S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Functional Servicing Report

1167 PLAINS ROAD EAST

PROPOSED MIX-USE BUILDING

(PHASE 1 OF 2)

CITY OF BURLINGTON

MAY 2021

SLA File: 20071

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1.0 INTRODUCTION AND BACKGROUND

1.1 OVERVIEW

S. Llewellyn & Associates Limited has been retained by Molinaro Group to provide consulting engineering services for the proposed development located at 1167 Plains Road East in the City of Burlington (see Figure 1.0 for location plan). This report will outline the functional servicing strategy for Phase 1 of the proposed overall development with Phase 2 being 1134 Plains Road East.

Phase 1 of the proposed development consists of constructing a 30 to 35-storey mixed-use building containing approximately 587 residential units, 791m^2 retail area, and 5 levels of underground parking. The proposed site will also include concrete curbing/sidewalk, asphalt drive aisle and landscaped areas.

This Functional Servicing Report will provide detailed information of the proposed servicing scheme for this development. Please refer to the site engineering plans prepared by S. Llewellyn and Associates Limited and the site plan prepared by Graziani and Corazza Architects Inc. for additional information.

1.2 BACKGROUND INFORMATION

The following documents were referenced in the preparation of this report:

Ref. 1: MOE Stormwater Management Planning and Design Manual (Ministry of Environment, March 2003)

Ref. 2: Erosion & Sediment Control Guidelines for Urban Construction (December 2006)

Ref. 3: Low Impact Development Stormwater Management Planning and Design Guide (Toronto and Region Conservation Authority & Credit Valley Conservation, 2010)

Ref. 4: Water and Wastewater Linear Design Manual (Regional Municipality of Halton, October 2019)

Ref. 5: Stormwater Management Design Guidelines (City of Burlington, May 2020)



Figure 1.0 - Location Plan

1.3 HYDROGEOLOGICAL INVESTIGATION

A hydrogeological investigation was prepared by Landtek Limited dated April 21, 2021. Six (6) boreholes were drilled between August 22 and September 8, 2020 to approximate depths ranging between 21.5m and 23.5m below grade. Topsoil and fill were encountered ranging in thickness from 0.1m to 1.4m below grade. Native soils of silty sand and silty clay were found underlaying the fill soils. Shale bedrock was encountered below the silty clay layer in all boreholes at depths ranging from 11.2m to 14.0m below grade.

Groundwater was encountered at depths between 4.20m and 4.96m below grade (elevations of 93.23m to 92.38m). Temporary construction dewatering will be required and the dewatering flow rate outside periods of active precipitation is approximately 68,749 l/day (0.8 l/s) (FS 1.3) which is less than the 5-year allowable discharge rate of 53 l/s (see Table 2.2 of this report). A permit to take water (PTTW) is required for this volume of water taking, as the estimated discharge rate is more than 50,000 l/s. Long-term dewatering will not be required for the site, as the developer has proposed to waterproof the below grade structure to prevent inflow of groundwater into the subsurface parking structures and foundation.

The groundwater quality was analysed and found that the levels of total suspended solids and total manganese exceed the City of Burlington Municipal Storm Sewer Discharge Limits Guidelines. Based on these results, pre-treatment of the groundwater will be required prior to discharging to the storm sewer system.

Groundwater levels are continued to being monitored to determine the seasonal high groundwater level and the report will be updated upon completion of the groundwater monitoring program. For additional information, refer to the hydrogeological investigation in Appendix E.

2.0 STORMWATER MANAGEMENT

The following stormwater management (SWM) criteria will be applied to the site, in accordance with the City of Burlington requirements:

Quantity Control

The City of Burlington requires the stormwater discharge rate from the proposed site to be controlled to the 5-year pre-development conditions discharge rate for all storm events (2 to 100-year storm events). The MTO requires the stormwater discharge rate from the proposed site to be controlled to the pre-development conditions discharge rate for all storm events (2 to 100-year storm events). Therefore, the lands draining to Hager Creek will be controlled under the City of Burlington standards and the lands draining to the existing ditch on MTO lands will be controlled under the MTO standards.

Quality Control

The stormwater runoff from the proposed site must meet Level 1 (Enhanced) stormwater quality control (80% TSS removal, 90% average annual runoff treatment).

Erosion Control

Erosion and sediment control measures will be implemented in accordance with the standards of the City of Burlington.

Flood Plain Control

All door sill elevations to be a minimum of 0.15m above the worst-case flood plain analysis elevation for 100-year and Regional Storm Events.

2.1 EXISTING CONDITIONS

In the existing conditions, the 0.80ha site consists entirely of pervious areas. The site is bound by Hager Creek to the north, Plains Road East to the east, Queen Elizabeth Way to the south, and CN Railway to the west. An existing 375mmø storm sewer is located perpendicular to the south property line and flows east along Plains Road East. An existing 200mmø storm sewer is located adjacent to the south property line and flows north along Plains Road East, ultimately discharging to the Hager Creek culvert.

The topography of the existing site generally slopes from west to east with the majority of the site sheet draining to Hager Creek while the remainder of the site sheet drains towards the existing ditch to the south, which ultimately discharges to the exiting storm sewers on Plains Road East.

Two (2) catchment areas, Catchments 101 and 102, have been identified in the existing condition. See Table 2.1 and the Pre-Development Storm Drainage Area Plan in Appendix A for details.

Catchment 101 represents the existing conditions discharge from the subject site draining towards Hager Creek.

Catchment 102 represents the existing conditions drainage from the subject site draining towards the existing south ditch located within MTO lands and ultimately Plains Road East.

Table 2.1 – Existing Conditions Catchment Areas

Catchment ID	Description	Area (ha)	Percent Impervious (%)	Runoff Coefficient (C)
101	Drainage from the subject lands north towards Hager Creek	0.38	0	0.25
102	Drainage from the subject lands south towards Plains Road East	0.42	0	0.25
	Total	**0.80**	**0**	**0.25**

An analysis was performed on Catchments 101, 102 and 103 using the SWMHYMO hydrologic modelling program developed by J.F. Sabourin & Associates for the 2 to 100-year City of Burlington 6-hour Chicago Design Storms. A summary of the results can be found in Table 2.2 below and the detailed SWMHYMO input/output information in Appendix A.

Table 2.2 – Existing Conditions Stormwater Discharge

Storm Event	Catchment 101 Discharge (m^3/s)	Catchment 102 Discharge (m^3/s)	Total Site Discharge (m^3/s)
2-year	0.015	0.016	0.031
5-year	**0.025**	**0.028**	**0.053**
10-year	0.033	0.037	0.070
25-year	0.044	0.049	0.094
50-year	0.053	0.059	0.112
100-year	0.062	0.068	0.130

2.2 PROPOSED CONDITIONS

It is proposed to develop the site by constructing a 30 to 35-storey mix-use building containing approximately 587 residential units, 791m^2 retail area and 5-levels of underground parking. The proposed site will also include concrete curbing/sidewalk, asphalt drive aisle and landscaped areas. It is proposed to service the site with a private storm sewer system designed and constructed in accordance with the standards and specifications of the City of Burlington, directing all captured stormwater runoff to the Hager Creek. Allocating all stormwater runoff to this location will limit the number of quantity and quality control facilities to one location.

Three (3) catchment areas, Catchments 201, 202 and 203, have been identified in the proposed condition. Refer to Table 2.3 below and the Proposed Condition Drainage Area Plan in Appendix A for details.

Catchment 201 represents the drainage area for the portion of the site which will be captured and controlled prior to discharging to Hager Creek.

Catchment 202 represents the drainage area for the portion of the site which will sheet drain uncontrolled to Hager Creek.

Catchment 203 represents the drainage area for the portion of the site which will sheet drain uncontrolled to the existing south ditch, ultimately discharging to the existing storm sewers along Plains Road East.

Table 2.3 – Proposed Condition Catchment Areas

Catchment ID	Description	Area (ha)	Percent Impervious	Run-off Coefficient
201	Controlled to Hager Creek	0.51	98	0.89
202	Uncontrolled to Hager Creek	0.06	0	0.25
203	Uncontrolled to south ditch	0.23	13	0.33
	Total	**0.80**	**66**	**0.68**

Water Quantity Control

It is proposed to apply quantity control measures to the runoff from Catchment 201 by means of an 75mmø orifice pipe installed on the outlet of MH2, downstream of the SWM tank to restrict discharge from the site to the allowable 5-year pre-development discharge rate.

With the installation of on-site quantity control measures for Catchment 201, it will be required to provide stormwater storage during storm events up to and including the 100-year event. To provide the required storage, a cast in place storage vault within the underground parking structure with approximately 300m^3 of storage will be provided.

The proposed storage vault will be designed with an upper and lower section. The upper section of the vault will drain via gravity to MH2. Once the upper vault storage volume is full, stormwater will spill over the weir, filling up the lower section of the vault which will be equipped with a pump capable of pumping 7l/s. Once the water level drops below the weir elevation, stormwater will be pumped from the lower level of the tank to the upper level until the lower level is empty.

