FUNCTIONAL SERVICING & STORMWATER MANAGEMENT REPORT

IN8 DEVELOPMENTS INC.

170 & 180 Columbia Street West, Waterloo, Ontario
Project No.: 2024-0457-10

July 31, 2026

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ISSUANCE AND REVISION RECORD					
REV	**DATE**	**WRITTEN BY**	**QA BY**	**SEALED BY**	**ISSUED FOR**
1	April 18, 2025	Z Schnurr C Mahoney	S Forwell	S Forwell	OPA/ZBA Submission
2	January 23, 2026	Z Schnurr	S Forwell	Z Schnurr S Forwell	ZBA Resubmission
3	July 31, 2026	Z Schnurr C Mahoney	J Zehr	Z Schnurr	ZBA Resubmission



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1.0 INTRODUCTION

WalterFedy Group Inc. has been retained by IN8 Developments Inc. to provide civil engineering consulting services in support of an Official Plan Amendment and Zoning By-law Amendment for 170 and 180 Columbia Street West in Waterloo. The site is proposed to be redeveloped into a mixed-use high rise, primarily residential development. The purpose of this functional servicing and stormwater management report is to identify how the development will be serviced, including water, sanitary, and storm connections to existing municipal infrastructure. The report will discuss existing boundary servicing conditions and the availability in the municipal system to accommodate the development. A preliminary stormwater management design has been included, demonstrating adherence to the City of Waterloo and Region of Waterloo design criteria.

Given the size of the development, construction will be completed in phases. Detailed phasing for grading, servicing, and stormwater management is discussed in this report.

1.1 Background

The proposed site is comprised of two properties - 170 Columbia Street West (hereby referred to as the East Lands) with an approximate 0.834 ha site area, and 180 Columbia Street West (hereby referred to as the West Lands) with an approximate 0.764 ha site area. These two properties are separated by a 10m wide strip of property owned by 176 Columbia, which also includes property to the rear. There are easement agreements in place between the three parcels to cover shared access and shared private services to Columbia Street. These parcels were all part of a previous severance.

The subject properties are located just west of the intersection of Phillip Street and Columbia Street West. The overall site is bound by existing Waterloo Spur/LRT Corridor and tracks to the west, an existing commercial/industrial property to the east, Columbia Street West to the south, and an existing commercial property to the north (176 Columbia Street West).

Vehicular entrances to the East Lands are located at the south east corner of the site to Columbia Street West, at the north east corner of the site (providing access to the neighbouring 156 and 160 Columbia Street West properties, and 358-387 Philip Street), and at the south west and north west corners of the site (to the shared access of 176 Columbia Street West). Vehicular entrances to the West Lands are located solely from the shared access on 176 Columbia Street West.

Both parcels are currently zoned "(Holding) Business Employment Two A–81" ((H)E2A-81). To permit residential uses on the lands, both an Official Plan Amendment and Zoning By-Law Amendment are required.

The development concept for the Site envisions a mix of residential, commercial, and an outdoor at-grade park. The concept proposes five buildings, with tower heights ranging from 25 to 35 stories. The development is planned to include 1,907 units (2,889 bedrooms), in the form of apartment units with a mix of bachelor, 1-, 2-, and 3-bedroom units. Additionally, 2,967 m^2 of retail and office spaces are provided within the planned development. A total of 409 parking spaces are proposed both above and below ground. Two levels of underground parking are proposed for Phases 2, 3, 4, and 5. Phase 1 will have no underground parking.

An internal grid of service roads and supporting layby parking areas are proposed to provide vehicular connectivity throughout the Site. WalterFedy understands that a new private right-of-way is proposed on the east side of the site.

1.2 Reference Reports and Drawings

In the preparation of this functional servicing and stormwater management report, the following reports/drawings were referenced:

1. *Stormwater Management Report Technology Business Park 180 Columbia Street West, Waterloo, Ontario,* by Cumming-Cockburn & Associates Limited, dated October 1984.

2. *Geotechnical Investigation, Proposed High-Rise Development 170 Columbia Street West, Waterloo, Ontario,* by Chung & Vander Doelen Engineering Ltd., dated February 5, 2025.

3. *Preliminary Geotechnical Investigation Proposed 35 to 40-Storey Apartment Buildings 170 & 180 Columbia Street West, Waterloo, Ontario*, by Chung & Vander Doelen Engineering Ltd., dated January 6, 2023.

4. *Draft Phase One Environmental Site Assessment 170 Columbia Street West Waterloo, Ontario*, by Chung & Vander Doelen Engineering Ltd., dated November 2022.

5. *Draft Phase One Environmental Site Assessment 180 Columbia Street West Waterloo, Ontario*, by Chung & Vander Doelen Engineering Ltd., dated November 2022.

6. *Draft Phase II Environmental Site Assessment 170 Columbia Street West Waterloo, Ontario*, by Chung & Vander Doelen Engineering Ltd., dated January 2023.

7. *Draft Phase II Environmental Site Assessment 180 Columbia Street West Waterloo, Ontario*, by Chung & Vander Doelen Engineering Ltd., dated November 2023.

8. *Site Topographic Survey*, by WalterFedy Group Inc., dated November 2024.

9. *Legal Survey,* by Van Harten Surveying Inc., dated August 2022.

10. *Subsurface Utility Investigation,* by SiteTech Infrastructure Mapping Ltd., dated November 2024.

11. *City of Waterloo Sanitary Master Plan Volume 1,* by Stantec Consulting Ltd., dated August 2015.

12. *Design Guidelines and Supplemental Specifications for Municipal Services,* by the Region of Waterloo and Area Municipalities, dated January 2026.

13. Plan, Profile, Storm, Sanitary and Watermain Information from the City of Waterloo.

2.0 EXISTING INFORMATION

2.1 Existing Topography and Land Use

The lands have been used for commercial purposes and each property consists of a building, associated parking at the front and rear, and an internal right-of-way on the east side of East Lands. Topographic survey was completed by WalterFedy dated November 2024, and legal boundary information for this site was obtained from Van Harten Surveying Inc., dated August 2022.

The elevations of these lands range from approximately 337.00 m along the north property line of the site to 336.50 m at the south west corner of the site, 336.70 m at the south vehicular connection to Columbia Street West (the shared access), and 337.00 m at the south east vehicular connection to Columbia Street West.

Both sites are comprised predominantly of existing buildings and asphalt parking. Drainage from the front of the sites (within the parking lots) is collected within internal catchbasin structures, and controlled via existing orifice plates, before being discharged to the existing storm sewer within the shared access (on 176 Columbia Street West property). On the West Lands, the rear asphalt parking lot is used to provide surface storage for stormwater management purposes. The storm network conveys flows out of the parking lot at the north east corner, to the existing storm sewer on the 176 Columbia Street West access road. This storm sewer also conveys minor flows from 176 Columbia at the rear.

Major overland flow from 176 Columbia travels through the rear parking lot of 180 Columbia before outletting to Columbia Street via the shared access (on 176 Columbia). Generally, major overland flow is conveyed towards this shared access road from 170 and 180 Columbia as well and routed to Columbia Street West. The east drive aisle on the East Lands also conveys major overland flow to Columbia Street West.

2.2 Environmental Site Assessments (ESAs)

Environmental Site Assessments (Both Phase One and Phase Two) have been previously completed for both subject properties by Chung & Vander Doelen Engineering Ltd. (CVD) in November 2022 and January 2023. It is understood that Areas of Potential Environmental Concern (APECs) were identified on both 170 and 180 properties, given the site's historical use as an industrial facility for metal culvert manufacturing and asphalt dipping (between late 1950's to early 1980's), the presence of an existing auto garage on the 160 Columbia Street West lands, and historical industrial manufacturing at several properties surrounding the properties. As a result, CVD recommended proceeding with Phase Two ESAs for both properties.

The Phase Two ESA for 170 Columbia Street West involved advancing four boreholes and installing two monitoring wells to characterize the underlying soil and groundwater conditions. Both soil and groundwater samples were submitted for chemical analyses to determine if any Table 6 exceedances per O.Reg. 153/04 existed. Similarly, the Phase Two ESA for 180 Columbia Street West involved advancing eight boreholes and installing two monitoring wells to characterize the underlying soil and groundwater conditions. Both soil and groundwater samples were submitted for chemical analyses to determine if any exceedances in O.Reg. 153/04 existed. The results of the testing revealed the following:

170 Columbia Street West

Table 6 exceedances in PHCs (F3 (C16-C34)) were noted in the soil samples, while all other BTEX, PHC and metals concentrations were below the applicable Table 6 standards. Table 6 exceedances in dissolved arsenic and cobalt were detected in the groundwater samples, while all other BTEX, PHC, VOC and metals concentrations were below the applicable Table 6 standards.

180 Columbia Street West

No Table 6 exceedances were noted in the soil samples tested, and all BTEX, PHC, VOC and metals concentrations remained below the Table 6 standards. Testing of the groundwater samples revealed Table 6 exceedances in dissolved metals (arsenic, barium, and cobalt) and VOCs (tetrachloroethylene, trichlroethylene and cis-1, 2-dichloroethylene). All other BTEX, PHC, VOC and metals concentrations were below the applicable Table 6 standards.

Based on the above, it is expected that Records of Site Condition (RSCs) will be required for both properties, with Certificates of Property Use (CPUs) and risk assessments registered on title to follow, to permit residential occupancies on the properties.

2.3 Geotechnical Conditions

At the time of writing, a geotechnical investigation for 170 Columbia Street West and a preliminary geotechnical investigation for 180 Columbia Street West were available for reference. These investigations were completed by Chung & Vander Doelen Engineering Ltd.

170 Columbia Street West

Seven boreholes were advanced between November 18 and 28, 2024, to depths ranging from 19.94-31.06 m below ground surface. The boreholes indicated the presence of asphalt pavement (75-100 mm of asphalt and 200-400 mm of granular base materials), underlain by a layer of fill materials underlaying the pavement in boreholes 5 and 101-105. The fill layer extended to depths between 0.9-2.3 m below ground surface. The fill materials were primarily sand and silt with trace to some gravel and trace clay. Interlayered Fine Granular Deposits (IFGD) were encountered in boreholes 4-6, 101-103, and 105, at depths ranging from 3.5-10m, consisting primarily of sand and silt (silt to silty sand). In boreholes 4-6 and 101-105, a clayey silt till layer underlaid the IFGD layer, extending to depths between 15.2-20.12 m below the ground surface. The layer consists of trace sand, trace gravel, and occasional to frequent sand and silt seams. A silt interlayer (~2m thick) was encountered in boreholes 5-6 at depths between 10.9-15.2 m. Finally, a deposit of sand and silt till was encountered in boreholes 4-6 and 101-105 at depths ranging from 19.80-39.80 m. The layer consists of some gravel, trace clay, and occasional cobbles and boulders.

Groundwater was observed at a depth of approximately 1 to 2 m, corresponding to elevations between 335-336 m, and it is noted that the observed groundwater table will fluctuate seasonally and in response to major weather events.

The investigation recommends the use of a raft foundation to support the building. Given the two levels of underground parking proposed for Phase 2, the “basement walls and floor slabs will have to be water-proofed, and the basement designed like a “boat”. A dewatering system will be required during construction.

180 Columbia Street West (based on 170 and 180 Columbia Street West Testing)

Six boreholes were advanced between the two properties, with Boreholes 1-3 being located on the 180 Columbia Street West property. The boreholes were advanced to depths ranging from 19.8-39.8 m below ground surface. Asphalt pavement was encountered at the ground surface ranging between 65-100 mm of asphalt and 200-400 mm of granular base. This was underlain by loose to dense fill materials at depths ranging from 1.4-3.3 m below existing grade (and deeper around existing building foundations/utility service trenches). The fill materials are underlain by fine granular deposits “generally in compact to very dense compactness condition” and interlayering a major clayey silt till deposit. This deposit is very stiff to hard consistency and extends to depths between 16.5-2.0 m below ground surface. Below this, to a depth of at least 39.8 m, a very dense sand and silt till layer exists.

Groundwater was observed at a depth of approximately 0.9-2.2 m below ground surface, corresponding to elevations between 335.00-335.90 m below ground surface.

2.4 Existing Servicing and Utilities

Services on and around the site were identified as part of the topographic survey by WalterFedy and Plan and Profile drawings provided by the City of Waterloo.

2.4.1 Water Servicing

Columbia Street West contains an existing 300 mm diameter PVC watermain located on the south side of the street. Existing hydrants exist on the south side of Columbia Street West, at the north east corner of 195 Columbia Street West, and fronting 175 Columbia Street West.

170, 176 and 180 Columbia appear to be serviced via an existing 150 mm diameter private watermain located on the west side of the shared access road to 176 Columbia Street West. It appears that a 50 mm diameter service currently services the East Lands, while a service of unknown diameter currently services the West Lands from this watermain. Connections to this private watermain from 170 and 180 Columbia will not be allowed upon re-development, and independent services to the municipal main in Columbia Street will be required for each site. The existing water services will require removal/abandonment and capping at the 176 Columbia access road property line. Existing private hydrants on 176 Columbia Street West exist at the north east and south west corners of the shared road access.

2.4.2 Sanitary Servicing

170, 176 and 180 Columbia appear to be serviced via an existing 200 mm diameter private sanitary sewer located in the centerline of the shared access road to 176 Columbia Street West. Connections to this private sanitary sewer from 170 and 180 Columbia will not be allowed upon re-development, and independent services from each site to the municipal sewer in Columbia Street will be required. The existing sanitary connections to the shared access will require removal and capping/abandonment at property line.

The existing East Lands generate approximately 1.25 L/s of sanitary flow, while the existing West Lands generate approximately 1.15 L/s of sanitary flow. Refer to **Table I** below for more details. These buildings are serviced by existing 150 mm diameter sanitary service laterals, which appear to be blind connected to an existing 200 mm diameter sanitary sewer located within the 176 Columbia Street West shared road access. This sanitary sewer connects to the existing 375 mm diameter sanitary sewer on Columbia Street West. This sewer flows west before entering the existing 600 mm diameter sanitary trunk sewer located on the west side of the Waterloo Spur/LRT corridor. The trunk sewer flows south towards the Lower Forwell Creek Trunk Sanitary Sewer (LFCTSS).

