ADEQUACY OF PUBLIC SERVICING REPORT
136944-6.04.03

CRT LANDS PHASE 4
FERNBANK COMMUNITY

CITY OF OTTAWA

IBI

Prepared for CRT DEVELOPMENT INC.
by IBI Group
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Table of Contents

Table of Contents (continued)

Table of Contents (continued)

1 INTRODUCTION

1.1 Objective

IBI Group Professional Services (Canada) Inc. (hereinafter referred to as IBI, or IBI Group) has been retained by CRT Development Inc. to prepare this Adequacy of Public Services Report in support of their draft plan of subdivision application to the City of Ottawa. This report will provide stakeholders with a conceptual level layout of the proposed development sufficient to support the draft plan approval of the subject lands.

1.2 Location

The subject property is approximately 63Ha in size and is located in the City of Ottawa, within the former Goulbourne township, within the Fernbank Community, and is being marketed as the Westwood Stittsville community. The site is bound to the north by Abbott Street with existing residential lands; to the east by Goldhawk Drive with residential lands currently under construction (CRT Phase 1 to 3); to the south by vacant lands zoned for Agricultural use; and immediately to the west by a school block and recreation center, with vacant rural lands to the southwest part. Refer to **Figure 1.1** below for key map of site location, and **Appendix A** for a copy of draft plan of subdivision.

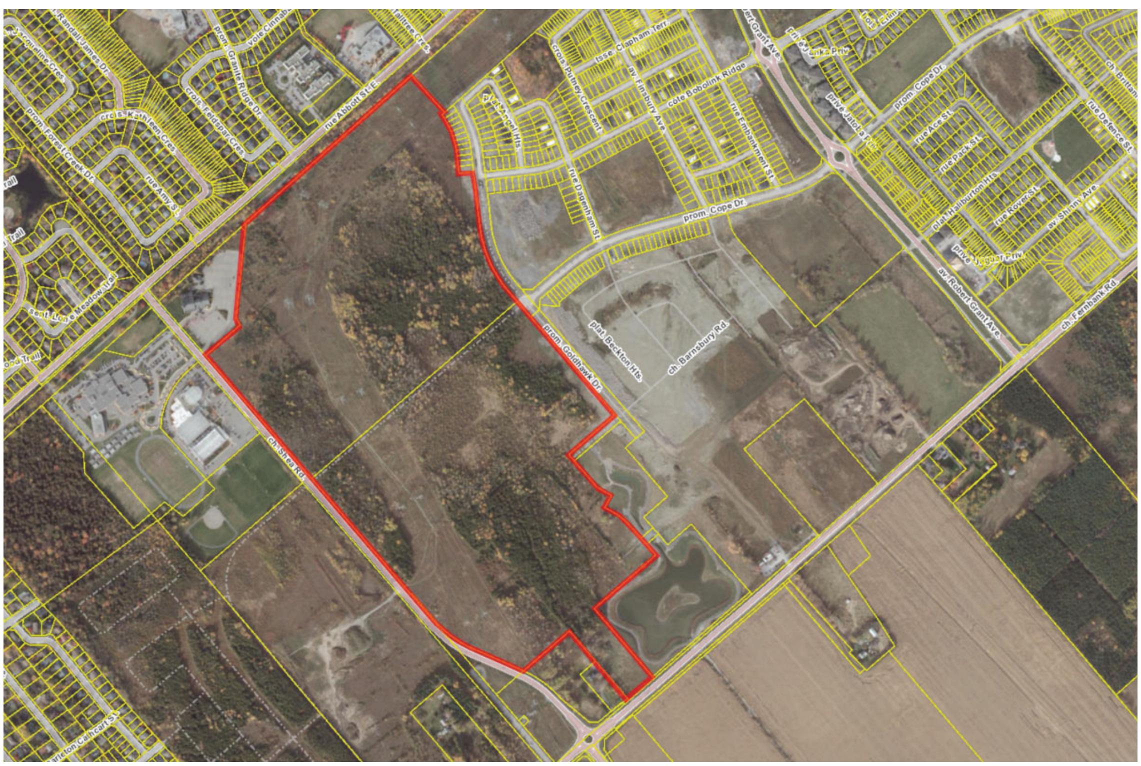

Figure 1.1 – Key Map of Subject Lands

1.3 Proposed Development

CRT Developments Inc. is proposing to proceed the fourth phase in its Westwood Stittsville community. The proposed development would combine a mix of low and medium density residential uses and a park block.

The current concept plan identifies 286 single family homes, 336 townhouses units, 54 back to back units, 4 medium density blocks, one school block and two park blocks approximate 5.1 Ha in total; a copy of the plan is included in **Appendix A**.

Vehicular access to the subject lands is primarily proposed off Abbott Street, Shea Road, Fernbank Road, Goldhawk Drive, and Cope Drive.

1.4 Previous Studies

The Fernbank Community Development Plan process included a number of background studies that are pertinent to the subject site. Three integrated Class Environmental Assessment Studies/Master Plans were prepared in support of the FCDP which include:

- Transportation Master Plan;
- Environmental Management Plan (EMP);
- Master Servicing Study (MSS).

In January 2012, Novatech Engineering Consultants Ltd. completed the Fernbank Community Sanitary Trunk Sewer Design Report of the Fernbank Trunk Sewer. That sewer was identified in the 2009 MSS report. The 2012 report built upon previous design elements and included some changes to the proposed sewer design originally identified in the 2009 MSS document. It is the latter report that will provide the design framework for the sanitary sewer design for the subject site.

In 2013, IBI Group completed a Conceptual Site Servicing Plan for the CRT Lands. That report was designed to assist the City in preparation of draft conditions for development of the subject property.

Subsequent development applications under the Planning Act will be supported by these studies/plans. These studies were prepared and followed integration with the Planning Act provision of the Municipal Engineers Association Class Environmental Assessment Process

The subject property will follow closely the recommendations of those three reports. With respect to the provision of water supply, wastewater disposal and treatment of stormwater runoff, the recommendations of the EMP, MSS and the 2012 Fernbank Sewer Report will provide the development criteria on which the subject property will develop. Any deviations from the previous report criteria will be identified in later sections of this report.

Additionally, CRT Development Inc. commissioned IBI Group to prepare detail design for its Phases 1, 2 and 3 of the community. A design brief was completed in July 2017 for Phase 1, September 2020 for Phase 2, and February 2020 for Phase 3 of the CRT Lands. At the time of writing this report, the design brief for Phase 3 was still under review by the City of Ottawa.

1.5 Environmental Issues

IBI has consulted the Rideau Valley Conservation regarding any regulatory approvals and/or permits which may be required as part of the development of Phase 4. There is an existing watercourse within Phase 4 that requires formal closure and a permission from the CA.

1.6 Pre-Consultation

A pre-consultation meeting was hosted virtually by the City of Ottawa in on December 10, 2021. Notes of the meeting were circulated by City staff on December 17th, 2021. With respect to servicing, there were no specific concerns flagged during the pre-consult.

As noted in the pre-consultation notes, included in **Appendix A**, all drainage boundaries from the subject lands are set out by previous servicing studies, and the master servicing study for the community.

1.7 Geotechnical Considerations

Paterson Group has been retained by CRT Developments Inc. to prepare a Geotechnical investigation PG6087-1 dated February 16, 2022 for the subject lands.

The report provides recommendations for grading, backfilling, bearing resistance values and design considerations for home construction, pavement structures, etc.

The report identifies a 2.5m grade raise restriction, primarily located on the southeast portion of the proposed development site.

2 WATER DISTRIBUTION

2.1 Existing Conditions

The subject site is located within Pressure Zone 3W of the City of Ottawa's water distribution system. There is an existing 400mm diameter watermain along Abbott Street. The existing 300mm watermain in Shea Road will be extended to Cope Drive during Shea Road Lands Development. Another 300mm was constructed along Goldhawk Drive to service CRT Phase 2 and 3, and will provide four connections to service Phase 4.

2.2 Design Criteria

2.2.1 Water Demands

As previously noted, the proposed development will consist of 286 single family homes, 336 townhouses units, 54 back to back units, 4 medium density blocks and one school block. Based on projected populations taken from Table 4.1 of the City Design Guidelines, a watermain demand calculation sheet was prepared; a copy is included in **Appendix B** and the total water demands are summarized as follows:

Average Day	9.32 l/s
Maximum Day	21.48 l/s
Peak Hour	46.18 l/s
Fire Flow	10,000 l/min (Single Family and Townhouse)
Fire Flow	15,000 l/min (Medium-density Block)

2.2.2 System Pressure

The 2010 City of Ottawa Water Distribution Guidelines states that the preferred practice for design of a new distribution system is to have normal operating pressures range between 345 kPa (50 psi) and 552 kPa (80 psi) under maximum daily flow conditions. Other pressure criteria identified in the guidelines are as follows:

Minimum Pressure	Minimum system pressure under peak hour demand conditions shall not be less than 276 kPa (40 psi)
Fire Flow	During the period of maximum day demand, the system pressure shall not be less than 140 kPa (20 psi) during a fire flow event.
Maximum Pressure	Maximum pressure at any point in the distribution system shall not exceed 689 kPa (100 psi). In accordance with the Ontario Building/Plumbing Code, the maximum pressure should not exceed 552 kPa (80 psi). Pressure reduction controls may be required for buildings where it is not possible/feasible to maintain the system pressure below 552 kPa

2.2.3 Boundary Conditions

The boundary condition request has been submitted to the City of Ottawa. Detailed water model analysis and results will be provided in 2nd submission. Nine watermain connections are proposed in Phase 4. Four of the locations are at connections to the Phase 2/3 watermains along Goldhawk Drive at Bobolink Ridge, Cope Drive, Street No.9 and Street No.12. Another four connections along Shea Road. The ninth connection is at the 400 mm diameter watermain on Abbott Street.

At each location a pressure is provided for the maximum HGL, peak hour and max day plus fire scenarios based on the existing ground elevations.

2.2.4 Watermain Layout

The conceptual watermain layout for this development is shown on **Figure 2.1** in **Appendix B.** A 300 mm diameter main will be extended from Cope Drive. Another 300mm watermain will be extended from Street No.12 and along Shea Road to the existing 300 mm diameter watermain at Cope Drive and Shea Road intersection. There are another two connections to existing 200 mm diameter mains on Bobolink Ridge and Street No.9 in the Phase 3 site. The watermain along Bobolink will also be extended to connect to the existing 400mm watermain on Abbott Street to complete a loop on the north half of site.

Apart from the 300 mm diameter watermains on Bobolink Ridge, Cope Drive, Street No. 12 and Shea Road, all other mains in Phase 4 are expected to be 200 or 150 mm diameter. A hydraulic model using the InfoWater program will be produced during detailed design that will confirm the watermain sizes. Based on the pressures provided by the boundary conditions it is expected that all the watermain pressure and fire flow requirements will be met for this phase. As the proposed watermain layout is well looped without dead end mains it is expected that all the requirements will be achieved at the detailed design phase.

There are several locations where the rear of a unit will likely be within 10 meters of the side of a unit which will violate the 10,000 l/min fire flow cap per Technical bulletin ISDTB-2014-02. At these locations it is proposed to introduce 3-meter separations between buildings in order to calculate a fire flow with the Fire Underwriters Survey (FUS) method.

3 WASTEWATER DISPOSAL

3.1 Existing Conditions

The Fernbank Trunk sewer was extended as part of CRT Lands Phase 1 development. The main trunk sewer for the subject lands was previously constructed in Goldhawk Drive with servicing stubs into Phase 4.

The CRT Phase 1 sewer design included an allocation into MH110A for the Phase 4. The design of Phase 1 was completed based on the outdated Ottawa Sewer Design Guidelines, for which a demand of 350L/Day/cap was used. It had estimated an area allocation of 67.85Ha and an allocation of 60 people/Ha for residential lands, for a total population allowance of 3446.3. The total peak flow anticipated to MH207 from Phase 4 was **81.49/s**, including the sanitary flow from Shea Road Lands Development.

3.2 Design Criteria

The sanitary flows for the subject lands are determined based on current City of Ottawa design criteria and the population densities established in the MSS, which includes, but is not limited to the following:

3.2.1 Design Flow:

Average Residential Flow	-	280 l/cap/day
Average Commercial/Institution Flow	-	28,000 l/Ha/day
Peak Residential Factor	-	Harmon Formula
Peak Commercial/Institution Factor	-	1.0
Infiltration Allowance	-	0.33 l/sec/Ha

3.2.2 Population Density per MSS:

Single Family	-	3.3 person/unit
Townhouse	-	2.5 person/unit
Back to Back Units	-	1.8 person/unit
Medium Density Blocks	-	60 person/ha

3.3 Proposed Wastewater Disposal System

It is proposed that the subject lands discharge into the existing wastewater disposal system from the existing 600mm sanitary sewer on Cope Drive, eventually into the 600mm sanitary trunk on Goldhawk Drive. The MSS had identified Phase 4 in its entirety discharging to Cope Drive. Crossing conflicts were flagged between the sanitary sewer system and the upper reaches of the storm sewer network. Therefore, it is proposed for the sanitary flows for all areas north of Cope Drive to discharge into the existing sanitary sewer at Goldhawk and Bobolink. This connection is within the same trunk sewer system, and is located further downstream, therefore the capacity for these lands is accounted for in the existing pipe. All lands south of Cope Drive will discharge to Cope, as per the MSS.

The 600mm sanitary trunk along Cope Drive has been constructed during Shea Road Lands Development.

Proposed Sanitary sewers will consist of 300mm to 200mm diameter sewers, constructed to current City of Ottawa design standards. A conceptual Sanitary Sewer layout is provided on **Figure 3.1**, and a Sanitary Drainage Area Plan **Figure 3.2**, and a conceptual **Sanitary Sewer Design Sheet** have been prepared for this Adequacy of Public Servicing Report in order to confirm approximate pipes sizes and sewer crossing information that corresponds with the grade raise restriction, unit types and macro grading concept of the proposed phase. These documents can be found in **Appendix C.**

3.3.1 Proposed Population Calculations

As previously noted, the concept development plan will consist of 286 single family homes, 336 townhouses units, 54 back to back units, 4 medium density blocks. The total design population is indicated below.

Table 3-1

UNIT TYPE	# OF UNITS	POPULATION DENSITY	POPULATION
Single Family Home	286	3.3 pp/unit	943.8
Townhouse	336	2.5 pp/unit	840.0
Back to Back	54	1.8 pp/unit	97.2
Medium Density Blocks	7.26 Ha*	60p/ha	435.6
TOTAL	**-**	**-**	**2316.6**

*Unit counts not available for the medium density blocks, thus 60p/ha rate has been applied.

The total proposed population does not exceed the assumed population in the CRT Phase 1 design.

3.3.2 Design Flows

Design flows for the proposed development lands are determined in the following table.

Table 3-2

POP	280 L/POP/DAY	PEAK FACTOR	PEAK FLOW	AREA	TOTAL FLOW
2316.6	280	3.03	22.73/s	60.55	**42.72/s**

Based on the results, peak flows estimated from the proposed draft plan are less than the assumed peak flows from Phase 1. Therefore, the subject development is anticipated to have no negative impact on downstream infrastructure.

4 STORMWATER MANAGEMENT

4.1 Existing Conditions

The subject lands are inclusive in the Fernbank Community, and more specifically in the CRT development lands. CRT Phase 1 and 2 have been constructed, and CRT Phase 3 is under review of the City of Ottawa. The aforementioned phases outlet to a large storm trunk sewer located on Goldhawk Drive, which discharges into the approved Pond 5 Stormwater Management Facility. A larger diameter overflow sewer was also constructed along Goldhawk Drive extending through a portion of Phase 4.

4.2 Synopsis of Previous Studies

The 2009 EMP and MSS reports made preliminary recommendations for design of the stormwater management system for the FCDP. These recommendations included preliminary sizing of the stormwater management facilities complete with operating levels.

The MSS report recommended construction of Pond 5 on the subject site with an outlet to the existing Flewellyn Drain. In an effort to limit storm sewer hydraulic gradients and significant grade raising, the MSS report recommend that the 1:100 operating level of Pond 5 to be about 104.4 m. To accomplish that elevation, about 375 meters of the Flewellyn Drain south of Fernbank Road was recommended to be lowered.

The 2013 Conceptual Site Servicing Study report completed a further analysis with respect to grade raising and recommended that the 1:100 year operating level of Pond 5 be lowered to about 103.9 m. It was also recommended that the Flewellyn Drain be lowered south of Fernbank Road for a distance of about 600 meters in order to accommodate the proposed operating levels.

In 2016, IBI Group prepared the Design Brief for CRT Lands Phase 1, which included the design and construction of Storm on Goldhawk Drive through Phases 2&3. These sewers were sized to accommodate stormwater flows from the proposed PHASE 4 development. The stormwater management facility, Pond #5 was also designed and constructed as part of Phase 1 of the development, and was sized to receive minor system stormwater flows from the proposed PHASE 4 development based on the MSS stipulated 85 L/s/Ha level of service.

In 2020, IBI Group prepared the Design Brief for CRT Lands Phase 2, which outlined the detailed design of Phase 2. Additionally, in 2022, IBI Group prepared the Design Brief for CRT Lands Phase 3, which outlined the detailed design for Phase 3.

4.3 Proposed Stormwater Management Plan

The stormwater management system for the site incorporates standard urban drainage design and stormwater management features that can be summarized as follows:

- a dual drainage concept;
- routing of surface runoff; and,
- an end-of-pipe SWM facility (Pond 5).

The stormwater management system has been developed based on the MOE *Stormwater Management Planning and Design Manual* (March 2003) and the *City of Ottawa Sewer Design Guidelines* (October 2012). Additionally, the system has incorporated, wherever possible given the existing trunk sewer inlet capacity restrictions, the new guidelines set forth within the Technical Bulletin ISDTP-2014-1 and PIEDTB-2016-01.

4.4 Minor Storm Sewer Design Criteria

In keeping with guidelines published by the City of Ottawa for storm sewers in Greenfield developments, the storm drainage system proposed for the CRT PHASE 4 lands will follow the principles of dual drainage.

