Carleton
UNIVERSITY
Canada's Capital University

Report
35843-5.2.2

SERVICING STUDY
STUDENT RESIDENCE 2017
CARLETON UNIVERSITY CAMPUS
OTTAWA, ONTARIO

IBI

Prepared for Carleton University
by IBI Group

April 2016

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List of Appendices

1 INTRODUCTION

1.1 Development Servicing Study Checklist

The Servicing Study Guideline Checklist is included in **Appendix A** for reference. The list identifies where elements in this report can be found. Some elements are not applicable and are identified accordingly. Otherwise, the checklist items are address in this report.

1.2 Purpose

The purpose of this report is to outline the required municipal services, including water supply, stormwater management and wastewater disposal, needed to support the redevelopment of a portion of the Carleton University campus. The area being redeveloped is approximately 1.15 hectares in area and is located north of the existing Leeds Residence Building within the existing Parking Lot 6 on the Carleton University Campus. See **Figure 1** for the site location.

As requested by the City of Ottawa this Design Brief is being completed as a requirement and in support of the Site Plan Application for the subject site.

1.3 Subject Site

Carleton University plans to develop a student residence on the subject site lands. **Appendix B** contains Site Plan Drawing A-100 prepared by Vincent P. Colizza Architects which illustrates the proposed works.

The site is currently zoned 12 AF (1.5) – Major Institutional zone.

A portion of the land to be redeveloped is currently used as a parking lot and the remaining area is a landscaped area.

The proposed student residence building will consist of 14 storeys, accommodating 204 units with 500 beds. The main entrance to the building will be accessed via the private road off Campus Avenue. It should be noted that the proposed residence will not comprise any surface or underground parking, nor will it include any commercial usages (the adjacent parking lot function will remain).

1.4 Pre-Consultation

Consultation meetings were held with City of Ottawa and MOE; minutes or notes from those meetings are included in **Appendix C**.

1.5 Geotechnical Investigation

A geotechnical investigation for the proposed development was prepared by Paterson Group. The report number is PG-3292-2 dated November, 2014.

The objectives of the investigation were:

- Determination of the subsoil and groundwater conditions.
- Provision of geotechnical recommendations pertaining to the design and development of the subject site including construction considerations.

Among other items, the report comments on the following:

J:\35843-CarletonRes\5.9 Drawings\59civil\current\35843Figure1-2.dwg Layout Name: FIGURE 1

Scale	Project Title	Drawing Title	Sheet No.
NTS	CARLETON UNIVERSITY	SITE LOCATION PLAN	FIGURE 1

- Excavation shoring;
- Foundation design;
- Seismic hazard;
- Impact on existing adjacent structures due to excavation;
- Groundwater control;
- Corrosion and cement type;
- Pavement Structure;
- Pipe Bedding & Backfill.

With respect to this report, the key findings were:

- Pavement structure:

MATERIAL	LIGHT DUTY	HEAVY DUTY
Wear course HL3 or Superpave 12.5 Asphaltic Concrete	50 mm	40 mm
Binder Course HL8 or Superpave 19 Asphaltic Concrete	NR	50 mm
Base OPSS Gran 'A'	150 mm	150 mm
Sub Base OPSS Gran 'B' II	300 mm	400 mm

Pavement granular base and sub base should be placed in maximum 300 mm lifts and compacted to 98% SPMDD.

- Pipe bedding and backfill: minimum 150 mm OPSS Gran 'A' to be used for pipe bedding and extended to 300 mm above obvert of pipe. Gran 'A' to be placed in maximum 225 mm lifts and compacted to 95% SPMDD.

2 WATER SUPPLY

2.1 Existing Conditions

A 200 mm watermain services the adjacent buildings, an extension off this main will provide the water supply to the proposed student residence. The existing 200 mm watermain is connected to an existing 406 mm watermain on Campus Avenue which is connected to a 400 mm watermain on Colonel By Drive to the north.

An existing fire hydrant is located on the west side of Campus Avenue at the intersection with the Private Drive, and another hydrant is located directly in front of the Leeds student residence.

2.2 Design Criteria

The following City of Ottawa criteria was used to complete our analysis:

• Average Daily Demand Flow Rate (ADD) residential	350 l/cap/day
• Maximum Daily Demand (MDD)	2.5 X ADD
• Maximum Hourly Demand	2.2 X MDD
• Fire Flow per Fire Underwriters Survey (FUS) Calculation for Fire Resistive Building Construction provided in **Appendix D** and FUS definitions.	8,000 l/min (133.3 l/s)

Based on a student population of 500, the following are the anticipated water demands:

• Average Day Demand	2.03 l/s
• Maximum Day Demand	5.06 l/s
• Maximum Hour Demand	11.14 l/s

2.3 Hydraulic Analysis

A hydraulic model of the existing watermain system in the vicinity of the new student residence has been created using the H20 MAP software model by MWH Soft Inc. The model includes the existing fire hydrant adjacent to Campus Avenue and the hydrant adjacent to Leeds House. In 2014, fire hydrant tests were carried out on all hydrants on the Carleton University Campus, which are used in the hydraulic model to create boundary conditions for the hydraulic model.

Results of the hydrant tests are included in **Appendix D**. The Campus Avenue hydrant is identified as Hydrant 60 while the Leeds House is Hydrant 141. The tests record the residual pressure (pressure without flow) and the pressure with the hydrant flowing (the rate of flow is also measured). With this data, the theoretical flow is calculated at a residual pressure of 140 kPa. In the hydraulic model, the hydrants are represented by a pump fed by a reservoir. The pump requires three data points to create a 3 point pump curve. Using the hydrant tests, the residual pressure represents the shutoff head while the flow test is used to represent the design head and flow in the pump curve. Finally, the theoretical flow is used as the high head and high flow in the pump curve. A calculation is included in **Appendix D** showing the values.

In the hydraulic model, the new 200 mm watermain has been added along with a new hydrant and connection to the new building. The model is run with the building demand flows (at node 20) under the basic day, maximum day and peak hour conditions to determine the pressures in the watermain. A further analysis is carried out to determine the fire flow available at the new hydrant (represented by node 16) under maximum day conditions at a residual pressure of 140 kPa.

Results of the analysis gives a pressure at the building under the basic day condition and peak hour condition which varies from 467.1 kPa to 459.0 kPa. As the pressure of the building is less than 552 kPa, pressure reducing valves will not be required for this project. The peak hour pressure exceeds the minimum requirement of 276 kPa at first floor level, however, due to the height of the building, an internal booster pump will be required to service the upper floors.

The design fire flow at the new hydrant under maximum day condition is 150.7 l/s at a residual pressure of 140 kPa. The fire flow rate exceeds the requirement of 133.3 l/s as determined by the Fire Underwriters Survey method. Results of the analysis and a schematic of the hydraulic model are included in **Appendix D**.

2.4 Proposed Water Plan

A 200 mm watermain will be extended along the east side of the building with a fire hydrant and a 150 mm water service to the student residence. Prior to construction, a water data card will be submitted to the City to determine the water meter size. The location of the watermain is illustrated on drawing C-100 included in **Appendix D**.

3 WASTEWATER DISPOSAL

3.1 Existing Conditions

An existing 200 mm PVC sanitary sewer services the adjacent 396 bed Leeds Residential Building (just south of the proposed building).

It should be noted that all sanitary sewer ultimately outlet to the Carleton University Pump Station at Bronson Avenue, which discharges to the City of Ottawa wastewater collection system.

3.2 Sewer Capacity Analysis

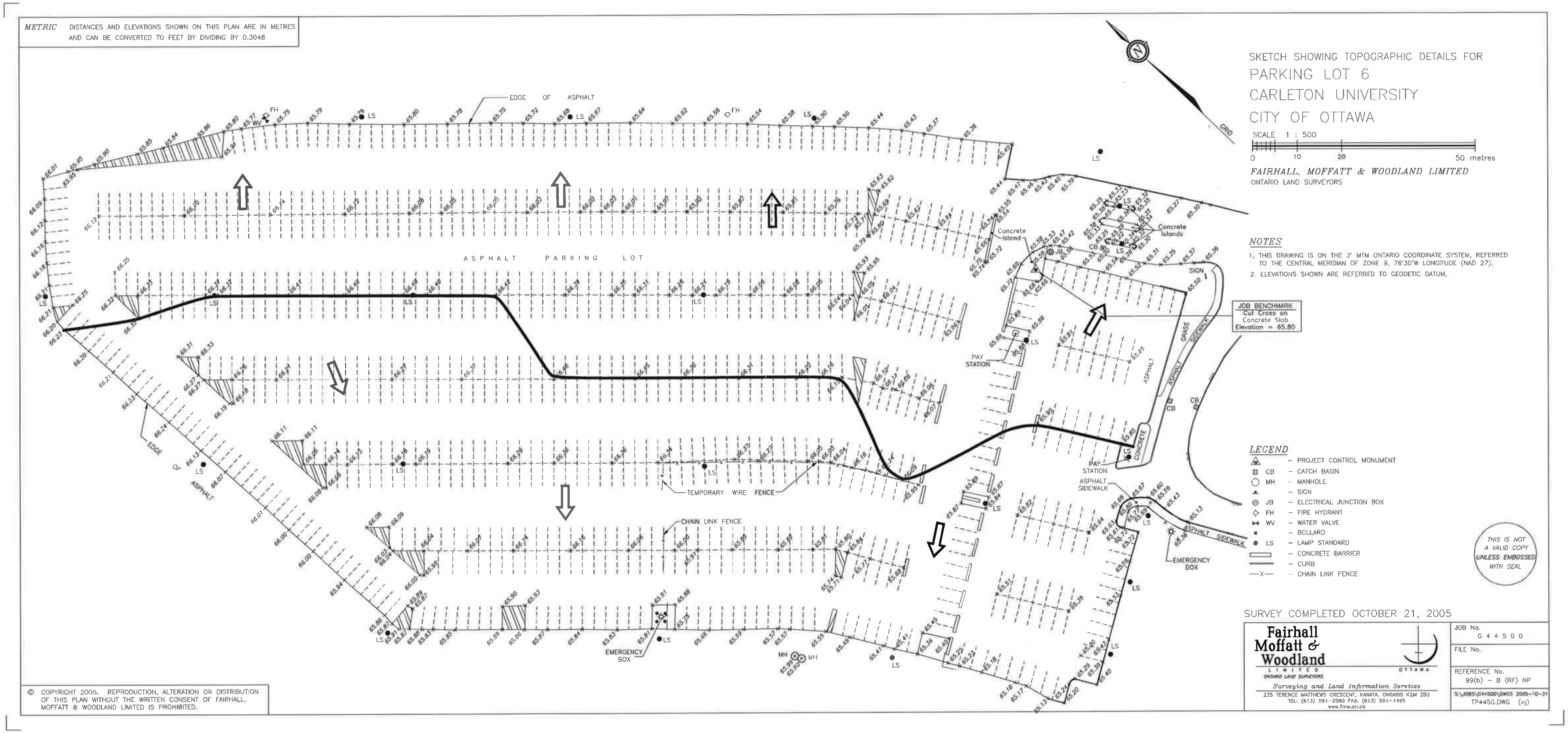
The proposed student residence will consist of 500 beds. IBI estimates that the peaked wastewater flow from the proposed development will be approximately 6.57 l/s. This is based on the following Design Guidelines:

• Population density	1.0 pp/bed
• Average Residential Flow	275 l/p/d (as per City Guidelines for Boarding School)
• Residential Peaking Factor	Harmon Formula [max = 4.0, min. = 2.0]
• Infiltration Allowance	0.28 l/s/ha
• Average Population Flow	500 x 275 = 137,500 l/d = 1.591 l/s
• Peak Factor	1 + (14/4+√.5) = 3.97
• Area	0.91 Ha
• Infiltration	0.91 x .28 = 0.25 l/s
• Peak flow	(3.97 x 1.157) + 0.25 = 6.568 l/s

3.3 Proposed Wastewater Plan

It is proposed to extend the existing 200 mm diameter sewer servicing the existing Leeds Residence building to service the new residential building. A 200 mm diameter service will enter the building at the north-east quadrant of level-1. Please refer to the Site Servicing Plan C-100 located in **Appendix D.**

The detailed sewer design sheet, together with C-501 Sanitary Drainage Area Plan, is included in **Appendix E**. The proposed sewer will connect to the existing sewer system which is a private system. The owner has advised the existing private sanitary sewer system has sufficient spare capacity to accommodate the proposed residence building.



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Scale	Project Title	Drawing Title	Sheet No.
NTS	CARLETON UNIVERSITY		FIGURE 2

4 STORMWATER MANAGEMENT

The area being redeveloped is part of the University's Parking Lot P6. Currently this area is not serviced by catchbasins, the area sheet drains to its outlets. **Figure 2** illustrates the high point within the parking lot which splits the drainage to the west and east. The western portion drains to a landscaped area and is eventually picked up by a catchbasin connected to the University's storm sewer system. The east side sheet drains to the O-Train ditch system. Ultimately, the University plans to redevelop the P6 parking area into a residence quadrant complete with storm sewers. The University also recognizes the capacity limitations of their existing downstream storm sewer system. To that end, a stormwater management pond is proposed to be located just north of the Leeds Building to service the entire P6 development area. This pond would control flow from the area limiting post development flow to the existing storm sewer system to 10 l/s. As part of this phase of the redevelopment of Parking Lot P6, the stormwater management pond and outlet to the pond will be constructed.

The stormwater management pond will connect to the existing 300 mm diameter storm sewer servicing the Leeds Building and adjacent area.

4.1 Overall Stormwater Management Approach

A stormwater management facility will be used to capture the major and minor flow from the site. Dual drainage is employed with storm sewers sized to accommodate at a minimum the 5 year storm event. The balance of flow is conveyed overland to a stormwater pond. The storm sewers inlet into the pond and an orifice sized to limit the flow to 10 l/s during the 100 year storm event

The ultimate conditions drainage scheme for the 100 year Chicago storm event has been used to evaluate the extended storage requirements of the pond, the storm sewer system, and the sizing of the outlet structure. Inlet control devices have been sized based on the interim conditions drainage scheme. See **Section 4.1.1** for further details.

The hydrologic modeling was completed using SWMHYMO. This technique offers a single storm event flow generation and routing. Land use, storm events and input parameters are discussed in **Section 4.2**. Drainage areas and a model schematic are presented on **Figure F-500** and model files are enclosed in attached CD. The hydrographs generated in the SWMHYMO model were exported to XPSWMM to determine the pond volume and outlet structure requirements. This is discussed in more detail in **Section 4.4**.

This evaluation and design takes into consideration the City of Ottawa Sewer Design Guidelines (OSDG) (November 2004, updated 2008), the January 2012 Technical Bulletin ISDTB-2012-1, and the June 2012 Technical Bulletin ISDTB-2012-4.

4.1.1 Interim Versus Ultimate Conditions

The ultimate conditions drainage scheme includes the future development of drainage areas E1 and E2. The stormwater management facility has been designed with consideration of the potential future development of these two (2) drainage areas. Drainage area E1 is considered to overland flow to the pond when in excess of the 5 year storm event. Major and minor flow, up to the 100 year Chicago storm event, is fully captured into MH3 for drainage area E2 to prevent overland flow from this area draining out of the development site under ultimate conditions.

During interim conditions, half of the flow from drainage area E1 and all of the flow from drainage area E2 drains away from the site. As such, the ultimate conditions drainage scheme fully accounts for interim conditions.

4.1.2 Storm Events

The following storm events were evaluated:

- and 100 year, 3 hour Chicago storm event with a 10 minute time step;
- July 1, 1979 historical storm as per the City of Ottawa Sewer Design Guidelines (2012);
- 100 year, 3 hour Chicago storm event with a 20% increase in intensity, as per the Technical Memorandum.

4.2 Hydrology

4.2.1 Design Parameters

The following design parameters were used in the evaluation of the stormwater system and design of the pond. Applicable references to specific parameters are noted. Drawing F-500 provides the SWMHYMO schematic as well as information on the drainage areas.

- **Run-off Coefficients** Catchment areas for the subject site have been lumped together for modeling purposes and area weighted run-off coefficients have been used.
- **Imperviousness** The total and directly connected imperviousness was based upon the City of Ottawa Sewer Guidelines (2004, updated 2008).
- **Time to Peak** Time to peak for the pond area was established using a time of concentration (Tc) of 15 minutes. Time to peak is applied in the model and determined from Tc by applying the formula Tp= 0.6Tc (based on the SWMHYMO User's Manual).
- **Infiltration** Infiltration losses were selected to be consistent with the Geotechnical Investigation Report (Paterson Group, November 2014). The Horton values for paved areas are as follows: f_o = 76.2 mm/h, f_c = 2.4 mm/h, k = 2 hr^{-1}. The Horton values for non-paved areas are as follows: f_o = 127.2 mm/h, f_c = 6.6 mm/h, k = 2 hr^{-1}The SCS methodology was applied to the pond area. A CN value of 95 was selected.
- **Length** The impervious length applied is based on an average measured length through the catchment and the calculated length based on the SWMHYMO User's Manual. This approach is consistent with the City of Ottawa Sewer Design Guidelines. The pervious length has been set to 20 m.
- **Initial Abstraction (Depression Storage)** Depression storage depths of 0.8 mm and 1.5 mm were used for impervious and pervious areas, respectively. These values are more conservative than those in the City of Ottawa Sewer Design Guidelines.
- **Manning's Roughness** Manning's roughness coefficients of 0.013 and 0.25 were used for impervious and pervious areas, respectively.
- **Slope** A slope of 0.15% was used for impervious surfaces and a slope of 2% was used for pervious areas (lot grading).
- **Allowable Release Rates** The allowable minor system release rate from the pond is 10 l/s.
- **On-site Storage** On-site storage has not been considered in this evaluation.

The main hydrological parameters applied in the SWMHYMO model are summarized in the below table.

Table 4.1: Summary of Input Parameters

DRAINAGE AREA	AREA (HA)	IMP (%) [TIME TO PEAK (H)]	LENGTH (M)	IMPERVIOUS LENGTH (M)		
			PERVIOUS	MEASURED	CALCULATED	AVERAGE
E1	2.07	99	20	270	118	194
E2	0.38	99	20	111	51	81
E3	0.20	99	20	129	37	83
E4	0.19	14	20	65	36	50
E5	0.19	83	20	71	36	53
E6	0.56	[0.15]	n/a	n/a	n/a	n/a

4.2.2 Hydrological Simulation Results

A summary of the results of the modeling for each of the storm events is presented in the table below. The minor system capture of Inlet Control Devices (ICDs) is based on the 5 year Chicago SWMHYMO generated flows for individual areas. Drainage areas E2 and E5 are set to capture the 100 year flows to prevent overland flow exiting the redevelopment.

