Robinson
Land Development

Proposed Reis Equipment Dealership
1575 Diamondview Road
Ottawa, Ontario
Servicing and Stormwater Management Report

Prepared For:

PRI-TEC Construction Ltd.

Prepared By:

Robinson Land Development Inc.
Consulting Engineers

Our Project No. 13083
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Legal Notification

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1.0 INTRODUCTION

Pri-Tec Construction Ltd. has retained Robinson Land Development to provide engineering services for the preparation of site grading, servicing and stormwater management for a proposed agricultural machinery dealership. The site is located at 1575 Diamondview Road (See Figure1-Key Plan in Appendix A).

2.0 EXISTING CONDITIONS

The site is currently undeveloped and has recently had the existing on-site vegetation (tree and scrub bush) cleared in anticipation of development. A new drilled well has also been constructed to service the proposed development. The 4.65 Ha property is zoned for Rural Commercial. The property currently drains northerly to the existing 1250mm x 1500mm CSPA crossing Diamondview Road.

3.0 DEVELOPMENT PROPOSAL

The proposed development will consist of a 1798 m^2 one storey heavy equipment dealership with gravel parking areas and a future 1865 m^2 storage shed.

4.0 WATERMAIN AND SANITARY SERVICING

As municipal services are not available for this site, private services will be required. The potable water service for the site will be provided through the use of a new on-site drilled well that has been constructed. The location of the new well is shown on the site servicing and grading plan (Appendix A).

The proposed sanitary service for the site will utilize a septic system. The location and design of both these will be determined by others but has been conceptually shown on the servicing and grading plan (Dwg. 13083-GR1, see Appendix A).

In addition, an on-site underground tank will be required to provide water storage for fire suppression. The location is to be provided in the grassed area at the west entrance.

5.0 STORM AND STORMWATER MANAGEMENT

This section of the report documents the proposed methods of mitigating the post development storm water runoff for the subject site. Items that are addressed include:

- Calculating pre-development and post-development runoff and the corresponding storage volume requirements.
- Determine the location, sizes and storage volumes of the proposed drainage system components located within the site.
- Identifying the quantity and quality control requirements.
- Identifying external drainage area and sizing of cut-off swales to temporarily accommodate the off-site drainage around the site

5.1 Quantity Requirements

In accordance with City of Ottawa requirements, the maximum release rate from the site is calculated using the following parameters and equations:

Time of Concentration:	T_c	= 20 minutes
Coefficient for impervious area		= 0.9
Coefficient for gravel area		= 0.7
Coefficient for pervious (grass) area		= 0.2
5 year Rainfall Intensity:	I_5	= $(998.071)/((T_c+6.053)^{0.814})$
where T_c = time in minutes	**I_5**	**= 70.25 mm/hr**
100 year Rainfall Intensity:	I_{100}	= $(1735.688)/((T_c+6.014)^{0.82})$
where T_c = time in minutes	**I_{100}**	**= 119.95 mm/hr**

In addition to maintaining the pre-development drainage boundaries, the post-development flow will be controlled (up to the 100 year design storm) to meet the 5 year pre-development flow allowable release rate. The 5 year allowable rate (pre-development rate) will be calculated with the actual pre-development runoff coefficient using the pervious and impervious coefficients identified above.

5.1.1 Allowable Release Rate

The corresponding pre-development (i.e. allowable) release rate for this area, based on the pre-development runoff coefficient calculated above, is as follows:

$Q_{5yr} = 2.78\ CI_{5yr}\ A$
$Q_{5yr} = 2.78\ (0.20)(70.25)(4.65)$
$Q_{5yr} = 181.6$ L/s

$Q_{100yr} = 2.78\ CI_{100yr}\ A$
$Q_{100yr} = 2.78\ (0.20)(119.95)(4.65)$
$Q_{100yr} = 310.1$ L/s

Therefore, the allowable release rate for the site is 181.6 L/s for all events up to the 100 year design storm event (control post development flow to 5 year pre-development flow).

5.2 Quality Requirements

At the request of City Staff, the Mississippi Valley Conservation Authority (MVCA) was contacted in order to determine any additional stormwater management criteria applicable to the site. Based on the recent review comments provided by the MVCA for the previous report submission, the site ultimately drains (via off-site roadside ditches running along the Klondike Road and March Road) to a cold water tributary of the Carp River ~ 800 meters downstream of the site. Even though the runoff from the site will remix with untreated roadside runoff, the MVCA have requested that on-site quality and temperature mitigating measures be provided. Consequently, it was agreed during a May 27th 2014 conference call with the MVCA that the volume for the 25 mm/first flush storm be provided within the proposed dry facility. In order to achieve this, the invert of the outlet pipe within the facility has been raised to accommodate the 25 mm/first flush volume. The containments from the 25 mm storm will settle out and the storm water from the 25 mm storm is expected to infiltrate into the mostly sandy like native soils. In addition, some quality cleansing will also be provided by the roadside ditches themselves before the stormwater enters the nearest watercourse. Temperature mitigation of the on-site stormwater will be achieved by additional plantings around the stormwater facility in order to provide shading, by infiltrating the storm flows through the bottom of the facility and lastly by sheet flow across the site which encourages at-source infiltration. Calculations for the 25mm storm are found in Appendix A.

