FUNCTIONAL SERVICING & STORMWATER MANAGEMENT REPORT

NORTHFIELD PROPERTIES LP

65 Northfield Drive West, Waterloo

DRAFT PLAN OF SUBDIVISION 30T-21401
OFFICIAL PLAN AMENDMENT NO. 35
ZONE CHANGE (Z-21-03)

Project No.: 2019-0654-10

Addendum #2
September 29, 2023

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ISSUANCE AND REVISION RECORD					
REV	**DATE**	**WRITTEN BY**	**QA BY**	**SEALED BY**	**ISSUED FOR**
1	Jun 4, 2021	R Khakharia	S Forwell M Ninomiya	R Khakharia S Forwell M Ninomiya	OPA/ZBA and Draft Plan of Subdivision Approval
2	Mar 28, 2023	Z Schnurr	R Khakharia	R Khakharia	OPA/ZBA and Draft Plan of Subdivision Approval – Addendum #1
3	Sep 27, 2023	R Khakharia	M Ninomiya	R Khakharia	OPA/ZBA and Draft Plan of Subdivision Approval – Addendum #2



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EXECUTIVE SUMMARY

The proposed development at 65 Northfield Drive West, Waterloo will result in the construction of approximately 3,353 purpose built rental units, with ancillary retail/commercial developments and a large central park, all serviced with a crescent shaped municipal roadway. Underground parking is proposed for all blocks as well as underneath the central park. Three stories of above-ground podium parking is proposed for the blocks adjacent ON-85, while internal layby parking is proposed within the municipal roadway. The development is subject to an official plan amendment, zoning bylaw amendment and a plan of subdivision.

The proposed development will be serviced through municipal infrastructure located within a hydro corridor to the south and within Conestogo Road.

Sanitary servicing for the full build out can be accommodated within the sanitary sewers on Conestogo Road. Downstream capacity constraints are known to exist within the hydro corridor and in the Lower Forwell Creek Trunk Sanitary Sewer. Approximately 36 L/s of residual capacity is available, without surcharging in dry weather conditions. In wet weather conditions, existing surcharging within the LFCTSS also surcharges the existing sewers in the hydro corridor, extending to within the Conestogo Road sanitary system. Hydraulic assessments were completed to understand impacts of adding additional dry weather flow to the system. It was determined that approximately 700 units or 15 L/s of additional flow can be accommodated in the existing system without surcharging additional manholes. Further development will require an upgrade to a 450mm diameter sanitary sewer within the hydro corridor to limit wet weather surcharging to existing conditions.

Water servicing for the full build out can be accommodated from the existing watermains on Conestogo Road. Hydraulic modelling provided by the Region of Waterloo for boundary conditions confirms that sufficient flow is available within the municipal infrastructure to provide concurrent domestic water and fire flows to the proposed development, at or above the minimum pressures stipulated by the Ministry of Environment, Conservation and Parks. 300mm diameter watermains are proposed to be connected to existing servicing on Conestogo Road.

The site has two stormwater outlets: an overland flow discharge to a drainage channel adjacent to Conestoga Parkway (ON-85) and piped connections to a municipal storm sewer in the hydro corridor, which ultimately also drains to the same drainage channel. A 1050mm diameter storm sewer is proposed to connect to the municipal storm sewer within the hydro corridor, with smaller diameter sewers located upstream within the municipal roadways. The 1050mm diameter storm sewer is required as part of the full build out, whereas in interim conditions, an outlet to the ON-85 drainage ditch is proposed.

The existing conditions on the site are more impervious than proposed conditions and no further quantity control is proposed. Quality control is provided by means of oil-grit separators within the municipal right-of-way, primarily designed to remove 80% of long-term total suspended solids from the road runoff, and infiltration measures are proposed for rooftop and parkland runoff. Major overland flow will be directed towards the ditch on ON-85.

Existing flood mapping for the subject site was updated as part of this study. Flood plains within the site are a result of back-water effects due to downstream surcharging. The updated flood plain marginally encroaches within the limits of Block 8 and 9, corresponding to approximately 26 m^3 of flood storage. As part of the redevelopment, cut and fill operations within the floodplain will balance flood volumes.

Other existing utilities are available within the surrounding municipal rights-of-way and can be extended through the development to service the proposed blocks.

Erosion control measures will be implemented during the construction period to ensure sediment from the site does not migrate downstream to the regulated water feature and elsewhere offsite.

NORTHFIELD PROPERTIES LP

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65 Northfield Drive West, Waterloo, ON

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1.0 INTRODUCTION

WalterFedy Inc. has been retained by Northfield Properties LP to provide civil engineering consulting services in support of an Official Plan and Zoning By-law Amendment and Draft Plan of Subdivision for the lands with municipal addresses of 65 Northfield Drive West in Waterloo.

The purpose of this functional servicing and stormwater management report is to identify how the development will be serviced, including water, sanitary, and storm connections to the existing municipal infrastructure. The report will discuss existing boundary servicing conditions and the availability in the municipal system to accommodate the development. Preliminary stormwater management design has been included, demonstrating consistency with the City of Waterloo and Region of Waterloo design criteria.

1.1 Background

The approximately 7.27-hectare site is located in Waterloo, Ontario, at the southeastern corner of the Northfield Drive and Conestoga Parkway interchanges. The site is bound by Northfield Drive West to the north, Conestoga Parkway to the west, Conestogo Road to the east, and a Hydro One Inc. (HONI) utility corridor to the south. Access to the site is off of Conestogo Road.

The site is currently zoned as “Deferred Status Industrial,” and “Business Employment”; an official plan and zoning bylaw amendment (OPA/ZBA) application is required to permit the proposed uses.

The subject Site is the former home of Kraus Carpets and Flooring, a manufacturing facility for carpets and flooring material. The factory was shut down in 2019 and the Site is currently unoccupied except for limited warehousing uses. Lands south of the hydro corridor are also owned by the applicant, however, do not form part of the redevelopment.

The updated development concept for the Site envisions a mix of residential, institutional and retail uses spread across eight blocks. The development is expected to consist of a mix of densities to support approximately 3,353 residential units, supporting non-residential spaces, and associated parking and amenity spaces. The proposed towers are situated around a crescent shaped municipal roadway, with a large central park as the defining feature in the centre. Underground parking is proposed for all blocks as well as underneath the central park. Three stories of above-ground podium parking is proposed for the blocks adjacent ON-85, while internal layby parking is proposed within the municipal roadway.

Additionally, the development is expected to convert an existing utility corridor into landscape and amenity space, providing pedestrian connectivity to Northfield Drive, Conestogo Road and the ION Light Rail Transit (LRT) system. As part of this network, a pedestrian bridge is envisioned over the abutting Conestoga Parkway for connectivity to the Northfield Drive LRT station. This pedestrian bridge does not form part of this application.

1.2 Reference Reports and Drawings

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

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

2. Utility mapping information obtained from Waterloo North Hydro and ON1Call.

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

4. *Phase I Environmental Site Assessment, 65 Northfield Drive West, Waterloo, Ontario,* by Trow Associates Inc., dated February 28, 2007.

5. *Draft Phase I Environmental Site Assessment, 65 Northfield Drive West, Waterloo, Ontario,* by exp Services Inc., dated February 8, 2012.

6. *Phase II Environmental Site Assessment, 65 Northfield Drive West, Waterloo, Ontario,* by S2S Environmental Inc., dated July 29, 2013.

7. *Phase I Conceptual Site Model, 65 Northfield Drive West, Waterloo, Ontario,* by S2S Environmental Inc., dated December 15, 2015.

8. *Phase Two Conceptual Site Model, 65 Northfield Drive West, Waterloo, Ontario,* by S2S Environmental Inc., dated February 7, 2020.

9. *525-564 Conestogo Road, Waterloo, Transportation Impact Study and Transportation Demand Management Report,* by Paradigm Transportation Solutions Limited, dated August 2020.

10. *Comment Response And Letter Of Opinion Regarding New Development Plan, Proposed Mixed Use Development, 562-565 Conestogo Road, Waterloo ON,* by Paradigm Transportation Solutions Limited, dated March 2023

11. *Kraus Flooring Property, 525-565 Conestoga Road, Waterloo, Scoped Environmental Impact Study,* by Natural Resource Solutions Inc., dated August 14, 2020.

2.0 EXISTING INFORMATION

2.1 Existing Topography and Land Use

The subject lands have historically been used for manufacturing purposes and consist of two separate buildings, associated parking, and internal asphalt roadways. Existing topographic information was obtained from a survey completed by Automated Engineering Technologies (AET) in 2013, and updated for information along Northfield Drive by WalterFedy in 2021. Legal boundary information was obtained from Holding Jones Vanderveen inc., dated February 7, 2023.

The centerline of Northfield Road along the frontage ranges in elevation from approximately 342-345 m while the Site is lower, ranging in elevation from approximately 339-340 m along the northern limits. The Site is approximately 335 m near the southern limits and generally falls from northeast-to-southwest.

Drainage from the site is directed towards Conestoga Parkway (ON-85) and outlets to a ditch along the western limits of the site, outside of the property limits. Drainage from within the site is directed to either the ditch directly, or collected in a storm sewer system connected to Conestogo Road or a municipal storm sewer within the utility corridor, which ultimately all discharge to the ditch along ON-85.

The ditch in question appears to be a drainage feature regulated by the Grand River Conservation Authority (GRCA). According to GRCA mapping (provided as Figure 1), a portion of this drainage feature appears to be a tributary of Forwell Creek and its associated floodplain and allowances. The Regulatory Flood Elevation of this reach is 334.05 m. Further discussion related to this drainage feature is provided within the body of this report.

2.2 Environmental Site Assessments (ESAs)

The site has been subject to numerous environmental assessments to identify potential sources of contaminating activities in or around the site. Based on these environmental investigations, the large majority of 65 Northfield Drive West (excluding a small portion to the northeast) had no soil or groundwater contaminant concentrations

which exceeded the applicable Site Condition Standards. The property as a whole, is not expected to have any ongoing Risk Management Measures (RMMs) for the proposed residential development.

As of March 2023, two Record of Site Condition (RSC) filings are underway with the Ontario Ministry of the Environment, Conservation and Parks (MECP) for the property.

The main RSC filing for the large portion of the property does not require a Modified Generic Risk Assessment (MGRA) (as there were no concentrations that exceeded the applicable Site Condition Standards) and will be reviewed by the MECP in that context.

The remaining RSC filing was targeted at the small parcel of the property on the northeast corner and required the submission of a MGRA due to minor groundwater concentrations of barium and cobalt which exceeded the applicable Site Condition Standards. It should be noted that no discernable source for the groundwater contamination was found however it was determined to be localized to the small northeast portion of the property. As per discussions between S2S and the MECP, it is anticipated that ongoing RMMs will not be required for this portion of the property, due to the fact that local by-law 2018-050, Sections 3.S.2.2 and 3.W.1 prohibit any on-site drinking water wells, which would have been the sole RMM, according to the MGRA.

2.3 Geotechnical Conditions

While a site-specific geotechnical assessment has not been completed, the various environmental investigations did include numerous boreholes advanced throughout the site. Based on the information gathered on site, S2S reports that *"…the subsoils at the north and central portions of the Phase Two Property were found to generally consist of granular fill overlying sand overlying silt to a depth of approximately 11.0m bgs (328m amsl), overlying sand, clay and silt to a depth of approximately 35.4m bgs[1] (304 m amsl[2]). The subsoils in the south portion of the Phase Two Property were found to generally consist of sand with silt or gravel to a depth of approximately 12.2 m bgs (326 m amsl)."*

Additionally, through the investigations, S2S infers groundwater flow direction towards the southeast. A groundwater contour drawing is provided within the S2S Conceptual Phase Two Model, along with cross-sections depicting the site's stratigraphy.

2.4 Environmental Impact Study

A scoped environmental impact study (EIS) was completed for the subject site due to its proximity to natural features. The study concluded that the highly developed nature of the site does not provide any natural habitat. The study also notes that Forwell Creek, which is the immediate downstream watercourse is highly channelized. Habitat for species at risk (SAR) or any significant wildlife habitat (SWH) was not present in the study area. Marginal habitat for Wavy-rayed Lampmussel was noted in Forwell Creek, however, no negative impacts to this habitat are anticipated as a result of the redevelopment.

2.5 Traffic Impact Study

A traffic impact study was completed for the subject development to analyse existing traffic conditions, and estimate the impact of the full build-out on the surrounding traffic infrastructure as well as recommend any improvements or mitigation measures to support the increased density.

The report recommends northbound left turn lanes on Conestogo Road at each of the entrances to the site, a northbound left turn lane on Conestogo Road at Northfield Drive and an eastbound right-turn lane on Conestogo Road at the signalized intersection with King Street North.

[1] *below ground surface (bgs)*
[2] *above mean sea level (amsl)*

The proposed recommendations can be accommodated within the existing paved sections on Conestogo Road with repainting of the roadway and therefore no further impacts are anticipated.

2.6 Existing Servicing and Utilities

Existing services on and around the site were identified as part of a topographic survey conducted by Automated Engineering Technologists (AET) in 2013. Significant road reconstruction of Northfield Drive has since been completed as part of the Region of Waterloo's Light Rail Transit (LRT) project. The new servicing and utilities information was taken from the City of Waterloo's GIS data, as well as LRT plan and profile drawings and utility mapping provided by various agencies. WalterFedy also surveyed the new infrastructure with the assistance of private locators in May and June 2020.

Utility information collected from various sources is provided in Appendix A.

2.6.1 Water Servicing

As a previous industrial manufacturing facility, the Site is bound by significantly-sized infrastructure. On Northfield Drive, a 600-mm-diameter, Region-owned transmission watermain provides connections to local distribution mains. Local 300-mm-diameter watermains surround the subject Site on Northfield Drive and Conestogo Road, and as many as six separate connections exist to the facility. The status of the 300-mm-diameter watermain along Northfield Drive abutting the northern property limits is unclear; the main appears to only service the Site and a public hydrant for fire protection to the site.

Internal to the site, visual observations and surveyed data appear to note Post Indicator Valves (PIVs) around the buildings. Presumably, the PIVs are connected to an exterior fire water loop as would be typical for a high-hazard industrial facility.

Historical records of water usage for this site were unavailable, but it is understood to have been a large water user, utilizing municipal water for production purposes.

2.6.2 Sanitary Servicing

A 200-mm- to 300-mm-diameter sanitary sewer exists on Conestogo Road. This sewer crosses through the site within a utility corridor consisting of a Hydro One Inc. (HONI) right-of-way as well as City of Waterloo and Waterloo North Hydro (WNH) easements, that bisects the site, and continues under ON-85. The Site currently has multiple connections to the municipal infrastructure. This sewer ultimately connects to the Lower Forwell Creek Trunk Sanitary Sewer (LFCTSS).

Historical sanitary discharge rates from the site were unavailable, but they are understood to have been significant. At its peak as a heavy industrial site, the expected flow rate would have been roughly 16 L/s. The peak flow rate currently in the City of Waterloo sanitary sewer model is approximately 7 L/s.

2.6.3 Storm Servicing

Storm servicing for the site is provided through a 300-mm-diameter storm sewer within Conestogo Road, a 900-mm by 1500-mm elliptical storm sewer within the HONI corridor, a ditch along Northfield Drive, and a ditch along ON-85. It is understood that the existing Site does not have any stormwater management features to limit discharge rates to surrounding infrastructure.

2.6.4 Gas Servicing (Enbridge Gas)

Based on locates obtained by WalterFedy, the Site is serviced by a 250-mm-diameter steel gas main located on the southern side of Northfield Drive. Additional services are provided to the Site on either side of the HONI corridor, from a 100-mm-diameter steel gas main on Conestogo Road, which appears to be located within the

eastern boulevard. Both of the gas mains are noted to be coated and wrapped, and operating at 420 kPa (60 psi). A customer-owned station is located on the western side of the existing manufacturing facility.

2.6.5 Communications (Bell Canada)

Bell servicing is provided to the site via buried conduits on the southern side of Northfield Drive and on Conestogo Road. Bell servicing within Conestogo Road is split roughly at the HONI corridor and does not appear to be connected across it. North of the HONI corridor, Bell servicing appears to be connected to the Northfield Drive system. Servicing from the southern side of the HONI corridor appears to be connected elsewhere. Bell infrastructure appears to be right along the municipal property line.

2.6.6 Communications (Rogers Communications)

Rogers appears to have an aerial fiberoptic cable strung on the WNH-owned pole lines on Northfield Drive and Conestogo Road. Locates indicate that a buried cable provides service from Northfield Drive and an aerial service is provided to the building south of the HONI corridor. The aerial service was not visually evident; however, a dip pole located within the fenced compound at the rear of the site may be the location of an underground service to the building.

2.6.7 Power (Waterloo North Hydro)

WNH owns and operates a transformer station directly across from the site on Conestogo Road. As a result, the roadways surrounding the site have significant hydro infrastructure including multiple high-voltage circuits, above ground and below grade on both roadways. Overhead pole lines are located along the property lines shared with the site on both of the roadways.

WNH also owns three switchgears within an easement on the site at the corner of Northfield Drive and Conestogo Road. Additionally, WNH owns and operates an underground high-voltage line within the utility corridor in a 3-m-wide easement.

WNH provides service to the site from multiple connections from Northfield Drive and Conestogo Road.

3.0 REVIEW AGENCIES

3.1 City of Waterloo

The City of Waterloo will be responsible for the review and approval of this functional servicing design for the purposes of the official plan amendment, zoning bylaw amendment the draft plan of subdivision, and subsequent site plan applications for the various blocks.

3.2 Region of Waterloo

As the property abuts Northfield Drive, a Region of Waterloo owned road allowance, the subject development will require grading and stormwater management clearance by the Region. Additionally, the Region's Corridor Management division will be involved in infrastructure planning and approval decisions as it relates to servicing within the Northfield Drive municipal right-of-way.

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

3.3 Grand River Conservation Authority

As the overall site contains a regulated drainage feature and its flood plain, development within the regulated are will require approval from the GRCA through a permit pursuant to Ontario Regulation 150/06. The GRCA

will also comment on storm servicing and stormwater management for the subject development as it relates to discharge to the regulated feature.

A floodplain associated with the regulated feature also extends within the site. The development is proposing minor alterations to this floodplain and the GRCA will therefore also be involved in the associated approvals.

3.4 Ontario Ministry of Transportation (MTO)

Due to the site's proximity to ON-85 and the discharge of stormwater to lands within the jurisdiction of the MTO, the servicing and stormwater management for the development will be subject to development approvals by the MTO.

3.5 Ministry of the Environment, Conservation and Parks (MECP)

As the development will consist of new municipal infrastructure, an Environmental Compliance Approval (ECA) from the MECP will be required. Such an approval can be obtained through a delegated approval process to the City under the Consolidated Linear Infrastructure Environmental Compliance Approval

The MECP will also be responsible for review and approval for the RSC that is required to permit the change in land use. The RSC may include certain risk mitigation measures that may impact grading and servicing for the subject development.

4.0 PROPOSED PHASING AND DEVELOPMENT STRATEGY

The Site is subject to redevelopment under a Plan of Subdivision to create nine new blocks. As part of the redevelopment, a crescent shaped municipal roadway is proposed through the site, connected to Conestogo Road on the northern and southern limits of the site. The proposed municipal roadway will connect all blocks and will contain the required servicing infrastructure to support the development.

The individual blocks are expected to be developed as purpose built rental developments. To maintain flexibility in ownership, it is anticipated that each block would also contain a single plan of condominium, with all units within the condominium owned by a single entity.

It is possible that, in the future, the individual blocks could have multiple, separate condominium corporations, which would form distinct property boundaries within the block itself at the time of registration. The development structure within the blocks shall be reviewed at the time of Site Plan Approval for the individual blocks to ensure an appropriate number of service connections are provided to the blocks.

It is also anticipated that the overall subdivision will be developed in phases. Specific phasing was not known at the time of writing; however, it is generally anticipated that the phasing of the development within the site is likely to follow the block numbering as presented in the proposed Draft Plan of Subdivision by GSP Group Inc. With this suggested phasing, portions of the existing site may remain operational as buildings to the north are constructed. As such, the proposed municipal roadway is also likely to be constructed in phases.

5.0 SOURCE WATER PROTECTION

According to the Province of Ontario's *Source Protection Information Atlas*, the Site is located within an Intake Protection Zone 3, with a vulnerability score of 7.2. The site is not located within any other water quality-related source protection zone or any water quantity-related source protection area. Table i provides the source protection details for the Site.

Table i: Source Protection Details

Source Protection Area	Grand River
Water Quality	
Wellhead Protection Area	No
Wellhead Protection Area E (GUDI):	No
Intake Protection Zone:	3; score of 7.2
Issue Contributing Area:	No
Significant Groundwater Recharge Area:	No
Highly Vulnerable Aquifer:	No
Event Based Area:	No
Water Quantity	
Wellhead Protection Area Q1:	No
Wellhead Protection Area Q2:	No
Intake Protection Zone Q:	No

Figure 3 provides the mapping for the subject site as exported from the Source Protection Information Atlas.

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

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

6.0 SANITARY SERVICING

6.1 Proposed Sanitary Servicing

In accordance with the City of Waterloo Engineering Standards and the Design Guidelines and Supplementary Specifications for Municipal Services (DGSSMS) 2023, the sanitary flows from the subject development were calculated based on the split in land uses between residential and commercial developments within the site.

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

Table ii provides a summary of the total domestic flow expected to be generated from the overall development in accordance with DGSSMS.

Table ii: Proposed Sanitary Flow

Relevant Site Area	7.27 ha
Number of Residential Units	3353 units
Design Population density	1.76 ppu
Design Population	5901 persons
Average Residential Daily Flow	275 L/c/d
Residential Peaking Factor	3.18
Total Residential Sanitary Peak Flow	**57.94 L/s**
Equivalent Commercial Area	0.589 ha
Average Commercial Daily Flow	0.5 L/s/ha
Commercial Peaking Factor	2.5
Commercial Sanitary Flow	**0.73 L/s**
Extraneous Flow Allowance	0.25 L/s/ha
Total Extraneous Flow	**1.82 L/s**
Total Sanitary Flow	**60.49 L/s**

At the time of writing, it is proposed that each of the eight Blocks will contain an individual sanitary service connection to either a proposed sanitary sewer on the proposed internal municipal roadway, or directly to Conestogo Road. Currently, two municipal sanitary sewers are proposed within this municipal roadway (to account for phasing). One sewer is proposed on the northmost section of the roadway to collect Blocks 1, 3 and 5 and direct flows to the existing Conestogo Road sanitary sewer. The second sewer is proposed on the southern section of the proposed municipal roadway to collect flows from Blocks 7, 8, and 9. It is proposed that Blocks 2 and 6 will directly connect to the existing Conestogo Road sanitary sewer.

To estimate the proposed sanitary flow for each block, the extraneous flows were divided proportionally by area between the nine services. The table below summarizes the proposed cumulative sanitary flow for each of the nine blocks.

Table iii: Distribution of Sanitary Flow

Block	Area (ha)	Number of Units	Block Sanitary Flow (L/s)	Cumulative Sanitary Flow (L/s)
Northern ROW	0.372	0	**0.09**	**0.09**
Southern ROW	0.325	0	**0.08**	**0.18**
1	0.644	225	**5.36**	**5.54**
2	0.834	250	**5.46**	**11.00**
3	1.160	676	**13.14**	**24.14**
5	1.019	628	**11.31**	**35.45**
6	0.625	270	**4.79**	**40.24**
7	0.400	126	**2.73**	**42.97**
8	1.124	618	**10.34**	**53.31**
9	0.769	560	**9.00**	**62.31**
	7.27 ha	**3353 Units**		

The peak flow anticipated by the development is 62.31 L/s. The two independent sanitary sewer systems proposed on the future municipal roadway can accommodate the relevant block flows via a 300-mm-diameter sanitary sewer, sloped at 0.3%.

