TATHAM ENGINEERING

10 Diana Drive, Unit 7
Orillia, Ontario L3V 8K8

T 705-325-1753
E info@tathameng.com
tathameng.com

File 325099

December 18, 2025

Michael Sullivan
President
Sullnet Holdings Inc.
16 Hopkins Street
Thorold, Ontario L2V 0E9
sullnetholdings@icloud.com

Re: 120 Bond Street, City of Orillia
Functional Servicing and Stormwater Management Review

Dear Michael:

As noted in our previous correspondence and discussions, the following report documents prepared in support of the 116 Bond Street development (Tatham File No. 323899) included consideration for the future development of the 120 Bond Street property:

- Functional Servicing Report, dated September 11, 2025;
- Stormwater Management Report, dated September 11, 2025;
- Operations & Maintenance Manual, dated September 11, 2025;
- Parking Justification Study, dated January 22, 2025; and
- Transportation Impact Brief, dated January 22, 2025 supplemented with letter correspondence dated July 4, 2025.

These reports were all prepared on the basis 120 Bond Street would be developed with 16 residential units in two stacked townhome buildings with 20 parking spaces accessed from the 116 Bond Street property. As confirmed in recent meetings, we understand it is your intention to ultimately combine 116 and 120 Bond Street into a single parcel, which was a requirement from the City to allow shared servicing between the two existing properties.

We have prepared and enclose updated engineering design drawings for the 120 Bond Street property in support of the Zoning Bylaw Amendment (ZBA) and Site Plan Application (SPA). We have also reviewed our previous reports to verify our previous findings remain consistent with the latest rendition of the proposed Site Plan for the 120 Bond Street development. Our review and findings follow below.

FUNCTIONAL SERVICING REPORT (FSR)

Water Supply and Distribution

On the 116 Bond Street development, a 50 mm diameter valve and stub were provided on the water service for future extension of water servicing to the 120 Bond Street site. On the enclosed drawings, the proposed 50 mm diameter watermain is connected to this service and extended across the frontage of the proposed buildings. Individual 25 mm diameter water services are extended from the 50 mm diameter watermain to provide individual service connections to each of the proposed units. The proposed watermain terminates with a second service valve and blowoff at the northwest corner of Block B-3.

Water supply for fire protection will continue to be provided from the hydrant in front of 110 Bond Street. Both proposed buildings on the 120 Bond Street property will have water demands consistent with those for Block B on the 116 Bond Street property (100 L/s) which the existing hydrant can supply.

This proposed servicing configuration is therefore consistent with what was presented in our previous FSR and will be capable of providing water service to the proposed development.

Sanitary Sewer Collection

On the 116 Bond Street development, the sanitary MH at the property line included a 200 mm diameter service stub to extend service to the 120 Bond Street property in the future. On the enclosed drawings, extension of the 200 mm diameter sewer to the 120 Bond Street property and across the front of the proposed buildings is proposed. Connection to the new sewer will be provided via 125 mm diameter service laterals with each lateral servicing two units.

This proposed servicing configuration, occupancy and sewage flow is consistent with what was presented in our previous FSR and therefore will be capable of providing sanitary sewer service to the proposed development.

STORMWATER MANAGEMENT (SWM)

In terms of SWM, the updated site plan has minimal impact to surface runoff compared with the conceptual plan considered in our previous assessment. The most substantial changes include relocating the retaining wall at the north limit of the property, relocating the concrete pad for bicycle parking, and including a hydro transformer between the two proposed buildings. While these changes slightly modify drainage boundaries and the location of impervious surfaces, the effect is so small the catchment areas and runoff coefficients are unaffected. A revised figure DP.3 from the SWM report is enclosed and illustrates the new site plan and the negligible impact it has on the previous assessment.

Runoff Quantity

Quantity control for the development will continue to be provided by the orifice control and combined underground and surface storage designed in support of the 116 Bond Street development. These controls reduce peak discharge from the site to well below pre-development flow rates and service the proposed parking area, sidewalks and building rooftops from the 120 Bond Street site. The controlled flow is discharged to an enhanced grass swale and infiltration storage at the northwest corner of the 116 Bond Street property where they are captured by a ditch inlet catchbasin on the adjacent lands, consistent with the existing condition.

Directing uncontrolled surface runoff to Bond Street is consistent with the existing condition and the previous SWM report. Drainage from the rear yard area of 120 Bond Street will be conveyed via a surface swale to the north side of the property, consistent with existing conditions. A combination of an infiltration gallery and gravel diaphragm is proposed along the north property line to promote infiltration in the existing flat area, to maintain existing drainage patterns working alongside the 0.5% swale and to form a level spreader along the property line so the nature of surface runoff to the adjacent parcel is consistent with existing conditions.

Emergency overflow to Bond Street will continue to be provided for the parking area by a weir formed at the driveway entrance.

Runoff Quality

Quality control of the impervious surfaces will be provided by the oil-grit separator, enhanced swale and infiltration gallery treatment train included in the 116 Bond Street development. The area of impervious surfaces is consistent with the previous SWM report and thus, the development will continue to achieve the Enhanced, 80% Total Suspended Solids removal rate.

Water Budget

The proposed controls for 116 Bond Street will continue to provide a water budgeting surplus for the proposed development as nearly the entirety of the proposed impervious surfaces continue to be conveyed to the enhanced swale outlet. While an additional infiltration gallery is proposed in the rear yard of the 120 Bond Street property, it receives minimal runoff from impervious surfaces on site so its overall impact on water balance is minimal.

Phosphorous Budget

As noted in the previous SWM report, the proposed infiltration gallery in the rear yard swale coincides with a 60% phosphorous removal efficiency for Catchment 302. The proposed development is consistent with the previous phosphorous budget assessment.

Siltation and Erosion Controls

Siltation and erosion control for 120 Bond Street will primarily consist of silt fencing, entrance mud mats, catchbasin filters and straw bale check dams as illustrated on Drawing ESC.1. This is similar to the controls proposed for the 116 Bond Street site and, combined with standard practices as described in the SWM report, the proposed controls will mitigate the conveyance of sediment and debris from the site during construction.

OPERATIONS & MAINTENANCE

Operation and maintenance recommendations for the property are consistent with those described in the Operations & Maintenance manual. The updated site plan does not implement any new infrastructure that would require revision to the original document.

PARKING JUSTIFICATION

The occupancy and number of parking spaces for the 120 Bond Street property are consistent with those assessed in the 116 Bond Street Parking Justification Study and therefore, the findings of the original report are unaffected.

TRANSPORTATION IMPACT BRIEF

The occupancy for the 120 Bond Street site and configuration of the common site entrance remain consistent with those assessed in the Transportation Brief prepared for the 116 Bond Street development and the findings of the original report are therefore unaffected.

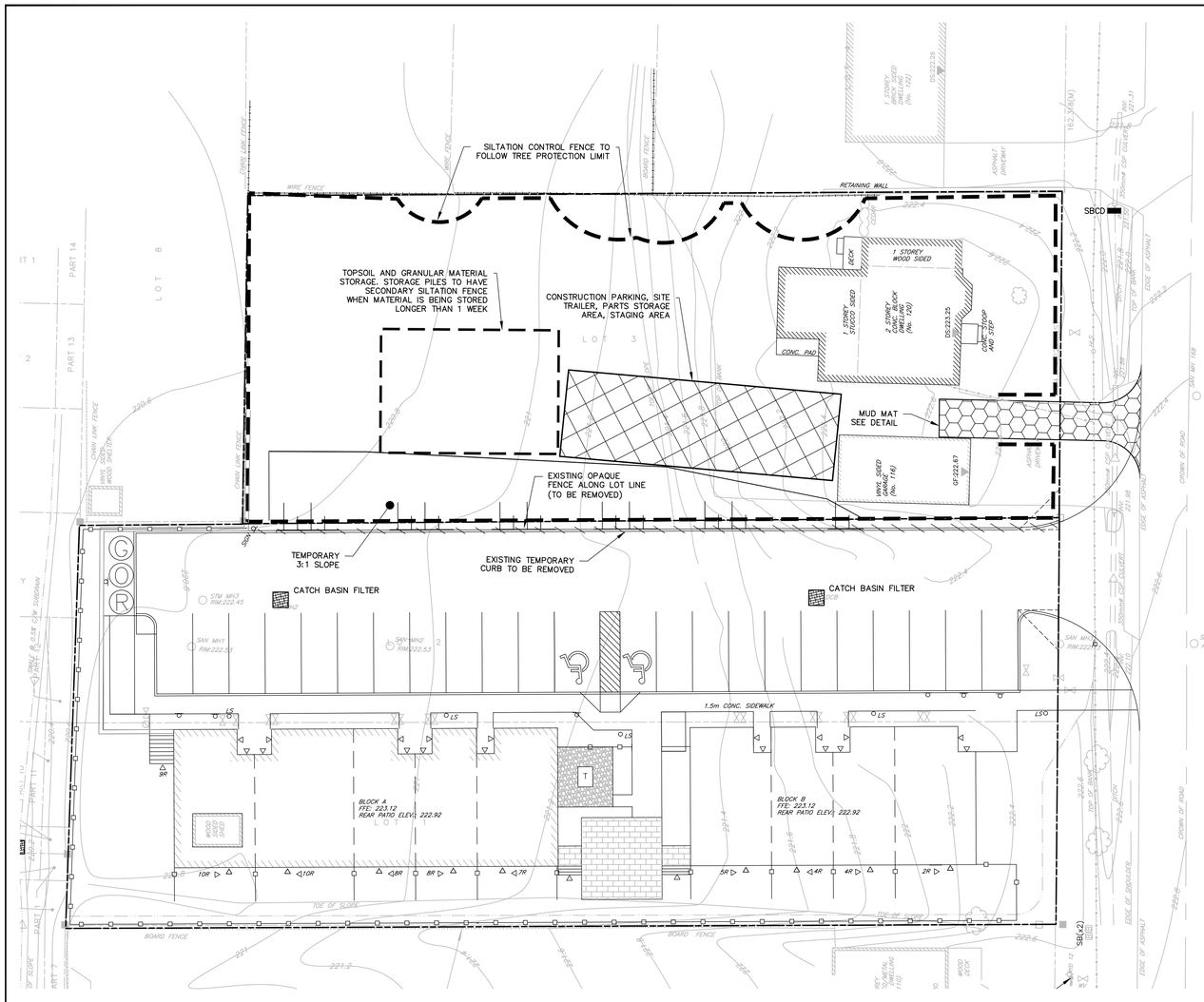
SUMMARY

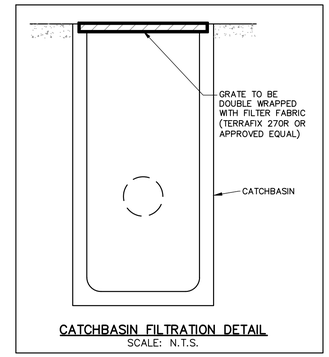
As noted above, the updated 120 Bond Street site plan is generally consistent with the preliminary concept assessed in support of the 116 Bond Street development. The previous reports and studies in conjunction with the updated engineering design drawings therefore sufficiently meet the development needs in terms of water and sewer servicing, stormwater management, parking requirements and transportation impacts.

Yours truly,
Tatham Engineering Limited

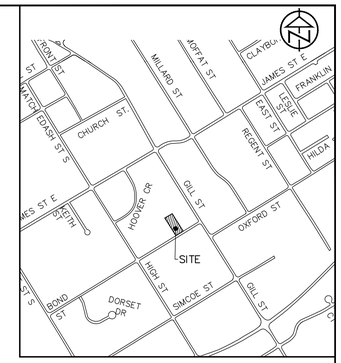
Joshua Nemisz, P.Eng.
Senior Engineer, Project Manager
JN:ha

I:\2025 Projects\325099 - 120 Bond Street, Orillia\Documents\Reports\120 Bond St\L - Sullivan - FSR and SWM Review.docx



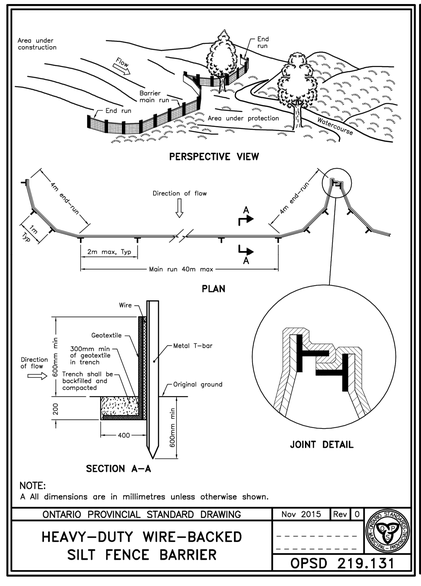


CATCHBASIN FILTRATION DETAIL
SCALE: N.T.S.



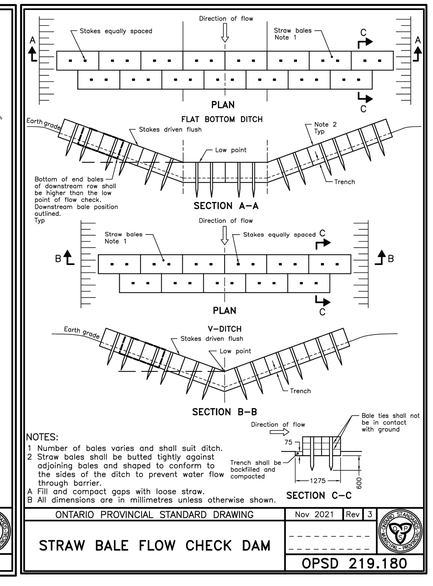
KEY PLAN
N.T.S.

BOND STREET



NOTE:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev 0
HEAVY-DUTY WIRE-BACKED SILT FENCE BARRIER		OPSD 219.131



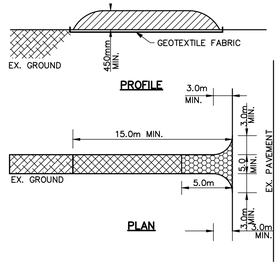
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2021	Rev 3
STRAW BALE FLOW CHECK DAM		OPSD 219.180

SILTATION AND EROSION CONTROL NOTES

1. ALL SILTATION AND EROSION CONTROL MEASURES TO BE IN PLACE PRIOR TO CONSTRUCTION.
2. CONTRACTOR TO INSTALL AND MAINTAIN SILTATION CONTROL DEVICES AT LOCATIONS SHOWN, OR AS DIRECTED BY THE ENGINEER IF ADDITIONAL CONTROLS ARE DEEMED NECESSARY.
3. CONTRACTOR TO ARRANGE PRE-CONSTRUCTION MEETING WITH ENGINEER IMMEDIATELY AFTER PLACING ALL SILTATION CONTROL DEVICES.
4. SILTATION CONTROL DEVICES TO BE INSPECTED BY CONTRACTOR WEEKLY AND AFTER EACH RAINFALL. REPAIRS TO SILTATION CONTROL DEVICES TO BE COMPLETED PROMPTLY WHEN REQUIRED.
5. THE ENGINEER WILL INSPECT THE SEDIMENT AND EROSION CONTROL MEASURES PERIODICALLY, AND AFTER EACH MAJOR STORM EVENT. THE ENGINEER WILL NOTIFY THE CONTRACTOR OF CORRECTIVE ACTIONS REQUIRED AS SOON AS DEFICIENCIES ARE NOTED. THE CONTRACTOR MAINTAINS ULTIMATE RESPONSIBILITY TO ENSURE PROPER SEDIMENT AND EROSION CONTROL MEASURES ARE IMPLEMENTED AND MAINTAINED. ALL DEFICIENCIES AND CORRECTIVE MEASURES WILL BE DOCUMENTED BY THE CONTRACTOR IN A WEEKLY INSPECTION REPORT. A COPY OF THE WEEKLY INSPECTION REPORT WILL BE PROVIDED TO THE ENGINEER.
6. INSTALL SILT SACK IN ALL NEW CATCHBASINS/CATCHBASIN MAINTENANCE HOLES AND EXISTING CATCHBASINS/CATCHBASIN MAINTENANCE HOLES WITHIN THE CONSTRUCTION LIMITS AND/OR AREAS EXPOSED TO SILTATION. SILT SACK – REGULAR FLOW BY TERRAFIX OR APPROVED EQUAL.
7. CONTRACTOR TO REMOVE SILTATION CONTROL DEVICES ONLY AFTER ALL PAVING IS COMPLETED AND VEGETATION HAS STABILIZED.
8. ALL SILT FENCE PER OPSD 219.131.

CONSTRUCTION ENTRANCE NOTES

1. CONSTRUCT AND MAINTAIN CONSTRUCTION ENTRANCE AS SHOWN AND IN ACCORDANCE WITH O.P.S.D. 301.020.
2. ALL CONSTRUCTION VEHICLES TO ACCESS THE SITE USING THE DESIGNATED CONSTRUCTION ENTRANCE.
3. CONTRACTOR TO INSTALL AND MAINTAIN STONE MUD MAT AS DETAILED.
4. REMOVE TOPSOIL (WHERE APPLICABLE) BEFORE INSTALLING CONSTRUCTION ENTRANCE.
5. PROMPTLY REMOVE ANY MUD OR DUST WHICH IS TRANSPORTED BEYOND THE STONE MUD MAT TO MAINTAIN EXISTING ROAD DRIVING CONDITION.
6. ENTRANCE RADII TO BE MINIMUM 8.0m.



STONE SIZE – THE STONE PAD SHALL BE A MIN. 450mm THICK. USE 50ømm STONE OR RECLAIMED CONCRETE EQUIVALENT FOR FIRST 5m FROM ADJACENT ROAD & 150mmø STONE FOR REMAINDER OF STONE PAD.

LENGTH – AS REQUIRED BUT NOT LESS THAN 15m.

WIDTH – 5m MIN. BUT NOT LESS THAN THE WIDTH AT POINTS WHERE INGRESS AND EGRESS OCCURS.

GEOTEXTILE FABRIC (TERRAFIX 270R OR EQUAL) WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING STONE.

SURFACE WATER – ALL SURFACE WATER FLOWING OR DIRECTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE.

MAINTENANCE – THE CONTRACTOR SHALL MAINTAIN THE ENTRANCE AT ALL TIME, IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAY. THIS MAY REQUIRE PERIODIC DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHT-OF-WAY MUST BE REMOVED IMMEDIATELY BY THE CONTRACTOR. UPON OBSERVATION OF CONTINUOUS MUD TRACKING ONTO ADJACENT STREETS, THE STONE MAT IS TO BE FULLY REPLACED.

WASHING – WHEELS SHALL BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO PUBLIC RIGHT-OF-WAY. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.

INSPECTION AND REQUIRED MAINTENANCE AFTER EACH RAIN SHALL BE PROVIDED BY THE CONTRACTOR.

STONE MUD MAT DETAIL
SCALE: NTS

LEGEND

- SBCD — STRAW BALE CHECK DAM PER OPSD 219.180
- SILT FENCE PER OPSD 219.131
- PROPERTY LINE
- EXISTING DITCH
- EXISTING BELL LINE
- EXISTING HYDRO LINE
- EXISTING GAS LINE
- EXISTING HYDRO POLE/LIGHT STANDARD
- EXISTING HYDRO POLE
- EXISTING BENCH MARK
- STONE MUD MAT
- CATCH BASIN FILTER

DISCLAIMER AND COPYRIGHT

CONTRACTOR MUST VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR SAME. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER BEFORE COMMENCING WORK. DRAWINGS ARE NOT TO BE SCALED.

TATHAM ENGINEERING LIMITED CLAIMS COPYRIGHT TO THIS DRAWING WHICH MAY NOT BE USED FOR ANY PURPOSE OTHER THAN THAT PROVIDED IN THE CONTRACT BETWEEN THE OWNER/CLIENT AND THE ENGINEER WITHOUT THE EXPRESS CONSENT OF TATHAM ENGINEERING LIMITED.

BENCHMARKS

TBM #1 – TOP OF RAISED ARROWHEAD SITUATED ATOP OF FIRE HYRDRANT #12 LOCATED ON THE NORTH SIDE OF BOND STREET, APPROXIMATELY 4m SOUTH WEST OF THE SOUTH WEST CORNER OF LOT 1, REGISTERED PLAN 992, ELEVATION OF 223.68m.

NOTES

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SITE PLAN INFORMATION OBTAINED FROM SITE PLAN PREPARED BY API DEVELOPMENT CONSULTANTS INC. AND FABIANI ARCHITECTS LTD. RECEIVED 20/11/2024.

No.	REVISION DESCRIPTION	DATE
1.	1ST SUBMISSION	DEC. 2025

ENGINEER STAMP

LICENSED PROFESSIONAL ENGINEER
J. A. NEMISZ
100181826
Dec. 18, 2025
325099
PROVINCE OF ONTARIO

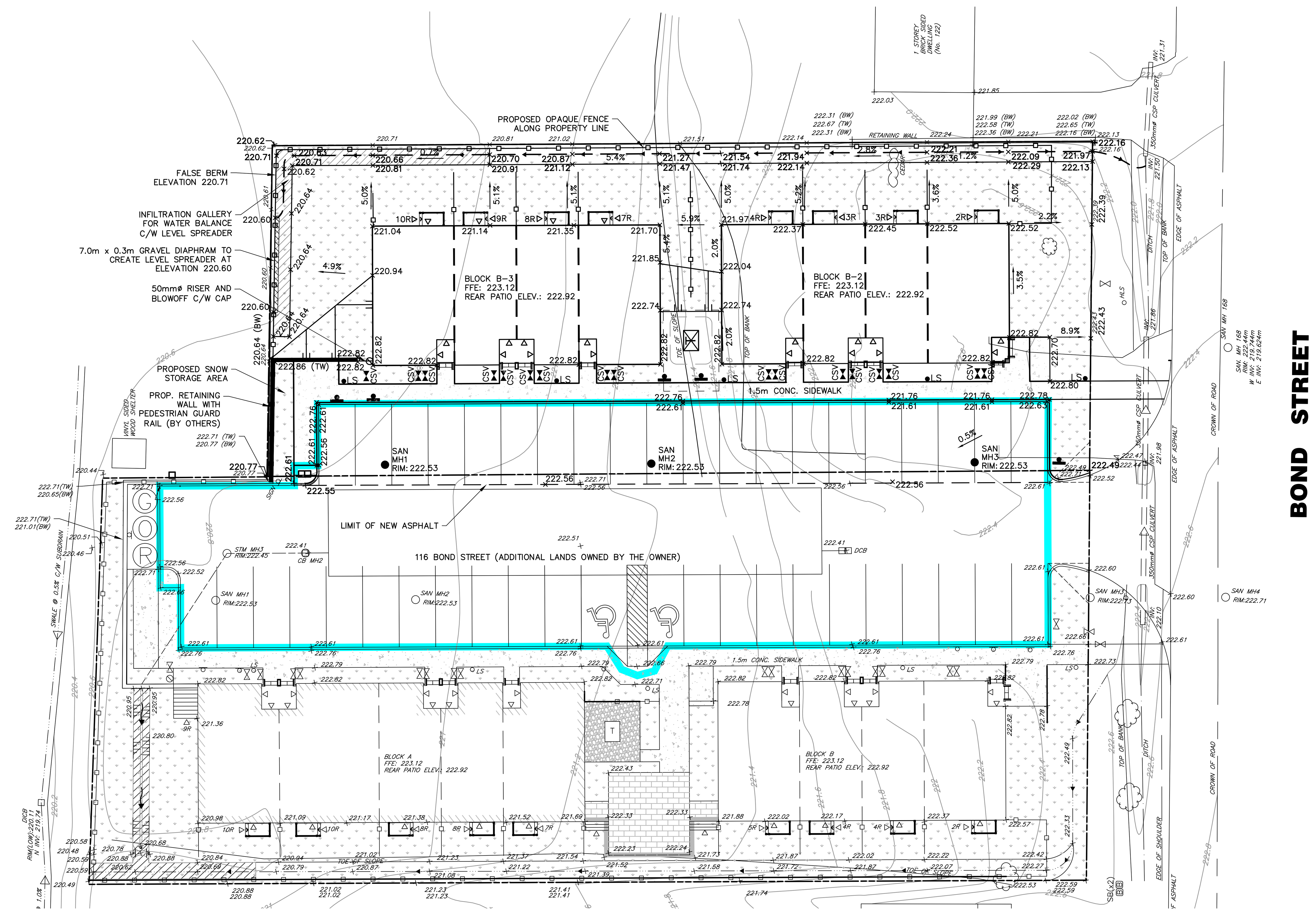
120 BOND STREET
CITY OF ORILLIA

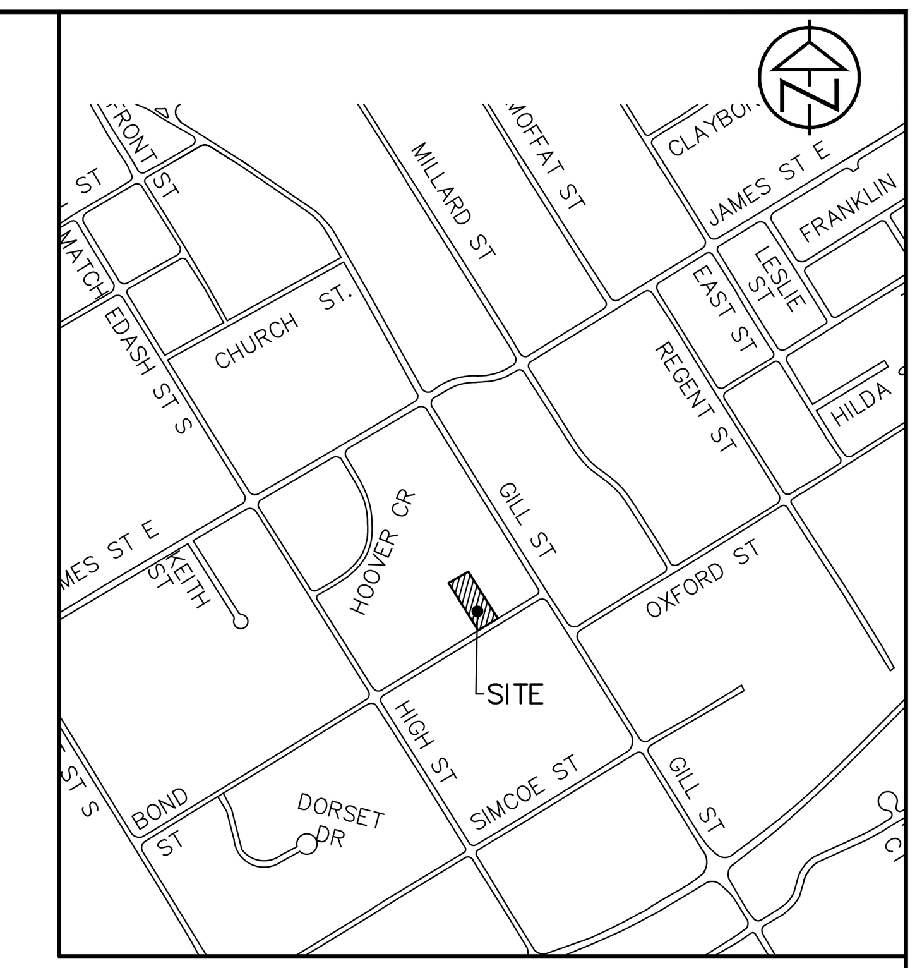
REMOVALS AND EROSION & SILTATION CONTROL PLAN

TATHAM ENGINEERING

DESIGN: JN	FILE: 325099	DWG:	ESC.1
DRAWN: WL/JH	DATE: AUG. 2025		
CHECK: RS	SCALE: 1:200		

Drawing Name: 323899 – ESC01.dwg, Plotted: Dec 18, 2025

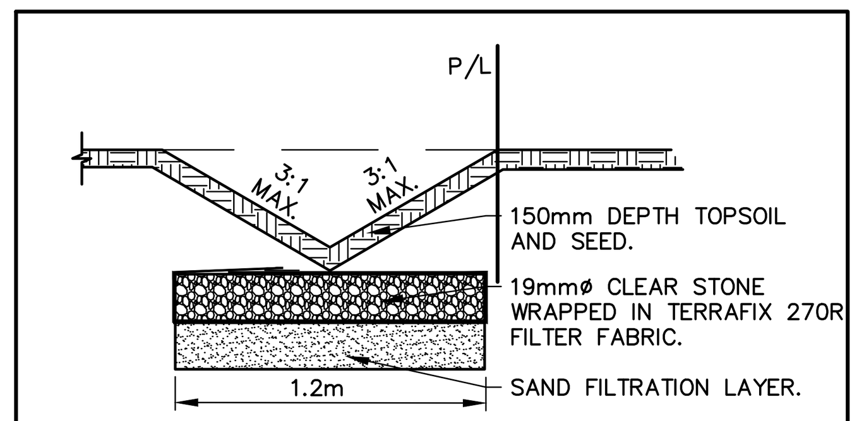




KEY PLAN
N.T.S.

LEGEND

- 221.50 — PROPOSED GROUND ELEVATION
- 221.50 — EXISTING GROUND ELEVATION
- PROPERTY LINE
- EXISTING DITCH
- 1.9% — PROPOSED OVERLAND FLOW DIRECTION
- STM MH — PROPOSED MH
- CB — PROPOSED CB
- DCB — ENTRANCE/EXIT – VEHICULAR
- CBMH — ENTRANCE/EXIT – PEDESTRIAN
- PROPOSED FENCE
- WV — PROPOSED WATER VALVE
- HYD — PROPOSED HYDRANT & VALVE
- PROPOSED STREET SIGNS
- HYD — EXISTING HYDRANT
- PROPOSED CULVERT
- PROPOSED STORM SEWER INSULATION
- PROPOSED INFILTRATION GALLERY
- PROPOSED SIDEWALKS
- PROPOSED GRASSED AREAS
- PROPOSED GRAVEL AREAS
- LIMIT OF PONDING DURING EMERGENCY OVERFLOW CONVEYANCE



INFILTRATION GALLERY DETAIL
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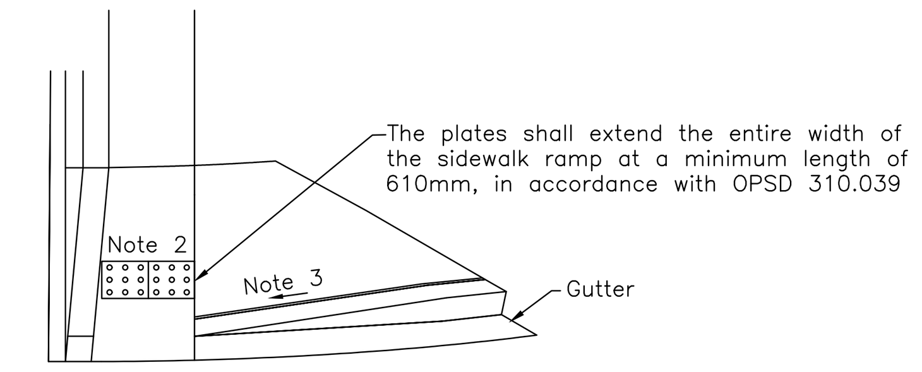
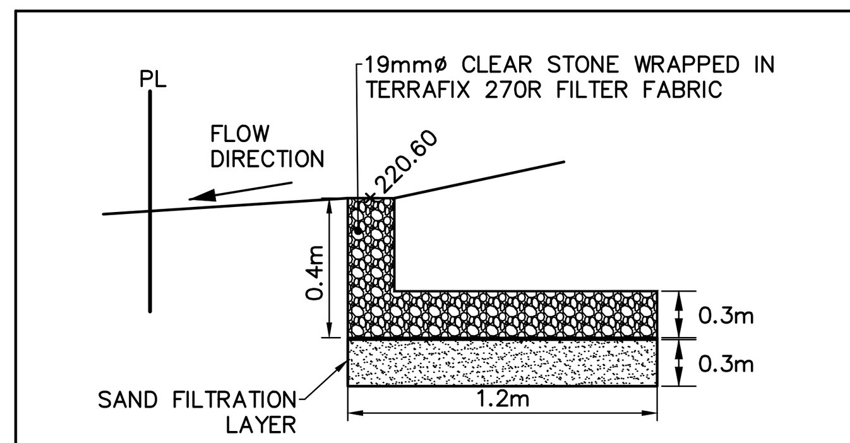


RAMP ELEVATION

NOTES:
1 Cross slope of ramp shall not exceed 2% in either direction.
2 Cross slope of flared side of ramp shall not exceed 8%.

CONCRETE SIDEWALK RAMP DETAIL
SCALE: N.T.S.



GRAVEL DIAPHRAGM (TYP.) DETAIL
NTS

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BENCHMARKS

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ENGINEER STAMP

LICENSED PROFESSIONAL ENGINEER
J. A. NEMISZ
100181826
Dec. 18, 2025
325099
PROVINCE OF ONTARIO

120 BOND STREET
CITY OF ORILLIA

SITE GRADING PLAN

TATHAM ENGINEERING

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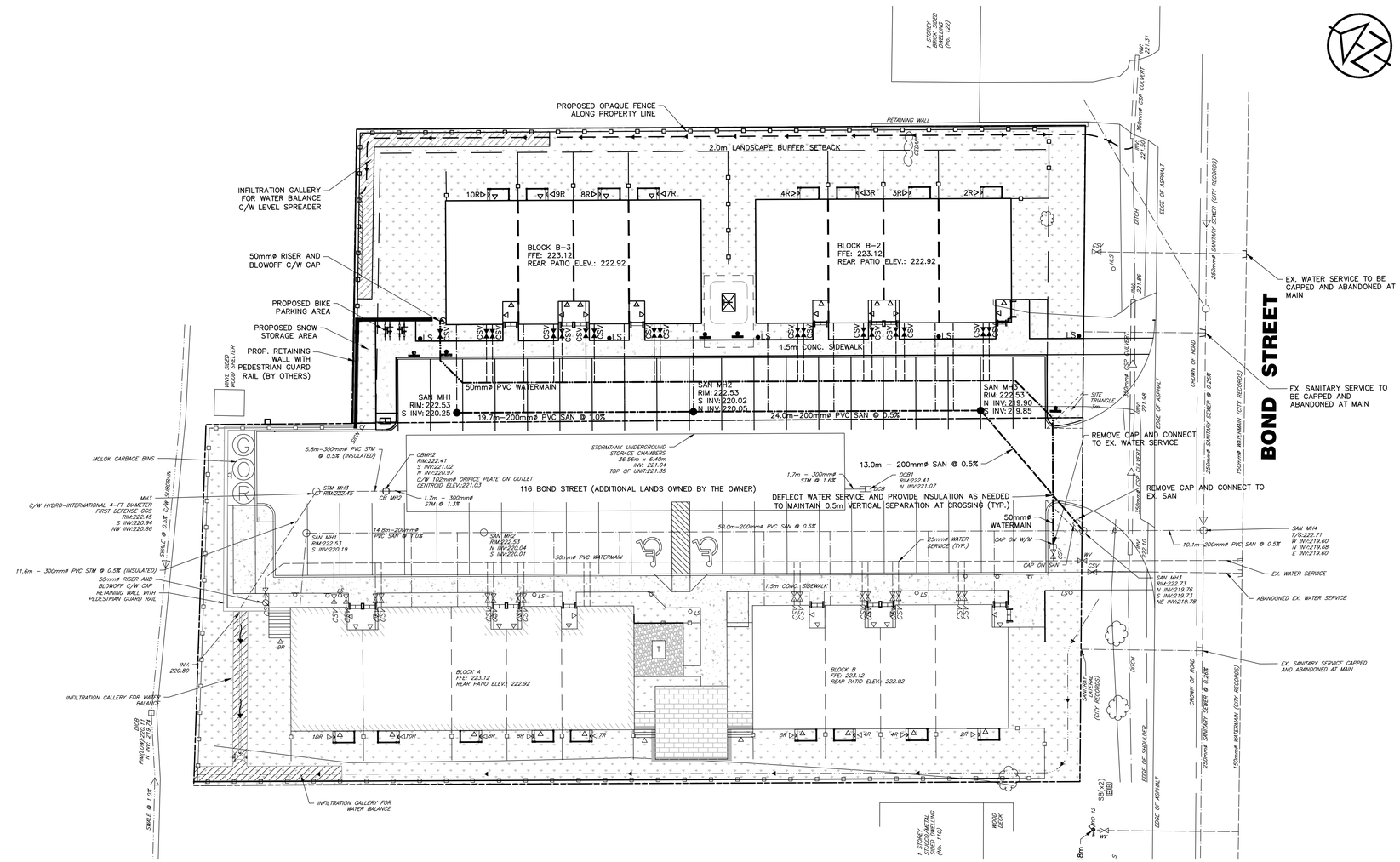

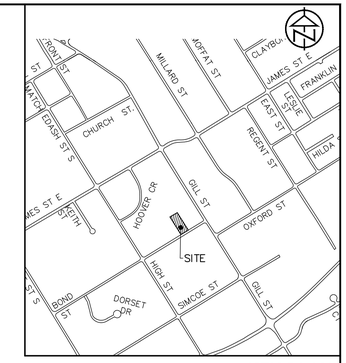

KEY PLAN
N.T.S.

LEGEND

- PROPERTY LINE
- EXISTING DITCH
- 200ø SAN — PROPOSED SANITARY SEWER/ SIZE/ DIRECTION OF FLOW
- 450ø STM — PROPOSED STORM SEWER/ SIZE/ DIRECTION OF FLOW
- 50ø WATERMAIN — WATERMAIN/SIZE
- 200ø SAN — SANITARY SEWER/ SIZE/ DIRECTION OF FLOW
- PROPOSED SANITARY SERVICE
- PROPOSED WATER SERVICE
- PROPOSED DITCH
- C.O. — PROPOSED CLEAN OUT
- SAN MH2 — PROPOSED SANITARY MANHOLE/ NUMBER
- STM MH2 — PROPOSED STORM MANHOLE/ NUMBER
- CBMH — PROPOSED CATCH BASIN MANHOLE
- CB — PROPOSED CATCHBASIN
- DCB — PROPOSED DOUBLE CATCHBASIN
- HYD & WV — PROPOSED HYDRANT & WATER VALVE
- WV — PROPOSED WATER VALVE
- CSV — PROPOSED WATER CURB STOP
- PROPOSED STREET SIGNS
- ENTRANCE/EXIT – VEHICULAR
- ENTRANCE/EXIT – PEDESTRIAN
- PROPOSED FENCE
- HYD — EXISTING HYDRANT
- PROPOSED CULVERT
- C2 C3 — ELECTRIC CAR CHARGERS
- PROPOSED TACTILE PLATE
- PROPOSED PRECAST CURB
- PROPOSED STORM SEWER INSULATION
- PROPOSED INFILTRATION GALLERY
- PROPOSED SIDEWALKS
- PROPOSED GRASSED AREAS
- PROPOSED GRAVEL AREAS

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ENGINEER STAMP

LICENSED PROFESSIONAL ENGINEER — J. A. NEMISZ — 100181826 — Dec. 18, 2025 — 325099 — PROVINCE OF ONTARIO

120 BOND STREET
CITY OF ORILLIA

SITE SERVICING PLAN

TATHAM ENGINEERING

DESIGN: JN	FILE: 325099	DWG: SS.1
DRAWN: WL/JH	DATE: AUG. 2025	
CHECK: RS	SCALE: 1:200	

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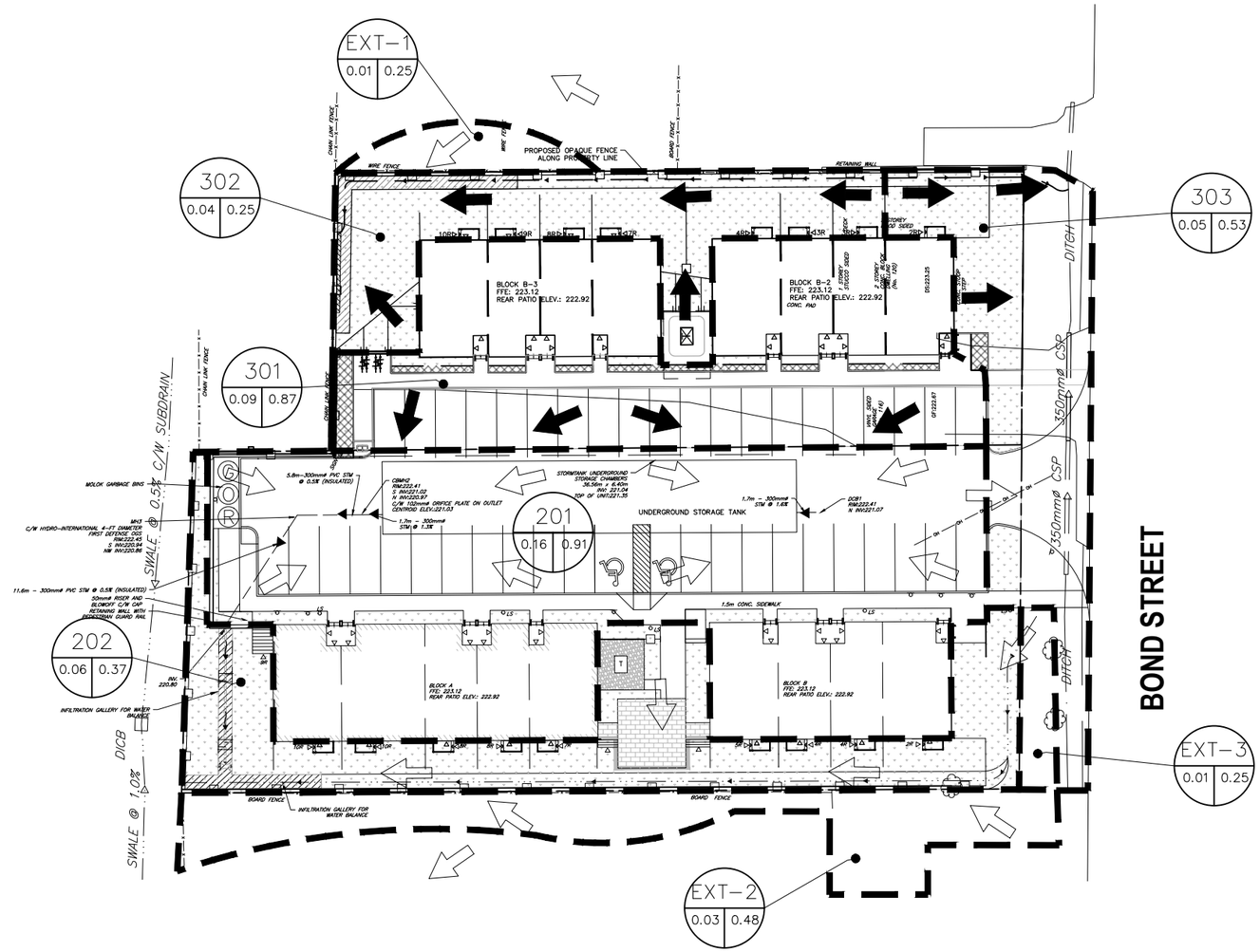


LEGEND

- PROPOSED SWALE
- 221.00 EXISTING CONTOURS
- EXISTING LOT LINES
- SUBJECT PROPERTY
- PROPOSED DEVELOPMENT DRAINAGE BOUNDARY
- 301 / 0.09 | 0.87 — CATCHMENT ID / RUNOFF COEFFICIENT / CATCHMENT AREA (ha)
- PROPOSED DEVELOPMENT OVERLAND FLOW DIRECTION
- EXISTING CONDITIONS OVERLAND FLOW DIRECTION

TATHAM ENGINEERING

120 BOND STREET
CITY OF ORILLIA
EXPANDED–DEVELOPMENT DRAINAGE PLAN

DWG. No. **DP.3**

SCALE: 1:500 | DRAWN: WL/JH | DATE: AUG. 2025 | JOB NO. 325099

Drawing Name: 323899 – DP01.dwg, Plotted: Dec 18, 2025

TATHAM ENGINEERING

Enhancing our communities

116 Bond Street

FUNCTIONAL SERVICING REPORT

Sullnet Holdings Inc.

File 323899 | September 11, 2025

Document Control

File:

323899

Date:

September 11, 2025

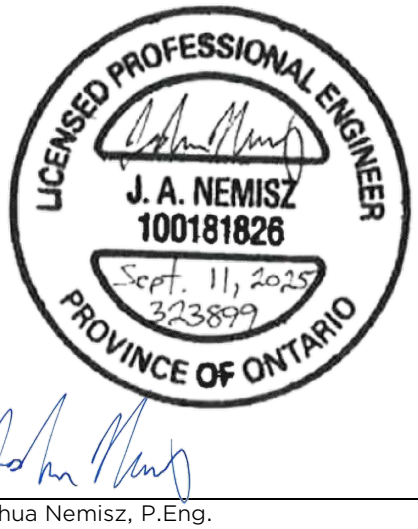
Prepared by:

Tatham Engineering Limited
10 Diana Drive, Unit 7
Orillia, Ontario L3V 8K8

T 705-325-1753
tathameng.com

Prepared for:

Sullnet Holdings Inc.
16 Hopkins Street
Thorold, Ontario L2V 0E9
sullnetholdings@icloud.com

Authored by:	Reviewed by:
	
Jacob Hofstetter, B.Eng. Engineering Candidate	Joshua Nemisz, P.Eng. Senior Engineer, Project Manager

Issue	Date	Description
3	December 20, 2024	Revised Site Plan
4	July 2, 2025	City Review Comments
5	September 11, 2025	Final – Issued for ZBA

Document Contents

Tables

Figures

Appendices

1 Introduction

Tatham Engineering Limited has been retained by Sullnet Holdings Inc. to prepare a Functional Servicing Report (FSR) in support of a proposed residential townhome development located in the City of Orillia (City). A Stormwater Management Report and Traffic Impact Brief have been completed under separate cover.

1.1 SITE DESCRIPTION

The overall development site is approximately 0.22 ha in size and is located at 116 Bond Street within the City of Orillia. The property is bound by Bond Street to the south, existing single family residential properties to the east and west and an existing townhome development to the north. The adjacent 120 Bond Street parcel, approximately 0.15 ha in size, is also owned by the applicant and may be subject to future applications, however, is not proposed for development at this time.

The location of this property is shown on the Site Location Plan (Figure 1) enclosed.

1.2 PROPOSED DEVELOPMENT

The proposed development includes eighteen residential townhome units accessed via a new private roadway, coinciding with the existing driveway on the east side of the parcel, extended from Bond Street. The proposed units will reside on the west side of the existing parcel with parking provided along the front of the units and additional snow storage areas provided at the northern limit of the parcel. Private water and sewer infrastructure will be extended to the site from existing municipal infrastructure on Bond Street. Additional details of the proposed development site are illustrated on the Site Plan prepared by API Development Consultants Inc. and Fabiani Architects Ltd. submitted under separate cover. This report provides background support for Zoning approvals.

1.3 BACKGROUND INFORMATION

A number of guidelines, background reports and studies relating to municipal services development in the area were utilized in preparation of this report as follows:

- City of Orillia, Wastewater System Master Plan Update (Ainley Group, 2022);
- City of Orillia, Water System Master Plan (Tatham Engineering, 2022);
- City of Orillia, Watermain Replacement and Asphalt Resurfacing Drawing P4 & P5 (2008);
- City of Orillia, Engineering Design Criteria (2012)

- Design Guidelines for Drinking Water Systems (MECP, 2008);
- Design Guidelines for Sewage Works, Storm Sewers and Forcemains for Alteration Authorized Under Environmental Compliance Approvals (MECP, 2022);
- Water Supply for Public Fire Protection (Fire Underwriters Survey, 2020); and
- Fire Hydrants: Installation, Field Testing, and Maintenance, 5th edition, AWWA.

2 Water Supply & Distribution

2.1 EXISTING WATER SYSTEM

The City maintains an existing 150 mm diameter PVC watermain along Bond Street located within pressure Zone 1. Hydrants numbered 12 & 13 are located along Bond Street with Hydrant 12 located in front of 110 Bond Street, southwest of the development. Hydrant flow testing was completed on May 14, 2025, by Simcoe Sewer & water Ltd. and was utilized to assess the water servicing capacity as summarized in Table 1. Supporting calculations and copies of the flow testing reports are provided in Appendix A.

Table 1: Fire Hydrant Flow Data Summary

HYD. NO.	LOCATION	STATIC PRESSURE		PITOT PRESSURE		FLOW RATE			
						Measured		Estimated at 20psi	
		(kPa)	(psi)	(kPa)	(psi)	(L/s)	(GPM)	(L/s)	(GPM)
12	No. 110 Bond St.	544	80	462	68	87.4	1,384	208	3,301
13	No. 430 Gill St.	558	82	394	58	80.8	1,280	135	2,137

An average available fire flow of 172 L/s is calculated for the Bond Street watermain across the frontage of the development when a residual pressure of 138 kPa (20 psi) is applied. Calculations are provided in Appendix A.

2.2 PROPOSED WATER SYSTEM

The proposed development will be serviced with a 50 mm diameter private watermain connected to the existing watermain on Bond Street. Each unit will be serviced with individual 25 mm water services connected to the new private watermain. A 50 mm riser with blowoff at the terminal end of the common watermain is provided for flushing and sampling.

A future 50 mm watermain complete with isolation valve and cap near the property line is conceptually shown along the property frontage to allow future servicing of the 120 Bond Street property, pending combination of the two properties through separate application. Should development of 120 Bond Street proceed, this configuration will minimize disruption to the proposed site, its residents and the municipal roadway. Additional details are provided on the Site Servicing Plan (Drawing SS.1).

The existing fire hydrant located adjacent to the property will provide sufficient fire protection to the development with all dwellings located within a 90 m radius of the hydrant, therefore no on-site hydrant is proposed.

2.3 PROPOSED DESIGN FLOWS

Water demands for the site have been estimated by applying an average daily consumption rate of 300 L/person/day and a density of 2.95 people/unit per City criteria. Maximum daily demand and peak hour demand were considered for both the City criteria and MECP guidelines. To ensure the proposed watermain is suitable to service development of 120 Bond Street in the future, an additional 16 units were also considered in the design calculations. The flows are summarized in Table 2 with supporting calculations provided in Appendix A.

Table 2: Water Servicing Demands

SCENARIO	AVERAGE DAILY FLOW (L/day)	CITY CRITERIA		MECP GUIDELINES	
		Max. Day (L/day)	Peak Hour (L/day)	Max. Day (L/day)	Peak Hour (L/day)
Proposed	16,200	25,920	72,900	139,320	210,600
Future	30,600	48,960	137,700	208,080	312,120

Applying the minimum peaking factors per City Criteria, pressure losses to the ceiling space of a 3-storey home were calculated to be 119.0 kPa (17.3 psi). The existing static pressure at Hydrant 12 is 551.6 kPa (80 psi) resulting in a supply pressure of 432.6 kPa (62.7 psi) to the ceiling space. There is minimal change to the supply pressure when accounting for future development when applying the City criteria.

Applying the peaking factors per the MECP Guidelines, pressure losses to the ceiling space of a 3-storey home were calculated to be 158.2 kPa (22.9 psi), resulting in a supply pressure of 393.4 kPa (57.1 psi) for the proposed development. Including allowances for future development, the pressure losses are calculated between 151.3 kPa and 154.5 kPa (21.9 psi to 22.4 psi), resulting in service pressures between 397.1 kPa and 400.3 kPa (57.6 psi to 58.1 psi). It is expected existing pressure in the main will be sufficient to service the proposed buildings recognizing the MECP peaking factors applied are very conservative.

2.4 FIRE PROTECTION

The fire flow demands of the site were calculated using Fire Underwriters Survey (2020). Assuming ordinary construction and no firewalls between units the fire flow demands for Blocks A and B-1 are 133 L/s and 100 L/s, respectively. The available flow from existing fire hydrant No. 12 is 208 L/s while the average available fire flow between hydrant No. 12 and hydrant No. 13 on Gill Street is 172 L/s. The average flow is suitable for protection of both Block A and Block B-1 with no further protection measures provided actual construction materials meet the definition of ordinary construction in the FUS.

Supporting fire protection calculations are included in Appendix A.

3 Sanitary Sewer Collection

3.1 EXISTING SANITARY SYSTEM

The proposed development is located within drainage area 12 and conveys sewage flows to the James Street trunk sanitary main. Bond Street is serviced by a 250 mm diameter sanitary sewer with existing peak flows between MH 167 and MH 166 reaching 2.92 L/s, representing 9.6% of the full flow capacity of 30.32 L/s. Existing flows are estimated based on City standards for occupancy and available mapping of sewer service areas.

3.2 PROPOSED SANITARY SYSTEM

A new 200 mm diameter communal sanitary sewer is proposed to service the site. Each pair of stacked units will discharge to the communal sewer via 125 mm diameter service laterals for a total of nine service connections to the proposed sewer. Connection to the existing Bond Street sewer is proposed via a new maintenance hole at the proposed connection and with a maintenance hole at the property line for access. Additional details are provided on the Site Servicing Plan (Drawing SS.1).

The calculated average daily flow from the development is 0.18 L/s. Applying the Harmon peaking factor and infiltration rate results in a peak sewage flow of 0.82 L/s. The development increases the flows between MH 167 and MH 166 to 3.61 L/s representing 11.9% of the full flow capacity.

A 200 mm service stub including a temporary cap and cleanout near the property line are also proposed for future servicing of 120 Bond Street. The proposed service stub will minimize disruption to both the proposed infrastructure and municipal roadway should the future development proceed. Accounting for the future development, average daily flows from the site increase to 0.35 L/s. Applying the Harmon peaking factor and infiltration rate results in a peak sewage flow of 1.51 L/s. Accounting for the future development, flows between MH 167 and MH 166 increase to 4.23 L/s representing 13.9% of the full flow capacity.

Sanitary sewer calculations are provided in Appendix B.

4 Erosion Control & Grading

Siltation and erosion controls should be implemented for all construction activities, including tree clearing, earthwork operations, service construction, building construction and grading works. Substantial volumes of fill will be required to raise the site to provide sufficient cover over the proposed services and to ensure emergency overflow drainage is conveyed to the Bond Street Road allowance and away from adjacent properties. A combination of retaining walls, 3:1 slopes and the proposed townhomes, as illustrated on the Site Grading Plan (Drawing SG.1), will be utilized to match existing elevations at the property limits. A temporary fill slope is also proposed on the 120 Bond Street property in lieu of retaining walls to accommodate the future development.

Details of the siltation and erosion control plan will be provided at detailed design however, controls are shown on the Removals and Erosion & Sediment Control Plan (Drawing ESC.1). A number of standard practices which will be implemented are summarized as follows:

- The disturbance area and disturbance activities will be minimized where possible;
- The smallest possible land area will be exposed for the shortest amount of time;
- Heavy duty silt control fences will be erected coincident with the property boundary prior to commencement of grading operations to control sediment movement;
- A stone mud mat will be implemented at a construction entrance in support of rough grading work and service installations;
- Straw bale check dams will be installed in ditches and swales downstream of the site and at key locations associated with proposed drainage works during rough grading work and service installations;
- Silt traps will be installed in ditch inlet catch basins adjacent to the development site;
- Regular inspection of control measures shall be instituted and repairs made as necessary; and,
- Promptly re-vegetating disturbed areas following completion of construction works within the site.

5 Utilities

All utilities (electrical, gas, telecommunications) are available within Bond Street and can be utilized to service the proposed development. Detailed design for servicing will be complete in conjunction with service providers during detailed design stage.

6 Summary

6.1 WATER SUPPLY & DISTRIBUTION

Each unit will be serviced by a 25 mm diameter domestic water service lateral connected to the new 50 mm diameter watermain extended into the property. Fire protection will be provided by the existing fire hydrant adjacent to the property.

Future servicing of 120 Bond Street can be accommodated through the proposed 50 mm service.

6.2 SANITARY SEWER COLLECTION

The site will be serviced by a 200 mm diameter sanitary sewer and 125 mm diameter service laterals to each pair of stacked townhouse units. A maintenance hole will be provided at property line to serve as a maintenance access.

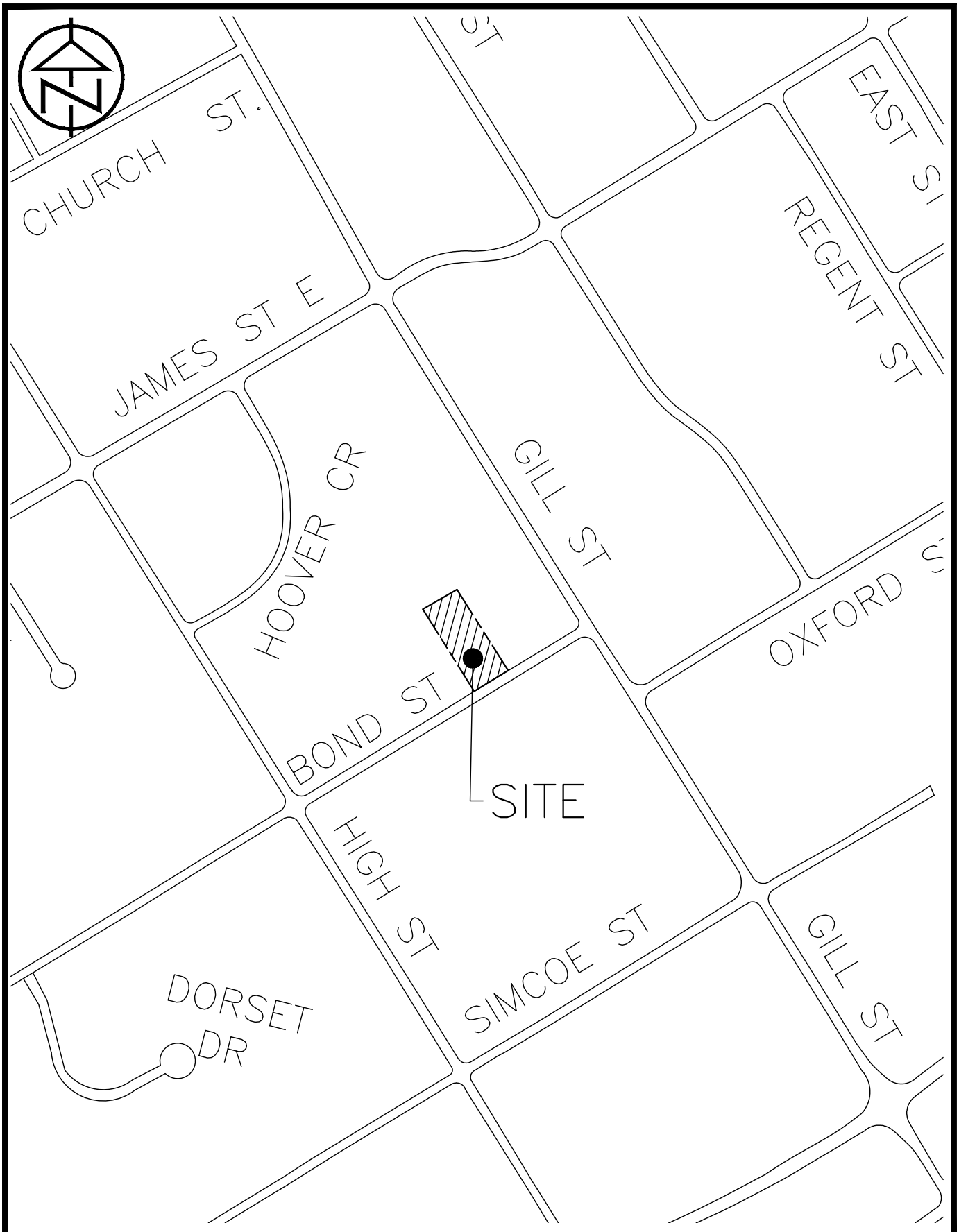
Future servicing of 120 Bond Street can be accommodated through the proposed 200 mm sewer.

6.3 EROSION CONTROL & GRADING

Erosion control devices will be installed around the perimeter of the site, inspected, and maintained regularly during construction. Proposed grading will match existing grades along the perimeter of the development.

6.4 UTILITIES

Utilities will be coordinated to service the development during the detailed design phase.



TATHAM ENGINEERING

116 BOND STREET
CITY OF ORILLIA

DWG. No.
FIG. 1

SCALE: NTS	DATE: MAR. 2024	JOB NO. 323899

Drawing Name: 323899 – FIG–1.dwg, Plotted: Dec 20, 2024

Appendix A:
Water Demand Calculations

ORILLIA

Hydrant Inspection & Test Report

NOTE: Hydrant Use Permit required prior to conducting inspection. Copy of both Use Permit and Inspection Report required for submission. Please submit the completed permit and test report to the City of Orillia at enviroservices@orillia.ca. Sullnetholdings@icloud.com

CUSTOMER NAME: Sullnet Holdings Inc
PHONE & FAX NO: 289-680-3644
ADDRESS: 16 Hopkins Street
HYDRANT LOCATION: 116 Bond Street
Thorold L2V 0E9
HYDRANT #: 12
CONTACT PERSON: Michael Sullivan
MAKE/MODEL: Darling (2008)

1. Secondary Valve	O/L ☐	O/R ☐	Closed ☐	Not Visible ☐	OK ☑	Inoperable ☐
2. Ground Flange	Solid ☐	Safety ☐	Buried ☐	Damaged ☐	OK ☑	
3. Barrel	Water Level:	Self-Draining ☑	Plugged ☐			
4. Caps and Gaskets	Replaced ☐	Lubricated ☐	OK ☑			
5. Nozzles and Threads	Loose ☐	Damaged ☐	Leaking ☐	Repaired ☐	Lead ☐	OK ☑
6. Nozzle Orientation	OK ☑	Improper ☐				
7. Lubricate Hydrant	OK ☑	Replaced ☐	Missing ☐			
8. Lube Screw	OK ☑	Replaced ☐	Missing ☐			
9. Hydrant Painted	Yes ☐	No ☑	Colour ☐			
10. Pumper Nozzle	Yes ☑	No ☐	Type ☐	Standard		
11. Traffic Bollards	OK ☐	Damaged ☐	Too Close ☐	N/A ☑		

☐ **Please check box if conducting visual inspection ONLY (no water flow & calculation required)**

1. Hydrostatic Testing

Prior to Opening:	underground leak	Yes ☐	No ☑
	above ground leak	Yes ☐	No ☑
Fully Open:	underground leak	Yes ☐	No ☑
Fully Closed:	underground leak	Yes ☐	No ☑

2. Fire Flow Testing

All flow tests require flow calculations to be completed as indicated below. Failure to fully complete this section will cause this form to be rejected by the Orillia Fire Department.

Pitot reading:	68 psi 462.4 kPa	minutes flowed:	1
Pressure Test:	80 psi 544 kPa	Fire flow rating:	5242 L/min
Water Used: (L/min. x Minutes Flowed) =	5242 Litres	L/min ÷ 1000 =	5.24 m3 of water used

COMMENTS:
pull from # 11, pull rate 75 kPa
static 82

Hydrant Operation Satisfactory ☑
Hydrant Operation Unsatisfactory ☐

INSPECTION CONDUCTED BY: Brett Sanderson
COMPANY NAME: Simcoe Sewer & Water Ltd
ADDRESS: 5-525 West Street South, Orillia
PHONE NO.: 705-325-8138
FAX: N/A.
SIGNATURE: Brett Sanderson (Inspector)
DATE: May 14th 2025
SIGNATURE: (Owner)
DATE: May 14, 2025

ORILLIA

Hydrant Inspection & Test Report

NOTE: Hydrant Use Permit required prior to conducting inspection. Copy of both Use Permit and Inspection Report required for submission. Please submit the completed permit and test report to the City of Orillia at enviroservices@orillia.ca. Sullnetholdings@icloud.com

CUSTOMER NAME: Sullnet Holdings Inc PHONE & FAX NO: 289-680-3644

ADDRESS: 16 Hopkins Street HYDRANT LOCATION: 430 Gill Street

Thorold L2V 0E9 HYDRANT #: 13

CONTACT PERSON: Michael Sullivan MAKE/MODEL: Darling

1. Secondary Valve	O/L ☐	O/R ☐	Closed ☐	Not Visible ☐	OK ☑	Inoperable ☐
2. Ground Flange	Solid ☐	Safety ☐	Buried ☐	Damaged ☐	OK ☑	
3. Barrel	Water Level:	Self-Draining ☐	Plugged ☑			
4. Caps and Gaskets	Replaced ☐	Lubricated ☐	OK ☑			
5. Nozzles and Threads	Loose ☐	Damaged ☐	Leaking ☐	Repaired ☐	Lead ☐	OK ☑
6. Nozzle Orientation	OK ☑	Improper ☐				
7. Lubricate Hydrant	OK ☑	Replaced ☐	Missing ☐			
8. Lube Screw	OK ☑	Replaced ☐	Missing ☐			
9. Hydrant Painted	Yes ☐	No ☑	Colour ☐			
10. Pumper Nozzle	Yes ☐	No ☑	Type ☐			
11. Traffic Bollards	OK ☐	Damaged ☐	Too Close ☐	N/A ☑		

☐ **Please check box if conducting visual inspection ONLY (no water flow & calculation required)**

1. Hydrostatic Testing

Prior to Opening:	underground leak	Yes ☐	No ☑
	above ground leak	Yes ☐	No ☑
Fully Open:	underground leak	Yes ☐	No ☑
Fully Closed:	underground leak	Yes ☐	No ☑

2. Fire Flow Testing

All flow tests require flow calculations to be completed as indicated below. Failure to fully complete this section will cause this form to be rejected by the Orillia Fire Department.