Preliminary details of the proposed storage vault can be found on the Preliminary Grading and Servicing Plans. The stage-storage-discharge characteristics can be seen in Table 2.4 and Appendix A for details.

Table 2.4 – Proposed Condition Stage-Storage-Discharge

Elevation (m)	Storage (m^3)	Discharge (m^3/s)	Comments
96.72	0.0	0.00000	Invert of 75mmø Orifice Pipe
96.76	0.0	0.0008	Bottom of Upper Section
96.95	6.6	0.0069	Top of Weir
90.50	6.6	0.0069	Bottom of Lower Section
92.00	80.9	0.0069	
93.50	155.2	0.0069	
95.00	229.4	0.0069	
96.00	278.9	0.0069	Top of Lower Section
96.95	278.9	0.0069	Top of Weir
97.55	299.9	0.0139	Top of Tank

The maximum discharge rates for Catchment 201 and 202 were calculated using the SWMHYMO hydrologic modelling program developed by J.F. Sabourin & Associates for the 2 to 100-year City of Burlington 6-hour Chicago Design Storms based on the post-development condition runoff coefficients. The proposed discharge rates and storage volumes are summarized in Tables 2.5 and 2.6 respectively, with details found in Appendix A.

Table 2.5 – Proposed Condition Stormwater Discharge

Storm Event	Discharge to Hager Creek				Discharge to MTO Ditch	
	201 (Controlled) (m^3/s)[1]	202 (Uncontrolled) (m^3/s)[1]	Total to Hager Creek (m^3/s)[1]	Allowable to Hager Creek (m^3/s)[2]	203 (Uncontrolled) (m^3/s)[1]	Allowable to Ditch (m^3/s)[2]
2-Year	0.007	0.003	0.010	0.015	0.010	0.016
5-Year	0.007	0.005	0.012	**0.025** [3]	0.018	0.028
10-Year	0.007	0.007	0.013	0.033	0.024	0.037
25-Year	0.007	0.009	0.016	0.044	0.031	0.049
50-Year	0.007	0.010	0.017	0.053	0.037	0.059
100-Year	0.010	0.012	0.019	0.062	0.043	0.068

[1] Based on SWMHYMO Output. Refer to Appendix A for details.
[2] Refer to Table 2.2.
[3] The total discharge to Hager Creek from the proposed site for all storm events (2 to 100-year storm events) does not exceed the 5-year pre-development discharge rate (as per City of Burlington standards).

Table 2.6 – Proposed Condition Storage Volumes

Storm Event	Storage Volume Required (m^3)[1]	Storage Volume Provided (m^3)[2]
2-Year	114.2	299.9
5-Year	158.1	
10-Year	190.4	
25-Year	233.4	
50-Year	266.6	
100-Year	288.5	

[1] Based on SWMHYMO Output. Refer to Appendix A for details.
[2] Refer to Table 2.5.

This analysis determined the following:

- The proposed condition discharge rates to Hager Creek will not exceed the allowable 5-year pre-development flow rate from the site.
- The proposed condition discharge rates to the existing ditch on MTO lands will not exceed the allowable pre-development flow rates from the site.
- Catchment 201 will require 288.5m^3 of stormwater storage during the 100-year event, which can be accommodated within the proposed storage tank, having a volume of 299.9m^3.

Water Quality Control

The proposed development is required to achieve an "Enhanced" (80% TSS removal) level of quality protection. To achieve this criterion, discharge from Catchments 201, 202 and 203 will be subject to a treatment train approach including grassed swales and a Hydrostorm oil/grit separator (or approved equivalent) before ultimately discharging to the existing 300mmø storm sewer within Plains Road East.

The Hydroworks sizing software was used to determine the required size of Hydrostorm unit for the site. It was determined that a Hydrostorm HS8 unit will provide 81% TSS removal and 100% average annual runoff treatment. See Hydrostorm unit sizing procedures in Appendix B.

The City of Burlington allows a maximum credit of 50% TSS removal for oil/grit separators. As such, the HS8 has been designed to achieve an 'Enhanced' (80% TSS removal) level of stormwater quality control, but only credited for 50% TSS removal within the treatment train.

The treatment train has been summarized in Table 2.7. In order to calculate the total TSS removal from the proposed development, the weighted average has been taken.

Table 2.7 – Proposed TSS Removal Rate

Catchment ID	Area (ha)	Treatment Train Features (% TSS Removal)	Total TSS Removal (%) [4]
301	0.15	Hydrostorm HS8 (50%) [1]	50%
302	0.36	Grass/Roof Area (80%) [2] + Hydrostorm HS8 (50%) [1]	90%
303	0.23	Grass Area (80%) [2] + Grassed Swale (60%) [3]	92%
Total	**0.80**	**Total Weighted TSS Removal (%) [5]**	**83%**

[1] The Hydrostorm unit has been designed to achieve 80% TSS removal. As per City of Burlington Standards, the Hydrostorm unit has been credited with 50% TSS removal.
[2] Grass and roof surfaces are considered clean runoff which does not require quality treatment and have been assigned a TSS removal of 80%.
[3] Grassed swales have been assigned a TSS removal of 60%, as per the City of Burlington Standards.
[4] Total TSS removal calculated using the following formula: R=A+B-[(AxB)/100], where R=total TSS removal rate, A=TSS removal rate for first feature, B=TSS removal rate of second feature.

As seen in Table 2.7, the weighted average of TSS removal from the proposed development using the treatment train approach is 83% and therefore meets the 'Enhanced' (80% TSS removal) level of water quality protection.

Hydrostorm units require regular inspection and maintenance as per the manufacturer's specifications to ensure the unit operates properly. See the Hydrostorm Maintenance Manual in Appendix B for details.

2.3 SEDIMENT AND EROSION CONTROL

In order to minimize erosion during the grading and site servicing period of construction, the following measures will be implemented:

- Install silt fencing along the outer boundary of the site to ensure that sediment does not migrate to the adjacent properties;
- Install sediment control (silt sacks) in the nearby existing catchbasins to ensure that no untreated runoff enters the existing conveyance system; and
- Stabilize all disturbed or landscaped areas with hydro seeding/sodding to minimize the opportunity for erosion.

To ensure and document the effectiveness of the erosion and sediment control structures, an appropriate inspection and maintenance program is necessary. The program will include the following activities:

- Inspection of the erosion and sediment controls (e.g. silt fences, sediment traps, outlets, vegetation, etc.) with follow up reports to the governing municipality; and
- The developer and/or his contractor shall be responsible for any costs incurred during the remediation of problem areas.

For details on the proposed erosion and sediment control for the proposed site, see the Preliminary Grading & Erosion Control Plan included in the engineering drawings.

2.4 FLOOD PLAIN CONTROL

The Halton Region Conservation Authority (HRCA) requires all door sill elevations to be a minimum of 0.15m above the flood plain elevations for the 100-year and Regional Storm Events. A Floodplain Analysis was conducted by S. Llewellyn and Associates, dated March 23, 2021. It was concluded that the Regional Storm Event governed through Phase 1, with a maximum floodplain elevation of 97.83m when considering upstream stormwater management controls. The minimum door sill elevation proposed through Phase 1 is 98.10m, which is 0.27m above the floodplain elevation. Therefore, the grading design adheres to the HRCA requirements. The Floodplain Analysis was submitted to the HRCA for review and commentary. For additional information, see the Preliminary Grading & Erosion Control Plain included in the engineering drawings and the Floodplain Analysis included in Appendix D.

3.0 SANITARY SEWER SERVICING

3.1 EXSTING CONDITIONS

The site is located on Plains Road East, north of Fairview Street with an existing 300mmø sanitary sewer located along Plains Road East flowing south which services the existing building on site.

3.2 SANITARY DEMAND

The proposed development consists of constructing a 30 to 35-storey mixed-use building containing 587 residential units and 791m^2 of commercial floor area. Wastewater generation for the site was calculated based on Tables 3-1 Residential Dry Weather Flow and 3-2 Commercial, Industrial, and Community Dry Weather Flow of the 2019 Regional Municipality of Halton Water and Wastewater Linear Design Manual.

Table 3.1 summarizes the population and Table 3.2 summarizes the sanitary sewer discharge rates from the proposed site.