Table 4.2: Simulation Results

DRAINAGE AREA	DOWNSTREAM SEGMENT	XPSWMM NODE ID	MINOR SYSTEM RESTRICTION		OVERFLOW (L/S)			
			5 year modeled flow (l/s)	100 year ICD flow (l/s)	5 year chicago	100 year chicago	100 year chicago+ 20%	July 1979
E1	E6	MH4	443	496	0	344	534	38
E2	n/a	MH3	98	199*	0	0	0	0
E3	E6	MH4	52	58	0	36	56	0
E4	E6	MH4	8	8	0	29	47	18
E5	n/a	MH3	44	91*	0	0	0	0
E6	n/a	MH6	78	n/a	n/a	n/a	n/a	n/a
		Total	**723**	**852**	**0**	**409**	**637**	**56**

** ICDs have been increased to capture the 100 year Chicago storm event*

4.3 Inlet Control Device Sizing

ICDs are proposed to control the surcharge in the minor system during infrequent storm events. The 5 year flow restriction was based on the 5 year 3 hour Chicago (10 minute time step) modeled flow. During the 100 year 3 hour Chicago storm event, the flow into the minor system was increased by approximately 12% from the 5 year modeled flow. The purpose of the increased inflow into the system is to account for the additional flows captured by standard inlet control devices during the 100 year storm event with ponding.

ICD sizing is presented in the below table for interim conditions.

Table 4.3: ICD Sizing

CATCHBASIN ID	DRAINAGE AREA	ICD	ICD TYPE
RYCB3	E4 + portion of E3 (eastern portion of 7th floor)	n/a	n/a
RYCB6		n/a	n/a
RYCB7	portion of E5 + portion of E3 (eastern portion of 12th floor roof)	15	Custom MHF Tempest
DCBMH8	E1+ portion of E3 (eastern portion of 12^{th} floor)	n/a	250 l/s inflow restriction due to grate
CB11	proportion of E5	14	Custom MHF Tempest
CB5	proportion of E5	4	Custom LMF Tempest
CB4	proportion of E5	9	Custom LMF Tempest
CB9	proportion of E5	29	Custom MHF Tempest
CB10	proportion of E5	22	Custom MHF Tempest
	Total	**384**	

4.4 Hydraulic Evaluation

The hydrographs generated in SWMHYMO were downloaded to XPSWMM to evaluate the storage requirements for the pond. Junction losses for the hydraulic modeling were determined from the City of Ottawa Sewer Design Guidelines Appendix 6-B (2004, updated 2008).

The XPSWMM model schematic is enclosed in **Appendix F**. The hydraulic grade line analysis was evaluated using the 100 year Chicago storm event. During the 100 year event, the storm sewer operates under free flow conditions. The table below indicates the HGL and obvert at each manhole as well as the surcharge.

Table 4.4: Hydraulic Grade Line – Chicago 100 year 3 hour storm event

MH	PIPE OBVERT (M)	HGL (M)	SURCHARGE (HGL – OBV) (M)
3	62.21	62.10	-0.12
4	61.94	61.82	-0.12
8	61.79	61.56	-0.23
Pond	61.69	61.21	-0.48

4.5 Stormwater Management Facility

4.5.1 Water Quality Control

Water quality control is not proposed for the Stormwater Management Facility. The University will be constructing an end of pipe treatment facility to service the entire drainage area prior to discharging to the Rideau River. The University will be constructing the facility under a separate program at a later date.

4.5.2 Water Quantity Control

The pond will be used to store major and minor flow from the redevelopment site. Outflow from the pond is limited to 10 l/s. Backwater effects from the existing storm sewer system were accounted for by basing the tailwater on the rating curve from the pond and the obvert elevation (60.004) of the downstream pipe. Supporting calculations for tailwater for the 100 year Chicago storm event are presented in **Appendix F**. The same approach for tailwater was used for all other storm events modeled in XPSWMM. A summary of the hydraulic evaluation of the stormwater facility is presented in the following table.

Table 4.5: Stormwater Facility Characteristics

	STORM EVENTS			
	5 YEAR CHICAGO	100 YEAR CHICAGO	100 YEAR CHICAGO+ 20%	JULY 1979
Outflow from SWM Facility (l/s)	7.8	10.0	10.0	10.9
Storage Volume Provided (m^3)	1230	2194	2194	2673
Water Level (m)	60.77	61.21	61.21	61.40
Difference between top of pond and Water Level (m)	1.6	1.2	1.2	1.0

4.5.3 Features of the Stormwater Facility

The features of the stormwater management facility are summarised in the sections below.

4.5.3.1 Inlet Structure

The inlet structures consist of two headwalls, OPSD 804.03.

4.5.3.2 Pond

A pre-consultation meeting with local MOE, Charles Goulet indicated that a dry pond should be considered for safety reasons due to the proximity of the pond to the proposed residence. However, a wet pond has been proposed to promote cattail growth and to enhance the aesthetics of the pond which will be frequently inundated by water.

The bottom of the pond is located at an elevation of 59.85 m. The permanent water level is 0.15 m higher at 60.0 m. The extended stage-storage curve for the pond is provided in **Appendix F**.

During 100 year conditions, the extended storage used by the facility is 2194 m^3. The corresponding water level in the facility is 61.21 m, as shown on Drawing C-200 in **Appendix F**. This provides a clearance of 1.2 m between the 100 year water level and the top of the pond (62.40 m).

4.5.3.3 Outlet Structure

The pond facility profile is indicated on Drawing C-200. An MCON 600 x 600 mm Type A ditch inlet catch basin will function as the outlet structure. The top of grate elevation will correspond to the permanent water level of the pond at 60.0 m. Runoff will cascade through the top of grate and exit via an outlet pipe of 300 mm diameter with an invert elevation of 59.83 m. An orifice of 0.0031 m^2 will be used to control the flow rate to 10 l/s using a Hydrovex 75VHV Vortex ICD. The outlet pipe will tie into the existing storm sewer via an existing manhole.

4.6 Minor Storm Sewers Design Criteria

The minor storm sewers for this site will be sized based on standards of both the City of Ottawa and the provincial Ministry of the Environment. Some of the key criteria will include the following:

• Design Return Periods:	Local and Collector Roads	1:5 yr (Ottawa)
• Sewer Sizing by Rational Method		
• Runoff Coefficients:	Roof	C=0.90
	Asphalt	C=0.90
	Landscaped Areas	C=0.2
• Initial T of C	10 min	
• Min Velocity:	City Design Guidelines	0.80 m/s

The minor storm sewers for the subject site will be sized based on the rational method and the City of Ottawa 1:5 yr. event. Minor storm flow into these sewers will be controlled by Inlet Control Devices (ICD) to limit flows and prevent sewer surcharging.

The minor storm sewer system is illustrated on the General Plan C-100 including specifications and details. The storm sewer design sheets and related Storm Sewer Drainage Area plans C-500 is included in **Appendix F**.

Minor system discharges to the new stormwater management pond, the pond will discharge to the existing private storm sewer system with a release rate of 10 l/s. The owner has advised the existing private storm sewer system has sufficient spare capacity to accommodate the proposed works.

4.7 Adjacent Lands

As part of the servicing of the new Residence Building the existing pedestrian tunnel will be extended from the current terminus between the Stormount-Dundas House & Leeds Residence. At this point the tunnel is at grade. To extend it further north, the area around the Leeds Building will require regrading to ensure a fire route is maintained. To facilitate drainage in the re-graded area a new rearyard CB-subdrain system is proposed to replace a CB removed due to a conflict with the tunnel. To ensure the re-graded area has no negative impact on the existing storm sewer system, inflow from this area will be controlled to C=0.2 for 100 yr. rainfall event. The courtyard area 3C is approximately 1435 m^2 with an average runoff coefficient of 0.55.

As noted above, flow from the re-graded area to the storm sewer will be controlled to a level equivalent C=0.2 for a 1:100 yr. rainfall event to ensure no negative impact downstream. In order to control flow into the downstream sewers to meet this criteria, an Inlet Control Devices (ICD) is proposed. Drawing C-100 identifies the location of ICDs for the various inlets. These ICDs restrict flow into the minor system. For area 3C, the modified rational method was used to determine the volume of storage required to capture the 100 yr. event while limiting the accumulated flow to the downstream storm sewers to a maximum C=0.2 for the 100 yr. event.

Based on the proposed ICD at CBMH7 during a 100 yr. event, a maximum of 14.25 l/s is being allowed into the system, while 18.53 m^3 of storage has been provided. The modified rational method analysis is included in **Appendix F**.

5 SEDIMENT AND EROSION CONTROL PLAN

During construction, existing conveyance systems can be exposed to significant sediment loadings. Construction techniques to reduce unnecessary construction sediment loadings include:

- groundwater in trench will be pumped into a filter mechanism prior to release to the environment;
- seepage barriers will be constructed in any temporary drainage ditches;
- filter cloths will remain on open surface structure such as manholes and filter socks on catchbasins until structures are commissioned and put into use.

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 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.

In order to reduce sediment loading to the adjacent lands via overland flow, a combination of seepage barriers will be installed. Light Duty Silt Fence Barrier as per OPSD 219.110. Straw Bale Flow check as per OPSD, Rock flow check as per OPSD, Straw Bale Barrier as per OPSD. All seepage barriers will be inspected and maintained as needed.

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

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 rear yard catchbasins are usually installed after base course asphalt is placed.

Contamination of the environment as a result of stock piling of imported construction materials is generally not a concern. These materials are quickly used and in mitigative measures stated previously, such as and filter fabric in catchbasins and manholes help to manage these concerns.

To reduce the potential for tracking of sediment off-site, mud mat will be constructed at the entrance and maintained until site is ready for paving.

A sediment and erosion control plan is provided as Drawing C-900 in **Appendix G**.

6 APPROVALS AND PERMIT REQUIREMENTS

6.1 City of Ottawa

The City of Ottawa reviews all development documents including this report. Upon completion, the City will approve the proposed servicing and submit it to the Ministry of Environment for its review.

6.2 Province of Ontario

Because the receiving storm sewers on Campus Avenue are all private (owned and maintained by Carleton University), and ultimately outlet to the Rideau River, the Ministry of Environment (MOE) advised they will require to formally approve the proposed SWM facility and site servicing. If needed, the MOE will also issue a Permit to Take Water.

6.3 Conservation Authority

There are no approvals required from any Conservation Authority for this project.

6.4 Federal Government

There are no required permits, authorizations or approvals needed expressly for this development.

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

The existing 200 mm diameter sanitary in Campus Avenue provides the site with the necessary capacity to support the proposed development. In addition, the existing 200 mm diameter watermain in Campus Avenue will also provide sufficient water and pressures to meet the City's criteria for a reliable water supply and fire flow.

Limiting stormwater flow from the development area to 10 l/s reduces potential negative impact on the existing downstream storm sewers. The construction of a 2,400 m^3 quantity control pond is required to restrict post development 100 year runoff to 10 l/s.

7.2 Recommendations

Based on the findings and conclusions of our investigation, IBI confirms that the proposed 500 bed student residence can be serviced with the existing water supply, wastewater and controlled stormwater can outlet to existing surrounding infrastructure.

IBI GROUP

Demetrius Yannoulopoulos, P. Eng
Associate Director

APPENDIX A

Development Servicing Study Checklist

The following table is a customized copy of the current City of Ottawa's Development Servicing Study Checklist. It is meant to be a quick reference for location of each of the items included on the list. The list contains the various item descriptions and the study section in which the topic is contained.

GENERAL CONTENT

	ITEM DESCRIPTION	LOCATION
	Executive Summary (for larger reports only)	N/A
√	Date and revision number of the report	Front Cover
√	Location Map and plan showing municipal address, boundary, and layout of proposed development.	Figure 1
√	Plan showing the site and location of all existing services.	C-100
√	Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.	Section 1.3
√	Summary of Pre-consultation Meeting with City and other approval agencies.	Section 1.4
√	Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.	Section 1.5
√	Statement of objectives and servicing criteria	Section 1.1.2
√	Identification of existing and proposed infrastructure available in the immediate area.	C-100
√	Identification of Environmentally Significant Areas, Watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).	N/A
√	Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.	C-200
√	Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.	N/A
	Proposed phasing of the development, if applicable.	N/A
√	Reference to geotechnical studies and recommendations concerning servicing.	Section 1.5

√	All preliminary and formal site plan submissions should have the following information: • Metric scale • North arrow (including construction North) • Key plan • Name and contact information of applicant and property owner • Property limits including bearings and dimensions • Existing and proposed structures and parking areas • Easements, road widening and rights-of-way • Adjacent street names	C-100 C-200

DEVELOPMENT SERVICING REPORT: WATER

	ITEM DESCRIPTION	LOCATION
√	Confirm consistency with Master Servicing Study, if available	N/A
√	Availability of public infrastructure to service proposed development	Section 2.1
√	Identification of system constraints – external water needed	Sections 2.2
√	Identify boundary conditions	Section 2.3
√	Confirmation of adequate domestic supply and pressure	Section 2.4 & Appendix E
√	Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.	Section 2.3 & Appendix D
√	Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.	Appendix D
	Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defining phases of the project including the ultimate design.	N/A
	Address reliability requirements such as appropriate location of shut-off valves.	C-100
√	Check on the necessity of a pressure zone boundary modification.	N/A
√	Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range.	Section 2.4 Appendix D
√	Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.	Section 2.4 C-100
√	Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities and timing of implementation.	N/A
√	Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.	Section 2.2
√	Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.	Appendix D

DEVELOPMENT SERVICING REPORT: WASTEWATER

	ITEM DESCRIPTION	LOCATION
√	Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).	Section 3.2
√	Confirm consistency with Master Servicing Study and/or justifications for deviations.	N/A
√	Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age condition of sewers.	Section 3.2
√	Description of existing sanitary sewer available for discharge of wastewater from proposed development.	Section 3.1
√	Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)	Section 3.3
	Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix "C") format.	Section 3.3, & Appendix E
√	Description of proposed sewer network including sewers, pumping stations and forcemains.	Section 3.3 C-100
√	Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).	N/A
√	Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.	N/A
√	Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.	N/A
√	Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.	N/A
√	Special considerations such as contamination, corrosive environment etc.	N/A

DEVELOPMENT SERVICING REPORT: STORMWATER CHECKLIST

	ITEM DESCRIPTION	LOCATION
√	Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)	Sections 4
√	Analysis of available capacity in existing public infrastructure.	N/A
√	A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.	C-500B

√	Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.	Section 4.1
√	Water quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.	N/A
√	Description of the stormwater management concept with facility locations and descriptions with references and supporting information.	Section 4.5 Figure C-200
√	Set-back from private sewage disposal systems.	N/A
√	Watercourse and hazard lands setbacks.	N/A
√	Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.	Section 1.4
√	Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.	N/A
√	Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).	Section 4 Appendix F
√	Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.	N/A
	Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.	Section 4 Appendix F C-500B
√	Any proposed diversion of drainage catchment areas from one outlet to another.	N/A
√	Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.	C-100
	If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event.	N/A
√	Identification of potential impacts to receiving watercourses	N/A
√	Identification of municipal drains and related approval requirements.	N/A
√	Descriptions of how the conveyance and storage capacity will be achieved for the development.	Section 4
√ √	100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.	Section 4.4 C-200
	Inclusion of hydraulic analysis including hydraulic grade line elevations.	Section 4.4
√	Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.	Section 5
√	Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.	N/A
√	Identification of fill constraints related to floodplain and geotechnical investigation.	N/A

APPROVAL AND PERMIT REQUIREMENTS: CHECKLIST

	ITEM DESCRIPTION	LOCATION
√	Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.	Section 1.4
	Application for Certification of Approval (CofA) under the Ontario Water resources Act.	Section 6.2
√	Changes to Municipal Drains	N/A
√	Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)	Section 6

CONCLUSION CHECKLIST

	ITEM DESCRIPTION	LOCATION
√	Clearly stated conclusions and recommendations	Section 7
	Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.	Final Design
√	All draft and final reports shall be signed and stamped by professional Engineer registered in Ontario.	

APPENDIX B

Demetrius Yannoulopoulos

From: Goulet, Charles (MOECC) [Charles.Goulet@ontario.ca]
Sent: Friday, March 20, 2015 3:31 PM
To: Demetrius Yannoulopoulos
Subject: RE: Carleton

You're welcome Dimitri.

Have a great week-end!

Regards,
Charles Goulet, P. Eng.
District Engineer
MOECC Ottawa District Office
2430 Don Reid Drive
Ottawa ON
K1H 1E1

DL 613.521.3450 ext. 246
TF 800.860.2195 ext. 246
F 613.521.5437

From: Demetrius Yannoulopoulos [mailto:dyannoulopoulos@IBIGroup.com]
Sent: March-20-15 3:26 PM
To: Goulet, Charles (MOECC)
Subject: RE: Carleton

Hi Charles,
Thanks for meeting with me today.
As discussed I will advise the owner they will be required to submit for ECA's for this project.
If we advance an open pond solution, to mitigate safety concerns we should work towards a dry pond with gentle slopes (5:1), and consult with campus security regarding planting types around the perimeter.
Again thanks for meeting with me.
Thx
D

Demetrius Yannoulopoulos P.Eng.

Associate Director
mob +1 613 447 0504
email dyannoulopoulos@IBIGroup.com web www.ibigroup.com

IBI GROUP
400-333 Preston Street
Ottawa ON K1S 5N4 Canada
tel +1 613 225 1311 ext 590 fax +1 613 225 9868

From: Demetrius Yannoulopoulos
Sent: Tuesday, March 17, 2015 2:53 PM
To: charles.goulet@ene.gov.on.ca
Subject: Carleton

Hi Charles, we are working on a new residence building at Carleton U campus, is that your area or someone else's, please let me know.
Thx
D

Demetrius Yannoulopoulos P.Eng.

