



MTE Consultants

520 Bingham Centre Drive, Kitchener, Ontario N2B 3X9

September 6, 2024

MTE File No.: C32375-800

Mike Defoa
Engineering Technologist
City of Waterloo
100 Regina Street South
Waterloo, Ontario N2J 4A8

Dear Mike:

**RE: Functional Servicing and SWM Brief
1 Dunbar Road North, Waterloo**

BACKGROUND AND EXISTING CONDITIONS

MTE Consultants Inc. was retained by 2744668 Ontario Inc. to complete the grading, servicing, and stormwater management design for the proposed 10-storey residential building to be constructed at 142-154 Erb Street West and 5 Dunbar Road North (herein referred to as 'the Site') in the City of Waterloo. The client would like to use 1 Dunbar Road North to identify the property going forward.

The Site encompasses an area of approximately 0.289ha and currently consists of seven 2-storey residential dwellings, each with its own driveway entrance. Of the seven residential dwellings, six front Erb Street West and one fronts Dunbar Road North. The Site is bounded to the north by existing residential developments, to the east by Dunbar Road North, to the south by Erb Street West, and to the west by Roslin Avenue North. For the exact location of the Site, refer to the key plan located on the separately appended engineering drawings.

The following information detailing the proposed servicing and stormwater management strategy for the Site is provided in support of the functional engineering submission.

GRADING

The existing grades fall from east to west along Erb Street West. Existing elevations vary from 331.25+/- along Dunbar Road North to 330.30+/- along Roslin Avenue North. The front yards of the single detached houses fronting Erb Street West drain toward Erb Street West. The backyards drain north into the neighbouring properties on Roslin Avenue North and Dunbar Road North. Existing elevations are around 329.00 along the north property line. Refer to contours on MTE Drawing C1.1 for additional details. Ultimately, this area of the City drains to Laurel Creek/Silver Lake uncontrolled.

As part of the proposed development, runoff will be directed away from the building. The landscaped area flowing north to neighbouring properties will be decreased to improve upon existing conditions. Elevations along the building limit will vary (as coordinated with the architect), with barrier free access provided to the principal entrance on the east face of the building. A major storm overland flow route is proposed to be directed to Roslin Avenue North with the revised concept.

SERVICING

Existing services described below were determined through a combination of field investigations, private locates, and record drawings. The following information was referenced during the compilation of separately appended Drawing C1.1 and have been included in Appendix A:

- As-recorded plan and profile drawings from the Region of Waterloo dated February 1990 for Erb Street West (dwg # 143).
- MTE topographic survey and field investigation from May 2022.
- Buffalo Locating Inc. private locates dated June 2022 for the Site.

The proposed development will be serviced off of Roslin for Sanitary, Storm and Water. Schematic alignments for civil services are shown on C2.2 in support of OPA/ZBA. The alignment will be fine-tuned through the Site Plan Approval process and in coordination with the rest of the consultant team as the building design progresses.

Sanitary

The existing residential dwellings are individually serviced with their own sanitary service connections of unknown size. As previously mentioned, six of the existing residential dwellings front Erb Street West and are serviced by an existing 300mm diameter municipal sanitary sewer within the right-of-way which drains west. The 300mm sewer is located within the centerline of the four-lane road. The existing residential dwelling fronting Dunbar Road North is expected to be serviced by an existing 250mm diameter municipal sanitary sewer within the right-of-way which drains south. There is an existing 300mm municipal sanitary sewer on Roslin Avenue North which drains north. All existing sanitary services will be removed up to the property line as part of the redevelopment of the Site. Refer to the separately submitted Drawing C1.1 for more details.

The proposed 10-storey residential building has 125 studio/one-bedroom units and 33 two-bedroom units for a total of 158 units and 191 bedrooms. An anticipated peak sanitary demand of 4.36L/s was calculated based on 191 bedrooms and density of 1.77 people per unit. The combined total demand including infiltration allowance of 0.25L/s/ha for the Site is 4.44L/s.

It is proposed that the Site will be serviced by a new 150mm diameter sanitary sewer complete with a new manhole at the existing 300mm diameter municipal sanitary sewer within the Roslin Avenue North right-of-way which drains north. The new 150mm diameter sanitary sewer will enter the Site on the western limits and connect to a new manhole at the property line prior to entering the proposed building. The new 150mm diameter sanitary sewer has a full flow capacity of 15.22L/s at 1.0% slope, meaning the total demand of 4.44L/s represents only 29.2% of the pipe's full flow capacity. Refer to the separately submitted Drawing C2.2 and the sanitary sewer design sheet in Appendix B for more details.

Storm

Under existing conditions, the Site does not have a storm service however, there is an existing 450mm diameter municipal storm sewer within the Roslin Avenue North right-of-way which drains north and a 975mm diameter municipal storm sewer within the Erb Street West right-of-way which drains east. Refer to the separately submitted Drawing C1.1 for more details.

It is proposed that the Site will be serviced by a new 250mm diameter storm sewer complete with a new manhole at the existing municipal sewer on Roslin Avenue North. The new 250mm diameter storm sewer has a full flow capacity of 84.01L/s at 2.0% slope which is deemed

sufficient for the flow rates leaving the Site, discussed further in the Stormwater Management section below.

Stormwater Management (SWM)

The SWM criteria for the Site, as established by the City of Waterloo in the Record of Consultation, is to not provide any on-site attenuation for the major stormwater events and to direct the runoff to the municipal right-of-way.

In the existing condition, the Site is 46.5% impervious and there are no stormwater quantity or quality measures in place. In the proposed condition, the percent imperviousness of the Site will increase to 78.2%, equating to an additional impervious area of approximately 916m². As per the City of Waterloo's comment in the Record of Consultation, no on-site attenuation has been proposed for the Site.

The following table summarizes flows generated by the Site. Refer to Appendix C for MIDUSS outputs. In the event the City requires some level of attenuation of post-development flows, attenuation could be achieved through flow control roof drains and/or an underground stormwater tank coupled with an orifice plate.

Summary of Flows

Modelling Condition	5-Year Storm Event (m ³ /s)	100-Year Storm Event (m ³ /s)
Pre-Development	0.042	0.087
Post-Development	0.072	0.139

Given that majority of the proposed development consists of sidewalks, landscape areas and rooftops, no quality control measures are proposed as all runoff generated on site will be clean, with the exception of the two driveways where vehicles enter the building.

Water

Under existing conditions, all the residential dwellings are each serviced with their own water service of unknown size but are expected to be 25mm in diameter. Five of the dwellings facing Erb Street West (144-154) are serviced by the existing 200mm diameter municipal watermain within the Erb Street West right-of-way. The 200mm diameter watermain is located within the northern most west bound lane. The dwelling facing Dunbar Road North, as well as 142 Erb Street West are serviced by the existing 150mm diameter municipal watermain within the Dunbar Road North right-of-way. All existing water services will be removed up to the main as part of the redevelopment of the Site. Refer to the separately submitted Drawing C1.1 for details.

The required private water service will be confirmed by the mechanical engineer during detailed design but is assumed to be 200mm diameter. The new 200mm diameter watermain is proposed to connect to the existing 200mm diameter municipal watermain within the Roslin Avenue North right-of-way. The new watermain will enter the proposed building on the west face of the building where the water room is expected to be. The proposed water meter will be located within the water room inside the building.

The proposed location of the fire department connection has not been confirmed at this time; however, there is an existing municipal fire hydrant located within 45m of the principal entrance, located at the southwest quadrant of the Erb Street West and Dunbar Road North intersection.