Table I: Existing Sanitary Flow to Columbia Street West

170 Columbia Street West (East Lands) Site Area	0.834 ha
Average Commercial Daily Flow	0.5 L/s/ha
Commercial Peaking Factor	2.5
Commercial Sanitary Flow	**1.04 L/s**
Extraneous Flow Allowance	**0.25 L/s/ha**
Total Extraneous Flow	**0.21 L/s**
Total 170 Columbia Street West (East Lands) Sanitary Flow	**1.25 L/s**
180 Columbia Street West (West Lands) Site Area	0.764 ha
Average Commercial Daily Flow	0.5 L/s/ha
Commercial Peaking Factor	2.5
Commercial Sanitary Flow	**0.96 L/s**
Extraneous Flow Allowance	**0.25 L/s/ha**
Total Extraneous Flow	**0.19 L/s**
Total 180 Columbia Street West (West Lands) Sanitary Flow	**1.15 L/s**

The total existing sanitary flow generated from the Subject Lands is approximately 2.4 L/s.

2.4.3 Storm Servicing

An existing 1220 mm x 1920 mm helical elliptical storm sewer is located on the south side of Columbia Street West, flowing east to west. Along the site limits, an existing double catch basin with a 250 mm diameter lead extends to the north side of the street fronting the East Lands, while an existing double catchbasin manhole with 750 mm diameter pipe extends to the north side of the street at the south west corner of the West Lands. This

structure accommodates a piped outlet from a swale located west of the West Lands, within the existing Waterloo Spur/LRT corridor.

An existing 450 mm diameter storm sewer exists within the shared road access on 176 Columbia Street West, flowing towards Columbia Street West, and services 176 Columbia Street to the rear. The existing parking lots at the front of both the East and West Lands drain into this storm sewer via catchbasin structures with a 375 mm diameter lead (East Lands) and 250 mm diameter lead (West Lands). Both catchbasin structures have existing orifice plates of unknown diameters.

Further upstream, an existing 200 mm diameter storm service appears to be blind connected to this 450 mm diameter storm sewer from the existing 170 Columbia Street West building. On the opposite side of the access road, an existing 100 mm diameter, upsizing to 200 mm diameter (after manhole) storm service also appears to be blind connected to this storm sewer from the existing 170 Columbia Street West building.

At the rear of the East Lands, an existing catchbasin with a 375 mm diameter service lateral is connected to this existing 450 mm diameter storm sewer at an existing manhole (104). At the rear of the West Lands, an existing storm sewer network within the parking lot (4 catchbasins and a manhole) conveys drainage to the same existing manhole (104). Upstream of this 450 mm diameter storm sewer (on the 176 Columbia Street West lands), an existing Stormceptor OGS Unit exists in addition to further storm infrastructure.

After correspondence with the City of Waterloo, it is understood that connections from 170 and 180 Columbia to the private storm sewer in 176 Columbia Street access road will no longer be allowed when the properties are redeveloped. New independent storm connections for the 170 and 180 Columbia to Columbia Street West will be required, with all existing storm connections to the shared access disconnected, capped, and abandoned at the property line as part of development. Existing stormwater management exists at the site, which will be detailed further in Section 9.0.

2.4.4 Gas Servicing (Enbridge Gas)

Based on the Plan and Profile drawings for Columbia Street West, there is an existing gas main located on the north side of the road. An existing 100 mm diameter gas service is located parallel to the east property line of the East Lands, extending to service the existing building, but also extending to service what appears to be 176 Columbia Street West.

An existing 25 mm diameter gas service currently services the building on the West Lands and is located near the front parking lot. A second gas service is located along the west property of these lands, and extends to the north west corner of the existing building where the gas meter is located.

It is assumed that sufficient capacity exists in the main to accommodate the development, however further consultation with the provider will be required, also to remove the existing services, and confirm if the existing gas service (located within easement) servicing 176 Columbia Street West can be relocated to the shared road access as part of construction.

2.4.5 Communications (Bell Canada and Rogers Communications)

Based on the subsurface utility investigation completed by SiteTech Infrastructure Mapping Ltd., dated November 2024, existing communications lines enter the East Lands near the south east corner of the site, and extend to mid-way up, where they enter the existing building. An existing fibre optic cable leaves the building in this location, and wraps around the entirety of the north perimeter of the East and West Lands (crossing the shared access road), before entering the existing building on the West Lands at the north west corner.
Existing fibre optic cables enter the West Lands at the south west corner of the lands, with two cables extending along the west property line before entering the building at its north side. Three fibre optic conduits extend from 180 Columbia Street West to 170 Columbia Street West, interconnecting the two buildings and passing through

the shared road access. Finally, an existing fibre optic cable for 176 Columbia Street West crosses a portion of the East lands via an easement and is routed along the east side of the shared access road.

All existing communications infrastructure will likely require removal, with the existing 176 Columbia Street West fibre optic line requiring relocation before construction.

2.4.6 Hydro (Enova Power Corporation)

Enova Power Corporation owns and operates hydro infrastructure on the north side of Columbia Street West. Overhead pole lines are located across the extents of the lands, and three poles encroach onto the East Lands. These poles transfer power from the overhead lines to a buried line(s) that service the 176 Columbia Street North site.

It appears that Enova Power Corporation currently services both the East Lands and West Lands via Columbia Street West underground.

It is understood that the properties were developed to be high-usage data centres at one time, and therefore, it is expected that sufficient hydro infrastructure exists to service the development; however, this will need to be confirmed with Enova Power Corporation.

3.0 REVIEW AGENCIES

3.1 City of Waterloo

The City of Waterloo will be responsible for the review and approval of this functional site servicing, grading, and stormwater management design for the purposes of the zone change and ultimate site plan application. All servicing works within the right-of-way will also be reviewed and approved by the City of Waterloo.

3.2 Region of Waterloo and Keolis Grand River LP

Given the proximity of the lands to the existing Waterloo Spur/LRT corridor, Keolis Grand River LP, on behalf of the Region of Waterloo (authority having jurisdiction), will likely review and comment on the proposed plans.

The Region of Waterloo will also review and comment on Source Water Protection as it relates to the subject development.

3.3 Ministry of the Environment, Conservation and Parks

If a phase of this development requires new municipal infrastructure, an Environmental Compliance Approval (ECA) from the MECP will be required prior to building permits. Such an approval can be obtained through a Consolidated Linear Infrastructure (CLI) ECA through the City of Waterloo.

4.0 PROPOSED PHASING AND DEVELOPMENT STRATEGY

As part of the Official Plan/ Zoning By-law Amendment application, a Master Site Plan was prepared. Access to the development from Columbia Street West will be provided via the existing shared access road, and a new road along the east property line of the East Lands. Internal to the sites, privately-owned roads atop underground parking in a grid-like layout will provide connectivity to all towers.

The proposed servicing strategy assumes that the development on the East Lands will be under two separate ownerships for Phases One and Two. The proposed road along the east property line will form part of Phase Two. The development of the West Lands will be under one common ownership. As such, independent storm, sanitary, and water connections will be provided to Phase 1, Phase 2, and the West Lands. The existing

connections from Columbia Street municipal infrastructure to the 176 Columbia Street easement road will remain to service 176 Columbia.

The development on the East Lands will be broken up into two phases, while the development on the West Lands will be broken up into three phases, for a total of five phases. Construction will begin on the East Lands, nearest Columbia Street West. Phase 2 will be located at the middle of the East Lands. Phase 3 will be built on the West Lands fronting Columbia Street West. Phases 4 and 5 will proceed behind this working towards the rear of the West Lands. Refer to the Phasing Plan by AAA Architects Inc. for more details. Parkland at the rear of the East Lands will be dedicated to the City of Waterloo. The Functional Grading Plan and Functional Servicing Plans in Appendix E also highlight the phasing limits.

As part of the overall phasing and development strategy, the servicing for the East Lands and West Lands will remain independent and also be disconnected from existing storm, sanitary, and water infrastructure within the shared access road. This separate, independent servicing is proposed to ensure compliance with the OBC as well as the Safe Drinking Water Act.

5.0 SOURCE WATER PROTECTION

According to the Province of Ontario's Source Protection Information Atlas, the site is not located within any water quality-related source protection zone; however, both properties are located within a low stress water quantity wellhead protection area (Q1 and Q2). **Table II** provides the source protection details for the Site.

Table II: Source Protection Details

Source Protection Area	Grand River
Water Quality	
Wellhead Protection Area	No
Wellhead Protection Area E (GUDI):	No
Intake Protection Zone:	No
Issue Contributing Area:	No
Significant Groundwater Recharge Area:	No
Highly Vulnerable Aquifer:	No
Event Based Area:	No
Water Quantity	
Wellhead Protection Area Q1:	Yes; Low Stress
Wellhead Protection Area Q2:	Yes; Low Stress
Intake Protection Zone Q:	No

A Wellhead Protection Area Q1 (WHPA-Q1) refers to an area where activities that take water without returning it to the same source may be a threat. A Wellhead Protection Area Q2 (WHPA-Q2) refers to an area where activities that reduce recharge may be a threat.

Based on a review of applicable Source Protection Policies for the Region of Waterloo under the Grand River Source Protection Plan and a review of *2017-2018 Table of Drinking Water Threats,* the activities proposed on this Site are not considered to be threats to drinking water at any risk level.

To ensure that the infrastructure proposed as part of this development does not become a significant threat in the future, proposed infrastructure should be designed in accordance with MECP's publication titled *Design Guidelines for Sewage Works 2008* (updated May 2019). The design of sewers to this standard is done to maximize expected life and reduce the incidence of failure.

6.0 SANITARY SERVICING

6.1 Proposed Sanitary Servicing

In accordance with the City of Waterloo Engineering Standards and the Design Guidelines and Supplementary Specifications for Municipal Services (DGSSMS) 2026, the sanitary flows from the subject development were calculated based on the split in land uses between residential and commercial developments within the site.

Sanitary flows for the residential component were calculated using an average daily flow of 275 L/c/day, peaked using the Harmon Formula. For the residential towers, the City of Waterloo stipulates a population density of 1.76 people per unit (ppu). Similarly, the commercial flows were estimated using a daily flow allowance of 0.5 L/s/ha for general commercial areas, peaked using a peaking factor of 2.5. The total domestic and commercial flow was supplemented with an extraneous flow allowance of 0.25 L/s/ha.

The sanitary servicing strategy for the development includes independent sanitary services for Phases 1 and 2. The strategy relies on internal mechanical plumbing to convey Phases 3, 4, and 5 towards Columbia Street West. The West Lands will have a single proposed service to the municipal street.

In accordance with the DGSSMS 2026, **Table III** provides a summary of the total domestic sanitary flow expected to be generated to the Columbia Street West sanitary sewer from Phase 1.

Table III: Proposed Sanitary Flow to Columbia Street West (East Lands, Phase 1)

Relevant Site Area	0.258 ha
Number of Residential Units (Phase 1)	439 units
Design Population density	1.76 ppu
Design Population	773 persons
Average Residential Daily Flow	275 L/c/d
Residential Peaking Factor	3.87
Total Residential Sanitary Peak Flow	**9.52 L/s**
Equivalent Commercial Area	0.046 ha
Average Commercial Daily Flow	0.5 L/s/ha
Commercial Peaking Factor	2.5
Commercial Sanitary Flow	**0.06 L/s**
Extraneous Flow Allowance	0.25 L/s/ha
Total Extraneous Flow	**0.06 L/s**
Total Sanitary Flow	**9.64 L/s**

The proposed total sanitary flow rate to the Columbia Street West sanitary sewer from Phase 1 is 9.64 L/s. This flow can be accommodated with a 200-mm-diameter service @ 1.00%. Supporting calculations can be found in Appendix A.

Table IV below provides a summary of the total domestic flow expected to be directed to Columbia Street West from Phase 2.

Table IV: Proposed Sanitary flow to Columbia Street West (East Lands, Phase 2)

Relevant Site Area	0.292 ha
Number of Residential Units (Phase 2)	379 units
Design Population density	1.76 ppu
Design Population	667 persons
Average Residential Daily Flow	275 L/c/d
Residential Peaking Factor	3.91
Total Residential Sanitary Peak Flow	**8.29 L/s**
Equivalent Commercial Area	0.004 ha
Average Commercial Daily Flow	0.5 L/s/ha
Commercial Peaking Factor	2.5
Commercial Sanitary Flow	**0.01 L/s**
Extraneous Flow Allowance	0.25 L/s/ha
Total Extraneous Flow	**0.07 L/s**
Total Sanitary Flow	**8.37 L/s**

The proposed total sanitary flow rate to the Columbia Street West sanitary sewer from Phase 2 is 8.37 L/s. This flow can be accommodated within a 200-mm-diameter service @ 0.60%. Supporting calculations are provided in Appendix A.

Finally, **Table V** below provides a summary of the total domestic flow expected to be directed to Columbia Street West from the West Lands (Phases 3, 4, and 5).

Table V: Proposed Sanitary flow to Columbia Street West (West Lands)

Relevant Site Area	0.764 ha
Number of Residential Units (Phases 3, 4, and 5)	1,089 units
Design Population density	1.76 ppu
Design Population	1,917 persons
Average Residential Daily Flow	275 L/c/d
Residential Peaking Factor	3.60
Total Residential Sanitary Peak Flow	**21.96 L/s**
Equivalent Commercial Area	0.246 ha
Average Commercial Daily Flow	0.5 L/s/ha
Commercial Peaking Factor	2.5
Commercial Sanitary Flow	**0.31 L/s**
Extraneous Flow Allowance	0.25 L/s/ha
Total Extraneous Flow	**0.19 L/s**
Total Sanitary Flow	**22.46 L/s**

The proposed total sanitary flow rate to the Columbia Street West sanitary sewer from the West Lands is 22.46 L/s. This flow can be accommodated within a 200-mm-diameter service @ 1.00%. Supporting calculations can be found in Appendix A.

