FOLLOWS:
    - 40mm HL3 SURFACE COURSE HOT MIX ASPHALT
    - 50mm HL8 BINDER COURSE HOT MIX ASPHALT
    - 150mm GRANULAR 'A' (CRUSHED QUARRIED LIMESTONE)
    - 300mm GRANULAR 'B' (CRUSHED QUARRIED LIMESTONE)

    ALL IN ACCORDANCE WITH THE GEOTECHNICAL CONSULTANT'S RECOMMENDATIONS AND THE CITY'S SPECIFICATIONS. THE ASPHALT CEMENT SHALL BE A PG 58-28.

    EXTERNAL ROAD PAVEMENT IS TO BE CONSTRUCTED AS FOLLOWS:
    - 40mm HL3 SURFACE COURSE HOT MIX ASPHALT
    - 50mm HL8 BINDER COURSE HOT MIX ASPHALT
    - 150mm GRANULAR 'A' (CRUSHED QUARRIED LIMESTONE)
    - 300mm GRANULAR 'B' (CRUSHED QUARRIED LIMESTONE)

    ALL IN ACCORDANCE WITH THE GEOTECHNICAL CONSULTANT'S RECOMMENDATIONS AND THE CITY'S SPECIFICATIONS. THE ASPHALT CEMENT SHALL BE A PG 58-28.
11. ROAD RESTORATION ON EXISTING ROADS TO BE AT LEAST EQUAL TO EXISTING ROAD OR MINIMUM RESTORATION IS TO BE:
    - 40mm HL3 SURFACE COURSE HOT MIX ASPHALT
    - 50mm HL8 BINDER COURSE HOT MIX ASPHALT
    - 200mm GRANULAR 'A' (CRUSHED QUARRIED LIMESTONE)
    - 150mm GRANULAR 'B' (CRUSHED QUARRIED LIMESTONE)

    ALL IN ACCORDANCE WITH THE CITY'S SPECIFICATIONS. THE ASPHALT CEMENT SHALL BE A PG 58-28.
12. SUITABLE BACKFILL, FREE OF LARGE LUMPS, STONES, ROOTS AND OTHER FOREIGN MATTER IS TO BE PLACED AT THE BACK OF CURBS AND ALONG BOTH SIDES OF SIDEWALKS WITHIN 72 HOURS OF THE PLACEMENT OF THE CONCRETE. THIS BACKFILL IS TO BE LEVEL WITH THE TOP OF THE CURB AND THE SIDEWALK FOR A DISTANCE OF 0.3m AND THEN GRADED TO EXISTING GROUND WITH A MAXIMUM 3:1 SLOPE. BEFORE THE ACCEPTANCE OF THE ABOVEGROUND WORKS, THE REMAINDER OF THE BOULEVARD BETWEEN THE SIDEWALK AND THE DITCH, THE ROAD SHOULDER OR CURB SHALL BE BACKFILLED AND GRADED AS REQUIRED FOR DRAINAGE.
13. EXISTING SUBDRAINS ALONG THE CURB THAT ARE DISTURBED ARE TO BE RESTORED TO THEIR ORIGINAL CONDITION AT THE OWNER'S EXPENSE. NEW SUBDRAINS ARE TO BE CONSTRUCTED AS SHOWN ON THE PLANS.
14. CHAIN LINK FENCES ARE TO BE 1.5m HIGH, UNLESS OTHERWISE STATED ON THE DRAWINGS, AND CONSTRUCTED IN ACCORDANCE WITH OPSD 972.130, EXCEPT THEY ARE TO HAVE A TOP RAIL AND 40x40mm MESH WITH KNUCKLES UP AND BARBS DOWN.
15. A DRAWING SHOWING DRIVEWAY LOCATIONS IS TO BE SUBMITTED TO THE CITY ENGINEER FOR APPROVAL PRIOR TO THE CONSTRUCTION OF ANY FULL HEIGHT CURB AND GUTTER.
16. SEDIMENT CONTROL TO BE PROVIDED AT CATCH BASINS AS DIRECTED BY THE CITY ENGINEER.
17. ALL BOULEVARDS IN THIS SUBDIVISION THAT DO NOT ABUT A PROPOSED LOT ARE TO BE TOPSOILED (75mm OF TOPSOIL) AND SODDED FROM THE LIMIT OF THE ROAD ALLOWANCE TO THE BACK OF CURB/SHOULDER.
18. A MINIMUM OR 100mm OF TOPSOIL IS TO BE USED FOR ALL TOPSOIL AND SOD INSTALLATION ON PRIVATE AND PARK LANDS.
19. IN A LOCATION WHERE TWO OR MORE CATCH BASINS ARE CONNECTED TO EACH OTHER, THE FOLLOWING CRITERIA APPLIES:
    - 19.1. IF THE MOST UPSTREAM CATCH BASIN IS A SINGLE CATCH BASIN, THE OUTLET PIPE FROM THIS CATCH BASIN IS TO HAVE A MINIMUM DIAMETER OF 300mm WITH THE REMAINDER OF THE DOWNSTREAM PIPES TO HAVE A MINIMUM DIAMETER OF 375mm.
    - 19.2. IF THE MOST UPSTREAM CATCH BASIN IS A DOUBLE CATCH BASIN, THE OUTLET PIPE FROM THIS CATCH BASIN IS TO HAVE A MINIMUM DIAMETER OF 375mm ALONG WITH THE REST OF THE DOWNSTREAM OUTLET PIPES.
20. IF AT ALL POSSIBLE, THE MINIMUM GRADE FOR SWALES IS TO BE 1%. IF THIS GRADE IS NOT POSSIBLE, A SUBDRAIN, WHICH IS CONNECTED TO THE OUTLET CATCH BASIN, CAL BE INSTALLED UNDER THE SWALE, AND THEN THE SWALE CAN HAVE A GRADE AS LOW AS 0.5%.
21. EXISTING SANITARY MAINTENANCE HOLES TO BE RAISED WITH MAINTENANCE HOLE TOP ADJUSTMENT UNITS. HOWEVER, IF THE DISTANCE FROM THE PROPOSED TOP OF GRATE TO THE EXISTING FIRST STEP IS GREATER THAN 0.76m, THEN THE EXISTING SANITARY MAINTENANCE HOLE TO BE RAISED IS TO BE BROKEN DOWN TO THE BOTTOM OF THE SLOPED SECTION AND A NEW SECTION IS TO BE CAST IN PLACE COMPLETE WITH LADDER RUNGS IN ACCORDANCE WITH CITY DRAWING SPEC. I. EXISTING SANITARY MAINTENANCE HOLES TO BE LOWERED IN ACCORDANCE WITH CITY DRAWING SPEC. M-I-A (TYPICAL). NEW TOP STEP TO BE PROVIDED ABOVE EXISTING STEPS IF REQUIRED BY THE CITY.
22. DRIVEWAY LOCATIONS ARE TO BE NO CLOSER THAN 1.2m FROM POLES, HANDHOLES, TRANSFORMERS, SECONDARY PEDESTALS, HYDRANTS, AND CURB STOPS.
23. ALL CURB AS INTERSECTIONS SHOULD BE DEPRESSED WHERE THEY INTERSECT WITH SIDEWALKS. SIDEWALK RAMPS AT INTERSECTIONS TO BE CONSTRUCTED IN ACCORDANCE WITH THE CITY STANDARDS.

GENERAL NOTES:

1. ALL ELEVATIONS ARE RELATIVE TO THE BENCHMARKS INDICATED ON THE PLANS.
2. DIMENSIONS ARE IN METRES UNLESS OTHERWISE SPECIFIED.
3. THE CONTRACTOR IS TO VERIFY ALL DIMENSIONS AND GRADES. NOTIFY THE ENGINEER OF ANY DISCREPANCIES BEFORE WORK COMMENCES.
4. THE ORIGINAL TOPOGRAPHY AND GROUND ELEVATIONS, SERVICING AND SURVEY DATA SHOWN ON THESE PLANS ARE SUPPLIED FOR DESIGN AND APPROVAL PURPOSES ONLY AND BELIEVED TO BE ACCURATE. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE ACCURACY OF ALL INFORMATION OBTAINED FROM PLANS FOR CONSTRUCTION PURPOSES.
5. ALL MATERIAL AND CONSTRUCTION METHODS METHODS MUST COMPLY WITH CITY AND ONTARIO PROVINCIAL STANDARDS AND SPECIFICATIONS.
6. CONTRACTOR IS RESPONSIBLE FOR ALL LAYOUT.
7. ALL DISTURBED AREAS TO BE RESTORED TO ORIGINAL CONDITION OR BETTER, UNLESS OTHERWISE SPECIFIED.
8. RESTORE ALL TRENCHES AND SURFACES OF PUBLIC ROAD ALLOWANCES TO A CONDITION OF EQUAL OR BETTER THAN ORIGINAL CONDITION AND TO THE SATISFACTION OF THE APPROPRIATE AUTHORITIES.
9. EXCAVATE AND DISPOSE OF ALL EXCESS EXCAVATED MATERIAL, SUCH AS ASPHALT AND DEBRIS, OFF SITE AS DIRECTED BY THE OWNER. REMOVAL OF MATERIALS TO BE AT THE CONTRACTOR'S EXPENSE.
10. THE CONTRACTOR IS TO DETERMINE THE EXACT LOCATION, SIZE, MATERIAL AND ELEVATION OF ALL EXISTING UTILITIES PRIOR TO COMMENCING CONSTRUCTION. PROTECT AND ASSUME ALL RESPONSIBILITY FOR EXISTING UTILITIES WHETHER OR NOT SHOWN ON THE DRAWINGS. IF THERE IS ANY DISCREPANCY THE CONTRACTOR IS TO NOTIFY THE ENGINEER PROMPTLY.
11. THE EXTENT OF STRAW BALE PROTECTION SHOWN IS APPROXIMATE ONLY AND SUBJECT TO FINAL ADJUSTMENT IN THE FIELD. STRAW BALES TO BE AS PER OPSD 219.100.

SIDE YARD SWALE NOTES:

1. THE OWNER AGREES TO PROVIDE TEMPORARY YARD DRAINAGE FOR LOTS WHICH ARE PROPOSED TO HAVE SIDE YARD SWALES, TO THE SATISFACTION OF THE CITY ENGINEER AND ACKNOWLEDGES THAT THE CITY RETAINS THE RIGHT TO REFUSE TO ISSUE FURTHER BUILDING PERMITS IF SAID TEMPORARY DRAINAGE IS NOT SATISFACTORY. THE OWNER FURTHER AGREES TO CONSTRUCT THE PERMANENT SODDED SIDE YARD SWALE ALONG A LOT LINE UPON COMPLETION OF BOTH HOUSES ADJACENT TO SAID SIDE YARD SWALE AND SHALL PROVIDE TO THE CITY AS-CONSTRUCTED SWALE GRADES CERTIFIED BY A PROFESSIONAL ENGINEER OR ONTARIO LAND SURVEYOR AFTER COMPLETION OF EACH PERMANENT SODDED SIDE YARD SWALE.

WATER SYSTEM NOTES:

1. NOTWITHSTANDING THE FOLLOWING GENERAL NOTES, ALL WATERMAIN PIPE AND FITTINGS, VALVES, HYDRANTS, WATER SERVICES AND ALL OTHER APPURTENANCES ARE TO BE INSTALLED IN ACCORDANCE WITH THEIR RESPECTIVE SPECIFICATION IN THE CURRENT CITY MANUAL OF STANDARD SPECIFICATIONS.
2. THESE NOTES ARE INTENDED TO SUMMARIZE THE CITY'S REQUIREMENTS. HOWEVER, THE CONTRACTOR IS TO CONSULT THE RESPECTIVE CITY STANDARD SPECIFICATIONS FOR FURTHER DETAIL AND NOT RELY SOLELY ON THESE NOTES.
3. UNLESS SPECIFIED OTHERWISE, ALL REFERENCES TO CITY STANDARD SPECIFICATIONS, STANDARD DRAWINGS OR INDUSTRY STANDARDS REFER TO THE LATEST EDITION.
4. THE COVER FOR ALL WATERMAINS AND WATER SERVICES IS TO BE A MINIMUM OF 1.8m.
5. WHERE A WATERMAIN CROSSES OVER OR UNDER A SANITARY SEWER OR STORM SEWER (INCLUDING LATERALS AND CATCH BASIN LEADS), A MINIMUM CLEAR SEPARATION OF 0.5m MUST BE MAINTAINED, MEASURED FROM PIPE WALL TO PIPE WALL.
6. WHERE A WATERMAIN CROSSES OVER OR UNDER OTHER UTILITIES, 0.3m CLEARANCE SHALL BE PROVIDED, PROVIDED PROPER BEDDING CAN BE MAINTAINED.
7. UNLESS SPECIFIED OTHERWISE, A MINIMUM CLEAR HORIZONTAL SEPARATION OF 2.5m MEASURED FROM PIPE WALL TO PIPE WALL, MUST BE MAINTAINED BETWEEN ALL WATERMAINS AND SANITARY MAINS OR STORM MAINS.
8. WHERE A WATERMAIN CROSSES WITHIN 1.5m OF A STORM STRUCTURE, THE WATERMAIN IS TO BE PROTECTED IN ACCORDANCE WITH CITY STANDARD DRAWING NO. SD-WD-1031.
9. WATERMAIN PIPE MATERIALS ARE TO BE AS SPECIFIED IN CITY STANDARD SPECIFICATION NO. SS-WD-1110.
10. WATERMAIN FITTING MATERIALS ARE TO BE AS SPECIFIED IN CITY STANDARD SPECIFICATION NO. SS-WD-1110.
11. JOINT RESTRAINTS ARE TO BE PROVIDED IN ACCORDANCE WITH CITY STANDARD SPECIFICATION NO. SS-WD-1110.
12. FLOW CONTROL VALVES ARE TO BE AS SPECIFIED IN CITY STANDARD SPECIFICATION NO. SS-WD-1120.
13. HYDRANTS TO BE LOCATED AWAY FROM DRIVEWAYS, POLES, TRANSFORMERS, SECONDARY PEDESTALS, MAINTENANCE HOLES AND ANY OTHER ABOVE GROUND APPURTENANCES IN ACCORDANCE WITH CITY STANDARD SPECIFICATION NO. SS-WD-1130.
14. HYDRANTS TO BE CONNECTED TO THE WATERMAIN AS SPECIFIED IN CITY STANDARD SPECIFICATION NO. SS-WD-1130 AND STANDARD DRAWING NO. SD-WD-1101.
15. THE MINIMUM HORIZONTAL SEPARATION BETWEEN THE WATER SERVICE AND ANY OTHER SEWER LATERAL IS 0.6m.
16. CURB STOPS TO BE LOCATED AWAY FROM DRIVEWAYS, POLES, TRANSFORMERS, SECONDARY PEDESTALS, MAINTENANCE HOLES AND ANY OTHER ABOVEGROUND APPURTENANCES IN ACCORDANCE WITH CITY STANDARD SPECIFICATION NO. SS-WD-1140.
17. CURB STOPS TO BE LOCATED ON THE CITY ROAD ALLOWANCE 150mm FROM THE PROPERTY LINE.
18. WATER SERVICES ARE TO A MINIMUM DIAMETER OF 19mm.
19. WATER SERVICE MATERIALS, INCLUDING PIPES, FITTINGS, VALVES AND CONNECTIONS, ARE TO BE AS SPECIFIED IN CITY STANDARD SPECIFICATION NO. SS-WD-1140.
20. WATER SERVICES AT THE TIME OF INSTALLATION THAT ARE INSTALLED ONLY TO THE CURB STOP (E.G. IN A SUBDIVISION) ARE TO BE IDENTIFIED WITH A MARKER IN ACCORDANCE WITH CITY STANDARD SPECIFICATION NO. SS-WD-1140. APPROVED SERVICE TUBING, A MINIMUM OF 19mm IN DIAMETER, IS TO BE INSTALLED FROM THE CURB STOP TO THE SURFACE, CAPPED AND STAPLED TO THE POST. THE TUBING IS TO BE USED FOR TESTING PURPOSES ONLY.
21. ALL NEW WATERMAIN AND WATER SERVICE INSTALLATIONS SHALL BE INSPECTED, TESTED AND COMMISSIONED IN ACCORDANCE WITH CITY STANDARD SPECIFICATION NO. SS-WD-1190.
22. THE INTERRUPTION OF EXISTING WATER SERVICE SHALL ONLY BE AFFECTED IN ACCORDANCE WITH CITY STANDARD SPECIFICATION NO. SS-WD-1030.
23. ANY EXISTING WATER SERVICES TO THE SITE THAT ARE NOT REQUIRED ARE TO BE DISCONNECTED AT THE MAIN IN ACCORDANCE WITH THE REQUIREMENTS OF THE CITY AT THE OWNER'S EXPENSE.
24. UNLESS SPECIFIED OTHERWISE ON PLAN VIEW DRAWINGS, MAIN LINE PIPES SHALL BE INSTALLED AT THE LOCATIONS IDENTIFIED ON THE TYPICAL CROSS SECTIONS.
25. THE CONTRACTOR SHALL SUBMIT ALL REQUIRED SHOP DRAWINGS AND OTHER SUBMITTALS IN ACCORDANCE WITH THE RESPECTIVE CITY STANDARD SPECIFICATION PRIOR TO COMMENCING CONSTRUCTIONS.

STORM SEWER

1. STORM SEWER 600mm DIAMETER OR LESS TO BE RIBBED PVC, ALL STORM SEWER GREATER THAN 600mm DIAMETER TO BE REINFORCED CONCRETE 65D.
2. TWIN CATCH BASIN MAINTENANCE HOLES ARE A MINIMUM SIZE OF 1500mm DIAMETER.
3. NO UPSTREAM FLOWING CONNECTIONS ARE PERMITTED AT STRUCTURES OR BLIND TEES.
4. MAINTENANCE HOLE ACCESS RUNGS ARE NOT TO BE IN CONFLICT WITH THE CONNECTING PIPES AND THE RIM MUST BE ALIGNED TO THE MAINTENANCE HOLES ACCESS RUNGS.
5. CATCH BASIN MAINTENANCE HOLES ARE INSTALLED WITH A 0.3m SUMP, CATCH BASINS ARE TO HAVE A 0.6m SUMP AND REAR YARD CATCH BASINS ARE TO BE BENCHED.

SANITARY SEWER

1. SANITARY SEWER MAIN TO BE DR35 FLEXIBLE PIPE.
2. SANITARY SERVICE CONNECTIONS TO BE 125mm DR28 PIPE, UNLESS OTHERWISE STATED.
3. NO UPSTREAM FLOWING CONNECTIONS ARE PERMITTED AT STRUCTURES OR SERVICE CONNECTIONS.
4. MAINTENANCE HOLE ACCESS RUNGS ARE NOT TO BE IN CONFLICT WITH THE CONNECTING PIPES AND THE RIM MUST BE ALIGNED TO THE MAINTENANCE HOLE ACCESS RUNGS.
5. NO MORE THAN TWO SERVICE CONNECTIONS PERMITTED DIRECTLY TO MAINTENANCE HOLE STRUCTURES.
6. ALL MAINTENANCE HOLES AND PIPES TO BE WATERTIGHT (I.E. MAINTENANCE HOLE JOINTS TO BE WRAPPED IN BLUE SKIN OR APPROVED EQUIVALENT).

GRADING & DRAINAGE

1. LOT DEVELOPER TO REVIEW PROPOSED GRADING WIT THE PROJECT ENGINEER PRIOR TO ANY CONSTRUCTION.
2. DO NOT ALTER NATURAL DRAINAGE PATTERN WITHOUT APPROVAL FROM THE CITY.
3. LOT GRADING IS NOT TO BE REVISED WITHOUT WRITTEN PERMISSION FROM THE CITY.
4. THE BUILDER SHALL INSTALL NECESSARY SEDIMENT AND EROSION CONTROL MEASURES AS EACH LOT IS DEVELOPED.
5. DITCHES ARE TO BE TREATED WITH A MINIMUM OF 100mm TOPSOIL AND SOD AS SOON AS FEASIBLE.
6. DRAINAGE FLOWS SHALL BE DIRECTED AWAY FROM STRUCTURES. DRAINAGE FLOWS WHICH ARE CARRIES AROUND BUILDING STRUCTURES ARE TO BE CONFINED TO DEFINED SWALES LOCATED AS FAR AS POSSIBLE FROM THE BUILDING.
7. GRADING SHALL MATCH ORIGINAL GROUND NO LESS THAN 1m FROM THE BOUNDARY OF THE SUBDIVISION, IN ORDER THAT THE EXISTING BOUNDARY ELEVATIONS ARE MAINTAINED.
8. DRIVEWAYS SHALL BE SLOPED AT A MINIMUM OF 2.0% AND A MAXIMUM OF 8.0%.
9. BOULEVARDS AND SIDEWALKS ARE TO BE A MAXIMUM OF 4.0% SLOPE.

PHASING NOTES

1. ALL PIPES WILL BE TERMINATED APPROXIMATELY 4.0m BEYOND THE END OF THE PHASING LIMITS. WHERE PIPES DO NOT TERMINATE IN A MAINTENANCE HOLE, A MANUFACTURED WATERTIGHT CAP/PLUG IS TO BE USED.
2. WHERE REQUIRED, TEMPORARY DRAINAGE WILL BE CREATED TO PROMOTE POSITIVE DRAINAGE AT THE END OF PHASING LIMITS TO THE SATISFACTION OF THE CITY.
3. SWALES THAT ARE PRESENTLY PROPOSED TO BE CENTRED ON LOT LINES SHOULD STILL BE CENTRED ON THE LOT LINES, IF CONSTRUCTED AS PART OF THIS PHASE. THE OWNER WILL NEED TO ENTER INTO AN AGREEMENT WITH THE CITY TO CONSTRUCT AND MAINTAIN SWALES WITHIN FUTURE PHASES.
4. DEAD END BARRICADE (OPSD 973.130 C/W Wa-6 CHECKBOARD SIGN ON 11 x 15cm WOOD POSTS) REQUIRED AT THE END OF PHASING LIMITS.
5. WOODEN SIDEWALK BARRICADES TO BE MINIMUM 900mm HIGH x 1500mm WIDE, CONSTRUCTED OF 100mm x 100mm CEDAR POSTS AND 50mm x 150mm CEDAR PLANKING AND PAINTED WHITE.

GENERAL NOTES:

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- ALL UTILITY LOCATIONS SHOWN ON THE DRAWINGS ARE APPROXIMATE. THE CONTRACTOR SHALL CONFIRM THE LOCATION ON SITE AND ASSUME ALL LIABILITY FOR DAMAGE TO ALL UTILITIES.
- EXCLUDING THE BENCHMARK AND DESCRIPTION PROVIDED FOR THIS PROJECT, NO OTHER ELEVATIONS ARE TO BE USED AS A REFERENCE ELEVATION FOR ANY PURPOSE.

METRIC NOTE:

- ALL DIMENSIONS SHOWN ARE IN METRES OR MILLIMETRES, UNLESS OTHERWISE NOTED.

GEOMETRIC NOTE:

- ALL SURVEY DATA SHOWN ON THIS DRAWING WAS RECORDED USING REAL-TIME KINETIC (RTK) GPS OBSERVATIONS IN REFERENCE TO UTM 18 NORTH COORDINATE SYSTEM.
- ALL ELEVATIONS ARE IN REFERENCE TO LOCAL DATUM NAD83 - GEODETIC MODEL HT2_0, UNLESS DESCRIBED OTHERWISE.

* * DRAWINGS ARE NOT TO BE SCALED * *

REVISIONS

NO.	DATE	DESCRIPTION	BY
A	03/15/2024	ISSUED FOR CLIENT REVIEW	JH
1	04/11/2024	ENGINEERING SUBMISSION #1	JH

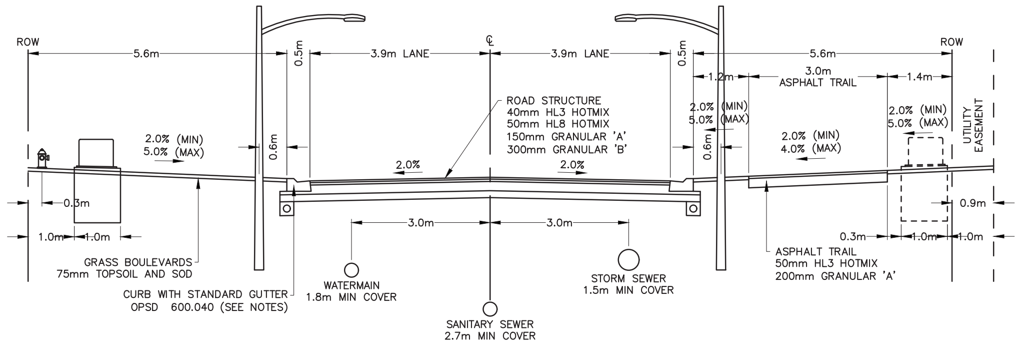
JEWELL ENGINEERING

2215100 ONTARIO INC.
2380416 ONTARIO INC.
SETTLERS RIDGE EAST
PHASE 3

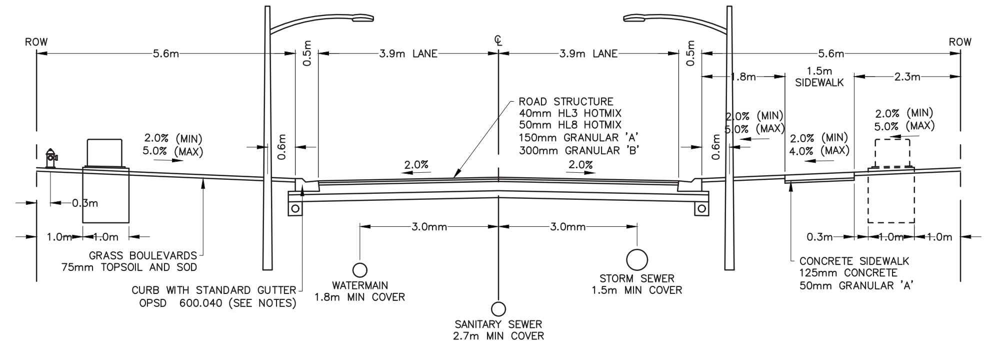
CITY OF BELLEVILLE

GENERAL NOTES

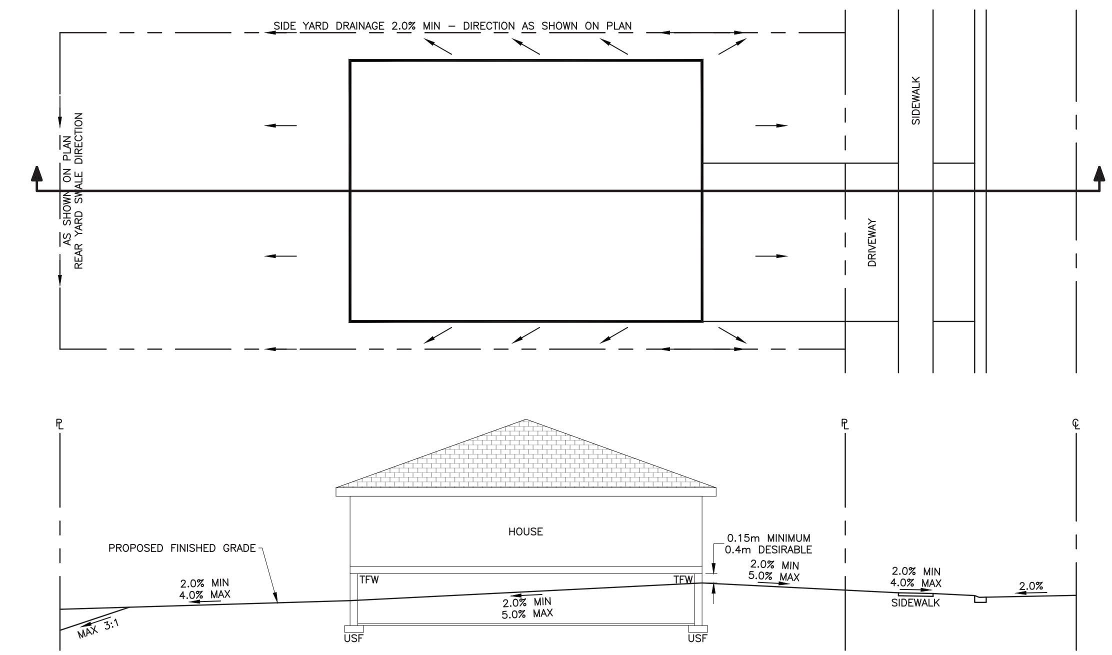
DRAWN BY: JH	PROJECT NO: 190-4502-3
DESIGNED BY: JH/BK	DATE: April 2024
CHECKED BY:	SCALE: HORIZONTAL - N/A, VERTICAL - N/A
APPROVED BY: BK	CONTRACT NO:
	DRAWING NO: ND-1



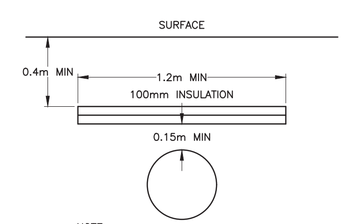
RAYCROFT DRIVE
20m TYPICAL CROSS-SECTION
WITH 3m ASPHALT TRAIL



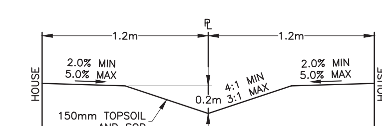
COUSINS CRESCENT
20m TYPICAL CROSS-SECTION



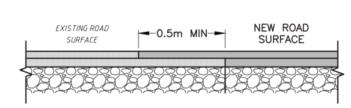
TYPICAL LOT GRADING DETAIL



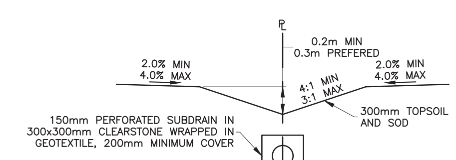
NOTE:
INSULATION TO BE PLACED IN TWO LAYERS WITH STAGGERED JOINTS
INSULATION DETAIL



TYPICAL SIDE YARD SWALE



JOINT LAP DETAIL



TYPICAL ENHANCED REAR YARD SWALE

GENERAL NOTES:

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METRIC NOTE:

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GEOMETRIC NOTE:

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- ALL ELEVATIONS ARE IN REFERENCE TO LOCAL DATUM NAD83 - GEODETIC MODEL HT2_0, UNLESS DESCRIBED OTHERWISE.

* * DRAWINGS ARE NOT TO BE SCALED * *

REVISIONS

NO.	DATE	DESCRIPTION	BY
A	03/15/2024	ISSUED FOR CLIENT REVIEW	JH
1	04/11/2024	ENGINEERING SUBMISSION #1	JH

JEWELL
ENGINEERING

2215100 ONTARIO INC.
2380416 ONTARIO INC.
SETTLERS RIDGE EAST
PHASE 3

CITY OF BELLEVILLE

TYPICAL DETAILS

DRAWN BY: JH
PROJECT NO: 190-4502-3
DESIGNED BY: JH/BK
DATE: April 2024
CHECKED BY:
SCALE:
HORIZONTAL - NOT TO SCALE
VERTICAL - NOT TO SCALE
APPROVED BY: BK
CONTRACT NO:
DRAWING NO: ND-2

04/11/2024

SANITARY STRUCTURES

STRUCTURE	STREET NAME STATION/OFFSET	STRUCTURE SIZE (mm) - OPSD	FRAME OPSD	GRATE OPSD	TOP OF GRATE ELEVATION	PIPES IN	PIPES OUT	STRUCTURE HEIGHT
SA1	RAYCROFT DRIVE 2+730.07 - 0.0	1200∅ - 701.010	401.010	TYPE A	111.70	N INV: 107.40 S INV: 107.41 E INV: 107.38	W INV: 107.35	4.4
SA2	RAYCROFT DRIVE 2+819.77 - 0.0	1200∅ - 701.010	401.010	TYPE A	111.27	E INV: 107.72 N INV: 107.72	W INV: 107.64	3.6
SA3	RAYCROFT DRIVE 2+840 - 0.0	1200∅ - 701.010	401.010	TYPE A	110.77		W INV: 107.78	3.0
SA4	COUSINS CRESCENT 6+100 - 0.0	1200∅ - 701.010	401.010	TYPE A	111.58	N INV: 107.75	S INV: 107.72	3.9
SA5	COUSINS CRESCENT 6+200 - 0.0	1200∅ - 701.010	401.010	TYPE A	111.58	N INV: 108.18	S INV: 108.15	3.4
SA6	COUSINS CRESCENT 6+273.19 - 5.5 L	1200∅ - 701.010	401.010	TYPE A	111.99		E INV: 109.33 S INV: 108.48	3.5
SA7	COUSINS CRESCENT 6+540 - 0.0	1200∅ - 701.010	401.010	TYPE A	111.60	N INV: 108.04	S INV: 108.01	3.6
SA8	COUSINS CRESCENT 6+450 - 0.0	1200∅ - 701.010	401.010	TYPE A	111.46	N INV: 108.43	S INV: 108.40	3.1
SA9	COUSINS CRESCENT 6+357.10 - 5.5 L	1200∅ - 701.010	401.010	TYPE A	111.77	W INV: 108.88	S INV: 108.82	2.9

STORM STRUCTURES (ROUND)

STRUCTURE	STREET NAME STATION/OFFSET	STRUCTURE SIZE (mm) - OPSD	FRAME OPSD	GRATE OPSD	TOP OF GRATE ELEVATION	PIPES IN	PIPES OUT	SUMP DEPTH	STRUCTURE HEIGHT
ST101 - MH	RAYCROFT DRIVE 2+727.06 - 3.1 R	1800∅ - 701.012	401.010	TYPE B	111.62	N INV: 108.76	W INV: 108.61	0.2	3.2
ST102 - MH	COUSINS CRESCENT 6+095.65 - 3.0 L	1200∅ - 701.010	401.010	TYPE B	111.55	N INV: 109.03	S INV: 109.00	0.2	2.8
ST103 - MH	COUSINS CRESCENT 6+168.84 - 3.0 L	1200∅ - 701.010	401.010	TYPE B	111.59	N INV: 109.32 E INV: 109.62	S INV: 109.24	0.2	2.5
ST104 - MH	COUSINS CRESCENT 6+270.24 - 6.0 L	1500∅ - 701.011	401.010	TYPE B	111.96	E INV: 109.77	S INV: 109.64	0.2	2.5
ST105 - MH	COUSINS CRESCENT 6+298.06 - 3.0 R	1200∅ - 701.010	401.010	TYPE B	112.14	N INV: 109.92	W INV: 109.86	0.2	2.5
ST106 - OGS A	RAYCROFT DRIVE 2+857.65 - 3.0 R	1800∅ - FD-6HC	HYDRO INT.	HYDRO INT.	110.22	W INV: 108.75	E INV: 108.72	1.8	3.3
ST107 - MH	RAYCROFT DRIVE 2+816.78 - 3.0 R	1800∅ - 701.012	401.010	TYPE B	111.26	N INV: 109.21 W INV: 109.52	E INV: 109.16	0.2	2.3
ST108 - MH	COUSINS CRESCENT 6+517.86 - 3.0 R	1500∅ - 701.011	401.010	TYPE B	111.36	N INV: 109.58 W INV: 109.75	S INV: 109.51	0.2	2.0
ST109 - MH	COUSINS CRESCENT 6+439.76 - 3.0 R	1200∅ - 701.010	401.010	TYPE B	111.52	N INV: 109.85	S INV: 109.82	0.2	1.9
ST110 - MH	COUSINS CRESCENT 6+367.51 - 3.0 R	1200∅ - 701.010	401.010	TYPE B	111.72	NW INV: 110.14	S INV: 110.06	0.2	1.9
ST111 - CBMH	COUSINS CRESCENT 6+354.67 - 3.9 R	1200∅ - 701.010	400.010	X1	111.75	N INV: 110.20	SE INV: 110.17	0.3	1.9
ST112 - CBMH	COUSINS CRESCENT 6+351.40 - 8.1 L	1200∅ - 701.010	400.010	X1	111.78	N INV: 110.26	S INV: 110.24	0.3	1.8
ST113 - MH	RAYCROFT DRIVE 2+775.21 - 3.0 R	1200∅ - 701.010	401.010	TYPE B	111.55	N INV: 110.15	E INV: 110.09	0.2	1.7

STORM STRUCTURES (RECTANGULAR)

STRUCTURE	STREET NAME STATION/OFFSET	STRUCTURE SIZE (mm) - OPSD	FRAME OPSD	GRATE OPSD	TOP OF GRATE ELEVATION	PIPES IN	PIPES OUT	SUMP DEPTH	STRUCTURE HEIGHT
CB201 - DCB	COUSINS CRESCENT 6+042 - 3.9 L	1450x600 705.020	400.010	X2	111.40		E INV: 108.98	0.6	3.0
CB202 - DCB	COUSINS CRESCENT 6+042 - 3.9 R	1450x600 705.020	400.010	X2	111.40		W INV: 109.67	0.6	2.3
CB203 - DCB	COUSINS CRESCENT 6+112 - 3.9 L	1450x600 705.020	400.010	X2	111.40		E INV: 109.18	0.6	2.8
CB204 - DCB	COUSINS CRESCENT 6+112 - 3.9 R	1450x600 705.020	400.010	X2	111.40		W INV: 109.87	0.6	2.1
CB205 - DCB	COUSINS CRESCENT 6+190.63 - 3.9 L	1450x600 705.020	400.010	X2	111.42	W INV: 109.59	E INV: 109.48	0.6	2.5
CB206 - DCB	COUSINS CRESCENT 6+190.63 - 3.9 R	1450x600 705.020	400.010	X2	111.42		W INV: 109.96	0.6	2.1
CB207 - CB	COUSINS CRESCENT 6+252.39 - 3.9 L	600x600 705.010	400.010	X1	111.79		E INV: 109.76	0.6	2.6
CB208 - CB	COUSINS CRESCENT 6+252.39 - 3.9 R	600x600 705.010	400.010	X1	111.79		W INV: 110.44	0.6	2.0
CB209 - CB	RAYCROFT DRIVE 2+850.65 - 3.9 R	600x600 705.010	400.010	X1	110.37		N INV: 109.01	0.6	2.0
CB210 - CB	RAYCROFT DRIVE 2+850.82 - 4.0 L	600x600 705.010	400.010	X1	110.36		S INV: 109.07	0.6	1.9
CB211 - DCB	COUSINS CRESCENT 6+599.84 - 3.9 R	1450x600 705.020	400.010	X2	111.03		E INV: 109.48	0.6	2.1
CB212 - DCB	COUSINS CRESCENT 6+599.84 - 3.9 L	1450x600 705.020	400.010	X2	111.03		W INV: 109.54	0.6	2.1
CB213 - DCB	COUSINS CRESCENT 6+515.36 - 3.9 R	1450x600 705.020	400.010	X2	111.30		E INV: 109.73	0.6	2.2
CB214 - DCB	COUSINS CRESCENT 6+515.36 - 3.9 L	1450x600 705.020	400.010	X2	111.30		W INV: 109.79	0.6	2.1
CB215 - DCB	COUSINS CRESCENT 6+454 - 3.9 R	1450x600 705.020	400.010	X2	111.35		E INV: 109.93	0.6	2.0
CB216 - DCB	COUSINS CRESCENT 6+454 - 3.9 L	1450x600 705.020	400.010	X2	111.35		W INV: 109.99	0.6	2.0
CB217 - DCB	COUSINS CRESCENT 6+378.26 - 3.9 R	1450x600 705.020	400.010	X2	111.65		E INV: 110.18	0.6	2.1
CB218 - DCB	COUSINS CRESCENT 6+378.26 - 3.9 L	1450x600 705.020	400.010	X2	111.65	E INV: 110.35	W INV: 110.24	0.6	2.0
RY301 - RYCB	COUSINS CRESCENT 6+168.84 - 44.8 R	600x600 705.010	400.010	X1	111.29		W INV: 110.10	0.0	1.2
RY302 - RYCB	COUSINS CRESCENT 6+190.63 - 41.6 L	600x600 705.010	400.010	X1	111.06		E INV: 109.78	0.0	1.3
RY303 - RYCB	COUSINS CRESCENT 6+232.04 - 12.0 R	600x600 705.010	400.010	X1	111.36		W INV: 110.00	0.0	1.4
RY304 - RYCB	COUSINS CRESCENT 6+298.06 - 44.1 L	600x600 705.010	400.010	X1	110.75		S INV: 110.16	0.0	0.6
RY305 - RYCB	COUSINS CRESCENT 6+530.57 - 51.4 L	600x600 705.010	400.010	X1	110.30		W INV: 109.96	0.0	0.3
RY306 - RYCB	COUSINS CRESCENT 6+112.44 - 44.8 R	600x600 705.010	400.010	X1	111.21		E INV: 109.87	0.0	1.3
RY307 - RYCB	COUSINS CRESCENT 6+378.26 - 45.3 L	600x600 705.010	400.010	X1	110.93		W INV: 110.47	0.0	0.5
RY308 - RYCB	COUSINS CRESCENT 6+349.78 - 49.7 L	600x600 705.010	400.010	X1	110.97		S INV: 110.39	0.0	0.6
RY309 - RYCB	RAYCROFT DRIVE 2+773.73 - 12.0 L	600x600 705.010	400.010	X1	111.20		S INV: 110.30	0.0	0.9

SANITARY PIPES

UPSTREAM	DOWNSTREAM	LENGTH	SIZE	MATERIAL	SLOPE
SA2	SA1	88.5m	375 mm	DR35 PVC	0.30%
SA3	SA2	19.0m	300 mm	DR35 PVC	0.30%
SA4	SA1	78.8m	200 mm	DR35 PVC	0.40%
SA5	SA4	98.8m	200 mm	DR35 PVC	0.40%
SA6	SA10	75.2m	200 mm	DR35 PVC	0.40%
SA6	SA5	74.8m	200 mm	DR35 PVC	0.40%
SA7	SA2	72.1m	300 mm	DR35 PVC	0.40%
SA8	SA7	88.8m	300 mm	DR35 PVC	0.40%
SA9	SA8	94.5m	300 mm	DR35 PVC	0.40%

STORM PIPES

UPSTREAM	DOWNSTREAM	LENGTH	SIZE	MATERIAL	SLOPE
CB201	TEE - CB201-202	0.6m	375 mm	RIBBED PVC	1.00%
CB202	TEE - CB201-202	6.6m	375 mm	RIBBED PVC	10.00%
CB203	TEE - CB203-204	0.6m	375 mm	RIBBED PVC	1.00%
CB204	TEE - CB203-204	6.6m	375 mm	RIBBED PVC	10.00%
CB205	TEE - CB205-206	0.6m	375 mm	RIBBED PVC	1.00%
CB206	TEE - CB205-206	6.6m	375 mm	RIBBED PVC	7.00%
CB207	TEE - CB207-208	0.6m	300 mm	RIBBED PVC	1.00%
CB208	TEE - CB207-208	6.6m	300 mm	RIBBED PVC	10.00%
CB209	TEE - CB209-210	0.6m	300 mm	RIBBED PVC	1.00%
CB210	TEE - CB209-210	6.7m	300 mm	RIBBED PVC	1.00%
CB211	TEE - CB211-212	0.6m	375 mm	RIBBED PVC	1.00%
CB212	TEE - CB211-212	6.6m	375 mm	RIBBED PVC	1.00%
CB213	TEE - CB213-214	0.6m	375 mm	RIBBED PVC	1.00%
CB214	TEE - CB213-214	6.6m	375 mm	RIBBED PVC	1.00%
CB215	TEE - CB215-216	0.6m	375 mm	RIBBED PVC	1.00%
CB216	TEE - CB215-216	6.6m	375 mm	RIBBED PVC	1.00%
CB217	TEE - CB217-218	0.6m	375 mm	RIBBED PVC	1.00%
CB218	TEE - CB217-218	6.6m	375 mm	RIBBED PVC	1.00%
RY301	ST103	46.9m	300 mm	RIBBED PVC	1.00%
RY302	CB205	37.1m	300 mm	RIBBED PVC	0.50%

STORM PIPES

UPSTREAM	DOWNSTREAM	LENGTH	SIZE	MATERIAL	SLOPE
RY303	TEE - RY303	14.7m	300 mm	RIBBED PVC	2.00%
RY304	ST105	46.2m	450 mm	RIBBED PVC	0.50%
RY305	TEE - RY305	54.1m	300 mm	RIBBED PVC	0.30%
RY306	ST108	40.8m	300 mm	RIBBED PVC	0.30%
RY307	CB218	40.8m	300 mm	RIBBED PVC	0.30%
RY308	ST112	41.0m	525 mm	RIBBED PVC	0.30%
RY309	ST113	14.2m	300 mm	RIBBED PVC	1.00%
ST102	ST101	77.2m	600 mm	RIBBED PVC	0.30%
ST103	ST102	72.0m	600 mm	RIBBED PVC	0.30%
ST104	ST103	102.9m	525 mm	RIBBED PVC	0.30%
ST105	ST104	29.4m	450 mm	RIBBED PVC	0.30%
ST106	OUTLET A	16.3m	675 mm	65-D RCP	0.25%
ST107	ST106	39.1m	675 mm	65-D RCP	1.00%
ST108	ST107	96.8m	675 mm	65-D RCP	0.30%
ST109	ST108	76.8m	600 mm	RIBBED PVC	0.30%
ST110	ST109	71.1m	600 mm	RIBBED PVC	0.30%
ST111	ST110	8.0m	525 mm	RIBBED PVC	0.30%
ST112	ST111	11.3m	525 mm	RIBBED PVC	0.30%
ST113	ST107	40.3m	300 mm	RIBBED PVC	1.35%

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REVISIONS

NO.	DATE	DESCRIPTION	BY
A	03/15/2024	ISSUED FOR CLIENT REVIEW	JH
1	04/11/2024	ENGINEERING SUBMISSION #1	JH

JEWELL ENGINEERING

2215100 ONTARIO INC.
2380416 ONTARIO INC.
SETTLERS RIDGE EAST
PHASE 3

CITY OF BELLEVILLE

PIPE AND STRUCTURE TABLES

DRAWN BY: JH
PROJECT NO: 190-4502-3
DESIGNED BY: JH/BK
DATE: April 2024
CHECKED BY:
SCALE: HORIZONTAL - N/A; VERTICAL - N/A
APPROVED BY: BK
CONTRACT NO:
DRAWING NO: ND-3

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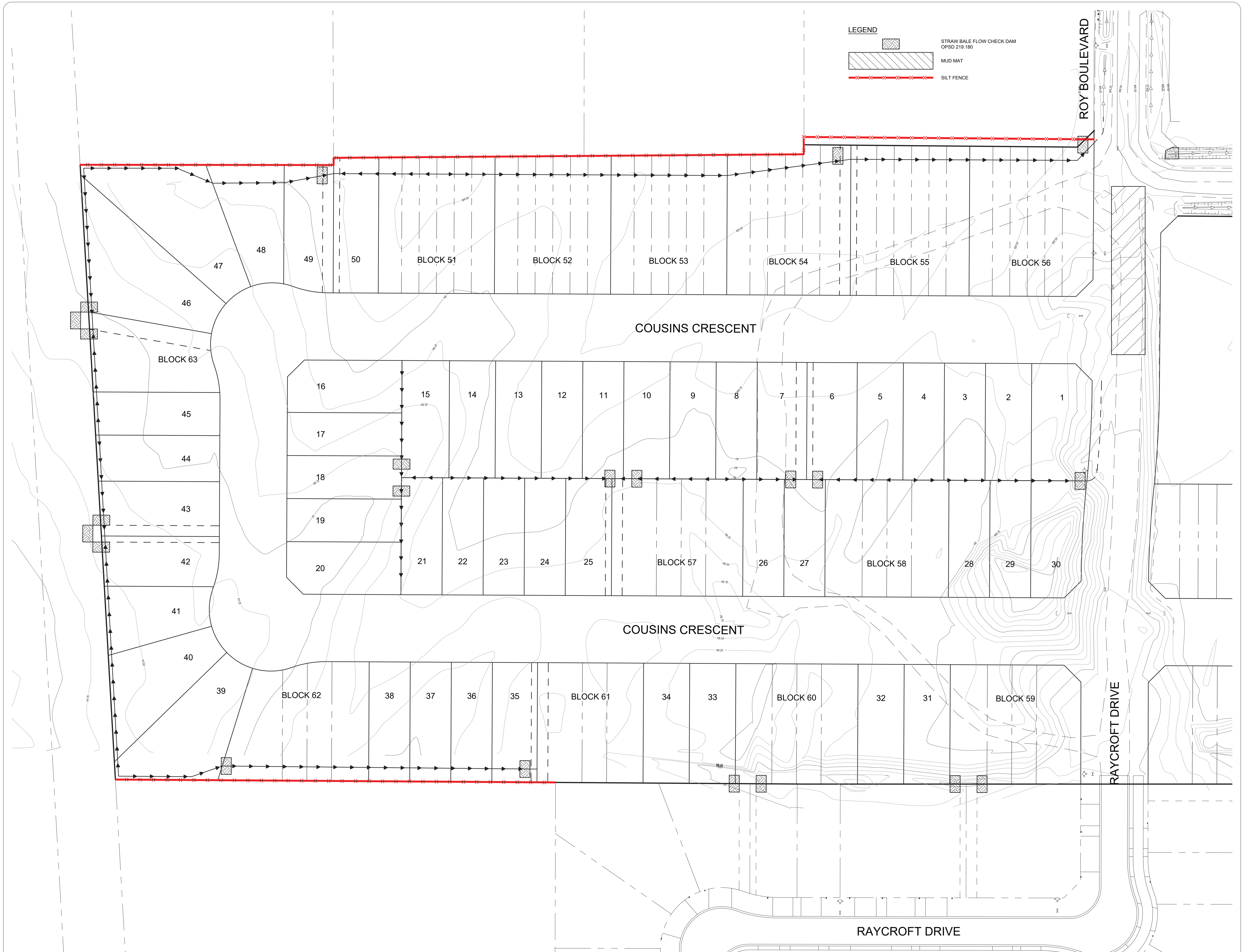

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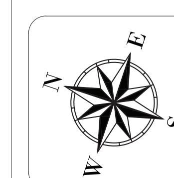
1	04/11/2024	ENGINEERING SUBMISSION #1	JH

NOTES

1. SEDIMENT AND EROSION CONTROL MEASURES WILL TO OPSS.MUNI 805.
2. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES TO PROVIDE THE PROTECTION OF THE AREA DRAINAGE SYSTEM AND THE RECEIVING WATERCOURSE DURING CONSTRUCTION ACTIVITIES. THIS INCLUDES LIMITING THE AMOUNT OF EXPOSED SOIL AND INSTALLING SILT FENCES AND OTHER SEDIMENT TRAPS.
3. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING EROSION AND SEDIMENT CONTROL MEASURES ARE INSTALLED CORRECTLY.
4. FOR STRAW BALE FLOW CHECK DAM, USE OPSD 219.100. FOR LIGHT DUTY AND HEAVY DUTY SILT FENCE BARRIER, USE OPSD 219.110 AND 219.130, RESPECTIVELY.
5. THE OWNER AGREES TO PREPARE AND IMPLEMENT AN EROSION AND SEDIMENT CONTROL PLAN TO THE SATISFACTION OF THE CONSERVATION AUTHORITY.
6. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE IN PLACE PRIOR TO ANY EXCAVATION OR CONSTRUCTION WORK COMMENCE.
7. ALL EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE REGULARLY MONITORED AND MAINTAINED UNTIL LANDSCAPING HAS BEEN ESTABLISHED.
8. ALL CATCH BASINS AND MANHOLES WHICH MAY COLLECT SEDIMENT FROM THE DISTURBED AREAS OF THE SITE SHALL HAVE FILTER CLOTH OR OTHER APPROVED MEANS OF SEDIMENT CONTROL INSTALLED AND MAINTAINED UNTIL THE CONTRIBUTING SURFACES HAVE ADEQUATELY STABILIZED, I.E. ASPHALT, SOD, OR 80% GRASS COVER.
9. MUD MAT MUST BE A MINIMUM OF 20 m IN LENGTH AND THE FULL WIDTH OF THE ENTRANCE (10 m MINIMUM). THE PAD SHOULD BE A MINIMUM OF 300 mm THICK BUT 450 mm THICKNESS IS RECOMMENDED. THE PAD SHOULD BE UNDERLAIN WITH A GEOTEXTILE (OR GRADED AGGREGATE FILTER) AND CONSIST OF 50 mm DIAMETER CLEAR STONE FOR THE FIRST 10 m (EXTENDING FROM THE STREET) AND THE REMAINDER OF THE LENGTH TO CONSIST OF 150 mm DIAMETER CLEAR STONE.