The minor storm flow estimates were reviewed by the rational method. A conceptual Storm sewer layout **Figure 4.1**, a conceptual Storm Drainage Area Plan **Figure 4.2**, and a conceptual **Storm Sewer Design Sheet** have been prepared for this adequacy of public servicing report in order to confirm approximate pipes sizes and sewer crossing information that corresponds with the grade raise restriction, unit types and macro grading concept of the proposed phase. These documents can be found in **Appendix D.** Criteria used in the minor storm sewer design include, but are not limited to the following:

- Intensity: 2 year curve (local and minor collector roads); 5 year for Cope & Bobolink Drive
- Initial Time of Concentration: 10 min
- Approximate Average Runoff Coefficients used for this assessment only:
  - Average Singles: 0.70
  - Average Townhomes: 0.75
  - Average Back to Back: 0.85
- Velocities: 0.80 m/s to 6.0 m/s
- Manning roughness coefficient: 0.013 (smooth wall pipes)
- Minimal allowable slopes: Refer to below table

Table 4-1 Minimal allowable slopes

DIAMETER (MM)	SLOPE (%)
250	0.432
300	0.340
375	0.250
450	0.195
525	0.160

- Minimum depth of cover of 2.0 m
- Inlet-control rate to capture 85 L/s/Ha average
- 100-year Hydraulic Grade Line (HGL) separation to be greater than 0.30 m from the underside of footing
- HGL analysis calculated with XPSWMM

The minimum minor system capture of ICDs for CRT PHASE 4 will be based on the 85 L/s/Ha capture rate proposed in the MSS. The subject site will be modelled using DDSWMM and XPSWMM to confirm minor and major system flows. Hydrographs from the site will be downloaded to XPSWMM hydraulic model to confirm hydraulic grade line within the proposed storm sewers.

4.5 Major System

Inlet control devices (ICDs) will be proposed to control the surcharge in the minor system during infrequent storm events and maximize the use of available on-site storage. The Phase 4 site is adjacent to the Hydro Corridor and there is opportunity to provide dry ponds at various locations to provide outlet for major system cascading flow from the development. The hydro corridor area will be provided with unit capture rate of approximately 20 l/s/ha per the MSS. Surface runoff in excess of the minor system capture will cascade via street segment and pathway blocks to the proposed hydro corridor or SWM facility. A lumped area model has been prepared to evaluate the potential major system routing and dry ponds to ensure the system can adequately convey overland flow while still respecting the OSDG. The preliminary dry pond volume estimated results are summarized in the table below.

Table 4-2 Summary of Dry Pond Storage during 100 year 3 hour Chicago storm

DRY POND LOCATION	INFLOW DURING 100 YEAR CHICAGO (CMS)	STORAGE VOLUME (M3)	OUTFLOW TO MINOR SYSTEM (CMS)
BLOCK 310	1.42	1900	0.042
BLOCK 309	2.99	4036	0.098
BLOCK 308	2.70	3307	0.095

4.6 Hydrological Analysis

The dual drainage system will be evaluated using the DDSWMM hydrological model, while the minor system hydraulic grade line analysis will be evaluated using the XPSWMM dynamic model.

The primary focus of the hydrological analysis will be to evaluate surface flow and ponding conditions during the 100-year storm event in order to satisfy City of Ottawa Sewer Design Guidelines (2012) in terms of velocity x depth. The parameters to be used to model the subject site are presented below.

4.6.1 Design Storms and Drainage Area Parameters

The following design parameters will be used in the evaluation of the stormwater management system for the subject site:

4.6.2 Design Storms

A detail design the site will be evaluated using the following storms:

- 2, 5, and 100 year 3 hour Chicago storm events (10 minute time step), as per the OSDG and the September 2016 Technical Bulletin;
- 2, 5 and 100 year 24 hour SCS Type II storm event (103.2 mm) as per OSDG;
- 25 mm 4 hour Chicago storm event with a 5 minute time step;
- July 1, 1979, August 4 1988 and August 8 1996 historical storm (for function of SWM facility only);
- 100 year 24 hour SCS Type II storm event (103.2 mm) with 20% increase for Climate Change consideration, as per OSDG; and
- 100 year 3 hour Chicago storm event (10 minute time step) with 20% increase for Climate Chang consideration, as per the OSDG.

4.6.3 Area and Imperviousness:

The catchment areas and imperviousness values are based on the rational method spreadsheet. The total and directly connected imperviousness rations will be based upon the previous and impervious areas for the front yard and rear yard catchment areas, to be calculated at detailed design.

4.7 Conceptual Storm Sewer System

Figure 4.1 in **Appendix D** illustrates a conceptual layout of the storm sewer network to service PHASE 4. The Storm Drainage Area **Figure 4.2** and Storm Sewer Design sheet, also found in **Appendix D,** have been updated to illustrate the existing downstream infrastructure is suitably sized to accommodate the proposed development. The storm sewers for PHASE 4 will be designed to meet City of Ottawa and MOE requirements. A new trunk sewer overflow pipe will be installed on Street No. 11 from Phase 4 to the SWMF to maintain the storm hydraulic grade line within the existing upstream residential development.

4.7.1 Lumped Area Analysis

A lumped area analysis has been prepared to evaluate flows during major storm events. A lumped drainage area plan, **Figure 4.3** has been provided in **Appendix D**. The lumped areas were reviewed based on assumed ponding storage rates, of 40m3/Ha for areas with Single Family Homes, and 30m3/ha for areas with townhomes. These storage figures were intentionally kept low, so as to reduce the depth of static ponding, and allow for increased depth of overland flow.

4.7.2 Hydraulic Grade Line Analysis

A conceptual hydraulic grade line analysis was evaluated based on the anticipated storm sewer servicing and grading within Phase 4. The XPSWMM model from the Phase 3 Design Brief was used as basis for the analysis, with the addition of the conceptual storm trunk sewer for Phase 4. The below table provides summary of the model results hydraulic grade line and anticipated underside of footing elevations for comparison.

Table 4-3 Storm Hydraulic Grade Line

XPSWMM NODE	PROPOSED USF (M)	100 YEAR 24HR SCS		100 YEAR 24HR SCS +20%	
		HGL (M)	USF– HGL (M)	HGL (M)	USF– HGL (M)
CRT PHASE4					
MH01	105.25	104.15	1.10	104.49	0.76
MH04	105.40	104.34	1.06	104.57	0.83
MH08	105.30	104.16	1.14	104.54	0.76
MH15	105.20	104.22	0.98	104.57	0.63
MH16	105.50	104.22	1.28	104.58	0.92
MH20	105.30	104.41	0.89	104.67	0.63
MH26	105.55	104.72	0.83	104.93	0.62
MH27	105.50	104.56	0.94	104.78	0.72
MH28	105.40	104.67	0.73	104.88	0.52
MH29	106.90	104.72	2.18	104.94	1.96
MH30	105.50	104.88	0.62	105.10	0.40
MH300	104.60	104.25	0.35	104.56	0.04
MH31	105.60	104.92	0.68	105.14	0.46
MH32	107.40	104.98	2.42	105.21	2.19

The above table indicates that minimum 0.3 m clearance between the USF and HGL is maintained across the subject site during the 100 year 3 hour SCS storm event. It should be noted that the above results also indicate that there would be no severe flooding to properties during the 100 year 24 hour SCS storm with a 20% increase in intensity. The results indicate that the HGL would be above the 0.3 m freeboard at some locations during the stress test, but below the USF across the site.

4.7.3 Pond 5 Evaluation

The hydraulic evaluation of the SWM facility (pond 5) was undertaken using the XPSWMM model. A comparison of the characteristics and performance between the SWM facility as originally designed, and with the subject development are presented in **Table 4-4**.

Table 4-4 Performance of the CRT Lands Fernbank Pond 5 SWM Facility

STORM EVENT	POND 5 EVALUATION (EXCERPT FROM MAY 2016 REPORT)		CRT PHASE 4	
	DISCHARGE (cms)	SWM FACILITY ELEVATION (m)	DISCHARGE (cms)	SWM FACILITY ELEVATION (m)
100 year 24 hour SCS Type II	3.60	104.32	3.39	104.28
Sensitivity Analysis				
100 year 24 Hour SCS Type II – 20% increase in intensity	6.15	104.52	6.52	104.54

The development of CRT PHASE 4 does not increase the SWM facility discharge rate or the elevation level during the 100 year 24 hour SCS Type II storm, and the results closely correspond for the 100 year 24 hour SCS Type II storm with a 20% increase in intensity. An excerpt from the 2016 Fernbank Pond 5 Stormwater Management Facility Report and Brief is provided in **Appendix D**. It is expected that detail design will further improve the critical modeled pond elevations.

Table 4-4 summarizes the major and minor flow from existing Phase 1 and Phase 2, proposed PHASE 3 and future Phase 4 during the 100 year 24 hour SCS Type II storm.

Table 4-6 Major and Minor Flow of the CRT Phases During the 100 Year 24 hour SCS Storm

PHASE	MAJOR FLOW (cms)	MINOR FLOW (cms)
Existing Phase 1	0.05	6.85
Existing Phase 2	0.07	1.40
Proposed PHASE 3	0.95	3.38
Future Phase 4	1.98	4.20

5 GRADING AND ROADS

5.1 Site Grading

The existing grades within portions of the proposed development lands vary significantly due to the existing topography of the site. The final grading plan will require the balancing of various requirements including but not limited to geotechnical constraints, minimum/maximum slopes, overland routing of stormwater, all to ensure the site is graded in accordance with municipal standards.

A conceptual macro grading plan has been prepared to identify the conceptual grading of the proposed development. Refer to F**igure 6.1** in **Appendix E**.

As noted in the Paterson Group Geotechnical Investigation, a permissible grade raise restriction of 2.5m has been established for the southeastern portion of the development lands. The grade raise restriction of 2.5m for the southeastern portion of the site has not been exceeded. There is no grade raise restriction on the rest of the site.

A retaining wall is anticipated along the Fernbank road frontage. During detailed design, it may be determined that terracing can be provided between the two ROWs.

5.2 Road Network

The concept plan delineates the proposed road pattern for the development. The proposed municipal roads within the development are all to be designed to City of Ottawa Standard 18.0m ROW, with 8.5m wide asphalt. Cope Drive and Bobolink Drive are 24.0m ROW, with 11m wide asphalt consistent with the ROW constructed in earlier phases of the development.

Cope Drive is a proposed bus route.

Noise attenuation features and housing noise provisions will be required for road noise generated by Goldhawk Drive, Fernbank Road, Abbott Street, Bobolink Ridge and Shea Road. Refer to the Noise Feasibility Study prepared by IBI Group.

Sidewalks and pathways will be provided as agreed in the draft conditions of subdivision.

5.3 Intersection Improvements

Any intersection improvements will be identified in the Traffic Impact Study.

6 SOURCE CONTROLS

6.1 General

Since an end of pipe treatment facility is already provided for the development lands, stormwater site management for the subject lands will focus on site level or source control management of runoff. Such controls or mitigative measures are proposed for this development not only for final development but also during construction and build out. Some of these measures are:

- flat site grading where possible;
- vegetation planting; and
- groundwater recharge in landscaped areas.

6.2 Lot Grading

Where possible, all of the proposed blocks within the development will make use gentle surface slopes on hard surfaces such as asphalt and concrete. In accordance with local municipal standards, all grading will be between 0.5 and 5.0 percent for hard surfaces and 2.0 and 7.0 percent for all landscaped areas. Significant grade changes will be accomplished through the use of terracing (3:1 max slope), ramps and/or retaining walls. All street and parking lot catchbasins shall be equipped with 3.0m subdrains on opposite sides of a curbside catchbasin running parallel to the curb, and with 3.0m subdrains extending out from all 4 sides of parking lot catchbasins.

6.3 Vegetation

As with most subdivision agreements, the developer will be required to complete a vegetation and planting program. Vegetation throughout the development including planting along roadsides and within the individual blocks provides opportunities to re-create lost vegetation.

6.4 Groundwater Recharge

Perforated sub-drain systems will be implemented at capture locations in all vegetated areas. Roof leaders for pitched roofs are to direct runoff to landscaped areas. This will promote increased infiltration during low flow events before water is collected by the storm sewer system.

6.5 Low Impact Development & Water Balance

Low impact development measures are not stipulated in the MSS or in the EMP. However, in section 8.5.3. of the EMP does recommend that infiltration Best Management Practices (BMPs) shall be implemented, and that for low and medium density residential development, the most suitable practices for groundwater infiltration include;

-infiltration of runoff captured by rear yard catchbasins

-direct roof leaders to landscape areas

-infiltration trenches beneath swales in parks and open spaces

-sandy loam topsoil in parks and residential lawns.

Refer to the EMP excerpt section 8.1.3, included in **Appendix E**.

The EMP does recommend that each area shall be evaluated on a case by case basis. An analysis of the post development infiltration, based on the EMP infiltration rates, and modified infiltration rates based on the Geotechnical Engineer's recommendation have been provided in

Appendix E. Based on standard practices, the estimated water budget is in deficit by approximately 20% of the total water budget.

Additional infiltration is required by implementing enhanced BMP measures specific blocks within the development. A Target infiltration rate of 250mm/yr/Ha is provided for each of the following blocks;

- Commercial Block 316
- Medium Density Blocks 314, 315, and 317
- School Block 289

Each of these blocks will need to provide site specific design measures in order to meet the annual infiltration water budget.

7 CONVEYANCE CONTROLS

7.1 General

Besides source controls, the development also proposes to use several conveyance control measures to improve runoff quality. These will include:

- vegetated swales; and
- catchbasin sumps and manhole sumps.

7.2 Vegetated Swales

All rearyards within the proposed development make use of relatively vegetated swales. These swales generally employ saw-toothing at regular intervals and encourage infiltration and runoff treatment.

7.3 Catchbasins and Maintenance Hole Sumps

All catchbasins within the development, either rear yard or street, will be constructed with minimum 600 mm deep sumps. These sumps trap pollutants, sand, grit and debris which can be mechanically removed prior to being flushed into the minor pipe system. Both rear yard and street catchbasins will be to OPSD 705.02. All storm sewer maintenance holes serving local sewers less than 900 mm diameter shall be constructed with a 300 mm sump as per City standards.

8 SEDIMENT AND EROSION CONTROL PLAN

8.1 General

During construction, existing stream and conveyance systems can be exposed to significant sediment loadings. A conceptual sediment and erosion control will be detailed during the detailed design stages. Although construction is only a temporary situation, it will be proposed to introduce a number of mitigative construction techniques to reduce unnecessary construction sediment loadings. These may include:

- groundwater in trench will be pumped into a filter mechanism prior to release to the environment;
- bulkhead barriers will be installed at the nearest downstream manhole in each sewer which connects to an existing downstream sewer;
- seepage barriers will be constructed in any temporary drainage ditches;
- filter cloths will remain on open surface structure such as manholes and catchbasins until these structures are commissioned and put into use; and
- Silt fence on the site perimeter.

8.2 Trench Dewatering

Although little groundwater is expected during construction of municipal services, any trench dewatering using pumps will be discharged into a filter trap made up of geotextile filters and straw bales similar in design to the OPSD 219.240 Dewatering Trap. These will be constructed in a bowl shape with the fabric forming the bottom and the straw bales forming the sides. Any pumped groundwater will be filtered prior to release to the existing surface runoff. The contractor will inspect and maintain the filters as needed including sediment removal and disposal and material replacement as needed.

8.3 Bulkhead Barriers

At the first new manhole constructed within the development that is immediately upstream of an existing sewer a temporary ½ diameter bulkhead will be constructed over the lower half of the outletting sewer. This bulkhead will trap any sediment carrying flows thus preventing any construction-related contamination of existing sewers. The bulkheads will be inspected and maintained including periodic sediment removal as needed and removed prior to top course asphalt being laid.

8.4 Seepage Barriers

The presence of road side ditches along Fernbank Road necessitate the installation of seepage barriers. These barriers will consist of both the Light Duty Straw Bale Barrier as per OPSD 219.100 or the Light Duty Silt Fence Barrier as per OPSD 219.110. The barriers are typically made of layers of straw bales or geotextile fabric staked in place. All seepage barriers will be inspected and maintained as needed.

8.5 Surface Structure Filters

All catchbasins, and to a lesser degree manholes, convey surface water to sewers. However, until the surrounding surface has been completed these structures should be covered in some fashion to prevent sediment from entering the minor storm sewer system. Until rearyards are sodded or until streets are asphalted and curbed, catchbasins and manholes will be constructed with geotextile filter bags or a geotextile filter fabric located between the structure frame and cover respectively. These will stay in place and be maintained during construction and build until it is appropriate to remove same.

8.6 Stockpile Management

During construction of any development similar to that proposed by the Owner, both imported and native soils are stockpiled. Mitigative measures and proper management to prevent these materials entering the sewer systems is needed. Significant excess material will be generated from the subject lands, and will need to be disposed of off-site in a manner consistent with all MOE regulations.

During construction of the deeper municipal services, water, sewers and service connections, imported granular bedding materials are temporarily stockpiled on site. These materials are however quickly used up and generally before any catchbasins are installed. Street catchbasins are installed at the time of roadway construction and rearyard catchbasins are usually installed after base course asphalt is placed.

Contamination of the environment as a result of stockpiling of imported construction materials is generally not a concern provided the above noted seepage barriers are installed. These materials are quickly used and the mitigative measures stated previously, especially the ½ diameter sewer bulkheads and filter fabric in catchbasins and manholes help to manage these concerns.

The roadway granular materials are not stockpiled on site. They are immediately placed in the roadway and have little opportunity of contamination. Lot grading sometimes generates stockpiles of native materials. However, this is only a temporary event since the materials are quickly moved off site.

To assist in the control of transporting sediment off-site into municipal roads, mud mats will be employed at the construction entrances.

9 CONCLUSIONS

Water, wastewater and stormwater systems required to accommodate the orderly development of CRT Development Inc's. Phase 4 lands are available to service the subject site. The attached figures and supporting conceptual analysis illustrate that the lands can be developed in an orderly and effective manner and in accordance with the City of Ottawa's current level of service requirements.

The use of lot level controls, conveyance controls and end of pipe controls outlined in the report will result in effective treatment of surface stormwater runoff from the site. Adherence to the proposed sediment and erosion control plan during construction will minimize harmful impacts on surface water.

This report outlined a conceptual servicing scheme to support the draft plan approval of the proposed development. Detail design of the infrastructure would be completed upon issuance of draft plan approval and would be subject to various governmental approvals prior to construction, including but not limited to the following:

- Certificate of Authorization (C of A) for sewers and SWM: Ministry of Environment;
- Commence Work Order: City of Ottawa;
- Municipal Consent: City of Ottawa.