6.0 STORMWATER DESIGN

6.1 Quantity Design

The post development runoff is restricted to the 5 year pre-development design event as calculated in the section above. This limits the total allowable release rate for the site to 181.6 L/s for both the 5 year and 100 year events. However, the critical event for the quantity design portion is the 100 year design event. The detailed quantity design calculations for this event are provided in the sub-sections below but relate to the storm drainage area plan in Appendix A (see Stormwater Management Plan, Dwg. #13083-SWM1).

6.1.1 Free Flow Area

Table 1.0
Weighted Runoff Coefficients (Free Flow Area A1)

Area No.	Surface	Area 'A' (m^2)	5 Year Runoff 'C'	5 year 'C'x'A' (m^2)	100 Year Runoff 'C'	100 Year 'C'x'A' (m^2)
A1	Grass	1070.2	0.2	214.0	0.25	267.6
	Total	**1070.2**	**Avg = 0.2**	**214.0**	**Avg = 0.25**	**267.6**

Post-Development Free Flow Release Rate Area A1 (5 Year)

$Q_{A1(5yr)} = 2.78\ CI_{5yr}\ A$
$Q_{A1(5yr)} = 2.78\ (0.20)(70.25)(0.11)$
$Q_{A1(5yr)} = 4.3$ L/s

Post-Development Free Flow Release Rate Area A1 (100 Year)

$Q_{A1(100\ yr)} = 2.78\ CI_{100yr}\ A$
$Q_{A1(100\ yr)} = 2.78\ (0.25)(119.95)(0.11)$
$Q_{A1(100\ yr)} = 9.2$ L/s

Note: Runoff coefficient has been increased by 25% in the above calculation as per Section 5.4.5.2.1 of the current 2012 Ottawa Sewer Design Guidelines or to a maximum of 1.0.

Table 1.1
Weighted Runoff Coefficients (Free Flow Area A2)

Area No.	Surface	Area 'A' (m^2)	5 Year Runoff 'C'	5 Year 'C'x'A'(m^2)	100 Year Runoff 'C'	100 Year 'C'x'A' (m^2)
A2	Grass	1842.08	0.2	368.4	0.25	460.52
	Building	932.52	0.9	839.3	1.0	932.52
	Total	**2774.6**	**Avg = 0.44**	**1207.7**	**Avg = 0.50**	**1393.04**

Post-Development Free Flow Release Rate Area A2 (5 Year)

Q_{A2} = 2.78 CI_{5yr} A
Q_{A2} = 2.78 (0.44)(70.25)(0.28)
Q_{A2} = 24.1 L/s

Post-Development Free Flow Release Rate Area A2 (100 Year)

Q_{A2} = 2.78 CI_{100yr} A
Q_{A2} = 2.78 (0.50)(119.95)(0.28)
Q_{A2} = 46.7 L/s
Note: Runoff coefficient has been increased by 25% in the above calculation as per Section 5.4.5.2.1 of the current 2012 Ottawa Sewer Design Guidelines or to a maximum of 1.0.

6.1.2 Remainder of Site

Therefore the allowable release rate for the remainder of the site is as follows:
Q_{All} = Total Site Allowable Release – Post Development Release Rate (Free Flow Areas A1 & A2)
Q_{All} = 181.6 – 9.2 – 46.7
Q_{All} = 125.7 L/s

Therefore the total remaining maximum allowable release rate of 125.7 L/s must not be exceeded by the flows generated for the remainder of the site (Area A3 and A4) up to and including the 100 year design storm. If the maximum rate is exceeded, flows are to be stored on-site and released at the maximum rate calculated above.