Associate Director
mob +1 613 447 0504
email dyannoulopoulos@IBIGroup.com web www.ibigroup.com

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Demetrius Yannoulopoulos

From: Jocelyn Chandler [jocelyn.chandler@rvca.ca]
Sent: Wednesday, April 01, 2015 4:01 PM
To: Demetrius Yannoulopoulos
Subject: Re: Carleton U residence

Hello Demetrius,
In general, if parking area is going to be changed to rooftop, and no additional parking area will be made available, then it is unlikely we would ask for additional quality controls. That said, I would be interested to know how far along Carleton is in implementing their retrofit to their storm system to responsibly implement quality control prior to outletting into the Rideau River. I have heard nothing for a long time. JOcelyn

---

From: Demetrius Yannoulopoulos <dyannoulopoulos@IBIGroup.com>
Sent: March-17-15 4:20 PM
To: Jocelyn Chandler
Subject: Carleton U residence

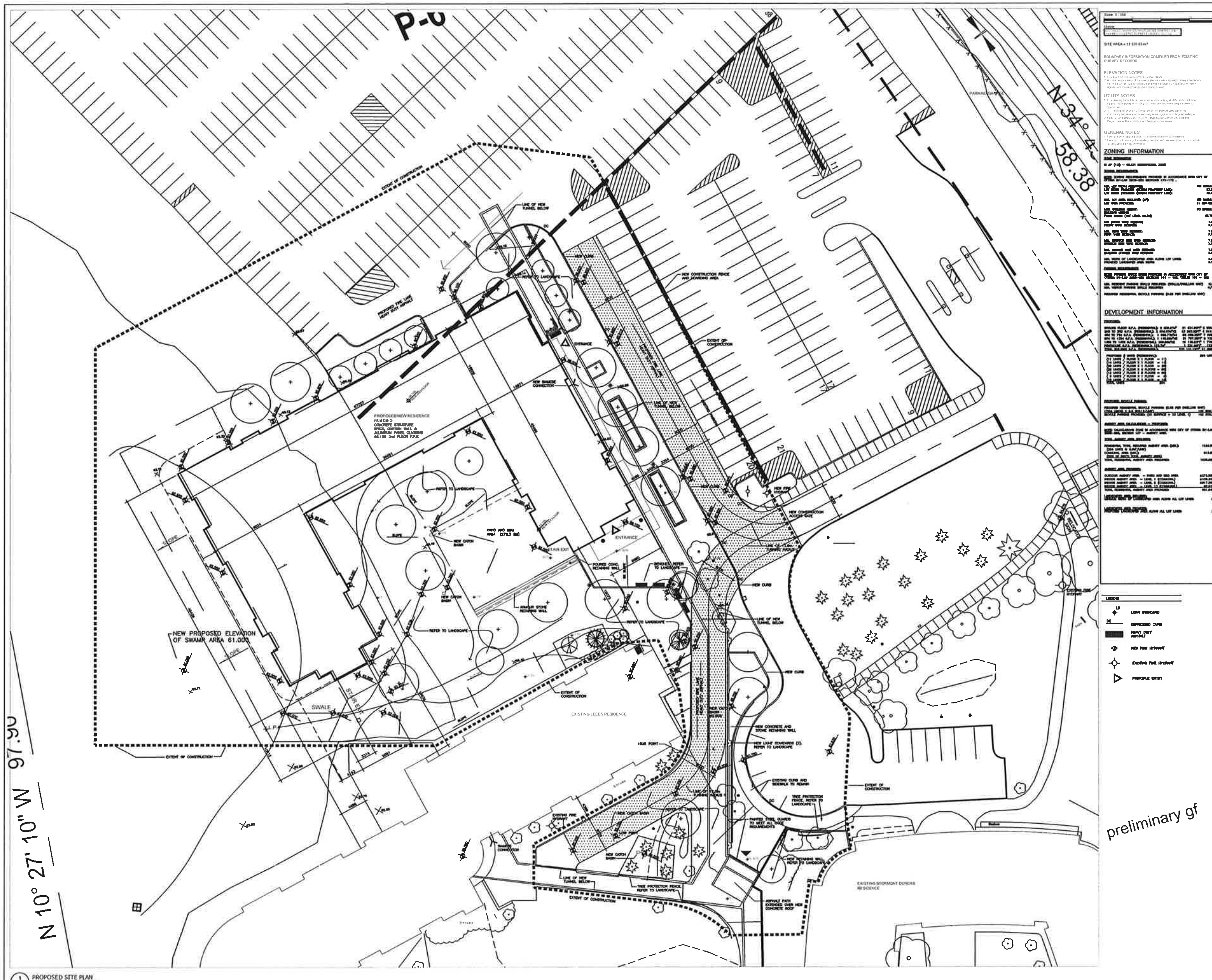
Hi Jocelyn
The Carleton University plans to constructing a new 15 storey residence just north of their last residence within their parking lot P6. We are working on the servicing for the new building, and propose to connect to the existing sanitary and storm sewers, we will also be proposing a small quantity control SWM pond. All of the servicing works are within the campus and will connect to their private sewer systems. I am meeting Charles Goulet on Friday at 2pm (at his office) for a pre-consult, you are welcome to join, or if you wish we can meet another time?
Let me know.
Thx
D

Demetrius Yannoulopoulos P.Eng.

Associate Director
mob +1 613 447 0504
email dyannoulopoulos@IBIGroup.com web www.ibigroup.com

IBI GROUP
400-333 Preston Street
Ottawa ON K1S 5N4 Canada
tel +1 613 225 1311 ext 590 fax +1 613 225 9868

APPENDIX C



1 PROPOSED SITE PLAN
A1.1 SCALE: 1 : 200

preliminary gf

Carleton UNIVERSITY
Canada's Capital University

REVISIONS

DO NOT SCALE THE DRAWINGS

Project North
True North

srm ARCHITECTS INC

VINCENT P. COLIZZA ARCHITECT INCORPORATED

CARLETON UNIVERSITY
1125 COLONEL BY RD., OTTAWA, ON. K1S 5B6

DWG. TITLE

SCALE

DWG. NO.

PROJ. NO. 0114

APPENDIX D

Basic Day - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
1		10	0.00	64.00	113.17	481.86
2		12	0.00	63.60	113.17	485.76
3		14	0.00	65.40	113.17	468.10
4		16	0.00	65.60	113.17	466.13
5		18	0.00	65.50	113.17	467.09
6		20	2.03	65.50	113.16	467.06
7		22	0.00	65.00	113.17	471.99
8		24	0.00	65.00	113.17	472.02
9		26	0.00	65.20	113.17	470.06
10		28	0.00	65.20	113.17	470.06

Peak Hour - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
1		10	0.00	64.00	112.57	475.95
2		12	0.00	63.60	112.52	479.41
3		14	0.00	65.40	112.48	461.34
4		16	0.00	65.60	112.45	459.05
5		18	0.00	65.50	112.40	459.56
6		20	11.14	65.50	112.34	459.02
7		22	0.00	65.00	112.40	464.46
8		24	0.00	65.00	112.48	465.26
9		26	0.00	65.20	112.48	463.30
10		28	0.00	65.20	112.48	463.30

Max Day + Fire - Fireflow Design Flow

		ID	Total Demand (L/s)	Critical Node 1 ID	Critical Node 1 Pressure (kPa)	Critical Node 1 Head (m)	Adjusted Fire-Flow (L/s)	Available Flow @Hydrant (L/s)	Critical Node 2 ID	Critical Node 2 Pressure (kPa)	Critcal Node 2 Head (m)	Adjusted Available Flow (L/s)	Design Flow (L/s)
1		16	133.30	16	201.93	86.21	150.67	150.67	16	139.96	79.88	150.67	150.67

Peak Hour - Pipe Report

		ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
1		11	10	12	48.11	204.00	110.00	11.14	0.34	0.05	0.98
2		13	12	14	44.39	204.00	110.00	11.14	0.34	0.04	0.98
3		15	14	16	34.54	204.00	110.00	11.14	0.34	0.03	0.98
4		17	18	16	48.71	204.00	110.00	-11.14	0.34	0.05	0.98
5		19	20	18	12.35	155.00	100.00	-11.14	0.59	0.06	4.47
6		21	18	22	16.58	204.00	110.00	0.00	0.00	0.00	0.00
7		23	24	26	94.22	393.00	120.00	0.00	0.00	0.00	0.00
8		25	26	14	33.25	204.00	110.00	0.00	0.00	0.00	0.00
9		27	26	28	6.26	393.00	120.00	0.00	0.00	0.00	0.00

IBI GROUP
333 PRESTON STREET
OTTAWA, ON
K1S 5N4

WATERMAIN DEMAND CALCULATION SHEET

PROJECT : CARLETON UNIVERSITY
LOCATION : 1125 COLONEL BY ROAD
CITY OF OTTAWA

FILE: 35843.5.7
DATE PRINTED: 1-Apr-15
DESIGN: LE
PAGE : 1 OF 1

NODE	RESIDENTIAL UNITS				NON-RESIDENTIAL			AVERAGE DAILY DEMAND (l/s)			MAXIMUM DAILY DEMAND (l/s)			MAXIMUM HOURLY DEMAND (l/s)			FIRE DEMAND
	SF	SD & TH	APT	POP'N	INDTRL (ha.)	COMM. (ha.)	INST. (ha.)	Res.	Non-res.	Total	Res.	Non-res.	Total	Res.	Non-res.	Total	(l/min)
Student Resident																	
20			204	500				2.03	0.00	2.03	5.06	0.00	5.06	11.14	0.00	11.14	6,000
TOTALS	**0**	**0**	**204**	**500**	**0.00**	**0.00**	**0.00**	**2.03**	**0.00**	**2.03**	**5.06**	**0.00**	**5.06**	**11.14**	**0.00**	**11.14**	

ASSUMPTIONS

AVG. DAILY DEMAND

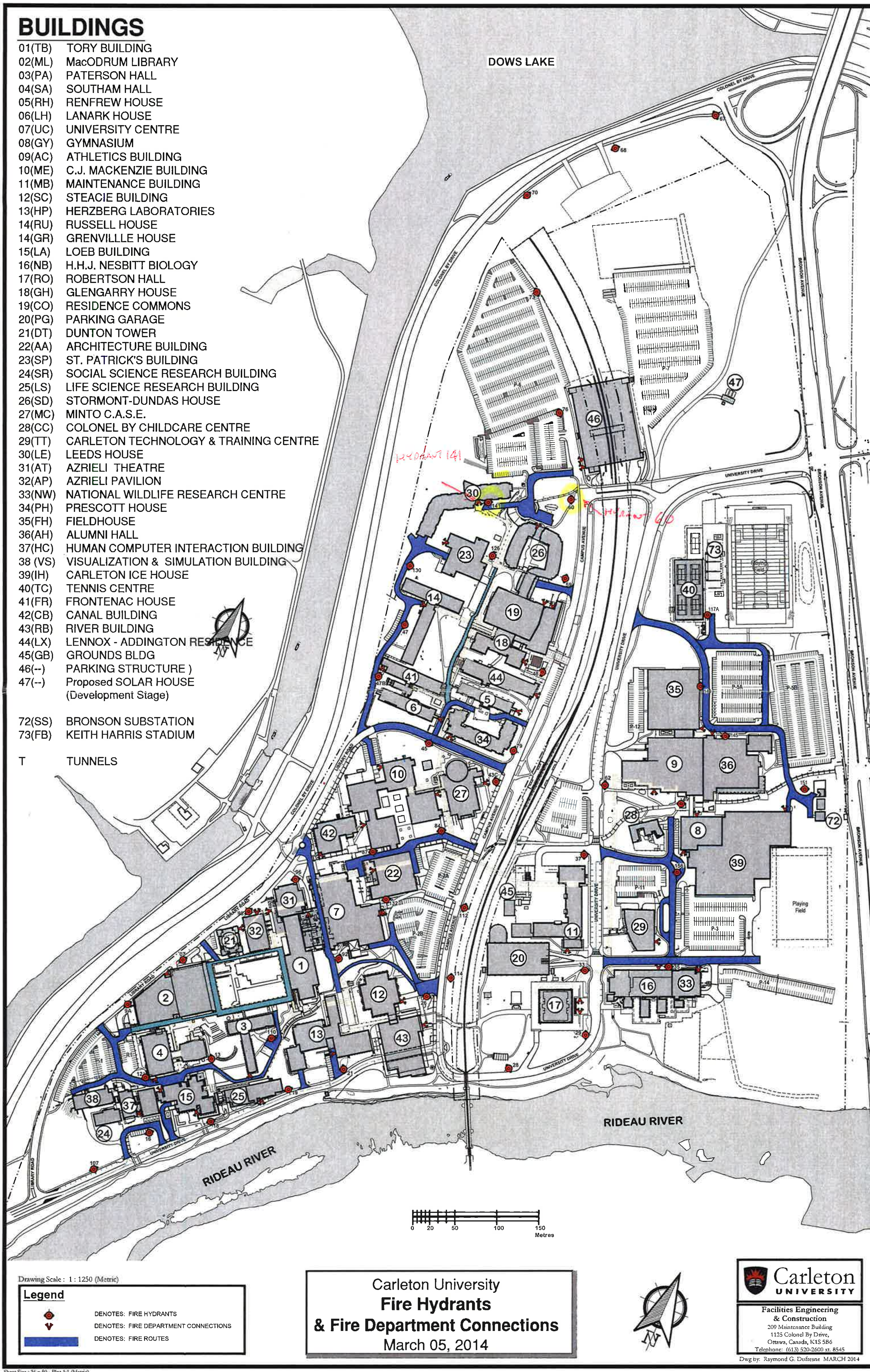
- Residential 350 l / cap / day
- Non-Residential 20,000 l / ha / day

MAX. DAILY DEMAND

- Residential 875 l / cap / day
- Non-Residential 30,000 l / ha / day

MAX. HOURLY DEMAND

- Residential 1,925 l / cap / day
- Non-Residential 54,000 l / ha / day


BUILDINGS
01(TB) TORY BUILDING
02(ML) MacODRUM LIBRARY
03(PA) PATERSON HALL
04(SA) SOUTHAM HALL
05(RH) RENFREW HOUSE
06(LH) LANARK HOUSE
07(UC) UNIVERSITY CENTRE
08(GY) GYMNASIUM
09(AC) ATHLETICS BUILDING
10(ME) C.J. MACKENZIE BUILDING
11(MB) MAINTENANCE BUILDING
12(SC) STEACIE BUILDING
13(HP) HERZBERG LABORATORIES
14(RU) RUSSELL HOUSE
14(GR) GRENVILLLE HOUSE
15(LA) LOEB BUILDING
16(NB) H.H.J. NESBITT BIOLOGY
17(RO) ROBERTSON HALL
18(GH) GLENGARRY HOUSE
19(CO) RESIDENCE COMMONS
20(PG) PARKING GARAGE
21(DT) DUNTON TOWER
22(AA) ARCHITECTURE BUILDING
23(SP) ST. PATRICK'S BUILDING
24(SR) SOCIAL SCIENCE RESEARCH BUILDING
25(LS) LIFE SCIENCE RESEARCH BUILDING
26(SD) STORMONT-DUNDAS HOUSE
27(MC) MINTO C.A.S.E.
28(CC) COLONEL BY CHILDCARE CENTRE
29(TT) CARLETON TECHNOLOGY & TRAINING CENTRE
30(LE) LEEDS HOUSE
31(AT) AZRIELI THEATRE
32(AP) AZRIELI PAVILION
33(NW) NATIONAL WILDLIFE RESEARCH CENTRE
34(PH) PRESCOTT HOUSE
35(FH) FIELDHOUSE
36(AH) ALUMNI HALL
37(HC) HUMAN COMPUTER INTERACTION BUILDING
38 (VS) VISUALIZATION & SIMULATION BUILDING
39(IH) CARLETON ICE HOUSE
40(TC) TENNIS CENTRE
41(FR) FRONTENAC HOUSE
42(CB) CANAL BUILDING
43(RB) RIVER BUILDING
44(LX) LENNOX - ADDINGTON RESIDENCE
45(GB) GROUNDS BLDG
46(--) PARKING STRUCTURE)
47(--) Proposed SOLAR HOUSE
(Development Stage)
72(SS) BRONSON SUBSTATION
73(FB) KEITH HARRIS STADIUM
T TUNNELS
DOWS LAKE
COLONEL BY DRIVE
BRONSON AVENUE
UNIVERSITY DRIVE
CAMPUS AVENUE
LIBRARY ROAD
RIDEAU RIVER
HYDRANT 141
HYDRANT 60
Playing Field
0 20 50 100 150
Metres
Drawing Scale: 1 : 1250 (Metric)
Legend
DENOTES: FIRE HYDRANTS
DENOTES: FIRE DEPARTMENT CONNECTIONS
DENOTES: FIRE ROUTES
Carleton University
Fire Hydrants
& Fire Department Connections
March 05, 2014
Carleton UNIVERSITY
Facilities Engineering & Construction
209 Maintenance Building
1125 Colonel By Drive,
Ottawa, Canada, K1S 5B6
Telephone: (613) 520-2600 xt. 8545
Dwg by: Raymond G. Dufresne MARCH 2014
Sheet Size: 36 x 50 - Plot 1:1 (Metric)

Troy Life & Fire Safety Ltd.

FIRE HYDRANT SERVICE REPORT

Inspection type:
- Annual *(flow)*: ✓
- Winterization:
- Mid-Winter:

Building Name:	Carleton University	Address:	1125 Colonel By Drive
Work Order #:	#521051	Contact:	
Inspector:	Scott Helmer	Date:	07-Aug-14

Hydrant #:	#141	Hydrant Location:	Leeds Residence
Make / Model:	McAvity M67	Drainage Quality:	OK
Distance *(valve to hydrant)*:	2'	Valve Condition:	OK

Cap Gaskets:	OK	OK		Replace	Nozzle Cap Chains:	No	OK		
Lubricate Hydrant:		Yes	No	No	Nozzle seal:		OK		Leaking
Drain Valve Operation	OK	OK		Requires Pumping					

Pressure reading taken on:

ID Post / Locator:	Yes	Fire Pump Affect (PSI):	N/A	City Pressure (PSI):	70
Wall Hydrant:	N/A	Confine Pit:	N/A		

Static Pressure:	70	PSI	Static GPM:		GPM
Dynamic Pressure *(Pitot)*:	10	PSI	Residual at:	67	PSI
Discharge nozzle size:	2	Inches	Total GPM:		GPM

Deficiencies noted: 1) No chains on cap.

Class AA - Light Blue: Rated Capacity = 1500 GPM +
Class A - Green: Rated Capacity = 1000 / 1499 GPM
Class B - Orange: Rated Capacity = 500 / 1900 GPM
Class C - Red: Rated Capacity = under 500 GPM

Date of Inspection: 07-Aug-14
Witnessed by:
Inspected by: Scott Helmer

Troy Life & Fire Safety Ltd.

