FUNCTIONAL SERVICING REPORT
ROSSMORE DEVELOPMENT

Preliminary Report for Draft Plan of Subdivision

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1. Background

George Georgiou engaged Jewell Engineering Inc. (Jewell) to complete a functional servicing study to review the feasibility of a 5-lot subdivision at the end of Hennessy Street in Rossmore, Ontario (as shown in Figure 1-1). Hennessy Street has municipal water but does not have municipal sewer.

The servicing report has been prepared to support the Zoning By-Law Amendment and the Plan of Subdivision applications for Part of Lots 47, 49, and 64, Registered Plan 3 (Rossmore), Part of Lot 60, Concession 1, Elm Island.

Figure 1-1: Draft Plan of Subdivision

Jewell has summarized the overall servicing of the development in this report. The following services have been considered:

- Water Distribution System
- Stormwater Management

1.1 Site Description

The proposed development area is approximately 4.5 hectares (ha). The surrounding land use is low density residential to the north-west, wetland to the south and the Bay of Quinte to the north-east. Rezoning and Plan of Subdivision applications will be required to permit the proposed development.

1.2 Proposed Development

The development is to be five (5) single family residential lots. The subdivision will extend Hennessy Street to provide frontage for every lot. The municipal water system will be extended to provide water services and fire protection. Each lot will have its own private septic system. Both municipal and private infrastructure will be designed to specifications set out by the Ministry of Environment (MOE) and the Fire Underwriters Survey (FUS).

2. Water Distribution System

2.1 Existing Conditions

There is an existing watermain on Hennessy Street. The watermain is a 150 mm ductile iron pipe that ends at a fire hydrant. The age of the pipe is unknown.

Jewell has requested hydrant data for Hydrant #4029 from Prince Edward County (PEC), which as of the writing of this report had not been received. Also, PEC policy does not allow for third parties to perform hydrant tests within PEC. However, Jewell was able to confirm that all of the fire hydrants on Hennessy Street have a BLUE classification, which means the flow available is greater than 1,500 USGPM. The available flow rate will be used to determine the feasibility of the proposed subdivision.

2.2 Design Criteria

The watermain design criteria used are based on MOE guidelines and are summarized below:

- Average Residential Daily Domestic Demand: 350 L/cap*day
- 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

2.3 Fire Flow

The subdivision is to consist of wood frame single-family detached dwellings not exceeding two storeys; therefore, the FUS Note J chart can be used to determine the required fire flow base on exposure distance. The dwellings are to have an exposure distance between 10.1 m to 30 m, which suggests a required fire flow of 3,000 L/min, or 793 USGPM.

2.4 Watermain Design

The maximum day (max day) and peak hour demands of the subdivision were calculated, as shown in Table 2-1 and Table 2-2, respectively. Peaking factors applied are from Table 3-1 in the MOE design guidelines.

Table 2-1: Max Day Demand

Type		Single	
# of Units		5	
Population/Unit		3.0	
Population		20.0	
Capita Usage		350	L/cap*d
Max Day	Peaking Factor	2.75	
	Demand	19,250	L/d
	Demand	13.37	L/min
	Demand	3.53	USGPM

Table 2-2: Peak Hour Demand

Type		Single	
# of Units		5	
Population/Unit		3.0	
Population		20.0	
Capita Usage		350	L/cap*d
Peak Hour	Peaking Factor	4.13	
	Demand	28,910	L/d
	Demand	20.08	L/min
	Demand	5.30	USGPM

Fire flow was added to both max day and peak hour demands to determine the maximum required flow rate, see Table 2-3.

Table 2-3: Required Flow

	Max Day	Peak Hour	Unit
Subdivision Demand	3.53	5.30	USGPM
Fire Flow	793	793	USGPM
Total Flow Required	**796.53**	**798.30**	**USGPM**

Both scenarios have a required flow less than 1,500 USGPM, therefore, there is sufficient supply to provide domestic service and fire protection to the subdivision.

2.5 Recommendations

As demonstrated by Table 2-3, there is sufficient flow available to provide service and fire protection to the subdivision with a 150 mm watermain connected to the existing system.

3. Stormwater Management

The proposed SWM solution focuses on Low Impact Development (LID) practices and stormwater conveyance. Since the proposed lots are directly connected to the Bay of Quinte, no quantity controls are required. The impervious area of the proposed development is very minor at 0.27 ha and does not require a review from Quinte Conservation Authority (QCA) as this impervious area is less than 0.5 ha (Quinte Conservation, 2012).

Although the site has very low contamination potential and does not require QCA review, this SWM section identifies common practices to meet Enhanced protection criteria. This is the highest level of treatment as per the Ministry of the Environment's (MOE's) *2003 SWM Planning and Design Guide*.

3.1 Quality Control

The surface hardening with the proposed development is comprised of rooftops, driveways, and a road extension for a low-traffic road. Each of these impervious surfaces have low contamination potential that can be accommodated by simple LID technologies. Quality treatment is a function of total suspended solids (TSS) removal as outlined by the MOE. TSS removal accounts for pollutants commonly found from vehicular traffic such as road salts and asphalt granules.

The following BMPs are applicable for the site:

1) Enhanced grass swales
2) Reduced lot grading
3) Vegetated filter strip (roadside and no site alteration setbacks)

Jewell has recommended these mitigating measures with guidance provided in MOE's guidelines as well as Toronto Region Conservation Authority (TRCA) and Credit Valley Conservation's (CVCs) *2010 Low Impact Development Stormwater Management Planning and Design Guide*.