EMERGENCY CONTACT INFORMATION
SPILLS ACTION CENTRE
PHONE: 416-325-3000
TOLL-FREE: 1-800-268-6060



JEWELL
ENGINEERING

2215100 ONTARIO INC.
2380416 ONTARIO INC.
SETTLERS RIDGE EAST
PHASE 3

CITY OF BELLEVILLE

SEDIMENT & EROSION CONTROL PLAN

DRAWN BY: JH	PROJECT NO: 190-4502-3	
DESIGNED BY: JH/BK	DATE: April 2024	
CHECKED BY:	SCALE: HORIZONTAL - 1:500 VERTICAL - N/A	
APPROVED BY: BK	CONTRACT NO:	DRAWING NO: ESC-1

01/09/2024

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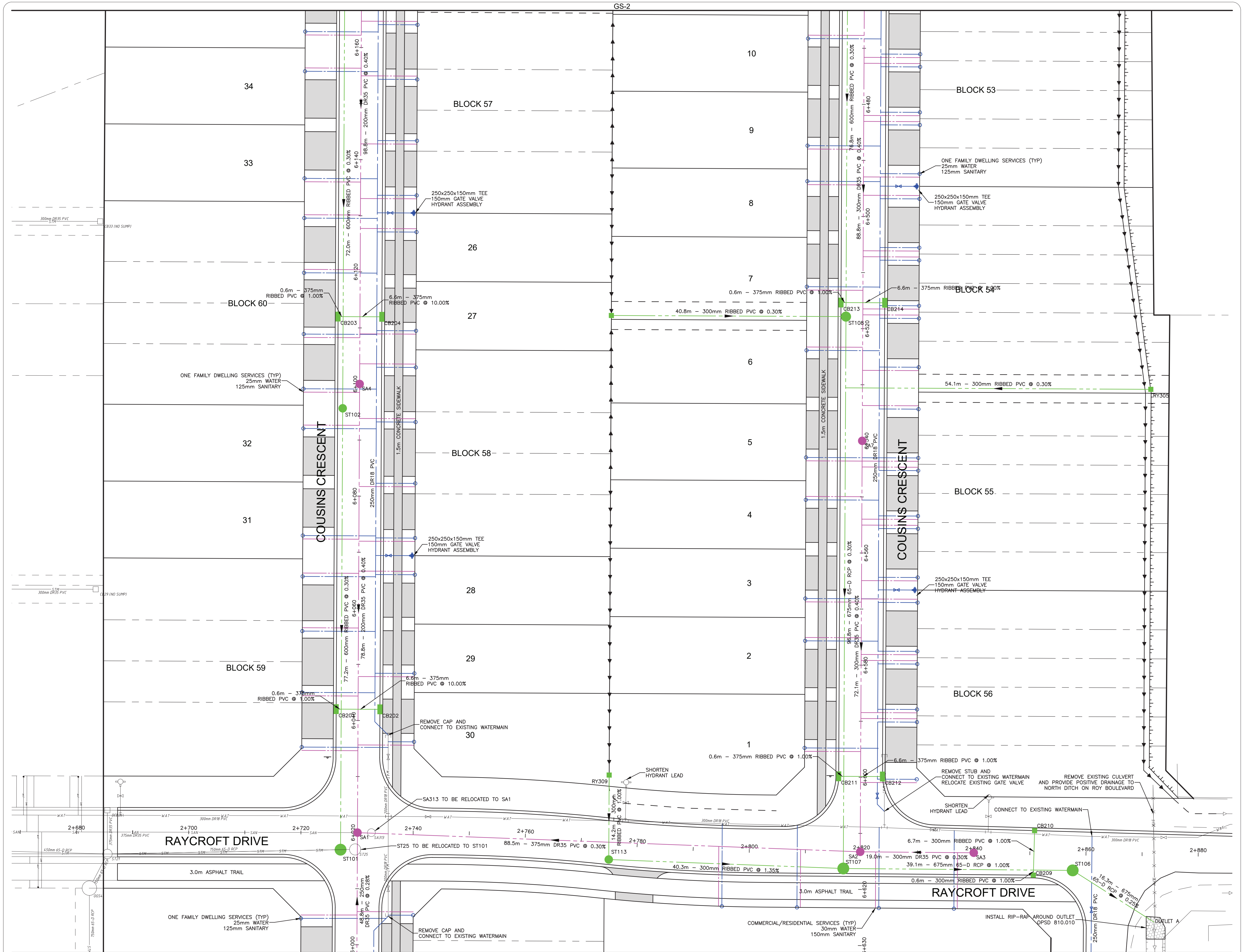

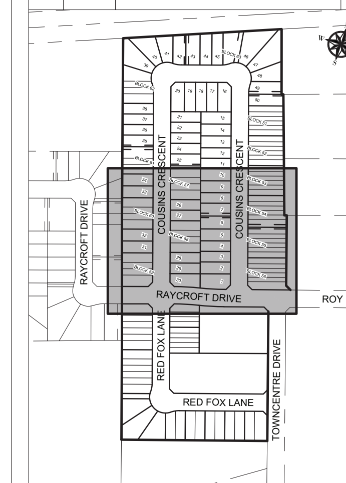

KEY PLAN
SCALE - N.T.S.

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REVISIONS

NO.	DATE	DESCRIPTION	BY
A	03/15/2024	ISSUED FOR CLIENT REVIEW	JH
1	04/11/2024	ENGINEERING SUBMISSION #1	JH

LICENSED PROFESSIONAL ENGINEER
B. C. KEENE
PROVINCE OF ONTARIO

JEWELL ENGINEERING

2215100 ONTARIO INC.
2380416 ONTARIO INC.
SETTLERS RIDGE EAST
PHASE 3

CITY OF BELLEVILLE

GENERAL SERVICING PLAN
1 of 3

DRAWN BY: JH	PROJECT NO: 190-4502-3	
DESIGNED BY: JH/BK	DATE: April 2024	
CHECKED BY:	SCALE: HORIZONTAL - 1:300 VERTICAL - N/A	
APPROVED BY: BK	CONTRACT NO:	DRAWING NO: GS-1

04/11/2024

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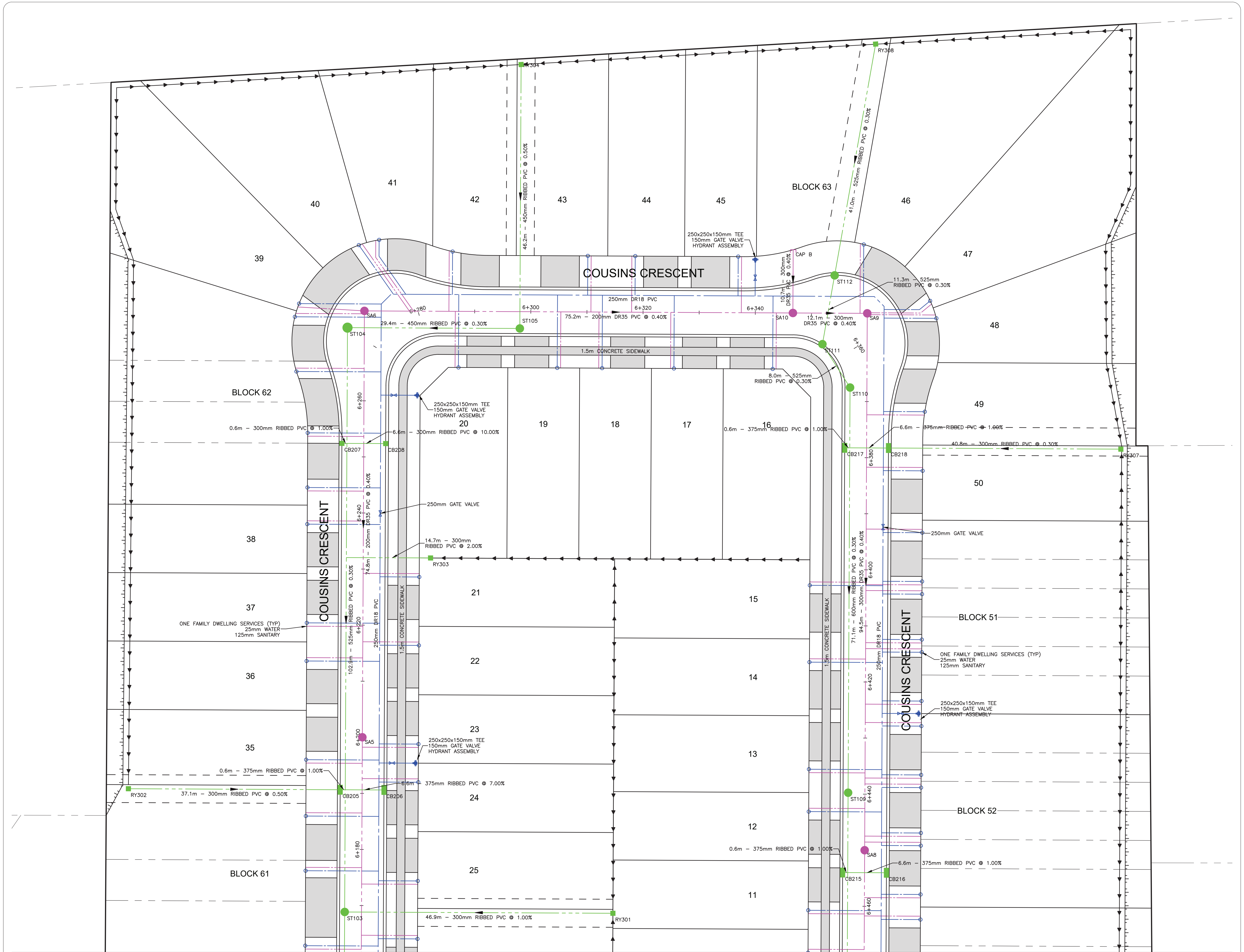
04/11/2024



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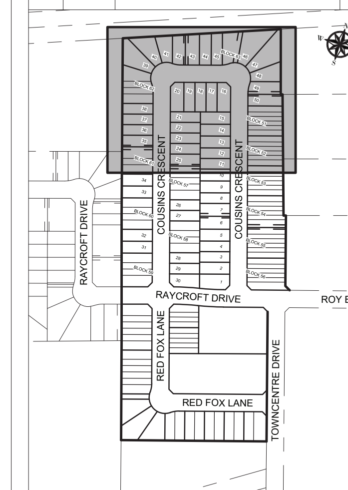
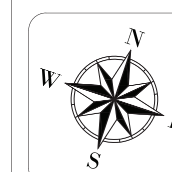


KEY PLAN
SCALE - N.T.S.



LICENSED PROFESSIONAL ENGINEER
B. C. KEENE
PROVINCE OF ONTARIO

JEWELL ENGINEERING

2215100 ONTARIO INC.
2380416 ONTARIO INC.
SETTLERS RIDGE EAST
PHASE 3

CITY OF BELLEVILLE

GENERAL SERVICING PLAN
2 of 3

DRAWN BY: JH
PROJECT NO: 190-4502-3
DESIGNED BY: JH/BK
DATE: April 2024
CHECKED BY:
SCALE: HORIZONTAL - 1:300
VERTICAL - N/A
APPROVED BY: BK
CONTRACT NO:
DRAWING NO: GS-2

GG-2

GG-3

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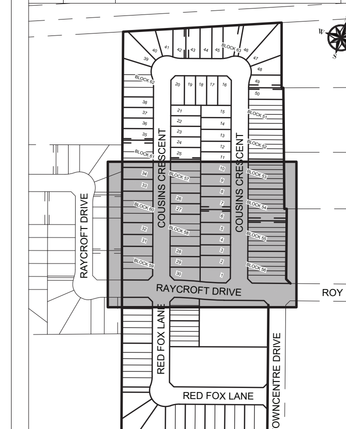
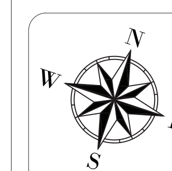


KEY PLAN
SCALE - N.T.S.



LICENSED PROFESSIONAL ENGINEER
B. C. KEENE
PROVINCE OF ONTARIO

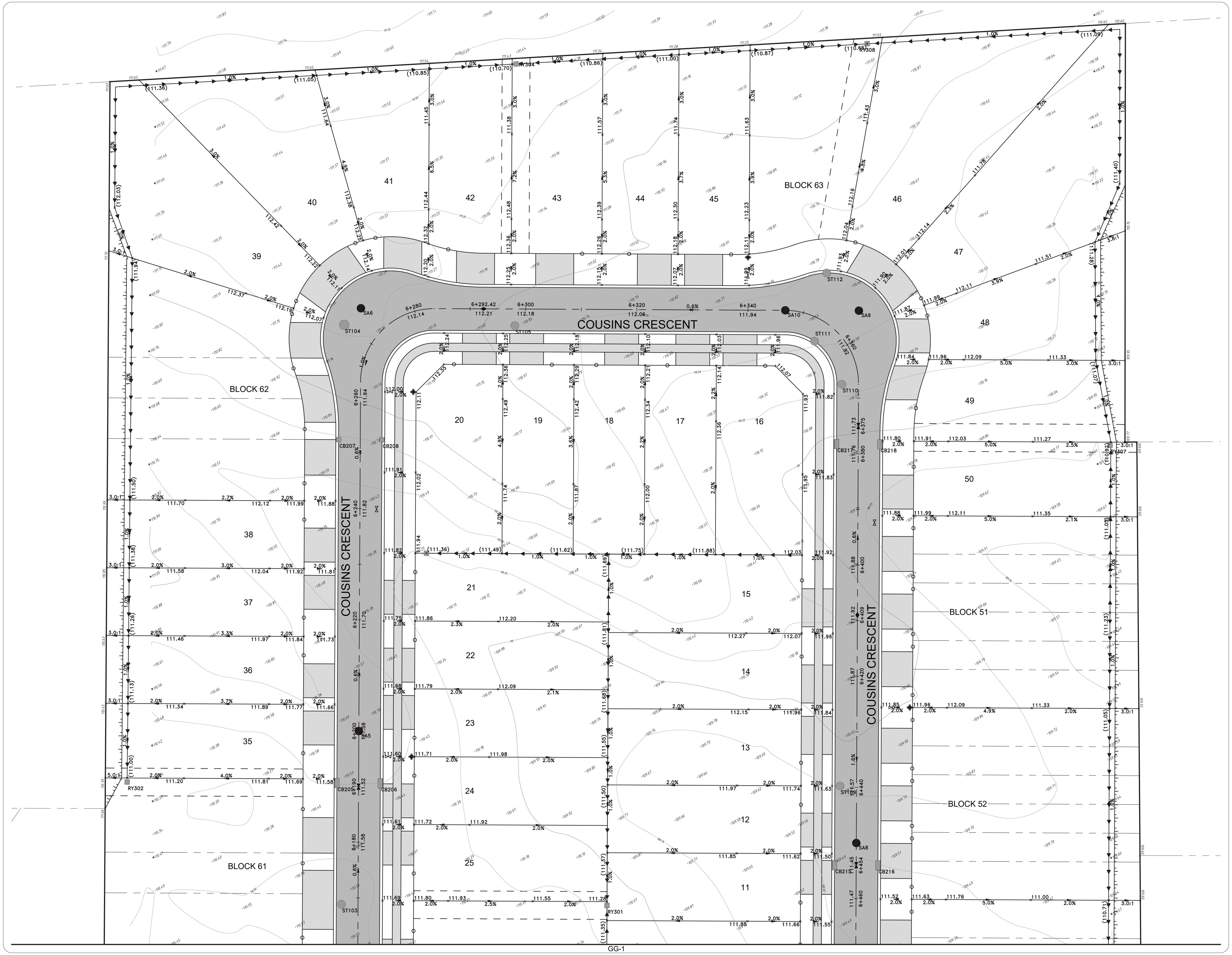
JEWELL ENGINEERING

2215100 ONTARIO INC.
2380416 ONTARIO INC.
SETTLERS RIDGE EAST
PHASE 3

CITY OF BELLEVILLE

GENERAL GRADING PLAN
1 of 3

DRAWN BY: JH	PROJECT NO: 190-4502-3
DESIGNED BY: JH/BK	DATE: March 2024
CHECKED BY:	SCALE: HORIZONTAL - 1:300 VERTICAL - N/A
APPROVED BY: BK	CONTRACT NO:
	DRAWING NO: GG-1



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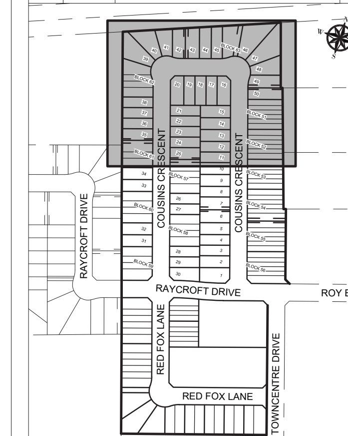
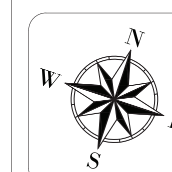
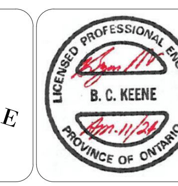


KEY PLAN
SCALE - N.T.S.





JEWELL
ENGINEERING

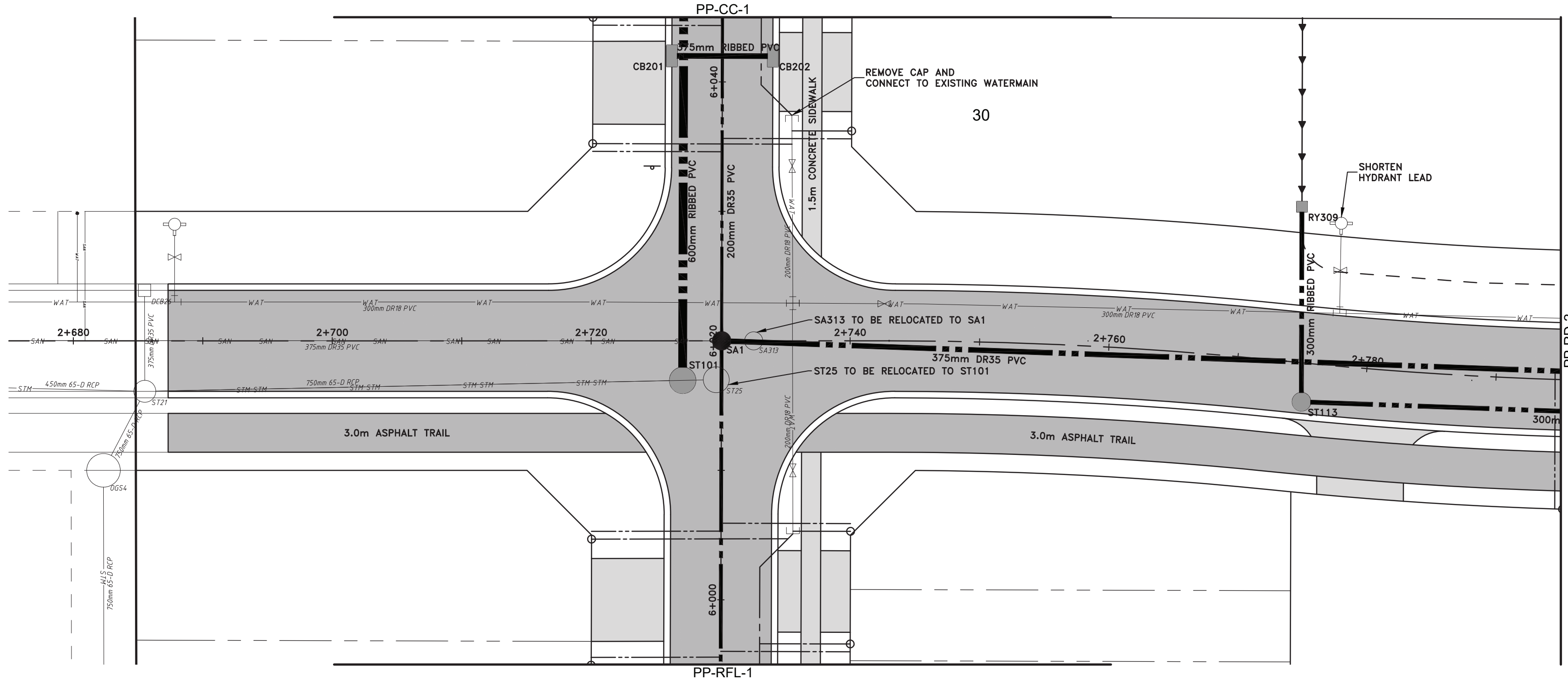
2215100 ONTARIO INC.
2380416 ONTARIO INC.
SETTLERS RIDGE EAST
PHASE 3

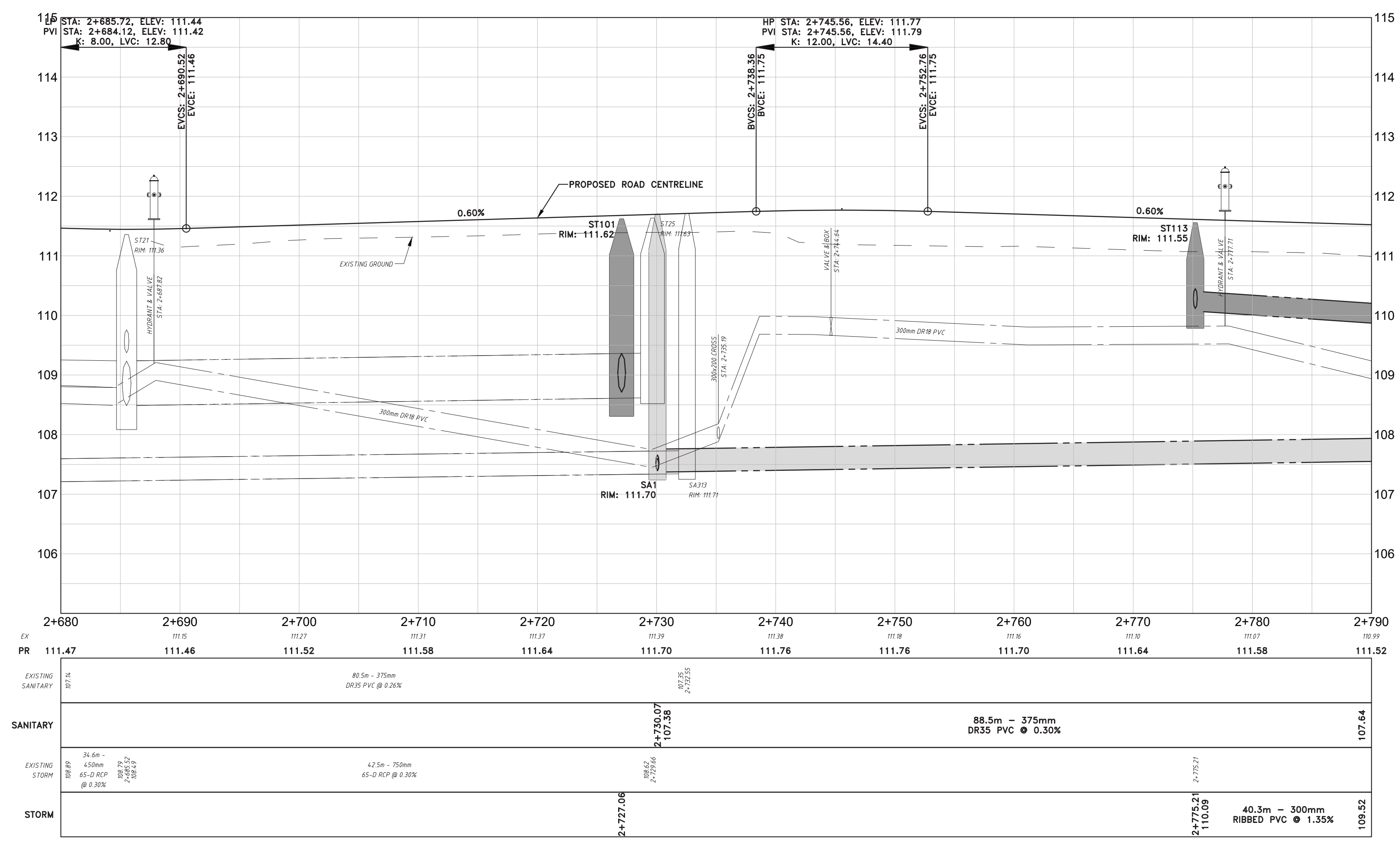
CITY OF BELLEVILLE

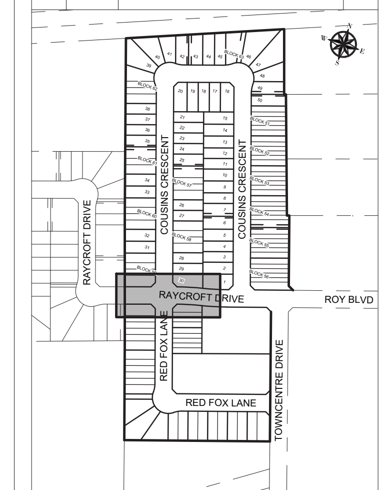
GENERAL GRADING PLAN
2 of 3

DRAWN BY: JH	PROJECT NO: 190-4502-3	
DESIGNED BY: JH/BK	DATE: March 2024	
CHECKED BY:	SCALE: HORIZONTAL - 1:300 VERTICAL - N/A	
APPROVED BY: BK	CONTRACT NO:	DRAWING NO: GG-2

RAYCROFT DRIVE







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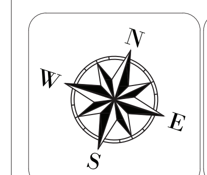
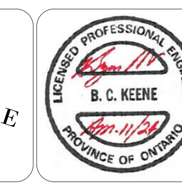
1	04/11/2024	ENGINEERING SUBMISSION #1	JH





JEWELL ENGINEERING

2215100 ONTARIO INC.
2380416 ONTARIO INC.
SETTLERS RIDGE EAST
PHASE 3

CITY OF BELLEVILLE

PLAN & PROFILE
RAYCROFT DRIVE
STA. 2+680 to 2+790

DRAWN BY: JH	PROJECT NO: 190-4502-3	
DESIGNED BY: JH/BK	DATE: April 2024	
CHECKED BY:	SCALE: HORIZONTAL - 1:250 VERTICAL - 1:50	
APPROVED BY: BK	CONTRACT NO:	DRAWING NO: PP-RD-1

02/21/2024

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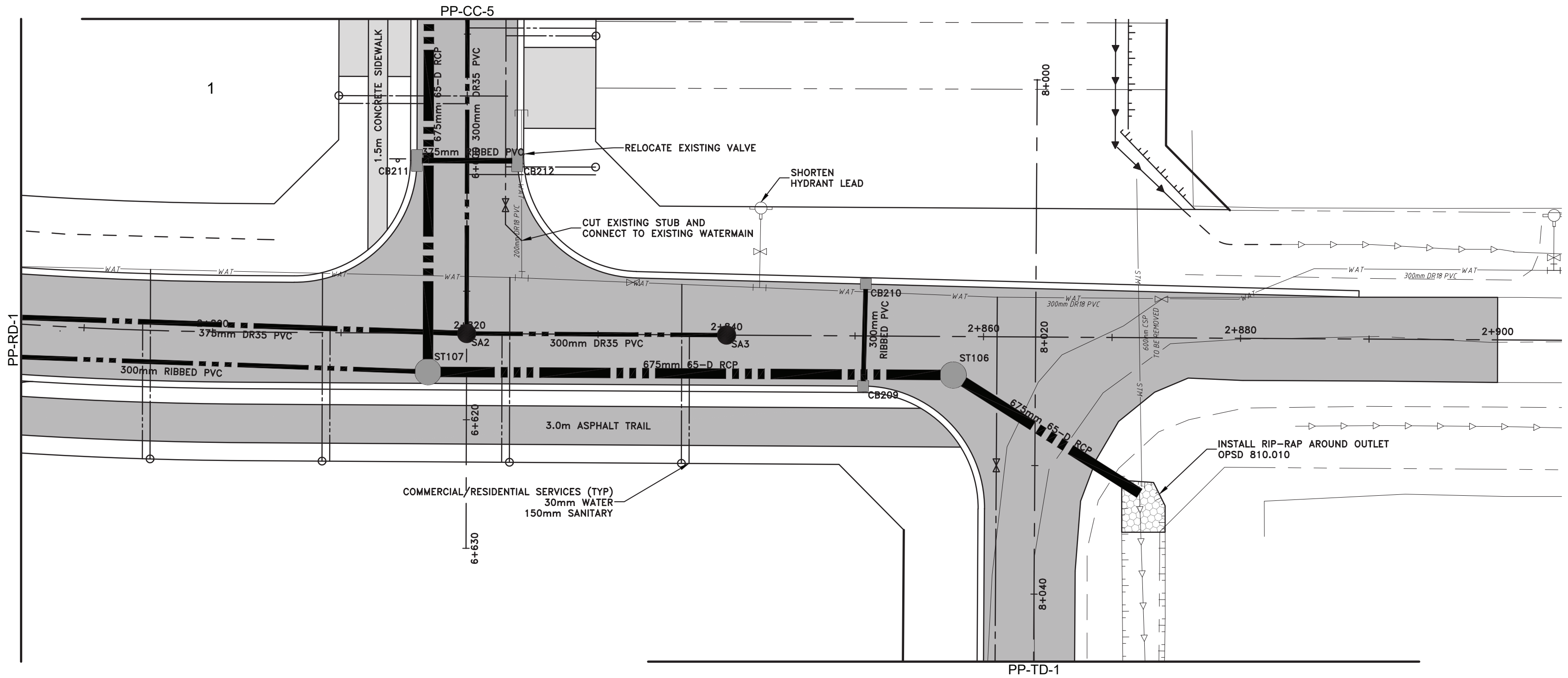
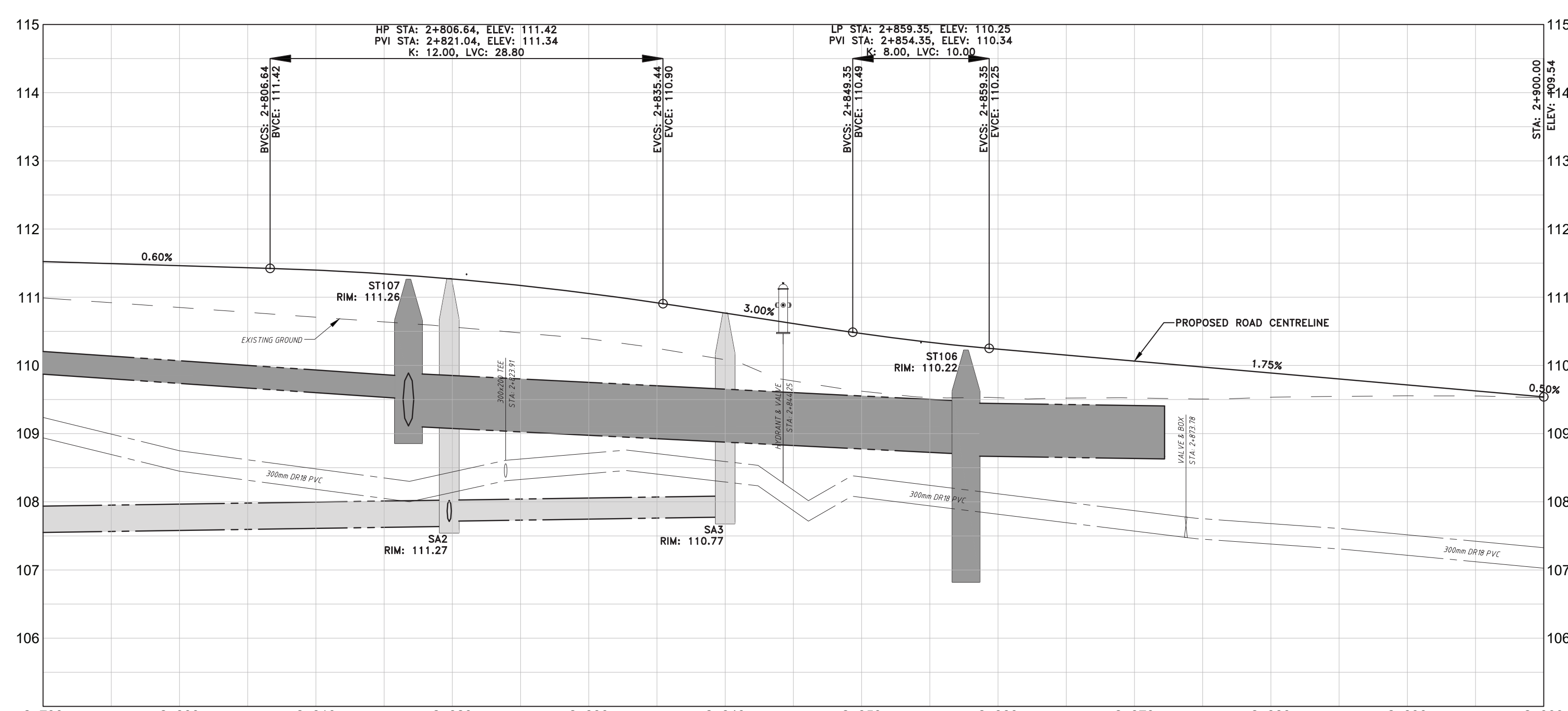
RAYCROFT DRIVE





	2+790	2+800	2+810	2+820	2+830	2+840	2+850	2+860	2+870	2+880	2+890	2+900
EX	110.99	110.85	110.71	110.56	110.39	110.08	109.62	109.53	109.52	109.53	109.55	109.53
PR	111.52	111.46	111.40	111.27	111.06	110.77	110.47	110.24	110.06	109.89	109.71	109.54

SANITARY: 107.38 — 88.5m - 375mm DR35 PVC @ 0.30% — 107.64 2+819.77 107.72 — 19.0m - 300mm DR35 PVC @ 0.30% — 107.78 2+840

STORM: 110.09 — 40.3m - 300mm RIBBED PVC @ 1.35% — 109.52 2+816.78 109.16 — 39.1m - 675mm 65-D RCP @ 1.00% — 108.75 2+857.65 108.72 — 16.3m - 675mm 65-D RCP @ 0.25% — 108.68 2+872.21

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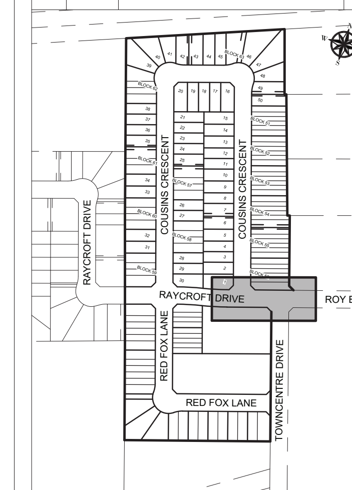
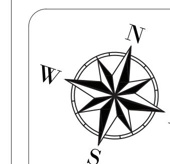
* * DRAWINGS ARE NOT TO BE SCALED * *

REVISIONS

NO.	DATE	DESCRIPTION	BY
A	03/15/2024	ISSUED FOR CLIENT REVIEW	JH
1	04/11/2024	ENGINEERING SUBMISSION #1	JH



KEY PLAN
SCALE - N.T.S.



LICENSED PROFESSIONAL ENGINEER
B. C. KEENE
PROVINCE OF ONTARIO

JEWELL ENGINEERING

2215100 ONTARIO INC.
2380416 ONTARIO INC.
SETTLERS RIDGE EAST
PHASE 3

CITY OF BELLEVILLE

PLAN & PROFILE
RAYCROFT DRIVE
STA. 2+790 to 2+900

DRAWN BY: JH
PROJECT NO: 190-4502-3
DESIGNED BY: JH/BK
DATE: April 2024
CHECKED BY:
SCALE: HORIZONTAL - 1:250, VERTICAL - 1:50
APPROVED BY: BK
CONTRACT NO:
DRAWING NO: PP-RD-2

02/21/2024
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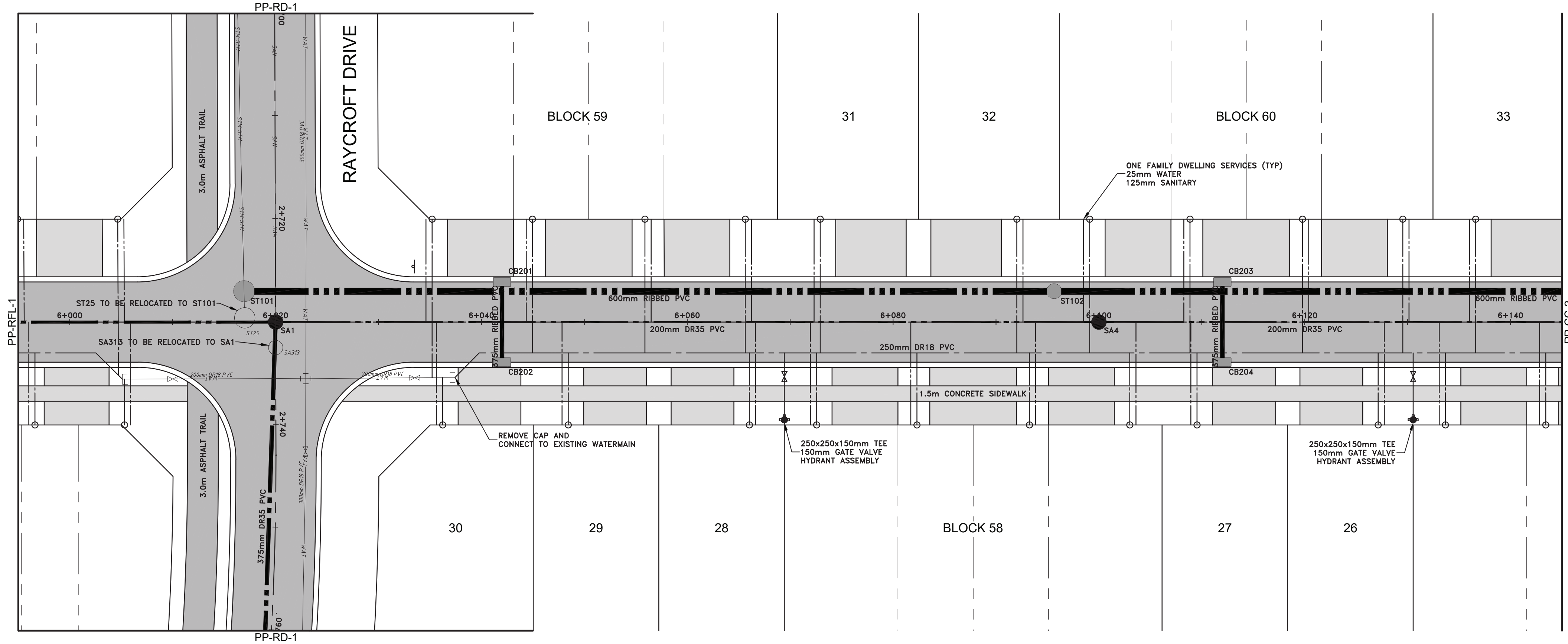
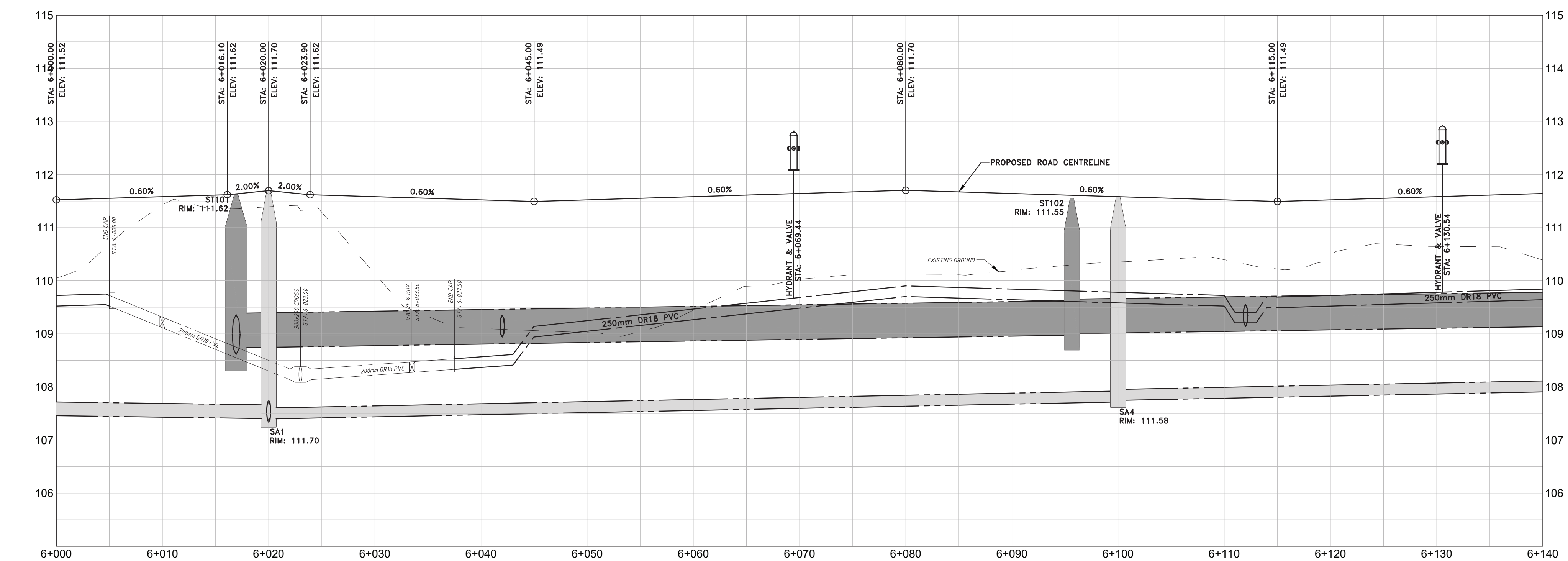
COUSINS CRESCENT





	6+000	6+010	6+020	6+030	6+040	6+050	6+060	6+070	6+080	6+090	6+100	6+110	6+120	6+130	6+140
PR	111.52	111.58	111.70	111.58	111.52	111.52	111.58	111.64	111.70	111.64	111.58	111.52	111.52	111.58	111.64

SANITARY: 107.55 — 48.8m – 250mm DR35 PVC @ 0.28% — 107.41 6+020 107.40 — 78.8m – 200mm DR35 PVC @ 0.40% — 107.72 6+100 107.75 — 98.8m – 200mm DR35 PVC @ 0.40% — 108.15

STORM: 6+016.94 108.78 — 6+042 — 77.2m – 600mm RIBBED PVC @ 0.30% — 109.00 6+095.65 109.03 — 6+112 — 72.0m – 600mm RIBBED PVC @ 0.30% — 109.24

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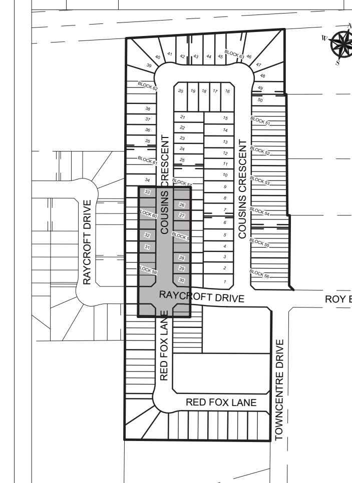


KEY PLAN
SCALE - N.T.S.

