Half Moon Bay South – Draft Plan #3, Barrhaven South, City of Ottawa
Stormwater Management Report

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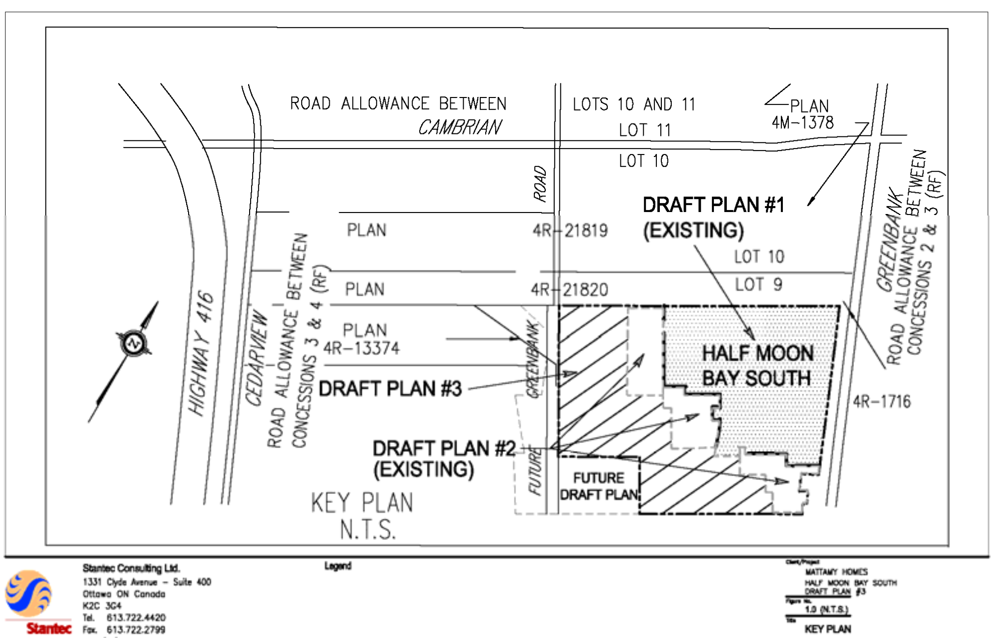
1.0 Introduction and Background

1.1 OVERVIEW

This stormwater management (SWM) report has been prepared in support of the engineering design of Draft Plan 3 (DP3) of the Half Moon Bay South (HMBS) development.

Stantec Consulting has been retained by Mattamy Homes Ltd. to complete the preliminary and detailed designs in support of Draft Plan #3 (DP3) of the Half Moon Bay South (HMBS) development. The proposed 23.8 ha-development consists mainly of residential land use and is located in the Barrhaven South Community in the city of Ottawa. DP3 is located south and west of the existing and approved phases, within the existing and Future Greenbank Roads, south of a residential development called Meadows in Half Moon Bay (Tamarack lands) and north-east of a future draft plan of the HMBS development (currently outside of the CDP). DP3 of the HMBS development is within the Barrhaven South Corrigan and Todd Ponds' tributary drainage areas. The south-eastern corner of Draft Plan #3 (DP3) is tributary to the Corrigan Pond sewershed area through the approved Phase 3 of the HMBS development, while the rest of DP3 is tributary to the Todd Pond through the approved Phase 3. **Figure 1.0** indicates the study area, while DP3 of the HMBS development is shown on **Drawing SD-1.**

Figure 1 Draft Plan #3 Key Plan



1.2 BACKGROUND

A preferred stormwater management (SWM) plan for the Barrhaven South Community was identified in the Jock River Reach One Subwatershed Study (Stantec, June 2007) and reflected in the Barrhaven South Master Servicing Study (Stantec, June 2007). The Barrhaven South MSS identified that the SWM ponds had to be designed to provide 80% Total Suspended Solids (TSS) removal, however, no quantity control storage and/or erosion control storage were required.

The SWM criteria and sewershed boundaries were subsequently modified in the Corrigan Stormwater Management Facility Stormwater Management Report and Design Brief (IBI Group, 2010), and the Servicing Brief for Half Moon Bay Development Phase One for Mattamy Homes in the City of Ottawa (DSEL, April 2008).

In order to allow the Meadows in Half Moon Bay (Tamarack lands north of the site) and the Half Moon Bay South (Mattamy lands) development to proceed prior to the update to the Barrhaven South MSS, J. F. Sabourin and Associates (JFSA) undertook an analysis in June 2011 to evaluate the performance of the existing Todd pond and proposed Clarke pond systems by combining several separate models developed by JFSA (Half Moon Bay subdivision), IBI (Meadows in Half Moon Bay) and Stantec (Half Moon Bay South). The analysis has been subsequently revised every time there are changes to the Meadows in Half Moon Bay and/or the Half Moon Bay South developments to assess impacts on the Todd and Clarke Pond storm systems. The results of the latest analyses are summarized in **Appendix A5**.

In August 2014, J.F. Sabourin & Associates (JFSA) presented a revised Todd pond model as part of their Model Keeper Analysis for Todd Pond making use of the dual routing procedure for DDSWMM outlined in Technical Bulletin ISDTB-2014-01. The resultant increase in storage provided in existing roadways permitted expanded Todd pond drainage boundaries also outlined in the JFSA Model Keeper Analysis. It is the intent of the proposed servicing scheme to make use of all available drainage area allocated to the Todd pond to limit requirements for a minor system sewer to the Clarke Pond to service Half Moon Bay South.

As a result of the above mentioned changes, the Barrhaven South MSS will be subject to an update in the very near future and as such, the design assumptions outlined in this report will be revisited once the update to the Barrhaven South MSS is completed.

1.3 PURPOSE

The purpose of this stormwater management (SWM) report is to assess the adequacy of the major system across the proposed Draft Plan #3, to estimate the 100 year hydraulic grade line (HGL), to assess impacts to the downstream approved and existing phases and to demonstrate adherence to previously established criteria.

1.4 BACKGROUND RESOURCES

The following studies were referenced in the preparation of this report:

- *Todd Pond Model Keeper Analysis*, J. F. Sabourin and Associates Inc., August, 2014.
- *Half Moon Bay South Draft Plan #2 – Detailed Design, Servicing Report*, Stantec, August 2014.
- *Half Moon Bay South – Phases 2 & 3, Barrhaven South, City of Ottawa, Stormwater Management Report,* Stantec Consulting Ltd., revised February 15, 2013
- *Technical Bulletin ISDTB-2012-1,* City of Ottawa, January 2012
- *Half Moon Bay South – Phase 1A, Barrhaven South, City of Ottawa, Stormwater Management Report,* Stantec Consulting Ltd., revised July 20, 2011
- *Geotechnical Investigation Report, Proposed Residential Subdivision Half Moon Bay South, Greenbank Road, Ottawa, ON,* Stantec Consulting Ltd., November 2011
- *City of Ottawa Sewer Design Guidelines*, City of Ottawa, November 2004

2.0 Criteria and Constraints

The following section discusses the criteria and constraints influencing the preliminary design of Draft Plan #3 (DP3) of the Half Moon Bay South (HMBS) development.

2.1 CRITERIA

Criteria were established through review of the background documentation, supplemented with current design practices outlined by the City of Ottawa Sewer Design Guidelines (City of Ottawa, October 2012) and the City of Ottawa's Technical Memo (City of Ottawa, January 2012).