Report Prepared By:

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Director – Office Lead

Ryan Magladry, C.E.T.
Project Manager

Amy Zhuang, P.Eng.
Project Engineer

Peter Deir, P.Eng.,
Associate

https://ibigroup.sharepoint.com/sites/Projects2/136944/Internal Documents/6.0_Technical/6.04_Civil/03_Reports/APSR Submission#1/CTR_CRT PH4_APSR_2022.docx\

APPENDIX A

- Conceptual Draft Plan with Units

SKETCH TO ILLUSTRATE

CRT DEVELOPMENT - PHASE 4
CITY OF OTTAWA

Prepared by Annis , O'Sullivan , Vollebekk Ltd.
May 31, 2021

Scale 1 : 1500

60 45 30 15 0 30 60 Metres

Metric

DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

LEGEND

- NUMBER OF 11.30 (37 FOOT) UNITS = 203
- NUMBER OF 13.75 (45 FOOT) UNITS = 83
- NUMBER OF TOWNHOUSE UNITS = 336
- NUMBER OF BACK TO BACK UNITS = 54
- INSTITUTIONAL
- PARK
- COMMERCIAL
- MEDIUM DENSITY

ANNIS, O'SULLIVAN, VOLLEBEKK LTD.
14 Concourse Gate, Suite 500
Nepean, Ont. K2E 7S6
Phone: (613) 727-0850 / Fax: (613) 727-1079
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Ontario Land Surveyors

Job No. 22099-21 Claridge PtLts 26 27 CIO GO PH4 N DPS DI | N

APPENDIX B

- Figure 2.1 Water Distribution
- Water Demand Calculation
- RESERVED – City of Ottawa Boundary Conditions
- RESERVED – Hydraulic Water Model

Scale	Project Title	Drawing Title	Sheet No.
N.T.S.	CRT PHASE 4	CONCEPTUAL WATERMAIN LAYOUT	FIGURE 2.1

IBI

WATERMAIN DEMAND CALCULATION SHEET

IBI GROUP
333 PRESTON STREET
OTTAWA, ONTARIO
K1S 5N4

PROJECT : CRT Phase 4
CLIENT : CRT Development Inc.

FILE: 136944-6.4.4
DATE PRINTED: 09-May-22
DESIGN: WZ
PAGE: 1 OF 1

NODE	RESIDENTIAL				NON-RESIDENTIAL (ICI)			AVERAGE DAILY DEMAND (l/s)			MAXIMUM DAILY DEMAND (l/s)			MAXIMUM HOURLY DEMAND (l/s)			FIRE DEMAND (l/min)
	SINGLE FAMILY UNITS	3 bedroom UNITS	2 bedroom UNITS	POPULATION	INDUST. (ha)	COMM. (ha)	INSTIT. (ha)	RESIDENTIAL	ICI	TOTAL	RESIDENTIAL	ICI	TOTAL	RESIDENTIAL	ICI	TOTAL	
Site	286	336	54	1881.0			3.13	6.10	1.81	7.91	15.24	2.72	17.96	33.53	4.89	38.42	10,000
Medium Density Block			7.26	435.3				1.41		1.41	3.53		3.53	7.76		7.76	15,000
			(ha)														
Total	**286**	**336**	**54**	**2316.3**			**3.13**	**7.51**	**1.81**	**9.32**	**18.77**	**2.72**	**21.48**	**41.29**	**4.89**	**46.18**	

POPULATION DENSITY

Single Family 3.3 persons/unit
3 Bedroom Units 2.5 persons/unit
2 Bedroom Units 1.8 persons/unit

Medium Density 60 ppl/ha
***Population Density per MSS**

WATER DEMAND RATES

Residential 280 l/cap/day

Commercial Shopping Center
2,500 L/(1000m2)/day
Institutional
50,000 L/Ha/day

PEAKING FACTORS

Maximum Daily
Residential 2.5 x avg. day
Commercial 1.5 x avg. day
Maximum Hourly
Residential 2.2 x avg. day
Commercial 1.8 x avg. day

FIRE DEMANDS

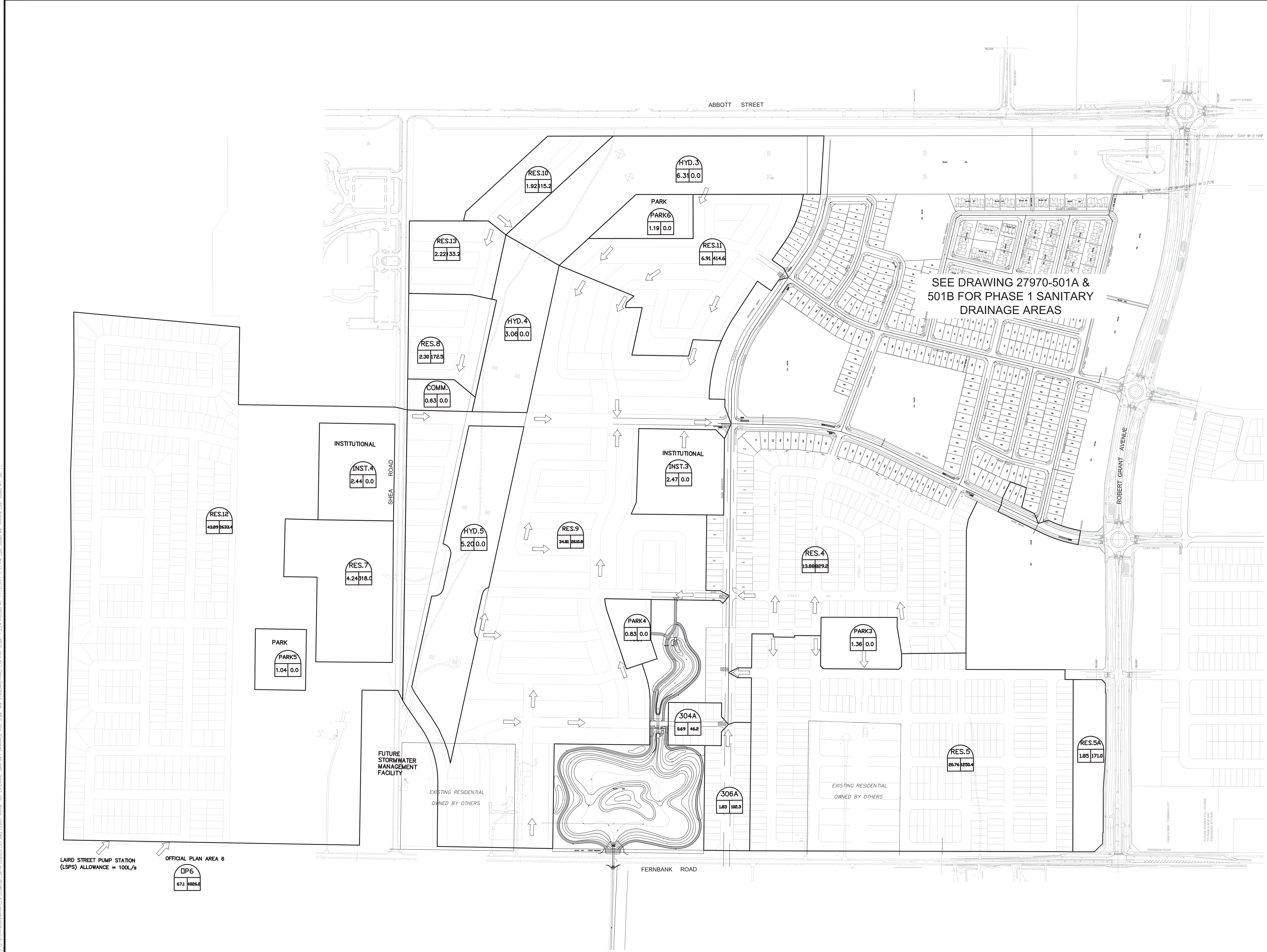
Single Family 10,000 l/min (166.7 l/s)

Semi Detached & Townhouse 10,000 l/min (166.7 l/s)

Medium Density 15,000 l/min (250 l/s)

APPENDIX C

- CRT Phase 1 Sanitary Sewer External Drainage Area Plan
- CRT Phase 1 Sanitary Sewer Design Sheet
- Figure 3.1 CRT Phase 4 Sanitary Sewer Layout
- CRT Phase 4 Sanitary Sewer design sheet
- Figure 3.2 CRT PHASE 4 Sanitary Drainage Area Plan



REVIEWED BY
DEVELOPMENT REVIEW SERVICES BRANCH

Signed ______________________

Date ______________________ 2017

Plan Number ______________________

LEGEND :

145A / 0.38 | 27.5 — AREA IDENTIFICATION; POPULATION; AREA IN HECTARES

⇨ FUTURE MINOR FLOW DIRECTION

POPULATION :

SINGLE FAMILY = 3.4 PPU
TOWNHOUSE / SEMIS = 2.7 PPU

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7	RESUBMISSION FOR MOE APPROVAL	JIM	17:07:14
6	SUBMISSION FOR MOE APPROVAL	JIM	17:02:10
5	SUBMISSION #5 FOR CITY REVIEW	JIM	16:11:10
4	SUBMISSION #4 FOR CITY REVIEW	JIM	15:06:15
3	SUBMISSION #3 FOR CITY REVIEW	JIM	14:08:22
2	SUBMISSION #2 FOR CITY REVIEW	JIM	14:01:22
1	SUBMISSION #1 FOR CITY REVIEW	JIM	13:08:29

CRT DEVELOPMENT INC.

IBI GROUP
400 – 333 Preston Street
Ottawa ON K1S 5N4 Canada
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Project Title

CRT LANDS
FERNBANK COMMUNITY
PHASE 1

LICENSED PROFESSIONAL ENGINEER
J. I. MOFFATT
2017/07/14
PROVINCE OF ONTARIO

N

Drawing Title

EXTERNAL SANITARY DRAINAGE
AREA PLAN

Scale 1:3000

Design	Date
J.I.M.	OCTOBER '12
Drawn	Checked
M.M.	P.K.
Project No.	Drawing No.
27970	501

D07-16-11-0003

#17366

IBI GROUP

IBI Group
400-333 Preston Street
Ottawa, Ontario
K1S 5N4

SANITARY SEWER DESIGN SHEET

PROJECT: CRT DEVELOPMENT
LOCATION: CITY OF OTTAWA
CLIENT: CRT DEVELOPMENT INC.

LOCATION				RESIDENTIAL									ICI AREAS							INFILTRATION ALLOWANCE			TOTAL	PROPOSED SEWER DESIGN						
				UNIT TYPES				AREA	POPULATION		PEAK	PEAK	AREA (Ha)						PEAK	AREA (Ha)		FLOW	FLOW	CAPACITY	LENGTH	DIA	SLOPE	VELOCITY	AVAILABLE	
											FACTOR	FLOW	INSTITUTIONAL		COMMERCIAL		INDUSTRIAL		FLOW									(full)	CAPACITY	
STREET	AREA ID	FROM MH	TO MH	SF	SD	TH	APT	(Ha)	IND	CUM		(L/s)	IND	CUM	IND	CUM	IND	CUM	(L/s)	IND	CUM	(L/s)	(L/s)	(L/s)	(m)	(mm)	(%)	(m/s)	L/s	(%)
PUTNEY CRESCENT	141A	141A	142A			1		0.06	2.5	2.5	4.00	0.04		0.00		0.00		0.00	0.00	0.06	0.06	0.02	0.06	24.19	9.07	200	0.50	0.746	24.14	99.76
PUTNEY CRESCENT	142A	142A	143A			11		0.35	27.5	30.0	4.00	0.49		0.00		0.00		0.00	0.00	0.35	0.41	0.11	0.60	47.16	55.56	200	1.90	1.454	46.56	98.73
PUTNEY CRESCENT	143A	143A	144A			17		0.49	42.5	72.5	4.00	1.17		0.00		0.00		0.00	0.00	0.49	0.90	0.25	1.43	41.91	64.86	200	1.50	1.292	40.48	96.60
FINSBURY AVENUE	136AA	136A	144A			21		0.65	52.5	52.5	4.00	0.85		0.00		0.00		0.00	0.00	0.65	0.65	0.18	1.03	53.56	110.44	200	2.45	1.652	52.52	98.07
PUTNEY CRESCENT	144A	144A	145A			10		0.36	25.0	150.0	4.00	2.43		0.00		0.00		0.00	0.00	0.36	1.91	0.53	2.97	32.46	80.25	200	0.90	1.001	29.50	90.86
CLAPHAM TERRACE	136AB	136A	137A			10		0.37	25.0	25.0	4.00	0.41		0.00		0.00		0.00	0.00	0.37	0.37	0.10	0.51	24.19	78.00	200	0.50	0.746	23.69	97.90
BRIXTON WAY	137AA	137A	160A			12		0.35	30.0	55.0	4.00	0.89		0.00		0.00		0.00	0.00	0.35	0.72	0.20	1.09	41.91	50.77	200	1.50	1.292	40.81	97.39
BRIXTON WAY	160A	160A	145A			18		0.54	45.0	100.0	4.00	1.62		0.00		0.00		0.00	0.00	0.54	1.26	0.35	1.97	52.45	78.53	200	2.35	1.617	50.48	96.24
PUTNEY CRESCENT	145A	145A	146A			11		0.34	27.5	277.5	4.00	4.50		0.00		0.00		0.00	0.00	0.34	3.51	0.98	5.48	39.76	70.87	200	1.35	1.226	34.28	86.22
CLAPHAM WAY	137AB	137A	138A			9		0.38	22.5	22.5	4.00	0.36		0.00		0.00		0.00	0.00	0.38	0.38	0.11	0.47	37.48	78.00	200	1.20	1.156	37.01	98.74
PUTNEY CRESCENT	138A	138A	148A			10		0.35	25.0	47.5	4.00	0.77		0.00		0.00		0.00	0.00	0.35	0.73	0.20	0.97	40.49	77.95	200	1.40	1.248	39.51	97.59
PUTNEY CRESCENT	148A	148A	147A			7		0.26	17.5	65.0	4.00	1.05		0.00		0.00		0.00	0.00	0.26	0.99	0.28	1.33	55.70	59.50	200	2.65	1.718	54.37	97.61
PUTNEY CRESCENT	147A	147A	146A			0		0.03	0.0	65.0	4.00	1.05		0.00		0.00		0.00	0.00	0.03	1.02	0.29	1.34	55.70	12.47	200	2.65	1.718	54.36	97.60
BLOCK 323	146A	146A	161A			0		0.03	0.0	342.5	4.00	5.55		0.00		0.00		0.00	0.00	0.03	4.56	1.28	6.83	28.63	38.97	200	0.70	0.883	21.80	76.15
BLOCK 316	HYD. 2	161A	*Ex.209*			0		5.12	0.0	342.5	4.00	5.55		0.00		0.00		0.00	0.00	5.12	9.68	2.71	8.26	28.63	53.67	200	0.70	0.883	20.37	71.15
BLOCK 324	RES.1	BULKHEAD	*Ex.209*					1.89	170.1	170.1	4.00	2.76		0.00		0.00		0.00	0.00	1.89	1.89	0.53	3.29	43.87	8.00	250	0.50	0.866	40.58	92.51
				Refer to ECA No. 9079-9LNNZC dated July 9, 2014 for description of existing sewers.																										

Design Parameters:

Residential			ICI Areas			Peak Factor
SF	3.3	p/p/u	INST	50,000	L/Ha/day	1.5
TH/SD	2.5	p/p/u	COM	50,000	L/Ha/day	1.5
APT	1.8	p/p/u	IND	35,000	L/Ha/day	MOE Chart
Low	60	p/p/Ha				
Med	75	p/p/Ha				
High	90	p/p/Ha				

Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 350 L/day
3. Infiltration allowance: 0.28 L/s/Ha
4. Residential Peaking Factor:
   Harmon Formula = 1+(14/(4+P^0.5))
   where P = population in thousands

Designed: J.I.M.

Checked: P.K.

Dwg. Reference: 27970 - 501, 501A, 501B

No.	Revision	Date
1.	Submission No. 1 to City of Ottawa	2013-08-29
2.	Submission No. 2 to City of Ottawa	2014-01-22
3.	Submission No. 3 to City of Ottawa	2014-08-22
4.	Submission No. 4 to City of Ottawa	2015-06-15
5.	Submission No. 5 to City of Ottawa	2016-11-10
6.	Submission for MOE Approval	2017-02-10
7.	Resubmission for MOE Approval	2017-07-14

File Reference:	Date:	Sheet No:
27970.5.7.1	2017-07-14	1 of 4

IBI GROUP

IBI Group
400-333 Preston Street
Ottawa, Ontario
K1S 5N4

SANITARY SEWER DESIGN SHEET

PROJECT: CRT DEVELOPMENT
LOCATION: CITY OF OTTAWA
CLIENT: CRT DEVELOPMENT INC.

