

**PROPOSED 6-STORY CONDO
277-270 HAZEL STREET
WALTERLOO, ONTARIO**

**STROMWATER MANAGEMENT
& FUNCTIONAL SERVCING REPROT**



REV 0 – March 2025



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1. INTRODUCTION

Luban Limited was retained by 1000383288 Ontario Inc. to provide engineering design in support of the rezoning and site plan application for the condo development at 277 and 279 Hazel Street in the City of Waterloo.

2. SITE DESCRIPTION

The site is situated on the west side of Hazel Street, about 20 meters south of Hickory Street West. It currently features two single-detached residential dwellings with driveways. The land has a slight elevation from Hazel Street, ranging from approximately 0.8 to 1.2 meters, and is generally flat with minor undulations.

According to the conceptual site plan prepared by Khalsa Design Inc. dated March 23, 2023, the existing dwellings will be demolished to make way for a 6-storey/25-unit residential building with an on-grade parking lot at the rear.

Existing infrastructure within the Hazel Street municipal right-of-way exists as follows: Hazel Street

- 150mm dia. cast iron watermain,
- 200mm dia. PVC sanitary main, and
- 300mm dia. PVC storm main.

3. REFERENCE

- City of Waterloo Comprehensive Engineering and Landscape Manual (2013)
- Grand River Source Protection Plan (February 9, 2022)
- Ministry of the Environment Stormwater Management Planning and Design Manual (2003)
- CVC/TRCA Low Impact Development Stormwater Management Planning and Design Guide, Version 1.0 (2010)
- Ministry of Transportation Drainage Management Manual (1997)
- Golden Horseshoe CA Erosion and Sediment Control Guideline for Urban Construction (2006)

4. STORMWATER MANAGEMENT

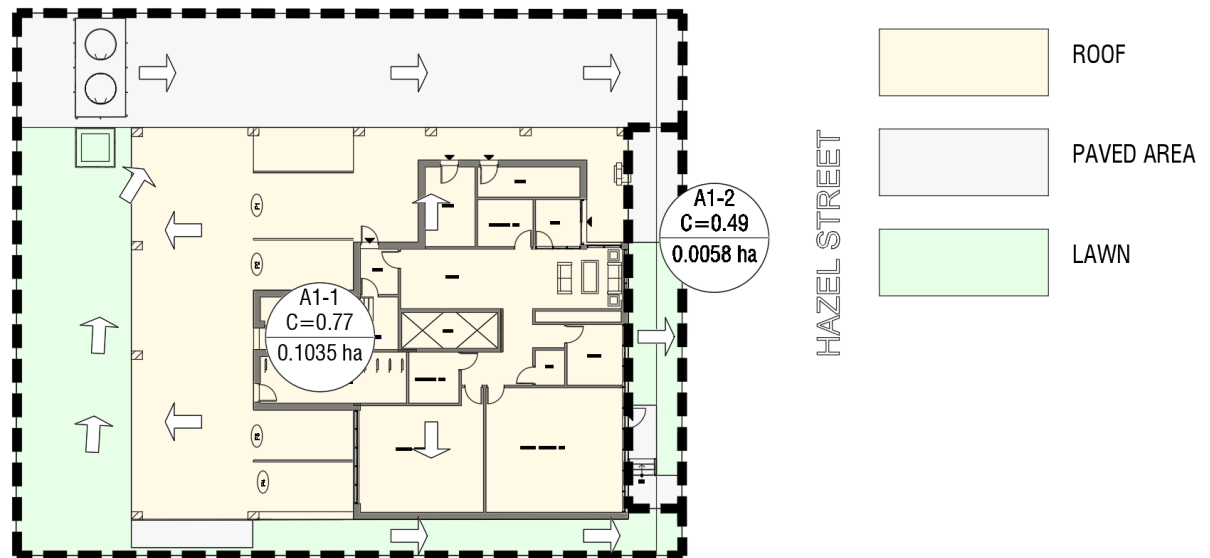
4.1. DESIGN CRITERIA

The following design criteria are applied to this project:

- Quantity Control – according to City of Waterloo Comprehensive Engineering and Landscape Manual, Volume 6: Stormwater Management, for stormwater Quantity Control, post development peak flows shall be attenuated to the lesser of: pre-development levels.
- Quality Control – Provide "Enhanced 80% long-term S.S. removal" level quality control.
- Water Balance – Retain the 5mm rainfall event on site.

4.2. QUANTITY CONTROL

- The post-development drainage area as Figure 4.2.1 shows below:



- Runoff Coefficient

Grass	C=0.20
Roof and Pavement	C=0.90
Post development (combined)	C=0.75

	Controlled Area A1-1		Uncontrolled Area A1-2		Entire Site	
	m2	C	m2	C	m2	C
Roof	590	0.77		0.49	590	0.75
Driveway	248		24		272	
Lawn	196		34		230	
Total	1035		58		1092	

- Time of Concentration $T_c=10$ min
- Rational Method, the peak flow rates are:

$$Q = \frac{CIA}{360}$$

- Standard IDF Rainfall Curve refers from City of Waterloo Comprehensive Engineering and

Landscape Manual, Table V6-1:

	2-yr	5-yr	25-yr	100-yr
a	1,101	1,755	3,261	4,692
b	9.3	12.3	16.2	17.4
c	0.882	0.895	0.938	0.956

- Required storage for different rainfall return period.

Return period	Entire Site - Pre-Develop	Entire Site - Post-Develop	Uncontrol Area	SWM Control Flow	Req'd Storage for Quantity Control
	m ³ /s	m ³ /s	m ³ /s	m ³ /s	m ³
2-year	0.0141	0.0185	0.0006	0.0135	2.9
5-year	0.0189	0.0248	0.0009	0.0181	3.6
100-year	0.0344	0.0452	0.0016	0.0329	13.0

Based on the above calculations, the total site 100-year release flow rate under pre-development conditions is 0.0344 m³/s. In the post-development scenario, there is an uncontrolled area of 58 m² in the front yard. The proposed stormwater management facilities will require a storage volume of 13.0 m³, controlling the 100-year release rate to 0.0329 m³/s for the managed area. When combined with the uncontrolled flow of 0.0016 m³/s, the total site release rate is 0.0344 m³/s, which matches the pre-development 100-year release flow rate. The site controlled release rate will be regulated by a 85 mm diameter orifice installed at the inlet of the control manhole (CBMH3), calculated control release rate from orifice is 0.0308 m³/s. (**Appendix I** provides Stormwater quantity control calculation and orifice size calculation.)

Solution: The site incorporates the following stormwater storage facilities, providing a total of 14.6 m³ of storage:

1. **Enlarged Storm Sewer** – 31.9 m of 300 mm diameter storm sewer, plus a DICB and two catchbasin manholes, providing 8.5 m³ of storage.
2. **Bio-Swales** – a 14 m of bio-swales at back yard and a 22 m of bio-swales at south side yard, both with 300 mm of clear stone at the bottom, providing 4.3 m³ of storage.
3. **Clear Stone Filter System** – A 14 m long by 0.8 m wide system along the back yard parking edge, providing 1.3 m³ of storage.
4. **Parking Lot Surface Ponding** – Providing 0.5 m³ of storage.

4.3. QUALITY CONTROL

The site impervious level of the proposed development is 79%. According to Table 3.2 of the Ministry of the Environment's Stormwater Management Planning and Design Manual, which outlines water quality storage requirements based on receiving waters, achieving a Enhanced 80% long-term S.S. removal with an infiltration stormwater management practice (SWMP) type requires providing 40 m³/ha of storage volume. For this development, this amounts to 4.4 m³.

$$40 \text{ m}^3 * 0.109 \text{ ha} = 4.4 \text{ m}^3$$

Solution: The site incorporates the following stormwater quality control facilities, providing a total of 5.6 m³ of quality control volume:

1. **Bio-Swales** – a 14 m of bio-swales at back yard and a 22 m of bio-swales at south side yard, both with 300 mm of clear stone at the bottom, providing 4.3 m³ of storage.
2. **Clear Stone Filter System** – A 14 m long by 0.8 m wide system along the back yard parking edge, providing 1.3 m³ of storage.

4.4. WATER BALANCE

Water balance is considered to retain the 5mm rainfall event on site. Therefore, the total lot area of 0.109 ha would require a retention volume of $0.109 \text{ ha} * 5\text{mm} = 5.5 \text{ m}^3$.

Solution: The site incorporates the following stormwater facilities, providing a total of 5.6 m³ of for water balance control:

1. **Bio-Swales** – a 14 m of bio-swales at back yard and a 22 m of bio-swales at south side yard, both with 300 mm of clear stone at the bottom, providing 4.3 m³ of storage.
2. **Clear Stone Filter System** – A 14 m long by 0.8 m wide system along the back yard parking edge, providing 1.3 m³ of storage.

According to the April 2024 geotechnical report by Soil Engineers Ltd., the groundwater level is at elevation 330.90 m. The bottom of the bio-swale is at elevation 332.25 m, which is 1.35 m above the groundwater level.

4.5. SUMMARY

In summary, the proposed on-site stormwater management facilities achieve the desired objectives.

	Required		Provided	
Quantity Control	100yr vs 100yr	14.2 m ³	Sewer System, Bio-Swales, Clear Stone Filter, Surface Ponding	14.6 m ³
Quality Control	Enhanced 80% long-term S.S. removal	4.4 m ³	Bio-Swales, Clear Stone Filter	5.6 m ³
Water Balance	runoff from a 5mm storm is detained for 24 hours	5.5 m ³	Bio-Swales, Clear Stone Filter	5.6 m ³

- See the stormwater facility design in the site servicing plan and grading plan in **Appendix B**.

4.6. INSPECTION AND MAINTENANCE

Maintenance requirements for bio-swale and clear stone filter typically involve a low level of activity after vegetation becomes established. Grass channel maintenance procedures should be compared to the recommendations below (Table 4.8.6) to assure that the infiltration and water quality benefits of bio-swale are preserved. The property owner or manager is responsible for maintenance as outlined in a legally binding maintenance agreement.

Table 4.8.6 Typical inspection and maintenance activities for enhanced grass swales

Activity	Schedule
Inspect for vegetation density (at least 80% coverage), damage by foot or vehicular traffic, channelization, accumulation of debris, trash and sediment, and structural damage to pretreatment devices.	After every major storm event (>25 mm), quarterly for the first two years, and twice annually thereafter.
- Regular watering may be required during the first two years while vegetation is becoming established; - Mow grass to maintain height between 75 to 150 mm; - Remove trash and debris from pretreatment devices, the swale surface and inlet and outlets.	At least twice annually. More frequently if desired for aesthetic reasons.
- Remove accumulated sediment from pretreatment devices, inlets and outlets; - Replace dead vegetation, remove invasive growth, dethatch, remove thatching and aerate (PDEP, 2006); - Repair eroded or sparsely vegetated areas; - Remove accumulated sediment on the swale surface when dry and exceeds 25 mm depth (PDEP, 2006); - If gullies are observed along the swale, regrading and revegetating may be required.	Annually or as needed

5. EROSION CONTROL

Prior to the initiation of any construction within the site, a comprehensive Erosion and Sediment Control (ESC) plan acceptable to the Township of Hamilton and the GRCA must be implemented. Erosion and Sediment control drawings are provided in **Appendix B**. Below is a list of erosion and sediment control measures that will be installed and maintained during the construction of the Subject Site:

1. Temporary sediment control fences will be placed prior to topsoil stripping and site grading.
2. A mud-pad will be placed the entrance of the construction access.

All temporary erosion and sediment control measures will be routinely inspected and repaired during construction. Temporary controls will not be removed until the areas they serve are restored and stable.

6. SANITARY

- 1) The proposed condo development is being built on two residential lots and will have a total of 40 units. The estimated population will increase from 7 to 70.
- 2) Following design criteria is used for the population estimate:
 - Residential Sewage Flow 275 L//c/day
 - Residential Peaking Factor $1+(14/4+P^{0.5})$, P = Pop/1000
 - Infiltration 0.25 L/s/ha

- Commercial Sewage Flow 0.5 L//s/ha(GFA)
- Density- Single Family 3.3 c/unit
- Density - Row Housing 2.18 c/unit
- Density - Apartment 1.76 c/unit

3) A sanitary drainage master plan and sanitary sewer design sheet (**Appendix C**) have been prepared to verify that the downstream pipe has adequate capacity for the increased flow from the development.

Since there is no as-built sanitary master drainage plan available, the existing sanitary sewer information in the sanitary drainage master plan is based on the as-built road plan and profiles provided by the city. The following assumptions are used to estimate the population for mid-rise residential drainage area A1, and commercial drainage areas A12 and A13:

- Drainage area A1:
 - Total GFA for 9 middle rise condos are 38,043 m²: (from City's Open Data, "building_Footprints" SHP file)
 - Assuming one-bedroom size is 650 sq.ft and two-bedroom size is 850 sq.ft
 - Assuming one-bedroom units is 50%, and two-bedroom units is 50%.
 - Assuming public corridor, elevation, stairs, amenity space is 20% of total GFA,
 - Estimated total residential units for 9 buildings to be 442 units, plus 2 residential houses, and the total estimated population to be 778.
- Drainage area A12:
 - Total GFA is 1,268 m² (0.13ha) , (from City's Open Data, "building_Footprints" SHP file)
 - Estimate design flow: $0.13 \times 0.5 = 0.06$ L/s
- Drainage area A13:
 - Total GFA for 6 buildings is 4,166 m² (0.42ha) , (from City's Open Data, "building_Footprints" SHP file)
 - Estimate design flow: $0.42 \times 0.5 = 0.21$ L/s

The sanitary sewer design sheet (**Appendix D**) shows that all downstream pipes have adequate capacity for increased population of 70, and there is no negative impact on the downstream pipes.