There is also another existing municipal fire hydrant located at the northeast quadrant of the Erb Street West and Roslin Avenue North intersection, near the southwest corner of the Site, which may be used for fire protection. Refer to the separately submitted Drawing C2.2 for further details.

Water Demand

Preliminary water demands were calculated for the proposed development and are included in Appendix D. The maximum day domestic water demand was determined to be 2.42L/s.

The proposed development was analyzed using both the OBC and FUS fire flow requirements. The fire flow requirement was determined to be 150L/s and 183L/s based on OBC and FUS fire flow requirements, respectively. The following table summarizes the preliminary domestic and fire flow demands for the proposed building. Refer to Appendix D for the water demand design sheet.

Water Demand Summary

Building	Max Day Domestic Demand (L/s)	OBC Fire Demand (L/s)	FUS Fire Demand (L/s)	Max Day + OBC Fire Demand (L/s)
Proposed Building	2.42	150	183	152.42

Many municipalities in Ontario use both the OBC and the FUS fire flow requirements for assessing firefighting water supply requirements. Ideally, fire flow demands for new developments are calculated based on the FUS criteria; however, it is not reasonable to expect that the existing municipal watermain infrastructure always has the operational capacity to supply water at the rates prescribed in the FUS guidelines. As a result, at no time shall the available fire flow be less than that required by the Ontario Building Code. The minimum allowable pressure permitted under firefighting conditions is 140.0kPa per OBC 2012.

A hydrant flow test was completed on the existing municipal hydrants mentioned above: one located at the southwest quadrant of the Erb Street West and Dunbar Road North intersection, and the other located at the northeast quadrant of the Erb Street West and Roslin Avenue North intersection. The following table illustrates the results of the testing completed by Classic Fire and Life Safety.

Results of Flow Tests Completed (October 19, 2023)

Test #	Outlet Inside Diameter (in.)	Number of Outlets	Pitot Pressure (PSI)	Residual Pressure (PSI)	Flow @ Residual (gal/min)
1	n/a	n/a	n/a	68	n/a
2	2.5	1	44	64	1,113
3	2.5	2	28 + 29	62	1,792

Refer to Appendix E for information obtained by Classic Fire and Life Safety.

The residual pressure at the existing municipal hydrant was calculated to be 353kPa and 302kPa when subject to a max day domestic flow + fire flow demand of 152.42L/s and 185.75L/s under OBC and FUS conditions, respectively. Therefore, the residual pressures are greater than the

minimum allowable pressure of 140kPa per OBC 2012. Refer to Appendix F for fire flow analysis calculations.

CONCLUSIONS

Based on the foregoing analysis, it is concluded that:

- i) The proposed sanitary sewer connection will enter the Site at the western limits, connecting to the municipal sanitary sewer on Roslin Avenue North, with adequate capacity to service the proposed development.
- ii) The proposed storm sewer connection will enter the Site at the western limits, connecting to the municipal storm sewer on Roslin Avenue North, with adequate capacity to service the proposed development.
- iii) No stormwater management controls are proposed as noted in the latest Record of Consultation.
- iv) The proposed water service connection will be along the west face of the proposed building, connecting to the municipal watermain on Roslin Avenue North.
- v) Fire protection is proposed to be provided by an existing municipal hydrant located at the southwest quadrant of the Erb Street West and Dunbar Road North intersection. Pending the location of the fire department connection, fire protection may also be provided by an existing municipal hydrant located at the northeast quadrant of the Erb Street West and Roslin Avenue North intersection.

We trust that this information is satisfactory for this functional submission. Please contact the undersigned if you have any questions.

Yours truly,

MTE Consultants Inc.



Dain Na, B.Eng.

Designer

519-743-6500 ext. 1222

dna@mte85.com

DXN:dlb

Encl.

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Andrei Tchoumatchev, P.Eng.

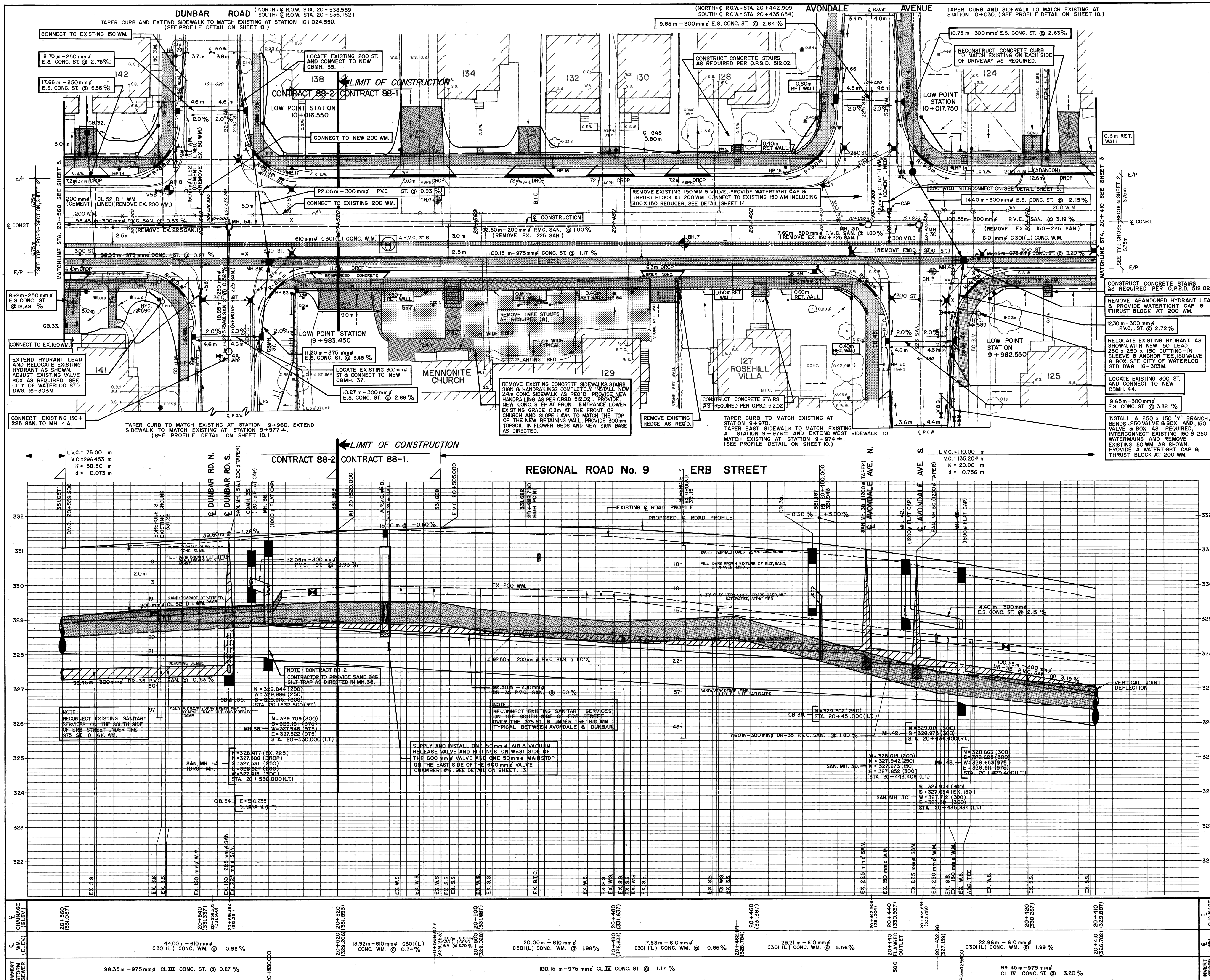
Design Engineer

519-743-6500 ext. 1377

atchoumatchev@mte85.com

Appendix A

Background Drawings



NOTES:

- THE POSITION OF POLE LINES, CONDUITS, WATERMANS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS. AND, WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES, AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.
- EXISTING SANITARY AND WATER SERVICES THAT ARE SHOWN MAY OR MAY NOT BE IN SERVICE. THE CITY OF WATERLOO FORCES WILL PROVIDE ON SITE DIRECTION REGARDING THE ABANDONMENT (PLUGGING) OR RECONNECTION OF ALL SUCH SERVICES AS ENCOUNTERED DURING THE NORMAL SEWER OR WATERMAIN INSTALLATIONS.
- HYDRANTS ARE TO BE LOCATED 0.60m BEHIND THE NEW SIDEWALK IN THE INTERSECTION DAYLIGHTING AREAS WHERE THE PROPERTY LINE ALLOWS. ON ERB STREET CERTAIN HYDRANTS MAY BE RESTRICTED TO WITHIN 0.30m BEHIND THE NEW SIDEWALK BECAUSE OF THE AVAILABLE R.O.W.
- ALL ROAD ELEVATIONS WHERE SHOWN ARE AT EDGE OF PAVEMENT GRADE.
- ROADWAY WIDTHS ARE TO EDGE OF GUTTER.
- BOREHOLE AND COREHOLE INFORMATION HAS BEEN SUPPLIED BY PETO MACCALLUM LTD. (877-240)

BENCHMARK:
Topo. No. 670102
Elevation 338.779

Topographical Survey
tablet in a concrete
pier 0.30m in diameter
and at ground level on
south side of Erb Street
West at #309 Erb Street
West.

Topo. No. 68-U-519
Elevation 328.538

City of Waterloo
Southeast corner of
King Street West
and Bridgeport Road,
tablet in face of
north foundation wall of
Waterloo Post Office

REVISIONS

NO.	REVISIONS	BY	DATE
1	"AS CONSTRUCTED"	J.E.L.	JAN, 1989
2	ALIGNMENT CHANGES	W.G.D.	FEB. 29/88

CUMMING-COCKBURN
LIMITED
CONSULTING ENGINEERS AND PLANNERS
WATERLOO - LONDON - TORONTO - OTTAWA

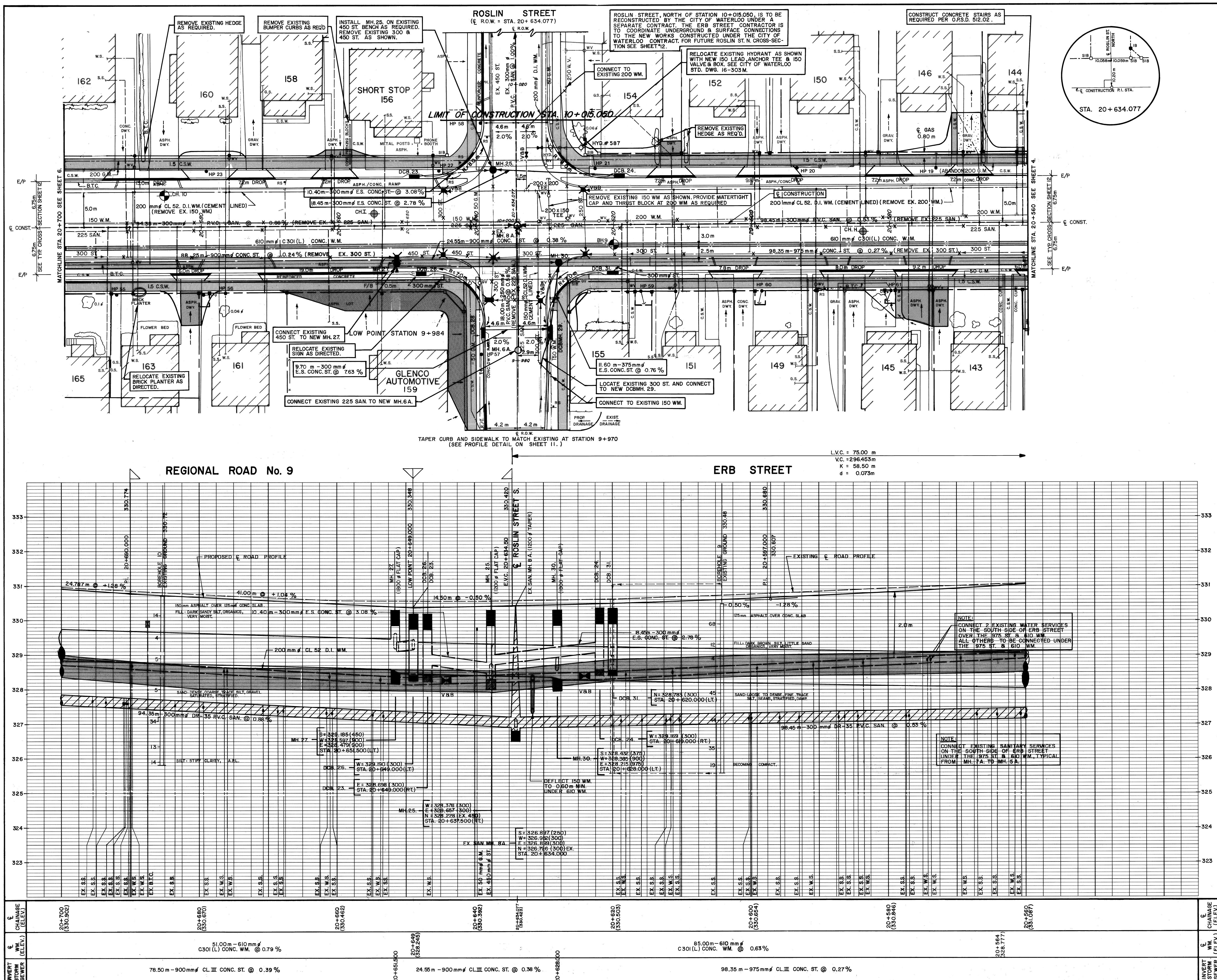
REGIONAL MUNICIPALITY OF WATERLOO

ERB STREET
REGIONAL ROAD No. 9
WATERLOO

**610 mm DIA. WATERMAIN AND
ERB STREET RECONSTRUCTION
STAGE 2
FROM STA. 20+410 TO STA. 20+560**

DRAWN BY: J. LEEMAN
CHECKED BY: A.J.I., W.G.D., R.L.T.
DATE: JAN. 15, 1988.
SCALE: HOR. 1"=250' VERT. 1"=50'

CONTRACT NO. 88-1
DRAWING NO. 143
SHEET 4 OF 4



NOTES:

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- ALL ROAD ELEVATIONS WHERE SHOWN ARE AT EDGE OF PAVEMENT GRADES.
- ALL ROADWAY WIDTHS ARE TO EDGE OF PAVEMENT I.E. WIDTH OF CURB AND GUTTER.
- BORERHOLE AND COREHOLE INFORMATION HAS BEEN SUPPLIED BY PETO MACCALLUM LTD. (877-2401)

BENCHMARK:
Topo. '670102
Elevation 338.779

Topographical Survey tablet in a concrete pier 0.30m in diameter and at ground level on south side of Erb Street West at #309 Erb Street West.