LOCATION				RESIDENTIAL									ICI AREAS							INFILTRATION ALLOWANCE			TOTAL	PROPOSED SEWER DESIGN						
				UNIT TYPES				AREA	POPULATION		PEAK	PEAK	AREA (Ha)						PEAK	AREA (Ha)		FLOW	FLOW	CAPACITY	LENGTH	DIA	SLOPE	VELOCITY	AVAILABLE	
		FROM	TO								FACTOR	FLOW	INSTITUTIONAL		COMMERCIAL		INDUSTRIAL		FLOW									(full)	CAPACITY	
STREET	AREA ID	MH	MH	SF	SD	TH	APT	(Ha)	IND	CUM		(L/s)	IND	CUM	IND	CUM	IND	CUM	(L/s)	IND	CUM	(L/s)	(L/s)	(L/s)	(m)	(mm)	(%)	(m/s)	L/s	(%)
CLAPHAM TERRACE	136AC	136A	135A			11		0.41	27.5	27.5	4.00	0.45		0.00		0.00		0.00	0.00	0.41	0.41	0.11	0.56	27.59	65.31	200	0.65	0.851	27.03	97.97
CLAPHAM TERRACE	135A	135A	134A			9		0.31	22.5	50.0	4.00	0.81		0.00		0.00		0.00	0.00	0.31	0.72	0.20	1.01	27.59	57.36	200	0.65	0.851	26.57	96.33
PUTNEY CRESCENT	141A	141A	134A			9		0.34	22.5	22.5	4.00	0.36		0.00		0.00		0.00	0.00	0.34	0.34	0.10	0.46	32.46	75.02	200	0.90	1.001	32.00	98.58
PUTNEY CRESCENT	134A	134A	140A	6				0.34	19.8	92.3	4.00	1.50		0.00		0.00		0.00	0.00	0.34	1.40	0.39	1.89	32.46	78.00	200	0.90	1.001	30.57	94.18
OSTERLEY WAY	153A	153A	152A	8				0.51	26.4	26.4	4.00	0.43		0.00		0.00		0.00	0.00	0.51	0.51	0.14	0.57	29.63	49.25	200	0.75	0.914	29.06	98.07
OSTERLEY WAY	152A	152A	151A	17				0.78	56.1	82.5	4.00	1.34		0.00		0.00		0.00	0.00	0.78	1.29	0.36	1.70	29.63	95.75	200	0.75	0.914	27.93	94.27
OSTERLEY WAY	151A	151A	150A	10				0.47	33.0	115.5	4.00	1.87		0.00		0.00		0.00	0.00	0.47	1.76	0.49	2.36	29.63	59.68	200	0.75	0.914	27.27	92.02
OSTERLEY WAY	150A	150A	140A	9				0.42	29.7	145.2	4.00	2.35		0.00		0.00		0.00	0.00	0.42	2.18	0.61	2.96	29.63	62.98	200	0.75	0.914	26.67	90.00
PUTNEY CRESCENT	140A	140A	124A	3				0.24	9.9	247.4	4.00	4.01		0.00		0.00		0.00	0.00	0.24	3.82	1.07	5.08	32.46	78.00	200	0.90	1.001	27.38	84.36
BLOCK 343	RES.2	BLKHD	129A					1.21	108.9	108.9	4.00	1.76		0.00		0.00		0.00	0.00	1.21	1.21	0.34	2.10	20.24	19.00	200	0.35	0.624	18.14	89.61
BOBOLINK RIDGE	129A	129A	128A	0				0.09	0.0	108.9	4.00	1.76		0.00		0.00		0.00	0.00	0.09	1.30	0.36	2.13	31.02	45.00	250	0.25	0.612	28.89	93.14
BOBOLINK RIDGE	128AA	128A	127A	6				0.41	19.8	128.7	4.00	2.09		0.00		0.00		0.00	0.00	0.41	1.71	0.48	2.56	31.02	78.00	250	0.25	0.612	28.46	91.73
BOBOLINK RIDGE	127AA	127A	126A	10				0.53	33.0	161.7	4.00	2.62		0.00		0.00		0.00	0.00	0.53	2.24	0.63	3.25	31.02	78.00	250	0.25	0.612	27.77	89.53
BOBOLINK RIDGE	126A	126A	125A	5				0.33	16.5	178.2	4.00	2.89		0.00		0.00		0.00	0.00	0.33	2.57	0.72	3.61	31.02	47.81	250	0.25	0.612	27.41	88.37
BOBOLINK RIDGE	125A	125A	124A	12				0.56	39.6	217.8	4.00	3.53		0.00		0.00		0.00	0.00	0.56	3.13	0.88	4.41	31.02	74.85	250	0.25	0.612	26.61	85.80
BOBOLINK RIDGE	124A	124A	123A	11				0.61	36.3	501.5	3.97	8.07		0.00		0.00		0.00	0.00	0.61	7.56	2.12	10.19	31.02	88.85	250	0.25	0.612	20.83	67.15
DAGENHAM STREET	PARK1, 131A	131A	130A	7				1.70	23.1	23.1	4.00	0.37		0.00		0.00		0.00	0.00	1.70	1.70	0.48	0.85	34.22	43.00	200	1.00	1.055	33.37	97.51
DAGENHAM STREET	130A	130A	123A	8				0.46	26.4	49.5	4.00	0.80		0.00		0.00		0.00	0.00	0.46	2.16	0.60	1.41	34.22	87.11	200	1.00	1.055	32.81	95.89
BOBOLINK RIDGE	123A	123A	122A	2				0.14	6.6	557.6	3.95	8.92		0.00		0.00		0.00	0.00	0.14	9.86	2.76	11.68	31.02	25.98	250	0.25	0.612	19.34	62.34
BOBOLINK RIDGE	122A	122A	121A	5				0.26	16.5	574.1	3.94	9.17		0.00		0.00		0.00	0.00	0.26	10.12	2.83	12.00	31.02	36.36	250	0.25	0.612	19.02	61.31
BOBOLINK RIDGE	121A	121A	120A	6				0.30	19.8	593.9	3.93	9.47		0.00		0.00		0.00	0.00	0.30	10.42	2.92	12.38	31.02	40.43	250	0.25	0.612	18.64	60.08
ANGEL HEIGHTS	111A	111A	112A	1				0.08	3.3	3.3	4.00	0.05		0.00		0.00		0.00	0.00	0.08	0.08	0.02	0.08	28.63	12.92	200	0.70	0.883	28.55	99.73
ANGEL HEIGHTS	112A	112A	113A	13				0.77	42.9	46.2	4.00	0.75		0.00		0.00		0.00	0.00	0.77	0.85	0.24	0.99	28.63	95.21	200	0.70	0.883	27.64	96.55
ANGEL HEIGHTS	113A	113A	114A	6				0.29	19.8	66.0	4.00	1.07		0.00		0.00		0.00	0.00	0.29	1.14	0.32	1.39	28.63	38.92	200	0.70	0.883	27.24	95.15
ANGEL HEIGHTS	114A	114A	120A	6				0.35	19.8	85.8	4.00	1.39		0.00		0.00		0.00	0.00	0.35	1.49	0.42	1.81	28.63	70.46	200	0.70	0.883	26.82	93.69
BOBOLINK RIDGE	120A	120A	105A	11				0.62	36.3	716.0	3.89	11.28		0.00		0.00		0.00	0.00	0.62	12.53	3.51	14.79	36.70	90.60	250	0.35	0.724	21.91	59.71

Design Parameters:

Residential			ICI Areas			Peak Factor
SF	3.3	p/p/u	INST	50,000	L/Ha/day	1.5
TH/SD	2.5	p/p/u	COM	50,000	L/Ha/day	1.5
APT	1.8	p/p/u	IND	35,000	L/Ha/day	MOE Chart
Low	60	p/p/Ha				
Med	75	p/p/Ha				
High	90	p/p/Ha				

Notes:

1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 350 L/day
3. Infiltration allowance: 0.28 L/s/Ha
4. Residential Peaking Factor:
   Harmon Formula = 1+(14/(4+P^0.5))
   where P = population in thousands

Designed: J.I.M.

Checked: P.K.

Dwg. Reference: 27970 - 501, 501A, 501B

No.	Revision	Date
1.	Submission No. 1 to City of Ottawa	2013-08-29
2.	Submission No. 2 to City of Ottawa	2014-01-22
3.	Submission No. 3 to City of Ottawa	2014-08-22
4.	Submission No. 4 to City of Ottawa	2015-06-15
5.	Submission No. 5 to City of Ottawa	2016-11-10
6.	Submission for MOE Approval	2017-02-10
7.	Resubmission for MOE Approval	2017-07-14

File Reference:	Date:	Sheet No:
27970.5.7.1	2017-07-14	2 of 4

IBI GROUP

IBI Group
400-333 Preston Street
Ottawa, Ontario
K1S 5N4

SANITARY SEWER DESIGN SHEET

PROJECT: CRT DEVELOPMENT
LOCATION: CITY OF OTTAWA
CLIENT: CRT DEVELOPMENT INC.

LOCATION				RESIDENTIAL									ICI AREAS							INFILTRATION ALLOWANCE			TOTAL	PROPOSED SEWER DESIGN						
				UNIT TYPES				AREA	POPULATION		PEAK	PEAK	AREA (Ha)						PEAK	AREA (Ha)		FLOW	FLOW	CAPACITY	LENGTH	DIA	SLOPE	VELOCITY	AVAILABLE CAPACITY	
											FACTOR	FLOW	INSTITUTIONAL		COMMERCIAL		INDUSTRIAL		FLOW									(full)		
STREET	AREA ID	FROM MH	TO MH	SF	SD	TH	APT	(Ha)	IND	CUM		(L/s)	IND	CUM	IND	CUM	IND	CUM	(L/s)	IND	CUM	(L/s)	(L/s)	(L/s)	(m)	(mm)	(%)	(m/s)	L/s	(%)
EMBANKMENT STREET	128AB	128A	188A	16				0.74	52.8	52.8	4.00	0.86		0.00		0.00		0.00	0.00	0.74	0.74	0.21	1.06	27.59	98.00	200	0.65	0.851	26.52	96.15
EMBANKMENT STREET	188A	188A	189A	11				0.52	36.3	89.1	4.00	1.44		0.00		0.00		0.00	0.00	0.52	1.26	0.35	1.80	27.59	74.80	200	0.65	0.851	25.79	93.49
BLOCK 344	RES.3	192A	189A					1.52	136.8	136.8	4.00	2.22		0.00		0.00		0.00	0.00	1.52	1.52	0.43	2.64	20.24	40.00	200	0.35	0.624	17.60	86.95
EMBANKMENT STREET	189A	189A	190A	14				0.69	46.2	272.1	4.00	4.41		0.00		0.00		0.00	0.00	0.69	3.47	0.97	5.38	20.24	92.53	200	0.35	0.624	14.86	73.42
EMBANKMENT STREET		190A	176A	0				0.00	0.0	272.1	4.00	4.41		0.00		0.00		0.00	0.00	0.00	3.47	0.97	5.38	20.24	10.78	200	0.35	0.624	14.86	73.42
BLOCK 345	INST.2	BULKHEAD	176A	0				0.00	0.0	0.0	4.00	0.00	6.53	6.53		0.00		0.00	5.67	6.53	6.53	1.83	7.50	20.24	21.00	200	0.35	0.624	12.75	62.97
COPE DRIVE	176A	176A	175A	3				0.63	9.9	282.0	4.00	4.57		6.53		0.00		0.00	5.67	0.63	10.63	2.98	13.21	20.24	76.03	200	0.35	0.624	7.03	34.72
COPE DRIVE	175A	175A	174A	5				0.46	16.5	298.5	4.00	4.84		6.53		0.00		0.00	5.67	0.46	11.09	3.11	13.61	20.24	84.94	200	0.35	0.624	6.63	32.76
BELSIZE WAY	127AB	127A	185A	11				0.53	36.3	36.3	4.00	0.59		0.00		0.00		0.00	0.00	0.53	0.53	0.15	0.74	27.59	88.50	200	0.65	0.851	26.85	97.33
BELSIZE WAY	185A	185A	186A	13				0.59	42.9	79.2	4.00	1.28		0.00		0.00		0.00	0.00	0.59	1.12	0.31	1.60	27.59	83.61	200	0.65	0.851	25.99	94.21
PINNER ROAD	191A	191A	186A	3				0.24	9.9	9.9	4.00	0.16		0.00		0.00		0.00	0.00	0.24	0.24	0.07	0.23	27.59	43.00	200	0.65	0.851	27.36	99.17
PINNER ROAD	186A	186A	187A	5				0.35	16.5	105.6	4.00	1.71		0.00		0.00		0.00	0.00	0.35	1.71	0.48	2.19	20.24	70.39	200	0.35	0.624	18.05	89.18
PINNER ROAD		187A	183A	0				0.00	0.0	105.6	4.00	1.71		0.00		0.00		0.00	0.00	0.00	1.71	0.48	2.19	20.24	9.00	200	0.35	0.624	18.05	89.18
FINSBURY AVENUE	182A	182A	183A	16				0.97	52.8	52.8	4.00	0.86		0.00		0.00		0.00	0.00	0.97	0.97	0.27	1.13	32.46	117.13	200	0.90	1.001	31.33	96.53
FINSBURY AVENUE	183A	183A	184A	4				0.33	13.2	171.6	4.00	2.78		0.00		0.00		0.00	0.00	0.33	3.01	0.84	3.62	20.24	65.71	200	0.35	0.624	16.62	82.10
FINSBURY AVENUE		184A	174A	0				0.00	0.0	171.6	4.00	2.78		0.00		0.00		0.00	0.00	0.00	3.01	0.84	3.62	20.24	17.89	200	0.35	0.624	16.62	82.10
COPE DRIVE	174A	174A	173A	7				0.47	23.1	493.2	3.98	7.95		6.53		0.00		0.00	5.67	0.47	14.57	4.08	17.69	31.02	82.90	250	0.25	0.612	13.33	42.96
COPE DRIVE	173A	173A	172A	6				0.41	19.8	513.0	3.97	8.25		6.53		0.00		0.00	5.67	0.41	14.98	4.19	18.11	31.02	76.02	250	0.25	0.612	12.91	41.62
BLOCK 313	INST.1	BULKHEAD	172A	0				0.00	0.0	0.0	4.00	0.00	2.88	2.88		0.00		0.00	2.50	2.88	2.88	0.81	3.31	20.24	16.00	200	0.35	0.624	16.94	83.67
COPE DRIVE	172A	172A	171B	3				0.23	9.9	522.9	3.96	8.40		9.41		0.00		0.00	8.17	0.23	18.09	5.07	21.63	31.02	36.96	250	0.25	0.612	9.39	30.27
COPE DRIVE	171B	171B	171A	2				0.22	6.6	529.5	3.96	8.50		9.41		0.00		0.00	8.17	0.22	18.31	5.13	21.79	31.02	41.21	250	0.25	0.612	9.23	29.75
DAGENHAM STREET	180A	180A	181A	7				0.50	23.1	23.1	4.00	0.37		0.00		0.00		0.00	0.00	0.50	0.50	0.14	0.51	20.24	90.00	200	0.35	0.624	19.73	97.46
DAGENHAM STREET	181A	181A	171A	0				0.11	0.0	23.1	4.00	0.37		0.00		0.00		0.00	0.00	0.11	0.61	0.17	0.55	20.24	67.50	200	0.35	0.624	19.70	97.31
COPE DRIVE	171A	171A	170B	1				0.17	3.3	555.9	3.95	8.90		9.41		0.00		0.00	8.17	0.17	19.09	5.35	22.41	45.12	37.91	300	0.20	0.618	22.71	50.33
COPE DRIVE	170B	170B	170A	3				0.25	9.9	565.8	3.95	9.04		9.41		0.00		0.00	8.17	0.25	19.34	5.42	22.63	45.12	43.98	300	0.20	0.618	22.49	49.84
BLOCK 312	RES.3A	BULKHEAD	sewer	0				3.26	195.6	195.6	4.00	3.17		0.00		0.00		0.00	0.00	3.26	3.26	0.91	4.08	20.24	16.22	200	0.35	0.624	16.16	79.83
COPE DRIVE	170A	170A	110A	6				0.62	19.8	781.2	3.87	12.24		9.41		0.00		0.00	8.17	0.62	23.22	6.50	26.91	45.12	120.00	300	0.20	0.618	18.21	40.36
GOLDHAWK DRIVE	306A	SOUTH	303A	31				1.83	102.3	102.3	4.00	1.66		0.00		0.00		0.00	0.00	1.83	1.83	0.51	2.17							
STREET NO. 26	304A	WEST	303A	14				0.69	46.2	46.2	4.00	0.75		0.00		0.00		0.00	0.00	0.69	0.69	0.19	0.94							
GOLDHAWK DRIVE	303A	303A	302A	10				0.62	33.0	181.5	4.00	2.94		0.00		0.00		0.00	0.00	0.62	3.14	0.88	3.82	20.24	94.58	200	0.35	0.624	16.42	81.13
Future Street	RES.5, 5A, Park3	EAST	302A					23.97	1421.4	1421.4	3.70	21.28		0.00		0.00		0.00	0.00	23.97	23.97	6.71	28.00							
GOLDHAWK DRIVE	302A	302A	301A	10				0.56	33.0	1635.9	3.65	24.20		0.00		0.00		0.00	0.00	0.56	27.67	7.75	31.95	50.44	70.68	300	0.25	0.691	18.49	36.66
GOLDHAWK DRIVE	301A	301A	207A	6				0.37	19.8	1655.7	3.65	24.47		0.00		0.00		0.00	0.00	0.37	28.04	7.85	32.32	50.44	70.00	300	0.25	0.691	18.12	35.93
STREET NO. 2	RES.4	EAST	207A					13.88	832.8	832.8	3.85	12.99		0.00		0.00		0.00	0.00	13.88	13.88	3.89	16.87							
GOLDHAWK DRIVE	207A	207A	206A	17				0.86	56.1	2544.6	3.50	36.10		0.00		0.00		0.00	0.00	0.86	42.78	11.98	48.08	70.84	107.19	375	0.15	0.621	22.76	32.13
GOLDHAWK DRIVE	206A	206A	205A	12				0.69	39.6	2584.2	3.50	36.60		0.00		0.00		0.00	0.00	0.69	43.47	12.17	48.78	70.84	106.61	375	0.15	0.621	22.07	31.15
GOLDHAWK DRIVE	205A	205A	110A	5				0.44	16.5	2600.7	3.49	36.81		0.00		0.00		0.00	0.00	0.44	43.91	12.29	49.11	70.84	100.61	375	0.15	0.621	21.73	30.68

Design Parameters:

Residential			ICI Areas			Peak Factor
SF	3.3	p/p/u	INST	50,000	L/Ha/day	1.5
TH/SD	2.5	p/p/u	COM	50,000	L/Ha/day	1.5
APT	1.8	p/p/u	IND	35,000	L/Ha/day	MOE Chart
Low	60	p/p/Ha				
Med	75	p/p/Ha				
High	90	p/p/Ha				

Notes:

1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 350 L/day
3. Infiltration allowance: 0.28 L/s/Ha
4. Residential Peaking Factor:
   Harmon Formula = 1+(14/(4+P^0.5))
   where P = population in thousands

Designed: J.I.M.

Checked: P.K.

Dwg. Reference: 27970 - 501, 501A, 501B

No.	Revision	Date
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File Reference:	Date:	Sheet No:
27970.5.7.1	2017-07-14	3 of 4

IBI Group
400-333 Preston Street
Ottawa, Ontario
K1S 5N4

SANITARY SEWER DESIGN SHEET

PROJECT: CRT DEVELOPMENT
LOCATION: CITY OF OTTAWA
CLIENT: CRT DEVELOPMENT INC.