The total proposed flow to the Columbia Street West sanitary sewer is 40.47 L/s. The existing conditions flow rate to the sewer is 2.4 L/s (see **Table II** above), resulting in an overall increase of 38.07 L/s. The City of Waterloo has completed a sanitary capacity analysis for the proposed development (modelling 41.46 L/s of additional

flow) and confirmed existing capacity exists to service the development. The capacity analysis can be found in Appendix A.

6.2 Lower Forwell Creek Trunk Sanitary Sewer

The City of Waterloo Sanitary Master Plan Volume 1 identified a downstream constraint that may exist in the 2029 Wet Weather flow conditions in the Lower Forwell Creek Trunk Sanitary Sewer (Appendix B, Stantec Figure 6-5). The constraint is located in an environmentally sensitive area and has no direct connections from any other developments; the existence of wetlands will also prevent such development from occurring in the area.

The surcharging identified in the Stantec report was deemed to be acceptable since the surcharged elevation was sufficiently below the surface to cause any spills into the environmentally sensitive areas. As such, at the time, it was recommended that no further improvements be carried out to alleviate the Lower Forwell Creek Capacity Constraint (Appendix B, Stantec Table 6-12 and Table B4).

The proposed development will contribute a higher peak flow than what is currently discharged from the two properties. The overall development would contribute an additional 38.07 L/s of flow to the LFCTSS. The impacts of this discharge to the LFCTSS will need to be confirmed with the city-wide sanitary sewer model.

It should be noted that, due to the proximity of this site to the trunk sewer and to the WWTP itself, it is anticipated that the morning and afternoon peak discharges from the site will reach the WWTP in advance of flows from neighbouring St. Jacobs, whose flows are contemplated to be re-routed to the WWTP within the 2015 Sanitary Master Plan.

It is understood that the City is in the process of updating the Master Plan, which will reassess the recommendations related to the identified constraints in the LFCTSS as a result of growth that has occurred within the City and anticipated future developments, such as the one considered in this report. However, presently, the City is not prohibiting any new developments from proceeding.

7.0 WATER SERVICING

The proposed development will have one set of connections for the East Lands and a second set of connections for the West Lands via Columbia Street West. As mentioned, all existing connections to the 150 mm diameter watermain within the shared road access will be removed/abandoned in place. The separate, independent servicing is proposed to ensure compliance with the Safe Drinking Water Act.

7.1 Design Criteria

The Region of Waterloo requires that watermain distribution systems be able to convey the larger of maximum daily demand and fire flow or the peak hourly demand. Additionally, the Region of Waterloo DGSSMS recommends that the average daily flow from any development be conveyed with a resulting pressure within the range of 350 kPa (50 psi) to 550 kPa (80 psi).

The Region also stipulates that the minimum resultant pressure under any non-fire demand scenario shall not be less than 275 kPa (40 psi). With the inclusion of fire flows, the minimum residual pressure in the distribution system shall not be less than 140 kPa (20 psi) and shall not cause velocities in the system to be greater than 5 m/s.

Should static pressures in the system exceed 550 kPa (80 psi), the Region requires the use of individual pressure-reducing valves for new developments. The distribution system is also required to be designed to ensure that pressures do not exceed 700 kPa (100 psi) at any point in the system.

7.2 Domestic Demand

Calculations of the water demand for the proposed development have been performed using the DGSSMS and *Design Guidelines for Drinking-Water Systems 2008*.

In accordance with the DGSSMS, the average residential demand for the proposed development was estimated using a demand of 225 L/c/day. A peaking factor of 1.42 was used to convert the average daily demand into a maximum day demand. This peaking factor is in accordance with the *Tri-City Water Distribution Masterplan*. Similarly, a peaking factor of 3.0 was used to convert the average daily demand into the peak hourly demand in accordance with Table 3-1 of the MECP guidelines for a design population between 3,001 and 10,000 persons.

For commercial uses, an allowance of 28 m^3/ha/day was utilized, factored for a 16-hour operating period per day, resulting in a demand of 42 m^3/ha/operating hour. Peaking factors of 1.42 for the maximum day demand and 3.0 for the peak hourly demand were utilized in accordance with the *Tri-City Water Distribution Masterplan*.

The usage rates and detailed demand calculations for each block are provided in Appendix C.

7.3 Fire Flow Demand

In addition to the daily domestic demand for the proposed development, fire flow demands were calculated to assess the adequacy of the proposed watermain system. The Region of Waterloo specifies that all fire flow requirements shall be determined in accordance with the current issue of Water Supply for Public Fire Protection published by the Fire Underwriters Survey (FUS), and the Ontario Building Code.

A fire and life safety report was not available for review at the time of writing; however, based on our experience, such buildings are typically classified as non-combustible construction in accordance with OBC 3.1.5. Such a building is also typically provided with:

- Floors constructed as fire separations with a resistance rating of 2 hours.
- Roofs intended for occupancy, such as roofs having exterior amenity or terrace space, will be constructed as fire separations equal to the floor assembly (i.e., 2 hr).
- Load-bearing walls, columns, and arches will have a fire-resistance rating not less than that required for the supported assembly.

The *OFM - TG-03-1999: Fire Protection Water Supply Guidelines for Part 3 in the Ontario Building Code* (October 1999) requires that the buildings shall be provided with a supply of water not less than the total volume of the building, multiplied by the water supply coefficient from Table 1 of the technical bulletin, and the spatial coefficient values obtained from Figure 1 of the technical bulletin. Regardless of the size of the building, the maximum fire flow resulting from this methodology is 9,000 L/min, or 150 L/s.

Phase 1 and Phase 2 were each treated as a separate building. Given the interconnectedness of the proposed underground parking levels, Phases 3, 4, and 5 were treated as one building for calculations. A proposed fire flow of 150 L/s for Phase 1, 133 L/s for Phase 2 and 183 L/s for Phases 3, 4, and 5 (West Lands) was determined using FUS methodology. Supporting calculations can be found in Appendix B, and fire flow calculations will be reconfirmed during detailed design.

7.4 Service Design

As per the DGSSMS, the water service required shall be able to convey the combination of the Maximum Day Demand (MDD) and the Fire Demand, within the pressure and velocity ranges as specified. A service size was selected for Phase 1, Phase 2, and Phases 3, 4, & 5 to ensure that velocities in the MDD + Fire scenario do not

exceed 5 m/s. A 200 mm diameter service (and redundant service) is proposed to service each property. It should be noted that Columbia Street West contains a 300 mm diameter watermain.

It is understood that, should any phase contain multiple plans of condominiums, individual services to each condominium may be required resulting in additional water service connections to the municipal system as the registration of a condominium results in a separate property under the Land Titles Act, R.S.O. 1990, CHAPTER L.5. For the purposes of this report, Phase 1, Phase 2, and the entirety of the West Lands are each assumed to be a single-phase condominium, and, therefore, a single property.

In accordance with Ontario Building Code Clause 3.2.9.4(4), "if a building is 84 m or more high, measured between grade and the ceiling level of the top storey, the building shall be served by no fewer than two sources of water supply from a public water system". As such, the three properties will require two service connections, separated by a valve, to the municipal system.

Each of the proposed towers will be a separate building with its own dedicated principal entrance. Accordingly, a proposed fire department connection (FDC) has been shown for each tower, with Phases 1, 2, 4, and 5 FDC's being within 45m of a private hydrant that has been proposed internal to each site. These hydrants (except Phase 1) will be serviced via the underground parking garage(s), and the pipe material servicing these hydrants, internal to the building, will need to be ductile iron to withstand any potential fire scenario. This will be further detailed during detailed design. Hydrant coverage will also be provided for Phase 3 via a municipal hydrant on Columbia Street.

In conformance with the DGSSMS Section B.2.12.3 Number of Services per Property, a testable backflow preventer in Part B Design Guidelines B-22 accordance with CAN/CAS-B64-10 shall be installed on each service to eliminate the possibility of system flow through private property.

7.5 Modelling and Results

A hydrant flow test was completed on August 14, 2025, flowing the hydrant south of Phase 1, by Stumpf Fire Protection Limited (See Appendix B for a map and the results). The results of the flow test were plotted on a hydraulic graph (N 1.85 graph) with the flow on a logarithmic scale with base 1.85 to reflect the relationship between pressure and flow in the Hazen-Williams equation.

Based on the results of the flow test, it is estimated that approximately 3150 USgpm (198 L/s) of flow is available at 275 kPa (40 psi), and 5150 USgpm (324 L/s) of flow is available at 140 kPa (20 psi) for Columbia Street West. The N 185 graph has been provided in Appendix B for reference.

Phase 1 produces an MDD + Fire Flow of 152.89 L/s. Phase 2 produces an MDD + Fire Flow of 135.47 L/s. Phases 3, 4, and 5 produce an MDD + Fire Flow of 190.26 L/s.

Based on the above, it is concluded that the municipal system appears to be sufficient to provide water servicing to the development. Watermain service sizing has been provided in Appendix B.

8.0 STORM SERVICING

8.1 Site Servicing

As proposed, underground parking footprint takes up the majority of the site area for Phases 2, 3, 4, and 5. All internal roadways will contain mechanically plumbed storm sewer systems to collect runoff from within the road allowance, landscaped areas, and roof runoff. It is expected that the redevelopment will have two connections to the municipal storm sewer on Columbia Street West – one each for the East and West Lands.

The design of these proposed storm sewer connections will be further refined during the detailed design phase, but it is expected at this time that a 300 mm diameter storm service at a minimum of 0.5% will be sufficient, given that there will be flow control provided on the sites.

8.2 Major Overland Flow

Major overland flow from the entirety of the site will be directed to Columbia Street West. The major overland flow will be controlled to be less than or equal to the peak flow rates directed to the Columbia Street West under existing conditions. The grading of the internal road network within the site permits the conveyance of the major overland flow to its designated outlet with a maximum ponding depth of 0.30 m.

9.0 STORMWATER MANAGEMENT

9.1 Stormwater Management Design

In accordance with the City of Waterloo's *Development Engineering Manual*, the post-development peak flow rates from this development are to be controlled to the pre-development rates for each design storm event and a Normal Level of Protection for water quality treatment (70% TSS removal) is required.

9.2 Existing Conditions

As per the *Stormwater Management Report Technology Business Park 180 Columbia Street West* by Cumming-Cockburn & Associates Ltd., dated October 1984, the existing conditions of the East and West Lands were taken as an entirely gravel-covered area, with a corresponding runoff coefficient of 0.45.

Runoff from both the East and West Lands are currently directed towards Columbia Street West through a series of 100 mm to 450 mm diameter storm sewer pipes alongside uncontrolled overland flow. The pre-development peak flow rates for both Sites were evaluated utilizing the rational method with a runoff coefficient of 0.45. The IDF parameters utilized were taken from the City of Waterloo's *Engineering and Landscape Manual, Volume 6* dated May 2024. The pre-development peak flow rates from the Sites are summarized in **Table VI** below. A detailed calculation of the pre-development peak flow rates is provided in Appendix D.

Table VI: Pre-Development Peak Flow Rates

Design Storm Event	East Lands Peak Flow Rate (L/s)	West Lands Peak Flow Rate (L/s)
2-Year	84.56	77.47
5-Year	113.54	104.01
25-Year	159.04	145.69
100-Year	206.41	189.09

It should be noted that the existing easement road to 176 Columbia Street West will remain under post-development conditions. The re-development does include regrading of the easement road to direct major flow toward Columbia Street.

9.3 Proposed Conditions

In proposed conditions, the Sites are to be developed with various buildings, private roadways, and associated landscape areas. The redevelopment will result in an overall imperviousness of approximately 90%. This increase will require various controls to be implemented to meet the stormwater management objectives for the site.

In general, the proposed design includes diverting rooftop runoff to cisterns located in the underground levels of the proposed Phase 1, Phase 2, and Phase 3 buildings in order to limit peak discharge rates to Columbia Street West. These measures are further discussed in the sections below.

9.4 Water Quality Control

The City of Waterloo's guidelines stipulate that a minimum Normal Level of Protection be provided, as defined by the MECP design guidelines. This corresponds to a 70% long-term removal of total suspended solids (TSS). This level of protection can be achieved through the use of an Oil Grit Separator (OGS), other low-impact development measures, or a combination of the two. It is noted that any cistern and OGS unit implemented on the Site will require access from the surface for maintenance purposes. The water quality control measures will be further refined during detailed design.

9.5 Water Quantity (Peak Flow) Control

The City of Waterloo guidelines indicate stormwater management controls are to match or reduce post-development peak flows to pre-development peak flows for the 2- through 100-year design storm events.

Under proposed conditions, the overall imperviousness of the site is increased from 45% to 93%. This results in an increase in runoff stemming from the Site, therefore necessitating on-site storage measures for each phase in order to match pre-development peak flow rates.

To attenuate flows to Columbia Street West, it is proposed that underground cisterns be provided within the Phase 1, Phase 2, and Phase 3 buildings on the East and West Lands, respectively. The proposed cistern storage units located underneath Phases 1, 2, and 3 must provide a minimum of approximately 143 m^3, 144 m^3, and 338 m^3 of storage, respectively. It's proposed that flow from the proposed cisterns are controlled using 150 mm diameter orifice pipes. The small diameter of the proposed outlet pipes acts to constrict flow leaving the cisterns, thereby requiring the usage of the provided storage volume. Peak inflow/outflow rates and maximum storage volumes recorded for the proposed cisterns within all modelled storm events are listed in Table 4 in Appendix C. The layout and details of the orifice pipes will be further defined during detailed design.

The peak flow rates recorded under post-development conditions after the implementation of the above noted stormwater management measures are summarized in Table VII and Table VIII.