FIRE HYDRANT SERVICE REPORT

Inspection type:

Annual *(flow)*:	✓
Winterization:	
Mid-Winter:	

Building Name:	*Carleton University*	Address:	*1125 Colonel By Drive*
Work Order #:	*#521051*	Contact:	
Inspector:	*Scott Helmer*	Date:	*01-Aug-14*

Hydrant #:	*#60*	Hydrant Location:	*Stormont Dundas*
Make / Model:	*Concord D67M*	Drainage Quality:	*OK*
Distance *(valve to hydrant)*:	*10'*	Valve Condition:	*OK*

Cap Gaskets:	*OK*	OK		Replace	Nozzle Cap Chains:	*No*	OK	
Lubricate Hydrant:		Yes	*No*	No	Nozzle seal:		OK	Leaking
Drain Valve Operation	*OK*	OK		Requires Pumping				

Pressure reading taken on:

ID Post / Locator:	*Yes*	Fire Pump Affect (PSI):	*N/A*	City Pressure (PSI):	*65*
Wall Hydrant:	*N/A*	Confine Pit:	*N/A*		

Static Pressure:	*65*	PSI	Static GPM:		GPM
Dynamic Pressure *(Pitot)*:	*14*	PSI	Residual at:	*60*	PSI
Discharge nozzle size:	*2*	Inches	Total GPM:		GPM

Deficiencies noted:

Class AA - Light Blue: Rated Capacity = 1500 GPM +
Class A - Green: Rated Capacity = 1000 / 1499 GPM
Class B - Orange: Rated Capacity = 500 / 1900 GPM
Class C - Red: Rated Capacity = under 500 GPM

Date of Inspection: *01-Aug-14*
Witnessed by:
Inspected by: *Scott Helmer*

Fire Hydrant Flow Test Results

Carleton University New Students Residence

Hydrant 60

Pressures

Static	65 psi	448.18 kPa	Shutoff Head	45.7 m
Residual	60 psi	413.70 kPa	Design Head	42.2 m

Flow

Pitot	14 psi		
D	2 inch		
Cd	0.90		
Cf	29.8		
Flow	401.41 gpm	25.29 l/s	Design Flow
Q @ 20 psi	1,314.84 gpm	82.84 l/s	High Flow @ 140 kPa High Head (14.3 m)

Hydrant 141

Pressures

Static	70 psi	482.65 kPa	Shutoff Head	49.2 m
Residual	67 psi	461.97 kPa	Design Head	47.1 m

Flow

Pitot	10 psi		
D	2 inch		
Cd	0.90		
Cf	29.8		
Flow	339.25 gpm	21.37 l/s	
Q @ 20 psi	1,549.95 gpm	97.65 l/s	High Flow @ 140 kPa High Head (14.3 m)

Fire Flow Requirement from Fire Underwriters Survey

Carleton University New Students Residence

Building Floor Area (2 largest adjoining floors plus 50% of floors above up to eight)

Floor 1 & 2	4,019	m^2
50% Floors 3 to 10	6,722	m^2
Total	10,741	m^2

Fire Flow

$F = 220C\sqrt{A}$

C	0.6		C =	1.5 wood frame
A	10,741	m^2		1.0 ordinary
				0.8 non-combustile
F	13,680	l/min		0.6 fire-resistive
Use	14,000	l/min		

Occupancy Adjustment

			-25% non-combustile
			-15% limited combustile
Use	-15%		0% combustile
			+15% free burning
Adjustment	-2100	l/min	+25% rapid burning
Fire flow	11,580	l/min	

Sprinkler Adjustment

			-30% system conforming to NFPA 13
			-50% complete automatic system
Use	-40%		
Adjustment	-4632	l/min	

Exposure Adjustment

Building Face	Separation	Charge
north		0%
east		0%
south	21	10%
west		0%
Total		10%

Separation	Charge
0 to 3m	+25%
3.1 to 10m	+20%
10.1 to 20m	+15%
20.1 to 30m	+10%
30.1 to 45m	+5%

Adjustment 1,158 l/min

Required Fire Flow

Total adjustments	(3,474)	l/min
Fire flow	8,106	l/min
Use	**8,000**	**l/min**
	133.3	**l/s**

APPENDIX

TYPES OF CONSTRUCTION

For the specific purpose of using the Guide, the following definitions may be used:

Fire-Resistive Construction - Any structure that is considered fully protected, having at least 3-hour rated structural members and floors. For example, reinforced concrete or protected steel.

Non-combustible Construction - Any structures having all structural members including walls, columns, piers, beams, girders, trusses, floors, and roofs of non-combustible material and not qualifying as fire-resistive construction. For example, unprotected metal buildings.

Ordinary Construction - Any structure having exterior walls of masonry or such non-combustible material, in which the other structural members, including but not limited to columns, floors, roofs, beams, girders, and joists, are wholly or partly of wood or other combustible material.

Wood Frame Construction - Any structure in which the structural members are wholly or partly of wood or other combustible material and the construction does not qualify as ordinary construction.

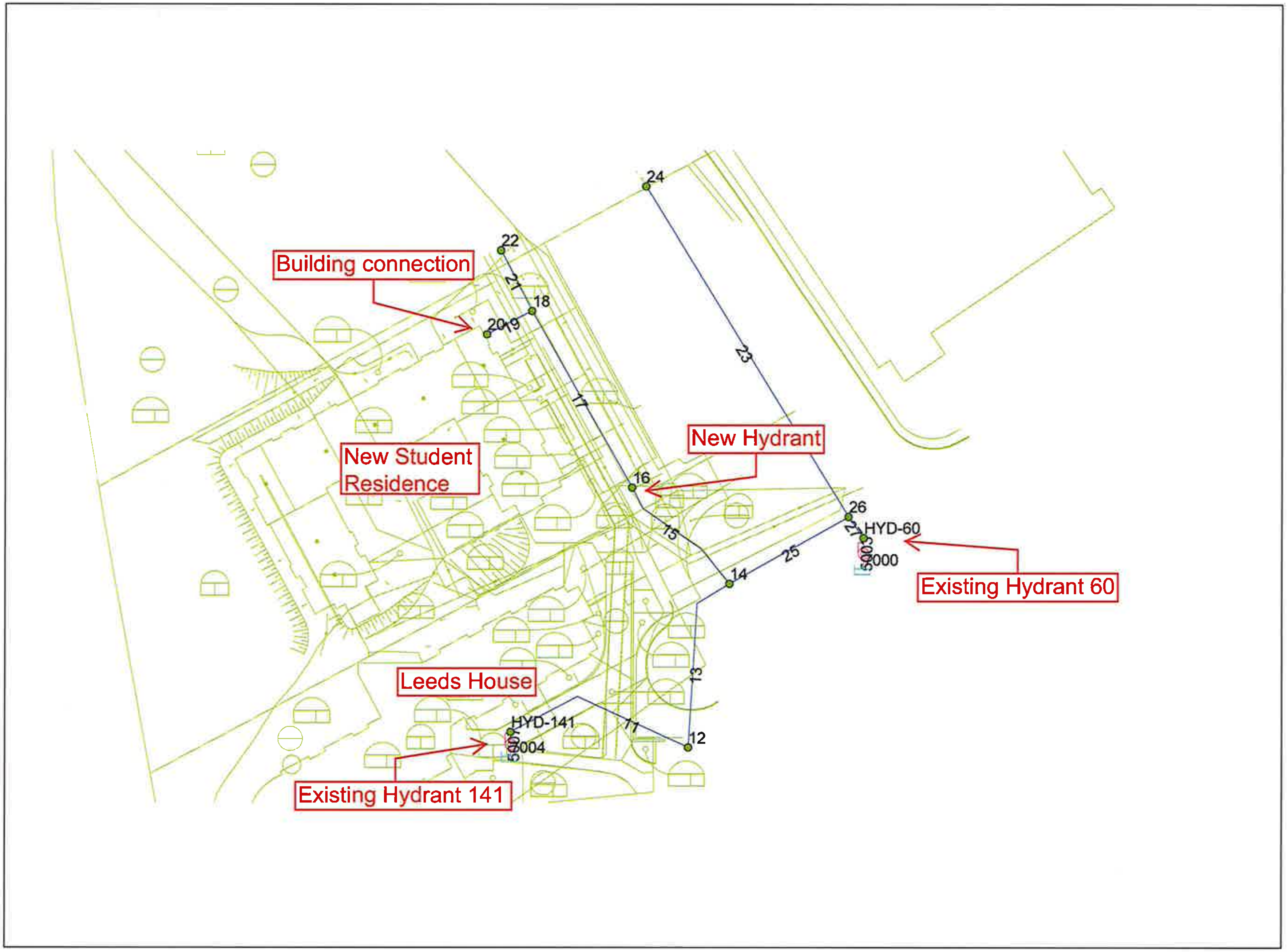
OCCUPANCIES

Examples of Low Hazard Occupancies:

Apartments
Asylums
Churches
Clubs
Colleges & Universities
Dormitories
Dwellings
Hospitals
Hotels
Institutions
Libraries, except Large Stack Room Areas
Museums
Nursing, Convalescent and Care Homes
Office Buildings
Prisons
Public Buildings
Rooming Houses
Schools
Tenements

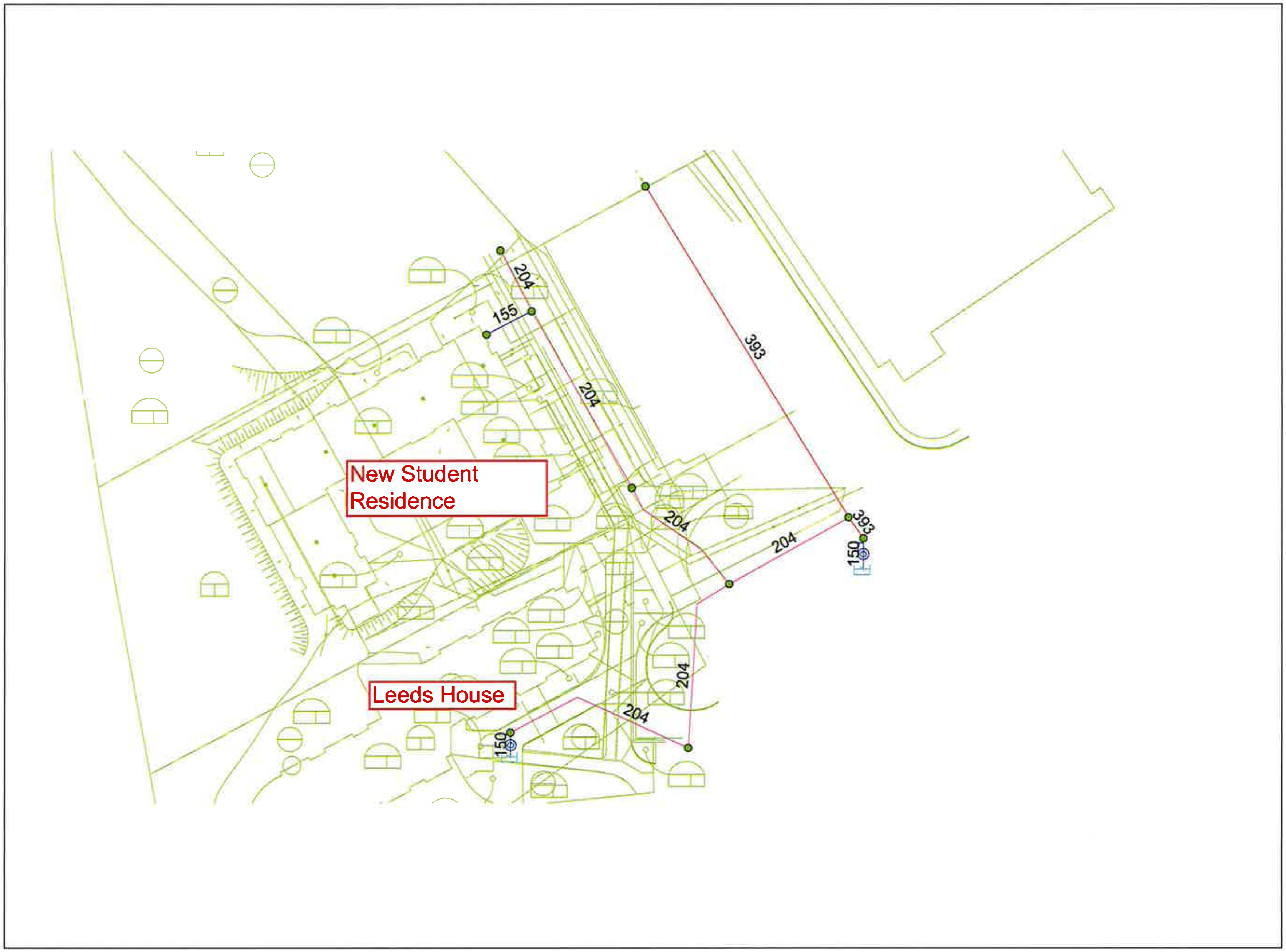
Generally, occupancies falling in National Building Code Groups A, B, C and D are of this class.

NODE AND PIPE ID'S

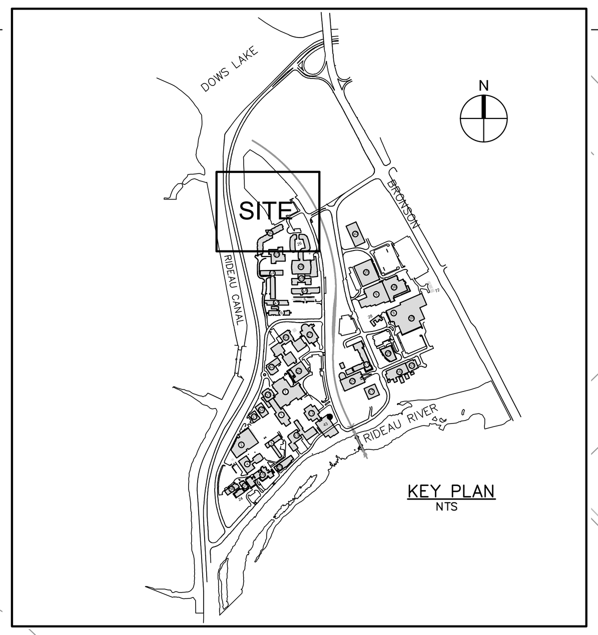


Date: Tuesday, March 31, 2015

PIPE SIZES



Date: Tuesday, March 31, 2015



	STATION	DESCRIPTION	FINISHED	TOP OF W/M	AS-BUILT
WATERMAIN SCHEDULE					
A	0+000	200Ø x 200Ø TEE	64.35	61.95	
	0+001	200Ø V&VB	64.45	62.05	
	0+009	22 1/2 BEND	65.45	62.88	
	0+020	--	65.42	63.02	
	0+026.7	22 1/2 BEND	65.55	63.15	
	0+032.1	HYDRANT TEE	65.64	63.24	
	0+040	--	65.69	63.29	
	0+060	--	65.79	63.39	
	0+080	--	65.89	63.49	
	0+084.4	150Ø x 200Ø TEE	65.97	63.57	
	0+085.4	200Ø V&VB	65.98	63.58	
B	0+099	200Ø CAP	66.10	63.70	

ICD TABLE

ICD#	STRUCTURE	HEAD (m)	FLOW (L/S)	ICD TYPE
E5.1	RYCB7	1.32	15.00	CUSTOM MHF TEMPEST
E5.2	CB11	1.44	14.00	CUSTOM MHF TEMPEST
E5.4	CB5	1.4	4.00	CUSTOM LMF TEMPEST
E5.7	CB4	1.38	9.00	CUSTOM LMF TEMPEST
E5.5	CB9	1.39	29.00	CUSTOM MHF TEMPEST
E5.10	CB10	1.25	22.00	CUSTOM MHF TEMPEST
3C1	CBMH7	5.64	14.25	CUSTOM LMF TEMPEST
SWM	DI10	1.14	10.00	HYDROVEX 75VHV VORTEX
3D	*EXISTING BUILDING*	*N/A*	*9.76**	*EXISTING ROOF DRAIN*

* existing roof drain

ROAD STRUCTURE ⊕

LIGHT DUTY (PARKING AREA):

50mm WEAR COURSE 12.5mm SUPERPAVE
150mm BASE GRANULAR "A"
300mm SUBBASE GRANULAR "B"

HEAVY DUTY (DRIVE ISLES AND FIRE ROUTES):

40mm WEAR COURSE 12.5mm SUPERPAVE
50mm BINDER COURSE 19.0mm SUPERPAVE
150mm BASE COURSE GRANULAR "A"
400mm SUBBASEGRANULAR "B"

REFER TO NOTE 1.15

DRAWING NOTES

1.0 GENERAL

1.1 CONTRACTOR TO VERIFY ALL DIMENSIONS PRIOR TO CONSTRUCTION.

1.2 DO NOT SCALE DRAWINGS.

1.3 CONTRACTOR TO REPORT ALL DISCOVERIES OF ERRORS, OMISSIONS OR DISCREPANCIES TO THE ARCHITECT OR DESIGN ENGINEER AS APPLICABLE.

1.4 USE ONLY THE LATEST REVISED DRAWINGS OR THOSE THAT ARE MARKED "ISSUED FOR CONSTRUCTION".

1.5 ALL CONSTRUCTION SHALL COMPLY WITH CURRENT CITY OF OTTAWA STANDARDS AND SPECIFICATIONS.

1.6 THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL RELEVANT DRAWINGS AND SPECIFICATIONS.

1.7 FOR LEGAL SURVEY INFORMATION REFER TO REGISTERED PLAN.

1.8 REFER TO SITE PLAN BY VINCENT P. COLIZZA ARCHITECT INC. FOR SITE PLAN LAYOUT.

1.9 REFER TO LANDSCAPE ARCHITECTURAL DRAWINGS FOR SURFACE FEATURES DETAILS.

1.10 CONTRACTOR TO IMPLEMENT EROSION AND SEDIMENT CONTROL MEASURES AS IDENTIFIED IN THE EROSION AND SEDIMENT CONTROL PLAN TO THE SATISFACTION OF THE CITY OF OTTAWA, PRIOR TO UNDERTAKING ANY SITE ALTERATIONS (FILLING, GRADING, REMOVAL OF VEGETATION, ETC.). [illegible]

1.11 ALL IRON WORK ELEVATIONS SHOWN ARE APPROXIMATE AND ARE SUBJECT TO MINOR ADJUSTMENTS AS DETERMINED BY THE ENGINEER.

1.12 ALL CONCRETE CURBS AND SIDEWALKS TO CONFORM TO O.P.S. AND CONSTRUCTED TO CITY STANDARDS. ALL ONSITE CURBS TO BE BARRIER TYPE, WITH DEPRESSIONS AS NOTED.