LOCATION				RESIDENTIAL									ICI AREAS							INFILTRATION ALLOWANCE			TOTAL	PROPOSED SEWER DESIGN						
				UNIT TYPES				AREA	POPULATION		PEAK	PEAK	AREA (Ha)						PEAK	AREA (Ha)		FLOW	FLOW	CAPACITY	LENGTH	DIA	SLOPE	VELOCITY	AVAILABLE CAPACITY	
													INSTITUTIONAL		COMMERCIAL		INDUSTRIAL													
STREET	AREA ID	FROM MH	TO MH	SF	SD	TH	APT	(Ha)	IND	CUM	FACTOR	FLOW (L/s)	IND	CUM	IND	CUM	IND	CUM	FLOW (L/s)	IND	CUM	(L/s)	(L/s)	(L/s)	(m)	(mm)	(%)	(full) (m/s)	L/s	(%)
																							0.00							
	LSPS	Allowance						0.00	0.0	0.0													108.00							
	STITTSVILLE 6 PS		110A					0.00	0.0	0.0				0.00		0.00		0.00	0.00				84.00							
Future Street	INST.3	BLKHD	110A					0.00	0.0	0.0			2.47	2.47		0.00		0.00	2.14											
	PARK4	BLKHD	110A					0.83	0.0	0.0				0.00		0.00		0.00	0.00											
	PARK5	BLKHD	110A					1.04	0.0	0.0				0.00		0.00		0.00	0.00											
	RES.9	BLKHD	110A					34.81	2610.8	2610.8				0.00		0.00		0.00	0.00											
	RES.7	BLKHD	110A					4.24	318.0	318.0				0.00		0.00		0.00	0.00											
	RES.13	BLKHD	110A					2.22	133.2	133.2				0.00		0.00		0.00	0.00											
	RES.12	BLKHD	110A					43.89	2633.4	2633.4				0.00		0.00		0.00	0.00											
	INST.4	BLKHD	110A					0.00	0.0	0.0			2.44	2.44		0.00		0.00	2.12											
	COMM.	BLKHD	110A					0.00	0.0	0.0				0.00	0.63	0.63		0.00	0.55											
	HYD.4	BLKHD	110A					3.06	0.0	0.0				0.00		0.00		0.00	0.00											
	RES.8	BLKHD	110A					2.30	172.5	172.5				0.00		0.00		0.00	0.00											
	HYD.5	BLKHD	110A					5.20	0.0	0.0				0.00		0.00		0.00	0.00											
Future Street	RES.11	BLKHD	110A					6.91	414.6	414.6				0.00		0.00		0.00	0.00											
	PARK6	BLKHD	110A					1.19	0.0	0.0				0.00		0.00		0.00	0.00											
	RES.10	BLKHD	110A					1.92	115.2	115.2				0.00		0.00		0.00	0.00											
	HYD.3	BLKHD	110A					6.31	0.0	0.0				0.00		0.00		0.00	0.00											
TOTAL		**BLKHD**	**110A**					**113.92**		**6397.7**	**3.14**	**81.49**		**4.91**		**0.63**		**0.00**	**4.81**	**119.46**	**119.46**	**33.45**	**311.74**	**320.28**	**24.02**	**600**	**0.25**	**1.097**	**8.54**	**2.67**
GOLDHAWK DRIVE		**110A**	**109A**					**0.00**	**0.0**	**9779.6**	**2.96**	**117.43**		**14.32**		**0.63**		**0.00**	**12.98**	**0.00**	**186.59**	**52.25**	**374.66**	**378.96**	**61.28**	**600**	**0.35**	**1.298**	**4.30**	**1.14**
GOLDHAWK DRIVE	**110A**	**1101A**	**1092A**	**1**				**0.18**	**3.3**	**3.3**	**4.00**	**0.05**								**0.18**	**0.18**	**0.05**	**0.10**	**28.63**	**61.28**	**200**	**0.70**	**0.883**	**28.52**	**99.64**
GOLDHAWK DRIVE		**109A**	**108A**					**0.00**	**0.0**	**9782.9**	**2.96**	**117.47**		**14.32**		**0.63**		**0.00**	**12.98**	**0.00**	**186.77**	**52.30**	**374.74**	**378.96**	**57.50**	**600**	**0.35**	**1.298**	**4.22**	**1.11**
GOLDHAWK DRIVE	**109A**	**1091A**	**1082A**	5				**0.32**	**16.5**	**16.5**	**4.00**	**0.27**								**0.32**	**0.32**	**0.09**	**0.36**	**28.63**	**57.50**	**200**	**0.70**	**0.883**	**28.27**	**98.75**
GOLDHAWK DRIVE		**108A**	**107A**					**0.00**	**0.0**	**9799.4**	**2.96**	**117.64**		**14.32**		**0.63**		**0.00**	**12.98**	**0.00**	**187.09**	**52.39**	**375.00**	**378.96**	**53.32**	**600**	**0.35**	**1.298**	**3.96**	**1.05**
GOLDHAWK DRIVE	**108A**	**1081A**	**1072A**	**4**				**0.30**	**13.2**	**13.2**	**4.00**	**0.21**							**0.00**	**0.30**	**0.30**	**0.08**	**0.30**	**28.63**	**53.32**	**200**	**0.70**	**0.883**	**28.33**	**98.96**
GOLDHAWK DRIVE		**107A**	**106A**					**0.00**	**0.0**	**9812.6**	**2.96**	**117.77**		**14.32**		**0.63**		**0.00**	**12.98**	**0.00**	**187.39**	**52.47**	**375.22**	**378.96**	**62.94**	**600**	**0.35**	**1.298**	**3.74**	**0.99**
GOLDHAWK DRIVE	**107A**	**1071A**	**1062A**	**7**				**0.31**	**23.1**	**23.1**	**4.00**	**0.37**		**0.00**		**0.00**		**0.00**	**0.00**	**0.31**	**0.31**	**0.09**	**0.46**	**28.63**	**62.94**	**200**	**0.70**	**0.883**	**28.17**	**98.39**
GOLDHAWK DRIVE		**106A**	**105A**					**0.00**	**0.0**	**9835.7**	**2.96**	**118.01**		**14.32**		**0.63**		**0.00**	**12.98**	**0.00**	**187.70**	**52.56**	**375.54**	**378.96**	**60.09**	**600**	**0.35**	**1.298**	**3.42**	**0.90**
GOLDHAWK DRIVE	**106A**	**1061A**	**1052A**	**2**				**0.24**	**6.6**	**6.6**	**4.00**	**0.11**		**0.00**		**0.00**		**0.00**	**0.00**	**0.24**	**0.24**	**0.07**	**0.17**	**28.63**	**60.09**	**200**	**0.70**	**0.883**	**28.45**	**99.39**
		105A	**104A**					**0.00**	**0.0**	**10558.3**	**2.93**	**125.37**		**14.32**		**0.63**		**0.00**	**12.98**	**0.00**	**200.47**	**56.13**	**386.48**	**389.64**	**72.85**	**600**	**0.37**	**1.335**	**3.16**	**0.81**
GOLDHAWK DRIVE	**105A**	**1051A**	**1042A**	**7**				**0.45**	**23.1**	**23.1**	**4.00**	**0.37**								**0.45**	**0.45**	**0.13**	**0.50**	**27.59**	**72.85**	**200**	**0.65**	**0.851**	**27.09**	**98.19**
GOLDHAWK DRIVE		**104A**	**103A**					**0.00**	**0.0**	**10581.4**	**2.93**	**125.60**		**14.32**		**0.63**		**0.00**	**12.98**	**0.00**	**200.92**	**56.26**	**386.84**	**389.64**	**48.77**	**600**	**0.37**	**1.335**	**2.80**	**0.72**
GOLDHAWK DRIVE	**104A**	**1041A**	**1032A**	**9**				**0.47**	**29.7**	**29.7**	**4.00**	**0.48**							**0.00**	**0.47**	**0.47**	**0.13**	**0.61**	**27.59**	**48.77**	**200**	**0.65**	**0.851**	**26.97**	**97.78**
GOLDHAWK DRIVE		**103A**	**102A**					**0.00**	**0.0**	**10611.1**	**2.93**	**125.90**		**14.32**		**0.63**		**0.00**	**12.98**	**0.00**	**201.39**	**56.39**	**387.27**	**389.64**	**45.00**	**600**	**0.37**	**1.335**	**2.37**	**0.61**
GOLDHAWK DRIVE	**103A, HYD1**	**1031A**	**1021A**	**6**				**2.01**	**19.8**	**19.8**	**4.00**	**0.32**							**0.00**	**2.01**	**2.01**	**0.56**	**0.88**	**27.59**	**45.00**	**200**	**0.65**	**0.851**	**26.70**	**96.80**
GOLDHAWK DRIVE	**102A**	**102A**	***FT-24 (EX)***					**0.12**	**0.0**	**10630.9**	**2.93**	**126.10**		**14.32**		**0.63**		**0.00**	**12.98**	**0.12**	**203.52**	**56.99**	**388.07**	**389.64**	**102.59**	**600**	**0.37**	**1.335**	**1.57**	**0.40**
HYDRO EASEMENT		***FT-24 (EX)***	***FT-23 (EX)***					**0.00**	**0.0**	**10650.7**	**2.93**	**126.30**		**14.32**		**0.63**		**0.00**	**12.98**	**0.00**	**205.53**	**57.55**	**388.83**	**400.03**	**107.50**	**600**	**0.39**	**1.371**	**11.20**	**2.80**

Design Parameters:

Residential			ICI Areas			Peak Factor
SF	3.3	p/p/u	INST	50,000	L/Ha/day	1.5
TH/SD	2.5	p/p/u	COM	50,000	L/Ha/day	1.5
APT	1.8	p/p/u	IND	35,000	L/Ha/day	MOE Chart
Low	60	p/p/Ha				
Med	75	p/p/Ha				
High	90	p/p/Ha				

Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 350 L/day
3. Infiltration allowance: 0.28 L/s/Ha
4. Residential Peaking Factor:
   Harmon Formula = 1+(14/(4+P^0.5))
   where P = population in thousands

Designed: J.I.M.

Checked: P.K.

Dwg. Reference: 27970 - 501, 501A, 501B

No.	Revision	Date
1.	Submission No. 1 to City of Ottawa	2013-08-29
2.	Submission No. 2 to City of Ottawa	2014-01-22
3.	Submission No. 3 to City of Ottawa	2014-08-22
4.	Submission No. 4 to City of Ottawa	2015-06-15
5.	Submission No. 5 to City of Ottawa	2016-11-10
6.	Submission for MOE Approval	2017-02-10
7.	Resubmission for MOE Approval	2017-07-14

File Reference:	Date:	Sheet No:
27970.5.7.1	2017-07-14	4 of 4

Scale	Project Title	Drawing Title	Sheet No.
N.T.S.	CRT PHASE 4	CONCEPTUAL SANITARY SEWER LAYOUT	FIGURE 3.1

IBI GROUP
400-333 Preston Street
Ottawa, Ontario K1S 5N4 Canada
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ibigroup.com

SANITARY SEWER DESIGN SHEET

CRT LANDS PHASE 4
CITY OF OTTAWA
CRT DEVELOPMENT INC.

LOCATION: STREET	AREA ID	FROM MH	TO MH	RESIDENTIAL: AREA w/ Units (Ha)	UNIT TYPES: SF	TH/SD	Back to Back	Medium Density	AREA w/o Units (Ha)	POPULATION: IND	CUM	RES PEAK FACTOR	PEAK FLOW (L/s)	ICI AREAS: AREA (Ha) INSTITUTIONAL IND	INSTITUTIONAL CUM	COMMERCIAL IND	COMMERCIAL CUM	INDUSTRIAL IND	INDUSTRIAL CUM	ICI PEAK FACTOR	PEAK FLOW (L/s)	INFILTRATION ALLOWANCE: AREA (Ha) IND	CUM	FLOW (L/s)	FIXED FLOW (L/s): IND	CUM	TOTAL FLOW (L/s)	PROPOSED SEWER DESIGN: CAPACITY (L/s)	LENGTH (m)	DIA (mm)	SLOPE (%)	VELOCITY (full) (m/s)	AVAILABLE CAPACITY L/s	AVAILABLE CAPACITY (%)
CRT Phase 4		MH110A	MH105A	41.18	286	336	54	7.26	19.37	2316.6	2316.6	3.03	22.73	0.00	0.0	0.00	0.0	0.00	0.0	1.00	0.00	60.55	60.6	19.98	0.00	0.0	42.72	320.28	120.00	600	0.25	1.097	277.56	86.66%
								ha																										

Design Parameters:

Residential			ICI Areas			
SF	3.3	p/p/u				
TH/SD	2.5	p/p/u	INST	28,000	L/Ha/day	
B2B	1.8	p/p/u	COM	28,000	L/Ha/day	
			IND	35,000	L/Ha/day	MOE Chart
Other	60	p/p/Ha		17000	L/Ha/day	

***Population Density per MSS**

Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 280 L/day 200 L/day
3. Infiltration allowance: 0.33 L/s/Ha
4. Residential Peaking Factor:
   Harmon Formula = 1+(14/(4+(P/1000)^0.5))0.8
   where K = 0.8 Correction Factor
5. Commercial and Institutional Peak Factors based on total area,
   1.5 if greater than 20%, otherwise 1.0

Designed: W.Z.

Checked: D.G.Y.
R.M.

Dwg. Reference: 136944-500

No.	Revision	Date
1.	APSR - Submission No. 1	2022-05-09

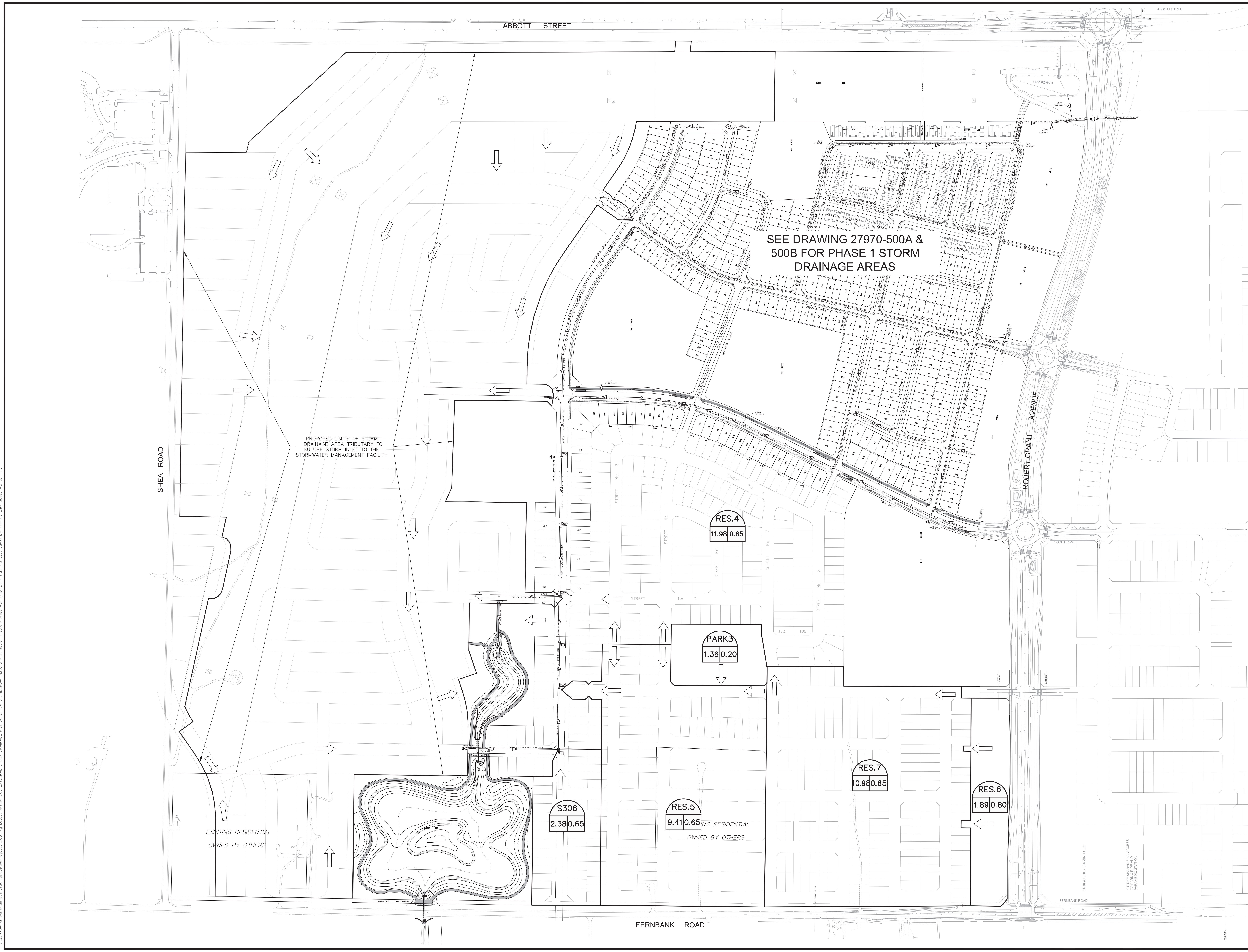
File Reference:	Date:	Sheet No:
136944-6.04.04	2022-05-09	1 of 1

Scale	Project Title	Drawing Title	Sheet No.
N.T.S.	CRT PHASE 4	CONCEPTUAL SANITARY TRIBUTARY AREA PLAN	FIGURE 3.2

IBI

APPENDIX D

- CRT Phase 1 Storm Sewer External Drainage Area Plan
- CRT Phase 1 Storm Sewer Design Sheet
- Figure 4.1 CRT Phase 4 Storm Sewer Layout
- CRT Phase 4 Sanitary Storm design sheet
- Figure 4.2 CRT PHASE 4 Storm Drainage Area Plan
- Excerpt from Fernbank Pond 5



REVIEWED BY
DEVELOPMENT REVIEW SERVICES BRANCH

Signed ______________________

Date ______________________ 2017

Plan Number ______________________

LEGEND :

22 — AREA NUMBER
0.80 — RUN OFF COEFFICIENT
6.53 — AREA IN HECTARES
⇨ FUTURE MINOR FLOW DIRECTION

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7	RESUBMISSION FOR MOE APPROVAL	JIM	17:07:14
6	SUBMISSION FOR MOE APPROVAL	JIM	17:02:10
5	SUBMISSION #5 FOR CITY REVIEW	JIM	16:11:10
4	SUBMISSION #4 FOR CITY REVIEW	JIM	15:06:15
3	SUBMISSION #3 FOR CITY REVIEW	JIM	14:08:22
2	SUBMISSION #2 FOR CITY REVIEW	JIM	14:01:22
1	SUBMISSION #1 FOR CITY REVIEW	JIM	13:08:29

CRT DEVELOPMENT INC.