Pitot reading:	58psi	399.4 kPa	minutes flowed:	1	
Pressure Test:	82 psi	557.6 kPa	Fire flow rating:	4845	L/min
Water Used: (L/min. x Minutes Flowed) =	4845 Litres		L/min ÷ 1000 =	4.85	m3 of water used

COMMENTS: pull from 39, pull rate 80 ~~kPa~~ psi
static 85 ~~kPa~~ psi

Hydrant Operation Satisfactory ☑
Hydrant Operation Unsatisfactory ☐

INSPECTION CONDUCTED BY: Brett Sanderson COMPANY NAME: Simcoe Sewer & Water Ltd

ADDRESS: 5-525 West Street South, Orillia

PHONE NO.: 705-325-8138 FAX: N/A.

SIGNATURE: Brett Sanderson (Inspector) DATE: May 14th 2025

SIGNATURE: (Owner) DATE: May 14, 2025

TATHAM ENGINEERING

PROJECT	116 Bond Street	FILE	323899
		DATE	6/11/2025
SUBJECT	Available Fire Flow from Hydrant Test	NAME	JH CHKD JN
		PAGE	1 OF 1

DESIGN EQUATION

The following equation provided by the *AWWA M17 Fire Hydrants: Installation, Field Testing, and Maintenance* calculates the available fire flow at a desired residual pressure, given observed hydrant test results of static pressure, hydrant flow and residual pressure.

$$Q_r = Q_f \left(\frac{h_r}{h_f} \right)^{0.54}$$

Where:

- Q_r is the flow at a desired residual pressure (U.S. GPM)
- Q_f is the observed flow (U.S. GPM)
- h_r is the difference between the static pressure and the desired residual pressure (psi)
- h_f is the observed drop in pressure from static pressure to residual pressure (psi)

CALCULATION

Enter values in the cells highlighted in blue

Hydrant Test Description	Observed			Calculated		Target		
	Static Pressure (psi)	Residual Pressure (psi)	Hydrant Flow (U.S. GPM) Q_f	h_r	h_f	Residual Pressure (psi)	Hydrant Flow Q_r (GPM)	(L/s)
Hyd 13	82	58	1,280	62	24	20	2,137	135
Hyd 12	80	68	1,384	60	12	20	3,301	208
						Average AFF at 20 psi		**172**

TATHAM ENGINEERING

PROJECT	116 Bond Street	FILE	323899
		DATE	11-Jun-2025
SUBJECT	Water Supply Calculations Typical City Criteria	NAME	JN CHECK
		PAGE	1 OF 6

SITE DESCRIPTION

Proposed 18 unit stacked townhouse development with allowance for future 16 unit stacked townhouse development.

DAILY DEMAND DESIGN PARAMATERS

	Prop.	Fut.			
				Max Day Factor	1.6
No. of Units	18	16		Peak Hour Factor	4.5
Pop. Density	2.95	2.95	p/unit		
Demand	300	300	L/p/d	Q = PxDxPF, where:	
Population	54	48	people	P = Population	
Units per Service	1	1		D = Per Capita Demand	
				PF = Peaking Factor	

Proposed Demand	Per Service		Total	
	L/day	L/s	L/day	L/s
Average Daily	885	0.01	16,200	0.19
Maximum Day	1,416	0.02	25,920	0.30
Peak Hour	3,983	0.05	72,900	0.84
Future Demand	L/day	L/s	L/day	L/s
Average Daily	885	0.01	14,400	0.17
Maximum Day	1,416	0.02	23,040	0.27
Peak Hour	3,983	0.05	64,800	0.75

WATERMAIN SERVICE SIZING AND FRICTION LOSS

Service Type	D (mm)	Q (L/s)	A (m^2)	V (m/s)	C	L (m)	Friction Loss (m)	Friction Loss psi	Friction Loss kPa
Service (M. Day)	25	0.02	0.0005	0.04	100	2.5	0.000	0.001	0.01
Service (Peak)	25	0.05	0.0005	0.10	100	2.5	0.003	0.005	0.04
Proposed W/M	50	0.84	0.0020	0.43	100	60.0	0.560	0.797	5.50
Future W/M	50	0.75	0.0020	0.38	100	65.0	0.488	0.694	4.79
Connection	50	1.59	0.0020	0.80	100	15.0	0.455	0.647	4.47

D - Pipe Diameter
Q - Demand Flow
A - Pipe Flow Area
V - Flow Velocity
C - Pipe Coefficient
L - Pipe Length

Notes: - Peak flow utilized for dedicated domestic watermain while maximum day and fire flow are applied for combined watermains.

- $A = (\pi D^2)/4$; where D is converted to m.
- $V = Q/A$; where Q is converted to m^3/s.
- $h_f = L \times \left(\frac{Q}{0.278 \times C \times D^{2.63}} \right)^{1/0.54}$; where Q is converted to m^3/s.

TATHAM ENGINEERING

PROJECT	116 Bond Street	FILE	323899
		DATE	11-Jun-2025
SUBJECT	Water Supply Calculations Typical City Criteria	NAME	JN CHECK
		PAGE	2 OF 6

STATIC HEAD LOSS

	Road C/L Elev (m)	Depth to W/M (m)	Finished Floor (m)	Building Height (m)	Total Head Loss		
					(m)	(psi)	(kPa)
Static Head Loss	222.50	1.80	223.12	8.70	11.12	15.813	109.03

TOTAL LOSSES

Service Type	Static Pressure		Static Loss	W/M Loss	Service Loss	Total Loss	Service Pressure	
	(psi)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(psi)
Proposed W/M	80	551.59	109.03	9.97	0.04	119.04	432.55	62.74
Future W/M	80	551.59	109.03	9.26	0.04	118.33	433.26	62.84

SUMMARY

Under typical residential peak demand, there will be sufficient pressure to service the highest floor of the development with residual pressure of 62.74 psi in the ceiling space of the uppermost floor of the proposed building.

TATHAM ENGINEERING

PROJECT	116 Bond Street	FILE	323899		
		DATE	11-Jun-2025		
SUBJECT	Water Supply Calculations MECP Criteria - Proposed	NAME	JN	CHECK	
		PAGE	3	OF	6

SITE DESCRIPTION

Proposed 18 unit stacked townhouse development with allowance for future 16 unit stacked townhouse development.

DAILY DEMAND DESIGN PARAMATERS

	Prop.	Fut.			
				Max Day Factor	8.6
No. of Units	18			Peak Hour Factor	13
Pop. Density	2.95		p/unit		
Demand	300		L/p/d	Q = PxDxPF, where:	
Population	54	0	people	P = Population	
Units per Service	1			D = Per Capita Demand	
				PF = Peaking Factor	

Proposed Demand	Per Service		Total	
	L/day	L/s	L/day	L/s
Average Daily	885	0.01	16,200	0.19
Maximum Day	7,611	0.09	139,320	1.61
Peak Hour	11,505	0.13	210,600	2.44
Future Demand	L/day	L/s	L/day	L/s
Average Daily	0	0.00	0	0.00
Maximum Day	0	0.00	0	0.00
Peak Hour	0	0.00	0	0.00

WATERMAIN SERVICE SIZING AND FRICTION LOSS

Service Type	D (mm)	Q (L/s)	A (m^2)	V (m/s)	C	L (m)	Friction Loss (m)	Friction Loss psi	Friction Loss kPa
Service (M. Day)	25	0.09	0.0005	0.18	100	2.5	0.010	0.015	0.11
Service (Peak)	25	0.13	0.0005	0.27	100	2.5	0.022	0.032	0.23
Proposed W/M	50	2.44	0.0020	1.22	100	60.0	3.995	5.681	39.17
Future W/M									
Connection	50	2.44	0.0020	1.22	100	15.0	0.999	1.421	9.80

D - Pipe Diameter
Q - Demand Flow
A - Pipe Flow Area
V - Flow Velocity
C - Pipe Coefficient
L - Pipe Length

Notes: - Peak flow utilized for dedicated domestic watermain while maximum day and fire flow are applied for combined watermains.

- $A = (\pi D^2)/4$; where D is converted to m.
- $V = Q/A$; where Q is converted to m^3/s.
- $h_f = L \times \left(\frac{Q}{0.278 \times C \times D^{2.63}} \right)^{1/0.54}$; where Q is converted to m^3/s.

TATHAM ENGINEERING

PROJECT	116 Bond Street	FILE	323899
		DATE	11-Jun-2025
SUBJECT	Water Supply Calculations MECP Criteria - Proposed	NAME	JN CHECK
		PAGE	4 OF 6

STATIC HEAD LOSS

	Road C/L Elev (m)	Depth to W/M (m)	Finished Floor (m)	Building Height (m)	Total Head Loss		
					(m)	(psi)	(kPa)
Static Head Loss	222.50	1.80	223.12	8.70	11.12	15.813	109.03

TOTAL LOSSES

Service Type	Static Pressure		Static Loss (kPa)	W/M Loss (kPa)	Service Loss (kPa)	Total Loss (kPa)	Service Pressure	
	(psi)	(kPa)					(kPa)	(psi)
Proposed W/M	80	551.59	109.03	48.97	0.23	158.23	393.36	57.06
Future W/M								

SUMMARY

Under typical residential peak demand, there will be sufficient pressure to service the highest floor of the development with residual pressure of 57.06 psi in the ceiling space of the uppermost floor of the proposed building.

TATHAM ENGINEERING

PROJECT	116 Bond Street	FILE	323899
		DATE	11-Jun-2025
SUBJECT	Water Supply Calculations MECP Criteria - Future	NAME	JN CHECK
		PAGE	5 OF 6

SITE DESCRIPTION

Proposed 18 unit stacked townhouse development with allowance for future 16 unit stacked townhouse development.

DAILY DEMAND DESIGN PARAMATERS

	Prop.	Fut.			
				Max Day Factor	6.8
No. of Units	18	16		Peak Hour Factor	10.2
Pop. Density	2.95	2.95	p/unit		
Demand	300	300	L/p/d	Q = PxDxPF, where:	
Population	54	48	people	P = Population	
Units per Service	1	1		D = Per Capita Demand	
				PF = Peaking Factor	

Proposed Demand	Per Service		Total	
	L/day	L/s	L/day	L/s
Average Daily	885	0.01	16,200	0.19
Maximum Day	6,018	0.07	110,160	1.28
Peak Hour	9,027	0.10	165,240	1.91
Future Demand	L/day	L/s	L/day	L/s
Average Daily	885	0.01	14,400	0.17
Maximum Day	6,018	0.07	97,920	1.13
Peak Hour	9,027	0.10	146,880	1.70

WATERMAIN SERVICE SIZING AND FRICTION LOSS

Service Type	D (mm)	Q (L/s)	A (m^2)	V (m/s)	C	L (m)	Friction Loss (m)	psi	kPa
Service (M. Day)	25	0.07	0.0005	0.14	100	2.5	0.007	0.010	0.07
Service (Peak)	25	0.10	0.0005	0.21	100	2.5	0.014	0.021	0.15
Proposed W/M	50	1.91	0.0020	0.96	100	60.0	2.549	3.626	25.01
Future W/M	50	1.70	0.0020	0.85	100	65.0	2.221	3.158	21.78
Connection	50	3.61	0.0020	1.81	100	15.0	2.069	2.943	20.30

D - Pipe Diameter
Q - Demand Flow
A - Pipe Flow Area
V - Flow Velocity
C - Pipe Coefficient
L - Pipe Length

Notes: - Peak flow utilized for dedicated domestic watermain while maximum day and fire flow are applied for combined watermains.

- $A = (\pi D^2)/4$; where D is converted to m.
- $V = Q/A$; where Q is converted to m^3/s.
- $h_f = L \times \left(\frac{Q}{0.278 \times C \times D^{2.63}} \right)^{1/0.54}$; where Q is converted to m^3/s.

TATHAM ENGINEERING

PROJECT	116 Bond Street	FILE	323899
		DATE	11-Jun-2025
SUBJECT	Water Supply Calculations MECP Criteria - Future	NAME	JN CHECK
		PAGE	6 OF 6

STATIC HEAD LOSS

	Road C/L Elev (m)	Depth to W/M (m)	Finished Floor (m)	Building Height (m)	Total Head Loss		
					(m)	(psi)	(kPa)
Static Head Loss	222.50	1.80	223.12	8.70	11.12	15.813	109.03

TOTAL LOSSES

Service Type	Static Pressure		Static Loss	W/M Loss	Service Loss	Total Loss	Service Pressure	
	(psi)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(kPa)	(psi)
Proposed W/M	80	551.59	109.03	45.31	0.15	154.49	397.10	57.6
Future W/M	80	551.59	109.03	42.08	0.15	151.26	400.33	58.07

SUMMARY

Under typical residential peak demand, there will be sufficient pressure to service the highest floor of the development with residual pressure of 57.6 psi in the ceiling space of the uppermost floor of the proposed building.

TATHAM ENGINEERING	Project: 116 Bond Street	Date:	June 11, 2025
	File No.: 323899	Designed:	JN
	Subject: Fire Flow Demand - Block A - Ten Units No Fire Separations	Checked	
	Revisions:		

Fire Underwriters Survey Fire Flow Calculations

Calculation Based on 2020 Publication "Water Supply for Public Fire Protection" by Fire Underwriters Survey (FUS).

Step	Description	Term	Options	Multiplier Associated with Option	Choose	Value used	Unit	Total Fire Flow (L/min)	
		Framing Material							
1	Frame Use for Construction of Unit	Coefficient related to type of construction (C)	Type V - Wood Frame Construction	1.5	Ordinary Construction	**1.0**	%	N/A	
			Type IVA - Mass Timber Construction	0.8					
			Type IVB - Mass Timber Construction	0.9					
			Type IVC - Mass Timber Construction	1.0					
			Type IVD - Mass Timber Construction	1.5					
			Ordinary Construction	1.0					
			Non-combustible Construction	0.8					
			Fire Resistive Construction	0.6					
2	Total Effective Area	Largest Floor Area				**291**	m^2	N/A	
		Percentage of the Total Area of the Other Floors for Coefficient 1.0 to 1.5			**100%**	**454**			
		Percentage of the Total Area of the Other Floors for Coefficient below 1.0:							
		a) If any vertical opening in the building are unprotected, consider the two largest adjoining floor areas plus 50% of all floors immediately above them up to a maximum of eight, **or**			**50%**				
		b) If all vertical openings and exterior vertical communications are properly protected in accordance with the National Building Code, consider only the single largest Floor Area plus 25% of each of the two immediately adjoining floors.			**25%**				
		Total Effective Area				**745**			
3	Required Fire Flow without Reductions or Increases	Required Fire Flows without Reductions or Increases per FUS): (RFF= 220 x C x $A^{0.5}$)							6,000
4	Factors Affecting Burning	**Reductions / Increases Due to Factors Affecting Burning**							
4.1	Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	%	(900)	5,100
			Limited combustible	-0.15					
			Combustible	0.00					
			Free burning	0.15					
			Rapid burning	0.25					
4.2	Reduction Due to Presence of Sprinklers	Sprinkler reduction	For a fully supervised system the conditions a), b) and c) below must be met.			0	%	-	5,100
			a) Automatic sprinkler protection designed and installed in accordance with NFPA 13	-0.3	No				
			b) Water supply is standard for both the system and the Fire Department hose lines	-0.1	No				
			c) Fully supervised system	-0.1	No				
			None	0.0	Yes				
4.3	Separation Distance Between Units (Use 10% for 2 hour Fire Separation between adjacent units)	Exposure distance between units	North Side	10.1 to 20.0 m	0.15	0.55	%	2,805	7,905
			East Side	20.1 to 30.0 m	0.10				
			South Side	3.1 to 10.0 m	0.20				
			West Side	20.1 to 30.0 m	0.10				
4.4	Combustibility of Wood Shingle or Shake Roof Material	Surcharge for potential to spread fire	Non-combustible roofing material	0	Non-combustible roofing material	0	L/min	0	7,905
			Low risk of fire spread	2000					
			Moderate risk of fire spread	3000					
			High risk of fire spread	4000					
		Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:							8,000
5	Required Fire Flow, Duration and Volume	Total Required Fire Flow (above) in L/s:							133
		Required Duration of Fire Flow of 8,000 L/min (hrs):							2
		Required volume for Fire Flow of 8,000 L/min (m^3):							960

TATHAM ENGINEERING	Project: 116 Bond Street	Date:	June 11, 2025
	File No.: 323899	Designed:	JN
	Subject: Fire Flow Demand - Block B-1 - Eight Units No Fire Separations	Checked	
	Revisions:		

Fire Underwriters Survey Fire Flow Calculations

Calculation Based on 2020 Publication "Water Supply for Public Fire Protection" by Fire Underwriters Survey (FUS).

Step	Description	Term	Options	Multiplier Associated with Option	Choose	Value used	Unit	Total Fire Flow (L/min)	
		Framing Material							
1	Frame Use for Construction of Unit	Coefficient related to type of construction (C)	Type V - Wood Frame Construction	1.5	Ordinary Construction	**1.0**	%	N/A	
			Type IVA - Mass Timber Construction	0.8					
			Type IVB - Mass Timber Construction	0.9					
			Type IVC - Mass Timber Construction	1.0					
			Type IVD - Mass Timber Construction	1.5					
			Ordinary Construction	1.0					
			Non-combustible Construction	0.8					
			Fire Resistive Construction	0.6					
2	Total Effective Area	Largest Floor Area				**216**	m^2	N/A	
		Percentage of the Total Area of the Other Floors for Coefficient 1.0 to 1.5			**100%**	**337**			
		Percentage of the Total Area of the Other Floors for Coefficient below 1.0:							
		a) If any vertical opening in the building are unprotected, consider the two largest adjoining floor areas plus 50% of all floors immediately above them up to a maximum of eight, **or**			**50%**				
		b) If all vertical openings and exterior vertical communications are properly protected in accordance with the National Building Code, consider only the single largest Floor Area plus 25% of each of the two immediately adjoining floors.			**25%**				
		Total Effective Area				**553**			
3	Required Fire Flow without Reductions or Increases	Required Fire Flows without Reductions or Increases per FUS): (RFF= 220 x C x $A^{0.5}$)							5,000
4	Factors Affecting Burning	**Reductions / Increases Due to Factors Affecting Burning**							
4.1	Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	%	(750)	4,250
			Limited combustible	-0.15					
			Combustible	0.00					
			Free burning	0.15					
			Rapid burning	0.25					
4.2	Reduction Due to Presence of Sprinklers	Sprinkler reduction	For a fully supervised system the conditions a), b) and c) below must be met.			0	%	-	4,250
			a) Automatic sprinkler protection designed and installed in accordance with NFPA 13	-0.3	No				
			b) Water supply is standard for both the system and the Fire Department hose lines	-0.1	No				
			c) Fully supervised system	-0.1	No				
			None	0.0	Yes				
4.3	Separation Distance Between Units (Use 10% for 2 hour Fire Separation between adjacent units)	Exposure distance between units	North Side	3.1 to 10.0 m	0.20	0.5	%	2,125	6,375
			East Side	20.1 to 30.0 m	0.10				
			South Side	Greater than 30.0 m	0.00				
			West Side	3.1 to 10.0 m	0.20				
4.4	Combustibility of Wood Shingle or Shake Roof Material	Surcharge for potential to spread fire	Non-combustible roofing material	0	Non-combustible roofing material	0	L/min	0	6,375
			Low risk of fire spread	2000					
			Moderate risk of fire spread	3000					
			High risk of fire spread	4000					
		Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:							6,000
5	Required Fire Flow, Duration and Volume	Total Required Fire Flow (above) in L/s:							100
		Required Duration of Fire Flow of 6,000 L/min (hrs):							2
		Required volume for Fire Flow of 6,000 L/min (m^3):							720

Appendix B:
Sanitary Flow Calculations

TATHAM ENGINEERING

Sanitary Sewer Design Sheet

Project Information

116 Bond Street - Existing Condition	323899

Drawing Reference

Prepared By

JN	December 16/24

Reviewed By

Municipality

City of Orillia

Population Density

Capita per Unit	Low	Medium	High
	2.95	2.95	2.95

Infiltration

Infiltration (L/s/ha)	0.1

Manning's Coefficient

Pipe Material	Value
Concrete	0.013
PVC	0.013
Applied	0.013

Flow

Development Type	Average (L/cap/day)	Peaking Factor
Residential	300	Harmon
Development Type	**Average (L/ha/day)**	**Peaking Factor**
Institution	28,000	1.6
Commercial	28,000	1.6
Industrial (High)	-	-
Industrial (Low)	36,000	-

Notes

Engineer Stamp

Version Date:	December 16, 2024
Version Number:	2

Street Name	Area Label/ID	Upstream Maintenance Hole	Downstream Maintenance Hole	Development Type	Population Density	Number of Units	Population (cap)	Accumulated Population (cap)	Peaking Factor	Area (ha)	Cumulative Area (ha)	Average Flow (L/s)			Peak Flow (L/s)			Proposed Sanitary Sewer							
												Development	Infiltration	Total	Development	Infiltration	Total	Sewer Length (m)	Sewer Slope (%)	Actual Sewer Diameter (mm)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Actual Velocity (m/s)	Calculated Sewer Diameter (mm)	Percentage of Full Flow Capacity (%)
EXISTING - Populations inferred from City Design Standards and sewer mapping.																									
Bond Street		EX 168	EX 167	Residential	Medium	54	159.3	159.3	4.18	1.44	1.44	0.55	0.14	0.70	2.31	0.14	2.46	69.8	0.4%	250	0.80	39.45	0.44	88	6.2%
		EX 167	EX 166	Residential	Low	9	26.6	185.9	4.16	0.88	2.32	0.65	0.23	0.88	2.68	0.23	2.92	61.0	0.3%	250	0.62	30.32	0.38	104	9.6%
		EX 166	EX 108	Residential	Low	4	11.8	197.7	4.15	0.56	2.88	0.69	0.29	0.97	2.85	0.29	3.14	71.0	1.4%	250	1.44	70.86	0.72	78	4.4%
Hoover Court		EX 128	EX 127	Residential	Low	5	14.8	14.8	4.40	0.68	0.68	0.05	0.07	0.12	0.23	0.07	0.29	45.1	1.0%	200	1.04	32.80	0.34	34	0.9%
		EX 127	EX 126	Residential	Low	6	17.7	32.5	4.35	0.73	1.41	0.11	0.14	0.25	0.49	0.14	0.63	64.9	1.0%	200	1.04	32.80	0.41	45	1.9%
		EX 126	EX 107	Residential	Low	2	5.9	38.4	4.34	0.19	1.60	0.13	0.16	0.29	0.58	0.16	0.74	69.2	1.0%	200	1.04	32.80	0.43	48	2.2%
High Street		EX 111	EX 110	Residential	Low	2	5.9	5.9	4.43	0.27	0.27	0.02	0.03	0.05	0.09	0.03	0.12	57.0	0.3%	200	0.57	17.96	0.17	30	0.7%
		EX 110	EX 1767	Residential	Medium	9	26.6	32.5	4.35	1.23	1.50	0.11	0.15	0.26	0.49	0.15	0.64	73.5	0.3%	200	0.57	17.96	0.27	57	3.6%
		EX 1767	EX 109	Residential	High	26	76.7	109.2	4.23	0.78	2.28	0.38	0.23	0.61	1.60	0.23	1.83	19.5	0.3%	200	0.57	17.96	0.36	85	10.2%
		EX 109	EX 108	Residential	Low	8	23.6	132.8	4.21	0.60	2.88	0.46	0.29	0.75	1.94	0.29	2.23	89.9	0.3%	200	0.57	17.96	0.37	91	12.4%
		EX 108	EX 107	Residential	Low	16	47.2	377.6	4.03	1.33	7.09	1.31	0.71	2.02	5.29	0.71	6.00	157.9	0.3%	300	0.75	52.97	0.48	132	11.3%
		EX 107	EX 75	Residential	Low	12	35.4	451.4	4.00	1.02	9.71	1.57	0.97	2.54	6.26	0.97	7.23	147.8	0.3%	300	0.75	52.97	0.50	142	13.7%

TATHAM ENGINEERING

Sanitary Sewer Design Sheet

Project Information

116 Bond Street - Proposed Condition	323899

Drawing Reference

Prepared By

JN	December 16/24

Reviewed By

Municipality

City of Orillia

Population Density

Capita per Unit	Low	Medium	High
	2.95	2.95	2.95

Infiltration

Infiltration (L/s/ha)	0.1

Manning's Coefficient

Pipe Material	Value
Concrete	0.013
PVC	0.013
Applied	0.013

Flow

Development Type	Average (L/cap/day)	Peaking Factor
Residential	300	Harmon
Development Type	**Average (L/ha/day)**	**Peaking Factor**
Institution	28,000	1.6
Commercial	28,000	1.6
Industrial (High)	-	-
Industrial (Low)	36,000	-

Version Date: December 16, 2024

Version Number: 2

Notes

Engineer Stamp

Street Name	Area Label/ID	Upstream Maintenance Hole	Downstream Maintenance Hole	Development Type	Population Density	Number of Units	Population (cap)	Accumulated Population (cap)	Peaking Factor	Area (ha)	Cumulative Area (ha)	Average Flow (L/s)			Peak Flow (L/s)			Proposed Sanitary Sewer							
												Development	Infiltration	Total	Development	Infiltration	Total	Sewer Length (m)	Sewer Slope (%)	Actual Sewer Diameter (mm)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Actual Velocity (m/s)	Calculated Sewer Diameter (mm)	Percentage of Full Flow Capacity (%)
PROPOSED - Populations inferred from City Design Standards and sewer mapping.																									
Bond Street	116	P SAN MH 1	P SAN MH 2	Residential	Medium	6	17.7	17.7	4.39	0.08	0.08	0.06	0.01	0.07	0.27	0.01	0.28	14.8	1.0%	200	1.04	32.80	0.33	33	0.8%
		P SAN MH 2	P SAN MH 3	Residential	Medium	12	35.4	53.1	4.31	0.14	0.22	0.18	0.02	0.21	0.79	0.02	0.82	50.0	0.5%	200	0.74	23.19	0.34	57	3.5%
		P SAN MH 3	P SAN MH 4	Residential	Medium	0	0.0	53.1	4.31	0.00	0.22	0.18	0.02	0.21	0.79	0.02	0.82	10.1	0.5%	200	0.74	23.19	0.34	57	3.5%
Bond Street		P 168	P SAN MH 4	Residential	Medium	27	79.7	79.7	4.27	0.53	0.53	0.28	0.05	0.33	1.18	0.05	1.23	14.4	0.4%	250	0.80	39.45	0.36	68	3.1%
		P SAN MH 4	P 167	Residential	Medium	26	76.7	209.5	4.14	0.69	1.44	0.73	0.14	0.87	3.01	0.14	3.16	55.4	0.4%	250	0.77	37.61	0.45	99	8.4%
		P 167	P 166	Residential	Low	9	26.6	236.0	4.12	0.88	2.32	0.82	0.23	1.05	3.38	0.23	3.61	61.0	0.3%	250	0.62	30.32	0.40	112	11.9%
		P 166	P 108	Residential	Low	4	11.8	247.8	4.11	0.56	2.88	0.86	0.29	1.15	3.54	0.29	3.83	71.0	1.4%	250	1.44	70.86	0.75	84	5.4%
Hoover Court		P 128	P 127	Residential	Low	5	14.8	14.8	4.40	0.68	0.68	0.05	0.07	0.12	0.23	0.07	0.29	45.1	1.0%	200	1.04	32.80	0.34	34	0.9%
		P 127	P 126	Residential	Low	6	17.7	32.5	4.35	0.73	1.41	0.11	0.14	0.25	0.49	0.14	0.63	64.9	1.0%	200	1.04	32.80	0.41	45	1.9%
		P 126	P 107	Residential	Low	2	5.9	38.4	4.34	0.19	1.60	0.13	0.16	0.29	0.58	0.16	0.74	69.2	1.0%	200	1.04	32.80	0.43	48	2.2%
High Street		P 111	P 110	Residential	Low	2	5.9	5.9	4.43	0.27	0.27	0.02	0.03	0.05	0.09	0.03	0.12	57.0	0.3%	200	0.57	17.96	0.17	30	0.7%
		P 110	P 1767	Residential	Medium	9	26.6	32.5	4.35	1.23	1.50	0.11	0.15	0.26	0.49	0.15	0.64	73.5	0.3%	200	0.57	17.96	0.27	57	3.6%
		P 1767	P 109	Residential	High	26	76.7	109.2	4.23	0.78	2.28	0.38	0.23	0.61	1.60	0.23	1.83	19.5	0.3%	200	0.57	17.96	0.36	85	10.2%
		P 109	P 108	Residential	Low	8	23.6	132.8	4.21	0.60	2.88	0.46	0.29	0.75	1.94	0.29	2.23	89.9	0.3%	200	0.57	17.96	0.37	91	12.4%
		P 108	P 107	Residential	Low	16	47.2	427.8	4.01	1.33	7.09	1.49	0.71	2.19	5.95	0.71	6.66	157.9	0.3%	300	0.75	52.97	0.49	138	12.6%
		P 107	P 75	Residential	Low	12	35.4	501.5	3.97	1.02	9.71	1.74	0.97	2.71	6.92	0.97	7.89	147.8	0.3%	300	0.75	52.97	0.52	147	14.9%

TATHAM ENGINEERING

Sanitary Sewer Design Sheet

Project Information

116 & 120 Bond Street - Future Condition	323899

Drawing Reference

Prepared By

JN	December 16/24

Reviewed By

Municipality

City of Orillia

Population Density

Capita per Unit	Low	Medium	High
	2.95	2.95	2.95

Infiltration

Infiltration (L/s/ha)	0.1

Manning's Coefficient

Pipe Material	Value
Concrete	0.013
PVC	0.013
Applied	0.013

Flow

Development Type	Average (L/cap/day)	Peaking Factor
Residential	300	Harmon
Development Type	**Average (L/ha/day)**	**Peaking Factor**
Institution	28,000	1.6
Commercial	28,000	1.6
Industrial (High)	-	-
Industrial (Low)	36,000	-

Version Date: December 16, 2024

Version Number: 2

Notes

Engineer Stamp

Street Name	Area Label/ID	Upstream Maintenance Hole	Downstream Maintenance Hole	Development Type	Population Density	Number of Units	Population (cap)	Accumulated Population (cap)	Peaking Factor	Area (ha)	Cumulative Area (ha)	Average Flow (L/s)			Peak Flow (L/s)			Proposed Sanitary Sewer							
												Development	Infiltration	Total	Development	Infiltration	Total	Sewer Length (m)	Sewer Slope (%)	Actual Sewer Diameter (mm)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Actual Velocity (m/s)	Calculated Sewer Diameter (mm)	Percentage of Full Flow Capacity (%)
FUTURE - Populations inferred from City Design Standards and sewer mapping.																									
Bond Street	116	P SAN MH 1	P SAN MH 2	Residential	Medium	6	17.7	17.7	4.39	0.08	0.08	0.06	0.01	0.07	0.27	0.01	0.28	14.8	1.0%	200	1.04	32.80	0.33	33	0.8%
		P SAN MH 2	P SAN MH 3	Residential	Medium	12	35.4	53.1	4.31	0.14	0.22	0.18	0.02	0.21	0.79	0.02	0.82	50.0	0.5%	200	0.74	23.19	0.34	57	3.5%
	120	F SAN MH 1	F SAN MH 2	Residential	Medium	6	17.7	17.7	4.39	0.06	0.06	0.06	0.01	0.07	0.27	0.01	0.28	17.5	1.0%	200	1.04	32.80	0.33	33	0.8%
		F SAN MH 2	F SAN MH 3	Residential	Medium	10	29.5	47.2	4.32	0.09	0.15	0.16	0.02	0.18	0.71	0.02	0.72	25.5	0.5%	200	0.74	23.19	0.33	54	3.1%
		F SAN MH 3	P SAN MH 3	Residential	Medium	0	0.0	47.2	4.32	0.00	0.15	0.16	0.02	0.18	0.71	0.02	0.72	14.0	0.5%	200	0.74	23.19	0.33	54	3.1%
		P SAN MH 3	P SAN MH 4	Residential	Medium	0	0.0	100.3	4.24	0.00	0.37	0.35	0.04	0.39	1.48	0.04	1.51	10.1	0.8%	200	0.93	29.34	0.48	66	5.2%
Bond Street		P 168	P SAN MH 4	Residential	Medium	27	79.7	79.7	4.27	0.53	0.53	0.28	0.05	0.33	1.18	0.05	1.23	14.4	0.4%	250	0.80	39.45	0.36	68	3.1%
		P SAN MH 4	P 167	Residential	Medium	25	73.8	253.7	4.11	0.69	1.59	0.88	0.16	1.04	3.62	0.16	3.78	55.4	0.4%	250	0.77	37.61	0.47	106	10.0%
		P 167	P 166	Residential	Low	9	26.6	280.3	4.09	0.88	2.47	0.97	0.25	1.22	3.98	0.25	4.23	61.0	0.3%	250	0.62	30.32	0.42	119	13.9%
		P 166	P 108	Residential	Low	4	11.8	292.1	4.08	0.56	3.03	1.01	0.30	1.32	4.14	0.30	4.44	71.0	1.4%	250	1.44	70.86	0.79	88	6.3%
Hoover Court		P 128	P 127	Residential	Low	5	14.8	14.8	4.40	0.68	0.68	0.05	0.07	0.12	0.23	0.07	0.29	45.1	1.0%	200	1.04	32.80	0.34	34	0.9%
		P 127	P 126	Residential	Low	6	17.7	32.5	4.35	0.73	1.41	0.11	0.14	0.25	0.49	0.14	0.63	64.9	1.0%	200	1.04	32.80	0.41	45	1.9%
		P 126	P 107	Residential	Low	2	5.9	38.4	4.34	0.19	1.60	0.13	0.16	0.29	0.58	0.16	0.74	69.2	1.0%	200	1.04	32.80	0.43	48	2.2%

TATHAM ENGINEERING

Sanitary Sewer Design Sheet

Project Information

116 & 120 Bond Street - Future Condition	323899

Drawing Reference

Prepared By

JN	December 16/24

Reviewed By

Municipality

City of Orillia

Population Density

Capita per Unit	Low	Medium	High
	2.95	2.95	2.95

Infiltration

Infiltration (L/s/ha)	0.1

Manning's Coefficient

Pipe Material	Value
Concrete	0.013
PVC	0.013
Applied	0.013

Flow

Development Type	Average (L/cap/day)	Peaking Factor
Residential	300	Harmon
Development Type	**Average (L/ha/day)**	**Peaking Factor**
Institution	28,000	1.6
Commercial	28,000	1.6
Industrial (High)	-	-
Industrial (Low)	36,000	-

Version Date: December 16, 2024

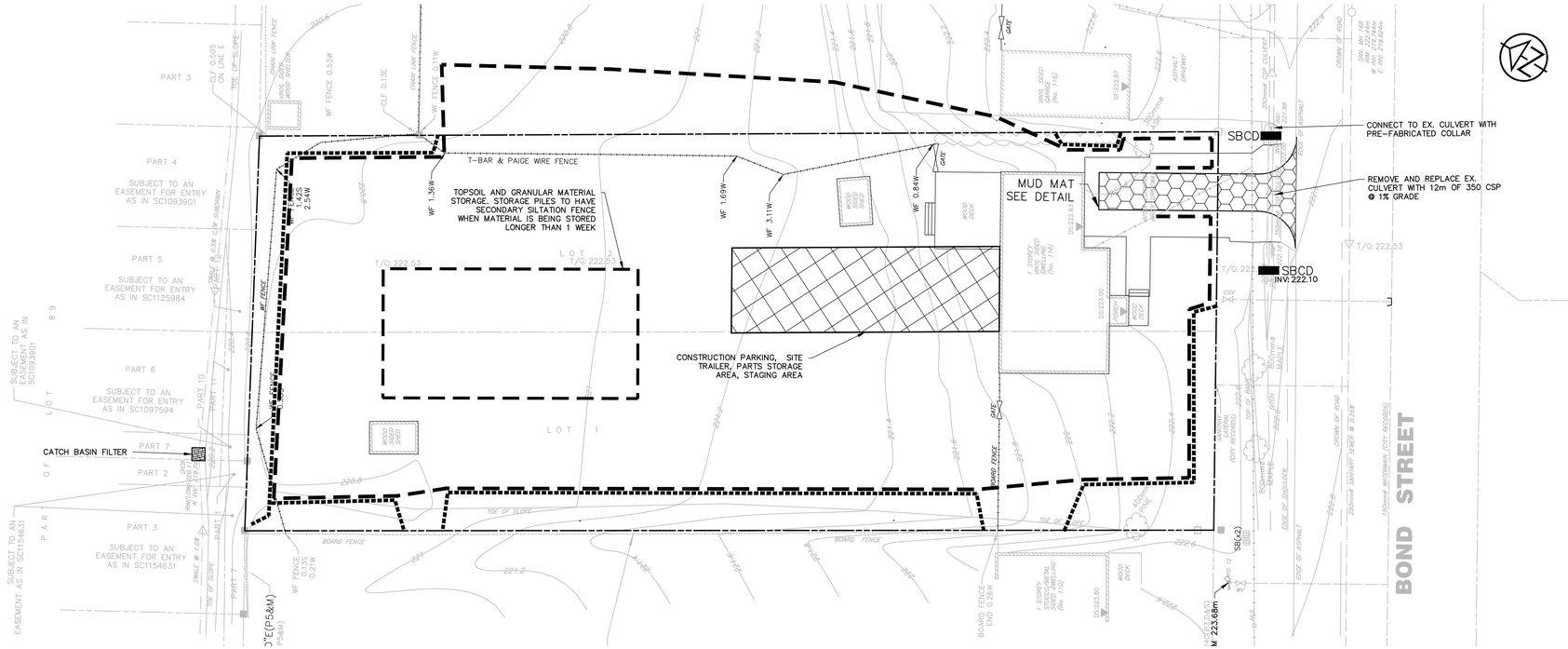
Version Number: 2

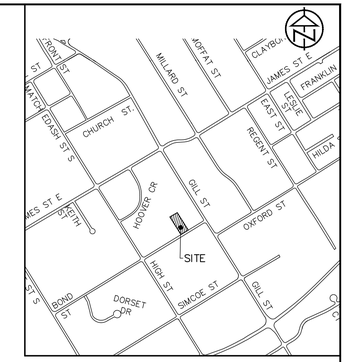
Notes

Engineer Stamp

Street Name	Area Label/ID	Upstream Maintenance Hole	Downstream Maintenance Hole	Development Type	Population Density	Number of Units	Population (cap)	Accumulated Population (cap)	Peaking Factor	Area (ha)	Cumulative Area (ha)	Average Flow (L/s)			Peak Flow (L/s)			Proposed Sanitary Sewer							
												Development	Infiltration	Total	Development	Infiltration	Total	Sewer Length (m)	Sewer Slope (%)	Actual Sewer Diameter (mm)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Actual Velocity (m/s)	Calculated Sewer Diameter (mm)	Percentage of Full Flow Capacity (%)
High Street		P 111	P 110	Residential	Low	2	5.9	5.9	4.43	0.27	0.27	0.02	0.03	0.05	0.09	0.03	0.12	57.0	0.3%	200	0.57	17.96	0.17	30	0.7%
		P 110	P 1767	Residential	Medium	9	26.6	32.5	4.35	1.23	1.50	0.11	0.15	0.26	0.49	0.15	0.64	73.5	0.3%	200	0.57	17.96	0.27	57	3.6%
		P 1767	P 109	Residential	High	26	76.7	109.2	4.23	0.78	2.28	0.38	0.23	0.61	1.60	0.23	1.83	19.5	0.3%	200	0.57	17.96	0.36	85	10.2%
		P 109	P 108	Residential	Low	8	23.6	132.8	4.21	0.60	2.88	0.46	0.29	0.75	1.94	0.29	2.23	89.9	0.3%	200	0.57	17.96	0.37	91	12.4%
		P 108	P 107	Residential	Low	16	47.2	472.0	3.99	1.33	7.24	1.64	0.72	2.36	6.53	0.72	7.26	157.9	0.3%	300	0.75	52.97	0.50	142	13.7%
		P 107	P 75	Residential	Low	12	35.4	545.8	3.95	1.02	9.86	1.89	0.99	2.88	7.49	0.99	8.48	147.8	0.3%	300	0.75	52.97	0.53	151	16.0%

Appendix C:
Design Drawings

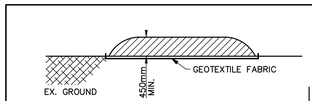




KEY PLAN
N.T.S.

LEGEND

- SBCD — STRAW BALE CHECK DAM PER OPSD 219.180
- SILT FENCE PER OPSD 219.131
- TREE PROTECTION FENCE
- PROPERTY LINE
- EXISTING DITCH
- EXISTING BELL LINE
- EXISTING HYDRO LINE
- EXISTING GAS LINE
- EXISTING HYDRO POLE/LIGHT STANDARD
- EXISTING HYDRO POLE
- EXISTING BENCH MARK
- STONE MUD MAT
- CATCH BASIN FILTER



STONE SIZE – THE STONE PAD SHALL BE A MIN. 450mm THICK. USE 50#mm STONE OR RECLAIMED CONCRETE EQUIVALENT FOR FIRST 5m FROM ADJACENT ROAD & 150mm# STONE FOR REMAINDER OF STONE PAD.

LENGTH – AS REQUIRED BUT NOT LESS THAN 15m.

WIDTH – 5m MIN. BUT NOT LESS THAN THE WIDTH AT POINTS WHERE INGRESS AND EGRESS OCCURS.

GEOTEXTILE FABRIC (TERRAFIX 270R OR EQUAL) WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING STONE.

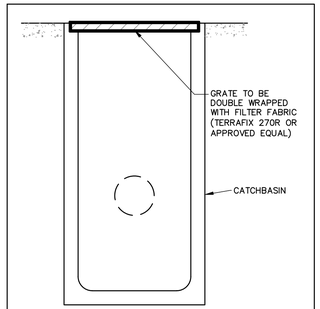
SURFACE WATER – ALL SURFACE WATER FLOWING OR DIRECTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE.

MAINTENANCE – THE CONTRACTOR SHALL MAINTAIN THE ENTRANCE AT ALL TIME, IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAY. THIS MAY REQUIRE PERIODIC DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHT-OF-WAY MUST BE REMOVED IMMEDIATELY BY THE CONTRACTOR. UPON OBSERVATION OF CONTINUOUS MUD TRACKING ONTO ADJACENT STREETS, THE STONE MAT IS TO BE FULLY REPLACED.

WASHING – WHEELS SHALL BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO PUBLIC RIGHT-OF-WAY. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.

INSPECTION AND REQUIRED MAINTENANCE AFTER EACH RAIN SHALL BE PROVIDED BY THE CONTRACTOR.

STONE MUD MAT DETAIL
SCALE: NTS



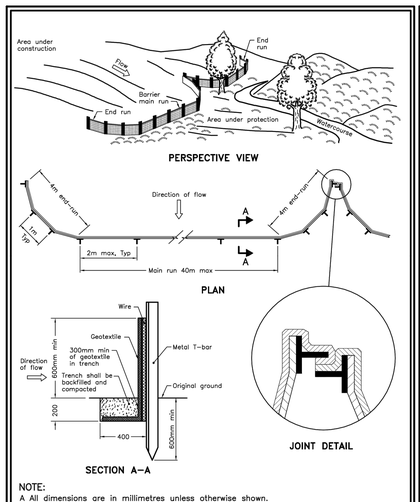
CATCHBASIN FILTRATION DETAIL
SCALE: N.T.S.

SILTATION AND EROSION CONTROL NOTES

1. ALL SILTATION AND EROSION CONTROL MEASURES TO BE IN PLACE PRIOR TO CONSTRUCTION.
2. CONTRACTOR TO INSTALL AND MAINTAIN SILTATION CONTROL DEVICES AT LOCATIONS SHOWN, OR AS DIRECTED BY THE ENGINEER IF ADDITIONAL CONTROLS ARE DEEMED NECESSARY.
3. CONTRACTOR TO ARRANGE PRE-CONSTRUCTION MEETING WITH ENGINEER IMMEDIATELY AFTER PLACING ALL SILTATION CONTROL DEVICES.
4. SILTATION CONTROL DEVICES TO BE INSPECTED BY CONTRACTOR WEEKLY AND AFTER EACH RAINFALL. REPAIRS TO SILTATION CONTROL DEVICES TO BE COMPLETED PROMPTLY WHEN REQUIRED.
5. THE ENGINEER WILL INSPECT THE SEDIMENT AND EROSION CONTROL MEASURES PERIODICALLY, AND AFTER EACH MAJOR STORM EVENT. THE ENGINEER WILL NOTIFY THE CONTRACTOR OF CORRECTIVE ACTIONS REQUIRED AS SOON AS DEFICIENCIES ARE NOTED. THE CONTRACTOR MAINTAINS ULTIMATE RESPONSIBILITY TO ENSURE PROPER SEDIMENT AND EROSION CONTROL MEASURES ARE IMPLEMENTED AND MAINTAINED. ALL DEFICIENCIES AND CORRECTIVE MEASURES WILL BE DOCUMENTED BY THE CONTRACTOR IN A WEEKLY INSPECTION REPORT. A COPY OF THE WEEKLY INSPECTION REPORT WILL BE PROVIDED TO THE ENGINEER.
6. INSTALL SILT SACK IN ALL NEW CATCHBASINS/CATCHBASIN MAINTENANCE HOLES AND EXISTING CATCHBASINS/CATCHBASIN MAINTENANCE HOLES WITHIN THE CONSTRUCTION LIMITS AND/OR AREAS EXPOSED TO SILTATION. SILT SACK – REGULAR FLOW BY TERRAFIX OR APPROVED EQUAL.
7. CONTRACTOR TO REMOVE SILTATION CONTROL DEVICES ONLY AFTER ALL PAVING IS COMPLETED AND VEGETATION HAS STABILIZED.
8. ALL SILT FENCE PER OPSD 219.131 (SEE DETAIL DWG DET-3) .

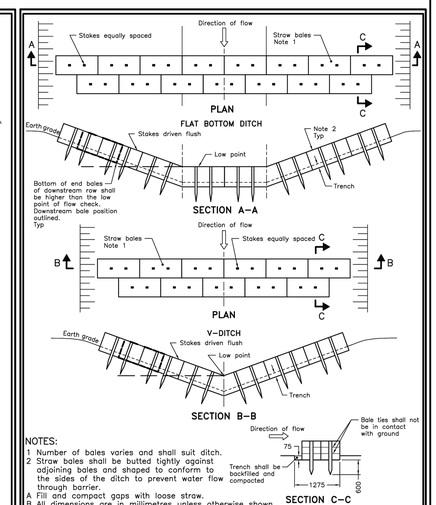
CONSTRUCTION ENTRANCE NOTES

1. CONSTRUCT AND MAINTAIN CONSTRUCTION ENTRANCE AS SHOWN AND IN ACCORDANCE WITH O.P.S.D. 301.020.
2. ALL CONSTRUCTION VEHICLES TO ACCESS THE SITE USING THE DESIGNATED CONSTRUCTION ENTRANCE.
3. CONTRACTOR TO INSTALL AND MAINTAIN STONE MUD MAT AS DETAILED.
4. REMOVE TOPSOIL (WHERE APPLICABLE) BEFORE INSTALLING CONSTRUCTION ENTRANCE.
5. PROMPTLY REMOVE ANY MUD OR DUST WHICH IS TRANSPORTED BEYOND THE STONE MUD MAT TO MAINTAIN EXISTING ROAD DRIVING CONDITION.
6. ENTRANCE RADII TO BE MINIMUM 8.0m.



NOTE:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev 0
HEAVY-DUTY WIRE-BACKED SILT FENCE BARRIER		OPSD 219.131



NOTES:
1 Number of bales varies and shall suit ditch.
2 Straw bales shall be butted tightly against adjoining bales and shaped to conform to the sides of the ditch to prevent water flow through barrier.
A Fill and compact gaps with loose straw.
B All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2021	Rev 3
STRAW BALE FLOW CHECK DAM		OPSD 219.180

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BENCHMARKS

TBM #1 – TOP OF RAISED ARROWHEAD SITUATED ATOP OF FIRE HYRDRANT #12 LOCATED ON THE NORTH SIDE OF BOND STREET, APPROXIMATELY 4m SOUTH WEST OF THE SOUTH WEST CORNER OF LOT 1, REGISTERED PLAN 992, ELEVATION OF 223.68m.

NOTES

LEGAL AND TOPOGRAPHIC INFORMATION ARE TAKEN FROM PLAN OF SURVEY SHOWING TOPOGRAPHIC FEATURES OF No. 116 & 120 BOND STREET, LOTS 1, 2 & 3, REGISTERED PLAN 992, CITY OF ORILLIA, COUNTY OF SIMCOE (PREPARED FOR: 1000444419 ONTARIO INC.) BY DEARDEN AND STANTON LTD. O.L.S. DATED 16/08/23 AND 17/04/24.

SITE PLAN INFORMATION OBTAINED FROM SITE PLAN PREPARED BY API DEVELOPMENT CONSULTANTS INC. AND FABIANI ARCHITECTS LTD. RECEIVED 20/11/2024.

No.	REVISION DESCRIPTION	DATE
1.	1ST SUBMISSION	OCT. 2023
2.	2nd SUBMISSION	JUL. 2025
3.	FINAL – ISSUED FOR ZBA	SEPT. 2025

ENGINEER

LICENSED PROFESSIONAL ENGINEER
J. A. NEMISZ
100181826
Sept. 11, 2025
323899
PROVINCE OF ONTARIO

116 BOND STREET
CITY OF ORILLIA

REMOVALS AND EROSION & SILTATION CONTROL PLAN

TATHAM ENGINEERING

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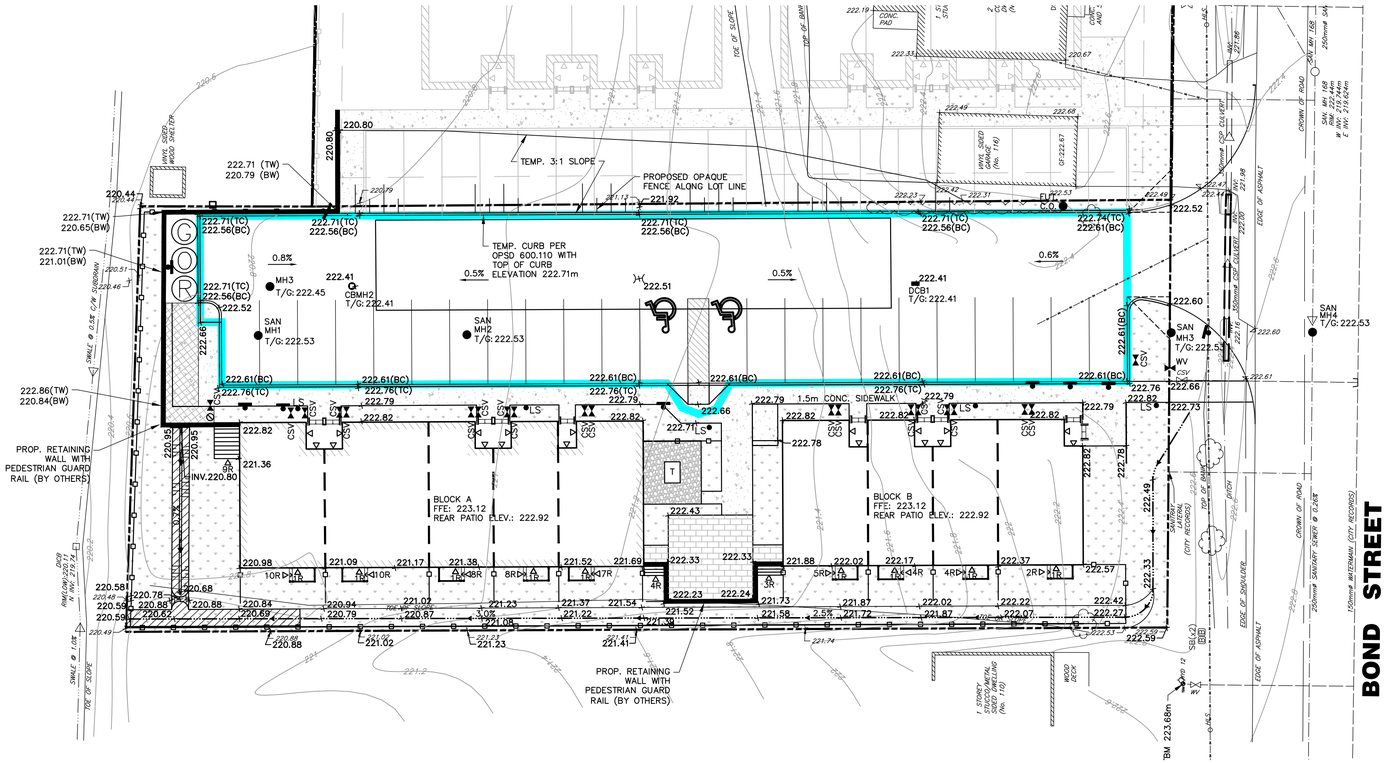
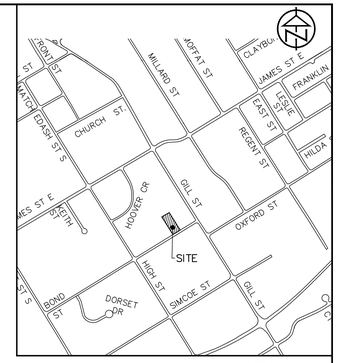
DRAWN: JH	DATE: MAR. 2024	
CHECK: RS	SCALE: 1:200	

Drawing Name: 323899 – ESC01.dwg, Plotted: Sep 11, 2025

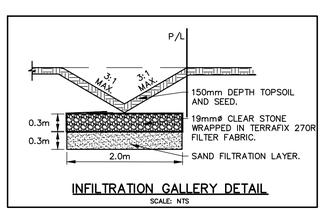




KEY PLAN
N.T.S.

LEGEND

- 221.50 — PROPOSED GROUND ELEVATION
- 221.50 — EXISTING GROUND ELEVATION
- PROPERTY LINE
- EXISTING DITCH
- FUTURE STORM SEWER
- STM MH — FUTURE STORM MH
- CB — FUTURE STORM CB
- 1.9% — PROPOSED OVERLAND FLOW DIRECTION
- STM MH — PROPOSED MH
- CB — PROPOSED CB
- DCB — ENTRANCE/EXIT – VEHICULAR
- CBMH — ENTRANCE/EXIT – PEDESTRIAN
- PROPOSED FENCE
- WV — PROPOSED WATER VALVE
- HYD — PROPOSED HYDRANT & VALVE
- PROPOSED STREET SIGNS
- HYD — EXISTING HYDRANT
- PROPOSED CULVERT
- PROPOSED STORM SEWER INSULATION
- PROPOSED INFILTRATION GALLERY
- PROPOSED SIDEWALKS
- PROPOSED GRASSED AREAS
- PROPOSED GRAVEL AREAS
- LIMIT OF PONDING DURING EMERGENCY OVERFLOW CONVEYANCE



INFILTRATION GALLERY DETAIL
SCALE: NTS

DISCLAIMER AND COPYRIGHT

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BENCHMARKS

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No.	REVISION DESCRIPTION	DATE
1.	1ST SUBMISSION	OCT. 2023
2.	2nd SUBMISSION	JUL. 2025
3.	FINAL – ISSUED FOR ZBA	SEPT. 2025

ENGINEER

LICENSED PROFESSIONAL ENGINEER — J. A. NEMISZ — 100161826 — PROVINCE OF ONTARIO

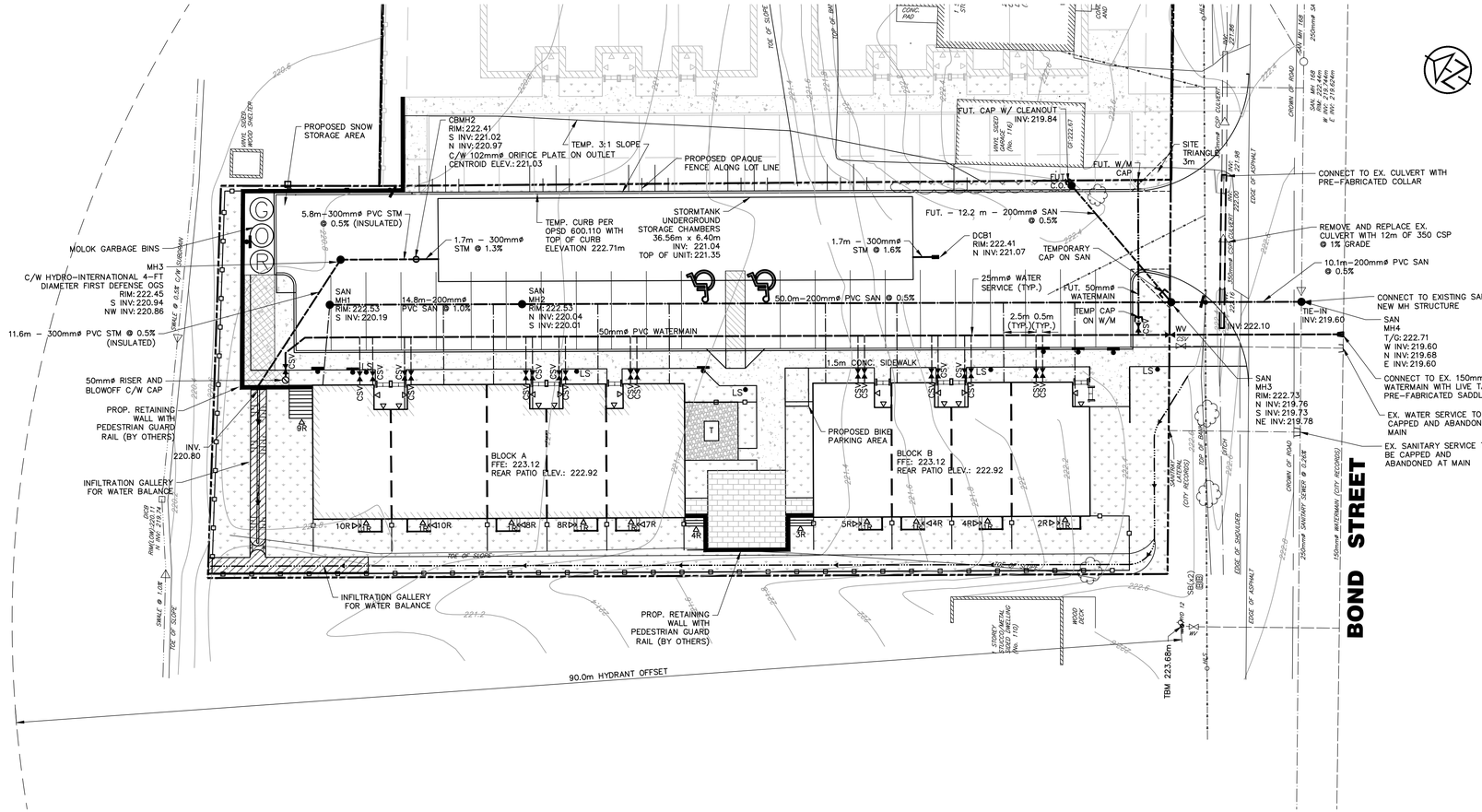
116 BOND STREET
CITY OF ORILLIA

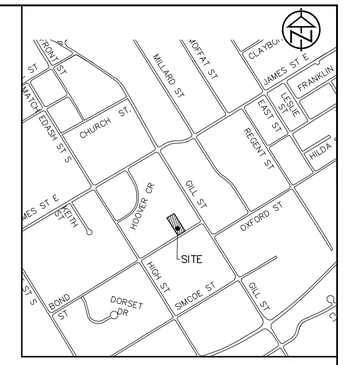
SITE GRADING PLAN

TATHAM ENGINEERING

DESIGN: JN	FILE: 323899	DWG: SG.1
DRAWN: JH	DATE: MAR. 2024	
CHECK: RS	SCALE: 1:200	

Drawing Name: 323899 – LG01.dwg, Plotted: Sep 11, 2025





KEY PLAN
N.T.S.

LEGEND

- PROPERTY LINE
- EXISTING DITCH
- FUTURE STORM SEWER
- STM MH — FUTURE STORM MH
- CP — FUTURE STORM CB
- 200ø SAN — PROPOSED SANITARY SEWER/ SIZE/ DIRECTION OF FLOW
- 450ø STM — PROPOSED STORM SEWER/ SIZE/ DIRECTION OF FLOW
- 150ø WATERMAIN — WATERMAIN/SIZE
- 50ø WATERMAIN — FUTURE WATERMAIN/SIZE
- 200ø SAN — FUTURE SANITARY SEWER/ SIZE/ DIRECTION OF FLOW
- PROPOSED SANITARY SERVICE
- PROPOSED WATER SERVICE
- PROPOSED DITCH
- C.O. — PROPOSED CLEAN OUT
- SAN MH2 — PROPOSED SANITARY MANHOLE/ NUMBER
- STM MH2 — PROPOSED STORM MANHOLE/ NUMBER
- CBMH — PROPOSED CATCH BASIN MANHOLE
- CB — PROPOSED CATCHBASIN
- DCB — PROPOSED DOUBLE CATCHBASIN
- HYD & WV — PROPOSED HYDRANT & WATER VALVE
- WV — PROPOSED WATER VALVE
- CSV — PROPOSED WATER CURB STOP
- PROPOSED STREET SIGNS
- ENTRANCE/EXIT – VEHICULAR
- ENTRANCE/EXIT – PEDESTRIAN
- PROPOSED FENCE
- HYD — EXISTING HYDRANT
- PROPOSED CULVERT
- C2 C3 — ELECTRIC CAR CHARGERS
- PROPOSED TACTILE PLATE
- PROPOSED PRECAST CURB
- PROPOSED STORM SEWER INSULATION
- PROPOSED INFILTRATION GALLERY
- PROPOSED SIDEWALKS
- PROPOSED GRASSED AREAS
- PROPOSED GRAVEL AREAS

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ENGINEER

LICENSED PROFESSIONAL ENGINEER
J. A. NEMISZ
100181826
Sept. 11, 2025
PROVINCE OF ONTARIO

116 BOND STREET
CITY OF ORILLIA

SITE SERVICING PLAN

TATHAM ENGINEERING

DESIGN: JN	FILE: 323899	DWG:	SS.1
DRAWN: JH	DATE: MAR. 2024		
CHECK: RS	SCALE: 1:200		

Drawing Name: 323899 – GS01.dwg, Plotted: Sep 11, 2025

TATHAM ENGINEERING

Enhancing our communities

116 Bond Street

STORMWATER MANAGEMENT REPORT

Sullnet Holdings Inc.

File 323899 | September 11, 2025

Document Control

File:

323899

Date:

September 11, 2025

Prepared by:

Tatham Engineering Limited
10 Diana Drive, Unit 7
Orillia, Ontario L3V 8K8

T 705-325-1753
tathameng.com

Prepared for:

Sullnet Holdings Inc.
16 Hopkins Street
Thorold, Ontario L2V 0E9
sullnetholdings@icloud.com

Authored by:	Reviewed by:
	
Jacob Hofstetter, B.Eng. Engineering Candidate	Joshua Nemisz, B.A.Sc., P.Eng. Senior Engineer, Project Manager

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Issue	Date	Description
1	December 20, 2024	Revised Site Plan
2	July 2, 2025	City Review Comments
3	September 11, 2025	Final – Issued for ZBA

Document Contents

Tables

Figures

Appendices

1 Introduction

Tatham Engineering Limited (Tatham) has been retained by Sullnet Holdings Inc. to prepare a Stormwater Management (SWM) Report in support of a proposed residential townhome development located in the City of Orillia (City). A Functional Service Report (FSR) and Traffic Impact Brief (TIB), prepared by Tatham are submitted under separate cover.

1.1 SITE DESCRIPTION

The development site is approximately 0.22 ha and is located at 116 Bond Street within the City of Orillia. The property is bound by Bond Street to the south, existing single family residential properties to the east and west and an existing townhome development on Taylor Drive to the north. The adjacent 120 Bond Street parcel, approximately 0.15 ha in area, is also owned by the applicant and may be subject to future applications, however, is not proposed for development at this time.

The location of this property is shown on the Site Location Plan (Figure 1) enclosed. The property is in the Lake Simcoe watershed, however, is outside the Lake Simcoe Region Conservation Authority (LSRCA) regulated area.