Table 1.2
Weighted Runoff Coefficient (Area A3)

Area No.	Surface	Area 'A' (m^2)	5 Year Runoff 'C'	5 Year 'C'x'A' (m^2)	100 Year Runoff 'C'	100 Year 'C'x'A' (m^2)
A3	Gravel	1965.6	0.7	1375.9	0.87	1710.1
	Grass	16537.1	0.2	3307.4	0.25	4134.3
	Building and Sidewalks	697.3	0.9	627.6	1	697.3
	Total	**19200**	**Avg = 0.28**	**5310.9**	**Avg = 0.34**	**6541.7**

Table 1.3
Weighted Runoff Coefficient (Area A4)

Area No.	Surface	Area 'A'(m^2)	5 Year Runoff 'C'	5 Year 'C'x'A' (m^2)	100 Year Runoff 'C'	100 Year 'C'x'A' (m^2)
A4	Grass	13241	0.2	2648.2	0.25	3310.3
	Gravel	6436.4	0.7	4505.5	0.87	5599.7
	Building and Sidewalk	3822.6	0.9	3440.3	1	3822.6
	Total	**23500**	**Avg = 0.45**	**10594.0**	**Avg = 0.54**	**12732.6**

6.2 Storage Requirements and Allocation

The required storage volume to accommodate the 100 year design storm, for each of the remaining areas (A3 & A4) is calculated by determining net runoff flow (L/s) over a period of time. The net runoff flow value is the difference in the actual flow at different intervals throughout the storm based on the IDF curve for Ottawa and the allowable runoff (L/s) for that area. As stated above for areas A1 and A2, the runoff coefficient has been increased by 25% in the above calculation as per Section 5.4.5.2.1 of the current 2012 Ottawa Sewer Design Guidelines or to a maximum of 1.0. The critical event to size the orifice and pond storage for this site will be the 100 year design event (see Sections 5.1.1 and 6.1.2 for details) as it will need to be controlled to the 5 year pre-development design event. As per City of Ottawa review comments, the design for the 5 year post-development event has been provided (using the 100 year storm values) in the following sections even though it is not the critical event.

Table 2.0
Area A3

Return Period	Time (min)	Intensity (mm/hr)	Flow Q in L/s	Allowable * Runoff in L/s	Net Runoff To Be Stored in L/s	Storage Req'd m^3
5 Year	5	141.18	211.00	50.50	160.50	48.15
	10	104.19	155.72	50.50	105.22	63.13
	15	**83.56**	**124.88**	**50.50**	**74.38**	**66.94**
	20	70.25	104.99	50.50	54.49	65.39
	25	60.90	91.01	50.50	40.51	60.77
	30	53.93	80.60	50.50	30.10	54.17

* Chosen through an iterative process

Table 2.1
Area A3

Return Period	Time (min)	Intensity (mm/hr)	Flow Q in L/s	Allowable * Runoff in L/s	Net Runoff To Be Stored in L/s	Storage Req'd m^3
100 Year	15	142.89	259.32	50.50	208.82	187.94
	20	119.95	217.68	50.50	167.18	200.62
	25	103.85	188.46	50.50	137.96	206.94
	30	**91.87**	**166.72**	**50.50**	**116.22**	**209.20**
	35	82.58	149.86	50.50	99.36	208.66
	40	75.15	136.37	50.50	85.87	206.09

* Chosen through an iterative process

Table 2.2
Area A4

Return Period	Time (min)	Intensity (mm/hr)	Flow Q in L/s	Allowable * Runoff in L/s	Net Runoff To Be Stored in L/s	Storage Req'd m^3
5 Year	5	141.18	415.04	75.2	339.8	102.0
	10	104.19	306.31	75.2	231.1	138.7
	15	83.56	245.65	75.2	170.4	153.4
	20	**70.25**	**206.53**	**75.2**	**131.3**	**157.6**
	25	60.90	179.03	75.2	103.8	155.7
	30	53.93	158.54	75.2	83.3	150.0

* Chosen through an iterative process

Table 2.3
Area A4

Return Period	Time (min)	Intensity (mm/hr)	Flow Q in L/s	Allowable * Runoff in L/s	Net Runoff To Be Stored in L/s	Storage Req'd m^3
100 Year	20	119.95	423.16	75.2	348.0	417.6
	25	103.85	366.35	75.2	291.2	436.7
	30	91.87	324.09	75.2	248.9	448.0
	35	82.58	291.32	75.2	216.1	453.9
	40	**75.15**	**265.10**	**75.2**	**189.9**	**455.8**
	45	69.05	243.60	75.2	168.4	454.7

* Chosen through an iterative process

6.3 Summary of Storage Provided

Table 3.0
Area A3

Storm Event	Release Rate	Required Storage	Provided Storage
100 Year	50.5 L/s	209.2 m^3	217.2 m^3

Table 3.1
Area A4

Storm Event	Release Rate	Required Storage	Provided Storage
100 Year	75.2 L/s	455.8 m^3	457.9 m^3

The volume of the surface storage available is calculated using "Civil 3D" by Autodesk. This program creates three dimensional models of the proposed pond and of the top of ponded water surface. It then calculates a volume between these two surfaces, using three different algorithms, to ensure an accurate result.