IBI GROUP
400 – 333 Preston Street
Ottawa ON K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

Project Title

CRT LANDS
FERNBANK COMMUNITY
PHASE 1

LICENSED PROFESSIONAL ENGINEER
J. I. MOFFATT
2017/07/14
PROVINCE OF ONTARIO

Drawing Title

EXTERNAL STORM DRAINAGE
AREA PLAN

Scale 1:2500

Design	J.I.M.	Date	OCTOBER '12
Drawn	M.M.	Checked	P.K.
Project No.	27970	Drawing No.	500

D07-16-11-0003

#17366

IBI GROUP

IBI Group
400-333 Preston Street
Ottawa, Ontario
K1S 5N4

STORM SEWER DESIGN SHEET

PROJECT: CRT DEVELOPMENT
LOCATION: CITY OF OTTAWA
CLIENT: CRT DEVELOPMENT INC.

LOCATION				AREA (Ha)										RATIONAL DESIGN FLOW													SEWER DATA								
STREET	AREA ID	FROM MH	TO MH	C= 0.20	C= 0.55	C= 0.65	C= 0.66	C= 0.75	C= 0.80	C= 0.90	C=	C=	C=	IND 2.78AC	CUM 2.78AC	INLET (min)	TIME IN PIPE	TOTAL (min)	i (5) (mm/hr)	i (10) (mm/hr)	i (100) (mm/hr)	5yr PEAK FLOW (L/s)	10yr PEAK FLOW (L/s)	100yr PEAK FLOW (L/s)	FIXED FLOW (L/s)	DESIGN FLOW (L/s)	CAPACITY (L/s)	LENGTH (m)	PIPE SIZE (mm) DIA	PIPE SIZE (mm) W	PIPE SIZE (mm) H	SLOPE (%)	VELOCITY (m/s)	AVAIL CAP (5yr) (L/s)	AVAIL CAP (5yr) (%)
PUTNEY CRESCENT	---	141	142					0.00						0.00	0.00	10.00	0.12	10.12	104.19	122.14	178.56	0.00				0.00	62.04	8.84	250			1.00	1.224	62.04	100.00%
PUTNEY CRESCENT	R142A, B	142	143		0.33									0.50	0.50	10.12	0.48	10.60	103.56	121.40	177.47	52.25				52.25	139.06	54.71	300			1.90	1.906	86.80	62.42%
PUTNEY CRESCENT	S143	143	144					0.32						0.67	1.17	10.60	0.68	11.28	101.13	118.54	173.26	118.50				118.50	266.03	65.86	450			0.80	1.620	147.53	55.45%
FINSBURY AVENUE	S136B, E, R136A	136	144		0.27			0.44						1.33	1.33	10.00	0.87	10.87	104.19	122.14	178.56	138.60				138.60	154.65	110.07	300			2.35	2.119	16.05	10.38%
PUTNEY CRESCENT	S144, R144A, B, C	144	145		0.57			0.25						1.39	3.89	11.28	0.74	12.02	97.90	114.73	167.68	381.31				381.31	401.29	80.25	525			0.80	1.796	19.98	4.98%
CLAPHAM TERRACE	S136C, D, R136B	136	137		0.23			0.18						0.73	0.73	10.00	0.94	10.94	104.19	122.14	178.56	75.75				75.75	100.88	77.99	300			1.00	1.383	25.14	24.92%
BRIXTON WAY	R137A	137	160		0.11									0.17	0.90	10.94	0.42	11.36	99.48	116.59	170.40	89.05				89.05	224.02	50.00	375			1.50	1.965	134.97	60.25%
BRIXTON WAY	S160A, B	160	145					0.43						0.90	1.79	11.36	0.54	11.90	97.50	114.26	166.98	174.69				174.69	280.40	78.98	375			2.35	2.459	105.71	37.70%
PUTNEY CRESCENT	S145A, B, R145	145	146		0.30			0.55						1.61	7.29	12.02	0.70	12.72	94.61	110.85	161.98	689.86				689.86	821.24	75.47	750			0.50	1.801	131.38	16.00%
CLAPHAM TERRACE	S137A, B, R137B	137	138		0.30			0.27						1.02	1.02	10.00	1.19	11.19	104.19	122.14	178.56	106.45				106.45	129.34	81.01	375			0.50	1.134	22.89	17.70%
PUTNEY CRESCENT	S138, R138	138	148		0.14			0.15						0.53	1.55	11.19	0.67	11.86	98.30	115.20	168.37	152.21				152.21	220.25	78.01	375			1.45	1.932	68.04	30.89%
PUTNEY CRESCENT	S148	148	147					0.22						0.46	2.01	11.86	0.38	12.24	95.28	111.65	163.15	191.25				191.25	297.76	59.30	375			2.65	2.612	106.51	35.77%
PUTNEY CRESCENT	---	147	146					0.00						0.00	2.01	12.24	0.10	12.34	93.68	109.76	160.37	188.02				188.02	332.54	12.13	450			1.25	2.026	144.52	43.46%
BLOCK 324		146	161											0.00	9.30	12.72	0.40	13.12	91.73	107.47	157.01	853.01				853.01	944.29	34.88	900			0.25	1.438	91.28	9.67%
BLOCK 324	R146	161	*Ex. 180*		0.14									0.21	9.51	13.12	0.56	13.68	90.15	105.61	154.28	857.65				857.65	944.29	48.00	900			0.25	1.438	86.65	9.18%
BLOCK 324	RES.1, RES. 2B	BULKHEAD	*Ex. 180*						2.45					5.45	5.45	13.00	0.07	13.07	90.63	106.17	155.11	493.82				493.82	731.45	5.00	900			0.15	1.114	237.62	32.49%
														Refer to ECA No. 9079-9LNNZC dated July 9, 2014 for description of existing sewers.																					

Definitions:
Q = 2.78CiA, where:
Q = Peak Flow in Litres per Second (L/s)
A = Area in Hectares (Ha)
i = Rainfall intensity in millimeters per hour (mm/hr)
[i = 998.071 / (TC+6.053)^0.814] 5 YEAR
[i = 1174.184 / (TC+6.014)^0.816] 10 YEAR
[i = 1735.688 / (TC+6.014)^0.820] 100 YEAR

Notes:
1. Mannings coefficient (n) = 0.013

Designed: J.I.M.
Checked: P.K.
Dwg. Reference: 27970 - 500, 500A, 500B

No.	Revision	Date
1.	Submission No. 1 to City of Ottawa	2013-08-29
2.	Submission No. 2 to City of Ottawa	2014-01-22
3.	Submission No. 3 to City of Ottawa	2014-08-22
4.	Submission No. 4 to City of Ottawa	2015-06-15
5.	Submission No. 5 to City of Ottawa	2016-11-10
6.	Submission for MOE Approval	2017-02-10
7.	Resubmission for MOE Approval	2017-07-14

File Reference:	Date:	Sheet No:
27970.5.7.1	2017-07-14	1 of 3

IBI Group
400-333 Preston Street
Ottawa, Ontario
K1S 5N4

STORM SEWER DESIGN SHEET

PROJECT: CRT DEVELOPMENT
LOCATION: CITY OF OTTAWA
CLIENT: CRT DEVELOPMENT INC.

LOCATION: STREET	LOCATION: AREA ID	FROM MH	TO MH	AREA (Ha) C= 0.20	C= 0.55	C= 0.65	C= 0.66	C= 0.75	C= 0.80	C= 0.90	C=	C=	C=	RATIONAL DESIGN FLOW: IND 2.78AC	CUM 2.78AC	INLET (min)	TIME IN PIPE	TOTAL (min)	i (5) (mm/hr)	i (10) (mm/hr)	i (100) (mm/hr)	5yr PEAK FLOW (L/s)	10yr PEAK FLOW (L/s)	100yr PEAK FLOW (L/s)	FIXED FLOW (L/s)	DESIGN FLOW (L/s)	SEWER DATA: CAPACITY (L/s)	LENGTH (m)	PIPE SIZE (mm) DIA	W	H	SLOPE (%)	VELOCITY (m/s)	AVAIL CAP (5yr) (L/s)	(%)
CLAPHAM TERRACE	S136A	136	135					0.17						0.35	0.35	10.00	1.03	11.03	104.19	122.14	178.56	36.93				36.93	50.02	61.00	250			0.65	0.987	13.09	26.16%
CLAPHAM TERRACE	S135A, B	135	134					0.26						0.54	0.90	11.03	1.08	12.11	99.05	116.08	169.66	88.80				88.80	108.21	61.66	375			0.35	0.949	19.41	17.94%
PUTNEY CRESCENT	---	141	134		0.00									0.00	0.00	10.00	1.31	11.31	104.19	122.14	178.56	0.00				0.00	108.21	74.74	375			0.35	0.949	108.21	100.00%
PUTNEY CRESCENT	S134A, B, C, R134	134	140		0.21			0.39						1.13	2.03	12.11	1.10	13.21	94.22	110.39	161.31	191.34				191.34	265.43	78.10	525			0.35	1.188	74.09	27.91%
OSTERLEY WAY	S153	153	152					0.12						0.25	0.25	10.00	1.04	11.04	104.19	122.14	178.56	26.07				26.07	43.87	53.80	250			0.50	0.866	17.80	40.57%
OSTERLEY WAY	S152A, B	152	151					0.40						0.83	1.08	11.04	1.82	12.85	99.02	116.05	169.61	107.36				107.36	148.72	98.72	450			0.25	0.906	41.36	27.81%
OSTERLEY WAY	S151A, R151A	151	150		0.18			0.10						0.48	1.57	12.85	0.96	13.81	91.21	106.85	156.10	143.00				143.00	170.86	59.71	450			0.33	1.041	27.86	16.30%
OSTERLEY WAY	S150A, B	150	140					0.32						0.67	2.24	13.81	0.91	14.72	87.62	102.63	149.90	195.83				195.83	257.73	63.00	525			0.33	1.153	61.90	24.02%
PUTNEY CRESCENT	S140, R140	140	124		0.21			0.25						0.84	5.11	14.72	0.91	15.63	84.48	98.93	144.48	431.53				431.53	636.13	76.57	750			0.30	1.395	204.60	32.16%
PUTNEY CRESCENT	S149A, B, S129C	149	128					0.22						0.46	0.46	10.00	0.61	10.61	104.19	122.14	178.56	47.79				47.79	62.04	45.00	250			1.00	1.224	14.25	22.96%
BLOCK 343	RES.2A	BULKHEAD	129						0.65					1.45	1.45	13.00	0.27	13.27	90.63	106.17	155.11	131.01				131.01	303.78	13.50	675			0.12	0.822	172.76	56.87%
BOBOLINK RIDGE		129	128					0.00						0.00	1.45	13.00	0.91	13.91	90.63	106.17	155.11	131.01				131.01	303.78	45.00	675			0.12	0.822	172.76	56.87%
BOBOLINK RIDGE	S128A, R128A	128	127		0.14			0.18						0.59	2.49	13.91	1.57	15.49	87.25	102.19	149.26	217.56				217.56	473.55	81.00	825			0.10	0.858	255.99	54.06%
BOBOLINK RIDGE	S127A, R127A	127	126		0.19			0.17						0.64	3.14	15.49	1.51	17.00	82.02	96.05	140.25	257.44				257.44	473.55	78.00	825			0.10	0.858	216.11	45.64%
FINSBURY AVENUE	S151B, C, R151B	151	126		0.20			0.25						0.83	0.83	10.00	0.79	10.79	104.19	122.14	178.56	86.17				86.17	117.21	76.50	300			1.35	1.606	31.04	26.48%
BOBOLINK RIDGE	---	126	125					0.00						0.00	3.97	17.00	0.81	17.81	77.61	90.86	132.63	307.77				307.77	597.22	44.30	900			0.10	0.909	289.46	48.47%
BOBOLINK RIDGE	S125, R125A, B	125	124		0.35			0.39						1.35	5.31	17.81	1.39	19.20	75.45	88.32	128.91	400.95				400.95	739.33	80.07	975			0.10	0.959	338.38	45.77%
BOBOLINK RIDGE	S124, R124A, B	124	123		0.32			0.26						1.03	11.45	19.20	1.23	20.44	72.05	84.32	123.05	825.24				825.24	1,760.81	88.10	1350			0.10	1.192	935.57	53.13%
DAGENHAM STREET	R131	131	130		0.20									0.31	0.31	10.00	0.84	10.84	104.19	122.14	178.56	31.86				31.86	59.68	41.39	300			0.35	0.818	27.82	46.61%
DAGENHAM STREET	S130, R130A, B	130	123		0.33			0.36						1.26	1.56	10.84	1.75	12.59	99.94	117.13	171.20	156.00				156.00	179.46	84.37	525			0.16	0.803	23.46	13.07%
BOBOLINK RIDGE	---	123	122		0.00									0.00	13.01	20.44	0.30	20.74	69.31	81.11	118.33	902.05				902.05	1,760.81	21.46	1350			0.10	1.192	858.77	48.77%
BOBOLINK RIDGE	S122, R122	122	121		0.17			0.31						0.91	13.92	20.74	0.39	21.13	68.68	80.36	117.24	956.05				956.05	3,040.59	39.49	1500			0.17	1.667	2084.54	68.56%
BOBOLINK RIDGE	R121	121	120		0.13									0.20	14.12	21.13	0.37	21.50	67.86	79.41	115.84	958.22				958.22	3,040.59	36.84	1500			0.17	1.667	2082.37	68.49%
ANGEL HEIGHTS	---	111	112		0.00									0.00	0.00	10.00	0.27	10.27	104.19	122.14	178.56	0.00				0.00	42.08	13.58	250			0.46	0.830	42.08	100.00%
ANGEL HEIGHTS	S112, R112A, B	112	113		0.20			0.27						0.87	0.87	10.27	1.68	11.95	102.77	120.47	176.10	89.29				89.29	139.51	85.60	450			0.22	0.850	50.22	36.00%
DAGENHAM STREET	PARK1	DICB	132	1.27										0.71	0.71	12.00	0.29	12.29	94.70	110.96	162.13	66.87				66.87	100.88	23.70	300			1.00	1.383	34.02	33.72%
DAGENHAM STREET	S132	132	113					0.24						0.50	1.21	12.29	0.55	12.83	93.49	109.54	160.05	112.80				112.80	210.32	42.00	450			0.50	1.281	97.52	46.37%
ANGEL HEIGHTS	S113	113	114					0.30						0.63	1.49	12.83	0.85	13.68	91.29	106.94	156.24	136.40				136.40	248.09	43.13	600			0.15	0.850	111.69	45.02%
ANGEL HEIGHTS	S114, R114	114	120		0.50			0.24						1.26	2.76	13.68	1.43	15.11	88.09	103.18	150.72	243.05				243.05	367.27	69.17	750			0.10	0.805	124.22	33.82%
BOBOLINK RIDGE	S120	120	105					0.28						0.58	17.46	21.50	0.96	22.45	67.13	78.54	114.57	1,172.18				1,172.18	3,040.59	95.64	1500			0.17	1.667	1868.41	61.45%
ANGEL HEIGHTS	S101	101	102					0.20						0.42	0.42	10.00	0.52	10.52	104.19	122.14	178.56	43.45				43.45	129.34	35.48	375			0.50	1.134	85.89	66.41%
GOLDHAWK DRIVE	R102	102	103		0.21									0.32	0.74	10.52	0.83	11.35	101.52	118.99	173.93	74.93				74.93	126.19	38.36	450			0.18	0.769	51.26	40.62%
GOLDHAWK DRIVE	S103, R103A, B	103	104		0.50			0.34						1.47	2.21	11.35	1.01	12.36	97.55	114.32	167.07	215.73				215.73	303.78	49.62	675			0.12	0.822	88.05	28.98%
GOLDHAWK DRIVE	S104, R104A, B, C	104	105		0.59			0.30						1.53	3.74	12.36	1.35	13.71	93.19	109.19	159.53	348.45				348.45	473.55	69.59	825			0.10	0.858	125.10	26.42%
GOLDHAWK DRIVE	S105A, S105B, R105	105	107		0.13	0.90								1.83	23.03	22.45	1.31	23.77	65.29	76.38	111.40	1,503.33				1,503.33	5,720.16	126.10	2100			0.10	1.600	4216.82	73.72%
GOLDHAWK DRIVE	S107	107	109			0.61								1.10	24.13	23.77	1.17	24.94	62.94	73.62	107.36	1,518.58				1,518.58	5,720.16	112.64	2100			0.10	1.600	4201.58	73.45%
GOLDHAWK DRIVE	S109	109	110			0.52								0.94	25.07	24.94	0.67	25.62	60.99	71.33	104.01	1,528.92				1,528.92	5,720.16	64.64	2100			0.10	1.600	4191.24	73.27%

Definitions:
Q = 2.78CiA, where:
Q = Peak Flow in Litres per Second (L/s)
A = Area in Hectares (Ha)
i = Rainfall intensity in millimeters per hour (mm/hr)
[i = 998.071 / (TC+6.053)^0.814] 5 YEAR
[i = 1174.184 / (TC+6.014)^0.816] 10 YEAR
[i = 1735.688 / (TC+6.014)^0.820] 100 YEAR

Notes:
1. Mannings coefficient (n) = 0.013

Designed: J.I.M.
Checked: P.K.
Dwg. Reference: 27970 - 500, 500A, 500B

No.	Revision	Date
1.	Submission No. 1 to City of Ottawa	2013-08-29
2.	Submission No. 2 to City of Ottawa	2014-01-22
3.	Submission No. 3 to City of Ottawa	2014-08-22
4.	Submission No. 4 to City of Ottawa	2015-06-15
5.	Submission No. 5 to City of Ottawa	2016-11-10
6.	Submission for MOE Approval	2017-02-10
7.	Resubmission for MOE Approval	2017-07-14

File Reference:	Date:	Sheet No:
27970.5.7.1	2017-07-14	2 of 3

IBI GROUP

IBI Group
400-333 Preston Street
Ottawa, Ontario
K1S 5N4

STORM SEWER DESIGN SHEET

PROJECT: CRT DEVELOPMENT
LOCATION: CITY OF OTTAWA
CLIENT: CRT DEVELOPMENT INC.

