STORMWATER MANAGEMENT REPORT

Alterations to 192 Main St.

Wellington,
Prince Edward County, ON

March, 2023

Prepared for:

The Principals of the
Wellington I. G.

192 Main St., Wellington

Prepared by:

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1. Introduction

Complying with the requirements of the Municipality of Prince Edward County, Gianni Deldegan of Royalcliff Homes Inc, engaged HAMBLY GROUP to evaluate the drainage of the existing site and design the drainage system for the proposed alterations to the subject site.

The development consists of the alteration of the main house and existing buildings as well as the construction of eight additional buildings and several parking spaces, a total of eleven buildings. The Municipality of Prince Edward County has requested a comparison of pre and post development runoff to evaluate the impact of development on runoff due to storm events.

The Quinte Conservation Authority has deemed this project sufficiently significant to warrant an enhanced level of treatment of the additional runoff due to the development. An element of this treatment is the 80% reduction of the suspended solids from the additional runoff caused by the development.

1.1 Design Objective:

1. To comply with the Storm Management principles of Prince Edward County, and
2. To implement the intent of the Stormwater Design Guidelines of the Province:
   - Preserve groundwater and base flow characteristics
   - Preserve water quality
   - Maintain existing water courses
   - Maintain existing stormwater runoff
   - Maintain diversity of aquatic life and opportunity for human use
   - Minimize erosion potential at stormwater drainage outlets where flow becomes concentrated
   - Provide temporary erosion and sediment control during the construction phase and to provide the owner with maintenance guidelines to preserve the intended function of the entire stormwater system.

The fundamental concerns contained in these principles and guidelines are:

1. there will be no increase in runoff from the subject property to the neighbouring properties
2. there will be no damage to property upstream nor down stream as a result of the change in runoff from the subject property.

2. Description of Property

2.1 Existing Condition:

The site is at 192 Main St., Wellington in Prince Edward County. Main St. is also known as Highway 33. The total area is 9113.8 sq.m. or 0.91 ha.

The facility is located in an area of a mix of residential and commercial properties with single family residences on the north side, to the west, in front and behind. The east side of the lot is occupied by a commercial enterprise.

The existing site condition for the purposes of designing a stormwater plan is a developed lot with a gravel driveway having a coefficient of runoff of 80%. The area of each of the buildings will have a coefficient of runoff of 95%.

The existing site has no provisions for stormwater management. The subject lot is flat with a low slope toward the south [towards Lake Ontario].

The lot is approximately 200 metres from Lake Ontario, having residences between the subject property and the Lake.

The indigenous soil and base material consists of shallow sandy/clay soil of 300 mm to 900 mm, over shale of 300 mm to 600 mm, over hard limestone bedrock.

This report and design has applied the principles of the MOE "Stormwater Management Planning and Design Manual"[SMPDM], 2003.

The nominal elevation of Lake Ontario is 74 metres with the maximum average elevation of 75.06 metres. The historic maximum Lake elevation is 75.95, while the minimum historic elevation was 73.73 metres. The historic time period is from 1900 to 2019.

The elevation of the pre-development footing was 79.77. The original foundation was constructed on bedrock - dark sound limestone.

2.2. Proposed Condition:

The proposed development will add 838.2 sq. m. of building area to the existing 529.2 sq.m. of buildings and add approximately 1957 sq.m. of parking area to the parking lot. The runoff from the west garden suites, the restaurant addition and the west side of the existing buildings will flow to lawn depression between the original building and the garden suites. The proposed drive and fire route will be paved with heavy duty asphalt pavement. The balance of driveways and parking lots will be finished with RAP [reclaimed asphalt pavement]. The driveway on the east side of the main building and south parking lot will drain to catch basins CB#10 and OGS#2. The runoff from OGS#2 and the south portion of the access driveway will be directed to the existing catch basin that is located at the south end of the driveway, near the property line. This catch basin is designated CB#ex. The elevations of the CB#10 catchment are of sufficient height to allow overflow from the south parking lot to the street in the event less frequent than a 1/100 year event. The proposed drive and parking lots will have a coefficient of runoff of 95%.

The proposed additional parking areas have been identified as three parking lots for the purposes of this analysis. The runoff from Lot#2 and Lot#3 will be collected in a system of interconnected catch basins [CB#1, CB#2 and CB#3] that supply effluent to OGS#1. This collected runoff is directed in a controlled flow to a 'Cultec' treatment system.