1.2 OBJECTIVES

The primary objective of this report is to demonstrate the proposed SWM plan will address potential adverse impacts the development may have on the local surface water features and water quality. This will be accomplished by evaluating the impacts of the development on local drainage conditions and, where necessary, provide solutions to mitigate potential adverse impacts.

1.3 PROPOSED DEVELOPMENT

The proposed development includes eighteen residential townhome units accessed via a new private driveway, coinciding with the existing driveway on the east side of the parcel. The proposed units will reside on the west side of the existing parcel with parking provided along the front of the units and additional snow storage areas provided at the northern limit of the parcel. Private water and sewer infrastructure will be extended to the site from existing municipal infrastructure on Bond Street. This report provides background support for Zoning approvals.

1.4 GUIDELINES AND BACKGROUND REPORTS

The report was prepared in accordance with municipal, regional and provincial guidelines on water resources, including the following publications:

- Drainage Management Manual, (Ministry of Transportation, 1995-1997);
- Stormwater Management Planning and Design Manual, (Ministry of the Environment, 2003);
- City of Orillia Engineering Design Criteria, (2012); and
- Design Guidelines for Sewage Works, Storm Sewers and Forcemains for Alteration Authorized Under Environmental Compliance Approvals (Ministry of the Environment, Conservation and Parks, 2022).

2 Existing Drainage Conditions

Information relating to existing topography, ground cover and drainage patterns was obtained through a review of available plans provided by the City of Orillia and base mapping. A detailed topographic survey was completed by Dearden and Stanton Ltd. O.L.S. on August 3, 2023. An additional topographic survey of the 120 Bond Street parcel was completed by Dearden and Stanton Ltd. O.L.S. on March 23, 2024.

The existing development area consists of a single-family residential dwelling fronting Bond Street with driveway access, two shed structures and topsoil and sod landscaping throughout. 120 Bond Street consists of a single-family dwelling with detached garage, driveway access and topsoil and sod landscaping throughout.

The site has relatively gentle topography with an existing high point crossing the front yard. To the north of the high point, grade of approximately 2.5% conveys drainage from the majority of the property northward through the parcel where it is captured by an existing ditch inlet catchbasin (DICB) located in the adjacent townhome development. Private storm sewers then convey drainage to the existing 1,050 mm diameter storm sewer on Gill Street which ultimately discharges to Lake Simcoe.

To the south of the high point, drainage is conveyed to the east via roadside ditches on Bond Street where it is captured by existing DICBs on Gill Street. The existing storm sewer on Gill Street conveys drainage north where it intercepts drainage from the existing townhomes described above.

The adjacent 120 Bond Street parcel has similar topography as 116 Bond Street with an existing high point generally aligning with the front of the garage and midpoint of the existing dwelling splitting drainage to the north and south. Drainage conveyed to the north discharges to the rear yard of 403 Gill Street where it ultimately reaches the same DICB as drainage from the 116 Bond Street property. Drainage conveyed to the south is also captured by the roadside ditch and storm sewer on Gill Street.

External drainage consists of rooftop areas and side yards of the existing residential property to the west and a portion of the rear yards of 407 and 409 Gill Street. The municipal boulevard along the frontage of the 116 Bond Street property is also conveyed through the subject lands. Drainage from all three external drainage areas is conveyed along the flanks of the subject parcel to the existing DICB in the adjacent townhouse development and to municipal infrastructure on Gill Street. There are currently no onsite stormwater management controls on either parcel.

Based on a review of Quaternary Geology Maps (Map P.2697 of the Ontario Geological Survey) and Ontario Soil Maps, the soils in the area are generally comprised of silt and clay and considered to be part of hydrologic soil group (HSG) C. The Preliminary Geotechnical Investigation report prepared by GEMTEC on August 13, 2024 identifies surface layers of silty clay and clayey silt underlain by layers of sand gravel and silt.

2.1 EXISTING HYDROLOGY

The Rational Method has been used to generate existing peak flow rates for the subject properties. The interior of the 116 Bond Street site has been modelled as one catchment, (Catchment 101) while 120 Bond Street is modelled as two catchments (Catchment 102 and 103). Catchment 103 includes a section of the municipal boulevard on Bond Street to assess impacts of the increased imperviousness within the boulevard. The external drainage areas are expressed as three separate catchments (Catchment EXT-1, EXT-2 and EXT-3). The areas are assessed as having two outlets, with Catchment 103 Discharging to Bond Street while all the other catchments discharge to the North as illustrated on the Existing Development Drainage Plan (Drawing DP.1) enclosed as Figure 2.

Catchment 101 is approximately 0.22 ha and is comprised mainly of grassed surfaces and the existing building rooftop of 116 Bond Street. An existing runoff coefficient (RC) of 0.35 is assigned in accordance with City design standards and with reference to Table 1.07 of the Ministry of Transportation Drainage Management Manual.

Catchment 102 is approximately 0.12 ha and is comprised mainly of grassed surfaces, existing rooftops and paved surfaces of 120 Bond Street. An existing RC of 0.37 is assigned to this catchment.

Catchment 103 is approximately 0.06 ha (0.03 ha of which is within the boulevard) and is comprised of grassed surfaces, asphalt driveway aprons and section of the building roof on 120 Bond Street. An existing RC of 0.48 is assigned to this catchment.

External catchment EXT-1 is approximately 0.01 ha and consists of existing grassed areas from the adjacent property to the east and has a corresponding RC of 0.25. This external catchment drains into Catchment 102 near its northern limit.

External catchment EXT-2 is approximately 0.03 ha and consists of existing rooftop and grassed areas from the adjacent property to the west and has a corresponding RC of 0.48. This external catchment contributes to Catchment 101 along the west side yard property limit.

External catchment EXT-3 is approximately 0.01 ha and consists of existing grassed boulevard and thus has an RC of 0.25. This external catchment contributes to catchment 101 along the property frontage and is conveyed along the west property limit.

Peak flows to the existing site outlets for the 1:2-year through 1:100-year return frequency design storms have been generated using the City of Orillia intensity-duration-frequency (IDF) parameters and are summarized in Table 1. Supporting calculations for the runoff coefficients are provided in Appendix A while peak flow calculations are provided in Appendix B.

Table 1: Existing Development - Peak Flow Summary

STORM	PEAK FLOW RATE - NORTH (L/s)	PEAK FLOW RATE - SOUTH (L/s)
1:2-year	23	7
1:5-year	30	9
1:10-year	35	10
1:25-year	46	13
1:50-year	55	16
1:100-year	63	18

3 Stormwater Management Plan

The proposed SWM plan has been developed to address potential adverse impacts the development may have on the local surface water features and surface water quality. This SWM plan is subject to review and approval in support of applications for Zoning By-law amendment and Site Plan Approval. The proposed SWM plan is outlined in the following sections.

Details of site grading and the overall stormwater management plan are provided on the Site Grading Plan (Drawing SG.1), Site Servicing Plan (Drawing SS.1) and Removals and Erosion & Siltation Control Plan (ESC.1) included in Appendix G.

3.1 DESIGN CRITERIA

Based on the background information collected and our analysis of this information, a clear understanding of the potential impacts and required mitigating measures was gained. The following design criteria are to be satisfied in the proposed SWM report:

- Post-development peak flow rates to the existing outlets must be controlled to existing rates to ensure no adverse impacts to downstream landowners. As such, water quantity controls will be provided to attenuate post-development peak flow rates to existing flow rates;
- The design of proposed stormwater quantity and quality controls will need to be capable of servicing the potential future development with minimal modification to the existing site;
- Water quality controls to the existing north outlet are to be provided to satisfy the MECP SWM Planning and Design Manual. "Enhanced" Level 1 water quality treatment corresponding with 80% long-term total suspended solids (TSS) removal is proposed;
- In accordance with policies outlined in the Lake Simcoe Protection Plan (LSPP), any works designated as 'major development' must demonstrate best efforts have been provided to minimize changes in water balance between the pre and post-development condition;
- The LSPP outlines any works designated as 'major development' must demonstrate best efforts have been provided to offset any net increase to phosphorous loading through a phosphorous budget analysis of pre and post-development; and
- A siltation and erosion control plan is required to prevent the migration of sediment off-site during construction activities.

3.2 PROPOSED WATER QUANTITY

As the proposed building and pavement surfaces will increase runoff, on-site stormwater quantity controls are required to reduce post-development peak flow rates to existing rates. The post-

development site is modelled as two drainage catchments (Catchments 201 and 202) alongside drainage Catchment 203 representing the Bond Street boulevard. Drainage Catchments 102 and the external drainage catchments are unchanged. A Post-Development Drainage Plan (Drawing DP.2) is enclosed as Figure 3, and calculations of the post-development runoff coefficients are provided in Appendix A.

3.2.1 Uncontrolled Areas

Catchment 202 consists of the rear yard areas, the side yard area facing Bond Street and the two amenity spaces. Drainage within this catchment is conveyed via a proposed rear yard swale toward the existing drainage outlet at the north limit of the property. The catchment area is 0.06 ha and has a RC of 0.37. All surface drainage within this catchment is conveyed overland via a rear yard swale to the existing DICB on the adjacent townhome property. While design of the swale incorporates measures providing some additional quantity control, these measures are excluded from quantity control analysis.

Catchment 203 consists of the municipal boulevard and a small section of the property frontage where proposed grades establish a new high point in the driveway. Drainage from this catchment is conveyed directly to the roadside ditch on Bond Street. The catchment area is 0.06 ha and has a RC of 0.6.

External drainage from Catchments EXT-2 and EXT-3 will continue to drain through the development via Catchment 202,consistent with existing conditions.

Drainage within Catchments 102, and External Catchment EXT-1 will remain consistent with existing conditions. A temporary 3:1 fill slope is proposed in the rear yard of 120 Bond Street to accommodate the change in site elevation and future development of the adjacent property while maintaining consistency with existing site drainage.

3.2.2 Controlled Areas

Catchment 201 represents the proposed building rooftop, front yard areas, walkways and parking lot within the proposed development. Catchment 201 has an area of approximately 0.16 ha and a RC of 0.91. Drainage within this catchment is conveyed overland to new catchbasin inlet structures within the proposed private driveway and conveyed to the existing DICB on the adjacent townhome development via the proposed quantity and quality controls.

3.2.3 Quantity Controls and Storage

North Outlet

Drainage captured by the new catchbasins in Catchment 201 is conveyed to an underground storage tank beneath the private driveway and parking area via 300 mm diameter storm sewers.

The underground storage units and storm sewers upstream of the orifice plate control are proposed to reduce post-development peak flows to existing rates. The orifice control is proposed in the maintenance hole (MH) immediately downstream of the underground storage tank. 300 mm diameter sewers downstream of the control MH will discharge the controlled flow to the northern amenity area and the DICB in the adjacent townhome development.

The Rational Method was used to compute the uncontrolled post-development peak flows discharging from the proposed development, existing parcel to remain (120 Bond St) and contributing external areas as summarized in Table 2. Results of the hydrologic analysis for the 1:2-year through 1:100-year return frequency design storms and supporting calculations are provided in Appendix B.

Table 2: Post-Development – Uncontrolled Peak Flow Summary

STORM	PEAK FLOW RATE (L/s)		
	Catchment 201 (Uncontrolled)	Catchment 102, 202 & External Areas (Uncontrolled)	Total (Uncontrolled)
1:2-Year	34	12	46 *(23)*
1:5-Year	44	16	60 *(30)*
1:10-Year	52	19	70 *(35)*
1:25-Year	66	24	90 *(46)*
1:50-Year	74	29	103 *(55)*
1:100-Year	81	33	114 *(63)*

Note: Values in brackets represent existing peak flow rates.

Peak flow attenuation of the 1:2-year through 1:100-year return frequency design storms generated from Catchment 201 will be provided through storage of stormwater in the proposed underground storage tanks, sewers and structures upstream of the quantity control orifice in CBMH2. Installation of a 102 mm (4-inch) diameter orifice control plate is proposed on the outlet pipe of CBMH2 immediately downstream of the underground storage. The invert of the orifice control is 220.98 m, 10 mm above the pipe invert of 220.97 m, corresponding with an orifice centroid elevation of 221.03 m.

The underground storage will consist of Brentwood Stormtank ST-12 units configured with footprint of approximately 234 m^2 (219 m^2 of storage accounting for support columns) and providing storage of approximately 66.9 m^3. Additional storage provided in upstream storm

sewers, structures and surface ponding in the private driveway and parking areas, with total combined volume of approximately 150.1 m^3, is available for storage of stormwater within the proposed development to a maximum surface ponding elevation of 222.61 m. The base elevation of the storage units is 221.04 m while the top of the units correspond with an elevation of approximately 221.34 m.

The Modified Rational Method was used to determine storage volumes required to control peak flow rates to pre-development rates. A stage-storage-discharge table was also developed for the storage area to determine the corresponding water surface elevations for the 1:2-year through 1:100-year return frequency design storms, which are summarized in Table 3. Supporting calculations including catchbasin inlet capacities and stage-storage-discharge tables are provided in Appendix C.

Table 3: SWM System Operating Characteristics Summary

STORM	PEAK FLOW RATE (L/s)			STORAGE VOLUME (m^3)	WATER ELEVATION (m)
	Catchment 201 (Controlled)	Catchment 102, 202 & External Areas (Uncontrolled)	Total (Controlled)		
1:2-Year	7	12	19 *(23)*	19	221.12
1:5-Year	8	16	24 *(30)*	27	221.16
1:10-Year	9	19	27 *(35)*	32	221.18
1:25-Year	10	24	34 *(46)*	44	221.23
1:50-Year	11	29	40 *(55)*	50	221.26
1:100-Year	12	33	45 *(63)*	56	221.29

Note: Values in brackets represent existing peak flow rates.

Since the post-development flows are maintained below existing flows, the proposed stormwater system satisfies the quantity control requirements.

Bond Street

The Rational Method was also used to compute the uncontrolled post-development peak flows discharging from the development site towards the Bond Street outlet. Due to the increase in impervious surfaces from the proposed driveway, peak flows from the site towards the Bond Street outlet are increased slightly compared with existing conditions, with the largest increase of 5 L/s occurring during the 1:100-year storm event. Mitigating measures are not proposed as

this represents a minor increase in peak flows that are offset by the reductions achieved at the north outlet. This is also considered a temporary increase as future development of the 120 Bond Street site, discussed further below, will reduce these flows back to pre-development levels.

Results of the hydrologic analysis for the 1:2-year through 1:100-year return frequency design storms and supporting calculations provided in Appendix B. Uncontrolled existing and post-development peak flow rates are summarized in Table 4.

Table 4: Proposed Development – Uncontrolled Peak Flow Summary – Bond Street Outlet

STORM	PEAK FLOW RATE (L/s)	
	Catchment 103 (Uncontrolled)	Catchment 203 (Uncontrolled)
1:2-Year	7	8
1:5-Year	9	11
1:10-Year	10	13
1:25-Year	13	16
1:50-Year	16	20
1:100-Year	18	23

3.2.4 External Drainage

As previously noted, conveyance of surface drainage from external contributing properties will generally be maintained under post-development through the establishment of swales in the rear yard areas and formed at the base of the temporary 3:1 slope shown on the design drawings and noted previously. Existing grades will be matched along the perimeter of the site.

3.2.5 Emergency Flow Conveyance

For storms exceeding the 1:100-year event, or where partial blockage of the quantity control drains should occur, the proposed grading design establishes a high point in the driveway entrance at an elevation of 222.61 m, approximately 0.20 m above the catchbasin inlets in the private driveway. In an emergency flow conveyance scenario, this high point will act as a weir discharging ponding water within the site to the Bond Street roadway without impacting the adjacent properties and minimizing potential for flooding at the design outlet.

The calculated, uncontrolled 1:100-year peak flow of 81 L/s is conveyed across this weir at a depth of approximately 0.04 m. Weir flow calculations are included in Appendix C.

3.3 FUTURE STORMWATER MANAGEMENT

The future development concept on 120 Bond Street is anticipated to generally mirror the proposed 116 Bond Street development. The future development is expected to similarly convey surface drainage from its asphalt, rooftop, walkway and front yard areas to the proposed stormwater quantity and quality controls. Rear yard areas are also expected to be conveyed toward existing outlets without any controls as the landscaped surfaces are considered to be clean in terms of stormwater management.

A Future-Development Drainage Plan (Drawing DP.3) is enclosed as Figure 4.

3.3.1 Future Uncontrolled Areas

Catchment 302 consists of the future rear yard areas and landscaped areas between the future units and along the northern property line. Future rear yard swales are anticipated to convey this rear yard drainage to the existing outlet along the northern property boundary. The catchment area is 0.04 ha and has a RC of 0.25.

Catchment 303 consists of the future rear yard areas continuing to be conveyed toward Bond Street in the future concept via rear yard swales alongside the side yard and Bond Street boulevard. The catchment area is 0.05 ha and has a RC of 0.53.

External drainage from Catchment EXT-1 will continue to be conveyed to the north outlet via Catchment 302 which is consistent with existing conditions.

3.3.2 Future Controlled Areas

Catchment 301 represents the future building rooftop, front yard areas, walkways and parking surfaces as previously indicated. With an area of approximately 0.09 ha, the catchment has a RC of 0.87. Drainage within this catchment would be conveyed overland to the proposed storm sewer, quantity and quality control infrastructure servicing the 116 Bond Street development.

3.3.3 Future Quantity Controls and Storage

North Outlet

Drainage from Catchment 301 will be conveyed overland to the catchbasins and underground storage proposed for the 116 Bond Street development. The proposed infrastructure has been designed with consideration of the future expansion so the increased runoff can be accommodated with minimal changes to the infrastructure and minimal disruption to residents.

The Rational Method was used to compute the uncontrolled post-development peak flows discharging from the combined proposed and future developments and contributing external areas. Results of the hydrologic analysis for the 1:2-year through 1:100-year return frequency design storms and supporting calculations provided in Appendix B and are summarized in Table 5.

Table 5: Future Development – Uncontrolled Peak Flow Summary – North Outlet

STORM	PEAK FLOW RATE (L/s)		
	Catchment 201 & 301 (Uncontrolled)	Catchment 202, 302 & External Areas (Uncontrolled)	Total (Uncontrolled)
1:2-Year	51	7	58 *(23)*
1:5-Year	68	9	77 *(30)*
1:10-Year	79	11	90 *(35)*
1:25-Year	102	14	116 *(46)*
1:50-Year	115	17	132 *(55)*
1:100-Year	127	19	146 *(63)*

Note: Values in brackets represent existing peak flow rates.

Peak flow attenuation of the 1:2-year through 1:100-year return frequency design storms generated from Catchments 201 and 301 will continue to be provided through the proposed underground storage tanks, sewers and structures upstream of the control orifice in CBMH2. The 102 mm (4-inch) diameter orifice control plate is maintained on the outlet pipe of CBMH2 immediately downstream of the underground storage. The underground storage is also to be maintained as currently proposed without any further modifications.

The Modified Rational Method was used to determine storage volumes required to control peak flow rates to pre-development rates. A stage-storage-discharge table was also developed for the storage area to determine the corresponding water surface elevations for the 1:2-year through 1:100-year return frequency design storms which are summarized in Table 6. Supporting calculations and stage-storage-discharge tables are provided in Appendix C.

Table 6: Future SWM System Operating Characteristics Summary

STORM	PEAK FLOW RATE (L/s)			STORAGE VOLUME (m^3)	WATER ELEVATION (m)
	Catchment 201 & 301 (Controlled)	Catchment, 202, 302 & External Areas (Uncontrolled)	Total (Controlled)		
1:2-Year	9	7	16 *(23)*	32	221.18
1:5-Year	10	9	20 *(30)*	45	221.24
1:10-Year	11	11	22 *(35)*	54	221.28
1:25-Year	15	14	29 *(46)*	68	221.50
1:50-Year	22	17	39 *(55)*	69	221.96
1:100-Year	27	19	46 *(63)*	72	222.40

Note: Values in brackets represent existing peak flow rates.

Since the post-development flows are maintained below existing flows, the proposed stormwater system satisfies the quantity control requirements for future expansion of the development. The future development will see the depth of water increase within the drainage infrastructure compared with proposed conditions however, the water surface is still maintained below finished grade within the inlet structures during the 1:100-Year return frequency storm event.

Bond Street

The Rational Method was also used again to assess the uncontrolled existing, post-development and future peak flows discharging from the future development site towards the Bond Street outlet. Results of the hydrologic analysis for the 1:2-year through 1:100-year return frequency design storms and supporting calculations provided in Appendix B. Uncontrolled existing, post-development and future peak flow rates are summarized in Table 7.

Table 7: Future Development – Uncontrolled Peak Flow Summary – Bond Street Outlet

STORM	PEAK FLOW RATE (L/s)		
	Catchment 103 (Uncontrolled)	Catchment 203 (Uncontrolled)	Catchment 303 (Uncontrolled)
1:2-Year	7	8	7
1:5-Year	9	11	9
1:10-Year	10	13	10
1:25-Year	13	16	13
1:50-Year	16	20	16
1:100-Year	18	23	18

Following future development of the 120 Bond Street site, peak flows to the Bond Street outlet are once again reduced to be consistent with existing conditions, mitigating the minor increase observed by development of 116 Bond Street alone.

3.3.4 Future Emergency Overflow

The proposed high point in the driveway on 116 Bond St will continue to act as a weir discharging ponding water under future conditions with minimal impact to surrounding properties. The calculated 1:100-year peak flow of 127 L/s is conveyed across this weir at a depth of approximately 0.06 m. Weir flow calculations are included in Appendix C.

3.4 IMPACT TO DOWNSTREAM PROPERTY OWNERS

Referring to drawings provided by the City for the Taylor Drive development, perimeter swales along the southern property line capture and convey drainage towards the DICB proposed as the outlet from the proposed development. The tributary areas for these existing swales, which serve to concentrate flows on the existing DICB, include the 116 and 120 Bond Street properties. An existing low point near the northwest corner of the 116 Bond Street property also serves to concentrate surface runoff toward the DICB in existing conditions.

The proposed outlet for the 116 Bond Street development, which includes both the controlled and uncontrolled drainage conveyed to the north, is consistent with the existing low point near the northwest corner of the 116 Bond Street property. This configuration therefore, is generally consistent with existing conditions in terms of the quantity and quality of water conveyed to the

DICB with the exception that drainage is concentrated toward the DICB by the proposed swale in lieu of the existing swale.

A portion of the drainage conveyed northward from 120 Bond Street reaches the existing swale via the rear yards of 403 Gill Street. Future drainage from the uncontrolled portion of 120 Bond Street will continue to utilize this existing outlet however, at a reduced rate. A flow spreader may be incorporated into the future 120 Bond Street design to mitigate potential for channelization of flow across the adjacent property.

Under extreme storm events, surface drainage from the proposed development is conveyed to the Bond Street road allowance. This configuration reduces potential for flooding or damage to the adjacent parcels under these extreme conditions compared with existing conditions.

3.5 WATER QUALITY CONTROL

Catchments 202, 302, and the external catchments consist entirely of grassed yard areas. As these catchment areas are proposed to remain pervious, quality controls are not proposed. There will be minor water balancing benefits provided through the infiltration component proposed however, this is not quantified as a quality control benefit.

Catchments 203 and 303 contain impervious surfaces associated with the existing and proposed driveways alongside the grassed yard areas. The majority of the impervious surfaces are contained within the municipal road allowance and quality treatment is presumed to be provided by the existing roadside ditch conveying drainage eastward to Gill Street.

For the remainder of the site draining toward the proposed quantity control features (Catchments 201 and 301), “Enhanced” Level 1 water quality control corresponding to 80% TSS removal is required. Quality control will be provided through a treatment train approach consisting of pre-treatment through an oil grit separator (OGS) and an enhanced grass swale where the quantity controls discharge into the proposed amenity area.

For pre-treatment, a Hydro International First Defense OGS unit (4-Foot Model) is proposed and is ETV certified to provide up to 66.5% TSS removal. Referring to the New Jersey Department of Environmental Protection (NJDEP) certification, the proposed unit is capable of achieving 50% TSS removal for flows up to 1.81 cfs (51.3 L/s). As the OGS is provided downstream of the proposed quantity control orifice, peak flows for storms up to and including the 1:100-year event for both the proposed (12 L/s) and future (27 L/s) scenarios are attenuated to well below the maximum treatment threshold of the unit, allowing it to provide quality treatment of storm events in excess of typical operating capacity.

The controlled flow from a 1:2-year storm was applied in estimating a treatment efficiency for the development site. For the proposed 116 Bond Street development, the OGS is capable of

achieving 50% TSS removal of the 7 L/s design flow. With the future addition of the 120 Bond Street site, the OGS is capable of achieving 47% TSS removal of the 9 L/s design flow.

Information for the proposed OGS unit and treatment efficiency calculations are provided in Appendix D.

Where the proposed SWM outlet discharges to finished grade in the northern amenity area, a 0.3 m wide swale graded at 1.0% is proposed to convey drainage to the north outlet. The swale is designed with sufficient capacity to convey the controlled discharge from the proposed storage in excess of the 1:100-year storm event.

Peak flow from the uncontrolled 25 mm storm event for both the entirety of Catchment 201 and the future combined Catchments 201 and 301, was calculated using Equations 4.5, 4.8 and 4.9 in the MECP Design Guidelines while Stokes' equation is applied to determine the settling distance as drainage is conveyed through the swale. With the grading proposed, the settling distance provided by the approximately 12.0 m long swale exceeds the minimum calculated in both conditions. A 100 mm high berm is proposed at the leeward end of the swale to promote storage, filtration and settlement of particles in surface runoff into the underlying clear stone and sand layers proposed to achieve water balance. Flows in excess of the storage capacity of the swale are conveyed over the berm via weir flow. The weir is configured to convey the controlled discharge from the 1:100-year storm event at depths of less than 100 mm to ensure the runoff is contained within the swale.

Combined in a treatment train configuration, the swale will need to achieve a TSS removal rate of 60 to 62% to ensure 80% TSS removal is provided for the site as a whole. Recognizing the controlled discharge from the future 1:100-year return frequency storm event is similar to the peak runoff from the uncontrolled 25 mm storm applied in designing the swale, the treatment efficiency of the proposed swale is maximized for quality design storms, capable of reaching the 80% TSS removal rate.

Supporting calculations for the settling distance, treatment train, swale conveyance and weir conveyance are provided in Appendix D.

3.6 WATER BUDGET

A water budget for the future condition has been prepared using the Thornthwaite and Mather approach to determine water surplus after evapotranspiration, though it should be noted while the site is within a highly vulnerable aquifer, it is not within a significant groundwater recharge area. Based on the Shanty Bay Climate Normal Data for 2002 – 2021 (Environment Canada), the annual surplus available for infiltration or runoff minus the annual deficit is 378.6 mm.

Infiltration from the annual surplus can be estimated based on infiltration factors from Table 3.1 of the MECP SWM Design Manual. Specific infiltration factors are provided for topography, soils and landcover.

Under existing conditions, the site has an infiltration factor of 0.3. Under post-development conditions, the area of pervious land cover will decrease however, the calculation of the infiltration factor is not impacted and remains at 0.3. As such, the annual infiltration is estimated to decrease by 204 m^3 under the proposed conditions.

The proposed infiltration gallery consists of the proposed 0.3 m wide and 12.0 m long swale conveying drainage from the proposed quantity controls to the site outlet. The shallow grades promote capture of runoff from the most frequent storm events while runoff from less frequent events can continue to the existing north outlet. Underlying the topsoil and sod of the swale is a 1.2 m wide infiltration gallery consisting of a 0.3 m thick layer of 19 mm diameter clear stone with a 0.3 m thick layer of sand to provide filtration prior to infiltrating into native material, where the existing underlying soil allows. To prevent migration of fines into the clear stone component, the clear stone volume is wrapped in a permeable geotextile filter fabric.

The proposed infiltration gallery further promotes infiltration into the native soils, with potential to increase infiltration by 132 m^3 annually in comparison with existing figures. Supporting calculations are provided in Appendix E.

Similar infiltration galleries are proposed in rear yard areas to promote the infiltration of surface drainage where feasible however, as there is limited impervious areas tributary to these features, they have not been quantified in terms of water balance but have been considered in calculation of phosphorous budgets.

3.7 PHOSPHOROUS BUDGET

A phosphorous budget has been completed for the site using loading rates and removal efficiency values from the MECP Phosphorous Budget Tool. Under existing conditions, the combined 116 and 120 Bond Street sites have been modelled as a Low Intensity Development with an associated phosphorous loading rate of 0.13 kg/ha/year. Applied over the proposed and future development areas, including a portion of the road allowance from Catchments 103, 203 and 303, the existing phosphorous load would therefore be 0.05 kg/year.

Under proposed and future development conditions, the site has been modelled as a High Intensity Development – R with an associated phosphorous loading rate of 1.32 kg/ha/year. Applied over the proposed and future development areas, and excluding external areas, the annual phosphorous load would be 0.31 kg/year and 0.53 kg/year respectively, before considering treatment methods.

Best efforts have been provided to mitigate phosphorous loadings from the site including gentle grading, conveying rooftop drainage over pervious areas, installation of an OGS unit and proposed infiltration galleries and enhanced grass swales.

For the proposed 0.16 ha of Catchment 201, expanded to 0.25 ha in the future with the addition of Catchments 301, a treatment train approach was considered. A phosphorous reduction of 25% is first applied for the underground quantity control storage, followed by a 20% reduction for the OGS as per the ETV certification, and finally with a 25% reduction for an enhanced grass swale at the outlet. While some phosphorous reduction via the infiltration gallery is anticipated, it is excluded from this analysis as the gallery is only sized for water balance and not quality control. Combined, these treatment measures achieve a phosphorous reduction efficiency of approximately 55%, reducing phosphorous loads from the proposed site by 0.11 kg/year and the future site by 0.18 kg/year.

A phosphorous removal efficiency of 60% is applicable to the 0.06 ha of Catchment 202 which is conveyed through one of the proposed infiltration galleries. The application of this control reduces phosphorous load from the site by 0.05 kg/year. The same 60% reduction is also applied to Catchment 302 in the future, reducing the phosphorous load by 0.03 kg/year.

When combined, the proposed mitigating measures reduce phosphorous loads from the proposed development site by 0.16 kg/year or approximately 52%, resulting in post-development phosphorous loads of 0.15 kg/year. In the future scenario, the mitigating measures reduce phosphorous loads by 0.26 kg/year or approximately 49%, resulting in post-development phosphorous loads of 0.27 kg/year.

The supporting phosphorous loading calculations are provided in Appendix F.

4 Siltation & Erosion Controls

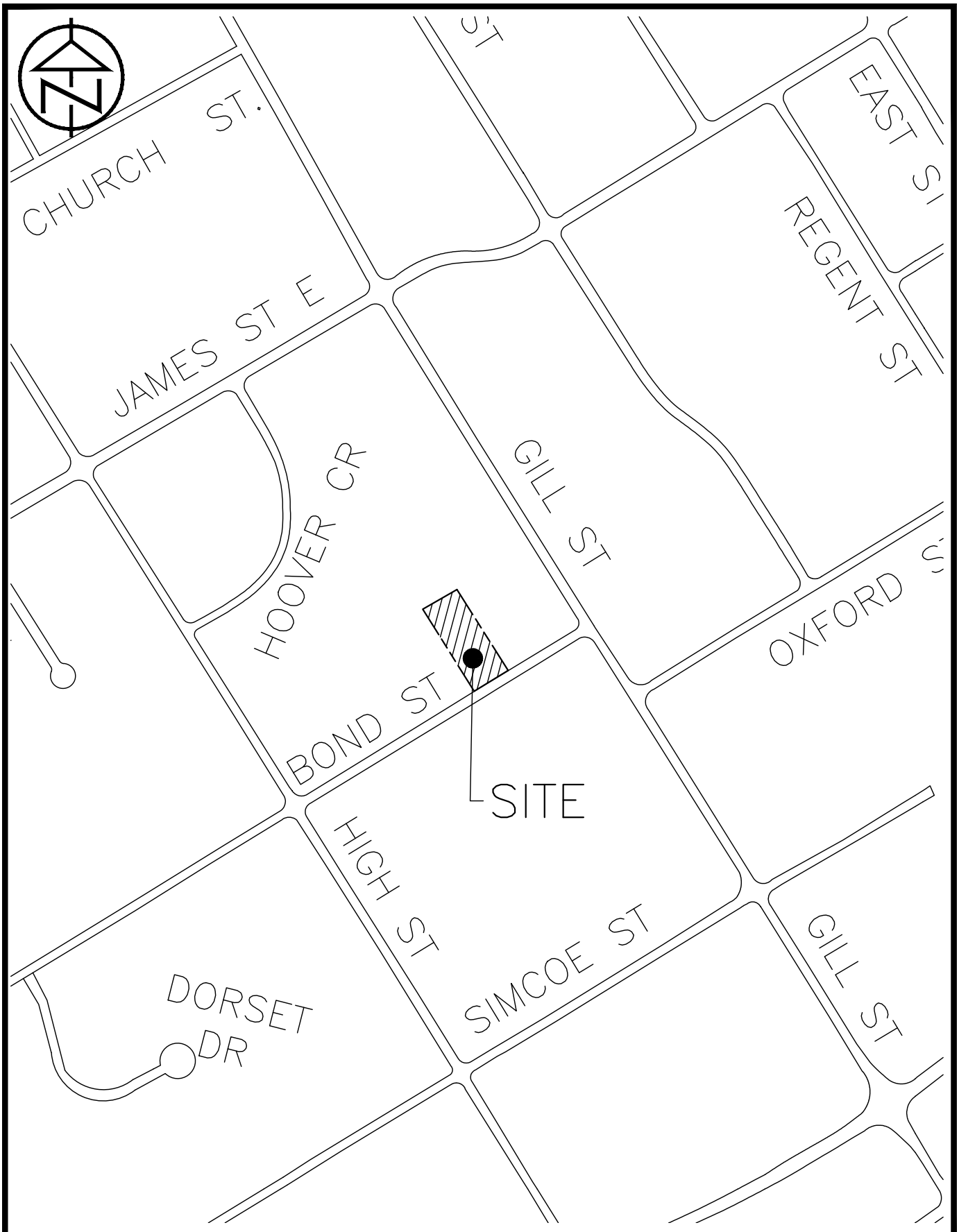
Siltation and erosion controls will be implemented for all construction activities, including removals, earthwork operations, service construction, building construction, paving and grading works. Details of the siltation and erosion controls are shown on the Removals and Erosion & Siltation Control Plan (Drawing ESC.1) in Appendix G. A number of standard practices which will be implemented are summarized as follows:

- The disturbance area and activities will be minimized where possible;
- The smallest possible land area will be exposed for the shortest amount of time;
- Heavy duty silt control fences will be erected coincident with the property boundary prior to commencement of grading operations to control sediment movement;
- A stone mud mat will be implemented at the construction entrance;
- Catchbasins on-site and downstream of the site will have grates wrapped in permeable geotextile to prevent migration of sediment into the storm sewers;
- Straw bale check dams will be installed in existing ditches and drainage features downstream of anticipated disturbance;
- Regular inspection of control measures shall be instituted and repairs made as necessary; and
- Promptly re-vegetating disturbed areas following completion of construction works within the site.

5 Summary

The proposed SWM plan established for the subject property at 116 Bond Street has been designed recognizing the relevant guidelines on water resources and the environment along with site-specific constraints and criteria. This SWM plan also demonstrates the ability to develop the adjacent 120 Bond Street property with minimal modification to the proposed site. The SWM plan ensures the development can be constructed in accordance with all applicable municipal and provincial guidelines while minimizing the impact of the development on the local drainage systems. The SWM design criteria described in Section 3.1 of this report will be achieved and is summarized as follows:

- Post-development and future development peak flow rates will be controlled to pre-development rates for the 2-year through 100-year storm events. Water quantity controls will be provided via controlled discharge from an underground storage area through a 102 mm diameter orifice;
- "Enhanced" Level 1 water quality controls corresponding to 80% TSS removal are provided through inclusion of an OGS unit and enhanced grass swale downstream of the quantity control feature, treating all runoff from nearly all impervious surfaces on the site;
- Best efforts have been provided to mitigate changes in water balance due to the proposed development. These measures include gentle grading, out-letting roof drains onto pervious ground surfaces and infiltration galleries beneath proposed surface drainage swales to promote infiltration into native soil; best efforts have been provided to mitigate phosphorous loadings on-site. The proposed gentle grading, OGS unit, enhanced grass swales and infiltration galleries will provide approximately 52% annual phosphorous reduction for the proposed site and approximately 49% annual phosphorous reduction for the future, expanded site; and
- A series of siltation and erosion controls including heavy duty silt fence, mud mat located at the construction entrance, straw bale check dams and catchbasin filters will be implemented for all construction activities.



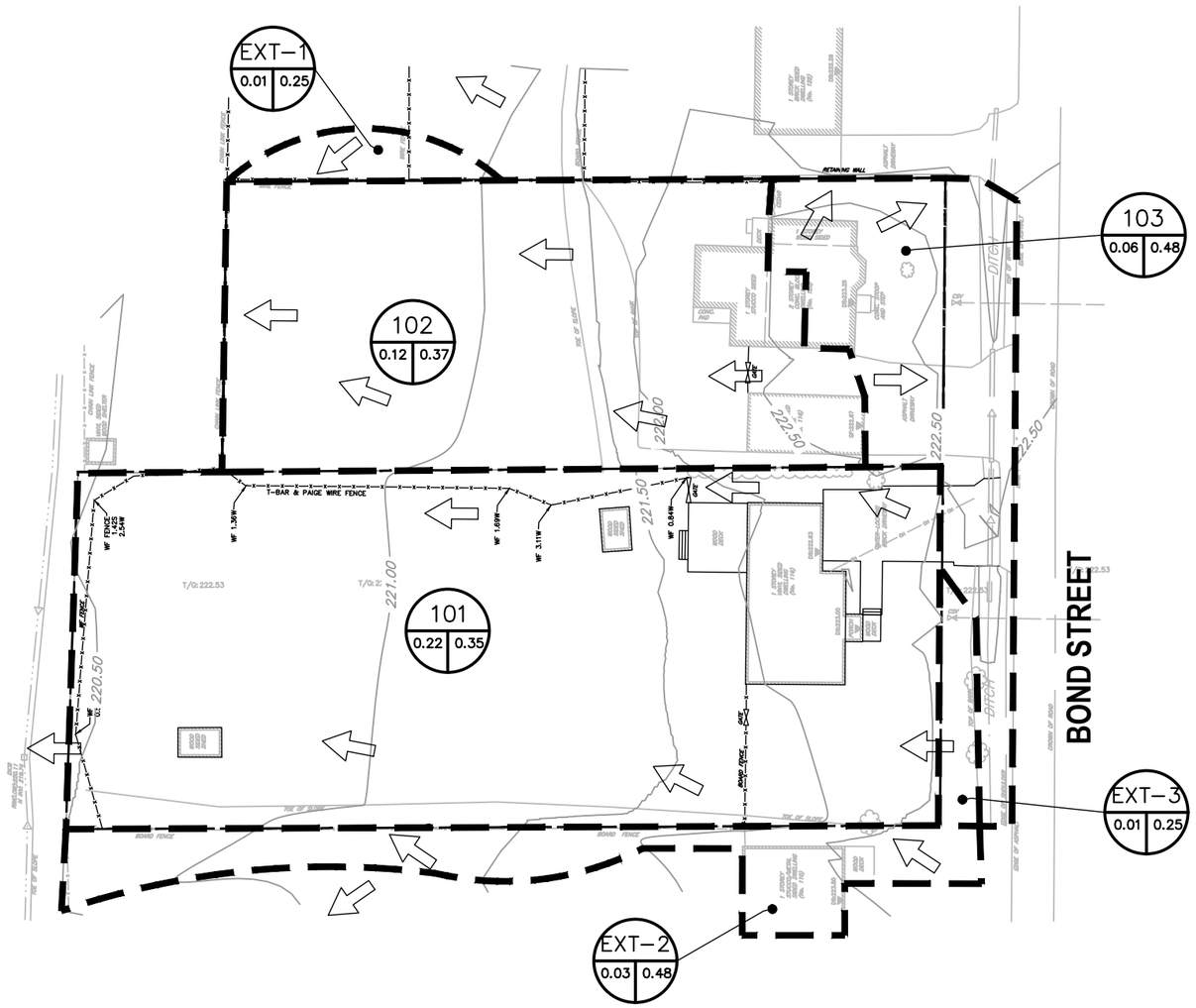
TATHAM ENGINEERING

116 BOND STREET
CITY OF ORILLIA

DWG. No.
FIG. 1

SCALE: NTS	DATE: MAR. 2024	JOB NO. 323899

Drawing Name: 323899 – FIG–1.dwg, Plotted: Dec 20, 2024



LEGEND

- 221.00 — EXISTING CONTOURS
- EXISTING LOT LINES
- PRE–DEVELOPMENT DRAINAGE BOUNDARY
- 101 — CATCHMENT ID
- 0.22 | 0.35 — RUNOFF COEFFICIENT
- CATCHMENT AREA (ha)
- EXISTING CONDITIONS OVERLAND FLOW DIRECTION

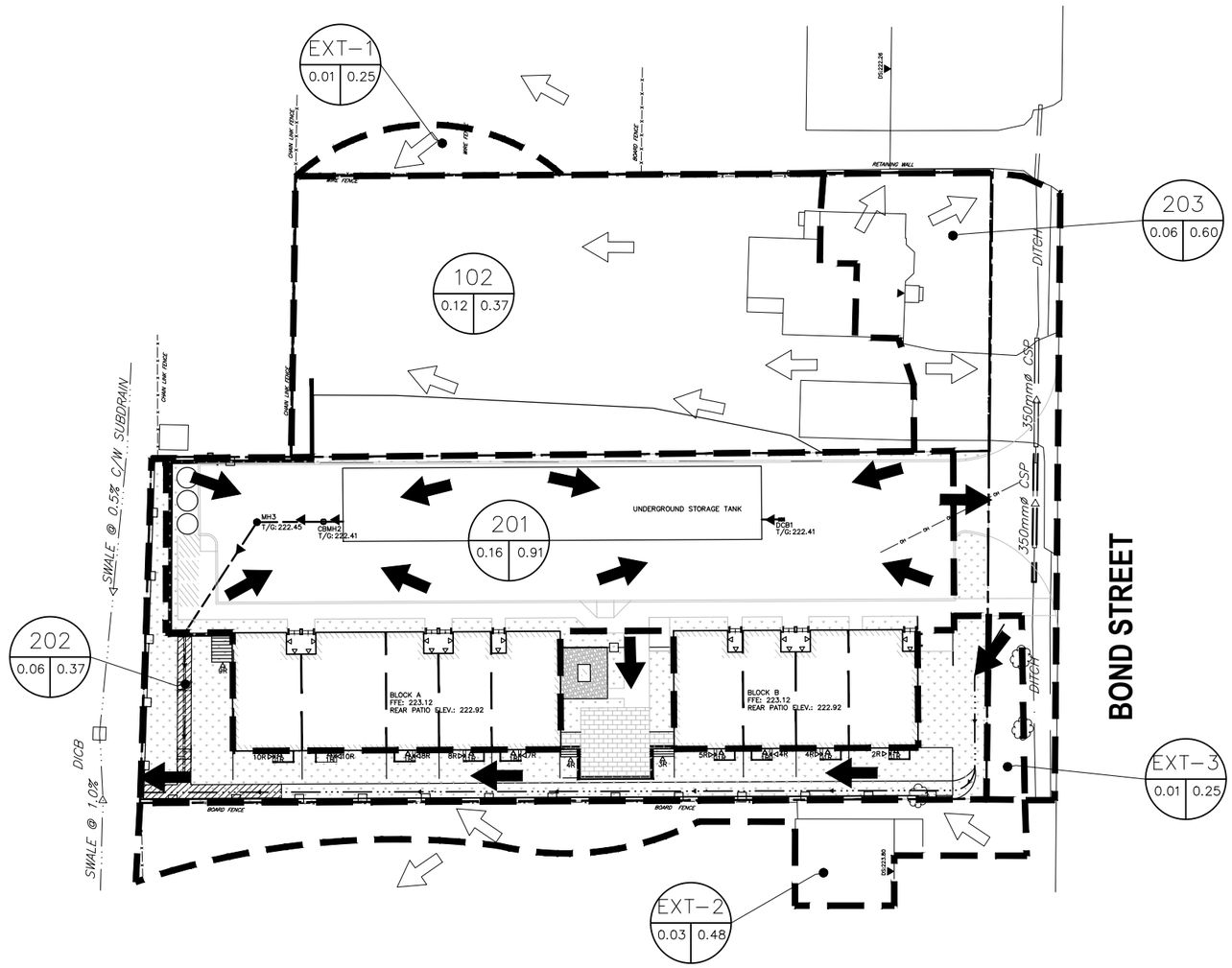
TATHAM ENGINEERING

116 BOND STREET
CITY OF ORILLIA
EXISTING–DEVELOPMENT DRAINAGE PLAN

DWG. No. **DP.1**

SCALE: 1:500 | DRAWN: WL/JH | DATE: MAR. 2024 | JOB NO. 323899

Drawing Name: 323899 – DP01.dwg, Plotted: Jun 26, 2025



LEGEND

- PROPOSED SWALE
- 221.00 EXISTING CONTOURS
- EXISTING LOT LINES
- POST DEVELOPMENT DRAINAGE BOUNDARY
- 201 / 0.16 | 0.91 — CATCHMENT ID; RUNOFF COEFFICIENT; CATCHMENT AREA (ha)
- POST DEVELOPMENT OVERLAND FLOW DIRECTION
- EXISTING CONDITIONS OVERLAND FLOW DIRECTION

TATHAM ENGINEERING

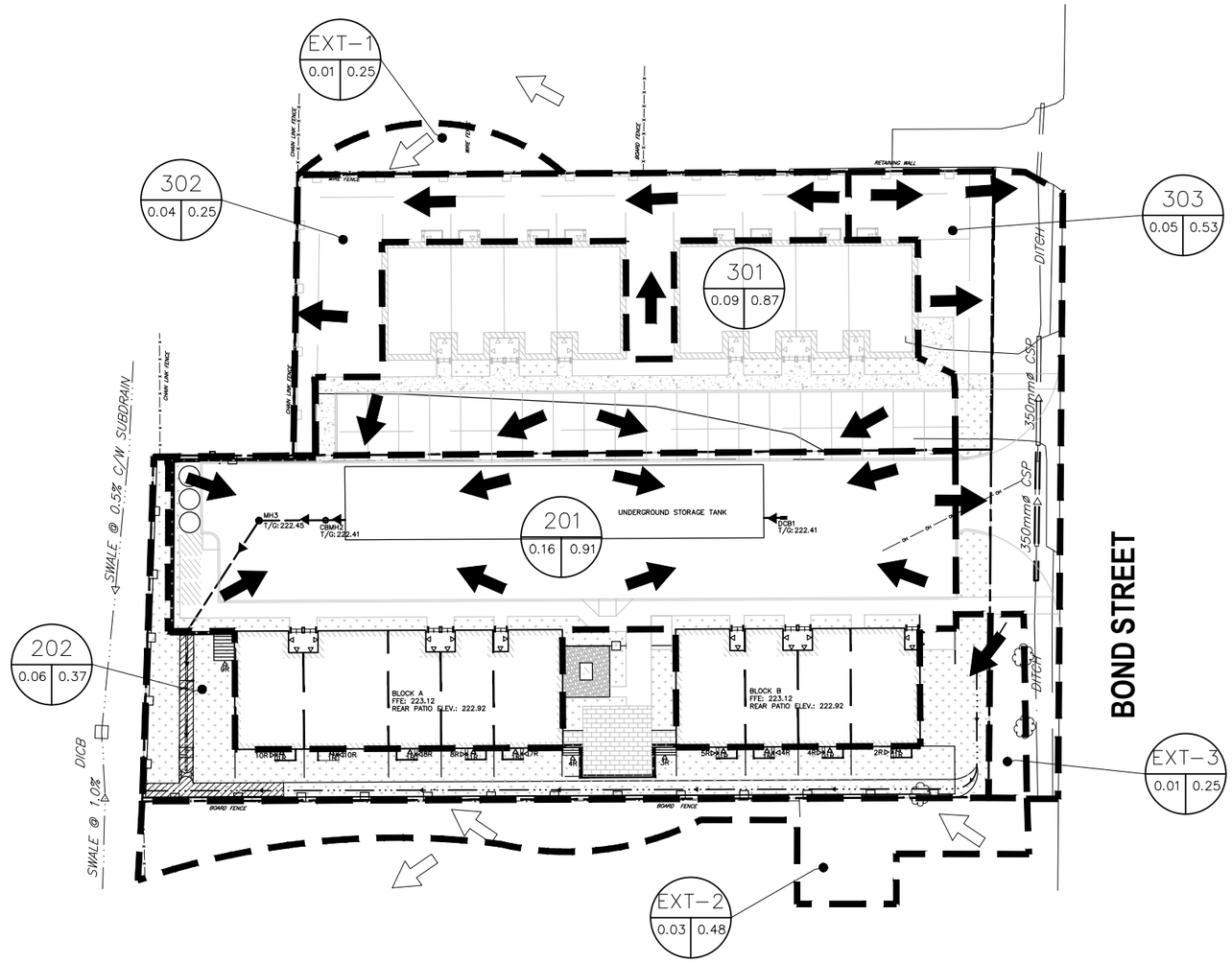
116 BOND STREET
CITY OF ORILLIA

POST-DEVELOPMENT DRAINAGE PLAN

DWG. No. **DP.2**

SCALE: 1:500	DRAWN: WL/JH	DATE: MAR. 2024	JOB NO. 323899

Drawing Name: 323899 - DP01.dwg, Plotted: Jun 26, 2025



LEGEND

- PROPOSED SWALE
- 221.00 EXISTING CONTOURS
- EXISTING LOT LINES
- SUBJECT PROPERTY
- FUTURE DEVELOPMENT DRAINAGE BOUNDARY
- 301 / 0.09 | 0.87 — CATCHMENT ID; RUNOFF COEFFICIENT; CATCHMENT AREA (ha)
- FUTURE DEVELOPMENT OVERLAND FLOW DIRECTION
- EXISTING CONDITIONS OVERLAND FLOW DIRECTION

TATHAM ENGINEERING

116 BOND STREET
CITY OF ORILLIA

FUTURE–DEVELOPMENT DRAINAGE PLAN

DWG. No. **DP.3**

SCALE: 1:500	DRAWN: WL/JH	DATE: MAR. 2024	JOB NO. 323899

Drawing Name: 323899 – DP01.dwg, Plotted: Jun 26, 2025

Appendix A:
Composite Runoff Coefficients

TATHAM ENGINEERING

Impervious Area & Runoff Coefficient Calculations

Project Details		Prepared By	
116/120 Bond Street - External	323899	JN	Jun. 12, 2025

Data Sources	MTO Drainage Management Manual Design Chart 1.07 (1997) & City of Orillia Design Standards (2012)

Watershed: City of Orillia

Impervious Area and Runoff Coefficient (C) for Catchment

Catchment ID		EXT-1			EXT-2			EXT-3					
Catchment Area		0.01			0.03			0.01					
Land Cover Category	**C**	**Area (ha)**	**TIMP (ha)**	**XIMP (ha)**	**Area (ha)**	**TIMP (ha)**	**XIMP (ha)**	**Area (ha)**	**TIMP (ha)**	**XIMP (ha)**	**Area (ha)**	**TIMP (ha)**	**XIMP (ha)**
Single Residential	0.45												
Multi - Residential	0.70												
Apartment	0.75												
Commercial	0.90												
Industrial	0.90												
Right-of-Ways	0.69												
Paved	0.95												
Roof	0.95				0.01	0.01							
Gravel	0.60												
Woodland	0.25												
Pasture/Lawns	0.25	0.01	0.00		0.02	0.00		0.01	0.00				
Meadows	0.25												
Cultivated	0.35												
Waterbody	0.05												
Runoff Coefficient (C)		0.25			0.48			0.25					
Catchment TIMP (%)		7.1%			38.1%			7.1%					
Catchment XIMP (%)		0.0%			0.0%			0.0%					

Notes:

TIMP - Total Impervious Area
XIMP - Directly Connected Impervious Area
TIMP, XIMP & C values averaged/estimated & should be adjusted to reflect site-specific parameters

TATHAM ENGINEERING

Impervious Area & Runoff Coefficient Calculations

Project Details

116/120 Bond Street - Existing	323899

Prepared By

JN	Jun. 12, 2025

Data Sources	MTO Drainage Management Manual Design Chart 1.07 (1997) & City of Orillia Design Standards (2012)

Watershed: City of Orillia

Impervious Area and Runoff Coefficient (C) for Catchment

Catchment ID		**101**			**102**			**103**					
Catchment Area		0.22			0.12			0.06					
Land Cover Category	**C**	**Area (ha)**	**TIMP (ha)**	**XIMP (ha)**	**Area (ha)**	**TIMP (ha)**	**XIMP (ha)**	**Area (ha)**	**TIMP (ha)**	**XIMP (ha)**	**Area (ha)**	**TIMP (ha)**	**XIMP (ha)**
Single Residential	0.45												
Multi - Residential	0.70												
Apartment	0.75												
Commercial	0.90												
Industrial	0.90												
Right-of-Ways	0.69												
Paved	0.95	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01			
Roof	0.95	0.02	0.02		0.01	0.01		0.01	0.01				
Gravel	0.60												
Woodland	0.25												
Pasture/Lawns	0.25	0.19	0.01		0.10	0.01		0.04	0.00				
Meadows	0.25												
Cultivated	0.35												
Waterbody	0.05												
Runoff Coefficient (C)		0.35			0.37			0.48					
Catchment TIMP (%)		19.8%			22.6%			38.1%					
Catchment XIMP (%)		4.3%			7.9%			15.8%					

Notes:

TIMP - Total Impervious Area
XIMP - Directly Connected Impervious Area
TIMP, XIMP & C values averaged/estimated & should be adjusted to reflect site-specific parameters

TATHAM ENGINEERING

Impervious Area & Runoff Coefficient Calculations

Project Details

116/120 Bond Street - Proposed	323899

Prepared By

JN	Jun. 12, 2025

Data Sources	MTO Drainage Management Manual Design Chart 1.07 (1997) & City of Orillia Design Standards (2012)

Watershed: City of Orillia

Impervious Area and Runoff Coefficient (C) for Catchment

Catchment ID		**201**			**202**			**203**					
Catchment Area		0.16			0.06			0.06					
Land Cover Category	**C**	**Area (ha)**	**TIMP (ha)**	**XIMP (ha)**	**Area (ha)**	**TIMP (ha)**	**XIMP (ha)**	**Area (ha)**	**TIMP (ha)**	**XIMP (ha)**	**Area (ha)**	**TIMP (ha)**	**XIMP (ha)**
Single Residential	0.45												
Multi - Residential	0.70												
Apartment	0.75												
Commercial	0.90												
Industrial	0.90												
Right-of-Ways	0.69												
Paved	0.95	0.10	0.10	0.10	0.01	0.01	0.01	0.02	0.02	0.02			
Roof	0.95	0.05	0.05					0.01	0.01				
Gravel	0.60												
Woodland	0.25												
Pasture/Lawns	0.25	0.01	0.00		0.05	0.00		0.03	0.00				
Meadows	0.25												
Cultivated	0.35												
Waterbody	0.05												
Runoff Coefficient (C)		0.91			0.37			0.60					
Catchment TIMP (%)		94.2%			22.6%			53.6%					
Catchment XIMP (%)		59.4%			15.8%			31.7%					

Notes:

TIMP - Total Impervious Area
XIMP - Directly Connected Impervious Area
TIMP, XIMP & C values averaged/estimated & should be adjusted to reflect site-specific parameters

TATHAM ENGINEERING

Impervious Area & Runoff Coefficient Calculations

Project Details

116/120 Bond Street - Future	323899

Prepared By

JN	Jun. 12, 2025

Data Sources	MTO Drainage Management Manual Design Chart 1.07 (1997) & City of Orillia Design Standards (2012)

Watershed: City of Orillia

Impervious Area and Runoff Coefficient (C) for Catchment

Catchment ID		**301**			**302**			**303**					
Catchment Area		0.09			0.04			0.05					
Land Cover Category	**C**	**Area (ha)**	**TIMP (ha)**	**XIMP (ha)**	**Area (ha)**	**TIMP (ha)**	**XIMP (ha)**	**Area (ha)**	**TIMP (ha)**	**XIMP (ha)**	**Area (ha)**	**TIMP (ha)**	**XIMP (ha)**
Single Residential	0.45												
Multi - Residential	0.70												
Apartment	0.75												
Commercial	0.90												
Industrial	0.90												
Right-of-Ways	0.69												
Paved	0.95	0.04	0.04	0.04				0.02	0.02	0.02			
Roof	0.95	0.04	0.04										
Gravel	0.60												
Woodland	0.25												
Pasture/Lawns	0.25	0.01	0.00		0.04	0.00		0.03	0.00				
Meadows	0.25												
Cultivated	0.35												
Waterbody	0.05												
Runoff Coefficient (C)		0.87			0.25			0.53					
Catchment TIMP (%)		89.7%			7.1%			44.3%					
Catchment XIMP (%)		42.2%			0.0%			38.0%					

Notes:

TIMP - Total Impervious Area
XIMP - Directly Connected Impervious Area
TIMP, XIMP & C values averaged/estimated & should be adjusted to reflect site-specific parameters

TATHAM ENGINEERING

Impervious Area & Runoff Coefficient Calculations

Project Details

116/120 Bond Street - Composites	323899

Prepared By

JN	Nov. 27, 2024

Data Sources	MTO Drainage Management Manual Design Chart 1.07 (1997) & City of Orillia Design Standards (2012)

Watershed: City of Orillia

Impervious Area and Runoff Coefficient (C) for Catchment

Catchment ID		101, 102, EXT-1-3			102, 202, EXT-1-3			202, EXT-2 & 3			302 & EXT-1		
Catchment Area		0.39			0.23			0.10			0.05		
Land Cover Category	**C**	**Area (ha)**	**TIMP (ha)**	**XIMP (ha)**	**Area (ha)**	**TIMP (ha)**	**XIMP (ha)**	**Area (ha)**	**TIMP (ha)**	**XIMP (ha)**	**Area (ha)**	**TIMP (ha)**	**XIMP (ha)**
Single Residential	0.45												
Multi - Residential	0.70												
Apartment	0.75												
Commercial	0.90												
Industrial	0.90												
Right-of-Ways	0.69												
Paved	0.95	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01			
Roof	0.95	0.04	0.04		0.02	0.02		0.01	0.01				
Gravel	0.60												
Woodland	0.25												
Pasture/Lawns	0.25	0.33	0.02		0.19	0.01		0.08	0.01		0.05	0.00	
Meadows	0.25												
Cultivated	0.35												
Waterbody	0.05												
Runoff Coefficient (C)		0.36			0.37			0.39			0.25		
Catchment TIMP (%)		21.4%			23.3%			25.7%			7.1%		
Catchment XIMP (%)		4.9%			8.3%			9.5%			0.0%		

Notes:

TIMP - Total Impervious Area
XIMP - Directly Connected Impervious Area
TIMP, XIMP & C values averaged/estimated & should be adjusted to reflect site-specific parameters

TATHAM ENGINEERING

Impervious Area & Runoff Coefficient Calculations

Project Details

116/120 Bond Street - Composites	323899

Prepared By

JN	Nov. 27, 2024

Data Sources	MTO Drainage Management Manual Design Chart 1.07 (1997) & City of Orillia Design Standards (2012)

Watershed: City of Orillia

Impervious Area and Runoff Coefficient (C) for Catchment

Catchment ID		**201 & 301**			**202, 302, EXT-1-3**								
Catchment Area		0.25			0.15								
Land Cover Category	**C**	**Area (ha)**	**TIMP (ha)**	**XIMP (ha)**	**Area (ha)**	**TIMP (ha)**	**XIMP (ha)**	**Area (ha)**	**TIMP (ha)**	**XIMP (ha)**	**Area (ha)**	**TIMP (ha)**	**XIMP (ha)**
Single Residential	0.45												
Multi - Residential	0.70												
Apartment	0.75												
Commercial	0.90												
Industrial	0.90												
Right-of-Ways	0.69												
Paved	0.95	0.14	0.14	0.13	0.01	0.01	0.01						
Roof	0.95	0.09	0.09		0.01	0.01							
Gravel	0.60												
Woodland	0.25												
Pasture/Lawns	0.25	0.02	0.00		0.13	0.01							
Meadows	0.25												
Cultivated	0.35												
Waterbody	0.05												
Runoff Coefficient (C)		0.89			0.34								
Catchment TIMP (%)		92.6%			19.5%								
Catchment XIMP (%)		53.2%			6.3%								

Notes:

TIMP - Total Impervious Area
XIMP - Directly Connected Impervious Area
TIMP, XIMP & C values averaged/estimated & should be adjusted to reflect site-specific parameters

Appendix B: Modified Rational Method Calculations

TATHAM ENGINEERING

PROJECT	116 & 120 Bond Street	FILE	323899
		DATE	Jun. 12, 2025
SUBJECT	Time of Concentration Calculator	NAME	JN
		PAGE	1 OF 3

Minimum Parameters

Minimum T_C (minutes): 10.0

Airport Method Formula

$$t_C = 3.26 \times \frac{(1.1 - C) \times L^{0.5}}{S_W^{0.33}}$$

where C < 0.4

Bransby-Williams Method Formula

$$t_C = \frac{0.057 \times L}{(S_W^{0.2} \times A^{0.1})}$$

where C >= 0.4

External Areas

Catchment EXT-1

Area (A):	0.01	ha	T_C, Airport Method (minutes):	9.16
C:	0.25		T_C, Bransby Williams Method (minutes):	1.11
Length (L):	13.0	m		
Slope (S_W):	1.30	%	**T_C, Governing (minutes):**	**10.00**

Catchment EXT-2

Area (A):	0.03	ha	T_C, Airport Method (minutes):	12.90
C:	0.48		T_C, Bransby Williams Method (minutes):	5.11
Length (L):	76.5	m		
Slope (S_W):	2.60	%	**T_C, Governing (minutes):**	**10.00**

Catchment EXT-3

Area (A):	0.01	ha	T_C, Airport Method (minutes):	8.76
C:	0.25		T_C, Bransby Williams Method (minutes):	0.90
Length (L):	10.0	m		
Slope (S_W):	1.00	%	**T_C, Governing (minutes):**	**10.00**

Pre-Development

Catchment 101

Area (A):	0.22	ha	T_C, Airport Method (minutes):	14.84
C:	0.35		T_C, Bransby Williams Method (minutes):	3.86
Length (L):	71.0	m		
Slope (S_W):	2.70	%	**T_C, Governing (minutes):**	**14.84**

Catchment 102

Area (A):	0.12	ha	T_C, Airport Method (minutes):	11.41
C:	0.37		T_C, Bransby Williams Method (minutes):	2.96
Length (L):	54.5	m		
Slope (S_W):	3.70	%	**T_C, Governing (minutes):**	**11.41**

Catchment 103

Area (A):	0.06	ha	T_C, Airport Method (minutes):	11.63
C:	0.48		T_C, Bransby Williams Method (minutes):	3.52
Length (L):	54.0	m		
Slope (S_W):	2.10	%	**T_C, Governing (minutes):**	**10.00**

TATHAM ENGINEERING

PROJECT	116 & 120 Bond Street	FILE	323899
		DATE	Jun. 12, 2025
SUBJECT	Time of Concentration Calculator	NAME	JN
		PAGE	2 OF 3

Proposed Development

Catchment 201

Area (A):	0.16	ha	T_C, Airport Method (minutes):	3.30
C:	0.91		T_C, Bransby Williams Method (minutes):	2.34
Length (L):	37.0	m		
Slope (S_W):	1.50	%	**T_C, Governing (minutes):**	**10.00**

Catchment 202

Area (A):	0.06	ha	T_C, Airport Method (minutes):	18.16
C:	0.37		T_C, Bransby Williams Method (minutes):	6.18
Length (L):	95.0	m		
Slope (S_W):	2.10	%	**T_C, Governing (minutes):**	**18.16**

Catchment 203

Area (A):	0.06	ha	T_C, Airport Method (minutes):	9.38
C:	0.60		T_C, Bransby Williams Method (minutes):	3.52
Length (L):	54.0	m		
Slope (S_W):	2.10	%	**T_C, Governing (minutes):**	**10.00**

Future Development

Catchment 301

Area (A):	0.09	ha	T_C, Airport Method (minutes):	3.99
C:	0.87		T_C, Bransby Williams Method (minutes):	2.47
Length (L):	37.0	m		
Slope (S_W):	1.50	%	**T_C, Governing (minutes):**	**10.00**