Table VII: Comparison of Pre- and Post-Development Peak Flow Rates for the Eastern Lands

Design Storm Event	Pre-Development Peak Flow Rate for Eastern Lands (L/s)	Post-Development Peak Flow Rate for Eastern Lands (L/s)
2-Year	84.56	63.40
5-Year	113.54	79.26
25-Year	159.04	81.46
100-Year	206.41	81.46

Table VIII: Comparison of Pre- and Post-Development Peak Flow Rates for the Western Lands

Design Storm Event	Pre-Development Peak Flow Rate for Western Lands (L/s)	Post-Development Peak Flow Rate for Western Lands (L/s)
2-Year	77.47	51.25
5-Year	104.01	64.89
25-Year	145.69	82.59
100-Year	189.09	97.67

The design of on-site stormwater management controls will be further refined during detailed design once the programming of the outdoor amenity space is better understood; however, implementing the proposed cistern storage measures will provide adequate controls to limit post-development peak flows to pre-development levels.

10.0 UTILITIES

While other utilities including hydro, gas, and communications have not been engaged at this time, servicing availability and capacities are not expected to be of particular concern for hydro and communications servicing.

11.0 SITE GRADING

The grading of the site will respect the existing grades along all property lines. Proposed grading will conform with slopes outlined as part of the Accessibility for Ontarians with Disabilities Act (AODA) and City of Waterloo Development Engineering Guidelines.

The proposed grading also allows for conveyance of major overland flow towards the shared access road, new road along the east property line, and ultimately Columbia Street West. Refer to the Functional Grading and Servicing Plans provided within Appendix E.

12.0 ADDITIONAL CONSTRUCTION CONSIDERATIONS FOR SERVICING

12.1 Short-Term Construction Dewatering

The proposed underground parking is to be situated within the groundwater table and will require dewatering efforts. Depending on the quantity to be dewatered, the dewatering activity could be considered a water taking requiring additional permits and approvals from the MECP.

In the short term, the dewatering can replace inflow to the storm sewer network from the relevant pre-development catchment area, as the contributing catchment is expected to be replaced with a large excavation. The groundwater will require treatment and sediment removal to provincial standards, and to comply with the City of Waterloo sewer use bylaw for discharge to storm sewers.

Further details of construction dewatering (if required) shall be made available at the Site Plan Approval stage for the various phases of the development.

12.2 Long-Term Dewatering

The proposed underground parking is to be situated within the groundwater table. It is noted that the Region of Waterloo does not permit permanent discharge systems to control groundwater. Therefore, as recommended by CVD above, the underground parking levels will require waterproofing accordingly.

13.0 EROSION AND SEDIMENT CONTROL

Sediment and erosion controls to be implemented during construction will include stabilized construction entrances, a perimeter silt fence, and sediment interceptor swales with installation of coir log check dams.

Prior to the start of any construction, all erosion and sediment control measures installed will be inspected by the Consultant. The controls will be maintained, and accumulated sediments removed once their capture capacity has been decreased by a third. The measures will also be periodically inspected and upgraded/altered as Site conditions change. Periodic inspections will consist of visual observation of the effectiveness of the control measures and sediment migration offsite.

Any sediment tracked onto the roadway during construction will be cleaned by the Contractor. To minimize the amount of mud tracked onto the roadway, a mud-mat will be installed at all construction exits and the Contractor will be required to ensure that vehicles leave through the exit. The mud-mat will be periodically inspected and cleaned/maintained as required to ensure it is functioning as intended.

To prevent sediment runoff from the Site, light-duty silt fencing (in accordance with OPSD 219.110) will be installed along the perimeter of the Site and at the base of all stockpiles. Stockpiles are to be visually monitored after rainfall events and will be hydraulically seeded if the stockpiles are to remain undisturbed for extended periods of time.

The outlets from the Site will be inspected for evidence of sediment migration offsite. In the event that sediments have migrated offsite, additional sediment controls shall be implemented as necessary to ensure that no additional sediment escapes from the Site. Any excessive sediment that has migrated offsite shall be removed and the area restored to pre-construction conditions.

As the servicing phase of the construction proceeds, each inlet structure will have an insert installed and/or filter fabric will be wrapped around the lids of all manholes to prevent intrusion of sediment into the storm sewer network. The inserts will be cleaned once they reach one-third their sediment accumulation capacity or as per the manufacturer's recommendations.

All erosion and sediment control measures will be removed at the end of construction.

14.0 SALT MANAGEMENT

The site is outside of water quality WHPAs, but located within a low stress water quantity WHPA as noted on the MECP Source Protection Information Atlas. Given the nature of the development as residential condominiums, only sodium chloride, through the use of de-icing salt, is expected to be a concern to ground water sources, as a result of this development.

The Region of Waterloo relies on groundwater as its primary source of drinking water. As such, a comprehensive Salt Management Plan and Winter Maintenance Worksheet are required to outline measures incorporated into the development to protect groundwater resources from impacts from road salt. The main objective of the Salt Management Plan is to achieve a reduction in salt impacts through the promotion and adoption of best management practices, and it will be created during the detailed design stage of the project.

In general, the design of the proposed development will take into account salt and the impacts of salt to neighbouring features. Salt-laden runoff from the parking lot and pedestrian walkways will be directed to private sewers and away from infiltration areas. Asphalt areas will be designed with a slope of 1.0%-5.0% in general to promote quick drainage towards collection structures, minimizing the exposure of runoff to the cold weather and, therefore, minimizing freezing. Larger slopes will also minimize the possibility of ponding or pooling of water on the surface in the event of post-construction settlement.

The stormwater management measures on the site also respect the objective to protect ground water sources. The City's stormwater management criteria are met without the need of subsurface infiltration from any salt-laden surfaces on the site.

Salt application and handling will be coordinated with a private contractor who will be expected to meet basic operational requirements such as not overloading material in spreaders to reduce spillage of salt. Preference should be given to contractors who are Smart About Salt™ Certified. Spreaders will not be washed on site. It is expected that the private contractor will keep track of application rates and adjust these rates to suit weather forecasts. Direct application of liquid materials or pre-wetted sand and salt have been proven methods to achieve salt reductions, and will be communicated to the contractor. All salt handling is to be limited to the paved asphalt area. The asphalt pavement will prohibit infiltration of salt into the ground.

It is also assumed the site will not receive bulk salt deliveries and no salt will not be stored on site (beyond small, covered bins). The future Condominium Corporations are to ensure that any salt spills are cleaned up immediately, using a broom and shovel, before the salt has a chance to dissolve and enter the storm system.

Further best practice measures include sand and salt mixing is occurring offsite. Mixing is to occur in good weather to reduce loss of salt due to precipitation and wind, and to reduce the moisture content of the mixture. A homogenous mixture is to be ensured to minimize the amount of salt required to prevent freezing of the pile. The sand used for the mixture is to be dry to minimize amount of salt required to prevent freezing. mixture is to be stored in the covered bins as soon as possible and the mix area is to be swept clean. The storage bins and the covering are to be checked periodically to ensure there are no leaks or cracks. Any damage is to be repaired immediately, with temporary measures if more permanent fixes cannot be carried out immediately. At no time should leaks be allowed to persist.

Any snow plowed from the paved asphalt area is to be directed to areas from where the meltwater will be collected into the storm system. As part of detailed design, snow storage areas will be located on impervious surfaces and in close proximity to drainage structures. Snow from offsite locations will not be stored at this facility.

During detailed design, a detailed Salt Management Plan and associated Winter Maintenance Worksheet will be completed for the development.

15.0 CONCLUSIONS

Based on the analysis presented in this report it is concluded that:

- Servicing will be provided such that the East Lands and West Lands can be serviced independently to municipal infrastructure. Existing use of private sanitary, storm and water infrastructure will be abandoned. Water, sanitary and storm servicing to 176 Columbia Street will remain in place and be separate once the new development is completed.
- Sanitary drainage from the site will be directed to the Columbia Street West sanitary sewer. An approximate additional 38.07 L/s of sanitary flow is expected from the development. The City of Waterloo has completed a sanitary capacity analysis and confirmed there is sufficient capacity to service the proposed development.
- The existing 300 mm diameter watermain on Columbia Street West is expected to be sufficient to provide domestic and fire flows to the proposed buildings within the pressure and velocity constraints stipulated by the DGSSMS. Additional redundant connections to any tower exceeding 84 m in height will be required to satisfy Ontario Building Code requirements. Existing municipal hydrants on Columbia Street and proposed internal hydrants are expected to provide adequate fire protection coverage for the new developments.
- Pre-development flow rates for the 2-year, 5-year, 25-year, and 100-year storm events will be met in post-development conditions through the use of underground cisterns. Existing municipal infrastructure surrounding the site is adequate to provide storm servicing.
- Quality control for the private roadways will be achieved through the use of oil/grit separators and/or through other low impact development measures which will be detailed at a later stage.
- Perimeter silt fence, silt fence at the base of all stockpiles, filter fabric over storm/sanitary structures, and construction entrance mud mats can provide erosion and sediment control. These will be detailed during detailed design.

- Salt Management measures will be implemented as part of the design and as part of the operational requirements for the development.

APPENDIX A

Sanitary Demand Calculations

- Sanitary Sewer Design Sheet
- Sanitary Service Sizing

Project:	170 & 180 Columbia Street				**Design Data**			**SANITARY SEWER DESIGN CALCULATIONS**															
Project No:	2024-0457-10				Min. Velocity	0.6	m/s																
Date:	2026-07-29				Max. Velocity	3.0	m/s			**Residential**					**Commercial**								
Designed By:	CM	Checked By:	ZS		Manning's 'n'	0.013		Peaking Factor	Harmon				Peaking Factor	2.5								
					Infiltration	0.25	l/s/ha	Avg. Daily Flow	275	L/c/d			Avg. Daily Flow	0.5	L/s/ha							
	Pipe Data			**Residential**				**Cumulative**					**Commercial**			**Infiltration**		**Total Block Flow**	**Total Block Flow**			
	From	To	Length	Area	Units	Density	Population	Area	Population	Peak Factor			Area	Total Area		Area	Total Area		(Dry Weather Only)			
			(m)	*(ha)*		*(ppu)*	*(people)*	*(ha)*	*(people)*				*(ha)*	*(ha)*		*(ha)*	*(ha)*	*(L/s)*	*(L/s)*			
170 Columbia Street West				0.550	(RES AREA ONLY)																		
PHASE 1				0.258	439	1.76	**773**	0.258	773	**3.87**			0.046	0.046		0.258	0.258	**9.64**	**9.58**			
PHASE 2				0.292	379	1.76	**667**	0.292	667	**3.91**			0.004	0.004		0.292	0.292	**8.37**	**8.30**			
180 Columbia Street West (Combined)				0.764																			
PHASE 3				0.255	443	1.76	**780**	0.255	780	**3.87**			0.028	0.028		0.764	0.764	**9.82**	**9.63**			
PHASE 4				0.255	268	1.76	**472**	0.255	1251	**3.74**			0.206	0.233		0.000	0.764	**15.36**	**15.17**			
PHASE 5				0.255	378	1.76	**665**	0.255	1917	**3.60**			0.013	0.246		0.000	0.764	**22.46**	**22.27**			

Project:	170 & 180 Columbia Street West			Design Data			**SANITARY SEWER DESIGN CALCULATIONS**																		
Project No:	2024-0457-10			Min. Velocity	0.8	m/s																			
Date:	2026-07-29			Max. Velocity	3.0	m/s				**Residential**				**Commercial**											
Designed By:	CM	Checked By:	ZS	Manning's 'n'	0.013		Peaking Factor	Harmon				Peaking Factor	2.5												
				Infiltration	0.25	l/s/ha	Avg. Daily Flow	275	L/c/d			Avg. Daily Flow	0.5	L/s/ha											
	Pipe Data		**Residential**				**Cumulative**			**Commercial**			**Infiltration**		**Total**	**Design Data**									
		Area	Units	Density	Population	Area	Population	Peak Factor	Area	Total Area	Area	Total Area	**Flow**	Diameter	Slope	Q_{FULL}	Q/Q_{FULL}	V_{FULL}							
		(ha)		*(ppu)*	*(people)*	*(ha)*	*(people)*		*(ha)*	*(ha)*	*(ha)*	*(ha)*	*(L/s)*	*(mm)*	*(%)*	*(L/s)*	*(%)*	*(m/s)*							
	Phase 1	0.258	439	1.76	**773**	0.258	773	**3.87**	0.046	0.046	0.258	0.26	**9.64**	200	1.00	**32.80**	29.40	**1.04**							
	Phase 2	0.292	379	1.76	**667**	0.292	667	**3.91**	0.004	0.004	0.292	0.29	**8.37**	200	0.60	**25.41**	32.95	**0.81**							
	Phases 3, 4, & 5	0.764	1089	1.76	**1917**	0.764	1917	**3.60**	0.246	0.246	0.764	0.76	**22.46**	200	1.00	**32.80**	68.48	**1.04**							

MEMORANDUM - INTERNAL

DATE: March 19, 2026
TO: Natasha Prepas-Strobeck, Development Engineering
FROM: Veronica Kroess, Engineering Infrastructure
SUBJECT: 170-180 Columbia Street W

I have conducted a preliminary assessment of the sanitary capacity in relation to, OPA67 & Z-25-14 and OPA68 & Z-25-15 for the Zone Change Application for 170-180 Columbia Street West.

The Functional Servicing Report (Report) for the application notes that the proposed development will have a sanitary discharge of 41.46L/s. As per the provided Report, the proposed sanitary flow rates are as summarized in Table 1.