3.1.1 Imperviousness

Site imperviousness is an estimate of the portion of the site that will be 'hardened'. These areas include the roof, asphalt and gravelled areas. Jewell estimated the overall impervious area of the site at full build out to be 2726 m^2 (0.27 ha), which is 6.1% of the entire site. This value was conservatively estimated based on an average house size of 2,500 sq. ft. (233 m^2), a 6 m wide paved driveway serviced to a proposed dwelling location, and a total roadway width (including shoulder) of 8.8m.

The total impervious area requiring treatment only applies to the new road and driveway structures since rooftop runoff typically does not require treatment. Therefore, the total area requiring quality treatment is approximately 1482 m^2 (0.15ha) which is only 3.2% of the total area.

3.1.2 Enhanced Grassed Swale

Enhanced grassed swales are the most important SWM control measure for this site. As simple as they may seem, when properly constructed and applied in an appropriate location such as this, they are a reputable technology for quality treatment and promoted by agencies such as Toronto and Region Conservation Authority, the United States Environmental Protection Agency (EPA), and the Ministry of the Environment. Enhanced grassed swales are known to provide significant quality treatment benefits through filtration and infiltration of pollutants. They are a commonly accepted practice to treat runoff from small (<2 ha), low-density residential areas.

Enhanced grass swales are vegetated open channels used to provide water quality treatment while conveying stormwater runoff. They can include design features such as modified geometry and check dams to help improve contaminant removal and attenuate runoff.

Figure 3-1: Example of Enhanced Grassed Swale (Figure 4.8.2 from TRCA & CVCs Low Impact Development SWM Planning and Design Guide)

This treatment method can individually achieve >80% TSS removal (United States Environmental Protection Agency, 1999). Since 80% removal corresponds to an Enhanced treatment level, these vegetated swales can achieve the highest level of treatment identified by MOE. In an effort to account for design uncertainties, filter strips and reduced lot grading have also been recommended as part of a LID treatment train approach to SWM as discussed in the following subsections.

Typical design considerations for enhanced grassed swales are provided below (Credit Valley Conservation and Toronto and Region Conservation Authority, 2010).

- 2m minimum width
- Longitudinal Slope 0.5% to 6% (check dams are recommended on slopes steeper than 3%)
- Trapezoidal shape: 0.75 m flat bottom with 3:1 side slope
- 4 m setback from building is recommended

3.1.3 Reduced Lot Grading

Jewell recommends lot grading changes include the provision for a typical standard slope (2 - 5%) within 2 - 4 metres of any building and a flatter slope (< 2%) for the remaining lot area (where applicable if gradient permits). The use of reduced lot grading will slow runoff velocities to promote filtration and infiltration of pollutants to provide water quality benefits *(Low Impact Development Stormwater Management Planning and Design Guide, 2010).*

3.1.4 Vegetated Filter Strips

Vegetative filter strips are gently sloping areas that provide filtration of suspended solids and reduce runoff velocities. Vegetated filter strips are commonly used to treat runoff from roads and parking areas and will provide pre-treatment for the grassed swale as part of a treatment train approach.

Vegetative filter strips are generally expected to remove between 20 - 80% of total suspended solids *(Low Impact Development Stormwater Management Planning and Design Guide, 2010).* This is a wide range of removal efficiencies, and Jewell typically expects a value of 50% TSS removal for this treatment technology.

Figure 3-2: Example of a Vegetative Filter Strip
(Figure 4.6.1 from Low Impact Development SWM Planning and Design Guide, 2010)

Typical design considerations for vegetated filter strips are provided below (Credit Valley Conservation and Toronto and Region Conservation Authority, 2010).

- Minimum flow path length across the vegetated filter strip is 5 m
- The recommended slope is between 1 - 5%
- Flow path across impermeable surface shall not exceed 25 m

The proposed layout of the site offers two locations on each lot where vegetative filter strips can be applied. The first location is along the shoulder of the roadway. Jewell recommends that gentle slopes be implemented along the edge of shoulder and front yards (adjacent to the

driveways). The second location occurs naturally for each lot and is located behind the buildable area.

3.1.5 Rock/Sand Filter

An added benefit in the SWM solution is a rock / sand filter proposed near the outlet of the drainage easement that incorporates an enhanced grassed swale. This will have a small footprint area and be located within the flat bottom area of the proposed swale. It will be comprised of a shallow rock layer with an underlying sand layer separated by a geotextile fabric. The purpose of this added treatment is to achieve added filtration benefits that will help remove some of the minor oils and fuels that may be contained within the stormwater runoff.

3.1.6 Combined Quality Treatment

The combination of treatment practices outlined in this section is designed to achieve Enhanced quality treatment. This is an acceptable level of treatment for stormwater runoff. The drainage easement outlets directly to the Bay and by-passes the wetland. No negative impacts to the wetland are expected with the proposed development and SWM controls.

3.2 Conveyance

Runoff from the proposed developments drains directly to the Bay of Quinte and therefore no quantity controls are required. However, grassed swales and driveway culverts are proposed for runoff conveyance. The road extension and driveways will drain to a roadside ditch that connects to a proposed drainage easement. Jewell recommends this drainage easement be located between Lots 2 and 3 where stormwater can outlet directly to the Bay.

The grassed swales will be sized to convey the 100-yr peak flow as calculated from the Rational Method. The driveway culverts will be sized to pass the 5-yr storm event.

4. Conclusion

Jewell studied the proposed subdivision and has the following conclusions:

1. Watermain
    a. Jewell recommends extending the existing 150 mm watermain to provide service.
    b. There is sufficient flow available to provide service and fire protection to the subdivision.
2. Stormwater Management
    a. Quantity control is not required.
    b. The quality control objective is to meet MOE's 2003 guidelines is to provide an enhanced level of treatment using Best Management Practices:
        i. Reduced lot grading
        ii. 5 m vegetated filter strip
        iii. Enhanced grassed swales

In conclusion, the proposed development is serviceable in accordance with the above recommendations.

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