- Use of the dual drainage principle
- Maximum 100 year flow depth of 0.30 m in road sags
- Standing water depths at road sags not to cause surface flooding on any building or structure
- Rear-yard storage not to be included in stormwater management (SWM) calculations
- Use of standard self-cleansing inlet-control devices where possible
- Ensure that 100 year overland flows from the proposed HMBS development tributary to River Mist Road are captured into the minor system prior to entering the adjacent Meadows in Half Moon Bay development to the north
- Maximum peak release rate from the HMBS development to the Corrigan pond at MH521 (existing manhole in phase 1A) to be 1,466 L/s as obtained from the 100 year XP-SWMM model included in the SWM Report of Phase 1A of the HMBS development (Stantec, July 2011)
- 100 year major flows entering Phase 1A at Andre Audet Avenue to be less than 1.48 m3/s as obtained from the 100 year DDSWMM model included in the SWM Report of Phase 1A of the HMBS development (Stantec, July 2011)
- Proposed schools in Draft Plan #3 of the HMBS development to store post development 100 year peak flows on site while restricting minor system flows to 120 L/s/ha
- 100 year hydraulic grade line (HGL) to be a minimum of 0.30 m below building foundation footings (3hr Chicago Storm) for existing and approved phases and a minimum of 2.5 m below proposed road grades across future development areas where possible

- Size storm sewers to convey the 5 year storm event under free-flow conditions using 2004 City of Ottawa I-D-F parameters with the exception of the trunk sewer along River Mist Road to the Todd pond, and the trunk sewer along Dundonald Drive to the future Clarke Pond which have been sized in XP-SWMM to capture and convey the 100 year post development flows, while meeting the Under Side of Footing (USF) / proposed road grade - HGL clearance criteria across the site
- Subdrains required in swales where longitudinal gradient is less than 1.5%
- Account for tributary external drainage through the system
- Provide adequate emergency overflow conveyance off-site
- Quality control is provided in the downstream Barrhaven South Todd and Corrigan Ponds

2.2 SITE CONSTRAINTS

As shown in the background documents, the HMBS development is within an area of Barrhaven South that has three separate outlets for both minor and major systems.

The proposed DP3 of the HMBS development has several storm sewer outlets. One storm outlet is proposed to the Corrigan Pond via an existing 525mm dia. storm sewer that directs runoff to the trunk sewer along Andre Audet Avenue through phase 2 towards the storm system in phase 1A of the HMBS development, which in turn ultimately discharges into an existing 1950 mm dia. trunk sewer on the existing Greenbank Road. The minor system allowable release rate to the existing MH521 at the Phase 1A boundary towards the Corrigan Pond is 1,466 L/s. Three storm outlets in DP3 will direct runoff to the Todd Pond storm system running north along River Mist Road towards the storm system across the Meadows in Half Moon Bay development (see **Drawing SD-1**).

2.3 GEOTECHNICAL CONSIDERATION

A geotechnical investigation for the HMBS development, which compiles the results from all the previous geotechnical investigations at the site, was prepared by Stantec in November 2011. As stated in the geotechnical investigation, the subsurface profile across the site consists of surficial topsoil or peat over a layer of clay or sand overlying a glacial till deposit. The deposit of peat was encountered within the footprint of the dense trees and brush located within the northwest quadrant of the site. Groundwater levels were recorded on August 11, 2008 and range from 0.1 to 1.7 m below existing ground surface and are subject to seasonal fluctuations. Due to the relatively high water table observed, high groundwater inflow rates could be encountered within deep excavations for services.

Due to the variable thickness of the clay layer encountered around the property, there are three grade raise restrictions for this site. Allowable grade raises were provided in the geotechnical report and should be limited to no greater than 2.5 m above existing grades across the majority of the Draft Plan. Within the northwest corner of the site, grade raises should be limited to no greater than 1.0 m above existing site grades. If higher grade raises are required in the site, a surcharge program could be carried out or the elevation of building foundations could be modified.

Due to the presence of clay, protective granular pads, mud mats and geotextiles will be required during construction to protect subgrades from disturbances. Temporary excavations should be carried out at side slopes no steeper than 1H:1V from the base of the excavation.

3.0 Proposed Stormwater Management Plan

The following sections describe the proposed stormwater management (SWM) plan for Draft Plan #3 (DP3) of the HMBS development in the context of the background documents and available governing criteria.

3.1 ULTIMATE CONDITIONS

The proposed DP3 of the MHBS development (the site) will comprise a combination of town-house units, terrace homes and single-family residential lots, two schools, park land and associated transportation and servicing infrastructure.

The proposed site is designed using the "dual drainage" principle, whereby the minor (pipe) system is designed to convey the peak rate of runoff from the 5 year design storm (or equivalent flow rate), and runoff from larger events is conveyed by both minor (pipe) and major (overland) channels such as roadways and walkways safely off site. A combination of vertical orifices and IPEX inlet control devices (ICDs) are specified for most street and rear yard catchbasins to limit the inflow to the minor system and thus control the hydraulic grade line from surcharging storm sewers into basements during major storms and to meet the target release rates from the site. Solid covers are proposed for all manholes located in ponding areas to limit inflows to the minor system to that of the ICD. As recommended by the Ottawa Sewer Design Guidelines, no storage will be accounted for in the rear yards. **Drawing SD-1** outlines the proposed drainage areas.

Major system runoff from the proposed DP3 development will be directed to two separate outlets. A major system outlet will be provided overland through Andre Audet Avenue which will direct major flows to Regatta Avenue at the Meadows in Half Moon Bay development while a second major system outlet will be provided through the storm trunk sewer along River Mist Road which conveys minor and major system flows to the Todd Pond.

Several unrestricted curb inlets have been installed along the section of River Mist Road within Phase 1A in order to capture the 100 year major flows from the portion of the HMBS development tributary to the River Mist Road outlet, while meeting the USF clearance criteria across the site.

A temporary dry pond is proposed to attenuate flows from external rural tributary areas (see **Appendix A.5**) per the results of the Barrhaven South Master Servicing Study. Flows will be attenuated to 350L/s in the 100yr storm event scenario. Pond sizing is to be completed at the detailed design stage.

3.2 ULTIMATE CONDITION HYDROLOGY

A comprehensive hydrologic modeling exercise was completed with DDSWMM, accounting for the estimated major and minor flows to evaluate the response of the storm sewer infrastructure and the site's major systems. Two DDSWMM models were created; one for the minor system to the Corrigan pond and major system to Andre Audet Avenue at the boundary of Phase 1A and a second model for the minor system to the Todd Pond and major system to River Mist Road. The DDSWMM models incorporate subcatchments within the proposed DP3 area, the approved Phases 2, 3 and part of the existing Phase 1A, and lumped drainage areas for future development lands southwest of the HMBS development tributary to the Todd Pond. Catchments within the approved phases of the development have been included in order to assess any impacts to the existing major and minor systems. Drawing SD-1 shows the drainage catchments in the HMBS development along with the preliminary storm servicing infrastructure.

3.2.1 Hydrologic Parameters and Assumptions

- Surface storage estimates for the subcatchments within the proposed DP3 and the approved and existing phases of the HMBS development were based on the grading plan designs, while the approximate surface storage available in the lumped catchments within future areas of the HMBS development was assumed based on the preliminary proposed road grade slope and type of road. The following assumptions were applied to the DDSWMM models:
- Hydrologic parameters as per Barrhaven South MSS (Stantec, 2007), including Horton infiltration, Manning's 'n' and depression storage values (see **Appendix A1**)
- 3hr Chicago Storm distribution as outlined in the Barrhaven South MSS (Stantec, 2007)
- Major system to be assessed during the July 1st, 1979 historical storm and during the 100 year design storm increased by 20%
- Impervious areas were measured in several representative catchments based on the type of units in the catchment (single, townhouse, etc.) and whether they were road or rear yard catchments. Impervious areas for these catchments were based on a maximum unit size based on lot setbacks and as such the impervious areas measured are considered conservative. The imperviousness values calculated were used in similar catchments across the site. Imperviousness values were converted to runoff coefficients for storm sewer sizing purposes using the relationship C = (Imp. x 0.7) + 0.2
- Imperviousness values for rear yard catchments within the proposed DP3 were assumed to be 80% effective
- DDSWMM segment lengths defined from high-point to low-point where sags occur
- Subcatchment width equal to two times the average segment length for two-sided catchments, equal to one time the segment length for one-sided catchments, and equal to 225 times the area of the catchment for any other catchments