LICENSED PROFESSIONAL ENGINEER
B. C. KEENE
PROVINCE OF ONTARIO

JEWELL ENGINEERING

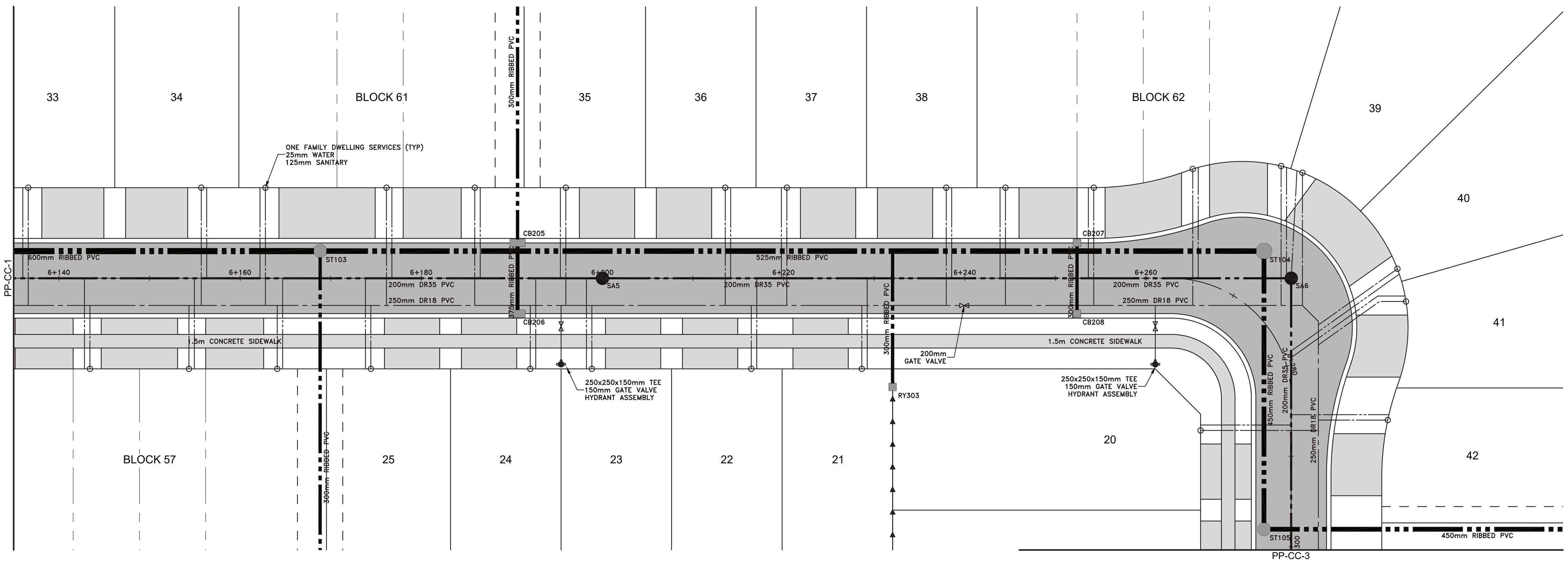
2215100 ONTARIO INC.
2380416 ONTARIO INC.
SETTLERS RIDGE EAST
PHASE 3

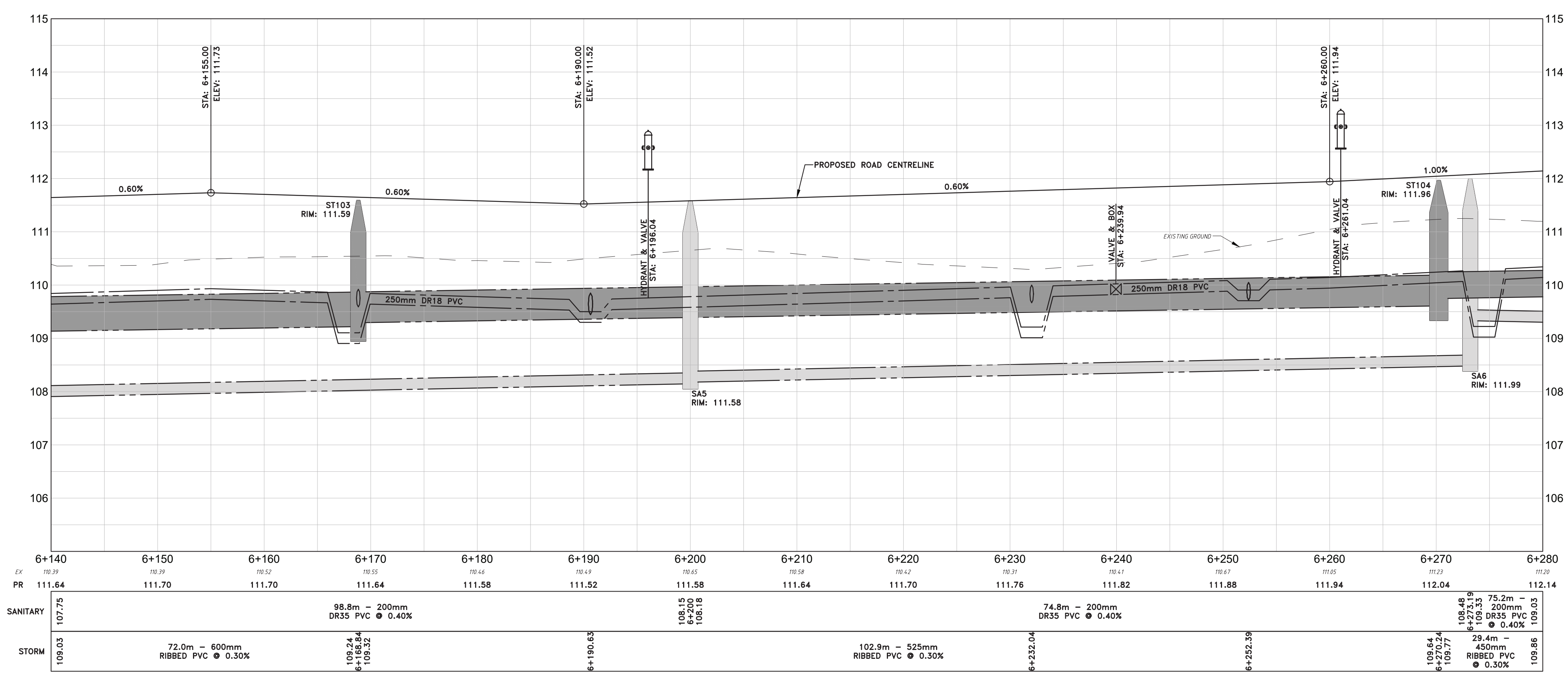
CITY OF BELLEVILLE

PLAN & PROFILE
COUSINS CRESCENT
STA. 6+000 to 6+140

DRAWN BY: JH
PROJECT NO: 190-4502-3
DESIGNED BY: JH/BK
DATE: April 2024
CHECKED BY:
SCALE: HORIZONTAL - 1:250, VERTICAL - 1:50
APPROVED BY: BK
CONTRACT NO:
DRAWING NO: PP-CC-1

COUSINS CRESCENT





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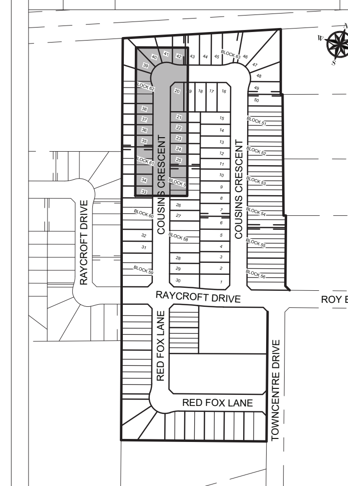
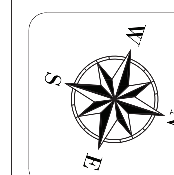
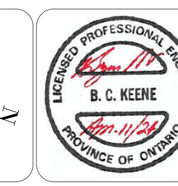


KEY PLAN
SCALE - N.T.S.





JEWELL ENGINEERING

2215100 ONTARIO INC.
2380416 ONTARIO INC.
SETTLERS RIDGE EAST
PHASE 3

CITY OF BELLEVILLE

PLAN & PROFILE
COUSINS CRESCENT
STA. 6+140 to 6+280

DRAWN BY: JH	PROJECT NO: 190-4502-3
DESIGNED BY: JH/BK	DATE: April 2024
CHECKED BY:	SCALE: HORIZONTAL - 1:250 VERTICAL - 1:50
APPROVED BY: BK	CONTRACT NO:
	DRAWING NO: PP-CC-2

03/11/2024

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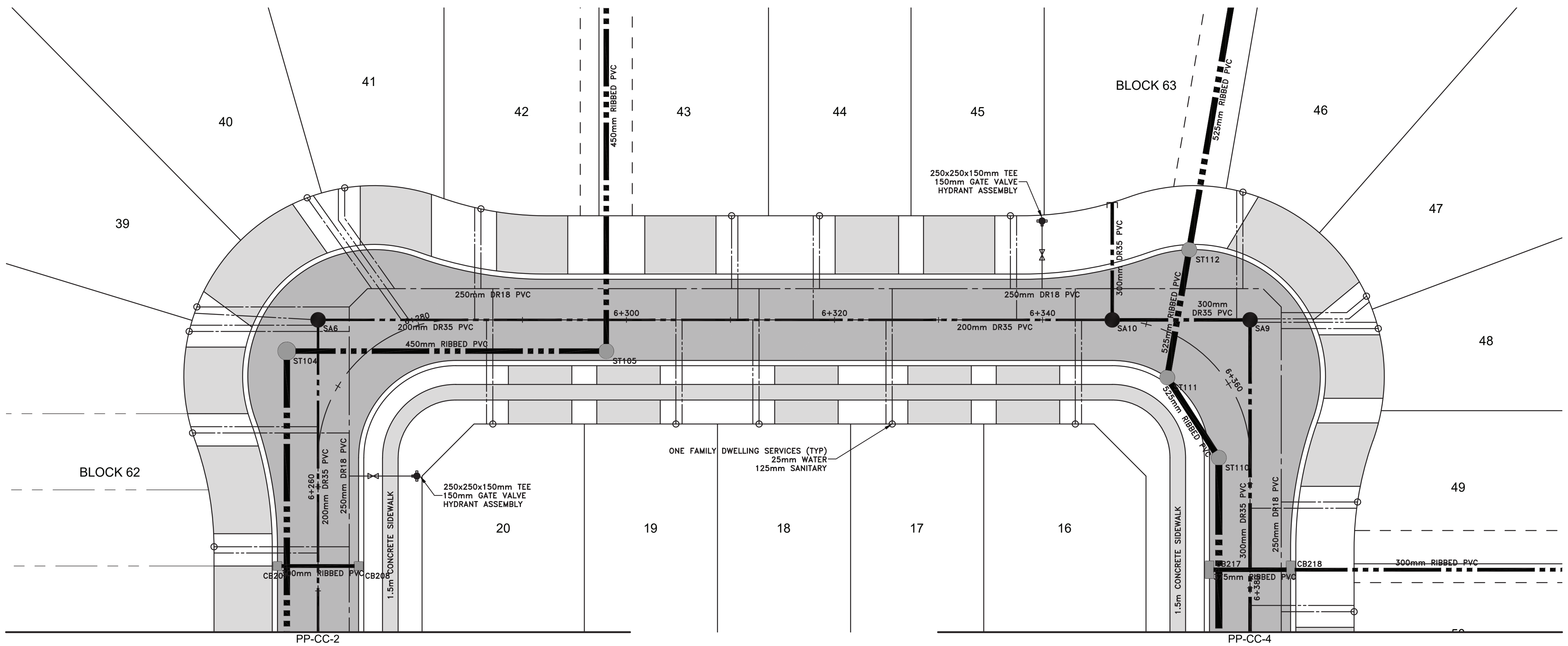
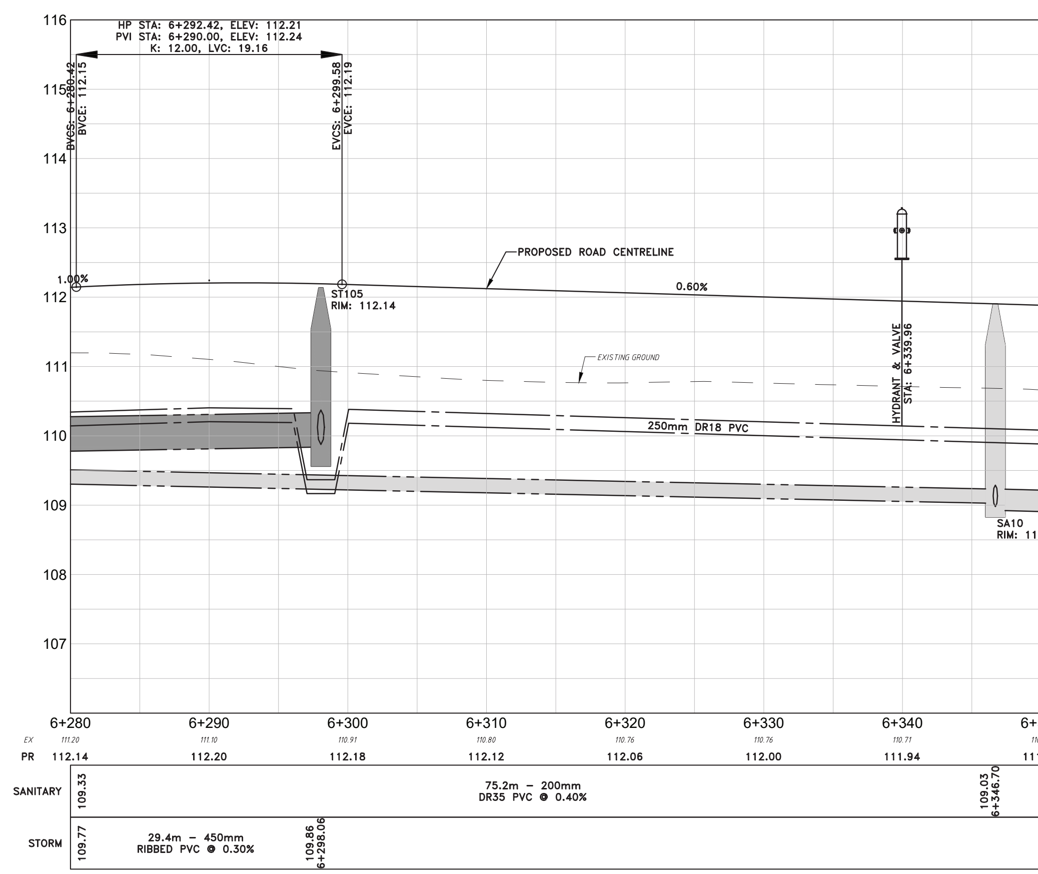
COUSINS CRESCENT





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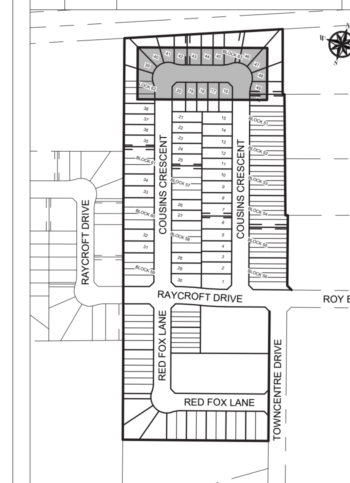
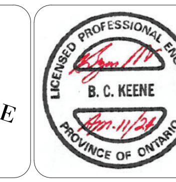


KEY PLAN
SCALE - N.T.S.



JEWELL ENGINEERING

2215100 ONTARIO INC.
2380416 ONTARIO INC.
SETTLERS RIDGE EAST
PHASE 3

CITY OF BELLEVILLE

PLAN & PROFILE
COUSINS CRESCENT
STA. 6+280 to 6+350

DRAWN BY: JH	PROJECT NO: 190-4502-3
DESIGNED BY: JH/BK	DATE: April 2024
CHECKED BY:	SCALE: HORIZONTAL - 1:250, VERTICAL - 1:50
APPROVED BY: BK	CONTRACT NO:
	DRAWING NO: PP-CC-3

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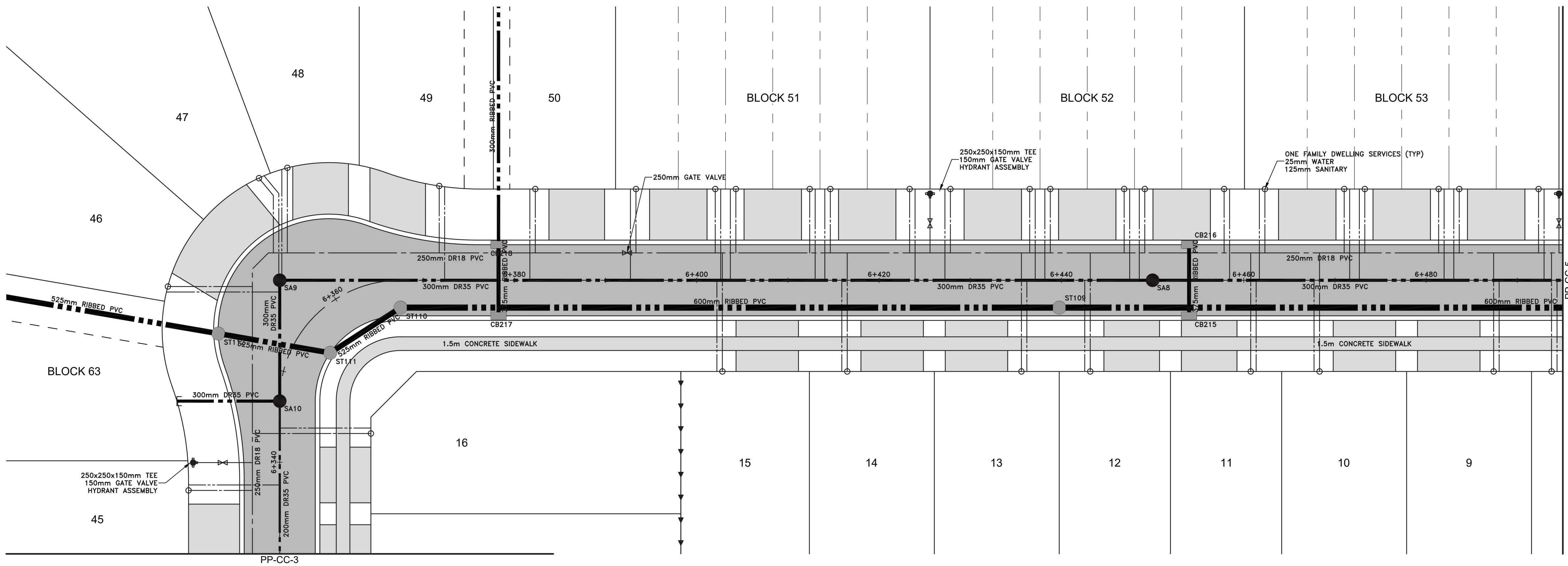
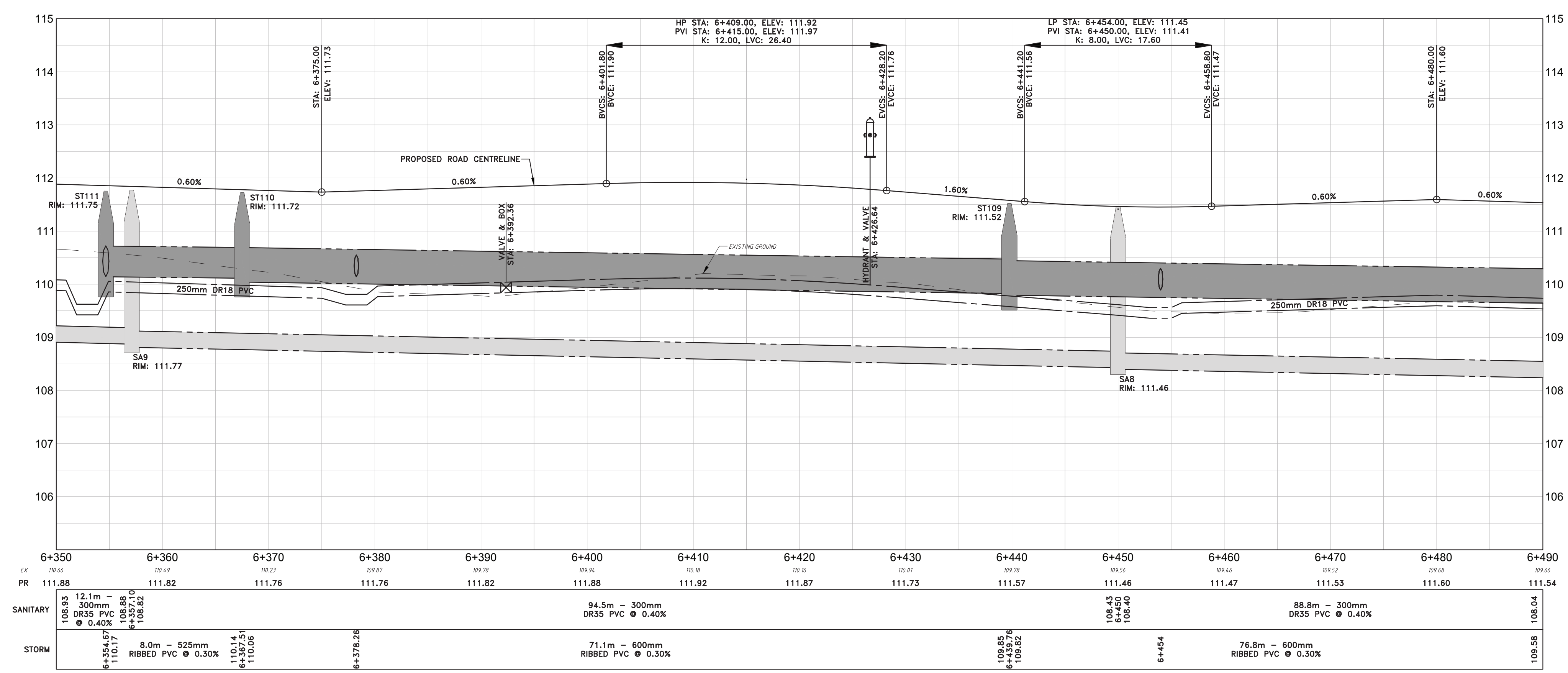
COUSINS CRESCENT





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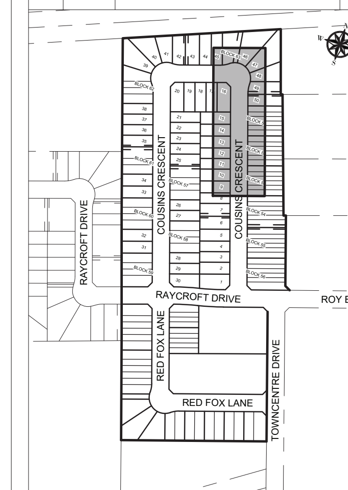
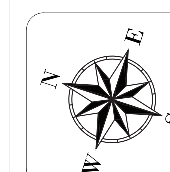
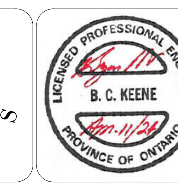


KEY PLAN
SCALE - N.T.S.





JEWELL ENGINEERING

2215100 ONTARIO INC.
2380416 ONTARIO INC.
SETTLERS RIDGE EAST
PHASE 3

CITY OF BELLEVILLE

PLAN & PROFILE
COUSINS CRESCENT
STA. 6+350 to 6+490

DRAWN BY: JH	PROJECT NO: 190-4502-3
DESIGNED BY: JH/BK	DATE: April 2024
CHECKED BY:	SCALE: HORIZONTAL - 1:250 VERTICAL - 1:50
APPROVED BY: BK	CONTRACT NO:
	DRAWING NO: PP-CC-4

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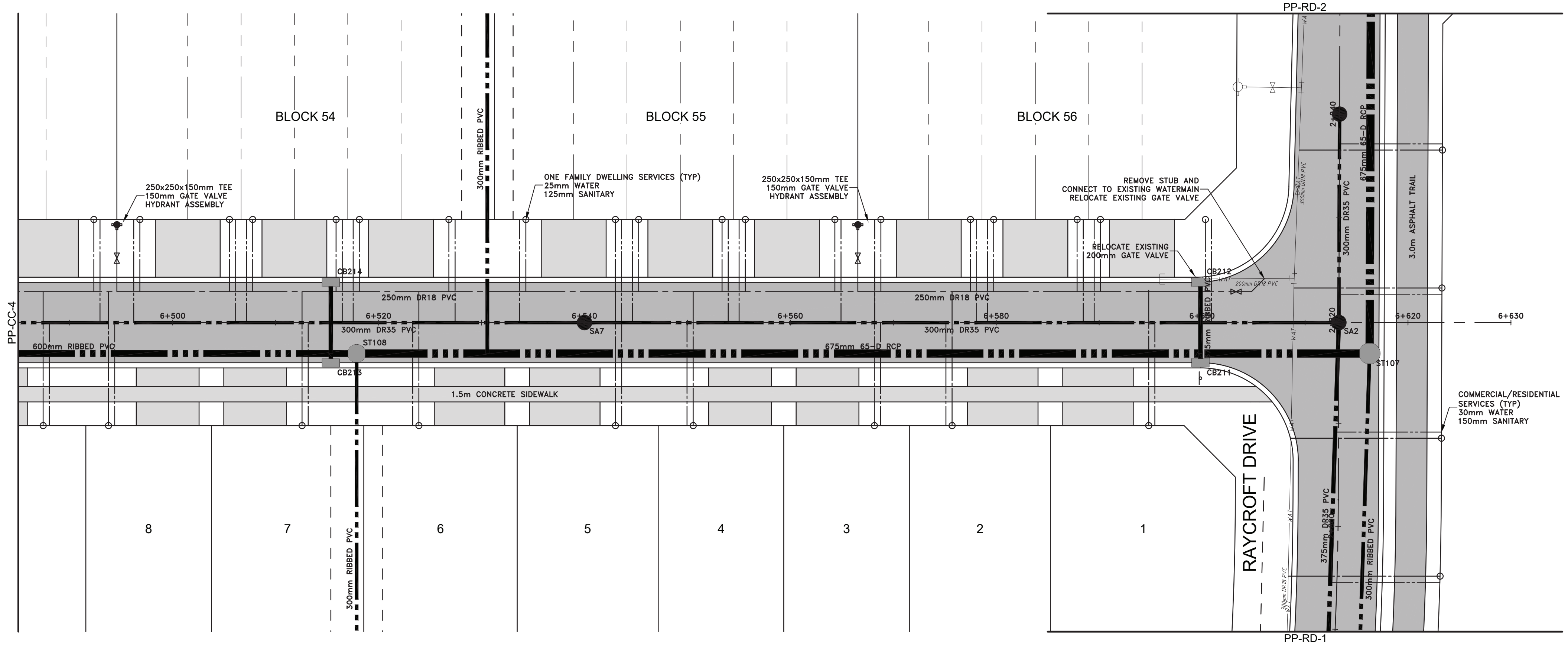
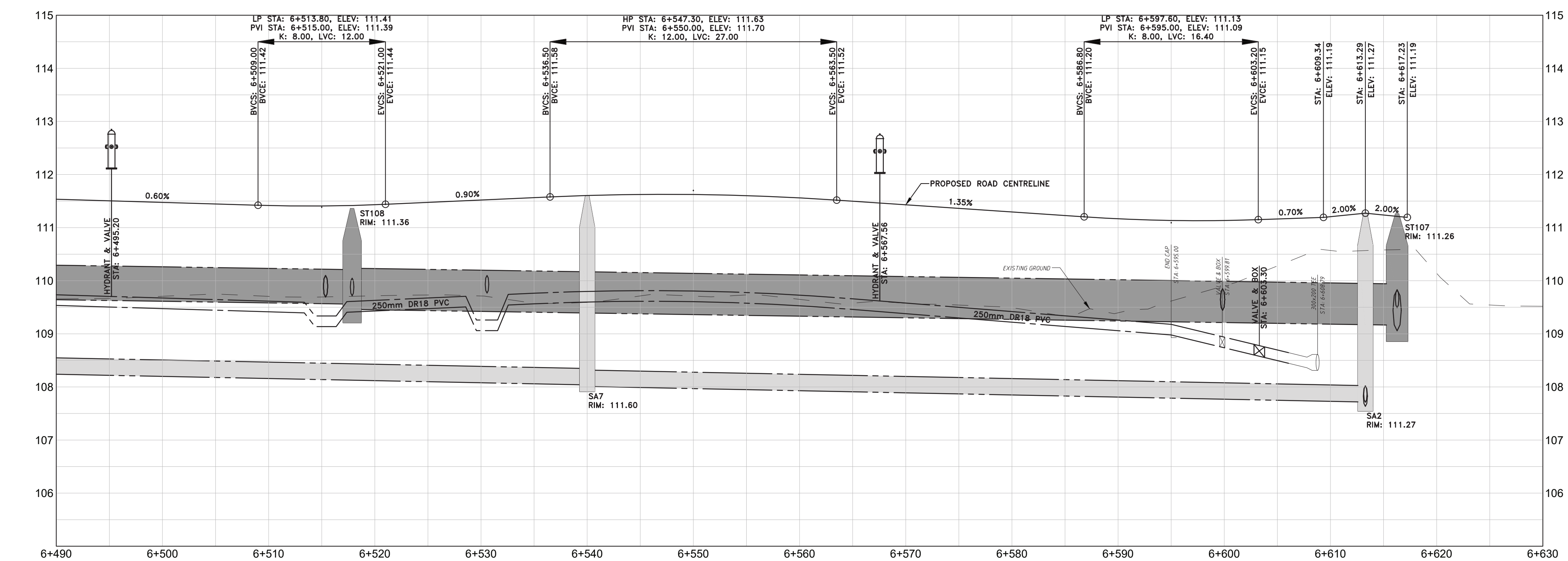
COUSINS CRESCENT





	6+490	6+500	6+510	6+520	6+530	6+540	6+550	6+560	6+570	6+580	6+590	6+600	6+610	6+620	6+630
EX	109.66	109.71	109.71	109.72	109.71	109.59	109.71	109.65	109.58	109.49	109.40	109.90	110.57	110.14	109.52
PR	111.54	111.48	111.42	111.43	111.52	111.60	111.62	111.56	111.43	111.30	111.17	111.13	111.21		

SANITARY: 108.40 — 88.8m – 300mm DR35 PVC @ 0.40% — 108.04 6+540 108.01 — 72.1m – 300mm DR35 PVC @ 0.40% — 107.72 6+613.29

STORM: 109.82 — 76.8m – 600mm RIBBED PVC @ 0.30% — 6+515.36 — 109.58 6+517.86 109.51 — 6+531.38 — 96.8m – 675mm 65-D RCP @ 0.30% — 6+599.84 — 109.21 6+616.28

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REVISIONS

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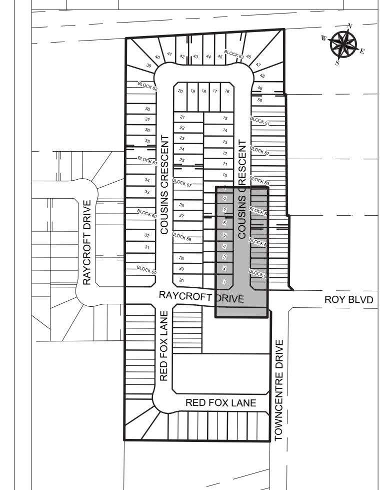
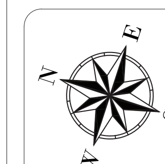
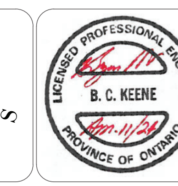


KEY PLAN
SCALE - N.T.S.





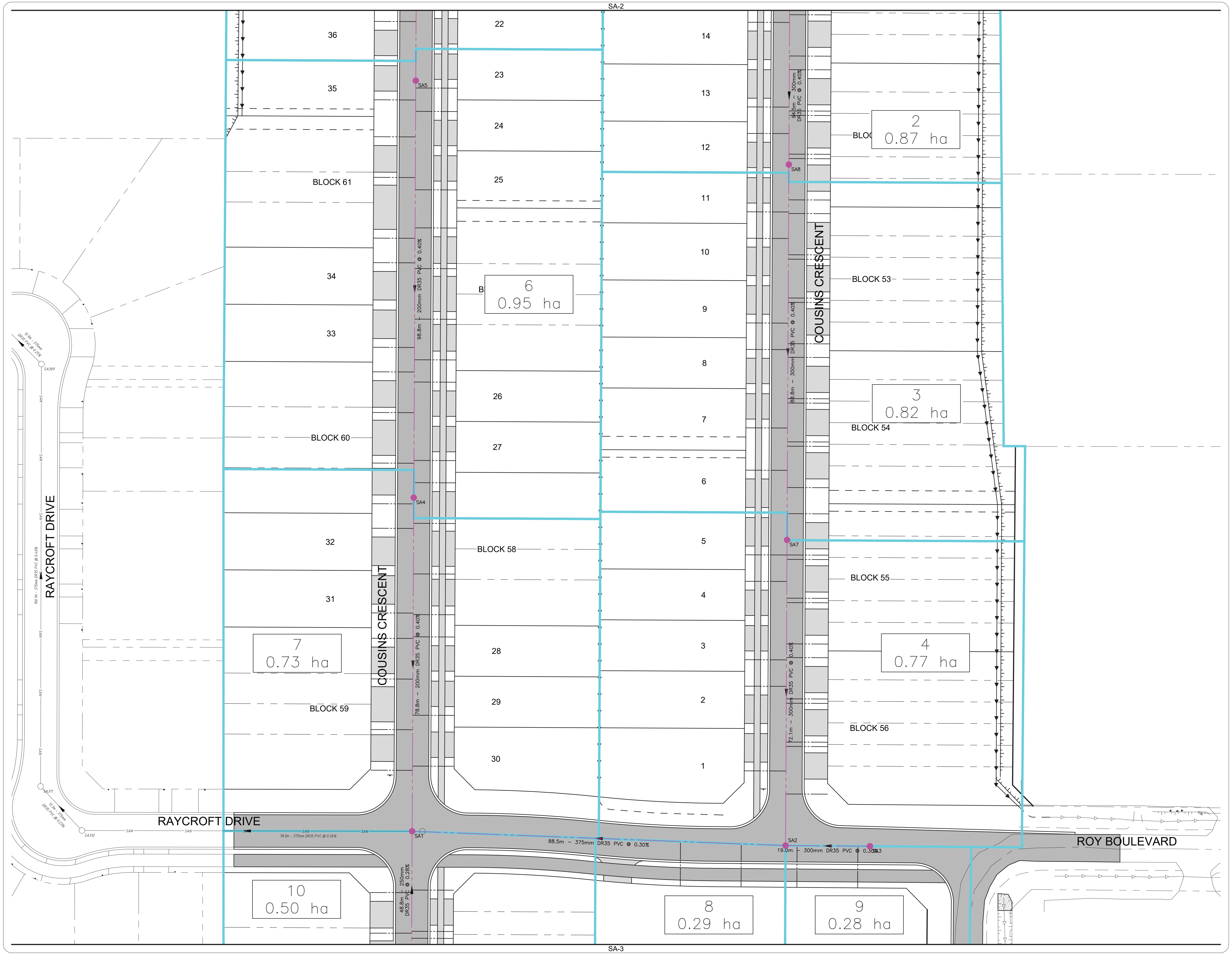
JEWELL ENGINEERING

2215100 ONTARIO INC.
2380416 ONTARIO INC.
SETTLERS RIDGE EAST
PHASE 3

CITY OF BELLEVILLE

PLAN & PROFILE
COUSINS CRESCENT
STA. 6+490 to 6+630

DRAWN BY: JH	PROJECT NO: 190-4502-3
DESIGNED BY: JH/BK	DATE: April 2024
CHECKED BY:	SCALE: HORIZONTAL - 1:250 VERTICAL - 1:50
APPROVED BY: BK	CONTRACT NO:
DRAWING NO: PP-CC-5	



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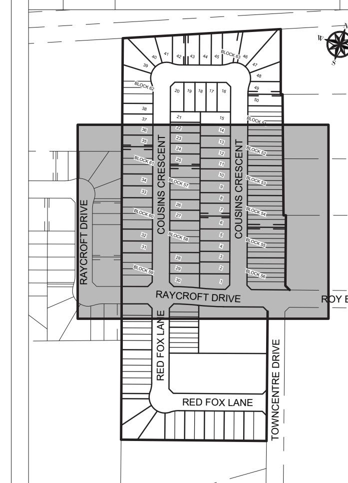

KEY PLAN
SCALE - N.T.S.

B. C. KEENE
LICENSED PROFESSIONAL ENGINEER
PROVINCE OF ONTARIO

JEWELL ENGINEERING

2215100 ONTARIO INC.
2380416 ONTARIO INC.
SETTLERS RIDGE EAST
PHASE 3

CITY OF BELLEVILLE

SANITARY SEWER NETWORK
CATCHMENT PLAN
1 of 3

DRAWN BY: JH	PROJECT NO: 190-4502-3
DESIGNED BY: JH/BK	DATE: April 2024
CHECKED BY:	SCALE: HORIZONTAL - 1:400, VERTICAL - N/A
APPROVED BY: BK	CONTRACT NO:
	DRAWING NO: SA-1

02/29/2024

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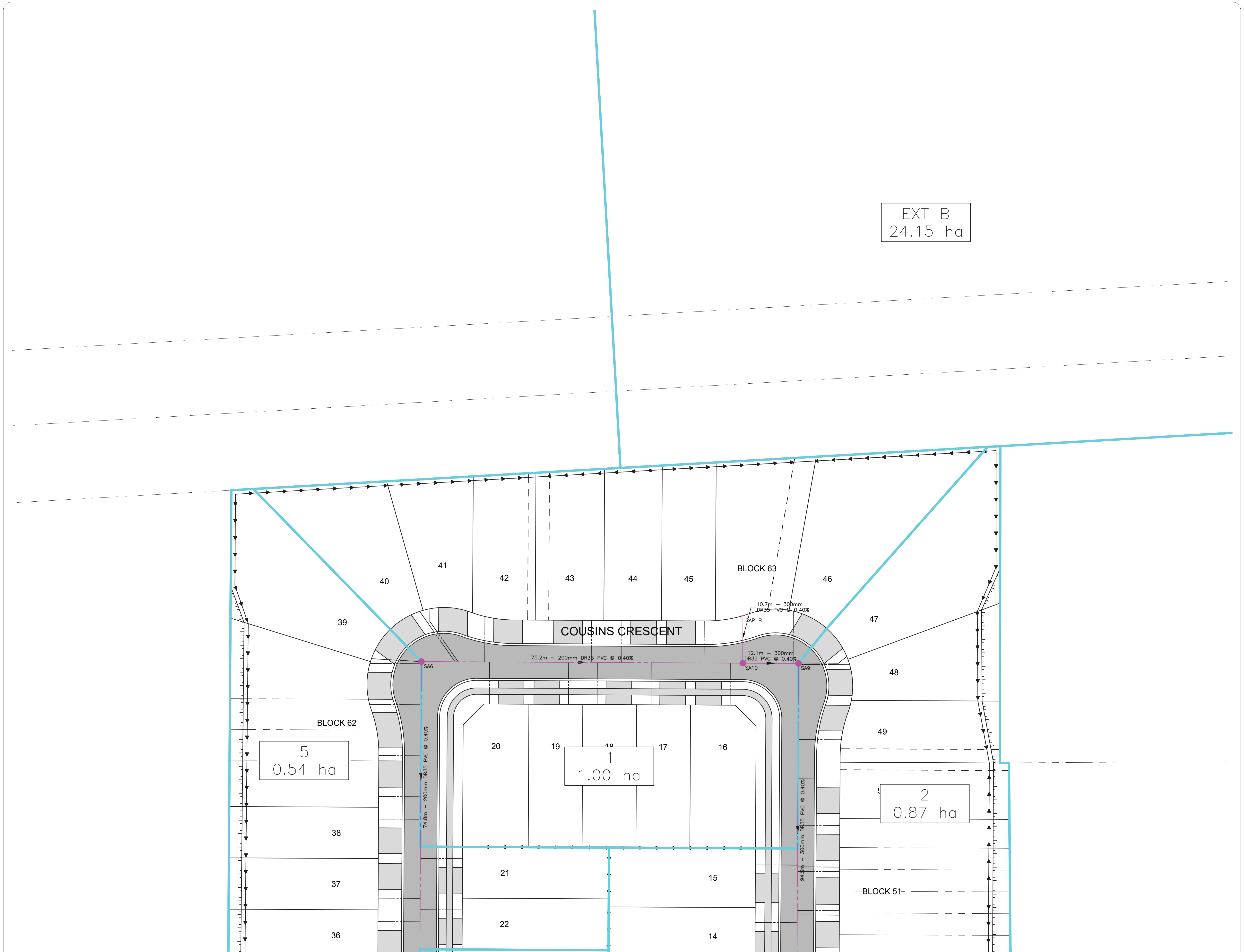

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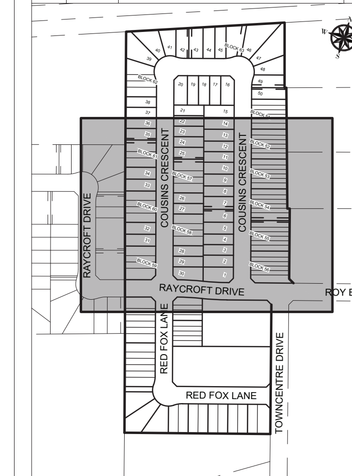
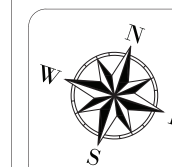
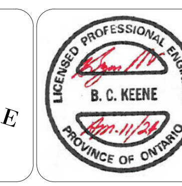
A	03/15/2024	ISSUED FOR CLIENT REVIEW	JH
1	04/11/2024	ENGINEERING SUBMISSION #1	JH



KEY PLAN
SCALE - N.T.S.





JEWELL ENGINEERING

2215100 ONTARIO INC.
2380416 ONTARIO INC.
SETTLERS RIDGE EAST
PHASE 3

CITY OF BELLEVILLE

SANITARY SEWER NETWORK
CATCHMENT PLAN
2 of 3

DRAWN BY: JH	PROJECT NO: 190-4502-3	
DESIGNED BY: JH/BK	DATE: April 2024	
CHECKED BY:	SCALE: HORIZONTAL - 1:400 VERTICAL - N/A	
APPROVED BY: BK	CONTRACT NO:	DRAWING NO: SA-2

SANITARY SEWER DESIGN SHEET

Peak Design Flow Calculation

Peak Design Flow (Q_d) = Peak Population Flow (Q_p) + Peak Extraneous Flow (Q_i)

$Q_d = Q_p + Q_i$

$Q_p = \frac{PqM}{86.4}$

$Q_i = IA$

$M = 1 + \frac{14}{4+\sqrt{P}}$

Where:

q	Average daily per capita flow	**350** L/d*cap
I	Unit of peak extraneous flow	**0.28** L/s*ha
M	Harmon peaking factor (min = 2)	
P	Population in 1000's	
A	Area in hectares (ha)	

Commercial Flows

Commercial Flows **1.05** L/s*ha

Peaking Factor **Included**

Residential Flows

Population Density **3.0** cap/unit

Pipe Capacity by Manning's Equation

$Q = \frac{1}{n} A R^{2/3} S^{1/2}$

Where:

A	Area of pipe in m^2	
R	Hydraulic radius = a/p	
P	Wetted perimeter	
S	Slope (m/m)	
n	Manning's friction coef.	

