

FUNCTIONAL SERVICING REPORT

IN SUPPORT OF Zoning By-Law Amendment

Owen Street - Barrie Mixed Use Building

55-57 McDonald St, 61-67 Owen St and 70-78 Worsley St Barrie,
ON



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File Number: 20020

Prepared For:

The Residences on Owen Ltd.

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1.0 INTRODUCTION

1.1 BACKGROUND

This Functional Servicing Report has been prepared on behalf of The Residences on Owen Ltd., in support of Site Plan Application for the proposed 0.40 ha mixed-use development located at 67 Owen Street.

The subject site is zoned 'Transition Centre Commercial Special Provision No. 563' (C2-1)(SP-563). The purpose of this report is to demonstrate that the existing municipal infrastructure within Owen Street and Worsley Street can support the proposed development and detail the proposed stormwater management plan for the site to support Site Plan Approval.

The subject site lies within the City of Barrie. It is located on the east side of Owen Street, extending the full block from McDonald Street at the north to Worsley Street at the south. The site is bounded by existing residential properties to the east. **Figure 1 – Site Location** located in **Appendix A**, illustrates the subject site within the context of its surroundings. The development concept proposes the following; The southern components consist of a 20 storey mixed use building with a combination of at grade commercial uses with all residential above. The northern component will consist of a 10 storey residential development with a combination of commercial and amenity areas at grade. The development proposes a total of 278 units (160 assisted living units, 118 residential apartment units). The development will have a building area of 0.30 ha.

The proposed ground floor layout is shown on in **Appendix A**.

The site is currently developed and is occupied by existing parking lots on the north half of the site and existing residential dwellings on the south half of the site.



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2.0 STUDY PARAMETERS

This servicing assessment is based on:

- Sanitary Sewage Collection System Policies And Design Guideline, City of Barrie, 2017
- Storm Drainage & Stormwater Management Policies And Design Guideline, City of Barrie, 2017
- Water Transmission & Distribution Policies And Design Guideline, City of Barrie, 2017
- Design Guidelines for Drinking-Water Systems, MOE, 2008
- Water Supply for Public Fire Protection (Fire Underwriters Survey), 1999
- Stormwater Management Planning and Design Manual, MOE, 2003
- Design drawings provided by the City of Barrie
- InfoWorks Sanitary Modelling provided by the City of Barrie
- LSRCA Technical Guidelines for Stormwater Management Submissions, September 1, 2016.

3.0 WATER SUPPLY

3.1 EXISTING WATER SUPPLY

There are existing municipal watermains adjacent to the subject site which provide connections to the existing residential dwellings. The existing system includes the following:

- 200mm ø PVC watermain along the west side of Owen Street.
- 200mm ø Ductile Iron watermain along the south side of McDonald Street.
- 300mm ø PVC watermain along the entire Owen Street Frontage.

In addition, existing hydrants are located near the site at the following locations:

- 1 hydrant on the east side of Owen Street at the middle of the site frontage.
- 1 hydrant at the northeast corner of Owen St & McDonald St.
- 1 hydrant at the southwest corner of Owen St & Worsley St.

The existing watermain network and hydrant locations surrounding the subject site are shown on **Drawing C-02** included in **Appendix F**.

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3.2 PROPOSED WATER SUPPLY

Two new connections to the existing 300mm PVC watermain along Owen are proposed to service the development. One 150mm domestic and one 200mm fire service, each with a separate bulk water meter and backflow prevention. **Drawing C-02** shows the existing and proposed watermain layout. All existing water services are to be abandoned by disconnecting and capping at the watermain connection.

The City of Barrie Watermain Design Guideline states that governing flows shall be the Maximum Day demand plus fire flow. Peak design flows of 225 L/cap/day was used to calculate the average Day Demand for the residential portion of the site and MOECC peaking factors were applied to calculate the Maximum Day and Peak Hour Demand. The average daily flow for the commercial component of the site was calculated at a rate of 28 m³/day/ha, as specified by the Design Standards. The calculated daily demands for the proposed development are as follows:

Residential:

- Average Day Demand = 61.0 L/min
- Maximum Hour Demand = 181.6 L/min
- Maximum Day Demand = 94.5 L/min

Commercial

- Average Day Demand = 7.9 L/min

The combined fire flow + Maximum Day demand (Commercial & Residential) is 8,103 L/min.

Flow tests of nearby fire hydrants were completed to confirm that residual system pressures are adequate at the governing flow rate. The theoretical flow rate available at the minimum fire flow pressure of 20 psi was calculated per NFPA standards and is approximately 8,303 L/min to 11,607 L/min. The available fire flow is greater than the calculated combined fire flow +



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Maximum Day demand (Commercial & Residential) for the proposed site. Therefore, the existing watermain system can support the proposed development.

The static pressure measured during fire flow tests in the vicinity of the site was 64 psi. The mechanical engineer will evaluate the need for booster pumps to provide adequate pressure to the upper floors of the tower(s). This information if required is provided by the mechanical engineer.

Refer to **Appendix B** for the supporting calculations of the proposed water supply system and hydrant flow test report.

4.0 SANITARY SERVICING

4.1 EXISTING SANITARY SERVICING

The subject site has existing sanitary sewers adjacent to the site. The existing sanitary infrastructure is summarized as follows:

- An existing 200mm sanitary sewer draining west along McDonald Street,
- An existing 300mm sanitary sewer draining south along Owen Street, and
- An existing 250mm sanitary sewer draining west along Worsley Street.

In addition, there are several service connections servicing the existing residential units along Owen Street & Worsley Street.

These existing mainline sanitary sewer network surrounding subject site are shown in **Drawing C-02** included in **Appendix F**.



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4.2 PROPOSED SANITARY SERVICING

The proposed development can be serviced by a new connection to the existing 300mm sanitary sewer located within Owen Street. The current plan is for the development to remain under single ownership and as such, a single sanitary service connection will be permitted. A connection location is shown on **Drawing C-02 Servicing Plan** included in **Appendix F**.

The peak design flow generated from the current development concept is approximately 5.0 L/s. Based on design sheets provided by the City (See **Appendix C** for Sanitary Sewer Design Information), the existing site is currently contributing approximately 0.52 L/s to the Owen Street sanitary sewer. In addition, based on information provided by the City of Barrie, the existing sanitary sewer on Owen Street is currently operating at approximately 50% full.

The City of Barrie Sanitary Sewage System Policies and Design Guidelines section 3.4.5. states:

“For local sewers, 375mm diameter or less, sanitary sewers shall be upsized if future peak flows including Inflow and Infiltration exceed 50% of full flow under future peak flow conditions including inflow and infiltration (± 0.5 depth of flow over diameter of pipe)”.

The anticipated increase in sanitary flows resulting from the proposed development will bring a critical length of existing sanitary sewer to approximately 60% full in peak flow conditions. Notwithstanding the policy noted above, it is our opinion that this pipe would be suitable to service the proposed development without replacement.

When evaluating the attached policy, the City has confirmed in email correspondence (attached in **Appendix E**) that future peak conditions are represented by the 2051 projected flows.

The City has provided the InfoWorks model showing the 2051 projections (A map of the Owen Street sewer in question and corresponding HGL profile is included in **Appendix C**). The 2051 InfoWorks model indicates there are two sections of sewer on Owen Street that are approaching 100% of full capacity in future conditions. These are the two pipes south of



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Worsley Street from MH03209 to MH03213 and the next length south, from MH03213 to MH03247.

From information provided by the City of Barrie, it appears that the existing sanitary sewer drops in size from 300mm to 250mm at MH03209 (the first MH south of Worsley Street). Based on a letter from the City of Barrie dated October 2, 2018 this section of pipe will not be required to be upgraded. Refer to correspondence in **Appendix E**.

Based on a review of the existing sanitary system, there is adequate capacity in the system to support the proposed development.

5.0 FOUNDATION DRAINAGE

Based upon the results from Grounded Engineering Hydrogeological Assessment October 6th, 2021, the construction groundwater flow is approximately 214.9 L/min or 3.6 L/s. Quality and storm sewer capacity is to be reviewed as part of the discharge agreement for temporary dewatering.

Based on requirements confirmed by the City, no permanent dewatering will be permitted. We understand that the building will be designed for floating raft construction and water-proofed, as required.



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6.0 STORMWATER SERVICING

6.1 EXISTING STORMWATER DRAINAGE

The property is within the Sophia Creek catchment area, which drains to Kempenfelt Bay. The existing site comprises 2 drainage areas (Refer to **Figure DAP1 – Existing Stormwater Drainage Plan**). The north catchment is an existing parking lot (circa 2004) which has a controlled release for all storm events. The parking lot storm system is connected to the existing municipal storm sewer system within Owen Street. The south portion of the site is part of a larger catchment area assigned a runoff-coefficient of 0.75 (Refer to drawing 1995-007-004 – Storm Drainage Plan in **Appendix D**). The south half of the site appears to drain overland to the southwest toward Owen Street and Worsley Street and it captured by street catch basins. There is no direct connection to the storm sewer shown on the survey or background drawings.

Existing flows from the north drainage area (Area 101) are controlled by a 75mm orifice plate for events less than the 25-year storm and a combination of the orifice plan and controlled weir discharge for the 25-year to 100-year storm events. The controlled flows from Area 101 are outlined in the 2004 City of Barrie SWM Report. Existing flows from the south drainage area (Area 102) have been calculated using the rational method with the City of Barrie's specified IDF curves. The existing release rates from the site are summarized below in **Table 1.1**.

Table 1.1 – Pre-Development Drainage Areas

Event Return Frequency	Peak Flow (L/s)		
	Area 101 (0.205 ha)	Area 102 (0.203 ha)	Total Site Release Rate
2 year	10	29	39
5 year	17	45	62
10 year	23	53	76
25 year	27	68	95
50 year	32	82	114
100 year	37	94	131



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The minor system within Owen Street and Worsley Street is sized for the 5 year event. Therefore, the allowable release rate to the minor system is 80 L/s. During the 25-year to 100-year events, overland flow from the existing parking area is released to Owen Street via the site entrance which has been graded as a control weir for the site.

Refer to **Appendix D** for pre-development flow calculations and relevant excerpt from the 2004 City of Barrie Report.

6.2 PROPOSED STORMWATER SERVICING

The site will be consolidated into a single drainage area with all roof and area drainage outleting to Owen Street. The connection will be sized to suit the existing pre-development (allowable) release rate of 62 L/s as discussed above.

An existing storm easement across the northeast corner of the site will need to be removed from the site and relocated within the McDonald Street and Owen Street right-of-ways. Refer to **Drawing C-2** for the existing and proposed stormwater sewer layout.

6.3 PROPOSED STORMWATER MANAGEMENT

6.3.1 QUANTITY CONTROL

Post-development peak run-off rates for all storms up to and including the 100-year event will be controlled to the allowable release rate for the storm sewer of 62 L/s. Controlled and uncontrolled areas are shown on **Figure DAP2**. There is a small portion of landscape buffer and sidewalk around the perimeter of the site that cannot be controlled due to grading and servicing constraints. **Table 2.1** provides summary of the allowable release rate and associated storage requirements development.



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Table 2.1 – Post Development Drainage

Event Return Frequency	“Post to Pre” Summary		
	Allowable Release Rate (L/s)	Total Release Rate (L/s)	Storage Required/Provided
2 year	39	20	19
5 year	62	32	29
100 year	62	62	65

Quantity control will be provided on-site by an underground storage tank within the building on the first parking level in combination with an orifice plate welded and bolted to the downstream end of the tank to ensure that the all peak flows up to and including the 100-year post redevelopment peak flows from the site are attenuated to the 5 year release rate of **30 L/s**. A **195 mm** orifice plate and a storage volume of approximately **70 m³** will be required to control the 100-year post development flows to the allowable release rate. The proposed tank has a base area of 150 m².

We note that an additional volume is made available for water reuse in a sump portion of the tank below the orifice outlet. Further discussion on this requirement is including in the next section.

In situations where the orifice control is not sufficient, the at grade access lid to the underground storage tank will allow water to discharge overland to Owen Street. Quantity Control calculations are provided in **Appendix D**. The tank, orifice control structure, filter and emergency hatch are shown on **Drawing C-2**.

The design of all internal piping within the building must provide adequate capacity for full capture and conveyance of all flows generated by storms up to and including the 100-year rainfall event. All design and associated calculations for the internal storm system, including the design of the internal inlet structures, piping and mechanical appurtenances is to be completed by the Mechanical Engineer.

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6.3.2 EXTERNAL FLOW CONVEYANCE

Drawing STM1 from the City of Barrie indicates a potential external drainage area entering through the site and exiting via Owen Street ultimately joining into Worsley Street. Counterpoint Engineering performed a site visit in May 2021 and it was determined that most rooftops along Worsley, Mulcaster and McDonald Street for the homes that could potentially contribute stormwater drainage through the site discharge to grade. The homes are assumed to be sump pumped to grade along Worsley, Mulcaster and McDonald or connected into the nearest storm sewer line on the municipal ROW. It should also be noted that for the site itself the groundwater flow is very low because the groundwater table is very deep, it is anticipated that the foundation drain water for the upstream external residential homes likely follows the same pattern. The conservatively assumed overland drainage area entering through the site is shown on **Figure DAP 1**. This drainage area is essentially assumed to be all the residential lots within the block to the east of the site. The site design currently allows for external drainage to overland flow through the site ground floor drive aisle underneath the rooftop towards Owen Street. Referring to **Grading Drawing C-1**. The narrowest flow through area was analyzed for overland flow conveyance and it had approximately $0.42 \text{ m}^3/\text{s}$ capacity with 0.39m freeboard clearance to the finished floor elevation of the building. The 100 year flows from the external areas was approximated to be $0.41 \text{ m}^3/\text{s}$. Therefore, there is sufficient capacity to convey the flows through the site.

6.3.3 QUALITY CONTROL & PHOSPHORUS CONTROL

The City of Barrie requires Enhanced Level Quality Control (80%TSS Removal) and the Lake Simcoe Region Conservation Authority (LSRCA) requires that phosphorous loading and water balance be incorporated into the SWM design. The entirety of the site is either covered by clean rooftop, green roof, or is landscape or clean walkway area. Therefore 80% TSS removal has been met inherently. In addition to this a SFPD0811 Stormfilter model with Phosphosorb



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has been specified. This filter has been specified as best efforts to reduce phosphorus loadings to Lake Simcoe. The filtration unit location is proposed near the site driveway entrance at the mid-block location along Owen Street so that it can be accessed at grade level for maintenance purposes. Refer to **Appendix D** for the phosphorus loading calculations.

The LSRCA has introduced a zero target for phosphorus release as per the LSRCA Phosphorus Offsetting Policy. Any deficient for the zero release will be compensated for at a rate for \$35,000 /kg of annual estimated phosphorus discharge.

The resulting phosphorus loading is **0.16 kg/yr**. As per the LSRCA's Lake Simcoe Phosphorus Offsetting Policy, a cash-in-lieu is proposed for the development based on the net pre- and post-development phosphorus loading. Therefore, the cash-in-lieu calculation is as follows:

$$0.16 \text{ kg/yr} \times 2.5 \text{ offset ratio} \times \$35,000 \text{ kg/yr} \times 15\% \text{ administration fees} = \$16,100.00$$

It is noted that a water balance offset fee has been established in the amount of \$16,515.84. As the water balance offset calculation is greater than the phosphorus offsetting fee, the water balance fee will be payable and payment of the phosphorus offset will not be applicable.

6.3.4 WINTER SALT

The proposed site is a relatively small condo development, with almost an entire rooftop covering the site causing reduced snow cover and salt pollution risk. The site will consist of an underground parking garage where vehicles will primarily remain below ground and keep pollutants away from the ground surface, and therefore preventing salt from being flushed downstream for the majority of the site parking area. Therefore, salt discharge is mitigated by the covered parking garage. In addition, all controlled stormwater flows shall be treated by the proposed Stormfilter Cartridge system with Phosphosorb media. Based on documentation regarding the Stormfilter cartridges, the system is able to provide treatment for pollutants such as soluble metals and nutrients as well, therefore, some salt shall also be removed from the runoff prior to discharge to the wetland, further reducing concern for salt pollution. Refer to **Appendix D** for documentation and specifications on the Stormfilter Cartridge System.



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6.3.5 WATER BALANCE

Water balance calculations have been performed by Grounded Engineering. An excerpt of the results are included in **Appendix D**. Results of the analysis indicate the existing and proposed conditions:

Development Phase	Precipitation (m ³)	Evapotranspiration (m ³)	Infiltration (m ³)	Run-Off (m ³)
Pre-Development	3,858	828	371	2,659
Post-Development	3,858	113	51	3,694

The infiltration deficit is approximately 321 m³/year. Due to a large underground parking lot covering almost the entirety of the site extents, it is not feasible to infiltrate into the groundwater system via LIDS. Therefore, cash in lieu will be pursued. As mentioned above the water balance offset amount has been confirmed by the LSRCA at \$16,515.84.

6.3.6 VOLUME CONTROL

As per LSRCA stormwater management guidelines, 5 mm retention for all impervious areas of the site are required at a minimum. This equates to approximately 12.3 m³. The sump below the orifice will provided at a minimum 12.3 m³ of retention storage that will be re-used for irrigation. Irrigation calculations provided by MHBC indicate that 14.43 m³ of stormwater can be re-used within 72 hours (4.81 m³/day on average x 3 days). Calculations are provided in **Appendix D**. It is also noted that post development landscape plus green roof area is higher than the existing conditions landscape area. Therefore, downstream erosion conditions from water volume are anticipated to not worsen.



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7.0 EROSION AND SEDIMENT CONTROL

The following erosion and sediment control measures will be implemented during construction to minimize sediment transport downstream of the site.

- A sediment control fence shall be erected around the perimeter of the site wherever runoff has the potential of leaving the site;
- A double silt fence will be installed along the site boundary at the low end (downstream end) of the site;
- A construction mud mat entrance shall be installed at the construction vehicle entrance;
- Temporary catchbasin sediment controls will be installed as necessary;
- The contractor shall keep adjacent properties free of dust, mud and any other refuse throughout the duration of construction;
- All sediment and erosion control works shall be inspected after each rainfall and/or on a bi-weekly basis and repaired/maintained as necessary; and
- All areas with slopes exceeding 2% shall be seeded if they will be exposed for greater than 30 days. All sloped areas that have not been seeded are to be scarified immediately after stripping and re-treated after each rainfall event.

All erosion and sediment control measures will be installed prior to commencement of site construction works and will remain in place through the duration of construction. During construction, the erosion and sediment control measures will be monitored and maintained. Refer to drawing **C-3** for erosion and sediment control design.

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8.0 CONCLUSION

Based on the assessment provided above, the existing adjacent infrastructure can accommodate the proposed change in lands use and the applicable stormwater management criteria can be met as follows:

WATER SERVICING:

New connections to the existing 300mm PVC watermain along Worsley Street are proposed to service the development concept. Based on the current site plan, two connections will be provided to the mechanical room located adjacent to Owen Street. All existing watermain services are to be disconnected and capped at the main.

The combined fire flow and maximum day demand (Commercial & Residential) is 8,103 L/min. Flow tests of nearby fire hydrants were completed to confirm the theoretical flow rate available at the minimum fire flow pressure of 20 psi is per NFPA standards and is approximately 8,303 L/min to 11,607 L/min. Therefore, the existing watermain system can support the proposed development.

The mechanical engineer will need to evaluate the need for booster pumps to provide adequate pressure to the upper floors of the tower(s).

SANITARY SERVICING:

The proposed development can be serviced by a new connection to the existing 300mm sanitary sewer located within Owen Street.

The existing site contributes approximately 0.52 L/s to the Owen Street sanitary sewer. The peak design flow generated from the current development concept is approximately 4.2 L/s resulting in a net increase in sanitary flow. The existing sanitary sewer on Owen Street is



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approximately 50% full and would increase to approximately 58% full due to the addition of flows from the subject site.

Based on a review of the proposed flows and the available capacity proposed above, there is adequate capacity in the system to service the development.

STORMWATER SERVICING:

The site will be consolidated into a single drainage area with all roof and area drainage outletting to a new storm sewer connection on Owen Street. The connection will be sized to suit the calculated allowable release rate of 62 L/s.

Quantity control will be provided on-site by an underground storage tank within the building on the first parking level in combination with an orifice plate to ensure that the all peak flows up to and including the 100-year post redevelopment peak flows from the site are attenuated to the 5 year release rate of **62 L/s**. A storage volume of approximately **65 m³** will be required to control the 100-year post development flows to the allowable release rate.

Enhanced level quality control will be provided by a Contech Stormfilter Unit with Phosphosorb. The filtration unit and water re-use will also address LSRCA phosphorus treatment and volume control requirements.

External drainage areas to the east will be accommodated overland through the site and outlet to Owen Street.



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We trust the information provided in the report meets with your requirements. Should there be any questions or comments, please feel free to contact the undersigned.

Sincerely,

Counterpoint Engineering Inc.