- Draft Plan #2 catchments were included in the model and the parameters used for these catchments (areas, length, width and inlet information) were obtained from the DDSWMM model included in the HMBS – Draft Plan #2 SWM Report (Stantec, August 2014)

- Phase 2 & 3 catchments were included in the model and the parameters used for these catchments (areas, length, width and inlet information) were obtained from the DDSWMM model included in the HMBS – Phases 2 & 3 SWM Report (Stantec, February 2014)

- Phase 1A catchments tributary to the minor and major system outlet at River Mist Road were included in the model and the parameters used for these catchments (areas, length, width and inlet information) were obtained from the DDSWMM model included in the HMBS – Phase 1A SWM Report (Stantec, July 2011)

- Existing catchment lengths and road segments were modified to permit double routing per City Technical Bulletin ISDTB-2014-01

- Several segment cross-section types were defined to represent 8.5 m wide roads at different longitudinal slopes, 11.0 m wide roads at different longitudinal slopes, rear yard swales at 1.0% longitudinal slope, and parks

- Minor flows from park areas in the proposed DP3 of the HMBS development to be controlled to 60 L/s/ha (approx. 5 year peak flows from pervious areas)

- School areas to store 100 year peak flows on-site and to restrict minor system inflows to 120 L/s/ha

3.2.2 Ultimate Condition Hydrologic Analysis Results

Appendices A2, and A3 summarize the DDSWMM modeling results for the various storm events included in this analysis. The total flow depth shown in the tables below is equal to the depth on the segment obtained from DDSWMM plus the maximum ponding depth on street sags, when the storage used obtained from DDSWMM equals the maximum storage available on the street sag. Otherwise, the actual ponding depth on street sags is interpolated using the maximum storage used obtained from DDSWMM. **Tables 3.2** and **3.3** summarize the DDSWMM modeling results for the proposed areas in DP3 and approved and existing phase areas along the major system outlets for the 5 year, and 100 year 3 hr Chicago storms respectively.

Table 3.1 HMBS- Draft Plan #3 – Major and Minor System 5 Year Storm Results

Segment Type	Segment ID	Peak Flow (m^3/s)	Depth on Segment (cm)	Max. Capture (L/s)	Storage Used (m^3)	Static Ponding Depth (cm)	Total Flow Depth (cm)
Minor System To Corrigan Pond							
EX. Road	ST525A	0.150	7.74	66.0	22.6	15.0	22.7
EX. Road	ST526A	0.079	6.10	44.0	12.8	15.0	5.8
EX. RY	ST526B	0.046	13.40	32.0	0.0	0.0	N/A
EX. Road	ST528A	0.053	5.10	32.0	8.7	20.0	1.3
EX. RY	ST529A	0.040	12.73	32.0	0.0	0.0	N/A
EX. Road	ST530A	0.092	6.39	44.0	12.7	15.0	21.4
EX. Road	ST532A	0.074	5.98	44.0	10.9	15.0	4.4
EX. Road	ST534A	0.062	5.49	32.0	12.0	17.0	3.8
EX. Road	ST535A	0.198	8.55	118.0	39.6	15.0	23.6
EX. Road	ST537A	0.064	5.58	32.0	12.5	15.0	5.4
EX. Road	ST538A	0.220	8.89	64.0	12.9	14.0	22.9
EX. RY	ST536A	0.049	13.82	32.0	0.0	0.0	N/A
EX. RY	ST534B	0.063	15.38	32.0	0.0	0.0	N/A
EX. Road	ST540A	0.045	4.53	44.0	0.0	10.0	14.5
EX. Road	ST551A	0.244	8.50	22.0	11.3	13.0	21.5
EX. RY	ST532B	0.060	15.16	22.0	0.0	0.0	N/A
EX. Road	ST552A	0.062	5.48	32.0	11.6	15.0	4.1
EX. Road	ST555A	0.029	3.70	22.0	2.9	0.0	0.5
EX. Road	ST554A	0.258	9.47	22.0	0.0	13.0	22.5
EX. RY	ST554B	0.021	10.14	20.5	0.0	0.0	N/A
EX. RY	ST554C	0.119	19.58	32.0	0.0	0.0	N/A
EX. RY	ST555B	0.011	7.53	11.4	0.0	0.0	N/A
EX. Road	ST556A	0.293	9.14	64.0	23.4	16.0	25.1
EX. Road	ST557A	0.101	5.37	22.0	0.0	0.0	5.4
EX. RY	ST557B	0.011	7.52	11.3	0.0	0.0	N/A
EX. RY	ST559B	0.026	10.79	22.0	0.0	0.0	N/A
EX. Road	ST559A	0.046	3.96	22.0	0.0	0.0	4.0
EX. Road	ST559C	0.016	3.08	15.4	0.0	5.0	8.1
Road	ST560A	0.072	5.87	32.0	11.6	15.0	20.9
Road	ST563A	0.083	6.19	32.0	14.0	15.0	21.2
Road	ST564A	0.068	5.73	32.0	11.2	15.0	20.7
RY	ST564B	0.044	13.16	32.0	0.0	0.0	N/A
RY	ST564C	0.017	9.26	17.0	0.0	0.0	N/A
RY	ST565A	0.013	8.01	12.9	0.0	0.0	N/A
Road	ST566A	0.068	5.70	32.0	11.2	0.0	5.7

Segment Type	Segment ID	Peak Flow (m^3/s)	Depth on Segment (cm)	Max. Capture (L/s)	Storage Used (m^3)	Static Ponding Depth (cm)	Total Flow Depth (cm)
EX. Road	ST541A	0.059	5.37	32.0	12.7	15.0	2.8
EX. Road	ST542A	0.055	5.19	32.0	0.0	15.0	20.2
EX. Road	ST544B	0.112	5.62	32.0	10.5	16.0	21.6
EX. RY	ST546B	0.092	17.58	32.0	0.0	0.0	N/A
EX. Road	ST546A	0.042	3.82	22.0	0.0	0.0	3.8
EX. RY	ST544A	0.091	6.38	64.0	11.4	15.0	N/A
-	EXT-5	0.115	3.51	0.0	0.0	0.0	N/A
Park	ST662A	0.069	2.10	41.5	0.0	0.0	2.1
Minor System To Todd Pond							
EX. Road	ST604A	0.111	6.31	64.0	11.5	15.0	21.3
EX. RY	ST602A	0.033	11.82	22.0	0.0	0.0	N/A
EX. RY	ST613B	0.065	15.58	32.0	0.0	0.0	N/A
EX. Road	ST614A	0.018	3.08	18.4	0.2	12.0	0.3
EX. Road	ST616A	0.144	6.66	64.0	33.1	19.0	4.6
EX. Road	ST606A	0.075	6.00	64.0	1.2	15.0	0.5
EX. Road	ST605A	0.134	7.45	86.0	19.5	24.0	2.0
EX. RY	ST606B	0.019	9.78	18.7	0.0	0.0	N/A
EX. RY	ST608C	0.033	11.80	32.0	0.0	0.0	N/A
EX. Road	ST620A	0.030	3.75	22.0	0.0	4.0	7.8
EX. Road	ST623A	0.185	7.68	140.0	15.9	22.0	1.5
EX. Road	ST614B	0.053	5.18	32.0	9.6	12.0	5.0
EX. Road	ST615A	0.066	5.66	44.0	7.1	0.0	3.3
EX. Road	ST614C	0.066	5.67	32.0	0.0	12.0	17.7
EX. Road	ST619B	0.032	4.33	22.0	0.0	15.0	19.3
EX. Road	ST620B	0.074	5.97	44.0	10.7	15.0	4.8
EX. Road	ST621A	0.095	6.50	64.0	9.5	15.0	5.4
EX. RY	ST619A	0.060	15.16	32.0	0.0	0.0	N/A
EX. RY	ST623B	0.053	14.32	32.0	0.0	0.0	N/A
EX. Road	ST628A	0.158	7.90	150.0	3.0	16.0	0.9
EX. Road	ST637A	0.094	5.67	92.8	0.4	30.0	0.0
EX. Road	ST640A	0.179	7.60	128.0	4.6	10.0	17.6
EX. Road	ST612A	0.070	5.82	64.0	0.3	5.0	3.6
EX. Road	ST643A	0.054	4.80	32.0	0.0	0.0	4.8
EX. Road	ST662A	0.015	0.47	8.8	0.0	0.0	0.5
EX. Road	ST663A	0.190	7.46	96.0	0.0	0.0	7.5
EX. RY	ST637B	0.047	13.65	42.0	0.0	0.0	N/A
EX. Road	ST609A	0.065	5.63	54.0	2.0	15.0	0.8