Catchment 302

Area (A):	0.04	ha	T_C, Airport Method (minutes):	14.56
C:	0.25		T_C, Bransby Williams Method (minutes):	3.60
Length (L):	57.0	m		
Slope (S_W):	3.00	%	**T_C, Governing (minutes):**	**14.56**

Catchment 303

Area (A):	0.05	ha	T_C, Airport Method (minutes):	9.75
C:	0.58		T_C, Bransby Williams Method (minutes):	3.58
Length (L):	54.0	m		
Slope (S_W):	2.10	%	**T_C, Governing (minutes):**	**10.00**

TATHAM ENGINEERING

PROJECT	116 & 120 Bond Street	FILE	323899
		DATE	Jun. 12, 2025
SUBJECT	Time of Concentration Calculator	NAME	JN
		PAGE	3 OF 3

Composites

Catchments 101, 102, EXT-1-3

Area (A):	0.39	ha	T_C, Airport Method (minutes):	16.05
C:	0.36		T_C, Bransby Williams Method (minutes):	4.22
Length (L):	81.0	m		
Slope (S_W):	2.50	%	**T_C, Governing (minutes):**	**16.05**

Catchments 102, 202, EXT-1-3

Area (A):	0.23	ha	T_C, Airport Method (minutes):	19.40
C:	0.37		T_C, Bransby Williams Method (minutes):	6.04
Length (L):	105.0	m		
Slope (S_W):	2.00	%	**T_C, Governing (minutes):**	**19.40**

Catchments 202, EXT-2 & 3

Area (A):	0.10	ha	T_C, Airport Method (minutes):	18.87
C:	0.39		T_C, Bransby Williams Method (minutes):	6.56
Length (L):	105.0	m		
Slope (S_W):	2.00	%	**T_C, Governing (minutes):**	**18.87**

Catchments 302 & EXT-1

Area (A):	0.05	ha	T_C, Airport Method (minutes):	14.56
C:	0.25		T_C, Bransby Williams Method (minutes):	3.52
Length (L):	57.0	m		
Slope (S_W):	3.00	%	**T_C, Governing (minutes):**	**14.56**

Catchments 201 & 301

Area (A):	0.25	ha	T_C, Airport Method (minutes):	3.64
C:	0.89		T_C, Bransby Williams Method (minutes):	2.23
Length (L):	37.0	m		
Slope (S_W):	1.50	%	**T_C, Governing (minutes):**	**10.00**

Catchments 202, 302 & EXT-1-3

Area (A):	0.15	ha	T_C, Airport Method (minutes):	20.20
C:	0.34		T_C, Bransby Williams Method (minutes):	6.30
Length (L):	105.0	m		
Slope (S_W):	2.00	%	**T_C, Governing (minutes):**	**20.20**

Modified Rational Method Calculation

TATHAM ENGINEERING

Project Details

116 Bond Street - Proposed	323899

Prepared By

JN	June 12, 2025

Municipality

City of Orillia

Pre-Development Analysis

Catchment ID	101, 102, Ext-1 - 3
Catchment Area (ha)	0.39
1:5-Year Runoff Coefficent	0.36
Time of Concentration (min)	16.0

Post-Development Analysis

Controlled Catchment	Uncontrolled Catchment
201	102, 202, EXT-1 - 3
0.16	0.23
0.91	0.37
10.0	19.4

Rational Method Calculations

Design Storm		2	5	10	25	50	100
IDF Curve	A	23	30	35	41	46	50
	B	-0.73	-0.73	-0.72	-0.72	-0.72	-0.72
	C	-	-	-	-	-	-
101, 102, Ext-1 - 3	i (mm/hr)	59	78	91	106	118	130
	C	0.36	0.36	0.36	0.40	0.43	0.45
	Q (m^3/s)	0.02	0.03	0.04	0.05	0.06	0.06

Design Storm		2	5	10	25	50	100
201	i (mm/hr)	83	110	127	149	166	182
	C	0.91	0.91	0.91	1.00	1.00	1.00
	Q (m^3/s)	0.03	0.04	0.05	0.07	0.07	0.08
102, 202, EXT-1 - 3	i (mm/hr)	51	68	79	93	103	113
	C	0.37	0.37	0.37	0.41	0.44	0.46
	Q (m^3/s)	0.01	0.02	0.02	0.02	0.03	0.03

Peak Flow Summary (m^3/s)

Storm	$Q_{existing}$	$Q_{uncontrolled}$	$Q_{controlled}$	Q_{total}	$Q_{existing} - Q_{proposed}$
2	0.023	0.012	0.007	0.019	0.004
5	0.030	0.016	0.008	0.024	0.006
10	0.035	0.019	0.009	0.027	0.008
25	0.046	0.024	0.010	0.034	0.011
50	0.055	0.029	0.011	0.040	0.015
100	0.063	0.033	0.012	0.045	0.018

Required Storage Volume Summary (m^3)

Duration (min)	2	5	10	25	50	100
20	18	25	29	39	44	49
25	19	26	31	41	46	51
30	19	26	31	42	47	52
35	19	27	32	43	48	53
40	**19**	27	32	43	49	54
45	19	**27**	32	44	49	55
50	19	27	**32**	44	50	55
55	19	27	32	44	50	56
60	19	27	32	**44**	50	56
65	18	26	32	44	**50**	**56**
70	18	26	32	44	50	56
75	18	26	31	44	50	56

Modified Rational Method Calculation

TATHAM ENGINEERING

Project Details

116/120 Bond Street - Pr. Front	323899

Prepared By

JN	June 12, 2025

Municipality

City of Orillia

Pre-Development Analysis

Catchment ID	103
Catchment Area (ha)	0.06
1:5-Year Runoff Coefficent	0.48
Time of Concentration (min)	10.0

Post-Development Analysis

Controlled Catchment	Uncontrolled Catchment
	203
	0.06
	0.60
	10.0

Rational Method Calculations

Design Storm		2	5	10	25	50	100	Design Storm		2	5	10	25	50	100
	A	23	30	35	41	46	50		i (mm/hr)	####	####	####	####	####	####
IDF Curve	B	-0.73	-0.73	-0.72	-0.72	-0.72	-0.72		C	0.00	0.00	0.00	0.00	0.00	0.00
	C	-	-	-	-	-	-		Q (m^3/s)	####	####	####	####	####	####
	i (mm/hr)	83	110	127	149	166	182		i (mm/hr)	83	110	127	149	166	182
103	C	0.48	0.48	0.48	0.53	0.58	0.60	203	C	0.60	0.60	0.60	0.66	0.72	0.75
	Q (m^3/s)	0.01	0.01	0.01	0.01	0.02	0.02		Q (m^3/s)	0.01	0.01	0.01	0.02	0.02	0.02

Peak Flow Summary (m^3/s)

Storm	$Q_{existing}$	$Q_{uncontrolled}$	$Q_{controlled}$	Q_{total}	$Q_{existing} - Q_{proposed}$
2	0.007	0.008		0.008	-0.002
5	0.009	0.011		0.011	-0.002
10	0.010	0.013		0.013	-0.003
25	0.013	0.016		0.016	-0.003
50	0.016	0.020		0.020	-0.004
100	0.018	0.023		0.023	-0.005

Modified Rational Method Calculation

TATHAM ENGINEERING

Project Details

116 Bond Street - Future	323899

Prepared By

JN	June 12, 2025

Municipality

City of Orillia

Pre-Development Analysis

Catchment ID	101, 102, Ext-1 - 3
Catchment Area (ha)	0.39
1:5-Year Runoff Coefficent	0.36
Time of Concentration (min)	16.0

Post-Development Analysis

Controlled Catchment	Uncontrolled Catchment
201 & 301	202, 302, EXT-1 - 3
0.25	0.15
0.89	0.34
10.0	20.2

Rational Method Calculations

Design Storm		2	5	10	25	50	100
IDF Curve	A	23	30	35	41	46	50
	B	-0.73	-0.73	-0.72	-0.72	-0.72	-0.72
	C	-	-	-	-	-	-
101, 102, Ext-1 - 3	i (mm/hr)	59	78	91	106	118	130
	C	0.36	0.36	0.36	0.40	0.43	0.45
	Q (m^3/s)	0.02	0.03	0.04	0.05	0.06	0.06

Design Storm		2	5	10	25	50	100
201 & 301	i (mm/hr)	83	110	127	149	166	182
	C	0.89	0.89	0.89	0.98	1.00	1.00
	Q (m^3/s)	0.05	0.07	0.08	0.10	0.12	0.13
202, 302, EXT-1 - 3	i (mm/hr)	50	66	77	90	100	110
	C	0.34	0.34	0.34	0.37	0.41	0.43
	Q (m^3/s)	0.01	0.01	0.01	0.01	0.02	0.02

Peak Flow Summary (m^3/s)

Storm	$Q_{existing}$	$Q_{uncontrolled}$	$Q_{controlled}$	Q_{total}	$Q_{existing} - Q_{proposed}$
2	0.023	0.007	0.009	0.016	0.007
5	0.030	0.009	0.010	0.020	0.011
10	0.035	0.011	0.011	0.022	0.013
25	0.046	0.014	0.015	0.029	0.016
50	0.055	0.017	0.022	0.039	0.016
100	0.063	0.019	0.027	0.046	0.017

Required Storage Volume Summary (m^3)

Duration (min)	2	5	10	25	50	100
20	29	40	47	60	64	68
25	30	41	49	62	66	70
30	31	43	50	64	68	71
35	31	43	51	66	68	72
40	32	44	52	67	69	**72**
45	32	44	53	67	**69**	71
50	**32**	45	53	68	69	71
55	32	45	54	68	68	70
60	32	**45**	54	**68**	68	69
65	31	45	**54**	68	67	68
70	31	45	54	68	66	66
75	31	44	54	67	65	65

Modified Rational Method Calculation

TATHAM ENGINEERING

Project Details

116/120 Bond Street - Fut. Front	323899

Prepared By

JN	June 12, 2025

Municipality

City of Orillia

Pre-Development Analysis

Catchment ID	103
Catchment Area (ha)	0.06
1:5-Year Runoff Coefficent	0.48
Time of Concentration (min)	10.0

Post-Development Analysis

Controlled Catchment	Uncontrolled Catchment
	303
	0.05
	0.58
	10.0

Rational Method Calculations

Design Storm		2	5	10	25	50	100	Design Storm		2	5	10	25	50	100
	A	23	30	35	41	46	50		i (mm/hr)	####	####	####	####	####	####
IDF Curve	B	-0.73	-0.73	-0.72	-0.72	-0.72	-0.72		C	0.00	0.00	0.00	0.00	0.00	0.00
	C	-	-	-	-	-	-		Q (m^3/s)	####	####	####	####	####	####
	i (mm/hr)	83	110	127	149	166	182		i (mm/hr)	83	110	127	149	166	182
103	C	0.48	0.48	0.48	0.53	0.58	0.60	303	C	0.58	0.58	0.58	0.64	0.70	0.73
	Q (m^3/s)	0.01	0.01	0.01	0.01	0.02	0.02		Q (m^3/s)	0.01	0.01	0.01	0.01	0.02	0.02

Peak Flow Summary (m^3/s)

Storm	$Q_{existing}$	$Q_{uncontrolled}$	$Q_{controlled}$	Q_{total}	$Q_{existing} - Q_{proposed}$
2	0.007	0.007		0.007	0.000
5	0.009	0.009		0.009	0.000
10	0.010	0.010		0.010	0.000
25	0.013	0.013		0.013	0.000
50	0.016	0.016		0.016	0.000
100	0.018	0.018		0.018	0.000

Appendix C: Stage Storage Discharge Calculations

TATHAM ENGINEERING

PROJECT	116 Bond Street	FILE	323899
		DATE	12-Jun-2025
SUBJECT	Orifice Flow	NAME	JN
		PAGE	1 OF 10

Orifice Parameters

Orifice Dia. (mm):	102
Orifice Centroid Elevation (m):	221.03
Orifice Invert Elevation (m):	220.98
Orifice Area (m^2):	0.00817
Orifice Coefficient (C):	0.63
Tailwater Elevation (m)	

$$Weir\ C_d = 0.555 + \frac{1}{110 \times (\frac{h}{d})} + 0.041 \times (\frac{h}{d})$$

$$Q_{Weir} = C_d \times [10.12 \times \left(\frac{h}{d}\right)^{1.975} - 2.66 \times \left(\frac{h}{d}\right)^{3.78}] \times d^{\frac{5}{2}}$$

Note: h and d in units of decimeters in the equations above.

Elevation (m)	h_{invert} (dm)	$h_{centroid}$ (m)	Weir C_d	Q_{Weir} (L/s)	$Q_{orifice}$ (L/s)	$Q_{Governing}$ (L/s)
220.98	0.00	0.00				0.00
221.09	1.10	0.06	0.61	5.24	5.54	5.54
221.14	1.60	0.11	0.63	6.59	7.53	7.53
221.19	2.10	0.16	0.64	0.92	9.09	9.09
221.24	2.60	0.21	0.66	0.00	10.42	10.42
221.29	3.10	0.26	0.68	0.00	11.60	11.60
221.34	3.60	0.31	0.70	0.00	12.68	12.68
221.39	4.10	0.36	0.72	0.00	13.66	13.66
221.89	9.10	0.86	0.92	0.00	21.13	21.13
222.39	14.10	1.36	1.12	0.00	26.58	26.58
222.46	14.80	1.43	1.15	0.00	27.26	27.26
222.51	15.30	1.48	1.17	0.00	27.73	27.73
222.56	15.80	1.53	1.19	0.00	28.20	28.20
222.61	16.30	1.58	1.21	0.00	28.65	28.65
222.66	16.80	1.63	1.23	0.00	29.10	29.10
222.67	16.90	1.64	1.23	0.00	29.19	29.19
222.68	17.00	1.65	1.24	0.00	29.28	29.28
222.69	17.10	1.66	1.24	0.00	29.37	29.37
222.70	17.20	1.67	1.25	0.00	29.46	29.46
222.71	17.30	1.68	1.25	0.00	29.55	29.55
222.72	17.40	1.69	1.25	0.00	29.63	29.63
222.73	17.50	1.70	1.26	0.00	29.72	29.72
222.74	17.60	1.71	1.26	0.00	29.81	29.81
222.75	17.70	1.72	1.27	0.00	29.90	29.90
222.76	17.80	1.73	1.27	0.00	29.98	29.98
222.77	17.90	1.74	1.28	0.00	30.07	30.07
222.78	18.00	1.75	1.28	0.00	30.16	30.16
222.79	18.10	1.76	1.28	0.00	30.24	30.24
222.80	18.20	1.77	1.29	0.00	30.33	30.33

TATHAM ENGINEERING

PROJECT	116 Bond Street	FILE	323899
		DATE	12-Jun-2025
SUBJECT	Structure Quantity Storage	NAME	JN
		PAGE	2 OF 10

ID	DCB 1	CBMH 2				
T/G Elev. (m)	222.41	222.41				
Inv. Elev. (m)	221.07	220.98				
Dia. (m)		1.20				
Length (m)	1.20					
Width (m)	0.60					
Area (m^2)	0.72	1.13	0.00	0.00	0.00	0.00
Tailwater (m)						

Elevation (m)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Total Vol. (m^3)
220.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00
221.09	0.01	0.12	0.00	0.00	0.00	0.00	0.14
221.14	0.05	0.18	0.00	0.00	0.00	0.00	0.23
221.19	0.09	0.24	0.00	0.00	0.00	0.00	0.32
221.24	0.12	0.29	0.00	0.00	0.00	0.00	0.42
221.29	0.16	0.35	0.00	0.00	0.00	0.00	0.51
221.34	0.19	0.41	0.00	0.00	0.00	0.00	0.60
221.39	0.23	0.46	0.00	0.00	0.00	0.00	0.69
221.89	0.59	1.03	0.00	0.00	0.00	0.00	1.62
222.39	0.95	1.59	0.00	0.00	0.00	0.00	2.55
222.46	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.51	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.56	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.61	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.66	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.67	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.68	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.69	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.70	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.71	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.72	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.73	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.74	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.75	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.76	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.77	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.78	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.79	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.80	0.96	1.62	0.00	0.00	0.00	0.00	2.58

TATHAM ENGINEERING

PROJECT	116 Bond Street	FILE	323899
		DATE	12-Jun-2025
SUBJECT	Pipe Quantity Storage	NAME	JN
		PAGE	3 OF 10

Upstream	DCB 1	Storage					
Downstream	Storage	CBMH 2					
Inv. Up (m)	221.07	221.04					
Inv. Dn (m)	221.04	221.02					
Inv. Avg. (m)	221.06	221.03					
Dia. (mm)	300	300					
Length (m)	1.70	1.70					
Tailwater (m)							
Elevation (m)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Total Vol. (m^3)
220.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00
221.09	0.01	0.04	0.00	0.00	0.00	0.00	0.05
221.14	0.04	0.06	0.00	0.00	0.00	0.00	0.10
221.19	0.06	0.09	0.00	0.00	0.00	0.00	0.15
221.24	0.09	0.11	0.00	0.00	0.00	0.00	0.19
221.29	0.11	0.12	0.00	0.00	0.00	0.00	0.23
221.34	0.12	0.12	0.00	0.00	0.00	0.00	0.24
221.39	0.12	0.12	0.00	0.00	0.00	0.00	0.24
221.89	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.39	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.46	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.51	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.56	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.61	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.66	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.67	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.68	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.69	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.70	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.71	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.72	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.73	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.74	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.75	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.76	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.77	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.78	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.79	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.80	0.12	0.12	0.00	0.00	0.00	0.00	0.24

TATHAM ENGINEERING

PROJECT	116 Bond Street	FILE	323899
		DATE	12-Jun-2025
SUBJECT	Surface Quantity Storage	NAME	JN
		PAGE	4 OF 10

Description	DCB 1	CBMH 2	Curb Height		
T/G Elev. (m)	222.41	222.41	222.61		
Area (m^2)	0.72	1.13	783.11		
Pond Elev. (m)	222.61	222.61	222.76		
Pond Area (m^2)	395.11	388.00	794.43		
Pond Vol (m^3)	39.58	38.91	118.31	0.00	0.00
TW Elev. (m)					

Elevation (m)	Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)	Total Vol. (m^3)
220.98	0.00	0.00	0.00	0.00	0.00	0.00
221.09	0.00	0.00	0.00	0.00	0.00	0.00
221.14	0.00	0.00	0.00	0.00	0.00	0.00
221.19	0.00	0.00	0.00	0.00	0.00	0.00
221.24	0.00	0.00	0.00	0.00	0.00	0.00
221.29	0.00	0.00	0.00	0.00	0.00	0.00
221.34	0.00	0.00	0.00	0.00	0.00	0.00
221.39	0.00	0.00	0.00	0.00	0.00	0.00
221.89	0.00	0.00	0.00	0.00	0.00	0.00
222.39	0.00	0.00	0.00	0.00	0.00	0.00
222.46	99.32	97.85	0.00	0.00	0.00	6.90
222.51	197.92	194.57	0.00	0.00	0.00	21.64
222.56	296.51	291.28	0.00	0.00	0.00	46.15
222.61	395.11	388.00	0.00	0.00	0.00	80.42
222.66	0.00	0.00	786.88	0.00	0.00	119.67
222.67	0.00	0.00	787.64	0.00	0.00	127.54
222.68	0.00	0.00	788.39	0.00	0.00	135.42
222.69	0.00	0.00	789.15	0.00	0.00	143.31
222.70	0.00	0.00	789.90	0.00	0.00	151.21
222.71	0.00	0.00	790.66	0.00	0.00	159.11
222.72	0.00	0.00	791.41	0.00	0.00	167.02
222.73	0.00	0.00	792.17	0.00	0.00	174.94
222.74	0.00	0.00	792.92	0.00	0.00	182.86
222.75	0.00	0.00	793.68	0.00	0.00	190.80
222.76	0.00	0.00	794.43	0.00	0.00	198.74
222.77	0.00	0.00	0.00	0.00	0.00	198.74
222.78	0.00	0.00	0.00	0.00	0.00	198.74
222.79	0.00	0.00	0.00	0.00	0.00	198.74
222.80	0.00	0.00	0.00	0.00	0.00	198.74

TATHAM ENGINEERING

PROJECT	116 Bond Street	FILE	323899
		DATE	12-Jun-2025
SUBJECT	Underground Quantity Storage	NAME	JN
		PAGE	5 OF 10

Module ID	ST-12					
Top Elev. (m)	221.34					
Inv. Elev. (m)	221.04					
Void Ratio (%)	93.7%					
Length (m)	36.56					
Width (m)	6.40					
Area (m^2)	219.17					
TW Elev. (m)						

Elevation (m)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Total Vol. (m^3)
220.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00
221.09	12.05	0.00	0.00	0.00	0.00	0.00	12.05
221.14	23.01	0.00	0.00	0.00	0.00	0.00	23.01
221.19	33.97	0.00	0.00	0.00	0.00	0.00	33.97
221.24	44.93	0.00	0.00	0.00	0.00	0.00	44.93
221.29	55.89	0.00	0.00	0.00	0.00	0.00	55.89
221.34	66.85	0.00	0.00	0.00	0.00	0.00	66.85
221.39	66.85	0.00	0.00	0.00	0.00	0.00	66.85
221.89	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.39	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.46	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.51	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.56	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.61	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.66	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.67	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.68	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.69	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.70	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.71	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.72	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.73	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.74	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.75	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.76	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.77	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.78	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.79	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.80	66.85	0.00	0.00	0.00	0.00	0.00	66.85

TATHAM ENGINEERING

PROJECT	116 Bond Street	FILE	323899
		DATE	12-Jun-2025
SUBJECT	Total Storage Summary	NAME	JN
		PAGE	6 OF 10

Elevation (m)	MH & CB (m^3)	Pipe (m^3)	Ditch (m^3)	Surface (m^3)	Underground (m^3)	Total Vol. (m^3)
220.98	0.00	0.00	0.00	0.00	0.00	0.00
221.09	0.14	0.05	0.00	0.00	12.05	12.24
221.14	0.23	0.10	0.00	0.00	23.01	23.34
221.19	0.32	0.15	0.00	0.00	33.97	34.44
221.24	0.42	0.19	0.00	0.00	44.93	45.54
221.29	0.51	0.23	0.00	0.00	55.89	56.63
221.34	0.60	0.24	0.00	0.00	66.85	67.69
221.39	0.69	0.24	0.00	0.00	66.85	67.78
221.89	1.62	0.24	0.00	0.00	66.85	68.71
222.39	2.55	0.24	0.00	0.00	66.85	69.63
222.46	2.58	0.24	0.00	6.90	66.85	76.57
222.51	2.58	0.24	0.00	21.64	66.85	91.31
222.56	2.58	0.24	0.00	46.15	66.85	115.82
222.61	2.58	0.24	0.00	80.42	66.85	150.09
222.66	2.58	0.24	0.00	119.67	66.85	189.34
222.67	2.58	0.24	0.00	127.54	66.85	197.21
222.68	2.58	0.24	0.00	135.42	66.85	205.09
222.69	2.58	0.24	0.00	143.31	66.85	212.98
222.70	2.58	0.24	0.00	151.21	66.85	220.88
222.71	2.58	0.24	0.00	159.11	66.85	228.78
222.72	2.58	0.24	0.00	167.02	66.85	236.69
222.73	2.58	0.24	0.00	174.94	66.85	244.61
222.74	2.58	0.24	0.00	182.86	66.85	252.53
222.75	2.58	0.24	0.00	190.80	66.85	260.47
222.76	2.58	0.24	0.00	198.74	66.85	268.41
222.77	2.58	0.24	0.00	198.74	66.85	268.41
222.78	2.58	0.24	0.00	198.74	66.85	268.41
222.79	2.58	0.24	0.00	198.74	66.85	268.41
222.80	2.58	0.24	0.00	198.74	66.85	268.41

TATHAM ENGINEERING

PROJECT	116 Bond Street	FILE	323899
		DATE	12-Jun-2025
SUBJECT	Overflow Weir Flow	NAME	JN
		PAGE	7 OF 10

Overflow Weir Parameters

Overflow Weir Base Elevation (m):	222.61
Overflow Weir Width, B (m):	6.5
Weir Crest Length, L (m):	0.2
Overflow Weir Material:	Asphalt
ϵ (mm):	5.4
δ/L :	0.03386

$$C_d \approx 0.544 \times (1 - \frac{\delta/L}{H/L})^{3/2}$$

$$\delta/L \approx 0.001 + 0.2 \times (\epsilon/L)^{0.5}$$

$$Q_{Weir} = C_d B g^{0.5} H^{3/2}$$

Source: Equation 10.57 for round-nosed broad-crested weirs
Frank M. White, *Fluid Mechanics Fifth Edition*, McGraw-Hill Companies Inc., New York, 2003.

Elevation (m)	h_{weir} (m)	Weir C_d	Q_{Weir} (L/s)
220.98	0.00		0.00
221.09	0.00		0.00
221.14	0.00		0.00
221.19	0.00		0.00
221.24	0.00		0.00
221.29	0.00		0.00
221.34	0.00		0.00
221.39	0.00		0.00
221.89	0.00		0.00
222.39	0.00		0.00
222.46	0.00		0.00
222.51	0.00		0.00
222.56	0.00		0.00
222.61	0.00		0.00
222.66	0.05	0.44	99.54
222.67	0.06	0.45	136.01
222.68	0.07	0.47	176.08
222.69	0.08	0.48	219.46
222.70	0.09	0.48	265.92
222.71	0.10	0.49	315.26
222.72	0.11	0.49	367.32
222.73	0.12	0.50	421.97
222.74	0.13	0.50	479.08
222.75	0.14	0.51	538.57
222.76	0.15	0.51	600.33
222.77	0.16	0.51	664.28
222.78	0.17	0.51	730.36
222.79	0.18	0.51	798.50
222.80	0.19	0.52	868.63

TATHAM ENGINEERING

PROJECT	116 Bond Street	FILE	323899
		DATE	12-Jun-2025
SUBJECT	Overflow Weir Flow	NAME	JN
		PAGE	8 OF 10

100 Year Storm Ponding Depth and Overflow Elevation

1:100-Year Uncontrolled Flow (L/s):	81.02
Overflow Weir Base Elevation (m):	222.61
Structure T/G Elevation (m):	222.41
Required Weir Head (m):	0.044
C_d:	0.42
Qweir, (L/s):	81.02
Max Ponding Over T/G (m):	0.244
Weir Overflow Elevation (m):	222.65

Detailed Weir Flow Table

Elevation (m)	h_{weir} (m)	Weir C_d	Q_{Weir} (L/s)
222.61	0.00		0.00
222.63	0.02	0.29	16.85
222.65	0.04	0.41	67.08
222.67	0.06	0.45	136.01
222.69	0.08	0.48	219.46
222.71	0.10	0.49	315.26
222.73	0.12	0.50	421.97
222.75	0.14	0.51	538.57
222.77	0.16	0.51	664.28
222.79	0.18	0.51	798.50
222.81	0.20	0.52	940.70
222.83	0.22	0.52	1090.47
222.85	0.24	0.52	1247.43
222.87	0.26	0.52	1411.28
222.89	0.28	0.52	1581.74
222.91	0.30	0.53	1758.55

TATHAM ENGINEERING

PROJECT	116 Bond Street	FILE	323899
		DATE	12-Jun-2025
SUBJECT	Stage Storage Discharge	NAME	JN
		PAGE	9 OF 10

Stage Storage Discharge Table

Elevation (m)	$Q_{Orifice\ Primary}$ (L/s)	$Q_{Orifice\ Secondary}$ (L/s)	$Q_{Orifice\ Tertiary}$ (L/s)	Q_{Weir} (L/s)	Q_{Total} (L/s)	Total Vol. (m^3)
220.98	0.00	0.00	0.00	0.00	0.00	0.00
221.09	5.54	0.00	0.00	0.00	5.54	12.24
221.14	7.53	0.00	0.00	0.00	7.53	23.34
221.19	9.09	0.00	0.00	0.00	9.09	34.44
221.24	10.42	0.00	0.00	0.00	10.42	45.54
221.29	11.60	0.00	0.00	0.00	11.60	56.63
221.34	12.68	0.00	0.00	0.00	12.68	67.69
221.39	13.66	0.00	0.00	0.00	13.66	67.78
221.89	21.13	0.00	0.00	0.00	21.13	68.71
222.39	26.58	0.00	0.00	0.00	26.58	69.63
222.46	27.26	0.00	0.00	0.00	27.26	76.57
222.51	27.73	0.00	0.00	0.00	27.73	91.31
222.56	28.20	0.00	0.00	0.00	28.20	115.82
222.61	28.65	0.00	0.00	0.00	28.65	150.09
222.66	29.10	0.00	0.00	99.54	128.64	189.34
222.67	29.19	0.00	0.00	136.01	165.20	197.21
222.68	29.28	0.00	0.00	176.08	205.36	205.09
222.69	29.37	0.00	0.00	219.46	248.83	212.98
222.70	29.46	0.00	0.00	265.92	295.38	220.88
222.71	29.55	0.00	0.00	315.26	344.80	228.78
222.72	29.63	0.00	0.00	367.32	396.95	236.69
222.73	29.72	0.00	0.00	421.97	451.69	244.61
222.74	29.81	0.00	0.00	479.08	508.89	252.53
222.75	29.90	0.00	0.00	538.57	568.46	260.47
222.76	29.98	0.00	0.00	600.33	630.31	268.41
222.77	30.07	0.00	0.00	664.28	694.35	268.41
222.78	30.16	0.00	0.00	730.36	760.52	268.41
222.79	30.24	0.00	0.00	798.50	828.74	268.41
222.80	30.33	0.00	0.00	868.63	898.96	268.41

TATHAM ENGINEERING

PROJECT	116 Bond Street	FILE	323899
		DATE	12-Jun-2025
SUBJECT	Stage Storage Discharge	NAME	JN
		PAGE	10 OF 10

Discharge Summary - Modified Rational Method

Storm Event	Control Flow (L/s)	Storage (m^3)	Depth (m)	Elevation (m)
1:2-year	6.78	19.17	0.14	221.12
1:5-year	8.04	26.96	0.18	221.16
1:10-year	8.80	32.35	0.20	221.18
1:25-year	10.23	43.95	0.25	221.23
1:50-year	10.89	49.93	0.28	221.26
1:100-year	11.52	55.87	0.31	221.29

TATHAM ENGINEERING

PROJECT	116 & 120 Bond Street	FILE	323899
		DATE	12-Jun-2025
SUBJECT	Orifice Flow	NAME	JN
		PAGE	1 OF 10

Orifice Parameters

Orifice Dia. (mm):	102
Orifice Centroid Elevation (m):	221.03
Orifice Invert Elevation (m):	220.98
Orifice Area (m^2):	0.00817
Orifice Coefficient (C):	0.63
Tailwater Elevation (m)	

$$Weir\ C_d = 0.555 + \frac{1}{110 \times (\frac{h}{d})} + 0.041 \times (\frac{h}{d})$$

$$Q_{Weir} = C_d \times [10.12 \times \left(\frac{h}{d}\right)^{1.975} - 2.66 \times \left(\frac{h}{d}\right)^{3.78}] \times d^{\frac{5}{2}}$$

Note: h and d in units of decimeters in the equations above.

Elevation (m)	h_{invert} (dm)	$h_{centroid}$ (m)	Weir C_d	Q_{Weir} (L/s)	$Q_{orifice}$ (L/s)	$Q_{Governing}$ (L/s)
220.98	0.00	0.00				0.00
221.09	1.10	0.06	0.61	5.24	5.54	5.54
221.14	1.60	0.11	0.63	6.59	7.53	7.53
221.19	2.10	0.16	0.64	0.92	9.09	9.09
221.24	2.60	0.21	0.66	0.00	10.42	10.42
221.29	3.10	0.26	0.68	0.00	11.60	11.60
221.34	3.60	0.31	0.70	0.00	12.68	12.68
221.39	4.10	0.36	0.72	0.00	13.66	13.66
221.89	9.10	0.86	0.92	0.00	21.13	21.13
222.39	14.10	1.36	1.12	0.00	26.58	26.58
222.46	14.80	1.43	1.15	0.00	27.26	27.26
222.51	15.30	1.48	1.17	0.00	27.73	27.73
222.56	15.80	1.53	1.19	0.00	28.20	28.20
222.61	16.30	1.58	1.21	0.00	28.65	28.65
222.66	16.80	1.63	1.23	0.00	29.10	29.10
222.67	16.90	1.64	1.23	0.00	29.19	29.19
222.68	17.00	1.65	1.24	0.00	29.28	29.28
222.69	17.10	1.66	1.24	0.00	29.37	29.37
222.70	17.20	1.67	1.25	0.00	29.46	29.46
222.71	17.30	1.68	1.25	0.00	29.55	29.55
222.72	17.40	1.69	1.25	0.00	29.63	29.63
222.73	17.50	1.70	1.26	0.00	29.72	29.72
222.74	17.60	1.71	1.26	0.00	29.81	29.81
222.75	17.70	1.72	1.27	0.00	29.90	29.90
222.76	17.80	1.73	1.27	0.00	29.98	29.98
222.77	17.90	1.74	1.28	0.00	30.07	30.07
222.78	18.00	1.75	1.28	0.00	30.16	30.16
222.79	18.10	1.76	1.28	0.00	30.24	30.24
222.80	18.20	1.77	1.29	0.00	30.33	30.33

TATHAM ENGINEERING

PROJECT	116 & 120 Bond Street	FILE	323899
		DATE	12-Jun-2025
SUBJECT	Structure Quantity Storage	NAME	JN
		PAGE	2 OF 10

ID	DCB 1	CBMH 2				
T/G Elev. (m)	222.41	222.41				
Inv. Elev. (m)	221.07	220.98				
Dia. (m)		1.20				
Length (m)	1.20					
Width (m)	0.60					
Area (m^2)	0.72	1.13	0.00	0.00	0.00	0.00
Tailwater (m)						

Elevation (m)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Total Vol. (m^3)
220.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00
221.09	0.01	0.12	0.00	0.00	0.00	0.00	0.14
221.14	0.05	0.18	0.00	0.00	0.00	0.00	0.23
221.19	0.09	0.24	0.00	0.00	0.00	0.00	0.32
221.24	0.12	0.29	0.00	0.00	0.00	0.00	0.42
221.29	0.16	0.35	0.00	0.00	0.00	0.00	0.51
221.34	0.19	0.41	0.00	0.00	0.00	0.00	0.60
221.39	0.23	0.46	0.00	0.00	0.00	0.00	0.69
221.89	0.59	1.03	0.00	0.00	0.00	0.00	1.62
222.39	0.95	1.59	0.00	0.00	0.00	0.00	2.55
222.46	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.51	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.56	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.61	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.66	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.67	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.68	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.69	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.70	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.71	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.72	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.73	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.74	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.75	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.76	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.77	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.78	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.79	0.96	1.62	0.00	0.00	0.00	0.00	2.58
222.80	0.96	1.62	0.00	0.00	0.00	0.00	2.58

TATHAM ENGINEERING

PROJECT	116 & 120 Bond Street	FILE	323899
		DATE	12-Jun-2025
SUBJECT	Pipe Quantity Storage	NAME	JN
		PAGE	3 OF 10

Upstream	DCB 1	Storage					
Downstream	Storage	CBMH 2					
Inv. Up (m)	221.07	221.04					
Inv. Dn (m)	221.04	221.02					
Inv. Avg. (m)	221.06	221.03					
Dia. (mm)	300	300					
Length (m)	1.70	1.70					
Tailwater (m)							
Elevation (m)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Total Vol. (m^3)
220.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00
221.09	0.01	0.04	0.00	0.00	0.00	0.00	0.05
221.14	0.04	0.06	0.00	0.00	0.00	0.00	0.10
221.19	0.06	0.09	0.00	0.00	0.00	0.00	0.15
221.24	0.09	0.11	0.00	0.00	0.00	0.00	0.19
221.29	0.11	0.12	0.00	0.00	0.00	0.00	0.23
221.34	0.12	0.12	0.00	0.00	0.00	0.00	0.24
221.39	0.12	0.12	0.00	0.00	0.00	0.00	0.24
221.89	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.39	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.46	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.51	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.56	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.61	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.66	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.67	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.68	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.69	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.70	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.71	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.72	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.73	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.74	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.75	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.76	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.77	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.78	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.79	0.12	0.12	0.00	0.00	0.00	0.00	0.24
222.80	0.12	0.12	0.00	0.00	0.00	0.00	0.24

TATHAM ENGINEERING

PROJECT	116 & 120 Bond Street	FILE	323899
		DATE	12-Jun-2025
SUBJECT	Surface Quantity Storage	NAME	JN
		PAGE	4 OF 10

Description	DCB 1	CBMH 2	Curb Height		
T/G Elev. (m)	222.41	222.41	222.61		
Area (m^2)	0.72	1.13	1119.11		
Pond Elev. (m)	222.61	222.61	222.76		
Pond Area (m^2)	602.11	517.00	1120.50		
Pond Vol (m^3)	60.28	51.81	167.96	0.00	0.00
TW Elev. (m)					

Elevation (m)	Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)	Total Vol. (m^3)
220.98	0.00	0.00	0.00	0.00	0.00	0.00
221.09	0.00	0.00	0.00	0.00	0.00	0.00
221.14	0.00	0.00	0.00	0.00	0.00	0.00
221.19	0.00	0.00	0.00	0.00	0.00	0.00
221.24	0.00	0.00	0.00	0.00	0.00	0.00
221.29	0.00	0.00	0.00	0.00	0.00	0.00
221.34	0.00	0.00	0.00	0.00	0.00	0.00
221.39	0.00	0.00	0.00	0.00	0.00	0.00
221.89	0.00	0.00	0.00	0.00	0.00	0.00
222.39	0.00	0.00	0.00	0.00	0.00	0.00
222.46	151.07	130.10	0.00	0.00	0.00	9.84
222.51	301.42	259.07	0.00	0.00	0.00	30.88
222.56	451.76	388.03	0.00	0.00	0.00	65.89
222.61	602.11	517.00	0.00	0.00	0.00	114.86
222.66	0.00	0.00	1119.57	0.00	0.00	170.83
222.67	0.00	0.00	1119.67	0.00	0.00	182.02
222.68	0.00	0.00	1119.76	0.00	0.00	193.22
222.69	0.00	0.00	1119.85	0.00	0.00	204.42
222.70	0.00	0.00	1119.94	0.00	0.00	215.62
222.71	0.00	0.00	1120.04	0.00	0.00	226.82
222.72	0.00	0.00	1120.13	0.00	0.00	238.02
222.73	0.00	0.00	1120.22	0.00	0.00	249.22
222.74	0.00	0.00	1120.31	0.00	0.00	260.42
222.75	0.00	0.00	1120.41	0.00	0.00	271.63
222.76	0.00	0.00	1120.50	0.00	0.00	282.83
222.77	0.00	0.00	0.00	0.00	0.00	282.83
222.78	0.00	0.00	0.00	0.00	0.00	282.83
222.79	0.00	0.00	0.00	0.00	0.00	282.83
222.80	0.00	0.00	0.00	0.00	0.00	282.83

TATHAM ENGINEERING

PROJECT	116 & 120 Bond Street	FILE	323899
		DATE	12-Jun-2025
SUBJECT	Underground Quantity Storage	NAME	JN
		PAGE	5 OF 10

Module ID	ST-12					
Top Elev. (m)	221.34					
Inv. Elev. (m)	221.04					
Void Ratio (%)	93.7%					
Length (m)	36.56					
Width (m)	6.40					
Area (m^2)	219.17					
TW Elev. (m)						

Elevation (m)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Volume (m^3)	Total Vol. (m^3)
220.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00
221.09	12.05	0.00	0.00	0.00	0.00	0.00	12.05
221.14	23.01	0.00	0.00	0.00	0.00	0.00	23.01
221.19	33.97	0.00	0.00	0.00	0.00	0.00	33.97
221.24	44.93	0.00	0.00	0.00	0.00	0.00	44.93
221.29	55.89	0.00	0.00	0.00	0.00	0.00	55.89
221.34	66.85	0.00	0.00	0.00	0.00	0.00	66.85
221.39	66.85	0.00	0.00	0.00	0.00	0.00	66.85
221.89	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.39	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.46	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.51	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.56	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.61	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.66	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.67	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.68	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.69	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.70	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.71	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.72	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.73	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.74	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.75	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.76	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.77	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.78	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.79	66.85	0.00	0.00	0.00	0.00	0.00	66.85
222.80	66.85	0.00	0.00	0.00	0.00	0.00	66.85

TATHAM ENGINEERING

PROJECT	116 & 120 Bond Street	FILE	323899
		DATE	12-Jun-2025
SUBJECT	Total Storage Summary	NAME	JN
		PAGE	6 OF 10

Elevation (m)	MH & CB (m^3)	Pipe (m^3)	Ditch (m^3)	Surface (m^3)	Underground (m^3)	Total Vol. (m^3)
220.98	0.00	0.00	0.00	0.00	0.00	0.00
221.09	0.14	0.05	0.00	0.00	12.05	12.24
221.14	0.23	0.10	0.00	0.00	23.01	23.34
221.19	0.32	0.15	0.00	0.00	33.97	34.44
221.24	0.42	0.19	0.00	0.00	44.93	45.54
221.29	0.51	0.23	0.00	0.00	55.89	56.63
221.34	0.60	0.24	0.00	0.00	66.85	67.69
221.39	0.69	0.24	0.00	0.00	66.85	67.78
221.89	1.62	0.24	0.00	0.00	66.85	68.71
222.39	2.55	0.24	0.00	0.00	66.85	69.63
222.46	2.58	0.24	0.00	9.84	66.85	79.51
222.51	2.58	0.24	0.00	30.88	66.85	100.55
222.56	2.58	0.24	0.00	65.89	66.85	135.56
222.61	2.58	0.24	0.00	114.86	66.85	184.53
222.66	2.58	0.24	0.00	170.83	66.85	240.50
222.67	2.58	0.24	0.00	182.02	66.85	251.70
222.68	2.58	0.24	0.00	193.22	66.85	262.89
222.69	2.58	0.24	0.00	204.42	66.85	274.09
222.70	2.58	0.24	0.00	215.62	66.85	285.29
222.71	2.58	0.24	0.00	226.82	66.85	296.49
222.72	2.58	0.24	0.00	238.02	66.85	307.69
222.73	2.58	0.24	0.00	249.22	66.85	318.89
222.74	2.58	0.24	0.00	260.42	66.85	330.09
222.75	2.58	0.24	0.00	271.63	66.85	341.30
222.76	2.58	0.24	0.00	282.83	66.85	352.50
222.77	2.58	0.24	0.00	282.83	66.85	352.50
222.78	2.58	0.24	0.00	282.83	66.85	352.50
222.79	2.58	0.24	0.00	282.83	66.85	352.50
222.80	2.58	0.24	0.00	282.83	66.85	352.50

TATHAM ENGINEERING

PROJECT	116 & 120 Bond Street	FILE	323899
		DATE	12-Jun-2025
SUBJECT	Overflow Weir Flow	NAME	JN
		PAGE	7 OF 10

Overflow Weir Parameters

Overflow Weir Base Elevation (m):	222.61
Overflow Weir Width, B (m):	6.5
Weir Crest Length, L (m):	0.2
Overflow Weir Material:	Asphalt
ϵ (mm):	5.4
δ/L :	0.03386

$$C_d \approx 0.544 \times (1 - \frac{\delta/L}{H/L})^{3/2}$$

$$\delta/L \approx 0.001 + 0.2 \times (\epsilon/L)^{0.5}$$

$$Q_{Weir} = C_d B g^{0.5} H^{3/2}$$

Source: Equation 10.57 for round-nosed broad-crested weirs
Frank M. White, *Fluid Mechanics Fifth Edition*, McGraw-Hill Companies Inc., New York, 2003.

Elevation (m)	h_{weir} (m)	Weir C_d	Q_{Weir} (L/s)
220.98	0.00		0.00
221.09	0.00		0.00
221.14	0.00		0.00
221.19	0.00		0.00
221.24	0.00		0.00
221.29	0.00		0.00
221.34	0.00		0.00
221.39	0.00		0.00
221.89	0.00		0.00
222.39	0.00		0.00
222.46	0.00		0.00
222.51	0.00		0.00
222.56	0.00		0.00
222.61	0.00		0.00
222.66	0.05	0.44	99.54
222.67	0.06	0.45	136.01
222.68	0.07	0.47	176.08
222.69	0.08	0.48	219.46
222.70	0.09	0.48	265.92
222.71	0.10	0.49	315.26
222.72	0.11	0.49	367.32
222.73	0.12	0.50	421.97
222.74	0.13	0.50	479.08
222.75	0.14	0.51	538.57
222.76	0.15	0.51	600.33
222.77	0.16	0.51	664.28
222.78	0.17	0.51	730.36
222.79	0.18	0.51	798.50
222.80	0.19	0.52	868.63

100 Year Storm Ponding Depth and Overflow Elevation

1:100-Year Uncontrolled Flow (L/s):	126.60
Overflow Weir Base Elevation (m):	222.61
Structure T/G Elevation (m):	222.41
Required Weir Head (m):	0.058
C_d:	0.45
Qweir, (L/s):	126.60
Max Ponding Over T/G (m):	0.258
Weir Overflow Elevation (m):	222.67

Detailed Weir Flow Table

Elevation (m)	h_{weir} (m)	Weir C_d	Q_{Weir} (L/s)
222.61	0.00		0.00
222.63	0.02	0.29	16.85
222.65	0.04	0.41	67.08
222.67	0.06	0.45	136.01
222.69	0.08	0.48	219.46
222.71	0.10	0.49	315.26
222.73	0.12	0.50	421.97
222.75	0.14	0.51	538.57
222.77	0.16	0.51	664.28
222.79	0.18	0.51	798.50
222.81	0.20	0.52	940.70
222.83	0.22	0.52	1090.47
222.85	0.24	0.52	1247.43
222.87	0.26	0.52	1411.28
222.89	0.28	0.52	1581.74
222.91	0.30	0.53	1758.55

TATHAM ENGINEERING

PROJECT	116 & 120 Bond Street	FILE	323899
		DATE	12-Jun-2025
SUBJECT	Stage Storage Discharge	NAME	JN
		PAGE	9 OF 10

Stage Storage Discharge Table

Elevation (m)	$Q_{Orifice\ Primary}$ (L/s)	$Q_{Orifice\ Secondary}$ (L/s)	$Q_{Orifice\ Tertiary}$ (L/s)	Q_{Weir} (L/s)	Q_{Total} (L/s)	Total Vol. (m^3)
220.98	0.00	0.00	0.00	0.00	0.00	0.00
221.09	5.54	0.00	0.00	0.00	5.54	12.24
221.14	7.53	0.00	0.00	0.00	7.53	23.34
221.19	9.09	0.00	0.00	0.00	9.09	34.44
221.24	10.42	0.00	0.00	0.00	10.42	45.54
221.29	11.60	0.00	0.00	0.00	11.60	56.63
221.34	12.68	0.00	0.00	0.00	12.68	67.69
221.39	13.66	0.00	0.00	0.00	13.66	67.78
221.89	21.13	0.00	0.00	0.00	21.13	68.71
222.39	26.58	0.00	0.00	0.00	26.58	69.63
222.46	27.26	0.00	0.00	0.00	27.26	79.51
222.51	27.73	0.00	0.00	0.00	27.73	100.55
222.56	28.20	0.00	0.00	0.00	28.20	135.56
222.61	28.65	0.00	0.00	0.00	28.65	184.53
222.66	29.10	0.00	0.00	99.54	128.64	240.50
222.67	29.19	0.00	0.00	136.01	165.20	251.70
222.68	29.28	0.00	0.00	176.08	205.36	262.89
222.69	29.37	0.00	0.00	219.46	248.83	274.09
222.70	29.46	0.00	0.00	265.92	295.38	285.29
222.71	29.55	0.00	0.00	315.26	344.80	296.49
222.72	29.63	0.00	0.00	367.32	396.95	307.69
222.73	29.72	0.00	0.00	421.97	451.69	318.89
222.74	29.81	0.00	0.00	479.08	508.89	330.09
222.75	29.90	0.00	0.00	538.57	568.46	341.30
222.76	29.98	0.00	0.00	600.33	630.31	352.50
222.77	30.07	0.00	0.00	664.28	694.35	352.50
222.78	30.16	0.00	0.00	730.36	760.52	352.50
222.79	30.24	0.00	0.00	798.50	828.74	352.50
222.80	30.33	0.00	0.00	868.63	898.96	352.50

TATHAM ENGINEERING

PROJECT	116 & 120 Bond Street	FILE	323899
		DATE	12-Jun-2025
SUBJECT	Stage Storage Discharge	NAME	JN
		PAGE	10 OF 10

Discharge Summary - Modified Rational Method

Storm Event	Control Flow (L/s)	Storage (m^3)	Depth (m)	Elevation (m)
1:2-year	8.74	31.92	0.20	221.18
1:5-year	10.34	44.81	0.26	221.24
1:10-year	11.30	53.74	0.30	221.28
1:25-year	15.30	67.99	0.52	221.50
1:50-year	21.92	68.84	0.98	221.96
1:100-year	26.72	71.60	1.42	222.40

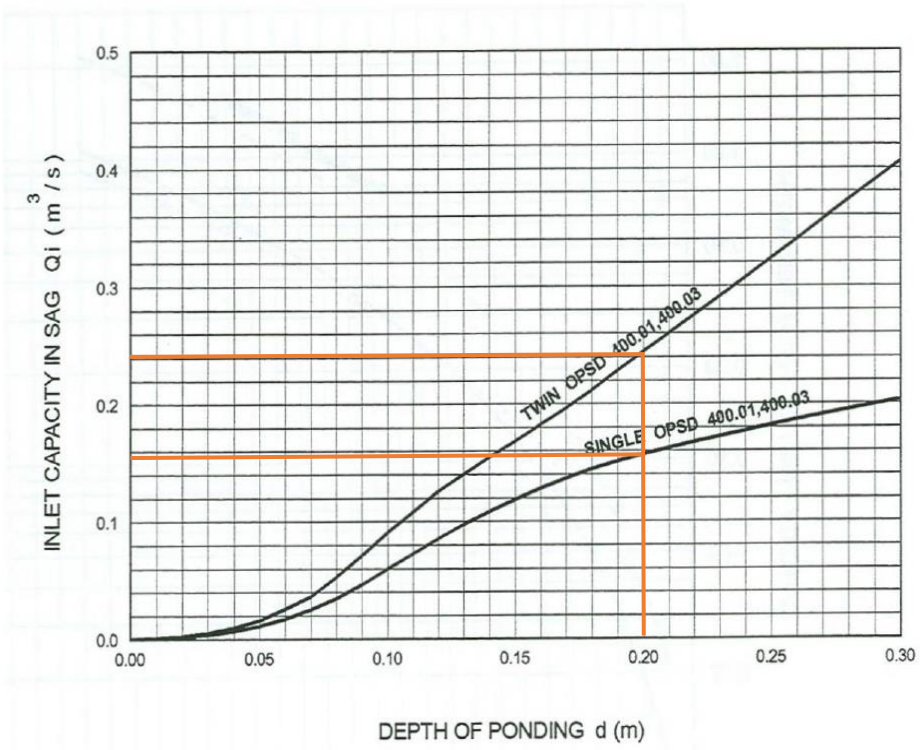
TATHAM ENGINEERING

PROJECT	116 Bond Street	FILE	323899
		DATE	June 12, 2025
SUBJECT	Storm Sewer Inlet Capacity	NAME	JN
		PAGE	1 OF 1

Municipality

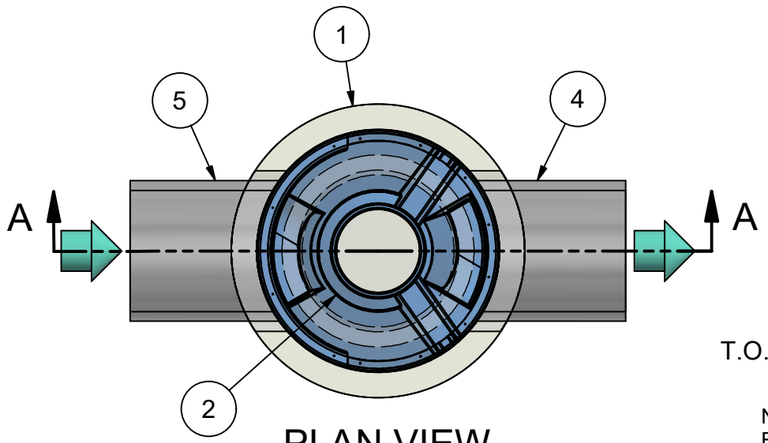
City of Orillia

Design Chart 4.19: Inlet Capacity at Road Sag

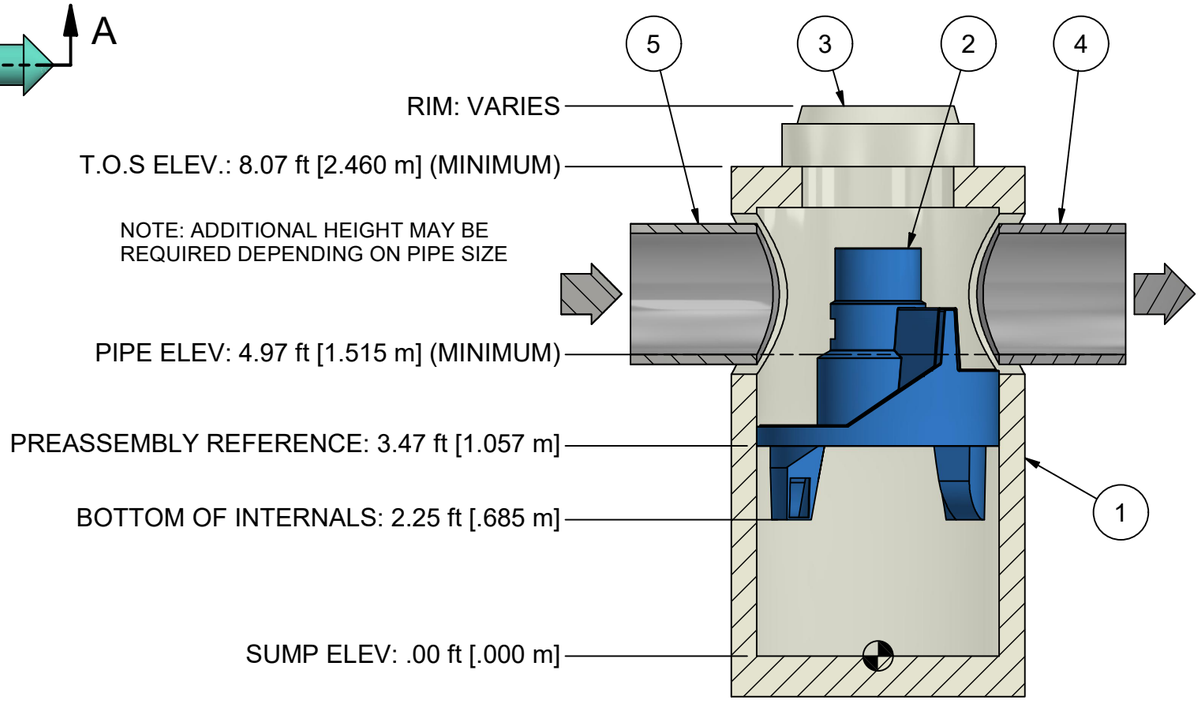


Inlet ID	No. of Inlets	Max. WL Depth (m)	Inlet Capacity (m^3/s)	Obstructed Inlet Capacity		Max. Inlet Design Flow (m^3/s)	Total Peak Overflow (m^3/s)
				Each (m^3/s)	Combined (m^3/s)		
DCB 1	1	0.20	0.240	0.120	0.120	0.070	-0.050
CBMH 2	1	0.20	0.158	0.079	0.079	0.060	-0.019

Appendix D:
Water Quality Controls



PLAN VIEW



SECTION A-A

HYDRO FRAME AND COVER (INCLUDED)

GRADE RINGS BY OTHERS AS REQUIRED

1. MANHOLE WALL AND SLAB THICKNESSES ARE NOT TO SCALE.

2. CONTACT HYDRO INTERNATIONAL FOR A BOTTOM OF STRUCTURE ELEVATION PRIOR TO SETTING FIRST DEFENSE MANHOLE.

3. CONTRACTOR TO CONFIRM RIM, PIPE INVERTS, PIPE DIA. AND PIPE ORIENTATION PRIOR TO RELEASE OF UNIT TO FABRICATION.

PRODUCT SPECIFICATION:

1. Peak Hydraulic Flow: 18.0 cfs (510 l/s)
2. Min Sediment Storage Capacity: 0.7 cu. yd. (0.5 cu. m.)
3. Maximum Inlet/Outlet Pipe Diameters: 24 in. (600 mm)
4. The Treatment System Shall Use An Induced Vortex To Separate Pollutants From Stormwater Runoff.
5. For More Product Information Including Regulatory Acceptances, Please Visit https://hydro-int.com/en/products/first-defense

GENERAL NOTES:
1. General Arrangement drawings only. Contact Hydro International for site specific drawings.
2. The diameter of the inlet and outlet pipes may be no more than 24".
3. Multiple inlet pipes possible (refer to project plan).
4. Inlet/outlet pipe angle can vary to align with drainage network (refer to project plans).
5. Peak flow rate and minimum height limited by available cover and pipe diameter.
6. Larger sediment storage capacity may be provided with a deeper sump depth.

PARTS LIST

ITEM	QTY	SIZE (in)	SIZE (mm)	DESCRIPTION
1	1	48	1200	I.D. PRECAST MANHOLE
2	1			INTERNAL COMPONENTS (PRE-INSTALLED)
3	1	30	750	FRAME AND COVER (ROUND)
4	1	24 (MAX)	600 (MAX)	OUTLET PIPE (BY OTHERS)
5	1	24 (MAX)	600 (MAX)	INLET PIPE (BY OTHERS)

PROJECTION

IF IN DOUBT ASK

DATE:	SCALE:
11/2/2021	1:30

DRAWN BY:	CHECKED BY:	APPROVED BY
ER	MRJ	

Title
4-ft DIAMETER
FIRST DEFENSE

GENERAL ARRANGEMENT

Hydro International®
hydro-int.com
HYDRO INTERNATIONAL

WEIGHT:	MATERIAL:

STOCK NUMBER:

DRAWING NO.: FD GA-4

SHEET SIZE:	SHEET:	Rev:
B	1 OF 1	-

Verification Statement

Hydro International First Defense® HC Oil Grit Separator
Registration number: (V-2018-10-01)
Date of issue: 2018-October-15 (rev 2019-02-01)

Technology type	Oil Grit Separator
Application	Technology to remove oil, sediment, trash and debris from stormwater and snowmelt runoff as well as other pollutants that attach to sediment particles, such as nutrients and metals
Company	Hydro International
Address	94 Hutchins Drive, Portland, Maine USA 04102 **Phone** +1-207-756 6200
Website	https://www.hydro-int.com
E-mail	dscott@hydro-int.com

Verified Performance Claims

The Hydro International First Defense® High Capacity (HC) Oil Grit Separator (OGS) was tested by Good Harbour Laboratories Inc. (GHL), Mississauga, Ontario, Canada in 2018. The performance test results were verified by Toronto and Region Conservation Authority (TRCA), Vaughan, Ontario, Canada following the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. The following performance claims were verified:

Capture test[1]:
With a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and an influent test sediment concentration of 200 mg/L, the First Defense® HC OGS device removes 67, 60, 55, 50, 45, 45, and 41 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 1000, and 1400 L/min/m^2, respectively.

Scour test[1]:
With 10.2 cm (4 inches) of test sediment pre-loaded onto a false floor reaching 50% of the manufacturer's recommended maximum sediment storage depth, the First Defense® HC OGS device generates adjusted effluent[2] concentrations of 0, 0, 11, 2, and 0 mg/L at 5-minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2, respectively.

[1] The claims can be applied to other units smaller or larger than the tested unit as long as the untested units meet the scaling rule specified in the Procedure for Laboratory of Testing of Oil Grit Separators (Version 3.0, June 2014)

[2] The effluent suspended sediment concentration is adjusted based on the background concentration and the smallest 5% of particles captured during the 40 L/min/m^2 sediment capture test (see Table 2)

Technology Application

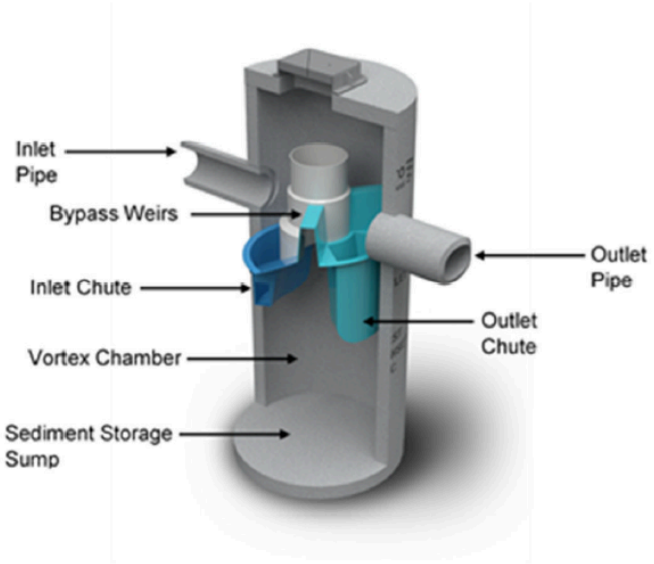
The First Defense® HC (FDHC) Oil Grit Separator can be used as a stand-alone stormwater treatment technology, depending on water quality objectives, or as a pretreatment component in a treatment train when higher TSS removals are required and polishing or volume reduction best management practices (BMPs), such as infiltration or bio-infiltration, are installed downstream. FDHC applications include: stormwater treatment at the point of entry into the drainage line; sites constrained by space, topography or drainage profiles with limited slope and depth of cover; retrofit installations where stormwater treatment is placed on or tied into an existing storm drain line; pretreatment for filters, infiltration, other sedimentation BMPs and storage.

Technology Description

The Hydro International First Defense® HC (FDHC) is an Oil Grit Separator designed to remove oil, sediment, trash and debris from stormwater and snowmelt runoff as well as other pollutants that attach to sediment particles, such as nutrients and metals. The patented flow modifying internal components are designed to be inserted into standard precast concrete manholes where they collect and treat runoff as part of the drainage system (Figure 1).

Flow entering the manhole via an inlet pipe or inlet grate is diverted into a vortex chamber beneath a separation module that includes both inlet/outlet chutes and bypass weirs. The internal bypass weirs divert flows greater than the maximum design treatment flow rate over the separation module and away from the vortex chamber where oil, sediment, debris and attached pollutants are accumulating. This function prevents high velocities from re-suspending previously captured pollutants during large storm events. The FDHC can be designed and sized to function effectively in either online or offline configurations.

Figure 1: Hydro International First Defense® HC Oil Grit Separator



The test unit was 1.2 m (4 foot) in diameter with a 1.51 m (59 5/8 inches) sump depth measured from the outlet invert to the floor of the unit. The effective treatment area (also known as the effective sedimentation area) is 1.2 m^2 (12.6 ft^2). The maximum sediment storage depth is 0.457 m (18 inches).

Description of Test Procedure

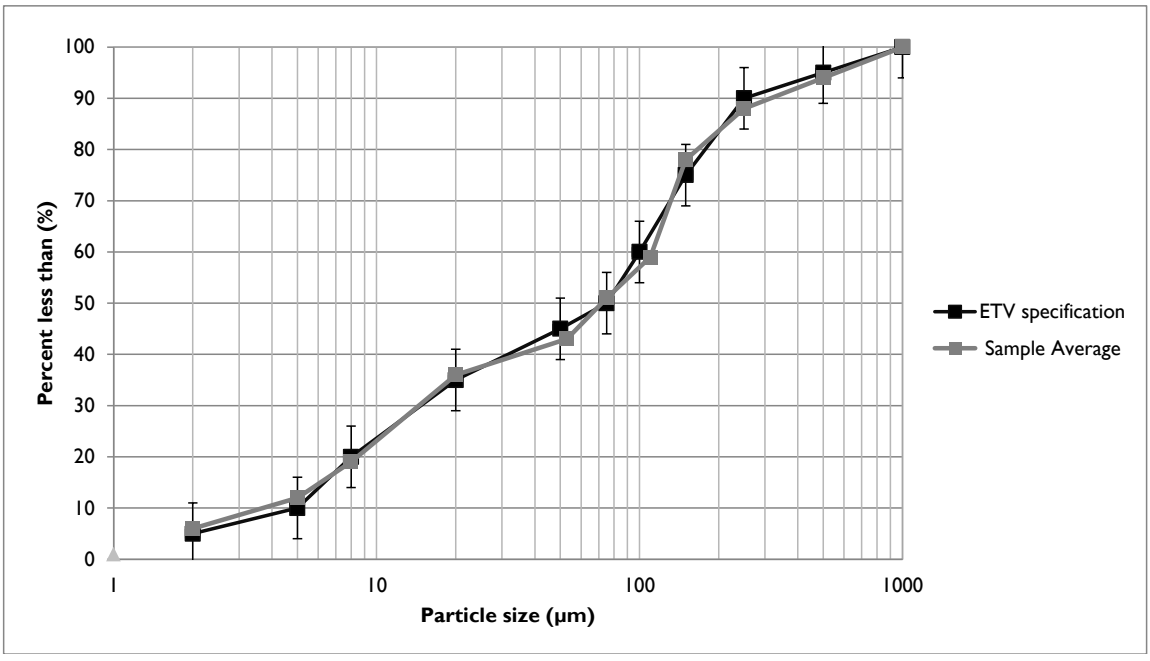
The test data and results for this verification were obtained from independent testing conducted on a 1.2 m (48 inch) diameter Hydro International First Defense® HC OGS device, in accordance with the *Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014)*. The laboratory test procedure was originally prepared by the Toronto and Region Conservation Authority (TRCA) in association with a 31 member advisory committee from various stakeholder groups.