A new 150mm diameter sanitary pipe will be installed, along with a sanitary inspection control manhole at the property line.

7. WATERMAIN

The proposed residential building will be equipped with sprinkler protection, and a requested fire flow of 100.0 L/s has been specified. The calculation for fire flow is provided in **Appendix E**.

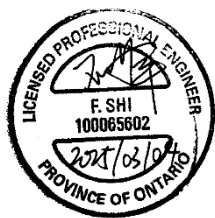
For the residential building, a water demand of 275 L/cap.d is utilized. Water demand and water main distribution calculations are detailed in **Appendix F**. As the result, water demands are:

- Domestic Maximum Day Flow 0.6 L/s
- Domestic Peak Hour Demand 0.9 L/s
- Fire Flow 100.0 L/s
- Maximum Day + Fire Flow 100.6 L/s
- Peak Hour Demand 0.9 L/s

There is an existing 150mm dia. cast iron water main on Hazel Street and an existing hydrant at the northwest corner of Hazel Street and Balsam Street, located 105m away from the subject location. A fire flow test conducted by Vipond Inc. is detailed in **Appendix H**. According to the fire hydrant test report, the existing hydrant has a residual pressure of 58 PSI. The estimated fire pressure at the subject location is 36 PSI, as outlined in **Appendix G**.

Yours truly,

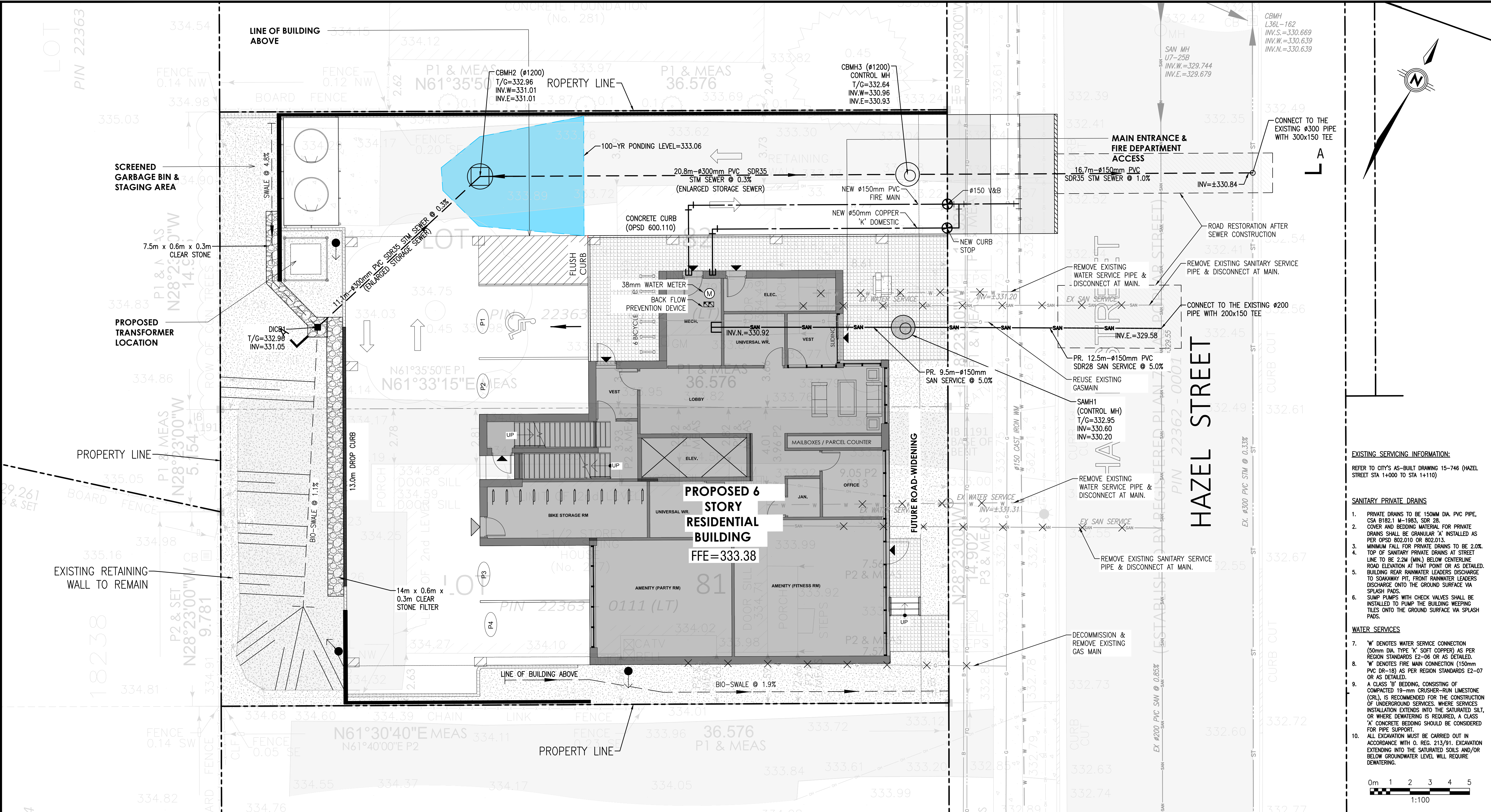
Feng Shi, P.Eng.
Principal Engineer



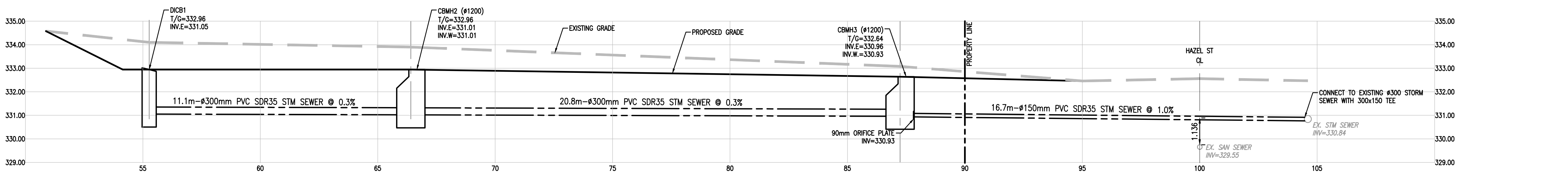
APPENDIX

Appendix A. Geotechnical Investigation report (Soil Engineers Ltd.)

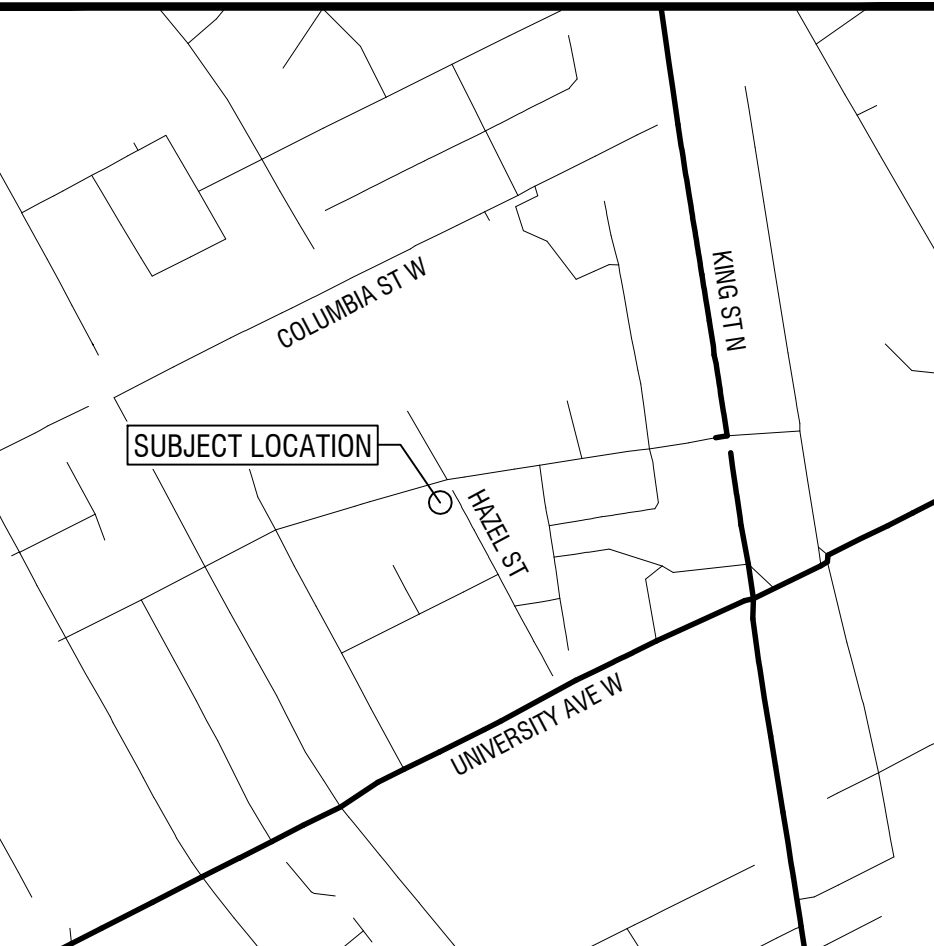
Appendix B. Site Servicing Plan, Grading Plan, Erosion Control Plan



- EXISTING SERVICING INFORMATION:**
REFER TO CITY'S AS-BUILT DRAWING 15-746 (HAZEL STREET STA 1+000 TO STA 1+110)
- SANITARY PRIVATE DRAINS**
- PRIVATE DRAINS TO BE 150MM DIA. PVC PIPE, CSA B182.1 M-1983, SDR 28
 - COVER AND BEDDING MATERIAL FOR PRIVATE DRAINS SHALL BE GRANULAR 'A' INSTALLED AS PER CPD 802.010 OR 802.013.
 - MINIMUM FALL FOR PRIVATE DRAINS TO BE 2.0%.
 - TOP OF SANITARY PRIVATE DRAINS AT STREET LINE TO BE 2.2M (MIN.) BELOW CENTERLINE ROAD ELEVATION AT THAT POINT OR AS DETAIL.
 - BUILDING REAR RAINWATER LEADERS DISCHARGE TO SKYDRAVEY PIT. FRONT RAINWATER LEADERS DISCHARGE ONTO THE GROUND SURFACE VIA SPLASH PADS.
 - SUMP PUMPS WITH CHECK VALVES SHALL BE INSTALLED TO PUMP THE BUILDING WEEPING TILES ONTO THE GROUND SURFACE VIA SPLASH PADS.
- WATER SERVICES**
- 'W' DENOTES WATER SERVICE CONNECTION (50mm DIA. TYPE 'K' SOFT COPPER) AS PER REGION STANDARDS E2-06 OR AS DETAIL.
 - 'W' DENOTES FIRE MAIN CONNECTION (150mm PVC DR-18) AS PER REGION STANDARDS E2-07 OR AS DETAIL.
 - A CLASS 'B' BEDDING, CONSISTING OF COMPACTED 19-mm CRUSHER-RUN LIMESTONE (CRL), IS RECOMMENDED FOR THE CONSTRUCTION OF UNDERGROUND SERVICES. WHERE SERVICES INSTALLATION EXTENDS INTO THE SATURATED SILT, OR WHERE DEWATERING IS REQUIRED, A CLASS 'A' CONCRETE BEDDING SHOULD BE CONSIDERED FOR PIPE SUPPORT.
 - ALL EXCAVATION MUST BE CARRIED OUT IN ACCORDANCE WITH O. REG. 213/91. EXCAVATION EXTENDING INTO THE SATURATED SILT AND/OR BELOW GROUNDWATER LEVEL WILL REQUIRE DEWATERING.
- 0m 1 2 3 4 5
1:100



SECTION A-A: STORM SEWER PROFILE



KEYPLAN

- LEGENDS:**
- EX GAS
 - EX WATER MAIN
 - EX STORM
 - EX SAN
 - PR SANITARY2
 - PR SILT FENCE
 - SWALE
 - RETAINING WALL
 - PROPOSED GRADE
 - WATER VALVE
 - WATER METER
 - BACK FLOW PREVENTER
 - CB
 - SANITARY MANHOLE
 - SUMP PUMP
 - DOWNSPOUT
 - ENTRANCE SYMBOL
 - OVERLAND FLOW