LOCATION				AREA (Ha)										RATIONAL DESIGN FLOW													SEWER DATA								
STREET	AREA ID	FROM MH	TO MH	C= 0.20	C= 0.55	C= 0.65	C= 0.66	C= 0.75	C= 0.80	C= 0.90	C=	C=	C=	IND 2.78AC	CUM 2.78AC	INLET (min)	TIME IN PIPE	TOTAL (min)	i (5) (mm/hr)	i (10) (mm/hr)	i (100) (mm/hr)	5yr PEAK FLOW (L/s)	10yr PEAK FLOW (L/s)	100yr PEAK FLOW (L/s)	FIXED FLOW (L/s)	DESIGN FLOW (L/s)	CAPACITY (L/s)	LENGTH (m)	PIPE SIZE (mm) DIA	W	H	SLOPE (%)	VELOCITY (m/s)	AVAIL CAP (5yr) (L/s)	(%)
EMBANKMENT STREET	S128B, R128B	128	188		0.09			0.31						0.78	0.78	10.00	1.76	11.76	104.19	122.14	178.56	81.68				81.68	108.21	100.00	375			0.35	0.949	26.53	24.52%
EMBANKMENT STREET	S188, R188A, B	188	189		0.19			0.30						0.92	1.70	11.76	0.97	12.72	95.75	112.20	163.96	162.77				162.77	210.32	74.32	450			0.50	1.281	47.54	22.61%
BLOCK 344	RES.3	BULKHEAD	189						1.58					3.51	3.51	13.95	0.66	14.61	87.11	102.03	149.03	306.10				306.10	402.33	35.00	750			0.12	0.882	96.23	23.92%
EMBANKMENT STREET	S189, R189	189	190		0.09			0.28						0.72	5.94	14.61	1.69	16.30	84.83	99.35	145.10	503.52				503.52	739.33	97.00	975			0.10	0.959	235.81	31.89%
EMBANKMENT STREET	S190	190	176					0.05						0.10	6.04	16.30	0.20	16.50	79.59	93.19	136.05	480.69				480.69	739.33	11.54	975			0.10	0.959	258.64	34.98%
COPE DRIVE	S177, R177	177	176		0.08			0.14						0.41	0.41	10.00	1.17	11.17	104.19	122.14	178.56	43.16				43.16	59.68	57.46	300			0.35	0.818	16.52	27.69%
BLOCK 345 (SCHOOL)	INST.2	BULKHEAD	176						6.57					14.61	14.61	12.00	0.15	12.15	94.70	110.96	162.13	1,383.66				1,383.66	1,575.26	12.00	1200			0.15	1.349	191.60	12.16%
COPE DRIVE	S176	176	175					0.14						0.29	21.36	16.50	1.05	17.55	79.01	92.51	135.05	1,687.52				1,687.52	2,332.02	80.65	1500			0.10	1.278	644.51	27.64%
COPE DRIVE	S175, R175	175	174		0.36			0.42						1.43	22.78	17.55	1.12	18.67	76.14	89.13	130.09	1,734.64				1,734.64	2,332.02	86.28	1500			0.10	1.278	597.38	25.62%
FINSBURY AVENUE	S182A,B, R182A,B,C	182	183		0.58			0.58						2.10	2.10	10.00	1.57	11.57	104.19	122.14	178.56	218.40				218.40	283.76	119.30	525			0.40	1.270	65.35	23.03%
PINNER ROAD	S191, R191A	191	186		0.19			0.60						1.54	1.54	10.00	0.55	10.55	104.19	122.14	178.56	160.61				160.61	378.96	43.00	600			0.35	1.298	218.35	57.62%
BELSIZE WAY	S127B, R127B, C	127	185		0.41			0.26						1.17	1.17	10.00	1.31	11.31	104.19	122.14	178.56	121.80				121.80	188.11	90.00	450			0.40	1.146	66.31	35.25%
BELSIZE WAY	---	185	186											0.00	1.17	11.31	1.29	12.60	97.75	114.56	167.42	114.27				114.27	175.96	82.92	450			0.35	1.072	61.69	35.06%
PINNER ROAD	S186, R186	186	187		0.23			0.23						0.83	3.54	12.60	1.38	13.97	92.21	108.04	157.85	326.60				326.60	473.55	70.83	825			0.10	0.858	146.95	31.03%
PINNER ROAD	---	187	183					0.00						0.00	3.54	13.97	0.19	14.17	87.03	101.93	148.88	308.22				308.22	473.55	10.00	825			0.10	0.858	165.33	34.91%
FINSBURY AVENUE	S183, R183	183	184		0.22			0.24						0.84	6.47	14.17	1.14	15.30	86.34	101.13	147.71	559.05				559.05	900.87	68.70	1050			0.10	1.008	341.82	37.94%
FINSBURY AVENUE	---	184	174					0.00						0.00	6.47	15.30	0.32	15.62	82.59	96.71	141.22	534.72				534.72	900.87	19.07	1050			0.10	1.008	366.15	40.64%
COPE DRIVE	S174, R174	174	173		0.12			0.25						0.70	29.96	18.67	0.94	19.61	73.30	85.80	125.21	2,196.41				2,196.41	3,792.13	81.44	1800			0.10	1.444	1595.72	42.08%
COPE DRIVE	S173	173	172					0.29						0.60	30.57	19.61	0.84	20.46	71.11	83.22	121.43	2,173.69				2,173.69	3,792.13	73.01	1800			0.10	1.444	1618.44	42.68%
BLOCK 313 (SCHOOL)	INST.1	BULKHEAD	172						2.88					6.41	6.41	12.00	0.25	12.25	94.70	110.96	162.13	606.54				606.54	755.43	17.02	900			0.16	1.150	148.90	19.71%
COPE DRIVE	S172	172	171					0.23						0.48	37.45	20.46	0.93	21.39	69.27	81.05	118.25	2,594.13				2,594.13	3,792.13	80.84	1800			0.10	1.444	1198.00	31.59%
DAGENHAM STREET	S180A,B, R180A	180	181		0.09			0.37						0.91	0.91	10.00	1.42	11.42	104.19	122.14	178.56	94.72				94.72	245.74	94.00	525			0.30	1.100	151.02	61.46%
DAGENHAM STREET	S181, R181	181	171		0.09			0.14						0.43	1.34	11.42	1.23	12.66	97.23	113.94	166.51	130.14				130.14	286.47	72.50	600			0.20	0.982	156.32	54.57%
COPE DRIVE	S171	171	170					0.26						0.54	39.33	21.39	0.94	22.33	67.34	78.79	114.94	2,648.73				2,648.73	3,792.13	81.06	1800			0.10	1.444	1143.40	30.15%
BLOCK 312	RES.3A	CBMH549	sewer				3.26							5.98	5.98	12.00	0.22	12.22	94.70	110.96	162.13	566.42				566.42	844.60	16.74	900			0.20	1.286	278.18	32.94%
COPE DRIVE	S170A,B	170	110					0.33						0.69	46.00	22.33	1.33	23.66	65.53	76.66	111.82	3,014.45				3,014.45	4,694.42	121.89	1950			0.10	1.523	1679.97	35.79%
GOLDHAWK DRIVE	S110B	110	205			0.47								0.85	71.92	25.62	0.83	26.45	59.93	70.09	102.19	4,310.29				4,310.29	11,180.46	94.32	2700			0.10	1.892	6870.17	61.45%
														0.00																					
GOLDHAWK DRIVE	INST.3	BULKHEAD	205						2.47					5.49	5.49	12.00	0.17	12.17	94.70	110.96	162.13	520.19				520.19	620.09	17.00	675			0.50	1.679	99.90	16.11%
GOLDHAWK DRIVE	205A, 205B	205	206			1.46								2.64	80.05	26.45	0.94	27.39	58.68	68.62	100.04	4,697.53				4,697.53	11,180.46	107.00	2700			0.10	1.892	6482.93	57.98%
GOLDHAWK DRIVE	S206	206	207			0.84								1.52	81.57	27.39	0.90	28.29	57.33	67.04	97.72	4,676.48				4,676.48	11,726.17	107.16	2700			0.11	1.984	7049.69	60.12%
														0.00																					
STREET NO. 2	RES. 4, 6 & 7		207			22.96			1.89					45.69	45.69	10.00	0.83	10.83	104.19	122.14	178.56	4,760.80				4,760.80	5,720.16	80.00	2100			0.10	1.600	959.36	16.77%
STREET NO. 2	S305	305	CULVERT			0.03								0.05	0.05												13,335.43	22.00	1500			3.27	7.311	13335.43	100.00%
STREET NO. 26	S304	304	CULVERT			0.03								0.05	0.05												12,579.97	22.00	1500			2.91	6.896	12579.97	100.00%
FUTURE STREET	S304B	304	303			0.69								1.25	1.25												5,720.16	98.94	2100			0.10	1.600	5720.16	100.00%
GOLDHAWK DRIVE	S303, S306	303	302			3.19								5.76	7.01												5,720.16	94.58	2100			0.10	1.600	5720.16	100.00%
GOLDHAWK DRIVE	S302,Park3,Res 5	302	301	1.36		10.06								18.93	25.95	These pipes are sized by stormwater modeling (See Design Brief-Fernbank Pond 5 Stormwater Management Facility Report)											5,720.16	70.65	2100			0.10	1.600	5720.16	100.00%
GOLDHAWK DRIVE	S301	301	207			0.49								0.89	26.83												5,720.16	70.00	2100			0.10	1.600	5720.16	100.00%
STREET NO. 25	---	207	300											0.00	154.09												2,332.02	93.73	1500			0.10	1.278	2332.02	100.00%
POND		300	HEADWALL	9.21		52.74								100.42	254.51												3,006.86	75.63	1650			0.10	1.362	3006.86	100.00%

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Q = Peak Flow in Litres per Second (L/s)
A = Area in Hectares (Ha)
i = Rainfall intensity in millimeters per hour (mm/hr)
[i = 998.071 / (TC+6.053)^0.814] 5 YEAR
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Notes:
1. Mannings coefficient (n) = 0.013

Designed: J.I.M.
Checked: P.K.
Dwg. Reference: 27970 - 500, 500A, 500B

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File Reference:	Date:	Sheet No:
27970.5.7.1	2017-07-14	3 of 3

Scale	Project Title	Drawing Title	Sheet No.
N.T.S.	CRT PHASE 4	CONCEPTUAL STORM SEWER LAYOUT	FIGURE 4.1

IBI

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STORM SEWER DESIGN SHEET

CRT LANDS PHASE 4
CITY OF OTTAWA
CRT DEVELOPMENT INC.

LOCATION				AREA (Ha)										RATIONAL DESIGN FLOW															SEWER DATA									
STREET	AREA ID	FROM	TO	C= 0.20	C= 0.25	C= 0.40	C= 0.50	C= 0.57	C= 0.65	C= 0.70	C= 0.70	C= 0.76	C= 0.80	IND 2.78AC	CUM 2.78AC	INLET (min)	TIME IN PIPE	TOTAL (min)	i (2) (mm/hr)	i (5) (mm/hr)	i (10) (mm/hr)	i (100) (mm/hr)	2yr PEAK FLOW (L/s)	5yr PEAK FLOW (L/s)	10yr PEAK FLOW (L/s)	100yr PEAK FLOW (L/s)	FIXED FLOW IND	FIXED FLOW CUM	DESIGN FLOW (L/s)	CAPACITY (L/s)	LENGTH (m)	PIPE SIZE (mm) DIA	PIPE SIZE (mm) W	PIPE SIZE (mm) H	SLOPE (%)	VELOCITY (m/s)	AVAIL CAP (2yr) (L/s)	AVAIL CAP (2yr) (%)
	MH32	MH32	MH31								2.02			3.93	3.93	15.00	3.47	18.47	61.77	83.56	97.85	142.89	242.80	328.46	384.65	561.71	0.00	0.00	242.80	385.20	175.90	750			0.11	0.845	142.39	36.97%
	MH31, BLK310	MH31	MH30	3.06							3.04			7.62	11.55	18.47	1.37	19.84	54.63	73.80	86.38	126.06	630.86	852.21	997.49	1,455.75	0.00	0.00	630.86	944.84	87.07	1050			0.11	1.057	313.98	33.23%
	MH30	MH30	MH28								3.87			7.53	19.08	19.84	5.62	25.46	52.28	70.60	82.62	120.54	997.54	1,346.91	1,576.24	2,299.89	0.00	0.00	997.54	1,348.97	389.60	1200			0.11	1.155	351.43	26.05%
	MH29, BLK309, 314-317	MH29	MH28	6.34						7.25		0.59		18.88	18.88	25.46	1.49	26.95	44.63	60.17	70.37	102.59	842.64	1,135.95	1,328.54	1,936.95	0.00	0.00	842.64	1,348.97	103.26	1200			0.11	1.155	506.33	37.53%
		MH28	MH27											0.00	37.96	26.95	1.45	28.40	43.00	57.95	67.76	98.78	1,632.24	2,199.62	2,572.20	3,749.45	0.00	0.00	1,632.24	2,445.85	116.40	1500			0.11	1.341	813.61	33.27%
	MH26, BLK290	MH26	MH27		4.11						1.61			5.99	5.99	28.40	0.90	29.30	41.54	55.96	65.43	95.36	248.79	335.16	391.88	571.14	0.00	0.00	248.79	385.20	45.77	750			0.11	0.845	136.41	35.41%
	MH27, MH27E, BLK289S	MH27	MH20							1.04	3.18			8.21	52.16	29.30	1.90	31.20	40.68	54.79	64.06	93.35	2,121.87	2,857.99	3,341.41	4,869.37	0.00	0.00	2,121.87	3,153.62	162.72	1650			0.11	1.429	1031.76	32.72%
	MH30, MH20E	MH20	MH16							1.61	1.42			5.90	58.06	31.20	1.75	32.95	39.00	52.51	61.38	89.43	2,264.16	3,048.49	3,563.60	5,192.08	0.00	0.00	2,264.16	3,153.62	150.11	1650			0.11	1.429	889.46	28.20%
	MH04, MH04E, BLK308	MH04	MH01	5.86						2.29	3.18			13.90	13.90	32.95	3.96	36.91	37.58	50.58	59.12	86.12	522.46	703.22	821.94	1,197.33	0.00	0.00	522.46	775.41	239.15	975			0.11	1.006	252.95	32.62%
	MH01	MH01	MH08								1.35			2.63	16.53	36.91	0.84	37.75	34.76	46.75	54.63	79.55	574.54	772.79	903.01	1,314.92	0.00	0.00	574.54	4,923.55	80.37	1950	Upsized for swm overflow		0.11	1.597	4349.02	88.33%
	MH08, MH08E	MH08	MH16							2.26	1.96			8.21	24.74	37.75	1.56	39.31	34.22	46.02	53.77	78.30	846.65	1,138.66	1,330.46	1,937.19	0.00	0.00	846.65	5,999.35	156.82	2100	Upsized for swm overflow		0.11	1.678	5152.70	85.89%
	MH16E	MH16	MH15							0.59				1.15	83.95	39.31	0.97	40.28	33.27	44.73	52.26	76.08	2,792.70	3,755.04	4,387.14	6,386.92	0.00	0.00	2,792.70	3,153.62	82.85	1650			0.11	1.429	360.92	11.44%
	MH15, BLK301	MH15	*MH300*							1.04	2.88			7.63	91.58	40.28	0.84	41.12	32.71	43.97	51.37	74.78	2,995.06	4,026.57	4,704.11	6,847.80	0.00	0.00	2,995.06	3,153.62	71.94	1650			0.11	1.429	158.56	5.03%
		MH300	*POND*											0.00	91.58	41.12	0.98	42.09	This pipe is sized by stormwater modeling. (See Design Brief - Fernbank Pond 5 SWM Facility Report)											2,852.56	75.79	*1650*			*0.09*	*1.292*		
														91.58	TRUE																							

Definitions:
Q = 2.78CiA, where:
Q = Peak Flow in Litres per Second (L/s)
A = Area in Hectares (Ha)
i = Rainfall intensity in millimeters per hour (mm/hr)
[i = 732.951 / (TC+6.199)^0.810] 2 YEAR
[i = 998.071 / (TC+6.053)^0.814] 5 YEAR
[i = 1174.184 / (TC+6.014)^0.816] 10 YEAR
[i = 1735.688 / (TC+6.014)^0.820] 100 YEAR

Notes:
1. Mannings coefficient (n) = 0.013

Designed: W.Z.

Checked: D.G.Y.
R.M.

Dwg. Reference: 136944-500

No.	Revision	Date
1.	APSR - Submission No. 1	2022-05-09

File Reference:	Date:	Sheet No:
136944-6.04.04	2022-05-09	1 of 1

Scale	Project Title	Drawing Title	Sheet No.
N.T.S.	CRT PHASE 4	CONCEPTUAL STORM TRIBUTARY AREA PLAN	FIGURE 4.2

Report
27970-5.2.3

FERNBANK POND 5 STORMWATER MANAGEMENT FACILITY REPORT AND DESIGN BRIEF

Prepared for CRT DEVELOPMENT INC
by IBI GROUP
Revision 6 - March 2016
Revision 7 - May 2016

7.5 Additional Features

The following additional features are incorporated into the SWM facility design for maintenance or aesthetic purposes. The features are detailed on **DWG-711**.