6.2 Local Sanitary Constraints

The sanitary flow from the subject development is directed to a 300-mm-diameter municipal sanitary sewer on Conestogo Road. This sewer outlets to a municipal sanitary sewer located within the utility corridor at the south end of the Site. This municipal sewer crosses ON-85 and connects to the LFCTSS that directs wastewater to the Waterloo Waste Water Treatment Plant (WWTP).

The local municipal sanitary system is comprised of 200mm diameter to 300mm diameter sanitary sewers on Northfield Drive, Durward Place, and Conestogo Road, ultimately combining to a 300mm diameter sanitary sewer within the utility corridor on the subject site. Based on City of Waterloo plan and profile drawings dated February 1973, this sanitary sewer was designed to be installed at a slope of 0.61 to 0.62%.

Table iv provides capacities of the pipe calculated using the Chézy-Manning formula with a roughness coefficient of 0.013 for smooth walled concrete pipe in accordance with the DGSSMS.

Table iv: Hydraulic Properties of Local System

Diameter of Sewer	300	*mm*
Design Slope	0.61	*%*
Full Flow Capacity	75.53	*L/s*
Full Flow Velocity	1.07	*m/s*

In addition to the subject development, the local system conveys flows from approximately 34.36 ha of external drainage area bound by Northfield Drive to the north, King Street to the east, ON-85 to the south, and the subject site to the west. This external catchment is comprised primarily of Employment Lands (26.93 ha, zoned E2) and some commercial lands fronting onto King Street (7.43 ha, zoned C2/C4).

Combined, the external drainage areas contribute approximately 39.42 L/s of flow to the local sanitary system. Appendix B provides the external drainage areas and their corresponding flow contributions.

It is recognized that the arithmetic addition of peak flows from the subject development and the external drainage area exceed the full flow capacity of the local system within the utility corridor. However, the flows from the proposed development are largely dominated by residential peak flow that is characterized by a diurnal pattern with an AM and PM peaks, whereas the flows from the external catchment are largely expected to be uniform with their peaks not coinciding with the AM and PM peaks from the subject development. As such, the peak flows cannot be considered to be additive and the local system may have capacity to service the development.

Arithmetically, a residual capacity of approximately 36.11 L/s is available within the local systems and the first four phases may be able to connect to the existing systems prior to requiring upgrades. The residual capacity amounts to approximately 1840 units.

A total projected flow of 98.4 L/s, determined using the full build out of the proposed development and the existing sanitary flows can be accommodated within a 375mm diameter sanitary sewer at the same slope of 0.61%. Such a sewer will have a full flow capacity of 137 L/s. Ultimately, the full build out will require an upgrade to the sanitary sewer within the hydro easement connecting to the LFCTSS.

6.3 Sanitary Sewer Hydraulic Modelling

Hydraulic Modeling from the City of Waterloo suggests that the full build out cannot be accommodated within the downstream systems without surcharging, confirming the conclusions noted in Section 6.2. To understand

the impact of the surcharging conditions, and the triggers for downstream upgrades, hydraulic modelling was completed for the sanitary sewers upstream of the LFCTSS.

Although the proposed flow from the subject development and offsite sources are not considered additive to one another due to different land uses, a simplified hydraulic grade line (HGL) analysis was completed to understand extent of surcharging, should the peak discharges ever combine. The simplified model assumed the following:

- Peak discharges occurred simultaneously and no lag was present due to travel time in pipes. This included the inflow and infiltration flows and was considered to be highly conservative.

- The offsite flow enters the Conestogo Road municipal sanitary sewer along the site frontage at 3 points. 10% of the flow occurs at the extreme north via Northfield Drive (node 51A), 20% of the flow occurs at Durward Place and 70% of the flow occurs via the southern leg of the sanitary sewer on Conestogo Road.

- Surcharging conditions within the LFCTSS were modelled using an existing HGL of 333.05m at the connection point between the trunk and sanitary sewer from the hydro corridor. This represents the extreme wet conditions in the current city-wide sanitary sewer model.

The purpose of this analysis was to establish surcharging depths to evaluate whether the surcharging has the potential to negatively impact upstream properties draining to the Conestogo Road sanitary sewer system. The model surcharging depths and link capacities are illustrated in Appendix B.

The analysis noted that in existing conditions, prior to any development, the sanitary sewer within the hydro corridor is surcharged for its entire length, and some surcharging is noted within the sanitary sewers on either side of the hydro corridor connection on Conestogo Road. A maximum surcharged depth of 1.69m is noted at the connection to the hydro corridor, which is the lowest point along Conestogo Road.

With the addition of Block 1 and Block 2 flows, the maximum surcharge depth increases to 1.72m and 1.97m respectively. These additional flows do not surcharge any additional lengths of pipe beyond the existing conditions. This section of surcharged piping does not appear to have any sanitary sewer laterals connected to it and is unlikely to have any connections due to the presence of a hydro owned transformer station on the east side of Conestogo Road and Client owned lands on the west side of the road. As such, the surcharging does not negatively impact properties upstream of the site and it is suggested that Block 1 and 2 be allowed to proceed without necessitating downstream upgrades.

The addition of Block 3 flows increases the surcharge to a depth of 2.52m and inundates additional sections of pipe further south on Conestogo Road. This has the potential to obstruct free-flow from upstream properties and therefore Block 3 could be considered the trigger point for downstream works. In general, approximately 15 L/s of additional flow (amounting to approximately 700 units) can be accommodated within the system without surcharging additional manholes.

In existing conditions, the HGL at the Conestogo Road junction with the hydro corridor is noted to be 333.33m. The full build out (62.31 L/s) would cause node flooding at this junction. Replacing the 300-mm-diameter municipal sanitary sewer within the hydro corridor with a 375-mm-diameter sewer results in an HGL of 333.93m and a 450-mm-diameter sewer results in an HGL of 333.39m, which closely matches existing conditions. As such, a 450-mm-diameter sewer is recommended within the hydro corridor.

It is also noted that this analysis does not include additional flows from upstream catchments (in the local system or a resultant increase in HGL within the trunk) and therefore the modelling should be revisited at the Site Plan Approval stage for each block to ensure the assumptions and recommendations in this report remain valid. The evaluation of sanitary capacity at SPA, using the City wide model is typical as the City does not reserve capacity for future development and capacity allocation is based on a first-come-first-served basis.

6.4 Lower Forwell Creek Trunk Sanitary Sewer

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

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

The proposed development will contribute a higher peak flow than what is currently discharged from the site. According to Appendix K of *The City of Waterloo Sanitary Master Plan,* the modelled sanitary flow rate from the site was 6.94 L/s, and this flow rate was continued through the 2029 master planned scenario. Thus, the Sanitary Master Plan did not account for any potential growth of the site. With the anticipated flow from the developed Site of 62.31 L/s, the net increase from development is roughly 55.37 L/s.

While the development will contribute a larger flow than what was considered in the 2015 Sanitary Master Plan, the impact of this increase is not apparent. Due to the proximity of this site to the trunk sewer and to the waste water treatment plant (WWTP) itself, it is anticipated that the AM and PM peak discharges from the site will reach the WWTP much in advance of flows from neighboring St. Jacobs, whose flows are contemplated to be re-routed to the WWTP within the 2015 Sanitary Master Plan.

Finally, it is also important to note that it is understood the City is currently in the process of updating the Sanitary Master Plan and will re-assess the recommendations related to the identified constraint in the LFCTSS as a result of growth that has occurred within the City, and anticipated future developments such as the one considered in this report. However, presently, the City is not prohibiting any new developments from proceeding.

At the time of writing, Notice of Public Consultation Centre #2 for the Master Plan addendum was posted online, for public comment and review. The materials posted for this public consultation did not identify a concern with the LFCTSS in the immediate vicinity of the site. A constraint, similar to one noted in the 2015 Master Plan was flagged further downstream and the recommendation to do nothing still stands from the master plan consultant.

7.0 WATER SERVICING

The proposed subdivision will have multiple connections to the existing infrastructure surrounding the Site as well as a proposed municipal looped watermain off Conestogo Road. In general, Blocks 1, 3, 7, 8, and 9 are proposed to connect to directly the internal municipal looped watermain, while Blocks 2 and 6 are proposed to connect directly to the existing Conestogo Road watermain.

The separate, independent servicing for each Block is proposed to ensure compliance with the Safe Drinking Water Act.

7.1 Design Criteria

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

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

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

7.2 Domestic Demand

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

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

For commercial uses, an allowance of 28 m^3/ha/day for the commercial uses was utilized, factored for a 16-hour operating period per day, resulting in a demand of 42 m^3/ha/operating hour. A maximum day demand peak factor of 1.42 and a peak hour factor of 3.0 were applied in accordance with correspondence with the Region of Waterloo, to keep consistency with residential peaks.

The usage rates and detailed demand calculations for each node are provided in appended Table C-1 and graphically illustrated in appended Figure C-2.

7.3 Fire Flow Demand

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

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

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

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

The FUS methodology is likely to result in fire flows greater than 150 L/s. While full details on the adjacencies and exposures, and floor areas for the towers were not available, a required fire flow of 200 L/s was estimated based on past experience, and utilized to complete updated water modelling for the Site.

7.4 Service Design

As per the DGSSMS, the water service required shall be able to convey the combination of the Maximum Day Demand (MDD) and the Fire Demand, within the pressure and velocity ranges as specified. A service size was selected for each block to ensure that velocities in the MDD + Fire scenario do not exceed 5 m/s. This service size was increased as required to minimize hydraulic losses through the system to ensure the total demand can be delivered at acceptable pressure levels. The selected service size is presented in Table C-3.

Each block is proposed to have individual service connections to comply with the requirements of the *Safe Drinking Water Act* (SDWA). It is noted that, should any block contain multiple plans of condominiums, individual services to each condominium may be required resulting in additional water service connections to the municipal system as the registration of a condominium results in a separate property under the Land Titles Act.

In accordance with Ontario Building Code Clause 3.2.9.4(4), "if a building is 84 m or more high, measured between grade and the ceiling level of the top storey, the building shall be served by no fewer than two sources of water supply from a public water system". As such, Blocks 3, 5, 8, and 9 are proposed to have two source of water supply from the public system.

7.5 Modelling and Results

The Region of Waterloo was previously contacted to obtain modelling simulations to establish boundary conditions around the subject development. The hydraulic grade lines were obtained for the average day and maximum day, as well as data pertaining to maximum available fire flow. Correspondence from the Region is appended as Appendix C-4.

A reservoir was assigned the hydraulic grade line determined from the Region's model for each demand scenario. This reservoir was connected to a pump with a head loss curve to simulate the drop in pressure corresponding to the modelling obtained from the Region.

An EPANET model was created to model the distribution network within the subdivision. Transmission losses within the Conestogo Road watermain were not accounted for in the subdivision model as they are assumed to be incorporated within the modelling results provided by the Region, as the municipal distribution system is looped and fed from many different locations. Changes in pressure due to elevation differences are captured in the system model. The model was run for two configurations, further described below:

- **Interim Conditions:** As development will occur in phases, it is anticipated that the municipal watermain within the crescent shaped roadway will also be completed in phases. An interim conditions model was completed to simulate a dead-end condition, servicing Blocks 1, 3, 4, and 5. This condition allows for the existing building within the site to remain operational, while development occurs to the north. The interim condition model would be considered the critical phase of the development, subjected to high transmission losses in the single, dead ended run.

- **Ultimate Conditions:** As the crescent shaped roadway is completed, the watermain within the roadway will be looped back to Conestogo Road. This connection will provide for a significant reduction in transmission losses and boost available fire flow in the ultimate conditions.

The model was run for average day demands and maximum day demands to understand residual pressures within the system. The results are tabulated in appended Tables C-5 and C-6. The results indicate that in non-fire conditions the residual pressures in the system are within acceptable ranges as specified in the DGSSMS.

Additionally, the maximum day model was evaluated to determine the maximum available flow at each node while ensuring that the remainder of the system remains at or above 140 kPa (20 psi). The results of this analysis are tabulated in Table C-7 for the complete system and summarized in Table v below. The results indicate that sufficient flow is available to each block to provide maximum daily demand and fire flows concurrently, above the minimum pressure of 14.1m.

Table v: Water Distribution Modelling Results

Block	Domestic Flow *(L/s)*	Required Fire Flow *(L/s)*	Total Flow *(L/s)*	Available Flow (Interim Conditions) *(L/s)*	Available Flow (Ultimate Conditions) *(L/s)*
Block 1	1.537	200	201.54	704.40	738.20
Block 2	1.671	200	201.67	-	795.30
Block 3	4.401	200	204.40	513.40	646.70
Block 5	4.086	200	204.09	490.80	647.30
Block 6	1.790	200	201.79	-	795.60
Block 7	1.077	200	201.08	-	728.10
Block 8	4.023	200	204.02	-	656.20
Block 9	3.646	200	203.65	-	651.40

As such, it is concluded that the municipal system is sufficient to provide water servicing to the subdivision. A hydrant flow test should be conducted during detailed design to confirm the modelling results provided by the Region.

The complete EPANET model is provided as appendix C-8.

To maintain compliance with the Safe Drinking Water Act, the water supply sources shall remain independent and at no point shall be interconnected between separate parcels of land.

7.6 Water Quality

As a dead-end condition for the watermain is likely to exist within the subdivision, for an indeterminate amount of time, the water turnover was calculated for the worst-case condition defined as the initial development of Block 1.

To service Block 5 of the development, approximately 177 metres of watermain will need to be constructed (including the service connection to the main). For a 300mm diameter watermain, this results in a volume of approximately 12.51 m^3 of water being in the main at any given time. Block 5 is at the terminus of this watermain. Under average day conditions, Block 5 has an average daily demand of 2.878 L/s (0.0029 m^3/s). Thus, the turnover rate of water in the system from just the domestic use in Block 5 is approximately 4313 seconds, or 1.20 hours.

Based on the above, water quality issues are not anticipated for the dead-ended condition. During detailed design, the layout of the servicing will be further refined to ensure that any extent of watermain beyond the connection to Block 5 will be minimized or otherwise adequately protected or isolated to ensure quality does not become a concern for the in-service watermain.

8.0 STORM SERVICING

8.1 Local Servicing

As currently proposed, the development will contain a municipally owned storm sewer system to collect runoff from within the road allowance as well as runoff from the buildings and park area. It is expected that the subdivision will have one connection to the municipal storm sewer within the utility corridor. In interim

conditions when a portion of the existing factory still exists, a temporary outlet to the existing MTO ditch is proposed at the limits of Block 5 and Block 8.

Table vi illustrates the expected flow generated from a 5-year design storm event and associated pipe sizing for the Site. The flow is calculated using an estimated overall 90% imperviousness with a time of concentration of five minutes in accordance with City of Waterloo design standards.

Table vi: Proposed Storm Sewer Connection

Site Area (Blocks 1-9)	7.27	*ha*
Runoff Coefficient	0.9	
Time of Concentration	5	*min*
5-Year Design Flow	2544.70	*L/s*
Proposed Pipe Diameter	1050	*mm*
Proposed Slope	1.00	*%*
Full Flow Capacity	2730.73	*L/s*
Full Flow Velocity	3.58	*m/s*

In interim conditions, the storm sewer will outlet through a temporary outlet described in Table vii.

Table vii: Interim Conditions Storm Sewer Outlet

Site Area (Interim Conditions)	4.24	*ha*
Runoff Coefficient	0.75	
Time of Concentration	5	*min*
5-Year Design Flow	1205.86	*L/s*
Proposed Pipe Diameter	825	*mm*
Proposed Slope	1.00	*%*
Full Flow Capacity	1435.44	*L/s*
Full Flow Velocity	2.69	*m/s*

It is proposed that each Block will contain an individual storm service which will outlet to the municipally owned internal roadway. The allowable release rate for each block will be determined proportionally based on area for each block.

Given that the existing storm sewer on Conestogo Road is currently 500-mm-diameter at the proposed connection, it is anticipated that one run of pipe will need to be upsized to 1050-mm-diameter pipe within the right-of-way from the proposed connection to the existing manhole at the upstream end of the Hydro Corridor.

The exact pipe size and limits of upgrades required will be determined during detailed design for each phase.

8.2 Major Overland Flow

Major overland flow from within the private roadway will be directed to the utility corridor and ultimately discharged to the ditch along ON-85. The grading of the road network within the subdivision permits for the conveyance of the major overland flow to its designated outlet with a maximum ponding depth of 0.3 m.

Additionally, major overland flow from approximately 22 ha of external drainage area east of the subject development appears to cross through the property. Elevations on Conestogo Road appear to allow for this major overland flow to enter the property at the hydro corridor. The external drainage area and the low point on the site are illustrated on Figure 4.

The redevelopment plans allow for this major overland flow pathway to remain in its existing state.

8.3 Regulated Drainage Feature

Based on GRCA mapping, a portion of the ditch along ON-85 appears to be a regulated drainage feature and is considered to be a tributary of the Forwell Creek. Based on the mapping, the associated floodplains and allowances for this tributary encroach onto the development limits within the Site. Development within GRCA regulated areas require prior approval and authorization in the form of a permit pursuant to O.Reg 150/06.

Based on discussions with the GRCA, the subject lands are located within a Candidate Two Zone Floodplain Policy Area; however, its associated floodway and flood fringe have not been delineated to date.

To further study the hydrologic conditions and complete a two-zone technical analysis, WalterFedy obtained the HEC-RAS hydrologic model from the GRCA. A review of the model (without modifications), in conjunction with up-to-date survey information concluded the following:

- The flood plain noted within GRCA mapping is a result of backwater effects from downstream constraints. These constraints contribute to water pooling within the regulated drainage feature and are not caused by the size of the culvert under ON-85.

- The flood plain is a result of requiring flood storage volume and not a floodway conveying stormwater flows to Forwell Creek.

- The limits of the flood plain are not accurately defined within the GRCA mapping. Utilizing the Regional Flood Elevation of 334.05m amsl from the hydrologic model, the flood plain was mapped to be generally contained within the drainage channel with minor encroachment onto the subject lands in and around the utility corridor and Blocks 8 and 9. This is illustrated in Figure 5.

The proposed development is to be contained largely outside of the flood plain as mapped using up-to-date survey information. More specifically, the development limits on this site are defined by a 14 m setback from the shared properly line with ON-85 and the flood plain is generally contained outside of this limit. However, currently a portion of Block 8 and 9 conflict with the proposed flood plain. As this development would result in a reduction of storage volume, it must be compensated for by regrading activities in the vicinity of the proposed Blocks to restore the lost volume.

The floodplain that encroaches within the footprint of Block 8 and 9 represents approximately 26 m^3 of flood storage. This fill can be balanced by reshaping the ditch bottom along ON-85 at the time of maintenance or otherwise provided within the site via surface grading and/or oversized pipes. Detailed calculations for the cut and fill to balance flood storage volumes will be completed as part of designs for Block 8 or 9. Cut and fill activity within the floodplain will be completed upon approval by the GRCA.

9.0 STORMWATER MANAGEMENT

9.1 Stormwater Management Design

In accordance with the City of Waterloo's *Comprehensive Engineering and Landscape Manual*, an effective SWM design must address the following:

- Water Quantity: post development peak flows controlled to pre-development levels
- Water Quality: in accordance with the Forwell Creek Subwatershed requirements of the Laurel Creek Watershed Study (GRCA, 1993) and a minimum of average, long-term total suspended solids

reduction of 80% or greater in accordance with the Municipal Class EA Integrated Stormwater Management Master Plan (SWM-MP) (Aquafor Beech, 2021).
- Water Balance: to ensure groundwater protection and recharge.
- Volume Control: the site is subject to a volume control target of 12.5mm across the entire site in accordance with the SWM-MP.

The discharge from the site is ultimately directed to Forwell Creek. The City's Stormwater Management Master Plan identified Forwell Creek as having "the worst Subwatershed conditions in the City." As part of the redevelopment, opportunities to improve conditions through the design of the stormwater management systems have been explored.

9.2 Existing Conditions

The subject site has an area of 7.27 ha. Drainage from the site is directed towards Conestogo Road, the hydro corridor to the south or directly to a drainage channel to the west. Ultimately, drainage is all conveyed to the west as Conestogo Road drainage is directed to the hydro corridor, where an elliptical sewer conveys this drainage west and discharges to the drainage channel. This drainage pattern is to remain in the proposed conditions.

The overall imperviousness in existing conditions is approximately 91%.

Through an analysis completed in HEC-RAS, flood elevations of Forwell creek were determined as 333.235, 333.455 and 334.075 masl, for the 2-, 5- and 100-year design storm scenario, respectively. These flood elevations will be incorporated into both the existing and proposed hydrological models to represent the tailwater effects at the site outlets.

9.3 Proposed Conditions

As previously noted, the site is to be developed with buildings that largely comprise the entirety of the 8 blocks that surround a large central park. A crescent shaped municipal roadway separates the proposed buildings from the park. This consists of approximately 3.5 ha in rooftop areas, 0.98 ha in park areas and the balance as the municipal right-of-way, at grade parking, and drop off areas.

In interim conditions, the southern half of the site will remain as existing, resulting in an imperviousness of approximately 85%.

9.4 Peak Flow Control

The proposed development comprises of the entire site area being largely impervious, with a total imperviousness of 76%, which represents a decrease in overall imperviousness. This decrease will in turn decrease overall peak runoff discharge and volume from the site, improving on the requirements of the City of Waterloo and the Ministry of Transportation. Table viii below illustrates the noted pre- and post-development peak flow rates from the site under the 2, 5, and 100-year storm events using a 5-minute time of concentration.

Table viii: Comparison of Pre- and Post-Development Peak Flow Rates

Storm Event	Storm Intensity (mm/hr)	Pre-Development Peak Flow Rate (L/s)	Interim Conditions Peak Flow Rate (L/s)	Post Development Peak Flow Rate (L/s)
2-Year	105.66	1920.36	1813.67	1600.30
5-Year	136.51	2067.59	2343.27	2481.11
100-Year	239.79	4358.23	4116.11	3631.86

Based on the reduction in imperviousness, no further rate control measures are required. However, other measures proposed within the development will further decrease the peak discharge from the site and is

discussed below. A hydraulic model will be developed as part of detailed design to confirm actual decrease in peak discharge.

9.5 Water Quality Control

The City of Waterloo's guidelines stipulate that a minimum Enhanced Level of Protection be provided, as defined by the MECP design guidelines. This corresponds to 80% long-term removal of total suspended solids (TSS).

The proposed catchments consist primarily of rooftops (3.5 ha) and a large central park (0.98 ha), both of which generate relatively clean runoff that is not anticipated to require further TSS removal. This represents a total of 4.48 ha or 62% of the site area. This assumption will require further validation once programming within the park is better determined, and additional quality control measures can be implemented to compensate for impervious areas.

The proposed municipal roadways within the site will have runoff treated through an oil-grit separator (OGS), sized to provide a minimum of 80% long-term TSS removal (Enhanced Level). To allow for flexibility in the design, treatment was designed for 50% of the entire site area, with 90% imperviousness to account for roadways, driveways drop-offs and surface parking.

A Stormceptor EFO12 Unit has been specified for this development for ultimate conditions. This unit provides 86% TSS removal for 90% runoff capture using the MECP's Fine Particle distribution. While an EFO10 unit would meet the requirements for Enhanced Level Quality control by providing 81% TSS removal, the EFO12 unit provides 58% TSS removal using the ETV particle size distribution.