6			
5			
4			
3			
2			
1			
0	2025/03/04	FOR SITE PLAN APPROVAL	FS
REV.	DATE	DESCRIPTION	BY

MUNICIPALITY

THE CITY OF
Waterloo

ENGINEER'S STAMP
LUBAN
7373 LONGHEAD AVENUE, NIAGARA FALLS, ONTARIO, L2T6S4
TEL: 226-688-7828, EMAIL: FENG.SH@LUBAN.CA

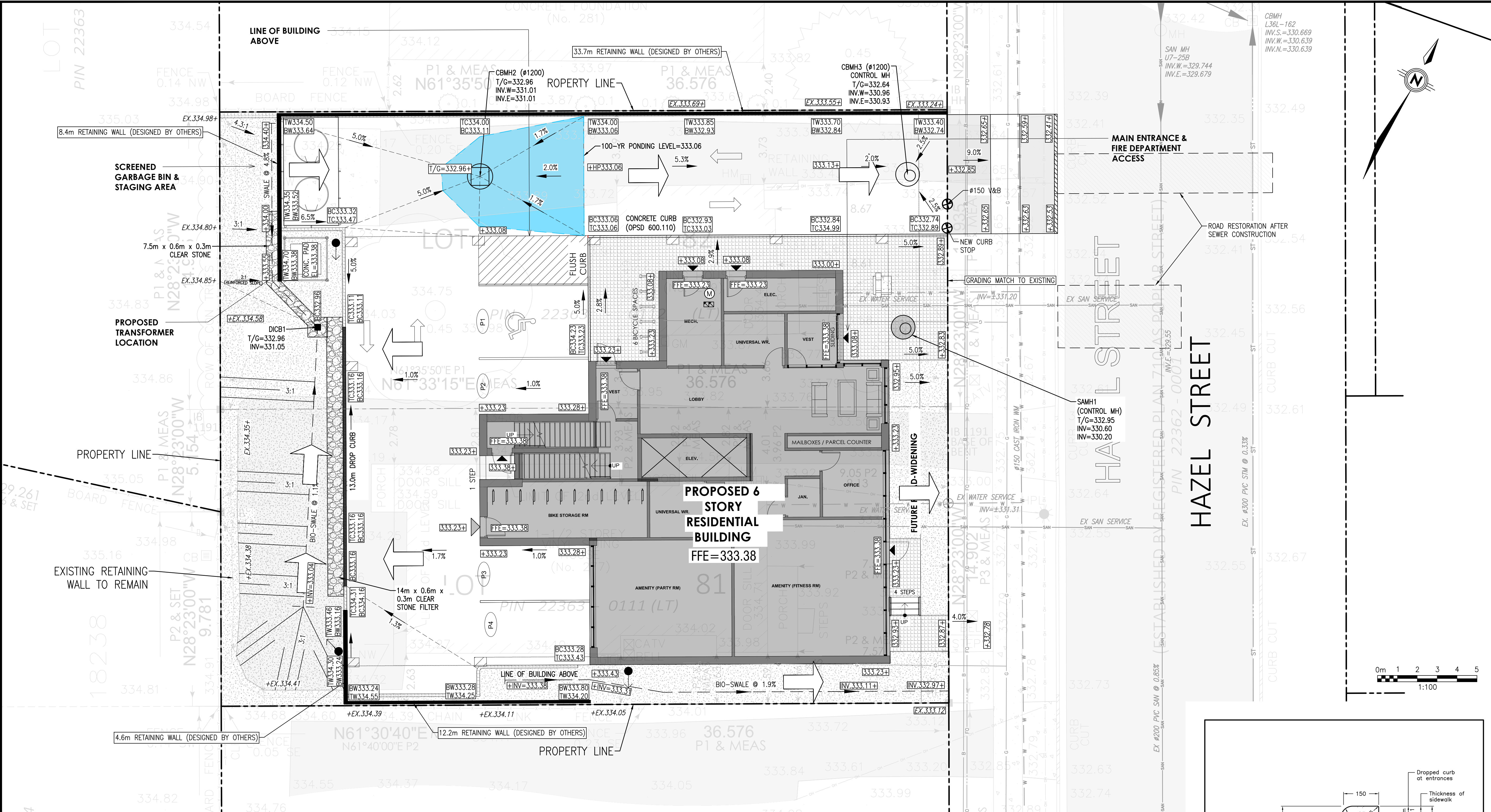
CIVIL ENGINEER

CLIENT

ARCHITECT
KHALSA

SITE SERVICING PLAN
APARTMENT
277-279 HAZEL ST, WATERLOO, ONTARIO

DESIGNED BY: MG	SCALE: HORIZONTAL: 1:100	CONTRACT No.
CHECKED BY: FS	VERTICAL:	No 2 OF 6
DRAWN BY: MG		C2
DATE: 2025/03/04		DRAWING No.



BENCHMARK:
ELEVATIONS ARE BASED ON GPS OBSERVATIONS FROM PERMANENT REFERENCE STATIONS IN THE NAD83 (CSRS-2010) COORDINATE SYSTEM, WITH HEIGHTS CONVERTED TO ORTHOMETRIC ELEVATIONS ON THE CYG028 DATUM (1978 ADJUSTMENT) WITH GEOID MODEL HTv2.0, AS SUPPLIED BY NATURAL RESOURCES CANADA.

SITE BENCHMARK #1: NAIL ON HYDRO POLE ALONG HAZEL STREET APPROX. 9.5m NORTH FROM NORTH EAST CORNER OF THE SUBJECT PROPERTY, HAVING AN ELEVATION OF 332.54 METRES.

SITE BENCHMARK #2: NAIL ON HYDRO POLE ALONG HAZEL STREET APPROX. 14.0m SOUTH EAST FROM SOUTH EAST CORNER OF THE SUBJECT PROPERTY, HAVING AN ELEVATION OF 332.87 METRES.

BEARING AND COORDINATE NOTE:
BEARINGS ARE GRID BEARINGS AND ARE DERIVED FROM GPS OBSERVATIONS AND ARE REFERRED TO THE UTM PROJECTION, ZONE 17, NAD 83 (CSRS-2010) ADJUSTMENT.

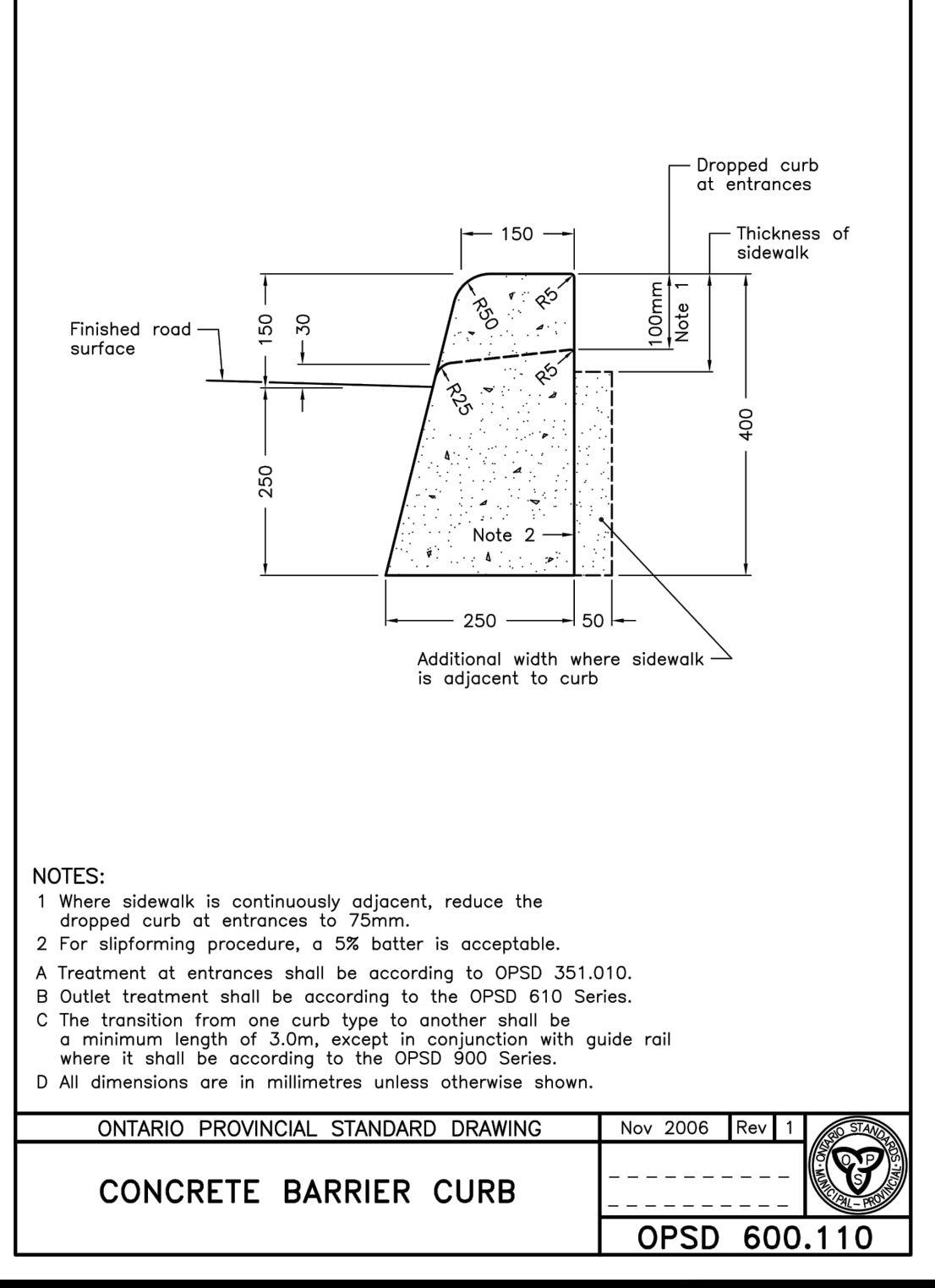
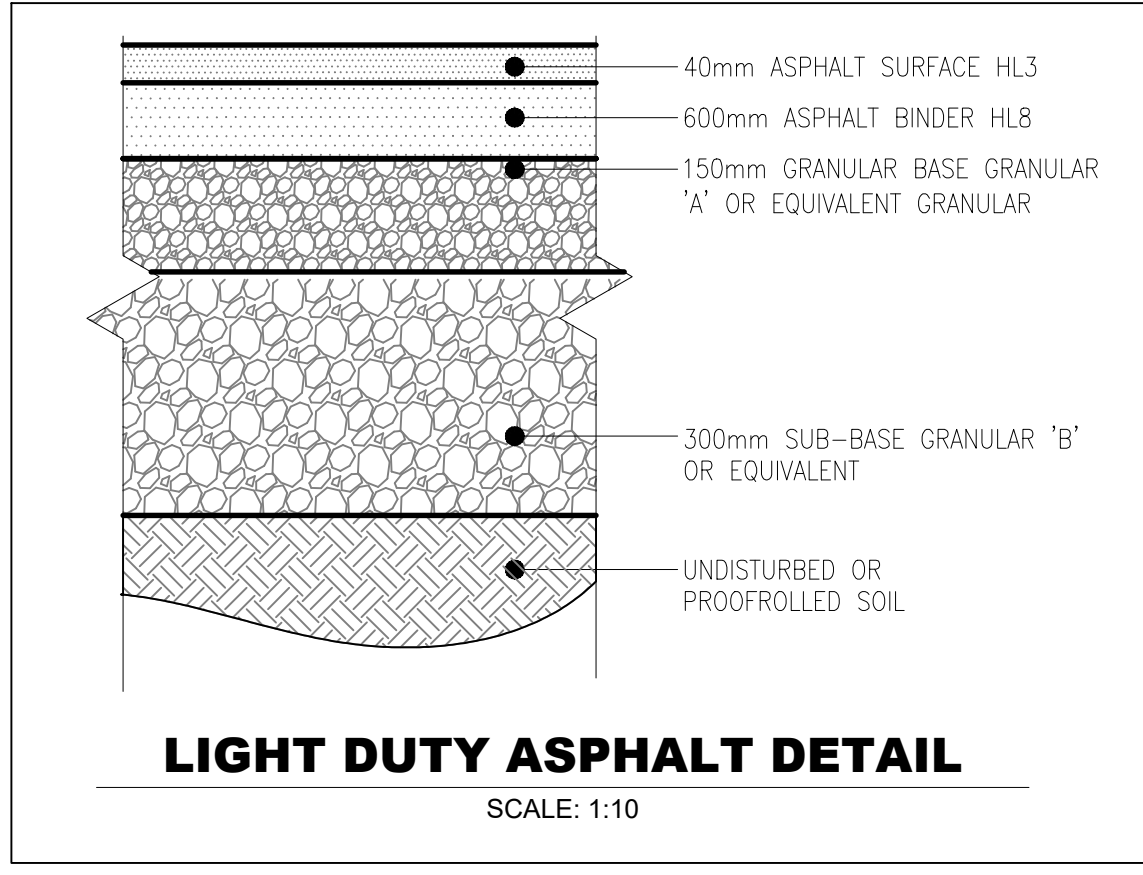
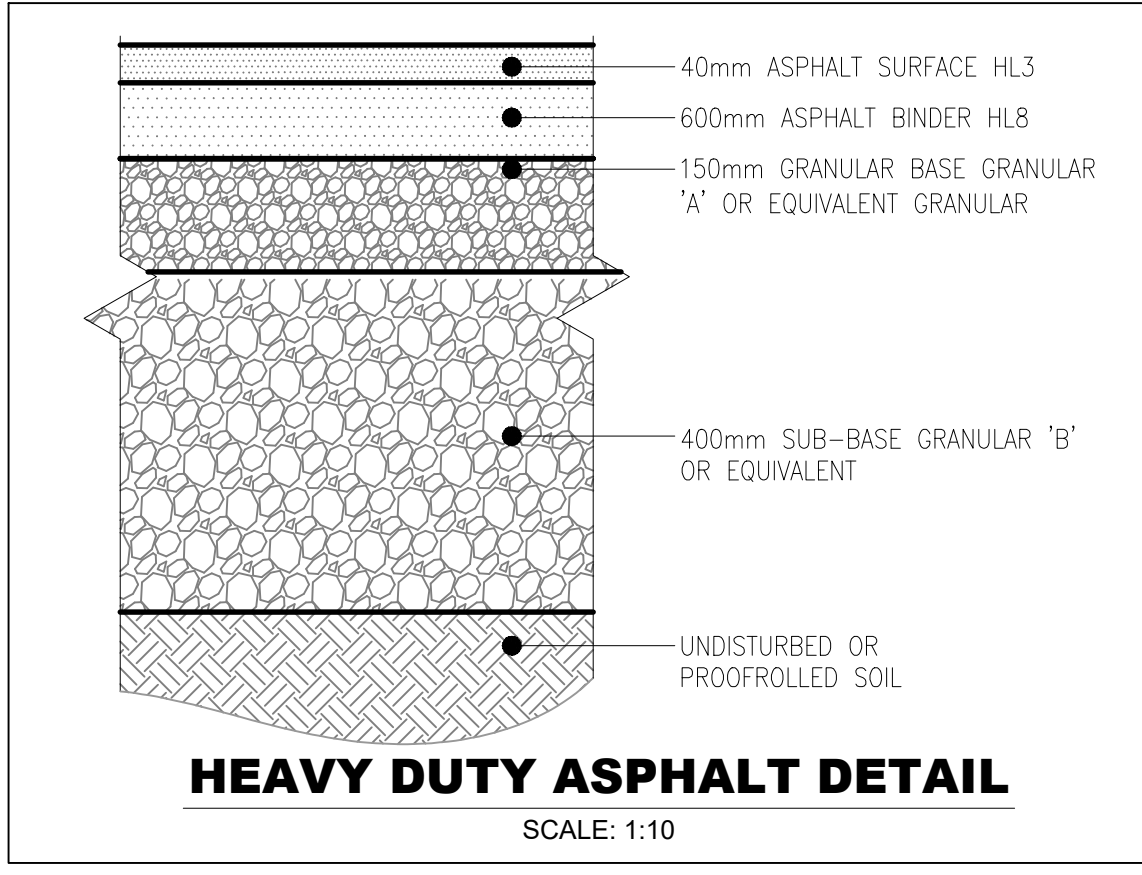
DISTANCES SHOWN ON THIS PLAN ARE ADJUSTED GROUND DISTANCES AND CAN BE CONVERTED TO GRID DISTANCES BY MULTIPLYING BY AN AVERAGED COMBINED SCALE FACTOR OF 0.999571