Check

$Q_d \leq 0.8 \cdot (Pipe\ Capacity)$

$0.6 \leq V \leq 3.0$

use Actual V if d:D < **0.3**

LOCATION				PEAK FLOW CALCULATION												SEWER DATA									
				RESIDENTIAL						COMMERCIAL															
				INDIVIDUAL			CUMULATIVE																		
CATCHMENT	STREET	UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	UNITS	POP.	AREA (A) (ha)	POP.	AREA (A) (ha)	RESID. PEAKING FACTOR (M)	INDIVIDUAL AREA (A) (ha)	CUMULATIVE AREA (A) (ha)	POP. FLOW Q_p (L/s)	COMM. FLOW Q_c (L/s)	PEAK EX. Q_i (L/s)	DESIGN FLOW Q_d (L/s)	LENGTH (m)	PIPE SIZE (mm)	PIPE MATERIAL	GRADE USE m/m (%)	CAPACITY n = 0.013 (L/s)	FULL FLOW VELOCITY (m/s)	RATIO d:D	ACTUAL VELOCITY AT Qd (m/s)	VELOCITY & CAPACITY CHECK	% FULL q/Q
13	Red Fox Ln	SA14	SA13	16	48.0	0.66	48.0	0.66	4.32		0.00	0.8	0.0	0.2	1.0	65.5	250	PVC	0.28%	31.47	0.64	0.12	0.64	OK	3.3%
12	Red Fox Ln	SA13	SA12	30	90.0	0.83	138.0	1.49	4.20		0.00	2.3	0.0	0.4	2.8	65.5	250	PVC	0.28%	31.47	0.64	0.20	0.64	OK	8.8%
11	Red Fox Ln	SA12	SA11	11	33.0	0.40	171.0	1.89	4.17		0.00	2.9	0.0	0.5	3.4	71.9	250	PVC	0.28%	31.47	0.64	0.22	0.64	OK	10.9%
10	Red Fox Ln	SA11	SA1	12	36.0	0.50	207.0	2.39	4.14		0.00	3.5	0.0	0.7	4.1	48.8	250	PVC	0.28%	31.47	0.64	0.24	0.64	OK	13.2%
EXT B	Park	CAP B	SA10		0.0		0.0	0.00	4.50	32.22	32.22	0.0	33.8	0.0	33.8	10.7	300	PVC	0.40%	61.16	0.87	0.53	0.87	OK	55.3%
1	Cousins Cres	SA6-E	SA10	12	36.0	1.00	36.0	1.00	4.34		0.00	0.6	0.0	0.3	0.9	75.2	200	PVC	0.40%	20.74	0.66	0.14	0.66	OK	4.4%
	Cousins Cres	SA10	SA9		0.0		36.0	1.00	4.34		32.22	0.6	33.8	0.3	34.7	12.1	300	PVC	0.40%	61.16	0.87	0.54	0.87	OK	56.8%
2	Cousins Cres	SA9	SA8	19	57.0	0.87	93.0	1.87	4.25		32.22	1.6	33.8	0.5	36.0	94.5	300	PVC	0.40%	61.16	0.87	0.55	0.87	OK	58.8%
3	Cousins Cres	SA8	SA7	20	60.0	0.82	153.0	2.69	4.19		32.22	2.6	33.8	0.8	37.2	88.8	300	PVC	0.40%	61.16	0.87	0.56	0.87	OK	60.8%
4	Cousins Cres	SA7	SA2	16	48.0	0.77	201.0	3.46	4.15		32.22	3.4	33.8	1.0	38.2	72.1	300	PVC	0.40%	61.16	0.87	0.57	0.87	OK	62.4%
5	Cousins Cres	SA6-S	SA5	10	30.0	0.54	30.0	0.54	4.35		0.00	0.5	0.0	0.2	0.7	74.8	200	PVC	0.40%	20.74	0.66	0.12	0.66	OK	3.3%
6	Cousins Cres	SA5	SA4	19	57.0	0.95	87.0	1.49	4.26		0.00	1.5	0.0	0.4	1.9	98.8	200	PVC	0.40%	20.74	0.66	0.20	0.66	OK	9.2%
7	Cousins Cres	SA4	SA1	13	39.0	0.73	126.0	2.22	4.21		0.00	2.2	0.0	0.6	2.8	78.8	200	PVC	0.40%	20.74	0.66	0.24	0.66	OK	13.4%
9	Raycroft Dr	SA3	SA2	8	24.0	0.28	24.0	0.28	4.37	0.05	0.05	0.4	0.1	0.1	0.6	39.0	300	PVC	0.30%	52.97	0.75	0.06	0.75	OK	1.0%
8	Raycroft Dr	SA2	SA1	8	24.0	0.29	249.0	4.03	4.11	0.05	32.32	4.1	33.9	1.1	39.2	88.5	375	PVC	0.30%	96.03	0.87	0.44	0.87	OK	40.8%
	Raycroft Dr	SA1	*SA312*		0.0		582.0	8.64	3.94		32.32	9.3	33.9	2.4	45.6	*78.0*	*375*	*PVC*	*0.26%*	89.40	0.81	0.51	0.81	OK	51.1%
	Stacked Towns	Service	Lateral	10	30.0	0.25	30.0	0.25	4.35		0.00	0.5	0.0	0.1	0.6	10.0	150	PVC	2.00%	21.54	1.22	0.11	1.22	OK	2.8%

Jewell Engineering Inc.
1 - 71 Millennium Parkway
Belleville, ON K8P 4Z5
Tel: 613-969-1111
Fax: 613-969-8988
Website: www.jewelleng.ca

Note:
All peaking factors are above the minimum of 2.00

Designed: Julie Humphries, C.E.T.
Checked: Bryon Keene P.Eng
Date: April 11, 2024

Project: Settlers Ridge East Phase 3 & Towncentre Place

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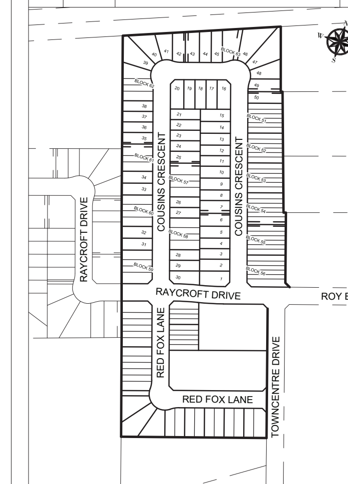
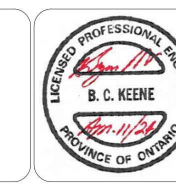


KEY PLAN
SCALE - N.T.S.



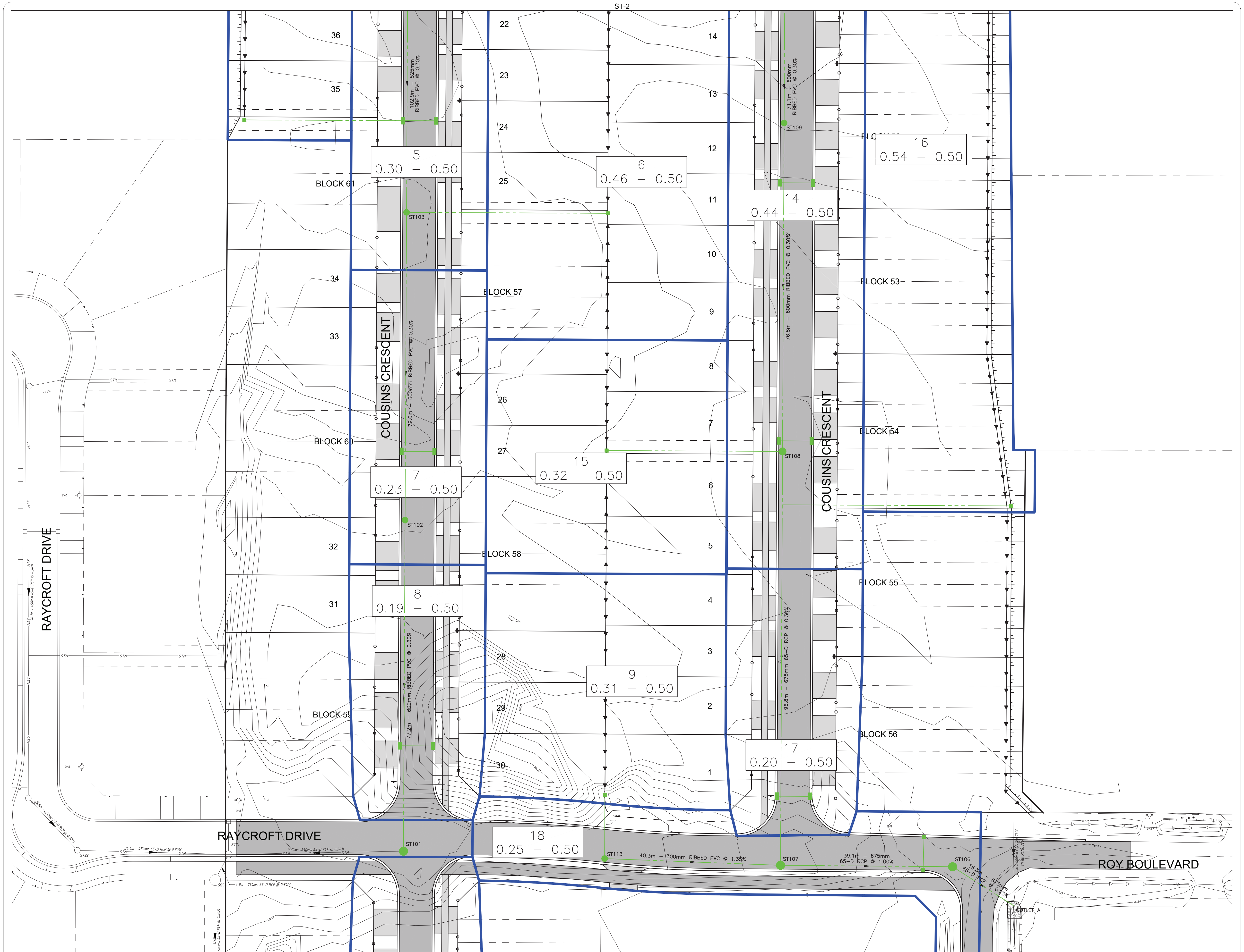
JEWELL ENGINEERING

2215100 ONTARIO INC.
2380416 ONTARIO INC.
SETTLERS RIDGE EAST
PHASE 3

CITY OF BELLEVILLE

SANITARY SEWER NETWORK
DESIGN SHEET

DRAWN BY: JH	PROJECT NO: 190-4502-3
DESIGNED BY: JH/BK	DATE: April 2024
CHECKED BY:	SCALE: HORIZONTAL - N/A VERTICAL - N/A
APPROVED BY: BK	CONTRACT NO:
	DRAWING NO: SA-4



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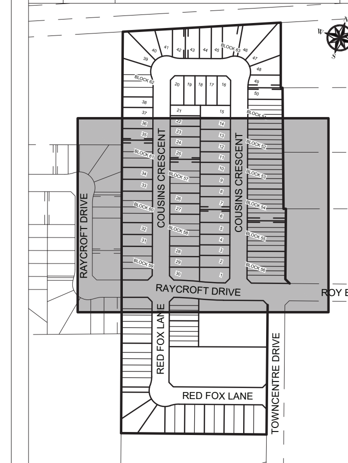

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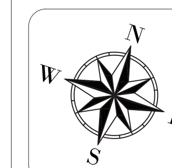

LICENSED PROFESSIONAL ENGINEER
B. C. KEENE
PROVINCE OF ONTARIO

JEWELL ENGINEERING

2215100 ONTARIO INC.
2380416 ONTARIO INC.
SETTLERS RIDGE EAST
PHASE 3

CITY OF BELLEVILLE

STORM SEWER NETWORK
CATCHMENT PLAN
1 of 3

DRAWN BY: JH	PROJECT NO: 190-4502-3
DESIGNED BY: JH/BK	DATE: April 2024
CHECKED BY:	SCALE: HORIZONTAL - 1:400 VERTICAL - N/A
APPROVED BY: BK	CONTRACT NO:
	DRAWING NO: ST-1

02/28/2024

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02/28/2024

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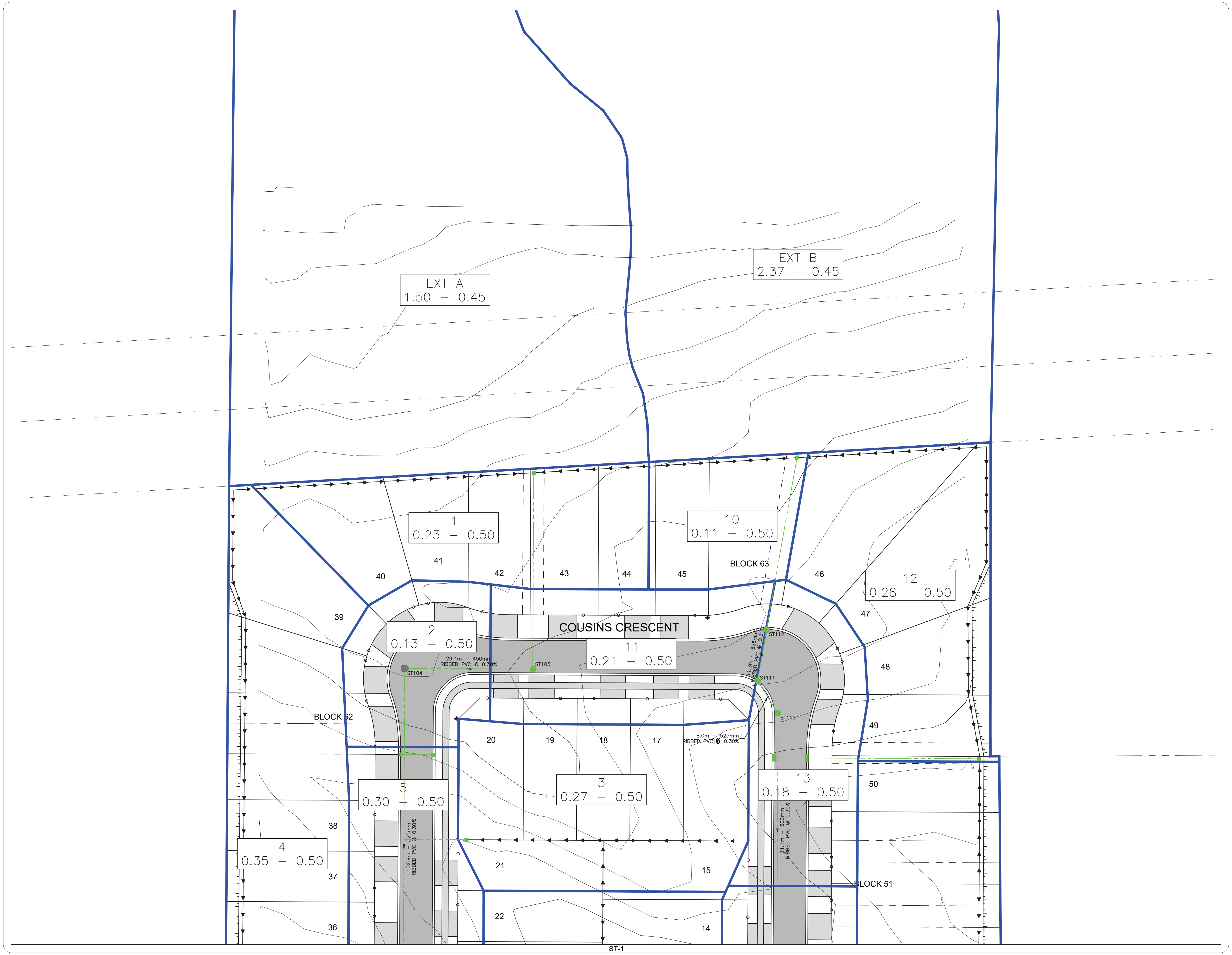

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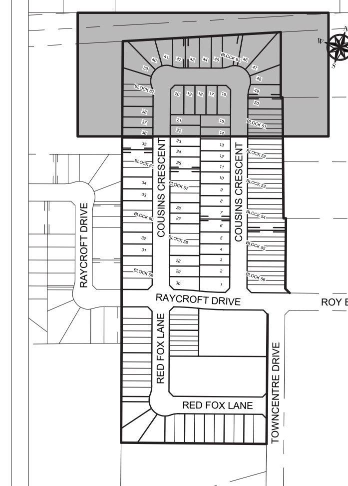

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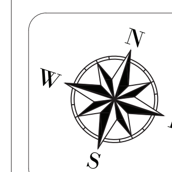
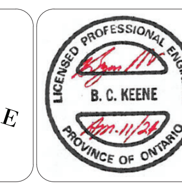
SCALE - N.T.S.





JEWELL ENGINEERING

2215100 ONTARIO INC.
2380416 ONTARIO INC.
SETTLERS RIDGE EAST
PHASE 3

CITY OF BELLEVILLE

STORM SEWER NETWORK
CATCHMENT PLAN
2 of 3

DRAWN BY: JH	PROJECT NO: 190-4502-3	
DESIGNED BY: JH/BK	DATE: April 2024	
CHECKED BY:	SCALE: HORIZONTAL - 1:400 VERTICAL - N/A	
APPROVED BY: BK	CONTRACT NO:	DRAWING NO: ST-2

STORM SEWER DESIGN SHEET

Peak Runoff Estimate by Rational Method

$$Q = \frac{1}{360} C\, i\, A$$

Where:

Q = Peak Flow in cms
C = Runoff Coefficient
i = Rainfall Intensity in mm/hr
A = Area in hectares

Intensity Equation: **Belleville**

$$i = A * T_c^{\,B}$$

Where:

i = Rainfall Intensity in mm/hr
T_c = Time of Concentration in hours

5-Year Parameters

A = 26.4
B = -0.677

Pipe Capacity by Manning's Equation

$$Q = \frac{1}{n} A\, R^{2/3}\, S^{1/2}$$

Where:

Manning's Coef	
CSP	0.024
RCP/PVC	0.013

A = area of pipe in m^2
R = Hydraulic radius = A / P
P = Wetted perimeter
S = Slope (m/m)
n = Manning's friction coef.

Check

$q \leq Q$
$V \leq 6\ m/s$

LOCATION				PEAK FLOW CALCULATION									PROPOSED SEWER									
STREET	CATCHMENT	FROM	TO	CATCHMENT AREAS / RUNOFF COEFFICIENT 0.25	0.45	0.50	0.60	R.C. x A (ha)	CUM. R.C x A (ha)	TIME OF CONCENTRATION (min)	INTENSITY (mm/hr)	PEAK FLOW (m^3/s)	DIAMETER (mm)	LENGTH (m)	TYPE OF PIPE	GRADE (m/m) (%)	CAPACITY (m^3/s)	FULL FLOW VELOCITY (m/s)	TIME OF FLOW (min)	ACTUAL VELOCITY AT Q_d (m/s)	q/Q (%)	CHECK CAPACITY
Cousins Cres	Ext A, 1	ST105	ST104		1.50	0.23		0.79	0.79	20.00	55.5	0.12	450	29.5	RCP	0.30%	0.16	0.98	0.50	1.09	78.1%	OK
	2, 3, 4, 5	ST104	ST103			1.05		0.53	1.32	20.50	54.6	0.20	525	103.9	RCP	0.30%	0.24	1.09	1.59	1.22	84.8%	OK
	6, 7	ST103	ST102			0.69		0.35	1.66	22.09	51.9	0.24	600	71.1	RCP	0.30%	0.34	1.19	1.00	1.29	71.2%	OK
	8	ST102	ST101			0.19		0.10	1.76	23.09	50.4	0.25	600	77.2	RCP	0.30%	0.34	1.19	1.08	1.30	73.1%	OK
Raycroft Dr		ST101	ST21					0.00	1.76	24.17	48.9	0.24	*750*	39.9	*RCP*	*0.30%*	0.61	1.38	0.48	1.29	39.1%	OK
Easement	*116,117,118,119*	ST21	OGS4			1.80		0.90	2.66	24.65	48.2	0.36	*750*	*4.9*	*RCP*	*0.30%*	0.61	1.38	0.06	1.43	58.4%	OK
		OGS4	ST20					0.00	2.66	24.71	48.1	0.36	*750*	*40.3*	*RCP*	*0.30%*	0.61	1.38	0.49	1.43	58.3%	OK
		ST20	HW57					0.00	2.66	25.20	47.5	0.35	*750*	*28.9*	*RCP*	*0.30%*	0.61	1.38	0.35	1.42	57.5%	OK
Raycroft Dr	9	ST113	ST107			0.31		0.16	0.16	15.00	67.5	0.03	300	40.3	PVC	1.35%	0.11	1.59	0.42	1.33	25.9%	OK
Cousins Cres	Ext B, 10, 11	ST112	ST111		2.37	0.32		1.23	1.23	20.00	55.5	0.19	525	11.3	PVC	0.30%	0.24	1.09	0.17	1.22	80.4%	OK
		ST111	ST110					0.00	1.23	20.17	55.2	0.19	525	8.0	PVC	0.30%	0.24	1.09	0.12	1.22	79.9%	OK
	12, 13	ST110	ST109			0.46		0.23	1.46	20.30	55.0	0.22	600	71.1	PVC	0.30%	0.34	1.19	1.00	1.27	66.2%	OK
	14	ST109	ST108			0.44		0.22	1.68	21.29	53.2	0.25	600	76.8	PVC	0.30%	0.34	1.19	1.08	1.30	73.8%	OK
	15, 16, 17	ST108	ST107			1.06		0.53	2.21	22.37	51.5	0.32	675	96.8	RCP	0.30%	0.46	1.29	1.25	1.38	68.6%	OK
Raycroft Dr	18	ST107	ST106			0.25		0.13	2.49	23.62	49.6	0.34	675	38.1	RCP	1.00%	0.84	2.35	0.27	2.22	40.8%	OK
Raycroft Dr		ST106	OUTLET A					0.00	2.49	23.89	49.2	0.34	675	54.3	RCP	0.25%	0.42	1.17	0.77	1.32	81.0%	OK
Red Fox Ln	19	ST115	ST114				0.43	0.26	0.26	15.00	67.5	0.05	300	91.6	PVC	0.60%	0.07	1.06	1.44	1.12	64.6%	OK
		ST114	OUTLET B					0.00	0.26	16.44	63.4	0.05	300	14.0	PVC	1.90%	0.13	1.89	0.12	1.70	34.1%	OK
Red Fox Ln	20	ST118	ST117				0.31	0.19	0.19	15.00	67.5	0.03	300	52.2	PVC	0.60%	0.07	1.06	0.82	1.04	46.6%	OK
Service Route		ST117	ST116					0.00	0.19	15.82	65.1	0.03	300	8.5	PVC	1.30%	0.11	1.56	0.09	1.37	30.5%	OK
		ST116	OUTLET C					0.00	0.19	15.82	65.1	0.03	300	46.9	PVC	1.80%	0.13	1.84	0.43	1.54	25.9%	OK

JEWELL ENGINEERING
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1-71 Millennium Parkway
Belleville, ON, K8N 4Z5
Ph. 613-969-1111
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Designed:	Julie Humphries, C.E.T.
Checked:	Bryon Keene, P.Eng.
Date:	April 11, 2024
Project:	Settlers Ridge Phase 3 & Towncentre Place

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- ALL UTILITY LOCATIONS SHOWN ON THE DRAWINGS ARE APPROXIMATE. THE CONTRACTOR SHALL CONFIRM THE LOCATION ON SITE AND ASSUME ALL LIABILITY FOR DAMAGE TO ALL UTILITIES.
- EXCLUDING THE BENCHMARK AND DESCRIPTION PROVIDED FOR THIS PROJECT, NO OTHER ELEVATIONS ARE TO BE USED AS A REFERENCE ELEVATION FOR ANY PURPOSE.

METRIC NOTE:

- ALL DIMENSIONS SHOWN ARE IN METRES OR MILLIMETRES, UNLESS OTHERWISE NOTED.

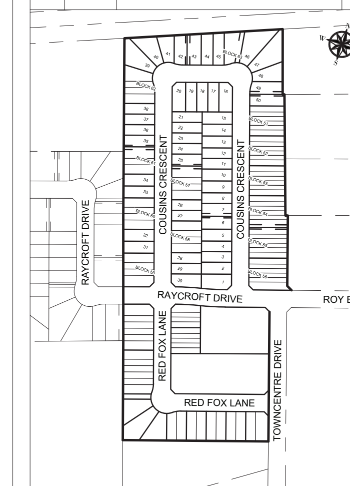
GEOMETRIC NOTE:

- ALL SURVEY DATA SHOWN ON THIS DRAWING WAS RECORDED USING REAL-TIME KINETIC (RTK) GPS OBSERVATIONS IN REFERENCE TO UTM 18 NORTH COORDINATE SYSTEM.
- ALL ELEVATIONS ARE IN REFERENCE TO LOCAL DATUM NAD83 - GEODETIC MODEL HT2_0, UNLESS DESCRIBED OTHERWISE.

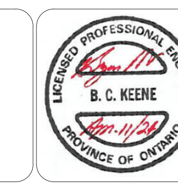
* * DRAWINGS ARE NOT TO BE SCALED * *

REVISIONS

NO.	DATE	DESCRIPTION	BY
A	03/15/2024	ISSUED FOR CLIENT REVIEW	JH
1	04/11/2024	ENGINEERING SUBMISSION #1	JH



KEY PLAN
SCALE - N.T.S.



JEWELL ENGINEERING

2215100 ONTARIO INC.
2380416 ONTARIO INC.
SETTLERS RIDGE EAST
PHASE 3

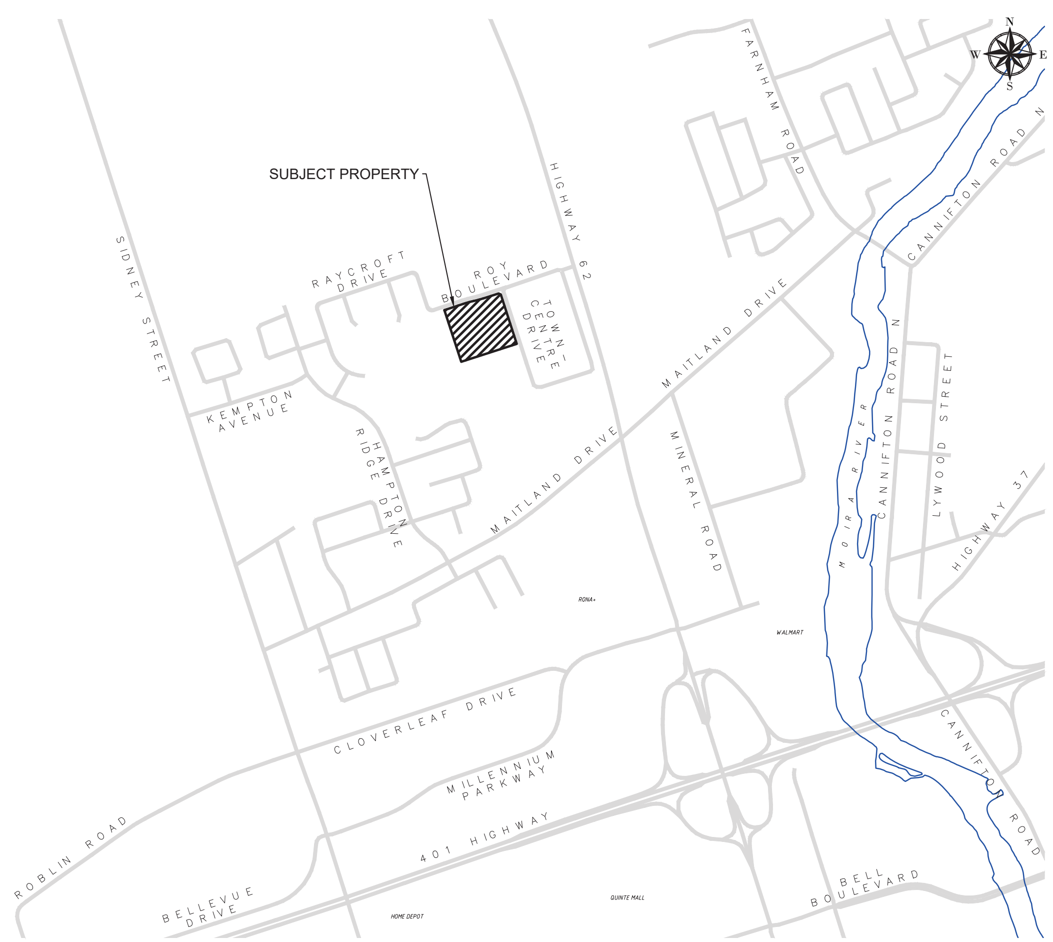
CITY OF BELLEVILLE

STORM SEWER NETWORK
DESIGN SHEET

DRAWN BY: JH	PROJECT NO: 190-4502-3	
DESIGNED BY: JH/BK	DATE: April 2024	
CHECKED BY:	SCALE: HORIZONTAL - N/A, VERTICAL - N/A	
APPROVED BY: BK	CONTRACT NO:	DRAWING NO: ST-4

TOWNCENTRE PLACE

CITY OF BELLEVILLE



DRAWING LIST

DRAWING NO.	DRAWING NAME
ND-1	GENERAL NOTES
ND-2	TYPICAL DETAILS
ND-4	PIPE AND STRUCTURE TABLES
ESC-2	EROSION AND SEDIMENT CONTROL PLAN
GS-3	GENERAL SERVICING PLAN - 3 of 3
GG-3	GENERAL GRADING PLAN - 3 of 3
PP-RFL-1	PLAN & PROFILE - RED FOX LANE - STA. 7+000 to 7+140
PP-RFL-2	PLAN & PROFILE - RED FOX LANE - STA. 7+140 to 7+280
PP-TD-1	PLAN & PROFILE - TOWNCENTRE DRIVE - STA. 8+000 to 8+110
PP-TD-2	PLAN & PROFILE - TOWNCENTRE DRIVE - STA. 8+110 to 8+220
SA-3	SANITARY SEWER NETWORK - CATCHMENT PLAN - 3 of 3
SA-4	SANITARY SEWER NETWORK - DESIGN SHEET
ST-3	STORM SEWER NETWORK - CATCHMENT PLAN - 3 of 3
ST-4	STORM SEWER NETWORK - DESIGN SHEET

BELLEVILLE SUBDIVISION NOTES:

1. THE OWNER COVENANTS AND AGREES NOT TO MAKE A MATERIAL CHANGE OR CAUSE A MATERIAL CHANGES TO BE MADE TO A PLAN, SPECIFICATION, DOCUMENT OR OTHER INFORMATION ON THE BASIS OF WHICH THESE DRAWINGS WERE APPROVED BY THE CITY, WITHOUT NOTIFYING, FILING DETAILS WITH AND OBTAINING THE WRITTEN AUTHORIZATION OF THE CITY.
2. ALL UNDERGROUND AND ABOVEGROUND WORK IS TO BE DONE IN ACCORDANCE WITH CURRENT CITY PLANS, STANDARDS AND SPECIFICATIONS INCLUDING THE FOLLOWING:
   SPEC. M-9 URBAN LOCAL ROAD, 20m RIGHT-OF-WAY STANDARD UTILITY LOCATIONS
   SPEC. M-111A STANDARD RESIDENTIAL ROAD (SUBDIVISIONS)
   SPEC. M-118A CONCRETE HEADER
   SPEC. M-120 TYPICAL 90° CRESCENT
   SPEC. M-43B DEPRESSED CURB AND GUTTER AT SIDEWALK RAMPS
   OPSD 219.110 LIGHT DUTY SILT FENCE BARRIER
   OPSD 310.010 CONCRETE SIDEWALK
   DELETE FIRST SENTENCE IN "NOTE 1"
   DELETE "NOTE 2"
   50mm OF GRANULAR FILL TO BE PLACED UNDER THE SIDEWALK CROSSFALL SLOPE ON THE SIDEWALK IS TO BE 2% OR AS SPECIFIED ON THE GRADING PLAN OR AS DIRECTED BY THE CITY ENGINEER
   OPSD 310.033 CONCRETE SIDEWALK RAMPS AT UNSIGNALIZED INTERSECTION
   OPSD 310.039 CONCRETE SIDEWALK RAMPS TACTILE WALKING SURFACE
   OPSD 400.010 CAST IRON, SQUARE FRAME WITH SQUARE OVERFLOW TYPE DISHED GRATE FOR CATCH BASINS, HERRING BONE OPENINGS
   OPSD 401.010 CAST IRON, SQUARE FRAME WITH CIRCULAR CLOSED OR OPEN COVER FOR MAINTENANCE HOLES
   DELETE "TYPE B" OPEN COVER
   OPSD 403.010 GALVANIZED STEEL, HONEY COMB GRATING FOR DITCH INLET
   OPSD 404.020 ALUMINUM SAFETY PLATFORM FOR CIRCULAR MAINTENANCE HOLE
   OPSD 405.010 MAINTENANCE HOLE STEPS, HOLLOW
   DELETE "RECTANGULAR STAINLESS STEEL" STEP DETAILS
   OPSD 600.040 CONCRETE BARRIER CURB WITH STANDARD GUTTER
   EXCEPT FOR MOUNTABLE CURB DROP BACK OF CURB 75mm, WITH NO ADDITIONAL DROP AT ENTRANCES
   OPSD 701.010 PRECAST CONCRETE MAINTENANCE HOLE, 1200mm DIAMETER
   EXCEPT USE PRECAST MONOLITHIC BASE ONLY
   OPSD 701.011 PRECAST CONCRETE MAINTENANCE HOLE, 1500mm DIAMETER
   EXCEPT USE PRECAST MONOLITHIC BASE ONLY
   OPSD 701.012 PRECAST CONCRETE MAINTENANCE HOLE, 1800mm DIAMETER
   OPSD 701.021 MAINTENANCE HOLE BENCHING AND PIPE OPENING DETAILS
   EXCEPT ON THE "SECTION" DETAIL, THE BENCHING IS TO BE CONSTRUCTED TO THE OBVERT OF THE PIPE, I.E. D MAX
   OPSD 704.010 PRECAST CONCRETE ADJUSTMENT UNITS FOR MAINTENANCE HOLES, CATCH BASINS, AND VALVE CHAMBERS
   OPSD 704.011 HIGH DENSITY POLYETHYLENE ADJUSTMENT UNITS FOR MAINTENANCE HOLES, CATCH BASINS, AND VALVE CHAMBERS
   OPSD 705.010 PRECAST CONCRETE CATCH BASIN, 600 x 600mm
   OPSD 705.020 PRECAST CONCRETE TWIN INLET CATCH BASIN, 600 x 1450mm
   OPSD 705.030 PRECAST CONCRETE DITCH INLET, 600 x 600mm
   OPSD 708.010 CATCH BASIN CONNECTION FOR RIGID MAIN PIPE SEWER
   OPSD 708.020 SUPPORT FOR PIPE AT CATCH BASIN OR MAINTENANCE HOLE
   OPSD 708.030 CATCH BASIN CONNECTION FOR FLEXIBLE MAIN PIPE SEWER
   OPSD 802.030 RIGID PIPE BEDDING, COVER AND BACKFILL
   USE "CLASS B – BEDDING" DETAIL ONLY FOR ALL PIPE BEDDING
   DELETE "CLASS C – BEDDING" DETAIL
   "GRANULAR BEDDING MATERIAL" IS TO BE GRANULAR 'A'
   "COVER MATERIAL" IS TO BE SAND FILL
   DELETE "150mm" FROM "NOTE 2" AND INSERT 225mm FOR THE MINIMUM BEDDING DEPTH
   FOR A "WET TRENCH" CONDITION AS DETERMINED BY THE CITY ENGINEER:
   "GRANULAR BEDDING MATERIAL" IS TO BE AN "HL8 COURSE" GRADATION, CRUSHED LIMESTONE MATERIAL
   "COVER MATERIAL" IS TO BE LIMESTONE SCREENINGS OR GRANULAR 'A' CRUSHED MATERIAL
   OPSD 804.030 CONCRETE HEADWALL FOR PIPE LESS THAN 900mm DIAMETER
   OPSD 804.050 GRATING FOR CONCRETE ENDWALL
   OPSD 1003.010 CAST-IN-PLACE MAINTENANCE HOLE DROP STRUCTURE TEE
   INVERT OF THE INLET END OF THE 90° BEND IS TO BE PLACED AT THE "SPRINGLINE" OF THE MAIN SEWER PIPE
   OPSD 1006.010 SEWER SERVICE CONNECTIONS FOR RIGID MAIN PIPE SEWER
   LATERAL IS TO BE 135mm PVC DR28 PIPE OR AS SPECIFIED
   LATERAL IS TO BE 2.5m BELOW THE PROPOSED GRADE AT THE STREET LINE OR AS SPECIFIED
   "MARKER" AT THE PROPERTY LINE IS TO BE A 2x4 BOARD EXTENDING FROM THE INVERT OF THE LATERAL TO 600mm ABOVE THE GROUND SURFACE, AND THE SECTION OF THE BOARD ABOVE THE GROUND IS TO BE PAINTED SEWER GREEN
   BEDDING AND COVER MATERIALS ARE TO BE SUPPLIED AND INSTALLED IN ACCORDANCE WITH OPSD 802.030, AS REVISED BY THE CITY OF BELLEVILLE'S SPECIAL REVISIONS
3. THE CONTRACTOR IS REQUIRED TO OBTAIN A 'ROAD CUT PERMIT' FROM THE CITY BEFORE COMMENCING ANY WORK ON EXISTING CITY ROAD ALLOWANCES.
4. NO BLASTING IS PERMITTED ON CITY ROAD ALLOWANCES OR WITHIN THE SUBDIVISION.
5. ALL PVC PIPE, INCLUDING RIBBED PVC PIPE 320 KPa, IS TO HAVE A MINIMUM COVER OF 0.8m.
6. RE-BENCH EXISTING MAINTENANCE HOLES AS DIRECTED BY THE CITY ENGINEER.
7. WHEREVER THE COVER OVER A SANITARY SEWER IS 1.5m OR LESS, IT IS TO BE INSULATED WITH 100mm THICK x 1.2m WIDE INSULATION PLACED IN TWO (2) LAYERS WITH STAGGERED JOINTS, AND TO BE STYROFOAM BRAND H.I. TYPE IV.
8. ALL SANITARY SEWERS, STORM SEWERS AND WATERMAINS CONSTRUCTED ON PRIVATE PROPERTY ARE TO BE DONE IN ACCORDANCE WITH THE ONTARIO BUILDING CODE.
9. THE RE-INSTATEMENT OF ASPHALT ROADWAYS, CONCRETE SIDEWALKS AND CURBS ON THE CITY ROAD ALLOWANCE IS TO BE DONE BY THE OWNER IN ACCORDANCE WITH CITY SPECIFICATIONS AT THE OWNER'S EXPENSE.
10. INTERNAL ROAD PAVEMENT IS TO BE CONSTRUCTED AS FOLLOWS:
    40mm HL3 SURFACE COURSE HOT MIX ASPHALT
    50mm HL8 BINDER COURSE HOT MIX ASPHALT
    150mm GRANULAR 'A' (CRUSHED QUARRIED LIMESTONE)
    300mm GRANULAR 'B' (CRUSHED QUARRIED LIMESTONE)
    ALL IN ACCORDANCE WITH THE GEOTECHNICAL CONSULTANT'S RECOMMENDATIONS AND THE CITY'S SPECIFICATIONS. THE ASPHALT CEMENT SHALL BE A PG 58-28.

    EXTERNAL ROAD PAVEMENT IS TO BE CONSTRUCTED AS FOLLOWS:
    40mm HL3 SURFACE COURSE HOT MIX ASPHALT
    50mm HL8 BINDER COURSE HOT MIX ASPHALT
    150mm GRANULAR 'A' (CRUSHED QUARRIED LIMESTONE)
    300mm GRANULAR 'B' (CRUSHED QUARRIED LIMESTONE)
    ALL IN ACCORDANCE WITH THE GEOTECHNICAL CONSULTANT'S RECOMMENDATIONS AND THE CITY'S SPECIFICATIONS. THE ASPHALT CEMENT SHALL BE A PG 58-28.
11. ROAD RESTORATION ON EXISTING ROADS TO BE AT LEAST EQUAL TO EXISTING ROAD OR MINIMUM RESTORATION IS TO BE:
    40mm HL3 SURFACE COURSE HOT MIX ASPHALT
    50mm HL8 BINDER COURSE HOT MIX ASPHALT
    200mm GRANULAR 'A' (CRUSHED QUARRIED LIMESTONE)
    150mm GRANULAR 'B' (CRUSHED QUARRIED LIMESTONE)
    ALL IN ACCORDANCE WITH THE CITY'S SPECIFICATIONS. THE ASPHALT CEMENT SHALL BE A PG 58-28.
12. SUITABLE BACKFILL, FREE OF LARGE LUMPS, STONES, ROOTS AND OTHER FOREIGN MATTER IS TO BE PLACED AT THE BACK OF CURBS AND ALONG BOTH SIDES OF SIDEWALKS WITHIN 72 HOURS OF THE PLACEMENT OF THE CONCRETE. THIS BACKFILL IS TO BE LEVEL WITH THE TOP OF THE CURB AND THE SIDEWALK FOR A DISTANCE OF 0.3m AND THEN GRADED TO EXISTING GROUND WITH A MAXIMUM 3:1 SLOPE. BEFORE THE ACCEPTANCE OF THE ABOVEGROUND WORKS, THE REMAINDER OF THE BOULEVARD BETWEEN THE SIDEWALK AND THE DITCH, THE ROAD SHOULDER OR CURB SHALL BE BACKFILLED AND GRADED AS REQUIRED FOR DRAINAGE.
13. EXISTING SUBDRAINS ALONG THE CURB THAT ARE DISTURBED ARE TO BE RESTORED TO THEIR ORIGINAL CONDITION AT THE OWNER'S EXPENSE. NEW SUBDRAINS ARE TO BE CONSTRUCTED AS SHOWN ON THE PLANS.
14. CHAIN LINK FENCES ARE TO BE 1.5m HIGH, UNLESS OTHERWISE STATED ON THE DRAWINGS, AND CONSTRUCTED IN ACCORDANCE WITH OPSD 972.130, EXCEPT THEY ARE TO HAVE A TOP RAIL AND 40x40mm MESH WITH KNUCKLES UP AND BARBS DOWN.
15. A DRAWING SHOWING DRIVEWAY LOCATIONS IS TO BE SUBMITTED TO THE CITY ENGINEER FOR APPROVAL PRIOR TO THE CONSTRUCTION OF ANY FULL HEIGHT CURB AND GUTTER.
16. SEDIMENT CONTROL TO BE PROVIDED AT CATCH BASINS AS DIRECTED BY THE CITY ENGINEER.
17. ALL BOULEVARDS IN THIS SUBDIVISION THAT DO NOT ABUT A PROPOSED LOT ARE TO BE TOPSOILED (75mm OF TOPSOIL) AND SODDED FROM THE LIMIT OF THE ROAD ALLOWANCE TO THE BACK OF CURB/SHOULDER.
18. A MINIMUM OR 100mm OF TOPSOIL IS TO BE USED FOR ALL TOPSOIL AND SOD INSTALLATION ON PRIVATE AND PARK LANDS.
19. IN A LOCATION WHERE TWO OR MORE CATCH BASINS ARE CONNECTED TO EACH OTHER, THE FOLLOWING CRITERIA APPLIES:
    19.1. IF THE MOST UPSTREAM CATCH BASIN IS A SINGLE CATCH BASIN, THE OUTLET PIPE FROM THIS CATCH BASIN IS TO HAVE A MINIMUM DIAMETER OF 300mm WITH THE REMAINDER OF THE DOWNSTREAM PIPES TO HAVE A MINIMUM DIAMETER OF 375mm.
    19.2. IF THE MOST UPSTREAM CATCH BASIN IS A DOUBLE CATCH BASIN, THE OUTLET PIPE FROM THIS CATCH BASIN IS TO HAVE A MINIMUM DIAMETER OF 375mm ALONG WITH THE REST OF THE DOWNSTREAM OUTLET PIPES.
20. IF AT ALL POSSIBLE, THE MINIMUM GRADE FOR SWALES IS TO BE 1%. IF THIS GRADE IS NOT POSSIBLE, A SUBDRAIN, WHICH IS CONNECTED TO THE OUTLET CATCH BASIN, CAL BE INSTALLED UNDER THE SWALE, AND THEN THE SWALE CAN HAVE A GRADE AS LOW AS 0.5%.
21. EXISTING SANITARY MAINTENANCE HOLES TO BE RAISED WITH MAINTENANCE HOLE TOP ADJUSTMENT UNITS. HOWEVER, IF THE DISTANCE FROM THE PROPOSED TOP OF GRATE TO THE EXISTING FIRST STEP IS GREATER THAN 0.76m, THEN THE EXISTING SANITARY MAINTENANCE HOLE TO BE RAISED IS TO BE BROKEN DOWN TO THE BOTTOM OF THE SLOPED SECTION AND A NEW SECTION IS TO BE CAST IN PLACE COMPLETE WITH LADDER RUNGS IN ACCORDANCE WITH CITY DRAWING SPEC. I. EXISTING SANITARY MAINTENANCE HOLES TO BE LOWERED IN ACCORDANCE WITH CITY DRAWING SPEC. M-I-A (TYPICAL). NEW TOP STEP TO BE PROVIDED ABOVE EXISTING STEPS IF REQUIRED BY THE CITY.
22. DRIVEWAY LOCATIONS ARE TO BE NO CLOSER THAN 1.2m FROM POLES, HANDHOLES, TRANSFORMERS, SECONDARY PEDESTALS, HYDRANTS, AND CURB STOPS.
23. ALL CURB AS INTERSECTIONS SHOULD BE DEPRESSED WHERE THEY INTERSECT WITH SIDEWALKS. SIDEWALK RAMPS AT INTERSECTIONS TO BE CONSTRUCTED IN ACCORDANCE WITH THE CITY STANDARDS.