Verification Results

Toronto and Region Conservation Authority verified the performance test data and other information pertaining to the First Defense® HC Oil Grit Separator. A Verification Plan was prepared to guide the verification process based on the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol.

The test sediment consisted of ground silica (1 – 1000 micron) with a specific gravity of 2.65, uniformly mixed to meet the particle size distribution specified in the testing procedure. The *Procedure for Laboratory Testing of Oil Grit Separators* requires that the three sample average of the test sediment particle size distribution (PSD) meet the specified PSD percent less than values within a boundary threshold of 6%, and a median particle size no greater than 75 µm. Comparison of the individual sample and average test sediment PSD to the specified PSD shown in Figure 2 indicates that the test sediment used for the capture and scour tests met this condition. The median particle size was 73 µm. Samples from test sediment batches used for each run met the specified PSD within the required tolerance thresholds.

Figure 2 - The three sample average particle size distribution (PSD) of the test sediment used for the capture and scour test compared to the specified PSD



The capacity of the device to retain sediment was determined at seven surface loading rates using the modified mass balance method. This method involved measuring the mass and particle size distribution of the injected and retained sediment for each test run. Performance was evaluated with a false floor simulating the technology filled to 50% of the manufacturer's recommended maximum sediment storage depth. The test was carried out with clean water that maintained a sediment concentration below 20 mg/L. Based on these conditions, removal efficiencies for individual particle size classes and for the test sediment as a whole were determined for each of the tested surface loading rates (Table 1).

In some instances, the removal efficiencies were above 100% for certain particle size fractions. These discrepancies are not unique to any one test laboratory and are attributed to errors relating to the blending of sediment, collection of representative samples for laboratory submission, and laboratory analysis of PSD. Due to these errors, caution should be exercised in applying the removal efficiencies by particle size fraction for the purposes of sizing the tested device (see Bulletin # CETV 2016-11-0001). The results for "all particle sizes by mass balance" (see Table 1) are based on measurements of the total injected and retained sediment mass, and are therefore not subject to blending, sampling or PSD analysis errors.

Table 1 - Removal efficiencies (%) of the First Defence HC at specified surface loading rates

Particle size fraction (µm)	Surface loading rate (L/min/m²)						
	40	80	200	400	600	1000	1400
>500	100*	100*	100*	81	72	86	80
250 - 500	100*	97	99	100*	100*	59	88
150 - 250	100*	91	95	93	47	100*	84
105 - 150	96	89	94	89	90	70	75
75 - 105	100*	90	95	77	-20**	100	51
53 - 75	74	100*	97	62	100*	46	37
20 - 53	60	33	10	5	4	0	0
8 - 20	29	16	8	3	3	1	1
5 – 8	8	5	8	4	4	4	3
<5	5	3	0	0	0	3	3
All particle sizes By mass balance	**66.5**	**59.9**	**55.4**	**50.2**	**44.9**	**45.2**	**40.5**

* Removal efficiencies were calculated to be above 100%. Calculated values ranged between 101 and 184% (average 115%). See text and Bulletin # CETV 2016-11-0001 for more information.
** An outlier in the retained sediment sample sieve data resulted in negative removal for this size fraction. The outlier at the 75 um particle size is shown in Figure 3.

Figure 3 - Particle size distribution of sediment retained in the First Defense HC in relation to the injected test sediment average

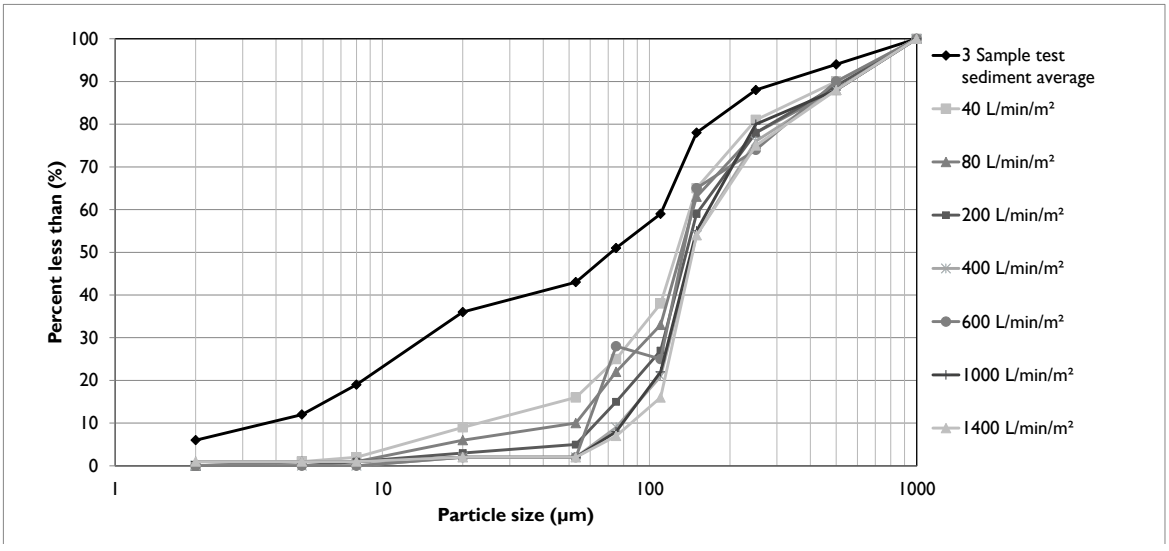


Figure 3 compares the particle size distribution (PSD) of the three sample average of the test sediment to the PSD of the sediment retained by the FDHC device at each of the tested surface loading rates. As expected, the capture efficiency for fine particles was generally found to decrease as surface loading rates increased, particularly in the 40 to 400 L/min/m² range.

Table 2 shows the results of the sediment scour and re-suspension test for the First Defense® HC unit. The scour test involved preloading 10.2 cm (4 inches) of fresh test sediment into the sedimentation sump of the device. The sediment was placed on a false floor to mimic a device filled to 50% of the maximum recommended sediment storage depth. Clean water was run through the device at five surface loading rates over a 30 minute period. Each flow rate was maintained for 5 minutes with a one minute transition time between flow rates. Effluent samples were collected at one minute sampling intervals and analyzed for Suspended Sediment Concentration (SSC) and PSD by recognized methods. The effluent samples were subsequently adjusted based on the background concentration of the influent water. The smallest 5% of particles captured during the 40 L/min/m^2 sediment capture test (13.5 μm in this case) was used to further adjust the effluent sediment concentrations, as per the method described in Bulletin # CETV 2016-09-0001. Results showed average adjusted effluent sediment concentrations below 11 mg/L at all surface loading rates. Effluent concentrations would be expected to decrease at higher flow rates since bypass over the insert bypass weirs was observed to begin at 1,032 L/min/m^2.

Table 2 - Scour test adjusted effluent sediment concentration at each surface loading rate

Run	Surface loading rate (L/min/m^2)	Run time (min)	Background sample concentration (mg/L)	Average adjusted effluent suspended sediment concentration (mg/L)*
1	200	1:00 – 6:00	0.8	0
2	800	7:00 – 12:00	1.0	0
3	1400	13:00 – 18:00	1.1	10.6
4	2000	19:00 – 24:00	2.8	2.4
5	2600	25:00 – 30:00	6.6	0

*The effluent suspended sediment concentration is adjusted based on the background concentration and the smallest 5% of particles captured during the 40 L/min/m^2 sediment capture test, as per the method described in Bulletin # CETV 2016-09-0001.

Variances from the Procedure

Minor variances from the *Procedure for Laboratory Testing of Oil-Grit Separators* used as the basis of testing for this verification were as follows:

1. The *Procedure* states that the tested device "must be a full scale commercially available device with the same configuration and components as would be typical for an actual installation." The unit tested for this verification had the same internal components as would be typical for a commercial installation, but the internal components were placed inside a structure constructed of composite materials, rather than a manhole made of concrete, the latter of which is typical for most installations. The dimensions of the structure were the same as would have been the case had the manhole been concrete. The use of alternate materials for the structure was not believed to significantly affect system performance.

2. As part of the capture test, evaluation of the 40 and 80 L/min/m^2 surface loading rate was split into 3 and 2 parts, respectively. The test was conducted in parts because of the long duration (i.e. over 10 hours) needed to feed the required minimum 11.3 kg of test sediment into the unit. At the end of the first and second parts of the test, the flow rates were gradually decreased to prevent capture of particles that would have been washed out under normal circumstances. The requirement to split the test into parts was not anticipated in the *Procedure for Laboratory Testing of Oil-Grit Separators*, but has been a common feature of testing at the 40 L/min/m^2 surface loading rate. Conducting the test in two parts for the 80 L/ min/m^2 surface loading rate is less common. The testing did not assess the significance of the breaks, however, the test laboratory and verifier do not believe that the breaks significantly affected the test results.

3. During the sediment scour test, the flow rate coefficient of variation (COV) at the 200 L/min/m^2 surface loading rate of 0.045 slightly exceeded the target COV of 0.04. The average flow rate during the test remained within ±10% of the target flow rate.

Quality assurance

Performance testing and verification of the First Defense® HC Oil Grit Separator were performed in accordance with the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. The verifier, Toronto and Region Conservation Authority, has confirmed that quality assurance requirements were addressed throughout the performance testing process and in the generation of performance test results. This includes reviewing all data sheets and data downloads, as well as overall management of the test system, quality control and data integrity.

Verification Summary

In summary, the First Defense® HC Oil Grit Separator is designed to remove oil, sediment, trash and debris from stormwater and snowmelt runoff as well as other pollutants that attach to sediment particles, such as nutrients and metals. Verification of performance claims for the Hydro International First Defense® HC Oil Grit Separator was conducted by Toronto and Region Conservation Authority based on independent third-party performance test results provided by Good Harbour Laboratories, as well as additional information provided by Hydro International. Table 3 summarizes the verification results in relation to the technology performance parameters that were identified to determine the efficacy of the First Defense® HC Oil Grit Separator.

Table 3 - Summary of Verification Results Against Performance Parameters

Performance Parameter	Verified Performance
Sediment Removal Rate	The sediment removal rate of the FDHC is dependent upon flow rate, particle density and particle size. Removal efficiency decreased with increasing surface loading rate from 67% at 40 L/min/m^2 to 41% at 1400 L/min/m^2. The weighted average removal efficiency achieved by the unit will vary depending on the rainfall distribution of the jurisdiction in which it is installed, and site characteristics.
Sediment Scour	When pre-loaded with sediment with a particle size distribution matching that of the feed sediment used in the sediment capture test, the FDHC generated effluent suspended solids concentrations of less than 11 mg/L at surface loading rates ranging from 200 to 2600 L/min/m^2.
Bypass flow rate	The flow rate at which bypass occurs will vary based on model size. For the 1.2 m (4 foot) diameter test unit, the flow rate at which bypass occurred over the insert bypass weirs was 1238 L/min (327 gpm).
Head loss	The loss of hydraulic head across the FDHC was determined by measuring the water elevation difference between the inlet and outlet sides of the insert. Head loss may vary based on model size. For the tested unit the head loss ranged from 2 mm (0.08 inches) at 93.5 L/min (12.3 gpm) to 100 mm (3.94 inches) at 1238 L/min (327 gpm) when bypass was observed to occur. At 327 gpm, when bypass occurred, the depth of the water was 177 mm upstream and 77 mm downstream for a difference of 100 mm (3.94 inches). The highest water elevation difference was 111mm (4.37 inches) at a flow rate of 1635 L/min (431.8 gpm), after which head loss declined up to the maximum measured flow rate of 3036 L/min (801.9 gpm).

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 First Defense® HC Oil Grit Separator, contact:	For more information on VerifiGlobal, contact:
Hydro International 94 Hutchins Drive, Portland, Maine USA 04102 t +1-207-756 6200 e: dscott@hydro-int.com w: www.hydro-int.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 Hydro International: *Original signed by:* *David Scott* David Scott Technical Product Manager, Americas Stormwater	Signed for VerifiGlobal: *Original signed by:* *Thomas Bruun* Thomas Bruun, Managing Director *Original signed by:* *John Neate* 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, Toronto and Region Conservation Authority, 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.

VerifiGlobal and the Verification Expert, Toronto and Region Conservation Authority, provide the verification services solely on the basis of the information supplied by the applicant or vendor and assume no liability thereafter. The responsibility for the information supplied remains solely with the applicant or vendor and the liability for the purchase, installation, and operation (whether consequential or otherwise) is not transferred to any other party as a result of the verification.

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
PHILIP D. MURPHY
Governor
SHEILA Y. OLIVER
Lt. Governor
DIVISION OF WATERSHED PROTECTION AND RESTORATION
BUREAU OF NJPDES STORMWATER PERMITTING & WATER QUALITY MANAGEMENT
P.O. Box 420 Mail Code 401-02B
Trenton, New Jersey 08625-0420
609-633-7021 / Fax: 609-777-0432
www.njstormwater.org
SHAWN M. LATOURETTE
Commissioner

July 19, 2021

Mr. Jeremy Fink
Pr. Product Development Engineer
Hydro International
94 Hutchins Drive
Portland, ME 04102

Re: MTD Lab Certification
First Defense® Optimum Vortex Separator by Hydro International
Online Installation

TSS Removal Rate 50%

Dear Mr. Fink:

The Stormwater Management rules under N.J.A.C. 7:8-5.2(f) and 5.2(j) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Bio Clean Environmental, Inc. has requested an MTD Laboratory Certification for the First Defense® Optimum Vortex Separator (FD Optimum).

The project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advance Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Laboratory Testing Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report dated June 2021 with the Verification Appendix for this device is published online at http://www.njcat.org/verification-process/technology-verification-database.html.

The NJDEP certifies the use of the First Defense® Optimum Vortex Separator by Hydro International at a TSS removal rate of 50% when designed, operated and maintained in accordance with the information provided in the Verification Appendix and the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5.

2. The FD Optimum shall be installed using the same configuration reviewed by NJCAT and shall be sized in accordance with the criteria specified in in item 6 below.

3. This FD Optimum cannot be used in series with another MTD or a media filter (such as a sand filter), to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.

4. Additional design criteria for MTDs can be found in Chapter 11.3 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual which can be found online at www.njstormwater.org.

5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the FD Optimum, which is attached to this document. However, it is recommended to review the maintenance manual at https://www.hydro-int.com/en/resources/first-defense-operations-maintenance-manual for any changes to the maintenance requirements.

6. Sizing Requirements:

   The example below demonstrates the sizing procedure for the FD Optimum:

   Example: A 0.25-acre impervious site is to be treated to 50% TSS removal using a FD Optimum. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs.

   Maximum Treatment Flow Rate (MTFR) Evaluation:

   The site runoff (Q) was based on the following:
   time of concentration = 10 minutes
   i=3.2 in/hr (page 21, Fig. 5-10 of Chapter 5 of the NJ Stormwater BMP Manual)
   c=0.99 (curve number for impervious)
   Q=ciA=0.99x3.2x0.25=0.79 cfs

   Given the site runoff is 0.79 cfs and based on Table 1 below, the FD Optimum 3-ft model with a MTFR of 1.02 cfs would be the smallest model approved that could be used for this site that could remove 50% of the TSS from the impervious area without exceeding the MTFR.

   The sizing table corresponding to the available system models is noted below. Additional specifications regarding each model can be found in the Verification Appendix under Table A-1 and Table A-2.

Table 1. FD Optimum Model and MTFRs

FD Optimum Model	Manhole Diameter (ft)	MTFR (cfs)
3-ft	3	1.02
4-ft	4	1.81
5-ft	5	2.83
6-ft	6	4.07
7-ft	7	5.53
8-ft	8	7.23
10-ft	10	11.33

Be advised a detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8. The plan must include all the items identified in the Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of inspection and maintenance equipment and tools, specific corrective and preventative maintenance tasks, indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact Lisa Schaefer of my office at lisa.schaefer@dep.nj.gov.

Sincerely,

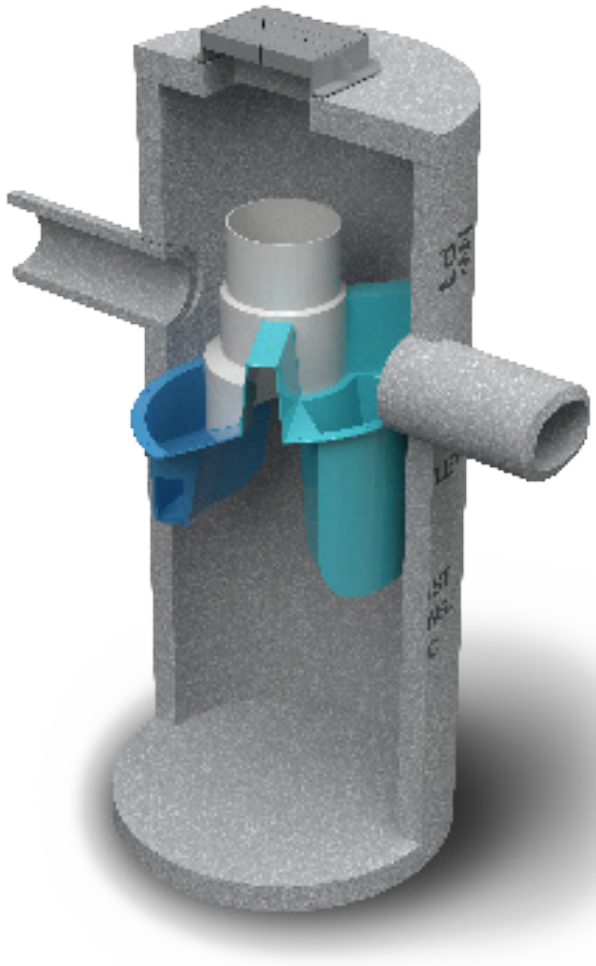
Gabriel Mahon

Gabriel Mahon, Chief
Bureau of NJPDES Stormwater Permitting & Water Quality Management
Division of Watershed Protection and Restoration
New Jersey Department of Environmental Protection

Attachment: Maintenance Plan

cc: Richard Magee, NJCAT

Hydro International



Operation and Maintenance Manual

First Defense® High Capacity and First Defense®Optimum

Vortex Separator for Stormwater Treatment

Table of Contents

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

I. First Defense® by Hydro International

Introduction

The First Defense® is an enhanced vortex separator that combines an effective and economical stormwater treatment chamber with an integral peak flow bypass. It efficiently removes total suspended solids (TSS), trash and hydrocarbons from stormwater runoff without washing out previously captured pollutants. The First Defense® is available in several model configurations to accommodate a wide range of pipe sizes, peak flows and depth constraints.

The two product models described in this guide are the First Defense® High Capacity and the First Defense® Optimum; they are inspected and maintained identically.

Operation

The First Defense® operates on simple fluid hydraulics. It is self-activating, has no moving parts, no external power requirement and is fabricated with durable non-corrosive components. No manual procedures are required to operate the unit and maintenance is limited to monitoring accumulations of stored pollutants and periodic clean-outs. The First Defense® has been designed to allow for easy and safe access for inspection, monitoring and clean-out procedures. Neither entry into the unit nor removal of the internal components is necessary for maintenance, thus safety concerns related to confined-space-entry are avoided.

Pollutant Capture and Retention

The internal components of the First Defense® have been designed to optimize pollutant capture. Sediment is captured and retained in the base of the unit, while oil and floatables are stored on the water surface in the inner volume (Fig.1).

The pollutant storage volumes are isolated from the built-in bypass chamber to prevent washout during high-flow storm events. The sump of the First Defense® retains a standing water level between storm events. This ensures a quiescent flow regime at the onset of a storm, preventing resuspension and washout of pollutants captured during previous events.

Accessories such as oil absorbent pads are available for enhanced oil removal and storage. Due to the separation of the oil and floatable storage volume from the outlet, the potential for washout of stored pollutants between clean-outs is minimized.

Applications

- Stormwater treatment at the point of entry into the drainage line
- Sites constrained by space, topography or drainage profiles with limited slope and depth of cover
- Retrofit installations where stormwater treatment is placed on or tied into an existing storm drain line
- Pretreatment for filters, infiltration and storage

Advantages

- Inlet options include surface grate or multiple inlet pipes
- Integral high capacity bypass conveys large peak flows without the need for “offline” arrangements using separate junction manholes
- Long flow path through the device ensures a long residence time within the treatment chamber, enhancing pollutant settling
- Delivered to site pre-assembled and ready for installation

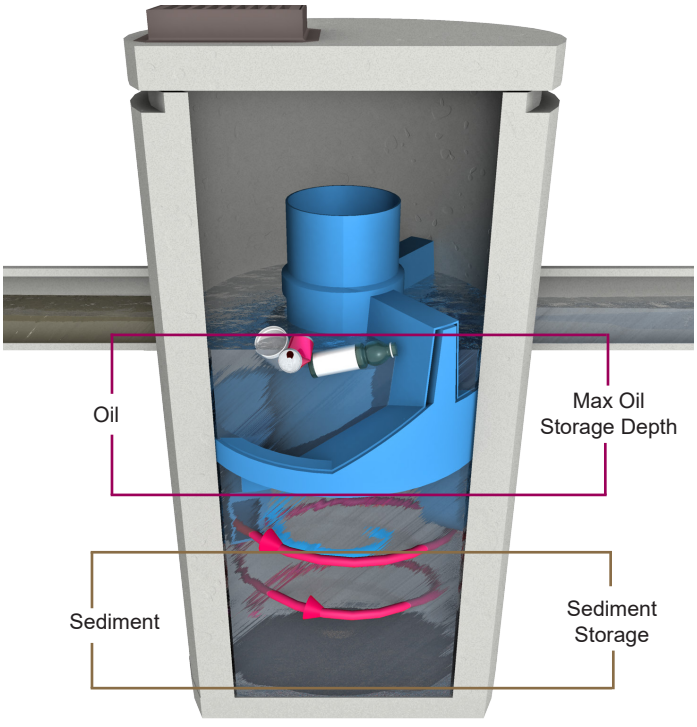


Fig.1 Pollutant storage volumes in the First Defense®.

II. Model Sizes & Configurations

The First Defense® inlet and internal bypass arrangements are available in several model sizes and configurations. The components have modified geometries allowing greater design flexibility to accommodate various site constraints.

All First Defense® models include the internal components that are designed to remove and retain total suspended solids (TSS), gross solids, floatable trash and hydrocarbons (Fig.2). First Defense® model sizes (diameter) are shown in Table 1.

III. Maintenance

First Defense® Components

1. **Built-In Bypass**
2. **Inlet Pipe**
3. **Inlet Chute**
4. **Floatables Draw-off Port**
5. **Outlet Pipe**
6. **Floatables Storage**
7. **Sediment Storage**
8. **Inlet Grate or Cover**

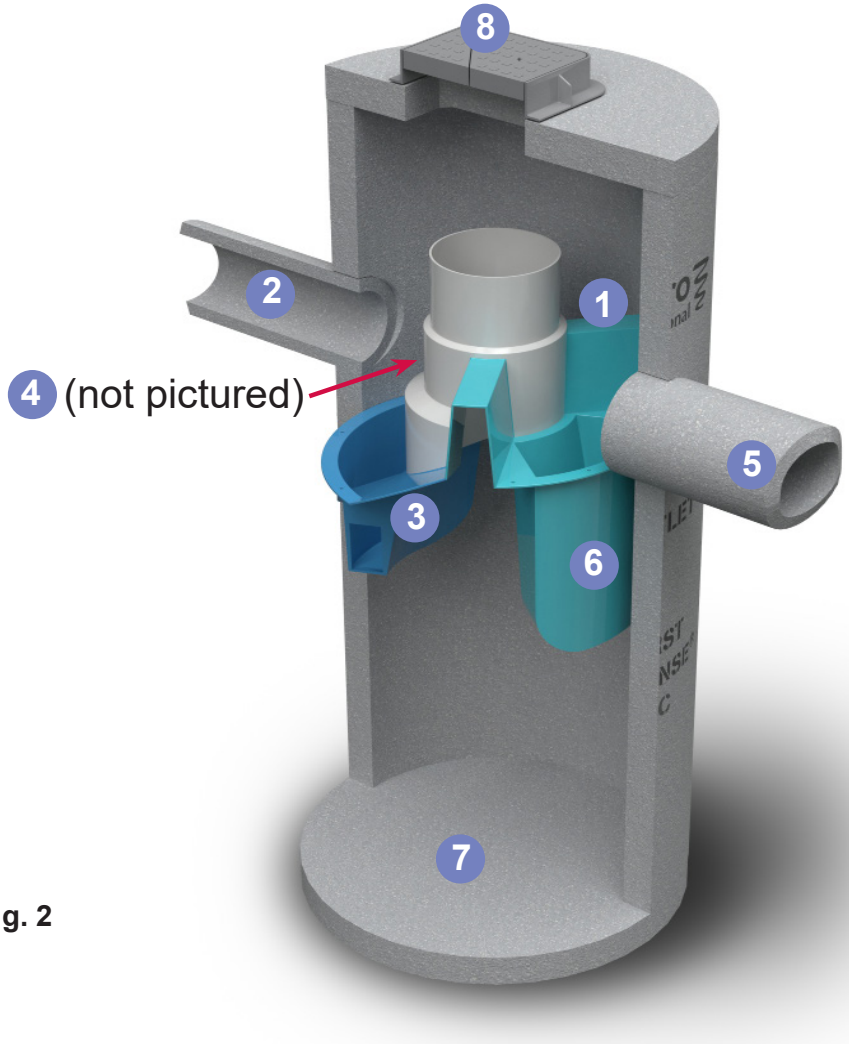


Fig. 2

Table 1

First Defense® Model Sizes
(ft / m) diameter
3 / 0.9
4 / 1.2
5 / 1.5
6 / 1.8
7 / 2.1
8 / 2.4
10 / 3.0

Overview

The First Defense® protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the continuous, long-term functioning of the First Defense®. The First Defense® will capture and retain sediment and oil until the sediment and oil storage volumes are full to capacity. When sediment and oil storage capacities are reached, the First Defense® will no longer be able to store removed sediment and oil.

The First Defense® allows for easy and safe inspection, monitoring and clean-out procedures. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables. Access ports are located in the top of the manhole.

Maintenance events may include Inspection, Oil & Floatables Removal, and Sediment Removal. Maintenance events do not require entry into the First Defense®, nor do they require the internal components of the First Defense® to be removed. In the case of inspection and floatables removal, a vactor truck is not required. However, a vactor truck is required if the maintenance event is to include oil removal and/or sediment removal.

Maintenance Equipment Considerations

The internal components of the First Defense® have a centrally located circular shaft through which the sediment storage sump can be accessed with a sump vac hose. The open diameter of this access shaft is 15 inches in diameter (Fig.3). Therefore, the nozzle fitting of any vactor hose used for maintenance should be less than 15 inches in diameter.

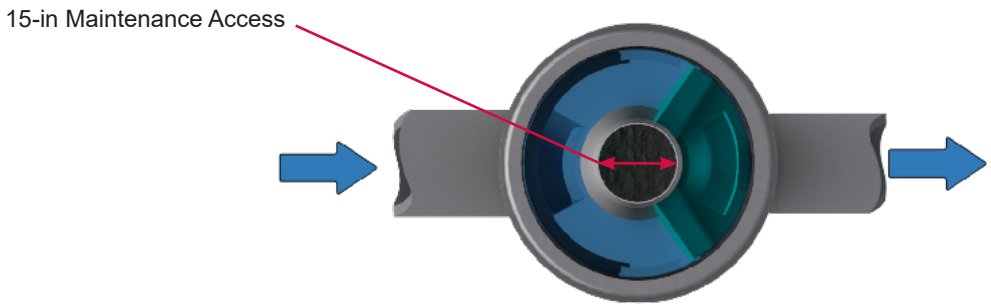


Fig.3 The central opening to the sump of the First Defense®is 15 inches in diameter.

Determining Your Maintenance Schedule

The frequency of clean out is determined in the field after installation. During the first year of operation, the unit should be inspected every six months to determine the rate of sediment and floatables accumulation. A simple probe such as a Sludge-Judge® can be used to determine the level of accumulated solids stored in the sump. This information can be recorded in the maintenance log (see page 9) to establish a routine maintenance schedule.

The vactor procedure, including both sediment and oil / flotables removal, for First Defense® typically takes less than 30 minutes and removes a combined water/oil volume of about 765 gallons.

Inspection Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.

2. Remove the grate or lid to the manhole.

3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities. Fig.4 shows the standing water level that should be observed.

4. Without entering the vessel, use the pole with the skimmer net to remove floatables and loose debris from the components and water surface.

5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel.

6. On the Maintenance Log (see page 9), record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.

7. Securely replace the grate or lid.

8. Take down safety equipment.

9. Notify Hydro International of any irregularities noted during inspection.

Floatables and Sediment Clean Out

Floatables clean out is typically done in conjunction with sediment removal. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables (Fig.4).

Floatables and loose debris can also be netted with a skimmer and pole. The access port located at the top of the manhole provides unobstructed access for a vactor hose to be lowered to the base of the sump.

Scheduling

- Floatables and sump clean out are typically conducted once a year during any season.

- Floatables and sump clean out should occur as soon as possible following a spill in the contributing drainage area.

Fig.4 Floatables are removed with a vactor hose

Recommended Equipment

- Safety Equipment (traffic cones, etc)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net (if only floatables are being removed)
- Sediment probe (such as a Sludge Judge®)
- Vactor truck (flexible hose recommended)
- First Defense® Maintenance Log

Floatables and Sediment Clean Out Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.

2. Remove the grate or lid to the manhole.

3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.

4. Remove oil and floatables stored on the surface of the water with the vactor hose or with the skimmer or net

5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel and record it in the Maintenance Log (page 9).

6. Once all floatables have been removed, drop the vactor hose to the base of the sump. Vactor out the sediment and gross debris off the sump floor

7. Retract the vactor hose from the vessel.

8. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components, blockages, or irregularly high or low water levels.

9. Securely replace the grate or lid.

Maintenance at a Glance

Inspection	- Regularly during first year of installation - Every 6 months after the first year of installation
Oil and Floatables Removal	- Once per year, with sediment removal - Following a spill in the drainage area
Sediment Removal	- Once per year or as needed - Following a spill in the drainage area
NOTE: For most clean outs the entire volume of liquid does not need to be removed from the manhole. Only remove the first few inches of oils and floatables from the water surface to reduce the total volume of liquid removed during a clean out.	

First Defense® Installation Log

HYDRO INTERNATIONAL REFERENCE NUMBER:	
SITE NAME:	
SITE LOCATION:	
OWNER:	CONTRACTOR:
CONTACT NAME:	CONTACT NAME:
COMPANY NAME:	COMPANY NAME:
ADDRESS:	ADDRESS:
TELEPHONE:	TELEPHONE:
FAX:	FAX:

INSTALLATION DATE: / /

MODEL SIZE (CIRCLE ONE): [3-FT] [4-FT] [5-FT] [6-FT] [7-FT] [8-FT] [10-FT]

INLET (CIRCLE ALL THAT APPLY): GRATED INLET (CATCH BASIN) INLET PIPE (FLOW THROUGH)

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

First Defense® Inspection and Maintenance Log

Date	Initials	Depth of Floatables and Oils	Sediment Depth Measured	Volume of Sediment Removed	Site Activity and Comments

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

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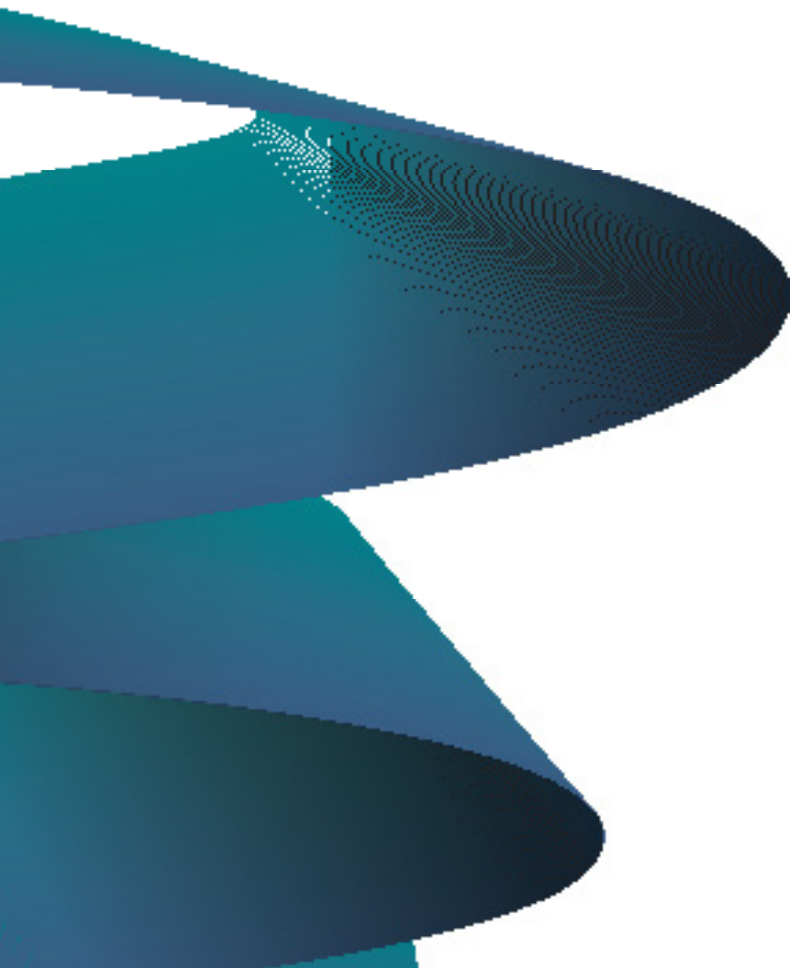
Hydro International



Stormwater Solutions

94 Hutchins Drive
Portland, ME 04102

Tel: (207) 756-6200
Fax: (207) 756-6212
stormwaterinquiry@hydro-int.com

www.hydro-int.com

Turning Water Around...®

FD_O+M_K_2105

OIL GRIT SEPARATOR TREATMENT EFFICIENCY
Hydro-International 4-Ft. Diameter First Defense Oil-Grit Separator
6/23/2025

Mass Surface Loading Rate
For 116 Bond Street Only

25-mm Design Storm Peak Flow Rate =	7	L/s	Controlled discharge from 1:2-year design storm applied.
	407	L/min	
4-Ft. Diameter =	1.2	m	
4-Ft. Treatment Area =	1.1	m^2	
Mass Surface Loading Rate =	360	$L/min/m^2$	

Particle Size (µm)	Percent Less Than (ETV Average)	Particle Size Fraction	Treatment Efficiency - ETV 200 (%)	Sediment Removal (%)
> 500	100.0%	5.00%	100.0%	5.0%
250 - 500	95.0%	5.00%	99.0%	5.0%
150 - 250	90.0%	15.00%	95.0%	14.3%
105 - 150	75.0%	15.00%	94.0%	14.1%
73 - 105	60.0%	10.00%	95.0%	9.5%
53 - 75	50.0%	5.00%	97.0%	4.9%
20 - 53	45.0%	10.00%	10.0%	1.0%
8 - 20	35.0%	15.00%	8.0%	1.2%
5 - 8	20.0%	10.00%	8.0%	0.8%
< 5	10.0%	10.00%	0.0%	0.0%
0	0.0%	0.00%	0.0%	0.0%
Total		**100.0%**		**55.7%**

Particle Size (µm)	Percent Less Than (ETV Average)	Particle Size Fraction	Treatment Efficiency - ETV 360 (%)	Sediment Removal (%)
> 500	100.0%	5.00%	84.8%	4.2%
250 - 500	95.0%	5.00%	99.8%	5.0%
150 - 250	90.0%	15.00%	93.4%	14.0%
105 - 150	75.0%	15.00%	90.0%	13.5%
73 - 105	60.0%	10.00%	80.6%	8.1%
53 - 75	50.0%	5.00%	69.1%	3.5%
20 - 53	45.0%	10.00%	6.0%	0.6%
8 - 20	35.0%	15.00%	4.0%	0.6%
5 - 8	20.0%	10.00%	4.8%	0.5%
< 5	10.0%	10.00%	0.0%	0.0%
0	0.0%	0.00%	0.0%	0.0%
Total		**100.0%**		**49.9%**

Particle Size (µm)	Percent Less Than (ETV Average)	Particle Size Fraction	Treatment Efficiency - ETV 400 (%)	Sediment Removal (%)
> 500	100.0%	5.00%	81.0%	4.0%
250 - 500	95.0%	5.00%	100.0%	5.0%
150 - 250	90.0%	15.00%	93.0%	14.0%
105 - 150	75.0%	15.00%	89.0%	13.4%
73 - 105	60.0%	10.00%	77.0%	7.7%
53 - 75	50.0%	5.00%	62.0%	3.1%
20 - 53	45.0%	10.00%	5.0%	0.5%
8 - 20	35.0%	15.00%	3.0%	0.5%
5 - 8	20.0%	10.00%	4.0%	0.4%
< 5	10.0%	10.00%	0.0%	0.0%
0	0.0%	0.00%	0.0%	0.0%
Total		**100.0%**		**48.5%**

OIL GRIT SEPARATOR TREATMENT EFFICIENCY
Hydro-International 4-Ft. Diameter First Defense Oil-Grit Separator
6/23/2025

Mass Surface Loading Rate
For 116 and 120 Bond Street

25-mm Design Storm Peak Flow Rate =	9	L/s	Controlled discharge from 1:2-year design storm applied.
	524	L/min	
4-Ft. Diameter =	1.2	m	
4-Ft. Treatment Area =	1.1	m^2	
Mass Surface Loading Rate =	464	$L/min/m^2$	

Particle Size (µm)	Percent Less Than (ETV Average)	Particle Size Fraction	Treatment Efficiency - ETV 400 (%)	Sediment Removal (%)
> 500	100.0%	5.00%	81.0%	4.0%
250 - 500	95.0%	5.00%	100.0%	5.0%
150 - 250	90.0%	15.00%	93.0%	14.0%
105 - 150	75.0%	15.00%	89.0%	13.4%
73 - 105	60.0%	10.00%	77.0%	7.7%
53 - 75	50.0%	5.00%	62.0%	3.1%
20 - 53	45.0%	10.00%	5.0%	0.5%
8 - 20	35.0%	15.00%	3.0%	0.5%
5 - 8	20.0%	10.00%	4.0%	0.4%
< 5	10.0%	10.00%	0.0%	0.0%
0	0.0%	0.00%	0.0%	0.0%
Total		**100.0%**		**48.5%**

Particle Size (µm)	Percent Less Than (ETV Average)	Particle Size Fraction	Treatment Efficiency - ETV 464 (%)	Sediment Removal (%)
> 500	100.0%	5.00%	78.1%	3.9%
250 - 500	95.0%	5.00%	100.0%	5.0%
150 - 250	90.0%	15.00%	78.4%	11.8%
105 - 150	75.0%	15.00%	89.3%	13.4%
73 - 105	60.0%	10.00%	77.0%	7.7%
53 - 75	50.0%	5.00%	74.1%	3.7%
20 - 53	45.0%	10.00%	4.7%	0.5%
8 - 20	35.0%	15.00%	3.0%	0.5%
5 - 8	20.0%	10.00%	4.0%	0.4%
< 5	10.0%	10.00%	0.0%	0.0%
0	0.0%	0.00%	0.0%	0.0%
Total		**100.0%**		**46.8%**

Particle Size (µm)	Percent Less Than (ETV Average)	Particle Size Fraction	Treatment Efficiency - ETV 600 (%)	Sediment Removal (%)
> 500	100.0%	5.00%	72.0%	3.6%
250 - 500	95.0%	5.00%	100.0%	5.0%
150 - 250	90.0%	15.00%	47.0%	7.1%
105 - 150	75.0%	15.00%	90.0%	13.5%
73 - 105	60.0%	10.00%	77.0%	7.7%
53 - 75	50.0%	5.00%	100.0%	5.0%
20 - 53	45.0%	10.00%	4.0%	0.4%
8 - 20	35.0%	15.00%	3.0%	0.5%
5 - 8	20.0%	10.00%	4.0%	0.4%
< 5	10.0%	10.00%	0.0%	0.0%
0	0.0%	0.00%	0.0%	0.0%
Total		**100.0%**		**43.1%**

TATHAM ENGINEERING

PROJECT	116 Bond Street	FILE	323899
		DATE	23-Jun-2025
SUBJECT	Settling Distance Design Sheet	NAME	JN
		PAGE	1 OF 2

Proposed Catchment **201**

Particle Settling Length

Central Lake Ontario Conservation Authority (CLOCA) Average Distribution

Particle Diameter (microns)	Distribution Percent (%)	Percent Greater (%)	Specific Gravity
0.5	4.5%	95.5%	2.65
3.0	4.5%	95.5%	2.65
6.5	6.0%	94.0%	2.65
9.0	7.0%	93.0%	2.65
12.0	7.0%	93.0%	2.65
21.0	7.5%	92.5%	2.65
35.0	8.5%	91.5%	2.65
70.0	13.5%	86.5%	2.65
100.0	17.0%	83.0%	2.65
250.0	37.0%	63.0%	2.65
300.0	51.5%	48.5%	2.65
800.0	74.5%	25.5%	2.65
1000.0	80.0%	20.0%	2.65
4000.0	92.5%	7.5%	2.65
9000.0	97.5%	2.5%	2.65
11000.0	100.0%	0.0%	2.65

Quality Control Storm - Peak Flow Runoff

Catchment Area, A, (ha): 0.16

Runoff Coefficient, C: 0.91

Rainfall Intensity, i_{25mm}, (mm/hr): 45.03 $i = 43C + 5.9$ (MECP Equation 4.9)

Peak Flow, Q_{P25mm}, (m^3/s): 0.018 $Q = \frac{CiA}{360}$ (MECP Equation 4.8)

TATHAM ENGINEERING

PROJECT	116 Bond Street	FILE	323899
		DATE	23-Jun-2025
SUBJECT	Settling Distance Design Sheet	NAME	JN
		PAGE	2 OF 2

Distance required to settle 83% of particles

Length, (m):	12.0	
Width, (m):	0.3	
Length to Width Ratio, r:	40.0	:1
Peak Flow - Q_{P25mm}, (m^3/s):	0.018	
Settling Velocity - V_S, (m/s):	0.0085	- For particles >= 21 microns
Settling Distance, D (m):	9.24	

$$Dist = \sqrt{\frac{r Q_p}{V_s}}$$ (MECP Equation 4.5)

Diameter of Particle, d, (cm):	0.010
Gravitational acceleration, g, (cm/s^2):	980
Kinematic Viscosity, v, ($m^2/s \times 10^{-6}$):	1.0526
Specific Gravity of particle, SG:	2.65

$$V_s = \frac{1}{18}\left[\frac{d^2 g}{v}(SG - 1)\right]$$ (Stokes' Law)

Settling Distance Provided > Settling Distance Required

Therefore, min. 80% water quality target achieved.

TATHAM ENGINEERING

PROJECT	116 & 120 Bond Street	FILE	323899
		DATE	23-Jun-2025
SUBJECT	Settling Distance Design Sheet	NAME	JN
		PAGE	1 OF 2

Proposed Catchment **201 & 301**

Particle Settling Length

Central Lake Ontario Conservation Authority (CLOCA) Average Distribution

Particle Diameter (microns)	Distribution Percent (%)	Percent Greater (%)	Specific Gravity
0.5	4.5%	95.5%	2.65
3.0	4.5%	95.5%	2.65
6.5	6.0%	94.0%	2.65
9.0	7.0%	93.0%	2.65
12.0	7.0%	93.0%	2.65
21.0	7.5%	92.5%	2.65
35.0	8.5%	91.5%	2.65
70.0	13.5%	86.5%	2.65
100.0	17.0%	83.0%	2.65
250.0	37.0%	63.0%	2.65
300.0	51.5%	48.5%	2.65
800.0	74.5%	25.5%	2.65
1000.0	80.0%	20.0%	2.65
4000.0	92.5%	7.5%	2.65
9000.0	97.5%	2.5%	2.65
11000.0	100.0%	0.0%	2.65

Quality Control Storm - Peak Flow Runoff

Catchment Area, A, (ha): 0.25

Runoff Coefficient, C: 0.89

Rainfall Intensity, i_{25mm}, (mm/hr): 44.17 $i = 43C + 5.9$ (MECP Equation 4.9)

Peak Flow, Q_{P25mm}, (m^3/s): 0.027 $Q = \frac{CiA}{360}$ (MECP Equation 4.8)

TATHAM ENGINEERING

PROJECT	116 & 120 Bond Street	FILE	323899
		DATE	23-Jun-2025
SUBJECT	Settling Distance Design Sheet	NAME	JN
		PAGE	2 OF 2

Distance required to settle 83% of particles

Length, (m):	12.0	
Width, (m):	0.3	
Length to Width Ratio, r:	40.0 :1	
Peak Flow - Q_{P25mm}, (m^3/s):	0.027	
Settling Velocity - V_S, (m/s):	0.0085	- For particles >= 21 microns
Settling Distance, D (m):	11.31	

$$Dist = \sqrt{\frac{r\,Q_p}{V_s}}$$ (MECP Equation 4.5)

Diameter of Particle, d, (cm):	0.010
Gravitational acceleration, g, (cm/s^2):	980
Kinematic Viscosity, v, ($m^2/s \times 10^{-6}$):	1.0526
Specific Gravity of particle, SG:	2.65

$$V_s = \frac{1}{18}\left[\frac{d^2 g}{v}(SG - 1)\right]$$ (Stokes' Law)

Settling Distance Provided > Settling Distance Required

Therefore, min. 80% water quality target achieved.

TATHAM ENGINEERING

PROJECT	116 Bond Street	FILE	323899
		DATE	23-Jun-2025
SUBJECT	Water Quality - Treatment Train	NAME	JN
		PAGE	1 OF 1

Water Quality Treatment Train Calculation

Catchment Label: 201

Total Drainage Area, (ha): 0.16

Catchment Imperviousness, (%): 94.2% (weighted average)

Treatment Control		Target TSS Removal	Actual Area (ha)	Actual TSS Removal
Pre-Treatment	First Defense - OGS	49.9%	0.16	49.9%
Primary Treatment	Enhanced Swale	60.0%	0.16	60.0%
Optional Treatment				0.0%

$$\text{TSS Removal} = 1 - ((1 - R_1) \times (1 - R_2) \times (1 - R_3))$$

Where:

R_1: % TSS Removal by Pre-Treatment

R_2: % TSS Removal by Primary Treatment

R_3: % TSS Removal by Optional Treatment

TSS Removal (Primary Controls) = 80.0%

TSS Removal (Incl. Secondary Controls): 80.0%

Notes:

TSS = Total Suspended Solids.

Refer to ETV Certification documents for First Defense treatment unit and treatment efficiency calculations.

Refer to Settling Distance Design Sheet for calculation of TSS settlement in swales.

TATHAM ENGINEERING

PROJECT	116 & 120 Bond Street	FILE	323899
		DATE	23-Jun-2025
SUBJECT	Water Quality - Treatment Train	NAME	JN
		PAGE	1 OF 1

Water Quality Treatment Train Calculation

Catchment Label: 201 & 301

Total Drainage Area, (ha): 0.25

Catchment Imperviousness, (%): 92.6% (weighted average)

Treatment Control		Target TSS Removal	Actual Area (ha)	Actual TSS Removal
Pre-Treatment	First Defense - OGS	46.8%	0.25	46.8%
Primary Treatment	Enhanced Swale	62.4%	0.25	62.4%
Optional Treatment				0.0%

$$\text{TSS Removal} = 1 - ((1 - R_1) \times (1 - R_2) \times (1 - R_3))$$

Where:

R_1: % TSS Removal by Pre-Treatment

R_2: % TSS Removal by Primary Treatment

R_3: % TSS Removal by Optional Treatment

TSS Removal (Primary Controls) = 80.0%

TSS Removal (Incl. Secondary Controls): 80.0%

Notes:

TSS = Total Suspended Solids.

Refer to ETV Certification documents for First Defense treatment unit and treatment efficiency calculations.

Refer to Settling Distance Design Sheet for calculation of TSS settlement in swales.

TATHAM ENGINEERING

Manning's Equation Flow Calculations

Project Details	
116 & 120 Bond Street	323899

Prepared By	
JN	6/23/2025

Manning's Equation: $Q = \frac{1}{n} \cdot A \cdot R^{\frac{2}{3}} \cdot S^{\frac{1}{2}}$

Where:

Q = flow (m^3/s)

n = Manning's roughness coefficient

A = area of flow (m^2)

R = hydraulic radius (m) equal to flow area divided by wetted perimeter

S = channel slope (m/m)

Enhanced Swale - Maximum Capacity

Manning's n =	0.035		Area =	0.180 m^2
Slope =	0.010	m/m	Wetted Perimeter =	1.565 m
Right Side Slope =	3.0	:1 (H:V)	Hydraulic Radius =	0.115 m
Left Side Slope =	3.0	:1 (H:V)	Flow =	0.122 m^3/s
Depth =	0.20	m	Design Flow =	0.027 m^3/s
Bottom Width =	0.30	m		

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Enhanced Swale - 116 Bond Street - 100-year storm discharge

Manning's n =	0.035		Design Flow =	0.012 m^3/s
Slope =	0.010	m/m		
Right Side Slope =	3.0	:1 (H:V)	Area =	0.033 m^2
Left Side Slope =	3.0	:1 (H:V)	Wetted Perimeter =	0.721 m
Depth =	0.07	m	Hydraulic Radius =	0.046 m
Bottom Width =	0.30	m	Flow =	0.012 m^3/s
			Velocity =	0.368 m/s

TATHAM ENGINEERING

Manning's Equation Flow Calculations

Enhanced Swale - 116 & 120 Bond Street - 100-year storm discharge

Manning's n =	0.035		Design Flow =	0.027	m^3/s
Slope =	0.010	m/m			
Right Side Slope =	3.0	:1 (H:V)	Area =	0.060	m^2
Left Side Slope =	3.0	:1 (H:V)	Wetted Perimeter =	0.930	m
Depth =	0.10	m	Hydraulic Radius =	0.064	m
Bottom Width =	0.30	m	Flow =	0.027	m^3/s
			Velocity =	0.458	m/s

TATHAM ENGINEERING

PROJECT	116 Bond Street	FILE	323899
		DATE	23-Jun-2025
SUBJECT	Enhanced Swale Overflow Weir	NAME	JN
		PAGE	1 OF 1

Overflow Weir Parameters

Overflow Weir Base Elevation (m):	220.78
Overflow Weir Width, B (m):	0.9
Weir Crest Length, L (m):	0.3
Overflow Weir Material:	Earth Channel, Clean
ϵ (mm):	37
δ/L :	0.07124

	Left Flank	Right Flank
Grade (%):	33.3%	33.3%
Width (m):	0.2	0.2

$$\delta/_L \approx 0.001 + 0.2 \times (\epsilon/_L)^{0.5}$$

100 Year Storm Ponding Depth and Overflow Elevation

1:100-Year Uncontrolled Flow (L/s):	11.52
Overflow Weir Base Elevation (m):	220.78
Structure T/G Elevation (m):	220.68
Required Weir Head (m):	0.057
C_d:	0.27
Qweir, (L/s):	11.52
Max Ponding Over T/G (m):	0.157
Weir Overflow Elevation (m):	220.84

$$C_d \approx 0.544 \times (1 - \frac{\delta/_L}{H/_L})^{3/2}$$

$$Q_{Weir} = C_d B g^{0.5} H^{3/2}$$

Note: for flow over flanks, H in Q_{weir} formula is "Required Weir Head" divided by 2.

Detailed Weir Flow Table

Elevation (m)	h_{weir} (m)	Weir C_d	Q_{Weir} (L/s)
220.78	0.00		0.00
220.79	0.01		0.00
220.80	0.02		0.00
220.81	0.03	0.08	1.75
220.82	0.04	0.17	4.70
220.83	0.05	0.24	8.55
220.84	0.06	0.28	13.12
220.85	0.07	0.31	18.31
220.86	0.08	0.34	24.05
220.87	0.09	0.36	30.29
220.88	0.10	0.38	36.99
220.90	0.12	0.41	51.68
220.92	0.14	0.42	67.93
220.94	0.16	0.44	85.59
220.96	0.18	0.45	104.57
220.98	0.20	0.46	124.77

TATHAM ENGINEERING

PROJECT	116 & 120 Bond Street	FILE	323899
		DATE	23-Jun-2025
SUBJECT	Enhanced Swale Overflow Weir	NAME	JN
		PAGE	1 OF 1

Overflow Weir Parameters

Overflow Weir Base Elevation (m):	220.78
Overflow Weir Width, B (m):	0.9
Weir Crest Length, L (m):	0.3
Overflow Weir Material:	Earth Channel, Clean
ϵ (mm):	37
δ/L :	0.07124

	Left Flank	Right Flank
Grade (%):	33.3%	33.3%
Width (m):	0.2	0.2

$$\delta/_L \approx 0.001 + 0.2 \times (\epsilon/_L)^{0.5}$$

100 Year Storm Ponding Depth and Overflow Elevation

1:100-Year Uncontrolled Flow (L/s):	26.72
Overflow Weir Base Elevation (m):	220.78
Structure T/G Elevation (m):	220.68
Required Weir Head (m):	0.081
C_d:	0.34
Qweir, (L/s):	26.72
Max Ponding Over T/G (m):	0.181
Weir Overflow Elevation (m):	220.86

$$C_d \approx 0.544 \times (1 - \frac{\delta/_L}{H/_L})^{3/2}$$

$$Q_{Weir} = C_d B g^{0.5} H^{3/2}$$

Note: for flow over flanks, H in Q_{weir} formula is "Required Weir Head" divided by 2.

Detailed Weir Flow Table

Elevation (m)	h_{weir} (m)	Weir C_d	Q_{Weir} (L/s)
220.78	0.00		0.00
220.79	0.01		0.00
220.80	0.02		0.00
220.81	0.03	0.08	2.19
220.82	0.04	0.17	5.38
220.83	0.05	0.24	9.50
220.84	0.06	0.28	14.37
220.85	0.07	0.31	19.88
220.86	0.08	0.34	25.97
220.87	0.09	0.36	32.58
220.88	0.10	0.38	39.68
220.90	0.12	0.41	55.21
220.92	0.14	0.42	72.37
220.94	0.16	0.44	91.02
220.96	0.18	0.45	111.05
220.98	0.20	0.46	132.37

Appendix E:
Water Budget Calculations

TATHAM ENGINEERING

Water Budget
Climate Normal Data

Project Details

116 & 120 Bond Street	323899

Prepared By

JN	June 23, 2025

Water Budget Details

Methodology	Thornthwaite Method
Climate Data & Source	Shanty Bay
	Climate Normal Data for 2002 to 2021 (Environment Canada)
Thornthwaite Coefficient	1.063

Month	Temp (°C)	Precip (mm)	Heat Index	PET (mm)	Daylight Factor	Days	Average Day Length	Adjusted PET (mm)	AET (mm)	Surplus (mm)	Deficit (mm)
Jan.	-7.7	88.8	0.0	0.0	0.77	31	9.290	0.0	0.0	88.8	0.0
Feb.	-6.5	69.8	0.0	0.0	0.87	28	10.464	0.0	0.0	69.8	0.0
Mar.	-1.9	63.8	0.0	0.0	1.00	31	11.941	0.0	0.0	63.8	0.0
Apr.	5.7	65	1.2	26.4	1.12	30	13.483	29.7	29.7	35.3	0.0
May	12.1	79.9	3.8	58.8	1.23	31	14.800	74.9	74.9	5.0	0.0
Jun.	17.4	88.6	6.6	86.4	1.29	30	15.477	111.5	88.6	0.0	22.9
Jul.	20.1	73.2	8.2	100.8	1.26	31	15.144	131.4	73.2	0.0	58.2
Aug.	19.2	86.2	7.7	96.0	1.17	31	13.989	115.6	86.2	0.0	29.4
Sep.	15.2	92.2	5.4	74.9	1.04	30	12.513	78.1	78.1	14.1	0.0
Oct.	8.7	78.2	2.3	41.4	0.92	31	10.983	39.1	39.1	39.1	0.0
Nov.	2.6	98	0.4	11.5	0.80	30	9.625	9.2	9.2	88.8	0.0
Dec.	-3.6	84.3	0.0	0.0	0.74	31	8.909	0.0	0.0	84.3	0.0
Total	**-**	**968**	**35.6**	**496.0**	**-**	**365**	**-**	**589.4**	**478.9**	**489.1**	**110.5**

Additional Notes

PET = Potential Evapotranspiration; AET = Actual Evapotranspiration

Equations

$PET = 16\left(\frac{L}{12}\right)\left(\frac{N}{30}\right)\left(\frac{10T_d}{I}\right)^{\alpha}$ Where

PET is the estimated potential evapotranspiration (mm/month)

T_d is the average daily temperature (degrees Celsius; if this is negative, use 0) of the month being calculated

N is the number of days in the month being calculated

L is the average day length (hours) of the month being calculated

$\alpha = (6.75 \times 10^{-7})I^3 - (7.71 \times 10^{-5})I^2 + (1.792 \times 10^{-2})I + 0.49239$

$I = \sum_{i=1}^{12}\left(\frac{T_{m_i}}{5}\right)^{1.514}$ is a heat index which depends on the 12 monthly mean temperatures T_{m_i}.[1]

TATHAM ENGINEERING

Water Budget

Pre and Post Development Comparison

Project Details

116 & 120 Bond Street	323899

Prepared By

JN	Jun-25

Pre-Development Catchment Details

Area (ha)	0.42
Pervious Area (ha)	0.35
Impervious Area (ha)	0.07

Post Development Catchment Details

Area (ha)	0.42
Pervious Area (ha)	0.17
Impervious Area (ha)	0.25

Infiltration Factor

Infiltration Factor	Pre-Development		Post Development	
	Pervious	Impervious	Pervious	Impervious
Topography	0.100	0.0	0.100	0.0
Soil	0.100	0.0	0.100	0.0
Land Cover	0.100	0.0	0.100	0.0
Infiltration Factor	0.300	0.0	0.300	0.0

Water Budget

Water Budget	Pervious	Impervious	Total	Pervious	Impervious	Total
Water Surplus (m^3)	1,325	265	1,590	644	946	1,590
Infiltration (m^3)	398	0	398	193	0	193
Runoff (m^3)	928	265	1,193	451	946	1,397
Reduction in Infiltration Volume (m^3)						**204**

Additional Notes

Site area includes runoff directed onto the subject lands from external properties.

Infiltration Factors

Topography	Flat Land, average slope < 0.6 m/km	0.3
	Rolling Land, average slope 2.8 m to 3.8 m/km	0.2
	Hilly Land, average slope 28 m to 47 m/km	0.1
Soils	Tight impervious clay	0.1
	Medium combinations of clay and loam	0.2
	Open Sandy loam	0.4
Cover	Cultivated Land	0.1
	Woodland	0.2

(Stormwater Planning and Design Manual. MOE, 2003.)

TATHAM ENGINEERING

Water Budget

Mitigation Measures
LID Design

Project Details

116 & 120 Bond Street	323899

Prepared By

JN	Jun-25

LID System Design Details

LID Measure	Infiltration Gallery
LID Impervious Drainage Area (ha)	0.25
Number of LIDs	1
Void Ratio	0.33
Footprint of LID (m^2)	14.40
Depth of LID (m)	0.60
Storage Volume Required (m^3)	1.7
Volume Required / LID (m^3)	1.7
Volume Provided / LID (m^3)	2.8
Volume Provided (m^3)	2.8
Design Precipitation Depth (mm)	1.1
Annual Volume Captured (mm)	168.2
Annual Volume Captured excluding Evapotransiration (m^3)	421
Annual Volume Captured after Evapotranspiration (m^3)	336

Additional Notes

Void Ratio represents composite of 25% for 0.3 m of sand and 40% for 0.3 m of clear stone.