In interim conditions, an OGS will be installed prior to the outlet. This OGS will be removed as development proceeds with the next phase.

The balance of the site area must be discharged downstream of the OGS Unit (clean runoff from the central park/rooftops only). This will be achieved using a parallel pipe system, consisting of a linear infiltration feature and overflow to the storm system, further discussed in subsequent sections of the report. This system is sized to retain and infiltrate >90% average annual rainfall and therefore no further quality control is proposed.

As part of the Laurel Creek Subwatershed Study, the Forwell Creek subwatershed was also assigned additional water quality targets. Some of these targets have superseded by the SWM-MP, however, the targets from the 1993 study include:

- May 1 – October 31 instream temperature: <29 deg.C.
- June 1 – August 1 instream temperature: <26 deg.C
- Instream E. coli: <200 counts/100mL
- Instream DO: > 6mg/L
- Instream phosphorus: 0.05-0.08 mg/L
- BMPs to remove 90% phosphorus
- Storage discharge: <25 mg/L suspended solids (event mean concentrations and flow proportional sampling)

Given the nature of the development, potential sources for phosphorus in runoff include plant and leaf litter, pet and animal waste, road salt and fertilizer applied to lawns and plant beds within the proposed park areas. The presence of phosphorus also contributes to eutrophication (which is a reduction in dissolved oxygen in water), however, this is typically associated with dissolved phosphorus and not commonly particulate phosphorus (which is attached to sediment). Similarly, potential sources for E.coli in stormwater include pet/wildlife waste or through malfunctioning sewage collection systems that may leech bacteria into surface water sources.

In addition to the OGS unit described above (which addresses the TSS parameter), the development incorporates the following pollution prevention control measures to address the water quality, specifically E. Coli control, phosphorus control and instream dissolved oxygen:

- Minimize or eliminate dry water flows. In urban environments, dry weather flows are typically a result of sanitary sewer leaks that are intercepted by storm drain system. The sanitary sewer system for this project will be constructed and tested (low pressure air-test, per OPSS 410) to be completely watertight to prevent infiltration of groundwater into the sanitary sewer system. Such construction is intended to prevent sewage leaks from the sanitary sewer.

- Non-stormwater discharges in dry weather will be limited to routine cleaning and maintenance and irrigation overspray. Irrigation systems will be designed by qualified professionals to minimize overspray.

- Implementation of proper waste management to minimize naturally-occurring and human attracted urban wildlife. The project does not include any open/outdoor waste storage areas, that will attract wildlife.

- Litter and animal waste control measures will be encouraged and incorporated during detailed design of the park lands to ensure that pet waste is litter is properly disposed in a timely manner.

- Limit use of fertilizers in the park and lawn areas, and consideration for incorporation of sorbent additives to growing medium substrates to limit the total phosphorus in runoff. Instead, maintain healthy lawns in organic-rich soil to prevent soil erosion and filter stormwater contaminants.

- Incorporate native landscaping to reduce turf areas and reduce the need for irrigation and watering. Over watering lawns can be a significant source of bacteria.

The following maintenance measures are proposed for the municipal roadway within the subdivision to ensure that water quality is maintained. These measures are typical for municipal infrastructure:

- Street sweeping to reduce surface contaminants that may drain to stormwater systems.

- Curb side leaf collection and composting to prevent growth of bacteria and decomposition of the leaf piles.

- Storm sewer cleaning and catch basin cleaning to remove accumulated debris and sediment.

- Maintenance of sanitary sewer systems, including regular inspection and flushing to ensure any leaks are identified and repaired.

Lastly, the development also incorporates the following BMPs designed to capture stormwater runoff:

- Infiltration and retention measures (further described in Section 9.6) to collect runoff from the park and rooftops, with a total volume exceeding 25mm for these surfaces. These represent approximately 62% of the entire site area. Bacteria and phosphorus removal is considered to be 100% for these measures as no runoff is anticipated for the water quality event. The infiltration from 62% of the proposed catchment area will also significantly decrease the volume of warm water discharge from the site.

- Oil/Grit Separator, as described above for removal of sediments, which will also remove particulate phosphorus and bacteria in the sediments.

As the existing facility does not contain any quality control measures, the proposed development will significantly improve discharge quality to Forwell Creek, exceeding the minimum requirements specified the City of Waterloo.

9.6 Volume Control

The site is subject to a volume control requirement to retain a minimum of 12.5mm of runoff across the entire site, amounting to approximately 909 m^3 of rainfall runoff retention. The development proposes to incorporate the following measures:

- Natural retention within the park areas: These could be considered as extensive green roofs, due to the presence of a parking structure below grade. A 7mm of natural retention is assumed over approximately 70% of the area (to allow for other programming), resulting in 48 m^3 of retention for a 0.98 ha park area.

- Linear infiltration gallery: A linear infiltration gallery is proposed as part of a parallel storm sewer system to capture rainfall runoff from the clean building rooftops and parks. Conservatively, accounting for bends in the roadway where such linear systems are not feasible, a length of approximately 360m is available for such a system. A StromBrixx HD system, rated for AASTHO Heavy Duty (HS-20) truck loading is approximately 1.2m long, 0.6m wide and 0.6m tall, and provides approximately 418 L of storage per module. 4 parallel runs (2.4m total width) for a dual stack system (1.2m total depth) provides 1000 m^3 of storage, or approximately 28.5mm of retention from the entire proposed roof surface.

The total retention proposed within the development exceeds minimum requirements by approximately 15%, accounting for potential clogging and decrease in efficiency for the infiltration systems overtime.
The feasibility of the infiltration system was evaluated based on the following:

- Figure 2 provides inferred groundwater flow contours prepared by S2S Consulting in support of environmental approvals associated with the industrial nature of the site. The groundwater elevations appear to be between 331 and 328.5 mASL, with a gradient from north to south.

- Finished grade elevations for the roadway range from approximately 339.5 to 337 mASL, resulting in an approximate bottom elevation of 337.1 to 334.6 mASL for the infiltration gallery. Approximately 6m separation to the groundwater elevations is anticipated based on the information available.

- Borehole logs prepared for the environmental assessments note the presence of sand, silty sand and sand/gravel underneath the site.

- Based on the subsurface material, a design infiltration rate of 75mm/hr can be anticipated. When applying a factor of safety of 2, with a base area of 864m^2, approximately 30m^3/hour of infiltration is anticipated, resulting in a draw down time of 33 hours for the full 1000m^3 storage.

Geotechnical and hydrogeological studies to support the infiltration measures will be required as part of the detailed design for the subdivision.

9.7 Water Balance and Stream Erosion Control

The redevelopment provides a net reduction in overall imperviousness across the site, and as such, will result in a net decrease in runoff volume from the site. The infiltration from the proposed rooftops and park areas will provide a net increase in groundwater recharge. The large park areas will provide a net increase in evapotranspiration.

A detailed site-specific water balance will be completed as part of the detailed design for the subdivision.

10.0 UTILITIES

10.1 Waterloo North Hydro

Waterloo North Hydro (WNH) was contacted to determine hydro servicing needs for the proposed development. WNH has suggested that existing infrastructure at the corner of Northfield Drive and Conestogo Road can provide hydro servicing to the overall development. Each block is anticipated to be serviced internally through the underground parking level, and it is WNH's preference not to run high-voltage distribution within the road allowance.

Smaller utility owned transformers within the road allowance will power the streetlighting around the proposed roadway.

10.2 Gas

Enbridge Gas was contacted to determine layout of gas servicing for the development. Specifically, it was flagged to Enbridge that the overall development will be interconnected below grade by a parking structure. It is not known at this time if each block will be serviced by a gas service or if a single master shutoff is required for the interconnected building (to be able to shut off gas during an emergency). In such a case, the development could be serviced by existing infrastructure on Northfield Drive and/or Conestogo Road.

Space for a gas main is available in the proposed road cross section but the need for one will be further validated with Enbridge during detailed design.

10.3 Other Utilities

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

11.0 SITE GRADING

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

The proposed grading also allows for conveyance of major overland flow towards the utility corridor and then ultimately west towards the drainage feature along ON-85.

11.1 Compliance with On-Site and Excess Soil Management Provincial Regulations

The MECP has introduced a new regulation, O.Reg. 406/19 titled "On-Site and Excess Soil Management" under the Environmental Protection Act. The excavation of excess material, and subsequent off-site disposal of excess soils from this Site, will require compliance with this new regulation should it be in force during construction of the blocks.

A Qualified Person (QP), as defined within the O.Reg, should be retained to provide site specific guidance related to the Excess Soil regulation.

12.0 ADDITIONAL CONSTRUCTION CONSIDERATIONS FOR SERVICING

12.1 Short-Term Construction Dewatering

The construction of underground parking structures may require dewatering of perched ground water under the surficial layers of the site. Should shallow perched groundwater be encountered, depending on the quantity to

be dewatered, the dewatering activity could be considered a water taking requiring additional permits and approvals from the MECP.

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

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

12.2 Long-Term Dewatering

It is noted that the City and Region of Waterloo do not permit buildings that rely active dewatering systems for waterproofing. As such, should construction of underground levels encounter ground water, mitigation measures such as a caisson cut-off wall or "tanking" of the underground level to create a watertight system should be pursued.

13.0 EROSION AND SEDIMENT CONTROL

Sediment and erosion controls to be implemented during construction will include stabilized construction entrances, a perimeter silt fence, and sediment interceptor swales with installation of coir log check dams.
Prior to the start of any construction, all erosion and sediment control measures installed will be inspected by the Consultant. The controls will be maintained, and accumulated sediments removed once their capture capacity has been decreased by one-third. The measures will also be periodically inspected and upgraded/altered as Site conditions change. Periodic inspections will consist of visual observation of the effectiveness of the control measures and sediment migration offsite.

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

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

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

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

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

14.0 CONCLUSIONS

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

- The existing 300mm diameter sanitary sewer on Conestogo Road is sufficient to accommodate the additional flows from the proposed development.
- Downstream capacity constraints are expected within the Hydro Corridor and in the Lower Forwell Creek Trunk Sanitary Sewer in the City of Waterloo's 2029 Wet Weather flow conditions assessment. Approximately700 units can be constructed before downstream infrastructure upgrades are required.
- The existing 300mm diameter watermain on Conestogo Road is expected to be sufficient to provide domestic and fire flows to the proposed buildings, within the pressure and velocity constraints stipulated by the DGSSMS.
- The identified flood plain is a result of flood storage from backwater effects and not a floodway for conveyance. A portion of the flood plain encroaches within the development limits for the site which accounts for approximately 26m^3 of flood volume. Cut and fill operations within the existing regulated feature, outside of the block limits can balance flood volumes.
- The proposed development will decrease overall imperviousness as compared to existing conditions, and therefore reduce peak discharge from the various design storm events without any further controls.
- Quality control will be achieved through an oil/grit separator for the public roadway. The balance of the site will generally comprise of rooftops and park land, which is expected to generate clean runoff not expected to require further treatment.
- Infiltration measures are proposed for enhanced treatment and meeting water quality objectives of the Forwell Creek watershed.
- Other utilities exist within close proximity to provide service to the proposed development.
- Perimeter silt fence, silt fence at the base of all stockpiles, filter fabric over storm and sanitary structures, and construction entrance mud mats can provide erosion and sediment control. These will be designed during detailed design.

FIGURES

- Figure 1 Regulated Area Mapping (GRCA)
- Figure 2 Inferred Groundwater Flow (S2S)
- Figure 3 Source Protection Mapping
- Figure 4 External Major Overland Drainage Area
- Figure 5 Corrected Flood Plain Mapping
- Figure 6 Existing Conditions Catchments
- Figure 7 Proposed Conditions Catchments



Grand River Conservation Authority

Date: Jul 26, 2020

Author: 525-565 Conestogo Road W,

Figure 1: Regulated Area Mapping

Legend

- Lake Erie Shoreline Reach (GRCA)
- Lake Erie Flood (GRCA)
- Regulated Watercourse (GRCA)
- Parcel - Assessment Public (MPAC/MNRF)
- Floodplain - Special Policy Area (GRCA)

Floodplain (GRCA)

- Engineered
- Estimated
- Approximate
- Lake Erie Erosion (GRCA)
- Lake Erie Dynamic Beach (GRCA)
- Wetland (GRCA)

Slope Valley (GRCA)

- Steep
- Oversteep

Slope Erosion (GRCA)

- Steep

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0 30 60 120 180 Metres

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Map Centre (UTM NAD83 z17): 537,441.40 4,816,157.21

This map is not to be used for navigation | 2015 Ortho (ON)

NAD 1983 UTM Zone 17N

Scale: 5,113

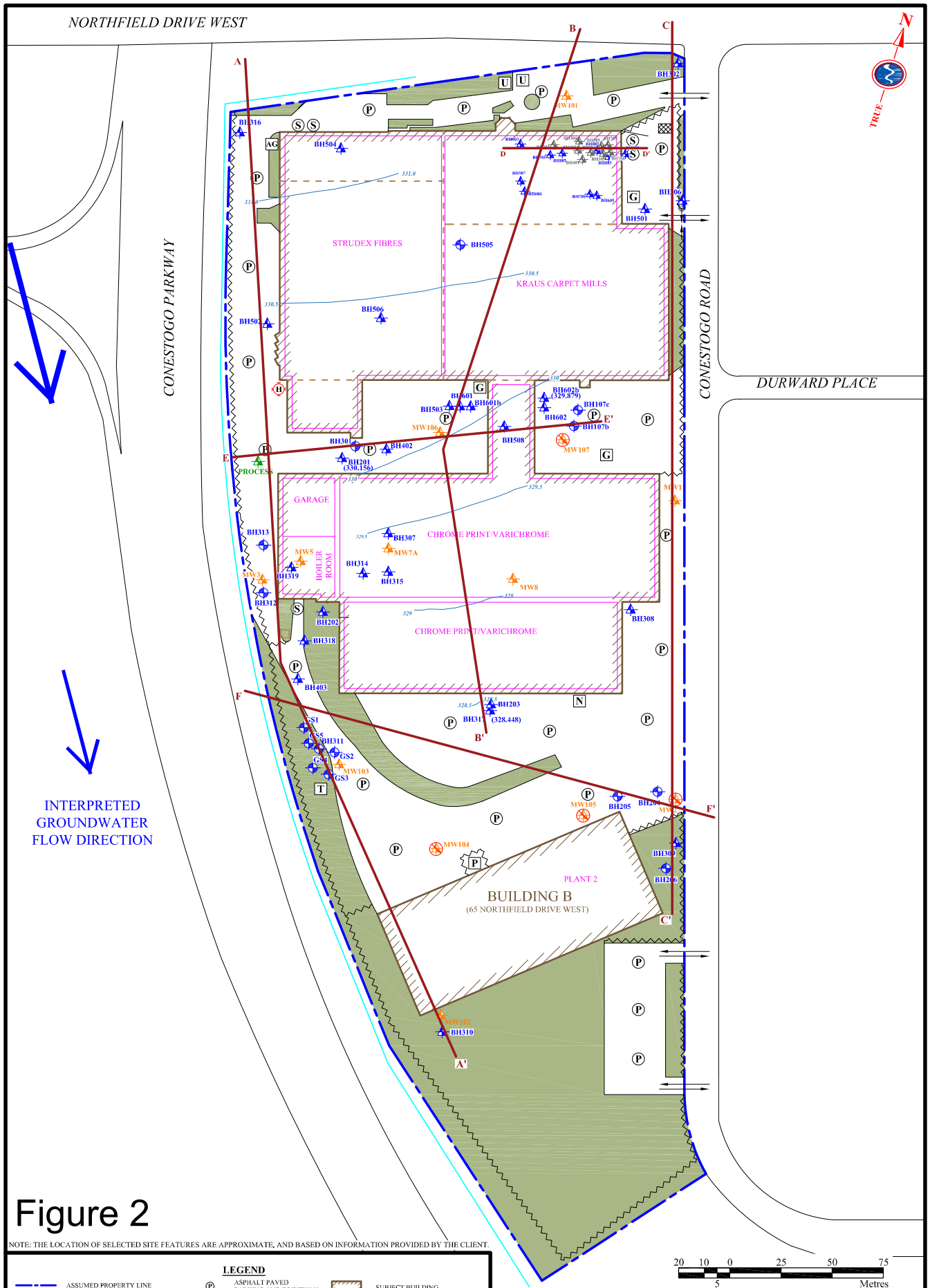


Figure 2

NOTE: THE LOCATION OF SELECTED SITE FEATURES ARE APPROXIMATE, AND BASED ON INFORMATION PROVIDED BY THE CLIENT.

LEGEND

- ASSUMED PROPERTY LINE
- SITE ACCESS
- CHAIN LINK FENCE
- DRAINAGE CHANNEL
- FIRE HYDRANT
- ASPHALT PAVED PARKING AND DRIVEWAY
- CATCH BASIN
- METAL GATE
- APPROXIMATE LOCATION OF MONITORING WELL INSTALLED BY S2S
- APPROXIMATE LOCATION OF BOREHOLE INSTALLED BY S2S
- APPROXIMATE LOCATION OF INJECTION WELLS INSTALLED BY S2S
- (P) ASPHALT PAVED PARKING AND DRIVEWAY
- (S) SILO
- (G) GARBAGE BIN
- (AC) OUTDOOR AIR CONDITIONING UNIT
- (N) NATURAL GAS INSTALLATION
- (U) UTILITY BOX
- (P) PROPANE TANK STORAGE AREA
- APPROXIMATE LOCATION OF PROCESS WATERING WELL
- APPROXIMATE LOCATION OF MONITORING WELLS INSTALLED BY OTHERS
- 330.00 ESTIMATED CONTOUR LINE FOR GROUNDWATER ELEVATION
- SUBJECT BUILDING
- CONCRETE WALKWAY
- LANDSCAPED AREA
- CONCRETE RETAINING WALL
- TOOL SHED
- APPROXIMATE LOCATION OF DAMAGED OR NOT FOUND MONITORING WELL INSTALLED BY OTHERS

S2S Environmental Inc.

SCALE:	
AS SHOWN	
PROJECT NO:	SITE LOCATION: / DRAWING NO:
7883	65 NORTHFIELD DRIVE WEST, WATERLOO, ONTARIO / 5

SITE PLAN SHOWING INTERPRETED CONTOURS OF GROUNDWATER ELEVATIONS

DATE: AUG 26, 2019 | DRAWN BY: MS

Figure 3: 525-565 Conestogo Road - Source Protection Mapping



Legend

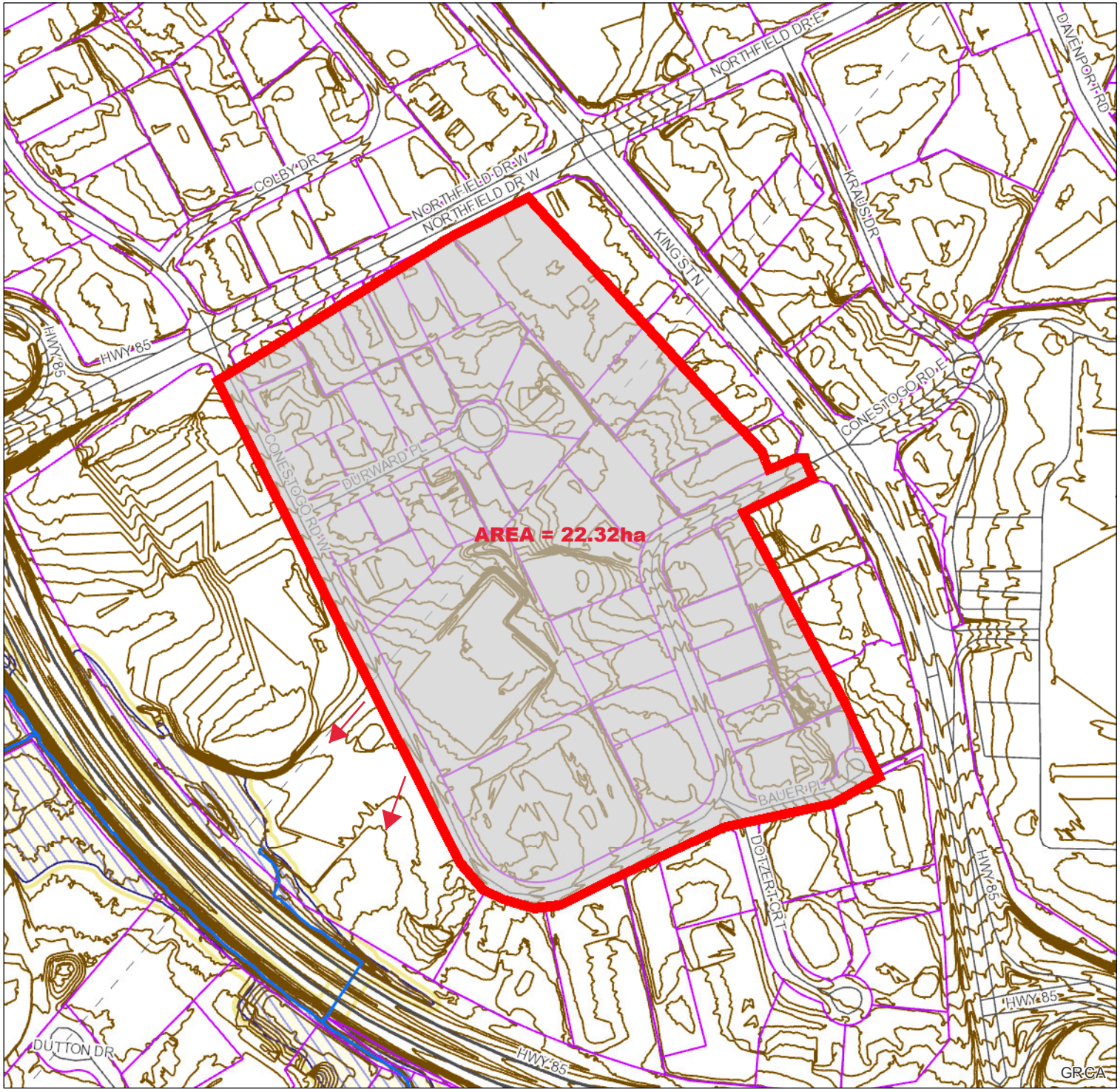
- Source Protection Areas
- Issue Contributing Areas
- WHPA Groundwater Under Direct Influence (WHPA-E)
- Wellhead Protection Area
  - A
  - B
  - C
  - C1
  - D
  - F
- Intake Protection Zone 1
- Event Based Areas
- Intake Protection Zone 2
- Assessment Parcel

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Ontario

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Map Created: 7/26/2020
Map Center: 43.49764 N, -80.53784 W



Grand River Conservation Authority

Date: Jul 26, 2020

Author: 525-565 Conestogo Road W,

Figure 4: External Overland Flow Area

Drainage Flow Path

External Catchment Area

Legend

- Regulation Limit (GRCA)
- Regulated Watercourse (GRCA)
- Regulated Waterbody (GRCA)
- Wetland (GRCA)
- Floodplain (GRCA)
  - Engineered
  - Estimated
  - Approximate
  - Special Policy Area
- Slope Valley (GRCA)
  - Steep
  - Oversteep
  - Steep
- Slope Erosion (GRCA)
  - Oversteep
  - Toe
- Lake Erie Flood (GRCA)
- Lake Erie Shoreline Reach (GRCA)
- Lake Erie Dynamic Beach (GRCA)
- Lake Erie Erosion (GRCA)
- Parcel - Assessment (MPAC/MNRF)

This legend is static and may not fully reflect the layers shown on the map. The text of Ontario Regulation 150/06 supercedes the mapping as represented by these layers.