Table 3.1 – Proposed Population

Occupancy Type	No. of Beds [A]	Gross Floor Area (m^2) [A]	Population Density [B]	Population
Residential	854	---	2 per/bed	1,708
Commercial	---	791	3.7m^2/per	214
			Total Population [C]:	**1,922**

[A] Information from site plan prepared by Graziana & Corazza Architects Inc., dated April 13, 2021.
[B] Residential population density per OBC 3.1.17.1.1(b); commercial population density as per OBC Table 3.1.13.1 (5).
[C] Total population = Residential Population + Commercial Population

Table 3.2 – Proposed Sanitary Sewer Discharge

Site Area (ha)	Population [A]	Avg. Demand [B] (l/s)	Peak Factor [C]	Infiltration [D] (l/s)	Peak Flow [E] (l/s)
0.80	1,922	6.12	3.60	0.23	**22.25**

[A] From Table 3.1.
[B] Based on a unit sewage flow of 0.275m^3pcd (as per Table 3-1 of the Regional Municipality of Halton Water and Wastewater Linear Design Manual).
[C] Based on the modified Harmon Formula (as per section 3.2.3 of the Regional Municipality of Halton Water and Wastewater Linear Design Manual).
Peak Factor, $M = 1 + [14 / (4+P^{0.5})]$, where P is in thousands
[D] Based on an infiltration rate of 0.286 l/ha/s (as per Section 3.2.4 of the Regional Municipality of Halton Water and Wastewater Linear Design Manual).
[E] Peak Flow = (Avg. Demand x Peak Factor) + Infiltration

Based on the above, the estimate of sanitary demand for the mixed-use buildings is:

22.25 l/s

3.3 PROPOSED SANITARY SERVICING AND CAPACITY ANALYSIS

The proposed mixed-use building will be serviced by a 200mmø sanitary sewer off of a proposed sanitary municipal sewer extension, designed and constructed in accordance with the Region of Halton standards and to be submitted and approved by MECP. Drainage from this sewer will discharge to the existing 300mmø sanitary sewer along Plains Road East located south of the development.

The minimum grade of the proposed 200mmø sanitary sewer will be 1.0%. At this minimum grade, the proposed sanitary sewer will have a capacity of 0.033 m^3/s (33 l/s). Therefore, the proposed 200mmø sanitary sewer at 1.0% grade is adequately sized to service the proposed development.

4.0 DOMESTIC AND FIRE WATER SUPPLY SERVICING

4.1 EXISTING CONDITIONS

The existing municipal water distribution system consists of a 400mmø watermain located on Plains Road East which extends west to the western property line of the site and south to Fairview Street. Existing fire hydrants are located within the boulevard in front of 1184 Plains Road East and at 1133 Plains Road East, within the existing west parking lot area.

4.2 DOMESTIC WATER DEMAND

The following is an estimate of the water usage for the proposed building. Water usage for the site was calculated based on the "Fixture Unit Method" as per Table 7.6.3.2.A. forming part of sentences 7.6.3.1(1) to (3) and 7.6.3.4.(2), (3) and (5) of the 2012 Ontario Building Code. See Table 4.1 for fixture unit (FU) calculations.

Table 4.1 – Domestic Water Demand

Component	No. of Fixtures	FU/ Fixture	Total FU
Lavatory (8.3L/min or less per head) (Private)[1]	614	0.7	429.8
Shower Head (9.5L/min or less per head) (Private)[1]	614	1.4	859.6
Water Closet (6 LPF or less with flush tank) (Private)[1]	614	2.2	1,350.8
Sink (kitchen, domestic, 8.3 L/min or less) (public)[2,3]	588	4	2,352
Dishwasher (domestic)[2,3]	588	1.4	823.2
Clothes Washer (3.5 kg) (private)[2]	587	1.4	821.8
Mop Sink[4]	5	3	15
		Total FU:	**6,652.2**
		Water Usage (l/s):	**49.4**

[1] Each 1-bed,1-bed+den, and 2-bed unit was assumed to have 1 full bathroom and each 3-bed unit was assumed to have 2 full bathrooms
[2] Each unit was assumed to have one kitchen with dishwasher and one washing machine
[3] The building was assumed to have one common room that includes a kitchen with dishwasher
[4] The building was assumed to have one mop sink per parking level

Total peak water usage for the site was derived below from the fixture unit count as per Table 7.4.10.5 of the Ontario Building Code.

Total Fixture Unit Count = 6,652.2 FU

Water Usage: 652 IGPM (49.4 l/s)

4.3 FIRE FLOW DEMAND

Fire flow demands for development are governed by a number of guidelines and criteria, such as the Water Supply for Public Fire Protection (Fire Underwriters Survey, 1999), the Ontario Building Code (OBC), and various codes and standards published by the National Fire Protection Association (NFPA). Since FUS criteria provides adjustments for sprinklered buildings (OBC does not), the FUS method was used to determine the fire flow demand for the proposed development.

The proposed development consists of constructing a 30 to 35-storey mix-use building. Existing hydrants are located along Plains Road East; however, they are not within 90m separation to the building face of the proposed building (per Sentence 3.2.5.7 of the Ontario Building Code). Therefore, a municipal hydrant has been proposed within the Plains Road East boulevard adjacent to the site.

The proposed building is fire-resistive construction (C=0.6), with limited combustible occupancy (-15% correction) and a fully supervised sprinkler system (-50% correction). Exposure components are based on the following:

North Face: 30.1 to 45m (5% correction) for both towers
South Face: >45m (0% correction) for both towers
East Face: 20.1 to 30m (10% correction) for both towers
West Face: >45m (0% correction) for the 35-storey tower and 20.1 to 30m (10% correction for the 30-storey tower)

It is estimated that the required fire flow for the proposed development will be **100 l/s** (worst case scenario between the two towers). See the Fire Flow Demand Requirements in Appendix C for details.

A hydrant flow test was performed by Aquacom Contracting on the private fire hydrant located at 1133 Plains Road East to determine the performance of the existing water distribution system. The following hydrant flow test data has been analyzed to determine if the municipal system adjacent to the site is adequate to provide the required fire flow, with a minimum pressure of 20 psi. Table 4.2 summarizes the hydrant flow data, provided by Jackson Waterworks.

Table 4.2 – Hydrant Flow Test Data

Hydrant ID	HA30H033
Location	1133 Plains Road East
Static Pressure	51 psi
Residual Pressure During Test Flow	46 psi
Test Flow Rate	1,602 USGPM (101.07 l/s)
Theoretical Flow @ 20 psi	**4,291 USGPM (270 l/s)**

Based on the above hydrant flow test data, the theoretical maximum available flow rate from the hydrant is **270 l/s**, while the maximum required fire flow for the proposed development is only **100 l/s**. Therefore, the water distribution system has adequate pressure and capacity to service the subject site.

4.4 PROPOSED WATER SERVICING AND ANALYSIS

Proposed water servicing for the site consists of connecting a 150mmø water service off of the existing 400mmø watermain adjacent to the site on Plains Road East. The proposed 150mmø water service will provide domestic and fire water service for the proposed mix-use building. Water services for the site are to be designed and constructed in accordance with City of Burlington and Region of Halton standards.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the information provided herein, it is concluded that the proposed development at Plains Road East can be constructed to meet the requirements of the City of Burlington and Region of Halton. Therefore, it is recommended that:

- The development be graded and serviced in accordance with the Preliminary Grading & Erosion Control Plan and the Preliminary Site Servicing Plan prepared by S. Llewellyn & Associates Limited;

- A 75mmø orifice pipe be installed as per the Preliminary Site Servicing Plan and this report to provide adequate quantity control;
- An underground storage vault be incorporated into the underground parking garage as per the Preliminary Site Servicing Plan and this report to provide effective stormwater storage during storm events;
- Short-term dewatering will be required at a discharge rate of 0.8 l/s and will need to be filtered prior to discharging to the existing storm sewer system;
- Erosion and sediment controls be installed as described in this report to meet City of Burlington requirements;
- All door sill elevations are a minimum of 0.15m above the Regional Floodplain; and
- The proposed sanitary and water servicing system be installed as per the Preliminary Site Servicing Plan and this report to adequately service the proposed development.

We trust the information enclosed herein is satisfactory. Should you have any questions please do not hesitate to contact our office.

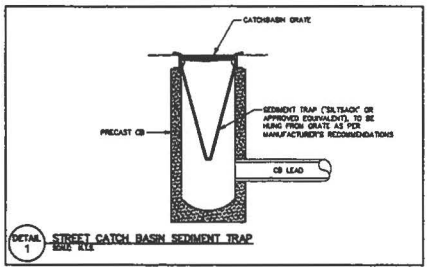
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S. LLEWELLYN & ASSOCIATES LIMITED

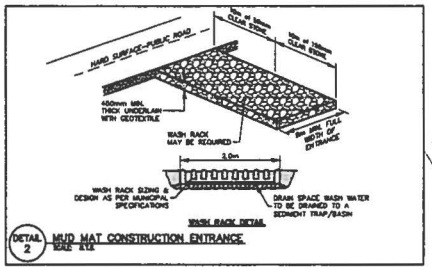
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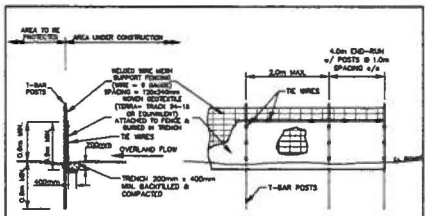
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PRELIMINARY GRADING AND EROSION CONTROL PLAN (PHASE 1 OF 2)



DETAIL 1 STREET CATCH BASIN SEDIMENT TRAP
SCALE N.T.S.



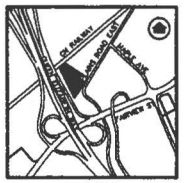
DETAIL 2 MUD MAT CONSTRUCTION ENTRANCE
SCALE N.T.S.