Scott Corley, E.I.T
Scorley@counterpointeng.com



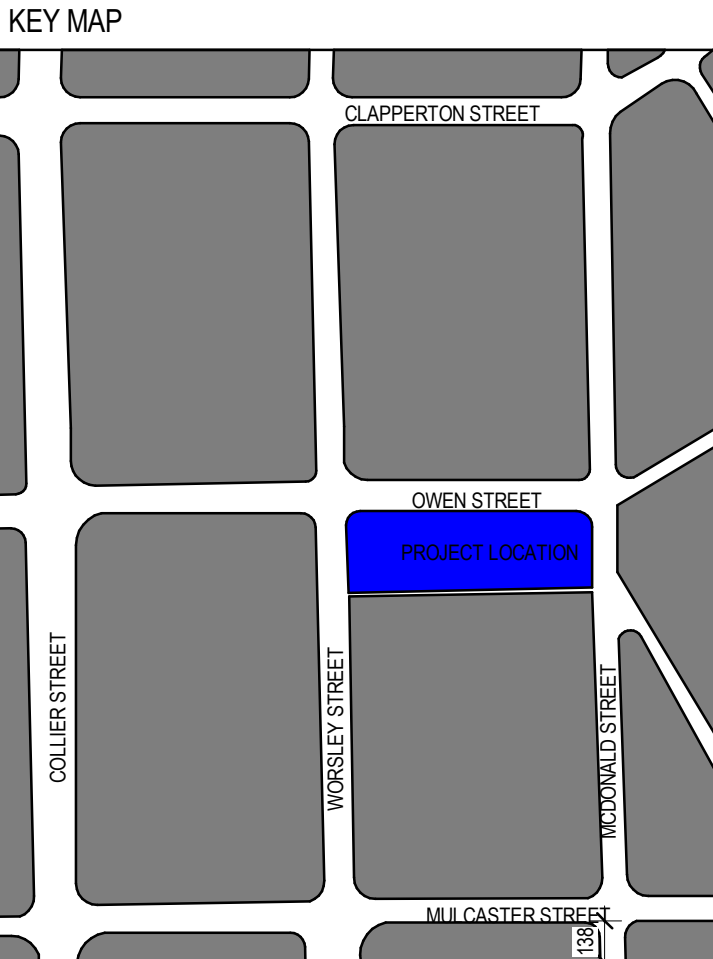
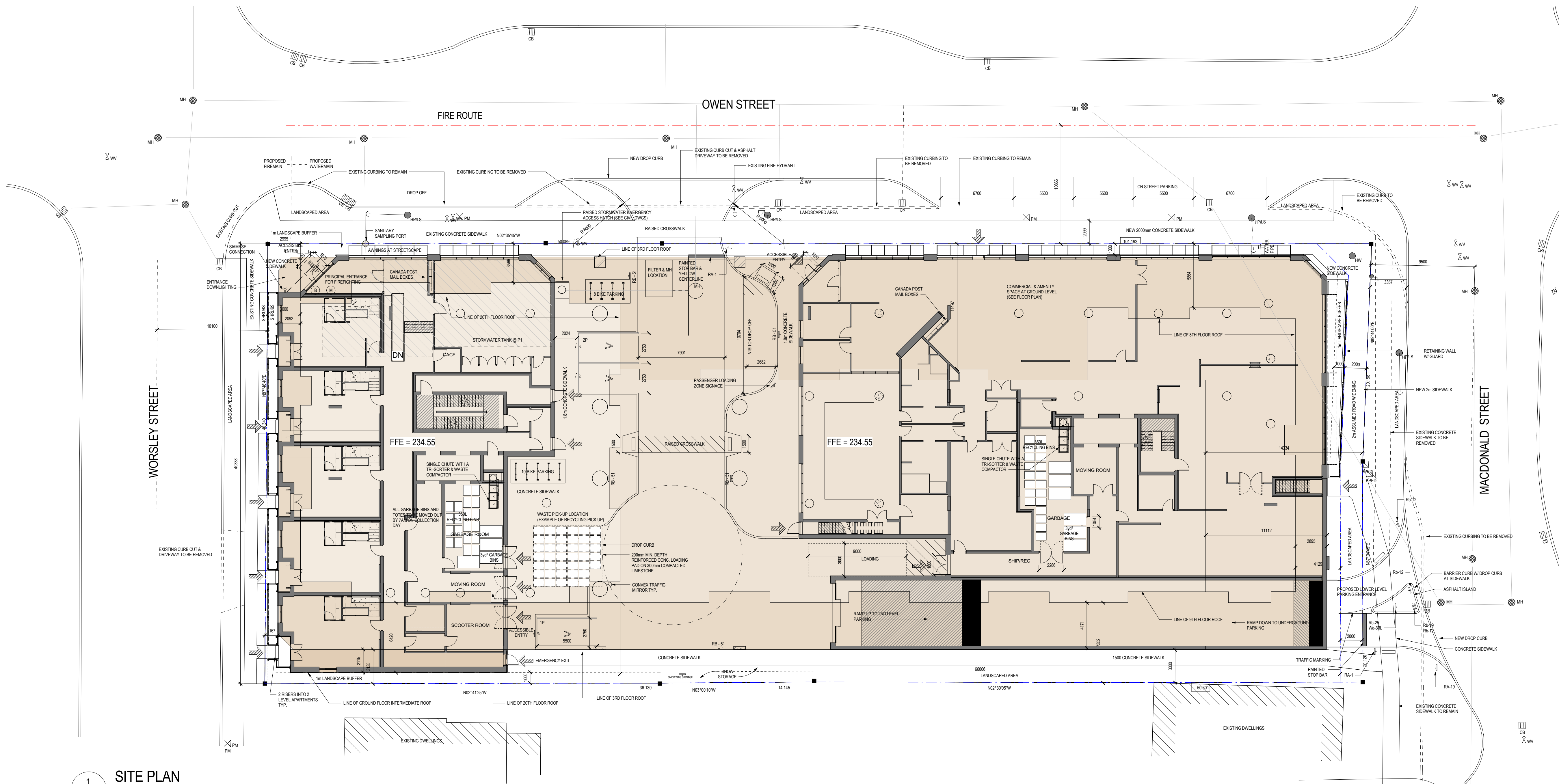
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Appendix A

Site Plan



SITE PLAN LEGEND	
	DENOTES EXISTING CATCH BASIN (SEE CIVIL DWGS FOR FINAL LOCATIONS)
	PEDESTRIAN ENTRY DOOR LOCATION
	B.F. PARKING STALL
	DENOTES EXISTING FIRE HYDRANT
	DENOTES EXISTING HYDRO POLE W/ LAMP STANDARD
	DENOTES EXISTING MAN HOLE (SEE CIVIL DWGS FOR FINAL LOCATIONS)
	VISITOR PARKING c/w PAINTED TV
	SIAMESE CONNECTION
	DENOTES EXISTING BELL PEDESTAL
	DENOTES EXISTING PARKING METER
	DENOTES EXISTING TRAFFIC LIGHT
	DENOTES EXISTING CABLE TV PEDESTAL
	DENOTES EXISTING WATER VALVE
	DENOTES EXISTING GAS METER

1 SITE PLAN
A1.1 1 : 200

ZONING STANDARDS MATRIX C2-1 (SP-563)		
	REQUIRED	PROPOSED
LOT AREA	N/A	0.4053ha (4053 sqm)
LOT FRONTAGE	N/A	40.3m
FRONT YARD SETBACK	N/A	1.0m
SIDE YARD ADJOINING, STREET	1.0m	1.0m
SIDE YARD ADJOINING, RESIDENTIAL	3.0m	3.0m
SIDE YARD, ADJOINING COMMERCIAL	1.0m	1.0m
LOT COVERAGE	N/A	87%
BELOW GRADE SETBACK	0m	1.0m
GFA	760%	648% (924% INCL. PK, MECH)
BUILDING HEIGHT	SOUTH BUILDING: 13m WITHIN 3m OF A STREET LINE 67m BEYOND 3m OF A STREET LINE NORTH BUILDING: 13m WITHIN 3m OF A STREET LINE 35m BEYOND 3m OF STREET LINE	SOUTH 13.0m AT 1.0m SETBACK 67.0m AT 3.0m SETBACK ON WORSLEY STREET AND AT 3.56m SETBACK ON OWEN STREET NORTH 13.0m AT 1.0m SETBACK ON OWEN STREET AND AT 3.0m SETBACK ON MACDONALD STREET 30.0m AT 5.0m SETBACK ON OWEN STREET AND AT 4.1m SETBACK ON MACDONALD STREET 35.0m AT 11.4m SETBACK ON OWEN STREET AND 11.1m SETBACK ON MACDONALD STREET
MIN. COVERAGE, COMMERCIAL	20% OF LOT AREA	20% (810 sqm REQUIRED) BAR/LOUNGE = 275 sqm FITNESS = 362 sqm DINING = 316 sqm TOTAL = 954 sqm

ZONING STANDARDS MATRIX (CONT.)		
PARKING	0.8/ UNIT (1.65/UNIT MAX) = 91 0.5/ ASSISTED LIVING = 80 0 FOR COMMERCIAL/RETAIL TANDEM PARKING INCLUDED	TOTAL = 212 PARKING SPOTS + 3 SURFACE PARKING (TANDEM PARKING NOT INCLUDED)
BARRIER FREE PARKING SPACES	7 REQUIRED (1+3% OF PARKING)	7 (3 TYPE A; 4 TYPE B)
PARKING SIZES	2.7 x 5.5m	2.75 x 5.5m
LOADING SPACES	MIN 3.0m x 9.0m WITH 4m VERTICAL CLEARANCE	1 PROVIDED (SEE SITE PLAN FOR LOCATION)
BIKE PARKING	0.32/UNIT (278 UNITS * 0.32 = 89)	89 (19 @ ENTRANCE; 27 VERTICAL @ 2ND FLOOR; 44 HORIZONTAL @ 2ND FLOOR)
LANDSCAPE BUFFER	1m TO OWEN ST, MACDONALD ST, AND WORSLEY ST 3m ADJOINING RESIDENTIAL ZONE TO THE NORTH 0M TO THE SIDE LOT LINE ADJOINING COMMERCIAL ZONE	1m TO OWEN ST, MACDONALD ST, AND WORSLEY ST 3m ADJOINING RESIDENTIAL ZONE TO THE NORTH 1m TO THE SIDE LOT LINE ADJOINING COMMERCIAL ZONE
GREEN ROOF AREA	30% OF FOOTPRINT AREA 1057 sqm (11380 sf) REQUIRED	4TH FLOOR ROOF (664 sqm) 9TH FLOOR ROOF (89 sqm) 10TH FLOOR ROOF (446 sqm)

STATISTICS	
GROSS SITE AREA	0.4053ha (4053 sqm)
ROAD SIDING AREA	85m²
NET SITE AREA	3968m²
GFA	26252m² APPROX
BUILDING AREA	3452m²
UNIT COUNT	278
DENSITY	(278 UNITS) / 0.4053ha = 686 UPH
PARKING	215

PARKING SCHEDULE (NOT INCLUDING TANDEM PARKING)				
LEVEL	STANDARD	H/C	TOTALS	BIKE
UNDERGROUND	53	0	53	0
SURFACE	3	0	3	18
MEZZANINE				
2ND FLOOR	72	3	75	57
3RD FLOOR	80	4	84	14
TOTAL	209	7	215	89

SUITE SCHEDULE				
LEVEL	ASSISTED LIVING	APARTMENTS	2 LEVEL APARTMENTS	TOTALS
GROUND	0	0	5	5
INTERMEDIATE	0	3	0	3
2ND FLOOR	0	0	0	0
3RD FLOOR	0	0	0	0
4TH FLOOR	26	0	0	26
5TH FLOOR	27	0	0	27
6TH FLOOR	28	0	0	28
7TH FLOOR	28	0	0	28
8TH FLOOR	28	0	0	28
9TH FLOOR	23	0	0	23
10TH FLOOR	0	10	0	10
11TH FLOOR	0	10	0	10
12TH FLOOR	0	10	0	10
13TH FLOOR	0	10	0	10
14TH FLOOR	0	10	0	10
15TH FLOOR	0	10	0	10
16TH FLOOR	0	10	0	10
17TH FLOOR	0	10	0	10
18TH FLOOR	0	10	0	10
19TH FLOOR	0	10	0	10
20TH FLOOR	0	10	0	10
TOTAL	160	113	5	278

GROSS AREA (APPROX)	
LEVEL	AREA
LOWER LEVEL	830m² (2652m² PK)
GROUND	2240m² (300m² PK)
GROUND FLOOR INTERMEDIATE	1640m² (592m² PK)
2ND FLOOR	3447m² (PK)
3RD FLOOR	3447m² (PK)
4TH FLOOR	2177.5m² (97.4m² TERRACE)
5TH FLOOR	2177.5m²
6TH FLOOR	2177.5m²
7TH FLOOR	2177.5m²
8TH FLOOR	2177.5m²
9TH FLOOR	1886.5m² (264m² ROOF)
10TH FLOOR	796m² (229m² MECH)
11TH FLOOR	796m²
12TH FLOOR	796m²
13TH FLOOR	796m²
14TH FLOOR	796m²
15TH FLOOR	796m²
16TH FLOOR	796m²
17TH FLOOR	796m²
18TH FLOOR	796m²
19TH FLOOR	796m²
20TH FLOOR	796m²
PENTHOUSE MECH	188.5m²
TOTAL	37468.9m² (INCL. PARKING, ACCESSIBLE ROOF, MECH) 26252m² (APPROX)

3	ISSUED FOR SPA RESUBMISSION	NOV 19, 2021
2	ISSUED FOR SPA	JUNE 28, 2021
1	ISSUED FOR PRECONSULTATION	FEB. 10, 2020

ISSUES/REVISIONS	
ALL DIMENSIONS TO BE CHECKED AND VERIFIED ON SITE. DISCREPANCIES TO BE REPORTED TO THE ARCHITECT. LATEST APPROVED STAMPED DRAWINGS ONLY TO BE USED FOR CONSTRUCTION.	

ONTARIO ASSOCIATION
OF
ARCHITECTS
MICHAEL W. MCKNIGHT
LICENCE
3808

MCLARCHITECTS
MCKNIGHT CHARRON LIMITED

48 ALLIANCE BLVD, UNIT 110
BARRIE, ONTARIO L4M 9K3
WWW.MCLARCHITECTS.CA

T 705 722 8739
F 705 726 5418

DRAWING TITLE:
SITE PLAN W/ GROUND FLOOR

PROJECT NAME:
OWEN STREET
55-57 MACDONALD STREET, 61-67 OWEN STREET AND 70-78 WORSLEY STREET BARRIE, ON
(FOR THE EASE OF REFERENCE, THE SITE WILL BE DESCRIBED AS 67 OWEN STREET)
THE RESIDENCES ON OWEN LTD.

DATE:	11/19/2021	PROJECT #		SHEET #
DRAWN BY:	KSN	PROJECT		
SCALE:	As indicated	#		A1.1



The Residences on Owen Ltd.
67 Owen Street

Appendix B

Water Calculations and Flow Test Information

counterpoint engineering

NFPA Theoretical Flow Calculations

Project Name: 67 Owen Street

Project Number: 20020

Based on National Fire Protection Association Guidelines, the available flow at the minimum residual pressure of 20psi can be calculated based on the observed flow at the observed pressure readings, as follows:

$$Q_F = 29.83 \times c \times d^2 \times p^{0.5}, \text{ where}$$

Q_F = observed flow (US GPM)

c = hydrant nozzle coefficient (0.90 - 0.95)

d = nozzle diameter (in)

p = observed pitot pressure

$$Q_R = Q_F \times h_F^{0.54} / h_R^{0.54}, \text{ where}$$

Q_R = available flow

Q_F = observed flow (US GPM)

h_F = drop from measured static to desired baseline pressure

h_R = drop from measured static to measured residual pressure

Based on flow test results obtained by **Vipond, October 23, 2017**

c =	0.9
d =	2.5 in
number of ports =	1
p =	42

Q_F = 1087 US GPM

Measured Static Pressure =	64 psi
Measured Residual Pressure =	52 psi
Desired Residual Pressure =	20 psi

, minimum per City of Barrie design criteria

Q_R = 2193 US GPM per fire connection
8,303 L/min

counterpoint engineering

NFPA Theoretical Flow Calculations

Project Name: 67 Owen Street

Project Number: 20020

Based on National Fire Protection Association Guidelines, the available flow at the minimum residual pressure of 20psi can be calculated based on the observed flow at the observed pressure readings, as follows:

$$Q_F = 29.83 \times c \times d^2 \times p^{0.5}, \text{ where}$$

Q_F = observed flow (US GPM)

c = hydrant nozzle coefficient (0.90 - 0.95)

d = nozzle diameter (in)

p = observed pitot pressure

$$Q_R = Q_F \times h_F^{0.54} / h_R^{0.54}, \text{ where}$$

Q_R = available flow

Q_F = observed flow (US GPM)

h_F = drop from measured static to desired baseline pressure

h_R = drop from measured static to measured residual pressure

Based on flow test results obtained by **Vipond, October 23, 2017**

c =	0.9
d =	2.5 in
number of ports =	2
p =	28

$$Q_F = 1776 \text{ US GPM}$$

Measured Static Pressure =	64 psi	
Measured Residual Pressure =	48 psi	
Desired Residual Pressure =	20 psi	, minimum per City of Barrie design criteria

$$Q_R = 3066 \text{ US GPM} \quad \text{per fire connection}$$

11,607 L/min

Counterpoint Engineering Inc.

Water Demand Design Calculations

Project: 67 Owen Street
Project No: 20020
Location: Barrie, ON
Site Area: 0.405 ha

Population

1BR/1BR+Den	1.67	ppu
2BR/2BR+Den/	1.67	ppu
3BR/3BR+Den	1.67	ppu
Commercial / Retail	1.1	persons/100m ²
Offices	3.3	persons/100m ²

	Residential Units				Commercial
	1B / 1B+D	2B / 2B + D	3B / 3B+D	Total Units	Area (m ²)
Ground	-	-	-	0	810.0
Ground - Level 20	278	0	-	278	-
TOTAL UNITS / AREA (m ²)	278	0	0	278	810.0

		Population 1BR / 1B + D	Population 2BR / 2BR + D	Population 3BR / 3BR + D	TOTAL POPULATION
Residential		465	0	0	465
Commercial		-	-	-	
Total Equivalent Population					465

City of Barrie Watermain Guidelines

Per Capita Demand

Single Family	225	(l/capita/day)
Multi-Unit	225	(l/capita/day)

Commercial Demand	28	m ³ /day/ha
-------------------	----	------------------------

Peaking Factors

Land Use	Minimum Hour	Maximum Hour	Maximum Day
Residential	0.40	2.75	4.13
Commercial	0.84	1.20	1.10
Industrial	0.84	0.90	1.10
Institutional	0.84	0.90	1.10
Apartment	0.84	2.50	1.30

*Values used for Commercial Land Use

*Values used for Residential (Multi-Unit) Land Use

Water Demand based on Equivalent Population

Land Use	Population	Average Daily Demand (l/min)	Maximum Hour (l/min)	Maximum Day (l/min)	Fire Flow Required (l/min)	Max Day + Fire Flow (l/min)
Commercial	n/a	7.9	9.5	8.7	8000.0	8,103
Residential (Multi-Unit)	465	61.0	181.6	94.5		
Totals	465	68.9	191.1	103.1		

*Note the Minimum Apartment and Commercial Fire Flow Values from the City of Barrie were not used as a fire demand much lower was computed as per FUS calculations

Counterpoint Engineering Inc.

REQUIRED FIRE FLOW WORKSHEET - PROPOSED DEVELOPMENT

Fire Underwriters Survey

Project : 67 Owen Street

Project No: 20020

Guide for Determination of Required Flow Copyright I.S.O

$$F = 220C\sqrt{A}$$

where

F = the required fire flow in litres per minute.

C = coefficient related to the type of construction.

= 1.5 for wood frame construction (structure essentially all combustible).

= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).

= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).

= 0.6 for fire-resistive construction (fully protected frame floors, roof).

A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Type of Construction		Class Factor
WF	Wood Frame	1.5
OC	Ordinary Construction	1.0
NC	Non-Combustible	0.8
FC	Fire-Resistive	0.6

Area Notes for Fire Resistive Buildings (from FUS manual, 1999):

If Vertical Openings are inadequately protected (less than 1-hour fire rating): Area is the total of the two largest adjoining floors (above ground level) plus 50% of the area of each of the next 8 adjoining floors above that.

Contents		% Reduction
NC	Non-Combustible	25
LC	Limited Combustible	15
C	Combustible	0
FB	Free Burning	15
RB	Rapid Burning	25

If Vertical Openings are adequately protected (at least 1-hour fire rating): Area is the total of the largest floor (above ground level) plus 25% of the area of each of the next 2 immediately adjoining floors above that.

1) Fire Flow

Type of Construction:

C=

A*=

F=

FC
0.6
4722.00 m ²
9,071 L/min

Note: Assuming fire restive building. Assuming Vertical Openings are adequately protected. Area is the total of the largest floor (level 1) plus 25% of the next 2 adjoining floors above.

2) Occupancy Reduction/Surcharge

Contents Factor:

Reduction/Surcharge of

F=

9071L/min + -2268 L/min = 6,803 L/min

NC
-25%
= -2,268 L/min
6,803 L/min

3) System Type Reduction

NFPA 13 Sprinkler:

Standard Water Supply:

Fully Supervised:

Total

Reduction of

F=

6803L/min - 3,401 L/min = 3,401 L/min

YES	30%
YES	10%
YES	10%
Total	50%
50% L/min	= 3,401 L/min
3,401 L/min	= 3,401 L/min

4) Separation Charge

Building Face

North

East

South

West

Total

Dist(m)	Charge
20	15%
3	25%
20	15%
20	15%
Total	70% of 6803 L/min = 4,762 L/min

(max exposure charge can be 75%)

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

F= 3401L/min + 4762L/min = 8,164 L/min (2,000L/min<F<45,000L/min)

F=	8,000 L/min	(round to the nearest 1,000L/min)
F=	133 L/s	
F=	2,113 gpm	



The Residences on Owen Ltd.
67 Owen Street

Appendix C

Sanitary Design Flow Calculations

Counterpoint Engineering Inc.

Project: 67 Owen Street
Project No: 20020
Location: Barrie
Site Area: 0.405 ha

Proposed Sanitary Flow Calculations

As per Sanitary Sewage Collection System Policies and Design Guidelines, City of Barrie, 2017

Design flow = (Population in Thousands x Average Daily Flow x Peaking Factor)/86.4 + (Infiltration Rate x Area)

Persons Per Unit and per Land Use

1BR/1BR+Den	1.67	ppu
2BR/2BR+Den/	1.67	ppu
3BR/3BR+Den	1.67	ppu
Commercial / Retail	1.1	persons/100m ²
Offices	3.3	persons/100m ²

	Residential Units				Retail	Office
	1B / 1B+D	2B / 2B + D	3B / 3B+D	Total Units	Area (m ²)	Area (m ²)
Ground	-	-		0	954	-
Level 2 - 20	278	0		278		-
TOTAL UNITS / AREA (m ²)	278	0	0	278	954.00	0

	Population 1BR / 1B + D	Population 2BR / 2BR + D	Population 3BR / 3BR + D	TOTAL POPULATION
Residential	465	0	0	465
Commercial	-	-	-	na
Total Equivalent Population				465

Peak flow Design Parameters

Residential Average flow	225	litres/person/day
Commercial Average flow	28	m ³ /day/ha
Infiltration	0.1	litres/second/ha

Harmon Peaking Factor

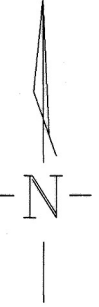
$PF = 1 + (14/(4+(P/1000)^{1/2}))$

Residential Population	Harmon Peak Factor
465	3.99

Residential Flow	4.83	l/s
Commercial Flow	0.03	l/s
Infiltration	0.04	l/s
Groundwater Flows	0.00	l/s

*assuming a 10gm pump

Flow	4.90	l/s
------	------	-----



NORTH SANITARY TRUNK DRAINAGE AREA
LAKE SHORE SANITARY TRUNK DRAINAGE AREA

LEGEND

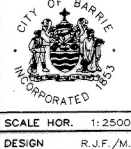
- SANITARY TRUNK DRAINAGE BOUNDARY
- ZONING BOUNDARY
- DRAINAGE BOUNDARY
- CATCHMENT BOUNDARY
- EXISTING SANITARY SEWER
- PROPOSED SANITARY SEWER
- AREA NUMBER
- ZONING
- AREA (ha)