TATHAM ENGINEERING

Water Budget
Summary

Project Details

116 & 120 Bond Street	323899

Prepared By

JN	Jun-25

Summary

Existing Infiltration (m^3)	398
Proposed Infiltration (m^3) - No Mitigtation	193
Infiltration Surplus Prior to Mitigation (m^3)	-204

Proposed Infiltration Measures

- [ ] Increase Topsoil Depth
- [x] Infiltration LID
- [ ] Impervious Area Routed Over Pervious Area

Mitigation - Increase Topsoil Reduction in Pervious Runoff (m^3)	0
Mitigation Measure - Implementing LID (m^3)	336
Mitigation Measure - Impervious Area Routed over Pervious Area (m^3)	0
Proposed Infiltration (m^3)	529
Infiltration Surplus after Mitigation (m^3)	132

Additional Notes

Appendix F: Phosphorous Reduction Calculations

TATHAM ENGINEERING

Phosphorus Budget Assessment

Project Details

116 & 120 Bond Street	323899

Prepared By

JN	June 23, 2025

Watershed

Oro Creeks North

Treatment Method

Treatment Train

LAND USE CATEGORY	Phosphorus Loading Rate (kg/ha/yr)	Pre-Development		Post-Development		Post-Development		Post-Development		Post-Development	
		Total Area		Treated Area (Catch. 201)		Treated Area (Catch. 202)		Treated Area (N/A)		Untreated Area (Catch. 102 & 203)	
		Area (ha)	Loading (kg/yr)	Area (ha)	Loading (kg/year)	Area (ha)	Loading (kg/year)	Area (ha)	Loading (kg/year)	Area (ha)	Loading (kg/year)
Cropland	0.39		0.00		0.00		0.00		0.00		0.00
Hay-Pasture	0.12		0.00		0.00		0.00		0.00		0.00
Turf -Sod	0.24		0.00		0.00		0.00		0.00		0.00
High Intensity Development - C/I	1.82		0.00		0.00		0.00		0.00		0.00
High Intensity Development - R	1.32		0.00	0.16	0.21	0.06	0.08		0.00		0.00
Low Intensity Development	0.13	0.40	0.05		0.00		0.00		0.00	0.18	0.02
Quarry	0.08		0.00		0.00		0.00		0.00		0.00
Unpaved Road	0.83		0.00		0.00		0.00		0.00		0.00
Forest	0.10		0.00		0.00		0.00		0.00		0.00
Transition	0.16		0.00		0.00		0.00		0.00		0.00
Wetland	0.10		0.00		0.00		0.00		0.00		0.00
Open Water	0.26		0.00		0.00		0.00		0.00		0.00
Total		**0.40**	**0.05**	**0.16**	**0.21**	**0.06**	**0.08**	**0.00**	**0.00**	**0.18**	**0.02**

CONTROLS

Proposed Treatment Method			Removal Efficiency (%)			Catch. 201		Catch. 202		N/A	
Catch. 201	Catch. 202	N/A	201	202	N/A	Area (ha)	Loading (kg/year)	Area (ha)	Loading (kg/year)	Area (ha)	Loading (kg/year)
Underground Storage	Infiltration Trench	Untreated	25.00	60.00	0.00	0.16	0.16	0.06	0.03	0.00	0.00
OGS - ETV Verified			20.00			0.16	0.13				
Enhanced Grass Swale			25.00			0.16	0.10				
Effective Removal Efficiency			**55.00**	**60.00**	**0.00**	**0.16**	**0.10**	**0.06**	**0.03**	**0.00**	**0.00**

SUMMARY

Existing Phosphorous Load	0.05 kg/year
Post Development Phosphorous Load (no controls)	0.31 kg/year
Post Development Phosphorous Load (with controls)	0.15 kg/year
Overall Increase in Phosphorus Load	0.10 kg/year

TATHAM ENGINEERING

Phosphorus Budget Assessment

Project Details

116 & 120 Bond Street	323899

Prepared By

JN	June 23, 2025

Watershed

Oro Creeks North

Treatment Method

Treatment Train

LAND USE CATEGORY	Phosphorus Loading Rate (kg/ha/yr)	Pre-Development		Post-Development		Post-Development		Post-Development		Post-Development	
		Total Area		Treated Area (Catch. 201 & 301)		Treated Area (Catch. 202)		Treated Area (Catch. 302)		Untreated Area (Catch. 303)	
		Area (ha)	Loading (kg/yr)	Area (ha)	Loading (kg/year)	Area (ha)	Loading (kg/year)	Area (ha)	Loading (kg/year)	Area (ha)	Loading (kg/year)
Cropland	0.39		0.00		0.00		0.00		0.00		0.00
Hay-Pasture	0.12		0.00		0.00		0.00		0.00		0.00
Turf -Sod	0.24		0.00		0.00		0.00		0.00		0.00
High Intensity Development - C/I	1.82		0.00		0.00		0.00		0.00		0.00
High Intensity Development - R	1.32		0.00	0.25	0.33	0.06	0.08	0.04	0.05	0.05	0.07
Low Intensity Development	0.13	0.40	0.05		0.00		0.00		0.00		0.00
Quarry	0.08		0.00		0.00		0.00		0.00		0.00
Unpaved Road	0.83		0.00		0.00		0.00		0.00		0.00
Forest	0.10		0.00		0.00		0.00		0.00		0.00
Transition	0.16		0.00		0.00		0.00		0.00		0.00
Wetland	0.10		0.00		0.00		0.00		0.00		0.00
Open Water	0.26		0.00		0.00		0.00		0.00		0.00
Total		**0.40**	**0.05**	**0.25**	**0.33**	**0.06**	**0.08**	**0.04**	**0.05**	**0.05**	**0.07**

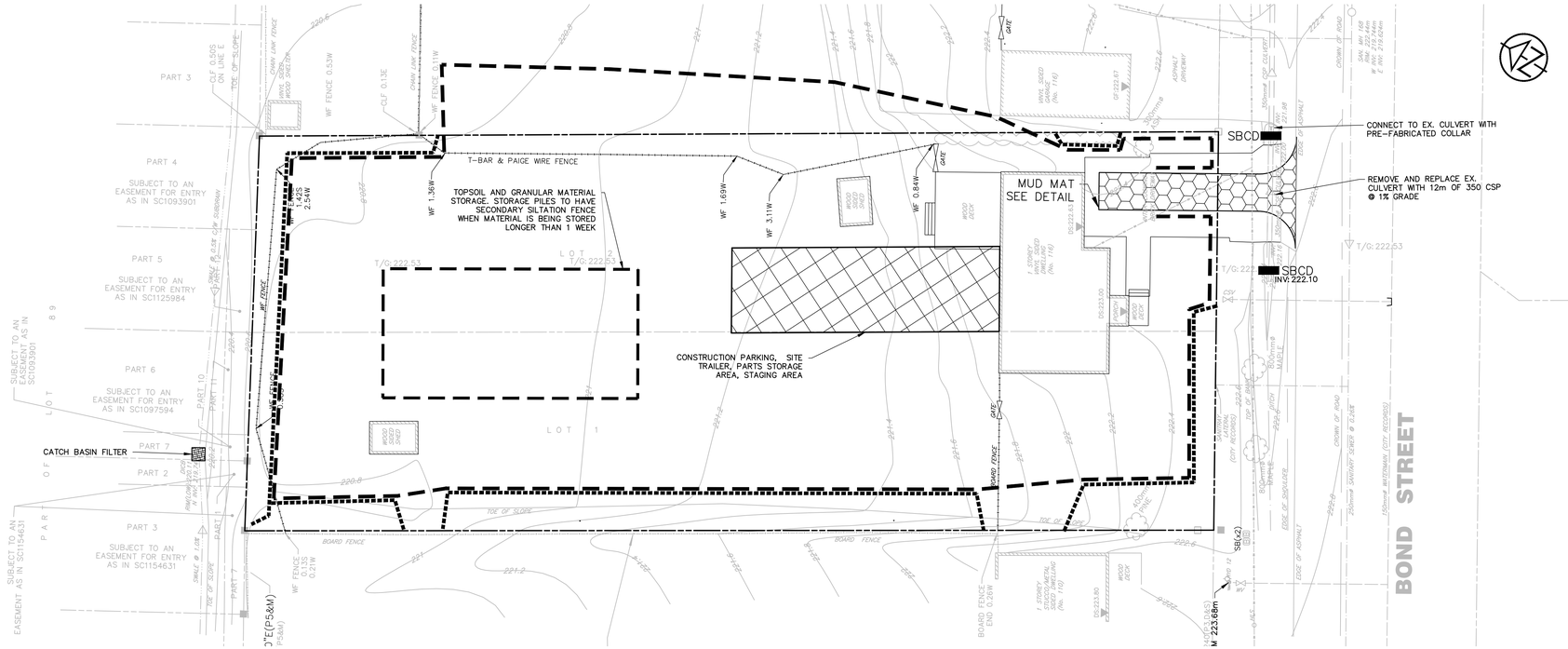
CONTROLS

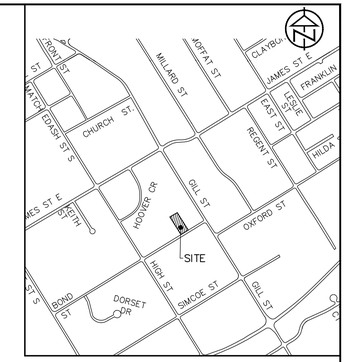
Proposed Treatment Method			Removal Efficiency (%)			Catch. 201 & 301		Catch. 202		Catch. 302	
Catch. 201 & 301	Catch. 202	Catch. 302	201 & 301	202	302	Area (ha)	Loading (kg/year)	Area (ha)	Loading (kg/year)	Area (ha)	Loading (kg/year)
Underground Storage	Infiltration Trench	Infiltration Trench	25.00	60.00	60.00	0.25	0.25	0.06	0.03	0.04	0.02
OGS - ETV Verified			20.00			0.25	0.20				
Enhanced Grass Swale			25.00			0.25	0.15				
Effective Removal Efficiency			**55.00**	**60.00**	**60.00**	**0.25**	**0.15**	**0.06**	**0.03**	**0.04**	**0.02**

SUMMARY

Existing Phosphorous Load	0.05 kg/year
Post Development Phosphorous Load (no controls)	0.53 kg/year
Post Development Phosphorous Load (with controls)	0.27 kg/year
Overall Increase in Phosphorus Load	0.22 kg/year

Appendix G:
Design Drawings

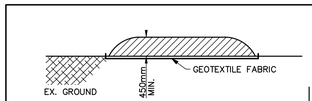




KEY PLAN
N.T.S.

LEGEND

- SBCD — STRAW BALE CHECK DAM PER OPSD 219.180
- SILT FENCE PER OPSD 219.131
- TREE PROTECTION FENCE
- PROPERTY LINE
- EXISTING DITCH
- EXISTING BELL LINE
- EXISTING HYDRO LINE
- EXISTING GAS LINE
- EXISTING HYDRO POLE/LIGHT STANDARD
- EXISTING HYDRO POLE
- EXISTING BENCH MARK
- STONE MUD MAT
- CATCH BASIN FILTER



STONE SIZE – THE STONE PAD SHALL BE A MIN. 450mm THICK. USE 50#mm STONE OR RECLAIMED CONCRETE EQUIVALENT FOR FIRST 5m FROM ADJACENT ROAD & 150mm# STONE FOR REMAINDER OF STONE PAD.

LENGTH – AS REQUIRED BUT NOT LESS THAN 15m.

WIDTH – 5m MIN. BUT NOT LESS THAN THE WIDTH AT POINTS WHERE INGRESS AND EGRESS OCCURS.

GEOTEXTILE FABRIC (TERRAFIX 270R OR EQUAL) WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING STONE.

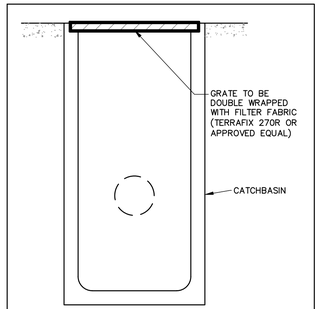
SURFACE WATER – ALL SURFACE WATER FLOWING OR DIRECTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE.

MAINTENANCE – THE CONTRACTOR SHALL MAINTAIN THE ENTRANCE AT ALL TIME, IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAY. THIS MAY REQUIRE PERIODIC DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHT-OF-WAY MUST BE REMOVED IMMEDIATELY BY THE CONTRACTOR. UPON OBSERVATION OF CONTINUOUS MUD TRACKING ONTO ADJACENT STREETS, THE STONE MAT IS TO BE FULLY REPLACED.

WASHING – WHEELS SHALL BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO PUBLIC RIGHT-OF-WAY. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.

INSPECTION AND REQUIRED MAINTENANCE AFTER EACH RAIN SHALL BE PROVIDED BY THE CONTRACTOR.

STONE MUD MAT DETAIL
SCALE: NTS



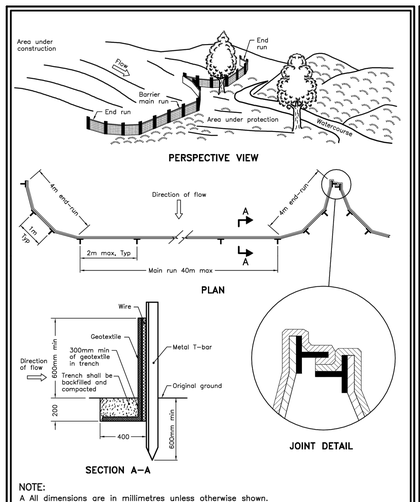
CATCHBASIN FILTRATION DETAIL
SCALE: N.T.S.

SILTATION AND EROSION CONTROL NOTES

1. ALL SILTATION AND EROSION CONTROL MEASURES TO BE IN PLACE PRIOR TO CONSTRUCTION.
2. CONTRACTOR TO INSTALL AND MAINTAIN SILTATION CONTROL DEVICES AT LOCATIONS SHOWN, OR AS DIRECTED BY THE ENGINEER IF ADDITIONAL CONTROLS ARE DEEMED NECESSARY.
3. CONTRACTOR TO ARRANGE PRE-CONSTRUCTION MEETING WITH ENGINEER IMMEDIATELY AFTER PLACING ALL SILTATION CONTROL DEVICES.
4. SILTATION CONTROL DEVICES TO BE INSPECTED BY CONTRACTOR WEEKLY AND AFTER EACH RAINFALL. REPAIRS TO SILTATION CONTROL DEVICES TO BE COMPLETED PROMPTLY WHEN REQUIRED.
5. THE ENGINEER WILL INSPECT THE SEDIMENT AND EROSION CONTROL MEASURES PERIODICALLY, AND AFTER EACH MAJOR STORM EVENT. THE ENGINEER WILL NOTIFY THE CONTRACTOR OF CORRECTIVE ACTIONS REQUIRED AS SOON AS DEFICIENCIES ARE NOTED. THE CONTRACTOR MAINTAINS ULTIMATE RESPONSIBILITY TO ENSURE PROPER SEDIMENT AND EROSION CONTROL MEASURES ARE IMPLEMENTED AND MAINTAINED. ALL DEFICIENCIES AND CORRECTIVE MEASURES WILL BE DOCUMENTED BY THE CONTRACTOR IN A WEEKLY INSPECTION REPORT. A COPY OF THE WEEKLY INSPECTION REPORT WILL BE PROVIDED TO THE ENGINEER.
6. INSTALL SILT SACK IN ALL NEW CATCHBASINS/CATCHBASIN MAINTENANCE HOLES AND EXISTING CATCHBASINS/CATCHBASIN MAINTENANCE HOLES WITHIN THE CONSTRUCTION LIMITS AND/OR AREAS EXPOSED TO SILTATION. SILT SACK – REGULAR FLOW BY TERRAFIX OR APPROVED EQUAL.
7. CONTRACTOR TO REMOVE SILTATION CONTROL DEVICES ONLY AFTER ALL PAVING IS COMPLETED AND VEGETATION HAS STABILIZED.
8. ALL SILT FENCE PER OPSD 219.131 (SEE DETAIL DWG DET-3) .

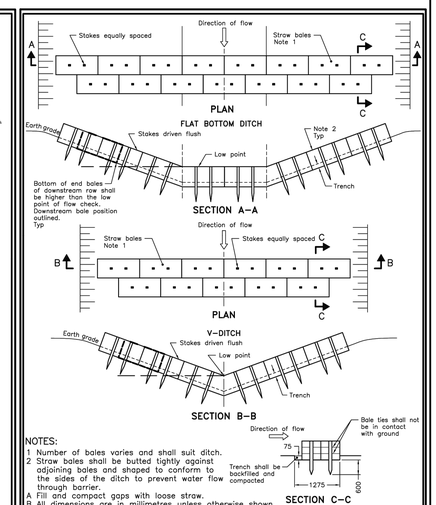
CONSTRUCTION ENTRANCE NOTES

1. CONSTRUCT AND MAINTAIN CONSTRUCTION ENTRANCE AS SHOWN AND IN ACCORDANCE WITH O.P.S.D. 301.020.
2. ALL CONSTRUCTION VEHICLES TO ACCESS THE SITE USING THE DESIGNATED CONSTRUCTION ENTRANCE.
3. CONTRACTOR TO INSTALL AND MAINTAIN STONE MUD MAT AS DETAILED.
4. REMOVE TOPSOIL (WHERE APPLICABLE) BEFORE INSTALLING CONSTRUCTION ENTRANCE.
5. PROMPTLY REMOVE ANY MUD OR DUST WHICH IS TRANSPORTED BEYOND THE STONE MUD MAT TO MAINTAIN EXISTING ROAD DRIVING CONDITION.
6. ENTRANCE RADII TO BE MINIMUM 8.0m.



NOTE:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev 0
HEAVY-DUTY WIRE-BACKED SILT FENCE BARRIER		OPSD 219.131



NOTES:
1 Number of bales varies and shall suit ditch.
2 Straw bales shall be butted tightly against adjoining bales and shaped to conform to the sides of the ditch to prevent water flow through barrier.
A Fill and compact gaps with loose straw.
B All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2021	Rev 3
STRAW BALE FLOW CHECK DAM		OPSD 219.180

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BENCHMARKS

TBM #1 – TOP OF RAISED ARROWHEAD SITUATED ATOP OF FIRE HYRDRANT #12 LOCATED ON THE NORTH SIDE OF BOND STREET, APPROXIMATELY 4m SOUTH WEST OF THE SOUTH WEST CORNER OF LOT 1, REGISTERED PLAN 992, ELEVATION OF 223.68m.

NOTES

LEGAL AND TOPOGRAPHIC INFORMATION ARE TAKEN FROM PLAN OF SURVEY SHOWING TOPOGRAPHIC FEATURES OF No. 116 & 120 BOND STREET, LOTS 1, 2 & 3, REGISTERED PLAN 992, CITY OF ORILLIA, COUNTY OF SIMCOE (PREPARED FOR: 1000444419 ONTARIO INC.) BY DEARDEN AND STANTON LTD. O.L.S. DATED 16/08/23 AND 17/04/24.

SITE PLAN INFORMATION OBTAINED FROM SITE PLAN PREPARED BY API DEVELOPMENT CONSULTANTS INC. AND FABIANI ARCHITECTS LTD. RECEIVED 20/11/2024.

No.	REVISION DESCRIPTION	DATE
1.	1ST SUBMISSION	OCT. 2023
2.	2nd SUBMISSION	JUL. 2025
3.	FINAL – ISSUED FOR ZBA	SEPT. 2025

ENGINEER

LICENSED PROFESSIONAL ENGINEER
J. A. NEMISZ
100181826
Sept. 11, 2025
323899
PROVINCE OF ONTARIO

116 BOND STREET
CITY OF ORILLIA

REMOVALS AND EROSION & SILTATION CONTROL PLAN

TATHAM ENGINEERING

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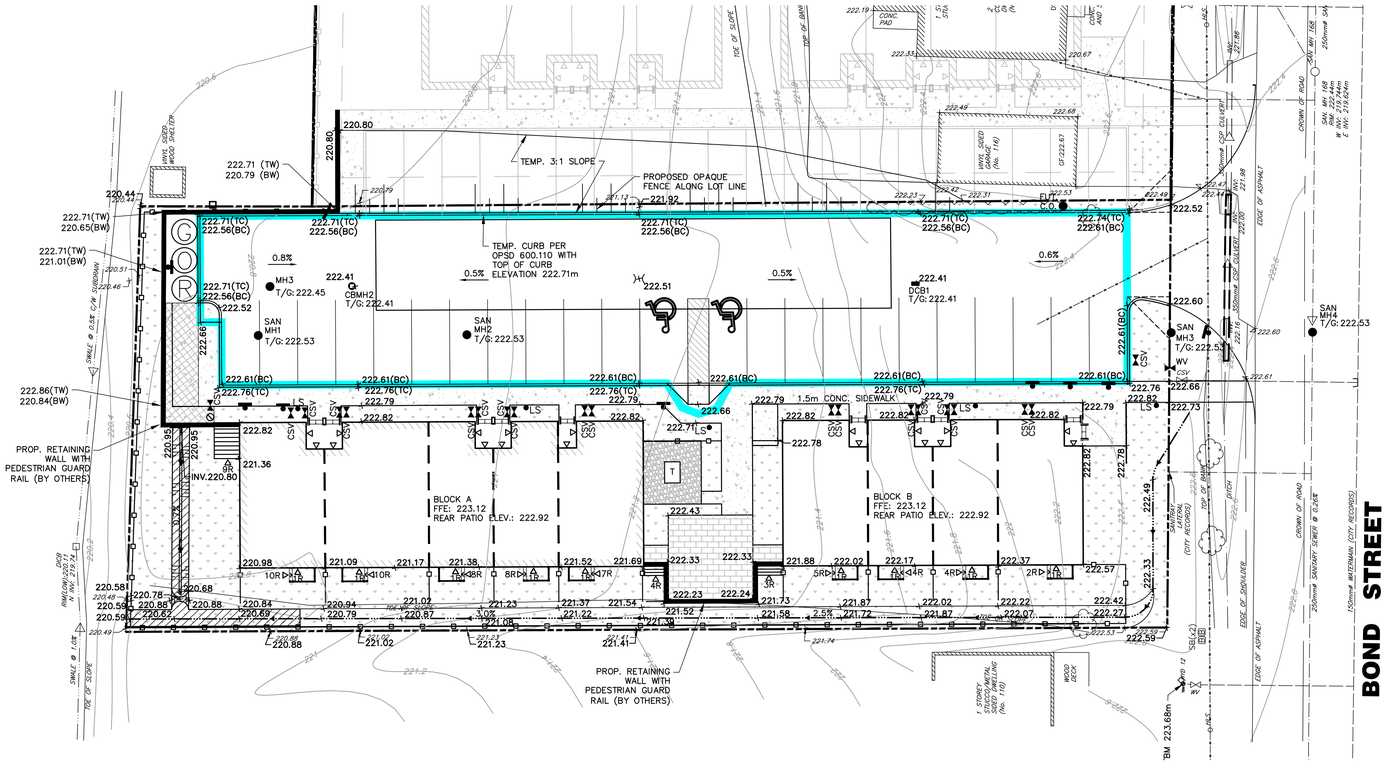
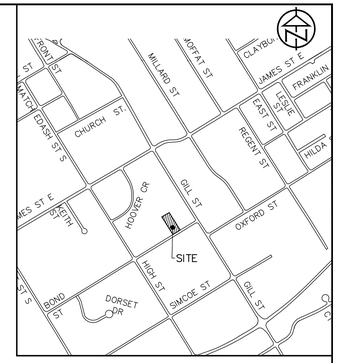
DRAWN: JH	DATE: MAR. 2024	
CHECK: RS	SCALE: 1:200	

Drawing Name: 323899 – ESC01.dwg, Plotted: Sep 11, 2025

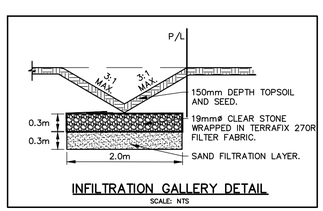




KEY PLAN
N.T.S.

LEGEND

- 221.50 — PROPOSED GROUND ELEVATION
- 221.50 — EXISTING GROUND ELEVATION
- PROPERTY LINE
- EXISTING DITCH
- FUTURE STORM SEWER
- STM MH — FUTURE STORM MH
- CB — FUTURE STORM CB
- 1.9% — PROPOSED OVERLAND FLOW DIRECTION
- STM MH — PROPOSED MH
- CB — PROPOSED CB
- DCB — ENTRANCE/EXIT – VEHICULAR
- CBMH — ENTRANCE/EXIT – PEDESTRIAN
- PROPOSED FENCE
- WV — PROPOSED WATER VALVE
- HYD — PROPOSED HYDRANT & VALVE
- PROPOSED STREET SIGNS
- HYD — EXISTING HYDRANT
- PROPOSED CULVERT
- PROPOSED STORM SEWER INSULATION
- PROPOSED INFILTRATION GALLERY
- PROPOSED SIDEWALKS
- PROPOSED GRASSED AREAS
- PROPOSED GRAVEL AREAS
- LIMIT OF PONDING DURING EMERGENCY OVERFLOW CONVEYANCE



INFILTRATION GALLERY DETAIL
SCALE: NTS

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BENCHMARKS

TBM #1 – TOP OF RAISED ARROWHEAD SITUATED ATOP OF FIRE HYRDRANT #12 LOCATED ON THE NORTH SIDE OF BOND STREET, APPROXIMATELY 4m SOUTH WEST OF THE SOUTH WEST CORNER OF LOT 1, REGISTERED PLAN 992, ELEVATION OF 223.68m.

NOTES

LEGAL AND TOPOGRAPHIC INFORMATION ARE TAKEN FROM PLAN OF SURVEY SHOWING TOPOGRAPHIC FEATURES OF No. 116 & 120 BOND STREET, LOTS 1, 2 & 3, REGISTERED PLAN 992, CITY OF ORILLIA, COUNTY OF SIMCOE (PREPARED FOR: 1000444419 ONTARIO INC.) BY DEARDEN AND STANTON LTD. O.L.S. DATED 16/08/23 AND 17/04/24.

SITE PLAN INFORMATION OBTAINED FROM SITE PLAN PREPARED BY API DEVELOPMENT CONSULTANTS INC. AND FABIANI ARCHITECTS LTD. RECEIVED 20/11/2024.

No.	REVISION DESCRIPTION	DATE
1.	1ST SUBMISSION	OCT. 2023
2.	2nd SUBMISSION	JUL. 2025
3.	FINAL – ISSUED FOR ZBA	SEPT. 2025

ENGINEER

LICENSED PROFESSIONAL ENGINEER — J. A. NEMISZ — 100161826 — PROVINCE OF ONTARIO

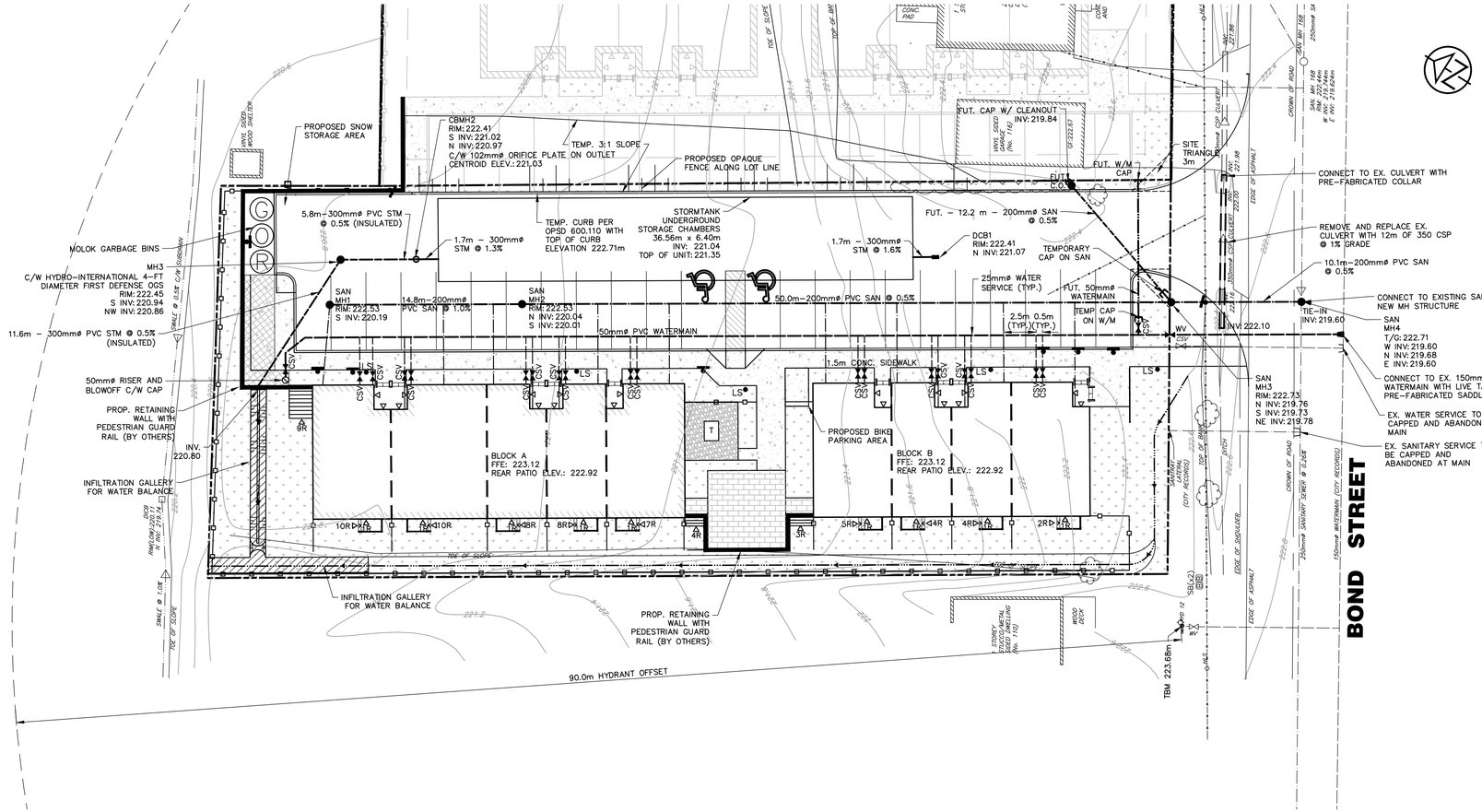
116 BOND STREET
CITY OF ORILLIA

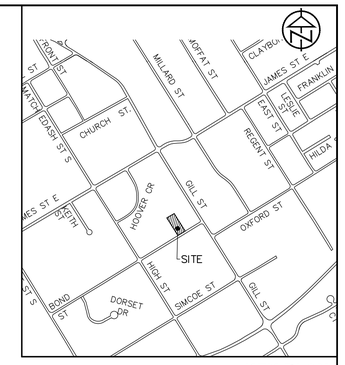
SITE GRADING PLAN

TATHAM ENGINEERING

DESIGN: JN	FILE: 323899	DWG: SG.1
DRAWN: JH	DATE: MAR. 2024	
CHECK: RS	SCALE: 1:200	

Drawing Name: 323899 – LG01.dwg, Plotted: Sep 11, 2025





KEY PLAN
N.T.S.

LEGEND

- PROPERTY LINE
- EXISTING DITCH
- FUTURE STORM SEWER
- STM MH — FUTURE STORM MH
- CP — FUTURE STORM CB
- 200ø SAN — PROPOSED SANITARY SEWER/ SIZE/ DIRECTION OF FLOW
- 450ø STM — PROPOSED STORM SEWER/ SIZE/ DIRECTION OF FLOW
- 150ø WATERMAIN — WATERMAIN/SIZE
- 50ø WATERMAIN — FUTURE WATERMAIN/SIZE
- 200ø SAN — FUTURE SANITARY SEWER/ SIZE/ DIRECTION OF FLOW
- PROPOSED SANITARY SERVICE
- PROPOSED WATER SERVICE
- PROPOSED DITCH
- C.O. — PROPOSED CLEAN OUT
- SAN MH2 — PROPOSED SANITARY MANHOLE/ NUMBER
- STM MH2 — PROPOSED STORM MANHOLE/ NUMBER
- CBMH — PROPOSED CATCH BASIN MANHOLE
- CB — PROPOSED CATCHBASIN
- DCB — PROPOSED DOUBLE CATCHBASIN
- HYD & WV — PROPOSED HYDRANT & WATER VALVE
- WV — PROPOSED WATER VALVE
- CSV — PROPOSED WATER CURB STOP
- PROPOSED STREET SIGNS
- ENTRANCE/EXIT – VEHICULAR
- ENTRANCE/EXIT – PEDESTRIAN
- PROPOSED FENCE
- HYD — EXISTING HYDRANT
- PROPOSED CULVERT
- C2 C3 — ELECTRIC CAR CHARGERS
- PROPOSED TACTILE PLATE
- PROPOSED PRECAST CURB
- PROPOSED STORM SEWER INSULATION
- PROPOSED INFILTRATION GALLERY
- PROPOSED SIDEWALKS
- PROPOSED GRASSED AREAS
- PROPOSED GRAVEL AREAS

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BENCHMARKS

TBM #1 – TOP OF RAISED ARROWHEAD SITUATED ATOP OF FIRE HYRDRANT #12 LOCATED ON THE NORTH SIDE OF BOND STREET, APPROXIMATELY 4m SOUTH WEST OF THE SOUTH WEST CORNER OF LOT 1, REGISTERED PLAN 992, ELEVATION OF 223.68m.

NOTES

LEGAL AND TOPOGRAPHIC INFORMATION ARE TAKEN FROM PLAN OF SURVEY SHOWING TOPOGRAPHIC FEATURES OF No. 116 & 120 BOND STREET, LOTS 1, 2 & 3, REGISTERED PLAN 992, CITY OF ORILLIA, COUNTY OF SIMCOE (PREPARED FOR: 1000444419 ONTARIO INC.) BY DEARDEN AND STANTON LTD. O.L.S. DATED 16/08/23 AND 17/04/24.

SITE PLAN INFORMATION OBTAINED FROM SITE PLAN PREPARED BY API DEVELOPMENT CONSULTANTS INC. AND FABIANI ARCHITECTS LTD. RECEIVED 20/11/2024.

No.	REVISION DESCRIPTION	DATE
1.	1ST SUBMISSION	OCT. 2023
2.	2nd SUBMISSION	JUL. 2025
3.	FINAL – ISSUED FOR ZBA	SEPT. 2025

ENGINEER

LICENSED PROFESSIONAL ENGINEER
J. A. NEMISZ
100181826
Sept. 11, 2025
PROVINCE OF ONTARIO

116 BOND STREET
CITY OF ORILLIA

SITE SERVICING PLAN

TATHAM ENGINEERING

DESIGN: JN	FILE: 323899	DWG:	SS.1
DRAWN: JH	DATE: MAR. 2024		
CHECK: RS	SCALE: 1:200		

Drawing Name: 323899 – GS01.dwg, Plotted: Sep 11, 2025

TATHAM ENGINEERING

Enhancing our communities

116 Bond Street

OPERATIONS & MAINTENANCE MANUAL

Sullnet Holdings Inc.

File 323899 | September 11, 2025

Document Control

File:

323899

Date:

September 11, 2025

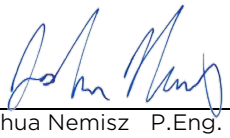
Prepared by:

Tatham Engineering Limited
10 Diana Drive, Unit 7
Orillia, Ontario L3V 8K8

T 705-325-1753
tathameng.com

Prepared for:

Sullnet Holdings Inc.
16 Hopkins Street
Thorold, Ontario L2V 0E9

Authored by:	Reviewed by:
	
Joshua Nemisz P.Eng. Senior Engineer, Project Manager	

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Issue	Date	Description
1	July 2, 2025	1st Submission
2	September 11, 2025	Final – Issued for ZBA

Document Contents

Appendices

1 Introduction

A maintenance program for civil servicing is necessary to provide an acceptable standard of service for the Owners on the property. Proper scheduled maintenance procedures for water supply, sanitary sewers and storm sewers will reduce the potential for unscheduled and costly repairs. The following document outlines a maintenance plan for the civil servicing for the development.

2 Private Watermain

Inspection and operation of watermain and service valves shall be undertaken by a qualified operator certified by the Ministry of the Environment, Conservation and Parks. Alternatively, the Owner is responsible for making arrangements with the City to have a certified operator undertake the inspection and maintenance, at the Owner's expense.

Once watermains and individual water services have been installed, flushed and tested, regular maintenance is required. Watermains shall be flushed a minimum of once per year to reduce sediment deposits. As there are no hydrants on the subject site, flushing is accommodated through the blow-off provided at the terminal end of the private watermain. All valves shall also be operated twice annually. The Owner shall be responsible for keeping maintenance records.

3 Sanitary Sewers

Sanitary sewers and individual sanitary services must be maintained to effectively convey sewage flows. Sanitary maintenance holes shall be opened twice annually and checked for debris, leaks or any type of damage. Cleaning or repairs within the maintenance holes are to be completed by a person with the Confined Space Entry qualification to ensure staff safety. Any parging or channel work must be completed to the City of Orillia standards.

Sanitary sewers may require flushing to remove debris depending on the size and slope of the pipe. Sanitary sewers shall be flushed a minimum of once every five years. The City of Orillia must be notified before any flushing is attempted.

4 Storm Sewers and Stormwater Management Works

There are several components of the stormwater management (SWM) system that require routine inspections and periodic maintenance, including all sewers, structures and siltation and erosion control measures. During construction, the siltation and erosion control measures as well as the SWM system will be inspected by the Engineer and maintained by the Contractor. Following construction, it will be the Owner's responsibility to inspect the system.

4.1 SILTATION AND EROSION CONTROL

Siltation and erosion controls will be implemented for all construction activities, including removals, earthwork operations, service construction, building construction, paving and grading works. A number of standard practices which will be implemented are summarized as follows:

- The disturbance area and activities will be minimized where possible;
- The smallest possible land area will be exposed for the shortest amount of time;
- Heavy duty silt control fences will be erected coincident with the property boundary prior to commencement of grading operations to control sediment movement;
- A stone mud mat will be implemented at the construction entrance;
- Catchbasins on-site and downstream of the site will have grates wrapped in permeable geotextile to prevent migration of sediment into the storm sewers;
- Straw bale check dams will be installed in existing ditches and drainage features downstream of anticipated disturbance;
- Regular inspection of control measures shall be instituted and repairs made as necessary; and
- Promptly re-vegetating disturbed areas following completion of construction works within the site.

Siltation and erosion control devices should be inspected by the Contract Administrator and Contractor on a bi-weekly basis and following every significant storm event throughout the course of construction. It is important to confirm these devices are operating properly to minimize erosion and the transfer of sediment off-site. It is recommended that a maintenance report be completed following each inspection. An inspection and maintenance checklist has been included in Appendix A.

4.2 STORM SEWER SYSTEM AND STRUCTURES

Storm sewers and drainage works must be maintained to convey stormwater properly and effectively. Catch basins and maintenance holes shall be opened twice annually (spring and autumn) and checked for debris, leaks or any other type of damage. All catch basin debris will be removed at least once a year. Cleaning or repairs within the catch basins and maintenance holes are to be completed by a person with the Confined Space Entry qualification to ensure staff safety. Any parging or channel work must be completed to OPSD or City of Orillia standards.

The drainage outlet and orifice plate shall be inspected twice annually (spring and autumn) and checked for debris, erosion or any other type of damage. The outlet and orifice plate shall be restored to original condition and completed to OPSD or City of Orillia standards. Repairs to the orifice plate requiring entry to the maintenance hole are to be completed by a person with the Confined Space Entry qualification to ensure staff safety.

4.3 FIRST DEFENSE OIL GRIT SEPARATOR

The Hydro International Oil Grit Separator must be maintained on a regular basis as stipulated by the Manufacturer to ensure long-term environmental protection through continual performance. The First Defense Operation and Maintenance Manual is included in Appendix B and should be referenced for all maintenance procedures with respect to the system. Maintenance of First Defense units should be coordinated with local contractors experienced in maintaining oil grit separator systems in conjunction with manufacturer specifications.

4.4 STORMTANK ST-25 UNDERGROUND STORAGE CHAMBERS

The StormTank ST-25 underground storage chambers must be inspected as part of the storm sewer inspection and maintenance program. The inlet and outlet connections to the underground storage chambers to the respective maintenance holes shall be checked as part of the maintenance hole inspection/maintenance, twice annually (spring and autumn) and checked for debris, leaks or any other type of damage. All debris will be removed at least once a year. Any parging must be completed to OPSD or City of Orillia standards.

Isolation rows incorporated into the underground storage tanks will be equipped with 250 mm diameter observation ports allowing inspection, maintenance and sediment removal from the isolator rows with access from the ground surface. The precise location of the observation ports will be coordinated with the supplier and contractor through shop drawings at the construction stage but generally coincide with the inlet and outlet pipes connecting the underground storage to the storm sewer infrastructure. Isolator rows are estimated to occupy four modules each at the upstream and downstream end of the underground storage.

The Brentwood Stormwater Treatment Debris Row guide is included in Appendix C.

4.5 INFILTRATION TRENCH

The infiltration trench must be inspected as part of the storm sewer inspection and maintenance program. The infiltration trench shall be visually inspected twice annually (spring and autumn) and checked for debris, accumulation of sediment, ponding water or other types of damage. All sediment and debris will be removed at least once a year.

5 Landscaping/Property Maintenance

The Owner will be responsible for regular inspection and maintenance of the roadway and parking area, landscaped areas, sidewalks, snow removal and site lighting within the development.

6 Snow Storage & Removal

The Owner is responsible for providing and maintaining now clearing operations for all;

- Property accesses and garbage drop-off locations;
- Hydrants, blow-offs and pad mounted electrical transformers;
- Communal walkways and amenity spaces; and
- Utility service meters and mail delivery boxes.

Potential snow storage locations are shown on the Site Plan. When the volume of snow exceeds the capacity of the storage locations, the Owner will be responsible for the removal of the snow to an approved off-site location to ensure sufficient on-site storage is available for on-going clearing operations.

Designated snow storage areas should not encroach on the municipal right-of-way or onto adjacent properties.

Regular clearing, piling and removal of snow through mechanical means should be utilized where feasible so salt and sand need only be applied where mechanical snow clearing alone is not sufficiently effective at mitigating slips, trips and falls due to winter conditions. Where salt application is necessary, it should focus on areas with heavy pedestrian traffic, i.e. sidewalks, parking stalls, etc. in lieu of blanket application across the site.

Mitigation of sanding applications includes prompt cleaning of excess sand from asphalt surfaces in the spring combined with removal of excess material from catch basins, maintenance holes, the underground storage and oil grit separator during the routine spring maintenance.

7 Traffic Signs

The manufacturing of all signs shall be in accordance with the Ontario Traffic Manual (OTM) and City of Orillia standards.

Maintenance, repair or replacement of all stop signs and parking restriction signs shall be the responsibility of the Owner.

All traffic signs should be kept in the proper position and should be cleaned and legible at all times. All damaged, defaced, or dirty signs as well as signs with degraded reflective sheeting shall be replaced as soon as possible. To ensure adequate maintenance, signs should be reviewed during day and night hours and on a bi-annual basis (spring and autumn) to ensure proper position and appearance.

For further information on recommended best practice guidelines for sign inspection, maintenance and repair, consult OTM Book 1 – Appendix B.

8 Summary

The documented monitoring and maintenance program is sufficient to confirm the civil servicing is operating as intended. Diligent maintenance and site inspections are key to ensuring the system remains effective over time.

Appendix A: Operations and Maintenance Inspection Reports

116 BOND STREET, ORILLIA INSPECTION DATE: _____

STORMWATER MANAGEMENT MAINTENANCE CHECKLIST INSPECTED BY: _____

SWALES & EROSION CONTROLS	**Yes/No**	**Maintenance Required/Action Taken:**	**Inspection Frequency ***
Adequate vegetation and ground cover?			S
Are there any signs of erosion?			S
Other (specify)			
STORM SEWER SYSTEM:	**Yes/No**	**Maintenance Required/Action Taken:**	**Inspection Frequency ***
All catch basin frame & grates un-obstructed?			B, S
All catch basin sumps free of sediment & debris?			B, S
(Note: Sediment depth is not to exceed 0.30 m) Max. Depth:			
Does the system require flushing?			A
Orifice plate secure and un-obstructed?			B, S
4-FT. FIRST DEFENSE - OIL AND GRIT SEPARATOR (OGS)	**Yes/No**	**Maintenance Required/Action Taken:**	**Inspection Frequency ***
Inspect inlet & outlet for debris and clogging			B, S
OGS free of sediment & debris?			B, S
(Note: Sediment depth is not to exceed 0.44 m) Depth:			
Is there a noticeable oils sheen at the outlet?			B, S
Annual Maintenance Required?			A
STORMTANK ST-25 UNDERGROUND STORAGE	**Yes/No**	**Maintenance Required/Action Taken:**	**Inspection Frequency ***
Inspect inlet & outlet for debris and clogging			B, S
Inspect observation ports for sediment and debris			B, S
(Note: Sediment depth is not to exceed 75 mm) Depth:			
Annual Maintenance Required?			A
INFILTRATION TRENCH	**Yes/No**	**Maintenance Required/Action Taken:**	**Inspection Frequency ***
Inspect standing water, sediment & debris			B, S
Annual Maintenance Required?			A

* A = Annual B = Bi-annual S = After major storm event

116 BOND STREET, ORILLIA INSPECTION DATE: _____

STORMWATER MANAGEMENT MAINTENANCE REPORT INSPECTED BY: _____

1. Inspectors Remarks: _____

_____

_____

_____

_____

_____

_____

2. Overall Conditions of Stormwater Management System:

a) Catch basins & maintenance structures:	Acceptable = _____	Un-acceptable = _____
b) Storm sewer system:	Acceptable = _____	Un-acceptable = _____
c) First Defense OGS system:	Acceptable = _____	Un-acceptable = _____
d) Stormtank Underground Storage:	Acceptable = _____	Un-acceptable = _____
e) Infiltration Trench:	Acceptable = _____	Un-acceptable = _____
f) Swales and Erosion Control:	Acceptable = _____	Un-acceptable = _____

3. Additional Comments & future inspection dates:

_____

_____

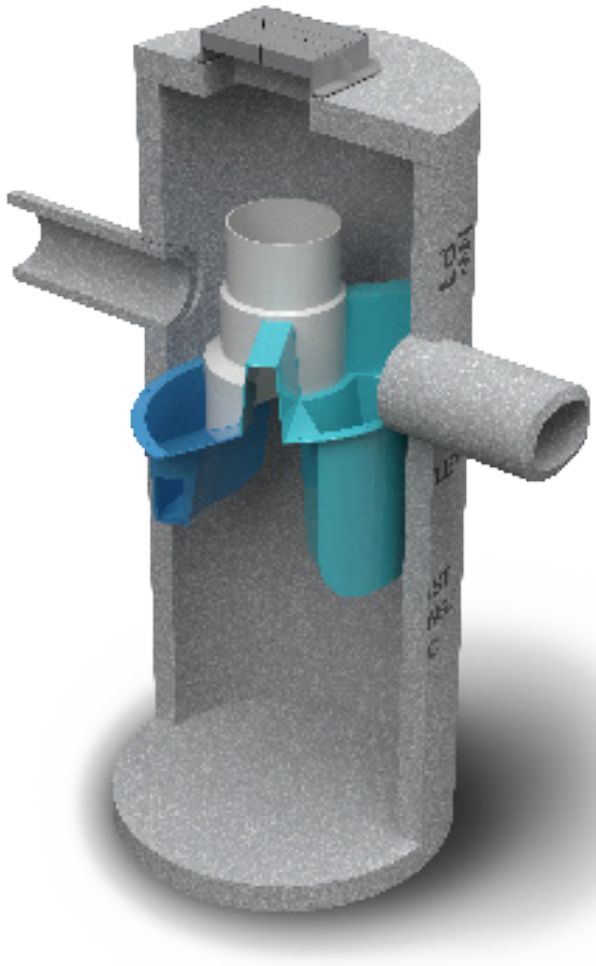
_____

_____

_____

Appendix B:
Operations & Maintenance for First Defense Oil Grit Separator

Hydro International



Operation and Maintenance Manual

First Defense® High Capacity and First Defense®Optimum

Vortex Separator for Stormwater Treatment

Table of Contents

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

I. First Defense® by Hydro International

Introduction

The First Defense® is an enhanced vortex separator that combines an effective and economical stormwater treatment chamber with an integral peak flow bypass. It efficiently removes total suspended solids (TSS), trash and hydrocarbons from stormwater runoff without washing out previously captured pollutants. The First Defense® is available in several model configurations to accommodate a wide range of pipe sizes, peak flows and depth constraints.

The two product models described in this guide are the First Defense® High Capacity and the First Defense® Optimum; they are inspected and maintained identically.

Operation

The First Defense® operates on simple fluid hydraulics. It is self-activating, has no moving parts, no external power requirement and is fabricated with durable non-corrosive components. No manual procedures are required to operate the unit and maintenance is limited to monitoring accumulations of stored pollutants and periodic clean-outs. The First Defense® has been designed to allow for easy and safe access for inspection, monitoring and clean-out procedures. Neither entry into the unit nor removal of the internal components is necessary for maintenance, thus safety concerns related to confined-space-entry are avoided.

Pollutant Capture and Retention

The internal components of the First Defense® have been designed to optimize pollutant capture. Sediment is captured and retained in the base of the unit, while oil and floatables are stored on the water surface in the inner volume (Fig.1).

The pollutant storage volumes are isolated from the built-in bypass chamber to prevent washout during high-flow storm events. The sump of the First Defense® retains a standing water level between storm events. This ensures a quiescent flow regime at the onset of a storm, preventing resuspension and washout of pollutants captured during previous events.

Accessories such as oil absorbent pads are available for enhanced oil removal and storage. Due to the separation of the oil and floatable storage volume from the outlet, the potential for washout of stored pollutants between clean-outs is minimized.

Applications

- Stormwater treatment at the point of entry into the drainage line
- Sites constrained by space, topography or drainage profiles with limited slope and depth of cover
- Retrofit installations where stormwater treatment is placed on or tied into an existing storm drain line
- Pretreatment for filters, infiltration and storage

Advantages

- Inlet options include surface grate or multiple inlet pipes
- Integral high capacity bypass conveys large peak flows without the need for “offline” arrangements using separate junction manholes
- Long flow path through the device ensures a long residence time within the treatment chamber, enhancing pollutant settling
- Delivered to site pre-assembled and ready for installation

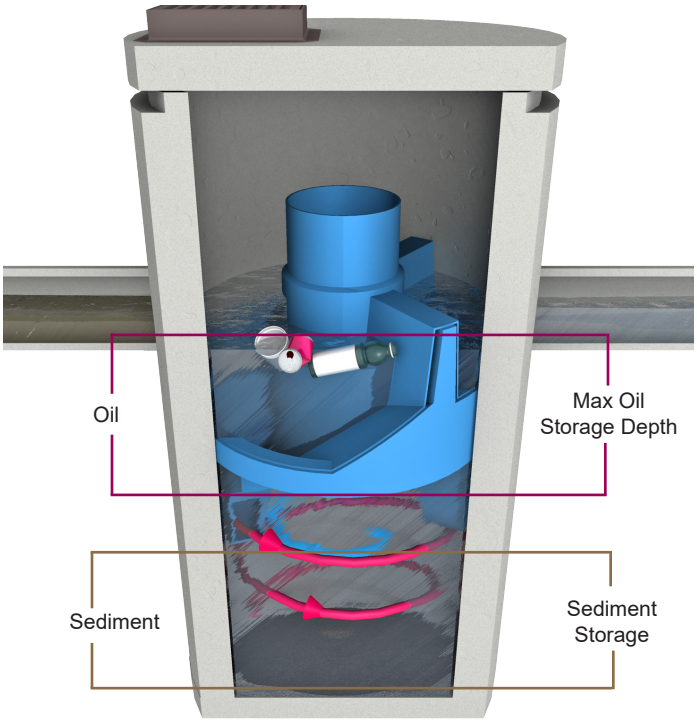


Fig.1 Pollutant storage volumes in the First Defense®.

II. Model Sizes & Configurations

The First Defense® inlet and internal bypass arrangements are available in several model sizes and configurations. The components have modified geometries allowing greater design flexibility to accommodate various site constraints.

All First Defense® models include the internal components that are designed to remove and retain total suspended solids (TSS), gross solids, floatable trash and hydrocarbons (Fig.2). First Defense® model sizes (diameter) are shown in Table 1.

III. Maintenance

First Defense® Components

1. **Built-In Bypass**
2. **Inlet Pipe**
3. **Inlet Chute**
4. **Floatables Draw-off Port**
5. **Outlet Pipe**
6. **Floatables Storage**
7. **Sediment Storage**
8. **Inlet Grate or Cover**

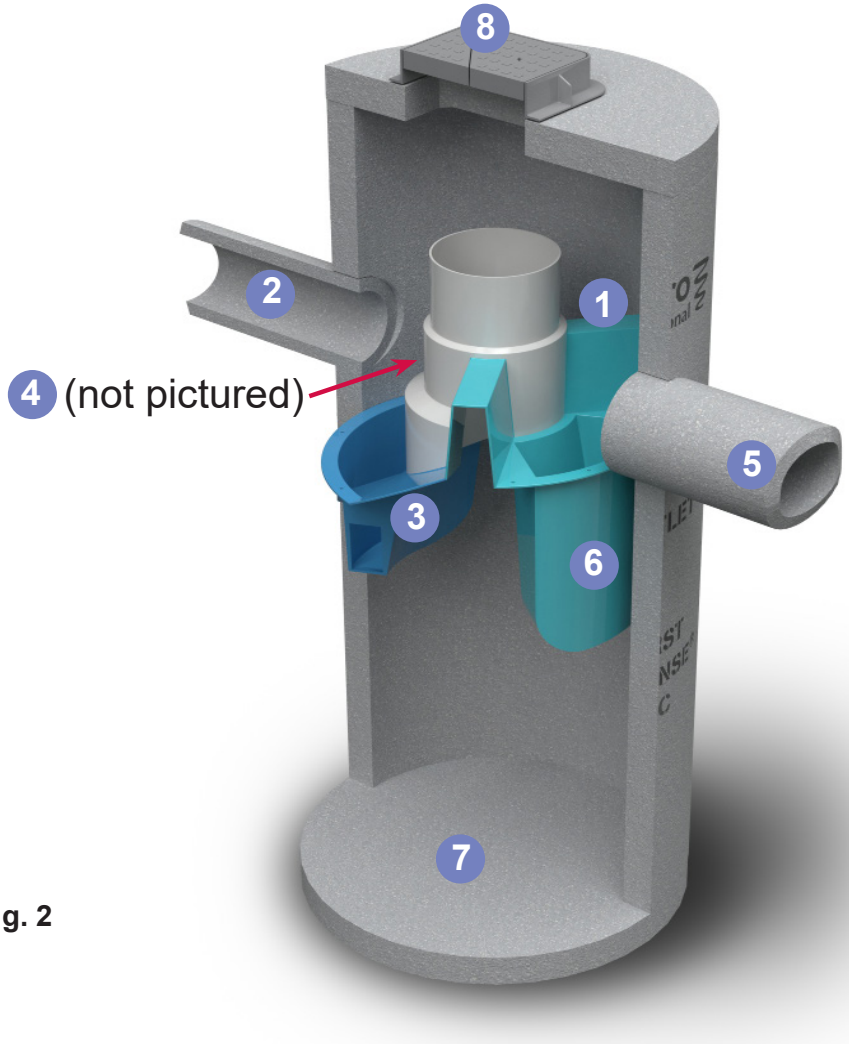


Fig. 2

Table 1

First Defense® Model Sizes
(ft / m) diameter
3 / 0.9
4 / 1.2
5 / 1.5
6 / 1.8
7 / 2.1
8 / 2.4
10 / 3.0

Overview

The First Defense® protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the continuous, long-term functioning of the First Defense®. The First Defense® will capture and retain sediment and oil until the sediment and oil storage volumes are full to capacity. When sediment and oil storage capacities are reached, the First Defense® will no longer be able to store removed sediment and oil.

The First Defense® allows for easy and safe inspection, monitoring and clean-out procedures. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables. Access ports are located in the top of the manhole.

Maintenance events may include Inspection, Oil & Floatables Removal, and Sediment Removal. Maintenance events do not require entry into the First Defense®, nor do they require the internal components of the First Defense® to be removed. In the case of inspection and floatables removal, a vactor truck is not required. However, a vactor truck is required if the maintenance event is to include oil removal and/or sediment removal.

Maintenance Equipment Considerations

The internal components of the First Defense® have a centrally located circular shaft through which the sediment storage sump can be accessed with a sump vac hose. The open diameter of this access shaft is 15 inches in diameter (Fig.3). Therefore, the nozzle fitting of any vactor hose used for maintenance should be less than 15 inches in diameter.

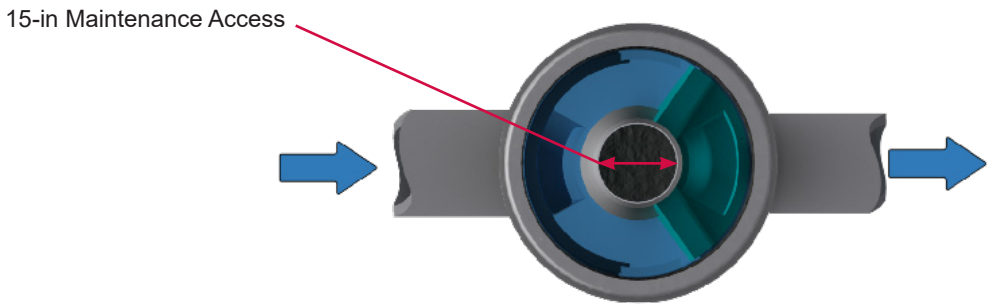


Fig.3 The central opening to the sump of the First Defense®is 15 inches in diameter.

Determining Your Maintenance Schedule

The frequency of clean out is determined in the field after installation. During the first year of operation, the unit should be inspected every six months to determine the rate of sediment and floatables accumulation. A simple probe such as a Sludge-Judge® can be used to determine the level of accumulated solids stored in the sump. This information can be recorded in the maintenance log (see page 9) to establish a routine maintenance schedule.

The vactor procedure, including both sediment and oil / flotables removal, for First Defense® typically takes less than 30 minutes and removes a combined water/oil volume of about 765 gallons.

Inspection Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.

2. Remove the grate or lid to the manhole.

3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities. Fig.4 shows the standing water level that should be observed.

4. Without entering the vessel, use the pole with the skimmer net to remove floatables and loose debris from the components and water surface.

5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel.

6. On the Maintenance Log (see page 9), record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.

7. Securely replace the grate or lid.

8. Take down safety equipment.

9. Notify Hydro International of any irregularities noted during inspection.

Floatables and Sediment Clean Out

Floatables clean out is typically done in conjunction with sediment removal. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables (Fig.4).

Floatables and loose debris can also be netted with a skimmer and pole. The access port located at the top of the manhole provides unobstructed access for a vactor hose to be lowered to the base of the sump.

Scheduling

- Floatables and sump clean out are typically conducted once a year during any season.

- Floatables and sump clean out should occur as soon as possible following a spill in the contributing drainage area.

Fig.4 Floatables are removed with a vactor hose

Recommended Equipment

- Safety Equipment (traffic cones, etc)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net (if only floatables are being removed)
- Sediment probe (such as a Sludge Judge®)
- Vactor truck (flexible hose recommended)
- First Defense® Maintenance Log

Floatables and Sediment Clean Out Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.

2. Remove the grate or lid to the manhole.

3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.

4. Remove oil and floatables stored on the surface of the water with the vactor hose or with the skimmer or net

5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel and record it in the Maintenance Log (page 9).

6. Once all floatables have been removed, drop the vactor hose to the base of the sump. Vactor out the sediment and gross debris off the sump floor

7. Retract the vactor hose from the vessel.

8. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components, blockages, or irregularly high or low water levels.

9. Securely replace the grate or lid.

Maintenance at a Glance

Inspection	- Regularly during first year of installation - Every 6 months after the first year of installation
Oil and Floatables Removal	- Once per year, with sediment removal - Following a spill in the drainage area
Sediment Removal	- Once per year or as needed - Following a spill in the drainage area
NOTE: For most clean outs the entire volume of liquid does not need to be removed from the manhole. Only remove the first few inches of oils and floatables from the water surface to reduce the total volume of liquid removed during a clean out.	

First Defense® Installation Log

HYDRO INTERNATIONAL REFERENCE NUMBER:	
SITE NAME:	
SITE LOCATION:	
OWNER:	CONTRACTOR:
CONTACT NAME:	CONTACT NAME:
COMPANY NAME:	COMPANY NAME:
ADDRESS:	ADDRESS:
TELEPHONE:	TELEPHONE:
FAX:	FAX:

INSTALLATION DATE: / /

MODEL SIZE (CIRCLE ONE): [3-FT] [4-FT] [5-FT] [6-FT] [7-FT] [8-FT] [10-FT]

INLET (CIRCLE ALL THAT APPLY): GRATED INLET (CATCH BASIN) INLET PIPE (FLOW THROUGH)

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

First Defense® Inspection and Maintenance Log

Date	Initials	Depth of Floatables and Oils	Sediment Depth Measured	Volume of Sediment Removed	Site Activity and Comments

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

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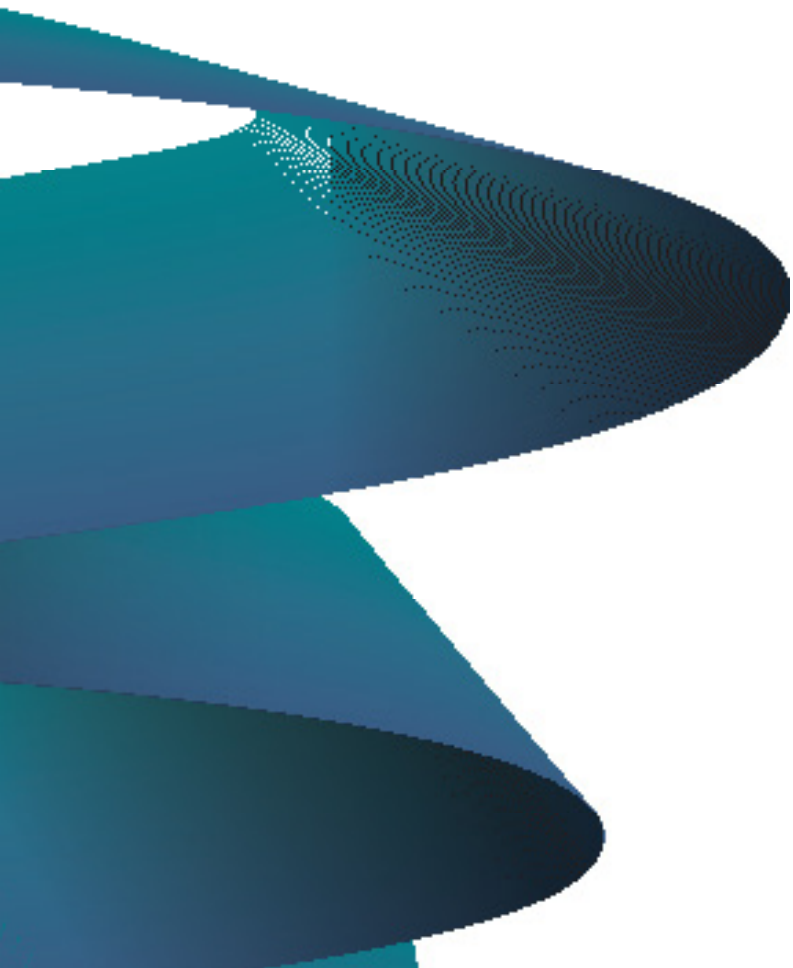
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

Hydro International



Stormwater Solutions

94 Hutchins Drive
Portland, ME 04102

Tel: (207) 756-6200
Fax: (207) 756-6212
stormwaterinquiry@hydro-int.com

www.hydro-int.com

Turning Water Around...®

FD_O+M_K_2105

Appendix C: Debris Row Installation and Maintenance Guide

STORMWATER TREATMENT

DEBRIS ROW

STORMTANK®
Expect Results™

A BRAND OF BRENTWOOD

CONTENT

GENERAL NOTES

1. Brentwood recommends that the installing contractor contact either Brentwood or the local distributor prior to installation of the system to schedule a pre-construction meeting. This meeting will ensure that the installing contractor has a firm understanding of the installation instructions.
2. All systems must be designed and installed to meet or exceed Brentwood's minimum requirements. Although Brentwood offers support during the design, review, and construction phases of the Module system, it is the ultimate responsibility of the Engineer of Record to design the system in full compliance with all applicable engineering practices, laws, and regulations.
3. Brentwood requires a minimum cover of 24" (610 mm) and/or a maximum Module invert of 11' (3.35 m). Additionally, a minimum 6" (152 mm) leveling bed, 12" (305 mm) side backfill, and 12" (305 mm) top backfill are required on every system.
4. Brentwood recommends a minimum bearing capacity and subgrade compaction for all installations. If site conditions are found not to meet any design requirements during installation, the Engineer of Record must be contacted immediately.
5. All installations require a minimum two layers of geotextile fabric. One layer is to be installed around the Modules, and another layer is to be installed between the stone/soil interfaces.
6. Stone backfilling is to follow all requirements of the most current installation instructions.
7. The installing contractor must apply all protective measures to prevent sediment from entering the system during and after installation per local, state, and federal regulations.
8. The StormTank® Module carries a Limited Warranty, which can be accessed at *www.stormtank.com*.

1.0 DEBRIS ROW SIZING

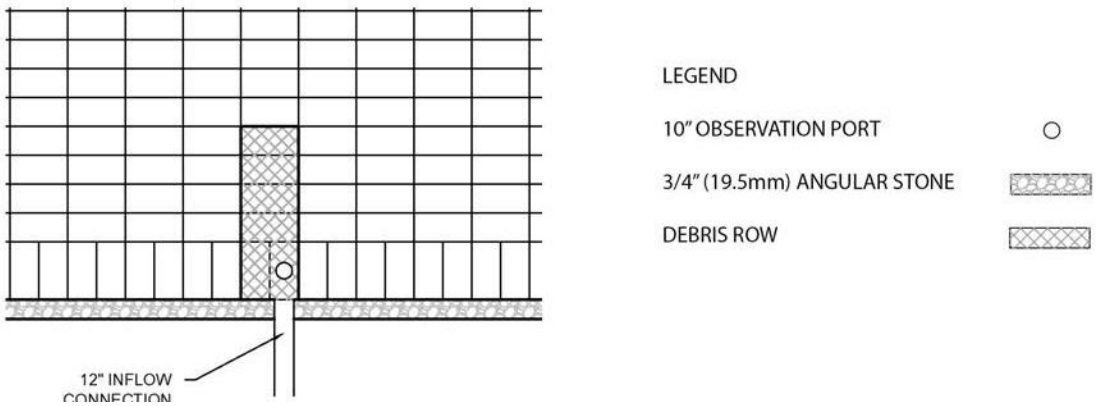
The Debris Row gathers debris and sediment in a section of modules. The Debris Row size is determined by the flow rate of the inflow connection to the system. Observation/cleanout ports are to be installed with a minimum of one port at the inflow pipe location. Based upon Debris Row size and shape, additonal ports may be required.