GENERAL NOTES:

1. ALL ELEVATIONS ARE RELATIVE TO THE BENCHMARKS INDICATED ON THE PLANS.
2. DIMENSIONS ARE IN METRES UNLESS OTHERWISE SPECIFIED.
3. THE CONTRACTOR IS TO VERIFY ALL DIMENSIONS AND GRADES. NOTIFY THE ENGINEER OF ANY DISCREPANCIES BEFORE WORK COMMENCES.
4. THE ORIGINAL TOPOGRAPHY AND GROUND ELEVATIONS, SERVICING AND SURVEY DATA SHOWN ON THESE PLANS ARE SUPPLIED FOR DESIGN AND APPROVAL PURPOSES ONLY AND BELIEVED TO BE ACCURATE. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE ACCURACY OF ALL INFORMATION OBTAINED FROM PLANS FOR CONSTRUCTION PURPOSES.
5. ALL MATERIAL AND CONSTRUCTION METHODS METHODS MUST COMPLY WITH CITY AND ONTARIO PROVINCIAL STANDARDS AND SPECIFICATIONS.
6. CONTRACTOR IS RESPONSIBLE FOR ALL LAYOUT.
7. ALL DISTURBED AREAS TO BE RESTORED TO ORIGINAL CONDITION OR BETTER, UNLESS OTHERWISE SPECIFIED.
8. RESTORE ALL TRENCHES AND SURFACES OF PUBLIC ROAD ALLOWANCES TO A CONDITION OF EQUAL OR BETTER THAN ORIGINAL CONDITION AND TO THE SATISFACTION OF THE APPROPRIATE AUTHORITIES.
9. EXCAVATE AND DISPOSE OF ALL EXCESS EXCAVATED MATERIAL, SUCH AS ASPHALT AND DEBRIS, OFF SITE AS DIRECTED BY THE OWNER. REMOVAL OF MATERIALS TO BE AT THE CONTRACTOR'S EXPENSE.
10. THE CONTRACTOR IS TO DETERMINE THE EXACT LOCATION, SIZE, MATERIAL AND ELEVATION OF ALL EXISTING UTILITIES PRIOR TO COMMENCING CONSTRUCTION. PROTECT AND ASSUME ALL RESPONSIBILITY FOR EXISTING UTILITIES WHETHER OR NOT SHOWN ON THE DRAWINGS. IF THERE IS ANY DISCREPANCY THE CONTRACTOR IS TO NOTIFY THE ENGINEER PROMPTLY.
11. THE EXTENT OF STRAW BALE PROTECTION SHOWN IS APPROXIMATE ONLY AND SUBJECT TO FINAL ADJUSTMENT IN THE FIELD. STRAW BALES TO BE AS PER OPSD 219.100.

SIDE YARD SWALE NOTES:

1. THE OWNER AGREES TO PROVIDE TEMPORARY YARD DRAINAGE FOR LOTS WHICH ARE PROPOSED TO HAVE SIDE YARD SWALES, TO THE SATISFACTION OF THE CITY ENGINEER AND ACKNOWLEDGES THAT THE CITY RETAINS THE RIGHT TO REFUSE TO ISSUE FURTHER BUILDING PERMITS IF SAID TEMPORARY DRAINAGE IS NOT SATISFACTORY. THE OWNER FURTHER AGREES TO CONSTRUCT THE PERMANENT SODDED SIDE YARD SWALE ALONG A LOT LINE UPON COMPLETION OF BOTH HOUSES ADJACENT TO SAID SIDE YARD SWALE AND SHALL PROVIDE TO THE CITY AS-CONSTRUCTED SWALE GRADES CERTIFIED BY A PROFESSIONAL ENGINEER OR ONTARIO LAND SURVEYOR AFTER COMPLETION OF EACH PERMANENT SODDED SIDE YARD SWALE.

WATER SYSTEM NOTES:

1. NOTWITHSTANDING THE FOLLOWING GENERAL NOTES, ALL WATERMAIN PIPE AND FITTINGS, VALVES, HYDRANTS, WATER SERVICES AND ALL OTHER APPURTENANCES ARE TO BE INSTALLED IN ACCORDANCE WITH THEIR RESPECTIVE SPECIFICATION IN THE CURRENT CITY MANUAL OF STANDARD SPECIFICATIONS.
2. THESE NOTES ARE INTENDED TO SUMMARIZE THE CITY'S REQUIREMENTS. HOWEVER, THE CONTRACTOR IS TO CONSULT THE RESPECTIVE CITY STANDARD SPECIFICATIONS FOR FURTHER DETAIL AND NOT RELY SOLELY ON THESE NOTES.
3. UNLESS SPECIFIED OTHERWISE, ALL REFERENCES TO CITY STANDARD SPECIFICATIONS, STANDARD DRAWINGS OR INDUSTRY STANDARDS REFER TO THE LATEST EDITION.
4. THE COVER FOR ALL WATERMAINS AND WATER SERVICES IS TO BE A MINIMUM OF 1.8m.
5. WHERE A WATERMAIN CROSSES OVER OR UNDER A SANITARY SEWER OR STORM SEWER (INCLUDING LATERALS AND CATCH BASIN LEADS), A MINIMUM CLEAR SEPARATION OF 0.5m MUST BE MAINTAINED, MEASURED FROM PIPE WALL TO PIPE WALL.
6. WHERE A WATERMAIN CROSSES OVER OR UNDER OTHER UTILITIES, 0.3m CLEARANCE SHALL BE PROVIDED, PROVIDED PROPER BEDDING CAN BE MAINTAINED.
7. UNLESS SPECIFIED OTHERWISE, A MINIMUM CLEAR HORIZONTAL SEPARATION OF 2.5m MEASURED FROM PIPE WALL TO PIPE WALL, MUST BE MAINTAINED BETWEEN ALL WATERMAINS AND SANITARY MAINS OR STORM MAINS.
8. WHERE A WATERMAIN CROSSES WITHIN 1.5m OF A STORM STRUCTURE, THE WATERMAIN IS TO BE PROTECTED IN ACCORDANCE WITH CITY STANDARD DRAWING NO. SD-WD-1031.
9. WATERMAIN PIPE MATERIALS ARE TO BE AS SPECIFIED IN CITY STANDARD SPECIFICATION NO. SS-WD-1110.
10. WATERMAIN FITTING MATERIALS ARE TO BE AS SPECIFIED IN CITY STANDARD SPECIFICATION NO. SS-WD-1110.
11. JOINT RESTRAINTS ARE TO BE PROVIDED IN ACCORDANCE WITH CITY STANDARD SPECIFICATION NO. SS-WD-1110.
12. FLOW CONTROL VALVES ARE TO BE AS SPECIFIED IN CITY STANDARD SPECIFICATION NO. SS-WD-1120.
13. HYDRANTS TO BE LOCATED AWAY FROM DRIVEWAYS, POLES, TRANSFORMERS, SECONDARY PEDESTALS, MAINTENANCE HOLES AND ANY OTHER ABOVE GROUND APPURTENANCES IN ACCORDANCE WITH CITY STANDARD SPECIFICATION NO. SS-WD-1130.
14. HYDRANTS TO BE CONNECTED TO THE WATERMAIN AS SPECIFIED IN CITY STANDARD SPECIFICATION NO. SS-WD-1130 AND STANDARD DRAWING NO. SD-WD-1101.
15. THE MINIMUM HORIZONTAL SEPARATION BETWEEN THE WATER SERVICE AND ANY OTHER SEWER LATERAL IS 0.6m.
16. CURB STOPS TO BE LOCATED AWAY FROM DRIVEWAYS, POLES, TRANSFORMERS, SECONDARY PEDESTALS, MAINTENANCE HOLES AND ANY OTHER ABOVEGROUND APPURTENANCES IN ACCORDANCE WITH CITY STANDARD SPECIFICATION NO. SS-WD-1140.
17. CURB STOPS TO BE LOCATED ON THE CITY ROAD ALLOWANCE 150mm FROM THE PROPERTY LINE.
18. WATER SERVICES ARE TO A MINIMUM DIAMETER OF 19mm.
19. WATER SERVICE MATERIALS, INCLUDING PIPES, FITTINGS, VALVES AND CONNECTIONS, ARE TO BE AS SPECIFIED IN CITY STANDARD SPECIFICATION NO. SS-WD-1140.
20. WATER SERVICES AT THE TIME OF INSTALLATION THAT ARE INSTALLED ONLY TO THE CURB STOP (E.G. IN A SUBDIVISION) ARE TO BE IDENTIFIED WITH A MARKER IN ACCORDANCE WITH CITY STANDARD SPECIFICATION NO. SS-WD-1140. APPROVED SERVICE TUBING, A MINIMUM OF 19mm IN DIAMETER, IS TO BE INSTALLED FROM THE CURB STOP TO THE SURFACE, CAPPED AND STAPLED TO THE POST. THE TUBING IS TO BE USED FOR TESTING PURPOSES ONLY.
21. ALL NEW WATERMAIN AND WATER SERVICE INSTALLATIONS SHALL BE INSPECTED, TESTED AND COMMISSIONED IN ACCORDANCE WITH CITY STANDARD SPECIFICATION NO. SS-WD-1190.
22. THE INTERRUPTION OF EXISTING WATER SERVICE SHALL ONLY BE AFFECTED IN ACCORDANCE WITH CITY STANDARD SPECIFICATION NO. SS-WD-1030.
23. ANY EXISTING WATER SERVICES TO THE SITE THAT ARE NOT REQUIRED ARE TO BE DISCONNECTED AT THE MAIN IN ACCORDANCE WITH THE REQUIREMENTS OF THE CITY AT THE OWNER'S EXPENSE.
24. UNLESS SPECIFIED OTHERWISE ON PLAN VIEW DRAWINGS, MAIN LINE PIPES SHALL BE INSTALLED AT THE LOCATIONS IDENTIFIED ON THE TYPICAL CROSS SECTIONS.
25. THE CONTRACTOR SHALL SUBMIT ALL REQUIRED SHOP DRAWINGS AND OTHER SUBMITTALS IN ACCORDANCE WITH THE RESPECTIVE CITY STANDARD SPECIFICATION PRIOR TO COMMENCING CONSTRUCTIONS.

STORM SEWER

1. STORM SEWER 600mm DIAMETER OR LESS TO BE RIBBED PVC, ALL STORM SEWER GREATER THAN 600mm DIAMETER TO BE REINFORCED CONCRETE 65D.
2. TWIN CATCH BASIN MAINTENANCE HOLES ARE A MINIMUM SIZE OF 1500mm DIAMETER.
3. NO UPSTREAM FLOWING CONNECTIONS ARE PERMITTED AT STRUCTURES OR BLIND TEES.
4. MAINTENANCE HOLE ACCESS RUNGS ARE NOT TO BE IN CONFLICT WITH THE CONNECTING PIPES AND THE RIM MUST BE ALIGNED TO THE MAINTENANCE HOLES ACCESS RUNGS.
5. CATCH BASIN MAINTENANCE HOLES ARE INSTALLED WITH A 0.3m SUMP, CATCH BASINS ARE TO HAVE A 0.6m SUMP AND REAR YARD CATCH BASINS ARE TO BE BENCHED.

SANITARY SEWER

1. SANITARY SEWER MAIN TO BE DR35 FLEXIBLE PIPE.
2. SANITARY SERVICE CONNECTIONS TO BE 125mm DR28 PIPE, UNLESS OTHERWISE STATED.
3. NO UPSTREAM FLOWING CONNECTIONS ARE PERMITTED AT STRUCTURES OR SERVICE CONNECTIONS.
4. MAINTENANCE HOLE ACCESS RUNGS ARE NOT TO BE IN CONFLICT WITH THE CONNECTING PIPES AND THE RIM MUST BE ALIGNED TO THE MAINTENANCE HOLE ACCESS RUNGS.
5. NO MORE THAN TWO SERVICE CONNECTIONS PERMITTED DIRECTLY TO MAINTENANCE HOLE STRUCTURES.

GRADING & DRAINAGE

1. LOT DEVELOPER TO REVIEW PROPOSED GRADING WIT THE PROJECT ENGINEER PRIOR TO ANY CONSTRUCTION.
2. DO NOT ALTER NATURAL DRAINAGE PATTERN WITHOUT APPROVAL FROM THE CITY.
3. LOT GRADING IS NOT TO BE REVISED WITHOUT WRITTEN PERMISSION FROM THE CITY.
4. THE BUILDER SHALL INSTALL NECESSARY SEDIMENT AND EROSION CONTROL MEASURES AS EACH LOT IS DEVELOPED.
5. DITCHES ARE TO BE TREATED WITH A MINIMUM OF 100mm TOPSOIL AND SOD AS SOON AS FEASIBLE.
6. DRAINAGE FLOWS SHALL BE DIRECTED AWAY FROM STRUCTURES. DRAINAGE FLOWS WHICH ARE CARRIES AROUND BUILDING STRUCTURES ARE TO BE CONFINED TO DEFINED SWALES LOCATED AS FAR AS POSSIBLE FROM THE BUILDING.
7. GRADING SHALL MATCH ORIGINAL GROUND NO LESS THAN 1m FROM THE BOUNDARY OF THE SUBDIVISION, IN ORDER THAT THE EXISTING BOUNDARY ELEVATIONS ARE MAINTAINED.
8. DRIVEWAYS SHALL BE SLOPED AT A MINIMUM OF 2.0% AND A MAXIMUM OF 8.0%.
9. BOULEVARDS AND SIDEWALKS ARE TO BE A MAXIMUM OF 4.0% SLOPE.

PHASING NOTES

1. ALL PIPES WILL BE TERMINATED APPROXIMATELY 4.0m BEYOND THE END OF THE PHASING LIMITS. WHERE PIPES DO NOT TERMINATE IN A MAINTENANCE HOLE, A MANUFACTURED WATERTIGHT CAP/PLUG IS TO BE USED.
2. WHERE REQUIRED, TEMPORARY DRAINAGE WILL BE CREATED TO PROMOTE POSITIVE DRAINAGE AT THE END OF PHASING LIMITS TO THE SATISFACTION OF THE CITY.
3. SWALES THAT ARE PRESENTLY PROPOSED TO BE CENTRED ON LOT LINES SHOULD STILL BE CENTRED ON THE LOT LINES, IF CONSTRUCTED AS PART OF THIS PHASE. THE OWNER WILL NEED TO ENTER INTO AN AGREEMENT WITH THE CITY TO CONSTRUCT AND MAINTAIN SWALES WITHIN FUTURE PHASES.
4. DEAD END BARRICADE (OPSD 973.130 C/W Wa-6 CHECKBOARD SIGN ON 11 x 15cm WOOD POSTS) REQUIRED AT THE END OF PHASING LIMITS.
5. WOODEN SIDEWALK BARRICADES TO BE MINIMUM 900mm HIGH x 1500mm WIDE, CONSTRUCTED OF 100mm x 100mm CEDAR POSTS AND 50mm x 150mm CEDAR PLANKING AND PAINTED WHITE.

GENERAL NOTES:

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REVISIONS

NO.	DATE	DESCRIPTION	BY
A	03/15/2024	ISSUED FOR CLIENT REVIEW	JH
1	04/11/2024	ENGINEERING SUBMISSION #1	JH

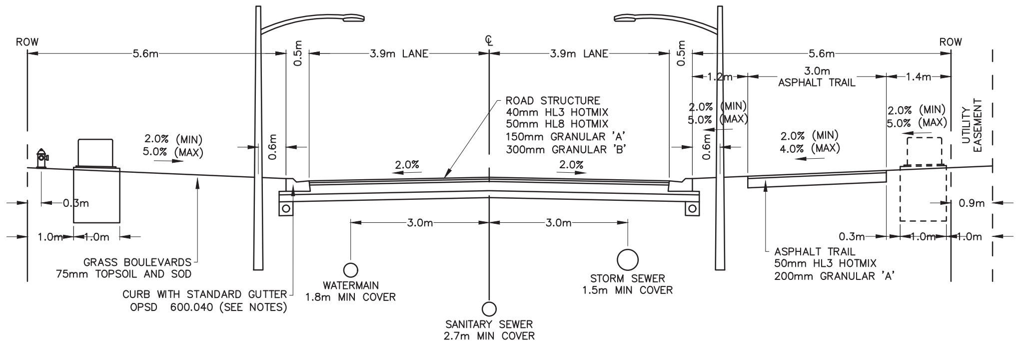
JEWELL ENGINEERING

2398513 ONTARIO INC.
TOWNCENTRE PLACE

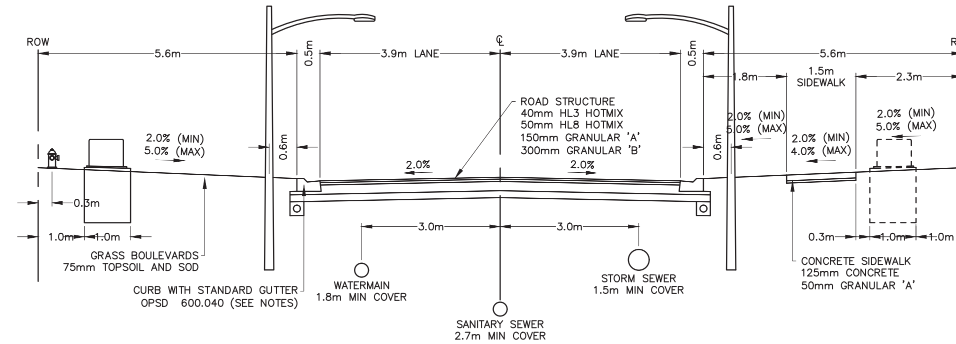
CITY OF BELLEVILLE

GENERAL NOTES

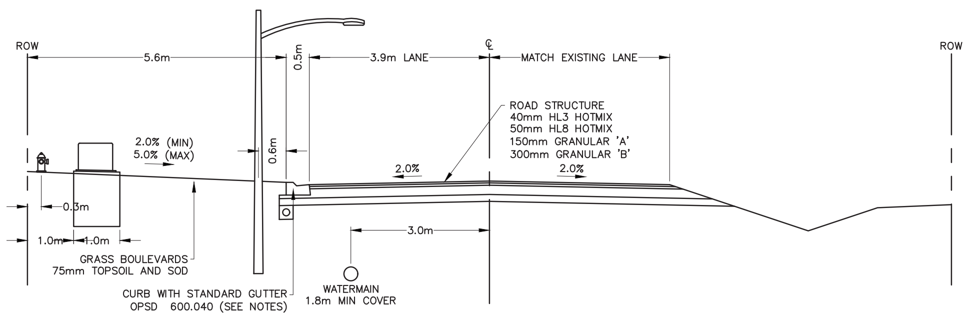
DRAWN BY: JH	PROJECT NO: 190-4585
DESIGNED BY: JH/BK	DATE: April 2024
CHECKED BY:	SCALE: HORIZONTAL - N/A, VERTICAL - N/A
APPROVED BY: BK	CONTRACT NO:
	DRAWING NO: ND-1



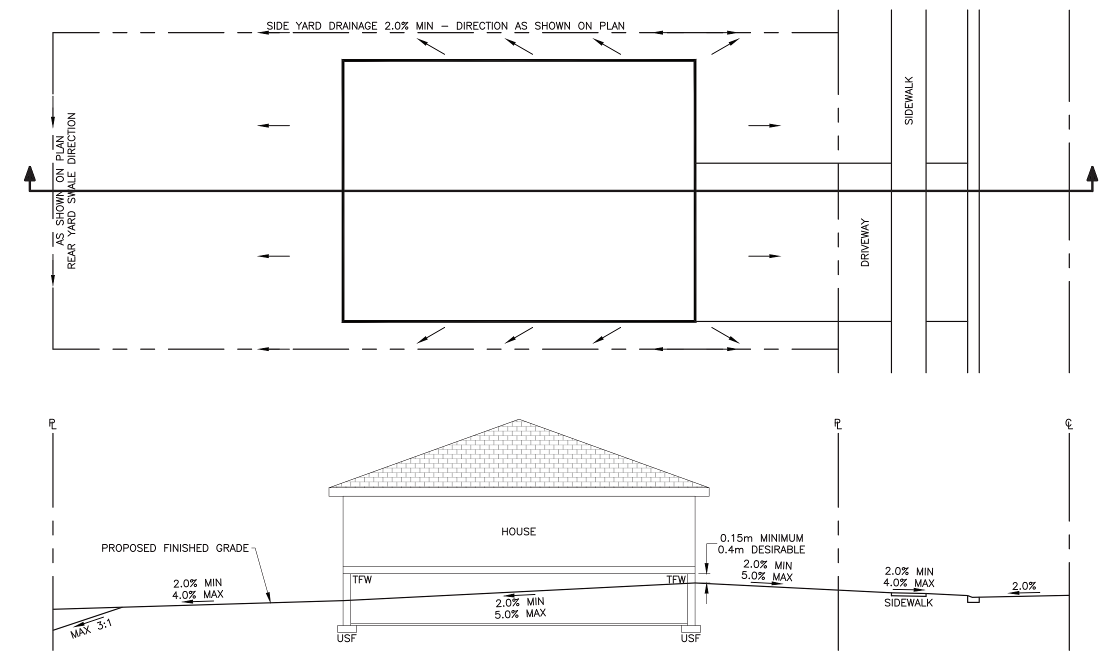
RAYCROFT DRIVE
20m TYPICAL CROSS-SECTION
WITH 3m ASPHALT TRAIL



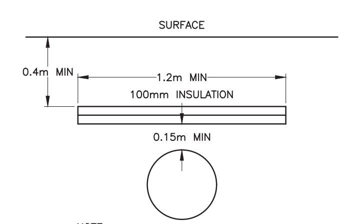
RED FOX LANE
20m TYPICAL CROSS-SECTION



TOWNCENTRE DRIVE
20m TYPICAL CROSS-SECTION

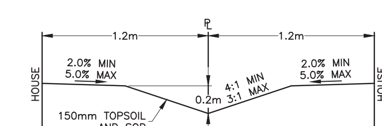


TYPICAL LOT GRADING DETAIL

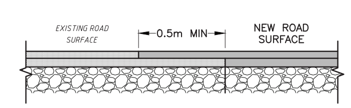


NOTE:
INSULATION TO BE PLACED IN TWO LAYERS WITH STAGGERED JOINTS

INSULATION DETAIL



TYPICAL SIDE YARD SWALE



JOINT LAP DETAIL

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1	04/11/2024	ENGINEERING SUBMISSION #1	JH

JEWELL ENGINEERING

2398513 ONTARIO INC.
TOWNCENTRE PLACE

CITY OF BELLEVILLE

TYPICAL DETAILS

DRAWN BY: JH	PROJECT NO: 190-4585
DESIGNED BY: JH/BK	DATE: April 2024
CHECKED BY:	SCALE: HORIZONTAL - NOT TO SCALE; VERTICAL - NOT TO SCALE
APPROVED BY: BK	CONTRACT NO:
	DRAWING NO: ND-2

SANITARY STRUCTURES

STRUCTURE	STREET NAME STATION/OFFSET	STRUCTURE SIZE (mm) - OPSD	FRAME OPSD	GRATE OPSD	TOP OF GRATE ELEVATION	PIPES IN	PIPES OUT	STRUCTURE HEIGHT
SA1	RAYCROFT DRIVE 2+730.07 – 0.0	1200∅ – 701.010	401.010	TYPE A	111.70	N INV: 107.40 S INV: 107.41 E INV: 107.38	W INV: 107.35	4.4
SA11	RED FOX LANE 7+070 – 0.0	1200∅ – 701.010	401.010	TYPE A	111.34	S INV: 107.56	N INV: 107.55	3.8
SA12	RED FOX LANE 7+140.28 – 5.5 R	1200∅ – 701.010	401.010	TYPE A	110.84	E INV: 107.82	N INV: 107.76	3.1
SA13	RED FOX LANE 7+204.20 – 0.0	1200∅ – 701.010	401.010	TYPE A	110.54	E INV: 108.02	W INV: 108.01	2.5
SA14	RED FOX LANE 7+270.93 – 0.0	1200∅ – 701.010	401.010	TYPE A	109.64		W INV: 108.21	1.4

STORM STRUCTURES (RECTANGULAR)

STRUCTURE	STREET NAME STATION/OFFSET	STRUCTURE SIZE (mm) - OPSD	FRAME OPSD	GRATE OPSD	TOP OF GRATE ELEVATION	PIPES IN	PIPES OUT	SUMP DEPTH	STRUCTURE HEIGHT
CB219	TOWNCENTRE DRIVE 8+127.02 – 3.9 R	600x600 705.010	400.010	X1	109.65		E INV: 108.42	0.6	1.8
CB220	RED FOX LANE 7+248.42 – 3.9 R	600x600 705.010	400.010	X1	110.00		N INV: 108.66	0.6	1.9
CB221	RED FOX LANE 7+248.42 – 3.9 L	600x600 705.010	400.010	X1	110.00		S INV: 108.72	0.6	1.9
CB222	RED FOX LANE 7+173.42 – 3.9 R	600x600 705.010	400.010	X1	110.64		N INV: 109.13	0.6	2.1
CB223	RED FOX LANE 7+173.42 – 3.9 L	600x600 705.010	400.010	X1	110.64		S INV: 109.19	0.6	2.1
CB224	RED FOX LANE 7+121.29 – 3.9 R	600x600 705.010	400.010	X1	110.96		E INV: 109.40	0.6	2.2
CB225	RED FOX LANE 7+121.29 – 3.9 L	600x600 705.010	400.010	X1	110.96		W INV: 109.46	0.6	2.1
CB226	RED FOX LANE 7+086.77 – 3.9 R	600x600 705.010	400.010	X1	111.16		E INV: 109.62	0.6	2.1
CB227	RED FOX LANE 7+086.77 – 3.9 L	600x600 705.010	400.010	X1	111.16		W INV: 109.68	0.6	2.1

STORM STRUCTURES (ROUND)

STRUCTURE	STREET NAME STATION/OFFSET	STRUCTURE SIZE (mm) - OPSD	FRAME OPSD	GRATE OPSD	TOP OF GRATE ELEVATION	PIPES IN	PIPES OUT	SUMP DEPTH	STRUCTURE HEIGHT
ST114	TOWNCENTRE DRIVE 8+143.42 – 6.4 R	1200∅ – FD–4HC	HYDRO INT.	HYDRO INT.	109.62	W INV: 108.56	E INV: 108.53	1.5	2.6
ST115	RED FOX LANE 7+171.70 – 3.0 R	1200∅ – 701.010	401.010	TYPE B	110.67		E INV: 109.11	0.2	1.8
ST116	RED FOX LANE 7+133.27 – 13.5 R	1200∅ – FD–4HC	HYDRO INT.	HYDRO INT.	111.13	E INV: 109.09	W INV: 109.06	1.5	3.6
ST117	RED FOX LANE 7+135.11 – 4.3 R	1200∅ – 701.010	401.010	TYPE B	110.87	N INV: 109.28	W INV: 109.22	0.2	1.9
ST118	RED FOX LANE 7+083.24 – 3.0 R	1200∅ – 701.010	401.010	TYPE B	111.20		S INV: 109.60	0.2	1.8

SANITARY PIPES

UPSTREAM	DOWNSTREAM	LENGTH	SIZE	MATERIAL	SLOPE
SA11	SA1	48.8m	250 mm	DR35 PVC	0.28%
SA12	SA11	71.9m	250 mm	DR35 PVC	0.28%
SA13	SA12	65.5m	250 mm	DR35 PVC	0.28%
SA14	SA13	65.5m	250 mm	DR35 PVC	0.28%

STORM PIPES

UPSTREAM	DOWNSTREAM	LENGTH	SIZE	MATERIAL	SLOPE
CB219	OUTLET CB210	11.4m	300 mm	HDPE	0.21%
CB220	TEE – CB220–221	0.6m	300 mm	RIBBED PVC	1.00%
CB221	TEE – CB220–221	6.6m	300 mm	RIBBED PVC	1.00%
CB222	TEE – CB222–223	0.6m	300 mm	RIBBED PVC	1.00%
CB223	TEE – CB222–223	6.6m	300 mm	RIBBED PVC	1.00%
CB224	TEE – CB224–225	0.6m	300 mm	RIBBED PVC	1.00%
CB225	TEE – CB224–225	6.6m	300 mm	RIBBED PVC	1.00%
CB226	TEE – CB226–227	0.6m	300 mm	RIBBED PVC	2.67%
CB227	TEE – CB226–227	6.6m	300 mm	RIBBED PVC	1.22%
ST114	OUTLET B	14.0m	300 mm	HDPE	1.90%
ST115	ST114	91.6m	300 mm	RIBBED PVC	0.60%
ST116	OUTLET C	46.9m	300 mm	RIBBED PVC	1.80%
ST117	ST116	8.5m	300 mm	RIBBED PVC	1.30%
ST118	ST117	52.2m	300 mm	RIBBED PVC	0.60%

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JEWELL ENGINEERING

2398513 ONTARIO INC.
TOWNCENTRE PLACE

CITY OF BELLEVILLE

PIPE AND STRUCTURE TABLES

DRAWN BY: JH
PROJECT NO: 190-4585
DESIGNED BY: JH/BK
DATE: April 2024
CHECKED BY:
SCALE: HORIZONTAL - N/A, VERTICAL - N/A
APPROVED BY: BK
CONTRACT NO:
DRAWING NO: ND-4

03/01/2024

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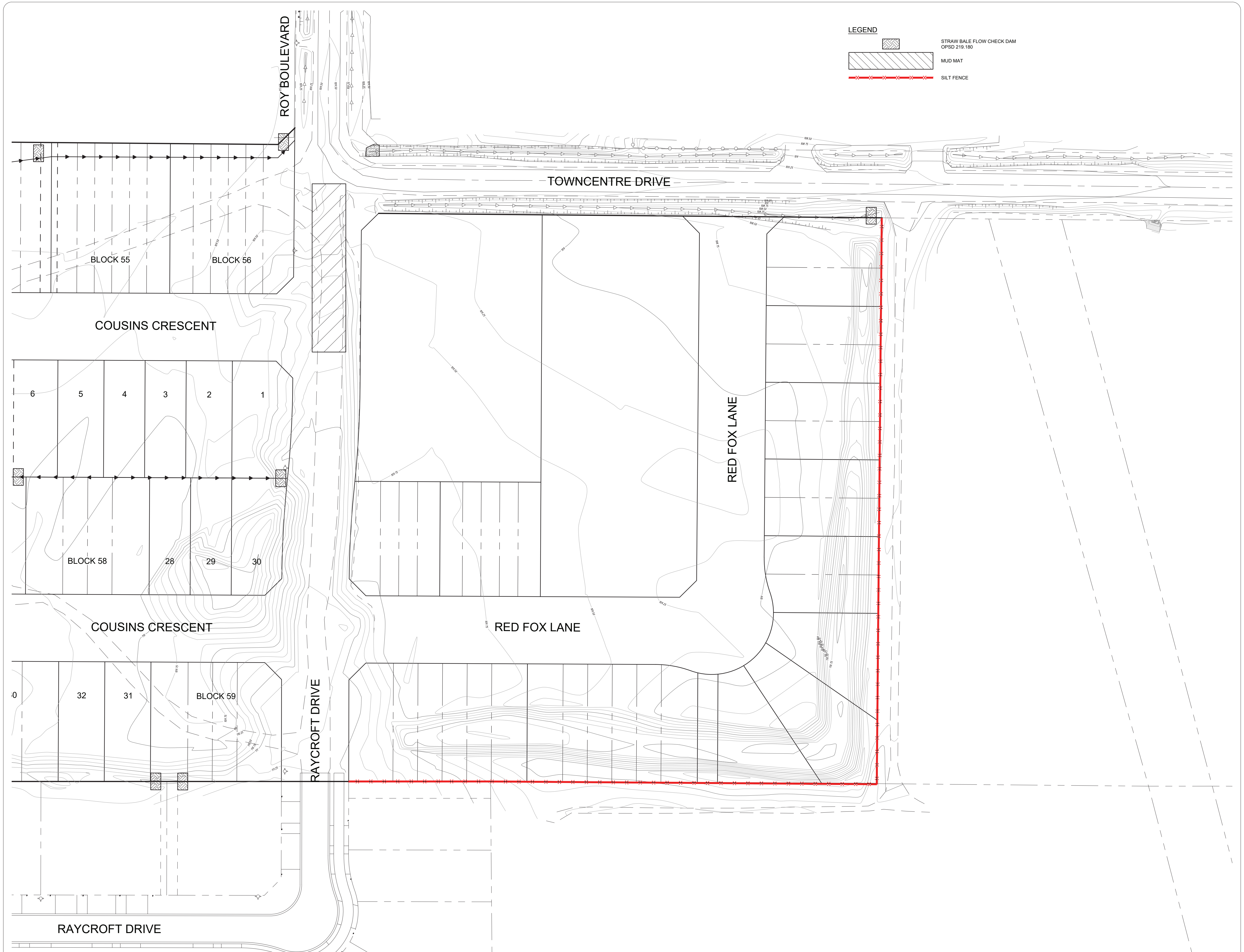

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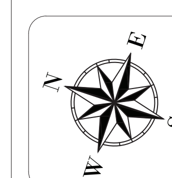
1	04/11/2024	ENGINEERING SUBMISSION #1	JH

NOTES

1. SEDIMENT AND EROSION CONTROL MEASURES WILL TO OPSS.MUNI 805.
2. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES TO PROVIDE THE PROTECTION OF THE AREA DRAINAGE SYSTEM AND THE RECEIVING WATERCOURSE DURING CONSTRUCTION ACTIVITIES. THIS INCLUDES LIMITING THE AMOUNT OF EXPOSED SOIL AND INSTALLING SILT FENCES AND OTHER SEDIMENT TRAPS.
3. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING EROSION AND SEDIMENT CONTROL MEASURES ARE INSTALLED CORRECTLY.
4. FOR STRAW BALE FLOW CHECK DAM, USE OPSD 219.100. FOR LIGHT DUTY AND HEAVY DUTY SILT FENCE BARRIER, USE OPSD 219.110 AND 219.130, RESPECTIVELY.
5. THE OWNER AGREES TO PREPARE AND IMPLEMENT AN EROSION AND SEDIMENT CONTROL PLAN TO THE SATISFACTION OF THE CONSERVATION AUTHORITY.
6. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE IN PLACE PRIOR TO ANY EXCAVATION OR CONSTRUCTION WORK COMMENCE.
7. ALL EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE REGULARLY MONITORED AND MAINTAINED UNTIL LANDSCAPING HAS BEEN ESTABLISHED.
8. ALL CATCH BASINS AND MANHOLES WHICH MAY COLLECT SEDIMENT FROM THE DISTURBED AREAS OF THE SITE SHALL HAVE FILTER CLOTH OR OTHER APPROVED MEANS OF SEDIMENT CONTROL INSTALLED AND MAINTAINED UNTIL THE CONTRIBUTING SURFACES HAVE ADEQUATELY STABILIZED, I.E. ASPHALT, SOD, OR 80% GRASS COVER.
9. MUD MAT MUST BE A MINIMUM OF 20 m IN LENGTH AND THE FULL WIDTH OF THE ENTRANCE (10 m MINIMUM). THE PAD SHOULD BE A MINIMUM OF 300 mm THICK BUT 450 mm THICKNESS IS RECOMMENDED. THE PAD SHOULD BE UNDERLAIN WITH A GEOTEXTILE (OR GRADED AGGREGATE FILTER) AND CONSIST OF 50 mm DIAMETER CLEAR STONE FOR THE FIRST 10 m (EXTENDING FROM THE STREET) AND THE REMAINDER OF THE LENGTH TO CONSIST OF 150 mm DIAMETER CLEAR STONE.

EMERGENCY CONTACT INFORMATION
SPILLS ACTION CENTRE
PHONE: 416-325-3000
TOLL-FREE: 1-800-268-6060



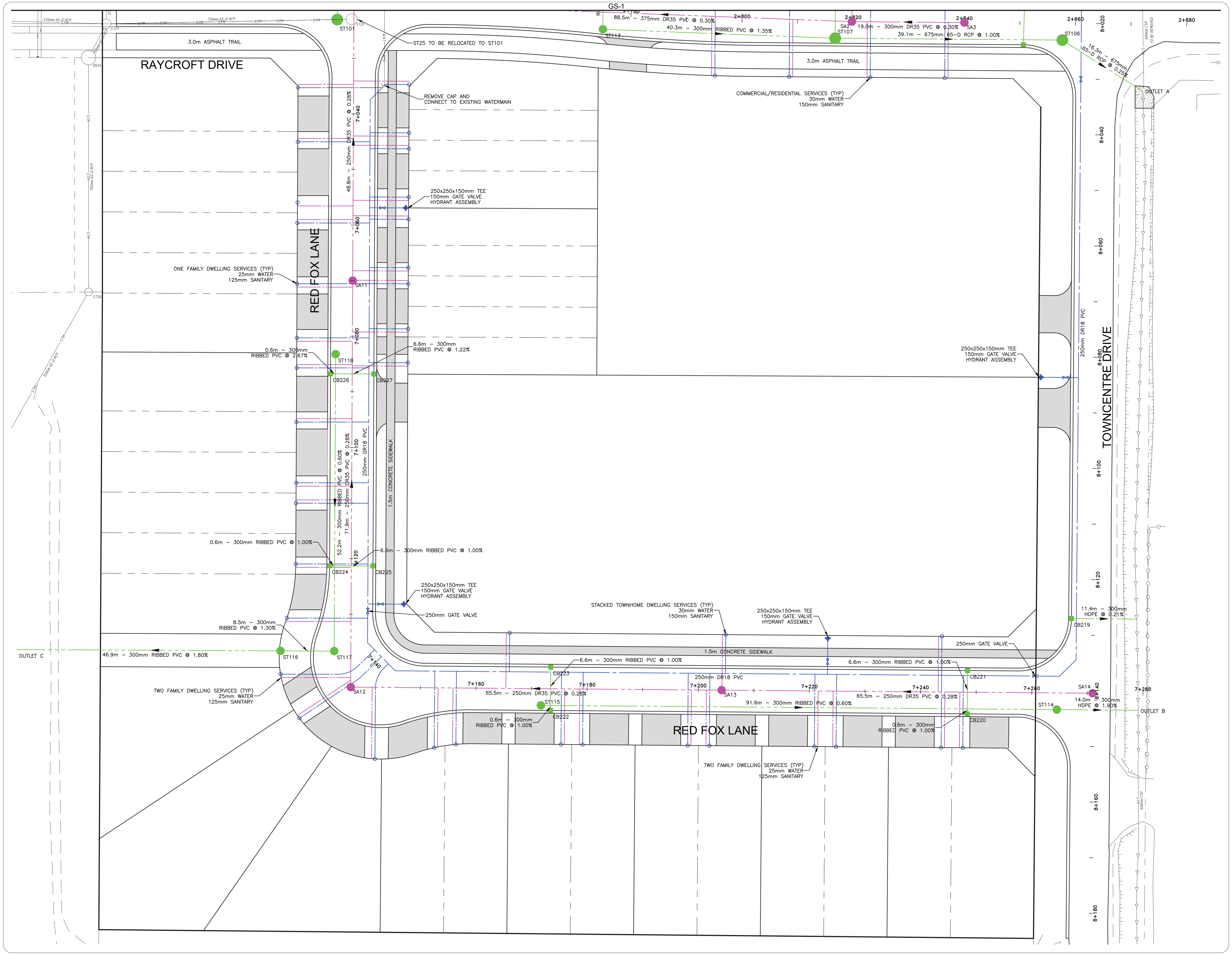
JEWELL ENGINEERING

2398513 ONTARIO INC.
TOWNCENTRE PLACE

CITY OF BELLEVILLE

SEDIMENT & EROSION CONTROL PLAN

DRAWN BY: JH	PROJECT NO: 190-4585
DESIGNED BY: JH/BK	DATE: April 2024
CHECKED BY:	SCALE: HORIZONTAL - 1:500 VERTICAL - N/A
APPROVED BY: BK	CONTRACT NO:
	DRAWING NO: ESC-2



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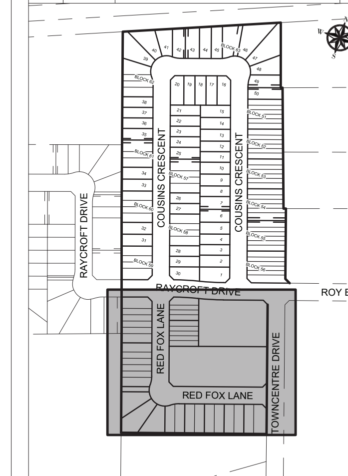

KEY PLAN
SCALE - N.T.S.

LICENSED PROFESSIONAL ENGINEER
B. C. KEENE
PROVINCE OF ONTARIO

JEWELL ENGINEERING

2398513 ONTARIO INC.
TOWNCENTRE PLACE

CITY OF BELLEVILLE

GENERAL SERVICING PLAN
3 of 3

DRAWN BY: JH	PROJECT NO: 190-4585
DESIGNED BY: JH/BK	DATE: April 2024
CHECKED BY:	SCALE: HORIZONTAL - 1:300; VERTICAL - N/A
APPROVED BY: BK	CONTRACT NO:
	DRAWING NO: GS-3

02/21/2024

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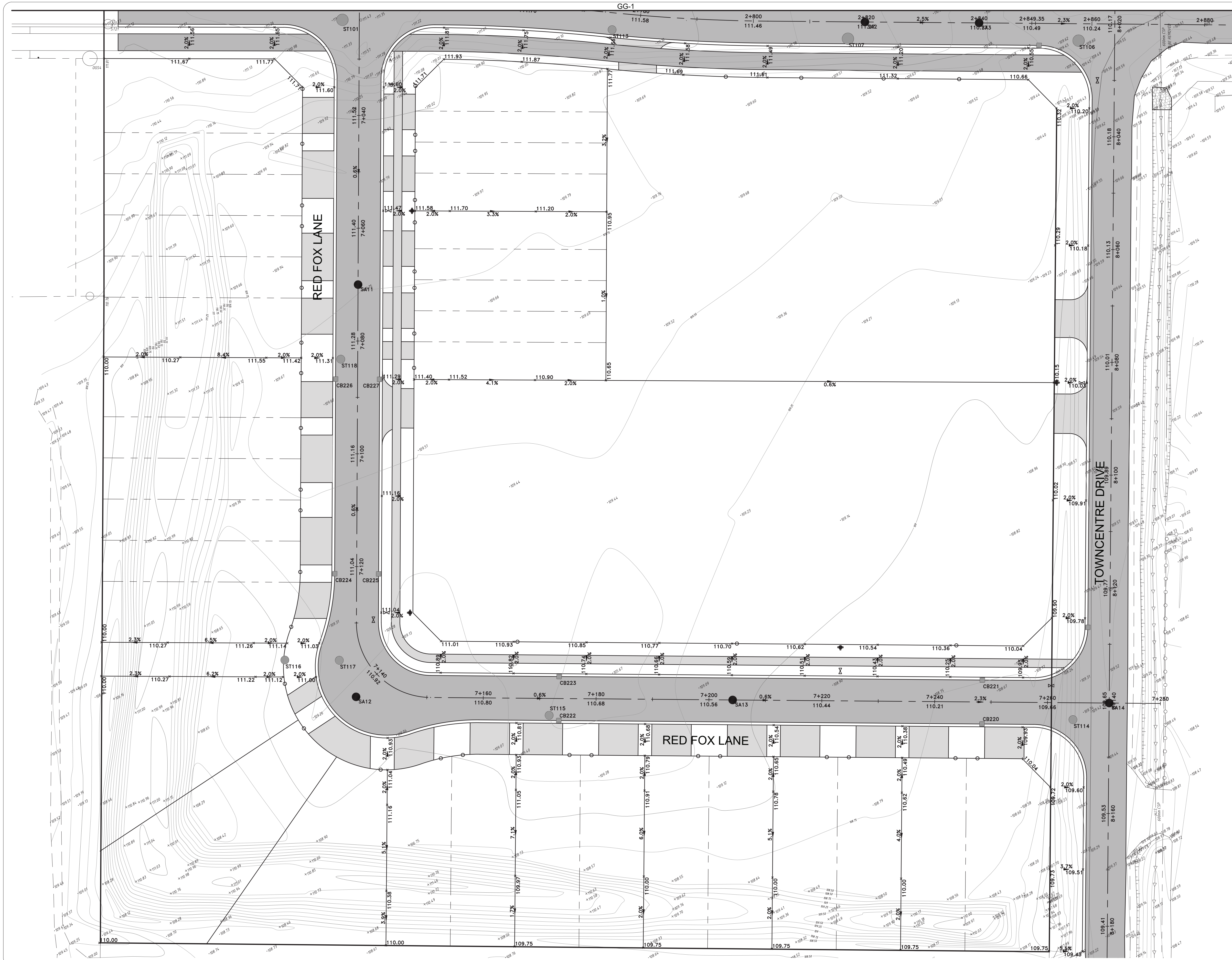

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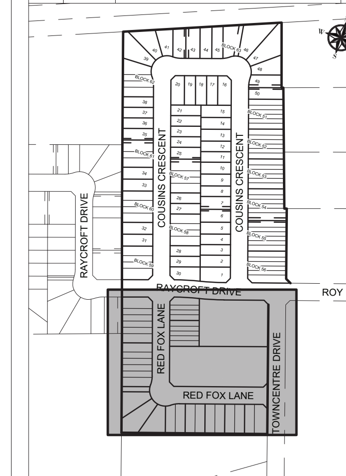
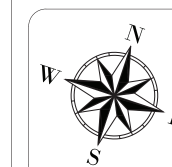
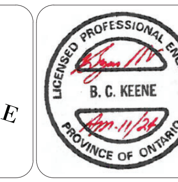


KEY PLAN
SCALE - N.T.S.