Topo. No. 68-0-519
Elevation 328.538

City of Waterloo, Southeast corner of King Street West and Bridgeport Road, tablet in face of north foundation wall of Waterloo Post Office

REVISIONS

NO.	REVISIONS	BY	DATE
3	"AS-BUILT" WM'S @ ROSLIN N.S. R.C.L.	FEB.15/90	
2	"AS CONSTRUCTED"	J.E.L. JAN, 1989	
1	ALIGNMENT CHAINAGES	W.G.D. FEB.29/88	

CUMMING - COCKBURN LIMITED
CONSULTING ENGINEERS AND PLANNERS
WATERLOO - LONDON - TORONTO - OTTAWA

THE REGIONAL MUNICIPALITY OF WATERLOO

ERB STREET
REGIONAL ROAD No. 9
WATERLOO

610 mm DIA. WATERMAIN AND
ERB STREET RECONSTRUCTION
STAGE 2
FROM STA. 20+560 TO STA. 20+700

DRAWN BY: J. LEEMAN

CHECKED BY: A.J.L., W.G.D., R.L.T.

DATE: JAN. 15, 1988.

SCALE: HOR. 1:250
VERT. 1:50

CONTRACT NO. 88-2

DRAWING NO. 143

SHEET 5 OF 20



CLIENT: MTE Consultants Inc

BILLING ADDRESS: 520 Bingham's Centre Dr
Kitchener

SITE CONTACT: Mark n Email
PHONE:
EMAIL:

PROJECT MANGER: Steve Shuss
PHONE: 519.743.6500 X1252
EMAIL: sshuss@mtebs.com

JOB SITE ADDRESS: 142 to 154 Erb St W
Kitchener

CLIENT REFERENCE #

BUFFALO JOB # 3825

LOCATE LIMITS: SUE/SUM - mark & locate all
UTILITIES on 142 to 154 ERB ST W.

PAGE # 1 OF 3

NOTE: THIS DRAWING IS NOT TO SCALE.

- 1) HYDRO: HYDRO overhead.
- 2) Comm: CATV LOCATED TO THE BACKYARD ALONG PROPERTY
FENCE - PEDS LOCATED (marked with solid line)
orange paint CATV HEAD(W) TO ROSLIN AVE
TELEPHONE WIRES LOCATED TO THE BACKYARD, TO
BELL PEDS - TELEPHONE EXITS TO DUNBAR RD
(marked with 'T' on site)
- 3) GAS: • GAS MAY VARY FROM PVC TO CAST
• TRACER WIRE FOUND AT SOME METERS (Yellow Paint)
• GAS MAIN (CAST) Pink Paint
• An unknown line located in Blvd, just (W) of W/L
OF Dunbar RD N.
- 4) Water: • Valves located in Blvd's
• Previous WATER LOCATED (OR ATTEMPTED) - Several lines
located everywhere).
• BLI MARKS were done with a 'W'
- 5) SANITARY: • Could only locate the Sanitary Service From House #150
(Since it had a cleanout) into ERB ST W.
• No Access to cleanouts for the remaining homes.
- 6) Storm: • Sounded storm sewer From CB into ERB ST W.
Roof Drains had a lot of soil & debris inside.
could not sound.

IF MARKS ARE NO LONGER VISIBLE OR DO NOT MATCH THIS SKETCH, A RELOCATE IS REQUIRED. DO NOT DISTURB SOIL WITHIN 1 M OF MARKED UTILITIES.

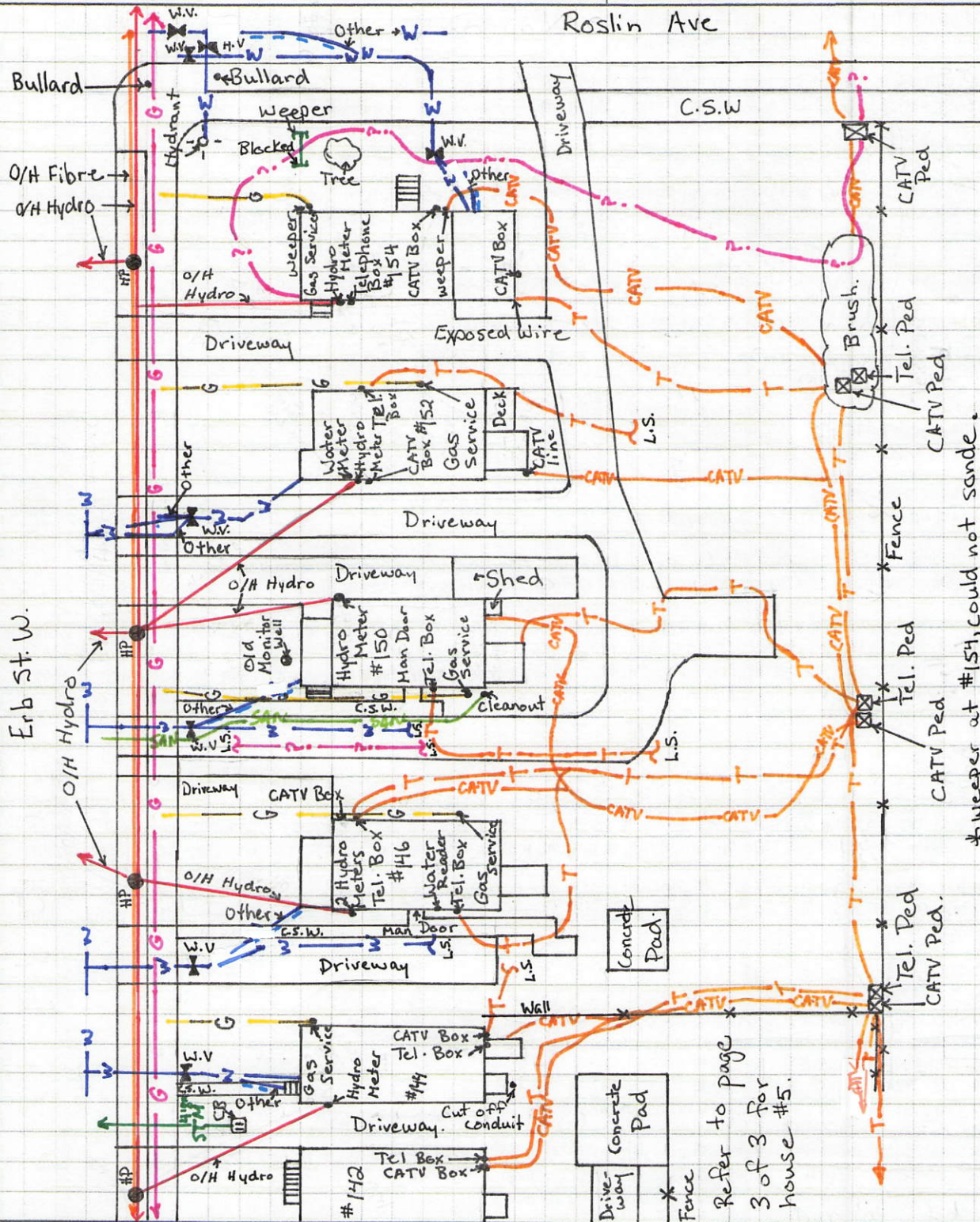
BILLING:	TECH 1	TECH 2	TOTALS	TRAVEL TIME
STANDARD	8 HRS LOC 3 HRS Report	7.0 HRS TECH 2		1.0
GPR				(TOTAL)

LOCATOR'S SIGNATURE

CLIENT'S SIGNATURE Sent by email

LOCATE DATE: MAY 30 2022

EXPIRY DATE: June 29 2022



* Could not send other sanitary services to #142, #144, #146, #152, #154. No access to clean outs.

W.V. = Water Valve
H.V. = Hydrant Valve
L.S. = Lost signal.

* Unknown line on property #154, could not be identified.

* Unknown line on property #150, could not be identified.