The development of garden suites in the far west and northwest yards is at an elevation below the neighbouring property lines. The runoff in this area is directed onto the subject development where it is treated on site. Shallow, minor swales in the rear yard of the suites direct stormwater around the suites to 'sheet' flow down and between the suite structures. Runoff from the

westerly portion of the development is directed with sheet flow toward the 'lawn depression' where runoff generated from storm events is proposed to be temporarily contained for a controlled drawdown to enhance the quality of the runoff and restrict the flow to pre-development levels. The southwest yard runoff from the south garden suite flows in a shallow swale to a catch basin, CB#8. This runoff is all from grassy areas so is untreated and directed to the municipal storm system via CB#9, CB#5 and CB#ex.

The garden suites will have a system of eaves troughs and down pipes that direct their flow to flow spreader devices that will contribute to the 'sheet' flow to the lawn depression.

The effluent from the lawn depression is directed to a proposed water tank of approximately 3600 litres to provide irrigation water for the lawns and garden/planters. The effluent from the Cultec system is also directed to the water storage tank. An outlet from the storage tank directs effluent to the storm catch basin, CB#9 and subsequently to CB#5 and CB#ex at the south end of the driveway at the entrance to the property.

The irrigation tank shall have a low pressure switch that will activate a control valve to permit irrigation from the municipal supply. Otherwise, all irrigation on the west side of the development will be supplied by the irrigation tank. The runoff from the western portion of the development, the additions and the original building will supply the irrigation tank.

The east portion of development will have a low [less than 900 mm] retaining wall constructed inside the east property line, beside parking lot of catchment OGS#2 and CB#10. There are two swales crossing Lot#1 catchment. One swale is across the south portion of the east parking lot, running east to southwest. The other directs water from the north to the south, through the green island in Lot#1.

The elevation of the post-development basement floor is 79.42, while the elevation of the base of proposed footing would be nominally at 79.16. The invert inlet to the Cultec units is 80.82. The treatment gravel base to the Cultec units is 80.67. The outlet inverts from CB#8 and CB#9 are 80.25 and 80.13 respectively. The effluent from the Cultec base infiltrates into the gravel and flows into an 8 m, 200 mm diameter pipe to the irrigation storage tank at a 0.5% slope. Inlet invert elevation of the tank would be 80.62 .

There are 3-sumps with duplex controlled pumps in each. These sumps are located at the north, south ends and the west side of the addition. These sumps also pump the effluent to the irrigation storage tank. Any overflow from the irrigation tank is gravity fed to the CB#9.

There is sufficient stormwater storage to satisfy the requirements of MOE "Stormwater Management Planning and Design Manual"[SMPDM], 2003. Also all outlets are controlled to maintain pre-development flows off the subject property.

3. Proposed Stormwater Management Plan

To evaluate the stormwater treatment requirements of the development, the site was divided into three catchment areas. The western one consists of the garden suites and court yard. The second, main building, four other buildings and the parking lots. The third one is the entry. The

first and third contribute in an insignificant way to additional runoff and TSS, therefore little treatment was allocated to this runoff. These areas were treated by sheet runoff and a controlled catch basin outlet.

In the second area containing the parking lots, to satisfy the stormwater management design criteria, a treatment train approach is proposed to control runoff by using lot-level, grassy lawns, grassy swales, a small lawn depression, a network of interconnected catch basins, two oil grease separators and a 'Cultec' treatment system. The rooftop runoff directly discharges, to garden beds, in the irrigation tank or onto a deflection device to enhance the 'sheet flow' to the lawn and to prevent erosion. The down spout at the north end of the addition has a drop connection to the buried drain pipe to the flower garden at the north west corner.

3.1 Quantity Control:

Post-development runoff is controlled to pre-development levels during the minor and major storm events. The site is designed to meet the existing direction of drainage. The whole area is subdivided into three major parts, the developed portion with Cr of 0.95 and a grassy portion with a Cr of 0.25. The rooftop runoff from the existing buildings and proposed west buildings are conveyed to the lawn area. The controlled effluent from the lawn depression is directed to an irrigation storage tank. Any over flow from here is directed to the municipal storm catch basin at the south end of the driveway.