COORDINATES ON THIS PLAN ARE UTM, ZONE 17, NAD83 (CSRS-2010) ADJUSTMENT AND ARE BASED ON GPS OBSERVATIONS FROM A NETWORK OF PERMANENT GPS REFERENCE STATIONS.

GENERAL GRADING NOTES:

1. ALONG ADJOINING PROPERTIES GRADE TO MEET EXISTING OR PROPOSED ELEVATIONS WITH SLOPED SLOPES (MIN. 3% TO 1%) AND/OR RETAINING WALLS AS SPECIFIED.
2. ALL RETAINING WALLS, WALKWAYS, CURBS, ETC., SHALL BE PLACED A MIN. OF 0.10m OFF THE PROPERTY LINE. ALL WALLS 1.0m OR HIGHER SHALL BE DESIGNED BY A P.E.N.G.
3. SHOULD A RETAINING WALL BE REQUIRED, THE TOP OF WALL ELEVATIONS SHALL BE SET 150mm ABOVE THE PROPOSED SIDE YARD SWALES.
4. RETAINING WALLS 0.6m IN HEIGHT OR GREATER REQUIRE CONSTRUCTION OF A FENCE OR GUARD RAIL AT THE TOP OF THE REAR OF THE WALL. GUARDS FOR RETAINING WALLS SHALL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH THE REQUIREMENTS OF EXTERIOR GUARDS AS CONTAINED IN THE ONTARIO BUILDING CODE.
5. SLOPES OF SWALES SHALL BE NO LESS THAN 2.0% GRADE AND NO GREATER THAN 33% GRADE (3:1 SLOPES).
6. WHEN MATCHING TO EXISTING PROPERTIES WHERE A 2.0% GRADE CANNOT BE ACHIEVED, A 1.5% GRADE IS PERMITTED PROVIDED A 150mm SUB-DRAIN IS INSTALLED BELOW THE BOTTOM OF THE

- SWALE AND DRAINED TO A SUITABLE OUTLET, (WITH A MINIMUM 0.3m COVER OVER THE SUB-DRAIN), OR OTHER MITIGATION MEASURES
7. MINIMUM GRADE FOR A WRAP-AROUND SWALE IN THE BACKYARD SHALL BE 1.0% UNLESS OTHERWISE NOTED. THE GROUND BETWEEN PROPOSED ELEVATIONS ON SIDE LOTS SHALL BE GRADED AS A STRAIGHT LINE.
 8. TOP OF FOUNDATION WALLS FOR BUILDINGS SHALL BE 150mm (MIN) ABOVE FINISHED GRADE.
 9. DRIVEWAY SLOPES SHALL NOT BE LESS THAN 2% AND NOT MORE THAN 7.0%. REVERSED SLOPED DRIVEWAYS IN NEW DEVELOPMENTS ARE NOT PERMITTED.
 10. GARAGE FLOOR ELEV. TO BE SET MINIMUM 0.3m HIGHER THAN BACK OF WALK, UNLESS OTHERWISE SPECIFIED.
 11. ALL FILL PLACED ON LOTS SHALL BE COMPACTED TO A MINIMUM 95% SPD (UNLESS OTHERWISE RECOMMENDED BY THE GEOTECHNICAL ENGINEER). ALL MATERIAL SHALL BE PLACED IN LAYERS NOT EXCEEDING 300mm LIFTS.
 12. FOR DELINEATION OF TREE PROTECTION ZONES, BUFFERS, REMOVALS AND PROTECTION SCHEMATICS, ETC., REFER TO TREE PROTECTION PLAN.
 13. IF GRADING IS REQUIRED ON LANDS ADJACENT TO THE DEVELOPMENT WHICH ARE NOT OWNED BY THE DEVELOPER, THEN THE DEVELOPER MUST OBTAIN WRITTEN PERMISSION FROM THE ADJACENT PROPERTY OWNER TO ALLOW THE DEVELOPER TO GRADE ON THE ADJACENT LANDS, OTHERWISE RETAINING WALLS MUST BE USED.
 14. THE WRITTEN PERMISSION REQUIRED FROM THE ADJACENT LANDOWNER SHALL BE OBTAINED PRIOR TO ENTERING THE LANDS. SHOULD PERMISSION NOT BE OBTAINED OR IS WITHDRAWN PRIOR TO COMMENCING THE WORK, THEN THE DEVELOPER SHALL LIMIT HIS ACTIVITIES TO THE LIMITS OF THE DEVELOPMENT SITE.
 15. DRIVEWAY AND DRIVEWAY APPROACHES SHALL BE LOCATED SUCH THAT HYDRO VAULTS AND OTHER STREET FURNITURE ARE A MIN. OF 1.2m FROM THE PROJECTIONS OF THE OUTSIDE GARAGE WALLS.
 16. SOIL REPORT:
- REFER TO A GEOTECHNICAL INVESTIGATION FOR PROPOSED RESIDENTIAL DEVELOPMENT, 277 AND 279 HAZEL STREET, CITY OF WATERLOO, REFERENCE NO. 2401-5069, APRIL 2024
- TOPOGRAPHIC SURVEY:**
REFER TO TOPOGRAPHIC SURVEY BY VAN HARTEN SURVEYING INC. (PROJECT #32045-22), FEBRUARY 1, 2023.



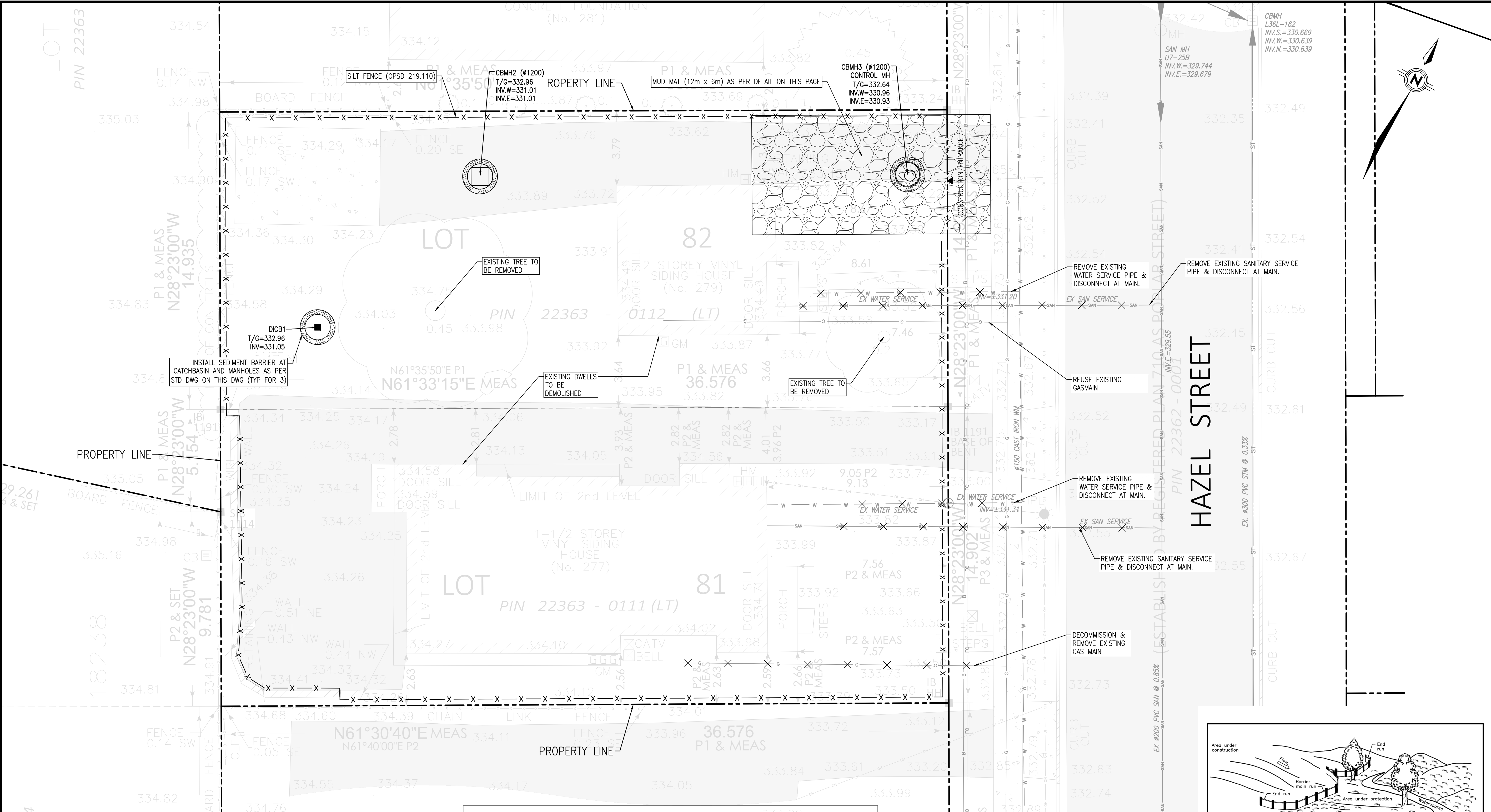
KEYPLAN

SUBJECT LOCATION

LEGENDS:

- EX GAS
- EX WATER MAIN
- EX STORM
- EX SAN
- PR SANITARY2
- PR SILT FENCE
- SWALE
- RETAINING WALL
- PROPOSED GRADE
- WATER VALVE
- WATER METER
- BACK FLOW PREVENTER
- CB
- SANITARY MANHOLE
- SUMP PUMP
- DOWNSPOUT
- ENTRANCE SYMBOL
- OVERLAND FLOW