NO.	REVISIONS	DATE	APPROVED

CITY OF BARRIE
APPROVED
DATE 9.8.05
R. J. FORWARD
PROVINCIAL ENGINEER



WORSLEY, OWEN, CLAPPERTON
AND McDONALD STREETS
ROAD RECONSTRUCTION
EXTERNAL SANITARY AREA
DRAINAGE PLAN



CITY of BARRIE
MUNICIPAL WORKS DEPARTMENT
SCALE HOR. 1:2500 VERT. ---
DESIGN R.J.F./M.D.N. DRAWN Z.M.S./L.A.J.
DRAWING NO. 95-07
SHEET NO. SAN1

n=0.013

 Subject Site Flows Highlighted

CITY of BARRIE

DESIGN SHEET

1/1

FILE NO

95-07

CONTRACT

95-07

SANITARY SEWER DESIGN

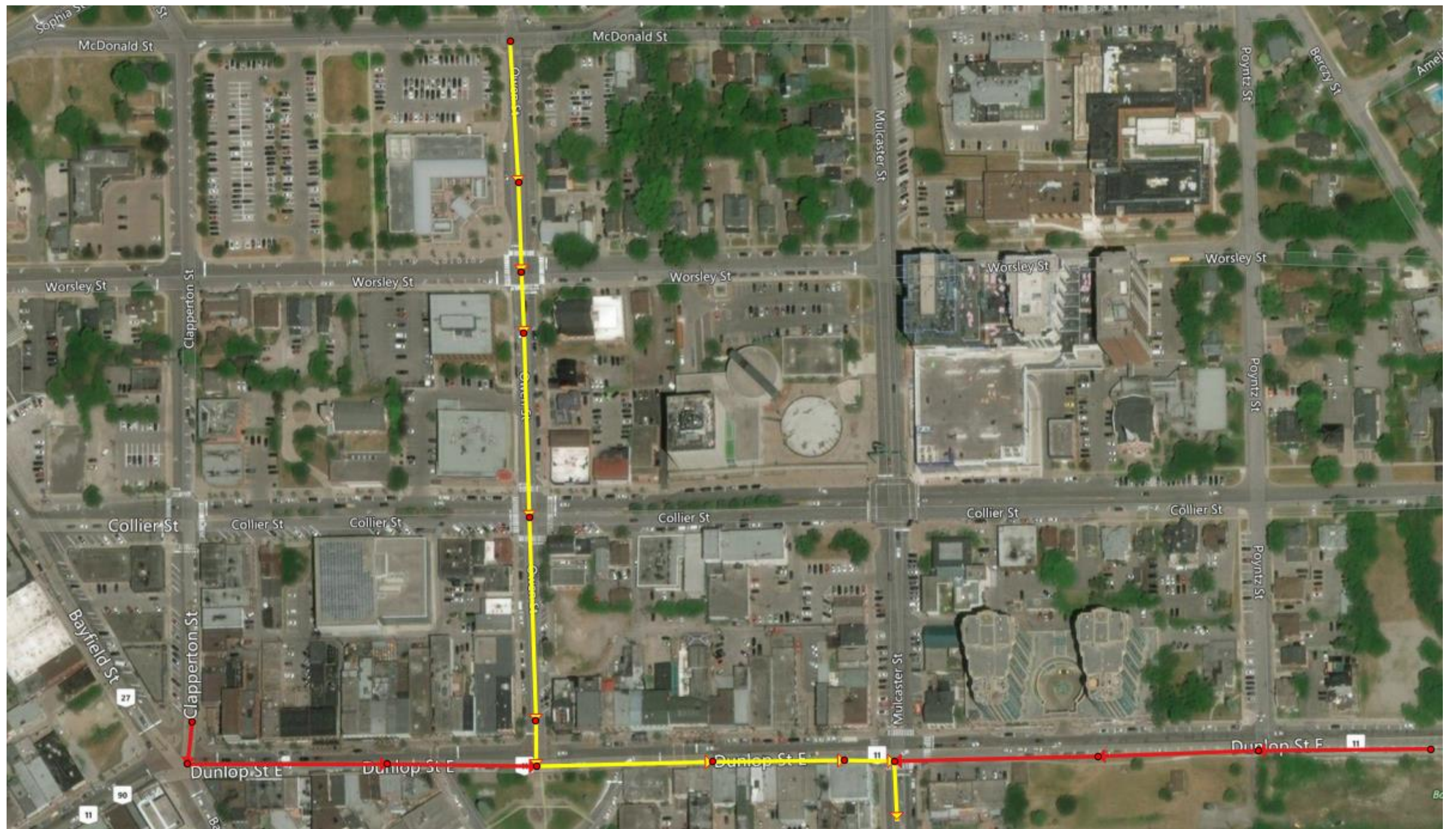
STREETS	MANHOLE		LENGTH (m)	LAND USE	INCREMENT			Q TOTAL (L/s)	D (mm)	S (%)	Q FULL (L/s)	V FULL (m/s)
	FROM	TO			q (cu.m/d/ha)	AREA (ha)	Q (qA) (L/s)					
Area 1a				C4	63.0	0.41	0.30					
Area 1b				R2	51.0	19.55	11.54					
Area 1c				C4	63.0	0.16	0.12					
Area 1d				RM2	141.5	0.45	0.74					
Area 1e				I	63.0	2.49	1.81					
Area 1f				RM2	125.0	14.13	20.44					
Owen Street	SAL03214	SAL03212	15.0					35.0	250	1.00	59.5	1.21
McDonald Street	SAL03216	SAL03212	14.5					35.0	250	1.50	72.8	1.48
Area 2a				RM2	141.5	0.23	0.38					
Owen Street	SAL03212	SAL03210	74.4					35.3	300	2.17	142.4	2.02
Area 4a				RA2	399.5	1.02	4.72					
Area 2b				C2	63.0	0.10	0.07					
Area 2c				C1	63.0	0.51	0.37					
Owen Street	SAL03210	SAL03209	46.8					40.5	300	1.06	99.6	1.41
Area 3a				I	63.0	2.20	1.60					
Area 3b				C1	63.0	0.85	0.62					
Area 3c				RM2	141.5	0.12	0.19					
Area 3d				C2	63.0	1.24	0.90					
Owen Street	SAL03209	SAL03213	31.1					43.8	300	0.79	85.9	1.22
Area 5				RM2	141.5	0.65	1.06					
McDonald Street	SAL03201	SAL03202	63.5					1.1	250	1.0	59.5	1.21
McDonald Street	SAL03202	SAL03203	63.5					1.1	250	0.4	37.6	0.77
Area 6a				RM2	141.5	0.45	0.73					
Clapperton Street	SAL03204	SAL03202	9.0					0.7	250	1.0	59.5	1.21
Area 6b				C2	63.0	0.20	0.15					
McDonald Street	SAL03216	SAL03203	18.0					0.15	250	1.0	59.5	1.21
Area 6c				RA2	399.5	0.56	2.59					
Clapperton Street	SAL03202	SAL03205	76.2					4.5	250	1.0	59.5	1.21
Area 6d				C2	63.0	0.24	0.18					
Clapperton Street	SAL03205	SAL03206	45.5					4.7	250	1.0	59.5	1.21
Area 4b				C2	63.0	1.27	0.92					
Worsley Street	SAN03208	SAN03206	100.0					0.9	250	0.6	45.3	0.92
Clapperton Street	SAL03206	SAL03207	31.8					5.6	250	0.5	42.0	0.86
Area 7				C2	63.0	0.96	0.70					
Worsley Street	SAN01011	Ex SAN	37.4					0.7	250	0.7	49.8	1.01

Approximately 20%
of 2c covers subject
site.

DATE: 1995 05 01

CALCULATED BY: MDN

CHECKED BY: RJF



Water Elevation Profile: Node SAL03212 - SAL03198



Hydrogeological Report Excerpts for Dewatering



Water Balance Totals

Development Phase	Precipitation (m ³)	Evapotranspiration (m ³)	Infiltration (m ³)	Run-Off (m ³)
Pre-Development	3,858	828	371	2,659
Post-Development	3,858	113	51	3,694

The volume of surface water run-off available from building roof tops was calculated to be 2,958 m³ (90% of volume captured). This volume of water will be available as a resource, to maintain groundwater recharge and function. The volume of roof run-off available is compared to the difference in infiltration volume between pre-development and post-development, as noted below:

Potential Post-Development Infiltration Deficit (m ³)	Volume of Roof Run-off Available (m ³)	Percentage of Roof Run-off Required to Match Pre-Development Infiltration (%)
321	2,958	11

3.4 Groundwater Control Requirements

For design purposes, a **design water table of Elev. 228 m** should be assumed in the proposed development area within the north portion of the site. For design purposes, a **design water table of Elev. 226 m** should be assumed in the proposed development area within the south portion of the site.

The lowest (P1) FFE is at about Elev. 230.9± m. Therefore,

- Bulk excavation will extend down to approximately Elev. 230.4± m, above the prevailing groundwater table in the north and south portions of the site.
- Foundations made for the proposed P1 level will bear on the upper sands at approximately Elev. 230± m.
- Per the recommendations of Grounded's Geotechnical Report (provided under a separate cover), where zones of weak soils are encountered, the foundations must extend deeper to approximately:
 - Elev. 228± m in the area surrounding BH203
 - Elev. 224.8± m in the area surrounding BH305
- As such, foundation excavations in these weaker zones will extend to the level of the prevailing groundwater table and will penetrate the wet upper sands, which will yield free-flowing water.
- As means, methods, and extent of sub-excavation have not yet been established (i.e. open cut or shored systems), it is assumed that to facilitate the installation of the foundations, positive dewatering across the site to lower the groundwater table prior to excavation will be required.



- In the long term, the P1 level will be above the prevailing groundwater table at the site.

Prior to excavation, positive dewatering to lower the groundwater table by **about 1.2 m** will be required to facilitate construction as well as to maintain the integrity of the subgrade for foundation and slab-on-grade support. The water level must be kept at least 1.2 m below the lowest excavation elevation during construction. Failure to dewater prior to excavation will result in unrecoverable disturbance of the subgrade, which will render advice provided for undisturbed subgrade conditions inapplicable.

Groundwater seepage estimates were conducted for both short term and long term dewatering scenarios. The modeling was conducted using an equivalent well radius approximation (Powers et al, 2007). The calculation for groundwater seepage indicates the short term (construction) and long term (permanent) dewatering requirements as provided below. The results are presented in Appendix O.

The groundwater seepage estimates, which have been provided, represent the steady state groundwater seepage. There will be an initial drawdown of the groundwater before a steady state condition is reached. The rate of the initial drawdown, and therefore discharge, is dependent on the dewatering contractor and how the groundwater is being dealt with at the site. An estimated initial volume of stored groundwater which will require removal before steady state is reached has been provided below.

Please note that if excavation is exposed to the elements, storm water will have to be managed. The short term control of groundwater should consider stormwater management from rainfall events. A dewatering system should be designed to consider the removal of rainfall from excavation. A design storm of 25 mm has been used in the quantity estimates.

Should additional excavation below the base of excavation be required for proper installation of footings, pumping of stored groundwater will need to be considered by the dewatering contractor, and accounted for in the dewatering plan.

Short Term (Construction) Groundwater Quantity – Safety Factor of 1.5 Used

Site Area	Groundwater Seepage		Design Rainfall Event (25 mm)		Total Daily Water Takings	
	L/day	L/min	L/day	L/min	L/day	L/min
North Portion	62,000	43.1	101,500	70.5	309,500	214.9
South Portion	146,000	101.4				

As required by Ontario Regulation 63/16, a plan for discharge must consider the conveyance of storm water from a 100-year storm. The additional volume that will be generated in the occurrence of a 100-year storm event (94mm) is approximately 381,000 L.



The groundwater control system is required to be designed by a dewatering contractor. The groundwater must be dewatered prior to excavation in order to maintain a stable working base in the excavation.

Mitigation measures based on dewatering and infiltration requirements as per the MECP are discussed in Section 3.6.

Long Term (Permanent) Groundwater Quantity – Safety Factor of 1.5 Used

Groundwater Seepage		Infiltration Design Rainfall Event (25mm)		Total Daily Water Takings	
L/day	L/min	L/day	L/min	L/day	L/min
0	0	2,000	1.4	2,000	1.4

Regulatory Requirements

Environmental Activity and Sector Registry (EASR) Posting	Required
Short Term Permit to Take Water (PTTW)	Not Required
Long Term Permit to Take Water (PTTW)	Not Required
Short Term Discharge Agreement (City of Barrie)	Required
Long Term Discharge Agreement (City of Barrie)	Required

3.5 Assessment of Potential Impact

It is understood that the Property will be developed with a 10 to 20 storey seniors' residential building with one-level of underground parking beneath the entire site. The proposed development includes 10 storeys of building across the entire Property, with an additional 10 storeys (20 storey tower) concentrated on the southern portion of the site. The underground basement level is set at a lowest Finished Floor Elevation (FFE) of 230.9± m. The Property will be serviced with municipal piped water, storm, and sanitary sewers. The proposed nature of the development does not pose any significant concern with respect to potential impact to groundwater quality in the area.

3.5.1 Short Term Discharge (Construction Dewatering)

The flow of water from the dewatering system must be treated to meet the City of Barrie Storm Sewer Discharge Requirements prior to discharge to the municipal sewer system or Provincial Water Quality Standards prior to overland discharge to meet regulation requirements. No



additional treatment is required should the groundwater be discharged to the City's Sanitary Sewer System. Sampling of the discharge water from the dewatering system is required during initial discharge and on-going basis as required by the Region during active dewatering activities. Visual monitoring of the dewatering discharge should be conducted daily. Adjustment to the dewatering system should be made if an increase in turbidity or sediment is noted.

3.5.2 Long Term Discharge (Post Construction)

A permanent dewatering system would be required if the buildings will be drained structures. Groundwater takings of approximately 1.4 L/min are likely. The flow of water from the dewatering system must be treated to meet the City of Barrie Storm Sewer Discharge Requirements prior to discharge to the municipal sewer system or Provincial Water Quality Standards prior to overland discharge to meet regulation requirements. No additional treatment is required should the groundwater be discharged to the City's Sanitary Sewer System. The permanent building drainage system must be properly installed and screened to ensure sediments and fines will not be removed, which is typically a primary cause of dewatering related settlement.

3.5.3 Zone of Influence (ZOI)

The Zone of Influence (ZOI) was calculated based on the estimated groundwater taking rate and the average hydraulic conductivity recorded at the Property. The stratigraphy of the relevant native soil (for dewatering purposes) located at the Property generally consists of a cohesionless upper sand deposit underlain by a tight clayey silt to silty clay. The ZOI calculated for the Property is as follows:

Equation:

$$R_0 = 3000 * dH * K^{0.5} \quad \text{Where} \quad R_0 = \text{Radius of Influence (Zone of Influence)}$$

dH = dewatering thickness (m) in area of largest drawdown

K = hydraulic conductivity (m/s)

Calculation:

The maximum short term ZOI for the Property is:

$$R_0 = 3000 * 2.4 \text{ m} * (3.6 \times 10^{-6} \text{ m/s})^{0.5}$$

$$R_0 = 14 \pm \text{ m}$$

The ZOI may reach up to 14± m during construction dewatering. Based on these ZOI distances, dewatering induced impacts on the surrounding environment and infrastructure may be possible. The ZOI is mostly constrained within the area of development and away from watercourses and wetlands.



Dewatering is not required in the long term. As such, a long term ZOI will not be generated for the Property.

3.5.4 Geotechnical Considerations

The Property is bound by Owen Street, the Barrie Public Library, and a public parking lot to the west, McDonald Street and residential properties to the north, residential properties to the east, and Worsley Street, St. Andrew's Presbyterian Church, and a Service Canada Centre to the south. The relevant groundwater table at the site is located within the Upper Sands Unit. The proposed shoring design may consist of permeable soldier-pile and lagging.

As a result of dewatering and draining the soil, changes in groundwater level have the potential to cause settlement based on the change in the effective stresses within the ZOI. Consideration should be given to implement a monitoring and mitigation program during dewatering activities to confirm that there are not potential implications to existing structures on adjacent properties.

3.5.5 Surface Water, Wetlands and Natural Significance

There are no natural waterbodies within the ZOI that will be affected by the proposed construction dewatering or permanent drainage. The nearest water bodies are Sophia Creek located approximately 180 m north of the Property and Lake Simcoe which is located approximately 400 m south of the Property. Regionally, groundwater and surface water is expected to flow to the south/southeast. A municipal wellhead is located approximately 400 m south of the Property, along the shoreline of Lake Simcoe. Groundwater will flow towards the wellhead.

3.5.6 Local Wells and Zone of Influence

The Property is in an area that is serviced by the City of Barrie. The Property and the surrounding area are provided with municipal piped water and sewer supply. The MECP well records were searched through the online Water Well Database for records located on the Property and within a 500 m radius.

Sixty-seven (67) wells were identified within the Study Area, whose uses range from test holes and monitoring wells to municipal/public water supply including The City of Barrie's Public/Municipal Wells 11 and 14 (220001192). Fire hydrants were present throughout the Study Area and the results of the Private Well Survey indicate that the Property and surrounding areas are supplied with water from municipal sources. Dewatering activities at the Property are unlikely to impact any of the wells identified in the Study Area including the City's Municipals Wells.

3.5.7 Contamination Sources

The Property and immediately surrounding area currently consist mostly of residential and commercial occupants. These activities are not expected to provide an area of potential



The Residences on Owen Ltd.
67 Owen Street

Appendix D

Stormwater Drainage and Stormwater Management Design Calculations

CITY of BARRIE

STORM SEWER DESIGN

$Q = 0.0028 * C * I * A$ (cms)

C : RUNOFF COEFFICIENT

I : RAINFALL INTENSITY

A : AREA (ha)

$I = 97 \times 25.4 / (T_c + 16)$

(5 yr. Design Storm)

DESIGN SHEET 1/1

FILE NO

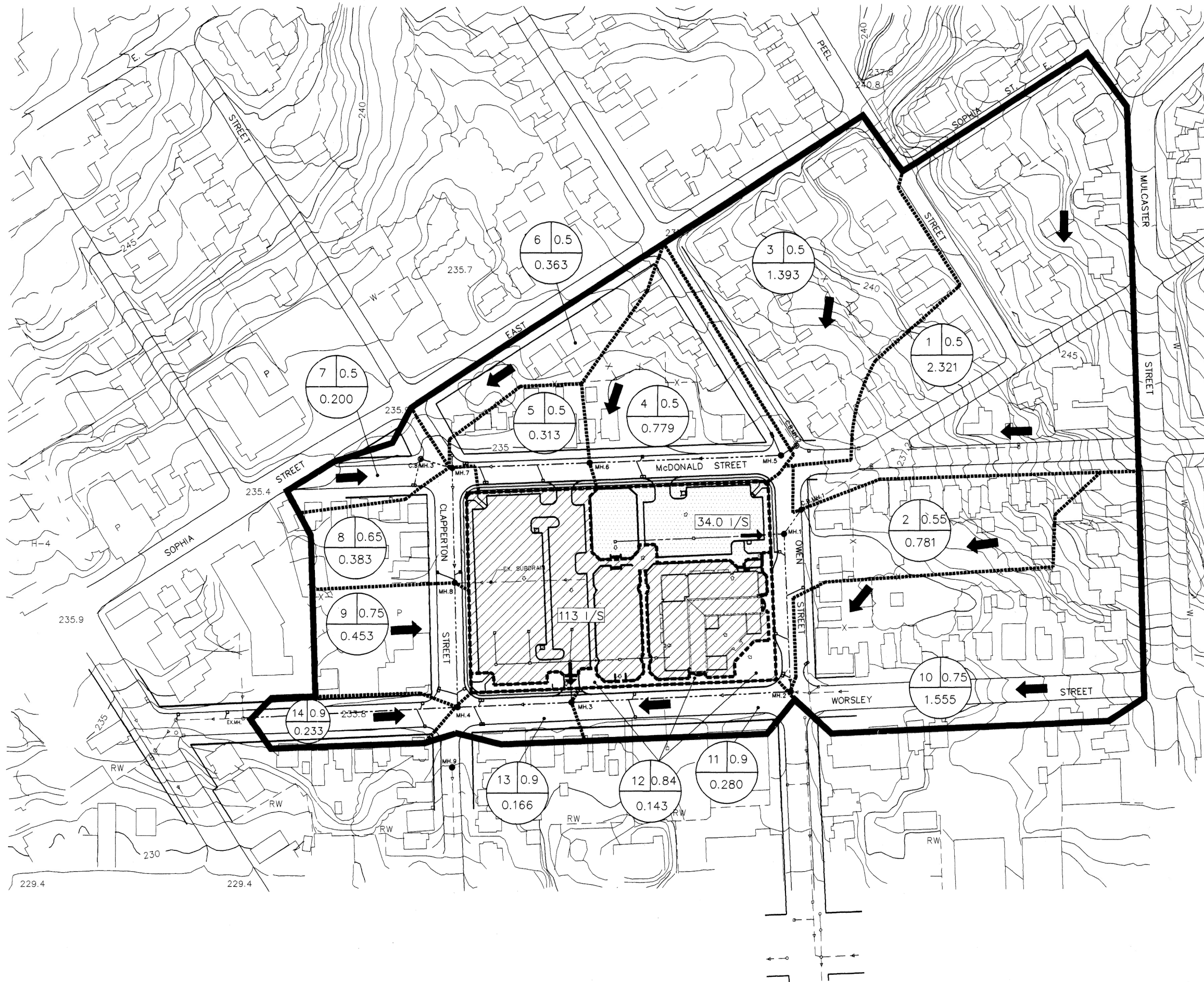
CONTRACT 95-07

LOCATION	MANHOLE		LENGTH (m)	INCREMENT			TOTAL CA	FLOW TIME (min)		I (mm/h)	Q TOTAL (cms)	S (%)	D (mm)	Q FULL (cms)	V FULL (m/s)
	FROM	TO		C	A	CA		TO	IN						
Area 1				0.50	2.32	1.16									
Owen Street	CBMH1	MH1	15.0				1.16	10.00	0.13	94.8	0.31	0.80	600	0.55	1.94
Area 2				0.55	0.78	0.43									
Point Source	North East Parking Lot										0.034				
Owen Street	MH1	MH2	81.0				1.59	10.13	0.70	94.3	0.45	0.80	600	0.55	1.94
Area 10				0.75	1.56	1.17									
Area 12				0.84	0.14	0.12									
Area 11				0.90	0.28	0.25									
Worsley Street	MH2	MH3	111.7				3.13	10.82	0.98	91.9	0.84	0.50	825	1.02	1.89
Area 13				0.90	0.17	0.15									
Point Source	West Parking Lot										0.113				
Worsley Street	MH3	MH4	58.1				3.28	11.80	0.51	88.6	0.96	0.50	825	1.02	1.89
Area 3				0.50	1.39	0.70									
McDonald Street	CBMH 2	MH5	9.3				0.70	10.00	0.10	94.8	0.18	0.75	450	0.25	1.55
Area 4				0.50	0.78	0.39									
McDonald Street	MH5	MH6	97.5				1.09	10.10	1.16	94.4	0.29	0.50	525	0.30	1.40
Area 5				0.50	0.31	0.16									
McDonald Street	MH6	MH7	70.0				1.24	11.26	0.85	90.4	0.31	0.40	600	0.39	1.37
Area 6				0.50	0.36	0.18									
Area 7				0.50	0.2	0.10									
McDonald Street	CBMH3	MH7	16.8				0.10	10.00	0.17	94.8	0.03	1.50	300	0.12	1.67
Area 8				0.65	0.38	0.25									
Clapperton Street	MH7	MH8	58.6				1.77	12.11	0.35	87.7	0.43	1.67	600	0.79	2.80
Area 9				0.75	0.45	0.34									
Clapperton Street	MH8	MH4	63.9				2.10	12.45	0.64	86.6	0.51	0.50	675	0.59	1.66
Area 14				0.90	0.23	0.21									
Worsley Street	MH4	Ex MH10	109.7				5.60	13.09	0.86	84.7	1.47	0.50	975	1.58	2.12

DATE: 1995 04 01

CALCULATED BY: MDN

CHECKED BY: RJF



GENERAL NOTES

BENCH MARKS

NO. REVISIONS DATE APPROVED

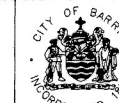
CITY OF BARRIE
APPROVED

DATE 95-09-25
R. J. FORWARD
PROVINCIAL ENGINEER



WORSLEY, OWEN, CLAPPERTON
AND McDONALD STREETS
ROAD RECONSTRUCTION

STORM DRAINAGE PLAN



CITY of BARRIE
MUNICIPAL WORKS DEPARTMENT

SCALE HOR. 1:1000 VERT. ---
DESIGN R.J.F./M.D.N. DRAWN Z.M.S./L.A.J.
DRAWING NO. 95-07
SHEET NO. STA 11



STORMWATER MANAGEMENT DESIGN

Owen and McDonald Parking Lot

EXCEPRTS

February 12, 2004

Table 3 shows the estimated peak flows with post-development conditions during storm events ranging from a 2-year event to a 100-year event with a Chicago 4 hour rainfall distribution and with an SCS Type-II 24 hour rainfall distribution.

In Appendix B, the peak flows with post-development conditions estimated by the Rational Method are compared to the peak flows calculated by SWMHYMO for the Chicago and SCS Type 2 events. The Rational Method was used to check the SWMHYMO modelling parameters. The peak flows from the Rational Method are approximately 25 % to 50 % greater than the Chicago 4 hour and the SCS 24 - hour event peak flows. The variation between the Rational Method and SWMHYMO results from computer modelling round-off error and the differences in peak rainfall intensities. The comparison indicates that the SWMHYMO modelling with post-development conditions is satisfactory.