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The source for each data layer is shown in parentheses in the map legend. For a complete listing of sources and citations go to: https://maps.grandriver.ca/Sources-and-Citations.pdf

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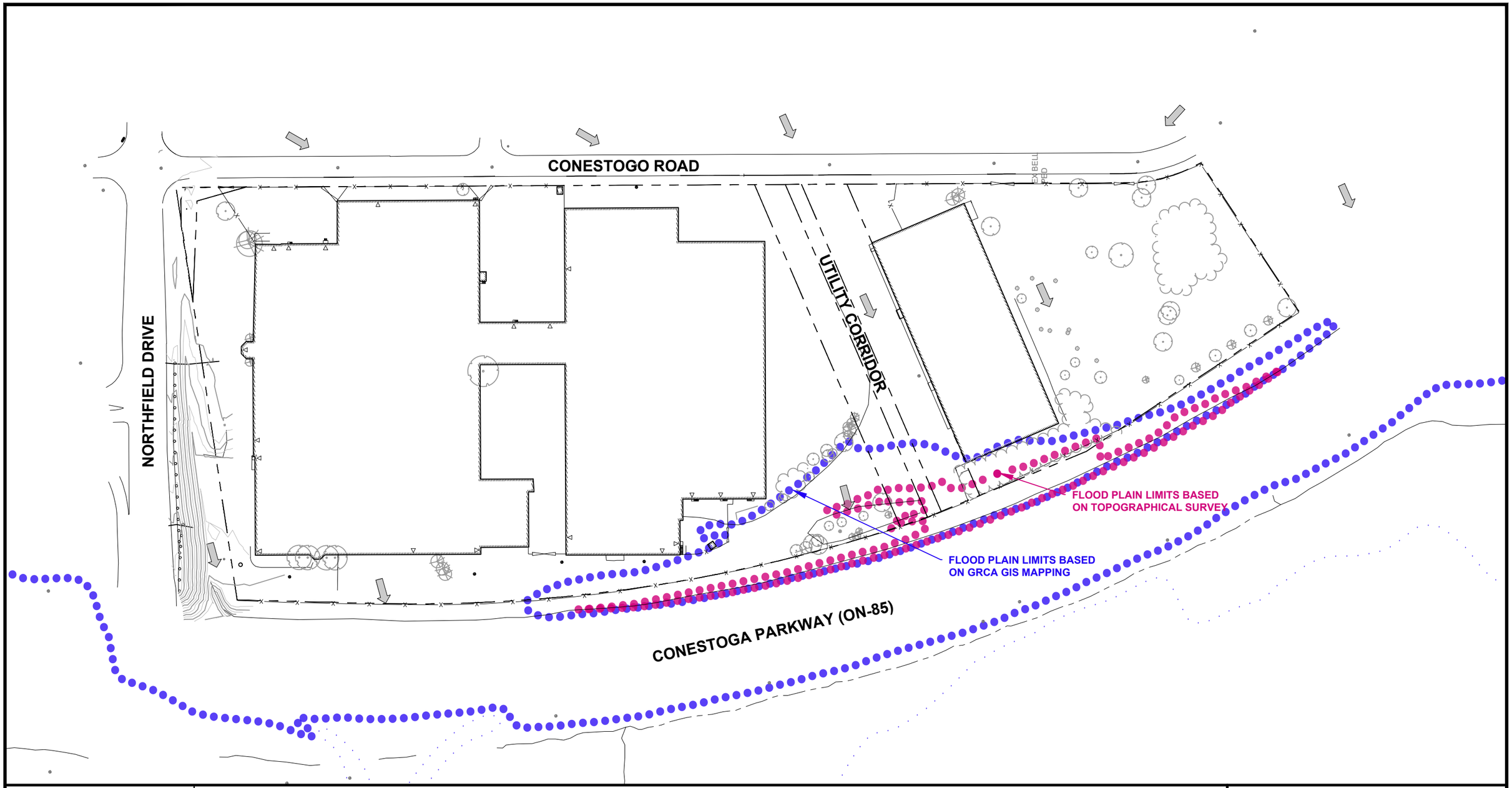
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NAD 1983 UTM Zone 17N

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This map is not to be used for navigation



project:
NORTHFIELD PROPERTIES LP
525-565 CONESTOGO ROAD

title:
CORRECTED FLOOD PLAIN MAPPING

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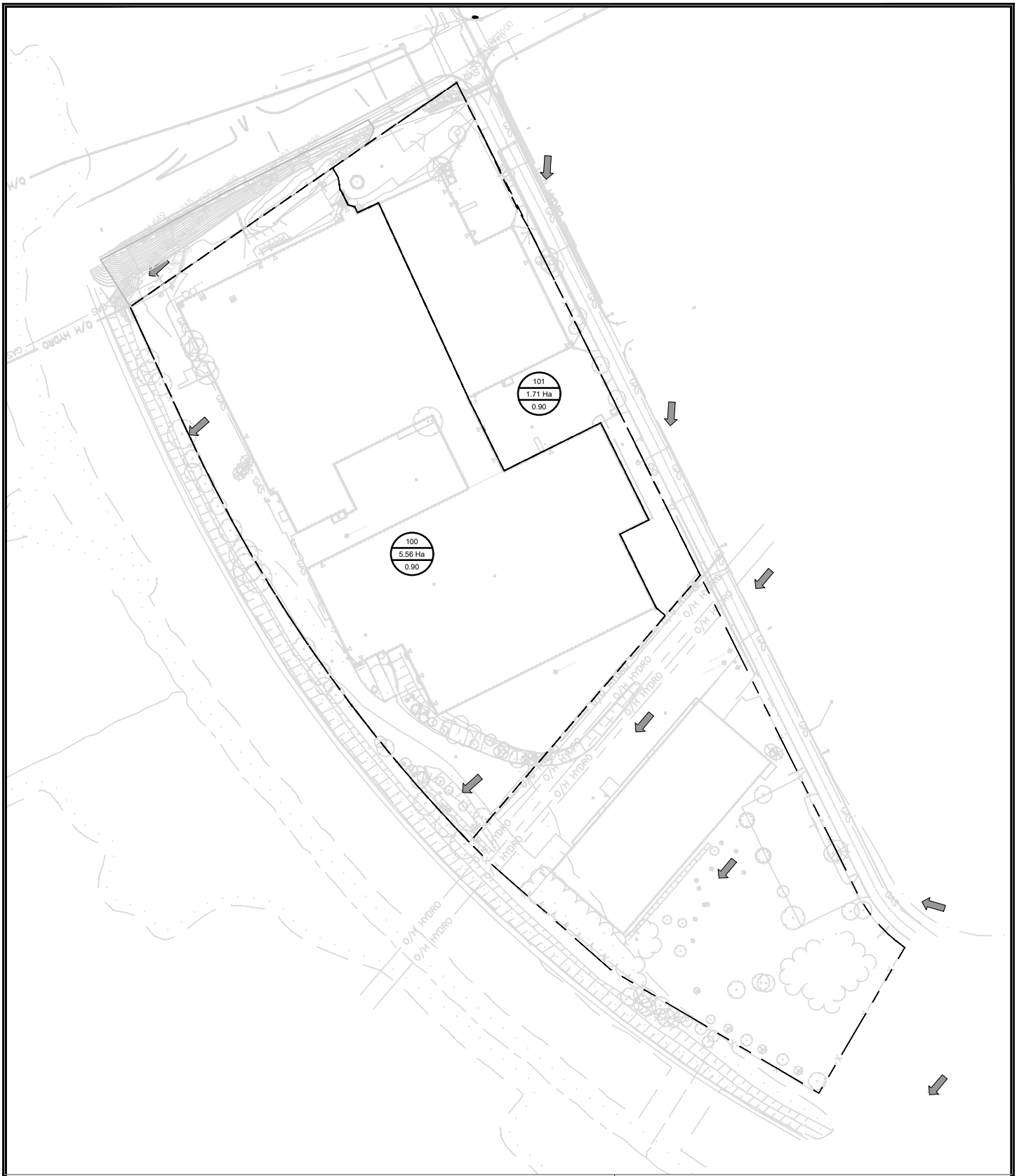
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scale:	1:2000	date:	2020.07.26
drawn by:	R.K.	project no.:	2019-0000-00
checked by:	R.K.	file:	2019-0654-10 EX-FLOOD

sheet no.:
FIG-5

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PROJECT:
65 Northfield Drive

WALTERFEDY

TITLE:
Existing Conditions Catchment Areas

SCALE:	1:3000	DATE:	2023.09.29
DRAWN BY:	RK	PROJECT NO.:	2019-0654-10
CHECKED BY:	RK	FILE:	2019-0654-10 EX_STM_REV

SHEET NO.:
FIG-6

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PROJECT:
65 Northfield Drive

WALTERFEDY

TITLE:
PROPOSED CONDITIONS CATCHMENT AREAS

SCALE:	1:3000	DATE:	2023.09.29
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CHECKED BY:	RK	FILE:	2019-0654-10 EX_STM_REV

SHEET NO.:
FIG-7

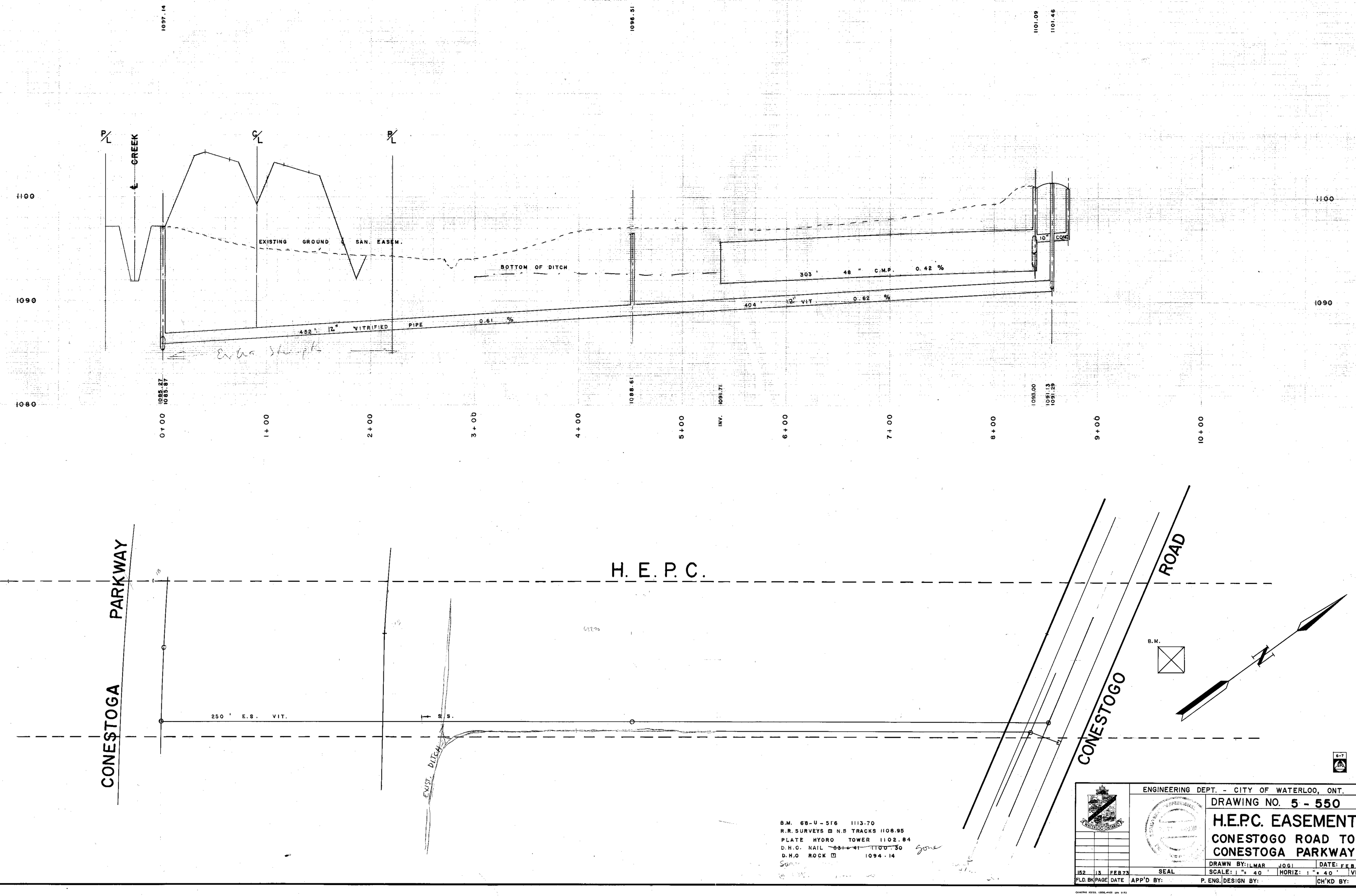
COPYRIGHT © 2023 WalterFedy

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APPENDIX A

Existing Utility Information

- City of Waterloo Plan and Profiles
- Region of Waterloo Plan and Profiles
- Region of Waterloo Street Lighting Locates
- Enbridge Gas Locates
- Bell Canada Locates
- Rogers Communications Locates
- Waterloo North Hydro Servicing



B.M. 68-U-516 1113.70
R.R. SURVEYS ⊠ N.S TRACKS 1108.95
PLATE HYDRO TOWER 1102.84
D.H.O. NAIL ~~1111.41~~ 1100.30 gone
D.H.O ROCK ⊡ 1094.14

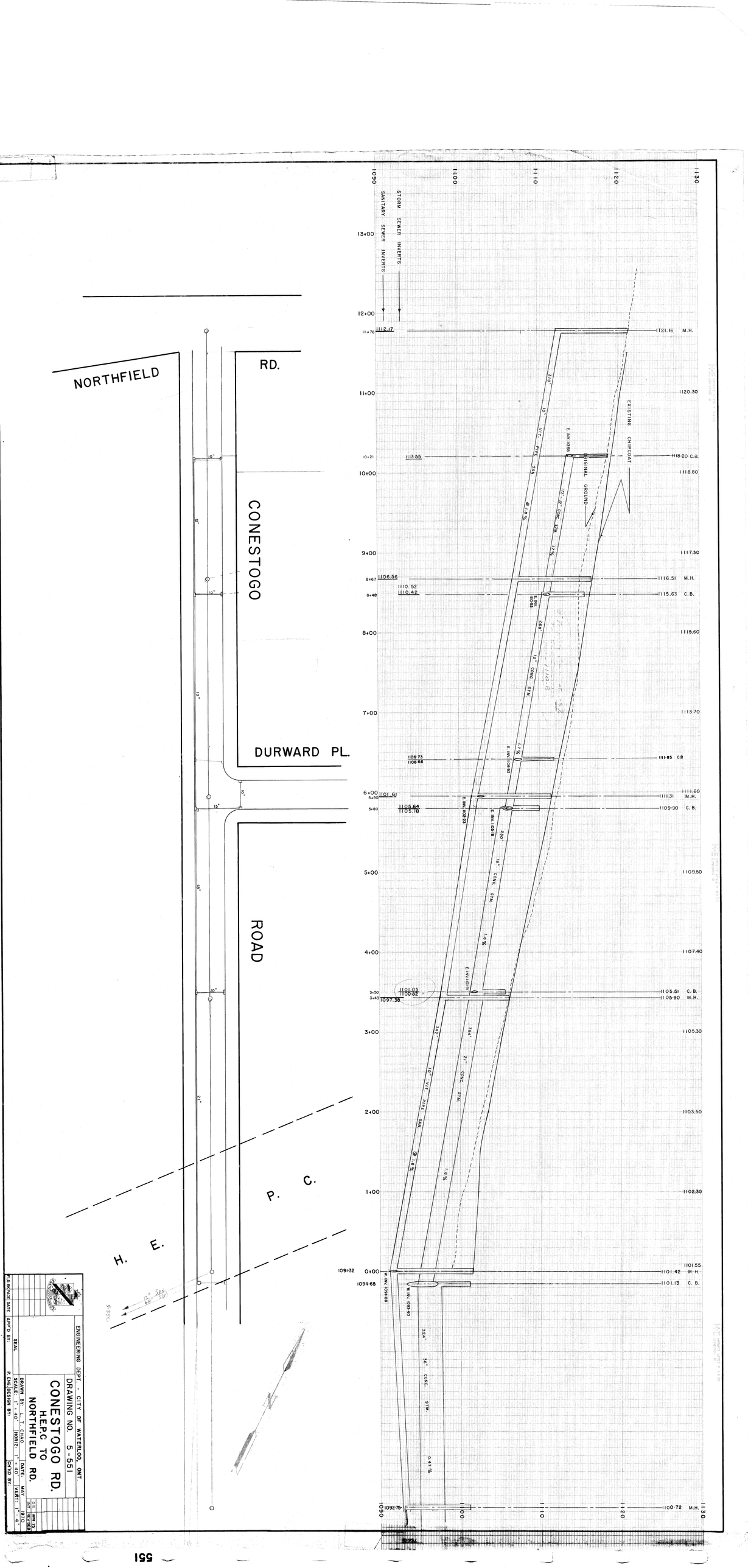
ENGINEERING DEPT. - CITY OF WATERLOO, ONT.

DRAWING NO. 5 - 550

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CONESTOGO ROAD TO CONESTOGA PARKWAY

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DRAWN BY: ILMAR JOGI				DATE: FEB. 23 1973			
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FLD. BK	PAGE	DATE	APP'D BY:	P. ENG.	DESIGN BY:	CH'KD BY:	

550



ENGINEERING DEPT. - CITY OF WATERLOO, ONT.

DRAWING NO. 5-551

CONESTOGO RD.
H.E.P.C. TO NORTHFIELD RD.

DRAWN BY: L.T. CHAO	DATE: MAY 1970	NO.	REVISION
SCALE: HORIZ. 1" = 40'			
VERT. 1" = 4'			
P. ENG. DESIGN BY:			
CHKD BY:			

SEAL

P.O. REVISION | DATE | APP'D BY:

P/L

CREEK

C/L

P/L

1100

1090

1080

1097.14

1096.51

1101.05

1101.46

EXISTING GROUND @ SAN. EASEM.

BOTTOM OF DITCH

350' - 48" @ 0.2%

M.H.

10" CONC.

303' 48" C.M.P. 0.42 %

404' 12" VIT 0.62 %

452' 12" VITRIFIED PIPE 0.61 %

1095.27
1095.87

1088.61

1093.71

1093.00

1091.13
1091.69

INV.

0+00 1+00 2+00 3+00 4+00 5+00 6+00 7+00 8+00 9+00 10+00

1100

1090

350 - @ #40 3/4 = #14,000
M.H. = 450 = 1,000
15,000
use #12 - @ 15"

H. E. P. C.

CONESTOGA PARKWAY

CONESTOGO ROAD

250' E.S. VIT.

S.S.

EXIST. DITCH

B.M.

B.M. 68-U-516 1113.70
R.R. SURVEYS @ N.E TRACKS 1108.95
PLATE HYDRO TOWER 1102.84
D.H.O. NAIL ~~631+41~~ 1100.30
D.H.O ROCK ⊡ 1094.14

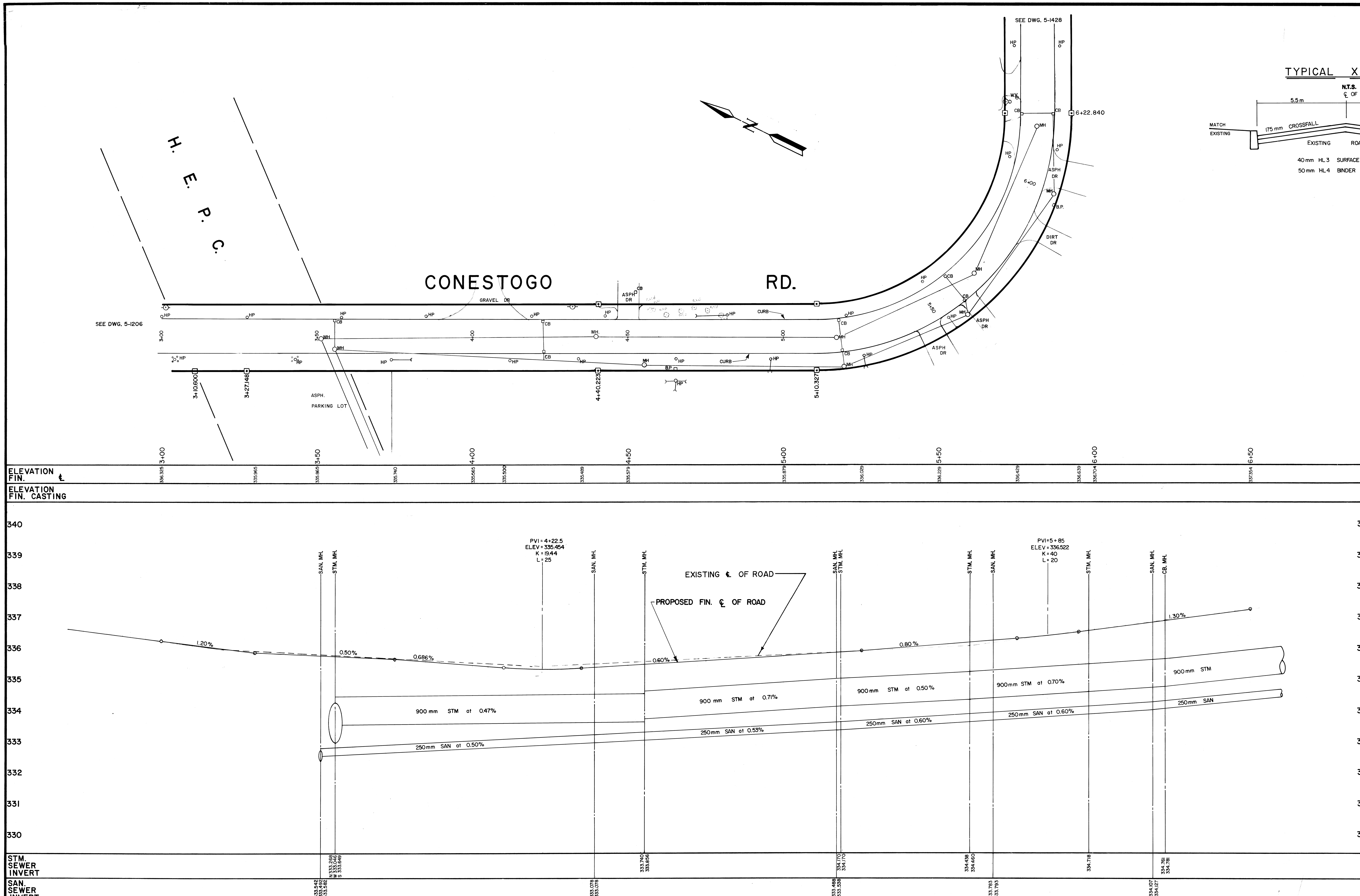
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DRAWING NO. 5 - 550

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CONESTOGO ROAD TO CONESTOGA PARKWAY

INT.