Table 1 – Sanitary Servicing anticipated maximum peak flow rates:

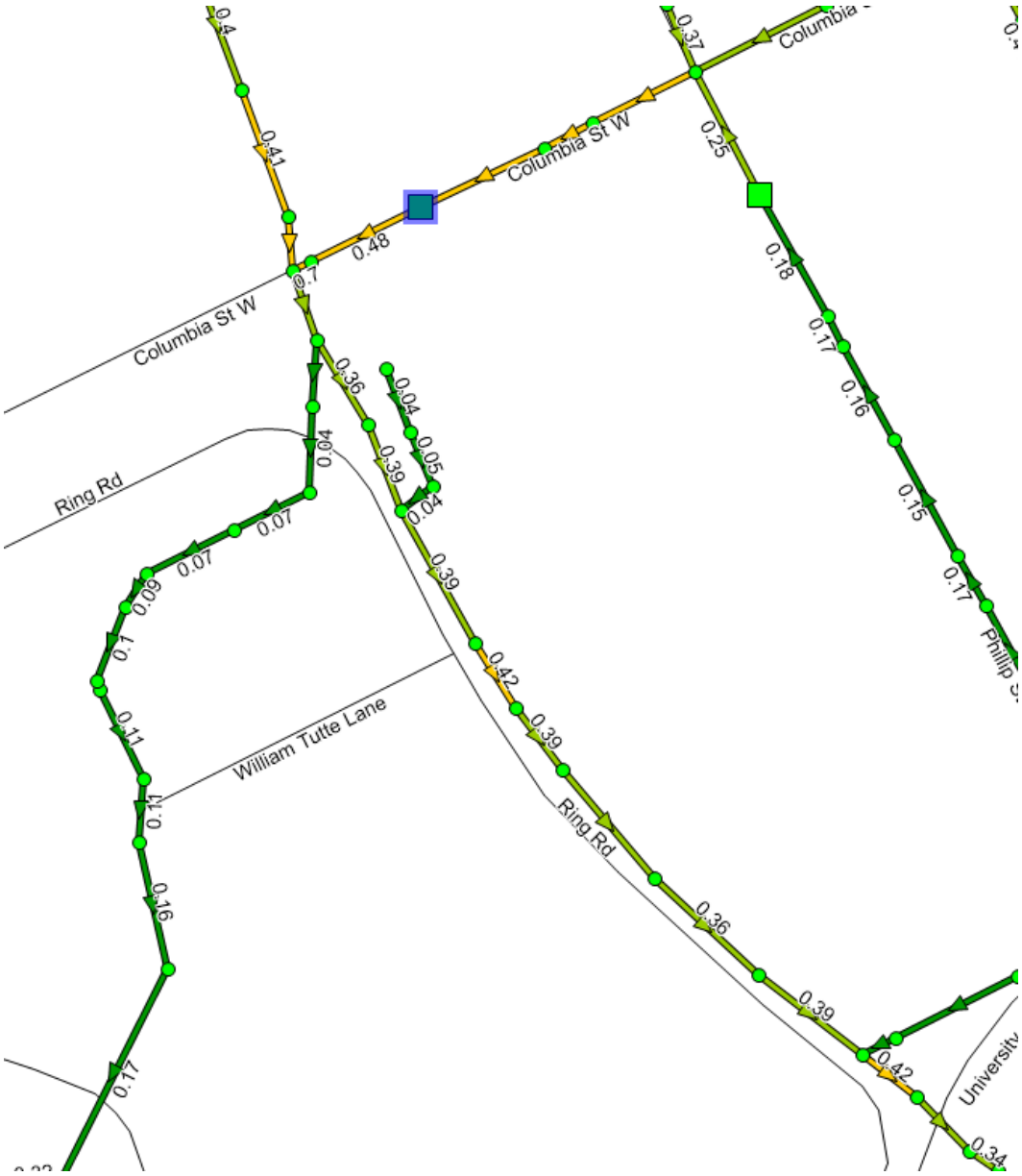
Source	Peak Flow (L/s)
Proposed Site	41.46

2051 Modelling Scenario

The future conditions PCSWMM sanitary sewer model includes loading rates that are projected to reflect 2051 conditions. The projected 2051 model estimated flows do not account for flows from the proposed development. To be conservative, the flows resulting from the proposed development were added to the sanitary sewer model flows to determine the effects of the proposed development on the sanitary sewer system. The analysis was conducted for the wet weather modelling scenario as it is more conservative, using the Sanitary Hydraulic model developed for the 2024 Sanitary Master Plan update.

Laurel Trunk System

The proposed flow of 41.46 L/s was accounted for in the MH CN22-2 flows, the closest downstream manhole. The 2051 projected 'post-development' modelling results indicate that the sanitary sewer on Columbia Street downstream of the proposed development appears to have available capacity under wet weather modelling scenarios, reaching a depth of 70 percent full, as shown on the figure below.



Projected 2051 Wet Weather modelling results

Legend:

Sanitary Sewers (fraction full):

- **< 0.2** — CapDepth < 0.2
- **0.2 - 0.4** — CapDepth >= 0.2 AND CapDepth < 0.4
- **0.4 - 0.8** — CapDepth >= 0.4 AND CapDepth < 0.8
- **> 0.8** — CapDepth >= 0.8

Maintenance Holes (depth to rim):

- **>= 1.8** — MinDepthBR >= 1.8
- **0 m to 1.8 m** — MinDepthBR > 0.0 and MinDepthBR < 1.8
- **= 0.0 m** — MinDepthBR = 0

APPENDIX B

Water Demand Calculations

- Domestic Water Demand
- Fire Flow Calculations (FUS 2020)

TABLE C-1 - DOMESTIC WATER DEMAND

DGSSMS 2025, Water Supply and Distribution Optimization Master Plan and ONTARIO BUILDING CODE

WALTERFEDY

Project	170 & 180 Columbia Street West
Project #	2024-0457-10
Designer	Circe Mahoney
Address	Waterloo, Ontario
Description	Overall Domestic Flows

Building Description	Area (ha) / Units	Density (ppu)	Population	Operating Hours	Demand	Max Daily Peak Factor	Max Hourly Peak Factor	Max Daily Demand (L/s)	Peak Hour Demand (L/s)	Average Day Demand (L/s)
170 Columbia Street West										
PHASE 1										
Residential	439	1.76	773	-	225 L/cap/day	1.42	3.0	2.858	6.039	2.013
Commercial	0.046			16	42000 L/ha/day	1.42	3.0	0.032	0.068	0.023
Total Phase 1				-				2.890	6.107	2.036
PHASE 2										
Residential	379	1.76	667	-	225 L/cap/day	1.42	3.0	2.467	5.211	1.737
Commercial	0.004			16	42000 L/ha/day	1.42	3.0	0.003	0.006	0.002
Total Phase 2				-				2.469	5.217	1.739
180 Columbia Street West										
PHASE 3										
Residential	443	1.76	780	-	225 L/cap/day	1.42	3.0	2.884	6.094	2.031
Commercial	0.028			16	42000 L/ha/day	1.42	3.0	0.019	0.040	0.013
PHASE 4										
Residential	268	1.76	472	-	225 L/cap/day	1.42	3.0	1.745	3.688	1.229
Commercial	0.206			16	42000 L/ha/day	1.42	3.0	0.142	0.300	0.100
PHASE 5										
Residential	378	1.76	665	-	225 L/cap/day	1.42	3.0	2.459	5.195	1.732
Commercial	0.013			16	42000 L/ha/day	1.42	3.0	0.009	0.019	0.006
Total 180 Columbia Street West				-				7.259	15.336	5.112

REQUIRED FIRE FLOW

Water Supply for Public Fire Protection (FUS 2020)

WALTERFEDY

Project	170 & 180 Columbia Street
Project #	2024-0457-10
Designer	CM
Address	170 & 180 Columbia Street West, Waterloo, ON
Description	Fire Demand - Phase 1

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

F = Required fire flow (LPM)
C = Coefficient related to type of construction
A = Total floor area (including all storeys but excluding any basement levels at least 50% below grade)

Type of Construction	Type II Non-Combustible Construction	**C =**	0.8
Description	**Unprotected Metal Structural Components, Masonry or Metal Walls. All Structural Members are Non-Combustible but does not qualify as Fire-Resisitive**		

Total Floor Area	29544	m^2
# Storeys	VARIES	
Fire Resistant Building?	NO	

Vertical Openings and Exterior Vertical Communications protected with minimum one (1) hr rating? NO

Area	5980	m^2
Description	Area of two largest floors + 50% of each of the floors above it (max 8)	
Required Fire Flow	14000	L/min

Occupancy Charge	Limited-Combustible Contents			
Fire Flow Reduction	-15%	**OR**	-2100	L/min
Required Fire Flow	11900	L/min		

Automated Sprinker Protection	YES		
Designed to NFPA 13 Standard	YES	-30%	
Standard Water Supply to Sprinklers and Standpipes	YES	-10%	
Fully Supervised System	YES	-10%	
Fire Flow Adjustment		-5950	L/min

Exposure 1 (North)	**Distance**	10.5	m	**Length-Height Factor**	>100	**Charge**	8%
Description	Phase 2						
Exposure 2 (East)	**Distance**	17	m	**Length-Height Factor**	>100	**Charge**	8%
Description	160 Columbia Street West (Existing Building)						
Exposure 3 (West)	**Distance**	18	m	**Length-Height Factor**	>100	**Charge**	8%
Description	Phase 3						
Exposure 4 (South)	**Distance**	>30	m	**Length-Height Factor**	N/A	**Charge**	0%
Description	195 Columbia Street West (Existing Building)						

Total Exposure Charge	24%	
Fire Flow Adjustment	2856	L/min

Total Required Fire Flow	9000	L/min
Total Required Fire Flow	2378	U.S. GPM
Total Required Fire Flow	150	L/s

REQUIRED FIRE FLOW

Water Supply for Public Fire Protection (FUS 2020)

WALTERFEDY

Project	170 & 180 Columbia Street
Project #	2024-0457-10
Designer	CM
Address	170 & 180 Columbia Street West, Waterloo, ON
Description	Fire Demand - Phase 2

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

F = Required fire flow (LPM)
C = Coefficient related to type of construction
A = Total floor area (including all storeys but excluding any basement levels at least 50% below grade)

Type of Construction	Type II Non-Combustible Construction	**C =**	0.8
Description	**Unprotected Metal Structural Components, Masonry or Metal Walls. All Structural Members are Non-Combustible but does not qualify as Fire-Resisitive**		

Total Floor Area	24718	m^2
# Storeys	VARIES	
Fire Resistant Building?	NO	

Vertical Openings and Exterior Vertical Communications protected with minimum one (1) hr rating? NO

Area	5734	m^2
Description	Area of two largest floors + 50% of each of the floors above it (max 8)	
Required Fire Flow	13000	L/min

Occupancy Charge	Limited-Combustible Contents			
Fire Flow Reduction	-15%	**OR**	-1950	L/min
Required Fire Flow	11050	L/min		

Automated Sprinker Protection	YES		
Designed to NFPA 13 Standard	YES	-30%	
Standard Water Supply to Sprinklers and Standpipes	YES	-10%	
Fully Supervised System	YES	-10%	
Fire Flow Adjustment		-5525	L/min

Exposure 1 (North)	**Distance**	>30	m	**Length-Height Factor**	N/A	**Charge**	0%
Description	176 Columbia Street West (Existing Building)						
Exposure 2 (East)	**Distance**	19	m	**Length-Height Factor**	>100	**Charge**	8%
Description	160 Columbia Street West (Existing Building)						
Exposure 3 (West)	**Distance**	17.6	m	**Length-Height Factor**	>100	**Charge**	8%
Description	Phase 4						
Exposure 4 (South)	**Distance**	10.5	m	**Length-Height Factor**	>100	**Charge**	8%
Description	Phase 1						

Total Exposure Charge	24%	
Fire Flow Adjustment	2652	L/min

Total Required Fire Flow	8000	L/min
Total Required Fire Flow	2113	U.S. GPM
Total Required Fire Flow	133	L/s

REQUIRED FIRE FLOW

Water Supply for Public Fire Protection (FUS 2020)

WALTERFEDY

Project	170 & 180 Columbia Street
Project #	2024-0457-10
Designer	CM
Address	170 & 180 Columbia Street West, Waterloo, ON
Description	Fire Demand - Phases 3,4, and 5

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

F = Required fire flow (LPM)
C = Coefficient related to type of construction
A = Total floor area (including all storeys but excluding any basement levels at least 50% below grade)

Type of Construction	Type II Non-Combustible Construction	**C =**	0.8
Description	**Unprotected Metal Structural Components, Masonry or Metal Walls. All Structural Members are Non-Combustible but does not qualify as Fire-Resisitive**		

Total Floor Area	73548	m^2
# Storeys	VARIES	
Fire Resistant Building?	NO	

Vertical Openings and Exterior Vertical Communications protected with minimum one (1) hr rating? NO

Area	16935	m^2
Description	Area of two largest floors + 50% of each of the floors above it (max 8)	
Required Fire Flow	23000	L/min

Occupancy Charge	Limited-Combustible Contents			
Fire Flow Reduction	-15%	**OR**	-3450	L/min
Required Fire Flow	19550	L/min		

Automated Sprinker Protection	YES		
Designed to NFPA 13 Standard	YES	-30%	
Standard Water Supply to Sprinklers and Standpipes	YES	-10%	
Fully Supervised System	YES	-10%	
Fire Flow Adjustment		-9775	L/min

Exposure 1 (North)	**Distance**	>30	m	**Length-Height Factor**	N/A	**Charge**	0%
Description	176 Columbia Street West (Existing Building)						
Exposure 2 (East)	**Distance**	17.6	m	**Length-Height Factor**	>100	**Charge**	8%
Description	Phases 1 and 2						
Exposure 3 (West)	**Distance**	>30	m	**Length-Height Factor**	N/A	**Charge**	0%
Description	200 Columbia Street West (Existing Building)						
Exposure 4 (South)	**Distance**	>30	m	**Length-Height Factor**	N/A	**Charge**	0%
Description	195 Columbia Street West (Existing Building)						

Total Exposure Charge	8%	
Fire Flow Adjustment	1564	L/min

Total Required Fire Flow	11000	L/min
Total Required Fire Flow	2906	U.S. GPM
Total Required Fire Flow	183	L/s

STUMPF
FIRE PROTECTION LIMITED

WWW.STUMPFFIRE.COM • 167 LEXINGTON CT., UNIT 1 • WATERLOO, ON N2J 4R9 • PHONE: 519-888-0043 • FAX: 519-888-9961

August 14, 2025

Attn: Manuela Restrepo

Hydrant flow test was done for the following project, on August 13, 2025 at approx. 9:00 am for a proposed project located at 170 Columbia Street, Waterloo.