2.2 Quantity Control

The peak flows with post-development conditions exceed the peak flows with existing conditions for storm events ranging from a 2-year event to a 100-year event. Quantity controls are required on site to reduce peak flows leaving the site to levels that are no greater than peak flows with existing conditions.

The grading of the proposed parking facility has been developed to create approximately 50m³ of storm water storage at a maximum depth of 0.29m. The proposed stormwater management system has been designed to control post-development peak flows to pre-development conditions as shown in Table 3 conforming to the Lake Simcoe Region Conservation Authority's (LSRCA) "Watershed Development Policies", updated July 13, 2000, Section 6.4 regarding Stormwater Management.

Control will be achieved utilizing a combination of an orifice plate and controlled overland flow. The orifice plate, designed with a diameter of 75mm, is attached to the catch basin covering the outlet pipe. Release volume calculations including head pressure are displayed in Appendix C. The orifice plate alone will provide control for the 2-year event to the 10-year event.

The controlled overland flow is a weir and channel created by grading the entrance to the parking lot at an elevation affecting only the events from, the 25-year events through the 100-year events. This design will allow a portion of the stormwater to flow through a graded channel in the entrance onto Owen Street where it will follow the street overland flow route. The use of both controls allow for more accurate control of all storm events while minimizing the depth of ponding on site.

Table 3 – Peak Flows Estimated With SWMHYMO

Storm Event	Existing Conditions	Post-Development Conditions		
		Uncontrolled	Controlled	Storage Requirement
CHICAGO 4hr	m ³ /s	m ³ /s	m ³ /s	m ³
2yr	0.010	0.026	0.011	8.56
5yr	0.016	0.039	0.012	18.91
10yr	0.020	0.047	0.012	28.20
25yr	0.023	0.052	0.017	34.44
50yr	0.028	0.058	0.021	37.45
100yr	0.032	0.066	0.029	39.68
SCS 24hr				
2yr	0.010	0.023	0.011	8.05
5yr	0.017	0.034	0.012	19.17
10yr	0.023	0.042	0.012	27.15
25yr	0.027	0.047	0.015	33.70
50yr	0.032	0.054	0.025	40.55
100yr	0.037	0.061	0.032	44.86

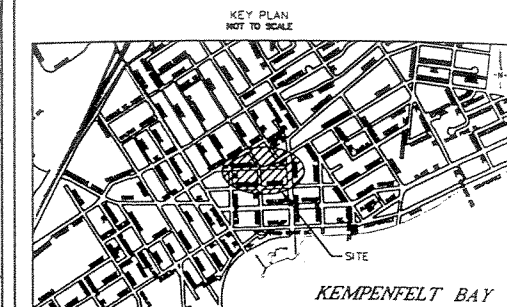
SWMHYMO Software was utilized to calculate the required post-development storage volume for peak flow quantity control. The required storage volume and corresponding release flows are shown in Table 3. The controlled peak flow release rates for post-development conditions are less than the peak flow rates with existing conditions for events ranging from the 5-year event to the 100-year event. The 2-year storm controlled peak flow release rates are greater than the existing condition rates by approximately 1 litre per second. The increase is insignificant. Reducing the release rate during a 2-year event involves reducing the orifice diameter or raising the orifice elevation to decrease the head. Both options raise maintenance concerns which indicate the increase in the peak flow during a 2-year event is acceptable.

The required storage volume to control the post-development peak flow during a 100-year event is approximately 45m³ stored at a maximum depth of 0.27 m over the catch basin.

In the event of a blockage in the storm sewer system, the storm water will overflow the parking lot grading exiting out the parking lot access onto Owen Street where it is contained in the street overland flow route. A storm sewer blockage in the parking lot system will not cause adverse effects on the neighbouring properties.

2.3 Quality Control

In accordance with the LSRCA "Watershed Development Policies" development of this site shall comply with Level 1 (Enhanced) stormwater quality protection. This project is considered to be new development, therefore, the goal of the stormwater quality control device is to meet or



GENERAL NOTES

LEGEND

- CATCHMENT BOUNDARY
- OVERLAND FLOW DIRECTION
- STORM SEWERS/MANHOLES/
FLOW DIRECTION
- SUBCATCHMENT
AREA (ha)

NO.	REVISIONS	DATE	APPROVED

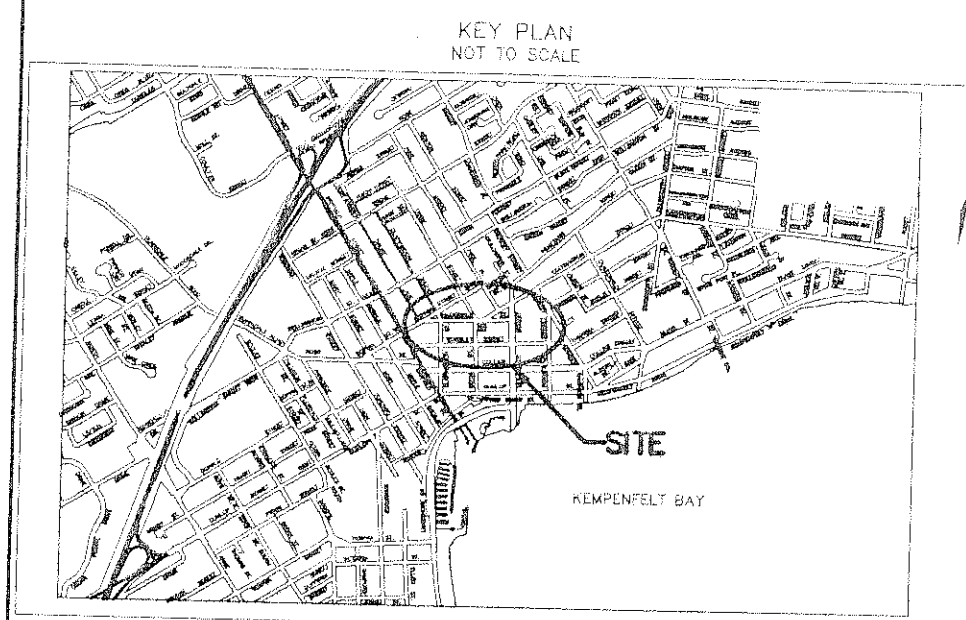
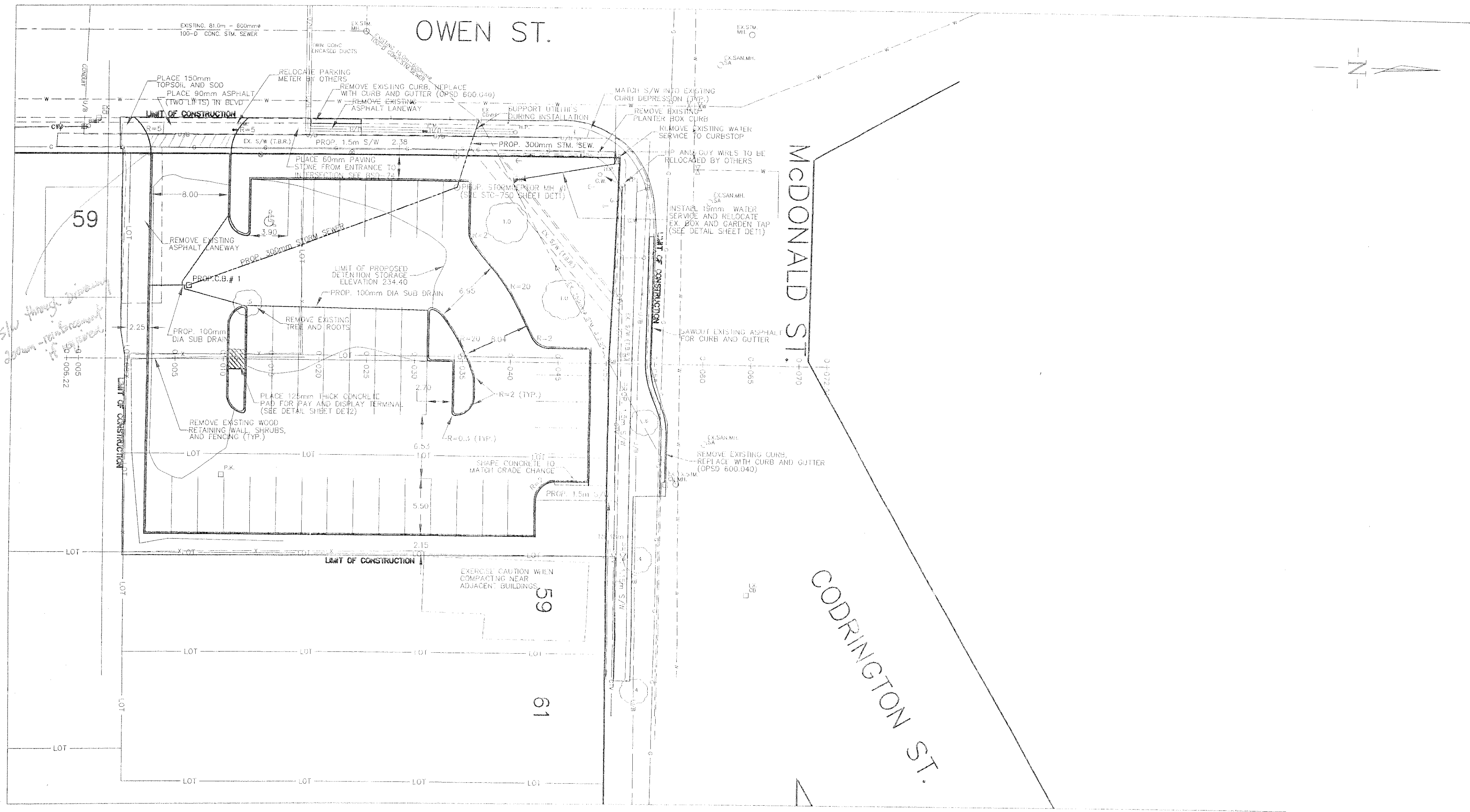
CITY OF BARRIE
APPROVED
DATE
DIRECTOR OF ENGINEERING

**OWEN & McDONALD
PARKING LOT**

STORM DRAINAGE PLAN

CITY OF BARRIE
ENGINEERING DEPARTMENT

SCALE HCR 1:1000	VERT.	DRAWING NO.
DESIGN J.J.H.	DRAWN J.J.H.	SHEET NO.
REVIEWED L.H.B.	DATE 2004.02.06	STM 1



GENERAL NOTES

1. LOCATION OF GAS MAIN PER ENBRIDGE CONSUMERS GAS MARKED DRAWINGS. ALL EXISTING MARKS AND SERVICES TO BE FIELD LOCATED.
2. EXISTING HYDRO, BELL AND CABLE SERVICES MARKED ON DRAWINGS ARE AS PER UTILITY COMPANY DRAWINGS. ALL SERVICES TO BE FIELD LOCATED.
3. FOR TYPICAL SECTIONS, GENERAL NOTES & LEGEND SEE DETAIL SHEET DET1.
4. CONCRETE CURB AND GUTTER PER OPSD 600.040
5. CONCRETE CURB PER OPSD 600.110
6. THE CONTRACTOR SHALL COORDINATE WITH THE UTILITY COMPANY UTILITY RELOCATIONS.
7. BACK FILL FOR STORM SEWER AS PER OPSD-802.010 AND 802.031.
8. RIGID PIPE BEDDING SHALL BE AS PER OPSD-802.031, TYPE 3 WITH GRANULAR 'A' BEDDING MATERIAL AND GRANULAR 'B' COVER MATERIAL. FLEXIBLE PIPE BEDDING SHALL BE AS PER OPSD-802.010, TYPE 3 WITH GRANULAR 'A' BEDDING MATERIAL AND GRANULAR 'A' COVER MATERIAL.
9. EXISTING ASPHALT WITHIN LIMITS OF CONSTRUCTION TO BE REMOVED.
10. COMPACTION OF BACK FILL TO BE ACHIEVED TO 95% STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMD) FOR NATIVE MATERIAL AND IMPORTED ENGINEERED FILL.
11. PROP. STORM SEWER CONNECTIONS TO EX. MANHOLES TO BE CORED.
12. ALL TOPSOIL OR DEBRIS IN THE SUB GRADE TO BE REMOVED.
13. IMMEDIATELY PRIOR TO PLACEMENT OF PAVEMENT GRANULAR COURSES, THE SUB GRADE IS TO BE PROOF ROLLED WITH A HEAVY RUBBER TIRE VEHICLE AND ANY LOOSE, SORT OR UNSTABLE AREAS TO BE SUB EXCAVATED AND BACK FILLED WITH COMPACTED GRANULAR MATERIAL.
14. GRANULAR BASE & SUB BASE TO BE COMPACTED TO A MINIMUM 100% STANDARD PROCTOR MAXIMUM DRY DENSITY.
15. ASPHALT MATERIAL TO BE ROLLED AND COMPACTED TO A MINIMUM 97% MARSHALL BULK DENSITY.
16. EXISTING SUB GRADE TO BE COMPACTED TO A MINIMUM 98% STANDARD PROCTOR MAXIMUM DRY DENSITY.
17. THE CONTRACTOR SHALL MAINTAIN POSITIVE DRAINAGE ON THE SITE DURING CONSTRUCTION AND AVOID SITUATION AND EROSION.
18. THE CONTRACTOR SHALL ENSURE THAT ALL OPEN EXCAVATIONS ARE BACK FILLED AT THE END OF EACH WORKING DAY.
19. ALL EXISTING TREES NOT FOR REMOVAL TO BE PROTECTED DURING CONSTRUCTION.
20. SUB DRAIN TO BE CONNECTED TO DOWNSTREAM CATCH BASIN OR AS NOTED.
21. STORM SEWER SHALL BE CL 65-D CONCRETE PIPE OR PVC DR-35 AND INSTALLED AS PER OPSD-708.01, 708-03.
22. ALL TO BE IN ACCORDANCE WITH THE CURRENT ONTARIO BUILDING CODE.
23. SPECIAL ORDER GOSS TRAP WITHOUT PRE CUT INLET, CUT 75mm DIAMETER HOLE ON SITE.
24. (T.B.R.) - (TO BE REMOVED)
25. (N.T.S.) - (NOT TO SCALE)

BENCH MARKS

DISTANCE NOTE

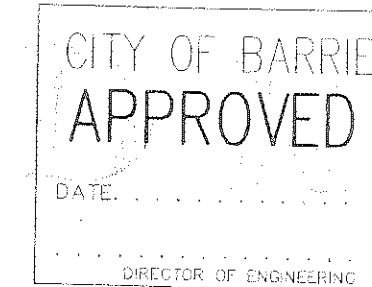
DISTANCES SHOWN HEREON ARE GROUND DISTANCES AND CAN BE CONVERTED TO GRID DISTANCES BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.9997054.

BEARING NOTE

BEARINGS HEREON ARE GRID BEARINGS AND ARE DERIVED FROM CONTROL MONUMENTS 001673105 (N=4915700.133, E=604482.056) AND 031910021 (N=4914550.905, E=605233.985) AND ARE REFERRED TO THE CENTRAL MERIDIAN (81 DEGREES OF LONGITUDE) IN ZONE 17 AND ARE BASED ON NAD83 (76 ADJUSTMENT).
BENCH MARK V010865470
232.569 - FEDERAL BUILDING, AT NW CORNER OF COLLIER AND OWEN STREETS. TABLET SET IN EAST SIDE SMOOTH STONE FOUNDATION WALL IN CENTRE OF FIRST STONE NORTH OF NOTCH IN WALL. 7m NORTH OF SOUTHEAST CORNER OF BUILDING, 300m BELOW BRICK SIDING. LOCATED 0.6m SOUTH AND 0.6m BELOW FIRE DEPT. STANDPIPE.

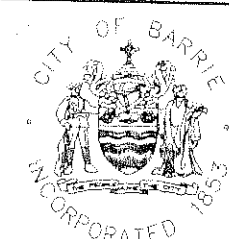
BENCH MARKS WILL BE FROM CITY OF BARRIE VERTICAL CONTROL NETWORK. INITIAL BENCH MARK TO BE OF 2nd ORDER ACCURACY

NO.	REVISIONS	DATE	APPROVED



OWEN AND MCDONALD PARKING LOT

OPTION 1 - STORMCEPTOR SYSTEM

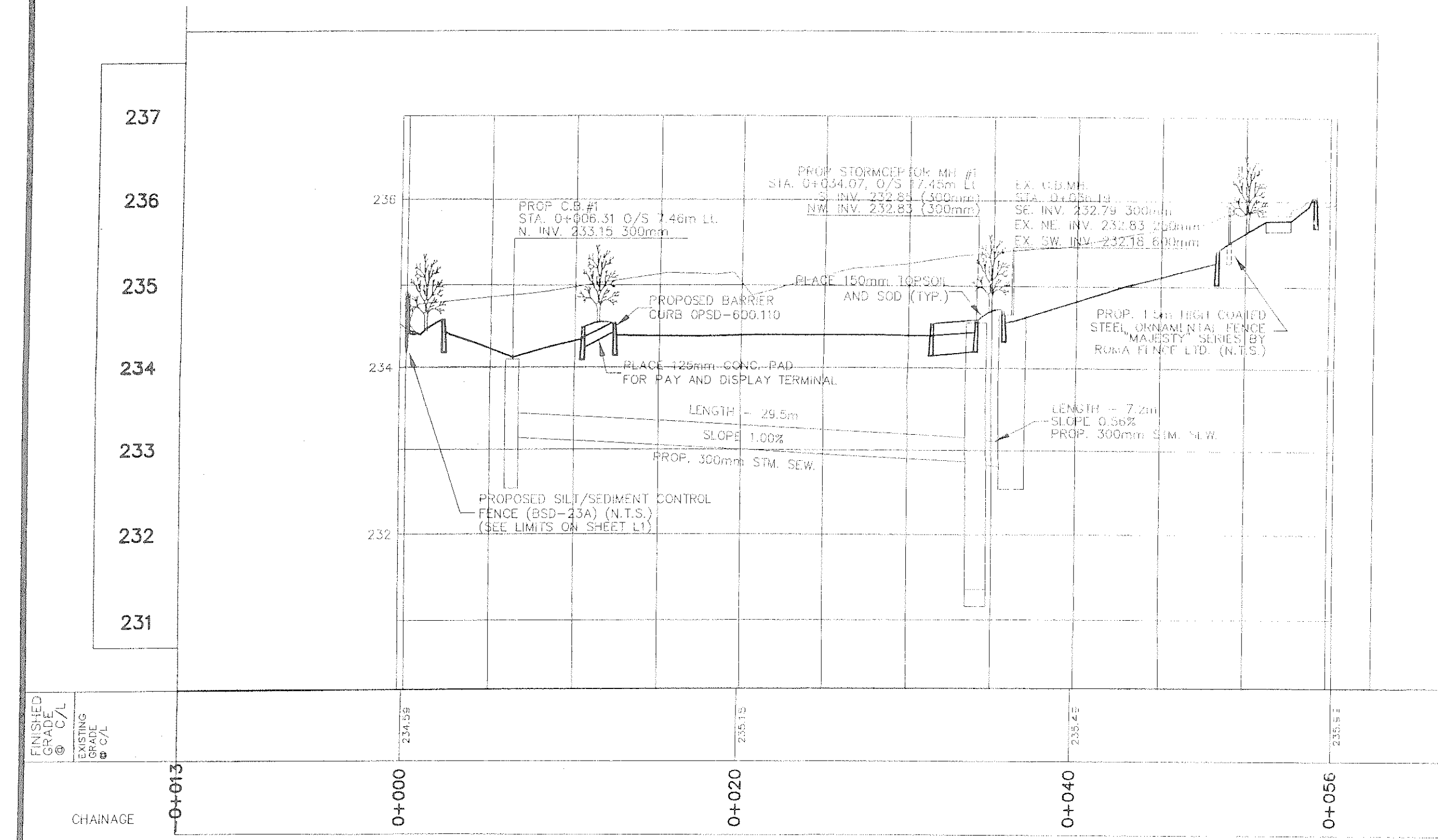
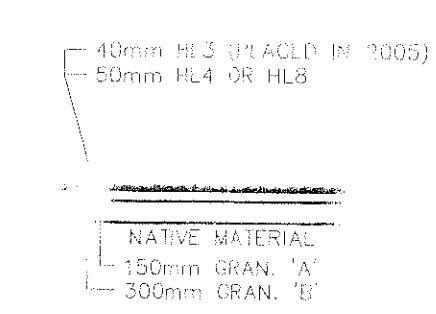


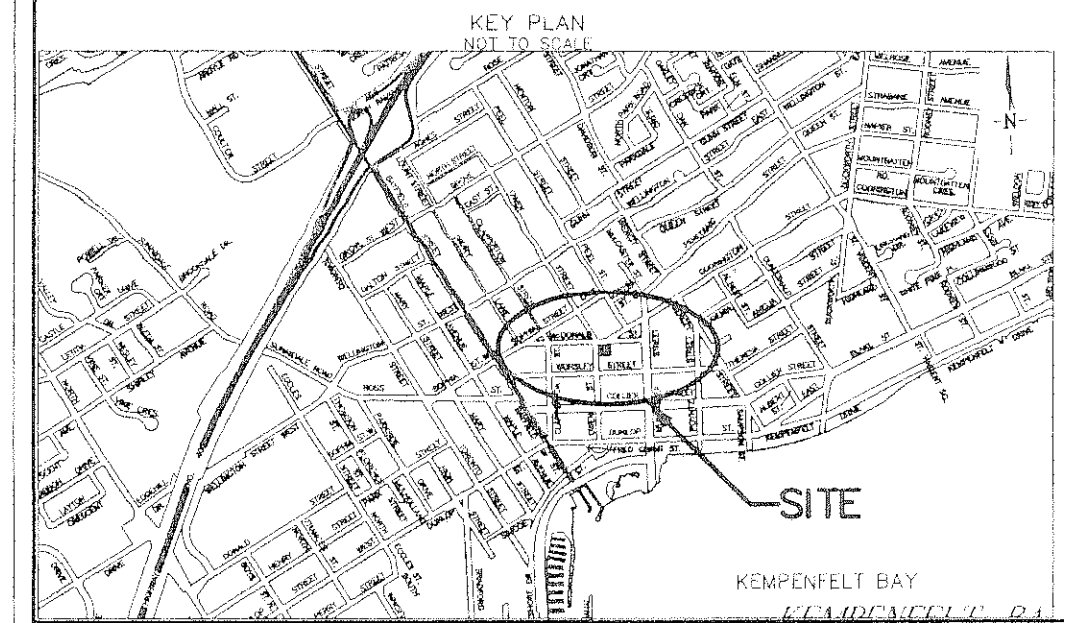
CITY of BARRIE
ENGINEERING DEPARTMENT

SCALE HOR. 1:250	VERT. 1:50	DRAWING NO. 2004-
DESIGN J.J.H.	DRAWN J.J.H.	SHEET NO. PP1
REVIEWED L.H.B.	DATE 2004.01.14	

Existing Services to be located and marked as per current policies

TYPICAL PAVEMENT STRUCTURE





GENERAL NOTES

BENCH MARKS

DISTANCE NOTE

DISTANCES SHOWN HEREON ARE GROUND DISTANCES AND CAN BE CONVERTED TO GRID DISTANCES BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.9997054.

BEARING NOTE

BEARINGS HEREON ARE GRID BEARINGS AND ARE DERIVED FROM CONTROL MONUMENTS 001673109 (N=4915700.133, E=60482.056) AND 031910021 (N=4914550.926, E=606123.998), AND ARE REFERRED TO THE CENTRAL MERIDIAN (81 DEGREES OF LONGITUDE) IN ZONE 17 AND ARE BASED ON NAD83 (75 ADJUSTMENT).