1.13 ALL CONCRETE SHALL BE "NORMAL PORTLAND CEMENT" IN ACCORDANCE WITH O.P.S.S AND SHALL ACHIEVE A MINIMUM STRENGTH OF 30MPa AT 28 DAYS.

1.14 ALL CONSTRUCTION TRAFFIC TO ACCESS SITE FROM CAMPUS AVENUE.

1.15 FOR DETAILS OF TEST PITS SEE GEOTECHNICAL REPORT BY PATERSON GROUP.

1.16 CONTRACTOR TO PROTECT EXISTING INFRASTRUCTURE AND PROPERTY SUCH AS TREES, PARKING METERS, SIDEWALKS, CURBS, ASPHALT, AND STREET SIGNS FROM DAMAGE DURING CONSTRUCTION. CONTRACTOR TO PAY THE COST TO REINSTATE OR REPLACE ANY DAMAGED INFRASTRUCTURE OR PROPERTY TO THE SATISFACTION OF THE CITY OR THE UNIVERSITY.

1.17 THE POSITION OF POLE LINES, CONDUITS, WATERMAIN, SEWERS, AND OTHER UNDERGROUND AND ABOVEGROUND UTILITIES AND STRUCTURES ARE NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK THE CONTRACTOR SHALL INFORM ITSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES, SHALL PROTECT ALL UTILITIES AND STRUCTURES, AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

1.18 CONTRACTOR TO SUPPLY SUITABLE FILL MATERIAL WHERE REQUIRED TO ROUGH GRADE THE SITE. ALL IMPORTED FILL MATERIAL TO BE CERTIFIED AS ACCEPTABLE BY THE GEOTECHNICAL ENGINEER.

1.19 CONTRACTOR TO HAUL EXCESS MATERIAL OFFSITE AS NECESSARY TO GRADE SITE TO MEET THE PROPOSED GRADES. ALL EXCESS MATERIAL TO BE HAULED OFFSITE AND DISPOSED OF AT AN APPROVED DUMP SITE. SHOULD THE CONTRACTOR DISCOVER ANY HAZARDOUS MATERIAL, CONTRACTOR IS TO NOTIFY ENGINEER. ENGINEER TO DETERMINE APPROPRIATE DISPOSAL METHODOLOCATION.

1.20 FILL MATERIAL WITHIN THE PARKING LOT AND BUILDING PAD AREAS, AND SUPPORTING BUILDING FOUNDATIONS SHALL BE COMPACTED TO 98% STANDARD PROCTOR DENSITY AND TO THE SATISFACTION OF THE GEOTECHNICAL ENGINEER.

1.21 ALL COMPACTION METHODS TO BE PERFORMED TO THE SATISFACTION OF THE GEOTECHNICAL ENGINEER TO INCLUDE BUT NOT BE LIMITED TO THE THICKNESS OF LIFTS, AND COMPACTION EQUIPMENT USED.

1.22 ALL DISTURBED BOULEVARDS TO BE REINSTATED WITH SOD ON 100mm TOPSOIL.

1.23 UTILITY DUCTS TO BE INSTALLED PRIOR TO ROAD AND PARKING LOT BASE CONSTRUCTION.

1.24 CLAY DIKES TO BE INSTALLED WHERE INDICATED ON THE DRAWINGS OR AS APPROVED AND DIRECTED BY THE GEOTECHNICAL ENGINEER. ALL IN ACCORDANCE WITH CITY OF OTTAWA STANDARDS AND SPECIFICATIONS.

1.25 ALL PIPE BEDDING TO BE OPSS GRANULAR 'A' PLACED A MINIMUM OF 300mm BELOW SEWER AND WATER PIPES AND COMPACTED TO SPRING LINE. BEDDING AND COVER MATERIAL AS PER RECOMMENDATIONS FROM GEOTECHNICAL ENGINEER.

2.0 SANITARY

2.1 ALL SANITARY SEWER MAINS TO BE CSA CERTIFIED, BELL AND SPIGOT TYPE. ONLY FACTORY FITTINGS TO BE USED. SEWER TO BE INSTALLED AS PER OSPD 1005.01. SANITARY SEWER MATERIALS TO BE:
250mmØ AND SMALLER - PVC DR 35

2.2 ALL SANITARY MAINTENANCE HOLES TO BE 1.2m DIAMETER AS PER CITY OF OTTAWA STANDARDS COMPLETE WITH BENCHING, RUNGS, FRAME AND COVER, DROP PIPES AND LANDINGS WHERE NEEDED.

2.3 SANITARY MANHOLE COVERS TO BE CITY OF OTTAWA STD. S25 (MOD. OPSD. 401.020). SANITARY MANHOLE COVER TO BE CLOSED COVER TYPE, AS PER CITY STANDARD S24.

2.4 SANITARY SEWER LEAKAGE TEST AND CCTV INSPECTION SHALL BE COMPLETED AS PER CITY SPECIFICATIONS PRIOR TO INSTALLATION OF BASE COURSE ASPHALT.

2.5 ANY SANITARY SEWER WITH LESS THAN 2.0m COVER REQUIRES THERMAL INSULATION AS PER CITY OF OTTAWA STANDARD W22, OR AS APPROVED BY THE ENGINEER.

2.6 CONNECTION TO THE EXISTING SANITARY SEWER TO BE INCLUDED IN THE COST FOR SANITARY SEWER INSTALLATION. THIS INCLUDES REINSTATEMENT OF ROAD CUTS TO CITY STANDARDS.

3.0 STORM

3.1 ALL STORM SEWERS TO BE CSA CERTIFIED, BELL AND SPIGOT TYPE. ALL STORM SEWERS TO BE INSTALLED PER MANUFACTURER'S INSTRUCTIONS. ONLY FACTORY FITTINGS TO BE USED. STORM SEWER MATERIALS TO BE : 375mmØ AND SMALLER - PVC DR 35
450mmØ TO 750mmØ - CONC. CL. 100-D
825mmØ AND LARGER - CONC. CL 65-D

3.2 ALL STORM MAINTENANCE HOLES TO BE SIZED IN ACCORDANCE WITH THE PLANS AND AS PER CITY OF OTTAWA STANDARDS COMPLETE WITH BENCHING, RUNGS, AND FRAME AND COVER.

3.3 STORM MH COVERS TO BE OPEN TYPE, AS PER CITY STANDARD S24.1, FRAMES TO BE PER CITY OF OTTAWA STD. S25.. CONTRACTOR TO INSTALL FILTER FABRIC UNDER STORM MH COVER UNTIL SODDING IS COMPLETE.

3.4 STORM MAINTENANCE HOLES AND CBMH'S TO BE OPSD, SIZE AS SPECIFIED, TAPER TOP FOR MH AND FLAT TOP FOR CBMH, UNLESS OTHERWISE NOTED.

3.5 ALL CATCH BASINS TO BE AS PER OPSD 705.010, FRAME & FISH TYPE GRATE AS PER CITY OF OTTAWA STD. S19.1, ALL CB LEAD PIPES TO BE 250mm DIAMETER PVC DR 35 @ 1.00% SLOPE WITH OUTLET INVERT AT 1.45m BELOW TOP OF GRATE, UNLESS OTHERWISE NOTED.

3.6 150mm DIAMETER SOCK-WRAPPED PERFORATED PVC SUBDRAINS TO BE INSTALLED AT ALL STREET/PARKING LOT CB'S, EXTEND 3.0m FROM 4 SIDES OF CB. WHERE CB IS ADJACENT TO CURB EXTEND SUBDRAIN 3.0m IN EACH DIRECTION ALONG CURB.

3.7 ANY STORM SEWER WITH LESS THAN 2.0m COVER REQUIRES THERMAL INSULATION AS PER CITY OF OTTAWA STANDARD W22, OR AS APPROVED BY THE ENGINEER.

3.8 CONNECTION TO THE EXISTING STORM SEWER TO BE INCLUDED IN THE COST FOR STORM SEWER INSTALLATION. THIS INCLUDES REINSTATEMENT OF ROAD CUT TO CITY STANDARDS.

3.9 CONTRACTOR TO PROVIDE IPEX-TEMPEST ICD'S (OR EQUIVALENT)SHOP DRAWINGS BASED ON HEAD AND FLOW RATE SPECIFIED IN ICD DATA TABLE, FOR ENGINEERS REVIEW PRIOR TO ORDERING ICD'S.

4.0 WATER

4.1 ALL WATERMAINS TO BE PVC DR 18, WITH MINIMUM COVER OF 2.4m AND INSTALLED PER CITY OF OTTAWA STANDARDS. ALL DOMESTIC WATER SERVICES ARE TO BE 200mmØ.

4.2 THRUST BLOCKS TO BE INSTALLED AT ALL BENDS, TEES, AND CAPS ALL AS PER OPSD 1103.01 AND 1103.02.

4.3 CONTRACTOR TO CONDUCT PRESSURE AND LEAKAGE TESTING OF ALL WATERMAINS AND DISINFECT AND CHLORINATE ALL WATERMAINS TO THE SATISFACTION OF M.O.E. AND THE CITY OF OTTAWA.

4.4 TRACER WIRE TO BE INSTALLED ALONG THE FULL LENGTH OF WATERMAIN AND ATTACHED TO EACH MAIN STOP AS PER CITY OF OTTAWA STANDARDS.

4.5 ALL COMPONENTS OF THE WATER DISTRIBUTION SYSTEM SHALL BE CATHODICALLY PROTECTED AS PER CITY OF OTTAWA STANDARDS.

4.6 ALL VALVES & VALVE BOXES AND CHAMBERS, HYDRANTS, AND HYDRANT VALVES AND ASSEMBLIES SHALL BE INSTALLED AS PER CITY OF OTTAWA STANDARDS.

4.7 ANY WATERMAIN WITH LESS THAN 2.4m COVER REQUIRES THERMAL INSULATION AS PER CITY OF OTTAWA STANDARD W21,W22, W23, OR AS APPROVED BY THE ENGINEER.

4.8 CONTRACTOR IS RESPONSIBLE FOR ACQUIRING THE WATER PERMIT FROM THE CITY OF OTTAWA AND PAYMENT OF ANY FEES ASSOCIATED WITH SECURING THE WATER PERMIT. OWNER IS RESPONSIBLE FOR REIMBURSING THE CONTRACTOR FOR THE ACTUAL COST OF ACQUIRING THE WATER PERMIT.

4.9 CONNECTION TO EXISTING WATERMAIN TO BE INCLUDED IN THE COST FOR THE WATERMAIN INSTALLATION. THIS COST INCLUDES REINSTATEMENT OF ROAD CUTS TO CITY STANDARDS.

5.0 PARKING LOT AND WORK IN PUBLIC RIGHTS OF WAY

5.1 CONTRACTOR TO REINSTATE ROAD CUTS PER CITY OF OTTAWA STANDARD R-10.

5.2 THE CONTRACTOR SHALL PREPARE A TRAFFIC MANAGEMENT PLAN FOR REVIEW AND APPROVAL BY THE CITY OF OTTAWA AND THE UNIVERSITY. CONTRACTOR TO MAINTAIN TRAFFIC FLOW DURING THE ENTIRE CONSTRUCTION PERIOD. MAINTENANCE OF ROAD CUTS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. PROVISION OF FLAGMEN, DETOURS AS NECESSARY, BARRICADES AND SIGNS TO THE FULL SATISFACTION OF THE ENGINEER AND ROAD AUTHORITY SHALL BE THE CONTRACTOR'S RESPONSIBILITY.

5.3 CONTRACTOR TO PREPARE SUBGRADE, INCLUDING PROOFROLLING, TO THE SATISFACTION OF THE GEOTECHNICAL ENGINEER PRIOR TO THE COMMENCEMENT OF PLACEMENT OF GRANULAR B MATERIAL.

5.4 FILL TO BE PLACED AND COMPACTED PER THE GEOTECHNICAL REPORT REQUIREMENTS.

5.5 CONTRACTOR TO SUPPLY, PLACE AND COMPACT GRANULAR B MATERIAL IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE GEOETCHNICAL ENGINEER. CONTRACTOR TO PROVIDE ENGINEER WITH SAMPLES OF GRANULAR B MATERIAL FOR TESTING AND CERTIFICATION FROM THE GEOTECHNICAL ENGINEER THAT THE MATERIAL MEETS THE GRADATION REQUIREMENTS SPECIFIED IN THE GEOTECHNICAL REPORT.

5.6 GRANULAR "A" MATERIAL TO BE PLACED ONLY UPON APPROVAL BY THE GEOTECHNICAL ENGINEER OF GRANULAR "B" PLACEMENT.

5.7 CONTRACTOR TO SUPPLY, PLACE AND COMPACT GRANULAR A MATERIAL IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE GEOETCHNICAL ENGINEER. CONTRACTOR TO PROVIDE ENGINEER WITH SAMPLES OF GRANULAR A MATERIAL FOR TESTING AND CERTIFICATION FROM THE GEOTECHNICAL ENGINEER THAT THE MATERIAL MEETS THE GRADATION REQUIREMENTS SPECIFIED IN THE GEOTECHNICAL REPORT.

5.8 ASPHALT MATERIAL TO BE PLACED ONLY UPON APPROVAL BY THE GEOTECHNICAL ENGINEER OF GRANULAR A PLACEMENT.

5.9 CONTRACTOR TO SUPPLY, PLACE AND COMPACT ASPHALT MATERIAL IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE GEOTECHNICAL ENGINEER. CONTRACTOR TO PROVIDE ENGINEER WITH SAMPLES OF ASPHALT MATERIAL FOR TESTING AND CERTIFICATION FROM THE GEOTECHNICAL ENGINEER THAT THE MATERIAL MEETS THE REQUIREMENTS SPECIFIED IN THE GEOTECHNICAL REPORT.

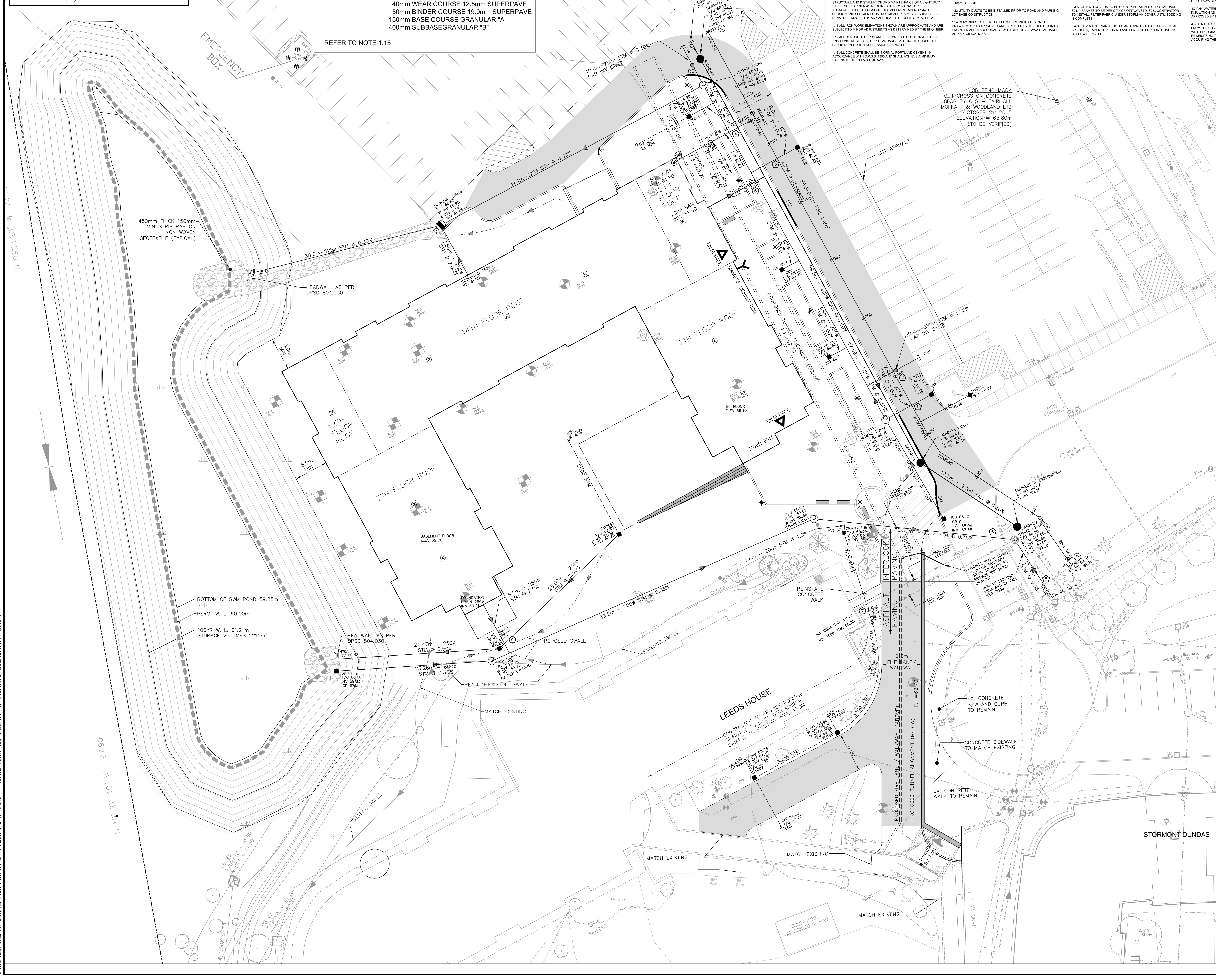
5.10 CONTRACTOR IS RESPONSIBLE FOR ESTABLISHING LINE AND GRADE IN ACCORDANCE WITH THE PLANS, AND FOR PROVIDING THE ENGINEER WITH VERIFICATION PRIOR TO PLACEMENT.

5.11 ANY DITCHES DISTURBED DURING SERVICING AND GRADING OPERATIONS ARE TO BE REINSTATED TO THEIR ORIGINAL CONDITION AND FLOWLINE GRADES.

5.12 ALL RE GRADED AREAS IN EXISTING PUBLIC RIGHTS OF WAY OR ON PRIVATE LANDS AND ANY OTHER DISTURBED AREAS IN EXISTING PUBLIC RIGHTS OF WAY OR PRIVATE LANDS ARE TO BE FINISHED WITH SOD ON 100mm TOPSOIL.

5.13 ALL EXCESS MATERIAL TO BE HAULED OFFSITE AND DISPOSED OF AT AN APPROVED DUMP SITE. SHOULD THE CONTRACTOR DISCOVER ANY HAZARDOUS MATERIAL, CONTRACTOR IS TO NOTIFY ENGINEER. ENGINEER TO DETERMINE APPROPRIATE DISPOSAL METHOD/LOCATION.