Static: 54 PSI

Test Hydrant: 2177
Flow Hydrant: 304

Residual:	52 PS
Pitot:	33 PSI
Flow:	746 USGPM

Results are from (1) 2-1/2" hydrant port.

Residual:	50 PSI
Pitot:	18/18 PSI
Flow:	1582 USGPM (791 ea. Port)

Results are from (2) 2-1/2" hydrant ports.

GPM's are from Table 4.10.1(a) of the NFPA 291, 2013 Edition.

If you any question, please feel free to call.

Sincerely

Jeff Hayhurst, Designer
STUMPF FIRE PROTECTION
CC: scott.donelle@waterloo.ca & Jeff.schultz@waterloo.ca

U.A. LOCAL 853 1976 SPRINKLER FITTERS ONTARIO
CASA Canadian Automatic Sprinkler Association MEMBER
CANADIAN FIRE ALARM ASSOCIATION

C. N. R.

5-347

#440 PHILLIP ST. INDUSTRIAL MALL

#435

200ø TO VALLEY BLADES

727

BURIED AND DECOMMISIONED

T.V

725

297

300ø

S.T.

1650

200ø TO RAYTHEON

BURIED AND DECOMMISIONED

T.V

#403 & #405

#400

5-346

723

200ø TO RAYTHEON

100ø TO RAYTHEON

722

BURIED AND DECOMMISIONED

#387

299

PHILLIP

2146

150ø #368

719

150ø TO #136 COLUMBIA ST

720

100ø TO CARVASH

#180

COLUMBIA ST.

5-253

#140

#134 COLUMBIA ST W

#130 COLUMBIA ST

#118 COLUMBIA ST.

PRIVATE

W.

#419 ALMUTH PRODUCTS

1212

296

3893

200ø

22.5

METER CHAMBER

#400

PRIVATE VALVES

#413

5-1196

ALBERT

CARDILL

#403

736

150ø

CRES

ST.

BELL CANADA

298

735

5-719

150ø #383 ALBERT ST TO HALLMAN APTS

2583

OPTOMETRY BUILDING

PRIVATE

150ø

BRICK WALL

PRIVATE HYD

SERVICE TO OPTOMETRY BLDG.

712

300ø

713-D

22 ½° BENDS

714-D

715-D

300ø

882-D

731-D

LESTER ST.

302

#350 LESTER ST.

15-701

BATAVIA PL.

794

5094

#195 B.F. GOODRICH

2177

#175 #185

SERVICE TO #295, 305 PHILLIP ST.

304

716

303

717

2178

#145 COLUMBIA ST. N.

TO TOWN HOUSES

300mm V/M OUT OFF & CAPPED

ABANDONED V/M

300mm D.I. MAIN

WATERMAIN SIZE	COLOUR
100 mm	MAGENTA
150 mm	RED
200 mm	GREEN
250 mm	CYAN
300 mm	BLUE
350 mm	9
400 mm	113
450 mm	220
600 mm	112
750 mm	140
900 mm	243

NOTE: ALL MEASUREMENTS SHOWN ARE IN METRIC UNLESS OTHERWISE SPECIFIED

NOTE

THE ACCURACY OF INFORMATION SHOWN ON THIS DRAWING IS NOT GUARANTEED TO ENSURE ITS ACCURACY, IT SHOULD BE VERIFIED IN THE FIELD.

Test

Flow

LEGEND

HYDRANT 1000

VALVE 1000

DIM: 2.0m OR AS SHOWN

25-2	12-1	12-2
25-4	12-3	12-4
24-2	13-1	13-2

06 24 2013	B.P.	VARIOUS ADDITIONS	Waterloo	WATERMAIN LAYOUT
97 10 24	M.M.			
DATE	INT	REVISION	DRAWN BY: IRENE	G.C.T. NO. 12-3
CAD STAT. NO.1	DATE 03 10 2013		SCALE N.T.S.	


N185 Residual Pressure vs. Hydrant Flow - 170 Columbia Street West
Pressure (PSI)
100
90
80
70
60
50
40
30
20
10
0
300
800
1100
1400
1700
2000
2300
2600
2900
3200
3500
3800
4100
4400
4700
5000
5300
5600
5900
6200
6500
6800
Flow (USgpm)

Phase 1

Hazen-Williams Equations

$$S = \frac{h_f}{L} = \frac{10.67 Q^{1.852}}{C^{1.852} d^{4.8704}}$$ SI Units

$$S = \frac{h_f}{L} = \frac{4.52 Q^{1.852}}{C^{1.852} d^{4.8704}}$$ US Customary

Q_d *(domestic flow rate)*	2.89	*L/s*
Q_f *(fire flow rate)*	150	*L/s*
Q *(total flow rate)*	152.891	*L/s*
C *(pipe roughness coefficient)*	150	
d *(inside diameter)*	200	*mm*
k *(conversion factor for units)*	10.67	*SI*
L *(length)*	36	*m*

Unit Conversion

1	*L/s*	=	15.850	*USgpm*
1	*USgpm*	=	0.063	*L/s*
1	*psi*	=	0.70307	*mH_2O*
2.806	*mH_2O*	=	3.991041	*psi*
1	*kPa*	=	0.101972	*mH_2O*
1	*mH_2O*	=	9.806614	*kPa*
1	*kPa*	=	0.145	*psi*
1	*psi*	=	6.895	*kPa*

Water Turnover - Domestic	6.520	min
Water Turnover - Combined	0.123	min

Domestic + Fire Flow

S *(hydraulic slope/head loss)*	0.0779	*mH_2O/m*	Elevation at Source		*m*
h_f *(total head loss)*	2.806	*mH_2O*	Head at Source	54	*psi*
V *(velocity)*	4.867	*m/s*	Elevation at Building		*m*
			Head at Building	50.009	*psi*

Domestic Only

S *(hydraulic slope/head loss)*	0.0001	*mH_2O/m*	Elevation at Source		*m*
h_f *(total head loss)*	0.002	*mH_2O*	Head at Source	54	*psi*
V *(velocity)*	0.092	*m/s*	Elevation at Building		*m*
			Head at Building	53.997	*psi*

Phase 2

Hazen-Williams Equations

$$S = \frac{h_f}{L} = \frac{10.67 Q^{1.852}}{C^{1.852} d^{4.8704}}$$ SI Units

$$S = \frac{h_f}{L} = \frac{4.52 Q^{1.852}}{C^{1.852} d^{4.8704}}$$ US Customary

Q_d *(domestic flow rate)*	2.47	*L/s*
Q_f *(fire flow rate)*	133	*L/s*
Q *(total flow rate)*	135.469	*L/s*
C *(pipe roughness coefficient)*	150	
d *(inside diameter)*	200	*mm*
k *(conversion factor for units)*	10.67	*SI*
L *(length)*	97	*m*

Unit Conversion

1	*L/s*	=	15.850	*USgpm*
1	*USgpm*	=	0.063	*L/s*
1	*psi*	=	0.70307	*mH_2O*
6.043	*mH_2O*	=	8.595035	*psi*
1	*kPa*	=	0.101972	*mH_2O*
1	*mH_2O*	=	9.806614	*kPa*
1	*kPa*	=	0.145	*psi*
1	*psi*	=	6.895	*kPa*

Water Turnover - Domestic	20.571	min
Water Turnover - Combined	0.375	min

Domestic + Fire Flow

S *(hydraulic slope/head loss)*	0.0623	*mH_2O/m*	Elevation at Source		*m*
h_f *(total head loss)*	6.043	*mH_2O*	Head at Source	54	*psi*
V *(velocity)*	4.312	*m/s*	Elevation at Building		*m*
			Head at Building	45.405	*psi*

Domestic Only

S *(hydraulic slope/head loss)*	0.0000	*mH_2O/m*	Elevation at Source		*m*
h_f *(total head loss)*	0.004	*mH_2O*	Head at Source	54	*psi*
V *(velocity)*	0.079	*m/s*	Elevation at Building		*m*
			Head at Building	53.995	*psi*

Phases 3, 4, & 5

Hazen-Williams Equations

$$S = \frac{h_f}{L} = \frac{10.67 Q^{1.852}}{C^{1.852} d^{4.8704}}$$ SI Units

$$S = \frac{h_f}{L} = \frac{4.52 Q^{1.852}}{C^{1.852} d^{4.8704}}$$ US Customary

Q_d *(domestic flow rate)*	7.26	*L/s*
Q_f *(fire flow rate)*	183	*L/s*
Q *(total flow rate)*	190.259	*L/s*
C *(pipe roughness coefficient)*	150	
d *(inside diameter)*	200	*mm*
k *(conversion factor for units)*	10.67	*SI*
L *(length)*	21	*m*

Unit Conversion

1	*L/s*	=	15.850	*USgpm*
1	*USgpm*	=	0.063	*L/s*
1	*psi*	=	0.70307	*mH_2O*
2.454	*mH_2O*	=	3.490398	*psi*
1	*kPa*	=	0.101972	*mH_2O*
1	*mH_2O*	=	9.806614	*kPa*
1	*kPa*	=	0.145	*psi*
1	*psi*	=	6.895	*kPa*

Water Turnover - Domestic	1.515	min
Water Turnover - Combined	0.058	min

Domestic + Fire Flow

S *(hydraulic slope/head loss)*	0.1169	*mH_2O/m*	Elevation at Source		*m*
h_f *(total head loss)*	2.454	*mH_2O*	Head at Source	54	*psi*
V *(velocity)*	6.056	*m/s*	Elevation at Building		*m*
			Head at Building	50.510	*psi*

Domestic Only

S *(hydraulic slope/head loss)*	0.0003	*mH_2O/m*	Elevation at Source		*m*
h_f *(total head loss)*	0.006	*mH_2O*	Head at Source	54	*psi*
V *(velocity)*	0.231	*m/s*	Elevation at Building		*m*
			Head at Building	53.992	*psi*

APPENDIX C

Stormwater Management

- IDF Parameters
- Existing Conditions Parameters
- Proposed Conditions Parameters
- Storage Requirement Summary

TABLE 1
DESIGN STORM PARAMETERS

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
170 & 180 COLUMBIA STREET WEST
WATERLOO, ON

Design Storm	IDF Storm Parameters			Time of Peak Ratio	Storm Duration	Max. Rainfall Intensity	Max. Rainfall Depth
	a	b	c	r	D (h)	(mm/hr)	(mm)
2-year	1101	9.258	0.882	0.3	4	81.1	33.9
5-year	1755	12.347	0.895	0.3	4	108.8	49.7
25-Year	3261	16.193	0.938	0.3	4	152.4	71.8
100-Year	4692	17.437	0.956	0.3	4	197.8	93.1

Notes:
(1) IDF curve parameters taken from the City of Waterloo's Engineering and Landscape Manual - Volume 6 (May 2024)

TABLE 2
POST-DEVELOPMENT CATCHMENT AREA PARAMETERS

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
170 & 180 COLUMBIA STREET WEST
WATERLOO, ON

ID	Description	Area [ha]	Impervious [%]	Width [m]	Length [m]	Slope [%]	Mannings n (Imperv) [-]	Mannings n (Perv) [-]	Curve Number [-]	Depression Storage (Imperv) [mm]	Depression Storage (Perv) [mm]	Zero-Imperv [%]	Subcatchment Routed To	Routed [%]
POST-DEVELOPMENT CONDITIONS														
201	Phase 1 building	0.15	100	50	30	0.5	0.013	0.25	85	2	4	0	OUTLET	100
202	Phase 2 building	0.13	100	43.333	30	0.5	0.013	0.25	85	2	4	0	OUTLET	100
203	Phase 3 building	0.13	100	43.333	30	0.5	0.013	0.25	85	2	4	0	OUTLET	100
204	Phase 4 building	0.13	100	43.333	30	0.5	0.013	0.25	85	2	4	0	OUTLET	100
205	Phase 5 building	0.13	100	43.333	30	0.5	0.013	0.25	85	2	4	0	OUTLET	100
206	Landscaped and roadway areas around the Phase 2 building	0.29	90	58	50	2	0.013	0.25	85	2	4	0	OUTLET	100
207	Landscaped and roadway areas around the Phase 1 building	0.26	80	52	50	2	0.013	0.25	85	2	4	0	OUTLET	100
208	landscaped and roadway areas on 180 Columbia street site	0.374	90	46.75	80	2	0.013	0.25	85	2	4	0	OUTLET	100
300	Proposed park and eastern ROW - not to be controlled on Site	0.28	25	23.333	120.002	2	0.013	0.25	85	2	4	0	OUTLET	100
	Total Area	**1.87**	**82.48**											

TABLE 3
POST-DEVELOPMENT PEAK RUNOFF RATES

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
170 & 180 COLUMBIA STREET WEST
WATERLOO, ON

	Design Storm			
	Chicago (2-Year)	**Chicago (5-Year)**	**Chicago (25-Year)**	**Chicago (100-Year)**
POST-DEVELOPMENT CONDITIONS [LPS]				
Subcatchments				
201	33.48	45.15	63.41	82.36
202	29.02	39.13	54.95	71.38
203	29.02	39.13	54.95	71.38
204	29.02	39.13	54.95	71.38
205	29.02	39.13	54.95	71.38
206	59.61	82.65	118.18	154.91
207	47.78	67.75	99.75	133.04
208	75.6	105.01	151.07	198.72
300	16.28	24.49	40.83	61.27
Outfalls				
EX.DCBMH15.2 (West Outfall)	51.25	64.89	82.59	97.67
EX_STM (East Outfall)	63.4	79.26	81.46	81.46
Uncontrolled	16.28	24.49	40.83	61.27

TABLE 4
POST-DEVELOPMENT PEAK RUNOFF VOLUMES

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
170 & 180 COLUMBIA STREET WEST
WATERLOO, ON