IF MARKS ARE NO LONGER VISIBLE OR DO NOT MATCH THIS SKETCH, A RELOCATE IS REQUIRED. DO NOT DISTURB SOIL WITHIN 1 M OF MARKED UTILITIES.

LOCATOR'S SIGNATURE

LOCATE DATE: May 30/22

CLIENT'S SIGNATURE Sent by e-mail

EXPIRY DATE: June. 29/22

CLIENT: MTE Consultants Inc

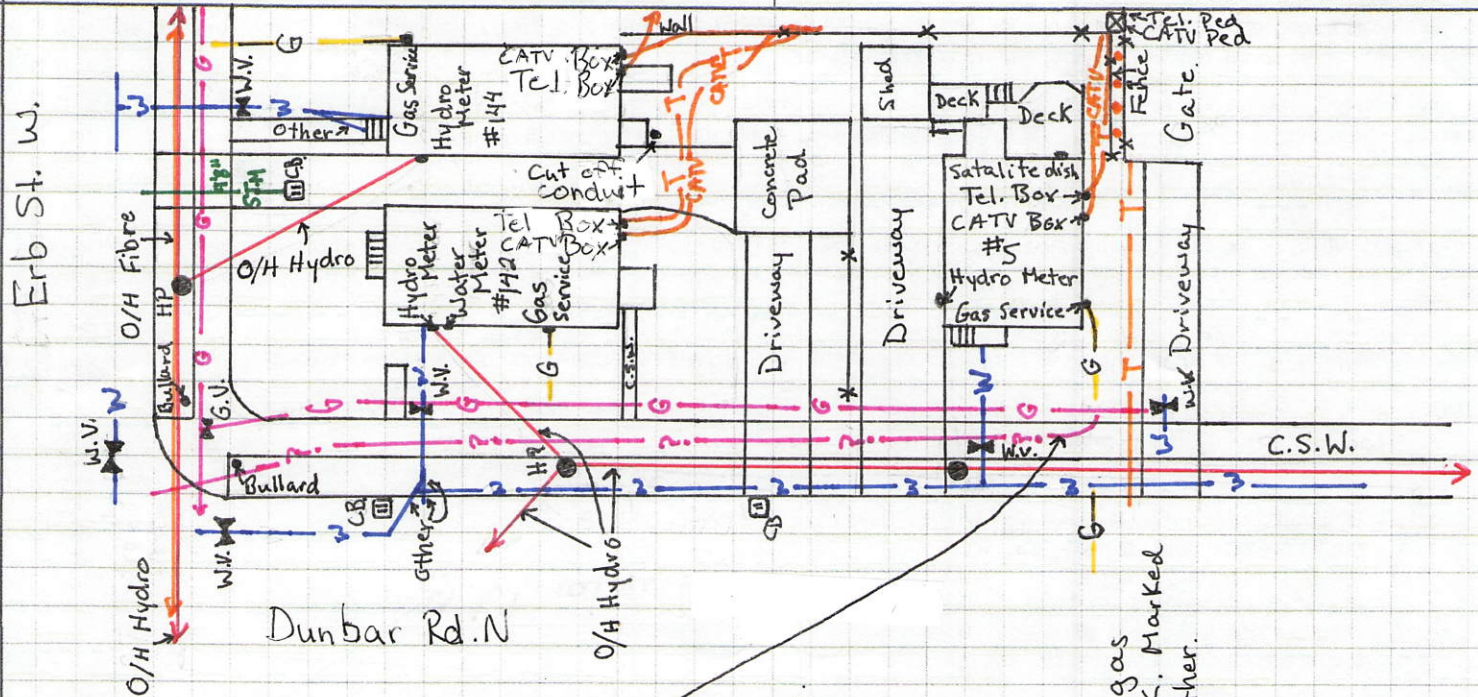
JOB SITE: 142 to 154 Erb St. w Kitchen

LOCATE LIMITS: Sue/Sum

BUFFALO JOB # 3825

PAGE # 3 OF 3

NOTE: THIS DRAWING IS NOT TO SCALE.



* Cut off conduit, could not locate.

* The water lines with other pointing to them were marked by other and could not be confirmed.

* Unknown line in sidewalk, maybe a second gas service or abandon gas line or: any other public utility. Could not identify.

* Could not send other sanitary services to #142, #144 and #5. No access to clean outs.

*old gas
Mark. Marked
by other.

IF MARKS ARE NO LONGER VISIBLE OR DO NOT MATCH THIS SKETCH, A RELOCATE IS REQUIRED. DO NOT DISTURB SOIL WITHIN 1 M OF MARKED UTILITIES.

LOCATOR'S SIGNATURE Mr. F. J.

LOCATE DATE: May 30/22

CLIENT'S SIGNATURE Sent by e-mail.

EXPIRY DATE: June 29/22

PROJECTS@BUFFALOLOCATING.CA

647-519-5525

POINT CLARK • LISTOWEL • LONDON • ST. GEORGE

WWW.BUFFALOLOCATING.CA

Disclaimer

1. The client acknowledges that the fundamental laws of physics do apply and that certain environmental conditions may restrict our ability to detect certain subterranean utilities, objects, features and structures.
2. The service to be provided to the client is the location and marking of horizontally (laterally and longitudinally) locatable utilities, objects, features or structures, in compliance with ORGCA Standards for the Subsurface Utility Locating Industry.
3. The depth and size of pipes, utilities, objects, features or structures is not a part of the service provided.
4. It is the responsibility of the Client to identify and provide direct access to all utilities, cables, conduits, valves, and meters present on the site. Buffalo Locating Inc. will not accept any liability for failing to locate utilities where access was not granted for direct connection, coupling or sonding.
5. Buffalo Locating Inc. will not locate high voltage DC (direct current) lines without the supervision of a licensed electrician.
6. Buffalo Locating Inc. is not responsible if the client digs, excavates, drills or disturbs the soil in any way outside of the Locate Limits.
7. Buffalo Locating is not responsible if the client digs, excavates, drills or disturbs the soil within one meter of a marked utility.
8. A re-locate is required when any of the following conditions are true:
 - a) marks are no longer visible
 - b) the locate limit has changed
 - c) the locate has expired (30 days)
 - d) the work intentions have changed
 - e) the locate report does not match the markings on site.
9. Buffalo Locating Inc. will not locate or take responsibility for any public utilities. All Public Locate requirements must be fulfilled by a designated Public Utility locating company prior to digging, excavating, drilling or otherwise disturbing the soil.
10. Buffalo Locating Inc. takes no responsibility if a utility is cracked, punctured and/or damaged in any way while the Client is performing work, or as a result of the work performed. If damages do occur (and Buffalo Locating Inc. is believed to be at fault), the Client must notify Buffalo Locating Inc. of the damage promptly upon its occurrence so that Buffalo Locating Inc. may complete its own on-site damage investigation. Failure to notify in due time or otherwise preventing Buffalo Locating Inc. from performing its own investigation alleviates Buffalo Locating Inc. from any and all liabilities for claims and damages.

Locatable Utilities:

- Conduits that are capable of carrying an electrical current. All utilities require a connection point for the locating equipment to be locatable.
- Non-conductive conduits that have a continuous tracer wire which is capable of transmitting a signal from the locating equipment.
- Any conduit that does not cause interference with the operation of the locating instruments due to common bonding (services that share the same electrical ground).
- Non-pressurized, Non-metallic conduits (private sewers, empty ducts, etc.) that facilitate the use of a sonde can be traced as far as the sonde can be pushed. Note: A licensed electrician must be on site during a sonde locate into an empty duct structure to prevent direct contact with live wires.