The additional runoff generated from the proposed development requires stormwater storage of 56.6 cubic metres [ref line 44], based on a 15 minute duration of inundation for a 1/100 year event.

The stormwater storage is provided as follows:

	Volume in cubic metres	Maximum depth In mm
surface of parking lot at CB#1	8.94	100
surface of parking lot at CB#2	22.1	200
surface of parking lot at CB#10	40.3	230
lawn depression ar CB#7	18.2	70
volume in drain/conveyance pipes and catch basins	4.8	n/a

The parking lot storage at CB#10 is adequate to store the added runoff generated from the overflow of CB#3. The overflow from CB#3 is due to the controlled outlet of CB#3 to the Cultec units. The flow is set for a flow rate that is designated by the manufacturer. It's flow rate is for untreated parking lot runoff. However there is a pretreatment here, using an oil grease separator that will collect the bulk of TTS and floating materials. The discharge rate from CB#3 could reasonably increase in size.

At current settings all frequent rainfall will be treated with no over flow.

During the 1/100 year event some runoff will overflow to the driveway. This flow will be directed to the existing catch basin at the south end of the driveway. The overflow during this event is approximately 36.8% of the parking lot runoff [ref line 346].

The total stormwater storage provided for a 1 in 100 year event is 63.3 cubic metres. The extra stormwater storage is proposed to provide treatment of the stormwater at a rate slower rate to the oil grease separators [OGS] and the 'Cultec' units. The designed flow rate is predicated on the maximum allowable flow through the 'Cultec' system that reduces suspended solids by over 80% [ref Appendix 5].

3.1.1 Pre & Post Development Peak Flows:

The rational method was used to calculate the runoff. The attached IDF chart for Belleville [Appendix No.1 of references] was used to determine the rain intensity due to runoff for 1/100 year, 1/5 year and 1/2 year events. Calculated values of the time of concentration were 16 minutes over the grassy portion of the development and 10 minutes over the mainly paved portion of the development. Because of the small tributary area, a time of concentration of 15 minutes was used to determine the stormwater runoff and stormwater accumulation. The rain intensity for I_2, I_5 and I_{100} was 54, 68 and 115.0 mm/hr, respectively.
Considering the pre and post development, the calculated runoff from the subject property is:

Pre-development (l/s)			Post-development (l/s)			Difference (l/sec)		
Q(1/2)	Q(1/5)	Q(1/100)	Q(½)	Q(1/5)	Q(1/100)	Q(1/2)	Q(1/5)	Q(1/100)
45.7	57.6	97.4	77.0	97	164.0	31.3	39.4	66.6

Detailed calculations are shown in Appendix 2. There is a significant increase of runoff between pre and post development condition.

The combination of swales, low sloping lawns, collection/containment system of catch basins and controlled outlets will keep runoff on the property for an extended period of time. The resulting stormwater flow from the subject property will be at or moderately below pre-development flows.

3.2 Water Quality:

Runoff from the proposed development was assigned an enhanced level of protection. The runoff is treated using one of three methods to remove suspended solids.
1. The new garden suites and the west side of the main building generate runoff that sheet flows over low slope lawns.
2. The runoff from the new garden suites and west side of the building will flow to a 200 mm depression in the lawn. A controlled outlet will permit 0.78 hours detention and flow to a 4500 litre irrigation storage tank.
3. Stormwater runoff is collected and contained on the surfaces of the parking lots - at CB#1, & CB#2, CB#3 and CB#10 and in the stormwater conveyance fixtures - pipes and catch basins. This water is controlled to provide the optimal flow of effluent to the 'Cultec' stormwater treatment system from CB#3 and to OGS's after CB#3 and after CB#10.

The flow through the 'Cultec' system would be 3.8 litres per second. The maximum flow through the units that would provide a minimum of 80% TSS removal from raw parking lot

stormwater would be 3.8 litres per second. In this case the stormwater is pre-treated with an OGS.

Comparing the analytical catchments areas in pre and post conditions, catchment 'A' for both conditions remained unchanged. In both cases there is a driveway with landscaping. The post development landscaping will be extensive and beautifying. There will be significant soil imported. It could be argued that the post development will lend itself to significantly greater infiltration, through the lawns and gardens.

Catchment 'B' is all grass and small buildings. This area has only 'clean' runoff - from lawns and new roofs. The post condition does have more buildings, put also well developed landscaping. Again it can be argued that the pre and post conditions in 'B' are equivalent in terms of runoff quality.