Segment Type	Segment ID	Peak Flow (m^3/s)	Depth on Segment (cm)	Max. Capture (L/s)	Storage Used (m^3)	Static Ponding Depth (cm)	Total Flow Depth (cm)
EX. RY	ST652B	0.014	8.29	13.8	0.0	0.0	N/A
EX. Road	ST638A	0.024	3.82	22.0	0.0	9.0	12.8
EX. Road	ST608A	0.098	6.06	76.0	4.8	19.0	0.8
EX. Road	ST608D	0.033	4.41	32.0	0.1	5.0	0.4
EX. RY	ST608B	0.020	10.06	19.9	0.0	0.0	N/A
EX. Road	ST609B	0.017	9.34	17.3	0.0	0.0	9.3
School	ST647A	0.024	3.14	24.1	0.0	9.0	12.1
EX. Road	ST663B	0.398	9.80	339.0	37.0	0.0	0.6
EX. Park	ST630A	0.041	4.71	32.0	1.0	20.0	24.7
Prop. Road	ST631B	0.019	0.59	19.4	0.0	0.0	0.6
Park	ST630AB	0.159	6.67	134.0	2.9	20.0	0.6
EX. Road	ST630AA	0.048	13.67	32.0	0.0	0.0	13.7
EX. RY	ST629A	0.089	6.36	70.9	1.8	13.0	N/A
EX. Road	ST632C	0.089	17.33	88.1	0.0	0.0	17.3
EX. Road	ST632A	0.103	6.68	84.0	0.0	0.0	6.7
EX. Road	ST638B	0.096	6.51	74.0	5.1	15.0	2.2
EX. RY	ST641A	0.063	5.57	54.0	1.8	15.0	N/A
EX. Road	ST632B	0.078	16.55	67.0	0.0	0.0	16.6
EX. RY	ST646A	0.076	6.03	54.0	1.0	5.0	N/A
EX. RY	ST611A	0.044	13.18	42.0	0.0	0.0	N/A
EX. RY	ST631A	0.022	10.34	21.9	0.0	0.0	N/A
EX. RY	EXT-1	0.028	11.09	0.0	0.0	0.0	N/A
EX. RY	ST509AB	0.048	13.77	22.0	0.0	0.0	N/A
EX. RY	ST521E	0.048	13.74	22.0	0.0	0.0	N/A
EX. RY	ST521D	0.140	7.57	22.0	81.6	30.0	N/A
EX. Park	ST510A	0.009	0.28	2.7	0.0	0.0	0.3
EX. Road	ST613A	0.153	7.12	149.8	1.3	30.0	0.1
EX. School	ST624AA	0.468	10.47	232.9	117.3	0.0	2.1
EX. Road	ST624A	0.068	5.21	57.5	7.5	30.0	0.5
EX. Road	ST627A	0.057	5.34	55.9	0.7	20.0	25.3
EX. Road	ST524A	0.060	4.78	44.0	8.0	30.0	0.7
EX. RY	ST637C	0.053	14.37	22.0	0.0	0.0	N/A
Road	Clarke	0.000	0.00	0.0	0.0	0.0	0.0
RY	ST648A	0.020	10.12	20.4	0.0	0.0	N/A
Road	ST660B	0.019	9.94	19.3	0.0	0.0	9.9
Road	ST660A	0.121	7.14	120.3	0.1	14.0	0.1
Road	ST657A	0.070	5.81	69.5	0.0	23.0	5.8

Segment Type	Segment ID	Peak Flow (m³/s)	Depth on Segment (cm)	Max. Capture (L/s)	Storage Used (m³)	Static Ponding Depth (cm)	Total Flow Depth (cm)
RY	ST659A	0.073	5.92	72.2	0.1	0.0	N/A
Road	ST656B	0.035	12.04	32.0	0.0	0.0	12.0
Road	ST656A	0.031	4.27	31.1	0.0	0.0	4.3
RY	ST655A	0.058	5.35	57.0	0.1	0.0	N/A
Road	ST655B	0.021	10.16	20.7	0.0	0.0	10.2
Road	ST650A	0.124	5.87	123.7	0.1	15.0	0.0
RY	ST649A	0.082	4.98	82.0	0.1	0.0	N/A
RY	ST654A	0.029	11.17	28.4	0.0	0.0	N/A
Road	ST664A	0.084	4.77	82.0	0.2	0.0	1.5
RY	ST715B	0.041	12.82	40.8	0.0	0.0	N/A
RY	ST719B	0.009	6.76	8.8	0.0	0.0	N/A
Road	ST719A	0.027	3.23	26.5	0.0	0.0	3.2
Road	ST717A	0.075	4.59	70.0	0.0	0.0	4.6
Road	ST705A	0.187	6.81	186.4	0.0	0.0	6.8
Road	ST709A	0.078	4.87	77.0	0.0	0.0	4.9
Road	ST715A	0.086	5.74	84.0	0.0	0.0	5.7
Road	ST713A	0.115	6.99	114.1	0.1	15.0	0.1
Road	ST711A	0.074	5.96	73.2	0.1	15.0	0.1
Road	ST710A	0.086	6.26	84.7	0.1	14.0	0.1
RY	ST710B	0.056	14.78	55.2	0.0	0.0	N/A
RY	ST705C	0.016	8.93	16.0	0.0	0.0	N/A
RY	ST705B	0.016	8.89	15.8	0.0	0.0	N/A
Park	ST708A	0.052	1.58	46.0	0.1	0.0	0.0
School	ST703C	0.836	14.84	699.6	40.0	0.0	0.6
Road	ST703B	0.121	7.13	115.0	1.1	0.0	0.8
Road	ST703A	0.067	4.82	67.1	0.0	6.0	10.8

Table 3.2 HMBS- Draft Plan #3 – Major and Minor System 100 Year Storm Results

Segment Type	Segment ID	Peak Flow (m³/s)	Depth on Segment (cm)	Max. Capture (L/s)	Storage Used (m³)	Static Ponding Depth (cm)	Total Flow Depth (cm)
Minor System To Corrigan Pond							
EX. Road	ST525A	1.063	16.30	66.0	22.6	15.0	31.3
EX. Road	ST526A	0.156	7.88	44.0	13.4	15.0	22.9
EX. RY	ST526B	0.114	19.22	32.0	0.0	0.0	N/A
EX. Road	ST528A	0.106	6.71	32.0	33.4	20.0	26.7