Non-Locatable Utilities:

- Any utility service-line for which there is no access to a suitable connection point for the locate equipment.
- Conduits that are buried too deep for the locating instruments to detect.
- Conduits that are buried under metallic material.
- Broken conduits that cause discontinuity in the tracer signal.
- Abandoned or "cut-off" conduits that have been completely buried at both ends.
- Non-metallic conduits (such as fibre optics, PVC pipes), unless a tracer wire exists that can be connected to the locating equipment.
- Pressurized non-metallic conduits (force-mains), unless a tracer wire exists that can be connected to the locating equipment.
- Vertical conduits, structures, or features (such as buried stand pipes with no valve).
- Conduits placed in close proximity to each other can not be individually identified.

Appendix B

Sanitary Demand

1 Dunbar Road North CITY OF WATERLOO				SANITARY SEWER DESIGN SHEET ENGINEERING AND PUBLIC WORKS				Design Parameters																						
Project Number: 32375-800 Date: August 26, 2024 Design By: DXN Checked By: AXT File: Q:\32375\800\SAN\Sanitary Sewer Design Sheet Waterloo (SSMS) Rev7.xls								Average Daily Flow								Mannings "n" 0.013 Min. Velocity 0.6 m/sec Max. Velocity 3.0 m/sec Residential Harmon Peaking Factor (F) F = 1 + 14/(4 + P ^{0.5}) Commercial Peaking Factor = 2.5 Residential Areas Infiltration 0.25 L/s/ha														
																Residential 0.00318 L/s/c				Commercial 0.95 L/s/ha										Industrial 0.40 L/s/ha
				Drainage Area Plan No:																										
LOCATION				RESIDENTIAL AREAS AND POPULATION								SCHOOL, INSTITUTIONAL			COMMERCIAL			INDUSTRIAL				INFILTRATION			DESIGN					
STREET	AREA NO.	MANHOLE LOCATION		AREA	No. UNITS @ 1.77 PPU	No. UNITS @ 2.18 PPU	POPUL.	CUMUL POPUL.	PEAK FACTOR "F"	PEAK RES. FLOW	HECTARES AND FLOW OF EACH ZONING									TOTALS- C-I FLOW	AREA	CUMUL AREA	INFIL FLOW	TOTAL VOLUME FLOW	LENGTH	SLOPE	PIPE SIZE	CAPACITY	FULL FLOW VELOCITY	
											0.25 L/s/ha			0.95 L/s/ha			0.40 L/s/ha													
		FROM MH	TO MH								AREA	CUMUL AREA	PEAK FLOW	AREA	CUMUL AREA	PEAK FLOW	AREA	CUMUL AREA	PEAK FLOW											
											ha	ha	L/sec	ha	ha	L/sec	ha	ha	L/sec											L/sec
Proposed Building					MH1A	MH2A	191.00	0.338	0.338	4.055809	4.3642							0.0000	0.29	0.29	0.0723	4.4364	11.0	1.00	150	15.2217	0.862			

Appendix C

MIDUSS Output

Pre-Development

```

"          MIDUSS Output ----->"
"          MIDUSS version          Version 2.25 rev. 473"
"          MIDUSS created          Sunday, February 7, 2010"
"          10 Units used:          ie METRIC"
"          Job folder:          Q:\32375\800\SWM\2024-08-28"
"          Output filename:          5 Year Pre.out"
"          Licensee name:          A"
"          Company          "
"          Date & Time last used:          8/28/2024 at 10:59:41 AM"
" 31          TIME PARAMETERS"
"          5.000 Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32          STORM Chicago storm"
"          1 Chicago storm"
"          1755.000 Coefficient A"
"          12.347 Constant B"
"          0.895 Exponent C"
"          0.400 Fraction R"
"          180.000 Duration"
"          1.000 Time step multiplier"
"          Maximum intensity          136.512 mm/hr"
"          Total depth          47.549 mm"
"          6 005hyd Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"          1 Triangular SCS"
"          1 Equal length"
"          1 SCS method"
"          101 Site"
"          46.500 % Impervious"
"          0.289 Total Area"
"          35.000 Flow length"
"          5.000 Overland Slope"
"          0.155 Pervious Area"
"          35.000 Pervious length"
"          5.000 Pervious slope"
"          0.134 Impervious Area"
"          35.000 Impervious length"
"          5.000 Impervious slope"
"          0.250 Pervious Manning 'n'"
"          75.000 Pervious SCS Curve No."
"          0.259 Pervious Runoff coefficient"
"          0.100 Pervious Ia/S coefficient"
"          8.467 Pervious Initial abstraction"
"          0.015 Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."
"          0.879 Impervious Runoff coefficient"
"          0.100 Impervious Ia/S coefficient"
"          0.518 Impervious Initial abstraction"
"          0.042 0.000 0.000 0.000 c.m/sec"

```

```

"          Catchment 101          Pervious Impervious Total Area "
"          Surface Area          0.155 0.134 0.289 hectare"
"          Time of concentration 16.025 1.663 5.299 minutes"
"          Time to Centroid 117.468 88.113 95.545 minutes"
"          Rainfall depth 47.549 47.549 47.549 mm"
"          Rainfall volume 73.52 63.90 137.42 c.m"
"          Rainfall losses 35.233 5.750 21.523 mm"
"          Runoff depth 12.316 41.799 26.026 mm"
"          Runoff volume 19.04 56.17 75.21 c.m"
"          Runoff coefficient 0.259 0.879 0.547 "
"          Maximum flow 0.007 0.041 0.042 c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"          4 Add Runoff "
"          0.042 0.042 0.000 0.000"
" 40          HYDROGRAPH Copy to Outflow"
"          8 Copy to Outflow"
"          0.042 0.042 0.042 0.000"
" 38          START/RE-START TOTALS 101"
"          3 Runoff Totals on EXIT"
"          Total Catchment area          0.289 hectare"
"          Total Impervious area          0.134 hectare"
"          Total % impervious          46.500"
" 19          EXIT"

```

```

"          MIDUSS Output ----->"
"          MIDUSS version          Version 2.25 rev. 473"
"          MIDUSS created          Sunday, February 7, 2010"
"          10 Units used:          ie METRIC"
"          Job folder:          Q:\32375\800\SWMM\2024-08-28"
"          Output filename:          100 Year Pre.out"
"          Licensee name:          A"
"          Company          "
"          Date & Time last used:          8/28/2024 at 11:03:10 AM"
" 31          TIME PARAMETERS"
"          5.000 Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32          STORM Chicago storm"
"          1 Chicago storm"
"          4692.000 Coefficient A"
"          17.437 Constant B"
"          0.956 Exponent C"
"          0.400 Fraction R"
"          180.000 Duration"
"          1.000 Time step multiplier"
"          Maximum intensity          239.793 mm/hr"
"          Total depth          89.960 mm"
"          6 100hyd Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"          1 Triangular SCS"
"          1 Equal length"
"          1 SCS method"
"          101 Site"
"          46.500 % Impervious"
"          0.289 Total Area"
"          35.000 Flow length"
"          5.000 Overland Slope"
"          0.155 Pervious Area"
"          35.000 Pervious length"
"          5.000 Pervious slope"
"          0.134 Impervious Area"
"          35.000 Impervious length"
"          5.000 Impervious slope"
"          0.250 Pervious Manning 'n'"
"          75.000 Pervious SCS Curve No."
"          0.442 Pervious Runoff coefficient"
"          0.100 Pervious Ia/S coefficient"
"          8.467 Pervious Initial abstraction"
"          0.015 Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."
"          0.923 Impervious Runoff coefficient"
"          0.100 Impervious Ia/S coefficient"
"          0.518 Impervious Initial abstraction"
"          0.087 0.000 0.000 0.000 c.m/sec"