DETAIL 3 HEAVY-DUTY SILT FENCE (PER OPSD 219.130)
SCALE N.T.S.

LEGEND:

- EXISTING GROUND ELEVATION
- x(100.00) PROPOSED GROUND ELEVATION
- x(100.00)EX PROPOSED ELEVATION TO MATCH EXISTING
- x(100.00)SW PROPOSED SWALE ELEVATION
- x(100.00)TW PROPOSED TOP OF WALL ELEVATION
- x(100.00)BW PROPOSED BOTTOM OF WALL ELEVATION
- PROPOSED DIRECTION OF SHEET FLOW
- EXISTING CATCHBASIN
- EXISTING STORM/SANITARY MANHOLE
- PROPOSED DOUBLE AREA DRAIN
- PROPOSED AREA DRAIN
- PROPOSED STORM/SANITARY MANHOLE
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED SILTATION CONTROL FENCE
- PROPOSED CATCHBASIN SILT SACK
- PROPOSED MUD MAT (CONSTRUCTION ACCESS)
- EMERGENCY OVERLAND FLOW ROUTE
- PROPOSED CURB STOP/GATE VALVE
- PROPOSED DRAINAGE BREAK LINE



KEY MAP
N.T.S.



BENCH MARK NOTE:
CITY OF BURLINGTON BM NO. 44:
MAPLEHURST SCHOOL, 483 PLAINS ROAD EAST (HIGHWAY NO. 2) 1.62 km NORTHEAST OF WATERDOWN ROAD; TABLET IN THE FRONT OF SOUTHEAST CONCRETE FOUNDATION WALL, 1.2m SOUTHWEST OF THE MOST EASTERLY OF TWO ENTRANCES, 0.1m BELOW RED BRICK SIGNS. NO. 3488.
ELEVATION 98.754 METRES

NO.	DATE	BY	REVISIONS

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DRAWN	AP	CHK'D	SF	AUG. 20, 2020

SCALE 1:300 (0, 5, 10, 15, 20)

APPROVALS

STAMP

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CONSULTING ENGINEERS
Tel. (905) 639-8070
3026 South Service Road, Suite 200 East Wing, Burlington, Ont., L7N 3H8

CLIENT
THE MOLINARO GROUP
472 BROCK AVENUE, UNIT 103
BURLINGTON, ONTARIO

PROJECT NAME
PLAINS ROAD
1167 PLAINS ROAD EAST, BURLINGTON

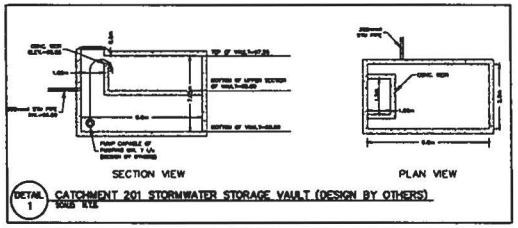
TITLE
PRELIMINARY GRADING AND EROSION CONTROL PLAN (PHASE 1 OF 2)

PROJECT No. 20071
DRAWING No. C101

S:\2007\Working\Current\20071 - Grading and Servicing.dwg
Plotted: May 7, 2021 4:10:26 PM By: Alexandra Perez

DWG No.: 20071-C102

PRELIMINARY SITE SERVICING PLAN (PHASE 1 OF 2)



DETAIL 1 CATCHMENT 201 STORMWATER STORAGE VAULT (DESIGN BY OTHERS)

KEY MAP

LEGEND:
- EXISTING CATCHBASIN
- EXISTING STORM/SANITARY MANHOLE
- PROPOSED DOUBLE AREA DRAIN
- PROPOSED AREA DRAIN
- PROPOSED STORM/SANITARY MANHOLE
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED CURB STOP/GATE VALVE
- PROPOSED WATER METER
- PROPOSED BACKFLOW PREVENTOR
- PROPOSED HYDRANT

BENCH MARK NOTE:

NO. | DATE | BY | REVISIONS

NOTES TO CONTRACTOR:

DESIGN	AP	CHK'D	SF
DRAWN	AP	CHK'D	SF

DATE: AUG. 20, 2020

SCALE: 1:300

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472 BROCK AVENUE, UNIT 103
BURLINGTON, ONTARIO

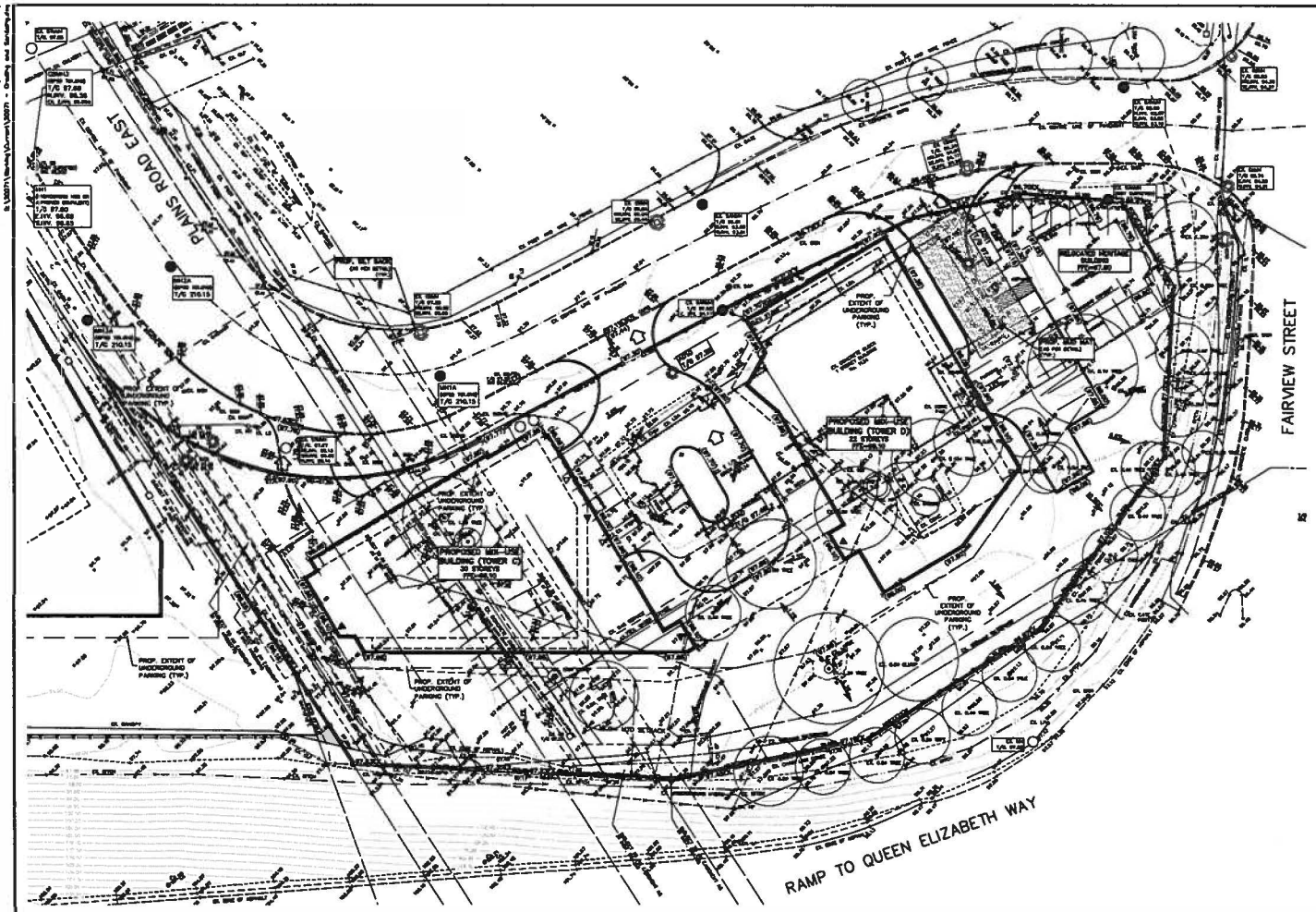
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PLAINS ROAD
1167 PLAINS ROAD EAST, BURLINGTON

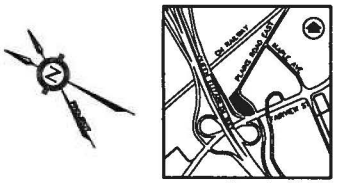
TITLE
PRELIMINARY SITE SERVICING PLAN (PHASE 1 OF 2)

PROJECT No. 20071 | DRAWING No. C102

DWG No.: 20071-C103

PRELIMINARY GRADING AND EROSION CONTROL PLAN (PHASE 2 OF 2)





LEGEND:

- EXISTING GROUND ELEVATION
- PROPOSED GROUND ELEVATION
- PROPOSED ELEVATION TO MATCH EXISTING
- PROPOSED SWALE ELEVATION
- PROPOSED DIRECTION OF SHEET FLOW
- EXISTING CATCHBASIN
- EXISTING STORM/SANITARY MANHOLE
- PROPOSED DOUBLE AREA DRAIN
- PROPOSED AREA DRAIN
- PROPOSED STORM/SANITARY MANHOLE
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED SILTATION CONTROL FENCE
- PROPOSED CATCHBASIN SILT SACK
- PROPOSED MUD MAT (CONSTRUCTION ACCESS)
- EMERGENCY OVERLAND FLOW ROUTE
- PROPOSED CURB STOP/GATE VALVE
- PROPOSED DRAINAGE BREAK LINE

BENCH MARK NOTE:
CITY OF BURLINGTON BM NO. 548
MAPLEHURST SCHOOL, 484 PLAINS ROAD EAST (BENCHMARK NO. 23 1.465 km NORTHEAST OF WATERDOWN ROAD), TABLET IN THE FRONT OF SOUTHEAST CONCRETE FOUNDATION WALL, 1.2m SOUTHWEST OF THE MOST EASTERLY OF TWO ENTRANCES, 0.1m BELOW RED BRICK SIGNAL NO. 3488.
ELEVATION: 68.576m METRES

NO.	DATE	BY	REVISIONS

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DRAWN	AP	CHK'D	SF	

SCALE: 1:300

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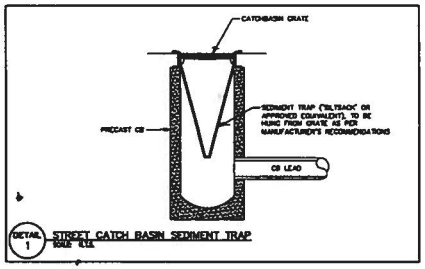
S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS
TEL. (905) 634-4779
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EMAIL: slla@sllewellyn.com
3228 South Service Road, Suite 200 East Wing, Burlington, Ont., L7N 3H8

CLIENT:
THE MOLINARO GROUP
472 BROCK AVENUE, UNIT 103
BURLINGTON, ONTARIO

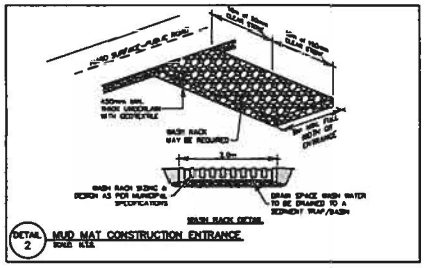
PROJECT NAME:
PLAINS ROAD
1134 PLAINS ROAD EAST, BURLINGTON

TITLE:
PRELIMINARY GRADING AND EROSION CONTROL PLAN (PHASE 2 OF 2)

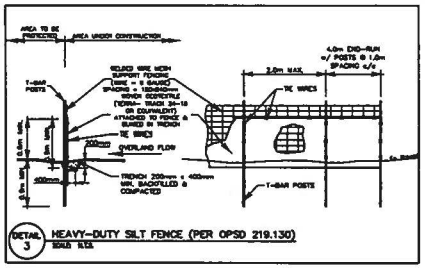
PROJECT No.: 20071
DRAWING No.: C103



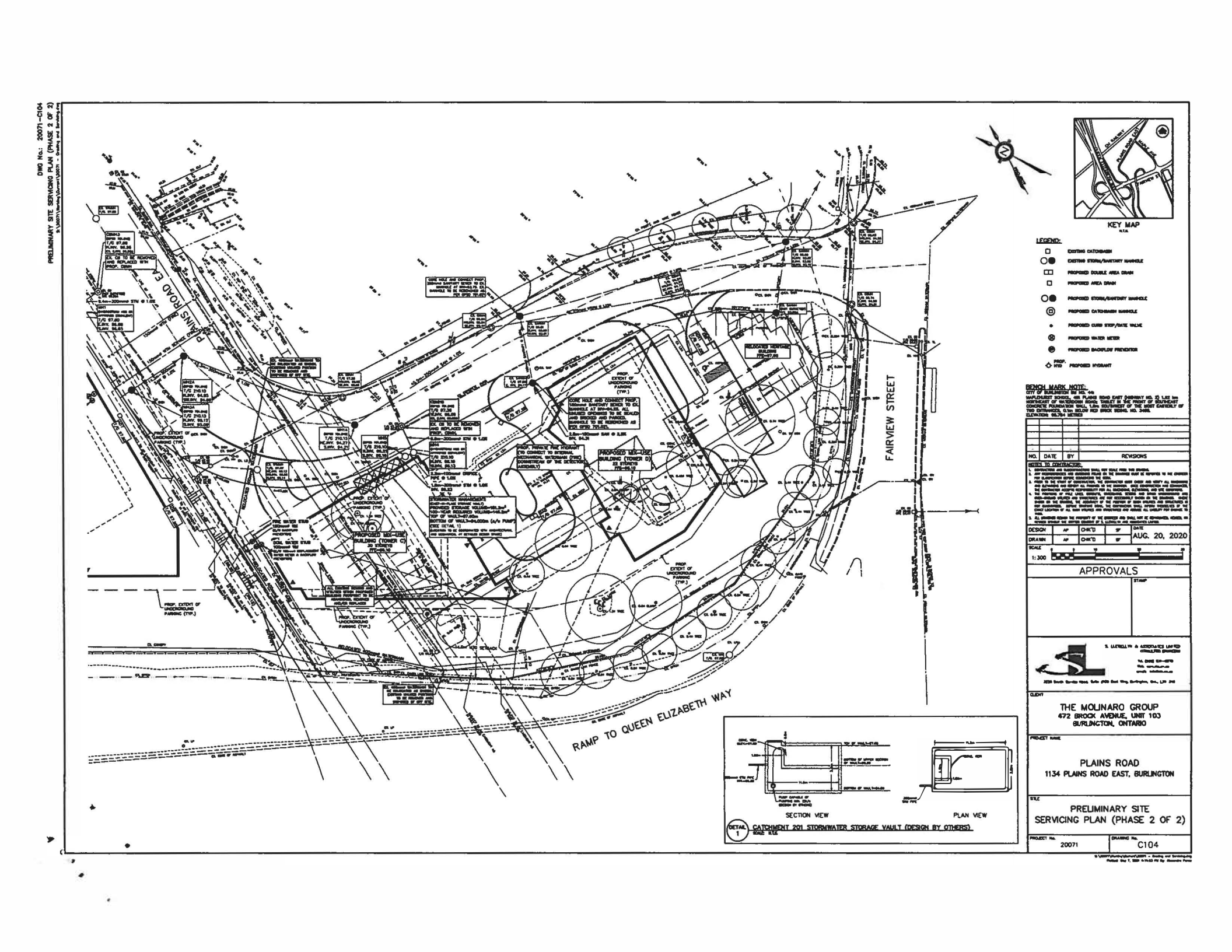
DETAIL 1 — STREET CATCH BASIN SEDIMENT TRAP
SCALE: N.T.S.



DETAIL 2 — MUD MAT CONSTRUCTION ENTRANCE
SCALE: N.T.S.



DETAIL 3 — HEAVY-DUTY SILT FENCE (PER OPSD 219.130)
SCALE: N.T.S.