Segment Type	Segment ID	Peak Flow (m^3/s)	Depth on Segment (cm)	Max. Capture (L/s)	Storage Used (m^3)	Static Ponding Depth (cm)	Total Flow Depth (cm)
EX. RY	ST529A	0.101	18.22	32.0	0.0	0.0	N/A
EX. Road	ST530A	0.209	8.72	44.0	12.7	15.0	23.7
EX. Road	ST532A	0.147	7.66	44.0	14.2	15.0	7.4
EX. Road	ST534A	0.123	7.11	32.0	17.5	17.0	24.1
EX. Road	ST535A	1.009	15.99	118.0	39.6	15.0	31.0
EX. Road	ST537A	0.127	7.20	32.0	13.0	15.0	22.2
EX. Road	ST538A	0.887	15.15	64.0	12.9	14.0	29.2
EX. RY	ST536A	0.125	20.04	32.0	0.0	0.0	N/A
EX. RY	ST534B	0.161	21.83	32.0	0.0	0.0	N/A
EX. Road	ST540A	0.089	5.82	44.0	0.0	10.0	15.8
EX. Road	ST551A	0.938	14.16	22.0	11.3	13.0	27.2
EX. RY	ST532B	0.151	21.34	22.0	0.0	0.0	N/A
EX. Road	ST552A	0.124	7.13	32.0	15.5	15.0	22.1
EX. Road	ST555A	0.057	4.87	22.0	16.3	0.0	3.5
EX. Road	ST554A	0.899	15.23	22.0	0.0	13.0	28.2
EX. RY	ST554B	0.054	14.47	22.0	0.0	0.0	N/A
EX. RY	ST554C	0.302	27.73	32.0	0.0	0.0	N/A
EX. RY	ST555B	0.029	11.23	22.0	0.0	0.0	N/A
EX. Road	ST556A	0.762	13.08	64.0	23.4	16.0	29.1
EX. Road	ST557A	0.389	9.04	22.0	0.0	0.0	9.0
EX. RY	ST557B	0.027	11.00	22.0	0.0	0.0	N/A
EX. RY	ST559B	0.117	19.43	22.0	0.0	0.0	N/A
EX. Road	ST559A	0.251	7.65	22.0	0.0	0.0	7.7
EX. Road	ST559C	0.030	4.20	22.0	0.0	5.0	9.2
Road	ST560A	0.279	9.79	32.0	11.6	15.0	24.8
Road	ST563A	0.165	8.05	32.0	14.0	15.0	23.1
Road	ST564A	0.169	8.12	32.0	11.2	15.0	23.1
RY	ST564B	0.109	18.83	32.0	0.0	0.0	N/A
RY	ST564C	0.042	12.92	32.0	0.0	0.0	N/A
RY	ST565A	0.032	11.64	31.8	0.0	0.0	N/A
Road	ST566A	0.131	7.29	32.0	11.2	0.0	7.3
EX. Road	ST541A	0.327	10.38	32.0	24.4	15.0	25.4
EX. Road	ST542A	0.366	10.80	32.0	0.0	15.0	25.8
EX. Road	ST544B	0.240	7.55	32.0	10.5	16.0	23.6
EX. RY	ST546B	0.209	24.19	32.0	0.0	0.0	N/A
EX. Road	ST546A	0.082	4.97	22.0	0.0	0.0	5.0
EX. RY	ST544A	0.260	9.50	64.0	12.7	15.0	N/A
-	EXT-5	0.229	5.46	0.0	0.0	0.0	N/A

Segment Type	Segment ID	Peak Flow (m^3/s)	Depth on Segment (cm)	Max. Capture (L/s)	Storage Used (m^3)	Static Ponding Depth (cm)	Total Flow Depth (cm)
Park	ST662A	0.249	5.60	55.0	0.0	0.0	5.6
Minor System to Todd Pond							
EX. Road	ST604A	0.395	10.21	64.0	11.5	15.0	25.2
EX. RY	ST602A	0.087	17.17	22.0	0.0	0.0	N/A
EX. RY	ST613B	0.169	22.21	32.0	0.0	0.0	N/A
EX. Road	ST614A	0.293	8.75	22.0	2.3	12.0	20.8
EX. Road	ST616A	0.454	10.33	64.0	48.1	19.0	29.3
EX. Road	ST606A	0.148	7.72	64.0	14.2	15.0	22.7
EX. Road	ST605A	0.493	12.14	86.0	72.7	24.0	36.1
EX. RY	ST606B	0.130	20.26	22.0	0.0	0.0	N/A
EX. RY	ST608C	0.082	16.83	32.0	0.0	0.0	N/A
EX. Road	ST620A	0.057	4.88	22.0	0.0	4.0	8.9
EX. Road	ST623A	0.608	12.04	140.0	81.3	22.0	34.0
EX. Road	ST614B	0.365	10.83	32.0	9.9	12.0	22.8
EX. Road	ST615A	0.127	7.28	44.0	12.0	0.0	7.3
EX. Road	ST614C	0.387	11.06	32.0	0.0	12.0	23.1
EX. Road	ST619B	0.090	6.38	22.0	0.0	15.0	21.4
EX. Road	ST620B	0.143	7.62	44.0	13.3	15.0	22.6
EX. Road	ST621A	0.185	8.36	64.0	11.5	15.0	23.4
EX. RY	ST619A	0.209	24.20	32.0	0.0	0.0	N/A
EX. RY	ST623B	0.135	20.52	32.0	0.0	0.0	N/A
EX. Road	ST628A	0.554	12.67	150.0	26.7	16.0	28.7
EX. Road	ST637A	0.768	12.57	760.2	3.3	30.0	0.6
EX. Road	ST640A	0.582	11.83	128.0	4.6	10.0	21.8
EX. Road	ST612A	0.134	7.46	64.0	0.5	5.0	12.5
EX. Road	ST643A	0.162	7.30	32.0	0.0	0.0	7.3
EX. Road	ST662A	0.102	3.11	55.2	0.0	0.0	3.1
EX. Road	ST663A	0.388	9.71	96.0	0.0	0.0	9.7
EX. RY	ST637B	0.237	25.42	42.0	0.0	0.0	N/A
EX. Road	ST609A	0.129	7.32	54.0	14.6	15.0	22.3
EX. RY	ST652B	0.035	12.00	22.0	0.0	0.0	N/A
EX. Road	ST638A	0.100	6.61	22.0	0.0	9.0	15.6
EX. Road	ST608A	0.228	8.28	76.0	35.3	19.0	27.3
EX. Road	ST608D	0.063	5.56	32.0	0.9	5.0	10.6
EX. RY	ST608B	0.114	19.25	22.0	0.0	0.0	N/A
EX. Road	ST609B	0.093	17.67	22.0	0.0	0.0	17.7
School	ST647A	0.402	9.15	55.0	0.0	9.0	18.2
EX. Road	ST663B	0.827	12.93	339.0	277.9	0.0	5.6