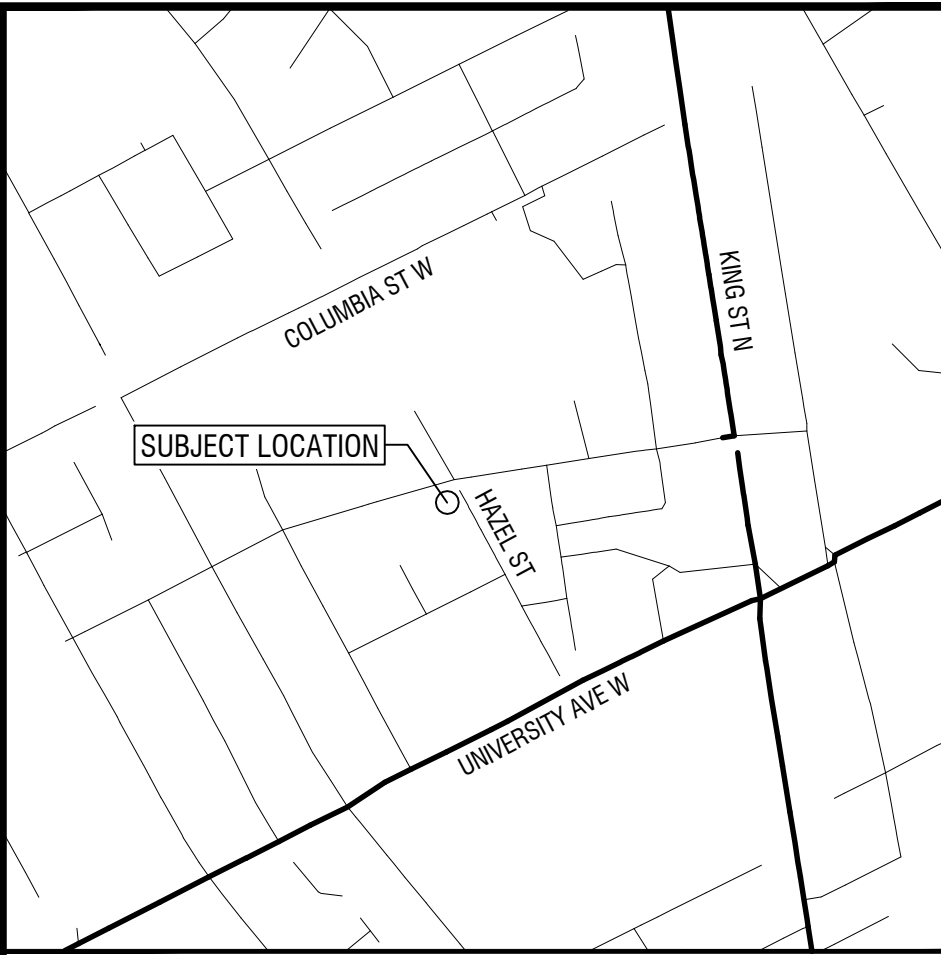
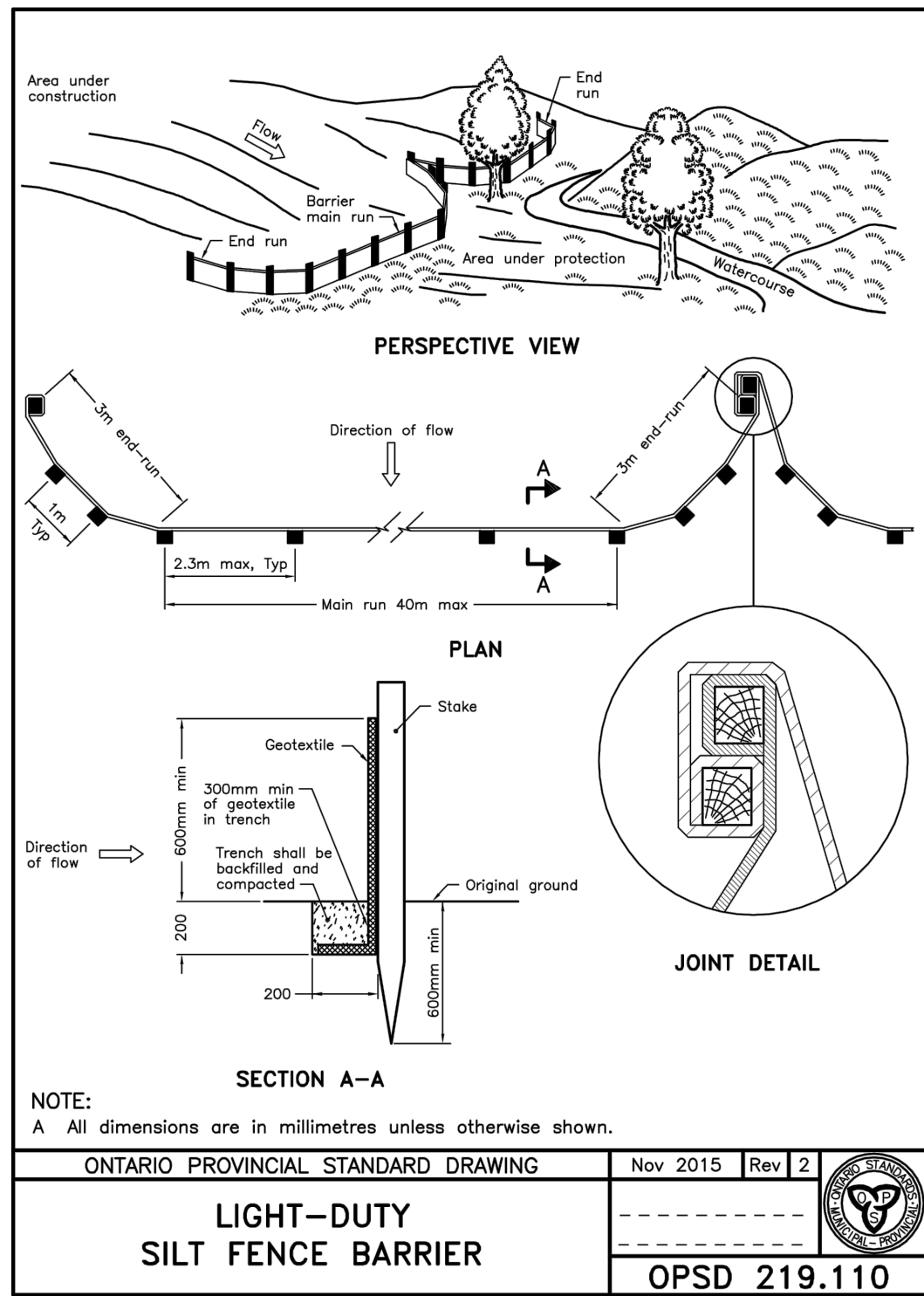
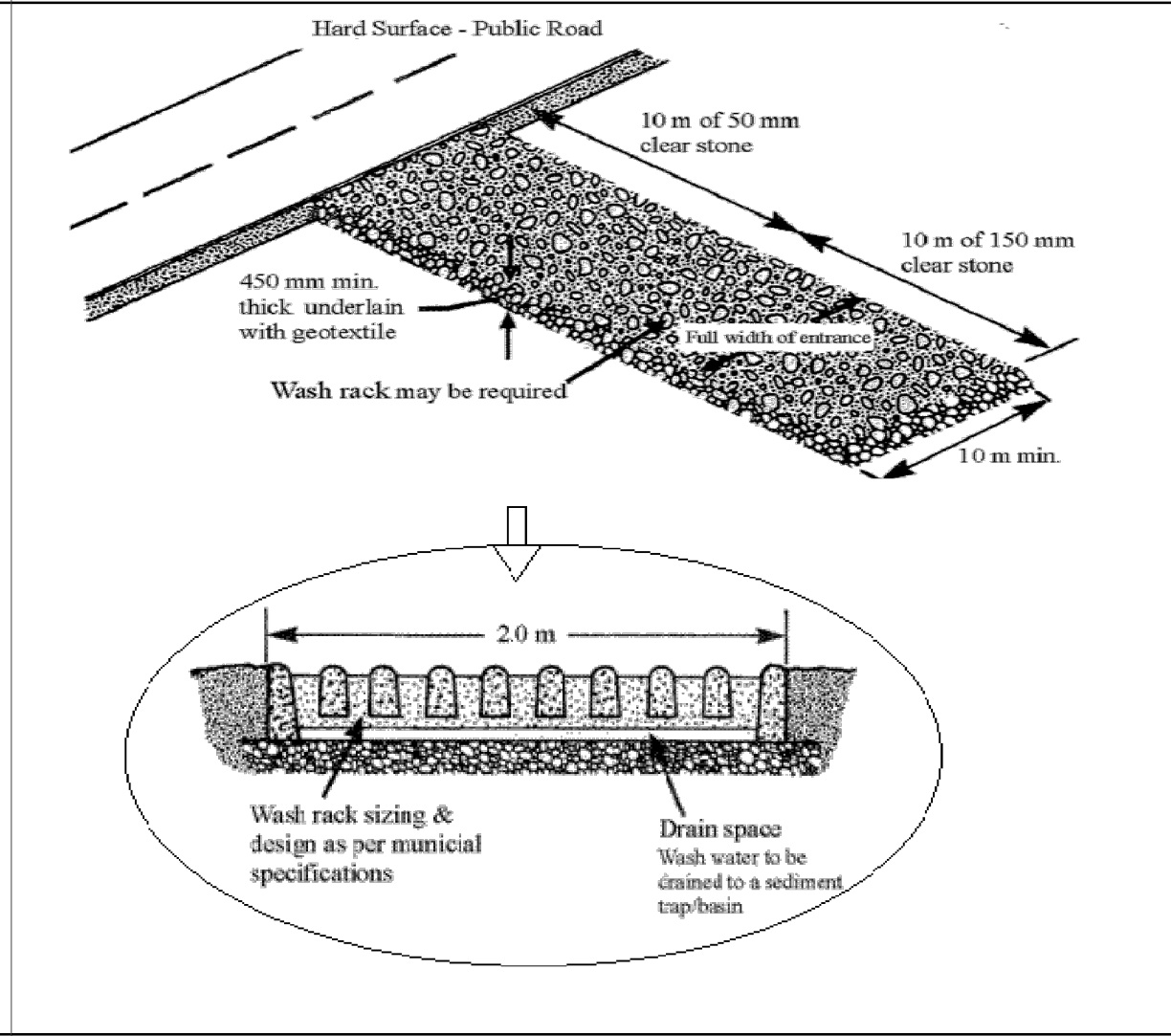
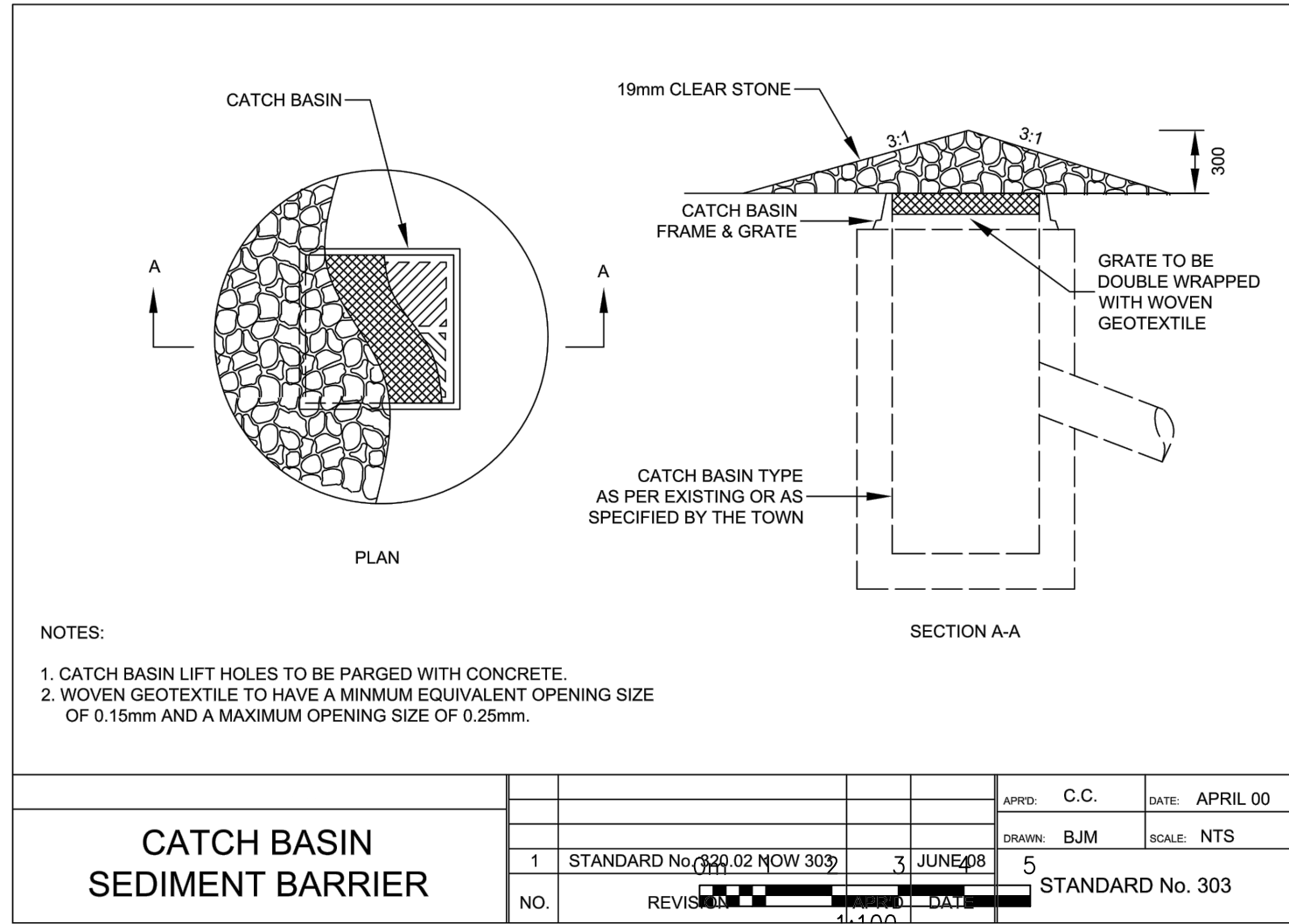
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MUNICIPALITY			
THE CITY OF WATERLOO			
ENGINEER'S STAMP		CIVIL ENGINEER	
CLIENT		ARCHITECT	
SITE GRADING PLAN			
APARTMENT			
277-279 HAZEL ST, WATERLOO, ONTARIO			
DESIGNED BY:	MG	SCALE:	CONTRACT No.
CHECKED BY:	FS	HORIZONTAL:	1:100
DRAWN BY:	MG	VERTICAL:	
DATE:	2025/03/04		
OPSD 600.110			
No 3 OF 6	C3		
DRAWING No.			