BENCH MARK V010865470

232.569 - FEDERAL BUILDING, AT NW CORNER OF COLLIER AND OWEN STREETS. TABLET SET IN EAST SIDE SMOOTH STONE FOUNDATION WALL IN CENTRE OF FIRST STOREY NORTH OF NOTCH IN WALL 7m NORTH OF SOUTHEAST CORNER OF BUILDING, 35m BELOW BRICK SIDING. LOCATED 0.6m SOUTH AND 0.8m BELOW FIRE DEPT. STANDPIPE.

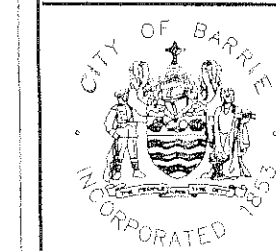
BENCH MARKS WILL BE FROM CITY OF BARRIE VERTICAL CONTROL NETWORK. INITIAL BENCH MARK TO BE OF 2nd ORDER ACCURACY.

NO.	REVISIONS	DATE	APPROVED

CITY OF BARRIE
APPROVED
DATE: 2004/02/11
DIRECTOR OF ENGINEERING

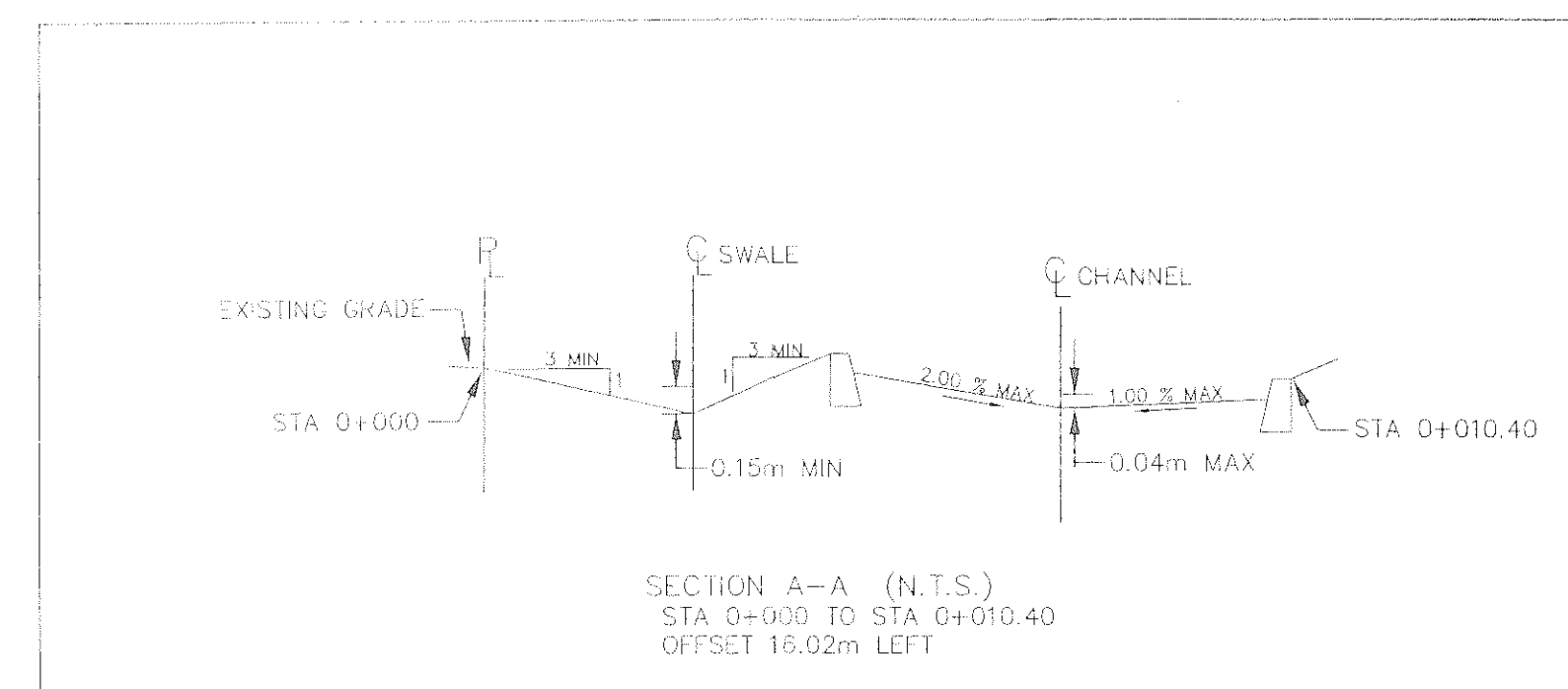
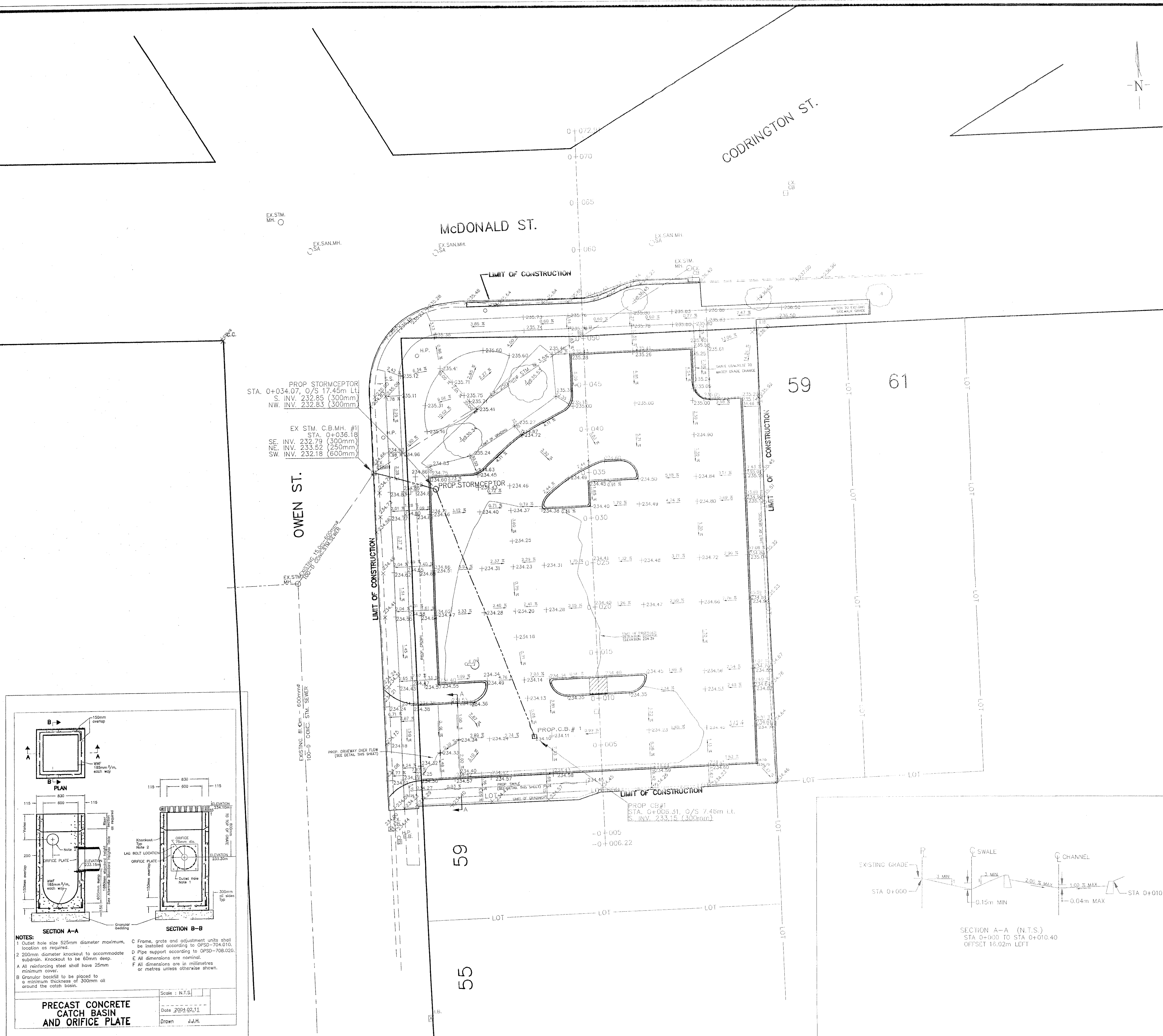
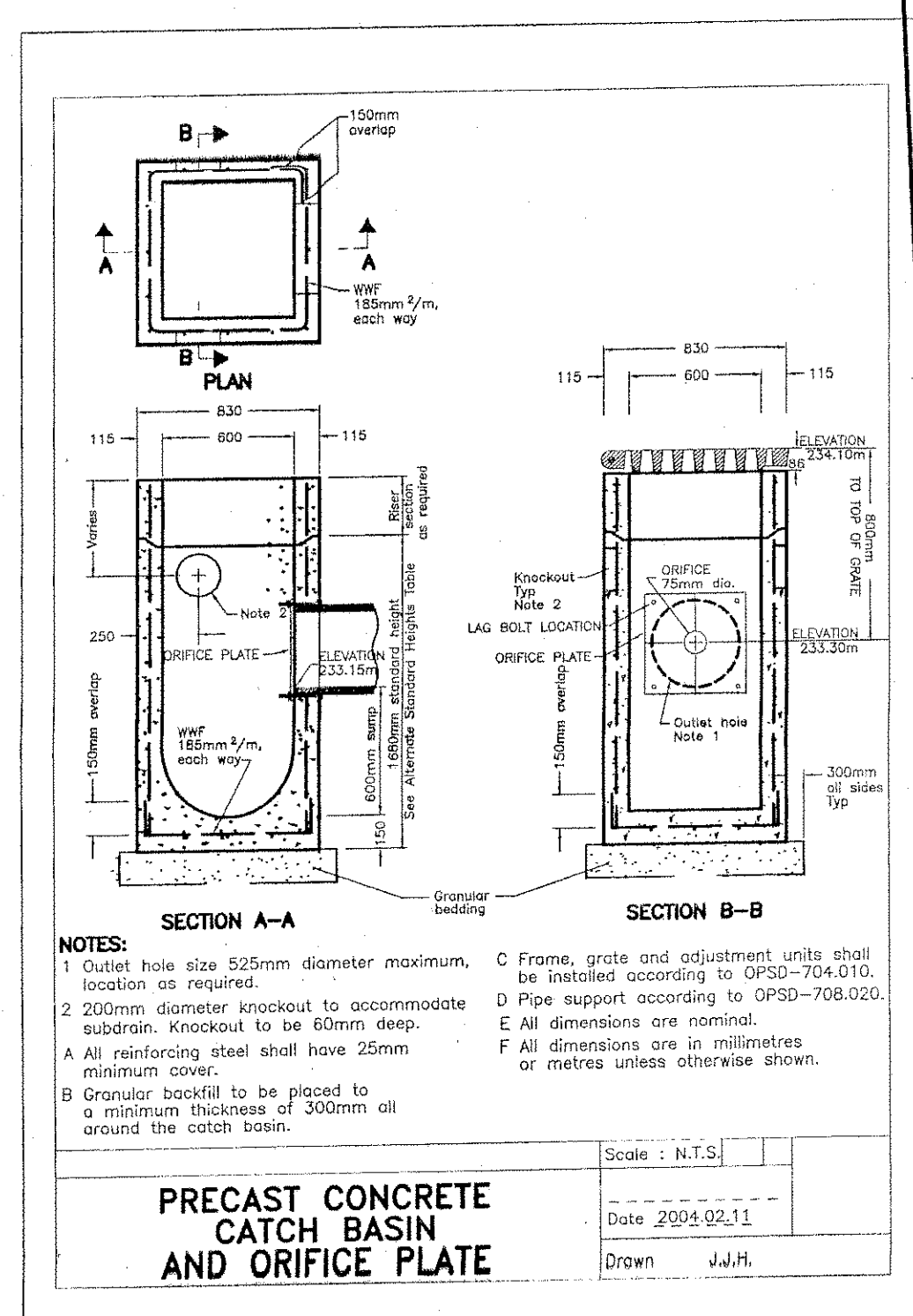
OWEN AND MCDONALD
PARKING LOT

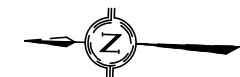
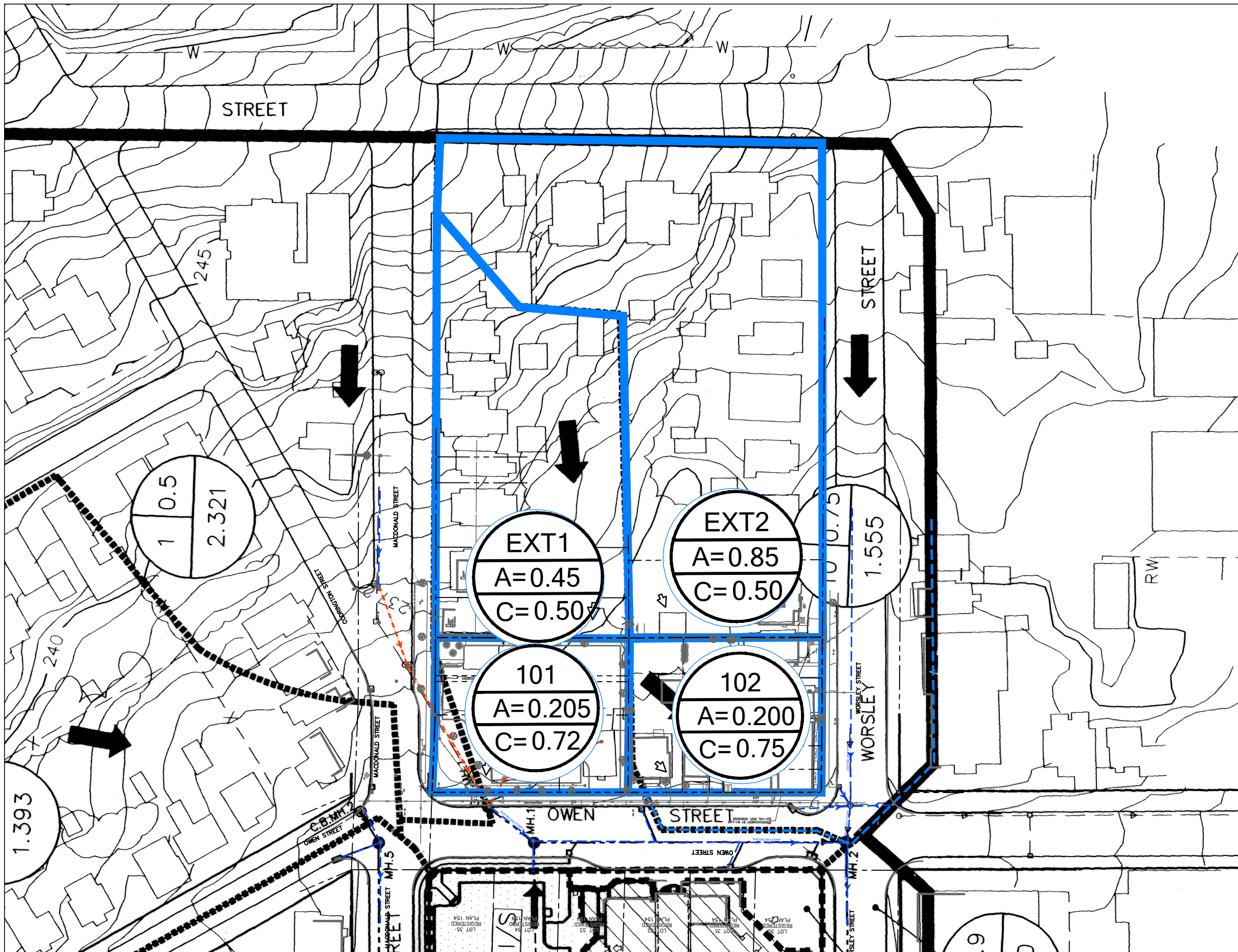
GRADING PLAN



CITY of BARRIE
ENGINEERING DEPARTMENT

SCALE HOR. 1:200	VERT.	DRAWING NO. 2004-
DESIGN J.J.H.	DRAWN J.J.H.	SHEET NO. G1
REVIEWED L.H.B.	DATE 2004/01/14	





LEGEND

- DRAINAGE AREA BOUNDARY
- - - - - EXTERNAL DRAINAGE AREA
- 101
A=0.40
C=0.80

 - ID NUMBER
 - DRAINAGE AREA (ha)
 - RUNOFF COEFFICIENT
- ➔ OVERLAND FLOW PATH
- ⬅ ——— EXISTING STORM SEWER
- - - - - ⬅ - - - - - EXISTING STORM SEWER TO BE REMOVED

counterpoint
ENGINEERING

COUNTERPOINT ENGINEERING INC.
8395 Jane St., Suite 100, Vaughan, ON L4K 5Y2 Phone 905.326.1404 Fax 905.326.1405

BALLANTRY SENIORS BARRIE GP INC 57 OWEN STREET BARRIE, ON	
EXISTING STORMWATER DRAINAGE PLAN	
DESIGNED BY: TN	DATE: JUNE 2021
CHECKED BY: TN	PROJECT No. 20020
DRAWING BY: TN	FIGURE No. DAP1
CHECKED BY: TN	
SCALE: 1:1000	

Prepared By Tim Ng	Pre Development Composite Runoff Coefficient		
	67 Owen Street 20020 2021-06-01		
Drainage Area 102			
		(ha)	
Total Area:	0.20		
Impervious:	0.15	Coefficient:	0.9
Landscaping:	0.05	Coefficient:	0.25
Composite C:	0.75		
Percent Impervious		76.92%	

Prepared By Tim Ng					Rational Method Pre-Development Flow Calculation			
					67 Owen Street 20020 2021-06-01			

Input Parameters

Area Number	Area	C	Tc
	(ha)		(min.)
EXT1	0.45	0.50	10
EXT2	0.85	0.50	10
102	0.20	0.75	10

Formula: $I = a(T+b)^c$

a,b,c	Constants
T	Time of concentration
I	Rainfall intensity

Rational Method Calculations

IDF Data Set: City of Barrie
 Event 2-Year
 a = 662.00
 b = 7.50
 c = -0.7900

Area Number	A	C	AC	Tc	I	Q	Q
	(ha)			(min.)	(mm/h)	(m³/s)	(L/s)
102	0.20	0.75	0.15	10	69.0	0.029	28.8

IDF Data Set: City of Barrie
 Event 5-Year
 a = 853.61
 b = 4.70
 c = -0.7660

Area Number	A	C	AC	Tc	I	Q	Q
	(ha)			(min.)	(mm/h)	(m³/s)	(L/s)
102	0.20	0.75	0.15	10	108.9	0.045	45.4

IDF Data Set: City of Barrie
 Event 10-Year
 a = 975.87
 b = 4.70
 c = -0.7600

Area Number	A	C	AC	Tc	I	Q	Q
	(ha)			(min.)	(mm/h)	(m³/s)	(L/s)
102	0.20	0.75	0.15	10	126.5	0.053	52.7

IDF Data Set: City of Barrie
 Event 25-Year
 a = 1146.28
 b = 4.92
 c = -0.7570

Area Number	A	C	AC	Tc	I	Q	Q
	(ha)			(min.)	(mm/h)	(m³/s)	(L/s)
102	0.20	0.83	0.17	10	148.2	0.068	67.9

IDF Data Set: City of Barrie
 Event 50-Year
 a = 1236.15
 b = 4.70
 c = -0.7510

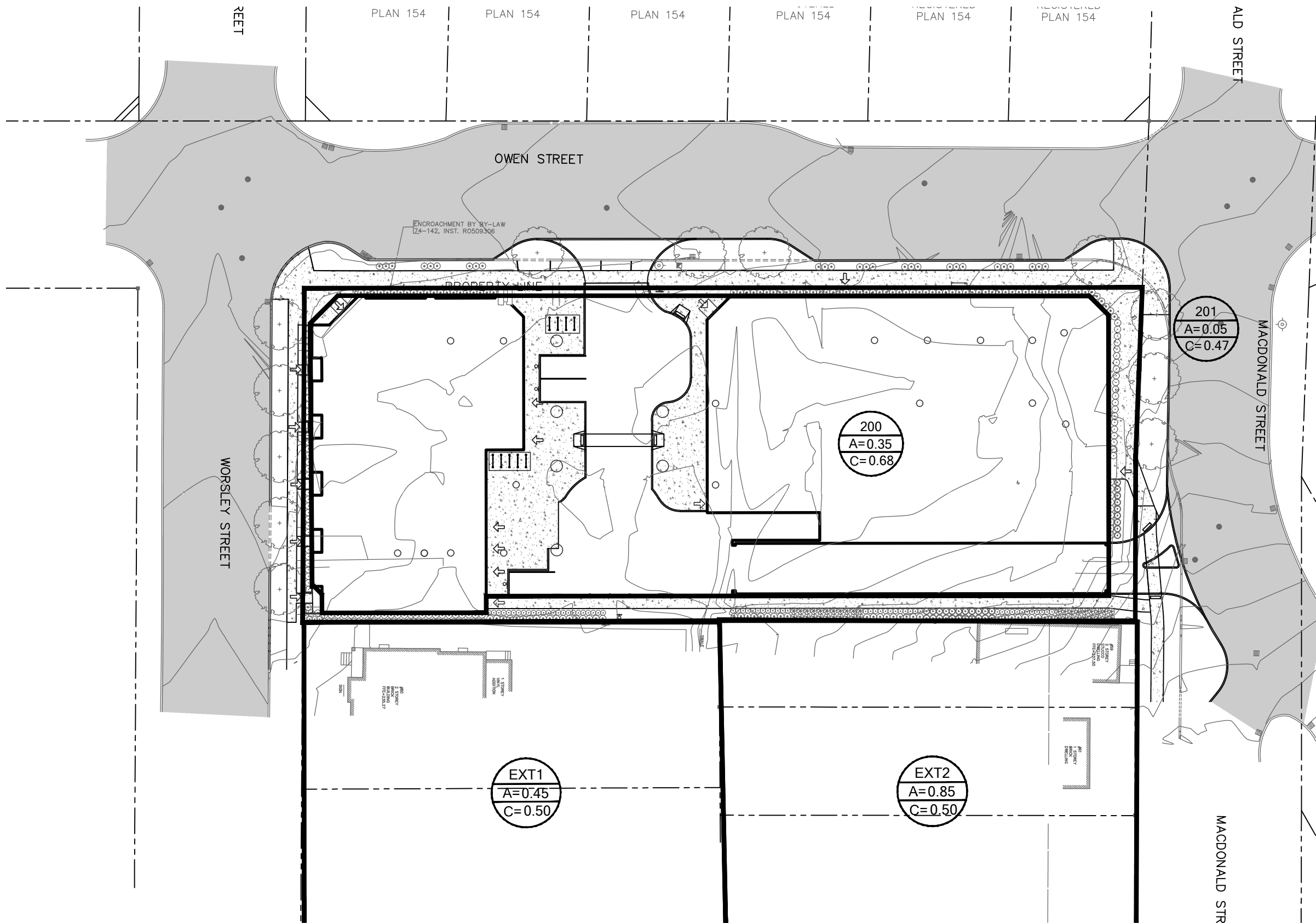
Area Number	A	C	AC	Tc	I	Q	Q
	(ha)			(min.)	(mm/h)	(m³/s)	(L/s)
102	0.20	0.90	0.18	10	164.2	0.082	82.1