Segment Type	Segment ID	Peak Flow (m^3/s)	Depth on Segment (cm)	Max. Capture (L/s)	Storage Used (m^3)	Static Ponding Depth (cm)	Total Flow Depth (cm)
EX. Park	ST630A	0.540	12.54	32.0	1.0	20.0	32.5
Prop. Road	ST631B	0.259	5.67	22.0	0.0	0.0	5.7
Park	ST630AB	0.559	10.79	134.0	32.5	20.0	30.8
EX. Road	ST630AA	0.123	19.90	32.0	0.0	0.0	19.9
EX. RY	ST629A	0.509	12.28	70.9	1.8	13.0	N/A
EX. Road	ST632C	0.242	25.59	100.5	0.0	0.0	25.6
EX. Road	ST632A	0.490	12.12	84.0	0.0	0.0	12.1
EX. Road	ST638B	0.198	8.60	74.0	15.1	15.0	23.6
EX. RY	ST641A	0.127	7.27	54.0	12.0	15.0	N/A
EX. Road	ST632B	0.195	23.50	67.0	0.0	0.0	23.5
EX. RY	ST646A	0.150	7.75	54.0	1.0	5.0	N/A
EX. RY	ST611A	0.095	17.79	42.0	0.0	0.0	N/A
EX. RY	ST631A	0.158	21.69	22.0	0.0	0.0	N/A
EX. RY	EXT-1	0.067	15.72	0.0	0.0	0.0	N/A
EX. RY	ST509AB	0.105	18.58	22.0	0.0	0.0	N/A
EX. RY	ST521E	0.117	19.42	22.0	0.0	0.0	N/A
EX. RY	ST521D	0.311	10.20	22.0	111.9	30.0	N/A
EX. Park	ST510A	0.062	1.90	33.0	0.0	0.0	1.9
EX. Road	ST613A	0.649	12.32	645.7	5.6	30.0	0.5
EX. School	ST624AA	0.907	13.41	242.4	407.5	0.0	9.3
EX. Road	ST624A	0.135	6.77	112.0	14.6	30.0	1.3
EX. Road	ST627A	0.397	11.17	389.1	4.9	20.0	2.5
EX. Road	ST524A	0.116	6.18	44.0	37.6	30.0	4.0
EX. RY	ST637C	0.162	21.86	22.0	0.0	0.0	N/A
Road	Clarke	0.000	0.00	0.0	0.0	0.0	0.0
RY	ST648A	0.102	18.33	22.0	0.0	0.0	N/A
Road	ST660B	0.048	13.72	22.0	0.0	0.0	13.7
Road	ST660A	0.254	9.44	121.0	14.1	14.0	23.4
Road	ST657A	0.148	7.71	70.0	0.0	23.0	30.7
RY	ST659A	0.143	7.62	73.0	0.5	0.0	N/A
Road	ST656B	0.089	17.31	32.0	0.0	0.0	17.3
Road	ST656A	0.153	7.80	42.0	0.0	0.0	7.8
RY	ST655A	0.199	8.61	74.0	0.5	0.0	N/A
Road	ST655B	0.060	15.16	59.1	0.0	0.0	15.2
Road	ST650A	0.246	7.61	124.0	15.6	15.0	22.6
RY	ST649A	0.376	8.93	82.0	0.5	0.0	N/A
RY	ST654A	0.069	15.83	32.0	0.0	0.0	N/A
Road	ST664A	0.166	6.19	82.0	0.5	0.0	6.2

Segment Type	Segment ID	Peak Flow (m^3/s)	Depth on Segment (cm)	Max. Capture (L/s)	Storage Used (m^3)	Static Ponding Depth (cm)	Total Flow Depth (cm)
RY	ST715B	0.098	18.04	42.0	0.0	0.0	N/A
RY	ST719B	0.026	10.78	25.2	0.0	0.0	N/A
Road	ST719A	0.056	4.32	32.0	0.0	0.0	4.3
Road	ST717A	0.171	6.25	70.0	0.0	0.0	6.3
Road	ST705A	0.620	10.75	187.0	0.0	0.0	10.8
Road	ST709A	0.151	6.29	77.0	0.0	0.0	6.3
Road	ST715A	0.171	7.47	84.0	0.0	0.0	7.5
Road	ST713A	0.296	9.99	115.0	14.1	15.0	25.0
Road	ST711A	0.191	8.47	74.0	9.0	15.0	23.5
Road	ST710A	0.206	8.74	86.0	10.5	14.0	22.7
RY	ST710B	0.136	20.57	55.2	0.0	0.0	N/A
RY	ST705C	0.040	12.71	22.0	0.0	0.0	N/A
RY	ST705B	0.039	12.59	22.0	0.0	0.0	N/A
Park	ST708A	0.345	6.28	52.0	15.5	0.0	6.3
School	ST703C	1.737	19.88	699.6	550.0	0.0	10.9
Road	ST703B	0.704	13.88	115.0	10.0	0.0	13.9
Road	ST703A	0.307	8.59	70.0	0.0	6.0	14.6

The 100 year, 3 hr Chicago major system overflow to Phase 1A of the HMBS development at Andre Audet Avenue is 1.13 m^3/s, which is less than the 1.48 m^3/s target. The overall 100 year (3 hr Chicago storm) minor system inflow from the proposed DP3 and approved phase areas to Phase 1A towards the Corrigan pond is 1,407 L/s as obtained from the XP-SWMM model (see details in **Section 3.3**), which is less than the allowable 1,466 L/s minor system release rate to Phase 1A.

The DDSWMM results also show that the overall resulting 100 year (3 hr Chicago storm) inflow to the trunk sewer along River Mist Road (to Todd Pond) from the proposed and future phase areas of the HMBS development is 8,350 L/s, with no 100 year overland spill flows onto the adjacent Meadows in Half Moon Bay development at River Mist Road (segment 2A-4). However, as mentioned before, the actual 100 year peak outflow from the HMBS development to the storm outlet at River Mist Road will be obtained from the XP-SWMM model, which takes into account routing and the differences in time to peak of the inflow hydrographs. The overall peak flow from the HMBS development to the trunk sewer along River Mist Road directed to the Todd Pond does not negatively impact the hydraulic grade line (HGL) elevation and underside of footing (USF) clearance downstream, as confirmed through correspondence with JFSA.

The results of the hydrologic analyses (DDSWMM input and output files) for the different storm events are summarized in **Appendix A2.**

The following table shows the segments with 100 year total flow depth greater than 30 cm as shown in the above **Table 3.3**, along with a comparison to the 100 year total flow depth on those segments as per the approved SWM Report for Draft Plan #2 (Stantec, August 2014).

Table 3.3 100 Year Total Flow Depth Comparison

Catchment ID	Approved SWM Plan (August 2014) Total Flow Depth (cm)	Draft Plan #3 SWM Plan (Sep 2014) Total Flow Depth (cm)
Minor System to Corrigan Pond		
'1-1' / ST525A	34.4	31.3
'1-9' / ST535A	39.3	31.0
'1-20' / ST551A	34.3	27.2
Minor System to Todd Pond		
'2-5' / ST616A	33.4	29.3
'2-7' / ST605A	38.7	36.1
'2-11' / ST623A	33.7	34.0

The above table shows that total flow depths have been reduced in the majority of areas with the exception of area ST623A which shows a negligible flow depth increase. It should be noted that several efforts were made during detailed design of the approved phases in order to reduce the 100 year flow depths on streets as much as possible.

3.3 ULTIMATE CONDITION HYDRAULIC GRADE LINE ANALYSIS

In order to assess the hydraulic grade line (HGL) elevation across the Draft Plan #3 areas of the HMBS development, the storm sewers tributary to the Todd Pond outlet at River Mist (EXMH601), to the Corrigan Pond at Andre Audet Avenue (EXMH521), as well as the detailed DDSWMM hydrology for the 100 year, 3 hr Chicago storm were incorporated into two XP-SWMM models. One model represents the minor system to the Corrigan Pond at the boundary with Phase 1A of the HMBS development (EXMH521) and the results of this analysis have been included in **Appendix A.3**. The second model represents the minor system to the Todd Pond including the storm sewer infrastructure across the existing phases (outlet at River Mist Road) and the results of this analysis have also been included in **Appendix A.3**. Given that the storm sewer systems to the Todd Pond have been designed to capture and convey major flows along River Mist Road, the minor system inflows during the 100 year, 3 hr Chicago storm increased by 20% increase considerably and as such, the storm systems were also stress tested during this storm event. A constant inflow rate of 350L/s was added to node 719 to simulate inflows from the temporary dry pond attenuating peak flows from the upstream rural area noted in the Barrhaven South MSS and reassessed by JL Richards & Associates for the future Minto lands to the south (see **Appendix A.5**). The 350L/s figure has been confirmed through correspondence with JFSA as to not negatively impact downstream USFs in the pre-weir expansion scenario. **Appendix A.4** presents the proposed storm sewer design sheet.