PLAINS ROAD EAST
FAIRVIEW STREET
RAMP TO QUEEN ELIZABETH WAY
PROP. EXTENT OF UNDERGROUND PARKING (TYP.)
PROPOSED MIX-USE BUILDING (TOWER C) 30 STOREYS
PROPOSED MIX-USE BUILDING (TOWER D) 22 STOREYS
RELOCATED HERITAGE BUILDING
STORMWATER MANAGEMENT
CORE HOLE AND CONNECT PROP. 250mm∅ SANITARY SEWER TO EX. MANHOLE AT SAN=93.73, EX. MANHOLE TO BE REMOVED AND REPLACED WITH PROP. CB/MH
PROP. PRIVATE FIRE HYDRANT TO CONNECT TO INTERNAL WATERMAIN (TYP.) DOWNSTREAM OF THE DETECTOR ASSEMBLY)
FIRE WATER STUB
DUAL WATER STUB
SECTION VIEW
PLAN VIEW
DETAIL 1
CATCHMENT 201 STORMWATER STORAGE VAULT (DESIGN BY OTHERS)
SCALE 1:100
KEY MAP
N.T.S.
LEGEND:
EXISTING CATCHBASIN
EXISTING STORM/SANITARY MANHOLE
PROPOSED DOUBLE AREA DRAIN
PROPOSED AREA DRAIN
PROPOSED STORM/SANITARY MANHOLE
PROPOSED CATCHBASIN MANHOLE
PROPOSED CURB STOP/GATE VALVE
PROPOSED WATER METER
PROPOSED BACKFLOW PREVENTER
PROPOSED HYDRANT
BENCH MARK NOTE:
CITY OF BURLINGTON BM NO. 44
MAPLECREST SCHOOL, 455 PLAINS ROAD EAST (ARMOURY NO. 2) 1.6± km NORTHEAST OF WATERDOWN ROAD; TABLET IN THE FRONT OF SOUTHEAST CONCRETE POLISHING WALL 1.5m SOUTHWEST OF THE MOST EASTERLY OF TWO ENTRANCES, 0.1m BELOW RED BRICK SIGNAL NO. 3488.
ELEVATION 98.764 METRES
NO. DATE BY REVISIONS
NOTES TO CONTRACTOR:
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2. ANY DISCREPANCIES OR EXISTING FIELD CONDITIONS DIFFERING FROM THOSE SHOWN ON THE DRAWINGS SHALL BE REPORTED TO THE ENGINEER PRIOR TO COMMENCEMENT OF WORK.
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4. THE POSITIONS OF PUBLIC UTILITIES, STRUCTURES, SEWERS AND OTHER UNDERGROUND AND OVERHEAD SERVICES INDICATED ARE APPROXIMATE ONLY AND NOT NECESSARILY EXACT OR ALL INCLUSIVE. THE CONTRACTOR SHALL NOT SUCCESSFULLY ENTER OR TO EXCAVATE WITHOUT FIRST LOCATING ALL SUCH UTILITIES AND STRUCTURES AND SHALL BE RESPONSIBLE FOR ANY DAMAGE TO SAME. THE CONTRACTOR SHALL EXPOSE SUCH UTILITIES AND STRUCTURES IN ADVANCE OF EXCAVATION AND SHALL BE RESPONSIBLE FOR THE PROTECTION OF SAME. THE CONTRACTOR SHALL NOTIFY ENGINEERING IF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES ARE UNABLE TO BE LOCATED.
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DRAWN AP CHK'D SF
SCALE 1:300
APPROVALS
STAMP
S. LLEWELLYN & ASSOCIATES LIMITED CONSULTING ENGINEERS
CLIENT
THE MOLINARO GROUP
472 BROCK AVENUE, UNIT 103
BURLINGTON, ONTARIO
PROJECT NAME
PLAINS ROAD
1134 PLAINS ROAD EAST, BURLINGTON
TITLE
PRELIMINARY SITE SERVICING PLAN (PHASE 2 OF 2)
PROJECT No. 20071
DRAWING No. C104
DWG No.: 20071-C104
PRELIMINARY SITE SERVICING PLAN (PHASE 2 OF 2)

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Functional Servicing Report

1134 PLAINS ROAD EAST

PROPOSED MIX-USE BUILDING

(PHASE 2 OF 2)

CITY OF BURLINGTON

MAY 2021

SLA File: 20071

3228 South Service Road, Suite 105, East Wing Burlington, Ontario L7N 3H8
Tel. (905) 631-6978 www.sla.on.ca

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APPENDICIES

Appendix A – Stormwater Management Information ..... Encl.
Appendix B – Quality Control Information ..... Encl.
Appendix C – Water Analysis Information ..... Encl.
Appendix D – Floodplain Analysis ..... Encl.
Appendix E – Hydrogeological Investigation ..... Encl.

1.0 INTRODUCTION AND BACKGROUND

1.1 OVERVIEW

S. Llewellyn & Associates Limited has been retained by Molinaro Group to provide consulting engineering services for the proposed development located at 1134 Plains Road East in the City of Burlington (see Figure 1.0 for location plan). This report will outline the functional servicing strategy for Phase 2 of the proposed development.

Phase 2 of the proposed development consists of constructing a 22 to 30-storey mixed-use building containing approximately 462 residential units, 207m^2 retail area, and 5 levels of underground parking. The proposed site will also include concrete curbing/sidewalk, asphalt drive aisle and landscaped areas. The existing heritage house will be relocated within Phase 2 of the development.

This Functional Servicing Report will provide detailed information of the proposed servicing scheme for this development. Please refer to the site engineering plans prepared by S. Llewellyn and Associates Limited and the site plan prepared by Graziani and Corazza Architects Inc. for additional information.

1.2 BACKGROUND INFORMATION

The following documents were referenced in the preparation of this report:

Ref. 1: MOE Stormwater Management Planning and Design Manual (Ministry of Environment, March 2003)

Ref. 2: Erosion & Sediment Control Guidelines for Urban Construction (December 2006)

Ref. 3: Low Impact Development Stormwater Management Planning and Design Guide (Toronto and Region Conservation Authority & Credit Valley Conservation, 2010)

Ref. 4: Water and Wastewater Linear Design Manual (Regional Municipality of Halton, October 2019)

Ref. 5: Stormwater Management Design Guidelines (City of Burlington, May 2020)



Figure 1.0 - Location Plan

1.3 HYDROGEOLOGICAL INVESTIGATION

A hydrogeological investigation was prepared by Landtek Limited dated April 21, 2021. Six (6) boreholes were drilled between August 22 and September 8, 2020 to approximate depths ranging between 21.5m and 23.5m below grade. Topsoil and fill were encountered ranging in thickness from 0.15m to 4.0m below grade. Native soils of silty sand and silty clay were found underlaying the fill soils. Shale bedrock was encountered below the silty clay layer in all boreholes at depths ranging from 10.7m to 14.0m below grade.

Groundwater was encountered at depths between 4.20m and 4.96m below grade (elevations of 93.23m to 92.38m). Temporary construction dewatering will be required and the dewatering flow rate outside periods of active precipitation is approximately 75,362 l/day (0.87 l/s) (FS 1.3) which is less than the 5-year allowable discharge rate of 136 l/s (see Table 2.2 of this report). A permit to take water (PTTW) is required for this volume of water taking, as the estimated discharge rate is more than 50,000 l/s. Long-term dewatering will not be required for the site, as the developer has proposed to waterproof the below grade structure to prevent inflow of groundwater into the subsurface parking structures and foundation.

The groundwater quality was analysed and found that the levels of total manganese exceed the City of Burlington Municipal Storm Sewer Discharge Limits Guidelines. Based on these results, pre-treatment of the groundwater will be required prior to discharging to the storm sewer system.

Groundwater levels are continued to being monitored to determine the seasonal high groundwater level and the report will be updated upon completion of the groundwater monitoring program. For additional information, refer to the hydrogeological investigation in Appendix E.

2.0 STORMWATER MANAGEMENT

The following stormwater management (SWM) criteria will be applied to the site, in accordance with the City of Burlington requirements:

Quantity Control

The City of Burlington requires the stormwater discharge rate from the proposed site to be controlled to the 5-year pre-development conditions discharge rate for all storm events (2 to 100-year storm events). The MTO requires the stormwater discharge rate from the proposed site to be controlled to the pre-development conditions discharge rate for all storm events (2 to 100-year storm events).

Quality Control

The stormwater runoff from the proposed site must meet Level 1 (Enhanced) stormwater quality control (80% TSS removal, 90% average annual runoff treatment).

Erosion Control

Erosion and sediment control measures will be implemented in accordance with the standards of the City of Burlington.

Flood Plain Control

All door sill elevations to be a minimum of 0.15m above the worst-case flood plain analysis elevation for 100-year and Regional Storm Events.

2.1 EXISTING CONDITIONS

In the existing conditions, the approximate 0.76ha site consists of a commercial building and addition with associated driveways, parking lots and landscaped areas. The site is bound by Plains Road East north, Fairview Street to the east, Queen Elizabeth Way to the south, and Phase 1 lands to the west. An existing 375mmø storm sewer is located adjacent to the property, along Plains Road East flowing east.

The topography of the existing site generally slopes from west to east with the majority of the site sheet draining to the existing ditch to the south, while the remainder of the site sheet drains towards Plains Road East, ultimately discharging to exiting storm sewers on Plains Road East. All drainage is collected by existing catchbasins and ditch inlet catchbasins within the right-of-ways where it is directed to the existing 375mmø and 400mmø storm sewers along Plains Road East.

One (1) catchment area, Catchments 101, has been identified in the existing condition. See Table 2.1 and the Pre-Development Storm Drainage Area Plan in Appendix A for details.

Catchment 101 represents the existing conditions discharge from Phase 2 of the subject site draining towards the existing storm sewers on Plains Road East.

Table 2.1 – Existing Conditions Catchment Areas

Catchment ID	Description	Area (ha)	% Impervious	Runoff Coefficient (C)
101	Drainage from Phase 2 of the subject lands towards Plains Road East	0.76	51	0.58

An analysis was performed on Catchments 101, 102 and 103 using the SWMHYMO hydrologic modelling program developed by J.F. Sabourin & Associates for the 2 to 100-year City of Burlington 6-hour Chicago Design Storms. A summary of the results can be found in Table 2.2 below and the detailed SWMHYMO input/output information in Appendix A.

Table 2.2 – Existing Conditions Stormwater Discharge

Discharge, Q (m^3/s)	Storm Event					
	2-year	5-year	10-year	25-year	50-year	100-year
Catchment 101	0.097	**0.136**	0.165	0.200	0.227	0.254

2.2 PROPOSED CONDITIONS

It is proposed to develop the site by constructing a 22 to 30-storey mix-use building containing approximately 462 residential units, 207m^2 retail area and 5-levels of underground parking. The proposed site will also include concrete curbing/sidewalk, asphalt drive aisle and landscaped areas. It is proposed to service the site with a private storm sewer system designed and constructed in accordance with the standards and specifications of the City of Burlington, directing all captured stormwater runoff to the 375mmø storm sewer located within Plains Road East. Allocating all stormwater runoff to this location will limit the number of quantity and quality control facilities to one location.