GENERAL NOTES (FOR SITE ALTERATION)

- PRIOR TO COMMENCEMENT OF ANY ON-SITE WORK/SOIL STRIPPING, EROSION & SEDIMENT CONTROL (ESC) MEASURES, AS PER ACCEPTED SITE ALTERATION PLANS. MUST BE INSTALLED AND APPROVED BY THE DEVELOPER'S ENGINEER. ADDITIONAL ESC MEASURES, IF REQUIRED, SHALL BE INSTALLED AS DIRECTED BY THE DEVELOPER'S ENGINEER. THE ESC MEASURES SHALL REMAIN IN PLACE UNTIL DIRECTED BY THE DEVELOPER'S ENGINEER FOR THEIR REMOVAL.
- NO CONSTRUCTION ACTIVITIES OR MACHINERY SHALL BE ALLOWED BEYOND THE SILT FENCE OR LIMITS OF THE PROPERTY.
- THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING ALL ESC MEASURES IN WORKING CONDITIONS AT ALL TIMES TO THE SATISFACTION OF THE DIRECTOR OF ENGINEERING. THE CONTRACTOR SHALL ROUTINELY INSPECT ALL ESC MEASURES AT A MINIMUM OF ONCE A WEEK AND AFTER EACH RAINFALL EVENT GREATER THAN 10 mm TO ENSURE THAT ESC MEASURES ARE IN PROPER WORKING CONDITIONS. ANY DAMAGES MUST BE REPAIRED WITHIN 24 HOURS.
- ALL CONSTRUCTION VEHICLES MUST ENTER AND EXIT THE SITE ONLY

- FROM THE APPROVED ACCESS ROUTE(S) AS SHOWN ON THE ACCEPTED EROSION CONTROL PLANS.
- ALL DISTURBED GROUND LEFT INACTIVE FOR OVER 30 DAYS SHALL BE VEGETATED, SUBJECT TO WEATHER CONDITIONS, BY SEEDING OR APPROVED EQUIVALENT TO THE SATISFACTION OF THE DIRECTOR OF ENGINEERING.
 - STREET SWEEPING/CATCHBASIN CLEANING PROGRAM SHALL BE IMPLEMENTED UPON COMPLETION OF BASE ASPHALT TO THE SATISFACTION OF THE DIRECTOR OF ENGINEERING.
 - THE CONTRACTOR SHALL ENDEAVOUR TO PREVENT MUD TRUCKING ONTO EXISTING RIGHT-OF-WAY AND SHALL PROVIDE CLEAN UP AT HIS/HER OWN EXPENSE AS DIRECTED BY THE DIRECTOR OF ENGINEERING.
 - NO EROSION MEASURES WILL BE REMOVED WITHOUT NOTIFICATION FROM THE ENGINEER.



KEYPLAN

LEGENDS:

- EX GAS
- EX WATER MAIN
- EX STORM
- EX SAN
- PR SANITARY2
- PR SILT FENCE
- SWALE
- RETAINING WALL
- 0.3m VERT. INTERVAL
- PROPOSED GRADE
- WATER VALVE
- WATER METER
- BACK FLOW PREVENTER
- CB
- SANITARY MANHOLE
- SUMP PUMP
- DOWNSPOUT
- ENTRANCE SYMBOL
- OVERLAND FLOW

6			
5			
4			
3			
2			
1			
0	2025/03/04	FOR SITE PLAN APPROVAL	FS
REV.	DATE	DESCRIPTION	BY

MUNICIPALITY

THE CITY OF **Waterloo**

ENGINEER'S STAMP

CIVIL ENGINEER

LUBAN

7373 LONGHEAD AVENUE, NIAGARA FALLS, ONTARIO, L2G7S4
TEL: 226-688-7828, EMAIL: FENG.SH@LUBAN.CA

CLIENT

ARCHITECT

DESIGN
KHALSA

REMOVAL & EROSION CONTROL PLAN

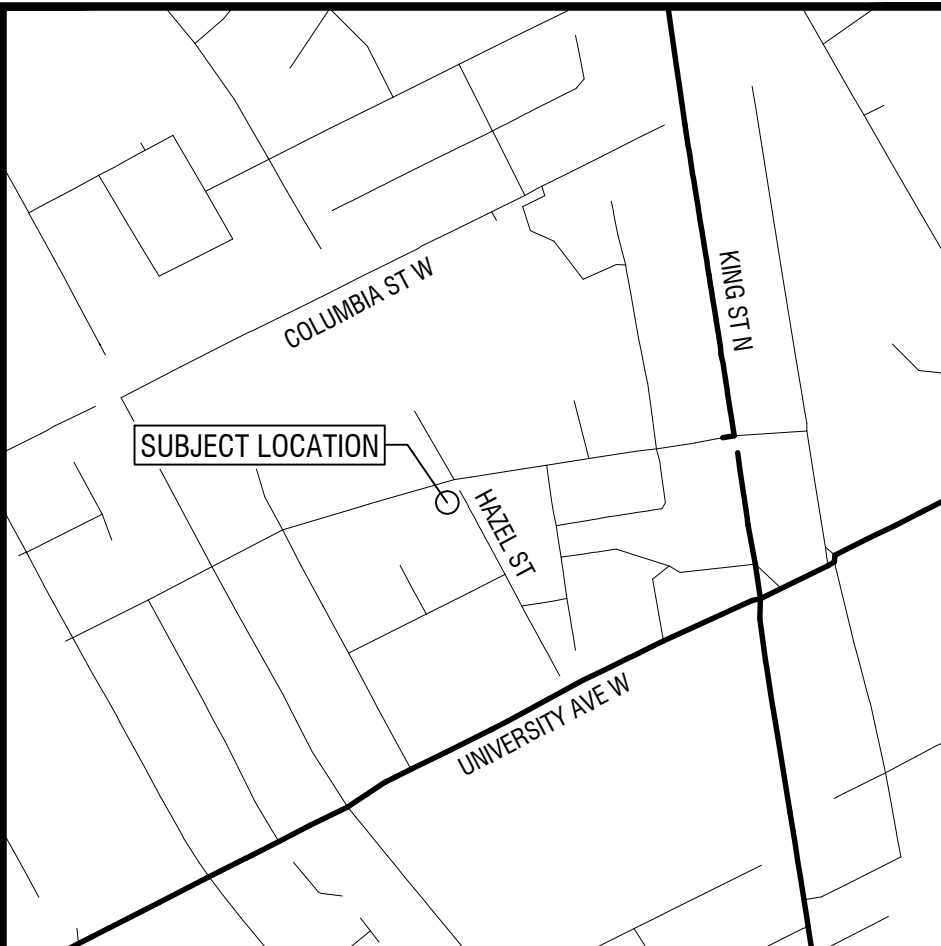
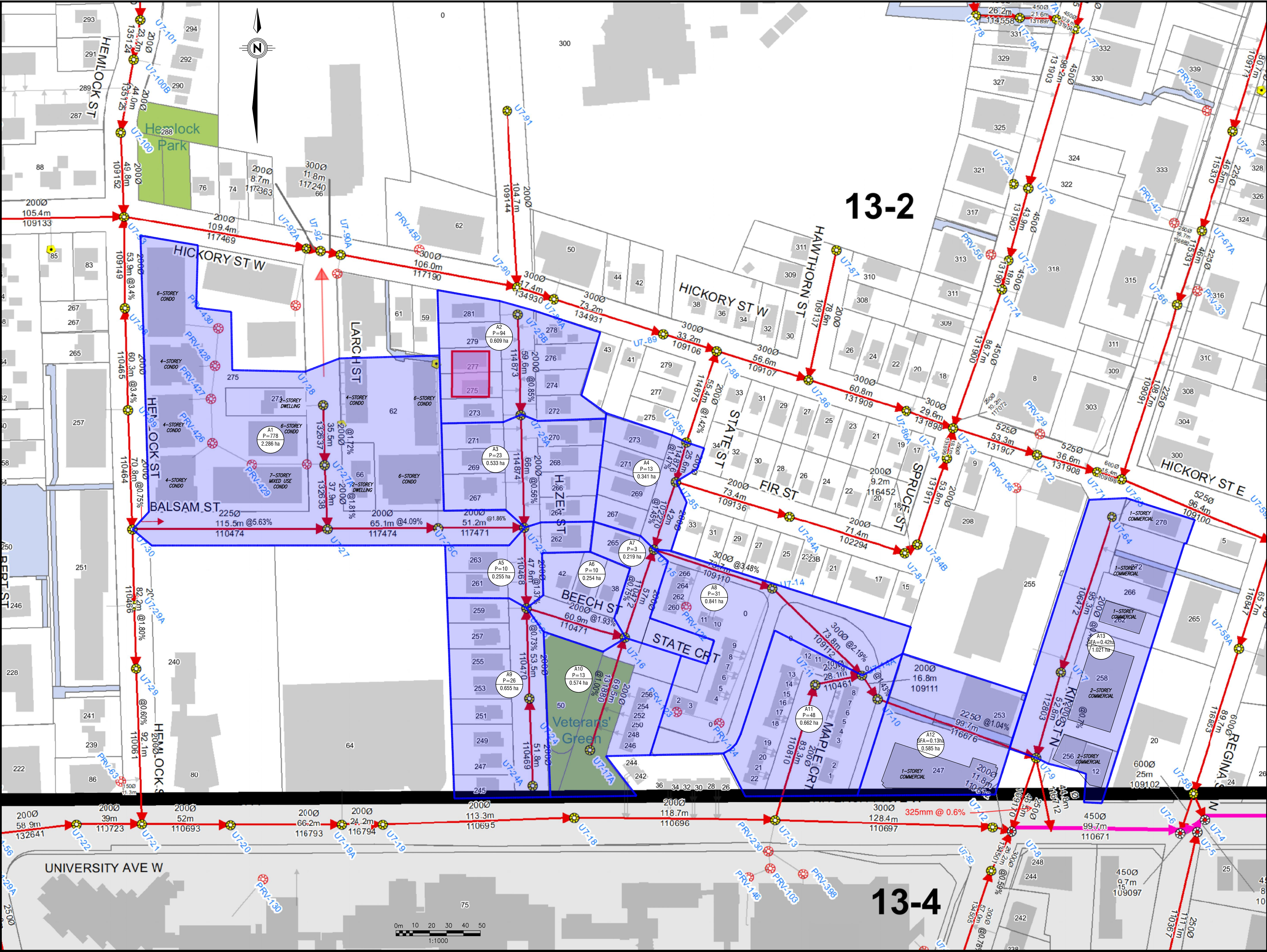
APARTMENT

277-279 HAZEL ST, WATERLOO, ONTARIO

DESIGNED BY:	MG	SCALE:	CONTRACT No.
CHECKED BY:	FS	HORIZONTAL:	1:100
DRAWN BY:	MG	VERTICAL:	
DATE:	2025/03/04		

SHEET	No 4 OF 6
DRAWING No.	C4

Appendix C. Sanitary Drainage Master Plan



KEYPLAN

METRIC:
DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

BENCHMARK:
ELEVATIONS ARE BASED ON GPS OBSERVATIONS FROM PERMANENT REFERENCE STATIONS IN THE NAD83 (CSRS-2010) COORDINATE SYSTEM, WITH HEIGHTS CONVERTED TO ORTHOMETRIC ELEVATIONS ON THE CGVD28 DATUM (1978 ADJUSTMENT) WITH GEOID MODEL HTv2.0, AS SUPPLIED BY NATURAL RESOURCES CANADA.

SITE BENCHMARK #1: NAIL ON HYDRO POLE ALONG HAZEL STREET APPROX. 9.5m NORTH FROM NORTH EAST CORNER OF THE SUBJECT PROPERTY, HAVING AN ELEVATION OF 332.87 METRES.

SITE BENCHMARK #2: NAIL ON HYDRO POLE ALONG HAZEL STREET APPROX. 14.0m SOUTH EAST FROM SOUTH EAST CORNER OF THE SUBJECT PROPERTY, HAVING AN ELEVATION OF 332.87 METRES.

BEARING AND COORDINATE NOTE:
BEARINGS ARE GRID BEARINGS AND ARE DERIVED FROM GPS OBSERVATIONS AND ARE REFERRED TO THE UTM PROJECTION, ZONE 17, NAD 83 (CSRS-2010) ADJUSTMENT.

DISTANCES SHOWN ON THIS PLAN ARE ADJUSTED GROUND DISTANCES AND CAN BE CONVERTED TO GRID DISTANCES BY MULTIPLYING BY AN AVERAGED COMBINED SCALE FACTOR OF 0.999571

COORDINATES ON THIS PLAN ARE UTM, ZONE 17, NAD83 (CSRS-2010) ADJUSTMENT AND ARE BASED ON GPS OBSERVATIONS FROM A NETWORK OF PERMANENT GPS REFERENCE STATIONS.

6			
5			
4			
3			
2			
1			
0	2025/03/04	FOR SITE PLAN APPROVAL	FS
REV.	DATE	DESCRIPTION	BY

MUNICIPALITY:

THE CITY OF
Waterloo

ENGINEER'S STAMP
LUBAN
7373 LONGHEAD AVENUE, NIAGARA FALLS, ONTARIO, L2G5Y4
TEL: 226-688-7828, EMAIL: FENG.SH@LUBAN.CA

CIVIL ENGINEER:
LUBAN

CLIENT:
ARCHITECT:
**DESIGN
KHALSA**

SANITARY DRAINAGE AREA PLAN
APARTMENT
277-279 HAZEL ST, WATERLOO, ONTARIO

DESIGNED BY: MG	SCALE: HORIZONTAL: 1:100	CONTRACT No.
CHECKED BY: FS	VERTICAL:	SHEET No 5 OF 6
DRAWN BY: MG		C5
DATE: 2025/03/04		DRAWING No.