```

```

"          Catchment 101          Pervious Impervious Total Area "
"          Surface Area          0.155 0.134 0.289 hectare"
"          Time of concentration          9.734 1.311 4.300 minutes"
"          Time to Centroid          105.362 85.842 92.770 minutes"
"          Rainfall depth          89.960 89.960 89.960 mm"
"          Rainfall volume          139.09 120.89 259.98 c.m"
"          Rainfall losses          50.240 6.894 30.084 mm"
"          Runoff depth          39.720 83.066 59.876 mm"
"          Runoff volume          61.41 111.63 173.04 c.m"
"          Runoff coefficient          0.442 0.923 0.666 "
"          Maximum flow          0.032 0.078 0.087 c.m/sec"
" 40          HYDROGRAPH Add Runoff "
" 4          Add Runoff "
"          0.087 0.087 0.000 0.000"
" 40          HYDROGRAPH Copy to Outflow"
" 8          Copy to Outflow"
"          0.087 0.087 0.087 0.000"
" 38          START/RE-START TOTALS 101"
" 3          Runoff Totals on EXIT"
"          Total Catchment area          0.289 hectare"
"          Total Impervious area          0.134 hectare"
"          Total % impervious          46.500"
" 19          EXIT"

```

Post-Development

```

"          MIDUSS Output ----->"
"          MIDUSS version                Version 2.25 rev. 473"
"          MIDUSS created                Sunday, February 7, 2010"
"          10 Units used:                  ie METRIC"
"          Job folder:                    Q:\32375\800\SWM\2024-08-28"
"          Output filename:                5 Year Post.out"
"          Licensee name:                  A"
"          Company                        "
"          Date & Time last used:          8/28/2024 at 11:07:31 AM"
" 31          TIME PARAMETERS"
"          5.000 Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32          STORM Chicago storm"
"          1 Chicago storm"
"          1755.000 Coefficient A"
"          12.347 Constant B"
"          0.895 Exponent C"
"          0.400 Fraction R"
"          180.000 Duration"
"          1.000 Time step multiplier"
"          Maximum intensity              136.512 mm/hr"
"          Total depth                    47.549 mm"
"          6 005hyd Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"          1 Triangular SCS"
"          1 Equal length"
"          1 SCS method"
"          201 Site"
"          78.200 % Impervious"
"          0.289 Total Area"
"          4.500 Flow length"
"          6.000 Overland Slope"
"          0.063 Pervious Area"
"          4.500 Pervious length"
"          6.000 Pervious slope"
"          0.226 Impervious Area"
"          4.500 Impervious length"
"          6.000 Impervious slope"
"          0.250 Pervious Manning 'n'"
"          75.000 Pervious SCS Curve No."
"          0.257 Pervious Runoff coefficient"
"          0.100 Pervious Ia/S coefficient"
"          8.467 Pervious Initial abstraction"
"          0.015 Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."
"          0.794 Impervious Runoff coefficient"
"          0.100 Impervious Ia/S coefficient"
"          0.518 Impervious Initial abstraction"
"          0.072 0.000 0.000 0.000 c.m/sec"

```

```

"          Catchment 201      Pervious  Impervious Total Area "
"          Surface Area      0.063      0.226      0.289 hectare"
"          Time of concentration 4.431      0.460      0.789 minutes"
"          Time to Centroid      103.340      86.961      88.319 minutes"
"          Rainfall depth      47.549      47.549      47.549 mm"
"          Rainfall volume      29.96      107.46      137.42 c.m"
"          Rainfall losses      35.309      9.803      15.363 mm"
"          Runoff depth      12.240      37.746      32.186 mm"
"          Runoff volume      7.71      85.31      93.02 c.m"
"          Runoff coefficient      0.257      0.794      0.677 "
"          Maximum flow      0.005      0.070      0.072 c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"          4 Add Runoff "
"          0.072 0.072 0.000 0.000"
" 40          HYDROGRAPH Copy to Outflow"
"          8 Copy to Outflow"
"          0.072 0.072 0.072 0.000"
" 38          START/RE-START TOTALS 201"
"          3 Runoff Totals on EXIT"
"          Total Catchment area              0.289 hectare"
"          Total Impervious area              0.226 hectare"
"          Total % impervious              78.200"
" 19          EXIT"

```

```

"          MIDUSS Output ----->"
"          MIDUSS version          Version 2.25 rev. 473"
"          MIDUSS created          Sunday, February 7, 2010"
"          10 Units used:          ie METRIC"
"          Job folder:          Q:\32375\800\SWM\2024-08-28"
"          Output filename:          100 Year Post.out"
"          Licensee name:          A"
"          Company          "
"          Date & Time last used:          8/28/2024 at 11:08:19 AM"
" 31          TIME PARAMETERS"
"          5.000 Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32          STORM Chicago storm"
"          1 Chicago storm"
"          4692.000 Coefficient A"
"          17.437 Constant B"
"          0.956 Exponent C"
"          0.400 Fraction R"
"          180.000 Duration"
"          1.000 Time step multiplier"
"          Maximum intensity          239.793 mm/hr"
"          Total depth          89.960 mm"
"          6 100hyd Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"          1 Triangular SCS"
"          1 Equal length"
"          1 SCS method"
"          201 Site"
"          78.200 % Impervious"
"          0.289 Total Area"
"          4.500 Flow length"
"          6.000 Overland Slope"
"          0.063 Pervious Area"
"          4.500 Pervious length"
"          6.000 Pervious slope"
"          0.226 Impervious Area"
"          4.500 Impervious length"
"          6.000 Impervious slope"
"          0.250 Pervious Manning 'n'"
"          75.000 Pervious SCS Curve No."
"          0.435 Pervious Runoff coefficient"
"          0.100 Pervious Ia/S coefficient"
"          8.467 Pervious Initial abstraction"
"          0.015 Impervious Manning 'n'"
"          98.000 Impervious SCS Curve No."
"          0.818 Impervious Runoff coefficient"
"          0.100 Impervious Ia/S coefficient"
"          0.518 Impervious Initial abstraction"
"          0.139 0.000 0.000 0.000 c.m/sec"

```

```

"          Catchment 201          Pervious Impervious Total Area "
"          Surface Area          0.063 0.226 0.289 hectare"
"          Time of concentration          2.692 0.363 0.663 minutes"
"          Time to Centroid          96.509 84.731 86.253 minutes"
"          Rainfall depth          89.960 89.960 89.960 mm"
"          Rainfall volume          56.68 203.31 259.98 c.m"
"          Rainfall losses          50.793 16.359 23.866 mm"
"          Runoff depth          39.167 73.601 66.094 mm"
"          Runoff volume          24.68 166.34 191.01 c.m"
"          Runoff coefficient          0.435 0.818 0.735 "
"          Maximum flow          0.016 0.125 0.139 c.m/sec"
" 40          HYDROGRAPH Add Runoff "
" 4          Add Runoff "
"          0.139 0.139 0.000 0.000"
" 40          HYDROGRAPH Copy to Outflow"
" 8          Copy to Outflow"
"          0.139 0.139 0.139 0.000"
" 38          START/RE-START TOTALS 201"
" 3          Runoff Totals on EXIT"
"          Total Catchment area          0.289 hectare"
"          Total Impervious area          0.226 hectare"
"          Total % impervious          78.200"
" 19          EXIT"