JEWELL ENGINEERING

2398513 ONTARIO INC.
TOWNCENTRE PLACE

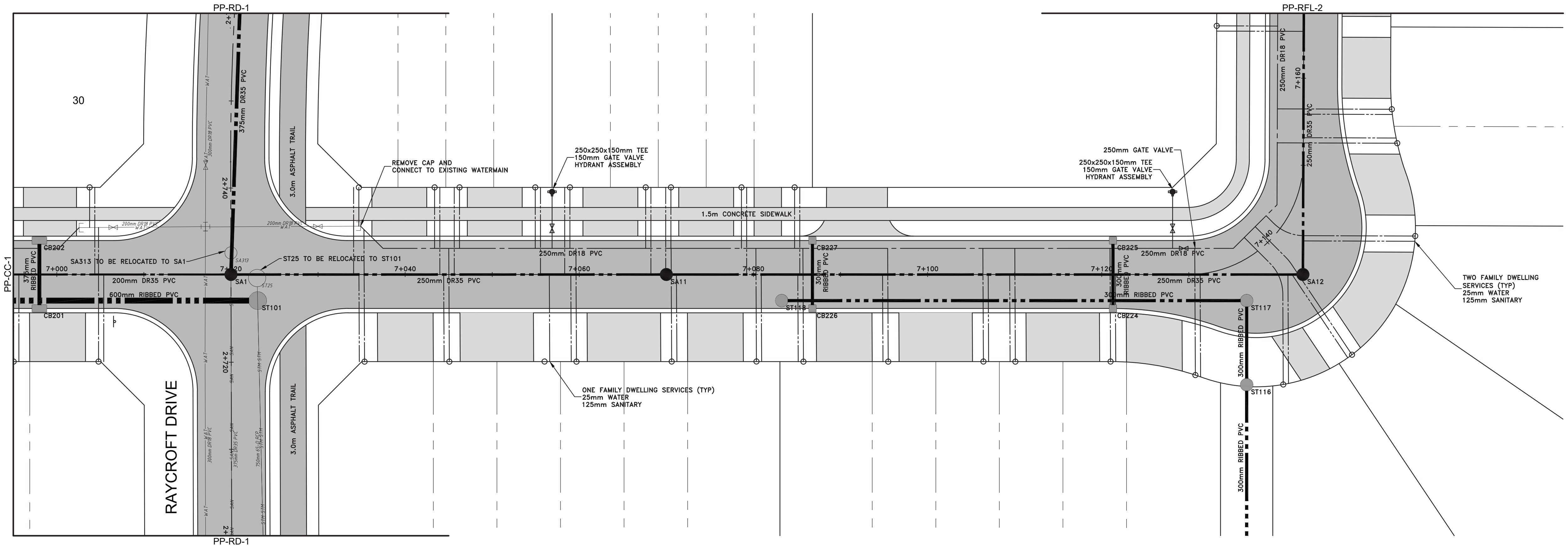
CITY OF BELLEVILLE

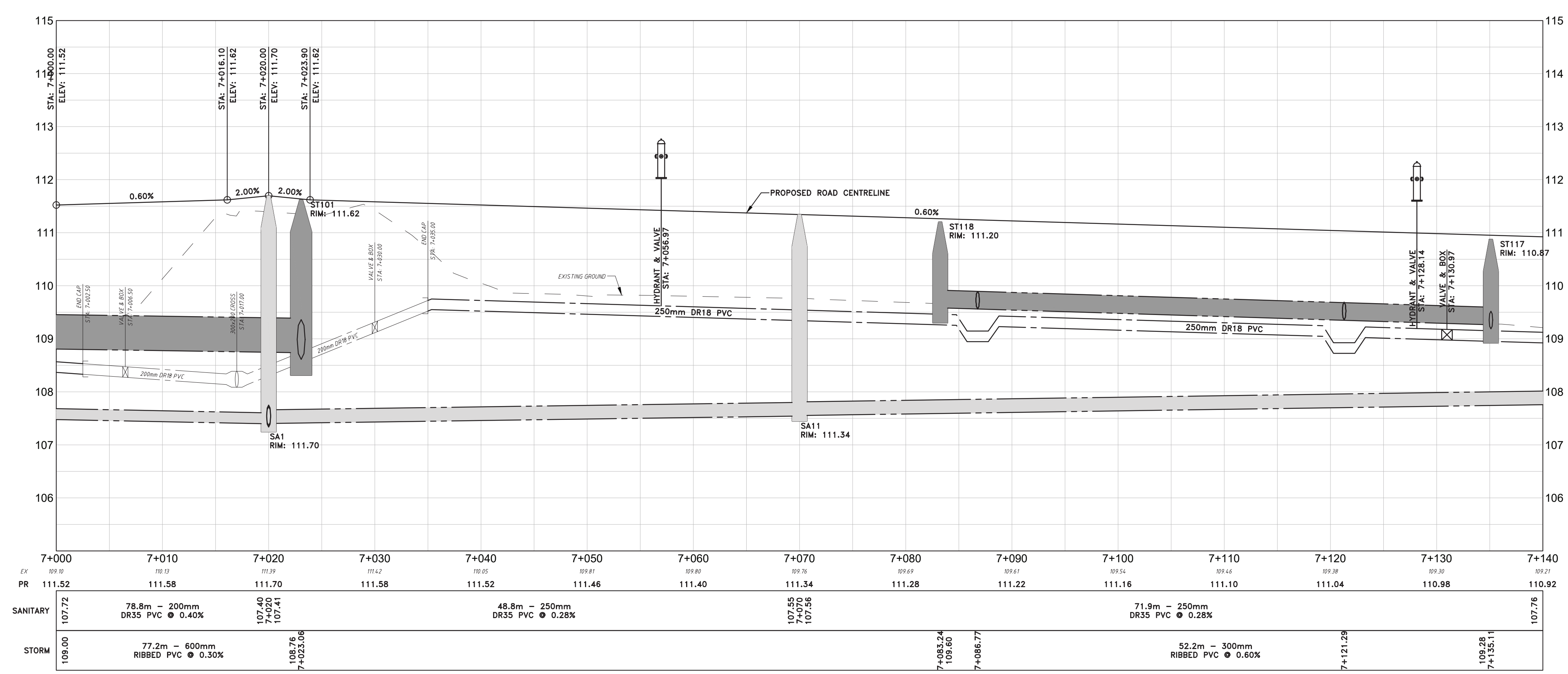
GENERAL GRADING PLAN
3 of 3

DRAWN BY: JH	PROJECT NO: 190-4585
DESIGNED BY: JH/BK	DATE: March 2024
CHECKED BY:	SCALE: HORIZONTAL - 1:300 VERTICAL - N/A
APPROVED BY: BK	CONTRACT NO:
	DRAWING NO: GG-3

03/01/2024

RED FOX LANE





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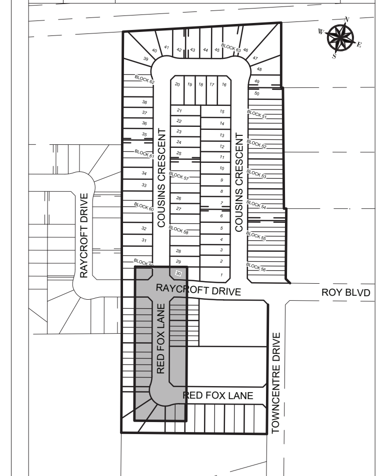
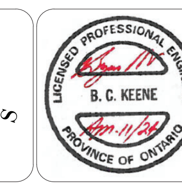


KEY PLAN
SCALE - N.T.S.



JEWELL ENGINEERING

2398513 ONTARIO INC.
TOWNCENTRE PLACE

CITY OF BELLEVILLE

PLAN & PROFILE
RED FOX LANE
STA. 7+000 to 7+140

DRAWN BY: JH
PROJECT NO: 190-4585
DESIGNED BY: JH/BK
DATE: April 2024
CHECKED BY:
SCALE: HORIZONTAL - 1:250, VERTICAL - 1:50
APPROVED BY: BK
CONTRACT NO:
DRAWING NO: PP-RFL-1

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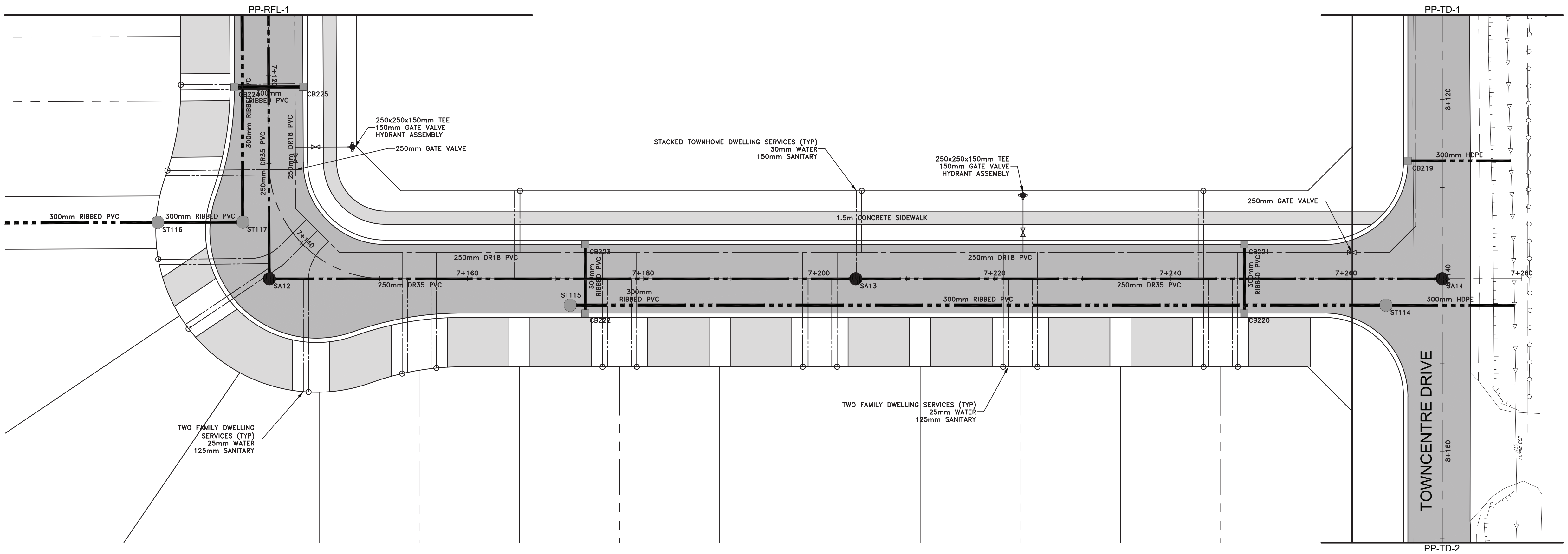
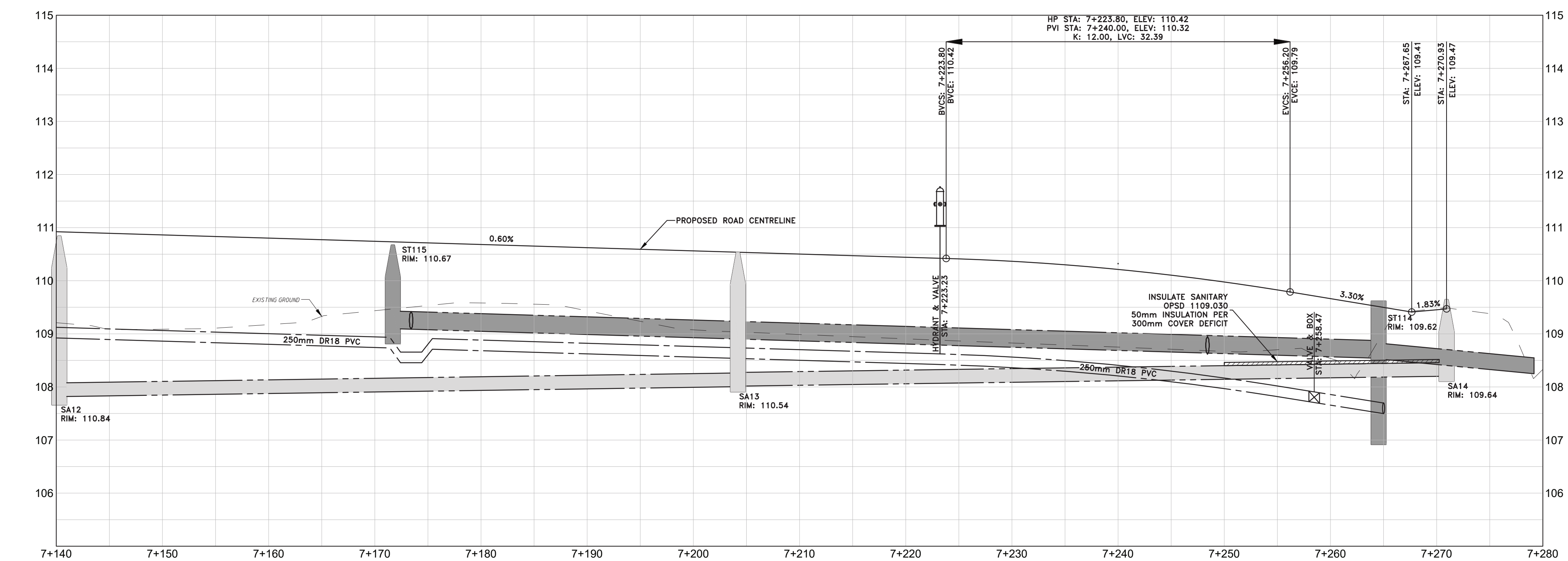
RED FOX LANE





	7+140	7+150	7+160	7+170	7+180	7+190	7+200	7+210	7+220	7+230	7+240	7+250	7+260	7+270	7+280
EX	109.21	109.09	109.17	109.44	109.58	109.43	109.08	108.99	108.91	108.83	108.75	108.67	108.54	109.47	108.33
PR	110.92	110.86	110.80	110.74	110.68	110.62	110.56	110.50	110.44	110.37	110.21	109.98	109.66	109.45	

SANITARY: 7+140.28 107.82 — 65.5m – 250mm DR35 PVC @ 0.28% — 108.01 7+204.20 108.02 — 65.5m – 250mm DR35 PVC @ 0.28% — 108.21 7+270.93

STORM: 7+171.70 109.11 7+173.42 — 91.6m – 300mm RIBBED PVC @ 0.60% — 7+248.42 — 108.56 7+264.35 108.53 — 14.0m – 300mm HDPE @ 1.90% — 108.25 7+279.17

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REVISIONS

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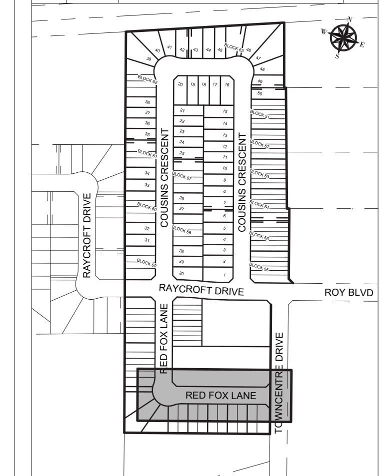
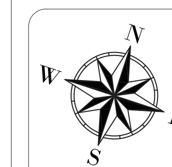
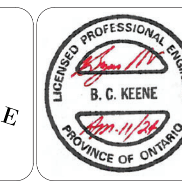
1	04/11/2024	ENGINEERING SUBMISSION #1	JH



KEY PLAN
SCALE - N.T.S.





JEWELL ENGINEERING

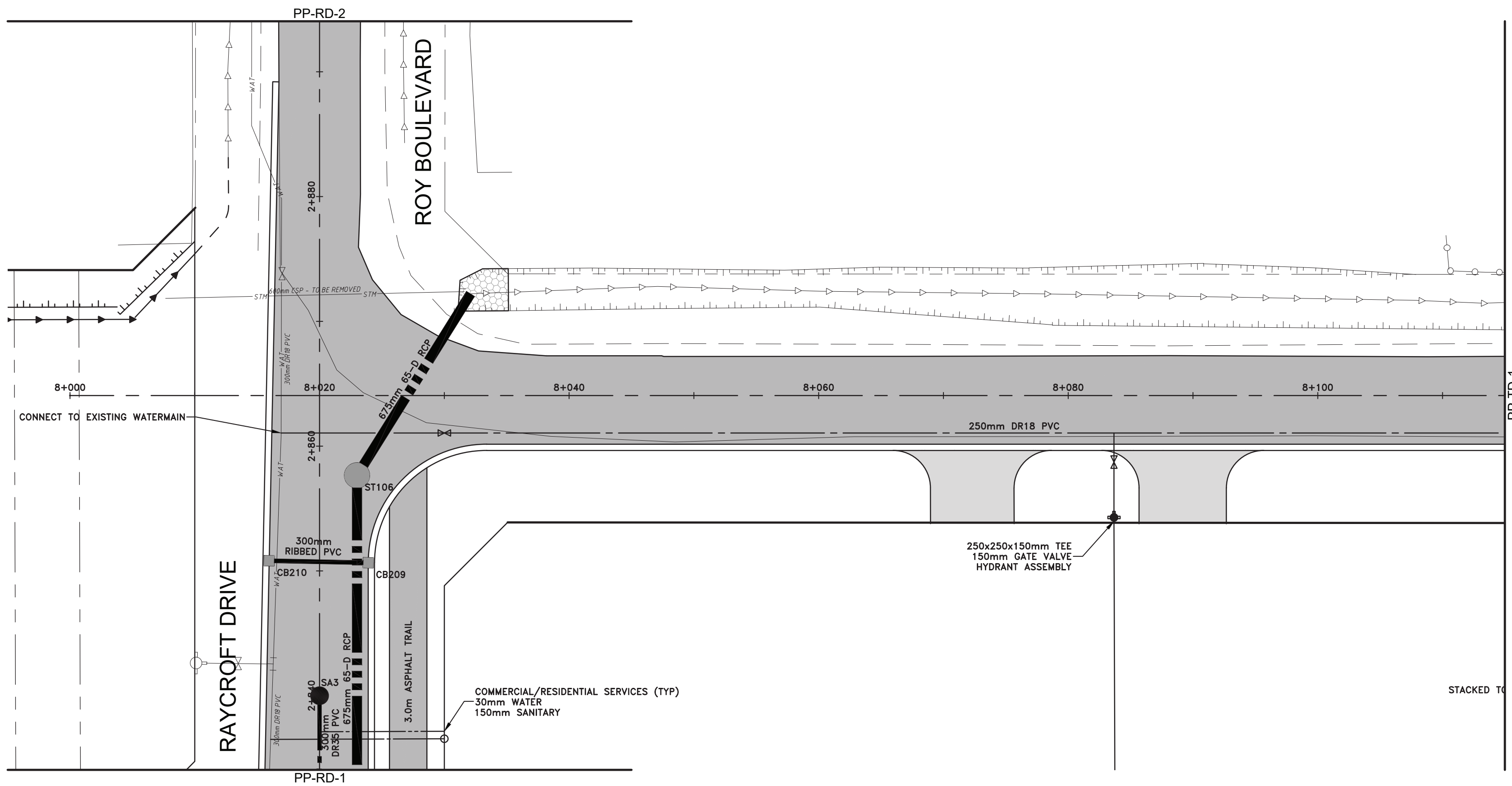
2398513 ONTARIO INC.
TOWNCENTRE PLACE

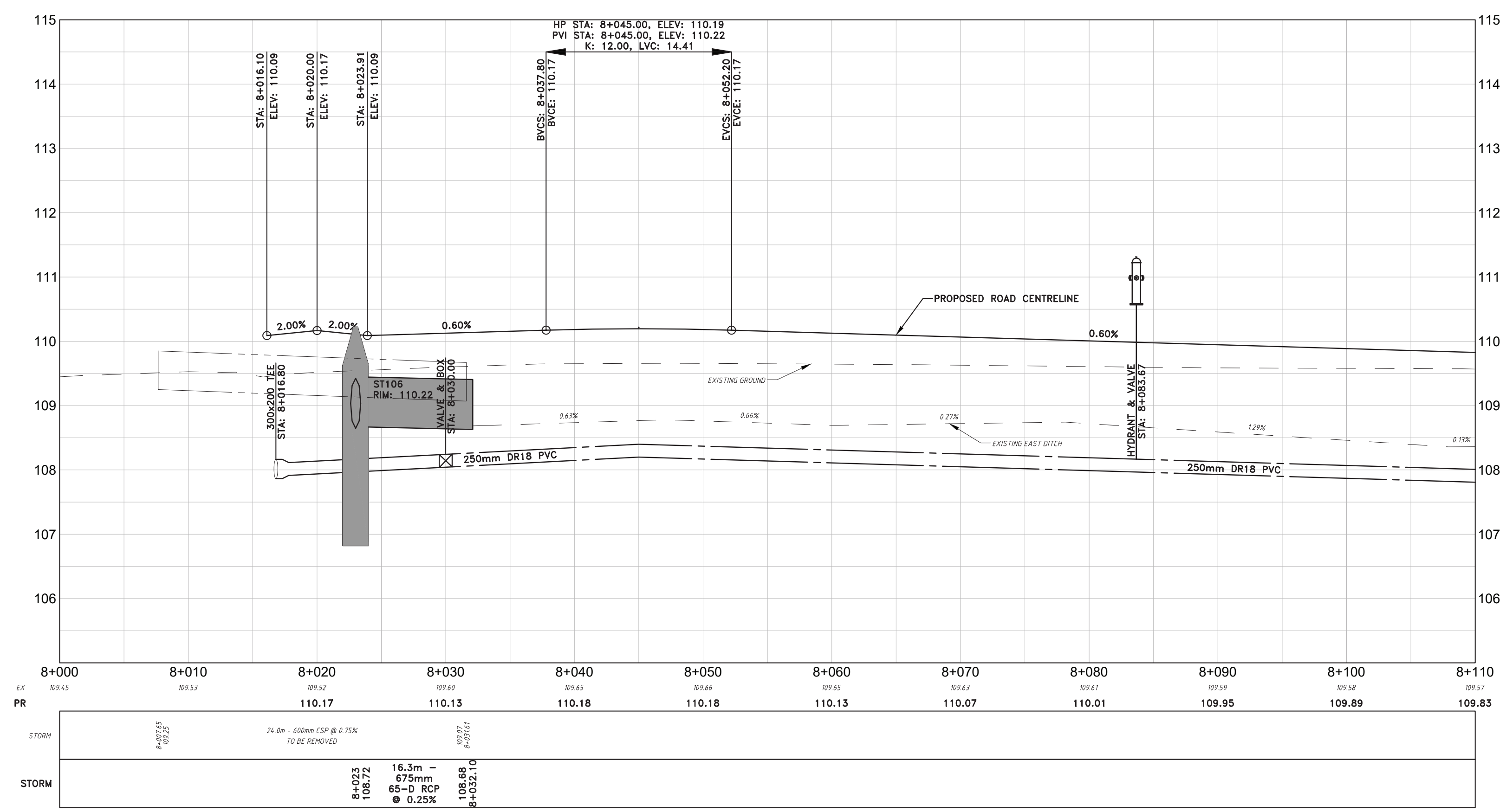
CITY OF BELLEVILLE

PLAN & PROFILE
RED FOX LANE
STA. 7+140 to 7+280

DRAWN BY: JH	PROJECT NO: 190-4585
DESIGNED BY: JH/BK	DATE: April 2024
CHECKED BY:	SCALE: HORIZONTAL - 1:250, VERTICAL - 1:50
APPROVED BY: BK	CONTRACT NO:
	DRAWING NO: PP-RFL-2

TOWNCENTRE DRIVE





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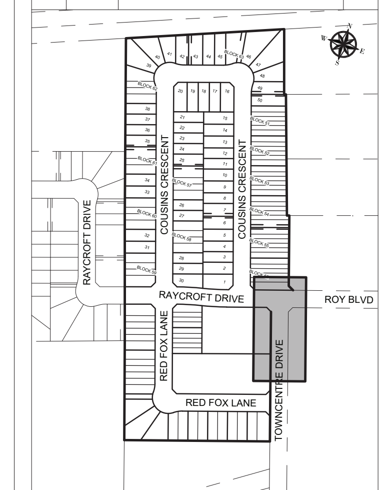
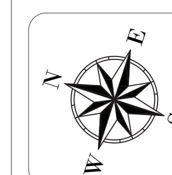
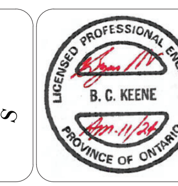


KEY PLAN
SCALE - N.T.S.





JEWELL ENGINEERING

2398513 ONTARIO INC.
TOWNCENTRE PLACE

CITY OF BELLEVILLE

PLAN & PROFILE
TOWNCENTRE DRIVE
STA. 8+000 to 8+110

DRAWN BY: JH	PROJECT NO: 190-4585
DESIGNED BY: JH/BK	DATE: April 2024
CHECKED BY:	SCALE: HORIZONTAL - 1:250 VERTICAL - 1:50
APPROVED BY: BK	CONTRACT NO:
	DRAWING NO: PP-TD-1

02/29/2024

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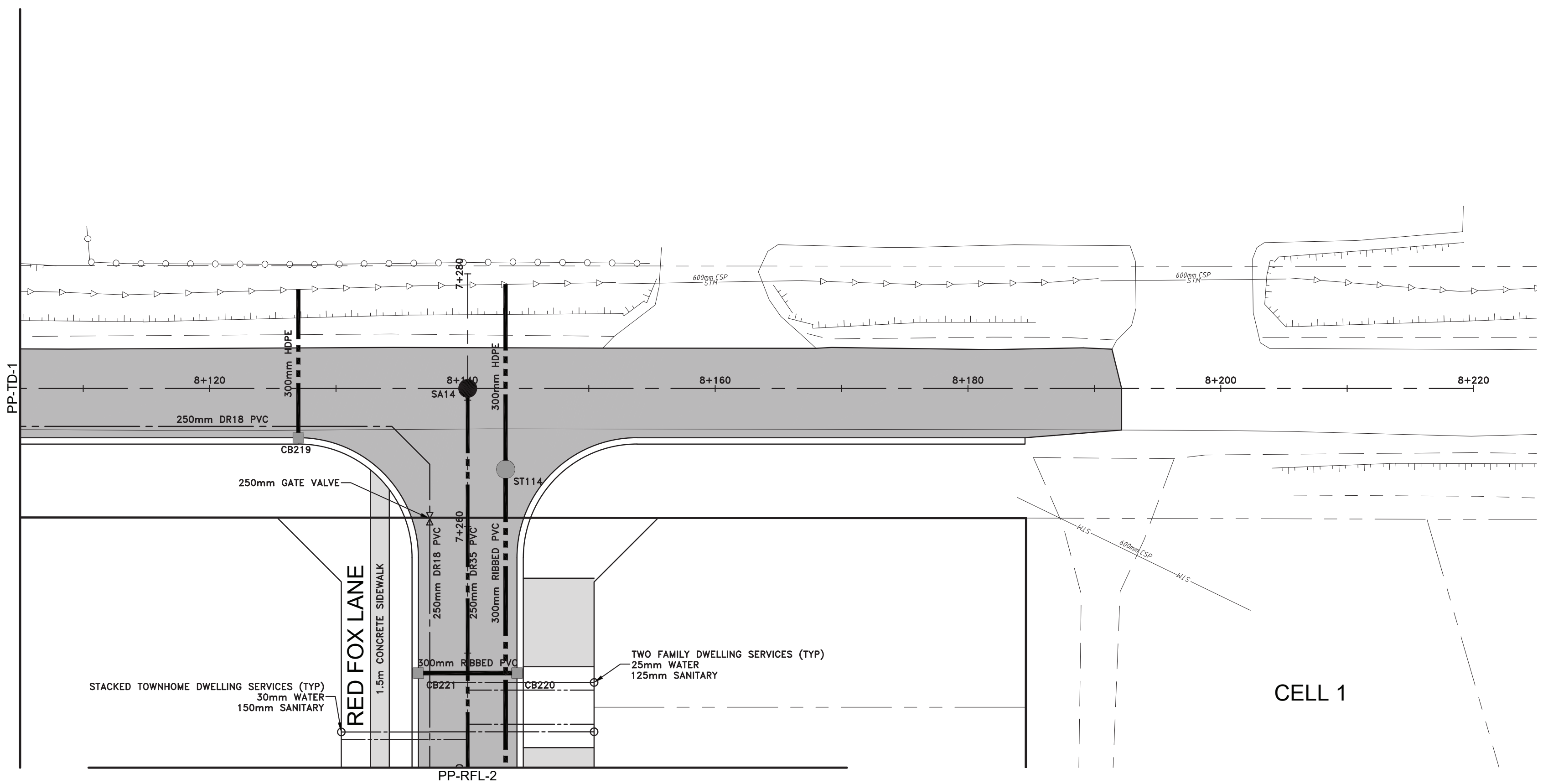
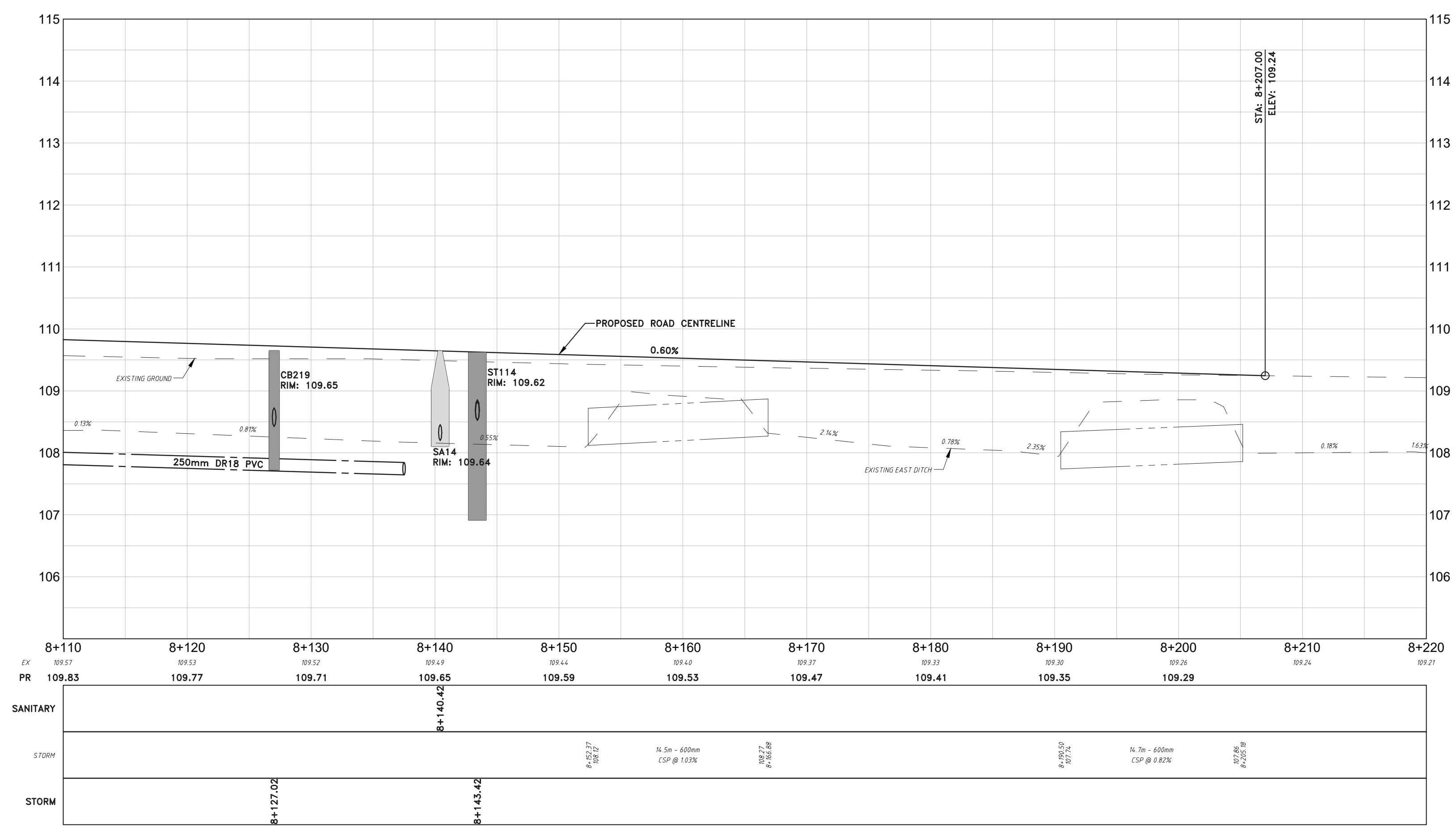
TOWNCENTRE DRIVE





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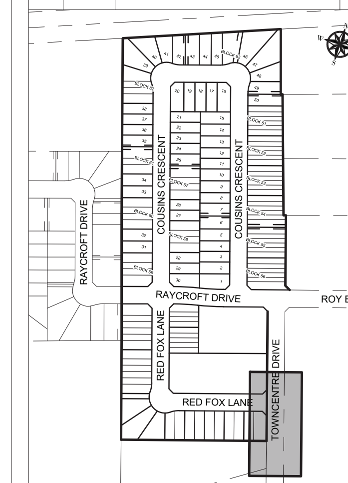
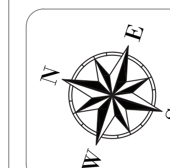
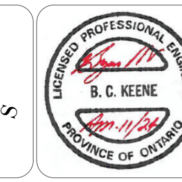


KEY PLAN
SCALE - N.T.S.





JEWELL ENGINEERING

2398513 ONTARIO INC.
TOWNCENTRE PLACE

CITY OF BELLEVILLE

PLAN & PROFILE
TOWNCENTRE DRIVE
STA. 8+110 to 8+220

DRAWN BY: JH	PROJECT NO: 190-4585
DESIGNED BY: JH/BK	DATE: April 2024
CHECKED BY:	SCALE: HORIZONTAL - 1:250, VERTICAL - 1:50
APPROVED BY: BK	CONTRACT NO:
	DRAWING NO: PP-TD-2

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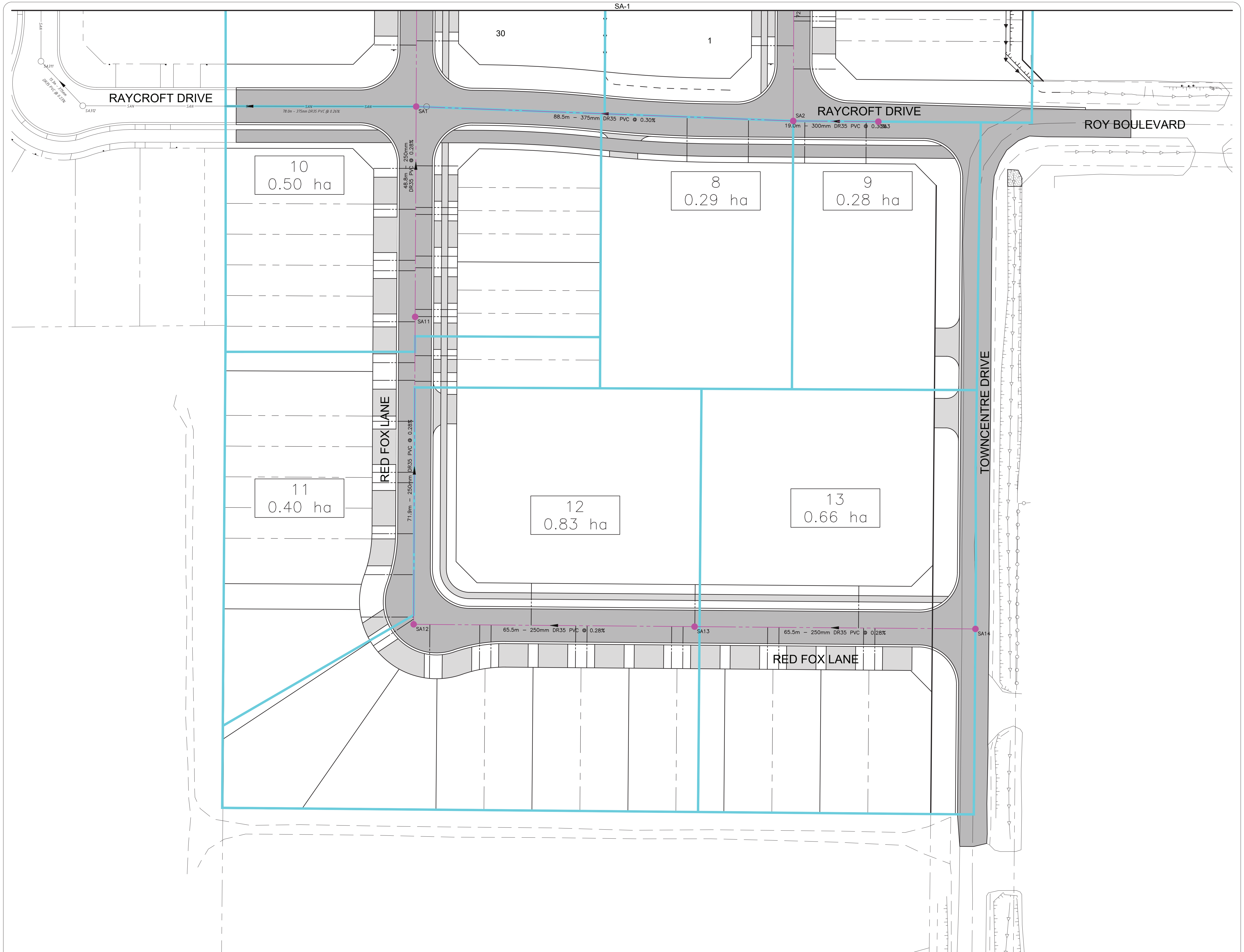

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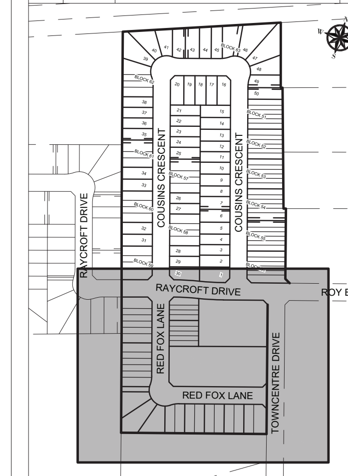
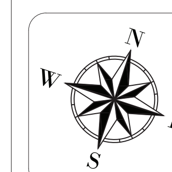
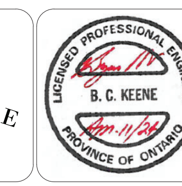


KEY PLAN
SCALE - N.T.S.





JEWELL ENGINEERING

2398513 ONTARIO INC.
TOWNCENTRE PLACE

CITY OF BELLEVILLE

SANITARY SEWER NETWORK
CATCHMENT PLAN
3 of 3

DRAWN BY: JH
PROJECT NO: 190-4585
DESIGNED BY: JH/BK
DATE: April 2024
CHECKED BY:
SCALE: HORIZONTAL - 1:400, VERTICAL - N/A
APPROVED BY: BK
CONTRACT NO:
DRAWING NO: SA-3

02/29/2024

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02/29/2024

SANITARY SEWER DESIGN SHEET

Peak Design Flow Calculation

Peak Design Flow (Q_d) = Peak Population Flow (Q_p) + Peak Extraneous Flow (Q_i)

$Q_d = Q_p + Q_i$ *Where:*

$Q_p = \frac{PqM}{86.4}$

$Q_i = IA$

$M = 1 + \frac{14}{4+\sqrt{P}}$

q	Average daily per capita flow	**350** L/d*cap
I	Unit of peak extraneous flow	**0.28** L/s*ha
M	Harmon peaking factor (min = 2)	
P	Population in 1000's	
A	Area in hectares (ha)	

Commercial Flows

Commercial Flows **1.05** L/s*ha

Peaking Factor **Included**

Residential Flows

Population Density **3.0** cap/unit

Pipe Capacity by Manning's Equation

$Q = \frac{1}{n} A R^{2/3} S^{1/2}$

Where:

A	Area of pipe in m^2	
R	Hydraulic radius = a/p	$Q_d \leq 0.8 \cdot (Pipe\ Capacity)$
P	Wetted perimeter	$0.6 \leq V \leq 3.0$
S	Slope (m/m)	
n	Manning's friction coef.	use Actual V if d:D < **0.3**

Check

LOCATION				PEAK FLOW CALCULATION													SEWER DATA									
				RESIDENTIAL						COMMERCIAL																
				INDIVIDUAL			CUMULATIVE																			
CATCHMENT	STREET	UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	UNITS	POP.	AREA (A) (ha)	POP.	AREA (A) (ha)	RESID. PEAKING FACTOR (M)	INDIVIDUAL AREA (A) (ha)	CUMULATIVE AREA (A) (ha)	POP. FLOW Q_p (L/s)	COMM. FLOW Q_c (L/s)	PEAK EX. Q_i (L/s)	DESIGN FLOW Q_d (L/s)	LENGTH (m)	PIPE SIZE (mm)	PIPE MATERIAL	GRADE USE m/m (%)	CAPACITY n = 0.013 (L/s)	FULL FLOW VELOCITY (m/s)	RATIO d:D	ACTUAL VELOCITY AT Qd (m/s)	VELOCITY & CAPACITY CHECK	% FULL q/Q
13	Red Fox Ln	SA14	SA13	16	48.0	0.66	48.0	0.66	4.32		0.00	0.8	0.0	0.2	1.0	65.5	250	PVC	0.28%	31.47	0.64	0.12	0.64	OK	3.3%
12	Red Fox Ln	SA13	SA12	30	90.0	0.83	138.0	1.49	4.20		0.00	2.3	0.0	0.4	2.8	65.5	250	PVC	0.28%	31.47	0.64	0.20	0.64	OK	8.8%
11	Red Fox Ln	SA12	SA11	11	33.0	0.40	171.0	1.89	4.17		0.00	2.9	0.0	0.5	3.4	71.9	250	PVC	0.28%	31.47	0.64	0.22	0.64	OK	10.9%
10	Red Fox Ln	SA11	SA1	12	36.0	0.50	207.0	2.39	4.14		0.00	3.5	0.0	0.7	4.1	48.8	250	PVC	0.28%	31.47	0.64	0.24	0.64	OK	13.2%
EXT B	Park	CAP B	SA10		0.0		0.0	0.00	4.50	32.22	32.22	0.0	33.8	0.0	33.8	10.7	300	PVC	0.40%	61.16	0.87	0.53	0.87	OK	55.3%
1	Cousins Cres	SA6-E	SA10	12	36.0	1.00	36.0	1.00	4.34		0.00	0.6	0.0	0.3	0.9	75.2	200	PVC	0.40%	20.74	0.66	0.14	0.66	OK	4.4%
	Cousins Cres	SA10	SA9		0.0		36.0	1.00	4.34		32.22	0.6	33.8	0.3	34.7	12.1	300	PVC	0.40%	61.16	0.87	0.54	0.87	OK	56.8%
2	Cousins Cres	SA9	SA8	19	57.0	0.87	93.0	1.87	4.25		32.22	1.6	33.8	0.5	36.0	94.5	300	PVC	0.40%	61.16	0.87	0.55	0.87	OK	58.8%
3	Cousins Cres	SA8	SA7	20	60.0	0.82	153.0	2.69	4.19		32.22	2.6	33.8	0.8	37.2	88.8	300	PVC	0.40%	61.16	0.87	0.56	0.87	OK	60.8%
4	Cousins Cres	SA7	SA2	16	48.0	0.77	201.0	3.46	4.15		32.22	3.4	33.8	1.0	38.2	72.1	300	PVC	0.40%	61.16	0.87	0.57	0.87	OK	62.4%
5	Cousins Cres	SA6-S	SA5	10	30.0	0.54	30.0	0.54	4.35		0.00	0.5	0.0	0.2	0.7	74.8	200	PVC	0.40%	20.74	0.66	0.12	0.66	OK	3.3%
6	Cousins Cres	SA5	SA4	19	57.0	0.95	87.0	1.49	4.26		0.00	1.5	0.0	0.4	1.9	98.8	200	PVC	0.40%	20.74	0.66	0.20	0.66	OK	9.2%
7	Cousins Cres	SA4	SA1	13	39.0	0.73	126.0	2.22	4.21		0.00	2.2	0.0	0.6	2.8	78.8	200	PVC	0.40%	20.74	0.66	0.24	0.66	OK	13.4%
9	Raycroft Dr	SA3	SA2	8	24.0	0.28	24.0	0.28	4.37	0.05	0.05	0.4	0.1	0.1	0.6	39.0	300	PVC	0.30%	52.97	0.75	0.06	0.75	OK	1.0%
8	Raycroft Dr	SA2	SA1	8	24.0	0.29	249.0	4.03	4.11	0.05	32.32	4.1	33.9	1.1	39.2	88.5	375	PVC	0.30%	96.03	0.87	0.44	0.87	OK	40.8%
	Raycroft Dr	SA1	*SA312*		0.0		582.0	8.64	3.94		32.32	9.3	33.9	2.4	45.6	*78.0*	*375*	*PVC*	*0.26%*	89.40	0.81	0.51	0.81	OK	51.1%
	Stacked Towns	Service	Lateral	10	30.0	0.25	30.0	0.25	4.35		0.00	0.5	0.0	0.1	0.6	10.0	150	PVC	2.00%	21.54	1.22	0.11	1.22	OK	2.8%

Jewell Engineering Inc.
1 - 71 Millennium Parkway
Belleville, ON K8P 4Z5
Tel: 613-969-1111
Fax: 613-969-8988
Website: www.jewelleng.ca

Note:
All peaking factors are above the minimum of 2.00

Designed: Julie Humphries, C.E.T.
Checked: Bryon Keene P.Eng
Date: April 11, 2024

Project: Settlers Ridge East Phase 3 & Towncentre Place

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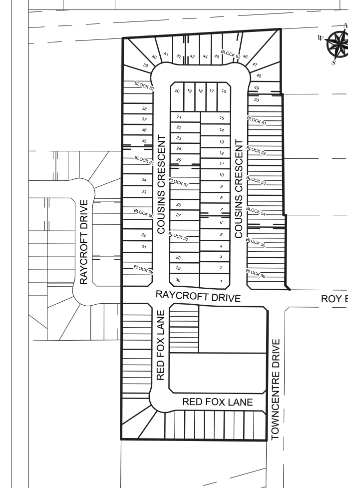
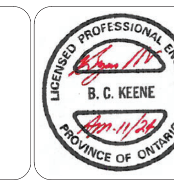


KEY PLAN
SCALE - N.T.S.