Appendix D. Sanitary Sewer Design Spreadsheet

277-279 HAZEL STREET, WATERLOO

City of Waterloo Design Criteria - Residential Sewage Flow Data

Residential Sewage Flow 275 L/c/day

Density- Single Family 3.3 c/unit

Density - Row Housing 2.18 c/unit

Density - Apartment 1.76 c/unit

Residential Peaking Factor $1 + (14/4 + P^{0.5})$ $P = \text{Pop}/1000$

Infiltration	0.25 L/s/ha
--------------	-------------

Commercial Sewage Flow

0.5 L/s/ha

LOCATION						RESIDENTIAL		COMMERCIAL	INSTITUTIONAL	SEWAGE FLOWS						SEWER DESIGN						
ID	STREET	From MH	To MH	Individual Area	Total Area	Individual Pop.	Total Pop.	Floor Space (ha)	Occupancy	Res. Peaking Factor	Average Res. Flow	Peak Res. Flow	Peak Com. Flow	Total Infiltration	Total Peak Flow	Mannings	Pipe Size	Slope	Length	Capacity	Velocity	Q/Qcap
				(ha)	(ha)						(L/s)	(L/s)	(L/s)	(L/s)	(L/s)	'n'	(mm)	(%)	(m)	(L/s)	(m/s)	(%)
A1	Balsam St			2.27	2.27	785	785			5.39	2.50	13.45		0.57	14.02	0.013	200	1.86%	51.2	44.7	1.4	31.3%
A2	Hazel St			0.61	0.61	94	94			4.81	0.30	1.43		0.15	1.58	0.013	200	0.85%	59.6	30.2	1.0	5.2%
A3	Hazel St			0.53	3.41	23	901			5.45	2.87	15.63		0.85	16.48	0.013	200	0.56%	66.0	24.5	0.8	67.1%
A5	Hazel St			0.23	3.64	10	911			5.45	2.90	15.82		0.91	16.72	0.013	200	1.37%	47.6	38.4	1.2	43.6%
A9	Hazel St			0.66	0.66	26	26			4.66	0.08	0.39		0.16	0.55	0.013	200	0.85%	53.5	30.2	1.0	1.8%
A6	Beech St			0.25	4.54	10	947			5.47	3.01	16.50		1.14	17.63	0.013	200	1.93%	60.9	45.6	1.5	38.7%
A10	Hazel St			0.57	0.57	13	13			4.61	0.04	0.19		0.14	0.33	0.013	200	0.85%	69.5	30.2	1.0	1.1%
A7	State St			0.22	5.34	3	963			5.48	3.07	16.80		1.33	18.14	0.013	200	0.75%	57.0	28.4	0.9	63.8%
A4	Hazel St			0.34	0.34	13	13			4.61	0.04	0.19		0.09	0.28	0.013	200	1.45%	42.0	39.5	1.3	0.7%
A8	Lane			0.84	6.52	31	1007			5.50	3.21	17.64		1.63	19.27	0.013	300	2.19%	73.8	143.1	2.0	13.5%
A11	Lane			0.66	7.18	48	1055			5.53	3.36	18.56		1.80	20.36	0.013	200	1.43%	16.8	39.2	1.2	51.9%
A12	Lane			0.59	7.77			0.13					0.06	1.94	22.36	0.013	225	1.04%	99.7	45.8	1.2	48.8%
A13	King St N			1.02	1.02			0.42					0.21	0.26	0.46	0.013	200	0.70%	52.8	27.4	0.9	1.7%
	King St N				8.79									2.20	25.02	0.013	325	0.60%	46.5	92.7	1.1	27.0%

[illegible]

Appendix E. Fire Flow Calculation

Fire Flow Calculation based on Fire Underwriters Survey

Location		275-277 Hazel Street, Waterloo			
1	Total Floor Area (m ²)	2663 m ²			
	Storeys	6			
	The height of storey	9.14 m			
Construction Coefficient		Type Non-combustible Construction	Coefficient 0.6		
$F = 220C\sqrt{A}$		6812 L/min			
Round to nearest 100 L/min		7000 L/min			
2	Occupancy factor	Type Non-Combustible	Factor -25%		
	NFF adjusted for occupancy	5250 L/min			
3	Sprinkler adjustment	1575 30% (max. 30%)	A maximum of 30% credit if complete automatic sprinkler		
	Sprinkler flow credit	525 10%	Additional credit of up to 10% may be granted if the water supply is standard for both the system and fire department hose lines required. Additional 10% credit for fully supervised system		
		525 10%			
4		N	S	E	W
	Separation (m)	10	7	30	24
	Charge	20%	20%	10%	10%
Exposure adjustment		60%	Total percentage shall be the sum of the percentage for all sides, but shall not exceed 75%		
Exposure flow debit		3150 L/min			
5	NFF	5775 L/min			
	NFF check	5775	The fire flow shall not exceed 45,000 L/min, nor less than 2,000 L/min		
	Round to nearest 1000 L/min	6000 L/min 100 L/s	1585 USgal/min		

Appendix F. Water Demand Calculation

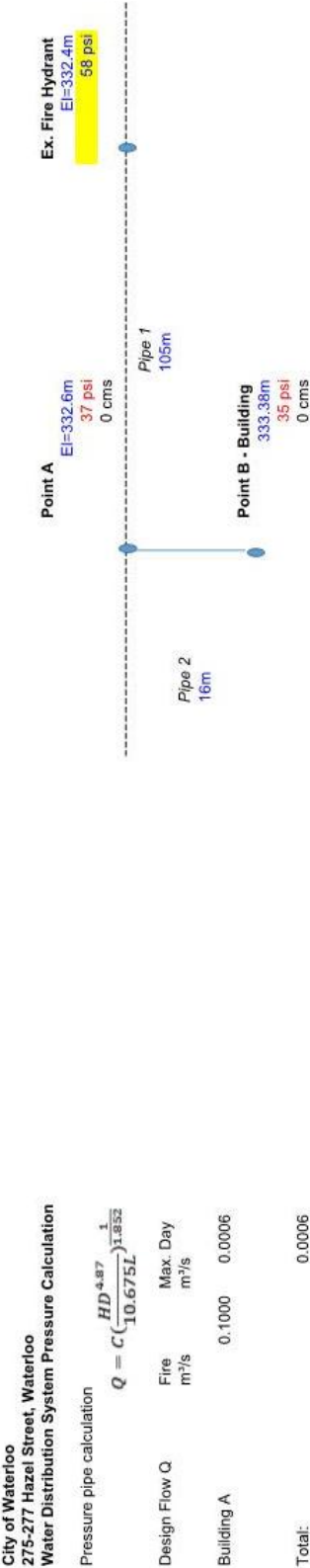
Proposed Warehouse Site Plan
275-277 Hazel Street
City of Waterloo
Water Supply Calculation

Water Supply Demand

Water Supply Demand: 275 l/capita/day
imum Day Demand Peaking Factor: 2.75
num Hour Demand Peaking Factor: 4.13

Land Use	Area (GFA) (sq.m)	Population	Average Day Demand (L/s)	Maximum Day Demand Peaking Factor	Maximum Day Demand (L/s)	Maximum Hour Demand Peaking	Maximum Hour Demand (L/s)	Fire Flow (L/s)	Maximum Day + Fire Flow Demand (L/s)	Maximum Day + Fire Flow Demand (US
Residential		70	0.22	2.75	0.6	4.13	0.9	100.0	100.6	1595

Appendix G. Water Pipe Pressure Figure and Calculation



Point A		0.100 cms	
Pipe 1			
Design Flow		0.099 m ³ /s	
C		150	
Head loss (friction)		2.27 m	
Pipe diameter		0.15 m	
Distance		105m	
Velocity		5.61 m/s	
Tees		(minor loss)	k
Valves		0	0.4
45 bends		0	0.17
90 bends		0	0.35
total head loss			14.88m

Point B		0.100 cms	
Pipe 2			
Design Flow		0.099 m ³ /s	
C		150	
Head loss (friction)		2.27 m	
Pipe diameter		0.15 m	
Distance		16m	
Velocity		5.61 m/s	
Tees		(minor loss)	k
Valves		1	0.4
45 bends		1	0.17
90 bends		0	0.35
total head loss			3.18m

Appendix H. Fire Flow Test Report by Vipond Inc

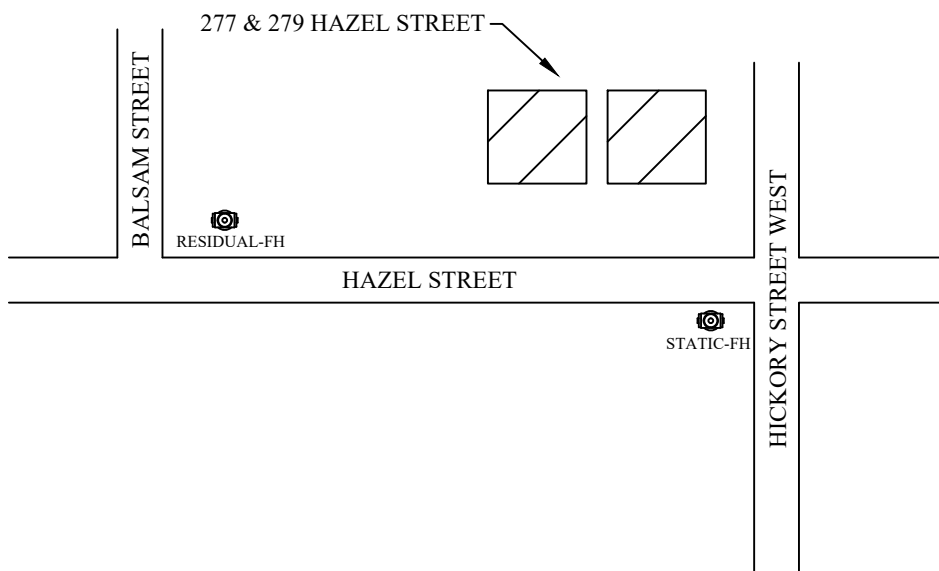
FLOW TEST RESULTS



DATE : MAY 9, 2024 TIME : 9:00AM

LOCATION : 277 & 279 HAZEL STREET
WATERLOO, ONTARIO

TEST BY : VIPOND & WATERLOO PUBLIC WORKS



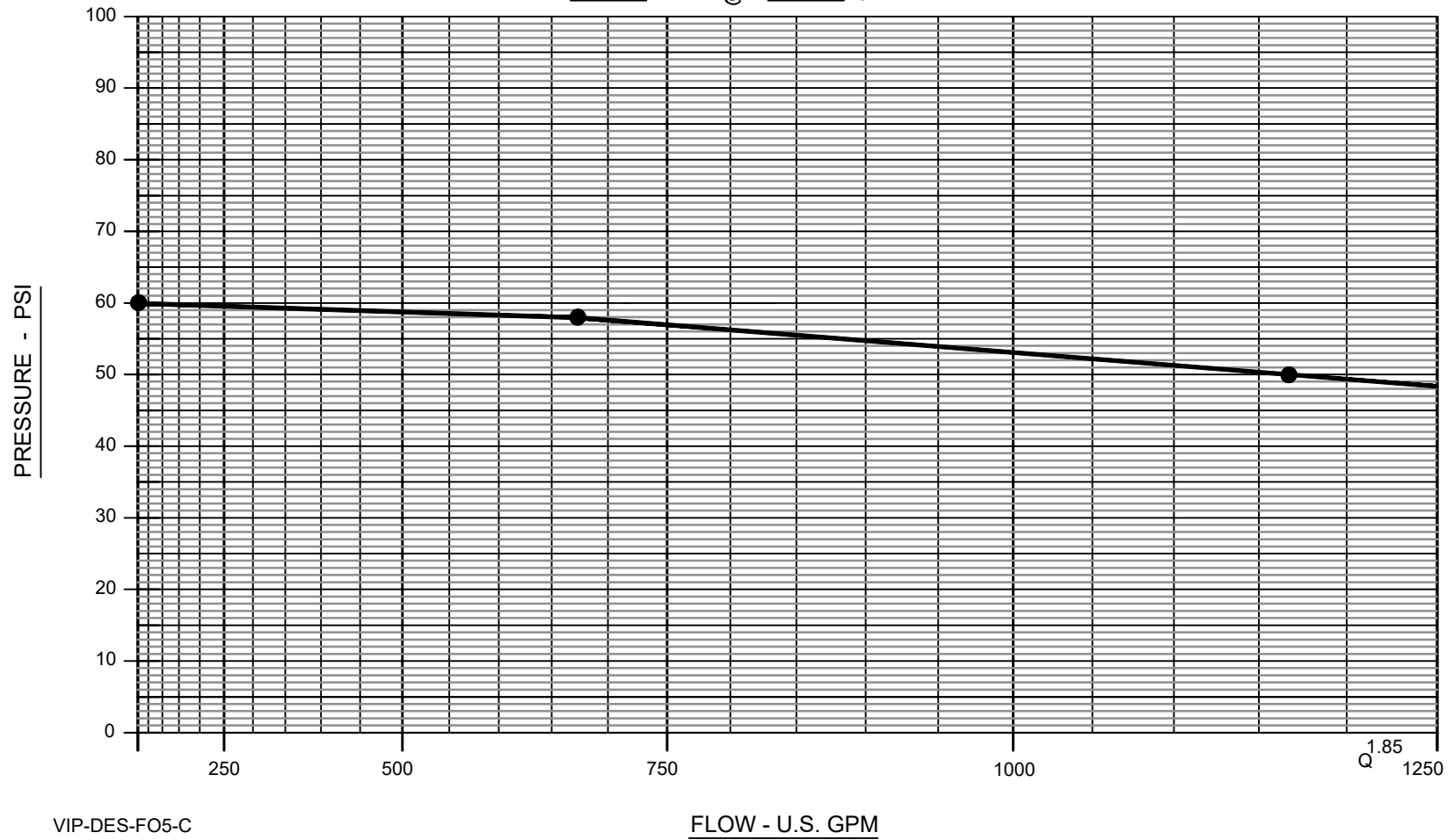
STATIC PRESSURE : 60 PSI

TEST NO.	NO. OF NOZZLES	NOZZLE DIAMETER (INCHES)	DISCHARGE CO-EFFICIENT	RESIDUAL PRESSURE (PSI)	PITOT PRESSURE (PSI)	DISCHARGE (U.S.GPM)
1	1	2 1/2"	0.90	58	16	671
2	2	2 1/2"	0.90	50	12	1162
3						
4						
5						