IDF Data Set: City of Barrie
 Event 100-Year
 a = 1426.41
 b = 5.27
 c = -0.7590

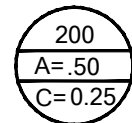
Area Number	A	C	AC	Tc	I	Q	Q
	(ha)			(min.)	(mm/h)	(m³/s)	(L/s)
EXT1	0.45	0.63	0.28	10	180.2	0.141	140.7
EXT2	0.85	0.63	0.53	10	180.2	0.266	265.9
102	0.20	0.94	0.19	10	180.2	0.094	93.8

Event Return Frequency	Peak Flow (L/s)		
	Area 101 (0.205 ha)	Area 102 (0.203 ha)	Total Site Release Rate
2 year	10	29	39
5 year	17	45	62
10 year	23	53	76
25 year	27	68	95
50 year	32	82	114
100 year	37	94	131

*from 2004 report *from pre-dev calcs



LEGEND



POST-DEVELOPMENT DRAINAGE AREA



OVERLAND FLOW ROUTE

counterpoint 
ENGINEERING
COUNTERPOINT ENGINEERING INC.
8395 Jane St., Suite 100, Vaughan, ON L4K 5Y2 Phone 905.326.1404 Fax 905.326.1405

The Residences on Owen Ltd.
67 OWEN STREET
BARRIE, ONTARIO

POST-DEVELOPMENT
DRAINAGE PLAN

DESIGNED BY: SC	DATE: NOV 2021
CHECKED BY: TN	PROJECT No. 20020
DRAWING BY: SC	
CHECKED BY: TN	FIGURE No. DAP2
SCALE: 1: 500	

Prepared By Tim Ng	Post Development Composite Runoff Coefficient																										
	67 Owen Street 20020 2021-06-01																										
200 Post Controlled																											
<table><tr><td></td><td>(ha)</td><td colspan="2"></td></tr><tr><td>Total Area:</td><td>0.35</td><td></td><td></td></tr><tr><td>Impervious:</td><td>0.23</td><td>Coefficient:</td><td>0.9</td></tr><tr><td>Landscaping:</td><td>0.12</td><td>Coefficient:</td><td>0.25</td></tr><tr><td>Composite C:</td><td>0.68</td><td colspan="2"></td></tr><tr><td colspan="2">Percent Impervious</td><td colspan="2">65.51%</td></tr></table>					(ha)			Total Area:	0.35			Impervious:	0.23	Coefficient:	0.9	Landscaping:	0.12	Coefficient:	0.25	Composite C:	0.68			Percent Impervious		65.51%	
	(ha)																										
Total Area:	0.35																										
Impervious:	0.23	Coefficient:	0.9																								
Landscaping:	0.12	Coefficient:	0.25																								
Composite C:	0.68																										
Percent Impervious		65.51%																									
201 Post Uncontrolled																											
<table><tr><td></td><td>(ha)</td><td colspan="2"></td></tr><tr><td>Total Area:</td><td>0.05</td><td></td><td></td></tr><tr><td>Impervious:</td><td>0.02</td><td>Coefficient:</td><td>0.9</td></tr><tr><td>Landscaping:</td><td>0.03</td><td>Coefficient:</td><td>0.25</td></tr><tr><td>Composite C:</td><td>0.47</td><td colspan="2"></td></tr><tr><td colspan="2">Percent Impervious</td><td colspan="2">34.20%</td></tr></table>					(ha)			Total Area:	0.05			Impervious:	0.02	Coefficient:	0.9	Landscaping:	0.03	Coefficient:	0.25	Composite C:	0.47			Percent Impervious		34.20%	
	(ha)																										
Total Area:	0.05																										
Impervious:	0.02	Coefficient:	0.9																								
Landscaping:	0.03	Coefficient:	0.25																								
Composite C:	0.47																										
Percent Impervious		34.20%																									

Prepared By Tim Ng		Modified Rational Method - 2 Year Storm Site Flow and Storage Summary 67 Owen Street 20020 2021-06-01					
		200 Post Controlled				201 Post Uncontrolled	
		Area= 0.35 ha "C" = 0.68 AC1= 0.24 Tc = 10.0 min Time Increment = 5.0 min Orifice Release Rate = 15.7 L/s Max. Required Storage = 19.4 m³				Area= 0.05 ha "C" = 0.47 AC1= 0.02 Tc = 5.0 min Time Increment = 5.0 min Releasee Rate = 4.5 L/s	
Rainfall Intensity Parameters							
a=		662.00					
b=		7.50					
c=		-0.79					
I=		A(T+b)^c					
Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Target Released Volume	Total Required Storage Volume	Storm Runoff	Runoff Volume
(min)	(mm/hr)	(m³/s)	(m³)	(m³)	(m³)	(m³/s)	(m³)
10.0	69.0	0.05	27.20	9.40	17.80	0.00	2.72
15.0	56.6	0.04	33.46	14.10	19.36	0.00	3.34
20.0	48.3	0.03	38.07	18.80	19.27	0.00	3.80
25.0	42.3	0.03	41.70	23.50	18.20	0.00	4.16
30.0	37.8	0.02	44.69	28.20	16.49	0.00	4.46
35.0	34.2	0.02	47.23	32.90	14.33	0.00	4.72
40.0	31.4	0.02	49.44	37.61	11.84	0.00	4.94
45.0	29.0	0.02	51.39	42.31	9.09	0.00	5.13
50.0	27.0	0.02	53.14	47.01	6.14	0.00	5.31
55.0	25.2	0.02	54.73	51.71	3.02	0.00	5.46
60.0	23.8	0.02	56.19	56.41	0.00	0.00	5.61
65.0	22.4	0.01	57.53	61.11	0.00	0.00	5.74
70.0	21.3	0.01	58.77	65.81	0.00	0.00	5.87
75.0	20.3	0.01	59.94	70.51	0.00	0.00	5.98
80.0	19.3	0.01	61.03	75.21	0.00	0.00	6.09
85.0	18.5	0.01	62.06	79.91	0.00	0.00	6.20
90.0	17.8	0.01	63.03	84.61	0.00	0.00	6.29
95.0	17.1	0.01	63.95	89.31	0.00	0.00	6.38
100.0	16.4	0.01	64.83	94.01	0.00	0.00	6.47
105.0	15.9	0.01	65.67	98.71	0.00	0.00	6.56
110.0	15.3	0.01	66.48	103.41	0.00	0.00	6.64
115.0	14.8	0.01	67.25	108.12	0.00	0.00	6.71
120.0	14.4	0.01	67.99	112.82	0.00	0.00	6.79
125.0	13.9	0.01	68.70	117.52	0.00	0.00	6.86
130.0	13.5	0.01	69.39	122.22	0.00	0.00	6.93
135.0	13.2	0.01	70.06	126.92	0.00	0.00	6.99
140.0	12.8	0.01	70.70	131.62	0.00	0.00	7.06
145.0	12.5	0.01	71.32	136.32	0.00	0.00	7.12
150.0	12.2	0.01	71.92	141.02	0.00	0.00	7.18
155.0	11.9	0.01	72.51	145.72	0.00	0.00	7.24
160.0	11.6	0.01	73.07	150.42	0.00	0.00	7.30
165.0	11.3	0.01	73.63	155.12	0.00	0.00	7.35
170.0	11.1	0.01	74.17	159.82	0.00	0.00	7.40
175.0	10.8	0.01	74.69	164.52	0.00	0.00	7.46
180.0	10.6	0.01	75.20	169.22	0.00	0.00	7.51
185.0	10.4	0.01	75.70	173.92	0.00	0.00	7.56
190.0	10.2	0.01	76.19	178.62	0.00	0.00	7.61
195.0	10.0	0.01	76.66	183.33	0.00	0.00	7.65
200.0	9.8	0.01	77.13	188.03	0.00	0.00	7.70
205.0	9.6	0.01	77.58	192.73	0.00	0.00	7.75
210.0	9.4	0.01	78.03	197.43	0.00	0.00	7.79
215.0	9.3	0.01	78.46	202.13	0.00	0.00	7.83
220.0	9.1	0.01	78.89	206.83	0.00	0.00	7.88
225.0	8.9	0.01	79.31	211.53	0.00	0.00	7.92
230.0	8.8	0.01	79.72	216.23	0.00	0.00	7.96
235.0	8.6	0.01	80.12	220.93	0.00	0.00	8.00
240.0	8.5	0.01	80.52	225.63	0.00	0.00	8.04
245.0	8.4	0.01	80.91	230.33	0.00	0.00	8.08
250.0	8.2	0.01	81.29	235.03	0.00	0.00	8.12
255.0	8.1	0.01	81.67	239.73	0.00	0.00	8.15
260.0	8.0	0.01	82.04	244.43	0.00	0.00	8.19
265.0	7.9	0.01	82.40	249.13	0.00	0.00	8.23
270.0	7.8	0.01	82.76	253.84	0.00	0.00	8.26
275.0	7.7	0.01	83.11	258.54	0.00	0.00	8.30
280.0	7.6	0.00	83.46	263.24	0.00	0.00	8.33
285.0	7.5	0.00	83.80	267.94	0.00	0.00	8.37
290.0	7.4	0.00	84.13	272.64	0.00	0.00	8.40
295.0	7.3	0.00	84.46	277.34	0.00	0.00	8.43
300.0	7.2	0.00	84.79	282.04	0.00	0.00	8.46

Flow Summary

Target Flow 38.8 L/s

Total Design Flow 20.2 L/s

Prepared By Tim Ng		Modified Rational Method - 100Year Storm Site Flow and Storage Summary 67 Owen Street 20020 2021-06-01							
		200 Post Controlled 							

					Orifice Control		
					67 Owen Street 20020 2021-06-01		
Prepared By Tim Ng							
Orifice Equation							
$Q = C \times A \times \sqrt{2 \times g \times h}$							
Storm Event	Orifice Coefficient	Diameter of Orifice	Orifice Invert	Headwater Elevation	Total Head	Area of Orifice	Release Rate
		(mm)	(m)	(m)	(m)	(m ²)	(L/s)
2-Year	0.60	195	232.65	232.79	0.04	0.030	15.7
5-Year	0.60	195	232.65	232.85	0.10	0.030	25.3
100-Year	0.60	195	232.65	233.10	0.35	0.030	47.1

		Tank Storage Calculations 67 Owen Street 20020 2021-06-01										
	Prepared By Tim Ng											
				Quantity Control Tank Storage						Water Retention Tank Storage within Sump		
				2 Year		5 Year		100 Year		Base Area (m ²)	Depth Below Orifice (m)	Volume (m ³)
				Water Level	232.79	Water Level	232.85	Water Level	233.10	25.00	0.50	12.5
	Orifice Invert	Top of Tank	Base Area (m ²)	Active Depth used for Storage (m)	Volume (m ³)	Active Depth used for Storage (m)	Volume (m ³)	Active Depth used for Storage (m)	Volume (m ³)			
	232.65	233.41	150.00	0.14	20.47	0.20	29.83	0.45	67.50			
			Total		20.47		29.83		67.50			

	5 mm Volume Control Requirement		
	67 Owen Street 20020 Jun-21		
Prepared by:			
	Site Area =	4000	m ²
	Rainfall Depth to be Retained over Impervious Surfaces =	5.0	mm
	Total Rainfall Volume to be Retained =	12.3	m³

SWM DESIGN CALCULATIONS
Overland Routes Weir Flow Capacity
Overland Flow = 0.42m³/s 100yr

Project Name: 67 Owen Street
Municipality: City of Barrie
Project No.: 20020
Date: 19-Nov-21

Capacity from Curb Inverts to Road Centerline Crown
(Part A)

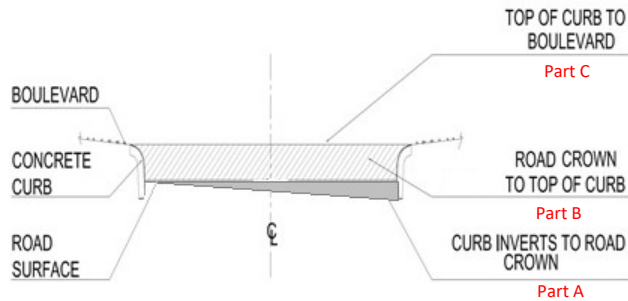
Input Parameters:

Road Cross Section Paved Slope	0.02	m/m	(1.8% Slope)
Road Cross Section Paved Width	7.5	m	
Bottom Width, b	0.00		
Flow Depth on High Point Above Curb, H	0.14	m	
Effective Flow Depth On The Road	0.07	m	
High Point Curb Invert Elevation (Weir Location)	234.14	m	
Low Point Curb Invert (Sag) Elevation	234.00		
Weir Discharge Coefficient C _w	1.60		

Computed Values:

Weir Bottom (Wetted) Width, B	7.8	m	
Water Surface Elevation at High Point	234.14	m	
Water Surface Elevation at Low Point	234.14	m	
Ponding Depth on Low Point (Sag)	0.14	m	

Capacity, Q (One side) 0.23 m³/s



Capacity from Road Centerline Crown to Top of Curb
(Part B)

Input Parameters:

Curb Side Slope (H:Z)	0.00	:1	
Flow Depth above Road Crown, H	0.00	m	
Cumulative Depth Above Curb Invert	0.14	m	
Cumulative Effective Flow Depth On The Road	0.07	m	
Weir Discharge Coefficient C _w	1.60		

Computed Values:

Cumulative Weir Bottom (Wetted) Width, B	7.8	m	
Water Surface Elevation at High Point	234.14	m ²	
Water Surface Elevation at Low Point	234.14	m	
Ponding Depth on Low Point (Sag)	0.14	m	

Cumulative Capacity, Q 0.23 m³/s

Weir equation: $Q = B \times C_w \times H^{3/2}$
C_w = weir discharge coefficient
B = bottom width (m)
Q = flow rate (m³/s)
H = head on the weir (m)

where:

Capacity from Top of Curb to Boulevard
(Part C)

Input Parameters:

Road Cross Section Boulevard Slope	0.02	m/m	(2% Slope)
Flow Depth Above Curb's Top Level, H	0.02	m	
Cumulative Depth Above Curb Invert	0.16	m	
Cumulative Effective Flow Depth On The Road	0.09	m	
Weir Discharge Coefficient C _w	1.60		

Computed Values:

Cumulative Weir Bottom (Wetted) Width, B	9.8	m	
Water Surface Elevation at High Point	234.16	m ²	
Water Surface Elevation at Low Point	234.16	m	
Ponding Depth on Low Point (Sag)	0.16	m	

Cumulative Capacity, Q 0.42 m³/s

Target Q (100Yr) 0.41 m³/s

P:\Projects\2020\20020_Owen Street\Design\Design\Stormwater Management\Oflow Weir Capacity - Check for profile alteration.xls\67 Owen Street

June 03, 2021

Site Water Balance / Rainwater Re-Use
67 Owen Drive, Barrie, Ontario
MHBC File: 2011C

To Whom It May Concern,

This letter is to confirm that the 12.5 cubic meters of rainwater can be reused within a 72 hour period on site through irrigation of the planting. Rainfall runoff will be collected from the rooftop and surface level hardscape areas and will be directed to a storage tank located underground on site. The water stored in the tank will be distributed by pumping to the irrigation system. The irrigation system will use an automated control system to distribute water to the ground floor plantings and soft cape areas.

As requested, please find attached and below irrigation calculations.

Total Water Requirements in May = 131m^3 (131,198)
Total Water Requirements in June = 161m^3 (161,286)
Total Water Requirements in July = 178m^3 (178,461L)
Total Water Requirements in August = 148m^3 (148,264L)
Total Water Requirements in September = 104m^3 (103,945L)

Average Water Requirements = 144m^3

Average Daily Use = 4.81m^3

Please direct any questions to the undersigned.

Best Regards,
MHBC Planning, Urban Design & Landscape Architecture



Nick A. Miele BLA, OALA, CSLA, ISA
Senior Landscape Architect, Partner

Irrigation Requirements

General Information: All measures are in Metric
Refer to the 'Water Efficiency' section of the LEED Canada-NC 1.0 Document.

Using the chart below please note:
Species Factor (Ks), Plant water needs is determined as follows:
North and East of the site will be shaded so enter the 'Low'
South and West of the site will be sunny so enter the 'High or Avg' based on building/other shade
Density Factor (Kd), Plant grouping spacing is determined as follows: Sparsely planted enter 'Low'
Densely Planted enter 'High'
Microclimate Factor (Kmc), Plant grouping exposure to wind, heat, reflected light: NE are shaded so enter 'Low'
SW are hot and gets the summer wind so enter 'Ave or High'

KI=KsxKdxKmc
Etl= KlxETo (for Toronto and region)
IE can either be Rotor or Spray Heads
TPWA (L)=Area (sqm) x (Etl/IE)

May

Landscape	Area	Species Factor	Density Factor	Microclimate	<i>Kl</i>	<i>ETl</i>	<i>IE</i>	<i>TPWA</i>
Type	<i>M²</i>	<i>Ks</i>	<i>Kd</i>	<i>Kmc</i>			Spray or Rotors	(LITERS)
Shrubs/Perennials	1504	0.5	1	1.3	0.65	66.04	0.900	110,360
Trees	62.5	0.5	1	1.4	0.70	71.12	0.900	4,939
Mixed	38	0.5	1	1.4	0.70	71.12	0.900	3,003
Green Roof	136	0.7	1	1.2	0.84	85.34	0.900	12,896
Subtotal [L]								131,198
Water Required [L] from Design Case for May:								131,198

June

Landscape	Area	Species Factor	Density Factor	Microclimate	<i>Kl</i>	<i>ETl</i>	<i>IE</i>	<i>TPWA</i>
Type	<i>M²</i>	<i>Ks</i>	<i>Kd</i>	<i>Kmc</i>			Spray or Rotors	(LITERS)
Shrubs/Perennials	1504	0.5	1	1.3	0.65	81.19	0.900	135,669
Trees	62.5	0.5	1	1.4	0.70	87.43	0.900	6,072
Mixed	38	0.5	1	1.4	0.70	87.43	0.900	3,691
Green Roof	136	0.7	1	1.2	0.84	104.92	0.900	15,854
Subtotal [L]								161,286
Water Required [L] from Design Case for June:								161,286

July

Landscape	Area	Species Factor	Density Factor	Microclimate	<i>Kl</i>	<i>ETl</i>	<i>IE</i>	<i>TPWA</i>
Type	<i>M²</i>	<i>Ks</i>	<i>Kd</i>	<i>Kmc</i>			Spray or Rotors	(LITERS)
Shrubs/Perennials	1504	0.5	1	1.3	0.65	89.83	0.900	150,116
Trees	62.5	0.5	1	1.4	0.70	96.74	0.900	6,718
Mixed	38	0.5	1	1.4	0.70	96.74	0.900	4,085
Green Roof	136	0.7	1	1.2	0.84	116.09	0.900	17,542
Subtotal [L]								178,461
Water Required [L] from Design Case for July:								178,461

August

Landscape	Area	Species Factor	Density Factor	Microclimate	<i>Kl</i>	<i>ETl</i>	<i>IE</i>	<i>TPWA</i>
Type	<i>M²</i>	<i>Ks</i>	<i>Kd</i>	<i>Kmc</i>			Spray or Rotors	(LITERS)
Shrubs/Perennials	1504	0.5	1	1.3	0.65	71.76	0.900	119,919
Trees	62.5	0.5	1	1.4	0.70	96.74	0.900	6,718
Mixed	38	0.5	1	1.4	0.70	96.74	0.900	4,085
Green Roof	136	0.7	1	1.2	0.84	116.09	0.900	17,542
Subtotal [L]								148,264
Water Required [L] from Design Case for August:								148,264

September

Landscape	Area	Species Factor	Density Factor	Microclimate	<i>Kl</i>	<i>ETl</i>	<i>IE</i>	<i>TPWA</i>
Type	<i>M²</i>	<i>Ks</i>	<i>Kd</i>	<i>Kmc</i>			Spray or Rotors	(LITERS)
Shrubs/Perennials	1504	0.5	1	1.3	0.65	46.54	0.900	77,774
Trees	62.5	0.5	1	1.4	0.70	77.28	0.900	5,367
Mixed	38	0.5	1	1.4	0.70	77.28	0.900	3,263
Green Roof	136	0.7	1	1.2	0.84	116.09	0.900	17,542
Subtotal [L]								103,945
Water Required [L] from Design Case for September:								103,945

Total Water Required [L] from Design Case for Growing Season: 723,155



3.2 Summary of Hydrogeologic Conditions

Based on the review of the available site information, the hydrogeologic conditions of the Property is summarized as follows:

- The site is characterized by surficial deposits of topsoil/fill underlain by native cohesionless sand to sandy silt deposits, overlying a cohesive clayey silt to silty clay deposit. Below the clayey silt to silty clay, boreholes observed an additional deposit of cohesionless sands. The sand deposits are of moderate to high permeability and provide for high recharge capability and groundwater movement.
- The groundwater table within the upper sand aquifer was observed to slope from approximately Elev. 228± m (6 mbgs) at the north end of the site to approximately Elev. 224± m (10 mbgs) at the south end of the site.
- The lower sands unit is confined by the overlying clay and silt deposits. Groundwater levels collected within the monitoring wells observed a lower groundwater table at Elev. 227 to 228± m, indicating a pressure head of about 14 to 16 m.
- The general direction of groundwater flow at the site is to the south.
- The Property is located within a Wellhead Protection Area (Zone D in north and Zone C in south) according to the Lake Simcoe Region Conservation Authority and Lake Simcoe Protection Plan.
- The Property falls within a Vulnerable Groundwater Scoring Area (Score of 2 in the north, score of 4 in the south). The Property falls within a Significant Groundwater Recharge Area with Highly Vulnerable Aquifers. The Property is not located within an Intake Protection Zone or within a Vulnerable Surface Water Scoring Area.
- MECP well records for wells completed in the vicinity of the Property show that there were sixty-seven (67) wells within 500 m of the site used for test holes, monitoring, and municipal/public supply purposes. The City of Barrie's Public/Municipal Wells 11 and 14 (220001192) are located approximately 400 m south of the Property.

The above hydrogeologic features and functions were considered in assessing the potential impact of the proposed development. This information was used to provide mitigating measures to ensure that hydrogeologic function is not adversely affected during the proposed development.

3.3 Water Balance Analysis

A water balance model was prepared for the Property to assess the distribution of rainfall run-off and infiltration for existing (pre- and post-development) conditions (Appendix N). The model is based on Lake Simcoe (Barrie Creeks) Weather Data presented in Section 2.6. The water balance for pre-and post-development conditions is summarized below:



Pre-Development Water Balance

Existing Development	Area (m ²)	Precipitation (m ³)	Evapotranspiration (m ³)	Infiltration (m ³)	Run-Off (m ³)
Building	713	679	-	-	679
Hard Surface Paving	1,483	1,412	-	-	1,412
Landscape Area	1,857	1,768	828	371	568
Total	4,053	3,858	828	371	2,659

The post-development water balance accounts for hard surfaced areas created by buildings and pavements and uses the proposed land use statistic information provided by MCL Architects.

Post-Development Water Balance

Proposed Development	Area (m ²)	Precipitation (m ³)	Evapotranspiration (m ³)	Infiltration (m ³)	Run-Off (m ³)
Building	3,452	3,286	-	-	3,286
Hard Surface Paving	347	330	-	-	330
Landscape Area	254	242	113	51	78
Total	4,053	3,858	113	51	3,694

Water Balance Totals

Development Phase	Precipitation (m ³)	Evapotranspiration (m ³)	Infiltration (m ³)	Run-Off (m ³)
Pre-Development	3,858	828	371	2,659
Post-Development	3,858	113	51	3,694

The volume of surface water run-off available from building roof tops was calculated to be 2,958 m³ (90% of volume captured). This volume of water will be available as a resource, to maintain groundwater recharge and function. The volume of roof run-off available is compared to the difference in infiltration volume between pre-development and post-development, as noted below:



Potential Post-Development Infiltration Deficit (m ³)	Volume of Roof Run-off Available (m ³)	Percentage of Roof Run-off Required to Match Pre-Development Infiltration (%)
321	2,958	11

3.4 Groundwater Control Requirements

For design purposes, a **design water table of Elev. 228 m** should be assumed in the proposed development area within the north portion of the site. The stabilized groundwater table in the southern portion of the property is at Elev. 224± m (10 mbgs), well below proposed founding elevations.