JEWELL ENGINEERING

2398513 ONTARIO INC.
TOWNCENTRE PLACE

CITY OF BELLEVILLE

SANITARY SEWER NETWORK
DESIGN SHEET

DRAWN BY: JH	PROJECT NO: 190-4585	
DESIGNED BY: JH/BK	DATE: April 2024	
CHECKED BY:	SCALE: HORIZONTAL - N/A VERTICAL - N/A	
APPROVED BY: BK	CONTRACT NO:	DRAWING NO: SA-4

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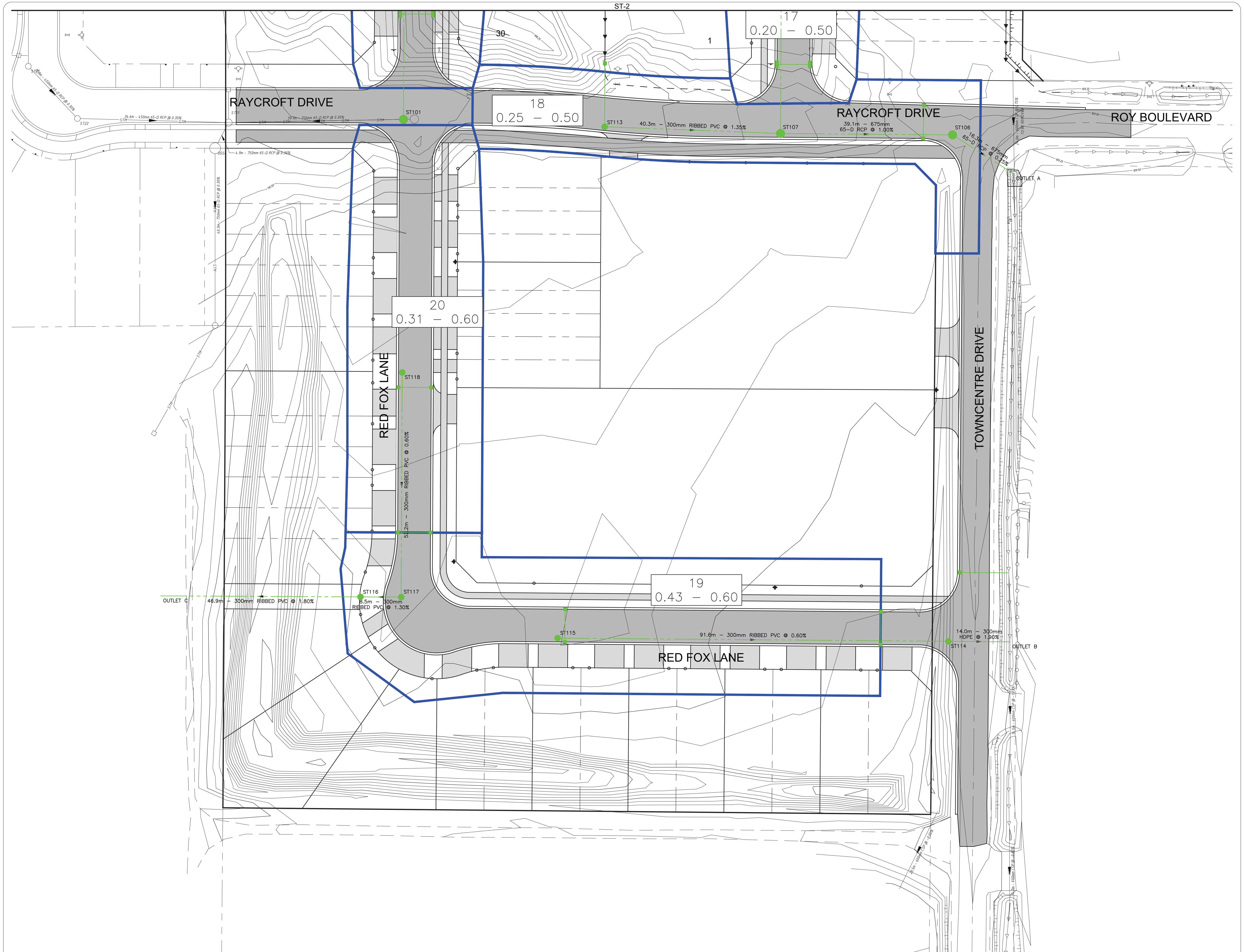

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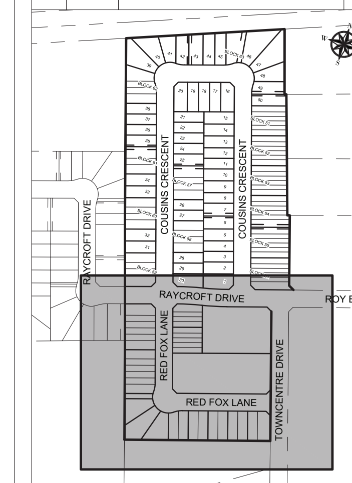
* * DRAWINGS ARE NOT TO BE SCALED * *

REVISIONS

NO.	DATE	DESCRIPTION	BY
A	03/15/2024	ISSUED FOR CLIENT REVIEW	JH
1	04/11/2024	ENGINEERING SUBMISSION #1	JH



KEY PLAN
SCALE - N.T.S.

LICENSED PROFESSIONAL ENGINEER
B. C. KEENE
PROVINCE OF ONTARIO

JEWELL ENGINEERING

2398513 ONTARIO INC.
TOWNCENTRE PLACE

CITY OF BELLEVILLE

STORM SEWER NETWORK
CATCHMENT PLAN
3 of 3

DRAWN BY: JH	PROJECT NO: 190-4585
DESIGNED BY: JH/BK	DATE: April 2024
CHECKED BY:	SCALE: HORIZONTAL - 1:400 VERTICAL - N/A
APPROVED BY: BK	CONTRACT NO:
	DRAWING NO: ST-3

02/28/2024

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STORM SEWER DESIGN SHEET

Peak Runoff Estimate by Rational Method

$$Q = \frac{1}{360} C\, i\, A$$

Where:

- Q = Peak Flow in cms
- C = Runoff Coefficient
- i = Rainfall Intensity in mm/hr
- A = Area in hectares

Intensity Equation: **Belleville**

$$i = A * T_c^{\ B}$$

Where:

- i = Rainfall Intensity in mm/hr
- T_c = Time of Concentration in hours

5-Year Parameters

- A = 26.4
- B = -0.677

Pipe Capacity by Manning's Equation

$$Q = \frac{1}{n} A\, R^{2/3}\, S^{1/2}$$

Manning's Coef

CSP	0.024
RCP/PVC	0.013

Where:

- A = area of pipe in m^2
- R = Hydraulic radius = A / P
- P = Wetted perimeter
- S = Slope (m/m)
- n = Manning's friction coef.

Check

$q \le Q$

$V \le 6\ m/s$

LOCATION				PEAK FLOW CALCULATION									PROPOSED SEWER									
STREET	CATCHMENT	FROM	TO	CATCHMENT AREAS RUNOFF COEFFICIENT 0.25	0.45	0.50	0.60	R.C. x A (ha)	CUM. R.C x A (ha)	TIME OF CONCENTRATION (min)	INTENSITY (mm/hr)	PEAK FLOW (m^3/s)	DIAMETER (mm)	LENGTH (m)	TYPE OF PIPE	GRADE (m/m) (%)	CAPACITY (m^3/s)	FULL FLOW VELOCITY (m/s)	TIME OF FLOW (min)	ACTUAL VELOCITY AT Q_d (m/s)	q/Q (%)	CHECK CAPACITY
Cousins Cres	Ext A, 1	ST105	ST104		1.50	0.23		0.79	0.79	20.00	55.5	0.12	450	29.5	RCP	0.30%	0.16	0.98	0.50	1.09	78.1%	OK
	2, 3, 4, 5	ST104	ST103			1.05		0.53	1.32	20.50	54.6	0.20	525	103.9	RCP	0.30%	0.24	1.09	1.59	1.22	84.8%	OK
	6, 7	ST103	ST102			0.69		0.35	1.66	22.09	51.9	0.24	600	71.1	RCP	0.30%	0.34	1.19	1.00	1.29	71.2%	OK
	8	ST102	ST101			0.19		0.10	1.76	23.09	50.4	0.25	600	77.2	RCP	0.30%	0.34	1.19	1.08	1.30	73.1%	OK
Raycroft Dr		ST101	ST21					0.00	1.76	24.17	48.9	0.24	*750*	39.9	*RCP*	*0.30%*	0.61	1.38	0.48	1.29	39.1%	OK
Easement	*116,117,118,119*	ST21	OGS4			1.80		0.90	2.66	24.65	48.2	0.36	*750*	*4.9*	*RCP*	*0.30%*	0.61	1.38	0.06	1.43	58.4%	OK
		OGS4	ST20					0.00	2.66	24.71	48.1	0.36	*750*	*40.3*	*RCP*	*0.30%*	0.61	1.38	0.49	1.43	58.3%	OK
		ST20	HW57					0.00	2.66	25.20	47.5	0.35	*750*	*28.9*	*RCP*	*0.30%*	0.61	1.38	0.35	1.42	57.5%	OK
Raycroft Dr	9	ST113	ST107			0.31		0.16	0.16	15.00	67.5	0.03	300	40.3	PVC	1.35%	0.11	1.59	0.42	1.33	25.9%	OK
Cousins Cres	Ext B, 10, 11	ST112	ST111		2.37	0.32		1.23	1.23	20.00	55.5	0.19	525	11.3	PVC	0.30%	0.24	1.09	0.17	1.22	80.4%	OK
		ST111	ST110					0.00	1.23	20.17	55.2	0.19	525	8.0	PVC	0.30%	0.24	1.09	0.12	1.22	79.9%	OK
	12, 13	ST110	ST109			0.46		0.23	1.46	20.30	55.0	0.22	600	71.1	PVC	0.30%	0.34	1.19	1.00	1.27	66.2%	OK
	14	ST109	ST108			0.44		0.22	1.68	21.29	53.2	0.25	600	76.8	PVC	0.30%	0.34	1.19	1.08	1.30	73.8%	OK
	15, 16, 17	ST108	ST107			1.06		0.53	2.21	22.37	51.5	0.32	675	96.8	RCP	0.30%	0.46	1.29	1.25	1.38	68.6%	OK
Raycroft Dr	18	ST107	ST106			0.25		0.13	2.49	23.62	49.6	0.34	675	38.1	RCP	1.00%	0.84	2.35	0.27	2.22	40.8%	OK
Raycroft Dr		ST106	OUTLET A					0.00	2.49	23.89	49.2	0.34	675	54.3	RCP	0.25%	0.42	1.17	0.77	1.32	81.0%	OK
Red Fox Ln	19	ST115	ST114				0.43	0.26	0.26	15.00	67.5	0.05	300	91.6	PVC	0.60%	0.07	1.06	1.44	1.12	64.6%	OK
		ST114	OUTLET B					0.00	0.26	16.44	63.4	0.05	300	14.0	PVC	1.90%	0.13	1.89	0.12	1.70	34.1%	OK
Red Fox Ln	20	ST118	ST117				0.31	0.19	0.19	15.00	67.5	0.03	300	52.2	PVC	0.60%	0.07	1.06	0.82	1.04	46.6%	OK
Service Route		ST117	ST116					0.00	0.19	15.82	65.1	0.03	300	8.5	PVC	1.30%	0.11	1.56	0.09	1.37	30.5%	OK
		ST116	OUTLET C					0.00	0.19	15.82	65.1	0.03	300	46.9	PVC	1.80%	0.13	1.84	0.43	1.54	25.9%	OK

JEWELL ENGINEERING

Jewell Engineering Inc
1-71 Millennium Parkway
Belleville, ON, K8N 4Z5
Ph. 613-969-1111
Fx. 613-969-8988
www.jewelleng.ca

Designed:	Julie Humphries, C.E.T.
Checked:	Bryon Keene, P.Eng.
Date:	April 11, 2024

Project: Settlers Ridge Phase 3 & Towncentre Place

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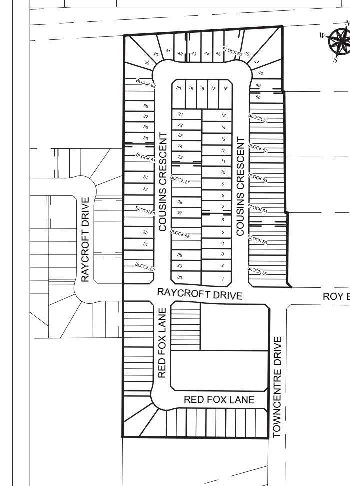
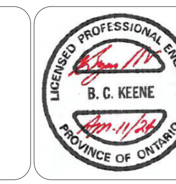


KEY PLAN
SCALE - N.T.S.



JEWELL ENGINEERING

2398513 ONTARIO INC.
TOWNCENTRE PLACE

CITY OF BELLEVILLE

STORM SEWER NETWORK
DESIGN SHEET

DRAWN BY: JH	PROJECT NO: 190-4585	
DESIGNED BY: JH/BK	DATE: April 2024	
CHECKED BY:	SCALE: HORIZONTAL - N/A VERTICAL - N/A	
APPROVED BY: BK	CONTRACT NO:	DRAWING NO: ST-4

APPENDIX G:
CITY OF BELLEVILLE CLI CHECKLIST

Revision 1, June 29 2023

STORM and SANITARY APPLICATIONS FOR APPROVAL

SUBMISSION GUIDELINE

Preamble

This document is intended only to provide guidance on applications for storm and sanitary approvals. It is not intended to provide specific details of the requirements. It is to be read in conjunction with Consolidated Linear Infrastructure Environmental Compliance Approval (CLI ECA) 151-W601 (sanitary) Issue # 2 issued on May 16, 2023 and CLI ECA 151-S701 (storm) Issue # 3 issued on May 16, 2023, or as amended from time to time. The most current applicable CLI ECA is the governing document and takes precedence over this guidance.

This document is currently an uncontrolled document. That means that users will NOT be automatically notified of changes when they are issued.

This document is preliminary and will evolve over time. It is intended to expand as the City continues to interpret the CLI ECA requirements and as experience is gained by working with each CLI ECA. Requirements may also change as the City develops and implements its standards for sanitary and storm sewers.

The following items must be submitted with each application for approval:

- Design Report
- Design Drawing Set
- Completed Checklists (all that are applicable)
- Completed MECP Pipe Data Form (PIBS 6238e)
- Applicable Completed Signed Forms (eg. SS1, SW1 and/or CS1 for pipes)
- Application Fee(s)

Design Reports must be submitted with applications for approval. Applications will not be reviewed without a Design Report. Design Reports must demonstrate how each requirement from the CLI ECA, and each associated document, is met. This is a requirement from the CLI ECA's. To help ensure this, the City has developed submission checklists. Designers must consider each of the items identified in the various checklists contained in this document and MUST discuss each item in the Design Report. Failure to do so will result in the application being returned.

Applications will be pre-screened for completeness based on the completed checklists. Incomplete applications will be returned prior to commencement of any detailed review.

Following successful pre-screening, a detailed review will be conducted to ensure that the requirements of the CLI ECA and all City requirements have been met. Comments/questions may be returned to the applicant in order to clarify any uncertainty or to address any issues/concerns and may result in the requirement for resubmissions. Overall review times will depend on the completeness of the applications.

Checklist templates can be found attached to this document as follows:

Schedule A – Sanitary Sewers

Schedule B – Storm Sewers

Schedule C – Combined Sewers (under development)

Schedule D – Sanitary Pumping Stations (under development)

Schedule E – Storm Pumping Stations (under development)

Schedule F – Stormwater Management Facilities (under development)

Schedule G – Third Pipe Systems (under development)

The checklists contain three parts: pre-authorization verification, application submission requirements and design requirements (report and drawings).

The first part is meant to verify that pre-authorization conditions are met. If pre-authorization conditions are not met then the City is not authorized to approve the proposed alteration and the application must be submitted to the Ministry of Environment, Conservation and Parks (MECP) for approval.

The second part is meant to ensure that application submissions are complete and ready for review. Incomplete applications complicate the review and lengthen the review times.

The third part is a detailed list of requirements organized in table format. The first table relates to the Design Report and the second table relates to the Design Drawings. In the tables, the first column contains an item number to facilitate easy reference. Each item (or row in the table) must be discussed in the Design Report or shown on the Design Drawings. The second column is a checkbox. The designer must check this box only if they have discussed the item in the Design Report or shown the item in the Design Drawings. This is meant to assist the designer in ensuring that all items have been discussed. The third column is a description of the required items. These are intended to provide an idea of the requirement but do NOT include a complete description of the requirement. The CLI ECA's (or associated documents) must be consulted to determine the exact details of each requirement. The fourth column provides a reference to the source of the requirement. The fifth column is blank and is intended for the designer to identify where in the Design Report (by section number) the discussion can be found or on which Design Drawing the item can be seen. This must be filled in for each item as it will facilitate both the pre-screening and the detailed review. It is possible that the City may not be pre-authorized to approve the proposed alteration if some of the requirements cannot be met. These will need to be considered on a case-by-case basis in order to determine next steps.

The following are the documents that are identified in column 4 (Source) of the checklist tables:

"City" refers to the most current version of the City of Belleville's document entitled "Engineering Requirements for Subdivisions",

"Design Criteria" refers to the most current version of the MECP document entitled "Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alterations Authorized under Environmental Compliance Approvals" along with section numbers,

"Design Guidelines" refers to the most current version of the MECP document entitled "Design Guidelines for Sewage Works" along with section numbers,

"ECA" refers to the most current version of the applicable CLI ECA along with schedule and section numbers,

"SOP" refers to the most current version of the MECP document entitled "Standard Operating Policy for Sewage Works",

"SPP" refers to the most current version of the "Approved Quinte Region Source Protection Plan" prepared by the Quinte Region Source Protection Committee, and

"Stormwater Manual" refers to the most current version of the MECP document entitled "Stormwater Management Planning and Design Manual" along with section numbers.

An attempt was made to try to group similar requirements together. Therefore, some document references may appear in other sections of the checklist.

SCHEDULE A

Submission Checklist – Sanitary Sewers

Checklist A Version 1, June 29 2023

PART A: Pre-Authorization Verification

Will the proposed alteration:

1. ☐ YES ☒ NO Involve lands where the designer is aware that Indigenous treaty rights or asserted rights may be impacted (ECA Schedule D, Section 3.11)?
2. ☐ YES ☒ NO Result in exceedance of hydraulic capacity of any part of the downstream sewage collection system including any pumping stations (ECA Schedule D, Section 4.1.3 (a))? Also see Part C, Item 13 below.
3. ☐ YES ☒ NO Result in exceedance of Uncommitted Reserve Hydraulic Capacity of the receiving sewage treatment plant (ECA Schedule D, Section 4.1.3 (a))? Also see Part C, Item 14 below.
4. ☐ YES ☒ NO Cause an adverse effect (ECA Schedule D, Section 4.1.3 (b), Design Criteria, Section 1.1.1.2)? Also see Part C, Item 15 below.
5. ☒ YES ☐ NO Be wholly located within the City of Belleville boundary (ECA Schedule D, Section 4.1.4)?
6. ☐ YES ☒ NO Pass under or through a body of surface water without the use of trenchless construction methods or an alternative construction method authorized by the local Conservation Authority (ECA Schedule D, Section 4.2.1)?
7. ☐ YES ☒ NO Include a gravity sewer pipe that has a nominal diameter greater than 1050 mm (ECA Schedule D, Section 4.2.2)?
8. ☐ YES ☒ NO Include a forcemain that has a nominal diameter greater than 450 mm (ECA Schedule D, Section 4.2.3)?
9. ☐ YES ☒ NO Include a combined sewer or partially separated sewer (ECA Schedule D, Section 4.2.4, Design Guidelines, Section 5.2)? Also see Part C, Item 5 below.
10. ☐ YES ☒ NO Create a new discharge point into the Natural Environment (ECA Schedule D, Section 4.2.6)? Also see Part C, Item 16 below.
11. ☐ YES ☒ NO Connect to a municipal sewage collection system of another municipality without written consent from that other municipality (ECA Schedule D, Section 4.2.5)? Also see Part C, Item 17 below.

12. ☐ YES ☒ NO Be part of an Undertaking under the Environmental Assessment Act where a Section 16 order has been issued (ECA Schedule D, Section 4.2.7)? Also see Part C, Item 18 below.

If the answer to any of these questions is **YES**, the proposed works may not be pre-authorized under the City's CLI-ECA whereby the City cannot approve the works. An Environmental Compliance Approval application for the proposed works may have to be submitted to the Ministry of the Environment, Conservation and Parks for approval. Consult with the City before proceeding any further.

Has the design of the alteration:

13. ☒ YES ☐ NO Been prepared by a Licensed Engineering Practitioner (ECA Schedule D, Section 4.1.1 (a), Design Criteria, Section 1.1.2.1 (a))?
14. ☒ YES ☐ NO Been designed only to collect and transmit sewage and not treat sewage (ECA Schedule D, Section 4.1.1 (b), Design Criteria, Section 1.1.2.1 (b))?
15. ☒ YES ☐ NO Satisfied the Design Criteria (ECA Schedule D, Section 4.1.1 (c), Design Criteria, Section 1.1.2.1 (c))? Also see Part C, Item 6 below.
16. ☒ YES ☐ NO Satisfied the municipal criteria (ECA Schedule D, Section 4.1.1 (c))? Also see Part C, Item 7 below.

If the answer to any of these questions is **NO**, the proposed works are not pre-authorized under the City's CLI-ECA and the City cannot approve the works. An Environmental Compliance Approval application for the proposed works will have to be submitted to the Ministry of the Environment, Conservation and Parks for approval. Consult with the City before proceeding any further.

Will the proposed Works:

17. ☒ YES ☐ NO Be tendered or construction commenced on, or before, July 25, 2024 (ECA Schedule D, Section 9.1.1)?
18. ☐ YES ☒ NO Be designed prior to the issue date of the sanitary CLI ECA and changes to the design would result in significant cost increase or significant project delays (ECA Schedule D, Section 9.1.3)?
19. ☐ YES ☒ NO Be the result of a Class Environmental Assessment that was completed prior to the issue date of the sanitary CLI ECA and changes to the design would result in significant cost increase or significant project delays (ECA Schedule D, Section 9.1.3)?

If the answer to any of these questions is **YES**, the project may qualify as a transitional project and may be exempt from some or all of the requirements highlighted throughout in grey. Consult with the City before proceeding any further.

PART B: Application Submission Requirements

Does the application submission include the following:

- ☒ YES ☐ NO Design Report?
- ☒ YES ☐ NO Complete Design Drawing Set?
- ☒ YES ☐ NO Completed Checklists (all that are applicable)?
- ☒ YES ☐ NO Completed MECP Pipe Data Form (PIBS 6238e)?
- ☒ YES ☐ NO Applicable Signed Forms (e.g. SS1, SW1 and/or CS1 for pipes)?
- ☒ YES ☐ NO Application Fee(s)?

If the answer to any of these is NO, then the application is incomplete and may not be reviewed. Contact the City to discuss further.

PART C: Design Requirements

In the Design Report (in no particular order) for sanitary sewers, the designer shall:

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
1	☒	Provide a summary of length for each main pipe and forcemain diameter and lateral diameter.	ECA Schedule D, Section 4.2.2, Design Criteria, Section 2.3	Section 3.8, Section 3.3.12
2	☒	Identify downstream pumping stations that Works will discharge to.	ECA Schedule D, Section 3.10.2 (a) (iii)	Section 3.1
3	☒	Identify downstream overflow points (CSO or SSO).	ECA Schedule D, Section 3.10.2 (c) (iv)	Section 3.3.10
4	☒	Verify whether any part of the Works is located in a source protection vulnerable area.	ECA Schedule D, Section 3.10.2 (c) (vi)	Section 3
5	☒	Identify whether the project is an addition, modification, replacement or extension of a separate sewer, nominally separate sewer, forcemain, combined sewer or partially separate sewer.	ECA Schedule D, Section 4.1, Design Guidelines, Section 5.2	Section 3
6		Confirm that the design satisfies the Design Criteria, by:	ECA Schedule D, Section 4.1.1 (c), Design Criteria, Section 1.1.2.1 (c)	

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
a)	☒	Identifying soil characteristics,	Design Criteria, Section 1.2.1	Section 1.3, Section 3
b)	☒	Discussing how the design has considered all relevant soil and hydrogeological conditions,	Design Criteria, Section 1.2.1	Section 1.3
c)	☒	Discussing how the design of all maintenance holes, chambers, and structures conforms to all applicable requirements such as Occupational Health and Safety Act, MOL Confined Space Guidelines, Fire Protection and Prevention Act, etc.,	Design Criteria, Section 1.2.2, Design Guidelines, Section 5.9.8	Section 3.6
d)	☒	Discussing how the design of all maintenance holes and chambers has considered future inspection, operation, and maintenance,	Design Criteria, Section 1.2.3	Section 3.6.2
e)	☒	Identifying if soil is susceptible to frost and where such soil is located,	Design Criteria, Section 1.2.4	Section 1.3, Section 3.3.4
f)	☒	Confirming all precast structures in frost susceptible soils include hardware to prevent heave due to frost,	Design Criteria, Section 1.2.4, Section 2.10.9, Design Guidelines, Section 5.9.10	Section 3.3.4
g)	☒	Identifying if any area is subject to flooding (regular or seasonal),	Design Criteria, Section 1.2.5	Section 3
h)	☒	Identifying groundwater levels,	Design Criteria, Section 1.2.5	Section 1.3, Section 3
i)	☒	Identifying inflow/infiltration prevention measures and flotation prevention measures for all sewers, maintenance holes and appurtenances in areas subject to flooding or high groundwater,	Design Criteria, Section 1.2.6, Section 2.9.5, Section 2.10.10, Design Guidelines, Section 5.7.4	Section 3, Section 3.6.3
j)	☒	Identifying specifications for adequate control of siltation and erosion during construction,	Design Criteria, Section 1.2.7.2	App F, ESC Dwg.
k)	☒	Providing an ESC plan that identifies how the requirements (measures, installation, maintenance, inspection) will be met,	ECA Schedule D, Section 3.8 and 3.9	App F, ESC Dwg.

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
l)	☒	Identifying the ESC standard to be followed,	ECA Schedule D, Section 3.8.4	App F, ESC Dwg, Note 1
m)	☒	Identifying, along with rationale for, the average daily flows to be used in the design of sizing of the pipe,	Design Criteria, Section 2.1.1.1, Section 2.1.2, Section 2.1.3, Section 2.1.4, Design Guidelines, Section 5.5.2.1	Section 3.2,
n)	☒	Identifying which formula is used to calculate the peaking factor for residential flows any why,	Design Criteria, Section 2.1.1.2, Design Guidelines, Section 5.5.2.1	Section 3.2
o)	☒	Calculating the peaking factor for residential flows and comparing to the minimum,	Design Criteria, Section 2.1.1.2, Design Guidelines, Section 5.5.2.1	Table 7, Section 3.2
p)	☒	Identifying, along with rationale for, the peak inflow and infiltration (I&I) rate to be used in the design of sizing of the pipe,	Design Criteria, Section 2.1.5, Design Guidelines, Section 5.5.2.5	Section 3.2
q)	☒	Discussing, calculating and summarizing the peak sewage flow,	Design Guidelines, Section 5.5.2, Section 5.5.2.1, Section 5.5.2.2, Section 5.5.2.3, Section 5.5.2.4, Section 5.5.2.5	Section 3.3, Section 3.8
r)	☒	Identifying, along with rationale for, the formula to be used to determine the sewer pipe capacity,	Design Criteria, Section 2.2.1, Design Guidelines, Section 5.7.1	Section 3.2
s)	☒	Identifying, along with the rationale for, and the source of, the friction factor to be used to determine sewer pipe capacity,	Design Criteria, Section 2.2.1, Design Guidelines, Section 5.7.1	Section 3.3.3
t)	☒	Discussing, calculating and summarizing the sewer pipe capacity,	Design Guidelines, Section 5.7.1	Section 3.8, Table 7

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
u)	☒	Verifying that the velocity in all sanitary sewers is less than the maximum allowable and greater than the minimum allowable,	Design Criteria, Section 2.4.4, Section 2.4.2, Design Guidelines Section 5.7.6	Table 7 Check Column Section 3.8, Section 3.3.8
v)	☒	Identifying the Seasonally High Groundwater Table level and how it was determined,	Design Criteria, Section 2.9.1, Section 2.9.2, Section 2.9.3	Section 1.3
w)	☐	Calculating the groundwater pressure that pipe joints and connections must withstand,	Design Criteria, Section 2.9.2, Section 2.9.3	
x)	☒	Identifying specifications for pipe joints and connections (to withstand groundwater pressure, minimize infiltration, prevent root entrance, etc.),	Design Criteria, Section 2.9.2, Section 2.9.3, Design Guidelines, Section 5.7.11.1	Section 3.7
y)	☒	Identifying specifications for waterproofing of maintenance holes,	Design Criteria, Section 2.9.4, Design Guidelines, Section 5.9.6	Section 3.6.3
z)	☒	Discussing the locations and spacing of maintenance holes and summarizing in tabular format,	Design Criteria, Section 2.10.1, Section 2.10.2, Design Guidelines, Section 5.9.1	Section 3.6.5, App F, Dwgs ND-3, ND-4
aa)	☐	Discussing provision of maintenance hole between subdivision phases,	Design Criteria, Section 2.10.3	
ab)	☐	Discussing grades across maintenance holes,	Design Criteria, Section 2.10.4	
ac)	☐	Discussing rationale for invert elevations across maintenance holes,	Design Criteria, Section 2.10.5	
ad)	☒	Discussing need and rationale for drop structures,	Design Criteria, Section 2.10.6, Design Guidelines, Section 5.9.2	Section 3.6.4

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
ae)	☐	Discussing specification for grading around maintenance holes,	Design Criteria, Section 2.10.7, Section 2.10.8	
af)	☒	Discussing design of maintenance hole sizing,	Design Criteria, Section 2.10.11, Design Guidelines, Section 5.9.3	Section 3.6.1
ag)	☐	Discussing design of maintenance hole safety platforms,	Design Criteria, Section 2.10.12	
ah)	☒	Discussing the flow channel configurations and benching in manholes,	Design Guidelines, Section 5.9.4, Section 5.9.5	Section 3.6.4
ai)	☐	Identifying if Works include any sanitary forcemains (if so, then discussing Sections 3, 7.1.2.1.c, and 8.5 of Design Criteria),	Design Criteria, Section 3, Section 7.1.2.1.c, Section 8.5	
aj)	☐	Discussing need for anchors/restraints,	Design Criteria, Section 2.5.1, Section 2.5.2	
ak)	☐	Discussing need for protective measures,	Design Criteria, Section 2.5.3	
al)	☐	Identifying source of specifications for all proposed materials,	Design Criteria, Section 2.6	
am)	☐	Ensuring that proposed pipe materials meet OPSS specifications,	Design Criteria, Section 2.6.1,	
an)	☐	Discussing presence of contamination,	Design Criteria, Section 2.6.2	
ao)	☐	Discussing materials that are selected based on specific site conditions,	Design Criteria, Section 2.6.3	
ap)	☒	Identifying loading conditions, pipe strength and associated safety factor,	Design Criteria, Section 2.7, Section 2.8.2, Design Guidelines Section 5.10.1	Section 3.3.4
aq)	☐	Providing manufacturer’s recommendations for pipe cover (or identifying to be considered in shop drawing review),	Design Criteria, Section 2.8.3	

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
ar)	☒	Identifying means for protection from frost,	Design Criteria, Section 2.8.1, Design Guidelines, Section 5.7.3	Section 3.3.4
as)	☒	Identifying if Works include any inverted syphons (if so, then discussing each part of Section 2.11 as well as 7.1.2.1.c),	Design Criteria, Section 2.11, Section 7.1.2.1.c, Design Guidelines, Section 5.10.2	Section 3.3.5
at)	☒	Describing how design meets service lateral requirements,	Design Criteria, Section 2.12, Design Guidelines, Section 5.7.11.2	Section 3.3.12
au)	☒	Providing hydraulic design sheets,	Design Criteria, Section 7.1.2.1.a, Design Guidelines, Section 5.7.12	Table 7
av)	☒	Identifying specifications for how inspection and testing requirements outlined in Design Criteria Section 8 will be met,	Design Criteria, Section 1.2.7.1, ECA Schedule D, Section 4.1.7	Section 3.7
aw)	☐	Providing and discussing inspection and testing plan (video inspection, deflection testing, etc.),	Design Criteria, Section 8.1.1, Section 8.1.3, Section 8.1.6, Section 8.1.7, Section 8.2, Section 8.4	
ax)	☐	Identifying how the requirement for notification of testing will be communicated to the contractor,	Design Criteria, Section 8.1.4	
ay)	☐	Identifying how the requirement for provision of inspection reports will be communicated to the contractor,	Design Criteria, Section 8.1.5	
az)	☐	Identifying need for special inspection and testing requirements,	Design Criteria, Section 8.1.8	
ba)	☐	Discussing how the leakage testing requirements will be met.	Design Criteria, Section 8.3	

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
7		Confirm that the design satisfies Municipal Criteria, by:	ECA Schedule D, Section 4.1.1 (c)	
a)	☒	Discussing how the design satisfies the City's Sanitary Sewer Design Criteria outlined in Section 2 (Standards) of the City's Engineering Requirements.	City, Section 2	Section 3.2
8		Confirm that the design is consistent with or addresses Design Guidelines, by:	ECA Schedule D, Section 4.1.1 (d)	
a)	☒	Identifying and summarizing all tributary areas that will flow to the system,	Design Guidelines, Section 5.5.1	Section 3.2 App F, Table 7
b)	☒	Identifying for the tributary area: the land uses, population densities, the design period, as wells as the source of the information,	Design Guidelines, Section 5.5.1	Section 3.2
c)	☒	Discussing foundation drainage,	Design Guidelines, Section 5.7.14	Section 3.3.6
d)	☒	Confirming that sizes of sanitary sewers and sanitary services are greater than minimum acceptable sizes,	Design Guidelines, Section 5.7.2	Section 3.3.7
e)	☒	Identifying, and describing rationale for, depths of all sewers,	Design Guidelines, Section 5.7.3	Section 3.3.4
f)	☒	Describing the method for calculating, and summarizing in table format, the velocity of sanitary flow, and slope of pipes,	Design Guidelines, Section 5.7.5, Design Criteria, Section 2.4.1, Section 2.4.2	Section 3.3.8, Table 7
g)	☒	Identifying hydraulic losses at manholes,	Design Guidelines, Section 5.7.5.1	Section 3.6.4
h)	☒	Discussing need for reduction in slopes,	Design Guidelines, Section 5.7.5.2	Section 3.3.8
i)	☒	Discussing slopes relative to solids deposition,	Design Guidelines, Section 5.7.5.3	Section 3.3.8
j)	☒	Discussing slopes relative to minimum and maximum velocities and depth of flow,	Design Guidelines, Section 5.7.6	Section 3.3.8

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
k)	☒	Discussing need for steep slope protection,	Design Guidelines, Section 5.7.6.1	Section 3.3.8
l)	☒	Discussing alignment of sewers,	Design Guidelines, Section 5.7.7	Section 3.3.9
m)	☒	Discussing changes in pipe sizes,	Design Guidelines, Section 5.7.8	Section 3.3.7
n)	☒	Discussing rationale for design of pipe materials,	Design Guidelines, Section 5.7.9	Section 3.3.3
o)	☒	Identifying the installation specifications to be used,	Design Guidelines, Section 5.7.10	App F, Dwg ND-1
p)	☒	Identifying testing requirement (ring deflection testing, leakage, hydrostatic, manhole),	Design Guidelines, Section 5.7.10, Section 5.7.11.3, Section 5.7.11.4, Section 5.7.12.1, Section 5.9.7	Section 3.7
q)	☒	Discussing bypass and overflow capabilities and likelihoods,	Design Guidelines, Section 5.7.13	Section 3.3.10
r)	☒	Discussing any proposed alternative installation and construction technologies,	Design Guidelines, Section 5.8	Section 3.6.12
s)	☒	Discussing the need for corrosion protection within maintenance holes,	Design Guidelines, Section 5.9.9	Section 3.6.8
t)	☒	Identifying special considerations for sewer system rehabilitations,	Design Guidelines, Section 5.11	Section 3.6.9
u)	☒	Identifying if the project involves a stream crossing (if so, then Design Guideline, Section 5.12 is to be discussed),	Design Guidelines, Section 5.12	Section 3.6.10
v)	☒	Identifying if the project involves an aerial crossing (if so, then Design Guideline, Section 5.13 is to be discussed),	Design Guidelines, Section 5.13	Section 3.6.11

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
w)	☒	Identifying if the project involves alternative sanitary sewer systems (if so, then Design Guideline, Section 5.15 is to be discussed),	Design Guidelines, Section 5.15	Section 3.6.12
x)	☒	Discussing challenging conditions affecting servicing.	Design Guidelines, Section 6	Section 3.6.13
9		Ensure design is protective of nearby drinking water systems, by:	ECA Schedule D, Section 4.1.1 (e), Section 7.1	
a)	☒	Including an assessment of whether proposed Works pose a Significant Drinking Water Threat and identifying mitigation measures,	Design Criteria, Section 1.3, SOP	Section 3
b)	☒	Including design considerations set out in Standard Operating Policy and Source Protection Plan, by:	ECA Schedule D, Section 4.1.1 (e)	Section 3
(i)	☒	Identifying if the proposed Works fall within IPZ1, IPZ2 for Belleville Drinking Water System or IPZ1, IPZ2, WHPAA, WHPAB or WHPAC for Pt Anne Drinking Water System,	ECA Schedule D, Section 4.1.1 (e)	Section 3
(ii)	☒	Identifying if any of the sewage policies from the Source Protection Plan apply to any of the proposed Works,	SPP	Section 3
(iii)	☒	Identifying if any part of the Proposed Works is a Prescribed Threat Activity or Sub-Threat Activity within a vulnerable area, as outlined in the Standard Operating Policy,	SOP	Section 3
(iv)	☒	Identifying mitigation measures for all Prescribed Threat Activities and Sub-Threat Activities,	SOP	Section 3
c)	☒	Identifying how protection is provided for drinking water systems as outlined in MECP F-6-1 and Section 15 of Watermain Design Criteria document,	Design Criteria, Section 1.4,	Section 3.2, Section 3.3.11
d)	☒	Identifying how protection is provided in accordance with Section 5.14 of Design Guideline,	Design Guidelines, Section 5.14,	Section 3.3.11

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
e)	☒	Identifying how the design is protective of drinking water sources in Vulnerable Areas,	ECA Schedule E, Section 7.1	Section 3
f)	☒	Demonstrating that the alteration is designed so that it will not cause overflows or backups nor increase surcharging anyplace in the system (including in service connections to basements),	ECA Schedule D, Section 4.1.2 (a), Section 4.1.3 (c), Design Criteria, Section 1.1.1.3	Section 3.3.10
g)	☒	Confirming that the proposed alteration will not result in any increase in the frequency or volume of bypasses or overflows at the sewage treatment plant.	ECA Schedule D, Section 4.1.3 (c), Design Criteria, Section 1.1.1.4	Section 3.5
10	☒	Identify how smooth flow transition is maintained to existing gravity storm sewers.	ECA Schedule D, Section 4.1.2 (b)	Section 3.6.6
11	☒	Describe how the design will not increase the generation of sulfides and other odourous compounds in the sewage collection system.	ECA Schedule D, Section 4.1.2 (c), Design Guidelines, Section 5.6	Section 3.3.8
12	☒	Identify all existing downstream pumping stations or unique sewage collection components (chambers, syphons, pressure sewers, etc.).	ECA Schedule D, Section 4.1.3 (a)	Section 3.1
13	☒	Demonstrate with calculations that the maximum discharge/generation of sewage by users who will be served by the alteration will not result in an exceedance of hydraulic capacity of any part of the downstream sewage collection system including any pumping stations.	ECA Schedule D, Section 4.1.3 (a), Design Criteria, Section 1.1.1.1, Section 1.1.2.2	Section 3.1
14	☒	Demonstrate with calculations that the maximum discharge/generation of sewage by users who will be served by the alteration will not result in an exceedance of the uncommitted reserve hydraulic capacity of the receiving sewage treatment plant.	ECA Schedule D, Section 4.1.3 (a), Design Criteria, Section 1.1.1.1, Section 1.1.2.2	Section 3.5, App B

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
15	☒	Confirm that the Works are designed not to cause adverse effects.	ECA Schedule D, Section 4.1.3 (b), Design Criteria, Section 1.1.1.2	Section 3.8
16	☒	Discuss whether the project creates a new discharge point into the natural environment.	ECA Schedule D, Section 4.2.6	Section 3.0
17	☒	Discuss whether the pipe will only be connected to the Belleville Sewage Collection System.	ECA Schedule D, Section 4.2.5	Section 3.0
18	☒	Discuss whether the project is part of an undertaking under EAA and a section 16 order has been issued.	ECA Schedule D, Section 4.2.7	Section 3.0

For the Design Drawings for sanitary sewers, the designer shall:

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
1	☒	Provide digital drawings that include information outlined in Section 3.10.2 (a) (i), (ii) and (iii) (where applicable) of ECA Schedule D.	ECA Schedule D, Section 3.10.2	App F
2	☒	Identify downstream pumping stations, storage structures or unique infrastructure (syphons, pressure sewers, etc.).	ECA Schedule D, Section 3.10.2 (a) (iii)	App F
3	☒	Identify any proposed small bore systems (if any).	ECA Schedule D, Section 3.10.2 (a) (v)	App F
4	☒	Identify any source protection vulnerable areas.	ECA Schedule D, Section 3.10.2 (a) (vi)	App F
5	☒	Identify any downstream CSO's or SSO's.	ECA Schedule D, Section 3.10.2 (a) (iv)	App F
6	☒	For subdivisions, prepare the drawings in accordance with the City's drawing configuration requirements.	City, Section 1.2, Section 1.3, Section 1.4, Section 1.5, Section 1.7	App F
7	☒	For subdivisions, include the City's standard notes.	City, Section 2	App F

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
8	☒	For subdivisions, include the City's standard Specification Drawings.	City, Section 2	App F

SCHEDULE B

Submission Checklist – Storm Sewers

Checklist B Version 1, June 29 2023

PART A: Pre-Authorization Verification

Will the proposed alteration:

1. ☐ YES ☒ NO Include municipally or privately owned works on industrial, commercial or institutional land (ECA Schedule D, Section 3.1.1)?
2. ☐ YES ☒ NO Include municipally or privately owned works serving a single parcel of land (ECA Schedule D, Section 3.1.2)?
3. ☐ YES ☒ NO Include municipally or privately owned works that are operated as a waste disposal site or snow dump/melt facility (ECA Schedule D, Section 3.1.3)?
4. ☐ YES ☒ NO Include municipally or privately owned works that propose to collect, store, treat, or discharge stormwater that contains substances or pollutants (other than total suspended solids or oil/grease) detrimental to the environment or human health (ECA Schedule D, Section 3.1.4)?
5. ☐ YES ☒ NO Involve lands where the designer is aware that Indigenous treaty rights or asserted rights may be impacted (ECA Schedule D, Section 3.13)?
6. ☐ YES ☒ NO Cause an adverse effect (ECA Schedule D, Section 4.1.3 (a))? Also see Part C, Item 14 below.
7. ☐ YES ☒ NO Result in any deterioration of approved effluent quality or quantity of downstream Stormwater Management Facilities (ECA Schedule D, Section 4.1.3 (b))? Also see Part C, Item 17 below.
8. ☒ YES ☐ NO Be wholly located within the City of Belleville boundary (ECA Schedule D, Section 4.1.4)?
9. ☐ YES ☒ NO Pass under or through a body of surface water without the use of trenchless construction methods or an alternative construction method authorized by the local Conservation Authority (ECA Schedule D, Section 4.3.1)?
10. ☐ YES ☒ NO Include a storm sewer pipe that has a nominal diameter greater than 2400 mm (ECA Schedule D, Section 4.3.2)?
11. ☐ YES ☒ NO Include a combined sewer (ECA Schedule D, Section 4.3.3)?
12. ☐ YES ☒ NO Include a concrete channel (ECA Schedule D, Section 4.3.4)?
13. ☐ YES ☒ NO Be designed to, at any time, transmit, store, or control sanitary sewage (ECA Schedule D, Section 4.3.5)?

14. ☐ YES ☒ NO Convert a rural road cross section ditch to curb, gutter and storm sewers and increase the stormwater volume or peak flow with no water quality treatment to offset the increase (ECA Schedule D, Section 4.3.6)? Also see Part C, Item 19 below.
15. ☐ YES ☒ NO Result in new discharges or increased discharges to a Municipal Drain without written approval from that Owner and a signed Engineer's Report (ECA Schedule D, Section 4.3.7)? Also see Part C, Item 20 below.
16. ☐ YES ☒ NO Establish a new outlet with direct discharge into the Natural Environment without monitoring and without achieving the requirements in Appendix A (ECA Schedule D, Section 4.3.8)? Also see Part C, Item 21 below.
17. ☐ YES ☒ NO Increase stormwater flow of an existing storm sewer or ditch without achieving water quality criteria set in Appendix A or without discharging to a downstream Stormwater Management Facility with sufficient capacity to accommodate the additional stormwater (ECA Schedule D, Section 4.3.9)? Also see Part C, Item 22 below.
18. ☐ YES ☒ NO Increase local hydraulic capacity of an existing storm sewer or ditch to accommodate new stormwater flows without discharging to a downstream Stormwater Management Facility with sufficient capacity to accommodate the additional stormwater (ECA Schedule D, Section 4.3.10)? Also see Part C, Item 23 below.
19. ☐ YES ☒ NO Connect to a municipal stormwater management system of another municipality without written consent from that other municipality (ECA Schedule D, Section 4.3.11)? Also see Part C, Item 24 below.
20. ☐ YES ☒ NO Be part of an Undertaking under the Environmental Assessment Act where a Section 16 order has been issued (ECA Schedule D, Section 4.3.12)? Also see Part C, Item 25 below.
21. ☐ YES ☒ NO Create a new outlet that increases discharge or creates new discharge to privately owned land without written consent of that land owner (ECA Schedule D, Section 7.2.1)? Also see Part C, Item 27 below.

If the answer to any of these questions is **YES**, the proposed works may not be pre-authorized under the City's CLI-ECA whereby the City cannot approve the works. An Environmental Compliance Approval application for the proposed works may have to be submitted to the Ministry of the Environment, Conservation and Parks for approval. Consult with the City before proceeding any further.