277 & 279 HAZEL STREET	BY : VIPOND	OF
WATERLOO, ONTARIO	OFFICE : KITCHENER, ONTARIO	
	TEST BY : VIPOND & WATERLOO PW	
STATIC : 60 PSI		

STATIC : 60 PSI
 58 PSI @ 671 GPM
 50 PSI @ 1162 GPM
 PSI @ GPM



Appendix I. Stormwater Management Quantity Control Storage Calculation

2-year Storage Calculation

	TIME minutes	2 Year INTENSITY mm/hr	Q 2 Year m ³ /s	Control Q (pre) m ³ /s	Q Stored m ³ /s	STORAGE m ³
Tc =>	5.0	105.7	0.023	0.013	0.010	2.9
	10.0	81.1	0.018	0.013	0.004	2.6
	15.0	66.1	0.015	0.013	0.001	1.0
	20.0	56.0	0.012	0.013	-0.001	-1.3
	25.0	48.8	0.011	0.013	-0.003	-4.1
	30.0	43.2	0.010	0.013	-0.004	-7.1
	35.0	38.9	0.009	0.013	-0.005	-10.3
	40.0	35.4	0.008	0.013	-0.006	-13.6
	45.0	32.5	0.007	0.013	-0.006	-17.0
	50.0	30.1	0.007	0.013	-0.007	-20.5
	55.0	28.0	0.006	0.013	-0.007	-24.1
	60.0	26.2	0.006	0.013	-0.008	-27.7
	65.0	24.6	0.005	0.013	-0.008	-31.3

Site - Controlled

Area (ha) 0.103

Pre-Development

Area (ha) 0.103

C_{composite} 0.57

Tc (min) 10.00

Intensity mm/hr 81.1

Qp (m³/s) 0.013

Qc 0.013

Post-Development

C 0.77

Time Incr. 5.0

Pre-development

Return Period 2 Year

Intensity

$$i = a / (b + T)^c \text{ (mm/hr)}$$

where,

$$a = 1101$$

$$b = 9.258$$

$$c = 0.882$$

$$Q = 0.013$$

Post-Development

Return Period 2 Year

Intensity

$$i = a / (b + T)^c \text{ (mm/hr)}$$

where,

$$a = 1101$$

$$b = 9.258$$

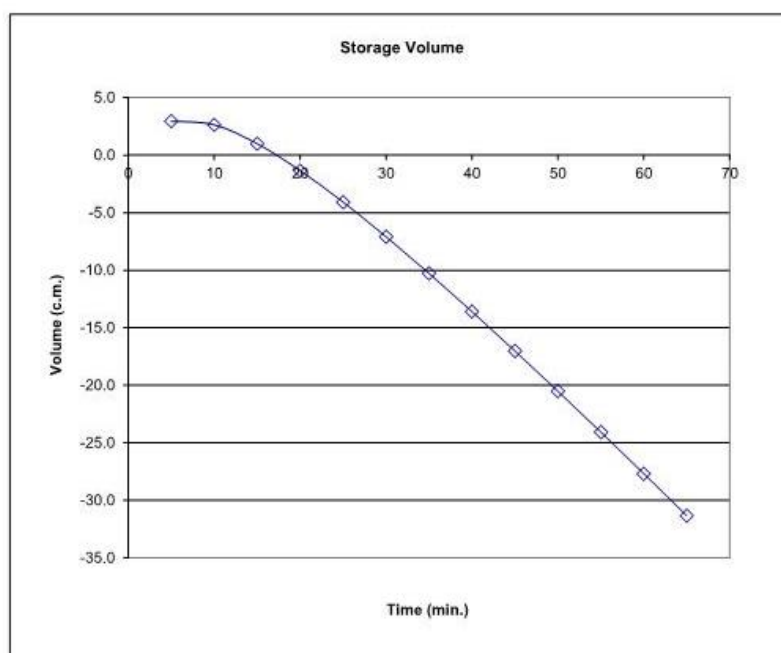
$$c = 0.882$$

$$Q = 0.013$$

DO NOT ERASE

Max.Storage

2.9



5-year Storage Calculation

	TIME minutes	5 Year INTENSITY mm/hr	Q 5 Year m ³ /s	Control Q (pre) m ³ /s	Q Stored m ³ /s	STORAGE m ³
T _c =>	5.0	136.5	0.030	0.018	0.012	3.6
	10.0	108.8	0.024	0.018	0.006	3.5
	15.0	90.8	0.020	0.018	0.002	1.7
	20.0	78.2	0.017	0.018	-0.001	-1.0
	25.0	68.7	0.015	0.018	-0.003	-4.4
	30.0	61.4	0.014	0.018	-0.005	-8.2
	35.0	55.6	0.012	0.018	-0.006	-12.3
	40.0	50.8	0.011	0.018	-0.007	-16.5
	45.0	46.8	0.010	0.018	-0.008	-21.0
	50.0	43.4	0.010	0.018	-0.009	-25.5
	55.0	40.5	0.009	0.018	-0.009	-30.2
	60.0	38.0	0.008	0.018	-0.010	-34.9
	65.0	35.8	0.008	0.018	-0.010	-39.7

Site - Controlled

Area (ha) 0.103

Pre-Development

Area (ha) 0.103

C_{composite} 0.57

T_c (min) 10.00

Intensity mm/hr 108.8

Q_p (m³/s) 0.018

Uncontrolled Flow 0.018084

Q_c 0.018

Post-Development

C 0.77

Time Incr. 5.0

Pre-development

Return Period 5 Year

Intensity

$$i = a / (b + T)^c \text{ (mm/hr)}$$

where,

a = 1755

b = 12.347

c = 0.895

Q = 0.018

Post-Development

Return Period 5 Year

Intensity

$$i = a / (b + T)^c \text{ (mm/hr)}$$

where,

a = 1755

b = 12.347

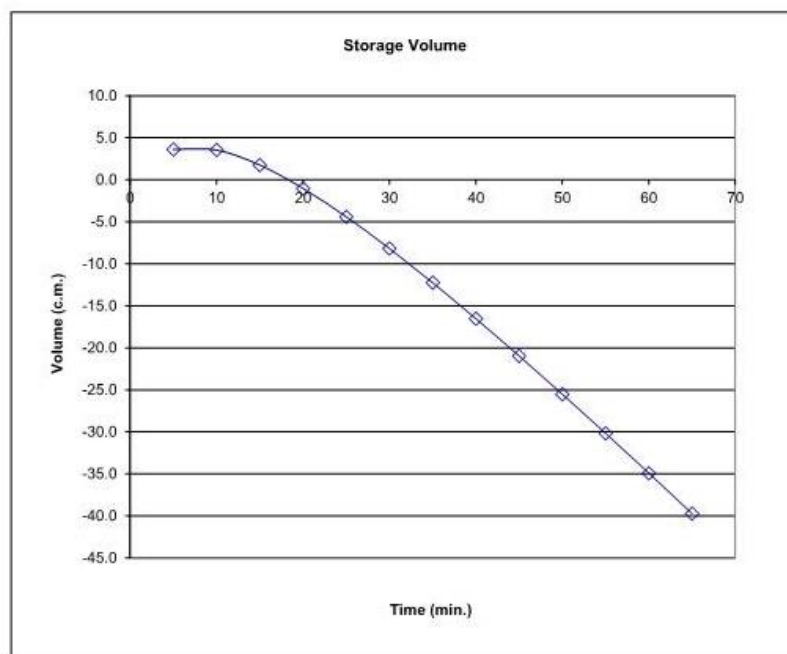
c = 0.895

Q = 0.024

DO NOT ERASE

Max.Storage

3.6



100-year Storage Calculation

TIME minutes	100 Year INTENSITY mm/hr	Q 100 Year m ³ /s	Control Q (pre) m ³ /s	Q Stored m ³ /s	STORAGE m ³
Tc => 5.0	239.8	0.066	0.033	0.033	10.0
10.0	197.8	0.055	0.033	0.022	13.0
15.0	168.6	0.046	0.033	0.014	12.2
20.0	147.0	0.040	0.033	0.008	9.1
25.0	130.4	0.036	0.033	0.003	4.6
30.0	117.2	0.032	0.033	-0.001	-1.0
35.0	106.5	0.029	0.033	-0.004	-7.4
40.0	97.6	0.027	0.033	-0.006	-14.3
45.0	90.1	0.025	0.033	-0.008	-21.7
50.0	83.7	0.023	0.033	-0.010	-29.4
55.0	78.2	0.022	0.033	-0.011	-37.4
60.0	73.4	0.020	0.033	-0.013	-45.6
65.0	69.1	0.019	0.033	-0.014	-54.0

Site - Controlled

Area (ha) 0.103

Pre-Development

Area (ha) 0.103

C_{composite} 0.57

Tc (min) 10.00

Intensity mm/hr 197.8

Qp (m³/s) 0.033

Qc 0.033

Post-Development

C 0.77

Time Incr. 5.0

Pre-development

Return Period 100 Year

Intensity

$$i = a / (b + T)^c \text{ (mm/hr)}$$

where,

$$a = 4692$$

$$b = 17.437$$

$$c = 0.956$$

$$Q = 0.033$$

Post-Development

Return Period 100 Year

Intensity

$$i = a / (b + T)^c \text{ (mm/hr)}$$

where,

$$a = 4692$$

$$b = 17.437$$

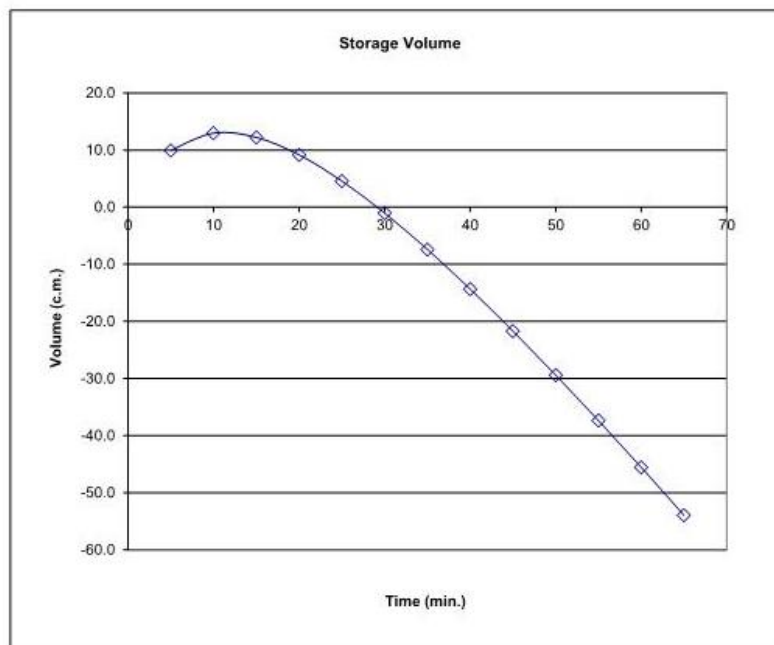
$$c = 0.956$$

$$Q = 0.044$$

DO NOT ERASE

Max.Storage

13.0



Orifice Calculation

**Proposed Apartment Development
277-279 HAZEL STREET
WATERLOO, ONTARIO
Orifice / Tube Control Calculation**

A Orifice / Tube Design Info

Location = Storm MH 3 Upstream

Max. Allowable Release Rate = 32.88 (L/s)
Inlet Pipe Invert = 330.93 (m)
Orifice / Tube Invert = 330.93 (m)
100-YEAR WL 333.06
High Water Level = 2.13 (m)
Orifice / Tube Size = 85.00 (mm)
SDR35 150mm

B Orifice / Tube Flow Calculation

$$Q = C \times A \times (2 \times g \times H)^{0.5}$$

Where:

Orifice Coefficient = 0.82 (Tube)
Acceleration due to gravity (g) = 9.81 (m/s/s)
Cross section area of orifice (A) = 0.01 (sq.m)
Downstream HGL N/A (m)
Q 30.08

Note:

* Actual average inside diameter size as per IPEX SDR 35