5.14 PAVEMENT STRUCTURE (MATERIAL TYPES AND THICKNESSES) FOR HEAVY DUTY AND LIGHT DUTY AREAS TO BE AS SPECIFIED IN THE GEOTECHNICAL REPORT AND SHOWN ON THE PLANS.



PIPE CROSSING TABLE

1.	200 mm dia. STM	0.90 m	Clearance Over	200 mm dia WM
	200 mm dia. STM	3.72 m	Clearance Over	200 mm dia. SAN
2.	200 mm dia. WM	0.90 m	Clearance Over	375 mm dia. STM
	375 mm dia. STM	1.30 m	Clearance Over	200 mm dia. SAN
3.	200 mm dia. STM	0.75 m	Clearance Over	200 mm dia. WM
	200 mm dia. STM	3.58 m	Clearance Over	200 mm dia. SAN
4.	150 mm dia. WM	2.68 m	Clearance Over	200 mm dia. SAN
	150 mm dia. WM	1.87 m	Clearance Over	525mm dia. STM
5.	525 mm dia. STM	0.40 m	Clearance Over	200 mm dia. SAN
6.	200 mm dia. SAN	0.25 m	Clearance Over	300 mm dia. STM
7.	300 mm dia. STM	3.00 m	Clearance Over	200 mm dia. SAN
	300 mm dia. STM	3.05 m	Clearance Over	150 mm dia. WM
8.	200 mm dia. WM	2.15 m	Clearance Over	300 mm dia. STM
9.	250 mm dia. STM	0.25 m	Clearance Over	250 mm dia. STM

Carleton UNIVERSITY
Canada's Capital University

LEGEND:

- STMH1 — PROPOSED STORM MANHOLE
- SANMH1A — PROPOSED SANITARY MANHOLE
- CB — PROPOSED CATCHBASIN
- CBMH — PROPOSED CATCHBASIN MANHOLE
- 300ø STM — PROPOSED STORM SEWER
- 250ø SAN. — PROPOSED SANITARY SEWER
- 100ø WATERMAIN — PROPOSED WATERMAIN
- V&VB — PROPOSED WM VALVE & VALVE BOX
- HYD B/F= — PROPOSED HYDRANT C/W BOTTOM OF FLANGE ELEVATION
- PROPOSED CONCRETE CURB
- DC — PROPOSED DEPRESSED CURB
- PROPOSED ENTRANCE
- PROPOSED STORM SUBDRAIN
- PROPOSED HEAVY DUTY ASPHALT
- PROPOSED HEAVY DUTY INTERLOCK
- BH 1 66.12 (60.58) — BOREHOLE LOCETION
- TP 2 65.97 — TEST PIT
- M — WATER METER
- RM — REMOTE WATER METER
- 2 — CROSSING NODE

No.	DESCRIPTION	DATE	CHK
05	REVISED AS PER CITY COMMENTS	16:03:31	DOY
04	REVISED AS PER CITY COMMENTS	15:08:13	DOY
03	100% SUBMISSION	15:06:02	DOY
02	SITE PLAN SUBMISSION	15:04:06	DOY
01	30% SUBMISSION	15:01:22	DOY

REVISIONS

CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ANY OMMISSIONS OR DISCREPANCIES TO THE ARCHITECT BEFORE PROCEEDING WITH THE WORK.

DO NOT SCALE THE DRAWINGS

THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES UNTIL SIGNED BY THE ARCHITECT.

LICENSED PROFESSIONAL ENGINEER D. Yiannoulopoulos 2016/03/31 PROVINCE OF ONTARIO

DATE 2014 12 15
DRAWN EH
DATE 2014 12 15
CHECKED DOY
DATE PRINTED 2014 12 15

Project North — True North

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

VINCENT P. COLIZZA ARCHITECT INCORPORATED

CARLETON UNIVERSITY
1125 COLONEL BY DRIVE,
OTTAWA, ON. K1S 5B6
TEL:(613)520-2600

REVIEWED BY DEVELOPMENT REVIEW SERVICES BRANCH
Signed ____________
Date ____________ 2016
Plan Number ____________

DWG. TITLE: SERVICING PLAN
SCALE: 1 : 200
DWG. NO.: C-100
PROJ. NO.: 35843

APPENDIX E

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

SANITARY SEWER DESIGN SHEET

PROJECT: Carleton Residence 2017
LOCATION: City of Ottawa
CLIENT: Carleton University

LOCATION				RESIDENTIAL									
STREET	AREA ID	FROM MH	TO MH	AREA w/ Units (Ha)	UNIT TYPES: SF	SD	TH	BEDS	AREA w/o Units (Ha)	POPULATION: IND	CUM	PEAK FACTOR	PEAK FLOW (L/s)
Future	Future	stub	4A	2.33				1280		1280.0	1280.0	3.73	15.19
Driveway	4A	4A	3A	0.91				500		500.0	1780.0	3.62	20.54
Driveway	3B	3A	2A	0.02				0		0.0	1780.0	3.62	20.54
Driveway	*3A, 2A*	*2A*	*Ex*	*0.84*				*396*		*396.0*	*2176.0*	*3.56*	*24.64*

AREA ID	ICI AREAS, AREA (Ha): INSTITUTIONAL IND	INSTITUTIONAL CUM	COMMERCIAL IND	COMMERCIAL CUM	INDUSTRIAL IND	INDUSTRIAL CUM	ICI PEAK FLOW (L/s)	INFILTRATION ALLOWANCE AREA (Ha): IND	CUM	INFILTRATION FLOW (L/s)	FIXED FLOW (L/s)	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 (%)
Future		0.00		0.00		0.00	0.00	2.33	2.33	0.65	0.00	15.84	24.19	3.00	200	0.50	0.746	8.35	34.52%
4A		0.00		0.00		0.00	0.00	0.91	3.24	0.91	0.00	21.44	24.19	69.50	200	0.50	0.746	2.75	11.38%
3B		0.00		0.00		0.00	0.00	0.02	3.26	0.91	0.00	21.45	24.19	17.50	200	0.50	0.746	2.75	11.35%
3A, 2A		*0.00*		*0.00*		*0.00*	*0.00*	*0.84*	*4.10*	*1.15*	*0.00*	*25.78*	*87.24*	*13.50*	*200*	*6.50*	*2.690*	*61.45*	*70.44%*

Design Parameters:

Residential			ICI Areas			Peak Factor
SF	3.4	p/p/u	INST	50,000	L/Ha/day	1.5
TH/SD	2.7	p/p/u	COM	50,000	L/Ha/day	1.5
Res.	1.0	p/p/bed	IND	35,000	L/Ha/day	MOE Chart
Other	60	p/p/Ha		17000	L/Ha/day	

Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita) Residence: 275 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: ABC

Checked: DEF

Dwg. Reference: 12345-501

No.	Revision	Date
1.	City submission No. 1	April/9/2015
2.	City submission No. 2	April/5/2016

File Reference: 12345.5.7.1 | **Date:** 9/6/2012 | **Sheet No:** 1 of 1

REVIEWED BY
DEVELOPMENT REVIEW SERVICES BRANCH

Signed ______________________

Date ______________________ 2016

Plan Number ______________________

LEGEND :

- # — AREA NUMBER
- POPULATION
- 2.33 — AREA IN HECTARES

No.	DESCRIPTION	DATE	CHD
05	REVISED AS PER CITY COMMENTS	16:03:31	DGY
04	REVISED AS PER CITY COMMENTS	15:08:13	DGY
03	100% SUBMISSION	15:06:02	DGY
02	SITE PLAN SUBMISSION	15:01:30	DGY
01	30% SUBMISSION	15:01:22	DGY

REVISIONS

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DO NOT SCALE THE DRAWINGS

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
2016/03/31
PROVINCE OF ONTARIO

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DATE 2014 12 15

DRAWN EH

DATE 2014 12 15

CHECKED DGY

DATE PRINTED 2014 12 15

Project North

True North

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

VINCENT P. COLIZZA ARCHITECT INCORPORATED

CARLETON UNIVERSITY
1125 COLONEL BY DRIVE,
OTTAWA, ON. K1S 5B6
TEL:(613)520-2600

DWG. TITLE

SANITARY DRAINAGE AREA PLAN

SCALE 1 : 500

PROJ. NO. 35843

DWG. NO. C-501

APPENDIX F

Inlet Capacity in a sag

Cd	0.61	
S22 Curb Inlet Area	0.08908	m^2
OPSD 400.1 Grate Area	0.1468	m^2

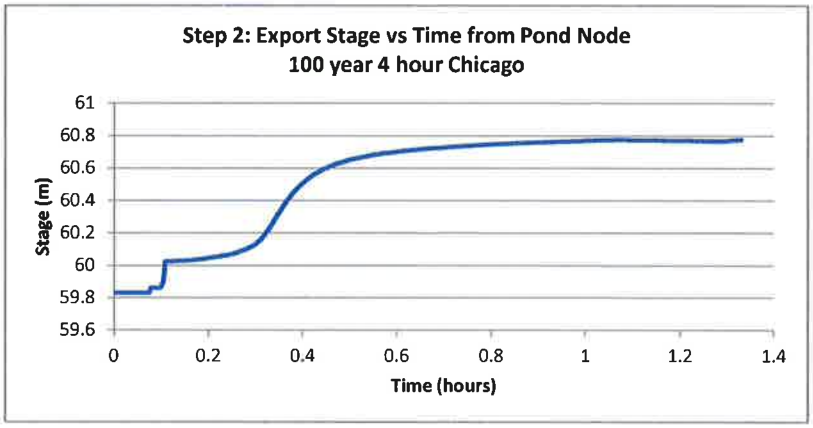
CB ID	Type of CB	Number of CB	T/G of CB	Spill elev at curb (m)	Max Head (m)	Head over Orifice (m)	CB inflow (m^3/s)
DCBMH8	grate	2	65.40	65.5	0.10	0.100	0.251

Total CB capture	0.251
100 yr modelled inflow	0.25
Overflow	**-0.001**

Appendix F - Tailwater Determination

Step 1. XPSWMM model run assuming "Free Outfall" with the depth criterion "minimum yc_yn". Where yc is critcal depth and yn is normal depth.

Step 2. Export Stage vs Time rating curve from Pond Node (see 100 year 3 hour Chicago example below)

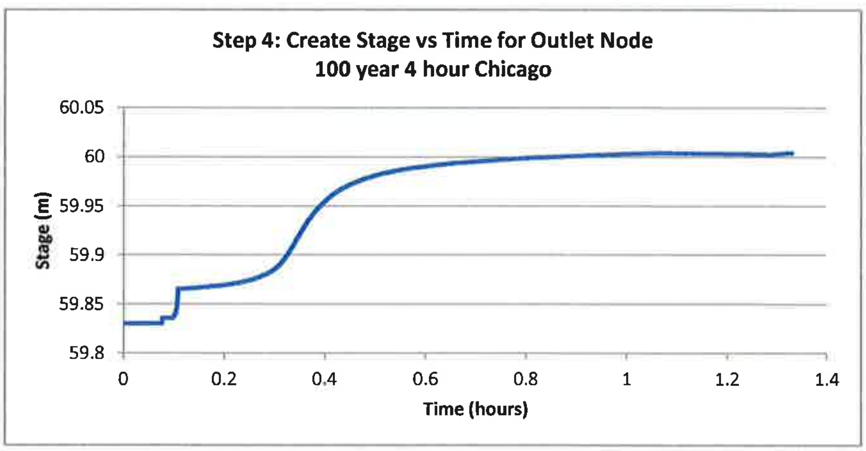


Step 3. Calculate a ratio based on stage (d) coefficient for each time step from the Pond Node Stage vs Time curve. See equation below.

Ratio (Rx): $R_x = \frac{d_x}{d_{max}}$

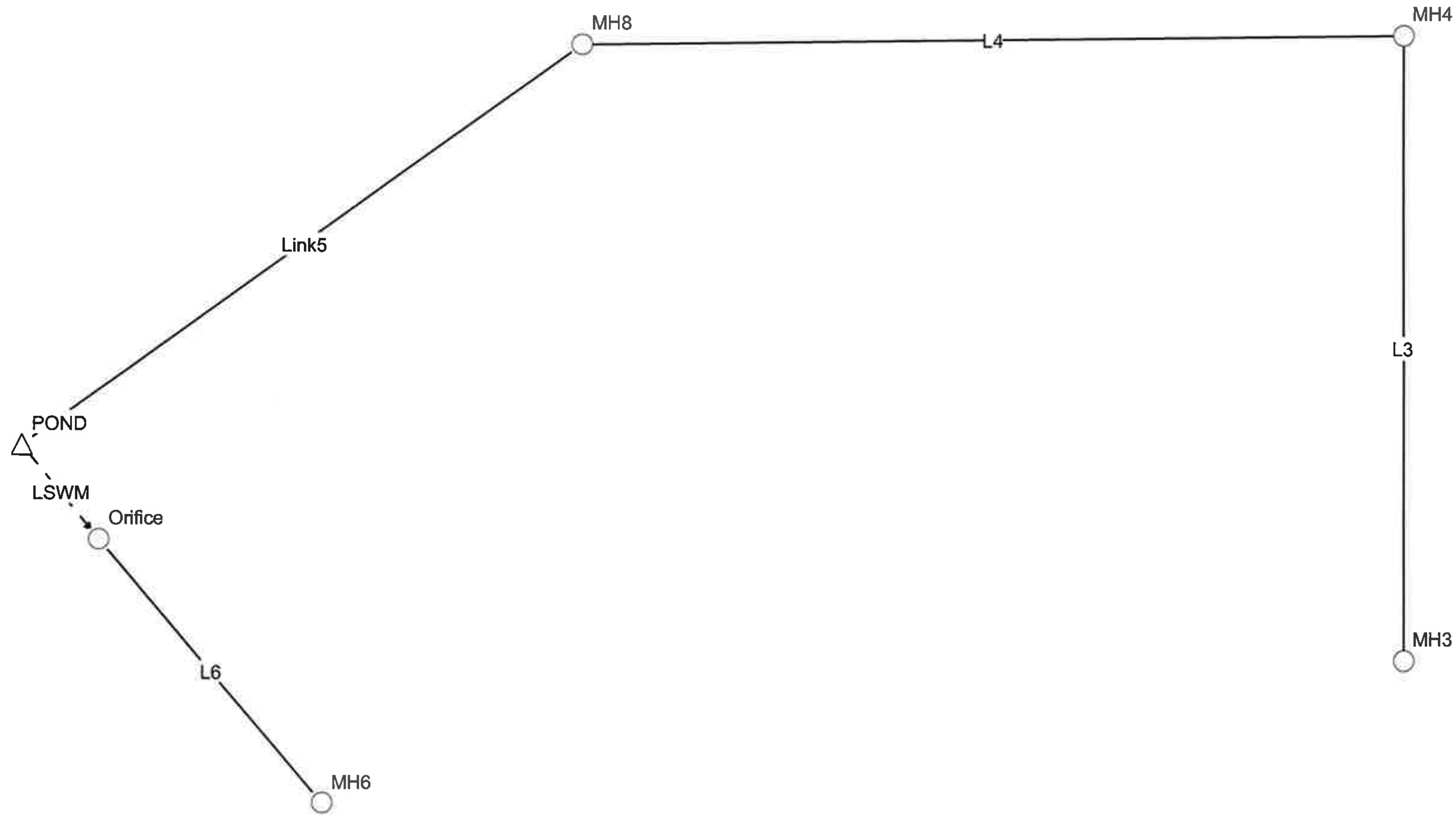
Step 4. Using outlet invert (59.83 m) and the downstream pipe obvert (60.004) and ratio developed from Step 3, create Stage vs Time curve for outlet (see equation and 100 year 3 hour Chicago example below)

Outlet Stage (Hx): $H_x = R_x(93.50 - 93.08) + 93.08$

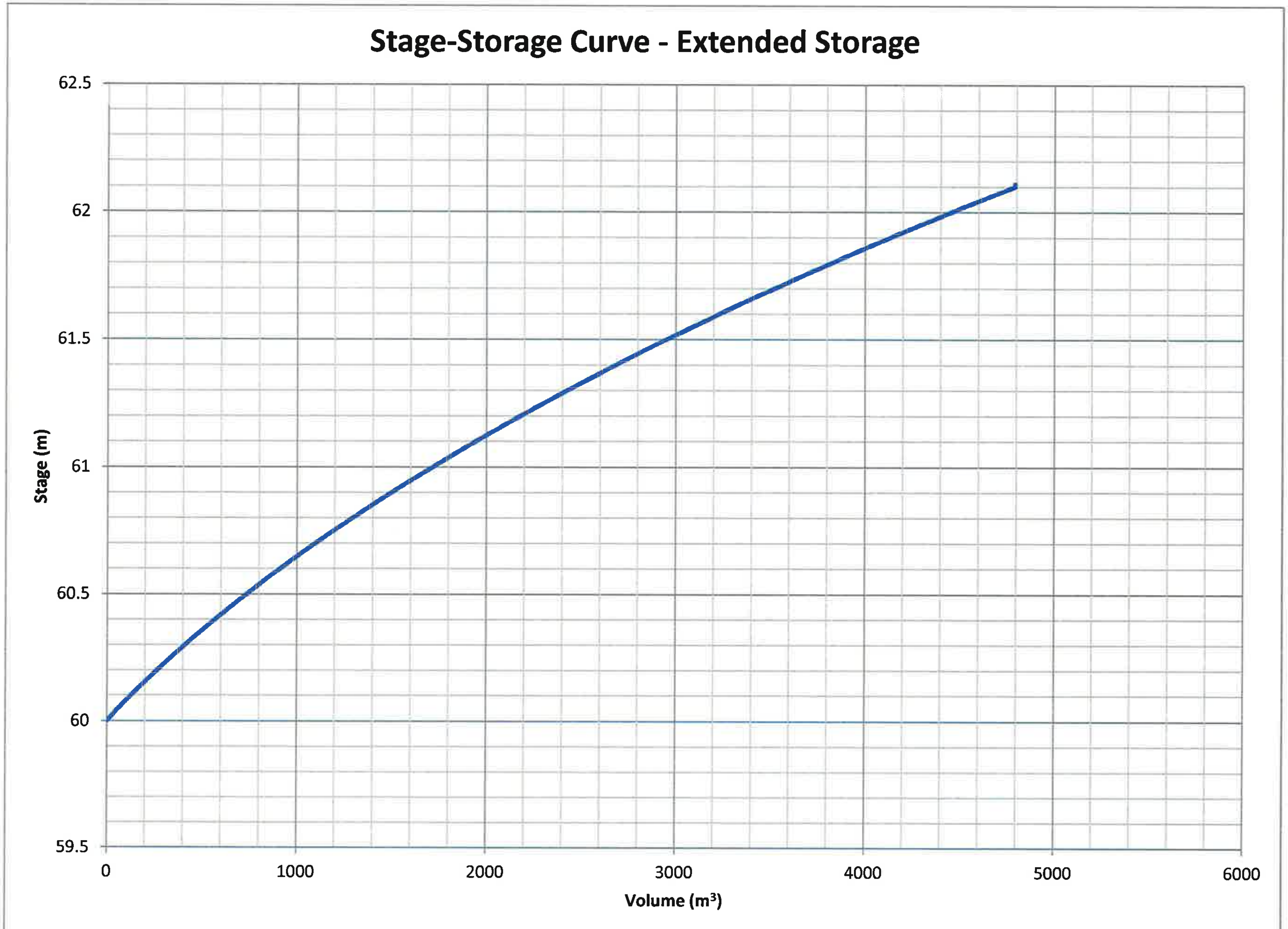


Step 5. Copy Stage vs Time curve created into Outlet Node -> Outfall -> User Stage History and rerun XPSWMM

Step 6. Repeat Steps 2 - 5 once more to ensure Pond stage versus time and Outlet stage versus time correspond adequately.