Has the design of the alteration:

22. ☒ YES ☐ NO Been prepared by a Licensed Engineering Practitioner (ECA Schedule D, Section 4.1.1 (a), Design Criteria, Section 1.1.4.1 (a))?
23. ☒ YES ☐ NO Been designed only to collect and transmit stormwater (ECA Schedule D, Section 4.1.1 (b), Design Criteria, Section 1.1.2.1 (b))?

24. ☒ YES ☐ NO Been designed NOT to collect or treat any sanitary sewage or combined sewage (ECA Schedule D, Section 4.1.1 (c), Design Criteria, Section 5.1.2, Design Guidelines, Section 5.2)?
25. ☒ YES ☐ NO Been designed NOT to collect, store, treat, control, or manage groundwater unless for the purpose of foundation drains, road subdrains, or LIDS (ECA Schedule D, Section 4.1.1 (d), Design Criteria, Section 5.1.1)?
26. ☐ YES ☐ NO Satisfied the Design Criteria (ECA Schedule D, Section 4.1.1 (e), Design Criteria, Section 1.1.4.1 (b))? Also see Part C, Item 8 below.
27. ☒ YES ☐ NO Satisfied the municipal criteria (ECA Schedule D, Section 4.1.1 (e))? Also see Part C, Item 9 below.
28. ☐ YES ☐ NO Been planned and designed to be consistent with MECP's Stormwater Management Planning and Design Manual (ECA Schedule D, Section 4.1.1 (h), Design Criteria, Section 1.1.4.1 (c))? Also see Part C, Item 11 below.

If the answer to any of these questions is **NO**, the proposed works are not pre-authorized under the City's CLI-ECA and the City cannot approve the works. An Environmental Compliance Approval application for the proposed works will have to be submitted to the Ministry of the Environment, Conservation and Parks for approval. Consult with the City before proceeding any further.

Will the proposed Works:

29. ☒ YES ☐ NO Be tendered or construction commenced on, or before, July 25, 2024 (ECA Schedule D, Section 9.1.1)?
30. ☐ YES ☒ NO Be designed prior to the issue date of the storm CLI ECA and changes to the design would result in significant cost increase or significant project delays (ECA Schedule D, Section 9.1.3)?
31. ☐ YES ☒ NO Be the result of a Class Environmental Assessment that was completed prior to the issue date of the storm CLI ECA and changes to the design would result in significant cost increase or significant project delays (ECA Schedule D, Section 9.1.3)?

If the answer to any of these questions is **YES**, the project may qualify as a transitional project and may be exempt from some or all of the requirements highlighted throughout in grey. Consult with the City before proceeding any further.

PART B: Application Submission Requirements

Does the application submission include the following:

☒ YES ☐ NO Design Report?
☒ YES ☐ NO Complete Design Drawing Set?
☒ YES ☐ NO Completed Checklists (all that are applicable)?

☒ YES ☐ NO Completed MECP Pipe Data Form (PIBS 6238e)?
☐ YES ☐ NO Applicable Signed Forms (eg. SS1, SW1 and/or CS1 for pipes)?
☐ YES ☐ NO Application Fee(s)?

If the answer to any of these is **NO**, then the application is incomplete and may not be reviewed. Contact the City to discuss further.

PART C: Design Requirements

In the Design Report (in no particular order) for storm sewers, the designer shall:

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
1	☒	Provide a summary of length for each main pipe diameter, ditch/swale, culvert diameter, and lateral diameter.	To accommodate an update to Table B.2 in ECA Schedule B, ECA Schedule D, Section 4.3.2, Design Criteria, Section 5.4	Section 4.4
2	☒	Identify tributaries and receiving water body that Works will discharge to.	ECA Schedule D, Section 3.12.2 (c)	Section 4
3	☒	Identify watershed and subwatershed that Works will discharge to.	ECA Schedule D, Section 3.12.2 (d)	Section 4
4	☒	Identify stormsewershed and outlet for each part of the Works.	ECA Schedule D, Section 3.12.2 (e)	Section 4
5	☒	Verify whether any part of the Works is located in a source protection vulnerable area.	ECA Schedule D, Section 3.12.2 (f)	Section 4
6	☒	Identify and discuss any CSO's or SSO's in proximity of project.	ECA Schedule D, Section 3.12.2 (g)	Section 4
7	☒	Identify whether the project is an addition, modification, replacement or extension of a storm sewer, ditch or culvert.	ECA Schedule D, Section 4.1	Section 4
8		Confirm that the design satisfies the Design Criteria, by:	ECA Schedule D, Section 4.1.1 (e)	

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
a)	☐	Demonstrating that proposed Works do NOT result in exceedance of hydraulic capacity of any downstream infrastructure (pipe, pump station, receiving treatment facility such as pond, OGS, etc.),	Design Criteria, Section 1.1.3.1	
b)	☐	Providing confirmation that the proposed Works will NOT cause an adverse effect,	Design Criteria, Section 1.1.3.2	
c)	☐	Demonstrating that the proposed Works will NOT adversely impact the effluent quality of the downstream stormwater works,	Design Criteria, Section 1.1.3.3	
d)	☐	Discussing how the proposed works is designed using an integrated stormwater treatment train approach,	Design Criteria, Section 1.1.4.3	
e)	☐	Identifying soil characteristics,	Design Criteria, Section 1.2.1	
f)	☐	Discussing how the design has considered all relevant soil and hydrogeological conditions,	Design Criteria, Section 1.2.1	
g)	☐	Discussing how the design of all maintenance holes, chambers, and structures conforms to all applicable requirements such as Occupational Health and Safety Act, MOL Confined Space Guidelines, Fire Protection and Prevention Act, etc.,	Design Criteria, Section 1.2.2	
h)	☐	Discussing how the design of all maintenance holes and chambers has considered future inspection, operation, and maintenance,	Design Criteria, Section 1.2.3	
i)	☐	Identifying if soil is susceptible to frost and where such soil is located,	Design Criteria, Section 1.2.4	
j)	☐	Confirming all precast structures in frost susceptible soils include hardware to prevent heave due to frost,	Design Criteria, Section 1.2.4	
k)	☐	Identifying if any area is subject to flooding (regular or seasonal),	Design Criteria, Section 1.2.5	
l)	☐	Identifying groundwater levels,	Design Criteria, Section 1.2.5	

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
m)	☒	Identifying inflow/infiltration prevention measures and flotation prevention measures for all sewers, maintenance holes and appurtenances in areas subject to flooding or high groundwater,	Design Criteria, Section 1.2.6, Section 5.1.6, Design Guidelines, Section 5.7.4	Section 4.4.2
n)	☐	Identifying specifications for adequate control of siltation and erosion during construction,	Design Criteria, Section 1.2.7.2	
o)	☒	Providing an ESC plan that identifies how the requirements (measures, installation, maintenance, inspection) will be met,	ECA Schedule D, Section 3.10 and 3.11	App F, ESC Dwgs
p)	☐	Identifying the ESC standard to be followed,	Appendix A “Construction Erosion and Sediment Control	
q)	☐	Identifying if Works include any storm forcemains (if so, then discussing Sections 3, 7.1.2.1.c, and 8.5 of Design Criteria),	Design Criteria, Section 3, Section 7.1.2.1.c, Section 8.5	
r)	☐	Identifying and providing copies of IDF curves used for the design,	Design Criteria, Section 5.1.3	
s)	☐	Identifying and providing local climate data used to establish storm frequency criteria,	Design Criteria, Section 5.1.4	
t)	☐	Calculating and identifying inlet times by modeling overland flow route under fully developed system conditions,	Design Criteria, Section 5.1.5	
u)	☐	Verifying storm sewer design with a major and minor system capacity analysis,	Design Criteria, Section 5.1.7	
v)	☐	Performing and providing runoff calculations,	Design Criteria, Section 5.2	
w)	☐	Identifying friction factors, source of friction factors, and equation for calculating capacity (Manning or Darcy-Weisbach),	Design Criteria, Section 5.3	

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
x)	☐	Identifying how the pipe colour coding requirements will be communicated to the contractor,	Design Criteria, Section 5.4	
y)	☐	Discussing need for additional protective measures,	Design Criteria, Section 5.5.2	
z)	☐	Discussing need for anchors/restraints,	Design Criteria, Section 5.6.1, Section 5.6.2	
aa)	☐	Discussing need for protective measures,	Design Criteria, Section 5.6.3	
ab)	☐	Identifying source of specifications for all proposed materials,	Design Criteria, Section 5.7	
ac)	☒	Ensuring that proposed pipe materials and ditches/culverts meet OPSS specifications,	Design Criteria, Section 5.7.1, ECA Schedule D, Section 4.1.1 (f)	Section 4.4.1
ad)	☐	Discussing presence of contamination,	Design Criteria, Section 5.7.2	
ae)	☐	Discussing materials that are selected based on specific site conditions,	Design Criteria, Section 5.7.3	
af)	☒	Identifying loading conditions, pipe strength and associated safety factor,	Design Criteria, Section 5.8, Section 5.9.2, Design Guidelines Section 5.10.1	Section 4.4.1
ag)	☐	Providing manufacturer’s recommendations for pipe cover (or identifying to be considered in shop drawing review),	Design Criteria, Section 5.9.3	
ah)	☒	Identifying means for protection from frost,	Design Criteria, Section 5.9.1, Design Guidelines, Section 5.7.3	Section 4.4.2
ai)	☒	Describing how design meets maintenance hole requirements,	Design Criteria, Section 5.10, City, Section 2	Section 4.5
aj)	☒	Describing how design meets catchbasin requirements,	Design Criteria, Section 5.11, City Section 2	Section 4.6

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
ak)	☒	Identifying if Works include any inverted syphons (if so, then discussing each part of Section 5.12 as well as 7.1.2.1.c),	Design Criteria, Section 5.12, Section 7.1.2.1.c, Design Guidelines, Section 5.10.2	Section 4.4.3
al)	☐	Describing how design meets service lateral requirements,	Design Criteria, Section 5.13	
am)	☒	Providing hydraulic design sheets,	Design Criteria, Section 7.1.2.1.a, Design Guidelines, Section 5.7.12	Section 4.7, Table 8
an)	☐	Identifying specifications for how inspection and testing requirements outlined in Design Criteria Section 8 will be met,	Design Criteria, Section 1.2.7.1, ECA Schedule D, Section 4.1.7	
ao)	☐	Providing and discussing inspection and testing plan (video inspection, deflection testing, etc.),	Design Criteria, Section 8.1.1, Section 8.1.3, Section 8.1.6, Section 8.1.7, Section 8.2, Section 8.4	
ap)	☐	Identifying how the requirement for notification of testing will be communicated to the contractor,	Design Criteria, Section 8.1.4	
aq)	☐	Identifying how the requirement for provision of inspection reports will be communicated to the contractor,	Design Criteria, Section 8.1.5	
ar)	☐	Identifying need for special inspection and testing requirements.	Design Criteria, Section 8.1.8	
9		Confirm that the design satisfies Municipal Criteria, by:	ECA Schedule D, Section 4.1.1 (e)	
a)	☐	Discussing how the design satisfies the City's Storm Sewer Design Criteria outlined in Section 2 (Standards) of the City's Engineering Requirements,	City, Section 2	Section 4.8

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
b)	☒	Discussing how the design satisfies the City's swale requirements outlined in Section 2 (Standards) of the City's Engineering Requirements.	City, Section 2	Section 4.9
10		Confirm that the design is consistent with or addresses Design Guidelines, by:	ECA Schedule D, Section 4.1.1 (g)	
a)	☒	Identifying and summarizing all drainage areas that will drain to the system,	Design Guidelines, Section 5.4.2	Figure 9
b)	☒	Providing intensity-duration-frequency curves used in design,	Design Guidelines, Section 5.4.3	Section 4.2.1.1
c)	☒	Identifying storm frequency and time of concentration used for major and minor drainage systems,	Design Guidelines, Section 5.4.3	Section 4.2.1, Section 4.2.1.3
d)	☒	Describing the major-minor drainage system approach,	Design Guidelines, Section 5.4.4	Section 4.2
e)	☒	Identifying, and describing rationale for, runoff coefficients for each drainage area,	Design Guidelines, Section 5.4.4	Section 4.2.1.2
f)	☒	Identifying, and describing rationale for, time of concentration,	Design Guidelines, Section 5.4.4	Section 4.2.1.3
g)	☒	Calculating peak rate of runoff for each area and identifying the method used,	Design Guidelines, Section 5.4.1	Section 4.2.1, Table 8
h)	☒	Calculating inlet times,	Design Guidelines, Section 5.4.4	Section 4.2.1.4
i)	☒	Describing rationale for size, type, spacing of catchbasins; need for sumps; need for inlet controls; size, slope of catchbasin leads; and summarizing all in table format,	Design Guidelines, Section 5.4.5, City, Section 2	Section 4.6, App F ND-3 and ND-4
j)	☒	Describing inlet and outlet gratings,	Design Guidelines, Section 5.4.6	Section 4.6, App F ND-3 and ND-4
k)	☒	Discussing foundation drainage,	Design Guidelines, Section 5.4.7	Section 4.4.4

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
l)	☒	Calculating and summarizing storm sewer capacities and identifying the method(s) used,	Design Guidelines, Section 5.4.8, Section 5.7.1	Section 4.3, Section 4.4
m)	☒	Confirming that sizes of storm sewers and storm services are greater than minimum acceptable sizes,	Design Guidelines, Section 5.7.2	Section 4.4.5
n)	☒	Identifying, and describing rationale for, depths of all sewers,	Design Guidelines, Section 5.7.3	Section 4.4.2
o)	☒	Describing the method for calculating, and summarizing in table format, the velocity of storm flow, and slope of pipes,	Design Guidelines, Section 5.7.5, Design Criteria, Section 5.5.1, Section 5.5.2	Section 4.4.6, Table 8, App F Dwgs ND-3, ND-4
p)	☒	Identifying hydraulic losses at manholes,	Design Guidelines, Section 5.7.5.1	Section 4.5.4
q)	☒	Discussing need for reduction in slopes,	Design Guidelines, Section 5.7.5.2	Section 4.4.6
r)	☒	Discussing slopes relative to solids deposition,	Design Guidelines, Section 5.7.5.3	Section 4.4.6
s)	☒	Discussing slopes relative to minimum and maximum velocities and depth of flow,	Design Guidelines, Section 5.7.6	Section 4.4.6
t)	☒	Discussing need for steep slope protection,	Design Guidelines, Section 5.7.6.1	Section 4.4.7
u)	☒	Discussing alignment of sewers,	Design Guidelines, Section 5.7.7	Section 4.4.8
v)	☒	Discussing changes in pipe sizes,	Design Guidelines, Section 5.7.8	Section 4.4.5
w)	☒	Discussing rationale for design of pipe materials,	Design Guidelines, Section 5.7.9	Section 4.4.1
x)	☒	Identifying the installation specifications to be used,	Design Guidelines, Section 5.7.10	Section 4.4.1
y)	☒	Identifying testing requirement (ring deflection testing, leakage, hydrostatic),	Design Guidelines, Section 5.7.10, Section 5.7.11.3,	Section 4.7

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
			Section 5.7.11.4, Section 5.7.12.1	
z)	☒	Discussing pipe joint requirements,	Design Guidelines, Section 5.7.11.1	Section 4.4.1
aa)	☒	Discussing service connection requirements,	Design Guidelines, Section 5.7.11.2	Section 4.4.4
ab)	☒	Discussing bypass and overflow capabilities and likelihoods,	Design Guidelines, Section 5.7.13	Section 4.4.9
ac)	☒	Discussing any proposed alternative installation and construction technologies,	Design Guidelines, Section 5.8	Section 4.5.12
ad)	☒	Discussing the locations of manholes and summarizing in tabular format,	Design Guidelines, Section 5.9.1 City, Section 2	App F, ND-3, ND-4, Pipe Data Form
ae)	☒	Discussing the need for drop type manholes and identifying associated details,	Design Guidelines, Section 5.9.2	Section 4.5.4
af)	☒	Discussing the proposed sizes of manholes and summarizing in tabular format,	Design Guidelines, Section 5.9.3	App F, ND-3, ND-4, Pipe Data Form
ag)	☒	Discussing the flow channel configurations and benching in manholes,	Design Guidelines, Section 5.9.4, Section 5.9.5	Section 4.5.4
ah)	☒	Discussing the specifications for manholes and pipe to manhole connections,	Design Guidelines, Section 5.9.6, Section 5.9.8, Section 5.9.9, Section 5.9.10	Section 4.5, Section 4.0
ai)	☒	Discussing specifications for manhole inspection and testing,	Design Guidelines, Section 5.9.7	Section 4.7
aj)	☒	Identifying special considerations for sewer system rehabilitations,	Design Guidelines, Section 5.11	Section 4.5.9
ak)	☒	Identifying if the project involves a stream crossing (if so, then Design Guideline, Section 5.12 is to be discussed),	Design Guidelines, Section 5.12	Section 4.5.10

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
al)	☒	Identifying if the project involves an aerial crossing (if so, then Design Guideline, Section 5.13 is to be discussed),	Design Guidelines, Section 5.13	Section 4.5.11
am)	☒	Discussing challenging conditions affecting servicing.	Design Guidelines, Section 6	Section 4.5.13
11		Ensure design is consistent with Stormwater Management Planning and Design Guidance Manual and Appendix A, by:	ECA Schedule D, Section 4.1.1 (h)	
a)	☐	Discussing how Water Balance criteria are met,	Stormwater Manual, Section 3.2; ECA, Appendix A	
b)	☐	Discussing how Water Quality criteria are met,	Stormwater Manual, Section 3.2; ECA, Appendix A	
c)	☐	Discussing how Watershed Erosion Control criteria are met,	Stormwater Manual, Section 3.2; ECA, Appendix A	
d)	☐	Discussing how Water Quantity criteria are met,	Stormwater Manual, Section 3.2; ECA, Appendix A	
e)	☐	Discussing how Flood Control criteria are met.	ECA, Appendix A	
12		Ensure design is protective of nearby drinking water systems, by:	ECA Schedule D, Section 4.1.1 (i), Section 7.1	
a)	☐	Including an assessment of whether proposed Works pose a Significant Drinking Water Threat and identifying mitigation measures,	Design Criteria, Section 1.3, SOP	
b)	☒	Including design considerations set out in Standard Operating Policy and Source Protection Plan, by:	ECA Schedule D, Section 4.1.1 (i)	Section 4.0
(i)	☒	Identifying if the proposed Works fall within IPZ1, IPZ2 for Belleville Drinking Water System or IPZ1, IPZ2, WHPAA, WHPAB or WHPAC for Pt Anne Drinking Water System,	ECA Schedule D, Section 4.1.1 (i)	Section 4.0
(ii)	☒	Identifying if any of the sewage policies from the Source Protection Plan apply to any of the proposed Works,	SPP	Section 4.0

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
(iii)	☒	Identifying any known or suspected risks from properties within proposed sewershed areas in project area (waste disposal sites, snow storage, fuel storage, chemical storage, chemical application, private sewer systems, agricultural activities, etc.),	Various SPP Policies	Section 4.0
(iv)	☐	Identifying if any part of the proposed Works is a Prescribed Threat Activity or Sub-Threat Activity within a vulnerable area, as outlined in the Standard Operating Policy,	SOP	
(v)	☐	Identifying mitigation measures for all Prescribed Threat Activities and Sub-Threat Activities,	SOP	
c)	☒	Confirming that the Works have been designed so as not to adversely affect ability to maintain a gravity flow in the system without overflowing or increasing surcharging in any maintenance holes,	ECA Schedule D, Section 4.1.2 (a)	Section 4.8
d)	☐	Identifying how protection is provided for drinking water systems as outlined in MECP F-6-1 and Section 15 of Watermain Design Criteria document,	Design Criteria, Section 1.4,	
e)	☒	Identifying how protection is provided in accordance with Section 5.14 of Design Guidelines,	Design Guidelines, Section 5.14,	Section 4.4.10
f)	☒	Identifying how the design is protective of drinking water sources in Vulnerable Areas.	ECA Schedule E, Section 8.1	Section 4.0
13	☒	Identify how smooth flow transition is maintained to existing gravity storm sewers.	ECA Schedule D, Section 4.1.2 (b)	Section 4.5.4
14	☒	Confirm that the Works are designed not to cause adverse effects.	ECA Schedule D, Section 4.1.3 (a)	Section 4.8
15	☒	Identify all existing downstream SWM Facilities.	ECA Schedule D, Section 4.1.3 (b)	Section 4.0

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
16	☒	Identify the SWM Facility that is required to service the storm sewer or ditch.	ECA Schedule D, Section 4.1.3 (b)	Section 4.0, Section 5.0
17	☐	Discuss how Works are designed so as not to result in a deterioration of effluent quality or quantity in any downstream SWM Facility which results in not being able to achieve overall criteria per Appendix A.	ECA Schedule D, Section 4.1.3 (b)	
18	☒	Confirm that the SWM Facility required to service the storm sewer or ditch is in service.	ECA Schedule D, Section 4.2	Section 4.0, Section 5.0
19	☒	Discuss whether the project converts a rural cross section to curb, gutter and storm sewers.	ECA Schedule D, Section 4.3.6	Section 4.3.2
20	☒	Discuss whether the project results in new or increased discharges to a Municipal Drain.	ECA Schedule D, Section 4.3.7	Section 4.0
21	☒	Discuss whether the project establishes a new outlet with direct discharge into the natural environment.	ECA Schedule D, Section 4.3.8	Section 4.3
22	☒	Discuss whether the project discharges into an existing storm sewer, ditch or SWM Facility.	ECA Schedule D, Section 4.3.9	Section 4.3
23	☒	Discuss whether the project increases the hydraulic capacity of an existing storm sewer or ditch.	ECA Schedule D, Section 4.3.10	Section 4.3
24	☒	Discuss whether the pipe will only be connected to the Belleville Stormwater System.	ECA Schedule D, Section 4.3.11	Section 4.3
25	☒	Discuss whether the project is part of an undertaking under EAA and a section 16 order has been issued.	ECA Schedule D, Section 4.3.12	Section 4.0
26	☒	Discuss how any outlet established or altered has regard to Appendix E of 2012 TRCA Stormwater Management Criteria document.	ECA Schedule D, Section 7.1	Section 4.4.11
27	☒	Discuss whether the project discharges stormwater to private property.	ECA Schedule D, Section 7.2.1	Section 4.4.11
28	☒	Confirm that any new outlet will not result in adverse effects.	ECA Schedule D, Section 7.2.2	Section 4.4.11

For the Design Drawings for storm sewers, the designer shall:

(1) Item #	(2) [X]	(3) Item Description	(4) Source	(5) Design Report Reference
1	☒	Provide digital drawings that include information outlined in Section 3.12.2 (a), (b) and (e) of ECA Schedule D.	ECA Schedule D, Section 3.12.2	App F
2	☒	Identify tributaries and receiving water body that Works will discharge to.	ECA Schedule D, Section 3.12.2 (c)	App F
3	☒	Identify watershed and subwatershed that Works will discharge to.	ECA Schedule D, Section 3.12.2 (d)	App F
4	☒	Identify stormsewershed and outlet for each part of the Works.	ECA Schedule D, Section 3.12.2 (e)	App F
5	☒	Identify any source protection vulnerable areas.	ECA Schedule D, Section 3.12.2 (f) (vi)	App F
6	☒	Identify any CSO's or SSO's in proximity of project.	ECA Schedule D, Section 3.12.2 (g)	App F
7	☒	For subdivisions, prepare the drawings in accordance with the City's drawing configuration requirements.	City, Section 1.2, Section 1.3, Section 1.4, Section 1.5, Section 1.7	App F
8	☒	For subdivisions, include the City's standard notes.	City, Section 2	App F
9	☒	For subdivisions, include the City's standard Specification Drawings.	City, Section 2	App F

APPENDIX H:
PIPE DATA FORM

Ontario

Ministry of the Environment, Conservation and Parks

Pipe Data Form - Watermain, Storm Sewer, Sanitary Sewer, and Forcemain Design Supplement to Application for Approval for Water and Sewage Works

General

Information requested in this form is collected under the authority of the *Ontario Water Resources Act*, R.S.O. 1990 (OWRA), the *Safe Drinking Water Act* (SDWA), the Drinking-Water Systems Regulation (O. Reg. 170.03) and the Environmental Bill of Rights, c. 28, Statutes of Ontario 1993 (EBR). This information will be used to evaluate applications for approval of municipal and private sewage works as required by Section 53 (OWRA) and to evaluate applications for approval of municipal and non- municipal drinking-water systems as required by Sections 31, 36, 38, 52 and 60 of the SDWA.

Instructions

1. This form should accompany all Applications for a Water and Sewage Works. It does not replace the Application form for a Certificate of Approval and is required in addition to the supporting technical information described in the Guide for Applying for Municipal and Private Water and Sewage Works. All designs are expected to be in accordance with MECP design guidelines and the 10 State Standards.
2. The information contained in this form and the required supporting stamped engineering drawings are the minimum information requirements used to process the application for a Certificate of Approval. All sections MUST be filled out and incomplete forms will be RETURNED to the applicant. If the design does not meet the MECP design guidelines and the 10 State Standards, please explain why and how the issue will be addressed. Additional information may be requested during the review process.
3. Application forms and supporting documentation are available from the Client Services and Permissions Branch (CSPB) toll free at 1-800-461-6290 (locally at 416-314-8001), from your local District Office of the Ministry of the Environment, Conservation and Parks, and in the "Publications" section of the Ministry of the Environment, Conservation and Parks website at https://www.ontario.ca/page/water-and-sewage-works-approvals-sample-applications-guides-and-resources
4. Questions regarding completion and submission of this data form should be directed to the Client Services and Permissions Branch (CSPB), 135 St. Clair Avenue West, 1st Floor, Toronto ON M4V 1P5, 1-800-461-6290 or 416-314-8001, or to your local District Office of the Ministry of the Environment, Conservation and Parks.

Information for Proponents Applying for a ECA for Water and Sewage Works

Section 53 of the *Ontario Water Resources Act* R.S.O. 1990 and Part V of the *Safe Drinking Water Act* require that anyone who establishes, alters, extends or replaces new or existing water or sewage works do so only in accordance with approval granted by the Director. As a result, any plans to change watermains, storm sewers, sanitary sewers, or combined sewers must first be granted a Certificate of Approval (works which are exempt from Certificate of Approval requirements are detailed in Ontario Regulation 525/98). Detailed information on approval requirements and procedures are contained in separate documents entitled "Guide for Applying for Approval of Municipal and Private Water and Sewage Works (Section 53 *Ontario Water Resources Act* R.S.O. 1990)" and "Guide For Applying For Approvals Related To Municipal And Nun-Municipal Drinking-Water-Systems – Parts V and VI of the *Safe Drinking Water Act* and Drinking-Water Systems Regulation" These documents are available on the Ministry of the Environment, Conservation and Parks website (https://www.ontario.ca/page/water-and-sewage-works-approvals-sample-applications-guides-and-resources) or can be obtained by contacting a client services representative at 413-314-8001.

Criteria for Approval – Water and Sewage Works

The anticipated environmental impacts of water and sewage works are land and water contamination, or overflow causing physical damage, or resulting in adverse effects. Generally, these impacts can be minimized by the appropriate design installation, operating and maintenance of the water and sewage pipes. There are a number of guideline assessment criteria, which will be explained in this data form, and which can be read in greater detail in the following guidelines:

- Guidelines for the design of water distribution systems, Ministry of the Environment, 1985
- Guidelines for the design of sanitary sewage systems, Ministry of the Environment, 1985
- Interim guidelines for the design of storm sewer systems, Ministry of the Environment, 1985
- Procedure for the Determination of Treatment Requirements for Municipal and Private Combined and Partially Separated Sewer Systems (Procedure F-5-5)
- Procedures to govern separation of sewers and watermains (Procedure F-6-1)

Cette publication hautement spécialisée {Pipe Data Form - Watermain, Storm Sewer, Sanitary Sewer, and Forcemain Design Supplement to Application for Approval for Water and Sewage Works} n'est disponible qu'en anglais conformément au Règlement 671/92, selon lequel il n'est pas obligatoire de la traduire en vertu de la *Loi sur les services en français*. Pour obtenir des renseignements en français, veuillez communiquer avec le Ministère de l'Environnement, de la Protection de la nature et des Parcs au 416-314-8001 ou par courriel à enviropermissions@ontario.ca.

1.0 General Project Information

1.1 Site Name

Settlers Ridge East Phase 3 & Towncentre Place

1.2 Municipality

City of Belleville

Client (if different from Municipality)

1.3 Type of Works Project (Please check all that apply)

☐ Watermain Please complete Sections 1.0 to 5.0 of this form

☑ Storm Sewer Please complete Sections 1.0 to 4.0, 6.0 and Appendix A of this form

☑ Sanitary Sewer Please complete Sections 1.0 to 4.0, 7.0 and Appendix B of this form

☐ Forcemain Please complete Sections 1.0 to 4.0, 8.0 and Appendix C of this form

1.4 (a) Project Purpose (Please check all that apply)

☐ Replacement

☐ Increased demand

☐ Connecting existing lines

☑ New development

☐ Other (specify) ______

2.0 Environmental Assessment Act Requirements

2.1 Is this a private sector project?

☑ Yes ☐ No If 'No', please complete 2.2 and 2.3

2.2 (a) Choose applicable Municipal sector Class EA Schedule

☐ Schedule A

☐ Schedule B

☐ Schedule C

(b) From the appropriate Schedule identified in 2.2(a), please identify Project Type and associated Schedule/Paragraph No. which applies to the proposed project

☐ Water Project

☐ Wastewater Project Schedule Number ______

For 'Schedule B' please complete 2.3(a),(b) For 'Schedule C', please complete 2.3(a),(b),(c)

2.3 (a) Has a Notice of Completion been submitted along with this application?

☐ Yes ☐ No

(b) Were any Part II Orders (ie "Bump-up" requests) received for this project?

☐ Yes ☐ No If 'Yes', please provide details:

(c) Has an Environmental Study Report (ESR) been completed?

☐ Yes If 'Yes', please include ESR Cover page with this submission ☐ No

3.0 Drawings

Note: All drawings must include an accurate scale and be stamped by a Professional engineer. If the drawing is of a large scale where small separation distances cannot be easily measured, these distances must be marked on the drawing or noted as a typical separation.

Have the following details been included with this submission?

- [x] Site Plan, including
  - [x] Proposed works
  - [x] Existing works (as appropriate)
  - [x] Property lines/Municipal boundaries
  - [x] Any water bodies in proximity to the works
- [x] Plan and Profile of all Pipes
  - [x] Horizontal distance between watermains and sewers
  - [x] Vertical distance between watermains and sewers
  - [x] Length, diameter and slope of each pipe segment
  - [x] Locations of valves, valve chambers if > 300mm diametre, pressure reducers, tees, etc
  - [x] Location of manholes (and their respective IDs)
- [x] Storm Drainage Area
  - [x] Indicate all areas which drain into the proposed works
  - [x] Physical area in hectares
  - [x] Runoff Coefficient for each drainage area
  - [x] Storm water drainage path
- [x] Sanitary Drainage Area
  - [x] Indicate all areas which drain into the proposed works
  - [x] Physical area in hectares
  - [x] Population for each drainage area
  - [x] Sanitary Sewer drainage path
- [x] Other Details
  - [x] Typical separations, where not easily measured from pipe drawings
  - [x] Appertunances
  - [x] Municipal drains

4.0 Additional Information

4.1 Are the proposed works laid below the frost penetration depth for the area at all points?

- [ ] Yes - [x] No

4.2 (a) Are all existing and proposed watermains separated by at least 2.5 m of clear horizontal distance from all existing and proposed sewers and storm water conveyance systems (ie. ditches)?

- [x] Yes - [ ] No

(b) Are all existing and proposed watermains separated by at least 0.5 m of clear vertical distance higher than all existing and proposed sewers and storm water conveyance systems (ie. ditches)?

- [x] Yes - [ ] No

(c) Are all existing and proposed sewers, including all drains and similar sources of contamination, separated by at least 15 metres from potable water reservoirs below normal ground surface and well supplies?

- [x] Yes - [ ] No

If 'No' to any part of Question 4.0, please refer to Procedure F-6-1 for solutions to prevent contamination when separation distances cannot be met

5.0 Watermains

For Questions 5.1 to 5.3, please attach an additional sheet if necessary

5.1 Description of Proposed Watermain(s) (including service area/development)

5.2 Description of Existing Works (in proximity to proposed works)

5.3 For each watermain, please provide the following details in the chart below (or equivalent)

Street	From (street/manhole)	To (street/manhole)	Diameter (mm)	Roughness

5.4 Are all of the watermains a minimum of 150 mm in diameter?

☐ Yes ☐ No

5.5 What is the expected operating pressure range for this watermain under maximum day demand?

____________________ to ____________________ (please indicate units)

5.6 (a) Will the watermain pressure drop below 275 kPa (40 psi)?

☐ Yes ☐ No

If 'Yes', please provide an explanation for this situation and future plans to address the problem

(b) Is there sufficient pressure (138 kPA or 20 psi) reserved for fire flow/protection?

☐ Yes ☐ No

5.7 If this is a feedermain or a pipe dedicated to transporting potable water only (ie. having no service connections), have hydraulic transients been considered?

☐ Yes ☐ No

If 'Yes', please describe the results

5.8 (a) Are there any dead end points in the system?

☐ Yes ☐ No If 'Yes', then please complete 5.8(b)

(b) How will water stagnation be addressed?

☐ Fire Hydrants ☐ Blow-off point ☐ Other (Specify) ____________________

5.9 (a) Are there any tee- or cross-connections?

☐ Yes ☐ No If 'Yes', then please complete 5.9(b)

(b) Are there at least two (2) shut-off valves at each tee-connection, and at least three (3) shut-off valves at each cross-connection?

☐ Yes ☐ No

If 'No', how will disruptions to the system be minimized during repairs or emergencies?

6.0 Storm Sewers

For Questions 6.1 to 6.3, please attach an additional sheet if necessary

6.1 Description of Proposed Storm Sewer(s) (including service area/development)

Installation of approximately 931.5 m of storm sewer system to service proposed development (ranging between 300 mm to 675 mm in diameter), see enclosed drawing.

6.2 Is this application for approval a part of a larger and/or phased development?

☐ Yes ☐ No

If 'Yes', please provide full details on any existing developments including all Certificates of Approval that have been approved or application that are currently under review. Clearly indicate in all stamped engineering drawings and reports which developments belong to which phase and whether they are existing, for current development, or for future development

6.3 Description of Existing Works (in proximity to proposed works)

Existing storm sewer mains on Raycroft Drive.

6.4 For each storm sewer, please provide the following details in the chart below (or equivalent)

Street	From (street/manhole)	To (street/manhole)	Diameter (mm)	Roughness
see attached storm sewer design sheet				

6.5 Has the Storm Sewer Hydraulic Design Sheet (or equivalent) been included with this submission? (refer to the Guidance Document in Appendix A)

☑ Yes ☐ No

6.6 Please indicate which land use surface types are included in the drainage area and list the runoff coefficient(s) used for each type

	Surface Type	Recommended	Used
☐	Asphalt, concrete, roof areas	0.90 - 1.00	
☐	Gravel	0.80 - 0.85	
☑	Grassed areas, parkland	0.15 - 0.35	0.45
☑	Commercial	0.75 - 0.85	0.60
☐	Industrial	0.65 - 0.75	
☑	Single family dwelling	0.40 - 0.45	0.50
☑	Semi-detached	0.45 - 0.60	0.50
☑	Row housing, Townhousing	0.50 - 0.70	0.50
☑	Apartments	0.60 - 0.75	0.60
☐	Institutional	0.40 - 0.75	
☐	Other		

If USED runoff coefficient does not fall within the RECOMMENDED range, please provide rationale below:

6.7 (a) What is the full flow velocity range for all storm sewers in the proposed works?

0.98 to 2.35 m/s

(b) If the full flow velocity is outside of the range of 0.8 m/s to 6.0 m/s, what measures will be employed to reduce sediment build up and/or erosion in the pipe?

6.8 (a) What is the municipality's requirement for the minor design storm event?

☐ 2 year ☑ 5 year ☐ 10 year ☐ Other

(b) What storm event has been used for the design of the proposed works?

☐ 2 year ☑ 5 year ☐ 10 year ☐ Other

(c) Are there any inlet control devices (ICDs) proposed in the catch basins?

☐ Yes ☑ No

6.9 Please indicate the first destination/location that will be receiving the storm water:

☐ Natural Water Body

Name

Has the Conservation Authority granted approval to discharge to this water body?

☐ Yes ☐ No

☑ Storm Water Management (SWM) Facility

Name Norbelle Pond

Certificate of Approval Number (if applicable) OR

Application Reference Number (if submitted)

Has the Operating Authority (of the SWM facility) granted approval to discharge to this facility?

☑ Yes ☐ No

☐ Municipal Drain

☐ Existing Sewers

7.0 Sanitary Sewers

For Questions 7.1 to 7.3, please attach an additional sheet if necessary

7.1 Description of Proposed Sanitary Sewer(s) (including service area/development)

Installation of approximately 995.0 m sanitary sewer to service proposed development (200 mm to 375 mm)

7.2 Description of Existing Works (in proximity to proposed works)

Existing sanitary sewer mains on Raycroft Drive.

7.3 For each sewer, please provide the following details in the chart below (or equivalent)

Street	From (street/manhole)	To (street/manhole)	Diameter (mm)	Roughness
See attached sanitary sewer design sheet				

7.4 Has the Sanitary Sewer Design Sheet (or equivalent) been included with this submission? (refer to Guidance Document in Appendix B)

☑ Yes ☐ No

7.5 Please indicate which sewage types are applicable in the drainage area and list the daily design flows used in the pipe design for each type.

	Sewage Type	Recommended	Used
☑	Domestic	225 - 450 L/cap/day	350 L/d*cap

	Sewage Type	Recommended	Used
☐	Hospitals	900 - 1800 L/bed/day	
☐	Schools	70 - 140 L/student/day	
☐	Trailer Parks	340 - 800 L/space/day	
☐	Infiltration	0.1 - 0.28 L/ha/s	
☐	Industrial	35 - 55 m3/ha/day	
☑	Shopping Centres	2500 - 5000 L/1000 m2/day	1.05 L/s*ha
☐	Hotels/Motels	150 - 225 L/bed space/day	
☐	Other		

If USED sewage daily design flow does not fall within the RECOMMENDED range, please provide rationale below
Municipal standard

7.6 (a) What is the full flow velocity range for all sanitary sewers in the proposed works?

0.64 to 1.22 m/s

(b) If the full flow velocity is outside of the range of 0.6 m/s to 3.0 m/s, what measures will be employed to reduce sewage build up and/or erosion in the pipe?

7.7 It is recommended that sanitary sewers be laid at sufficient depth to receive gravity flow from basements. Are any sanitary sewers above the depth of any basements in the area?

☑ Yes ☐ No

If 'Yes', what methods will be employed to prevent sewage backup into basements?
pumped basements

8.0 Forcemains

For Questions 8.1 to 8.3, please attach an additional sheet if necessary

8.1 Description of Proposed Forcemain(s) (including service area/development)

8.2 Description of Existing Works (in proximity to proposed works)

8.3 For each forcemain, please provide the following details in the chart below (or equivalent)

Street	From (street/manhole)	To (street/manhole)	Diameter (mm)	Roughness

8.4 (a) Is there an existing ECA for the pumping station associated with this forcemain?

☐ Yes ☐ No

If 'Yes', please provide the Certificate of Approval Number: ______________________

If 'No', please complete 8.4(b)

(b) Please provide the pumping station design elements by completing Tables 1, 2, and 3 in Appendix C. Have Tables 1, 2, and 3 been included with this submission?

☐ Yes ☐ No

8.5 If this system is not a grinder pump system, is the minimum pipe size at least 100 mm to allow for the passage of small solids?

☐ Yes ☐ No

If 'No', please indicate below which methods will be employed to prevent a blockage in the pipe

8.6 (a) What is the velocity range for all forcemains in the proposed works?

______________________________ to ______________________________ m/s

(b) If the velocity falls outside of the range of 0.8 m/s to 2.5 m/s, what measures will be employed to reduce sewage build up and/or erosion in the pipe?

8.7 Have the effects of hydraulic transient been considered?

☐ Yes ☐ No

If 'Yes', please indicate the results below

Appendix A - Sample Template

Storm Sewer Hydraulic Design Sheet

Site location (City)	n=	Checking Date (yyyy/mm/dd)
Ref #	Reviewer	

Design Storm: The ________ Year Storm Event

Rational Formula: Q = 2.78*CIA
Where: Q: peak flow (L/s)
C: runoff coefficient
I: rainfall intensity (mm/h)
A: area (ha)

Concentration time: tc = ti + tf (minute)
Where: ti: inlet time before pipe (minute)
tf: time of flow in pipe (minute)
tf = L/(60V) (minute)

Manning Equation:
Qcap. = (D/1000)^2.667*(S/100)^0.5/(3.211*n)*1000 (L/s)
D: pipe size (mm)
S: slope (grade) of pipe (%)
n: roughness coefficient

			Runoff							Pipe						
Street Name	**From (MH/CB)**	**To (MH/CB)**	Area (A) (ha)	Runoff Coefficient (C)	Section (AC) (ha)	Accum. (AC) (ha)	Concentration time (tc) (min.)	Rainfall Intensity (I) (mm/hr)	Peak Flow (Q) (L/s)	Length (L) (m)	Slope (S) (%)	N. D. (D) (mm)	Qcap. (full) (L/s)	V (full) (m/s)	Time of flow in pipe (min.) (tf)	(Q) / Qcap.

Note: This table has been provided as a reference template only. Applicants are encouraged to use this sample template as an example when creating their own Storm Sewer Hydraulic Design Sheet.

Appendix B - Sample Template

Sanitary Sewer Design Sheet

Site location (City)	n=	Checking Date (yyyy/mm/dd)

Ref #	Reviewer

Residential Unit average daily flow (q): ____________ L/cap.d (225~450 L/cap.d) Unit extraneous flow (E): ____________ L/s/ha (0.1-0.28L.s.ha)

q = average daily per capita flow (L/cap.d)
I = Unit of peak extraneous flow (L/s/ha)
Q(p) = peak population flow (L/s)
Q(I) = peak extraneous flow (L/s)
Q(d) = peak design flow (L/s)

Peaking Factor:
M =1+14/(4+(P/1000)^0.5)
Q(p) = (P/1000)qM/86.4 (L/s)
Q(I) = IA (L/s); where A = Area in hectares
Q(d) = Q(p) + Q(I) (L/s)

Manning Equation:
Qcap. = (D/1000)^2.667*(S/100)^0.5/(3.211*n)*1000 (L/s)
D: pipe size (mm)
S: slope (grade) of pipe (%)
n: roughness coefficient

			Inlet Flow							Pipe					
Location			Individual		Accumulative		Peaking	Pop.	Extran.	Design	Length	Size	Slope	Capacity	Velocity	
Street Name	**From (MH)**	**To (MH)**	P (person)	Area (ha)	P (person)	Area (ha)	Factor (M)	Q(p) (L/s)	Q(e) (L/s)	Q(d) (L/s)	L (m)	D (mm)	S (%)	Qcap. (L/s)	V (m/s)	Q(d)/ Qcap

Note: This table has been provided as a reference template only. Applicants are encouraged to use this sample template as an example when creating their own Sanitary Sewer Design Sheet.

Table 1 (H-1 of APPENDIX H)

Sewage Pumping Station Design – Table 1

Municipality

Pumping Station

Designed by

Date (yyyy/mm/dd)

Design Subject		Unit	Initial Period	10 Year Period	20 Year Period	Ultimate Period
Tributary	A) Residential	ha				
	B) Commercial	ha				
	C) Industrial	ha				
Population Density		Pers/ha				
Population or Equivalent	A) Residential	No.				
	B) Commercial	No.				
	C) Industrial	No.				
Per Capita Flow		L/cap.d				
Average Flow		L/s				
Peak Flow Factor*						
Peak Domestic Flow		L/s				
Infiltration Rate		L/ha.s				
Infiltration Flow		L/s				
Design Peak Flow		L/s				
Pumps		No.				
Pump Discharge		L/s				
Force Main Diameter		mm				
Velocity		m/s				

Note: * The peak flow factor is: 1+14/(4+P^0.5), where P is designed population, in thousand.

Table 2 (H-2 of APPENDIX H)

Sewage Pumping Station Design – Table 2

Municipality

Pumping Station

Designed by	Date (yyyy/mm/dd)

Design Subject	Unit	C=120	C=130	C=140
Pump Design Flow	L/s			
Forcemain Diam.	mm			
Velocity	m/s			
Forcemain Length	m			
Forcemain Head Loss	m			
Suction Line Head Loss	m			
Discharge Line Head Loss	m			
Total Head Loss	m			
Low Water Level Wet Well	m			
High Water Level Wet Well	m			
Forcemain End Elevation	m			
Static Head Max.	m			
Static Head Min.	m			
Total Danamic Head Max.	m			
Total Danamic Head Min.	m			

Table 3 (Abstracted from Appendix I)

Information Required for Sewage Pumping Stations Applications

Standby Power Supply

Is standby power required?

☐ Yes ☐ No

If yes, what kind of standby power is available for this pumping station?

☐ a) Standby Generator ☐ b) Portable Generator ☐ c) Additional hydro feed line

Receiving Watercourse

Will sewage be overflow/bypass any receiving watercourse?

☐ Yes ☐ No

If yes, then:

a) It will be necessary to know in detail the route by which overflow/bypass flow would gain access to the watercourse?

____

b) The flow in the receiving watercourse at the point of overflow/bypass from the pumping station is as follows:

______________ flow in dry weather (m^3/s)

______________ flow in wet weather (m^3/s)

c) The nearest water intake is located on the receiving watercourse within

______________ metres of the point of entry of the overflow.

Sewage Pumping Station

a) The operating authority responsible for maintenance and operation of this pumping station is

____

b) The high level alarm is set up to relay a signal to ______________________________

c) Between the time of activation of the high level alarm and the overflow/basement flooding, there are:

______________ m^3 of storage capacity available in the sewers;

______________ m^3 of storage capacity available in the pumping station.

d) This storage will provide:

______________ minutes retention before overflow/basement flooding occurs at the average daily design flow of ______________ L/s;

and ______________ minutes retention before overflow/basement flooding occurs at the peak design flow of ______________ L/s;

e) It is possible to bypass or pump around the pumping station with portable equipment by utilizing the following procedure

____