The 100 year, 3hr Chicago HGL boundary condition (fixed water level) at EXMH501 to the Corrigan Pond was obtained from the HMBS – Phase 1A SWM Report (Stantec, July 2011) as 92.70 m. The 100 year, 3hr Chicago HGL boundary condition at EXMH601 to the Todd Pond was obtained from JFSA as 92.377 m and for the 100 year, 3 hr Chicago storm increased by 20% as 92.714 m (see correspondence in **Appendix A.5**).

The DDSWMM hydrology was interfaced with the XP-SWMM models to determine the resulting HGL across the approved Draft Plans #1 and #2, and the proposed Draft Plan #3 (DP3) of the HMBS development. **Table 3.6** summarizes the HGL modeling results across the HMBS development and shows the lowest USF elevations and proposed road grades. HGL clearance from lowest USF has been calculated across approved phases, while HGL clearance across Draft Plan #3 development areas have been estimated based on preliminary proposed road elevations.

Table 3.4 100 Year, 3hr Chicago Hydraulic Grade Line Results

Node (CB/MH)	Prop. Road Elevation (m)	Lowest Underside of Footing (m)	Maximum 100yr HGL (m)	Difference (USF – HGL) / (Prop. Road - HGL) (m)	Maximum 100yr +20% HGL (m)	Difference (USF – HGL (20%Increase)) (m)
Proposed and Approved Phases - Minor System to Corrigan Pond (Outlet at Greenbank Road)						
566	99.40	96.90	96.80	0.11	96.80	0.11
565	99.26	96.76	96.67	0.08	96.67	0.08
564	99.26	96.76	96.34	0.42	96.34	0.42
563	99.15	96.65	96.49	0.16	96.49	0.16
562	98.94	96.44	96.15	0.29	96.15	0.29
561	98.99	96.49	96.09	0.41	96.09	0.41
560	99.03	96.53	95.60	0.93	95.60	0.93
EX521	96.24	95.79	93.12	2.67	93.12	2.67
EX525	96.17	94.24	93.21	1.03	93.21	1.03
EX526	96.25	94.41	93.45	0.96	93.45	0.96
EX527	96.32	94.48	93.66	0.82	93.66	0.82
EX528	96.28	94.54	93.75	0.79	93.75	0.79
EX529	96.20	94.34	93.24	1.10	93.24	1.10
EX530	96.41	94.34	93.26	1.08	93.26	1.08
EX531	96.40	94.59	93.27	1.32	93.27	1.32
EX532	96.47	94.59	93.32	1.27	93.32	1.27

EX533	96.48	94.48	93.33	1.15	93.33	1.15
EX534	96.31	94.48	93.69	0.79	93.69	0.79
EX535	96.26	94.54	93.26	1.28	93.26	1.28
EX536	96.38	94.56	93.33	1.23	93.33	1.23
EX537	96.46	94.56	93.87	0.69	93.87	0.69
EX538	96.51	94.54	93.29	1.25	93.29	1.25
EX539	96.87	94.73	93.33	1.40	93.33	1.40
EX540	97.34	95.02	93.46	1.56	93.46	1.56
EX541	97.31	95.41	94.73	0.68	94.73	0.68
EX542	97.51	95.86	93.77	2.09	93.77	2.09
EX543	97.56	95.61	94.02	1.59	94.02	1.59
EX544	97.55	95.68	94.85	0.83	94.85	0.83
EX545	97.86	95.73	95.02	0.71	95.02	0.71
EX546	98.96	96.84	96.37	0.47	96.37	0.47
EX551	96.44	94.56	93.35	1.21	93.35	1.21
EX552	96.49	94.56	93.86	2.63	93.86	2.63
EX553	96.55	94.63	93.86	2.69	93.86	2.69
EX554	96.55	94.66	93.65	2.90	93.65	2.90
EX555	96.54	94.82	94.09	2.45	94.09	2.45
EX556	97.03	95.13	93.91	3.11	93.91	3.11
EX557	97.91	95.79	94.41	1.38	94.41	1.38
EX558	98.10	96.22	94.55	1.68	94.55	1.68
EX559	98.95	96.72	95.02	1.70	95.02	1.70
Proposed and Approved Phases - Minor to Todd Pond						
649	98.43	95.93	95.29	0.63	95.29	0.63
650	98.71	96.21	95.97	0.25	95.97	0.25
651	98.86	96.36	95.69	0.67	95.69	0.67
653	99.67	97.17	96.53	0.64	96.53	0.64
654	99.57	97.07	95.90	1.16	95.90	1.16
655	99.92	97.42	96.69	0.73	96.69	0.73
656	100.30	97.80	97.14	0.66	97.14	0.66
657	100.32	97.82	97.89	-0.07	97.86	-0.04
658	100.35	97.85	97.89	-0.04	97.86	-0.01
659	101.01	98.51	97.33	1.17	97.33	1.17
660	100.34	97.84	97.79	0.05	97.79	0.05
661	100.37	97.87	97.79	0.08	97.81	0.06
662	98.53	96.03	95.16	0.87	95.16	0.87
663	99.49	96.99	95.56	1.42	95.56	1.42
664	100.99	98.49	98.28	0.21	98.28	0.21
703	97.62	95.12	94.42	0.70	94.56	0.56
704	99.92	97.42	96.68	0.73	96.68	0.73

705	97.77	95.27	94.90	0.37	94.92	0.35
706	98.13	95.63	95.23	0.39	95.23	0.39
707	98.27	95.77	95.41	0.35	95.41	0.35
708	99.20	96.70	96.38	0.32	96.38	0.32
709	100.18	97.68	97.51	0.17	97.51	0.17
710	97.93	95.43	95.15	0.28	95.17	0.26
711	97.84	95.34	95.20	0.14	95.22	0.12
712	97.89	95.39	95.23	0.16	95.25	0.14
713	97.90	95.40	95.32	0.08	95.33	0.06
714	97.97	95.47	95.35	0.12	95.36	0.11
715	98.84	96.34	96.24	0.10	96.24	0.10
716	99.29	96.79	94.98	1.81	94.99	1.80
717	101.01	98.51	96.41	2.09	96.42	2.09
718	100.33	97.83	97.17	0.66	97.17	0.66
719	101.67	99.17	98.71	0.47	98.71	0.46
EX509A	95.06	N/A	92.56	-	92.91	-
EX510	95.23	93.49	92.92	0.57	92.94	0.55
EX521	96.24	94.04	93.55	0.49	93.95	0.09
EX524	96.48	94.25	93.33	0.92	93.90	0.35
EX601	95.50	N/A	92.38	-	92.71	-
EX602	95.58	N/A	92.52	-	92.90	-
EX603	95.16	93.36	92.56	0.80	92.91	0.45
EX604	95.81	93.89	92.88	1.01	93.14	0.75
EX605	96.00	94.13	93.00	1.13	93.24	0.89
EX606	96.09	94.36	93.16	1.20	93.34	1.02
EX607	96.13	94.55	93.23	1.32	93.37	1.18
EX608	96.41	94.57	93.50	1.07	93.54	1.03
EX609	96.29	94.70	93.57	1.13	93.60	1.10
EX610	96.34	94.76	93.58	1.18	93.60	1.16
EX611	96.11	94.63	93.69	0.94	93.70	0.93
EX612	96.31	94.98	94.18	0.80	94.18	0.80
EX613	96.09	N/A	92.75	-	93.23	-
EX614	96.15	94.33	93.09	1.24	93.46	0.87
EX615	96.30	94.33	93.21	1.12	93.51	0.82
EX616	96.00	94.50	93.29	1.21	93.52	0.98
EX617	96.11	94.45	93.12	1.33	93.53	0.92
EX619	96.25	94.51	93.18	1.33	93.55	0.96
EX620	96.23	94.93	93.71	1.22	93.75	1.18
EX621	96.19	94.51	93.22	1.29	93.58	0.93
EX622	96.23	94.61	93.26	1.35	93.61	1.00
EX623	96.10	94.61	93.60	1.01	93.73	0.88
EX624	96.29	94.48	93.04	1.44	93.58	0.90