Two (2) catchment areas, Catchment 201 and 202, have been identified in the proposed condition. Refer to Table 2.3 below and the Proposed Condition Drainage Area Plan in Appendix A for details.

Catchment 201 represents the drainage area for the portion of the site which will be captured and controlled by the proposed stormwater management tank which will ultimately discharge to the existing 375mmø storm sewer along Plains Road East.

Catchment 202 represents the drainage area for the portion of the site which will sheet drain uncontrolled to Plains Road East, ultimately discharging to the existing storm sewers along Plains Road East.

Table 2.3 – Proposed Condition Catchment Areas

Catchment ID	Description	Area (ha)	Percent Impervious	Run-off Coefficient
201	Controlled to Plains Road East	0.42	95	0.87
202	Uncontrolled to Plains Road East	0.34	21	0.39
	Total	**0.76**	**62**	**0.65**

Water Quantity Control

It is proposed to apply quantity control measures to the runoff from Catchment 201 by means of a 100mmø orifice pipe installed on the outlet of MH5, downstream of the SWM tank to restrict discharge from the site to the allowable 5-year pre-development discharge rate.

With the installation of on-site quantity control measures for Catchment 201, it will be required to provide stormwater storage during storm events up to and including the 100-year event. To

provide the required storage, a cast in place storage vault within the underground parking structure with approximately 151m³ of storage will be provided.

The proposed storage vault will be designed with an upper and lower section. The upper section of the vault will drain via gravity to MH5. Once the upper vault storage volume is full, stormwater will spill over the weir, filling up the lower section of the vault which will be equipped with a pump capable of pumping 25l/s. Once the water level drops below the weir elevation, stormwater will be pumped from the lower level of the tank to the upper level until the lower level is empty.

Preliminary details of the proposed storage vault can be found on the Preliminary Grading and Servicing Plans. The stage-storage-discharge characteristics can be seen in Table 2.4 and Appendix A for details.

Table 2.4 – Proposed Condition Stage-Storage-Discharge

Elevation (m)	Storage (m^3)	Discharge (m^3/s)	Comments
96.15	0.0	0.0000	Invert of 150mmø Orifice Pipe
96.20	0.0	0.0000	Bottom of Upper Section
96.60	16.8	0.0176	
97.00	33.6	0.0249	Top of Weir
94.00	33.6	0.0249	Bottom of Lower Section
94.50	54.6	0.0249	
95.00	75.6	0.0249	
95.50	96.6	0.0249	
96.20	126.0	0.0249	Top of Lower Section
97.00	126.0	0.0249	Top of Weir
97.60	151.2	0.0329	Top of Tank

The maximum discharge rates for Catchment 201 and 202 were calculated using the SWMHYMO hydrologic modelling program developed by J.F. Sabourin & Associates for the 2 to 100-year City of Burlington 6-hour Chicago Design Storms based on the post-development condition runoff coefficients. The proposed discharge rates and storage volumes are summarized in Table 2.5, with details found in Appendix A.

Table 2.5 – Proposed Condition Stormwater Discharge and Storage Volumes

Storm Event	201 (Controlled) (m^3/s)[1]	202 (Uncontrolled) (m^3/s)[1]	Total Discharge (m^3/s)[1]	Existing Discharge (m^3/s)[2]	Required Storage (m^3)[1]	Storage Provided (m^3)[3]
2-Year	0.025	0.028	0.053	0.097	54.6	151.2
5-Year	0.025	0.045	0.070	**0.136** [4]	77.2	
10-Year	0.025	0.057	0.082	0.165	93.4	
25-Year	0.025	0.073	0.098	0.200	115.8	
50-Year	0.027	0.087	0.112	0.227	132.1	
100-Year	0.031	0.099	0.124	0.254	145.2	

[1] Based on SWMHYMO Output. Refer to Appendix A for details.
[2] Refer to Table 2.2.
[3] Refer to Table 2.4.
[4] The total discharge from the proposed site for all storm events (2 to 100-year storm events) does not exceed the 5-year pre-development discharge rate (as per City of Burlington standards).

This analysis determined the following:

- The proposed condition discharge rates will not exceed the allowable 5-year pre-development flow rate from the site.
- Catchment 201 will require 145.2m^3 of stormwater storage during the 100-year event, which can be accommodated within the proposed storage tank, having a volume of 151.2m^3.

Water Quality Control

The proposed development is required to achieve an "Enhanced" (80% TSS removal) level of quality protection. To achieve this criterion, discharge from Catchments 201 and 202 will be subject to a treatment train approach including grassed swales and a Hydrostorm oil/grit separator (or approved equivalent) before ultimately discharging to the existing 375mm ø storm sewer within Plains Road East.

The Hydroworks sizing software was used to determine the required size of Hydrostorm unit for the site. It was determined that a Hydrostorm HS8 will provide 83% TSS removal and 100% average annual runoff treatment. See Hydrostorm unit sizing procedures in Appendix B.

The City of Burlington allows a maximum credit of 50% TSS removal for oil/grit separators. As such, the HS8 has been designed to achieve an 'Enhanced' (80% TSS removal) level of stormwater quality control, but only credited for 50% TSS removal within the treatment train.

The treatment train has been summarized in Table 2.6. In order to calculate the total TSS removal from the proposed development, the weighted average has been taken.

Table 2.6 – Proposed TSS Removal Rate

Catchment ID	Area (ha)	Treatment Train Features (% TSS Removal)	Total TSS Removal (%) [4]
301	0.16	Hydrostorm HS8 (50%) [1]	50%
302	0.26	Grass/Roof Area (80%) [2] + Hydrostorm HS8 (50%) [1]	90%
303	0.29	Grass Area (80%) [2] + Grassed Swale (60%) [3]	92%
304	0.05	Grass Area (80%) [2]	80%
Total	**0.76**	**Total Weighted TSS Removal (%) [5]**	**82%**

[1] The Hydrostorm unit has been designed to achieve 80% TSS removal. As per City of Burlington Standards, the Hydrostorm unit has been credited with 50% TSS removal.
[2] Grass and roof surfaces are considered clean runoff which does not require quality treatment and have been assigned a TSS removal of 80%.
[3] Grassed swales have been assigned a TSS removal of 60%, as per the City of Burlington Standards.
[4] Total TSS removal calculated using the following formula: R=A+B-[(AxB)/100], where R=total TSS removal rate, A=TSS removal rate for first feature, B=TSS removal rate of second feature.

As seen in Table 2.7, the weighted average of TSS removal from the proposed development using the treatment train approach is 82% and therefore meets the 'Enhanced' (80% TSS removal) level of water quality protection.

Hydrostorm units require regular inspection and maintenance as per the manufacturer's specifications to ensure the unit operates properly. See the Hydrostorm Maintenance Manual in Appendix B for details.

2.3 SEDIMENT AND EROSION CONTROL

In order to minimize erosion during the grading and site servicing period of construction, the following measures will be implemented:

- Install silt fencing along the outer boundary of the site to ensure that sediment does not migrate to the adjacent properties;
- Install sediment control (silt sacks) in the nearby existing catchbasins to ensure that no untreated runoff enters the existing conveyance system; and
- Stabilize all disturbed or landscaped areas with hydro seeding/sodding to minimize the opportunity for erosion.

To ensure and document the effectiveness of the erosion and sediment control structures, an appropriate inspection and maintenance program is necessary. The program will include the following activities:

- Inspection of the erosion and sediment controls (e.g. silt fences, sediment traps, outlets, vegetation, etc.) with follow up reports to the governing municipality; and
- The developer and/or his contractor shall be responsible for any costs incurred during the remediation of problem areas.

For details on the proposed erosion and sediment control for the proposed site, see the Preliminary Grading & Erosion Control Plan included in the engineering drawings.

2.4 FLOOD PLAIN CONTROL

The Halton Region Conservation Authority (HRCA) requires all door sill elevations to be a minimum of 0.15m above the floodplain elevations for the 100-year and Regional Storm Events. A Floodplain Analysis was conducted by S. Llewellyn and Associates, dated March 23, 2021. It was concluded that the Regional Storm Event governed through Phase 2, with a maximum floodplain elevation of 97.73m when considering upstream stormwater management controls. The minimum door sill elevation proposed through Phase 2 is 97.90m, which is 0.17m above the floodplain elevation. Therefore, the grading design adheres to the HRCA requirements. The Floodplain Analysis was submitted to the HRCA for review and commentary. For additional information, see the Preliminary Grading & Erosion Control Plain included in the engineering drawings and the Floodplain Analysis included in Appendix D.

3.0 SANITARY SEWER SERVICING

3.1 EXSTING CONDITIONS

The site is located on Plains Road East, north of Fairview Street with an existing 300mmø sanitary sewer located along Plains Road East flowing south which services the existing building on site.