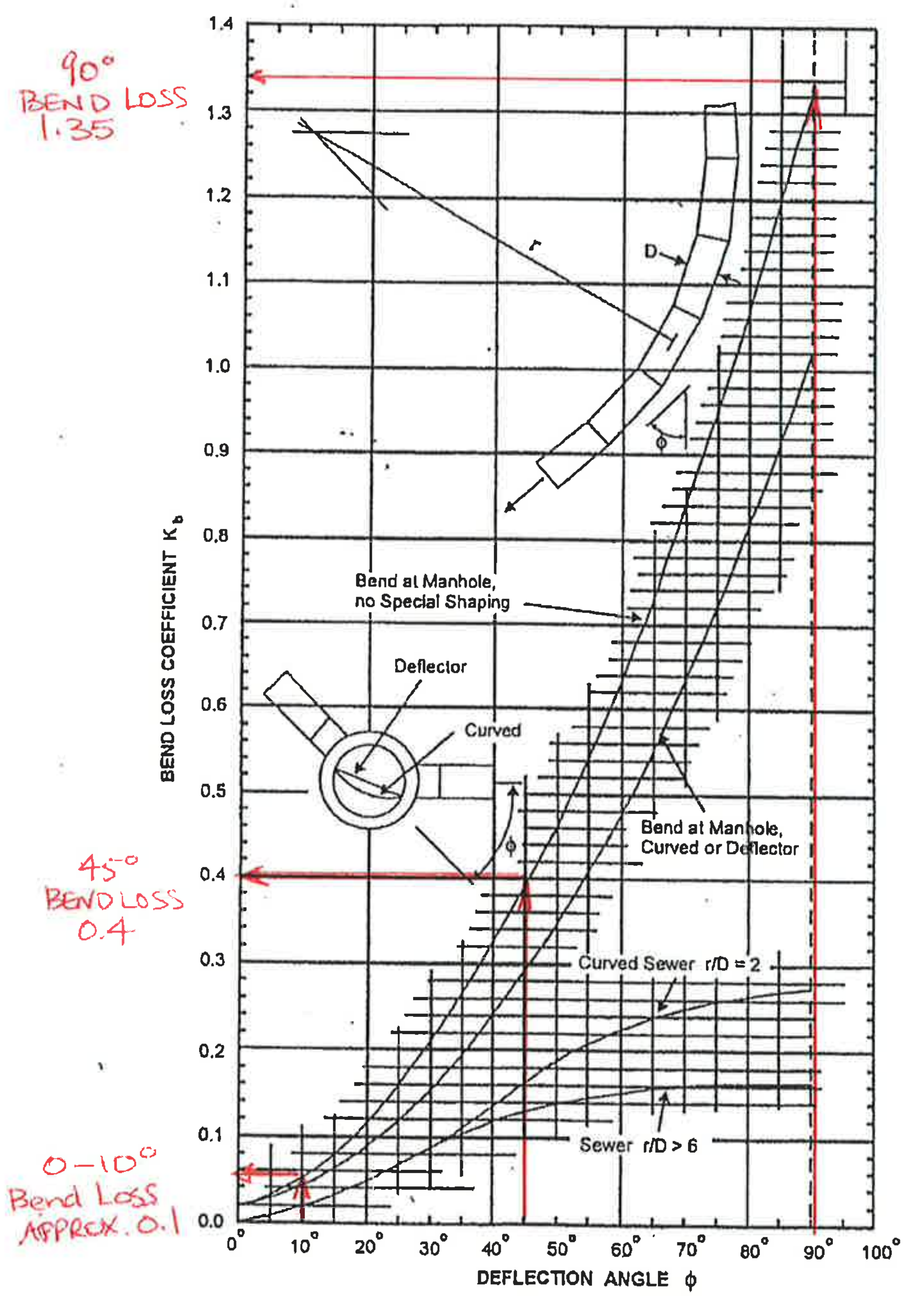


SWMM Version 9.12 	**Carleton University - Dry Pond Facility** Licenced To: IBI Group [42-1100-1763]	04/06/15 Page 1/1

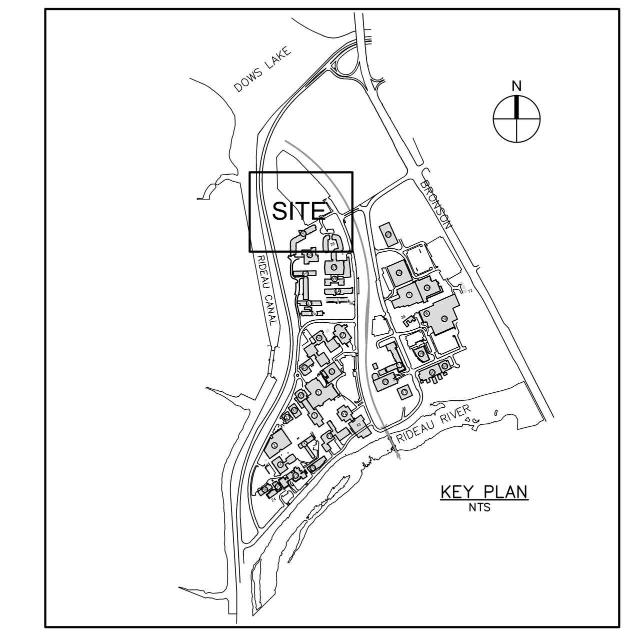


Stage-Storage Curve - Extended Storage
62.5
62
61.5
61
60.5
60
59.5
Stage (m)
0
1000
2000
3000
4000
5000
6000
Volume (m³)

Design Chart : Sewer Bend Loss Coefficients



Source: American Iron and Steel Institute (1980)



REVIEWED BY
DEVELOPMENT REVIEW SERVICES BRANCH

Signed ____________________

Date ____________________ 2016

Plan Number ____________________

PROPOSED CONDITIONS						
	5 year			100 year (25%)		
Area ID	**A**	**C**	**Avg C**	**A**	**C**	**Avg C**
1A1	0.0665	0.86		0.0665	1.00	
1A2	0.0035	0.20		0.0035	0.25	
TOTAL 1A	**0.0700**		**0.83**	**0.0700**		**0.96**
1B1	0.0050	0.2		0.0050	0.25	
TOTAL 1B1	**0.0050**		**0.20**	**0.0050**		**0.25**
3C1	0.0121	0.25		0.0121	0.31	
3C2	0.0024	0.2		0.0024	0.25	
3C3	0.0028	0.2		0.0028	0.25	
3C4	0.0076	0.2		0.0076	0.25	
3C5	0.0091	0.2		0.0091	0.25	
3C6	0.0192	0.9		0.0192	1.00	
3C7	0.0150	0.2		0.0150	0.25	
3C8	0.0194	0.2		0.0194	0.25	
3C9	0.0159	0.2		0.0159	0.25	
3C10	0.0149	0.9		0.0149	1.00	
3C11	0.0025	0.2		0.0025	0.25	
3C12	0.0226	0.9		0.0226	1.00	
TOTAL 3C	**0.1435**		**0.48**	**0.1435**		**0.55**
3D	0.2529	0.9		0.2529	1.00	
TOTAL 3D	**0.2529**		**0.90**	**0.2529**		**1.00**
6	0.1941	0.25		0.1941	0.31	
TOTAL 6	**0.1941**		**0.25**	**0.1941**		**0.31**
Total TO EX	**0.6655**		**0.61**	**0.6655**		**0.69**
E2	0.3842	0.9		0.3842	1	
TOTAL E2	**0.3842**		**0.90**	**0.3842**		**1.00**
E4.1	0.0599	0.2		0.0599	0.25	
E4.2	0.0133	0.9		0.0133	1.00	
E4.3	0.0072	0.2		0.0072	0.25	
E4.4	0.0139	0.9		0.0139	1.00	
E4.5	0.0302	0.2		0.0302	0.25	
SUBTOTAL	**0.1245**		**0.35**	**0.1245**		**0.41**
E4.6	0.0660	0.2		0.0660	0.25	
TOTAL E4	**0.1905**		**0.30**	**0.1905**		**0.36**
E5.1	0.0238	0.2		0.0238	0.25	
E5.1	0.0300	0.9		0.0300	1.00	
E5.3	0.0007	0.2		0.0007	0.25	
E5.4	0.0071	0.9		0.0071	1.00	
E5.5	0.0610	0.9		0.0610	1.00	
E5.6	0.0025	0.2		0.0025	0.25	
E5.7	0.0162	0.9		0.0162	1.00	
E5.8	0.0005	0.2		0.0005	0.25	
E5.9	0.0150	0.2		0.0150	0.25	
E5.10	0.0442	0.9		0.0442	1.00	
TOTAL E5	**0.2010**		**0.75**	**0.2010**		**0.84**
E3	0.2035	0.90		0.2035	1.00	
TOTAL E3	**0.2035**		**0.90**	**0.2035**		**1.00**
E1	2.0738	0.9		2.0738	1.00	
TOTAL E1	**2.0738**		**0.90**	**2.0738**		**1.00**
E6	0.5635	0.2		0.5635	0.25	
TOTAL E6	**0.5635**		**0.20**	**0.5635**		**0.25**
TOTAL TO SWM	**3.7410**		**0.74**	**3.7410**		**0.83**
TOTAL SITE	**4.4065**		**0.72**	**4.4065**		**0.81**

Carleton UNIVERSITY

Canada's Capital University

LEGEND :

112 — AREA NUMBER
3.4 — POPULATION
0.10 — AREA IN HECTARES

No.	DESCRIPTION	DATE	CHD
05	REVISED AS PER CITY COMMENTS	16:03:31	DGY
04	REVISED AS PER CITY COMMENTS	15:08:13	DGY
03	100% SUBMISSION	15:06:02	DGY
02	SITE PLAN SUBMISSION	15:01:30	DGY
01	30% SUBMISSION	15:01:22	DGY

REVISIONS

CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ANY OMMISSIONS OR DISCREPANCIES TO THE ARCHITECT BEFORE PROCEEDING WITH THE WORK.

DO NOT SCALE THE DRAWINGS

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
2016/03/31
PROVINCE OF ONTARIO

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DATE 2014 12 15

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DATE 2014 12 15

CHECKED DGY

DATE PRINTED 2014 12 15

Project North — True North

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

VINCENT P. COLIZZA ARCHITECT INCORPORATED

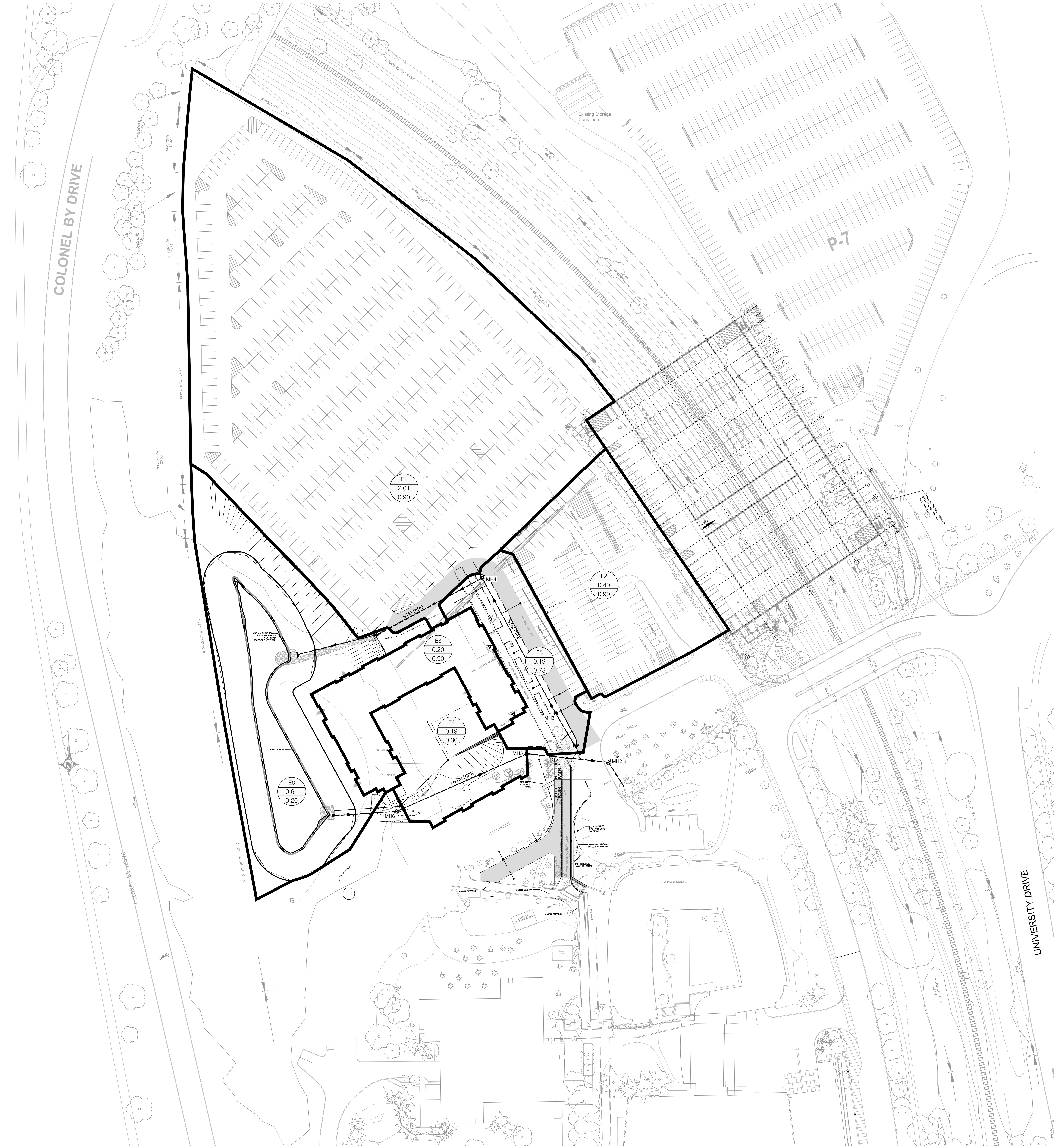
CARLETON UNIVERSITY
1125 COLONEL BY DRIVE,
OTTAWA, ON. K1S 5B6
TEL:(613)520–2600

DWG. TITLE
PROPOSE STORM
DRAINAGE AREA PLAN

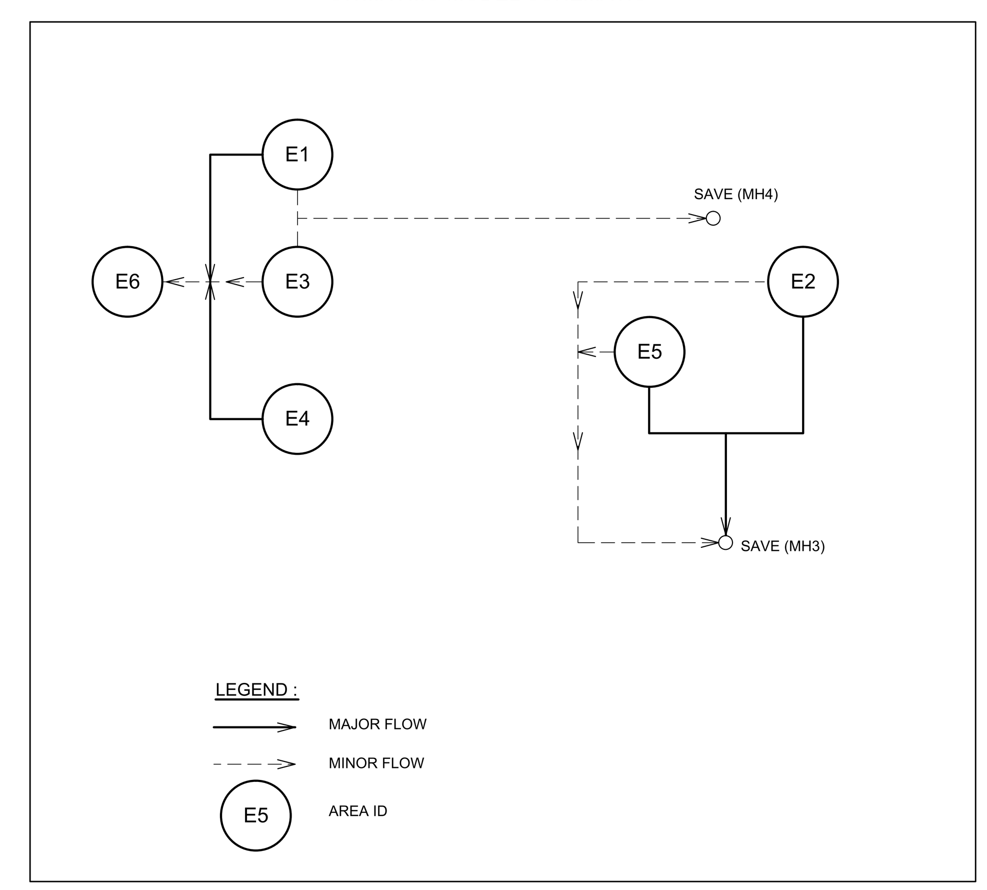
SCALE 1 : 500

PROJ. NO. 35843

DWG. NO. C–500B



SWMHYMO MODEL SCHEMATIC



REVIEWED BY
DEVELOPMENT REVIEW SERVICES BRANCH

Signed ____________________

Date ____________________ 2016

Plan Number ____________________

Carleton UNIVERSITY
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No.	DESCRIPTION	DATE	CHD
02	REVISED AS PER CITY COMMENTS	16:03:31	
01	SUBMISSION FOR CITY REVIEW	15:04:01	