EX624A	96.51	N/A	93.17	-	93.59	-
EX627	96.68	94.58	93.24	1.34	93.85	0.73
EX628	96.51	94.65	93.55	1.10	94.14	0.51
EX629	96.85	94.75	93.66	1.09	94.21	0.54
EX629A	96.63	N/A	93.78	-	94.25	-
EX630	96.68	94.86	93.81	1.05	94.30	0.56
EX630A	96.68	94.77	93.89	0.88	94.36	0.41
EX630B	97.88	94.86	94.04	0.82	94.48	0.38
EX631	97.12	94.88	94.10	0.78	94.41	0.47
EX632	97.70	95.58	95.14	0.44	95.14	0.44
EX637	96.56	94.51	93.32	1.19	93.97	0.54
EX638	96.46	94.62	93.65	0.97	94.12	0.50
EX639	96.51	94.76	93.66	1.11	94.12	0.64
EX640	96.76	94.65	93.39	1.26	94.04	0.61
EX641	96.64	95.08	94.01	1.07	94.15	0.93
EX642	96.68	94.88	94.00	0.88	94.15	0.73
EX643	97.37	94.97	93.76	1.21	94.33	0.64
EX646	97.39	95.31	94.22	1.09	94.47	0.84
EX647	97.88	95.60	94.83	0.77	94.84	0.76
EX648	98.18	N/A	95.17	-	95.17	-
EX652	97.79	N/A	94.33	-	94.46	-

As can be seen in **Table 3.6**, the 100 year storm (3 hr Chicago) results in HGL elevations that remain at least 0.30 m below the underside of footings (USFs) across the approved and existing phases of the HMBS development and, in general, 2.5 m below the proposed road grades across Draft Plan #3 development areas. USFs will be set during the detailed design stage to ensure a minimum separation of 0.30m from maximum HGL elevations is achieved.

The XP-SWMM results also show that the actual 100 year peak outflow to the trunk sewer on River Mist Road is 7,265 L/s. Similarly, the XP-SWMM results show that the actual 100 year peak outflow to EXMH521 in Phase 1A towards the Corrigan Pond is 1,407 L/s.

4.0 Erosion and Sediment Control

The existing site is intercepted by the former Todd Municipal Drain and Clark Municipal Drain. The Drains were abandoned by City Council in 2007, and currently serve as local drainage ditches for rural areas. Separate permits for compensation and filling of the ditches were received from the Department of Fisheries and Oceans (DFO).

A Permit to Take Water (CofA#8167-7K7RQV) for the development was obtained from the Ministry of the Environment (MOE) on January 16, 2009. The permit is valid from October 1, 2010 to September 30, 2015. The area is labeled as Area 3 & 4 HMB Phase 3. Water quality monitoring locations have been identified in the permit.

The grading and servicing methodology for the site requires the infill of the existing watercourses, temporary diversion of the on-site and external flows, and installation of interim sediment and erosion control facilities and fences during construction.

At this time it is proposed that the site be developed in several phases, as can be seen on **Drawing EC-1**. It is anticipated that site grading will involve topsoil stripping and grading for the entire parcel due to the location of earth cuts and fills, as determined by the proposed preliminary grading plan.

During construction, existing stream and conveyance systems can be exposed to significant sediment loadings. As a result, and although construction is only a temporary situation, it is proposed to introduce a number of mitigative construction techniques to reduce unnecessary sediment loadings. The construction techniques that will be employed by the contractor include:

- groundwater in trenches to be pumped into a GeoTube© filter mechanism prior to release to detention ponds;
- detention ponds and control structures to be used to attenuate pumped outflows and to manage runoff from site during construction
- a silt curtain to be installed in each detention pond to further prevent release of sediment
- erosion-blanket-reinforced ditches to be used to collect external flows and pond outflows;
- rock check dams to be used in the ditches to prevent erosion from high water velocities and to promote settling-out of suspended sediments;
- bulkhead barriers to be installed at the nearest downstream manhole in each sewer which connects to an existing downstream sewer;
- seepage barriers to be constructed in any temporary drainage ditch;
- filter cloths to remain on open surface structures such as manholes and catchbasins until these structures are commissioned and put into use; and

- a silt fence around the site perimeter and wattles or a silt fence within the site to be installed to prevent excessive velocities on exposed soils.

4.1 DITCHES

Two types of ditches are proposed: diversion and discharge ditches. All ditches will be sized to convey the 100 year storm event and will be lined with erosion control blankets to ensure that the ditch bottoms and side walls are not eroded. In addition, check dams will be put in place along the ditches to prevent excessive velocities.

4.1.1 Diversion Ditches

Diversion ditches are proposed to intercept external flows from entering the site during construction and generally run west-east and south-north along the northern and eastern edges of the site. The proposed diversion ditches will be directed to the existing storm sewers to the Todd Pond and Corrigan Pond as shown on **Drawing EC-1**.

4.1.2 Discharge Ditches

Discharge ditches will convey flows from the proposed interim sedimentation basins to the diversion ditches. The location of the discharge ditches is conceptually shown on **Drawing EC-1**; however it is to be noted that these ditches will have to be adjusted based on the contractor's activities and construction phasing.

At certain locations (as identified on **Drawing EC-1**), temporary diversion ditches are to be replaced by proposed sewers. When ditches are replaced by these sewers, the discharge ditches from the sedimentation basins will be redirected to enter the proposed sewers via catchbasins. Catchbasin grates connecting to the proposed sewers will be wrapped in filter fabric and surrounded by silt fence or wattles to prevent sediment particles from entering the storm sewer.

4.2 TEMPORARY SEDIMENTATION BASINS

There are three proposed temporary sedimentation basins (see **Drawing EC-1**). The sedimentation basins were sized to provide adequate sediment removal during pumping operation. Again, the location of the sedimentation basins will be adjusted based on the contractor's activities, construction phasing, and pumping requirements.

4.3 DEWATERING GEOTEXTILE BAGS

Tencate GeoTube© geotextile dewatering bags are proposed to be used to remove sediment from pumped water flows from trench dewatering. The effluent from these bags will drain into the temporary sedimentation basins.

4.4 EROSION CONTROL MONITORING

Frequent inspection of all controls during construction and after significant rainfall events will be conducted by the contractor and the consultant engineer's inspectors to ensure that the proposed erosion and sedimentation control measures are functioning properly. If any worker or inspector notices that erosion and sedimentation controls have been compromised or that erosion/sedimentation is taking place in locations that are unprotected, it is to be reported immediately so that the contractor and engineer may take action to remedy the situation.

Drawing EC-1, **Drawing EC-2**, and **Drawing EC-PD**, show the location of the existing water courses and ditches which are to be filled, the location of the temporary diversion and discharge ditches, the location of the sedimentation ponds, as well as proposed fencing and erosion and sediment control measures.

5.0 Conclusions and Recommendations

Based on the preceding report, the following conclusions can be drawn:

- Inlet control devices across the DP3 areas tributary to the Corrigan Pond are to be specified to meet the minor system release rates identified in this report
- Minor system inflows to the Todd Pond from DP3 areas are restricted to post development 5 year peak flows through the use of inlet control devices
- The proposed layout and drainage area configuration of DP3 of the HMBS development does not have any negative impacts on the existing infrastructure downstream
- Water quality control will be provided in the downstream Corrigan and Todd Ponds

Based on the findings of the report, the following recommendations are provided:

- An erosion and sediment control plan for the site be implemented as discussed

All of which is respectfully submitted;

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