- 3 m wide asphalt service road with 1 m reinforced grass on each side
- 5 m wide reinforced grass for maintenance access
- Galvanized railings on all headwall and outlet structures (300 mm above the permanent water level)
- Stop log gains on the first flush headwall structures and the outlet structure
- Debris grate on the first flush headwall
- Sluice gate on outlet structure to facilitate maintenance
- Sluice gates with 2 inch square bolt and non-rising stem
- Armour stone wall north and south of the box culvert connecting the sediment forebay to the wet cell

7.6 Summary of Pond 5 SWM Facility Performance

As discussed in **Section 6**, the hydraulic evaluation of the SWM facility (pond 5) was undertaken using the XPSWMM model. The XPSWMM model contains the proposed SWM facility; the improved Flewellyn Drain; and a detailed sewer system for Phase 1. The characteristics and performance of the SWM facility are presented in **Table 10**. The stage-storage and stage-outflow curves for Pond 5 are presented in **Appendix C.**

Table 10: Performance of the CRT Lands Fernbank Pond 5 SWM Facility

Storm Event		Extended Storage (m^3)*	Discharge (cms)	SWM Facility Elevation (m)
Permanent Storage:		35896.23	N/A	N/A
25 mm 4 hr Chicago Storm		14684.72	0.15	103.00
24 hour SCS Type II	2 year	30129.25	0.38	103.68
	5 year	37014.46	0.97	103.68
	100 year	60658.51	3.60	104.32
100 year 3 hour Chicago		54886.19	2.82	104.17
5 year 3 hour Chicago		30470.25	0.42	103.49
Sensitivity Analysis				
Aug-88	Historical	58698.62	3.32	104.27
Aug-96	Historical	52622.53	2.56	104.11
Jul-79	Historical	64907.11	4.90	104.43
100 year 24 Hour SCS Type II – 20% increase in intensity		68484.84	6.15	104.52

* Extended storage is the total storage used in the wet cell plus the sediment forebay

APPENDIX E

- Figure 6.1 – Macro Grading
- EMP excerpts infiltration
- EMP Based Infiltration Calculation Sheet
- Paterson Group Recommend Post Development Infiltration Memo

Scale

N.T.S.

Project Title

CRT
PHASE 4

Drawing Title

CONCEPTUAL MACRO GRADING

Sheet No.

FIGURE 6.1

8.1.3 Infiltration Best Management Practices

Infiltration of surface runoff is best accomplished through lot level and conveyance controls. However care must be taken to ensure that infiltration measures are suitable for the proposed type of development and soil conditions:

- Infiltration of runoff containing high concentrations of sediment can result in clogging of the pores in the soil, thereby reducing its infiltration capacity.
- Infiltration should be avoided in areas where there is potential for surface spills, which would potentially result in contamination of groundwater.

The majority of the Fernbank Community will be low and medium density residential development. The most suitable practices for groundwater infiltration include:

- Infiltration of runoff captured by rearyard catchbasins.
- Direct roof leaders to rearyard areas.
- Infiltration trenches underlying drainage swales in park and open space areas.
- The use of fine sandy loam topsoil in parks and on residential lawns.

By implementing infiltration BMPs as part of the storm drainage design for the Fernbank Community, the impacts of development on the hydrologic cycle can be considerably reduced. Infiltration of clean runoff will have additional benefits for stormwater management. By reducing the volume of "clean" water conveyed to the SWM facilities, the performance of the SWM facilities will be increased.

<u>Modeling of Infiltration BMPs</u>

The methodology used to incorporate infiltration BMPs into the SWMHYMO model have been developed based on the MOE design guidelines outlined in the *SWM Planning and Design Manual* (MOE, 2003). Details of this methodology are provided in **Appendix G.**

8.2 Results of Post Development Hydrologic Analysis - Event Based

The 12-hour SCS distribution generated the highest peak flows for lands in the Carp River subwatershed in the existing conditions analysis, and consequently was used as the benchmark for analysis of the SWM facilities in the Carp River Subwatershed. The use of the 12-hour SCS distribution is consistent with the design event used in the HEC-RAS analysis of the Carp River.

The 24-hour SCS distribution generated the highest peak flows for lands in the Jock River subwatershed in the existing conditions analysis, and consequently was used as the benchmark for analysis of the SWM facilities in the Jock River Subwatershed.

The results of the hydrologic analysis are summarized in **Tables 8-2 and 8-3**. Pre vs. post-development hydrographs for the 100-year storm events are provided as **Figures 8.2 - 8.7**. SWMHYMO modeling files and pre vs. post-development hydrographs (2 - 100yr) are provided in **Appendix D.**

8.4.5 Erosion Analysis Results

The largest increase in duration of flows exceeding the erosion threshold occurs in the Flewellyn Drain at Flewellyn Road for the year 1986 (refer to **Table 8-6**). Erosive flows occurred for an additional 26 hours which represents a 0.4% increase of the total annual flow volume above the erosion threshold (from model results), and a 0.4% increase in duration of annual flow above the erosion threshold (refer to calculations below).

<u>Ex. Flewellyn Drain @ Flewellyn Road (1986)</u>	
Duration of Flows above erosion threshold (existing conditions)	132 hrs
Duration of Flows above erosion threshold (post-development)	158 hrs
Increase in duration above erosion threshold (pre vs. post)	158 - 132 = 26 hrs 26 hrs = 1.1 days
Number of Days in Simulation	245 days
% Increase in Duration of Flows above Erosion Threshold	1.1 / 245 = 0.4%

The results of the erosion analysis for all outlet watercourses indicate that the proposed SWM Facilities will ensure that there is no increase in erosion potential resulting from the proposed development.

8.5 Groundwater Infiltration & Water Balance

The hydrogeologic conditions of the Fernbank Community are described in terms of infiltration potentials, groundwater recharge and discharge, and the groundwater flow systems. Infiltration rates are controlled by the nature of the surface and near-surface materials.

The hydrogeologic conditions of the Fernbank Community will be altered by the increase in hard surfaces and the increased efficiency of stormwater conveyance resulting from the proposed development. The net result will be a reduction in groundwater infiltration, which can potentially result in a reduction in the groundwater table, reduction of baseflow in watercourses, reduced well capacities and consolidation of the overburden, among other impacts.

8.5.1 Water Balance

A water balance has been completed for the Fernbank CDP lands to provide an estimate of infiltration under both existing conditions and post-development conditions. Infiltration, evapotranspiration, and runoff values used in the water balance calculations for the Fernbank Community have been established based on the results of the hydrogeologic and geotechnical investigations completed as part of the existing conditions analysis, in conjunction with values used in previous studies in the area (Robinson, 2001; MMM & WESA, 2005). Hydrologic cycle component values used for the Fernbank Community are provided in **Table 8-10**.

Table 8-10: Water Balance - Hydrologic Cycle Component Values

Land Use	Soil Type	Annual Precipitation: 944 mm		
		ET (mm)	INFIL (mm)	RUNOFF (mm)
Pasture / Meadow / Open Space	Beach Formations (Sand / Sand & Gravel)	510	300	134
	Fine to Medium Sand	520	250	174
	Thick Organic Deposits (Peat)	530	175	239
	Sensitive Marine Silty Clay	530	100	314
	Thin Discontinuous Organic Deposits	530	135	279
	Paleozolic Bedrock	530	120	294
	Glacial Till	530	73	341
Agricultural	Beach Formations (Sand / Sand & Gravel)	400	290	254
	Fine to Medium Sand	410	230	304
	Thick Organic Deposits (Peat)	420	160	364
	Sensitive Marine Silty Clay	420	110	414
	Thin Discontinuous Organic Deposits	420	130	394
	Paleozolic Bedrock	420	125	399
	Glacial Till	420	80	444
Woodland	Beach Formations (Sand / Sand & Gravel)	530	310	104
	Fine to Medium Sand	540	275	129
	Thick Organic Deposits (Peat)	550	220	174
	Sensitive Marine Silty Clay	550	150	244
	Thin Discontinuous Organic Deposits	550	145	249
	Paleozolic Bedrock	550	140	254
	Glacial Till	550	125	269
Urban Grassed Area (no BMPs)	Beach Formations (Sand / Sand & Gravel)	495	290	159
	Fine to Medium Sand	510	230	204
	Thick Organic Deposits (Peat)	525	160	259
	Sensitive Marine Silty Clay	525	145	274
	Thin Discontinuous Organic Deposits	525	130	289
	Paleozolic Bedrock	525	125	294
	Glacial Till	525	90	329
Urban Grassed Area (with Infiltration BMPs)	Beach Formations (Sand / Sand & Gravel)	300	580	64
	Fine to Medium Sand	400	460	84
	Thick Organic Deposits (Peat)	490	320	134
	Sensitive Marine Silty Clay	480	290	174
	Thin Discontinuous Organic Deposits	460	260	224
	Paleozolic Bedrock	500	250	194
	Glacial Till	480	180	284
Water / Wetland / SWMF	Clay / Silty Clay	660	50	234
Impervious Areas	N/A	194	0	750

The surficial soils underlying the majority of the Fernbank Lands are comprised of relatively impervious Paleozoic bedrock, sensitive marine clay, and glacial till and infiltration rates are quite low throughout the study area.

The impervious values used in the water balance calculations have been established based on the proposed land use areas shown on the demonstration land use plan. Standard imperviousness values from the City of Ottawa design guidelines were assigned for each land use and used to calculate an average imperviousness for each drainage basin.

The use of stormwater management Best Management Practices (BMPs) is encouraged to help minimize the impact of development on the hydrologic cycle. The native soils on-site are relatively impermeable, which results in a relatively low annual infiltration. Infiltration BMPs will not increase the infiltration rate of the native soil, but will promote the retention of storm runoff, thereby increasing the amount of runoff available for infiltration.

Recommended stormwater management BMPs are listed in **Section 8.1.3**. Infiltration BMPs were accounted for in the water balance calculations using the following methodology:

- Assume infiltration BMPs will double the amount of annual infiltration.

  i.e. Urban grassed areas with clay soil will have an average annual infiltration of approximately 145 mm/yr (refer to **Table 8-10**). With infiltration BMPs, average annual infiltration was assumed at 290 mm/yr.

The post-development water balance calculations have been completed for two scenarios:

1) Urban development with no infiltration BMPs.
2) Urban development with infiltration BMPs implemented over approximately 70% of the urban grassed areas.

8.5.2 Water Balance Results

Water balance calculations have been completed for the Carp, Faulkner, Flewellyn, and Monahan drainage areas. The results of the water balance analysis are summarized in **Tables 8-11 to 8-14**. Calculations are provided in **Appendix G.**

Table 8-11: Water Balance - Carp River Drainage Area

Component	Pre-Development	Post-Development, 43% Impervious			
		No Infiltration BMPs		With Infiltration BMPs	
	(mm/yr)	(mm/yr)	(% Change)	(mm/yr)	(% Change)
Precipitation	944	944	-	944	-
Evapotranspiration	437	393	10% Decrease	384	12% Decrease
Infiltration	112	70	38% Decrease	112	0%
Runoff	395	481	22% Increase	448	13% Increase

Table 8-12: Water Balance - Faulkner Drainage Area

Component	Pre-Development	Post-Development, 44% Impervious			
		No Infiltration BMPs		With Infiltration BMPs	
	(mm/yr)	(mm/yr)	(% Change)	(mm/yr)	(% Change)
Precipitation	944	944	0%	944	0%
Evapotranspiration	554	386	30% Decrease	375	32% Decrease
Infiltration	109	69	37% Decrease	100	8% Decrease
Runoff	281	489	74% Increase	469	67% Increase

Table 8-13: Water Balance - Flewellyn Drainage Area

Component	Pre-Development (mm/yr)	Post-Development, 38% Impervious			
		No Infiltration BMPs		With Infiltration BMPs	
		(mm/yr)	(% Change)	(mm/yr)	(% Change)
Precipitation	944	944	0%	944	0%
Evapotranspiration	486	406	17% Decrease	391	20% Decrease
Infiltration	107	68	37% Decrease	107	0%
Runoff	351	470	34% Increase	446	27% Increase

Table 8-14: Water Balance - Monahan Drainage Area

Component	Pre-Development (mm/yr)	Post-Development, 47% Impervious			
		No Infiltration BMPs		With Infiltration BMPs	
		(mm/yr)	(% Change)	(mm/yr)	(% Change)
Precipitation	944	944	0%	944	0%
Evapotranspiration	429	381	11% Decrease	368	14% Decrease
Infiltration	110	75	31% Decrease	114	4% Increase
Runoff	405	488	20% Increase	462	14% Increase

8.5.3 Water Balance Targets

The results of the water balance calculations indicate that there will be a change in the hydrologic cycle resulting from the proposed development. Changes in runoff and infiltration can potentially have adverse impacts on ground and surface water resources. Changes in evapotranspiration can have an impact on climate over a very large area in conjunction with other factors, but will have negligible impact on local hydrologic conditions.

Runoff

The increase in storm runoff will be accounted for by the proposed stormwater management facilities. The SWM facilities will control post-development flows to ensure that the outlet watercourses are not adversely impacted by the increase in runoff (water quality, peak flows, thermal impacts, flood risk, erosion potential). The increase in storm runoff will provide an opportunity for baseflow enhancement in the outlet watercourses.

Infiltration

The recommended infiltration target is to match pre-development infiltration rates. The water balance analysis indicates that maintaining annual pre-development infiltration should be achievable through the use of infiltration best management practices.

The types, locations, and suitability of infiltration BMPs will be dependant on site specific details and land use. Water balance targets will need to be evaluated and confirmed on a case-by-case basis as development plans are brought forward.

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INFILTRATION ANALYSIS

CRT PHASE 4
CITY OF OTTAWA
CRT DEVELOPMENTS INC.
2022-04-29

	Rate (mm/yr per EMP)	Total Area (ha)		%	Annual Infiltration Volume (m3)
Pre-Development Infiltration based on EMP	107	62.90		100%	67300

	Rate (mm/yr per EMP)	Total Area (ha)	% of Total Area	% of subarea for infiltration	Annual Infiltration Volume (m3)
Post Development BMP Infiltration (Rear Yard Areas only - 80% of Area with Native Glacial Till as subgrade)	90	32.02	80%	40%	9222
Post Development BMP Infiltration (Rear Yard Areas only - 20% of Area with disturbed Glacial Till **Fill** 1.0-2.0m height)	250	32.02	20%	40%	6404
Post Development Surface Infiltration (Front Yard Pervious Areas only -80% of Area with Native Glacial Till as subgrade)	90	32.02	80%	12%	2767
Post Development Surface Infiltration (Front Yard Pervious Areas only -20% of Area with disturbed Glacial Till Fill as subgrade)	120	32.02	20%	12%	922
Commercial Block 316	250	0.91	100%	100%	2263
Medium Density Block 314	250	2.40	100%	100%	6008
Medium Density Block 315	250	1.20	100%	100%	3005
Medium Density Block 317	250	2.72	100%	100%	6798
School Block 289	250	3.13	100%	100%	7828
Wood lot (City Parcel and Dev Parcel)	107	5.07	100%	100%	5425
Hydro Corridor (@ predevelopment rate)	107	14.55	100%	100%	15569
PARK (no BMP, 100% of area within Fill Area)	120	1.04	100%	100%	1249
				TOTAL Post Development	67457

Water Budget	**157**

Notes:
1. Total Area is inclusive of Phase 4 Park and Hydro Corridors (62.90Ha)
2. Pre-Development Infiltration rate for Flewellyn Drain per Table 8-13 of EMP (107mm/yr).
3. For areas where native soil is the rear yard substrate; infiltration rates for post development based on Table 8.3 of the EMP, using native Glacial Till (180mm/yr) as the soil substrate (80% of Total Area).
4. BMP Infiltration Area 40% based on typical rear yard drainage area share of total drainage area (inclusive of back half of house).
5. Surface Infiltration Area 12% (20% pervious area within typical Street Drainage Areas, which comprises of 60% of total area) based on typical pervious area within a typical street (front yard) drainage area.
6. 250mm/yr infiltration rate based on the average of the recommended infiltration rates for fill areas with BMP's (Rear Yards), provided by Paterson Group for similar area/soil as Phase 3
7. 120mm/yr infiltration rate based on a the average of the recommend infiltration rates for areas without BMP's, provided by Paterson Group
8. The drainage area assumptions made within this analysis are based on maximum zoning setbacks and averaged for single family homes and townhomes. This is considered a conservative approach.
9. Calculated split between "fill areas" and "non Fill areas" based on a cut fill of the site using a 1.0m below F.G. subgrade. Actual area of fill zone is 22% of total area. 20% used to provide a more conservative approach

patersongroup **memorandum**

consulting engineers

re:	**Potential Infiltration Rates** **Proposed Residential Development** **Westwood Phase 3 - Fernbank Road - Ottawa**
to:	IBI Group - **Ryan Magladry** - rmagladry@ibigroup.com
date:	December 6, 2021
file:	PG5451-MEMO.01R

Paterson Group (Paterson) prepared the following memorandum to provide recommendations regarding infiltration rates to be applied to the stormwater management design at the subject site.

It is understood that, as part of the development application for Phase 3 of the Westwood residential development, the City of Ottawa has requested clarification on the ability of standard Best Management Practices (BMP) identified in the Environmental Management Plan (EMP) to promote sufficient infiltration that the water balance of the site is maintained. To accomplish this, details regarding the post-development surficial soil composition across the site are required in order to be able to identify the most suitable corresponding infiltration rates, which were provided in the EMP.

Within the current phase of the proposed development, it is understood that variable grade raises could be expected across the majority of the site, resulting in a large portion of the proposed BMPs being sited within fill material. It is also expected that the fill material used to raise the grades would consist of a mixture of granular materials, blast rock and native soils, and that it would be compacted to acceptable levels of it's standard proctor maximum dry density (SPMDD) as required dependant on its use and location across the site.

As a result of the inherent variability in composition and compaction of the fill material relative to native material, it is recommended that a conservative range of potential infiltration rates be modelled to determine the theoretical suitability of the proposed infiltration BMPs to maintain the existing water balance at the site. The general composition of the fill material is expected to resemble soils ranging from silty clay to glacial till, comparable to the native materials on site which generally consist of either silty clay or glacial till dependant on location. Therefore, in reference to Table 8-10 of the EMP, it is recommended that infiltration rates ranging from approximately 200 to 300 mm/year be modelled to determine the theoretical applicability of the currently suggested BMPs.

Similar to areas where infiltration BMPs are proposed, it is recommended that a conservative range of potential infiltration rates be modelled in areas where fill will be placed without BMPs. As previously noted, the fill material is expected to resemble a variable combination of the native silty clay and glacial till soils on site. In reference to

Table 8-10 of the EMP, it is recommended that infiltration rates ranging from approximately 90 to 150 mm/year be modelled to determine the theoretical infiltration potential of the fill material in areas where no BMPs are being considered.

We trust that this information satisfies your immediate requirements.

Paterson Group Inc.

Michael Laflamme, P.Geo