			DRAWN BY: ILMAR JOGI		DATE: FEB. 23
152	13	FEB 73	SEAL	SCALE: 1"= 40'	HORIZ: 1"= 40' VERT: 1"
FLD. BK	PAGE	DATE	APP'D BY:	P. ENG. DESIGN BY:	CH'KD BY:



INT.	DATE	REVISIONS
D.H.K.	DEC 21/88	CORRECTED TYPO & INKED GIVEN INVERTS
D.H.K.	OCT 21/88	ADDED NEW ℄ of ROAD and NEW CURB

CITY OF WATERLOO
PUBLIC WORKS DEPARTMENT

REGISTERED PROFESSIONAL ENGINEER
P. G. LEMON
88 12 23
PROVINCE OF ONTARIO

SEAL

TITLE:

CONESTOGO RD.
H.E.P.C.
TO FIRST BEND

DATE: 88 04 26		DESIGNED BY:	G.B.
SCALE:	HORIZ. 1:500 VERT. 1:50	DRAWN BY:	L.C.
FIELD BK. 297	PAGE 29	CHECKED BY:	
DATE		DRAWING Nº	5-1427

6-7 SPD.

CONESTOGO DRIVE
SEE DWG C-1025

MATCHLINE AT STA 10+300
SEE DWG C-1009

MATCHLINE AT STA 10+480
SEE DWG C-1011

COLBY ROAD
SEE DWG C-1025

NORTHFIELD DRIVE

NB TRACK

SB TRACK

120+700

SICB 116L
STA. 10+316.37
O/S 13.60 L
T/G EL=343.344
INV. 342.333NW

SICB 117L
STA. 10+364.38
O/S 14.83 L
T/G EL=342.232
INV. 340.706NW

DSICB 118L
STA. 10+444.76
O/S 15.91 L
T/G EL=341.048
INV. 338.950NW

SICB 116R
STA. 10+316.46
O/S 15.55 R
T/G EL=343.391
INV. 342.561SE

SICB 117R
STA. 10+363.70
O/S 15.78 R
T/G EL=342.244
INV. 340.317SW

SICB 117-1
STA. 10+378.86
O/S 22.58 R
T/G EL=342.006
INV. 340.818SW

SICB 117-2
STA. 10+391.95
O/S 26.44 R
T/G EL=341.964
INV. 339.352SE

DSICBMH 118 - 1500mm∅
STA. 10+452.76
O/S 17.23 R
T/G EL=341.027
INV. 338.780SE (300∅)

TIE TO EXISTING

BUTT JOINT RMW 208

CONCRETE BARRIER CURB WITH STANDARD GUTTER OPSD 600.040

TRUNCATED DOME DETECTABLE WARNING PLATES (TYP.) RMW 224

CONTRACTOR TO VERIFY SIZE & LOCATION OF SERVICE RE-CONNECT AS REQUIRED

CONTRACTOR TO VERIFY LOCATION OF GAS

REPLACE WITH CATCH BASIN APRON TYPE IF IN CONFLICT

URBAN ACCESS AS PER RMW 222 (TYP.)

GRT 006
GRT SIGN POST

HYD SET

1.80m CONC. SIDEWALK

2.10m CONC. SIDEWALK

CONCRETE BARRIER CURB OPSD 600.110

CONCRETE MEDIAN SURFACE

0.5m MIN CLEAR VERTICAL SEPARATION

CONNECT TO EX. WM

300mm WM

CURB TERMINATION
SEE PACKAGE S00A.4 FOR DETAILS (TYP.)

SLEEVE (TYP.)

MODIFED CONCRETE BARRIER CURB
SEE PACKAGE S00A.4 DWG C-5004 FOR DETAILS (TYP.)

62.8m-375mmØ STM @ 2.50%
MODIFED CONCRETE BARRIER CURB OPSD 600.110
SEE PACKAGE S00A.4 SHEET C-5004 FOR DETAILS (TYP.)

LOWER WM TO ACHIEVE 0.5m MIN CLEAR VERTICAL SEPARATION

CONNECT TO EX. WM

22.8m-375mmØ STM @ 4.60%

MH 116

MH 117

MH 115

DSICBMH 118

1.00m SOD BLVD

CONNECT EX. STM PIPE

PRECAST CONCRETE CURB OPSD 603.020

CONCRETE BARRIER CURB WITH STANDARD GUTTER OPSD 600.040

PROPOSED RETAINING WALL
APPROX 176 m LONG
HEIGHT VARIES 0.10 m - 1.20 m
SEE DRAWING C-3004

GRT 005
GRT SIGN POST

REPLACE CBMH GRATE WITH MH LID

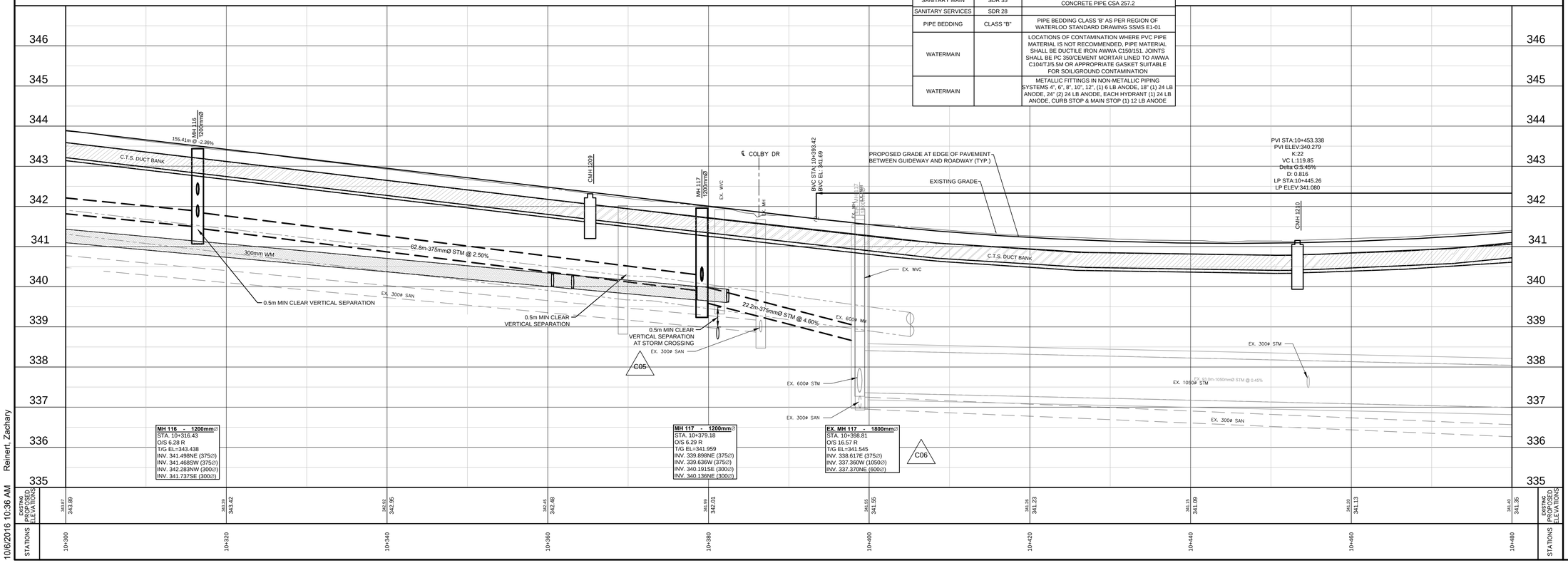
ROCK RETAINING WALL

EX. ASPHALT PARKING

TIE TO EXISTING

MUNICIPAL UTILITIES MATERIAL LIST

ITEM	TYPE/CLASS	NOTES
WATERMAIN	DR 18	
WATER SERVICES	DR 18	
STORM MAIN	SDR 35	GREATER THAN 450mm WILL BE REINFORCED CONCRETE PIPE CSA 257.2
STORM LEADS	SDR 35	
SANITARY MAIN	SDR 35	GREATER THAN 375mm WILL BE REINFORCED CONCRETE PIPE CSA 257.2
SANITARY SERVICES	SDR 28	
PIPE BEDDING	CLASS "B"	PIPE BEDDING CLASS 'B' AS PER REGION OF WATERLOO STANDARD DRAWING SSMS E1-01
WATERMAIN		LOCATIONS OF CONTAMINATION WHERE PVC PIPE MATERIAL IS NOT RECOMMENDED, PIPE MATERIAL SHALL BE DUCTILE IRON AWWA C150/151. JOINTS SHALL BE PC 350/CEMENT MORTAR LINED TO AWWA C104/TJ/5.5M OR APPROPRIATE GASKET SUITABLE FOR SOIL/GROUND CONTAMINATION
WATERMAIN		METALLIC FITTINGS IN NON-METALLIC PIPING SYSTEMS 4", 6", 8", 10", 12", (1) 6 LB ANODE, 18" (1) 24 LB ANODE, 24" (2) 24 LB ANODE, EACH HYDRANT (1) 24 LB ANODE, CURB STOP & MAIN STOP (1) 12 LB ANODE



PACKAGE NAME:

KING STREET & NORTHFIELD DRIVE
CIVIL & SYSTEMS

DISCLAIMER:
THIS DRAWING HAS BEEN PREPARED FOR THE USE OF GRANDLINQ AND MAY NOT BE USED, REPRODUCED OR RELIED UPON BY THIRD PARTIES, EXCEPT AS AGREED BY GRANDLINQ, AS REQUIRED BY LAW OR FOR USE BY GOVERNMENTAL REVIEWING AGENCIES. GRANDLINQ ACCEPTS NO RESPONSIBILITY, AND DENIES ANY LIABILITY WHATSOEVER, TO ANY PARTY THAT MODIFIES THIS DRAWING WITHOUT GRANDLINQ'S EXPRESS WRITTEN CONSENT.

DO NOT SCALE THIS DOCUMENT. ALL MEASUREMENTS MUST BE OBTAINED FROM STATED DIMENSIONS.

LEGEND:

- ℄ PROPOSED TRACK
- ℄ PROPOSED ROAD
- PROPOSED CURB
- PROPOSED DROPPED CURB
- PROPOSED RETAINING WALL
- PROPOSED GRADING LIMIT
- EXISTING R.O.W.
- PROPOSED R.O.W.
- UTILITY EXCLUSION ZONE
- FLOODLINE
- WETLAND LIMITS
- CONTAMINATION LIMITS
- OVERHEAD CONTACT SYSTEM

NOTES
1. MANHOLE LIDS AND LADDERS TO BE ORIENTATED AS SHOWN ON THE DRAWINGS.
2. CONTRACTOR TO VERIFY ALL SERVICE CONNECTIONS. DRAWINGS TO BE READ IN CONJUNCTION WITH CCTV FOR SANITARY/STORM PRE-CONSTRUCTION SURVEY.
3. SAWCUTTING OF EXISTING SIDEWALK TO BE AT JOINTS OR FULL PANELS REMOVED.
4. CONNECTIONS TO EXISTING CURBING TO BE CONFIGURED WITH COUNTERSUNK DOWELS WHERE REQUIRED. REFER TO SECTION 00A.04 PROJECT WIDE CIVIL
5. TRACK SIDE CATCH BASINS AND DOUBLE BASINS AT MOUNTABLE CURB WITH WIDE GUTTER, FRAMES TO BE OPSD 400.030.
6. CATHODIC PROTECTION SHALL BE AS PER SECTION 26 42 00 CATHODIC PROTECTION OF THE PROJECT SPECIFICATIONS AND DRAWING PACKAGE.
7. ANODES AS PER MUNICIPAL UTILITIES MATERIAL TABLE
8. CONNECTION DETAILS FOR TRACK DRAINS TO CB'S REFER TO CIVIL TRACK DRAWINGS.

REGISTERED PROFESSIONAL ENGINEER
D. J. McLEOD
OCT 6/16
PROVINCE OF ONTARIO

STAMP:

Region of Waterloo

GRANDLINQ

REV.	DESCRIPTION	BY.	DATE
C08	RELEASED FOR CONSTRUCTION	TOR	2016-10-07
C07	RELEASED FOR CONSTRUCTION	TOR	2016-05-19
C06	RELEASED FOR CONSTRUCTION	TOR	2015-12-10
C05	RELEASED FOR CONSTRUCTION	TOR	2015-11-06
C04	RELEASED FOR CONSTRUCTION	TOR	2015-09-10
C03	RELEASED FOR CONSTRUCTION	TOR	2015-07-09
C02	RELEASED FOR CONSTRUCTION	TOR	2015-05-26
C01	RELEASED FOR CONSTRUCTION	TOR	2015-05-12

REGION OF WATERLOO
STAGE I
LRT PROJECT

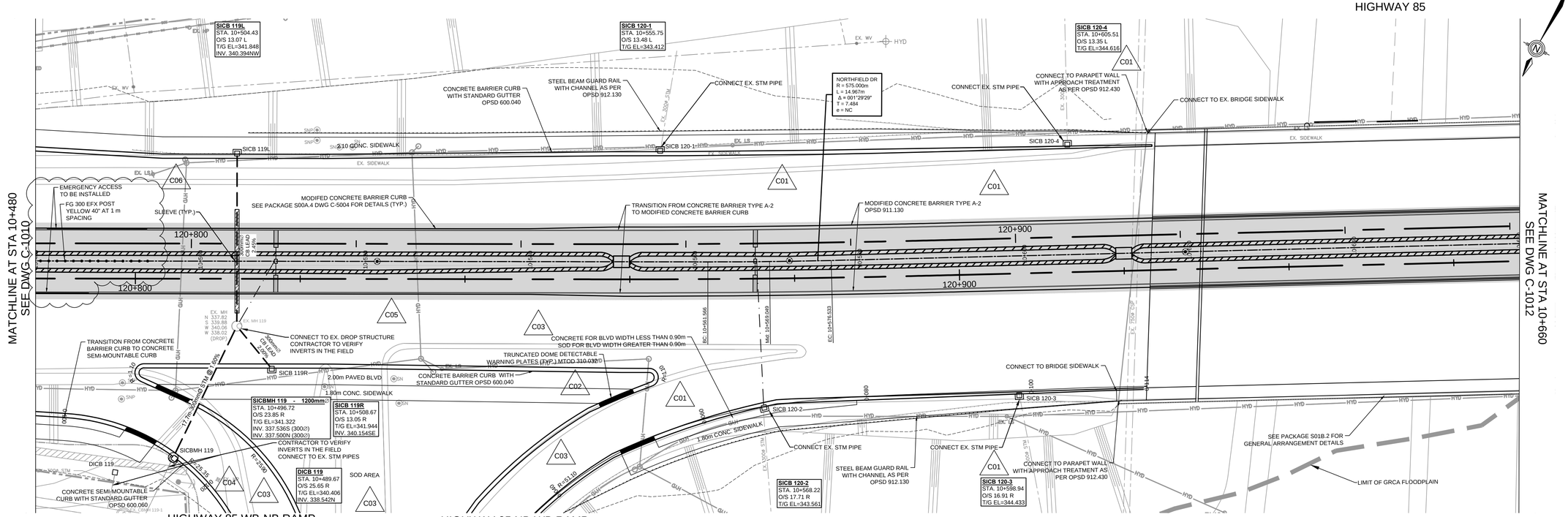
CIVIL ROADS/MUNICIPAL UTILITIES
PROPOSED NORTHFIELD DRIVE
STA 10+300 TO STA 10+480

DRAWN BY:	DESIGNED BY:	CHECKED BY:	SCALE:
CA/VY	CA/VY	DM/AS	HOR. 1:250 VERT. 1:50

PACKAGE:	DRAWING No.	SHEET:	REV.
S01B.1	C-1010	OF	C08

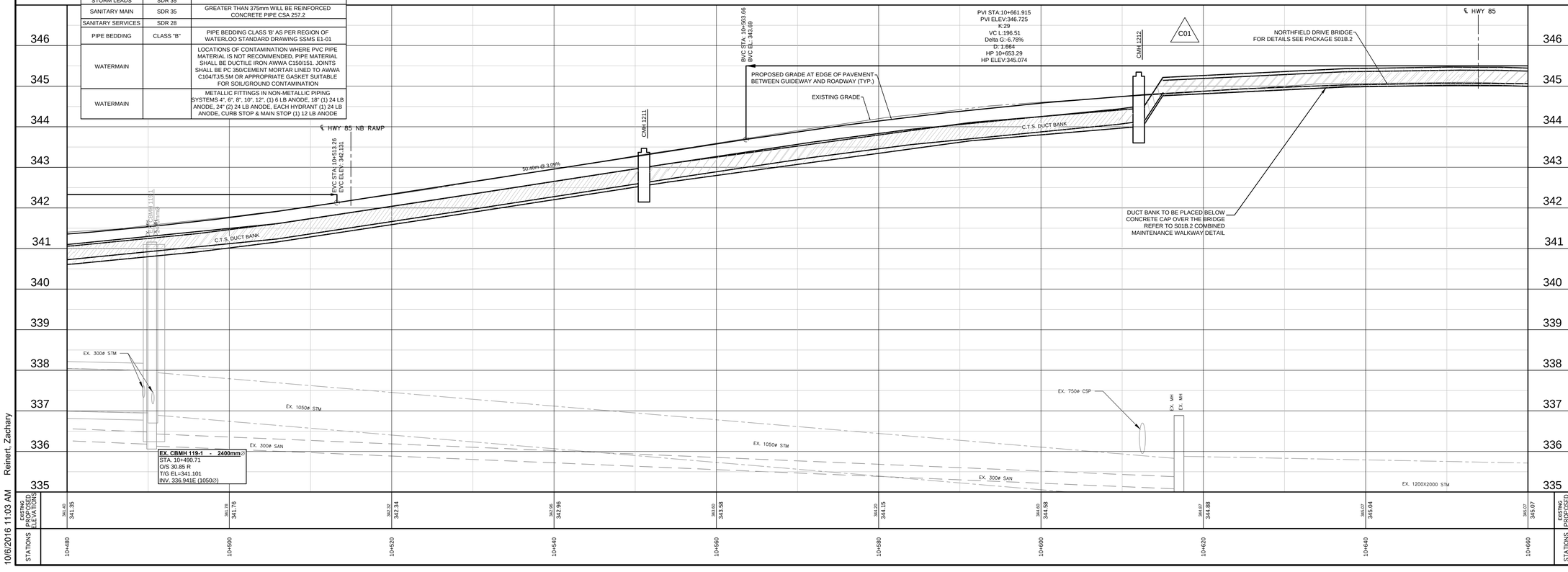
CADD FILE: S-121-C-1010.dwg

10/6/2016 10:36 AM Reinert, Zachary



MUNICIPAL UTILITIES MATERIAL LIST

ITEM	TYPE/CLASS	NOTES
WATERMAIN	DR 18	
WATER SERVICES	DR 18	
STORM MAIN	SDR 35	GREATER THAN 450mm WILL BE REINFORCED CONCRETE PIPE CSA 257.2
STORM LEADS	SDR 35	
SANITARY MAIN	SDR 35	GREATER THAN 375mm WILL BE REINFORCED CONCRETE PIPE CSA 257.2
SANITARY SERVICES	SDR 28	
PIPE BEDDING	CLASS "B"	PIPE BEDDING CLASS 'B' AS PER REGION OF WATERLOO STANDARD DRAWING SSMS E1-01
WATERMAIN		LOCATIONS OF CONTAMINATION WHERE PVC PIPE MATERIAL IS NOT RECOMMENDED, PIPE MATERIAL SHALL BE DUCTILE IRON AWWA C150/151. JOINTS SHALL BE PC 350/CEMENT MORTAR LINED TO AWWA C104/TJ/5.5M OR APPROPRIATE GASKET SUITABLE FOR SOIL/GROUND CONTAMINATION
WATERMAIN		METALLIC FITTINGS IN NON-METALLIC PIPING SYSTEMS 4", 6", 8", 10", 12", (1) 6 LB ANODE, 18" (1) 24 LB ANODE, 24" (2) 24 LB ANODE, EACH HYDRANT (1) 24 LB ANODE, CURB STOP & MAIN STOP (1) 12 LB ANODE



STATIONS	10+480	10+500	10+520	10+540	10+560	10+580	10+600	10+620	10+640	10+660	STATIONS
EXISTING	341.60	341.78	342.23	342.96	343.60	344.20	344.60	344.87	345.07	345.07	EXISTING
PROPOSED ELEVATIONS	341.35	341.76	342.34	342.96	343.58	344.15	344.58	344.88	345.04	345.07	PROPOSED ELEVATIONS

PACKAGE NAME:

KING STREET & NORTHFIELD DRIVE
CIVIL & SYSTEMS

DISCLAIMER:
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LEGEND:

- ℄ PROPOSED TRACK
- ℄ PROPOSED ROAD
- PROPOSED CURB
- PROPOSED DROPPED CURB
- PROPOSED RETAINING WALL
- PROPOSED GRADING LIMIT
- EXISTING R.O.W.
- PROPOSED R.O.W.
- UTILITY EXCLUSION ZONE
- FLOODLINE
- WETLAND LIMITS
- CONTAMINATION LIMITS
- OVERHEAD CONTACT SYSTEM

NOTES

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D. J. McLEOD
DEC 6/16
REGISTERED PROFESSIONAL ENGINEER
PROVINCE OF ONTARIO

STAMP:

Region of Waterloo

GRANDLINQ

REV	DESCRIPTION	BY	DATE
C06	RELEASED FOR CONSTRUCTION	TOR	2016-10-07
C05	RELEASED FOR CONSTRUCTION	TOR	2015-12-10
C04	RELEASED FOR CONSTRUCTION	TOR	2015-11-02
C03	RELEASED FOR CONSTRUCTION	TOR	2015-09-10
C02	RELEASED FOR CONSTRUCTION	TOR	2015-05-26
C01	RELEASED FOR CONSTRUCTION	TOR	2015-05-12
C00	RELEASED FOR CONSTRUCTION	TOR	2015-05-07

REGION OF WATERLOO
STAGE I
LRT PROJECT

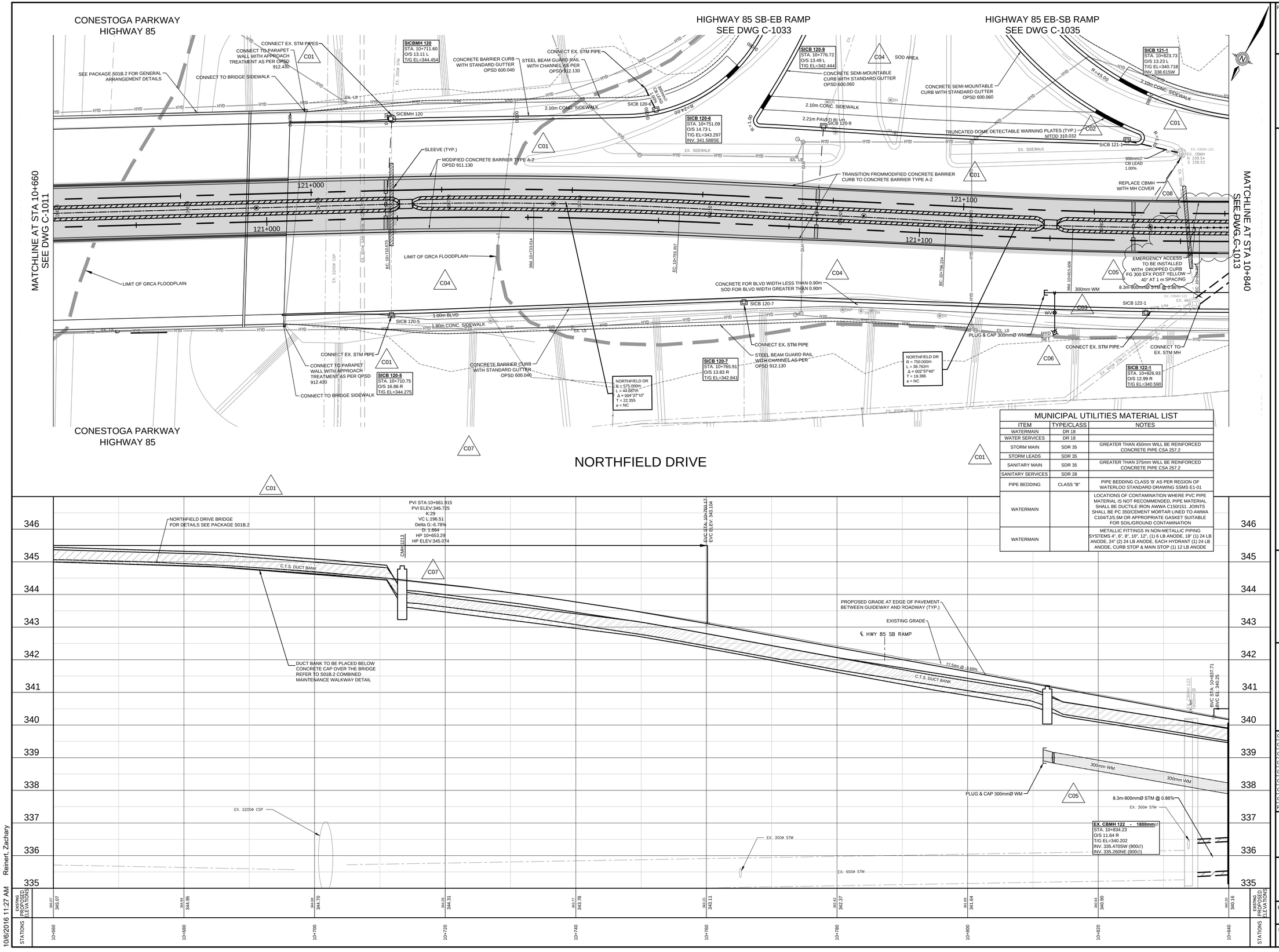
CIVIL ROADS/MUNICIPAL UTILITIES
PROPOSED NORTHFIELD DRIVE
STA 10+480 TO STA 10+660