	Design Storm			
	Chicago (2-Year)	**Chicago (5-Year)**	**Chicago (25-Year)**	**Chicago (100-Year)**
POST-DEVELOPMENT CONDITIONS [m^3]				
Subcatchments				
201	50	70	110	140
202	40	60	90	120
203	40	60	90	120
204	40	60	90	120
205	40	60	90	120
206	90	130	190	260
207	70	110	170	220
208	110	170	250	330
300	40	80	130	180
Outfalls				
EX.DCBMH15.2 (West Outfall)	238	357	525	687
EX_STM (East Outfall)	249	378	495	570
Uncontrolled	41	76	130	184

TABLE 5
STORAGE PERFORMANCE

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
170 & 180 COLUMBIA STREET WEST
WATERLOO, ON

Storm Type	Design Storm	Peak Inflow [L/s]	Peak Outflow [L/s]	Max. HGL [m]	Max. Storage [m³]	Max. Depth [m]
POST-DEVELOPMENT CONDITIONS						
Phase1_Cistern		Cistern under phase 1 - servicing catchments 201 and 207				
Chicago	2-Year	81.26	29.31	336.69	42	1.04
Chicago	5-Year	112.91	36.79	337.36	68	1.71
Chicago	25-Year	163.16	59.5	338.28	105	2.63
Chicago	100-Year	215.4	77.45	339.23	143	3.58
Phase2_Cistern		Cistern under phase 1 - servicing catchments 202 and 206				
Chicago	2-Year	88.63	34.38	336.81	42	1.16
Chicago	5-Year	121.78	42.65	337.54	68	1.89
Chicago	25-Year	173.14	65.81	338.58	106	2.93
Chicago	100-Year	226.29	84.21	339.65	144	4
Phase_3_Cistern		Underground cistern located on level P1 of phase 3				
Chicago	2-Year	162.64	51.25	333.62	98	1.09
Chicago	5-Year	222.41	64.89	334.23	153	1.7
Chicago	25-Year	315.93	82.59	335.24	244	2.71
Chicago	100-Year	412.86	97.67	336.29	338	3.76

TABLE 6
OUTLET COMPARISON

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
170 & 180 COLUMBIA STREET WEST
WATERLOO, ON

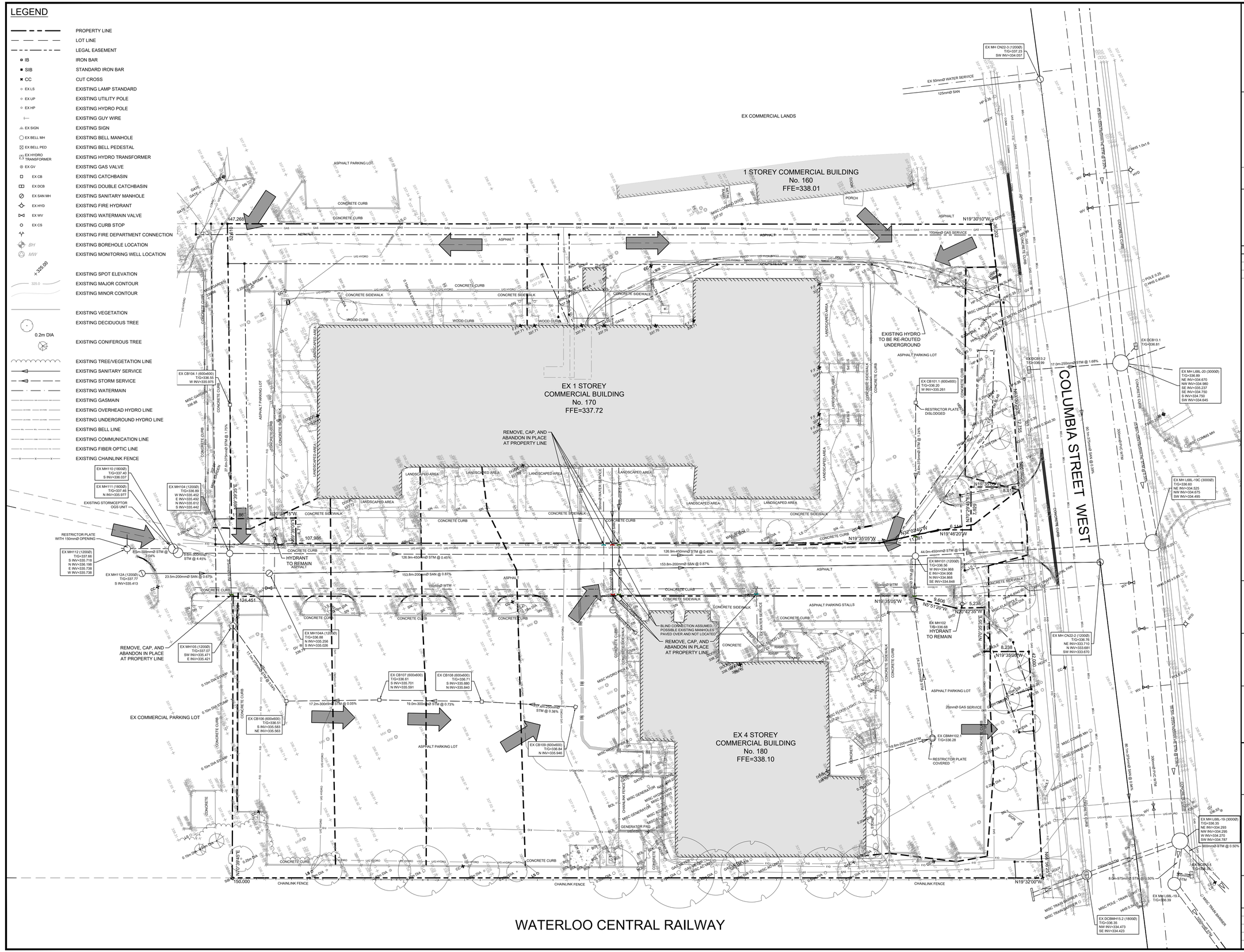
	To Columbia Street W. (from East Site)		**To Columbia Street W. (from West Site)**	
Design Storm Event	Existing (L/s)	Proposed (L/s)	Existing (L/s)	Proposed (L/s)
2-year	84.56	63.4	77.47	51.25
5-year	113.54	79.26	104.01	64.89
25-year	159.04	81.46	145.69	82.59
100-year	206.41	81.46	189.09	97.67

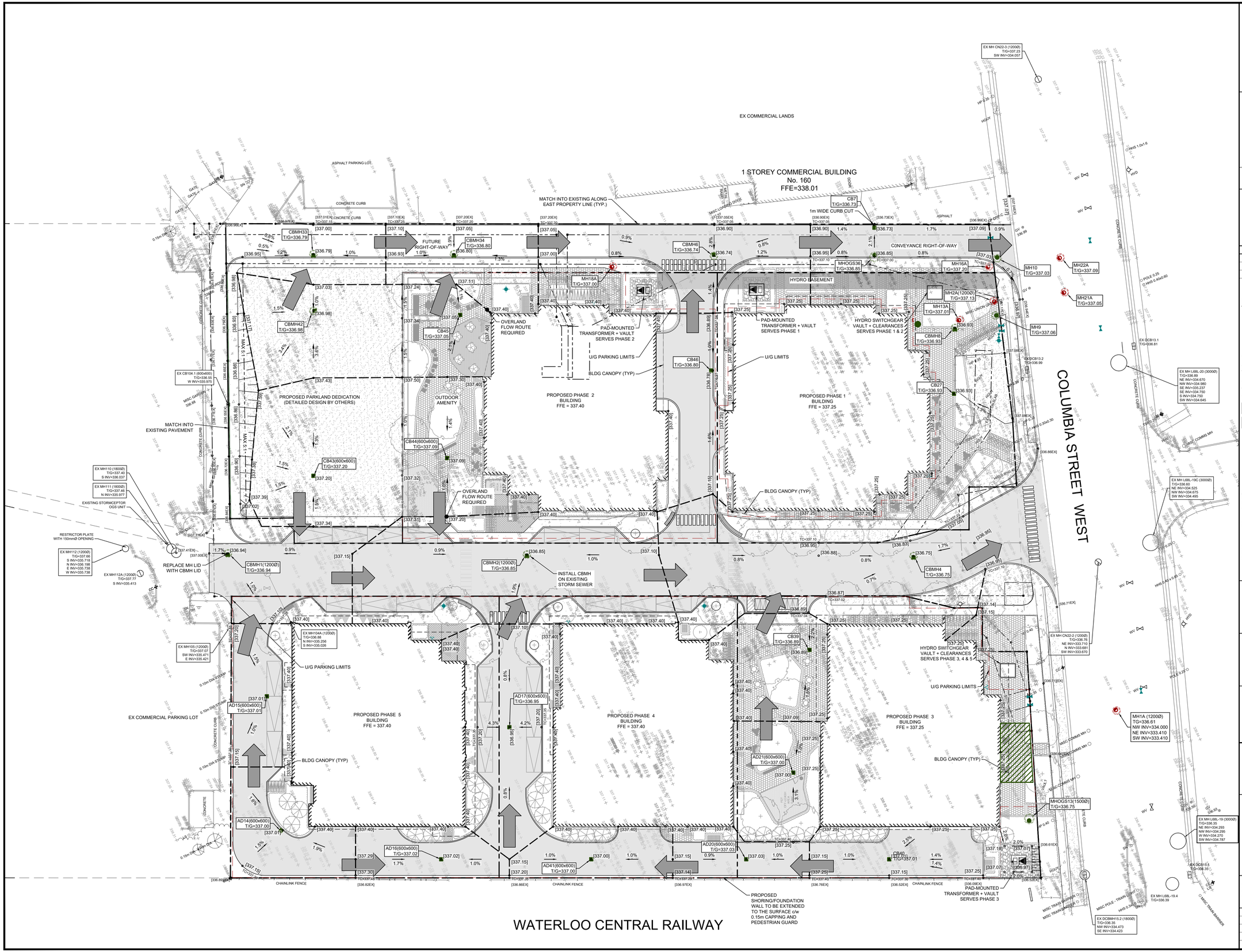
APPENDIX D

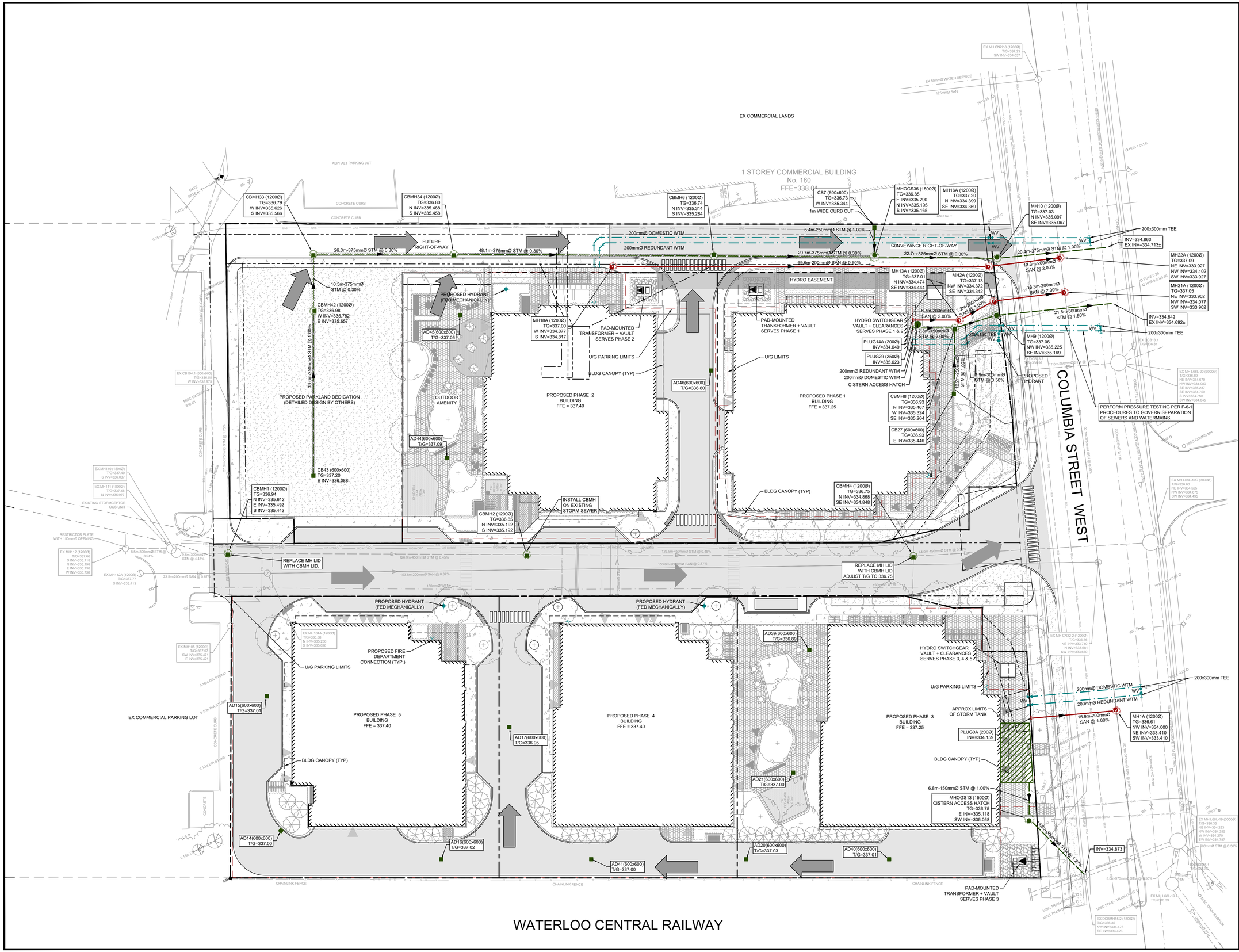
- Functional Grading Plan
- Functional Servicing Plan