Catchment 'C' has been significantly developed resulting in significantly more runoff than the pre-development condition. Here stormwater is to be stored on the parking lots and treated through OGS's. All runoff from the parking lots is controlled and treated. The pre-development flow in 'C' is 20.7, 26.1 & 44.1 l/sec for events ½, 1/5 and 1/100 years, respectively. The post development untreated flow would be 42.5, 53.6 and 90.6 l/sec for events ½, 1/5 and 1/100 years, respectively.

Treatment and controlled containment in 'C' has resulted in a reduction in post development flows, 22.7, 25.0 and 48.0 l/sec for ½, 1/5 and 1/100 years respectively. These exit flows from 'C' after development are less than the pre-development flows.

The proposed quantitative measures satisfy the MOE guidelines of "Stormwater Management Planning and Design Manual", 2003.

During a 1/5 year event, the additional runoff generated from development will be treated to the 'enhanced' level as described in MOE "Stormwater Management Planning and Design Manual"[SMPDM], 2003.

3.3 Erosion and Sediment Controls during Construction:

During construction, precautions are to be taken to minimize the impact of suspended particulate from entering the water shed or neighbouring properties. A silt barrier should be placed around the portion of the subject lot that is under construction and where grades are not draining onto the subject property. This is indicated on SP2.0 with the detail description on D1.1 - see Appendix 4. The silt fence should be installed prior to construction, be maintained during construction and be in place until mature vegetation has been established. All efforts shall be taken to reduce the limit and duration of disturbed areas. Disturbed areas shall be re-vegetated as soon as reasonably possible following work in that area. Also bales of straw shall be placed across newly constructed ditches and swales to filter suspended particulate from the runoff. These straw barriers are to be installed as swales are constructed. Straw bales are indicated on SP2.0 with a detail shown on D1.1, Appendix 4 and Appendix 6.

Also a geofabric should be installed over the catch basin, located at the south end of the driveway. It should be periodically cleaned and remain until mature vegetation is established.

It is the responsibility of the owner to ensure that straw and silt fence barriers are inspected daily to ensure their proper function. Any degradation must be addressed and corrected immediately. In the event of a significant storm event, should sediment reach the wetlands, the Conservation Authority is to be informed immediately.

4. Maintenance

After construction, the owner will be responsible for maintenance of all stormwater management facilities and associated outlets to their design standards. The swales, lawns and lawn depressions must be properly maintained to ensure a healthy and dense growth of grass. Over time, deposited sediment is to be excavated and removed off-site, and the bottom of the swales and depressions returned to the designed gradient. The grass should not be cut too short in swales. The cut length of grass should not be shorter than three inches in swales and two inches on the lawns.

The 'Cultec' equipment requires periodic maintenance. Over the first year, the units should be inspected after the first fall of operation and in the first spring. The 'Cultec' company recommends flushing as soon as 75 mm of sediment has built up over the units. A copy of the 'Cultec' maintenance procedures is attached to this report. The network of catch basins will reduce the sediment build up in the 'Cultec' units. The controlled outlets will slow flow of stormwater to laminar flow as soon as the under ground storage and pipes are filled. This laminar flow will permit the settlement of suspended solids in the catch basin sumps.

The catch basin sumps and OGS's will require periodic maintenance - removal of sediments from the sumps at 250 mm and 150 mm for OGS's [there is a 600 mm sump] and clearing the 'floating' sediments from the screens. This is done with a vacuum pump truck. These trucks operate in the County. Some materials trapped by the screens may require removal by hand.

A stormwater maintenance log should be maintained to demonstrate to the authorities that 'due diligence' has been exercised here with respect to conscientious maintenance of the stormwater equipment.

5. Conclusions

The proposed stormwater management scheme has been designed to meet the Ministry of Environment, Quinte Conservation Authority and the Municipality of Prince Edward County stormwater management criteria. The post development flows from the subject site are less than or equal to pre-development flows. The increased runoff caused by the proposed development will be treated to an 'enhanced' level, reducing the suspended solids by at least 80% during a one in 5 year event.

The total stormwater effluent flow that is generated by a 1/100 year event will not exceed the pre-development flow. Some of the runoff [36.8% of 'C'] from the 1/100 year event will bypass treatment and pass down the driveway to the municipal stormwater sewer system.

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