6.4 Inlet Control Device Calculations

Inlet controls were calculated for each of the storage facilities and are described in detail below.

For Area A3, the available head on the outlet was particularly small (due to the relatively flat slope of the contributing drainage area to the existing invert of the adjacent outlet ditch). As such the typical orifice pipe outlet was not suitable and a rectangular weir is proposed to provide the required flow control. The calculation of the outflow is based on the following:

$$Q = 1.84\ LH^{1.5}$$

$$L = Q / (1.84\ *H^{1.5})$$

Where:

H = 0.17 m (maximum head on weir)
L= length of weir crest (m);
Q= allowable outflow in m^3/s;

Table 4.0
Inlet Control Sizing Summary Area A3

		Weir	
Q(L/s)	**H(m)**	**Length (m)**	rectangular weir
50.5	0.17	0.39	

For Area A4, outflow was calculated based upon a standard orifice equation to achieve the target release rates as follows:

$$Q = C(A)(2gh)^{0.5}$$

$$A = Q / (C(2gh)^{0.5})$$

$$\pi r2 = Q / (C(2gh)^{0.5})$$

$$D= 2r=2x\ (Q / (\pi\ (C(2gh)^{0.5})))^{0.5}$$

Where:

C = 0.6 head loss coefficient for an orifice
H = 0.47 m (centroid of orifice)
A= Area of orifice;
r= radius of orifice;
g= acceleration due to gravity ($9.81 m/s^2$)

Table 4.1
Inlet Control Sizing Summary Area A4

		Orifice	Circ	Plate Type
Q(L/s)	**H(m)**	**Area(m^2)**	**(Dia-mm)**	
75.2	0.35	0.048	248	

$D = 2 \times (0.0752 / (\pi\ (0.6(2*9.81*0.35)^{0.5})))^{0.5}$ **= 248 mm**

6.5 Off-site Drainage

There is an approximately 8.2 Ha external drainage area (see Figure 2 – External Drainage Area Plan in Appendix A) that will need to be accommodated within the site. As these areas are undeveloped, the flows to be accommodated are proposed to be captured by two cut-off swales located adjacent to the southern property boundary (on-site) and western property boundary (within the joint use access road right-of way). The flows have been estimated (based on a 100 year design as the critical event) to be approximately 200 L/s for the area tributary to the on-site cut-off swale and is approximately 483.5 L/s for the area tributary to the access road swale. In order to convey this flow, the cut-off swales will need to be constructed (see supporting calculations in Appendix A) with the following:

- On-site swale: 1% slope, zero bottom width and a maximum depth of 0.3 meters.
- Access road swale: 0.5% slope, zero bottom width and a maximum depth of 1.0 meters.

7.0 EROSION AND SEDIMENT CONTROL MEASURES

Temporary erosion and sediment control measures will be implemented during construction. Erosion and Sediment Control measures are to be installed and maintained during construction as shown on (Dwg. #13083-EC1). Silt fences and straw bale check dams will be inspected daily, and after every rain event to determine maintenance, repair or replacement requirements. These measures will be implemented prior to the commencement of construction and maintained in good order until vegetation has been re-established on the site.

8.0 CONCLUSION

The 1575 Diamondview Road site can be adequately serviced to be in conformance with the City of Ottawa Design Guidelines. The water service for the site will be provided by an on-site well. The proposed development will utilize a septic system. Both these services will be designed and submitted by others at the appropriate detailed design stage. The following conclusions for the storm and stormwater management system are provided:

- Release of post development stormwater is controlled to the 5 year pre-development design event.
- The 25 mmm first flush even volume will be provided within the proposed stormwater management facilities and will infiltrate into the mostly sandy native soils

- The site will continue to sheet drain the stormwater runoff towards the existing roadside ditches to the north and east. These ditches will also provide some quality enhancement of the stormwater before it reaches the nearest tributary watercourses of the Carp River (~ 800 meters downstream of the site)
- The excess stormwater for the 5-year and 100-year storm event will be stored in two on-site storage ponds.
- Cut-off swales to accommodate the off-site external drainage through the site have been sized based on the 100 year design event.
- Temporary erosion and sediment control measures for the site have been identified.

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Appendix A

Figure 1 - Key Plan
Figure 2 - External Drainage Area Plan
25mm Storm Calculations
Cut-off swale supporting calculations
Stormwater Management Plan -
Dwg. #13083-SWM1
Site Servicing and Grading Plan –
Dwg. #13083-GR1
Erosion and Sediment Control Plan -
Dwg. #13083-EC1
Servicing Study Checklist