DRAWN BY:	DESIGNED BY:	CHECKED BY:	SCALE:
CA/VY	CA/VY	DM/AS	HOR. 1:250 VERT. 1:50

PACKAGE:	DRAWING No.	SHEET:	REV.
S01B.1	C-1011	OF	C06

CADD FILE: S-121-C-1011.dwg

10/6/2016 11:03 AM Reinert, Zachary



MUNICIPAL UTILITIES MATERIAL LIST

ITEM	TYPE/CLASS	NOTES
WATERMAIN	DR 18	
WATER SERVICES	DR 18	
STORM MAIN	SDR 35	GREATER THAN 450mm WILL BE REINFORCED CONCRETE PIPE CSA 257.2
STORM LEADS	SDR 35	
SANITARY MAIN	SDR 35	GREATER THAN 375mm WILL BE REINFORCED CONCRETE PIPE CSA 257.2
SANITARY SERVICES	SDR 28	
PIPE BEDDING	CLASS "B"	PIPE BEDDING CLASS 'B' AS PER REGION OF WATERLOO STANDARD DRAWING SSMS E1-01
WATERMAIN		LOCATIONS OF CONTAMINATION WHERE PVC PIPE MATERIAL IS NOT RECOMMENDED, PIPE MATERIAL SHALL BE DUCTILE IRON AWWA C150/151. JOINTS SHALL BE PC 350/CEMENT MORTAR LINED TO AWWA C104/UI5.5M OR APPROPRIATE GASKET SUITABLE FOR SOIL/GROUND CONTAMINATION
WATERMAIN		METALLIC FITTINGS IN NON-METALLIC PIPING SYSTEMS 4", 6", 8", 10", 12", (1) 6 LB ANODE, 18" (1) 24 LB ANODE, 24" (2) 24 LB ANODE, EACH HYDRANT (1) 24 LB ANODE, CURB STOP & MAIN STOP (1) 12 LB ANODE

PACKAGE NAME:

KING STREET & NORTHFIELD DRIVE CIVIL & SYSTEMS

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LEGEND:

- ℄ PROPOSED TRACK
- ℄ PROPOSED ROAD
- PROPOSED CURB
- PROPOSED DROPPED CURB
- PROPOSED RETAINING WALL
- PROPOSED GRADING LIMIT
- EXISTING R.O.W.
- PROPOSED R.O.W.
- UTILITY EXCLUSION ZONE
- FLOODLINE
- WETLAND LIMITS
- CONTAMINATION LIMITS
- OVERHEAD CONTACT SYSTEM

NOTES
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7. ANODES AS PER MUNICIPAL UTILITIES MATERIAL TABLE
8. CONNECTION DETAILS FOR TRACK DRAINS TO CB'S REFER TO CIVIL TRACK DRAWINGS.

STAMP: D. J. McLEOD — 100161 — REGISTERED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO

Region of Waterloo

GRANDLINQ

C08	RELEASED FOR CONSTRUCTION	TOR	2016-10-07
C07	RELEASED FOR CONSTRUCTION	TOR	2016-06-06
C06	RELEASED FOR CONSTRUCTION	TOR	2015-12-10
C05	RELEASED FOR CONSTRUCTION	TOR	2015-10-30
C04	RELEASED FOR CONSTRUCTION	TOR	2015-09-10
C03	RELEASED FOR CONSTRUCTION	TOR	2015-07-09
C02	RELEASED FOR CONSTRUCTION	TOR	2015-05-26
C01	RELEASED FOR CONSTRUCTION	TOR	2015-05-12
REV	DESCRIPTION	BY	DATE

REGION OF WATERLOO
STAGE I
LRT PROJECT

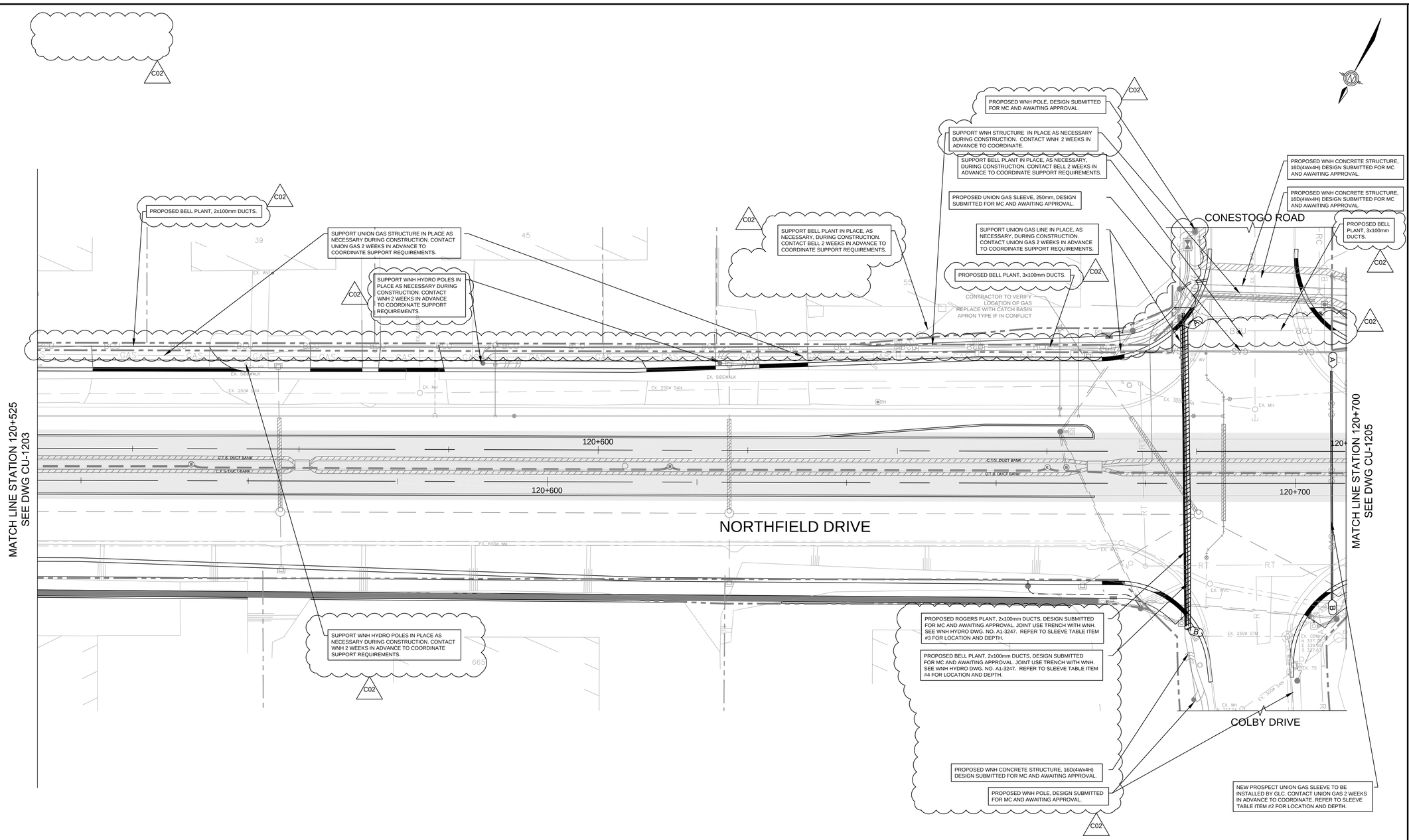
CIVIL ROADS/MUNICIPAL UTILITIES
PROPOSED NORTHFIELD DRIVE
STA 10+660 TO STA 10+840

DRAWN BY:	DESIGNED BY:	CHECKED BY:	SCALE:
CA/VY	CA/VY	DM/AS	HOR: 1:250 VERT. 1:50

PACKAGE:	DRAWING No.	SHEET:	REV.
S01B.1	C-1012	OF	C08

CADD FILE: S-121-C-1012.dwg

10/6/2016 11:27 AM Reinert, Zachary



SLEEVE TABLE

ID #	OWNER	A EASTING	A NORTHING	A ELEVATION	B EASTING	B NORTHING	B ELEVATION	LENGTH	CROSSING DETAIL REFERENCE	CONFIGURATION	MATERIAL
1	WATERLOO NORTH HYDRO	537395.59	4816444.32	339.50	537377.08	4816480.42	339.50	41m	WNH DWG. NO. A1-3247	16D (4Wx4H)	CONCRETE
2	UNION GAS	537361.67	4816468.10	339.45	537375.45	4816440.91	339.45	31m	N/A	150mm	STEEL, HEAVY WALL. SCH.40
3	ROGERS	537395.59	4816444.32	339.60	537377.08	4816480.42	339.60	41m	WNH DWG. NO. A1-3247	2x100mm	PVC - SCHED 80 OR DR25
4	BELL	537395.59	4816444.32	339.60	537377.08	4816480.42	339.60	41m	WNH DWG. NO. A1-3247	2x100mm	PVC - SCHED 80

NOTES:
1. SLEEVE ELEVATIONS ARE GIVEN FOR THE TOP OF THE STRUCTURE.

12.5 0 12.5 25m
SCALE 1:250

PACKAGE NAME:
KING STREET & NORTHFIELD DRIVE
CIVIL & SYSTEMS

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LEGEND

- PROPOSED TRACK
- PROPOSED CULVERT
- PROPOSED RETAINING WALL
- EXISTING R.O.W.
- PROPOSED R.O.W.
- REMOVALS
- ALL — ALL STREAM LINE
- AF — ATRIA FIBRE
- BCU — BELL LINE
- COW — CITY OF WATERLOO
- GAS — GAS LINE
- HYD — HYDRO LINE
- RC — ROGERS CABLE
- RF — ROGERS FIBRE
- RIM — RES. IN MOTION
- RT — TRAFFIC SIGNAL
- TEL — TELUS LINE
- UOW — U OF WATERLOO
- PROPOSED BASE MOUNTED OCTAGONAL STEEL TRAFFIC SIGNAL POLE
- PROPOSED BASE MOUNTED SECTIONAL STEEL TRAFFIC SIGNAL POLE
- PROPOSED DIRECT BURIED WOOD POLE
- EXISTING/RELOCATED DIRECT BURIED WOOD POLE
- PROPOSED DIRECT BURIED CONCRETE POLE
- EXISTING/RELOCATED DIRECT BURIED CONCRETE POLE
- PROPOSED OCS (OVERHEAD CONTACT SYSTEM) POLE
- STREET LIGHT HYDRO POLE
- HP PROPOSED HYDRO POLE

C01

LICENSED PROFESSIONAL ENGINEER J. J. HARROTT 18804504 Mar 31/16 PROVINCE OF ONTARIO

STAMP:

Region of Waterloo

GRANDLINQ

REV.	DESCRIPTION	BY	DATE
C02	RELEASED FOR CONSTRUCTION	TOR	2016-03-25
C01	RELEASED FOR CONSTRUCTION	TOR	2015-07-09
C00	RELEASED FOR CONSTRUCTION	TOR	2015-05-12

REGION OF WATERLOO
STAGE I
LRT PROJECT

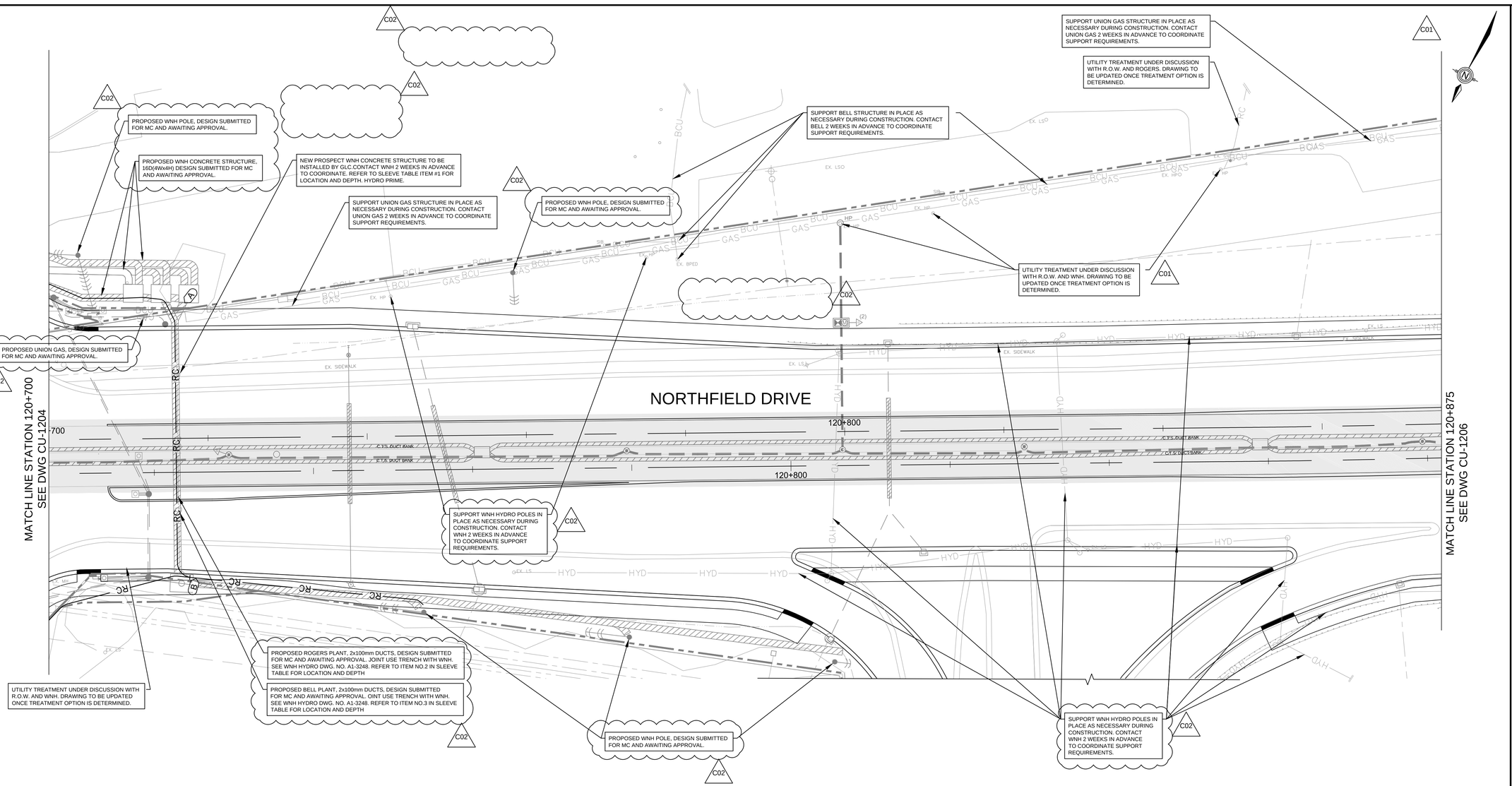
CIVIL UTILITIES
PRIVATE UTILITY RELOCATION PLAN
STA 120+525 TO STA 120+700

DRAWN BY:	DESIGNED BY:	CHECKED BY:	SCALE:
BH	BH	SH	1:250

PACKAGE:	DRAWING No.	SHEET:	REV.
S01B.1	CU-1204	OF	C02

CADD FILE: S-121-CU-1204.dwg

3/31/2016 2:48 PM Chatten, Julie



SLEEVE TABLE

		A			B						
ID #	OWNER	EASTING	NORTHING	ELEVATION	EASTING	NORTHING	ELEVATION	LENGTH	CROSSING DETAIL REFERENCE	CONFIGURATION	MATERIAL
1	WATERLOO NORTH HYDRO	537387.53	4816480.44	339.50	537403.40	4816452.08	339.50	33.0m	WNH HYDRO DWG. NO. A1-3248	16D (4Wx4H)	CONCRETE
2	ROGERS										
3	BELL										

NOTES:
1. SLEEVE ELEVATIONS ARE GIVEN FOR THE TOP OF THE STRUCTURE.

12.5 0 12.5 25m
SCALE 1:250

PACKAGE NAME:

KING STREET & NORTHFIELD DRIVE CIVIL & SYSTEMS

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LEGEND

- PROPOSED TRACK
- PROPOSED CULVERT
- PROPOSED RETAINING WALL
- EXISTING R.O.W.
- PROPOSED R.O.W.
- REMOVALS
- ALL STREAM LINE
- ATRIA FIBRE
- BELL LINE
- CITY OF WATERLOO
- GAS LINE
- HYDRO LINE
- ROGERS CABLE
- ROGERS FIBRE
- RES. IN MOTION
- TRAFFIC SIGNAL
- TELUS LINE
- U OF WATERLOO
- PROPOSED BASE MOUNTED OCTAGONAL STEEL TRAFFIC SIGNAL POLE
- PROPOSED BASE MOUNTED SECTIONAL STEEL TRAFFIC SIGNAL POLE
- PROPOSED DIRECT BURIED WOOD POLE
- EXISTING/RELOCATED DIRECT BURIED WOOD POLE
- PROPOSED DIRECT BURIED CONCRETE POLE
- EXISTING/RELOCATED DIRECT BURIED CONCRETE POLE
- PROPOSED OCS (OVERHEAD CONTACT SYSTEM) POLE
- STREET LIGHT HYDRO POLE
- PROPOSED HYDRO POLE

DRAWINGS LIMITS ADJUSTED

STAMP: LICENSED PROFESSIONAL ENGINEER J. J. HARROTT 18604504 MAR 23, 16 PROVINCE OF ONTARIO

Region of Waterloo

GRANDLINQ

REV	DESCRIPTION	BY	DATE
C02	RELEASED FOR CONSTRUCTION	TOR	2016-03-25
C01	RELEASED FOR CONSTRUCTION	TOR	2015-07-09
C00	RELEASED FOR CONSTRUCTION	TOR	2015-05-12

REGION OF WATERLOO
STAGE I
LRT PROJECT

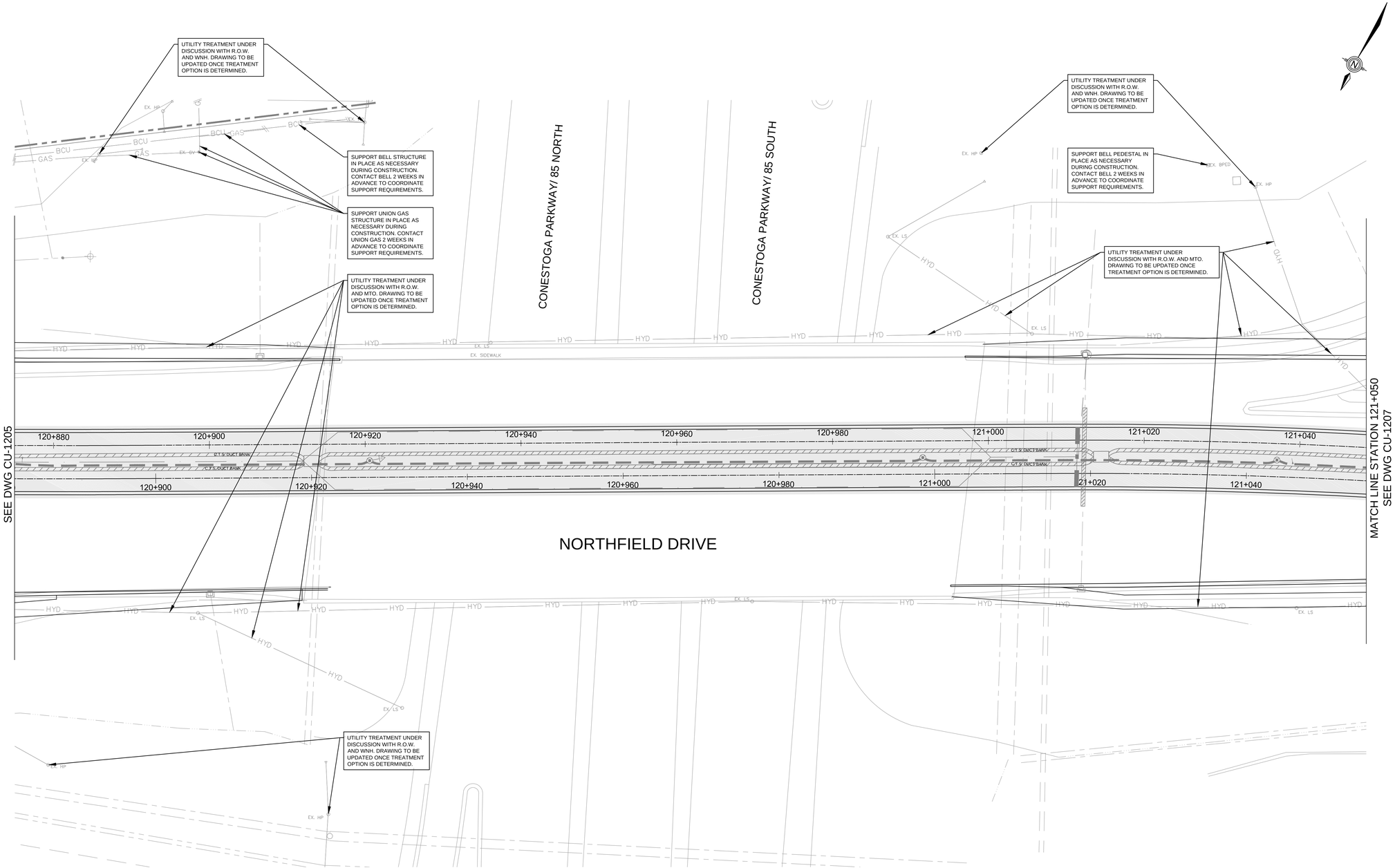
CIVIL UTILITIES
PRIVATE UTILITY RELOCATION PLAN
STA 120+700 TO STA 120+875

DRAWN BY:	DESIGNED BY:	CHECKED BY:	SCALE:
BH	BH	SH	1:250

PACKAGE:	DRAWING No.	SHEET:	REV.
S01B.1	CU-1205	OF	C02

CADD FILE: S-121-CU-1205.dwg

4/1/2016 1:59 PM Chatten, Julie



12.5 0 12.5 25m

SCALE 1:250

PACKAGE NAME:

KING STREET & NORTHFIELD DRIVE
CIVIL & SYSTEMS

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- PROPOSED CULVERT
- PROPOSED RETAINING WALL
- EXISTING R.O.W.
- PROPOSED R.O.W.
- REMOVALS
- ALL STREAM LINE
- ATRIA FIBRE
- BELL LINE
- CITY OF WATERLOO
- GAS LINE
- HYDRO LINE
- ROGERS CABLE
- ROGERS FIBRE
- RES. IN MOTION
- TRAFFIC SIGNAL
- TELUS LINE
- U OF WATERLOO
- PROPOSED BASE MOUNTED OCTAGONAL STEEL TRAFFIC SIGNAL POLE
- PROPOSED BASE MOUNTED SECTIONAL STEEL TRAFFIC SIGNAL POLE
- PROPOSED DIRECT BURIED WOOD POLE
- EXISTING/RELOCATED DIRECT BURIED WOOD POLE
- PROPOSED DIRECT BURIED CONCRETE POLE
- EXISTING/RELOCATED DIRECT BURIED CONCRETE POLE
- PROPOSED OCS (OVERHEAD CONTACT SYSTEM) POLE
- STREET LIGHT HYDRO POLE
- PROPOSED HYDRO POLE

C01

DRAWINGS LIMITS ADJUSTED

LICENSED PROFESSIONAL ENGINEER
J. J. HARROTT
100504
PROVINCE OF ONTARIO
July 9/15

STAMP:

Region of Waterloo

GRANDLINQ

REV.	DESCRIPTION	BY	DATE
C01	RELEASED FOR CONSTRUCTION	TOR	2015-07-09
C00	RELEASED FOR CONSTRUCTION	TOR	2015-05-12

REGION OF WATERLOO
STAGE I
LRT PROJECT

CIVIL UTILITIES
PRIVATE UTILITY RELOCATION PLAN
STA 120+875 TO STA 121+050

DRAWN BY:	DESIGNED BY:	CHECKED BY:	SCALE:
BH	BH	SH	1:250

PACKAGE:	DRAWING No.	SHEET:	REV.
S01B.1	CU-1206	OF	C01

CADD FILE: S-121-CU-1206.dwg

7/9/2015 9:41 AM Harper, Brett

Region of Waterloo

Call Date: 01/24/2020 Due Date: 01/31/2020

UNDERGROUND TRAFFIC SIGNAL LOCATE

Phone: 519-650-8201 Fax: 519-650-8209

Ticket No.: 2020048760 Page ____ of ____

City/Township: Waterloo

Meet Location and Date

Meet Date & Time: N/A

Location: Northfield Dr W & Conestogo Rd

Nature of Work: Design and Planning

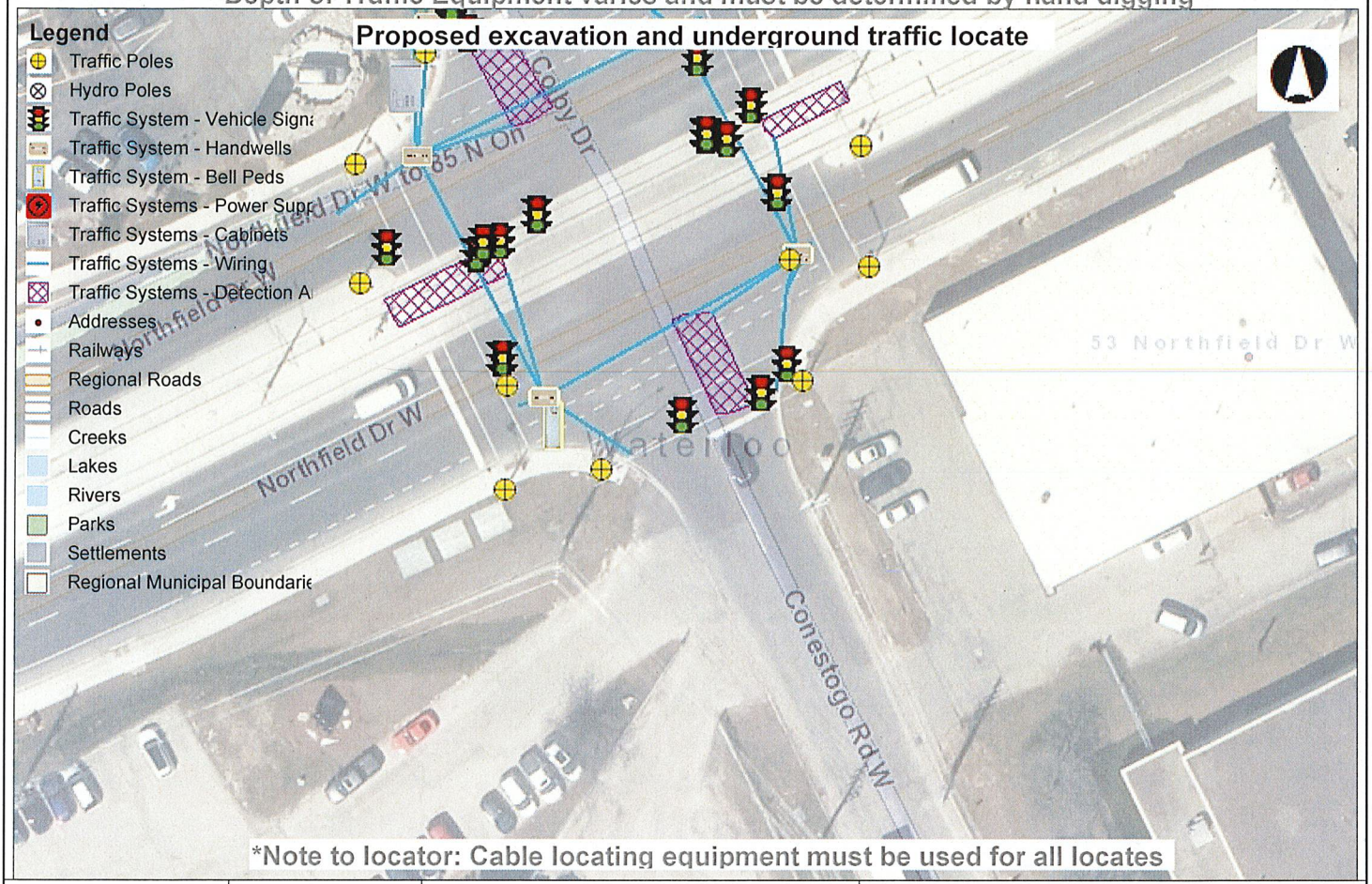
Fax/Email: zschnurr@walterfedy.com

Phone: (519) 576-2150

Requested By: WalterFedy

CAUTION: Hand dig within 1m of marking

Depth of Traffic Equipment varies and must be determined by hand digging



*Note to locator: Cable locating equipment must be used for all locates

Traffic Installation

Cable: ☐

Power Supply: ☐

Loops: ☐

System Loops: ☐

Puck Detection: ☐

Contact 519-650-8201 prior to PAVEMENT REMOVAL to allow removal of puck detection system.

Marking Method

Paint: ☐

Other: ☐

Locate Given

Date: Jan 24/20 Time: ____

Located By: ____

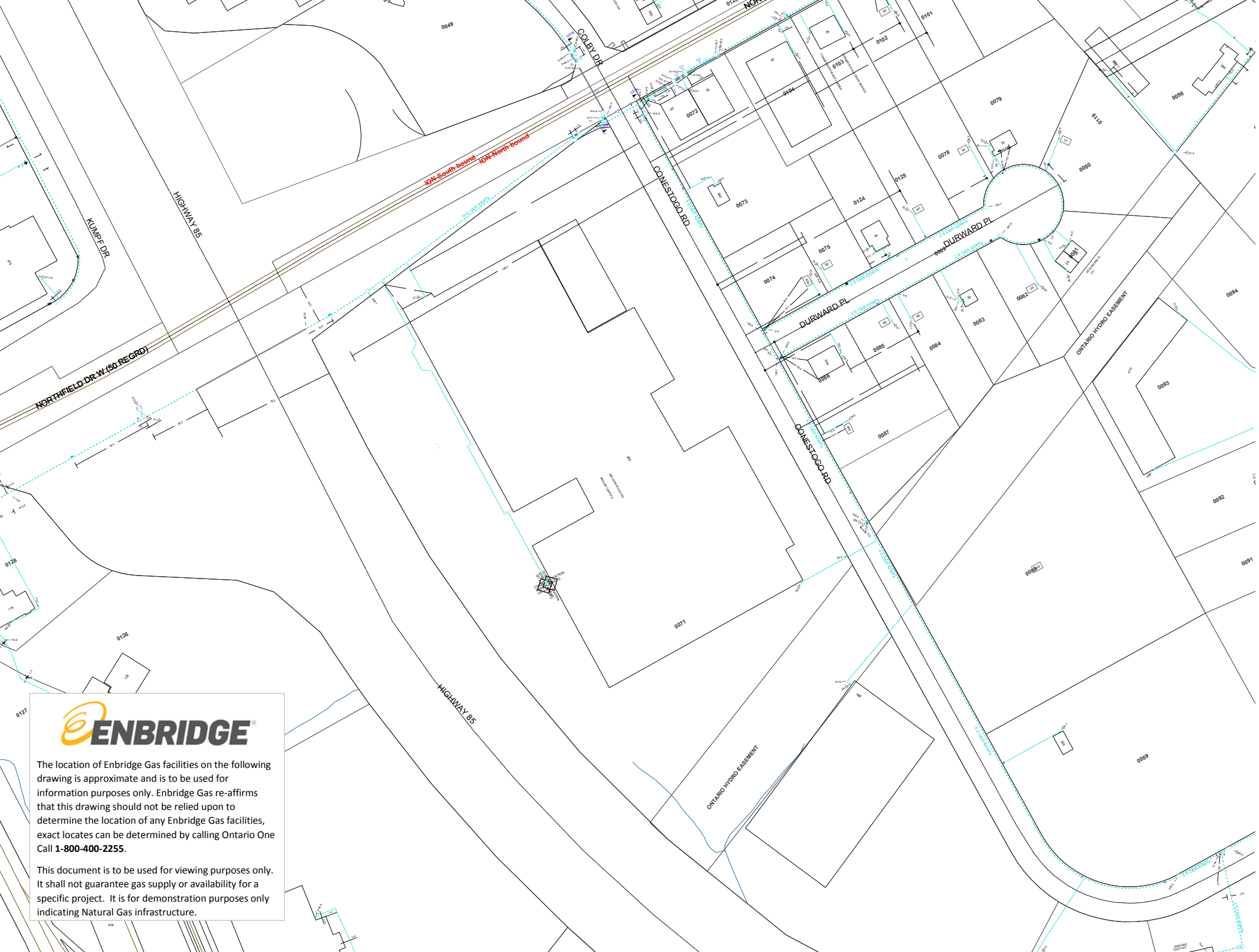
Accepted By: ____

Notes

Locate is valid for 60 days

Request for traffic locate should be at least five working days prior to digging.

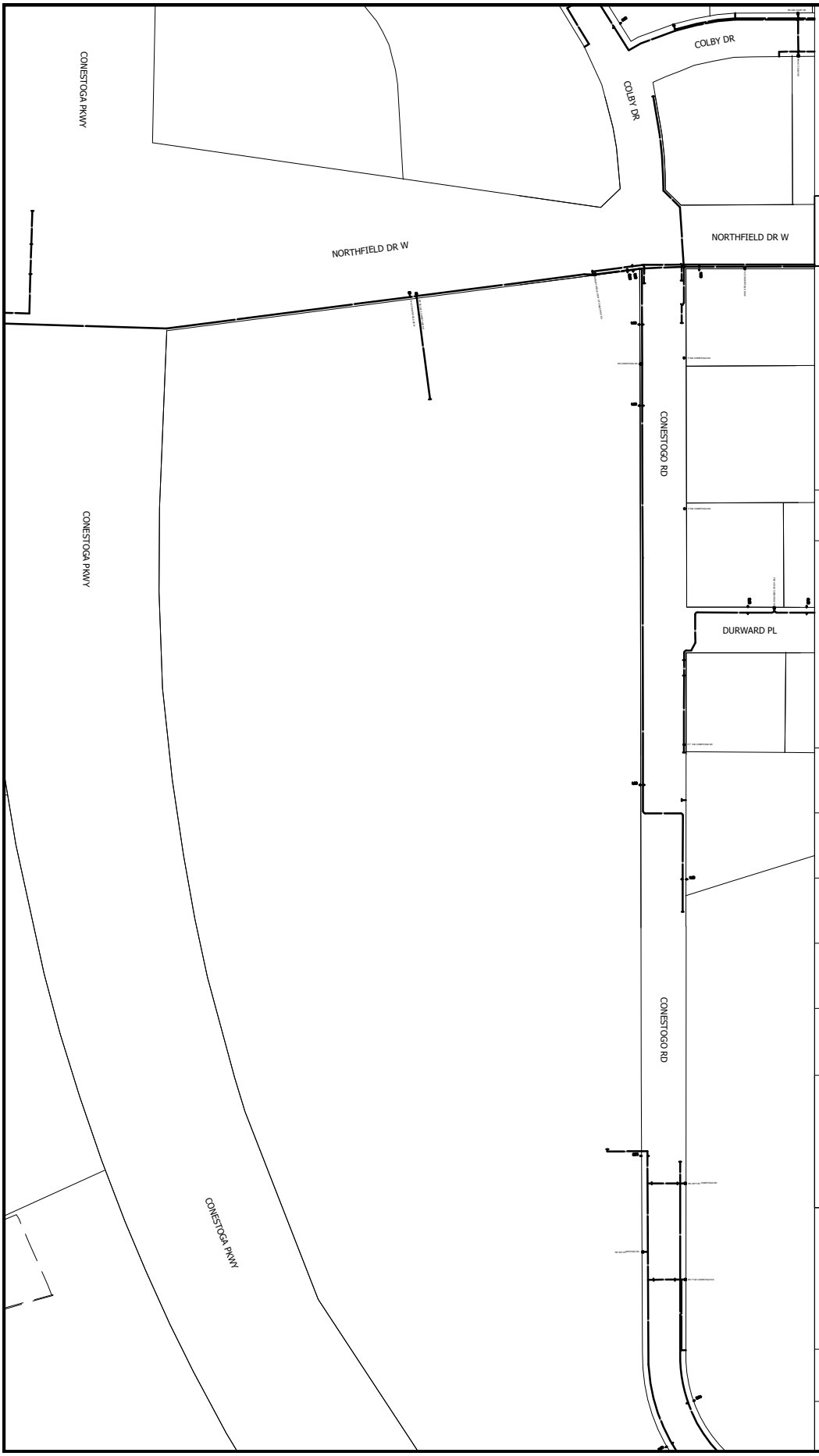
Thank you for calling before you dig.



ENBRIDGE

The location of Enbridge Gas facilities on the following drawing is approximate and is to be used for information purposes only. Enbridge Gas re-affirms that this drawing should not be relied upon to determine the location of any Enbridge Gas facilities, exact locates can be determined by calling Ontario One Call **1-800-400-2255**.

This document is to be used for viewing purposes only. It shall not guarantee gas supply or availability for a specific project. It is for demonstration purposes only indicating Natural Gas infrastructure.



PLEASE NOTE:

THIS DRAWING IS FOR MARKUP ONLY - NOT FOR PERMIT TO PROCEED CONSTRUCTION. BELL CANADA PLANT LOCATION IS APPROXIMATE.

BELL CANADA

Municipal Operations Department
Floor 5 Blue, 100 Borough Drive
Scarborough, Ontario, M1P 4W2
Ph. 416-296-6929

This plan or drawing is the property of Bell Canada and the copyright of which is owned by Bell Canada. This plan or drawing may not be copied or used by others without the written consent of Bell Canada, which may be withheld at Bell Canada's discretion.

Bell Canada Legend Info

C	Existing Conduit
B	Existing Buried Cable
HH	Existing Handhole / GLB
BP	Existing Bell Pole
	Existing Pedestal

CALL FOR LOCATES
1-800-400-2255

HAND DIG
if within 1m of Bell plant

HAND DIG
when crossing Bell plant

Maintain clearance of 0.6m

If further details required
You must acquire Locates or Test Pits

telecon design MEMBER OF TELECON GROUP
7777 WESTON RD
VAUGHAN, ONT, CANADA L4L 0G9
TEL: (905) 569-2882

Dwg # - 1

Mark Up # - 83003

CAD Tech - Alexandra Dabu



ROGERS

telecon
design · build · connect

7777 WESTON RD
VAUGHAN, ONT, CANADA, L4L0G9
TEL: 905-569-2882

- Existing Buried Fibre cable
- Existing Aerial Fibre cable
- Existing Rogers Ground Level Box
- Existing Rogers Bldg Attachement
- Existing Joint Use Pole
- Existing Hydro Pole

CAUTION

HAND DIG WHEN CROSSING ROGERS
HAND DIG IF WITHIN 1M OF ROGERS PLANT

CALL FOR LOCATES

1-800-400-2255

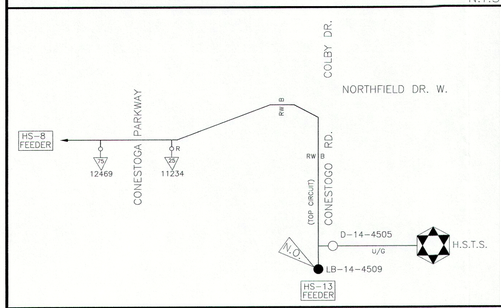
NOTE:

PLANT IS TO APPROXIMATION
PLAN NOT TO SCALE

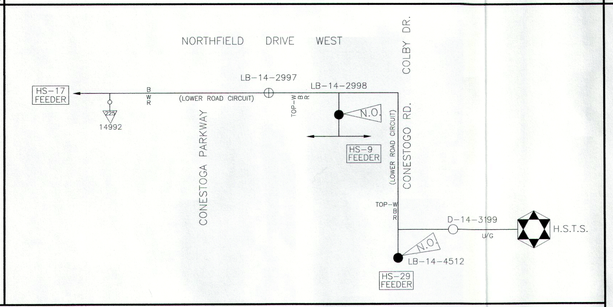
Rogers File # - G200526

CAD Tech - Simi Sunny

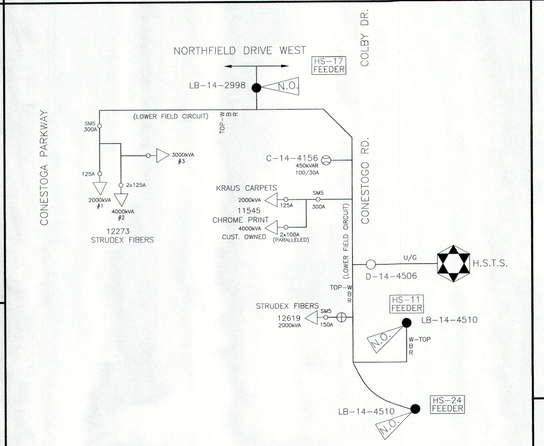
13.8kV PRIMARY SCHEMATIC (HS-8 FEEDER) N.T.S



13.8kV PRIMARY SCHEMATIC (HS-17 FEEDER) N.T.S

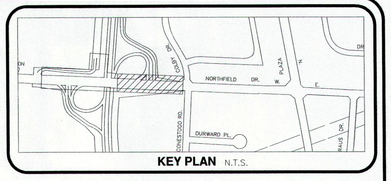


13.8kV PRIMARY SCHEMATIC (HS-9 FEEDER) N.T.S



LEGEND

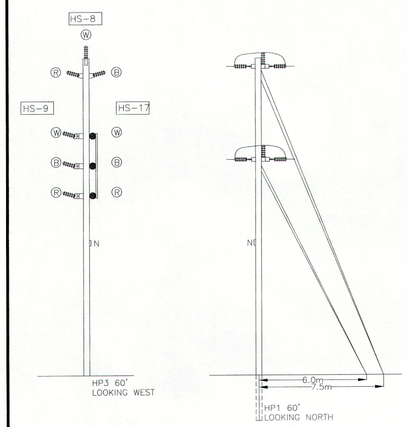
- 3ø 13.8/8.0kV PRIMARY (NEW)
- 3ø 13.8/8.0kV PRIMARY (EXISTING)
- 3ø SECONDARY (NEW)
- 3ø SECONDARY (EXISTING)
- STREET LIGHT CONTROL (EXISTING)
- 120V STREET LIGHT FEED (NEW)
- STREET LIGHT BREAKER (NEW)
- 100W HPS STREET LIGHT W/PHOTOCELL (NEW)
- 150W HPS STREET LIGHT (EXISTING)
- 150W HPS STREET LIGHT (NEW)
- (8') ARM LENGTH
- TRANSFORMER (NEW)
- TRANSFORMER (EXISTING)
- TRANSFORMER (REMOVE)
- 12345 / 50 / 222 TRANSFORMER LOC. NO. / TRANSFORMER KVA SIZE / ADDRESS NUMBER
- HYDRO POLE (NEW)
- HYDRO POLE (EXISTING)
- HYDRO POLE (REMOVE)
- HP HYDRO POLE
- CP CUSTOMER POLE
- GUY AND ANCHOR (NEW)
- GUY AND ANCHOR (EXISTING)
- GUY AND ANCHOR (REMOVE)
- DOUBLE GUY AND ANCHOR (NEW)
- DOUBLE GUY AND ANCHOR (EXISTING)
- DOUBLE GUY AND ANCHOR (REMOVE)
- TRIPLE GUY AND ANCHOR (NEW)
- SPAN GUY (NEW)
- DOUBLE SPAN GUY (NEW)



KEY PLAN N.T.S.