The lowest (P1) FFE is at about Elev. 230.9± m. Therefore,

- Bulk excavation will extend down to approximately Elev. 230.4± m, about 2.5± m above the prevailing groundwater table.
- Foundations made for the proposed P1 level will bear on the upper sands at approximately Elev. 230± m.
- Per the recommendations of Grounded's Geotechnical Report (provided under a separate cover), where zones of weak soils are encountered (surrounding Borehole 104 & 203), the foundations must extend deeper to approximately Elev. 228± m.
- As such, foundation excavations in these zones **within the north portion of the site** will extend to the level of the prevailing groundwater table and will penetrate the wet upper sands, which will yield free-flowing water.
- In the long term, the P1 level will be above the prevailing groundwater table at the site.

Prior to excavation, positive dewatering to lower the groundwater table by **about 1 m in the north portion of the site** will be required to facilitate construction as well as to maintain the integrity of the subgrade for foundation and slab-on-grade support. The water level must be kept at least 1 m below the lowest excavation elevation during construction. Failure to dewater prior to excavation will result in unrecoverable disturbance of the subgrade, which will render advice provided for undisturbed subgrade conditions inapplicable.

Groundwater seepage estimates were conducted for both short term and long term dewatering scenarios. The modeling was conducted using an equivalent well radius approximation (Powers et al, 2007). The calculation for groundwater seepage indicates the short term (construction) and long term (permanent) dewatering requirements as provided below. The results are presented in Appendix O.

The groundwater seepage estimates, which have been provided, represent the steady state groundwater seepage. There will be an initial drawdown of the groundwater before a steady state condition is reached. The rate of the initial drawdown, and therefore discharge, is dependent on the dewatering contractor and how the groundwater is being dealt with at the site. An estimated

Determining Number of Cartridges for Flow Based Systems

Date

27/05/2021

Black Cells = Calculation

Site Information

Project Name

57 Owen Street

Project Location

Barrie, ON

OGS ID

OGS

Drainage Area, Ad

0.86 ac (0.35 ha)

Impervious Area, Ai

0.73 ac

Pervious Area, Ap

0.13

% Impervious

85%

Runoff Coefficient, Rc

0.80

Treatment storm flow rate, Q_{treat}

0.36 cfs (10.1 L/s)

Peak storm flow rate, Q_{peak}

TBD cfs

Filter System

Filtration brand

StormFilter

Cartridge height

18 in

Specific Flow Rate

1.67 gpm/ft²

Flow rate per cartridge

12.53 gpm

SUMMARY

Number of Cartridges	13
Media Type	Phosphosorb

Event Mean Concentration (EMC)

150 mg/L

Annual TSS Removal

80%

Percent Runoff Capture

90%

Recommend SFPD0811 vault or CIP



THE STORMWATER MANAGEMENT STORMFILTER
8' x 11' PEAK DIVERSION STORMFILTER
STANDARD DETAIL

Verification Statement



StormTech Isolator® Row PLUS Registration number: (V-2020-10-01) Date of issue: (2020-October-27)

Technology type	Stormwater Filtration Device		
Application	Stormwater filtration technology to remove sediments, nutrients, heavy metals, and organic contaminants from stormwater runoff		
Company	StormTech, LLC.		
Address	520 Cromwell Avenue, Rocky Hill, CT 06067 USA	Phone	+1-888-892-2694
Website	www.stormtech.com		
E-mail	info@stormtech.com		

Verified Performance Claims

The StormTech Isolator® Row PLUS technology was tested at the Mid-Atlantic Storm Water Research Center (MASWRC), under the supervision of Boggs Environmental Consultants, Inc. The performance test results for two overlapping StormTech Isolator® Row PLUS chambers (commercial unit model SC-740) were verified by Good Harbour Laboratories Inc. (GHL), following the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. Based on the laboratory testing conducted, the verified performance claims are as follows:

Total Suspended Solids (TSS) Removal Efficiency - The StormTech Isolator® Row PLUS achieved $82\% \pm 1\%$ removal efficiency of suspended sediment concentration (SCC) at a 95% confidence level.

Average Loading Rate - Based on the reported flow rate data and the effective sedimentation and filtration treatment area of the test unit, the average loading rate of the test unit was 4.15 ± 0.03 GPM/ft² at a 95% confidence level.

Maximum Treatment Flow Rate (MTFR) - Although the MTFR varies among the StormTech Isolator® Row PLUS model sizes and the number of chambers, the design surface loading rate remains the same (4.13 gpm/ ft² of treatment surface area). The test unit consisted of two overlapping StormTech SC-740 chambers with a nominal MTFR of 225 GPM (0.501 CFS) and an effective filtration treatment area (EFTA) of approximately 54.5 ft².

Detention Time and Volume - The StormTech Isolator Row PLUS detention time and wet volume varies with model size. The unit tested had a wet volume of approximately 65.1 ft³ and a detention time of 2.2 minutes.

Maximum Sediment Storage Depth and Volume - The sediment storage volume and depth vary according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the maximum sediment storage volume is 2.3 ft³ at a sediment depth of 0.5 inches.

Effective Sedimentation/Filtration Treatment Areas - The Effective Sedimentation Area (ESA) and the Effective Filtration Treatment Area (EFTA) increase as the size of the system increases. For the two overlapping StormTech SC-740 chambers tested, the ESA and the ratio of ESA/EFTA were 54.5 ft² and 1.0, respectively.

Sediment Mass Load Capacity - The sediment mass load capacity varies according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the mass loading capture was 158.4 lbs ± 0.8 lbs (2.91 ± 0.01 lbs/ ft²) following a total sediment loading of 195.2 lbs.

Technology Application

The StormTech “Isolator® Row PLUS” is a stormwater treatment technology designed for use under parking lots, roadways and heavy earth loads while providing a superior and durable structural system. The technology comprises a row of chambers covered in a non-woven geotextile fabric with a single layer of proprietary woven fabric at the bottom that serves as a filter strip, providing surface area for infiltration and runoff reduction with enhanced suspended solids and pollutant removal. The following features make the Isolator® Row PLUS effective as a water quality solution:

- Enhanced infiltration Surface Area
- Runoff Volume Reduction
- Peak Flow Reduction
- Sediment/Pollutant Removal
- Internal Water Storage (IWS)
- Water Temperature Cooling (Thermal Buffer).

Technology Description

The Isolator® Row PLUS (shown in Figures 1 and 2) is the first row of StormTech chambers that is surrounded with filter fabric and connected to a closely located manhole for easy access. The Isolator® Row PLUS provides for settling and filtration of sediment as stormwater rises in the chamber and ultimately passes through the filter fabric. The open-bottom chambers allow stormwater to flow out of the chambers, while sediment is captured in the Isolator® Row PLUS.

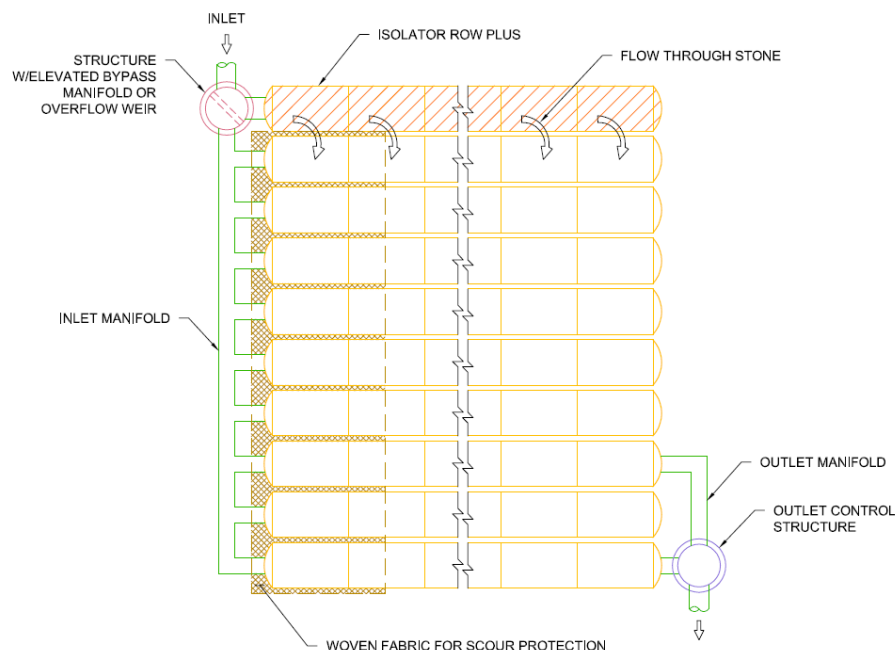


Figure 1: Schematic of the StormTech Isolator® Row PLUS System

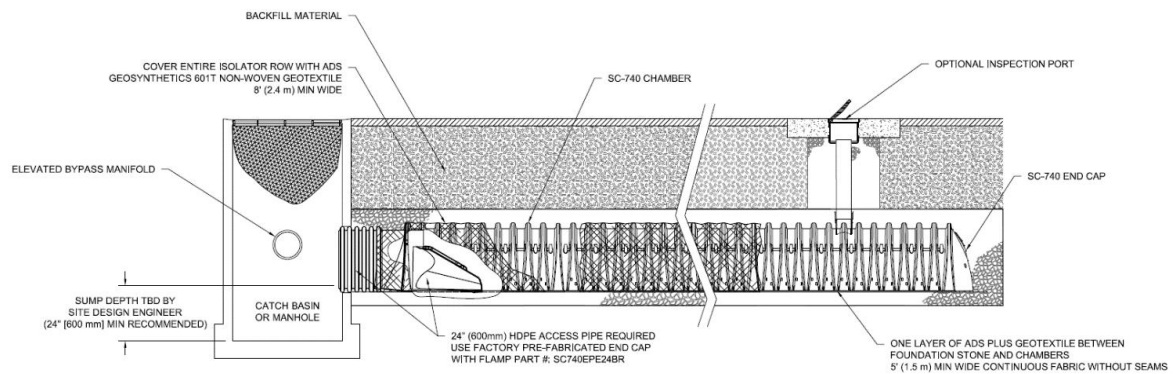


Figure 2: Isolator® Row PLUS Detail

A single layer of proprietary Advanced Drainage Systems (ADS) PLUS fabric is placed between the angular base stone and the Isolator Row PLUS chamber. The geotextile provides the means for stormwater filtration and provides a durable surface for maintenance operations. A 6 oz. non-woven fabric is placed over the chambers.

The Isolator® Row PLUS is designed to capture the “first flush” and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole not only provides access to the Isolator® Row PLUS but includes a high low/concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator® Row PLUS bypass through a manifold to the other chambers. This is achieved with either a high-flow weir or an elevated manifold. This creates a differential between the Isolator® Row PLUS and the manifold, thus allowing for settlement time in the Isolator® Row PLUS. After Stormwater flows through the Isolator® Row PLUS and into the rest of the StormTech chamber system it is either infiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

StormTech developed and owns the Isolator® Row PLUS technology and has filed a number of patent applications relating to the Isolator® Row PLUS system.¹

Description of Test Procedure for the StormTech Isolator® Row PLUS

In January 2020, two overlapping StormTech SC-740 Isolator® Row PLUS commercial size chambers were installed at the Mid-Atlantic Storm Water Research Center (MASWRC, a subsidiary of BaySaver), in Mount Airy, Maryland, to evaluate the performance of the Isolator® Row PLUS system for Total Suspended Solid (TSS) removal (Figure 3) All testing and data collection procedures were supervised by Boggs Environmental Consultants, Inc. (BEC), who was hired by ADS for third party oversight, and were in accordance with the *New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device (January 2013)*.

Prior to the start of testing, a Quality Assurance Project Plan (QAPP), revision dated January 09, 2020, was submitted and approved by the New Jersey Corporation for Advanced Technology (NJCAT), c/o Center for Environmental Systems, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ 07030.

¹ (U.S. Provisional Application No. 62/753,050, filed October 30, 2018; U.S. Non-Provisional Application No. 16/670,628, filed October 31, 2019; International Application No. PCT/US2019/059283, filed October 31, 2019; U.S. Application No. 16/938,482, filed July 24, 2020; U.S. Application No. 16/938,657, filed July 24, 2020; PCT International Application No. PCT/US2020/043543, filed July 24, 2020; PCT International Application No. PCT/US2020/043557, filed July 24, 2020.



Figure 3: StormTech “Isolator® Row PLUS” Test Set-up at MASWRC

Verification Results

The verification process for the StormTech Isolator® Row PLUS technology was conducted by GHIL in accordance with the VerifiGlobal Verification Plan for the StormTech “Isolator® Row PLUS” Technology – 2020-09-09. The technology performance claims verified by GHIL are summarized at the front of this Verification Statement and in Table 6 on Page 8 under the heading “Verification Summary”.

Particle size distribution analysis was performed by ECS Mid-Atlantic, LLC of Frederick, MD in accordance with ASTM D422-63(2007). ECS is accredited by the American Association of State Highways and Transportation Officials (AASHTO).

ASTM D422-63(2007) is a sieve and hydrometer method where the larger particles, > 75 microns, are measured using a standard sieve stack while the smaller particles are measured based on their settling time using a hydrometer.

The PSD meets the requirements of NJDEP, which is generally accepted as representative of the type of particle sizes an OGS would be designed to treat. Actual PSD is site and rainfall event specific, so it was necessary to choose a standard PSD to make testing and comparison manageable.

Table 1 shows the NJDEP PSD specification. Table 2 and Figure 4 show the incoming material PSD as determined by ECS Mid-Atlantic and confirmed by the verifier.

Table 1: NJDEP PSD Specification

Particle Size (µm)	NJDEP Minimum Specification
1000	98
500	93
250	88
150	73
100	58
75	48
50	43
20	33
8	18
5	8
2	3
d ₅₀	< 75 µm

Table 2 – Particle Size Distribution (PSD) of Test Sediment

Mesh (mm)	US Sieve Size	Sample ID		
		PSD A	PSD B	PSD C
		Percent Finer		
9.525	0.375	100.0	100.0	100.0
4.750	#4	100.0	100.0	100.0
4.000	#5	100.0	100.0	100.0
2.360	#8	100.0	100.0	100.0
2.000	#10	100.0	100.0	100.0
1.180	#16	100.0	100.0	100.0
1.000	#18	100.0	100.0	100.0
0.500	#35	100.0	100.0	100.0
0.425	#40	93.3	93.0	93.6
0.250	#60	90.3	89.8	90.2
0.150	#100	79.3	78.1	78.1
0.125	#120	73.6	71.7	71.7
0.106	#140	68.4	65.2	64.8
0.090	#170	60.2	58.3	57.5
0.075	#200	52.0	50.9	50.3
0.053	#270	48.0	48.3	47.8
0.045	Hydrometer	46.6	46.7	46.7
0.032		42.8	42.9	41.0
0.021		37.1	37.2	35.3
0.0125		25.7	25.7	25.8
0.0090		20.1	20.1	19.2
0.0064		16.3	16.4	14.5
0.0032		8.8	8.7	7.8
0.0014		3.8	3.7	3.8

The suspended sediment concentration analysis was completed by Fredericktowne Labs Inc., Meyersville, MD. Fredericktown Labs is accredited by the Maryland Department of Environment as Maryland Certified Water Quality Laboratory. The analysis procedure was ASTM D3977-97, Suspended Sediment Concentration. The sampling procedure and submission of samples to the test lab were overseen by the independent observer, Boggs Environmental Consultants, Inc.

All test data and calculations were detailed in the report “NJCAT TECHNOLOGY VERIFICATION Isolator® Row PLUS StormTech, LLC”, July 2020, which was submitted to and verified by the New Jersey Corporation for Advanced Technology (NJCAT).

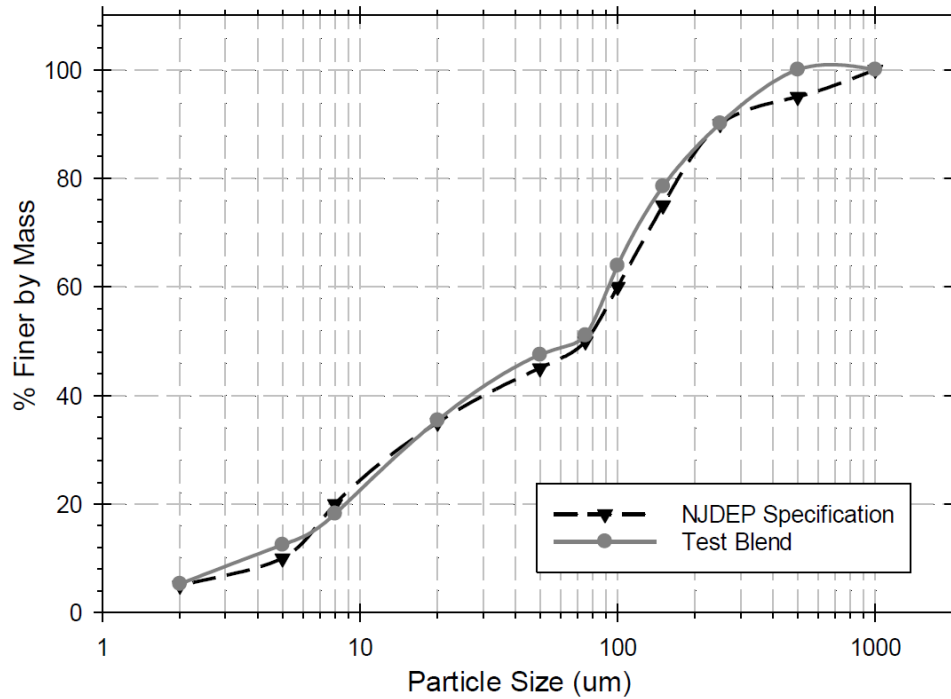


Figure 4– Particle Size Distribution (PSD)

The data in Table 3 (Flow Rate and Temperature) and Table 4 (Removal Efficiency) form the basis for the verified technology performance claim, specifically, flow rate, sediment captured and removal efficiency.

Table 3: Flow Rate and Temperature Summary

Run	Max Flow (gpm)	Min Flow (gpm)	Average Flow (gpm)	Flow COV	Flow Compliance (COV< 0.1)	Maximum Temperature (Fahrenheit)	NJDEP Temperature Compliance (< 80 F)
1	232.8	223.9	226.3	0.0078	Y	48.2	Y
2	228.9	218.6	220.8	0.0104	Y	51.5	Y
3	229.4	220.0	227.2	0.0094	Y	44.7	Y
4	230.2	218.7	223.2	0.0138	Y	40.5	Y
5	228.7	216.9	222.2	0.0103	Y	44.7	Y
6	227.6	217.0	224.2	0.0115	Y	46.7	Y
7	229.7	221.9	226.4	0.0092	Y	44.6	Y
8	230.3	222.2	226.8	0.0089	Y	43.5	Y
9	233.2	218.4	225.6	0.0136	Y	45.5	Y
10	232.2	219.7	228.4	0.0126	Y	44.7	Y
11	226.9	219.2	224.1	0.0088	Y	52.4	Y
12	232.2	222.1	226.9	0.0107	Y	48.5	Y
13	234.7	221.2	226.1	0.0109	Y	48.5	Y
14	231.9	223.4	228.7	0.0103	Y	45.6	Y
15	236.8	224.1	231.4	0.0131	Y	52.2	Y
16	232.5	221.3	229.0	0.0137	Y	47.8	Y

Table 4: Removal Efficiency Results

Run	Average Influent TSS (mg/L)	Influent Water Volume (gal)	Adjusted Average Effluent TSS (mg/L)	Effluent Water Volume (gal)	Adjusted Average Drain Down TSS (mg/L)	Drain Down Water Volume (gal)	Single Run Removal Efficiency (%)	Mass of Captured Sediment (g)	Cumulative Removal Efficiency (%)
1	203	7166	46	6881	34	285	77.8	4282	77.8
2	199	6993	32	6639	27	354	84.0	4415	80.8
3	207	7197	37	6793	27	403	82.6	4654	81.4
4	217	7068	33	6635	29	433	84.9	4923	82.3
5	215	7037	39	6593	29	444	82.2	4705	82.3
6	207	7097	40	6643	31	454	81.2	4504	82.1
7	198	7169	37	6693	30	476	81.6	4386	82.0
8	201	7184	37	6716	32	468	81.6	4473	82.0
9	205	7147	38	6675	30	472	81.8	4539	82.0
10	203	7235	38	6759	31	476	81.4	4523	81.9
11	208	7096	38	6624	30	472	81.8	4567	81.9
12	209	7185	41	6709	30	476	80.7	4584	81.8
13	198	7162	41	6680	32	482	79.7	4277	81.6
14	200	7242	43	6757	34	485	78.8	4318	81.4
15	196	7329	41	6842	32	487	79.5	4320	81.3
16	202	7254	44	6769	31	485	78.9	4384	81.2
Avg.	204.2	7160	39	6713	31	447	81.2	4491	N/A
Cumulative Mass Removed (g)							71854		
Cumulative Mass Removed (lb)							158.4		
Total Mass Loaded (lb)							195.2		
Cumulative Removal Efficiency (%)							81.2		

Quality Assurance

Performance verification of the StormTech Isolator® Row PLUS technology was performed in accordance with the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. This included reviewing all data sheets and calculated values, as well as overall management of the test system, quality control and data integrity.

Additional information on quality control measures taken can be found in section 5 of the QAPP for StormTech Isolator Row New Jersey Department of Environmental Protection Testing, Rev. 1/9/2020.

Specific QA/QC measures reviewed by the verifier are summarized in Table 5 below.

Table 5. Validation of QA/QC Procedures

QC Parameter	Acceptance Criteria
Independence of observer	Confirmed in letter from Boggs Environmental Consultants, Inc. to NJCAT
Consistency of procedure	Daily logs confirm proper procedure
Existence of QAPP	Confirmed. "QAPP For StormTech Isolator Row New Jersey Department of Environmental Protection Testing", Rev. 1/9/2020)
Use of appropriate sample analysis method – ASTM D3799	Confirmed by method reference on lab reports from Fredericktowne Labs Inc.
Test method appropriate for the technology	Used industry stakeholder approved protocol: <i>New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids</i>

	<i>Removal by a Filtration Manufactured Treatment Device (January 2013)</i>
Test parameters stayed within required limits	Confirmed in report "NJCAT TECHNOLOGY VERIFICATION Isolator® Row PLUS StormTech, LLC", July 2020
Third party verified data	All testing was observed and reviewed by Boggs Environmental Consultants, Inc.

Variance

Performance claims regarding structural load limitations were not verified as they are outside the scope of the performance testing that was conducted in accordance with the 'Quality Assurance Project Plan (QAPP) for StormTech Isolator Row, New Jersey Department of Environmental Protection Testing', revision dated January 09, 2020.

Verification Summary

The StormTech "Isolator® Row PLUS" is a stormwater treatment technology designed for use under parking lots, roadways and heavy earth loads while providing a superior and durable structural system. The technology comprises a row of chambers wrapped in woven geotextile fabric with two layers at the bottom that serve as a filter strip, providing surface area for infiltration and runoff reduction with enhanced suspended solids and pollutant removal.