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DATE	2015 03 30
DRAWN	S.V.
DATE	2015 03 30
CHECKED	
DATE PRINTED	2015 03 31

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True North

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

VINCENT P. COLIZZA
ARCHITECT
INCORPORAT

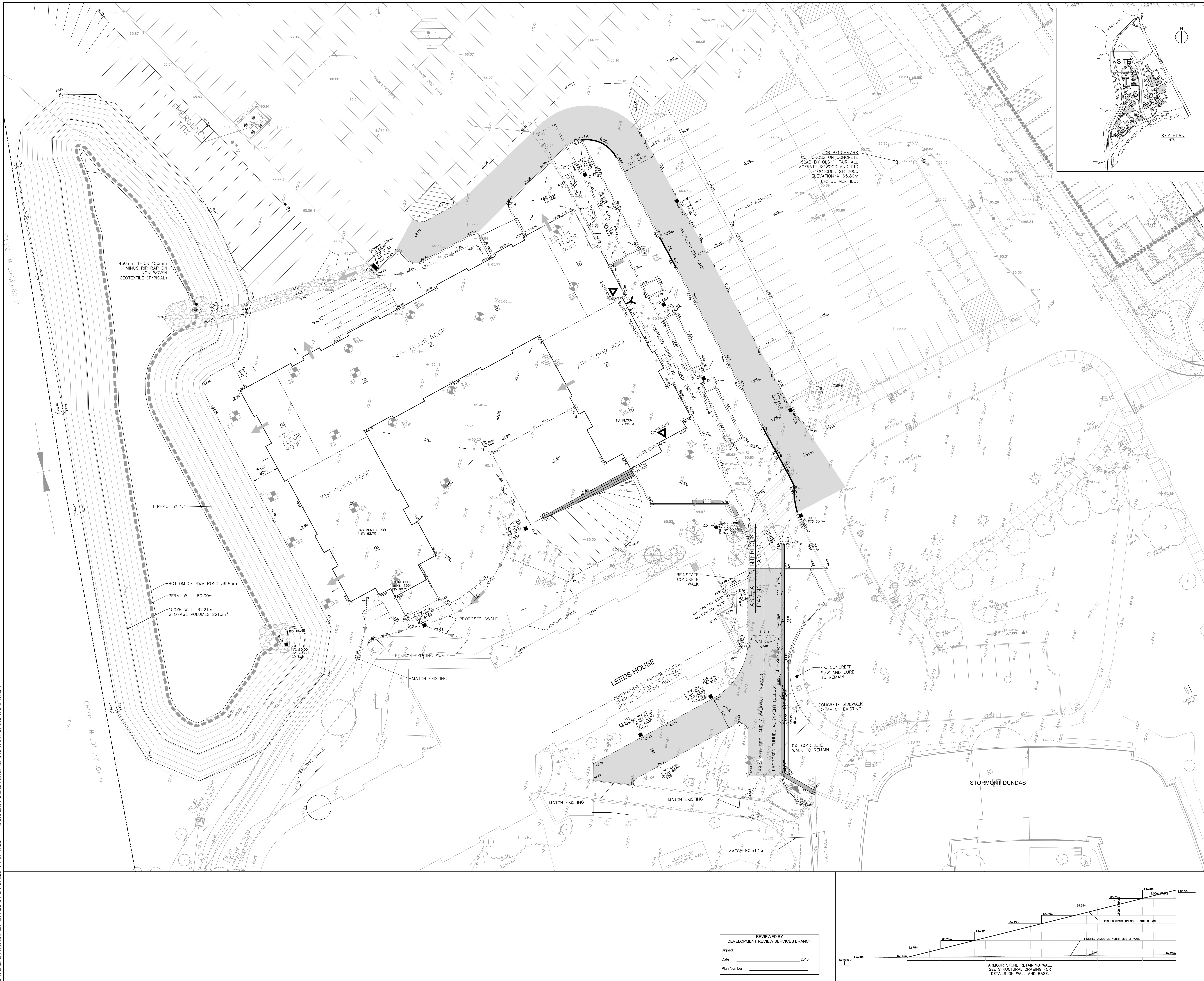
CARLETON UNIVERSITY

1125 COLONEL BY RD.,
OTTAWA, ON. K1S 5B6

DWG. TITLE

PROPOSED STORM DRAINAGE AREA PLAN

SCALE	PROJ. NO.	DWG. NO.
1 : 500	35843	F-500



REVIEWED BY
DEVELOPMENT REVIEW SERVICES BRANCH
Signed ____________
Date ____________ 2016
Plan Number ____________

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Canada's Capital University

LEGEND:

102.05 +	PROPOSED GRADES
+99.75	EXISTING GRADES
→	PROPOSED SURFACE FLOW DIRECTION
CBMH	PROPOSED CATCHBASIN MANHOLE
CB	PROPOSED STREET CATCHBASIN
F.F.=62.70	PROPOSED FINISH FLOOR ELEVATION
	PROPOSED RETAINING WALL
	PROPOSED TERRACING
HYD B/F 102.10	PROPOSED HYDRANT C/W BOTTOM OF FLANGE
	PROPOSED BARRIER CURB
	MAJOR STORM AND FLOW
	PROPOSED SWALE
TP 2 65.97	TEST PIT
BH 13 65.33	BOREHOLE

No.	DESCRIPTION	DATE	CHD
05	REVISED AS PER CITY COMMENTS	16:03:31	DGY
04	REVISED AS PER CITY COMMENTS	15:08:13	DGY
03	100% SUBMISSION	15:06:02	DGY
02	SITE PLAN SUBMISSION	15:04:06	DGY
01	30% SUBMISSION	15:01:22	DGY

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DATE 2014 12 15
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400 – 333 Preston Street
Ottawa ON K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
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VINCENT P. COLIZZA ARCHITECT INCORPORATED

CARLETON UNIVERSITY
1125 COLONEL BY DRIVE,
OTTAWA, ON. K1S 5B6
TEL:(613)520-2600

DWG. TITLE
GRADING PLAN

SCALE 1 : 200
PROJ. NO. 35843
DWG. NO. C-200

IBI GROUP
IBI
333 Preston St
OTTAWA, ONTARIO
K1S 5N4

ONSITE SWM 100yr design
PROJECT: Carleton Residence 2017
CITY OF OTTAWA
DEVELOPER Carleton University

JOB #: 35843
DATE: April 9, 2015
DESIGN: DY
Rev#

Outlet CBMH7
100yr design

MAXIMUM ALLOWABLE FLOW - Flow Restricted to C=0.2 for 100yr event

Area (ha) =	0.144
C	0.20

Intensity - 5 year event storm

10 min Tc	i5yr = 998.071/(T+6.053)^0.814=	104.2	mm/hr

Intensity - 100 year event storm

10 min Tc	i100yr = 1735.688/(T+6.014)^0.82=	178.6	mm/hr

restrict 100yr post development flow to 5yr C=0.2 flow
Allowable Release
100yr **14.25** l/s

COURT YARD 3C
1435 sm
100 -YR FLOW
Qp (l/s)

Flow restricted to 14.25 l/s

Area(ha)=	0.1435				
Cw =	0.55	STORMWATER MANAGEMENT Qm = FLOW AT 50% HEAD FOR STORAGE C		11.00 l/s	
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)
14	148.7	32.6	11.00	21.6	18.17
15	142.9	31.4	11.00	20.4	18.32
16	137.5	30.2	11.00	19.2	18.41
17	132.6	29.1	11.00	18.1	18.46
18	128.1	28.1	11.00	17.1	**18.47**
19	123.9	27.2	11.00	16.2	18.44
20	120.0	26.3	11.00	15.3	18.38
21	116.3	25.5	11.00	14.5	18.29
22	112.9	24.8	11.00	13.8	18.17
23	109.7	24.1	11.00	13.1	18.03
24	106.7	23.4	11.00	12.4	17.86

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
RYCB1	1.55	0.56
RYCB2	1.50	0.54
	1.50	0.54
		0.00
	Total:	**1.64**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
RYCB2- CBMH7	46.00	0.30	3.25
ECB-RYCB2	11.00	0.25	0.54
ECB-RYCB1	3.00	0.25	0.15
		Total:	**3.94**

IN-LINE STORAGE (Structure)

CBMH's		
1.2m dia=1.13 m3/m	Height	Storage
1.8m dia=2.54m3/m	(m)	(m3)
CBMH7 (2.4m)	5.10	12.95
	Total:	**12.95**

PARKING LOT STORAGE 100yr Maximum available

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
		Total:	**0.00**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

Total Storage required **18.47**
Total Storage provided **18.53**

ICD use Tempest LMF 14.25l/s @ 5.64m head, or approved equal

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

STORM SEWER DESIGN SHEET

Carleton Residence 2017
City of Ottawa
Carleton University

LOCATION				AREA (Ha)										RATIONAL DESIGN FLOW													SEWER DATA								
STREET	AREA ID	FROM	TO	C= 0.20	C= 0.25	C= 0.35	C= 0.48	C= 0.52	C= 0.65	C= 0.68	C= 0.75	C= 0.82	C= 0.90	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)	(%)
Parking Lot	E1	Stub	MH 4										2.0738	5.19	5.19	11.20	0.12	11.32	98.25	115.15	168.29	509.81				509.81	636.13	10.00	750			0.30	1.395	126.32	19.86%
Parking Lot	E2	Stub	MH 3/4										0.3842	0.96	0.96	10.00	0.08	10.08	104.19	122.14	178.56	100.16				100.16	224.02	9.00	375			1.50	1.965	123.86	55.29%
Drive Lane	E5	MH 3	MH 4								0.2010			0.42	1.38	10.08	0.67	10.75	103.79	121.67	177.86	143.27				143.27	317.25	57.30	525			0.50	1.420	173.98	54.84%
Parking Lot		MH4	DCBMH8											0.00	6.57	11.32	0.49	11.81	97.70	114.50	167.33	641.82				641.82	820.21	44.10	825			0.30	1.486	178.39	21.75%
Roof	E3	Bldg	DCBMH8										0.2035	0.51	0.51	10.00	0.08	10.08	104.19	122.14	178.56	53.05				53.05	87.74	8.56	250			2.00	1.731	34.69	39.53%
Landscaped area		DCBMH8	HW1											0.00	7.08	11.81	0.32	12.13	95.50	111.90	163.52	675.95				675.95	860.25	30.00	825			0.33	1.559	184.30	21.42%
Courtyard	E4.1 to E4.5	RYCB3	RYCB6			0.1245								0.12	0.12	10.00	0.48	10.48	104.19	122.14	178.56	12.62				12.62	43.87	25.00	250			0.50	0.866	31.25	71.23%
Courtyard	E4.6	RYCB6	HW2	0.0660										0.04	0.16	10.48	0.47	10.95	101.72	119.23	174.28	16.05				16.05	43.87	24.47	250			0.50	0.866	27.81	63.40%
Courtyard	SWM pond	DI10	MH6	SWM pond flow restricted to 10 l/s											0.00	10.00	0.47	10.47	104.19	122.14	178.56	0.00				10.00	59.68	23.26	300			0.35	0.818	49.68	83.24%
Courtyard		MH6	MH5	SWM pond flow restricted to 10 l/s											0.00	10.47	1.08	11.56	101.75	119.27	174.34	0.00				10.00	59.68	53.20	300			0.35	0.818	49.68	83.24%
Courtyard	3C	MH5	MH2				0.1435							0.19	0.19	11.56	0.62	12.18	96.63	113.23	165.47	18.50				28.50	59.68	30.50	300			0.35	0.818	31.18	52.24%
Drive Lane	3D	MH 2	EX	Existing roof restricted to 9.76 l/s											0.19	12.18	0.23	12.41	93.94	110.06	160.82	17.99				37.75	59.68	11.19	300			0.35	0.818	21.93	36.75%

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

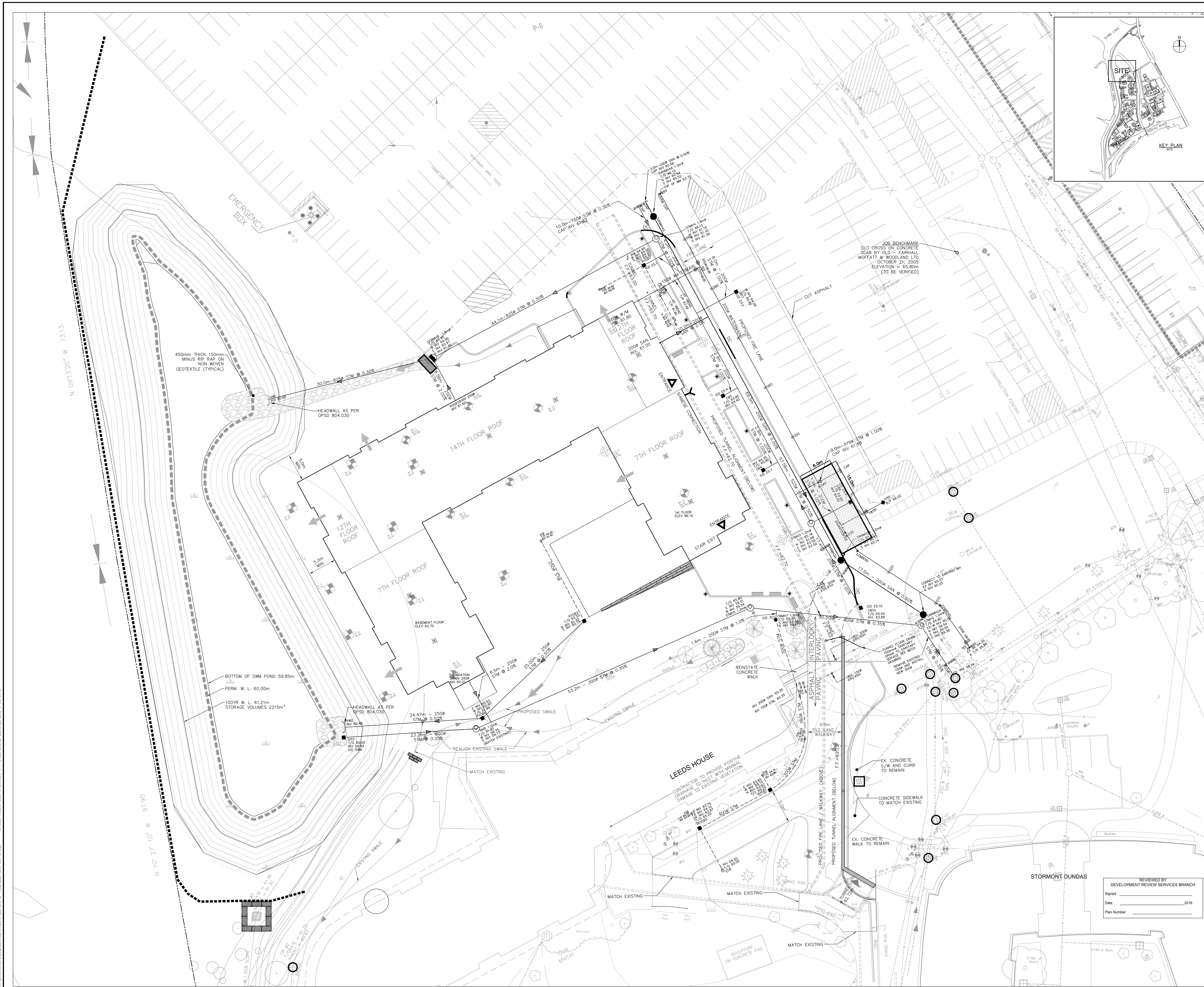
Tc for Area E1, 10min+ 100m at 1.4m/s = 11.2min

Designed: DY
Checked: DY
Dwg. Reference: 35843C-500

No.	Revision	Date
1.	City submission No. 1	April/9/2015

File Reference:	Date:	Sheet No:
35843.5.7.1	April/9/2015	1 of 1

APPENDIX G



Carleton UNIVERSITY

Canada's Capital University

LEGEND

- LIGHT DUTY SILT FENCE AS PER OPSD 219.110
- LIGHT DUTY STRAW BALE BARRIER AS PER OPSD 219.100
- STRAW BALE FLOW CHECK PER OPSD 219.180
- SILT BAG OR APPROVED EQUAL IN EXISTING CICB OR CB
- GEOTEXTILE FILTER CLOTH OR APPROVED EQUAL
- ROCK CHECK DAM PER OPSD 219.211
- MUD MAT 0.15m THICK 50mm CLEAR STONE ON NON WOVEN FILTER CLOTHE

NOTES :

SEDIMENT AND EROSION CONTROL MEASURE ARE TO BE INSTALLED PRIOR TO CONSTRUCTION. ALL MEASURE TO BE INSPECTED ON A DAILY BASIS AND RECTIFICATIONS MADE AS REQUIRED. THE ENGINEER IS TO BE NOTIFIED IN THE EVENT CONTROL MEASURE ARE DEEMED INSUFFICIENT AND MODIFICATION WILL BE IMPLEMENTED.

No.	DESCRIPTION	DATE	CHD
05	REVISED AS PER CITY COMMENTS	16:03:31	DGY
04	REVISED AS PER CITY COMMENTS	15:08:13	DGY
03	100% SUBMISSION	15:06:02	DGY
02	SITE PLAN SUBMISSION	15:01:30	DGY
01	30% SUBMISSION	15:01:22	DGY

REVISIONS

CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ANY OMMISSIONS OR DISCREPANCIES TO THE ARCHITECT BEFORE PROCEEDING WITH THE WORK.

DO NOT SCALE THE DRAWINGS

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
2016/03/31
PROVINCE OF ONTARIO

THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES UNTIL SIGNED BY THE ARCHITECT.

DATE 2014 12 15

DRAWN EH

DATE 2014 12 15

CHECKED DGY

DATE PRINTED 2014 12 15

Project North

True North

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

VINCENT P. COLIZZA ARCHITECT INCORPORATED

CARLETON UNIVERSITY
1125 COLONEL BY DRIVE,
OTTAWA, ON. K1S 5B6
TEL:(613)520–2600

DWG. TITLE

SEDIMENT AND EROSION CONTROL PLAN

SCALE 1 : 200

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