```

Appendix D

Water Demand



1 Dunbar Road North
FIRE FLOW DEMANDS

Waterloo, Ontario

Project #: 32375-800

Date: August 29, 2024

Date Printed: 8/29/2024

Designed By: DXN

Checked By: AXT

Development Information ¹								Fire Flow ^{2,3,4,5}													Domestic Flow ^{6,7}							
								Ontario Building Code						Fire Underwriters Survey														
Node ID / Area ID / Building #	F.F.E. (m.a.s.l.)	Description	# of Beds	Population	Bldg Area (1 st Floor)	Total Bldg Area	Building Volume	K	V	S _{tot}	Q	F	F	C	A	F	(2) Occupancy Reduction	(3) Sprinkler Protection	(4) Building Exposure	F	F	Fire Flow (Max OBC/FUS)	MOE Guidelines	Average Day	Max Day	Peak Hour	Minimum Hour	Max Day + Fire Flow
				# of people	m ²	m ²	m ³	m ³	L	L/min	L/s	m ²	L/min	L/min	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s	L/s
Proposed	331.54	Apartment	191	338	1,112	17,027	45,516	10	45,516	2.00	910,317	9,000	150	0.60	4,248	8,603	-15%	-30%	75%	11,000	183	183	0.880	0.880	2.421	3.636	0.352	186
TOTALS FOR SITE			191	338	1112	17027	45516	Max Fire Flow = 150						Max Fire Flow = 183						183	0.88	0.88	2.42	3.64	0.35	186		
																						Sum of Maximum Day Flows + OBC Fire Flow (L/s) =				152.42		
																						Sum of Maximum Day Flows + FUS Fire Flow (L/s) =				185.75		

Assumptions:

- 1 All building areas and populations are based on the Site Plan by ACDF Architecture. Assumed 1.77 persons per unit as per Region of Waterloo Water and Wastewater Monitoring Report 2023.
- 2 The building is assumed to be of Type 1 construction (non-combustible with fire separation and fire-resistance ratings).
- 3 The building is assumed to be fully sprinklered and the automatic sprinkler protection is assumed to be designed and installed in accordance with NFPA 13.
- 4 The building is classified as occupancy group C (Residential Occupancy).
- 5 For FUS calculations, vertical openings and exterior vertical communications are assumed to be properly protected in accordance with the National Building Code. Thus, only the single largest floor area plus 25% of each of the two immediately adjoining floors were considered.
- 6 Average Daily Demands for each building are based on "*Tri City Water Distribution Master Plan Final Report*" by AECOM, Dated May 2009 :

Residential = 225 L/cap/day
- 7 Peaking Factors based on "*Design Guidelines for Drinking-Water Systems*" (MOE, 2008):

Average Day = 1

Maximum Day = 2.75

Peak Hour = 4.13

Minimum Hour = 0.4

Appendix E

Fire Flow Results

PROJECT INFORMATION

Project Name:	142-154 Erb St West Flow Test	Const. Project #:	23-CAM-690-0719
Site Address:	142-154 Erb St West Waterloo ON	Design Project #:	2023-CFLS-605
City Contact:	Waterloo Utilities X30239	Phone #:	519-886-2310
CFLS Contact:	Rob Smith	Phone #:	
Technical Contact:	Andy Coghlin	Phone #:	519-476-0761

SITE INFORMATION

SITE MAP



Note: If the main is a dead end, the flowing hydrant shall be closest to the dead end

ITEMS TO LABEL ON MAP	HYDRANTS USED	MAIN SIZE
☒ Static / Residual & Flow Hydrants	☒ City Hydrant(s)	City:
☐ Flow Direction (if the main is dead end)	☐ Site Hydrant(s)	Site:
SITE NOTES		

TEST INFORMATION							
Minimum Required Flow:		NA			Min Ports:		2
CFLS Personnel Present:		Rob Smith			Test Date:		2023-10-19
City / External Company:		Waterloo Utilities			Test Time:		10:00am
TEST EQUIPMENT							
☐ Hose Monsters with built in Pitot				Hose length used:			
☐ Hand held pitot gauge				☒ Pollard diffuser elbow with built in Pitot			
☐ Other:							
TEST RESULTS							
Number of Ports	Outlet Size (IN)	Discharge Coefficient	Pitot Reading (PSI)			Total Flow (GPM)	Static / Residual Pressure (PSI)
0 Ports							68
1 Port	2.5	0.9	44			1,113	64
2 Ports	2.5	0.9	28	29		1,792	62
3 Ports	2.5	0.9				0	
4 Ports	2.5	0.9				0	
0 Ports	STATIC RE-CHECK						68
TEST NOTES							

HYDRAULIC ADJUSTMENTS (FOR OFFICE USE ONLY)			
ADJUSTMENTS FOR HYDRAULIC GRADE LINE (HGL)			
Reservoir HGL (m):			Site Elevation (m):
Theoretical Static Head (PSI):		0	PSI to subtract from test pressures:
68			
OTHER HYDRAULIC ADJUSTMENTS			
Other adjustment as required by the City / AHJ:			

Appendix F

Fire Flow Analysis



1 Dunbar Road North

FIRE FLOW ANALYSIS

Waterloo, Ontario

Project Number: 32375-800

Date: August 27, 2024

Design By: DXN

File: Q:\32375\800\WATER\Site Fire Flow Analysis.xlsx

CALCULATION OF RESIDUAL PRESSURE AT EXISTING HYDRANT (OBC)

1. Boundary Conditions (Based on Fire Flow Test Results):			
	Metric	Imperial	
P0 - Starting Pressure	47.82 m	68 psi	
P1 - Pressure at Q1	45.01 m	64 psi	
Q1 - From Fire Flow Test	4213 L/min	1113 U.S. gal/min	
Q2 - Required Flow	9145 L/min	2416 U.S. gal/min	From: Water Demand calculations by MTE
P-loss 1	2.81 m	4 psi	
P-loss 2	11.82 m	17 psi	
P2 - Residual Pressure	36.00 m	51 psi	Extrapolated from Fire Flow Test Results

ANALYSIS SUMMARY			
Total Losses	0.000 m		
	0.00 kPa	0.0 psi	
Residual Pressure after Losses	36.00 m		
	353 kPa	51.2 psi	PASS
Allowable Residual Pressure	140 kPa	20.3 psi	



1 Dunbar Road North

FIRE FLOW ANALYSIS

Waterloo, Ontario

Project Number: 32375-800

Date: August 29, 2024

Design By: DXN

File: Q:\32375\800\WATER\Site Fire Flow Analysis.xlsx

CALCULATION OF RESIDUAL PRESSURE AT EXISTING HYDRANT (FUS)

1. Boundary Conditions (Based on Fire Flow Test Results):			
	Metric	Imperial	
P0 - Starting Pressure	47.82 <i>m</i>	68 <i>psi</i>	
P1 - Pressure at Q1	45.01 <i>m</i>	64 <i>psi</i>	
Q1 - From Fire Flow Test	4213 <i>L/min</i>	1113 <i>U.S. gal/min</i>	
Q2 - Required Flow	11145 <i>L/min</i>	2944 <i>U.S. gal/min</i>	From: Water Demand calculations by MTE
P-loss 1	2.81 <i>m</i>	4 <i>psi</i>	
P-loss 2	17.04 <i>m</i>	24 <i>psi</i>	
P2 - Residual Pressure	30.78 <i>m</i>	44 <i>psi</i>	Extrapolated from Fire Flow Test Results

ANALYSIS SUMMARY			
Total Losses	0.000 <i>m</i> 0.00 <i>kPa</i>	0.0 <i>psi</i>	
Residual Pressure after Losses	30.78 <i>m</i> 302 <i>kPa</i>	43.8 <i>psi</i>	PASS
Allowable Residual Pressure	140 <i>kPa</i>	20.3 <i>psi</i>	