The StormTech Isolator® Row PLUS technology was tested at the Mid-Atlantic Storm Water Research Center (MASWRC), under the supervision of Boggs Environmental Consultants, Inc. The performance test results for two overlapping StormTech Isolator® Row PLUS chambers (commercial unit model SC-740) were verified by Good Harbour Laboratories Inc. (GHL), following the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. Table 6 summarizes the verification results in relation to the technology performance parameters that were identified in the Verification Plan to determine the efficacy of the StormTech Isolator® Row PLUS technology.

Table 6 - Summary of Verification Results Against Performance Parameters

Parameters	Verified Claims	Accuracy
Total Suspended Solids (TSS) Removal Efficiency	Based on the laboratory testing conducted, the StormTech Isolator® Row PLUS achieved an average 82% removal efficiency of SSC	± 1% (95% confidence level)
Average Loading Rate	Based on the laboratory testing parameters, the StormTech Isolator® Row PLUS maintained a loading rate of 4.15 GPM/sf	±0.03 GPM/sf (95% confidence level)
Maximum Treatment Flow Rate (MTFR)	Although the MTFR varies among the StormTech Isolator® Row PLUS model sizes and the number of chambers, the design surface loading rate remains the same (4.13 GPM/ft ² of treatment surface area). The test unit consisted of two overlapping StormTech SC-740 chambers with a nominal MTFR of 225 GPM (0.501 CFS) and an effective filtration treatment area (EFTA) of approximately 54.5 ft ² .	± 1.4 GPM (95% confidence level)
Detention Time and Volume	Detention time and wet volume varies with model size. The unit tested had a wet volume of approximately 65.1 ft ³ (based on	N/A

	physical measurement) and a detention time of 2.2 minutes.	
Maximum Sediment Storage Depth and Volume	The sediment storage volume and depth vary according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the maximum sediment storage volume is 2.3 ft ³ at a sediment depth of 0.5 inches.	N/A
Effective Sedimentation/ Filtration Treatment Area	The effective sedimentation and filtration treatment area increases as the size of the chamber increases. Under the tested conditions using 2 overlapping chambers, the treatment area was 54.5 ft ²	The sedimentation /filtration area was determined from the actual physical dimensions of the test unit*
Sediment Mass Load Capacity	The sediment mass load capacity varies according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the mass loading capture was 158.4 lbs (2.91 lbs/ ft ²) following a total sediment loading of 195.2 lbs	± 0.8 lbs (±0.01 lbs/ft ²) (95% confidence level)

*Note: These numbers are determined based on physical measurement or a dimensional drawing, which is standard practice. Highly accurate measurements are not practical.

In conclusion, the StormTech Isolator® Row PLUS is a viable technology that can be used to remove contaminants from stormwater runoff via filtration. This technology has proven effective at removing suspended sediment from stormwater through in-lab testing using an industry recognized laboratory protocol.

By extension of sediment removal, this technology should also remove particle bound nutrients, heavy metals, and a wide variety of organic contaminants. Performance is a function of pollutant properties, hydraulic retention time, filter media, pre-treatment, and flow rate, such that proper design of the system is critical to achieving the desired results.

What is ISO 14034?

The purpose of environmental technology verification is to provide a credible and impartial account of the performance of environmental technologies. Environmental technology verification is based on a number of principles to ensure that verifications are performed and reported accurately, clearly, unambiguously and objectively. The International Organization for Standardization (ISO) standard for environmental technology verification (ETV) is ISO 14034, which was published in November 2016.

Benefits of ETV

ETV contributes to protection and conservation of the environment by promoting and facilitating market uptake of innovative environmental technologies, especially those that perform better than relevant alternatives. ETV is particularly applicable to those environmental technologies whose innovative features or performance cannot be fully assessed using existing standards. Through the provision of objective evidence, ETV provides an independent and impartial confirmation of the performance of an environmental technology based on reliable test data. ETV aims to strengthen the credibility of new, innovative technologies by supporting informed decision-making among interested parties.

For more information on the StormTech "Isolator® Row PLUS" technology, contact:	For more information on VerifiGlobal, contact:
StormTech, LLC. 520 Cromwell Avenue, Rocky Hill, CT 06067 USA t: +1-888-892-2694 e: info@stormtech.com w: www.stormtech.com	VerifiGlobal c/o ETA-Danmark A/S Göteborg Plads 1, DK-2150 Nordhaven t +45 7224 5900 e: info@verifiglobal.com w: www.verifiglobal.com
Signed for StormTech: <i>Original signed by:</i>  Greg Spires, P.E. General Manager	Signed for VerifiGlobal: <i>Original signed by:</i>  Thomas Bruun, Managing Director <i>Original signed by:</i>  John Neate, Managing Director

NOTICE: Verifications are based on an evaluation of technology performance under specific, predetermined operational conditions and parameters and the appropriate quality assurance procedures. VerifiGlobal and the Verification Expert, Good Harbour Laboratories, make no expressed or implied warranties as to the performance of the technology and do not certify that a technology will always operate as verified. The end user is solely responsible for complying with any and all applicable regulatory requirements. Mention of commercial product names does not imply endorsement.

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The Stormwater Management StormFilter[®] with PhosphoSorb[®] Media

Performance Evaluation Study

Phosphorus is a common cause of impairment in freshwater bodies throughout the United States. In urban watersheds, loads contributed by stormwater runoff can be a dominant source. As a result, phosphorus removal requirements are increasingly common and innovative phosphorus removal technologies are needed that can be integrated into an urban environment. Phosphosorb[®] (PhosphoSorb) is a proprietary phosphorus removal media comprised of a perlite base with activated alumina coating developed by Contech Engineered Solutions LLC (Contech) for use in media filtration systems.

A Stormwater Management StormFilter[®] (StormFilter) using PhosphoSorb media was evaluated for the removal of sediment and phosphorus over a 17 month period starting in February 2012. During this period a total of 19 qualified storm events were sampled according to a Quality Assurance Project Plan (Contech, 2012) designed to conform to the requirements given in Guidance for Evaluating Emerging Stormwater Treatment Technologies, Technology Assessment Protocol – Ecology (TAPE) (Ecology, 2011). The stormwater treatment system tested during this evaluation is a StormFilter containing one 18-inch tall StormFilter cartridge with PhosphoSorb media operating at a specific flow rate of 1.67 gpm/ft² or 12.5 gpm per cartridge (for an 18-inch cartridge).

The evaluation site is located on Lolo Pass Road at Bear Creek Bridge in ZigZag, Oregon. The 0.063 acre contributing drainage area upstream of the StormFilter catchment is 100% impervious and includes the bridge deck and adjacent roadway. Time of concentration (t_c) on the site is estimated to be 1.4 minutes. A photo of the drainage area can be seen in Figure 1.



Figure 1. View of the drainage area of the StormFilter evaluation site located on Lolo Pass Road, ZigZag, Oregon.

Individual volume-paced influent and effluent samples were collected over the course of each qualified storm event using individual ISCO 6712 Portable Automated Samplers. Influent and effluent flows were measured using Large 60°V Trapezoidal Flumes in conjunction with individual ISCO 730 Bubbler Flow Modules. At the conclusion of each qualified runoff event, individual influent and effluent samples were combined to create influent and effluent bulk composite samples. Event Mean Concentration (EMC) subsamples were then taken from the bulk composite sample and submitted to Apex Laboratories, LLC in Beaverton, Oregon for analysis.

All 19 events had detectable influent concentrations for total phosphorus (TP), total suspended solids (SSC), and suspended solids concentration (SSC). Significant reductions in TP, TSS and SSC pollutant loads were observed between influent and effluent sampling locations. Performance was calculated using two different methods, the Efficiency Ratio (ER) method and the Summation of Loads (SOL) efficiency calculation method. The ER method defines the efficiency as the average event mean concentration of pollutants over a given time period.

$$ER = 1 - \frac{\text{mean effluent EMC}}{\text{mean influent EMC}}$$

The ER method assumes; 1) The weight of all storm events is equal regardless of the relative magnitude of the storm event and 2) that if all storm events at the site had been monitored, the average inlet and outlet EMCs would be similar to those that were monitored (URS/ EPA 1999). A summary of ER performance data for TP, TSS and SSC for the 19 sampled events is presented in Table 1.

Table 1. Performance summary and Efficiency Ratios (ER) for the StormFilter with PhosphoSorb media for the 19 events sampled to date at the Lolo Pass Road evaluation site.

Parameter	TSS (mg/L)		SSC (mg/L)		Total Phosphorus (mg/L)	
Analytical Method	SM 2540D		ASTM D3977		SM 4500PF	
Sample Location	Influent	Effluent	Influent	Effluent	Influent	Effluent
Min	40.0	6.00	46.0	7.59	0.068	0.0043
Max	780	120	1000	120	0.583	0.140
Median	360	27.0	404	25.7	0.170	0.0498
Mean	340	34.2	435	35.8	0.231	0.0580
Efficiency Ratio	90%		92%		75%	

The SOL method defines the efficiency as a percentage based on the ratio of the summation of all influent loads to the summation of all effluent loads.

$$SOL = 1 - \frac{\text{sum of all effluent loads}}{\text{sum of all influent loads}}$$

The SOL method assumes; 1) monitoring data accurately represents the actual entire total loads in and out of the BMP for a period long enough to overshadow any temporary storage or export of pollutants and 2) any significant storm events that were not monitored had a ratio of inlet to effluent loads similar to the storms events that were monitored (URS/ EPA 1999). SOL efficiency results for TP, TSS and SSC for the 19 sampled events is presented in Table 2.

Table 2. Summation of Loads (SOL) efficiency calculations for the StormFilter with PhosphoSorb media for the 19 events sampled to date at the Lolo Pass Road evaluation site.

Parameter	TSS (g)		SSC (g)		Total Phosphorus (mg)	
Analytical Method	SM 2540D		ASTM D3977		SM 4500PF	
Sample Location	Influent	Effluent	Influent	Effluent	Influent	Effluent
Total	43352	3577	54426	3691	33643	7228
SOL Efficiency	92%		93%		79%	

Particle size distribution information collected during sampled events confirms that the influent solids have a silt loam distribution which is typical for the Pacific Northwest and is comparable to other field evaluation studies. pH was also measured for all storm events using EPA Method 105.1. Median influent and effluent EMCs were 6.7 and 6.6 respectively.

Although testing is ongoing through the remainder of the 2013-2014 rain season, the 19 TAPE qualified events sampled to date provide a robust data set suitable for characterizing PhosphoSorb media performance. Data suggests that PhosphoSorb media can provide significant solids load reduction for both TSS and SSC as well as total phosphorus load reductions at or above levels dictated by stormwater permitting requirements and TMDL compliance plans.

References

Contech Engineered Solutions LLC. (Contech). (2012) Quality Assurance Project Plan: The Stormwater Management StormFilter, PhosphoSorb at a Specific Flow Rate 1.637 gpm/ft² Performance Evaluation. Portland, Oregon. (Revised September 2013).

URS Greiner Woodward Clyde, Urban Drainage and Flood Control District, Urban Water Resources Research Council (UWRRC) of ASCE, Office of Water, US Environmental Protection Agency (URS/EPA) (1999). Development of Performance Measures Task 3.1 – Technical Memorandum Determining Urban Stormwater Best Management Practice (BMP) Removal Efficiencies. Washington, D.C.

Washington State Department of Ecology (Ecology). (2011). Guidance for Evaluating Emerging Stormwater Treatment Technologies: Technology Assessment Protocol – Ecology (TAPE). Olympia, Washington.



The Residences on Owen Ltd.
67 Owen Street

Appendix E

Correspondence

MEMORANDUM

TO: Peter Dyck
Business Development Officer

Jordan Lambie
Senior Urban Design Planner

DATE: October 2, 2018

FROM: Gary Matthie
Senior Development Services Technologist

RE: **Proposed Development**
Owen/Worsley/McDonald Residential Towers
Sanitary Servicing

File: D14-1645

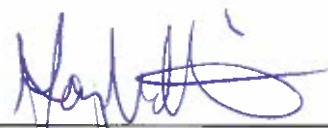
As discussed previously, the status of the downstream sanitary sewer that would be utilized by this proposed development has been re-evaluated.

Engineering, Development Services, has determined that although the one smaller sized downstream sanitary sewer section will still technically be undersized according to the City's new sewer design guidelines, the application of the particular specified flow volume limit under this situation may not be fully justified.

The new guidelines were formulated to provide guidance for new infrastructure installations to provide a conservative level of confidence (factor of safety) that maintenance issues would not develop in new systems. It really was not meant to evaluate existing systems in order to initiate upgrades. The re-evaluation of the particular sewer section in question looked at the specific flow evaluation criteria "depth of flow / pipe diameter" not to exceed 70% (not simply the rough calculation of "design flow / pipe capacity"). When evaluated this way (as per the guideline), the ratio ends up to be 76% for projected / calculated future flows. Which even though we are not required to hold existing infrastructure to meet, it is pretty close to the conservative criteria of 70%.

We therefore will not be requiring the downstream 250 dia. section of sanitary sewer to be upgraded to a 300 dia. pipe for this development to proceed as currently proposed.

Prepared by:



Gary Matthie, P.Eng.
Senior Development Services Technologist

Reviewed by:



Frank Palka, C.E.T.
Manager of Development Services

GM/st

Karl Repka

From: Gary Matthie <Gary.Matthie@barrie.ca>
Sent: November-06-17 3:29 PM
To: Karl Repka
Cc: Charlotte Bush; 17068_Owen Street,Barrie
Subject: RE: Owen St & McDonald St

Hi Karl,

The “future conditions” are to mean the projected conditions as per the current Master Plan(s), plus the proposed development. For this area around Owen where future development was anticipated to be low because it is mainly an older established residential neighbourhood I was told that the 20151 projections should be used. If another development upstream had already been approved and was continuing to construction shortly, then we would have had that development included as part of the future conditions as well. But in this case there are no such development plans upstream, so you will only have to account for the 2051 projection.

As for downstream developments, there was an application submission from 2015 for a property on Owen between Collier and Dunlop, but it has not come back for revisions/approval since its initial submission, so we don’t know if they will be proceeding, but it is downstream of the section of 250 diameter pipe that is likely causing problems, so it would not really benefit from any upgrades to that section of pipe.

There is a City property across Owen from yours (another parking lot) that I know was up for sale at the same time, so it could potentially be sold and redeveloped in the future, and it would definitely receive benefit from an upgraded sewer on Owen if servicing was done via Owen, but there is also available sanitary servicing off of McDonald Street that could be utilized.

The City has had infrastructure improvements/extensions done by developers where at later dates new developments utilizing those services had to contribute to a “landowners” group that had done the original improvements. I’m not sure of the exact format of the agreement needed in place to ensure the future contributions, I just know that if an agreement is in place that we look for confirmation from the agreement administrator (usually the landowners’ engineering consultant) that the new developer is in good standing (ie has contributed) before allowing them to proceed. So there is precedent to allow for future cost sharing by benefitting developments.

Gary Matthie, P.Eng.

Senior Development Services Technologist
Engineering Department
705.739.4220
Ext 4448

 Please consider the environment before printing this email

From: Karl Repka [mailto:krepka@counterpointeng.com]
Sent: Thursday, November 02, 2017 5:01 PM
To: Gary Matthie <Gary.Matthie@barrie.ca>
Cc: Charlotte Bush <cbush@counterpointeng.com>; 17068_Owen Street,Barrie <17068@counterpointeng.com>
Subject: RE: Owen St & McDonald St

Hi Gary,

As a follow up, we found the policy section dealing with upsizing local sewers.

Section 3.4.5. discusses 50% flow full under 'future conditions' and the critical design scenario. Feel free to skip questions 2 and 3 below.

However, can you confirm that for the purposes of a development application, 'future conditions' in Section 3.4.5. simply means the existing conditions plus flows from the proposed development?

Thank you,



Karl Repka, P.Eng, Project Manager
Counterpoint Engineering Inc.
8395 Jane Street, Suite 100
Vaughan, ON L4K 5Y2
Mobile: 647-459-5841
www.counterpointeng.com
krepka@counterpointeng.com

From: Karl Repka
Sent: November-02-17 10:43 AM
To: 'Gary Matthie' <Gary.Matthie@barrie.ca>
Cc: Charlotte Bush <cbush@counterpointeng.com>; 17068_Owen Street,Barrie <17068@counterpointeng.com>
Subject: RE: Owen St & McDonald St

Hi Gary,

Here are our main questions:

1. The modelling provided to date shows only dry weather flow but population based on 2051 projections. Is there an infoworks model based on current population?
2. What is the key criteria for confirming downstream capacity in support of an application? Is it;
 - a. present day flows + infiltration + proposed development flows,
 - b. 2051 dry weather + infiltration + proposed development flows, or
 - c. Some other scenario?
3. Based on the design sheets provided, it appears a length of sanitary sewer on Owen Street is at approximately 50% full under peak design flows. (Design flow is 43.8 L/s and capacity is 85.9 L/s). Adding ~ 5 L/s from the proposed development will bring the design flows to approximately 60% full. Based on the criteria provided in the attached email, this would necessitate an upgrade of the sanitary pipe. Does the 50% guideline attached represent a best practice suggestion or is it a formal policy? Would you be able to direct me to the policy for our review?
4. Last, if an upgrade is required to the Owen Street system are there any other pending applications that would benefit from the increased capacity (who we could approach for a cost sharing discussion)?

Thanks for your assistance,



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Mobile: 647-459-5841
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krepka@counterpointeng.com

From: Gary Matthie [<mailto:Gary.Matthie@barrie.ca>]

Sent: November-01-17 9:23 AM

To: Karl Repka <krepka@counterpointeng.com>

Cc: Charlotte Bush <cbush@counterpointeng.com>; 17068_Owen Street,Barrie <17068@counterpointeng.com>

Subject: RE: Owen St & McDonald St

Good morning Karl,

My apologies for the delay in responding to your voice mails and email, everything that lands on my desk lately seems to be needed "right away" by whomever dropped it there.

Our current Capital Plan/Capital Outlook 2017-2026 does not identify any planned sanitary upgrades on Owen. And I've been told that "typically" any development required sanitary upgrades that only result in pipes 350 dia or less are not DC eligible.

We are currently having our City Master plans updated, I think for completion in the first half of 2018, which may identify other works that are required to be added to the new Capital plan next year, but the only thing I've heard suggested so far is a possible Storm upgrade.

Unfortunately the staff that provided me the modelling information for you before is, if you can believe it, even busier than I am, so I have been instructed to try and determine as specifically as possible what information you are looking for with regard to downstream modelling and act as a middle man. But since I am not a modeller I would suggest an email, maybe with point form questions etc. that I can either forward to him or take to him to discuss.

Again, my apologies for the delayed response,

Regards,

Gary Matthie, P.Eng.

Senior Development Services Technologist
Engineering Department
705.739.4220
Ext 4448

Please consider the environment before printing this email

From: Karl Repka [<mailto:krepka@counterpointeng.com>]

Sent: Monday, October 23, 2017 3:32 PM

To: Gary Matthie <Gary.Matthie@barrie.ca>

Cc: Charlotte Bush <cbush@counterpointeng.com>; 17068_Owen Street,Barrie <17068@counterpointeng.com>

Subject: RE: Owen St & McDonald St

Hi Gary,

I have left some voicemails about this project but thought it might be best to follow up via email. I'm following up on two sanitary related items:

First, we would like to discuss whether downstream sanitary upgrades would be DC improvements and if there are any sanitary upgrades contemplated in the capital works budget.

Second, could put us in touch with the Infoworks modeling person at your office? We would like to establish the requirements of any downstream modeling required to support a site plan application on this file.

Please give me a call at your earliest convenience.

Thank you,



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From: Gary Matthie [<mailto:Gary.Matthie@barrie.ca>]
Sent: September-27-17 1:19 PM
To: Karl Repka <krepka@counterpointeng.com>
Subject: FW: Owen St & McDonald St

Last email today

Gary Matthie, P.Eng.
Senior Development Services Technologist
Engineering Department
705.739.4220
Ext 4448

Please consider the environment before printing this email

From: Karl Repka [<mailto:krepka@counterpointeng.com>]
Sent: Wednesday, September 27, 2017 1:04 PM
To: Gary Matthie <Gary.Matthie@barrie.ca>
Cc: Charlotte Bush <cbush@counterpointeng.com>
Subject: RE: Owen St & McDonald St

Hi Gary,

You can try this link:
<https://counterpoint.egnyte.com/fl/oBBsuottxb>

I'm not sure if it will give you permission to upload or not...

If not, we're okay with additional emails.

Thank you,



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Mobile: 647-459-5841
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krepka@counterpointeng.com

From: Gary Matthie [<mailto:Gary.Matthie@barrie.ca>]
Sent: September-27-17 10:00 AM
To: Karl Repka <krepka@counterpointeng.com>
Subject: RE: Owen St & McDonald St

Hi Karl,

Lorran has clipped another section of the sanitary model for us, as per the third point below.

I'm just wondering if you might have already, or can set up quickly an FTP or other file sharing site for me to drop this new clip into rather than sending multiple emails again? But if you're fine with multiple emails I can do that right away.

Regards,

Gary Matthie, P.Eng.

Senior Development Services Technologist
Engineering Department
705.739.4220
Ext 4448

Please consider the environment before printing this email

From: Gary Matthie
Sent: Monday, September 25, 2017 9:18 AM
To: 'Karl Repka' <krepka@counterpointeng.com>
Subject: RE: Owen St & McDonald St

Good morning Karl,

I have some answers for you. Also, I have been asked to have all requests can go through me rather than directly to other sections/staff, sorry for the confusion on that.

- Is there a design storm or set infiltration rate/ha to be used? **The Draft City of Barrie Sanitary Sewage Collection System Policies and Guidelines identify 0.1/l/s/ha as a RDII rate to use.**
- What is the maximum allowable surcharge condition? (e.g. 85% full or certain depth below centerline or specific analysis of basement elevations?) **The maximum allowable d/Dia ratio for TRUNK sewers is 70%. Please note the following in consideration that the sewer on Owen is equal or less than 375mm in diameter and is not officially a TRUNK (should be using d/D of 50% not 70%):**

Trunk sanitary sewers greater than 375mm in diameter shall be up sized when flows exceed 85% of full flow under future peak flow conditions including Inflow and infiltration (± 0.7 depth of flow over diameter of pipe). For local sewers, 375mm diameter or less, sanitary sewers shall be upsized if future peak flows including Inflow and infiltration exceed 50% of full flow under future peak flow conditions including Inflow and infiltration (± 0.5 depth of flow over diameter of pipe). The reason for this is that I&I on a local basis may be much higher and to account for potential blockages in the sanitary sewers.

- Does the model have contributing infiltration areas to be applied to the MHs? **We will try to pull the model catchment areas together this week.**

Regards,
Gary Matthie, P.Eng.
Senior Development Services Technologist
Engineering Department
705.739.4220
Ext 4448

 Please consider the environment before printing this email

From: Karl Repka [<mailto:krepka@counterpointeng.com>]
Sent: Friday, September 22, 2017 2:37 PM
To: Lorrان Cooney <Lorran.Cooney@barrie.ca>
Cc: Gary Matthie <Gary.Matthie@barrie.ca>; Charlotte Bush <cbush@counterpointeng.com>; Peter Rich <Peter@bobfor.com>
Subject: Owen St & McDonald St

Hi Lorrان,

Thank you for the modeling files. We were able to get them up and running and note the same minor surcharge that Gary described in his email.

It appears this is modeling a dry weather condition. Could you let us know the City's criteria for downstream analysis? Specifically:

- Is there a design storm or set infiltration rate/ha to be used?
- What is the maximum allowable surcharge condition? (e.g. 85% full or certain depth below centerline or specific analysis of basement elevations?)
- Does the model have contributing infiltration areas to be applied to the MHs?

Can we discuss when you are back in the office on Monday?

Have a great weekend,



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The Residences on Owen Ltd.
67 Owen Street

Appendix F

Engineering Drawings