StormTank Module Count = Q / (F * 0.059933)

Q = Treatment Flow Rate
F = Module Footprint = 4.5 sf

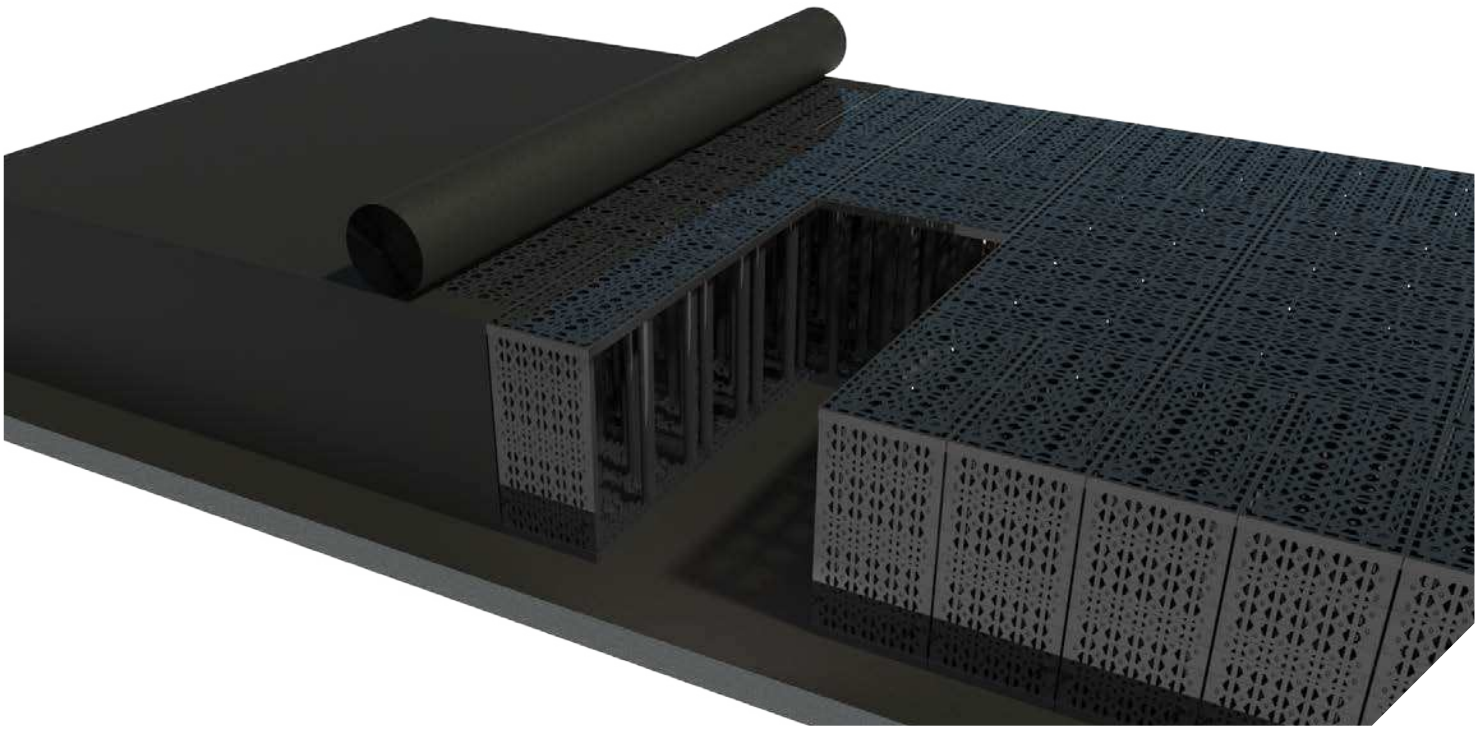
EXAMPLE:
5.5618 Modules = 1.5 CFS / (4.5*0.059933)

StormTank Module Count = 6 Modules



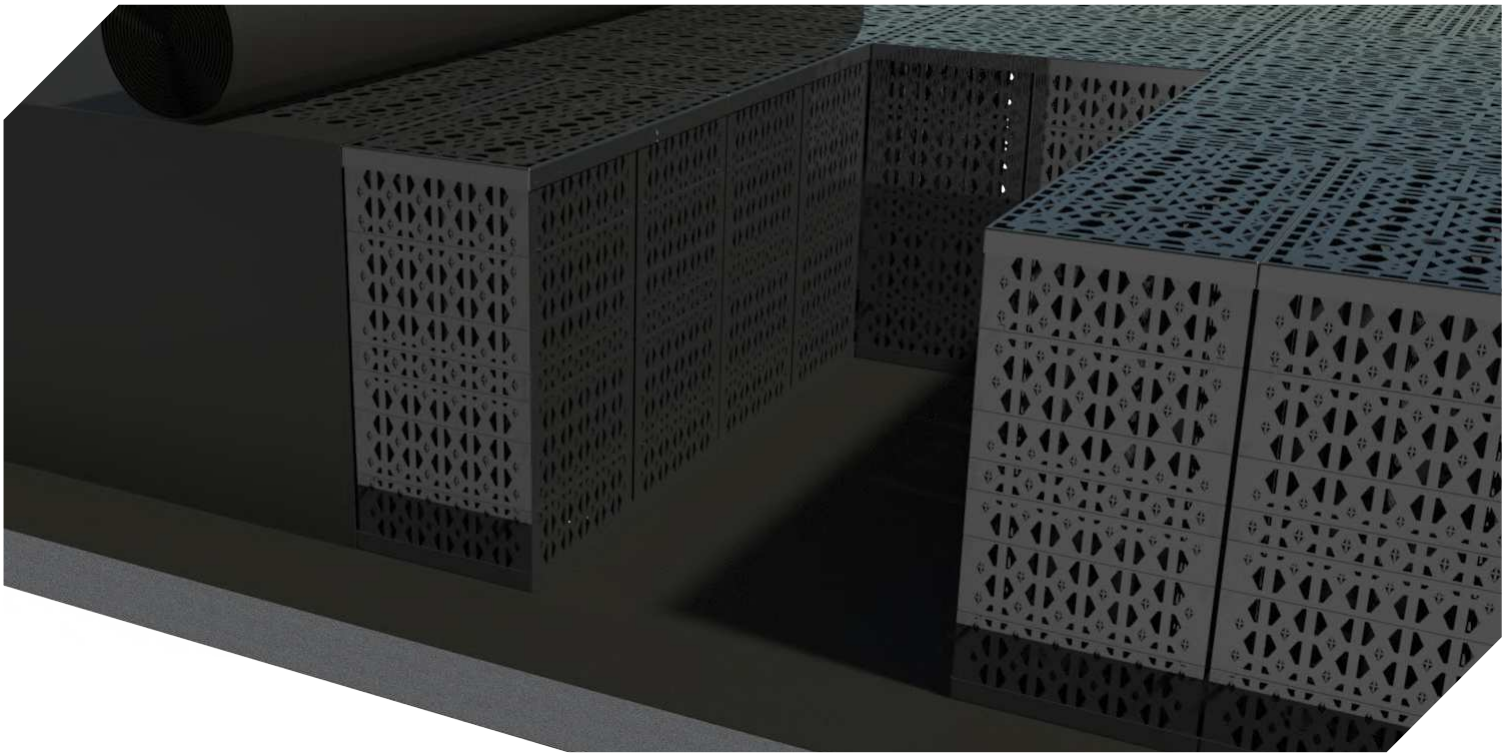
2.0 STORMTANK INSTALLATION

Install StormTank Modules per the approved StormTank submittal drawings. Do not include the Debris Row Modules.



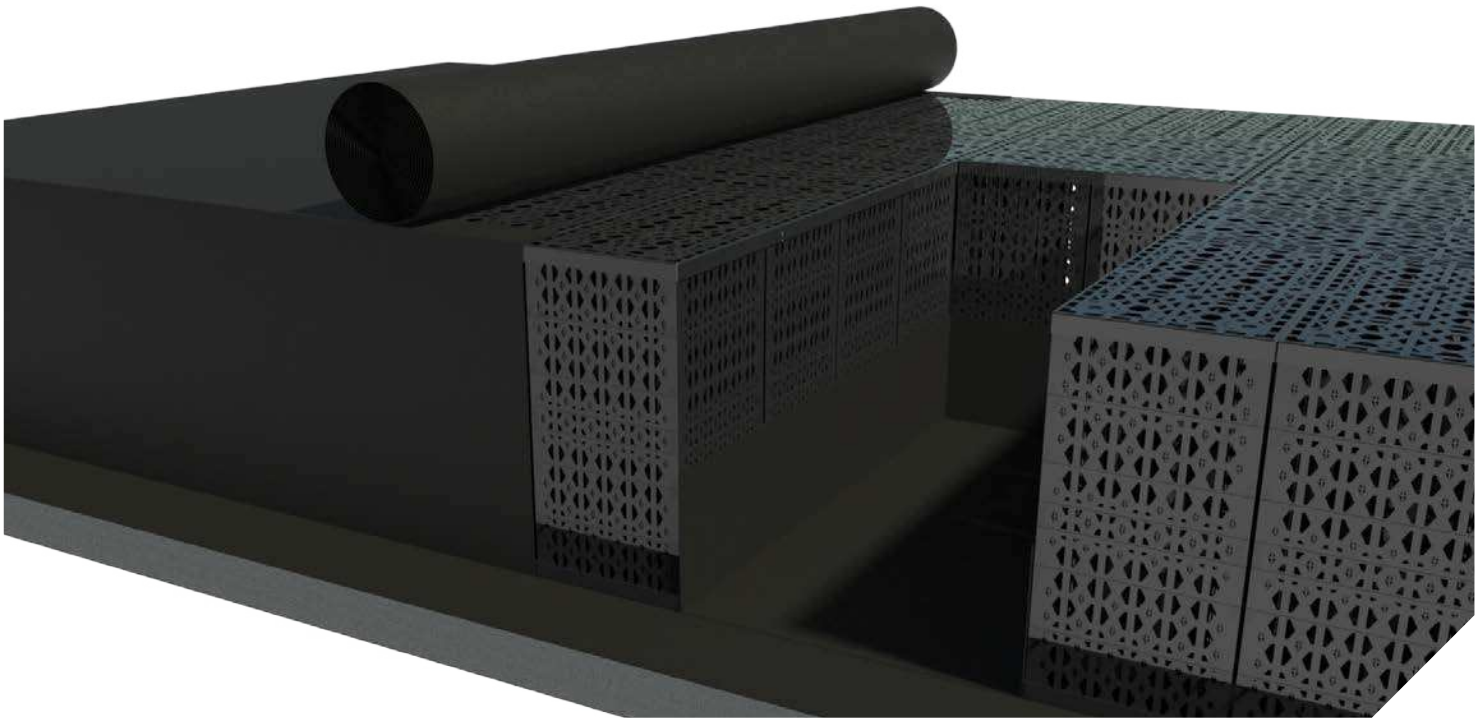
2.1 SIDE PANEL INSTALLATION

Install Debris Row side panels in the Modules adjacent to the Debris Row, per the approved plans.



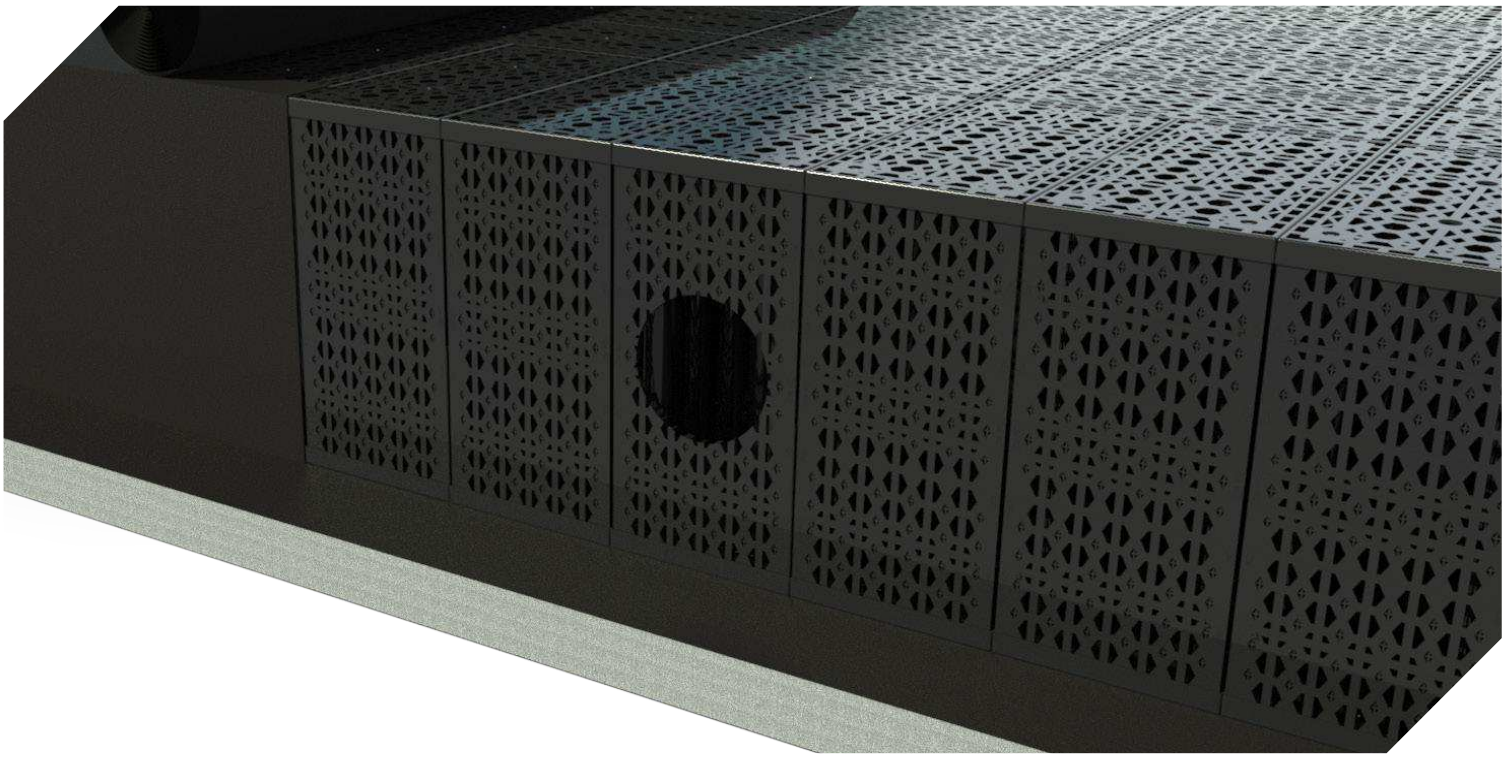
2.2 GEOTEXTILE INSTALLATION

Install a layer of geotextile across the bottom of the Debris Row, extending up the side panels of the adjacent Modules. Geotextile Fabric is to be installed to the height specified by the hydrograph elevation of the selected storm (per the engineer of record's plans), or a minimum of 12" (304.8mm), whichever is greater. Secure the geotextile fabric to the side panels with zip ties.



2.3 DEBRIS ROW MODULE PLACEMENT

Place and install the Debris Row Modules in the appropriate location per the approved StormTank submittal drawings.



2.4 COMPLETE SYSTEM INSTALLATION

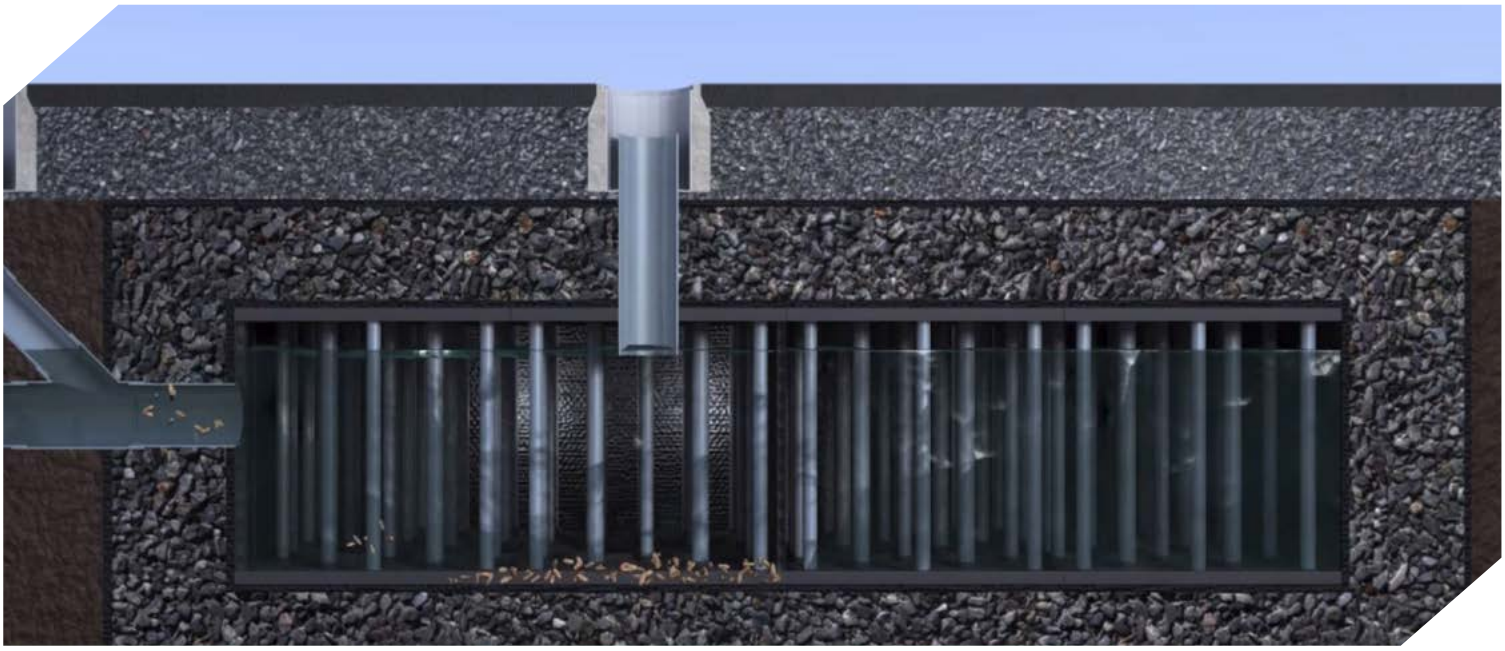
Finally, make any necessary connections and complete the system installation per the StormTank installation instructions.

3.0 OPERATIONS & MAINTENANCE

The Debris Row design and operation make maintaining the system easier by containing debris and sediment. The StormTank Module Debris Row is an inexpensive way to provide stormwater treatment, removing suspended solids from stormwater as well as other checmicals and nutrients that have bonded to the solids. The Debris Row provides a means of containing debris to a smaller, more manageable section of an overall storage system.

3.1 OPERATION

Designed to capture the first flush, the Debris Row provides full retention of large floatables. To do this, the Debris Row utilizes a layer of geotextile fabric around the lower perimeter of the cells. As stormwater enters the containment area, it passes through the geotextile, providing filtration of the stormwater. Internally located side panels are used to ensure retention of the debris by preventing large flow bypass and dispersion of captured material as the water elevation rises throughout the basin.



3.2 INSPECTION

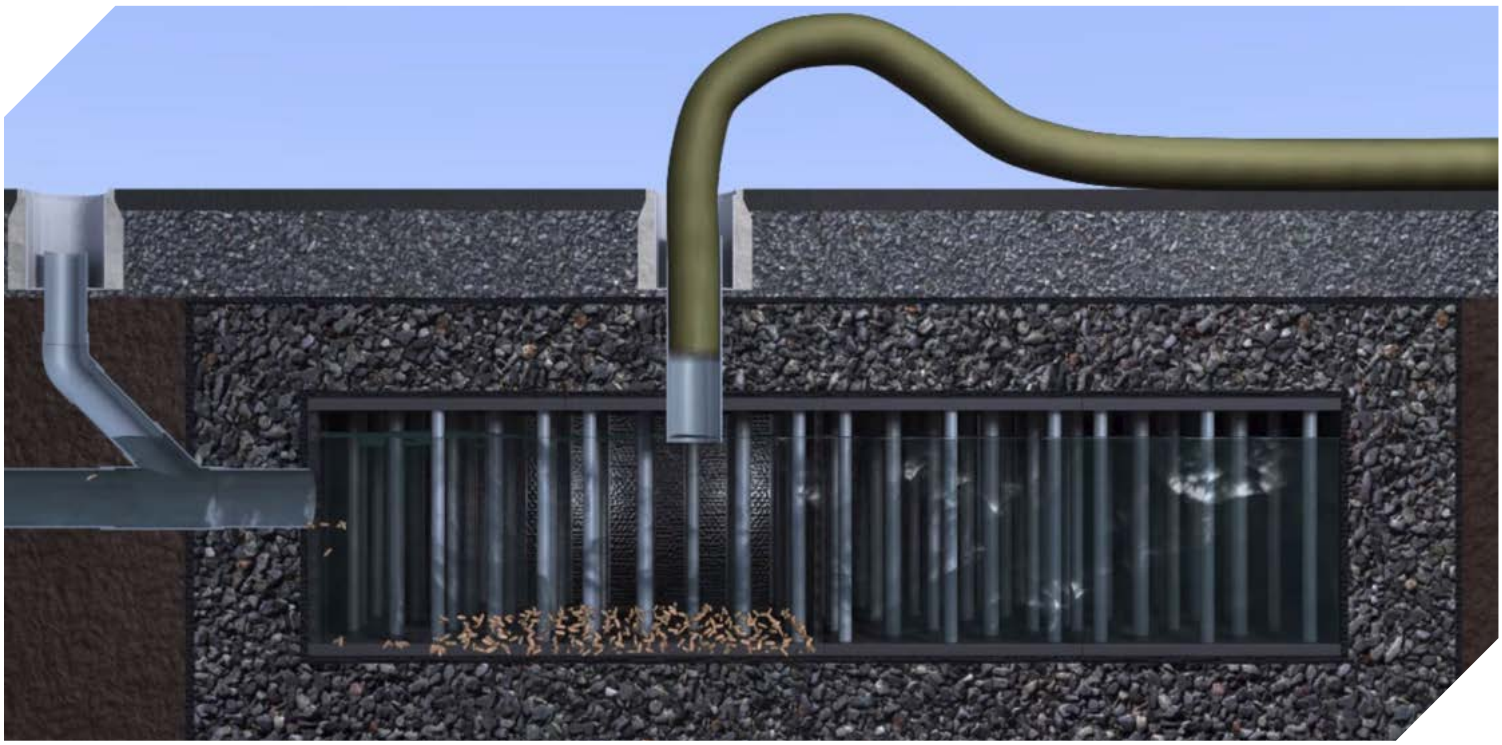
Although frequency is site-specific and dependent upon criteria like land use, pollutant load, and climate, it is recommended that the Debris Row be inspected, at a minimum, every six months. The system is inspected through access ports located in every Debris Row. To inspect the system, remove/open the access port lid.

Using a flashlight, complete a visual inspection to evaluate debris accumulation. If the area cannot be fully observed, insert a closed-circuit camera into the system to perform inspection. If accumulation is noted, record the depth of debris. If the debris accumulation is greater than three inches, proceed to maintenance of the Debris Row. If not, record all data and inspection results and close all access lids.

3.3 CLEANOUT

Designed to reduce maintenance time and cost, the Debris Row provides a contained area for sediment and debris within the larger stormwater storage basin. If inspection has determined maintenance is necessary, access is provided through the inflow connection and any access ports within the Debris Row.

Maintenance is accomplished using a high-pressure nozzle to loosen and suspend debris that can then be removed with a vacuum hose. Once debris has been removed, remove any equipment and close any open ports. Be sure to inspect and vacuum any upslope catch basins and manholes as necessary. Most municipalities and private companies have vacuum equipment with the combined capability to both loosen and remove the accumulated debris.



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TATHAM ENGINEERING

Enhancing our communities

116 Bond Street

PARKING JUSTIFICATION STUDY

Sullnet Holdings Inc.

File 323899 | January 22, 2025

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Date:

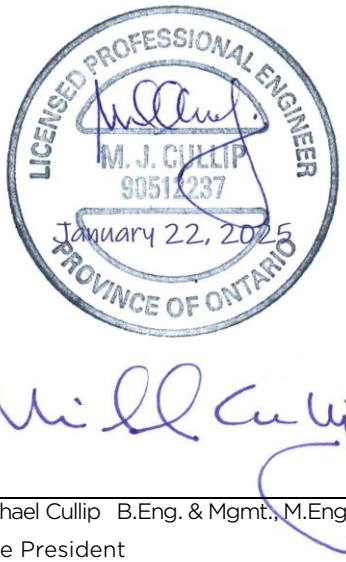
January 22, 2025

Prepared by:

Tatham Engineering Limited
10 Diana Drive, Unit 7
Orillia, Ontario L3V 8K8
T 705-325-1753
tathameng.com

Prepared for:

Sullnet Holdings Inc.
sullnetholdings@icloud.com

Authored by:	Reviewed by:
	
Karolina Kukielka C.E.T., EIT, rcsi Engineering Intern	Michael Cullip B.Eng. & Mgmt., M.Eng., P.Eng. Vice President

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Issue	Date	Description
1	January 22, 2025	Final Report

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1 Introduction

Tatham Engineering Limited was retained by Sullnet Holdings Inc. to conduct a parking justification study in support of the proposed residential development to be located at 116 Bond Street in the City of Orillia. The location of the development site is illustrated in Figure 1.

The purpose of this study is to establish the parking needs of the subject property. In this regard, the study has considered the following:

- the City of Orillia's current parking requirements;
- parking survey results from proxy sites;
- parking standards adopted by other municipalities;
- findings from similar parking studies; and
- methodologies employed in establishing parking demand.

2 Proposed Development

2.1 SITE LOCATION

The proposed development is to be located at 116 Bond Street in the City of Orillia (as illustrated in Figure 1). The site is bounded by residential properties to the west, north and east, and by Bond Street to the south.

2.2 DEVELOPMENT DETAILS

The proposed development will consist of 18 stacked townhouse units contained in 2 3-storey buildings. It is understood that the units will be 2-bedroom units.

Stacked townhouses are a type of multi-unit building that 'stacks' one or two-storey units on top of each other. Each unit has its own exterior front door and there are no elevators or shared lobbies. In this regard, they can be considered a cross between an apartment or condominium unit (accessed internally via shared hallways with multiple units stacked in one building), and a street townhouse (accessed externally but units are located side-by-side only).

A site plan is provided in Figure 2.

2.3 PARKING SUPPLY

The proposed development will provide 1.25 spaces per unit, or 23 spaces (18 x 1.25 = 22.5, or 23 spaces).

3 Parking Review

To establish an appropriate parking supply for the site, a review was conducted to consider the following:

- *City of Orillia Comprehensive Zoning By-Law 2014-44*[1] parking requirements;
- residential parking standards adopted by other municipalities for similar uses;
- parking demands per the *ITE Parking Generation Manual, 6th Edition*[2]; and
- results of parking surveys conducted at proxy sites.

3.1 MUNICIPAL PARKING STANDARDS

3.1.1 City of Orillia

The *City of Orillia Comprehensive Zoning By-law 2014-44* requires that a residential building containing more than 3 dwelling units must provide 1.5 parking spaces per unit, of which 25% must be designated for visitor parking. This equates to:

- 1.125 spaces per unit for residents; and
- 0.375 spaces per unit for visitors.

It is noted that the City's by-law does not further differentiate between types of residential land use (e.g. apartment building, 4-plex, condo building, stacked townhouse, etc.); rather the noted rate is applicable to all such developments providing more than 3 residential units.

3.1.2 Other Municipalities

As with the City of Orillia, other municipal parking rates do not provide parking requirements specific to a stacked townhouse style development. In this regard, parking requirements associated with an apartment building (or equivalent) have been considered, as summarized in Table 1. Given the similarities of a stacked townhouse building to a traditional small apartment building (e.g. 3 or 4 storey walk-ups), the comparison of apartment rates is considered appropriate to determine typical parking requirements.

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[1] *City of Orillia Comprehensive Zoning By-Law 2014-44*. City of Orillia. June 2, 2014 (Consolidation June 1, 2024).
[2] *Parking Generation Manual, 6th Edition*. Institute of Transportation Engineers. October 2023.

Table 1: Parking Rates by Municipality (Apartment or Equivalent)

MUNICIPALITY	PARKING RATES		
	Base	Visitor	Total
Orillia, City of	**1.125 per unit (75%)**	**0.375 per unit (25%)**	**1.5 per unit**
Barrie, City of	1.5	not specified	1.5
Blue Mountains, Town of	varies by size	0.25	varies
Bradford, Town of	1.5	0.25	1.75
Brockton, Municipality of	1.0	0.25	1.25
Cambridge, City of	1.0	0.25	1.25
Collingwood, Town of	1.0	0.25	1.25
Cornwall, City of	0.75	0.25 (to max of 30)	1.0
East Gwillimbury, Town of	1.0	0.25	1.25
Goderich, Town of	1.5	not specified	1.5
Gravenhurst, Town of	1.0	0.25	1.25
Huntsville, Town of	1.5	not specified	1.5
Innisfil, Town of	1.25 to 1.5	0.25	1.5 to 1.75
Kitchener, City of	1.0	not specified	1.0
Lambton Shores, Municipality of	1.5	not specified	1.5
London, City of	1.0 to 1.25	not specified	1.0 to 1.25
Midland, Town of	1.125 (75%)	0.375 (25%)	1.5
Newmarket, Town of	1.5	0.25	1.75
North Bay, City of	1.2	0.3	1.5
Owen Sound, City of	1.25	not specified	1.25
Parry Sound, Town of	1.25	not specified	1.25
Penetanguishene, Town of	1.5	0.25	1.75
Shelburne, Town of	1.0	not specified	1.0
Stratford, Town of	1.5	not specified	1.5
Whitchurch Stouffville, Town of	1.25	0.25	1.5

As indicated, the parking rates for apartment building land-uses range between 1.0 and 1.75 spaces per dwelling unit, with a predominant visitor supply rate of 0.25 spaces per unit.

3.2 ITE PARKING GENERATION MANUAL

The Institute of Transportation Engineers (ITE) *Parking Generation Manual, 6th Edition* provides parking supply and demand data for several residential land-uses. In considering the proposed use of the subject development, data provided for the *multifamily housing – 2+ bedroom low-rise* (ITE code 220) land-use was reviewed (the ITE land-use description for the noted land-use is provided in Appendix A). The ITE data is summarized in Table 2. It is noted the ITE data reflects a general urban/suburban location with no nearby rail transit.

Table 2: ITE Parking Generation

PARKING STATISTIC	PARKING RATES
Average Parking Supply	1.70 spaces per unit
Average Parking Demand	1.27
Range of Rates	0.58 to 3.16
95% Confidence Interval	1.22 to 1.32
Parking Demand – Fitted Curve Equation [1,2]	Ln(P) = 0.99Ln(X)+0.26 (R^2 = 0.95)

[1] fitted curve equation where P = number of parked cars and X = number of dwelling units
[2] reflects peak weekday parking demand (Mon-Fri) between 10:00PM and 5:00AM

As noted, the ITE data for *multifamily housing – low-rise* has an average parking demand of 1.27 spaces per unit, whereas the peak demand range is 0.58to 3.16 spaces per unit. The 95% confidence interval, which captures all but 5% of the outlying data, is 1.22 to 1.32 spaces per unit which is considered a more appropriate and applicable dataset.

In addition to parking supply and demand statistics provided in Table 2, the *Parking Generation Manual* also includes a fitted curve equations for the noted land use that have been derived from graphical representations of the parking demand data. This equation can be used to estimate parking demand and can be applied when the Coefficient of Determination (R^2) is greater than 0.50. The R^2 value is a statistical measure that illustrates the relationship between an independent variable (in this case dwelling units) and a dependent variable (parked cars). For example, an R^2 value of 0.75 indicates that 75% of the variance in the number of parked cars is accounted for by the variance in the number of dwelling units. With respect to the land use considered, the R^2

value is 0.95 suggesting that the number of dwelling units is a good indicator of parking demand based on ITE's data set.

3.3 PARKING SURVEYS AT PROXY SITES

Parking surveys at proxy sites are used to establish actual parking demands at comparable developments to that which is being proposed. Given the unique nature of stacked townhouses, similar proxy developments within the local area were not identified. In lieu of this, parking survey data was compiled 4 apartment/condo sites and 2 townhouse sites.

Given the hybrid nature of a stacked townhouse compared to the surveyed proxy sites, parking demand is expected to fall somewhere between the parking demand of a street townhouse (lower density with a higher parking demand per unit) and an apartment or condominium development (higher density with a lower parking demand per unit).

3.3.1 Proxy Sites

The noted proxy sites are detailed below and illustrated in Figure 3.

Atherley Place Apartments, 135 Atherley Road

Atherley Place Apartments is a 4-storey, 48-unit apartment development consisting of 1 and 2-bedroom units. The site provides 60 parking spaces of which 48 are available to residents (1 resident space/unit) with the remaining 12 available to visitors (0.25 visitor spaces/unit).

Bond Street Condos, 107-125 Bond Street

Bond Street Condos is a development consisting of three 3-storey, 24-unit condominium buildings each containing a mix of 1 and 2-bedroom units. The site provides a total of 86 spaces (1.2 per unit) of which 72 spaces are available to residents (1 resident space/unit) and 14 spaces are available to visitors (0.2 visitor spaces/unit).

Mariposa Place Apartments, 125 Fittons Road West

Mariposa Place is a 6 storey 88-unit apartment development located on the south side of Fittons Road West, west of Park Street. The site consists of 1, 2 and 3-bedroom apartments. Mariposa Place provides 110 parking spaces, or 1.25 spaces per unit.

Noble Towers Apartments, 391 Barrie Road

Noble Towers is a 7 storey 84-unit apartment building located on Barrie Road. The site consists of 1 and 2-bedroom apartments. In terms of parking supply, the site provides 84 parking spaces translating to 1 space per unit.

Coventry Townhomes, 337 West Street North

Coventry Townhomes is a 50-unit street townhouse development consisting of a mix of 2, 3, and 4-bedroom townhouse units. The site provides a total of 95 parking spaces (1.9 spaces per unit) of which 81 spaces are available to residents (1.62 spaces per unit) and 14 spaces are available to visitors (0.28 spaces per unit).

Village West Townhomes, 451 West Street North

Village West Townhomes is a 50-unit street townhouse development consisting entirely of 3-bedroom townhouse units. The site provides a total of 100 parking spaces (2 spaces per unit). No signage/pavement markings and/or segregated parking was identified on-site to distinguish visitor parking from resident parking.

3.3.2 Proxy Surveys - Apartments

Atherley Place & Bond Street Condos

The parking surveys at the Atherley Place and Bond Street Condos were conducted by Tatham Engineering staff on Wednesday, May 25, 2022, and Saturday, May 28, 2022, from 8:00 PM to 11:00 PM on each day. The weekday evening surveys ensure peak resident parking demand was captured (i.e. when most residents would be home), whereas weekend evening surveys ensure peak visitor parking rates were captured (i.e. when residents are most likely to have guests). The site was visited 3 times over the 3-hour period. The parking survey data and resulting peak parking demands for the site are summarized in Table 3 and Table 4.

Mariposa Place & Noble Towers

The parking surveys at Mariposa Place and Noble Towers were conducted by Tatham Engineering staff on Monday, April 26, 2020 (7:00 PM to 10:00 PM). It is further noted that the surveys were conducted during the COVID related provincial shutdown. In this respect, the observed parking demand may be more conservative than typical conditions. Regardless, the parking surveys are considered to have captured the peak parking demand at each site. The parking survey data and resulting peak parking demands for each site are summarized in Table 5 and Table 6.

Table 3: Proxy Parking Survey – Atherley Place Apartments

PARKING STATISTICS		WEEKDAY PARKING DEMAND			WEEKEND PARKING DEMAND		
		Count 1	Count 2	Count 3	Count 1	Count 2	Count 3
Number of Units		48 apartment units					
Resident Parking (48 spaces)	Demand	34	32	33	24	26	32
	Per Unit	0.71	0.67	0.69	0.50	0.54	0.67
Visitor Parking (12 spaces)	Demand	2	3	3	4	5	4
	Per Unit	0.04	0.06	0.06	0.08	0.10	0.08
Total Parking (60 spaces)	Demand	36	35	36	28	31	36
	Per Unit	**0.75**	0.73	**0.75**	0.58	0.65	**0.75**

Table 4: Proxy Parking Survey – Bond Street Condos

PARKING STATISTICS		WEEKDAY PARKING DEMAND			WEEKEND PARKING DEMAND		
		Count 1	Count 2	Count 3	Count 1	Count 2	Count 3
Number of Units		72 apartment units					
Resident Parking (74 spaces)	Demand	46	46	49	36	40	40
	Per Unit	0.64	0.64	0.68	0.50	0.56	0.56
Visitor Parking (12 spaces)	Demand	2	4	4	4	4	4
	Per Unit	0.03	0.06	0.06	0.06	0.06	0.06
Total Parking (86 spaces)	Demand	48	50	53	40	44	44
	Per Unit	0.67	0.69	**0.74**	0.56	0.61	0.61

Table 5: Proxy Parking Survey – Mariposa Place

PARKING STATISTICS		WEEKDAY PARKING DEMAND		
		Count 1	Count 2	Count 3
Number of Units			88 apartment units	
Total Parking (110 spaces)	Demand	73	79	81
	Per Unit	0.83	0.90	**0.92**

Table 6: Proxy Parking Survey – Noble Towers

PARKING STATISTICS		WEEKDAY PARKING DEMAND		
		Count 1	Count 2	Count 3
Number of Units			84 apartment units	
Total Parking (84 spaces)	Demand	58	64	68
	Per Unit	0.69	0.76	**0.81**

Survey Results - Apartments

As indicated, the peak parking demands for the apartment sites ranged from 0.74 to 0.92 spaces per unit. Peak visitor parking demand, at sites where visitor parking was marked, was between 0.06 and 0.10 spaces per unit.

It is noted that the parking provision at each site is lower than that required by the City of Orillia's corresponding zoning by-laws (1.5 spaces per unit).

3.3.3 Proxy Surveys - Townhouses

Coventry & Village West Townhomes

The parking surveys at the noted townhome sites were also completed by Tatham Engineering staff on Wednesday, May 25, 2022, and Saturday, May 28, 2022, from 8:00 PM to 11:00 PM on each day. The parking data and resulting peak parking demands are noted in Table 7 and Table 8.

Table 7: Parking Survey – Coventry Townhomes

PARKING STATISTICS		WEEKDAY PARKING DEMAND			WEEKEND PARKING DEMAND		
		Count 1	Count 2	Count 3	Count 1	Count 2	Count 3
Number of Units		50 townhouse units					
Resident Parking (81 spaces)	Demand	59	59	60	42	48	51
	Per Unit	1.18	1.18	1.20	0.84	0.96	1.02
Visitor Parking (14 spaces)	Demand	3	3	5	3	4	5
	Per Unit	0.06	0.06	0.10	0.06	0.08	0.10
Total Parking (95 spaces)	Demand	62	62	65	45	52	56
	Demand per Unit	1.24	1.24	**1.30**	0.90	1.04	1.12

Table 8: Parking Survey – Village West Townhomes

PARKING STATISTICS		WEEKDAY PARKING DEMAND			WEEKEND PARKING DEMAND		
		Count 1	Count 2	Count 3	Count 1	Count 2	Count 3
Number of Units		50 townhouse units					
Total Parking[1] (100 spaces)	Demand	54	62	62	59	62	69
	Per Unit	1.08	1.24	1.24	1.18	1.24	**1.38**

[1] There was no distinction between resident and visitor parking

Survey Results – Townhouses

The peak parking demand observed at the townhouse survey sites was between 1.30 to 1.38 spaces unit. Peak visitor parking demand, at sites where visitor parking was marked, was 0.10 spaces per unit.

3.4 SUMMARY

The key findings of the parking review are summarized below:

- The proposed parking supply for the residential development is 1.25 spaces per unit, or 23 spaces.

- Based on the City of Orillia's parking requirements, the proposed development is required to supply 27 spaces or 1.5 spaces per unit.
- Parking rates adopted by other local municipalities range from 1.0 to 1.75 spaces per unit (including visitor parking) for a multi-unit dwelling.
- ITE Parking Generation data for the *multifamily housing – 2+bedroom low-rise* land-use indicates an average peak parking demand of 1.27 spaces per unit and a 95% confidence interval of 1.22 to 1.32 spaces per unit.
- Parking surveys conducted at proxy sites indicate peak parking demands in the order of 0.74 to 0.92 spaces per unit for an apartment/condominium development and 1.30 to 1.38 spaces per unit for a street townhouse development.

4 Parking Needs Assessment

As previously noted, the site plan indicates a parking supply of 23 spaces for the development, representing a shortfall of 4 spaces when considering the City of Orillia's parking requirements for the proposed use (27 spaces). Based on the parking review conducted in Chapter 3, the following justification is provided in support of the proposed parking supply for the proposed development.

4.1 PARKING JUSTIFICATION

4.1.1 Municipal Parking Standards

A review of parking standards adopted by other surrounding and/or comparable municipalities for multi-unit residential developments reveals a consistent approach concerning parking rates, with 1.25 and 1.5 spaces per unit as the most common requirements (8 of the 23 noted municipalities require 1.25 spaces; 9 require 1.5 spaces, 3 require 1.0 and 3 require 1.75). Most municipalities require a visitor parking supply rate of 0.25 spaces per unit.

In the context of the range of rates adopted in other municipalities, the proposed parking supply of 1.25 spaces per unit is not considered low or unreasonable.

4.1.2 Proxy Site Parking Surveys

The proposed parking supply is supported by the results of the parking surveys conducted at 6 proxy sites. The observed peak parking demand was in the order of 0.74 to 0.92 spaces per apartment/condominium unit (combined resident + visitor parking demand) and 1.30 to 1.38 spaces per townhouse unit.

As previously noted, the proxy sites represent the extremes of the proposed development. Whereas the proposed development is of a stacked townhouse type, the surveyed sites were of an apartment/condominium type (higher density, lower per-unit parking demand) and street townhouse type (lower density, higher per-unit parking demand). In this regard, the proposed development is expected to have a parking demand somewhere between that of the two types of proxy sites – somewhat higher than the apartments and condominiums but somewhat lower than the street townhouses.

In addition, it is noted that the street townhouse proxy sites contained large numbers of 3-bedroom and some 4-bedroom units. These larger units are expected to have higher parking demands per unit due to their attractiveness to larger and/or higher-income families with multiple vehicles. Therefore, demand at the proposed development is expected to be more in

line with the demand observed at the apartment and condominium sites rather than the townhouse sites.

Based on the results of the proxy site surveys, the proposed parking supply of 1.25 spaces per unit is supported.

4.1.3 ITE Parking Rates

The ITE parking rates have been applied to the subject development, considering 18 residential units, the results of which are presented in Table 9.

Table 9: Parking Requirements – ITE Parking Rates

PARKING STATISTIC	PARKING RATES	PARKING REQUIRED
Average Parking Demand	1.27 spaces/unit	23 spaces
95% Confidence Interval	1.22 to 1.32	22 to 24
Parking Demand – Fitted Curve Equation	Ln(P) = 0.99Ln(X)+0.26 (R^2 = 0.95)	23

In context of the above, the proposed parking supply of 23 spaces is consistent with the findings of the *ITE Parking Generation* manual for the *multifamily housing – 2+ bedroom low-rise* land use. In this respect, the proposed parking rate is supported by the empirical ITE parking generation data and is not otherwise considered low or unreasonable.

4.1.4 Other Considerations

Unbundled Parking

Additional parking strategies, such as unbundled parking, may also be implemented to further reduce the required parking supply. By offering unbundled parking, residents have the option of renting a parking space for an additional fee or forgoing a parking space if not needed. Rather than providing each unit with a space, unbundled parking ensures that only those residents requiring a space have access to one while residents who do not require a space save money each billing period. Unbundled parking is considered an equitable approach (i.e. only those requiring parking pay for the parking space, instead of having the cost of parking shared across all residents regardless of use) and can reduce the total amount of parking required to support the needs of the development.

Reduced Parking Minimums

Reducing the minimum parking requirement for residential uses is typically low risk, recognizing that parking availability is usually a key decision for a prospective purchaser or renter. Developers are not inclined to reduce parking supply the extent that it compromises marketability however, providing surplus parking increases the cost of development. Thus, minimizing the parking requirement to the extent possible reduces development costs (in turn making the dwelling units more affordable) while still remaining appealing to prospective residents.

4.2 RECOMMENDATION

In consideration of the above, the proposed parking supply of 1.25 spaces per unit, or 23 spaces, is considered reasonable and acceptable.

5 Summary

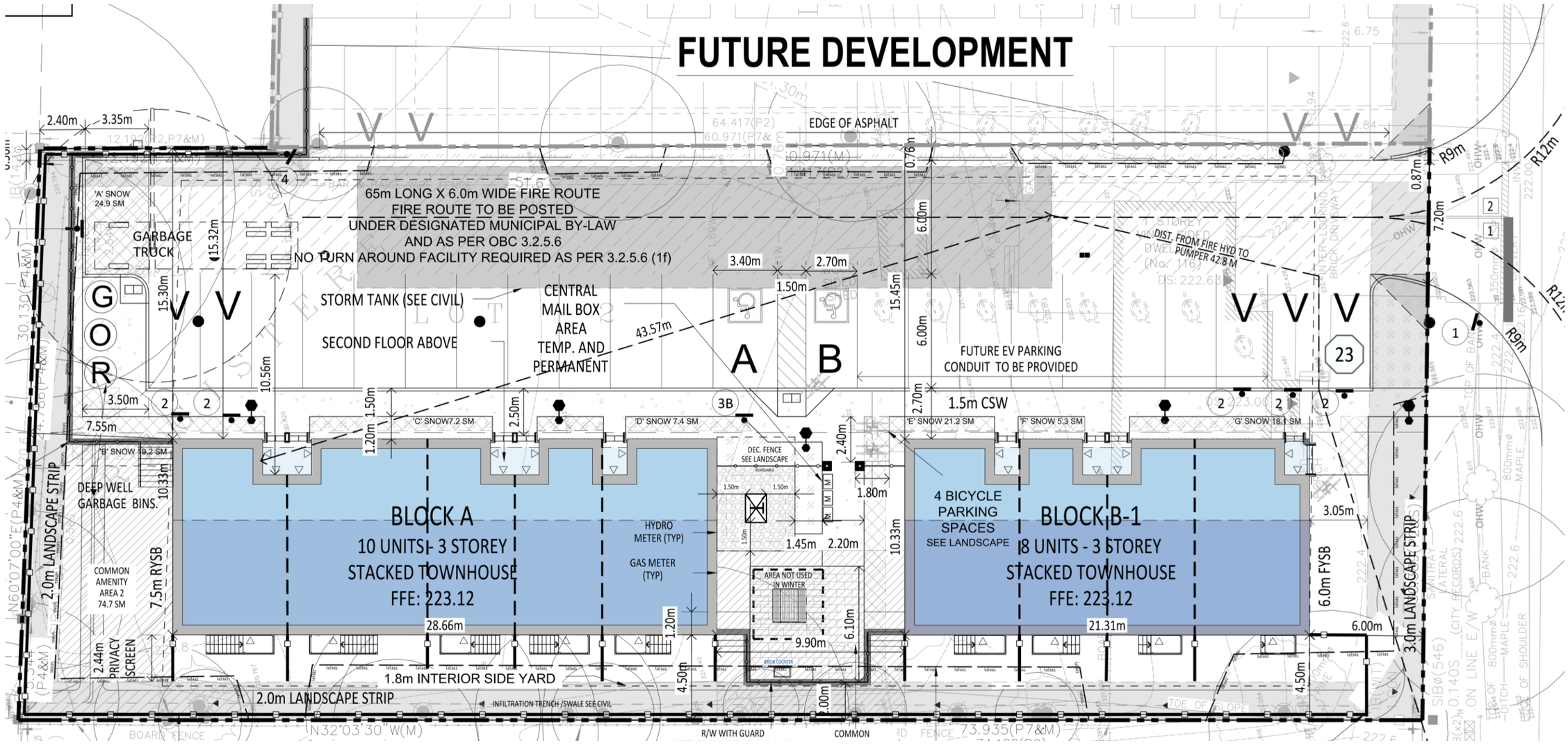
This parking study has reviewed the proposed parking supply for the proposed residential stacked-townhouse development located at 116 Bond Street in the City of Orillia. The proposed parking supply is 1.25 spaces per unit, or 23 spaces. The existing parking standards of the City of Orillia (1.5 spaces per unit) require a parking supply of 27 spaces to support the development. This study reviewed the proposed parking supply in consideration of parking survey data gathered at proxy sites within the City, parking standards adopted by other municipalities, and published ITE parking generation data.

While the proposed parking supply does not satisfy the minimum parking requirements per the City's zoning by-law, it is ultimately supported by the parking demand survey data collected from proxy sites, along with empirical ITE data and parking rates adopted by other nearby municipalities.

In consideration of this review, the proposed parking supply for the 116 Bond Street development is considered appropriate.

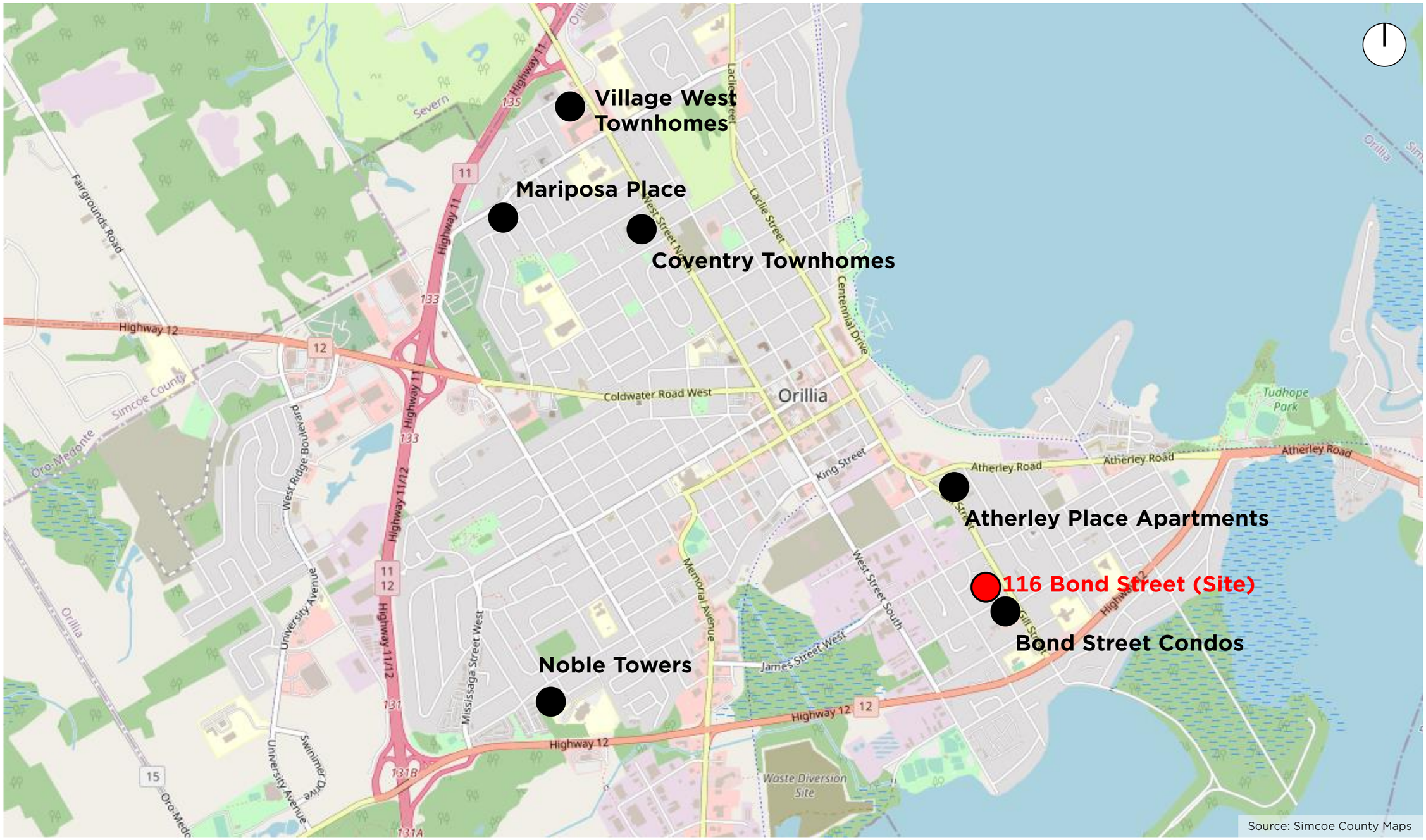
116 BOND STREET, PARKING JUSTIFICATION STUDY

Figure 1: Site Location



116 BOND STREET, PARKING JUSTIFICATION STUDY

Figure 2: Site Plan – Phase 1



116 BOND STREET, PARKING JUSTIFICATION STUDY

Figure 3: Proxy Site Locations

Appendix A:
ITE Land Use Description

Land Use: 220
Multifamily Housing (Low-Rise)

Description

Low-rise multifamily housing includes apartments, townhouses, and condominiums located within the same building with at least three other dwelling units and that have two or three floors (levels). Various configurations fit this description, including walkup apartment, mansion apartment, and stacked townhouse.

- A walkup apartment typically is two or three floors in height with dwelling units that are accessed by a single or multiple entrances with stairways and hallways.
- A mansion apartment is a single structure that contains several apartments within what appears to be a single-family dwelling unit.
- A fourplex is a single two-story structure with two matching dwelling units on the ground and second floors. Access to the individual units is typically internal to the structure and provided through a central entry and stairway.
- A stacked townhouse is designed to match the external appearance of a townhouse. But, unlike a townhouse dwelling unit that only shares walls with an adjoining unit, the stacked townhouse units share both floors and walls. Access to the individual units is typically internal to the structure and provided through a central entry and stairway.

Multifamily housing (mid-rise) (Land Use 221), multifamily housing (high-rise) (Land Use 222), affordable housing (Land Use 223), and off-campus student apartment (low-rise) (Land Use 225) are related land uses.

Land Use Subcategory

Data are presented for two subcategories for this land use: (1) not close to rail transit and (2) close to rail transit. A site is considered close to rail transit if the walking distance between the residential site entrance and the closest rail transit station entrance is ½ mile or less.

Additional Data

For the three sites for which both the number of residents and the number of occupied dwelling units were available, there were an average of 2.72 residents per occupied dwelling unit.

For the two sites for which the numbers of both total dwelling units and occupied dwelling units were available, an average of 96.2 percent of the total dwelling units were occupied.

The technical appendices provide supporting information on time-of-day distributions for this land use. The appendices can be accessed through either the ITETripGen web app or the trip

TATHAM ENGINEERING

Enhancing our communities

116 Bond Street

TRANSPORTATION IMPACT BRIEF

Sullnet Holdings Inc.

File 323899 | January 22, 2025

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January 22, 2025

Prepared by:

Tatham Engineering Limited
10 Diana Drive, Building 8, Unit 7
Orillia, Ontario L3V 8K8

T 705-325-1753
tathameng.com

Prepared for:

Sullnet Holdings Inc.
sullnetholdings@icloud.com

Authored by:	Reviewed by:
Karolina Kukielka C.E.T., EIT, rcsi Engineering Intern	Michael Cullip B.Eng. & Mgmt., M.Eng., P.Eng. Vice President

LICENSED PROFESSIONAL ENGINEER
M. J. CULLIP
90512237
January 22, 2025
PROVINCE OF ONTARIO

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Issue	Date	Description
1	January 22, 2025	Final Report

Document Contents

Tables

Figures

Appendices

1 Introduction

Tatham Engineering Limited was retained by Sullnet Holdings Inc. to prepare a Transportation Impact Brief in support of the proposed residential development to be located at 116 Bond Street in the City of Orillia. The location of the development site is illustrated in Figure 1.

1.1 REPORT OBJECTIVE

The objective of this report is to present the findings of the transportation impact brief and address the requirements of the City with respect to the potential impacts of the development on the area road network. In particular, the following will be discussed:

- existing conditions, including a description of the study area road network, traffic volumes, operations and planned/ proposed improvements;
- details of the proposed development and anticipated trip generation;
- assessment of the site access as per the City's Entrance Analysis requirements; and
- future conditions, including transportation impacts associated with the proposed development.

1.2 REPORT STRUCTURE

The report is structured as follows:

- Chapter 1: introduction and study purpose
- Chapter 2: existing conditions, detailing the road system and corresponding traffic operations;
- Chapter 3: proposed development, access assessment and trip generation;
- Chapter 4: future traffic operations associated with the proposed development; and
- Chapter 5: summary of the report and key findings.

2 Existing Conditions

This chapter will describe the road network, traffic volumes and operations for the existing conditions.

2.1 ROAD NETWORK

The road network to be addressed by this study consists of Bond Street and its intersection with Gill Street. Aerial mapping and photographs of the road system are provided in Figure 2.

2.1.1 Roads

Bond Street

Bond Street is classified as a local road as per Schedule D of the *City of Orillia Official Plan*[1]. The road is oriented east-west through the study area and has a 2-lane semi-urban cross-section with gravel/grass shoulders, open ditches and a sidewalk on the south side of the road. The speed limit is unposted; thus a 50 km/h speed has been assumed (as is typical within a built-up area).

Gill Street

Gill Street is classified as a collector road as per the *City's Official Plan.* The road is oriented north-south through the study area and has a 2-lane semi-urban cross-section with gravel/grass shoulders, open ditches and a sidewalk on the east side of the road to the north of Bond Street and on both sides of the road to the south of Bond Street. The speed limit is unposted; thus a 50 km/h speed has been assumed.

2.1.2 Intersection

Bond Street & Gill Street

The intersection of Bond Street with Gill Street is a 3-leg intersection with stop control on Bond Street. All approaches are single lane approaches (i.e. no exclusive turn lanes are provided).

2.2 TRAFFIC VOLUMES

2.2.1 Traffic Counts

To determine the existing traffic volumes on the study area road network, a turning movement count was conducted at the intersection of Bond Street with Gill Street on Thursday March 14,

[1] *City of Orillia Official Plan, Schedule D: Road Network*. City of Orillia, February 9, 2021.

2024 from 7:00 to 10:00 and 15:00 to 18:00. The observed peak hour traffic volumes are illustrated in Figure 3 with detailed count sheets provided in Appendix A.

2.2.2 2025 Traffic Volumes

To reflect existing 2025 volumes, a background growth rate of 2% per annum (refer to the justification provided in Section 4.1.1) was applied to the volumes observed during the 2024 traffic count. The resulting 2025 peak hour volumes are illustrated in Figure 4.

2.3 TRAFFIC OPERATIONS

The capacity, and hence operations, of a road system is effectively dictated by its intersections. As such, the traffic assessment has focused on the operations of the study area intersections, based on the following:

- procedures outlined in the *Highway Capacity Manual 6th Edition*[2] (using Synchro v.11);
- the 2025 traffic volumes; and
- the existing intersection configuration and control.

For the study area intersection, the analysis considers:

- the average delay (measured in seconds);
- level of service (LOS); and
- volume to capacity (v/c) for the critical (i.e. stop controlled) movements.

With respect to the noted metrics:

- level of service 'A' corresponds to the best operating condition with minimal delays whereas level of service 'F' corresponds to poor operations resulting from high intersection delays (additional details regarding Level of Service definitions are provided in Appendix B); and
- a v/c ratio of less than 1.0 indicates the intersection movement is operating at less than capacity while v/c of 1.0 indicates capacity has been reached.

A summary of the analysis is provided Table 1, whereas detailed worksheets are included in Appendix C. Based on the existing volumes, the subject intersection currently provides excellent overall levels of service (LOS A) with minor delays during both peak hours.

[2] *Highway Capacity Manual, 6th Edition*. Transportation Research Board, October 2016.

Table 1: Intersection Operations – 2025

INTERSECTION, MOVEMENT & CONTROL			WEEKDAY AM PEAK HOUR			WEEKDAY PM PEAK HOUR		
			Delay	LOS	V/C	Delay	LOS	V/C
Bond Street & Gill Street	EB LR	stop	9	A	0.02	10	A	0.03
	NB LT	free	7	A	0.01	8	A	0.01

L - left T - through R - right LTR - left-through-right LT - left-through TR - through-right LR - left-right

2.4 NEED FOR IMPROVEMENTS

Based on the results of the operations assessment, no intersection improvements are required to support the existing conditions.

3 Proposed Development

This chapter will provide additional details with respect to the proposed development, including its location, land use and the projected site generated traffic volumes and the assignment of such to the adjacent road network.

3.1 LOCATION

The proposed development is to be located at 116 Bond Street in the City of Orillia (as illustrated in Figure 1). The site is bounded by residential properties to the west, north and east, and by Bond Street to the south.

3.2 LAND USE

3.2.1 Current Development Application

The proposed development will consist of 18 stacked townhouse units contained in 2 3-storey buildings. A site plan is provided in Figure 5.

3.2.2 Future Development Application

It is understood that 120 Bond Street, which abuts the east limit of the subject site and is also owned by the applicant, will be developed as a future phase under a separate development application. The future phase will add another 16 stacked townhouse units and will share access with the 116 Bond Street parcel. It is noted that this future phase is still conceptual and subject to change.

3.2.3 Phasing

While not part of the development application for 116 Bond Street, the traffic study has considered full build-out of both 116 and 120 Bond Street by the 2028 horizon.

3.3 ACCESS

3.3.1 Location

The site will be served by a single, full moves access on Bond Street.

3.3.2 Configuration

The access has been reviewed in context of the Ontario Provincial Standard Drawing (OPSD) for urban industrial, commercial and apartment entrances (OPSD 350.010) and the recommended

practices for access design as published in the Transportation Association of Canada (TAC) *Geometric Design Guide for Canadian Roads*[3]. The design elements are discussed in detail below.

Width & Right Turn Radius

For access, OPSD 350.010 requires a throat width in the order of 7.2 to 12.0 metres, with a curb radius between 4.5 and 12.0 metres. It is noted that the OPSD access dimensions are consistent with those recommended in the TAC *Design Guide.*

The access has a width of 7.2 metres (measured at the property line) and maintains a minimum corner radius of 9.0 metres. In consideration of the above, the access width and turn radius are considered appropriate.

Corner Clearance

Corner clearance is the minimum suggested distance between a proposed access and an adjacent intersection or driveway. The distance is typically measured from the near curb of the adjacent street/access to the near edge of the proposed access. Inadequate corner clearance can result in interrupted traffic flow, poor access operations and safety concerns. Appropriate corner clearance is of particular concern at intersections where stop or signal control is present (i.e. stop control and traffic signals may create queues that encroach on the operations of the adjacent driveway).

The corner clearance distance consists of three measurements: the corner curb radius of the adjacent intersection or access, a tangent section and the radius of the proposed access. The tangent section provides separation between the end of the adjacent intersection corner radius and the end of the proposed access radius. For a commercial access, TAC guidelines recommend a minimum tangent length of 5.0 metres from the nearest intersection and 3.0 metres from the nearest adjacent commercial access. For the purpose of this review, the commercial access requirements have been considered.

The proposed access location will provide a tangent length of approximately 60 metres to Gill Street to the east and a tangent length of approximately 170 metres to High Street to the west. As such, the resulting corner clearances to the adjacent intersections satisfy the TAC guidelines.

With respect to separation from the adjacent driveways, a minimum tangent length of approximately 14 metres will be provided between the site access and the adjacent residential access points to the east and west.

---

[3] *Geometric Design Guide for Canadian Roads, Chapter 8.* Transportation Association of Canada. June 2017

Sight Lines

The sight line assessment has considered minimum stopping sight distance requirements as per the Transportation Association of Canada's (TAC) *Geometric Design Guide for Canadian Roads* as detailed below.

- The minimum stopping sight distance provides a sufficient distance for an approaching motorist to observe a stationary hazard in the road and bring their vehicle to a complete stop prior to the hazard.

The minimum stopping sight requirements for a design speed of 60 km/h (posted speed limit + 10 km/h on lower speed roads) is 85 metres.

The available sight lines along Bond Street are 65 metres to/from the east and 150 metres to/from the west. The sightlines to the east are limited by the termination of Bond Street at Gill Street. In this respect, the reduced sight distances are not considered problematic in that vehicles approaching from the east will be doing so at a reduced operating speed having just completed a turning movement from Gill Street to Bond Street.

Based on the above, the available sight lines along Bond Street at the site access are considered acceptable.

3.4 ON-SITE CIRCULATION

The *City of Orillia Zoning By-law 2014-44*[4] requires that an aisle providing access to parking spaces have a minimum width of 6.0 metres. As per the site plan, a minimum aisle width of 6.0 metres will be maintained throughout the site, thus satisfying the City's requirements.

With respect to emergency vehicle operations, an internal fire route has been established that will maintain the required minimum 6.0 metre clear width. As the fire route is not more than 90 metres, a turnaround facility within the site is not required. Rather, emergency vehicles will reverse out of the site as required.

3.5 PARKING

Vehicle Parking

For a residential development, the City's *Zoning By-law* requires a parking supply of 1.5 spaces per unit, or 27 spaces. As per the site plan, the development will provide 1.25 spaces per unit,

[4] *City of Orillia Zoning By-law 2014-44*. City of Orillia, June 2013 (Consolidated November 2022)

which translates to a parking supply of 23 spaces. The proposed parking supply is addressed in further detail in the *116 Bond Street Parking Justification Study*[5], provided under separate cover.

3.5.1 Bicycle Parking

For residential uses requiring more than 10 vehicle parking spaces, the City's *Zoning By-law* requires that 1 bicycle space be provided for every 10 vehicle spaces. With an overall parking requirement of 27 vehicle spaces, the site is required to provide 3 bicycle spaces. As per the site plan, 6 bicycle spaces will be provided.

3.6 SITE TRAFFIC

3.6.1 Trip Generation

The number of vehicle trips to be generated by the proposed development has been determined based on the type of use, development size and trip generation rates published in the *ITE Trip Generation Manual, 11th Edition*[6]. Based on the proposed development the trip rates for *multi-family housing – low-rise* (ITE code 220) have been applied.

The associated trip rates and trip estimates are provided in Table 2 and Table 3, respectively. As previously noted, trip generation for both 116 and 120 Bond Street has been considered.