LEGEND

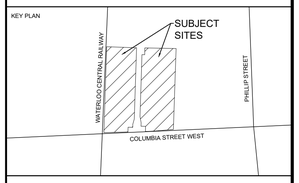
- PROPERTY LINE
- LOT LINE
- LEGAL EASEMENT
- IB — IRON BAR
- SIB — STANDARD IRON BAR
- CC — CUT CROSS
- EX LS — EXISTING LAMP STANDARD
- EX UP — EXISTING UTILITY POLE
- EX HP — EXISTING HYDRO POLE
- EXISTING GUY WIRE
- EX SIGN — EXISTING SIGN
- EX BELL MH — EXISTING BELL MANHOLE
- EX BELL PED — EXISTING BELL PEDESTAL
- EX HYDRO TRANSFORMER — EXISTING HYDRO TRANSFORMER
- EX GV — EXISTING GAS VALVE
- EX CB — EXISTING CATCHBASIN
- EX DCB — EXISTING DOUBLE CATCHBASIN
- EX SAN MH — EXISTING SANITARY MANHOLE
- EX HYD — EXISTING FIRE HYDRANT
- EX WV — EXISTING WATERMAIN VALVE
- EX CS — EXISTING CURB STOP
- EXISTING FIRE DEPARTMENT CONNECTION
- BH — EXISTING BOREHOLE LOCATION
- MW — EXISTING MONITORING WELL LOCATION
- +325.00 — EXISTING SPOT ELEVATION
- 325.0 — EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING VEGETATION
- 0.2m DIA — EXISTING DECIDUOUS TREE
- EXISTING CONIFEROUS TREE
- EXISTING TREE/VEGETATION LINE
- EXISTING SANITARY SERVICE
- EXISTING STORM SERVICE
- EXISTING WATERMAIN
- EXISTING GASMAIN
- EXISTING OVERHEAD HYDRO LINE
- EXISTING UNDERGROUND HYDRO LINE
- EXISTING BELL LINE
- EXISTING COMMUNICATION LINE
- EXISTING FIBER OPTIC LINE
- EXISTING CHAINLINK FENCE


EX COMMERCIAL LANDS
1 STOREY COMMERCIAL BUILDING
No. 160
FFE=338.01
EX 1 STOREY
COMMERCIAL BUILDING
No. 170
FFE=337.72
EX 4 STOREY
COMMERCIAL BUILDING
No. 180
FFE=338.10
EX COMMERCIAL PARKING LOT
ASPHALT PARKING LOT
ASPHALT PARKING STALLS
LANDSCAPED AREA
CONCRETE SIDEWALK
CONCRETE CURB
WOOD CURB
CHAINLINK FENCE
EXISTING HYDRO TO BE RE-ROUTED UNDERGROUND
REMOVE, CAP, AND ABANDON IN PLACE AT PROPERTY LINE
HYDRANT TO REMAIN ASPHALT
HYDRANT TO REMAIN
BLIND CONNECTION ASSUMED, POSSIBLE EXISTING MANHOLES PAVED OVER AND NOT LOCATED
RESTRICTOR PLATE WITH 150mmØ OPENING
RESTRICTOR PLATE DISLODGED
RESTRICTOR PLATE COVERED
EX CB104.1 (600x600) T/G=336.55 W INV=335.975
EX MH110 (1800Ø) T/G=337.40 S INV=336.037
EX MH111 (1800Ø) T/G=337.40 N INV=335.977
EX MH104 (1200Ø) T/G=336.89 W INV=335.452 E INV=335.492 N INV=335.612 S INV=335.442
EX MH112 (1200Ø) T/G=337.66 S INV=335.718 N INV=336.108 E INV=335.738 W INV=335.738
EX MH112A (1200Ø) T/G=337.77 S INV=335.413
EX MH105 (1200Ø) T/G=337.07 SW INV=335.471 E INV=335.421
EX MH104A (1200Ø) T/G=336.98 N INV=335.256 S INV=335.026
EX CB107 (600x600) T/G=336.61 S INV=335.701 N INV=335.591
EX CB108 (600x600) T/G=336.71 S INV=335.880 N INV=335.840
EX CB106 (600x600) T/G=336.51 S INV=335.583 NE INV=335.563
EX CB109 (600x600) T/G=336.84 N INV=335.946
EX CB101.1 (600x600) T/G=336.20 W INV=335.261
EX MH102 T/G=336.68
EX MH101 (1200Ø) T/G=336.56 W INV=334.968 E INV=334.908 N INV=334.868 SE INV=334.848
EX CBMH102.1 T/G=336.28
EX DCB13.1 T/G=336.81
EX DCB13.2 T/G=336.99
EX MH CN22-3 (1200Ø) T/G=337.23 SW INV=334.057
EX MH CN22-2 (1200Ø) T/G=336.70 NE INV=333.716 N INV=333.681 SW INV=333.670
EX MH L68L-20 (3000Ø) T/G=336.89 NE INV=334.670 NW INV=334.980 SE INV=335.237 SE INV=334.750 S INV=334.750 SW INV=334.645
EX MH L68L-19C (3000Ø) T/G=336.60 NE INV=334.525 NW INV=334.675 SW INV=334.495
EX MH L68L-19 (3000Ø) T/G=336.35 NE INV=334.293 NW INV=334.295 W INV=334.270 SW INV=334.787
EX DCBMH15.2 (1800Ø) T/G=336.35 NW INV=334.473 SE INV=334.423
EX MH L68L-19.1 T/G=336.30
EX CB104.2 T/G=336.76
COLUMBIA STREET WEST
WATERLOO CENTRAL RAILWAY
107.986
147.268
124.451
150.000
N70°39'45"E
N19°35'05"W
N19°30'10"W
N19°46'20"W
N19°32'00"W
N70°42'35"W
N70°51'20"W
N70°39'45"E
N19°35'05"W
N19°35'05"W
N19°32'00"W
N19°27'40"W
N32°02'40"W
N19°35'05"W
N19°35'05"W
N70°39'35"E
N70°39'45"E
N19°32'00"W
N19°32'00"W
N19°32'00"W


1 STOREY COMMERCIAL BUILDING
No. 160
FFE=338.01
EX COMMERCIAL LANDS
ASPHALT PARKING LOT
CONCRETE CURB
MATCH INTO EXISTING ALONG EAST PROPERTY LINE (TYP.)
FUTURE RIGHT-OF-WAY
1m WIDE CURB CUT
CONVEYANCE RIGHT-OF-WAY
ASPHALT
HYDRO EASEMENT
COLUMBIA STREET WEST
CBMH33 T/G=336.79
CBMH34 T/G=336.80
CBMH6 T/G=336.74
CB7 T/G=336.73
MHOGS36 T/G=336.85
MH16A T/G=337.20
MH10 T/G=337.03
MH22A T/G=337.09
MH21A T/G=337.05
MH2A(1200Ø) T/G=337.13
MH13A T/G=337.01
MH9 T/G=337.06
CBMH8 T/G=336.93
CB27 T/G=336.93
MH16A T/G=337.00
CBMH42 T/G=336.98
CB45 T/G=337.05
CB46 T/G=336.80
OVERLAND FLOW ROUTE REQUIRED
PAD-MOUNTED TRANSFORMER + VAULT SERVES PHASE 2
PAD-MOUNTED TRANSFORMER + VAULT SERVES PHASE 1
HYDRO SWITCHGEAR VAULT + CLEARANCES SERVES PHASE 1 & 2
U/G PARKING LIMITS
BLDG CANOPY (TYP)
U/G LIMITS
PROPOSED PHASE 2 BUILDING FFE = 337.40
PROPOSED PHASE 1 BUILDING FFE = 337.25
PROPOSED PARKLAND DEDICATION (DETAILED DESIGN BY OTHERS)
OUTDOOR AMENITY
MATCH INTO EXISTING PAVEMENT
CB44(600x600) T/G=337.09
CB43(600x600) T/G=337.20
OVERLAND FLOW ROUTE REQUIRED
BLDG CANOPY (TYP)
EX CB104.1 (600x600) T/G=336.55 W INV=333.975
EX MH110 (1800Ø) T/G=337.40 S INV=336.037
EX MH111 (1800Ø) T/G=337.40 N INV=335.977
EXISTING STORMCEPTOR OGS UNIT
RESTRICTOR PLATE WITH 150mmØ OPENING
EX MH112 (1200Ø) T/G=337.66 S INV=335.718 N INV=336.198 E INV=335.738 W INV=335.738
EX MH112A (1200Ø) T/G=337.77 S INV=335.413
REPLACE MH LID WITH CBMH LID
CBMH1(1200Ø) T/G=336.94
CBMH2(1200Ø) T/G=336.85
INSTALL CBMH ON EXISTING STORM SEWER
EX MH105 (1200Ø) T/G=337.07 SW INV=335.471 E INV=335.421
EX MH104A (1200Ø) T/G=336.96 N INV=335.256 S INV=335.026
U/G PARKING LIMITS
EX COMMERCIAL PARKING LOT
PROPOSED PHASE 5 BUILDING FFE = 337.40
PROPOSED PHASE 4 BUILDING FFE = 337.40
PROPOSED PHASE 3 BUILDING FFE = 337.25
BLDG CANOPY (TYP)
AD15(600x600) T/G=337.01
AD14(600x600) T/G=337.00
AD17(600x600) T/G=336.95
AD21(600x600) T/G=337.00
AD16(600x600) T/G=337.02
AD41(600x600) T/G=337.00
AD20(600x600) T/G=337.03
CB39 T/G=336.89
CB40 T/G=337.01
MHOGS13(1500Ø) T/G=336.75
CBMH4 T/G=336.75
PROPOSED SHORING/FOUNDATION WALL TO BE EXTENDED TO THE SURFACE c/w 0.15m CAPPING AND PEDESTRIAN GUARD
CHAINLINK FENCE
WATERLOO CENTRAL RAILWAY
EX MH CN22-3 (1200Ø) T/G=337.23 SW INV=334.057
EX MH CN22-2 (1200Ø) T/G=336.70 NE INV=333.710 N INV=333.681 SW INV=333.670
EX MH L68L-20 (3000Ø) T/G=336.89 NE INV=334.670 NW INV=334.980 SE INV=335.237 SE INV=334.750 S INV=334.750 SW INV=334.645
EX MH L68L-19C (3000Ø) T/G=336.60 NE INV=334.525 NW INV=334.675 SW INV=334.495
EX MH L68L-19 (3000Ø) T/G=336.35 NE INV=334.293 NW INV=334.295 W INV=334.270 SW INV=334.787
EX MH L68L-19.4 T/G=336.39
MH1A (1200Ø) TG=336.61 NW INV=334.000 NE INV=333.410 SW INV=333.410
EX DCB13.1 T/G=336.81
EX DCB13.2 T/G=336.99
EX DCB15.1 T/G=336.35
EX DCBMH15.2 (1800Ø) T/G=336.35 NW INV=334.473 SE INV=334.423
MISC POLE - TRAFFIC SIGNAL
MISC TRAIN SIGNAL
MISC TRAIN RUNNER
MISC COMMS MH
MISC UNION GAS MH
MISC CABLE TV MH
MISC HYDRO MH
MISC GAS MH
MISC GAS VALVE
MISC GAS VENT
MISC GAS METER
MISC GAS MANHOLE
MISC GAS VALVE CHAMBER



KEY PLAN



NORTH

DATE	ISSUANCE	NO.
2025.04.18	ISSUED FOR OPA/ZBA	1
2026.01.23	ISSUED FOR ZBA RESUBMISSION	2
2026.07.31	ISSUED FOR ZBA RESUBMISSION	3

LEGEND

- CB / DCB — PROPOSED CATCHBASIN / DOUBLE CATCHBASIN
- CBMH / DCBMH — PROPOSED CATCHBASIN MANHOLE / DOUBLE CATCHBASIN MANHOLE
- MH — PROPOSED STORM MANHOLE
- MH — PROPOSED SANITARY MANHOLE
- HYD — PROPOSED FIRE HYDRANT
- WV — PROPOSED WATERMAIN VALVE
- PROPOSED FIRE DEPARTMENT CONNECTION
- PROPOSED SANITARY SEWER/SERVICE
- PROPOSED STORM SEWER/SERVICE
- PROPOSED WATERMAIN/SERVICE
- PR HYDRO TRANSFORMER — PROPOSED HYDRO TRANSFORMER
- EXTENT OF UNDERGROUND PARKING
- PROPOSED PIPE INSULATION

NOTE:
IN ORDER TO REPRESENT TRUE DISTANCES, TOPOGRAPHICAL SURVEY WAS HORIZONTALLY SCALED FROM GRID TO GROUND BY A FACTOR OF 1.0004302, AS PROVIDED BY VAN HARTEN.

BENCHMARK NOTE:
ELEVATIONS ON THIS PLAN ARE REFERENCED AGAINST BENCHMARK WA-48 RMW145, LOCATED AS DESCRIBED:

TABLET SET HORIZONTALLY ON BUILDING #160 ON THE NORTH SIDE OF COLUMBIA STREET, 0.15km EAST OF CNR. TABLET IS SET ON THE SOUTH FACE OF THE BUILDING, 0.21 METRES EAST OF THE SOUTHWEST CORNER AND 0.40 METRES ABOVE GROUND LEVEL

1:300
0 3.0 6.0 15.0

CLIENT
170 COLUMBIA WATERLOO INCORPORATED
170 COLUMBIA STREET WEST

PROJECT
170 COLUMBIA STREET WEST

TITLE
SERVICING PLAN - FINAL

WALTERFEDY
TORONTO | CALGARY | **KITCHENER** | HAMILTON
800.685.1378 **walterfedy.com**

LICENSED PROFESSIONAL ENGINEER
Z. C. SCHNURR
100568704
2026.07.31
PROVINCE OF ONTARIO

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SCALE:	1:300
DATE:	2026-07-30
PROJECT NO.:	2024-0457-10
DRAWN BY:	TDK
CHECKED BY:	SF

SHEET NO.:
C303

\\BELL\Jobs_Files\2024\0457\10\06-DWGS\Civil\Plot Files\2024-0457-10_SVC_P1; C303 SERVICING PLAN - FINAL; Nonec Zach Schnurr; 2026-07-30 3:32:46 PM