3.2 SANITARY DEMAND

The proposed development consists of constructing a 22 to 30-storey mixed-use building containing 462 residential units and 207m^2 of commercial floor area. Wastewater generation for the site was calculated based on Tables 3-1 Residential Dry Weather Flow and 3-2 Commercial, Industrial, and Community Dry Weather Flow of the 2019 Regional Municipality of Halton Water and Wastewater Linear Design Manual.

Table 3.1 summarizes the population and Table 3.2 summarizes the sanitary sewer discharge rates from the proposed site. Sanitary discharge calculations will be confirmed upon completion of the Wastewater Generation Assessment, which will be prepared as part of the Site Plan Approval process.

Table 3.1 – Proposed Population

Occupancy Type	No. of Beds [A]	Gross Floor Area (m^2) [A]	Population Density [B]	Population
Residential	761	---	2 per/bed	1,522
Commercial	---	207	3.7m^2/per	56
			Total Population [C]:	**1,578**

[A] Information from site plan prepared by Graziana & Corazza Architects Inc., dated April 13, 2021.
[B] Residential population density per OBC 3.1.17.1.1(b); commercial population density as per OBC Table 3.1.13.1 (5).
[C] Total population = Residential Population + Commercial Population

Table 3.2 – Proposed Sanitary Sewer Discharge

Site Area (ha)	Population [A]	Avg. Demand [B] (l/s)	Peak Factor [C]	Infiltration [D] (l/s)	Peak Flow [E] (l/s)
0.76	1,578	5.02	3.66	0.22	**18.59**

[A] From Table 3.1.
[B] Based on a unit sewage flow of 0.275m^{3}pcd (as per Table 3-1 of the Regional Municipality of Halton Water and Wastewater Linear Design Manual).
[C] Based on the modified Harmon Formula (as per section 3.2.3 of the Regional Municipality of Halton Water and Wastewater Linear Design Manual).
Peak Factor, M = 1 + [14 / (4+P$^{0.5}$)], where P is in thousands
[D] Based on an infiltration rate of 0.286 l/ha/s (as per Section 3.2.4 of the Regional Municipality of Halton Water and Wastewater Linear Design Manual).
[E] Peak Demand = (Avg. Demand x Peak Factor) + Infiltration

Based on the above, the estimate of sanitary demand for the residential buildings is:

18.59 l/s

3.3 PROPOSED SANITARY SERVICING AND CAPACITY ANALYSIS

The proposed mix-use buildings will each be serviced by a 150mmø sanitary sewer, designed and constructed in accordance with the Region of Halton standards. Drainage from these sewers will discharge to the existing 150mmø sanitary sewer at the northeast property line, ultimately discharging to the existing 300mmø sanitary sewer along Plains Road East. The existing 150mmø sanitary sewer to be reused will be video inspected to confirm it is in usable conditions prior to construction.

The minimum grade of the proposed 150mmø sanitary sewer will be 2.5%. At this minimum grade, the proposed sanitary sewer will have a capacity of 0.024 m^3/s (24 l/s). Therefore, the proposed 150mmø sanitary sewer at 2.5% grade is adequately sized to service the proposed development.

4.0 DOMESTIC AND FIRE WATER SUPPLY SERVICING

4.1 EXISTING CONDITIONS

The existing municipal water distribution system consists of a 400mmø watermain located on Plains Road East which extends west to the western property line of the site and south to Fairview Street. Existing fire hydrants are located within the boulevard in front of 1184 Plains Road East and on-site within the existing west parking lot area.

4.2 DOMESTIC WATER DEMAND

The following is an estimate of the water usage for the proposed building. Water usage for the site was calculated based on the "Fixture Unit Method" as per Table 7.6.3.2.A. forming part of sentences 7.6.3.1(1) to (3) and 7.6.3.4.(2), (3) and (5) of the 2012 Ontario Building Code. See Table 4.1 for fixture unit (FU) calculations.

Table 4.1 – Domestic Water Demand

Component	No. of Fixtures	FU/ Fixture	Total FU
Lavatory (8.3L/min or less per head) (Private)[1]	518	0.7	362.6
Shower Head (9.5L/min or less per head) (Private)[1]	518	1.4	725.2
Water Closet (6 LPF or less with flush tank) (Private)[1]	518	2.2	1,139.6
Sink (kitchen, domestic, 8.3 L/min or less) (public)[2,3]	463	4	1,852
Dishwasher (domestic)[2,3]	463	1.4	648.2
Clothes Washer (3.5 kg) (private)[2]	462	1.4	646.8
Mop Sink[4]	5	3	15
		Total FU:	**5,389.4**
		Water Usage (l/s):	**41.8**

[1] Each 1-bed,1-bed+den, and 2-bed unit was assumed to have 1 full bathroom and each 3-bed unit was assumed to have 2 full bathrooms
[2] Each unit was assumed to have one kitchen with dishwasher and one washing machine
[3] The building was assumed to have one common room that includes a kitchen with dishwasher
[4] The building was assumed to have one mop sink per parking level

Total peak water usage for the site was derived below from the fixture unit count as per Table 7.4.10.5 of the Ontario Building Code.

Total Fixture Unit Count = 5,389.4 FU

Water Usage: 551 IGPM (41.8 l/s)

4.3 FIRE FLOW DEMAND

Fire flow demands for development are governed by a number of guidelines and criteria, such as the Water Supply for Public Fire Protection (Fire Underwriters Survey, 1999), the Ontario Building Code (OBC), and various codes and standards published by the National Fire Protection Association (NFPA). Since FUS criteria provides adjustments for sprinklered buildings (OBC does not), the FUS method was used to determine the fire flow demand for the proposed development.

The proposed development consists of constructing a 22 to 30-storey mix-use building. Existing hydrants are located along Plains Road East; however, they are not within 90m separation to the building face of the proposed building (per Sentence 3.2.5.7 of the Ontario Building Code). Therefore, a private hydrant has been proposed within the center island on-site.

The proposed building is fire-resistive construction (C=0.6), with limited combustible occupancy (-15% correction) and a fully supervised sprinkler system (-50% correction). Exposure components are based on the following:

North Face: >45m (0% correction) for both towers
South Face: >45m (0% correction) for both towers
East Face: 20.1 to 30m (10% correction) for both towers
West Face: 20.1 to 30m (10% correction) for both towers

It is estimated that the required fire flow for the proposed development will be **100 l/s** (worst case scenario between the two towers). See the Fire Flow Demand Requirements in Appendix C for details.

A hydrant flow test was performed by Aquacom Contracting on the private fire hydrant located at 1133 Plains Road East to determine the performance of the existing water distribution system. The following hydrant flow test data has been analyzed to determine if the municipal system adjacent to the site is adequate to provide the required fire flow, with a minimum pressure of 20 psi. Table 4.2 summarizes the hydrant flow data, provided by Jackson Waterworks.

Table 4.2 – Hydrant Flow Test Data

Hydrant ID	HA30H033
Location	1133 Plains Road East
Static Pressure	51 psi
Residual Pressure During Test Flow	46 psi
Test Flow Rate	1,602 USGPM (101.07 l/s)
Theoretical Flow @ 20 psi	**4,291 USGPM (270 l/s)**

Based on the above hydrant flow test data, the theoretical maximum available flow rate from the hydrant is **270 l/s**, while the maximum required fire flow for the proposed development is only **100 l/s**. Therefore, the water distribution system has adequate pressure and capacity to service the subject site.

4.4 PROPOSED WATER SERVICING AND ANALYSIS

Proposed water servicing for the site consists of connecting a 150mmø water service off of the proposed relocated 400mmø watermain adjacent to the site within a proposed servicing easement. The proposed 150mmø water service will provide domestic and fire water service for the proposed mix-use building. Water services for the site are to be designed and constructed in accordance with City of Hamilton standards.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the information provided herein, it is concluded that the proposed development at Plains Road East can be constructed to meet the requirements of the City of Burlington and Region of Halton. Therefore, it is recommended that:

- The development be graded and serviced in accordance with the Preliminary Grading & Erosion Control Plan and the Preliminary Site Servicing Plan prepared by S. Llewellyn & Associates Limited;
- A 100mmø orifice pipe be installed as per the Preliminary Site Servicing Plan and this report to provide adequate quantity control;
- An underground storage vault be incorporated into the underground parking garage as per the Preliminary Site Servicing Plan and this report to provide effective stormwater storage during storm events;
- Short-term dewatering will be required at a discharge rate of 0.8 l/s and will need to be filtered prior to discharging to the existing storm sewer system;
- Erosion and sediment controls be installed as described in this report to meet City of Burlington requirements;

- All door sill elevations are a minimum of 0.15m above the Regional Floodplain;and
- The proposed sanitary and water servicing system be installed as per the Preliminary Site Servicing Plan and this report to adequately service the proposed development.

We trust the information enclosed herein is satisfactory. Should you have any questions please do not hesitate to contact our office.

Prepared by:

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A. Porco, B.Eng.

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