Table 2: Trip Rates – Site

LAND USE	VARIABLE	WEEKDAY AM PEAK HOUR			WEEKDAY PM PEAK HOUR		
		In	Out	Total	In	Out	Total
multi-family housing – low-rise (ITE 220)	units	0.10	0.30	0.40	0.32	0.19	0.51

Table 3: Trip Estimates – 116 & 120 Bond Street

LAND USE	UNITS	WEEKDAY AM PEAK HOUR			WEEKDAY PM PEAK HOUR		
		In	Out	Total	In	Out	Total
116 Bond Street	18 units	2	5	7	6	3	9
120 Bond Street (Future)	16 units	1	5	6	5	3	8
	34 units	**3**	**10**	**13**	**11**	**6**	**17**

[5] *116 Bond Street Parking Justification Study.* Tatham Engineering Limited. January 2025.
[6] *ITE Trip Generation Manual, 11th Edition.* Institute of Transportation Engineers, September 2021.

As indicated, 116 Bond Street is expected to generate 7 trips during the AM peak hour and 9 trips during the PM peak hour.

When considering the completion of 120 Bond Street, the overall development block is expected to generate 13 trips during the AM peak hour and 17 trips during the PM peak hour.

3.6.2 Trip Distribution

The distribution of the site generated trips has been developed based on the results of the *Transportation Tomorrow Survey* (TTS) conducted in 2022. The TTS is a comprehensive travel survey conducted in the Greater Golden Horseshoe area once every five years. Based on data provided in the TTS, the following distribution was established:

- to from the north via Gill Street – 40%;
- to from the south via Gill Street – 25%; and
- to/from the west via Bond Street - 35%.

The distribution to the east along Bond Street considers the proximity of the site to the City's downtown and also includes traffic that will ultimately travel to/from the north, south and east. The distribution to/from the west along Bond Street includes traffic traveling to/from the west.

The assignment of the site generated traffic to the road network is illustrated in:

- Figure 6 for 116 Bond Street traffic;
- Figure 7 for 120 Bond Street traffic; and
- Figure 8 for both 116 and 120 Bond Street traffic.

4 Future Conditions

This chapter will address future traffic conditions and the resulting impacts of the proposed development on the adjacent road system. The following areas are to be addressed:

- traffic volumes;
- intersections operations including site access intersection with Bond Street; and
- potential improvements to the study area road network, if necessary.

For the purpose of this study, a 3-year full build-out horizon (2028) in addition to a 5-year beyond build-out horizon (2033) have been assessed and otherwise considered appropriate (in the context of the number of trips to be generated by the site) to determine the impact of the proposed development on the surrounding road network and as per City's guidelines.

4.1 TRAFFIC VOLUMES

Traffic volumes expected for the 2028 and 2033 horizon years have been determined based on the 2024 traffic counts, historical and projected growth, and consideration for the subject development volumes.

4.1.1 Background Growth

Background growth has been established in consideration of the following:

- Based on the Census data for the years 2016 and 2021, the population of the City of Orillia increased from 31,166 to 33,411 persons, translating to an annual growth rate of 1.4%.
- The *City of Orillia Official Plan*[7] estimates that the City's population will grow to 41,000 by the year 2031, translating to an annual growth of 2.0% from 2021 to 2031 (when considering the 2021 census population).
- The *City of Orillia Multi-Modal Transportation Master Plan*[8] (MTMP) forecasts the number of trips made to/from and within the City of Orillia to grow from 52,659 in 2016 to 63,900 by 2036, translating to an annual growth rate of approximately 1.0%.

Based on the above, and to ensure a conservative approach, an annual growth rate of 2% has been applied to the volumes on the road network.

---

[7] *City of Orillia Official Plan.* City of Orillia, March 2010 (Consolidated November 2022).
[8] *Multi-Modal Transportation Master Plan, City of Orillia*. Stantec, November 2019.

4.1.2 Future Volumes

The 2028 and 2033 traffic volumes, based on the 2024 traffic counts and adjusted to reflect the noted annual background growth and the trips associated with the subject development (116 Bond Street and 120 Bond Street), are illustrated in Figure 9 and Figure 10, respectively.

4.2 TRAFFIC OPERATIONS

The study area intersection and development access intersection were analyzed to consider the future total traffic volumes. The results of the operational review are summarized in Table 4 (2028) and Table 5 (2033), with detailed worksheets provided in Appendix D.

Table 4: Intersection Operations – 2028

INTERSECTION, MOVEMENT & CONTROL			WEEKDAY AM PEAK HOUR			WEEKDAY PM PEAK HOUR		
			Delay	LOS	V/C	Delay	LOS	V/C
Bond Street & Gill Street	EB LR	stop	9	A	0.03	10	A	0.04
	NB LT	free	7	A	0.01	8	A	0.01
Bond Street & Site Access	EB LT	free	7	A	0.00	7	A	0.00
	SB LR	stop	9	A	0.01	9	A	0.01

L - left T - through R - right LTR - left-through-right LT - left-through TR - through-right LR - left-right

Table 5: Intersection Operations – 2033

INTERSECTION, MOVEMENT & CONTROL			WEEKDAY AM PEAK HOUR			WEEKDAY PM PEAK HOUR		
			Delay	LOS	V/C	Delay	LOS	V/C
Bond Street & Gill Street	EB LR	stop	10	A	0.03	10	A	0.05
	NB LT	free	8	A	0.01	8	A	0.01
Bond Street & Site Access	EB LT	free	7	A	0.00	7	A	0.00
	SB LR	stop	9	A	0.01	9	A	0.01

L - left T - through R - right LTR - left-through-right LT - left-through TR - through-right LR - left-right

As indicated, the study area intersection will continue to provide excellent operations (LOS A) until 2033 horizon and the site access will provide excellent operations (LOS A).

4.3 NEED FOR IMPROVEMENTS

4.3.1 Intersection Operations

In consideration of the intersection operational analyses, no improvements are required to accommodate the additional site-generated traffic under future conditions.

4.3.2 Turn Lane Requirements

The peak hour turning volumes accessing the site (2 to 7 right turning vehicles and 2 to 5 left turning vehicles) are considered minimal and not such that would warrant or require the implementation of exclusive turn lanes.

5 Summary

Proposed Development

The study has addressed the transportation impacts associated with the proposed residential development to be located at 116 Bond Street in the City of Orillia. Upon completion, 116 Bond Street is expected to generate 7 trips during the AM peak hour and 9 trips during the PM peak hour. When considering the completion of 120 Bond Street, the overall development block is expected to generate 13 trips during the AM peak hour and 17 trips during the PM peak hour..

Transportation Impacts

In addressing the study area traffic operations, the intersection of Bond Street with Gill Street was analyzed under existing (2025) and future (2028 and 2033) horizon periods. Based on these assessments, the area road system can readily accommodate the development, and hence no improvements are required to support the proposed development.

Sight Line Assessment

Sight lines along Bond Street were reviewed at the access location and determined to satisfy the TAC guidelines for minimum stopping sight and intersection sight distances.

Turn Lane Requirements

Given the limited volumes accessing the site, exclusive turn lanes are not required to serve the subject site.

Source: OpenStreetMaps.org

116 BOND STREET, TRANSPORTATION IMPACT BRIEF

Figure 1: Site Location

116 BOND STREET, TRANSPORTATION IMPACT BRIEF

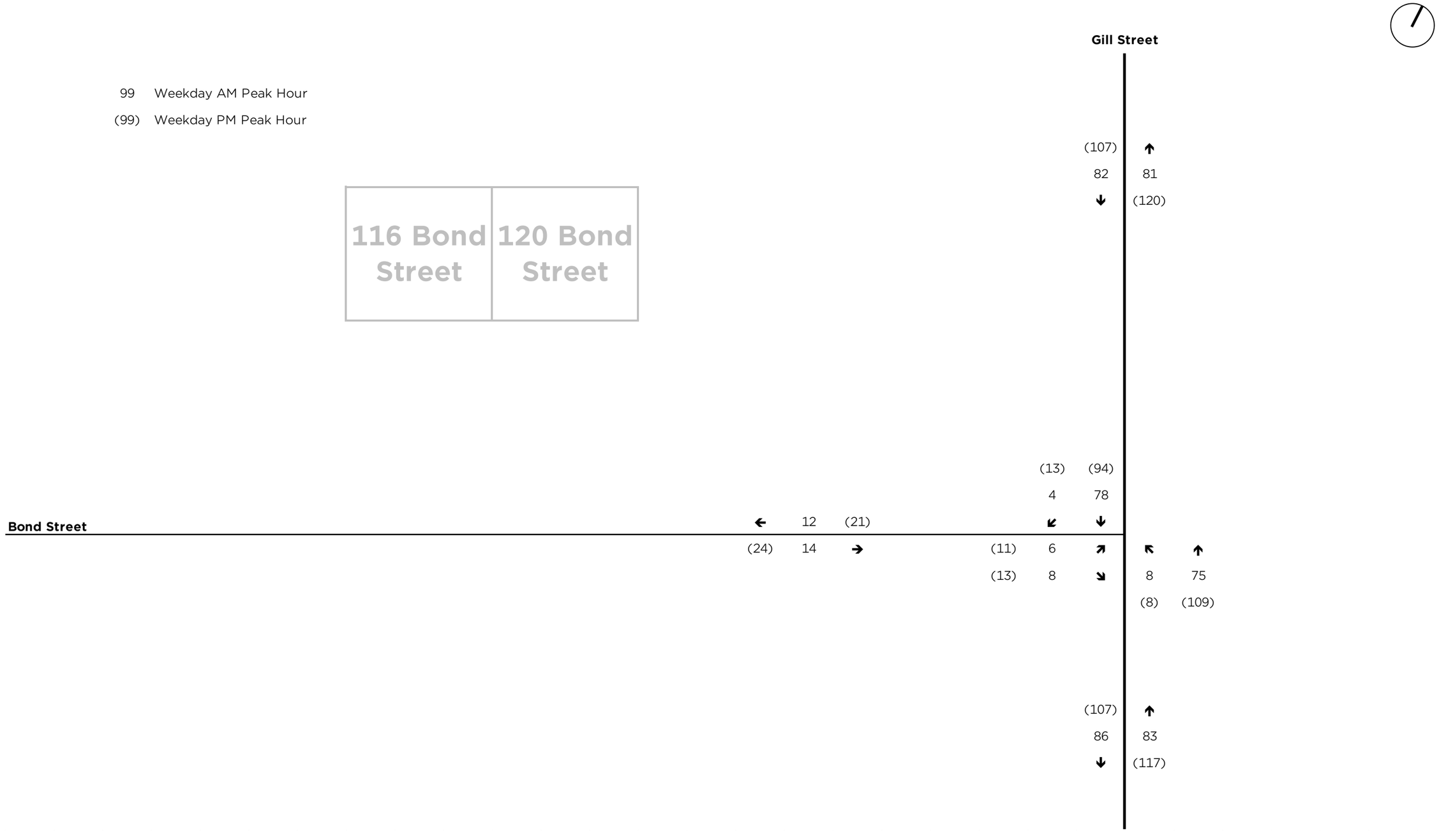
Figure 2A: Area Road Network

Looking west along Bond Street from site access

Looking east along Bond Street from site access

99 Weekday AM Peak Hour

(99) Weekday PM Peak Hour

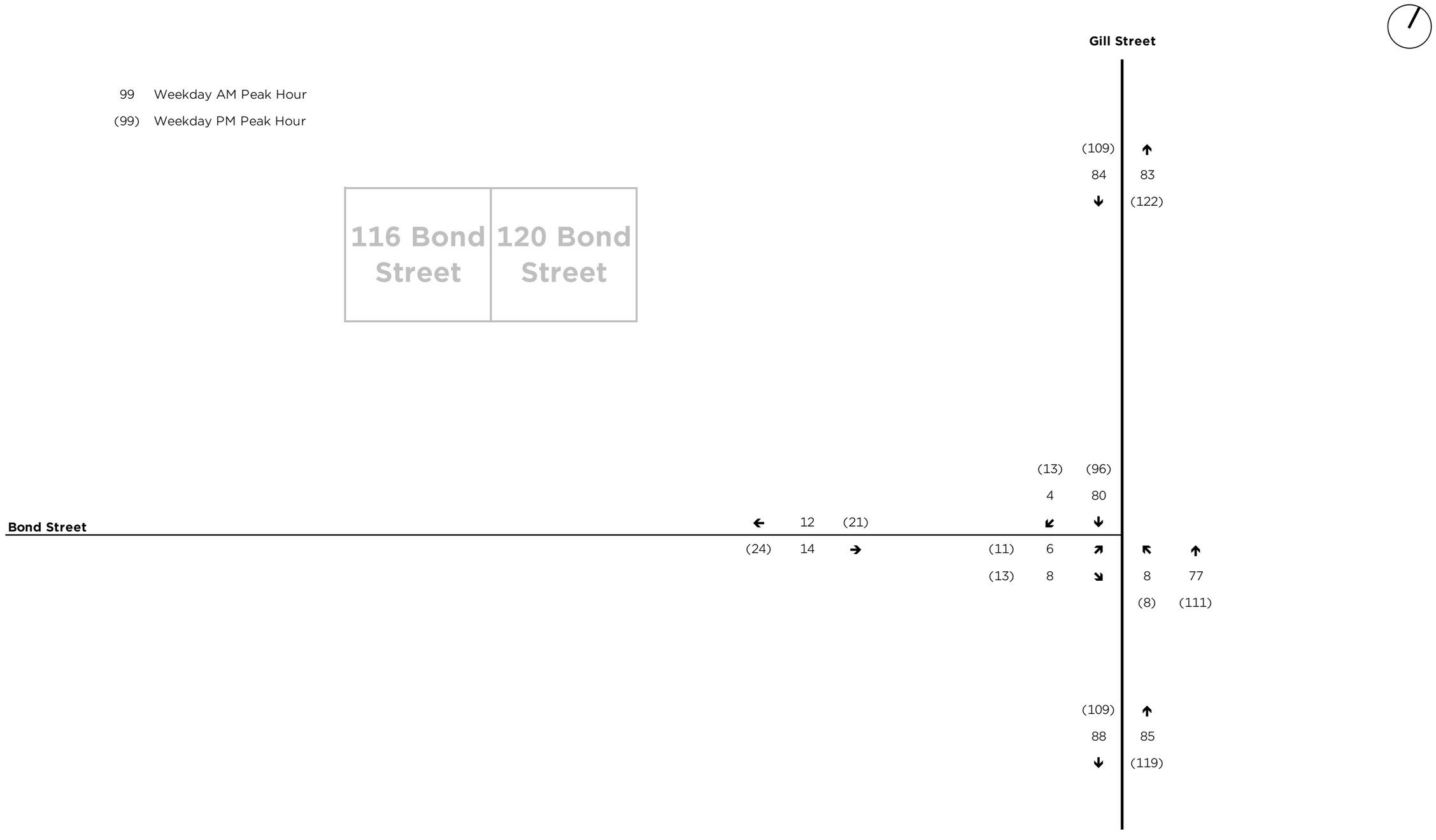


116 BOND STREET, TRANSPORTATION IMPACT BRIEF

Figure 3: Traffic Volumes – 2024 Counts

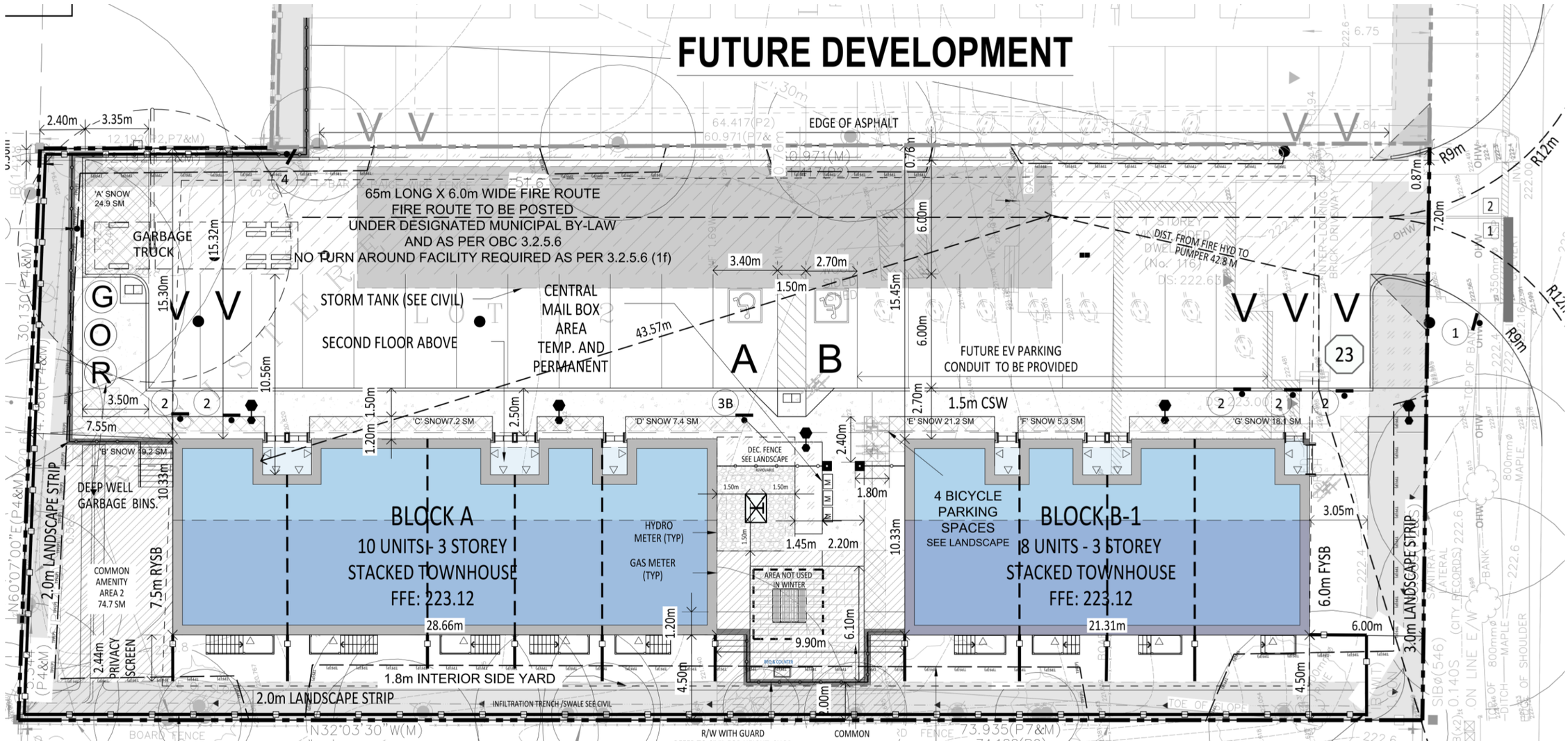
99 Weekday AM Peak Hour

(99) Weekday PM Peak Hour



116 BOND STREET, TRANSPORTATION IMPACT BRIEF

Figure 4: Traffic Volumes – 2025



116 BOND STREET, TRANSPORTATION IMPACT BRIEF

Figure 5: Site Plan

99 Weekday AM Peak Hour

(99) Weekday PM Peak Hour

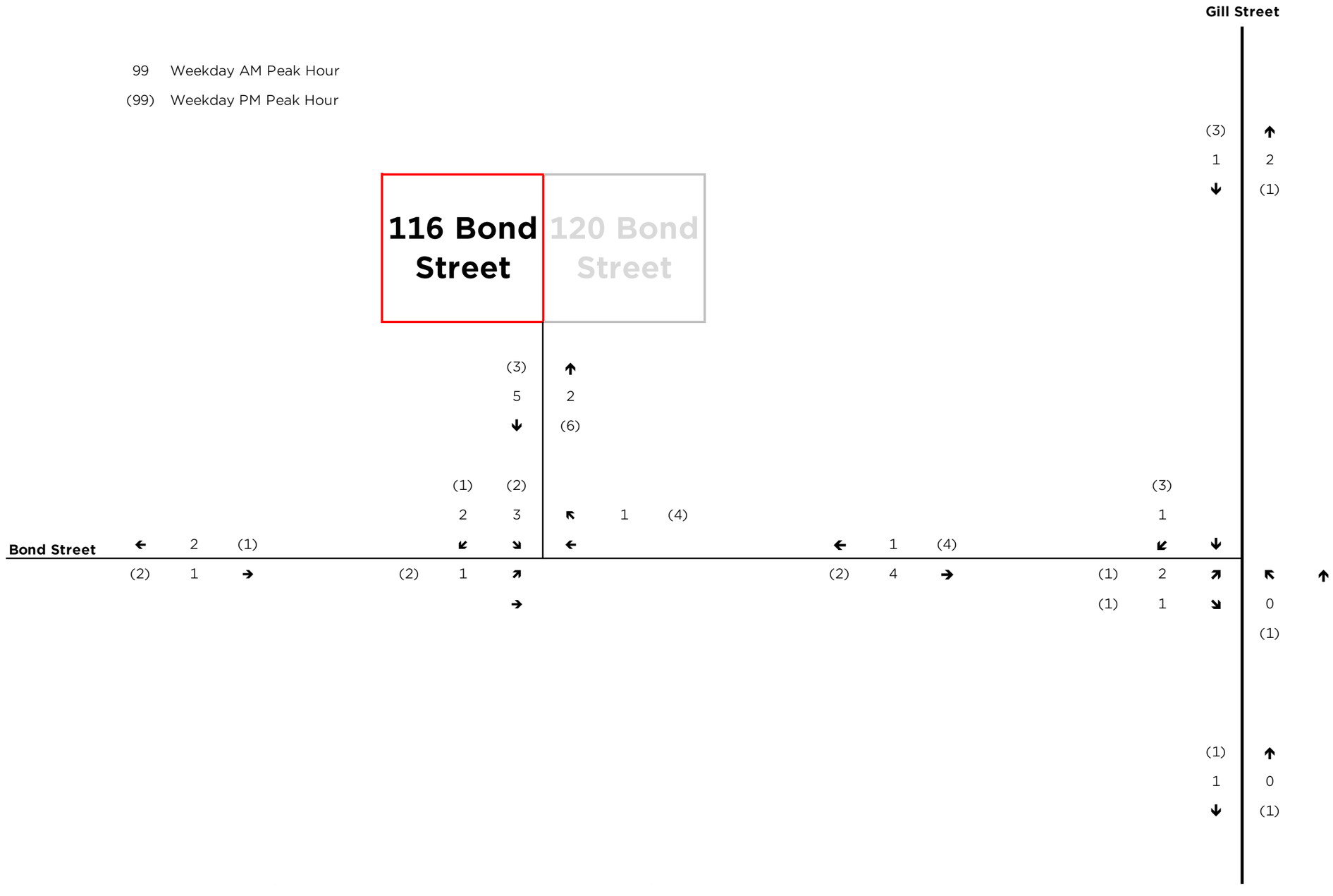
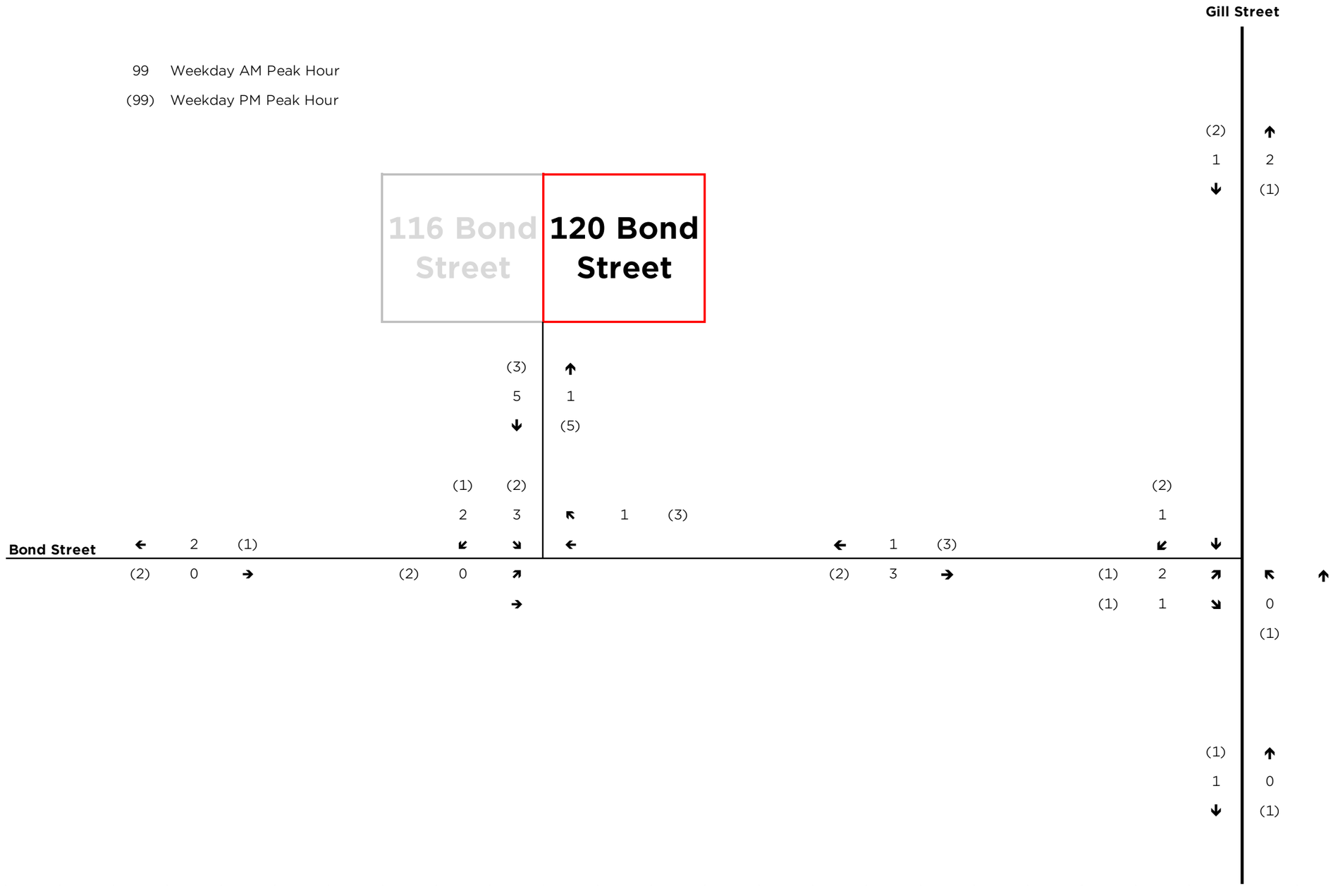


Figure 6: Site Generated Traffic – 116 Bond Street

99 Weekday AM Peak Hour

(99) Weekday PM Peak Hour



116 BOND STREET, TRANSPORTATION IMPACT BRIEF

Figure 7: Site Generated Traffic – 120 Bond Street

99 Weekday AM Peak Hour

(99) Weekday PM Peak Hour

116 BOND STREET, TRANSPORTATION IMPACT BRIEF

Figure 8: Site Generated Traffic – 116 & 120 Bond Street

99 Weekday AM Peak Hour

(99) Weekday PM Peak Hour

116 BOND STREET, TRANSPORTATION IMPACT BRIEF

Figure 9: Traffic Volumes – 2028 Total

99 Weekday AM Peak Hour

(99) Weekday PM Peak Hour

Figure 10: Traffic Volumes – 2033 Total

Appendix A:
Traffic Counts

Ontario Traffic Inc.
Traffic Monitoring • Services & Products

Project #24-110 - Tatham Engineering Ltd

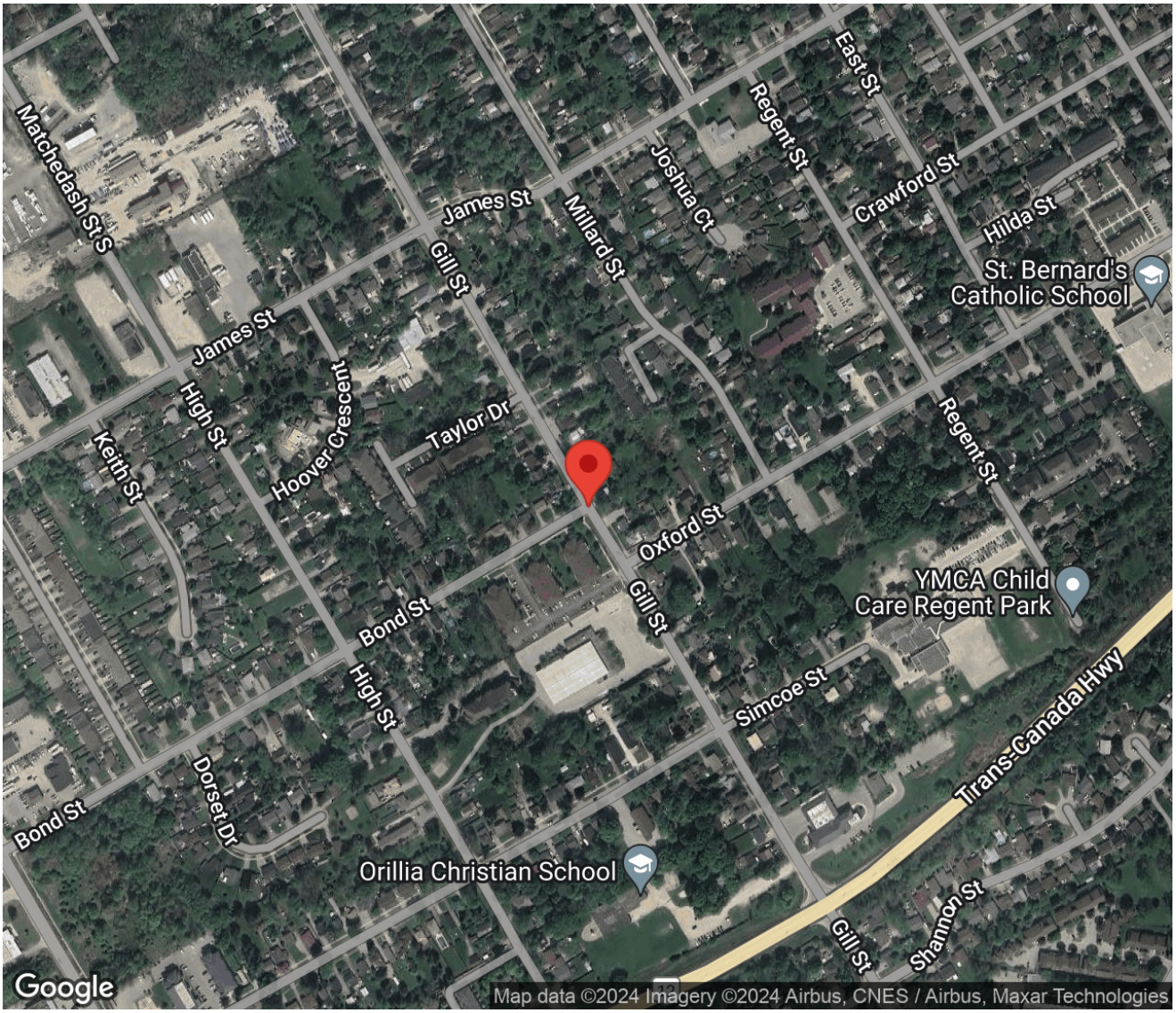
Intersection Count Report

Intersection:	Bond St & Gill St
Municipality:	Orillia
Count Date:	Thursday, Mar 14, 2024
Site Code:	2411000001
Count Categories:	Cars, Trucks, Bicycles, Pedestrians
Count Period:	07:00-10:00, 15:00-18:00
Weather:	Clear
Comments:	

Ontario Traffic Inc.
Traffic Monitoring • Services & Products

Traffic Count Map

Intersection:	Bond St & Gill St
Site Code:	2411000001
Municipality:	Orillia
Count Date:	Mar 14, 2024



Ontario Traffic Inc.
Traffic Monitoring • Services & Products

Traffic Count Summary

Intersection:	Bond St & Gill St
Site Code:	2411000001
Municipality:	Orillia
Count Date:	Mar 14, 2024

Gill St - Traffic Summary

	North Approach Totals						South Approach Totals						
	Includes Cars, Trucks, Bicycles						Includes Cars, Trucks, Bicycles						
Hour	Left	Thru	Right	U-Turn	Total	Peds	Left	Thru	Right	U-Turn	Total	Peds	Total
07:00 - 08:00	0	43	4	0	47	0	13	39	0	0	52	1	99
08:00 - 09:00	0	75	5	0	80	0	8	68	0	0	76	4	156
09:00 - 10:00	0	53	7	0	60	0	3	72	0	0	75	1	135
BREAK													
15:00 - 16:00	0	81	12	0	93	0	6	84	0	0	90	0	183
16:00 - 17:00	0	96	10	0	106	0	6	95	0	0	101	5	207
17:00 - 18:00	0	103	12	0	115	0	3	82	0	0	85	0	200
GRAND TOTAL	**0**	**451**	**50**	**0**	**501**	**0**	**39**	**440**	**0**	**0**	**479**	**11**	**980**

Ontario Traffic Inc.
Traffic Monitoring • Services & Products

Traffic Count Summary

Intersection:	Bond St & Gill St
Site Code:	2411000001
Municipality:	Orillia
Count Date:	Mar 14, 2024

Bond St - Traffic Summary

	East Approach Totals						West Approach Totals						
	Includes Cars, Trucks, Bicycles						Includes Cars, Trucks, Bicycles						
Hour	Left	Thru	Right	U-Turn	Total	Peds	Left	Thru	Right	U-Turn	Total	Peds	Total
07:00 - 08:00	0	0	0	0	0	0	1	0	8	0	9	1	9
08:00 - 09:00	0	0	0	0	0	0	4	0	10	0	14	0	14
09:00 - 10:00	0	0	0	0	0	0	5	0	6	0	11	0	11
BREAK													
15:00 - 16:00	0	0	0	0	0	0	4	0	10	0	14	0	14
16:00 - 17:00	0	0	0	0	0	0	9	0	11	0	20	0	20
17:00 - 18:00	0	0	0	0	0	0	13	0	7	0	20	0	20
GRAND TOTAL	**0**	**0**	**0**	**0**	**0**	**0**	**36**	**0**	**52**	**0**	**88**	**1**	**88**

Ontario Traffic Inc.
Traffic Monitoring • Services & Products

Traffic Count Data

Intersection: Bond St & Gill St
Site Code: 2411000001
Municipality: Orillia
Count Date: Mar 14, 2024

North Approach - Gill St

Start Time	Cars					Trucks					Bicycles					Total Peds
	↰	↑	↱	↻	Total	↰	↑	↱	↻	Total	↰	↑	↱	↻	Total	
07:00	0	11	1	0	12	0	0	0	0	0	0	0	0	0	0	0
07:15	0	10	0	0	10	0	0	0	0	0	0	0	0	0	0	0
07:30	0	11	0	0	11	0	0	0	0	0	0	0	0	0	0	0
07:45	0	9	3	0	12	0	2	0	0	2	0	0	0	0	0	0
08:00	0	9	2	0	11	0	1	0	0	1	0	0	0	0	0	0
08:15	0	14	0	0	14	0	0	0	0	0	0	0	0	0	0	0
08:30	0	21	1	0	22	0	2	0	0	2	0	0	0	0	0	0
08:45	0	27	2	0	29	0	1	0	0	1	0	0	0	0	0	0
09:00	0	13	1	0	14	0	0	0	0	0	0	0	0	0	0	0
09:15	0	14	2	0	16	0	0	1	0	1	0	0	0	0	0	0
09:30	0	14	2	0	16	0	0	1	0	1	0	0	0	0	0	0
09:45	0	12	0	0	12	0	0	0	0	0	0	0	0	0	0	0
SUBTOTAL	0	165	14	0	179	0	6	2	0	8	0	0	0	0	0	0

Ontario Traffic Inc.
Traffic Monitoring • Services & Products

Traffic Count Data

Intersection: Bond St & Gill St
Site Code: 2411000001
Municipality: Orillia
Count Date: Mar 14, 2024

North Approach - Gill St

Start Time	Cars					Trucks					Bicycles					Total Peds
	↰	↑	↱	↷	Total	↰	↑	↱	↷	Total	↰	↑	↱	↷	Total	
15:00	0	26	4	0	30	0	1	0	0	1	0	0	0	0	0	0
15:15	0	14	3	0	17	0	0	0	0	0	0	0	0	0	0	0
15:30	0	20	3	0	23	0	2	0	0	2	0	1	1	0	2	0
15:45	0	17	1	0	18	0	0	0	0	0	0	0	0	0	0	0
16:00	0	30	0	0	30	0	0	0	0	0	0	0	0	0	0	0
16:15	0	19	3	0	22	0	0	0	0	0	0	0	0	0	0	0
16:30	0	24	4	0	28	0	0	0	0	0	0	1	0	0	1	0
16:45	0	22	3	0	25	0	0	0	0	0	0	0	0	0	0	0
17:00	0	28	3	0	31	0	0	0	0	0	0	0	0	0	0	0
17:15	0	30	2	0	32	0	0	0	0	0	0	0	0	0	0	0
17:30	0	20	4	0	24	0	0	0	0	0	0	0	0	0	0	0
17:45	0	25	3	0	28	0	0	0	0	0	0	0	0	0	0	0
SUBTOTAL	0	275	33	0	308	0	3	0	0	3	0	2	1	0	3	0
GRAND TOTAL	0	440	47	0	487	0	9	2	0	11	0	2	1	0	3	0

Ontario Traffic Inc.
Traffic Monitoring • Services & Products

Traffic Count Data

Intersection: Bond St & Gill St
Site Code: 2411000001
Municipality: Orillia
Count Date: Mar 14, 2024

South Approach - Gill St

Start Time	Cars					Trucks					Bicycles					Total Peds
	↰	↑	↱	↶	Total	↰	↑	↱	↶	Total	↰	↑	↱	↶	Total	
07:00	1	8	0	0	9	0	0	0	0	0	0	0	0	0	0	0
07:15	5	13	0	0	18	0	0	0	0	0	0	1	0	0	1	0
07:30	2	7	0	0	9	0	2	0	0	2	0	0	0	0	0	0
07:45	5	8	0	0	13	0	0	0	0	0	0	0	0	0	0	1
08:00	0	14	0	0	14	0	1	0	0	1	0	0	0	0	0	0
08:15	1	16	0	0	17	0	1	0	0	1	0	0	0	0	0	1
08:30	3	16	0	0	19	0	1	0	0	1	1	0	0	0	1	1
08:45	2	19	0	0	21	0	0	0	0	0	1	0	0	0	1	2
09:00	0	22	0	0	22	0	0	0	0	0	0	0	0	0	0	1
09:15	0	17	0	0	17	0	1	0	0	1	0	0	0	0	0	0
09:30	1	18	0	0	19	1	2	0	0	3	0	0	0	0	0	0
09:45	1	12	0	0	13	0	0	0	0	0	0	0	0	0	0	0
SUBTOTAL	21	170	0	0	191	1	8	0	0	9	2	1	0	0	3	6

Ontario Traffic Inc.
Traffic Monitoring • Services & Products

Traffic Count Data

Intersection: Bond St & Gill St
Site Code: 2411000001
Municipality: Orillia
Count Date: Mar 14, 2024

South Approach - Gill St

Start Time	Cars					Trucks					Bicycles					Total Peds
	↰	↑	↱	↷	Total	↰	↑	↱	↷	Total	↰	↑	↱	↷	Total	
15:00	1	20	0	0	21	0	2	0	0	2	0	0	0	0	0	0
15:15	1	17	0	0	18	0	1	0	0	1	0	0	0	0	0	0
15:30	2	21	0	0	23	1	1	0	0	2	0	0	0	0	0	0
15:45	1	22	0	0	23	0	0	0	0	0	0	0	0	0	0	0
16:00	0	16	0	0	16	0	0	0	0	0	0	1	0	0	1	3
16:15	2	30	0	0	32	0	1	0	0	1	0	0	0	0	0	2
16:30	1	18	0	0	19	0	0	0	0	0	0	1	0	0	1	0
16:45	3	28	0	0	31	0	0	0	0	0	0	0	0	0	0	0
17:00	2	31	0	0	33	0	0	0	0	0	0	0	0	0	0	0
17:15	0	14	0	0	14	0	0	0	0	0	0	0	0	0	0	0
17:30	1	13	0	0	14	0	0	0	0	0	0	0	0	0	0	0
17:45	0	24	0	0	24	0	0	0	0	0	0	0	0	0	0	0
SUBTOTAL	14	254	0	0	268	1	5	0	0	6	0	2	0	0	2	5
GRAND TOTAL	35	424	0	0	459	2	13	0	0	15	2	3	0	0	5	11

Ontario Traffic Inc.
Traffic Monitoring • Services & Products

Traffic Count Data

Intersection: Bond St & Gill St
Site Code: 2411000001
Municipality: Orillia
Count Date: Mar 14, 2024

West Approach - Bond St

Start Time	Cars					Trucks					Bicycles					Total Peds
	↰	↑	↱	↩	Total	↰	↑	↱	↩	Total	↰	↑	↱	↩	Total	
07:00	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0
07:15	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1
07:30	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0
07:45	1	0	2	0	3	0	0	0	0	0	0	0	0	0	0	0
08:00	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0
08:15	3	0	4	0	7	0	0	0	0	0	0	0	0	0	0	0
08:30	1	0	2	0	3	0	0	0	0	0	0	0	0	0	0	0
08:45	0	0	1	0	1	0	0	1	0	1	0	0	0	0	0	0
09:00	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
09:15	2	0	1	0	3	0	0	0	0	0	0	0	0	0	0	0
09:30	1	0	3	0	4	0	0	0	0	0	0	0	0	0	0	0
09:45	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0
SUBTOTAL	10	0	23	0	33	0	0	1	0	1	0	0	0	0	0	1

Ontario Traffic Inc.
Traffic Monitoring • Services & Products

Traffic Count Data

Intersection: Bond St & Gill St
Site Code: 2411000001
Municipality: Orillia
Count Date: Mar 14, 2024

West Approach - Bond St

Start Time	Cars					Trucks					Bicycles					Total Peds
	↰	↑	↱	↶	Total	↰	↑	↱	↶	Total	↰	↑	↱	↶	Total	
15:00	2	0	3	0	5	0	0	0	0	0	0	0	0	0	0	0
15:15	2	0	3	0	5	0	0	0	0	0	0	0	0	0	0	0
15:30	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0
15:45	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
16:00	4	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0
16:15	1	0	3	0	4	0	0	0	0	0	0	0	0	0	0	0
16:30	2	0	3	0	5	0	0	0	0	0	0	0	0	0	0	0
16:45	2	0	5	0	7	0	0	0	0	0	0	0	0	0	0	0
17:00	6	0	2	0	8	0	0	0	0	0	0	0	0	0	0	0
17:15	3	0	2	0	5	0	0	0	0	0	0	0	0	0	0	0
17:30	1	0	2	0	3	0	0	0	0	0	0	0	0	0	0	0
17:45	3	0	1	0	4	0	0	0	0	0	0	0	0	0	0	0
SUBTOTAL	26	0	28	0	54	0	0	0	0	0	0	0	0	0	0	0
GRAND TOTAL	**36**	**0**	**51**	**0**	**87**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**

Ontario Traffic Inc.
Traffic Monitoring • Services & Products

Peak Hour Diagram

Specified Period		One Hour Peak	
From:	07:00:00	From:	08:15:00
To:	10:00:00	To:	09:15:00

Intersection: Bond St & Gill St
Site Code: 2411000001
Count Date: Mar 14, 2024

Weather conditions: Clear

**** Unsignalized Intersection ****

Major Road: Gill St runs N/S

North Approach

	Out	In	Total
Cars	79	79	158
Trucks	3	2	5
Bicycles	0	0	0
	82	**81**	**163**

Gill St

Bicycles	0	0	0
Trucks	0	3	0
Cars	4	75	0
Totals	**4**	**78**	**0**

Bond St

			Totals
0	0	0	**0**
0	0	6	**6**
0	1	7	**8**

Peds: 0

Peds: 0

Peds: 0

Peds: 5

West Approach

	Out	In	Total
Cars	13	10	23
Trucks	1	0	1
Bicycles	0	2	2
	14	**12**	**26**

Totals	**8**	**75**	**0**
Cars	6	73	0
Trucks	0	2	0
Bicycles	2	0	0

Gill St

South Approach

	Out	In	Total
Cars	79	82	161
Trucks	2	4	6
Bicycles	2	0	2
	83	**86**	**169**

Cars - Trucks - Bicycles

Comments

Ontario Traffic Inc.
Traffic Monitoring • Services & Products

Peak Hour Summary

Intersection:	Bond St & Gill St
Site Code:	2411000001
Count Date:	Mar 14, 2024
Period:	07:00 - 10:00

Peak Hour Data (08:15 - 09:15)

Start Time	North Approach Gill St						South Approach Gill St						East Approach						West Approach Bond St						Total Vehicles
					Peds	Total					Peds	Total					Peds	Total					Peds	Total	
08:15		14	0	0	0	14	1	17		0	1	18					0		3		4	0	0	7	39
08:30		23	1	0	0	24	4	17		0	1	21					0		1		2	0	0	3	48
08:45		28	2	0	0	30	3	19		0	2	22					0		0		2	0	0	2	54
09:00		13	1	0	0	14	0	22		0	1	22					0		2		0	0	0	2	38
Grand Total		**78**	**4**	**0**	**0**	**82**	**8**	**75**		**0**	**5**	**83**					**0**	**0**	**6**		**8**	**0**	**0**	**14**	**179**
Approach %		95.1	4.9	0		-	9.6	90.4		0		-						-	42.9		57.1	0		-	
Totals %		43.6	2.2	0		45.8	4.5	41.9		0		46.4						0	3.4		4.5	0		7.8	
PHF		**0.7**	**0.5**	**0**		**0.68**	**0.5**	**0.85**		**0**		**0.94**						**0**	**0.5**		**0.5**	**0**		**0.5**	**0.83**
Cars		75	4	0		79	6	73		0		79						0	6		7	0		13	171
% Cars		96.2	100	0		96.3	75	97.3		0		95.2						0	100		87.5	0		92.9	95.5
Trucks		3	0	0		3	0	2		0		2						0	0		1	0		1	6
% Trucks		3.8	0	0		3.7	0	2.7		0		2.4						0	0		12.5	0		7.1	3.4
Bicycles		0	0	0		0	2	0		0		2						0	0		0	0		0	2
% Bicycles		0	0	0		0	25	0		0		2.4						0	0		0	0		0	1.1
Peds					0	-					5	-					0	-					0	-	5
% Peds					0	-					100	-					0	-					0	-	

Ontario Traffic Inc.
Traffic Monitoring • Services & Products

Peak Hour Diagram

Specified Period		One Hour Peak	
From:	15:00:00	From:	16:15:00
To:	18:00:00	To:	17:15:00

Intersection: Bond St & Gill St
Site Code: 2411000001
Count Date: Mar 14, 2024

Weather conditions: Clear

**** Unsignalized Intersection ****

Major Road: Gill St runs N/S

North Approach

	Out	In	Total
Cars	106	118	224
Trucks	0	1	1
Bicycles	1	1	2
	107	**120**	**227**

Gill St

Bicycles	0	1	0
Trucks	0	0	0
Cars	13	93	0
Totals	**13**	**94**	**0**

Bond St

			Totals
0	0	0	**0**
0	0	11	**11**
0	0	13	**13**

Peds: 0

Peds: 0

Peds: 0

Peds: 2

West Approach

	Out	In	Total
Cars	24	21	45
Trucks	0	0	0
Bicycles	0	0	0
	24	**21**	**45**

Totals	**8**	**109**	**0**
Cars	8	107	0
Trucks	0	1	0
Bicycles	0	1	0

Gill St

South Approach

	Out	In	Total
Cars	115	106	221
Trucks	1	0	1
Bicycles	1	1	2
	117	**107**	**224**

Cars - Trucks - Bicycles

Comments

Ontario Traffic Inc.
Traffic Monitoring • Services & Products

Peak Hour Summary

Intersection:	Bond St & Gill St
Site Code:	2411000001
Count Date:	Mar 14, 2024
Period:	15:00 - 18:00

Peak Hour Data (16:15 - 17:15)

Start Time	North Approach Gill St						South Approach Gill St						East Approach						West Approach Bond St						Total Vehicles
					Peds	Total					Peds	Total					Peds	Total					Peds	Total	
16:15		19	3	0	0	22	2	31		0	2	33					0		1		3	0	0	4	59
16:30		25	4	0	0	29	1	19		0	0	20					0		2		3	0	0	5	54
16:45		22	3	0	0	25	3	28		0	0	31					0		2		5	0	0	7	63
17:00		28	3	0	0	31	2	31		0	0	33					0		6		2	0	0	8	72
Grand Total		**94**	**13**	**0**	**0**	**107**	**8**	**109**		**0**	**2**	**117**					**0**	**0**	**11**		**13**	**0**	**0**	**24**	**248**
Approach %		87.9	12.1	0		-	6.8	93.2		0		-						-	45.8		54.2	0		-	
Totals %		37.9	5.2	0		43.1	3.2	44		0		47.2						0	4.4		5.2	0		9.7	
PHF		**0.84**	**0.81**	**0**		**0.86**	**0.67**	**0.88**		**0**		**0.89**						**0**	**0.46**		**0.65**	**0**		**0.75**	**0.86**
Cars		93	13	0		106	8	107		0		115						0	11		13	0		24	245
% Cars		98.9	100	0		99.1	100	98.2		0		98.3						0	100		100	0		100	98.8
Trucks		0	0	0		0	0	1		0		1						0	0		0	0		0	1
% Trucks		0	0	0		0	0	0.9		0		0.9						0	0		0	0		0	0.4
Bicycles		1	0	0		1	0	1		0		1						0	0		0	0		0	2
% Bicycles		1.1	0	0		0.9	0	0.9		0		0.9						0	0		0	0		0	0.8
Peds					0	-					2	-					0	-					0	-	2
% Peds					0	-					100	-					0	-					0	-	

Appendix B:
LOS Definitions

TATHAM ENGINEERING

Level of Service – Unsignalized Intersections

Level of Service (LOS) for unsignalized intersections is defined in terms of control delay for each critical lane. Control delay includes initial deceleration, queue move-up time, stopped delay and final acceleration delay, and is a function of the service rate or capacity of the approach and degree of saturation.

The following table describes in detail the characteristics of each level of service, with A being the best and F being the worst.

LOS	EXPECTED DELAY TO STREET TRAFFIC	DELAY (sec/veh)
A	Little or no delays	$0 < d \leq 10$
B	Short traffic delays	$10 < d \leq 15$
C	Average traffic delays	$15 < d \leq 25$
D	Long traffic delays	$25 < d \leq 35$
E	Very long traffic delays	$35 < d \leq 50$
F	Extreme delays with queuing which may cause congestion affecting other traffic movements in the intersection	$50 < d$

source: 2010 Highway Capacity Manual

Appendix C:
Traffic Operations - Existing

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	6	8	8	77	80	4
Future Vol, veh/h	6	8	8	77	80	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	83	83	83	83	83	83
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	7	10	10	93	96	5

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	212	99	101	0	-	0
Stage 1	99	-	-	-	-	-
Stage 2	113	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	776	957	1491	-	-	-
Stage 1	925	-	-	-	-	-
Stage 2	912	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	771	957	1491	-	-	-
Mov Cap-2 Maneuver	771	-	-	-	-	-
Stage 1	919	-	-	-	-	-
Stage 2	912	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.2	0.7	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1491	-	867	-	-
HCM Lane V/C Ratio	0.006	-	0.019	-	-
HCM Control Delay (s)	7.4	0	9.2	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	11	13	8	111	96	13
Future Vol, veh/h	11	13	8	111	96	13
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	86	86	86	86	86	86
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	13	15	9	129	112	15

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	267	120	127	0	-	0
Stage 1	120	-	-	-	-	-
Stage 2	147	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	722	931	1459	-	-	-
Stage 1	905	-	-	-	-	-
Stage 2	880	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	717	931	1459	-	-	-
Mov Cap-2 Maneuver	717	-	-	-	-	-
Stage 1	899	-	-	-	-	-
Stage 2	880	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.6	0.5	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1459	-	819	-	-
HCM Lane V/C Ratio	0.006	-	0.034	-	-
HCM Control Delay (s)	7.5	0	9.6	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Appendix D:
Traffic Operations - Total

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	11	11	9	81	84	6
Future Vol, veh/h	11	11	9	81	84	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	83	83	83	83	83	83
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	13	13	11	98	101	7

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	225	105	108	0	-	0
Stage 1	105	-	-	-	-	-
Stage 2	120	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	763	949	1483	-	-	-
Stage 1	919	-	-	-	-	-
Stage 2	905	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	757	949	1483	-	-	-
Mov Cap-2 Maneuver	757	-	-	-	-	-
Stage 1	912	-	-	-	-	-
Stage 2	905	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.4	0.7	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1483	-	842	-	-
HCM Lane V/C Ratio	0.007	-	0.031	-	-
HCM Control Delay (s)	7.4	0	9.4	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	14	13	2	6	4
Future Vol, veh/h	1	14	13	2	6	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	15	14	2	7	4

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	16	0	-	0	32	15
Stage 1	-	-	-	-	15	-
Stage 2	-	-	-	-	17	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1602	-	-	-	982	1065
Stage 1	-	-	-	-	1008	-
Stage 2	-	-	-	-	1006	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1602	-	-	-	981	1065
Mov Cap-2 Maneuver	-	-	-	-	981	-
Stage 1	-	-	-	-	1007	-
Stage 2	-	-	-	-	1006	-

Approach	EB	WB	SB
HCM Control Delay, s	0.5	0	8.6
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1602	-	-	-	1013
HCM Lane V/C Ratio	0.001	-	-	-	0.011
HCM Control Delay (s)	7.2	0	-	-	8.6
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	14	16	11	118	102	19
Future Vol, veh/h	14	16	11	118	102	19
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	86	86	86	86	86	86
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	16	19	13	137	119	22

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	293	130	141	0	-	0
Stage 1	130	-	-	-	-	-
Stage 2	163	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	698	920	1442	-	-	-
Stage 1	896	-	-	-	-	-
Stage 2	866	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	691	920	1442	-	-	-
Mov Cap-2 Maneuver	691	-	-	-	-	-
Stage 1	887	-	-	-	-	-
Stage 2	866	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.7	0.6	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1442	-	797	-	-
HCM Lane V/C Ratio	0.009	-	0.044	-	-
HCM Control Delay (s)	7.5	0	9.7	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	4	22	23	7	4	2
Future Vol, veh/h	4	22	23	7	4	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	24	25	8	4	2

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	33	0	-	0	61	29
Stage 1	-	-	-	-	29	-
Stage 2	-	-	-	-	32	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1579	-	-	-	945	1046
Stage 1	-	-	-	-	994	-
Stage 2	-	-	-	-	991	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1579	-	-	-	942	1046
Mov Cap-2 Maneuver	-	-	-	-	942	-
Stage 1	-	-	-	-	991	-
Stage 2	-	-	-	-	991	-

Approach	EB	WB	SB
HCM Control Delay, s	1.1	0	8.7
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1579	-	-	-	974
HCM Lane V/C Ratio	0.003	-	-	-	0.007
HCM Control Delay (s)	7.3	0	-	-	8.7
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	11	12	10	90	93	6
Future Vol, veh/h	11	12	10	90	93	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	83	83	83	83	83	83
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	13	14	12	108	112	7

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	248	116	119	0	-	0
Stage 1	116	-	-	-	-	-
Stage 2	132	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	740	936	1469	-	-	-
Stage 1	909	-	-	-	-	-
Stage 2	894	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	733	936	1469	-	-	-
Mov Cap-2 Maneuver	733	-	-	-	-	-
Stage 1	901	-	-	-	-	-
Stage 2	894	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.5	0.7	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1469	-	827	-	-
HCM Lane V/C Ratio	0.008	-	0.034	-	-
HCM Control Delay (s)	7.5	0	9.5	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	2.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	16	14	2	6	4
Future Vol, veh/h	1	16	14	2	6	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	17	15	2	7	4

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	17	0	-	0	35	16
Stage 1	-	-	-	-	16	-
Stage 2	-	-	-	-	19	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1600	-	-	-	978	1063
Stage 1	-	-	-	-	1007	-
Stage 2	-	-	-	-	1004	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1600	-	-	-	977	1063
Mov Cap-2 Maneuver	-	-	-	-	977	-
Stage 1	-	-	-	-	1006	-
Stage 2	-	-	-	-	1004	-

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	8.6
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1600	-	-	-	1010
HCM Lane V/C Ratio	0.001	-	-	-	0.011
HCM Control Delay (s)	7.3	0	-	-	8.6
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	15	17	12	130	112	20
Future Vol, veh/h	15	17	12	130	112	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	86	86	86	86	86	86
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	17	20	14	151	130	23

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	321	142	153	0	-	0
Stage 1	142	-	-	-	-	-
Stage 2	179	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	673	906	1428	-	-	-
Stage 1	885	-	-	-	-	-
Stage 2	852	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	666	906	1428	-	-	-
Mov Cap-2 Maneuver	666	-	-	-	-	-
Stage 1	875	-	-	-	-	-
Stage 2	852	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.9	0.6	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1428	-	775	-	-
HCM Lane V/C Ratio	0.01	-	0.048	-	-
HCM Control Delay (s)	7.5	0	9.9	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	4	25	25	7	4	2
Future Vol, veh/h	4	25	25	7	4	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	27	27	8	4	2

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	35	0	-	0	66	31
Stage 1	-	-	-	-	31	-
Stage 2	-	-	-	-	35	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1576	-	-	-	939	1043
Stage 1	-	-	-	-	992	-
Stage 2	-	-	-	-	987	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1576	-	-	-	936	1043
Mov Cap-2 Maneuver	-	-	-	-	936	-
Stage 1	-	-	-	-	989	-
Stage 2	-	-	-	-	987	-

Approach	EB	WB	SB
HCM Control Delay, s	1	0	8.7
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1576	-	-	-	969
HCM Lane V/C Ratio	0.003	-	-	-	0.007
HCM Control Delay (s)	7.3	0	-	-	8.7
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

TATHAM ENGINEERING

10 Diana Drive, Unit 7
Orillia, Ontario L3V 8K8

T 705-325-1753
E info@tathameng.com
tathameng.com

File 323899

July 4, 2025

Michael Sullivan
Sullnet Holdings Inc.
16 Hopkins Street
Thorold, Ontario L2V 0E9
sullnetholdings@icloud.net

Re: 116 Bond Street, City of Orillia
Transportation Impact Brief – Response to City's Comments

Dear Michael:

We have prepared this letter in response to comments received from the City of Orillia (dated March 3, 2025) with respect to their review of the *116 Bond Street Transportation Impact Brief*. Our responses to City's comments are set out in this letter. For ease of reference, the comment matrix reference number and City comments have been included below (City comments provided in italics).

TRANSPORTATION IMPACT BRIEF

Comment #3

Include Bond Street and High Street and discuss volume split leaving the site.

Response: The traffic study considered the intersection of Bond Street with Gill Street recognizing that Gill Street is a collector road and carries greater traffic volumes than those experienced on High Street. The operations assessment indicates that the intersection of Bond Street with Gill Street will provide excellent operations (LOS A) through the 2033 horizon with the additional volumes associated with the proposed development (it is noted that the assessment included the development of both 116 and 120 Bond Street and thus reflects a conservative approach). As the intersection of Bond Street with Gill Street provides excellent operations under future total conditions, it can be reasonably and confidently be inferred that the lower order intersection of Bond Street with High Street (both local roads) will also provide excellent operations (recognizing that the overall volumes at the intersection will be lower).

To further illustrate the ability of the road network to accommodate the proposed development, a sensitivity analysis has been conducted that assumes 100% of the site traffic will travel to/from the east along Bond Street to Gill Street (i.e. 100% of site traffic travels through the Bond Street and Gill Street intersection). A summary of this analysis is provided in Table 1, with detailed worksheets included in Appendix A.

Table 1: Intersection Operations – 2033 (Sensitivity Analysis)

INTERSECTION, MOVEMENT & CONTROL			WEEKDAY AM PEAK HOUR			WEEKDAY PM PEAK HOUR		
			Delay	LOS	V/C	Delay	LOS	V/C
Bond Street & Gill Street	EB LR	stop	10	A	0.04	10	A	0.05
	NB LT	free	8	A	0.01	8	A	0.01
Bond Street & Site Access	EB LT	free	1	A	0.00	1	A	0.00
	SB LR	stop	9	A	0.01	9	A	0.01

L - left T - through R - right LTR - left-through-right LT - left-through TR - through-right LR - left-right

As anticipated, the study area intersection will continue to operate at an excellent level of service (LOS A) through the 2033 horizon despite the conservative assumption. This further indicates that the intersection of High Street with Bond Street would also provide excellent operations, even if 100% of the site traffic was to travel to/from the west along Bond Street to High Street.

The development traffic (which amounts to 9 peak hour trips or less when considering 116 Bond Street on its own), will not have any material impacts on the road network and can be readily accommodated without the need for improvements.

Comment #4

No document regarding ToR submission. Please provide.

Response: A Terms of Reference was not submitted to the City for review prior to the study commencing; however, the Transportation Impact Brief followed the standard TIS guidelines (reviewing existing conditions, year of build-out and 5-years beyond build-out) and included an Entrance Analysis as required by the City. Given the minimal traffic volumes generated by the site and excellent operations along the adjacent road network, the scope of the traffic study submitted is considered adequate in terms of assessing the impacts of the development.

CLOSING

We trust that the above adequately addresses the City of Orillia comments. Should you have any questions or comments regarding the responses above, please do not hesitate to contact us.

Yours truly,
Tatham Engineering Limited

Karolina Kukielka C.E.T., EIT, rcsi
Engineering Intern

David Perks M.Sc., PTP
Transportation Planner, Group Leader

KK: DP

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99 Weekday AM Peak Hour

(99) Weekday PM Peak Hour

116 BOND STREET, TRANSPORTATION IMPACT BRIEF

Figure 1: Traffic Volumes – 2033 Sensitivity Analysis

APPENDIX A: OPERATIONS ASSESSMENT

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	13	14	10	90	93	7
Future Vol, veh/h	13	14	10	90	93	7
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	83	83	83	83	83	83
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	16	17	12	108	112	8

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	248	116	120	0	-	0
Stage 1	116	-	-	-	-	-
Stage 2	132	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	740	936	1468	-	-	-
Stage 1	909	-	-	-	-	-
Stage 2	894	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	733	936	1468	-	-	-
Mov Cap-2 Maneuver	733	-	-	-	-	-
Stage 1	901	-	-	-	-	-
Stage 2	894	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.5	0.7	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1468	-	826	-	-
HCM Lane V/C Ratio	0.008	-	0.039	-	-
HCM Control Delay (s)	7.5	0	9.5	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	16	14	3	10	0
Future Vol, veh/h	0	16	14	3	10	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	17	15	3	11	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	18	0	-	0	34	17
Stage 1	-	-	-	-	17	-
Stage 2	-	-	-	-	17	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1599	-	-	-	979	1062
Stage 1	-	-	-	-	1006	-
Stage 2	-	-	-	-	1006	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1599	-	-	-	979	1062
Mov Cap-2 Maneuver	-	-	-	-	979	-
Stage 1	-	-	-	-	1006	-
Stage 2	-	-	-	-	1006	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	8.7
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1599	-	-	-	979
HCM Lane V/C Ratio	-	-	-	-	0.011
HCM Control Delay (s)	0	-	-	-	8.7
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	16	18	15	130	112	21
Future Vol, veh/h	16	18	15	130	112	21
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	86	86	86	86	86	86
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	19	21	17	151	130	24

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	327	142	154	0	-	0
Stage 1	142	-	-	-	-	-
Stage 2	185	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	667	906	1426	-	-	-
Stage 1	885	-	-	-	-	-
Stage 2	847	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	658	906	1426	-	-	-
Mov Cap-2 Maneuver	658	-	-	-	-	-
Stage 1	873	-	-	-	-	-
Stage 2	847	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.9	0.8	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1426	-	770	-	-
HCM Lane V/C Ratio	0.012	-	0.051	-	-
HCM Control Delay (s)	7.6	0	9.9	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	28	25	11	6	0
Future Vol, veh/h	0	28	25	11	6	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	30	27	12	7	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	39	0	-	0	63	33
Stage 1	-	-	-	-	33	-
Stage 2	-	-	-	-	30	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1571	-	-	-	943	1041
Stage 1	-	-	-	-	989	-
Stage 2	-	-	-	-	993	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1571	-	-	-	943	1041
Mov Cap-2 Maneuver	-	-	-	-	943	-
Stage 1	-	-	-	-	989	-
Stage 2	-	-	-	-	993	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	8.8
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1571	-	-	-	943
HCM Lane V/C Ratio	-	-	-	-	0.007
HCM Control Delay (s)	0	-	-	-	8.8
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0