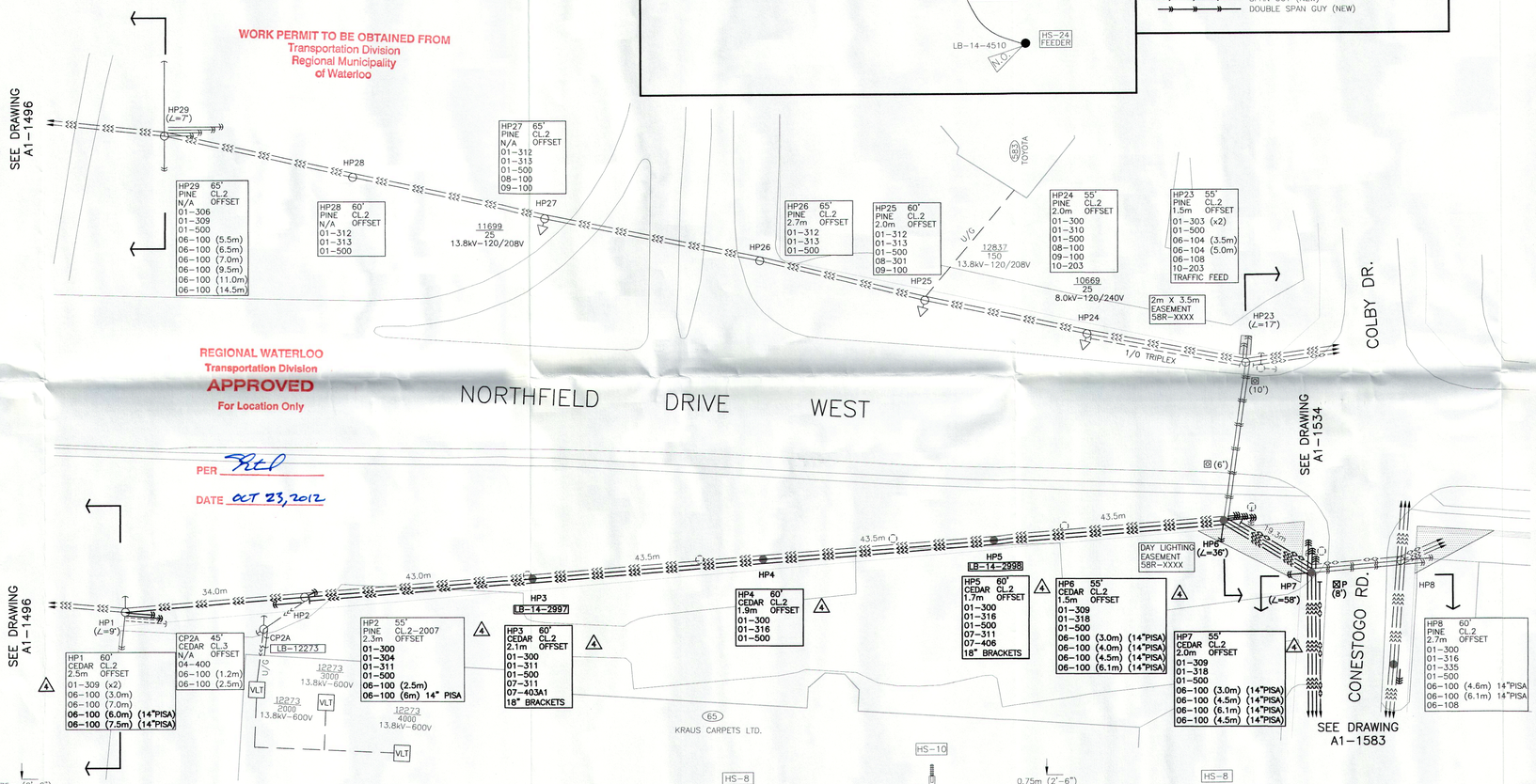
ROADWAY LIGHTING DESIGN

THE PHOTOMETRIC DESIGN OF THE ROADWAY LIGHTING PLANT IS PLACED BY WATERLOO NORTH HYDRO INC. ONLY AT THE DIRECTION AND APPROVAL OF THE OWNER AND MAY NOT BE DESIGNED IN ACCORDANCE WITH ANY ROADWAY LIGHTING STANDARDS



WORK PERMIT TO BE OBTAINED FROM
Transportation Division
Regional Municipality
of Waterloo

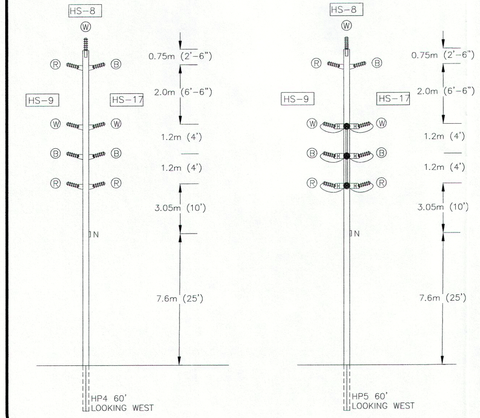
SEE DRAWING A1-1496

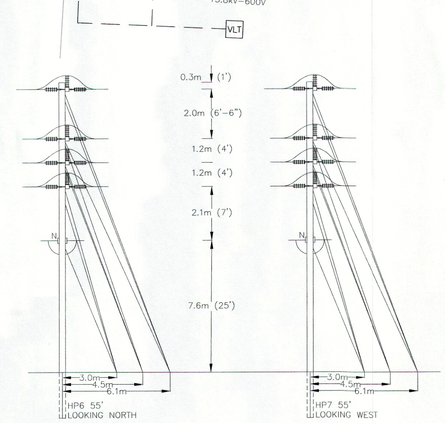


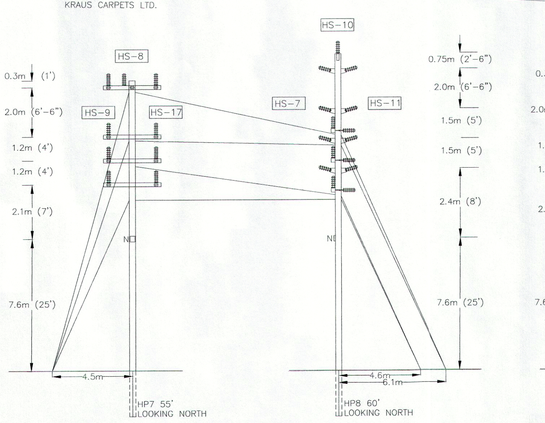
REGIONAL WATERLOO
Transportation Division
APPROVED
For Location Only

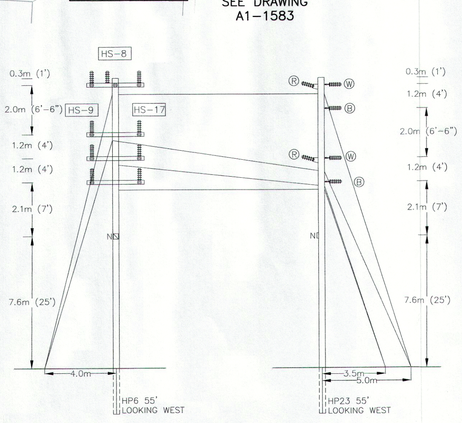
PER Rtd

DATE OCT 23, 2012









PROJECT NOTES

1. OBTAIN APPROVAL FROM THE ENGINEERING DEPARTMENT BEFORE MAKING ANY CHANGES TO THIS DESIGN.
2. ALL POLE OFFSETS ARE FROM NEW OR EXISTING PROPERTY LINE UNLESS OTHERWISE NOTED.
3. ALL POLES TO BE SET IN ACCORDANCE WITH USF STANDARD 05-100, 05-101 AND TABLE 05-04.
4. SPECIFIED ANCHOR LEAD LENGTHS ARE +/- 10% MEASURED FROM CENTRE OF POLE AND ANCHOR AT GRADE. STANDARD 10" PISA ANCHORS TO BE INSTALLED TO A MINIMUM TORQUE OF 2,750 FT-LBS. WHERE 14" PISA ANCHORS ARE SPECIFIED, THESE SHALL BE INSTALLED TO A MINIMUM TORQUE OF 4,000 FT-LBS.
5. GUYS TO BE 3/8" GRADE 180 INSTALLED AS PER USF STANDARDS 06-105 AND 06-106.
6. POLE LINE TO BE BUILT USING USF 15kV STANDARDS ON NORTHFIELD DRIVE WEST. LINE TO BE INSULATED FOR 13.8kV OPERATING VOLTAGE AND ENERGIZED AT 13.8kV OPERATING VOLTAGE.
7. CHARGE ALL LABOUR, LABOUR SAVING DEVICES AND MATERIAL TO:
   - # 5388-1 DISTRIBUTION
   - # 5388-2 TRANSFORMATION
8. TENSION STRING 6-556 ASC PRIMARY CONDUCTORS FROM HP2-HP6 INCLUSIVE USING 43.5m RULING SPAN (USF TABLE 03-14). STRING 9-556 ACS PRIMARY CONDUCTORS FROM HP6 TO HP7. RELOCATE EXISTING TOP CIRCUIT HS-8 FEEDER TO NEW POLES FROM HP3-HP6 INCLUSIVE.
9. TENSION STRING 1-556 ASC NEUTRAL CONDUCTOR FROM HP1-HP7 INCLUSIVE (USF TABLE 03-14).
10. REGIONAL WORK PERMIT REQUIRED TO WORK ON NORTHFIELD DRIVE WEST (REG # 22) BEFORE START OF CONSTRUCTION.
11. CITY OF WATERLOO WORK PERMIT REQUIRED TO WORK ON CONESTOGO ROAD BEFORE START OF CONSTRUCTION.

No.	REVISION	DATE	INITIALS
4	DRAWING CONVERTED TO AUTOCAD AND UPDATED. POLE LINE REBUILD ON SOUTH SIDE WITH LOAD BREAK TIES AS PER WR# 5388.	12.10.09	DMW JR
3	DRAWING CHANGED AS PER W.O. #129990.	93.06.07	JWS WM
2	DRAWING UPDATED. NEW 13.8kV CIRCUIT ADDED (UNIVERSITY OF WATERLOO FEEDER).	93.06.07	JWS WM
1	CHANGES AS PER FIELD INSTALLATION.	91.11.10	RPG WM

REFERENCE DRAWINGS
- A1-1496 NORTHFIELD DR. W. AND EXPRESSWAY INTERCHANGE, WATERLOO
- A1-1534 NORTHFIELD DR. W., CONESTOGO RD./COLBY DR. TO KING ST., WATERLOO
- A1-1583 CONESTOGO RD., NORTHFIELD DR. TO DOTZERT CT., WATERLOO
- ENG DRAWING FILE: OHENGDWT, REV. 15.02.07

WATERLOO NORTH HYDRO INC.

CERTIFICATE OF APPROVAL

THE INSTALLATION WORK COVERED BY THIS DOCUMENT MEETS THE SAFETY REQUIREMENTS OF SECTION 4 OF REGULATION 22/04.

NORTHFIELD DRIVE WEST

CONESTOGO RD TO CONESTOGA PARKWAY

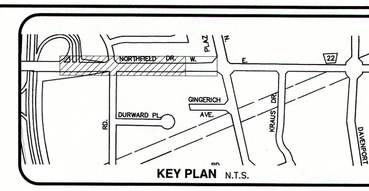
WATERLOO

SCALE: 1 : 500

DRAWING NO. A1-1497

DESIGNED	ROBERT PAUL GUDZAK	91.08.06
DRAWN	ROBERT PAUL GUDZAK	91.08.06
CHECKED	WJM, GGH, RDB	95.02.22
FILE #	WA-014-OH-N5	

MUNICIPAL CONSENT



ROADWAY LIGHTING DESIGN

THE PHOTOMETRIC DESIGN OF THE ROADWAY LIGHTING PLANT IS PLACED BY WATERLOO NORTH HYDRO INC. ONLY AT THE DIRECTION AND APPROVAL OF THE OWNER AND MAY NOT BE DESIGNED IN ACCORDANCE WITH ANY ROADWAY LIGHTING STANDARDS

WORK PERMIT TO BE OBTAINED FROM
Transportation Division
Regional Municipality
of Waterloo

REGIONAL WATERLOO
Transportation Division
APPROVED
For Location Only

PER _____
DATE Nov 28/15

SEE DRAWING A1-1535

NORTHFIELD DRIVE WEST

HP27 65' PINE CL.2 N/A OFFSET 01-111 (x2) 01-300 01-310 01-500 06-100 (3.0m) 08-100 09-100 10-203

HP26 65' CEDAR CL.1 2.1m OFFSET 01-300 01-311 (18"BRKTS) 01-500 06-100 (2.0m) 08-303 09-100 10-203

HP25 65' CEDAR CL.2 1.4m OFFSET 01-300 01-305 01-345B (18"BRKTS) 01-500 06-100 (4.0m) 06-100 (5.5m) 09-100 10-203

HP24 60' CEDAR CL.3 0.8m OFFSET 01-305 01-345B (18"BRKTS) 01-500 06-100 (4.0m) 06-100 (5.5m) 09-100 10-203

HP12 50' PINE CL.3 3.2m OFFSET 01-309 01-500 06-100 (3.1m) 06-100 (3.3m) 06-100 (5.8m) 08-301 09-100 10-301

HP11 55' PINE CL.3 4.0m OFFSET 01-301 01-306 01-329 01-500 06-100 (2.0m) 06-100 (4.0m) 06-100 (4.0m)

HP10 55' CEDAR CL.2 3.9m OFFSET 01-303 01-306 01-500 06-100 (2.5m)x2 06-100 (3.5m)x2 06-100 (4.5m) 09-100

HP9 55' CEDAR CL.3 1.8m OFFSET 01-306 01-343A1 01-500 06-100 (6.5m) 09-100

HP8 65' CEDAR CL.1 3.0m OFFSET 01-306 01-321 01-343A4 01-500 06-100 (5.0m) 06-100 (6.5m) 06-100 (8.0m) 09-100

HP6 65' CEDAR CL.1 N/A OFFSET 01-302A 01-320 01-500 06-100 (3.0m)x2 06-100 (4.5m)x2 06-100 (6.0m)x2

HP5 60' CEDAR CL.1 1.7m OFFSET 01-301 01-316A 01-500 06-100 (4.0m)

HP4 60' CEDAR CL.2 1.9m OFFSET 01-300 01-316 01-500 07-311 07-406 09-100 18" BRACKETS

HP3 60' CEDAR CL.2 2.1m OFFSET 01-300 01-311 01-500 07-104 07-311 07-403A1 09-100 18" BRACKETS

HP2 65' CEDAR CL.1 4.0m OFFSET 01-300 01-316 01-343A4 01-500 06-104 (3.0m) 06-104 (4.5m) 06-104 (6.0m) 09-100 10-203 10-400 6-18" BRACKETS

HP21 60' CEDAR CL.2 4.0m OFFSET 01-301 01-316A 01-343A4 01-500 06-100 (4.0m) 06-108 (x2) 09-100 14-500 6-18" BRACKETS

HP22 60' CEDAR CL.2 4.0m OFFSET 01-300 01-316 01-331 01-500

HP15 55' CEDAR CL.2 2.6m OFFSET 01-324 01-345B (18"BRKTS) 01-500 06-100 (3.5m) 06-100 (5.0m) 09-100 10-203

HP16 55' CEDAR CL.2 3.0m OFFSET 01-316 01-500 08-303 09-100 10-203

HP17 55' CEDAR CL.2 3.0m OFFSET 01-316 01-343A4 01-500 08-301 09-100 10-203 18" BRACKETS SEE COMMERCIAL LAYOUT

HP18 55' CEDAR CL.2 3.0m OFFSET 01-316 01-500 10-203 SEE COMMERCIAL LAYOUT

HP14 55' CEDAR CL.3 2.6m OFFSET 01-305 01-345B (18"BRKTS) 01-500 06-100 (3.5m) 06-100 (5.0m) 09-100 10-203

HP3 65' CEDAR CL.1 4.0m OFFSET 01-300 01-316 01-343 01-345 01-500 09-100 10-203

HP4 60' CEDAR CL.2 4.0m OFFSET 01-300 01-316 01-343A4 01-500 06-100 (3.0m) 08-301 09-100 10-203 6-18" BRACKETS

LB-14-2997 D-14-4535

LB-14-2998

C-14-4156

C-14-177

11693 / 25 13.8kV-120/208V

11611 / 150 13.8kV-600/347V

11913 / 150 13.8kV-347/600

11835 / 150 13.8kV-120/208V

LOC. # 12837

LOC. # 10669

LOC. # 11872

2mX3m EASEMENT

TO LOC # 11945

INSTALL 1/0 TRIPLEX

INSTALL 4/0 QUADRUPLEX

EX. 1/0 TRIPLEX

U/G

BLANKET

HS-26 FUTURE

HS-7 BOTTOM ROAD

HS-10 TOP

HS-10 BOTTOM

HS-11 BOTTOM

HS-7 ROAD BOTTOM

HS-11 FIELD BOTTOM

HS-9 FIELD BOTTOM

HS-11 ROAD HP14

HS-7 FIELD HP15

COLBY DR.

CONESTOGO RD.

KRAUS CARPETS LTD.

GOLDEN TRIANGLE COLLISION LTD.

NORTHFIELD LUMBER

KING'S AUTO SALES

JAY FENCING LTD.

SMENCO

KRAUS CARPETS 2000kVA

CHROME PRINT 4000kVA

200A 347/600V

400A 120/208V

400A 600/347V

MUNICIPAL CONSENT
FOR OFFSET LOCATION ONLY
SIGNATURE _____
PER _____
DATE _____

LEGEND

- 3ø 13.8/8.0kV PRIMARY (EXISTING)
- 3ø 13.8/8.0kV PRIMARY (NEW)
- 3ø SECONDARY (EXISTING)
- 3ø SECONDARY (NEW)
- 120/240V SECONDARY (EXISTING)
- 120/240V SECONDARY (NEW)
- 120V STREET LIGHT FEED (NEW)
- STREET LIGHT CONTROL (EXISTING)
- 100W HPS STREET LIGHT (EXISTING)
- 100W HPS STREET LIGHT W/PHOTOCELL (NEW)
- 150W HPS STREET LIGHT W/PHOTOCELL (NEW)
- STREET LIGHT BREAKER
- (8') ARM LENGTH
- TRANSFORMER (NEW)
- TRANSFORMER (EXISTING)
- TRANSFORMER (REMOVE)
- 12345 TRANSFORMER LOC. NO.
- 50 TRANSFORMER KVA SIZE
- (222) ADDRESS NUMBER
- HYDRO POLE (NEW)
- HYDRO POLE (EXISTING)
- HYDRO POLE (REMOVE)
- HP HYDRO POLE
- CP CUSTOMER POLE
- GUY AND ANCHOR (NEW)
- GUY AND ANCHOR (EXISTING)
- GUY AND ANCHOR (REMOVE)
- DOUBLE GUY AND ANCHOR (NEW)
- DOUBLE GUY AND ANCHOR (EXISTING)
- DOUBLE GUY AND ANCHOR (REMOVE)
- TRIPLE GUY AND ANCHOR (NEW)
- SPAN GUY (NEW)
- DOUBLE SPAN GUY (NEW)

SEE DRAWING A1-1535 FOR PROJECT NOTES, STRI
LIGHT AND PRIMARY SCHEMATICS.

No.	REVISION	DATE	IN
2	RISER POLE RELOCATIONS FOR LRT IMPROVEMENTS. W.R. #8666.	15.08.18	
1	CHANGES AS PER ECO 5387-01. AS CONSTRUCTED DRAWING. REGISTERED PLAN #58R-17669 ADDED.	14.01.30	D

REFERENCE DRAWINGS

A1-1497 NORTHFIELD DRIVE WEST, CONESTOGA PARKWAY TO COLBY DRIVE, WATERLOO
A1-1535 NORTHFIELD DRIVE WEST, KING STREET NORTH TO COLBY DRIVE, WATERLOO

WATERLOO NORTH HYDRO INC.

CERTIFICATE OF APPROVAL

THE INSTALLATION WORK COVERED BY THIS DOCUMENT MEETS THE SAFETY REQUIREMENTS OF SECTION 4 OF REGULATION 22/04.

NORTHFIELD DRIVE WEST

CONESTOGO RD/ COLBY DR TO KING STREET

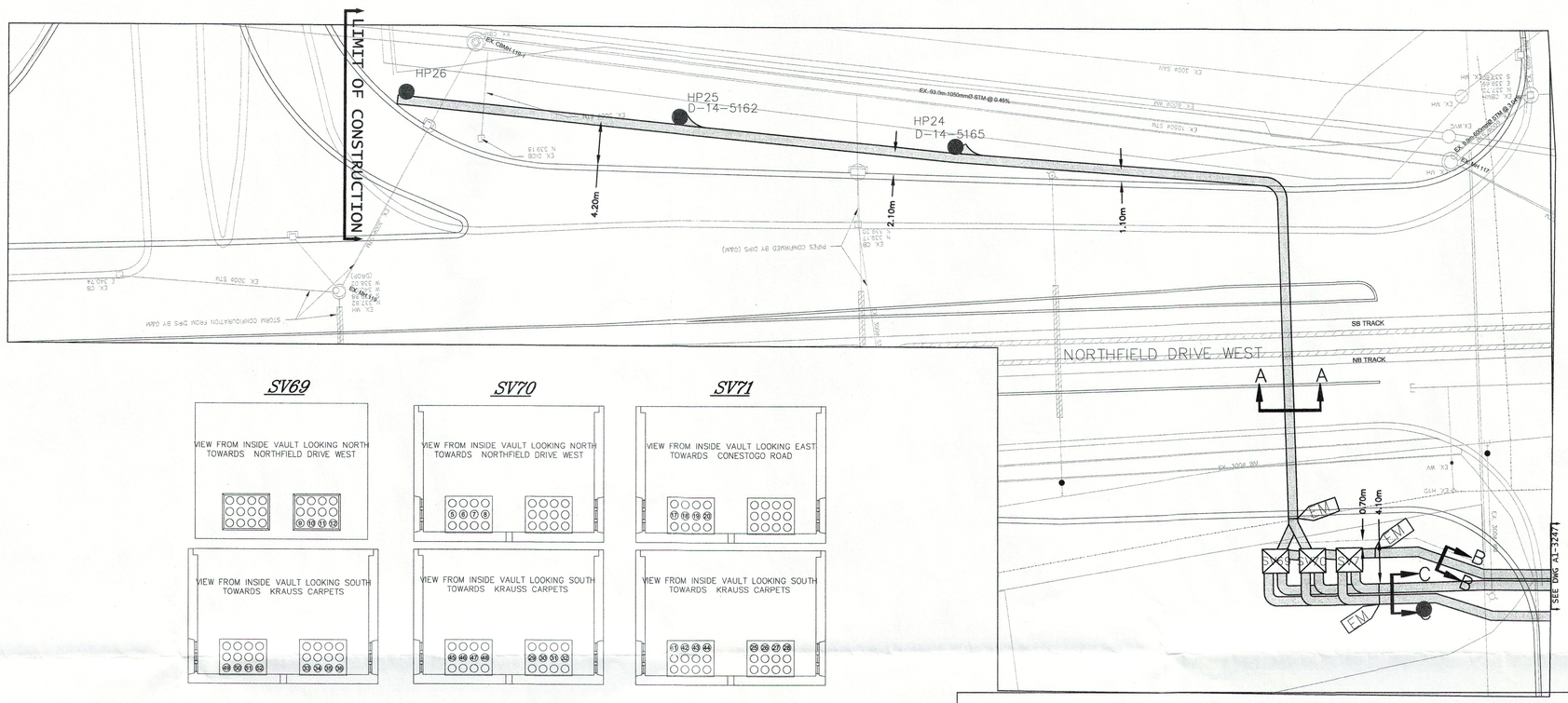
WATERLOO

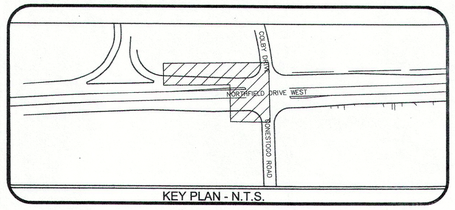
SCALE: 1 : 500

DRAWING NO. A1-1534

DESIGNED	DAVID WINKLER	12.02.22
DRAWN	CHRIS MAZEREEUW	12.06.13
CHECKED	DOROTHY MORYC	
FILE #	WA-014-OH-N14	

MUNICIPAL CONSENT





KEY PLAN - N.T.S.

LEGEND

- WNH CONCRETE-ENCASED DUCTBANK (NEW)
- HP WOOD HYDRO POLE(EXISTING)
- HP HYDRO POLE (REMOVE)
- HP WOOD HYDRO POLE(NEW)
- DRIVEWAY
- 222 MUNICIPAL ADDRESS
- OVERHEAD TRANSFORMER (EXISTING)
- 30 PADMOUNTED TRANSFORMER (EXISTING)
- 11273 / 50 TRANSFORMER LOCATION NUMBER / TRANSFORMER KVA SIZE
- SM SUBMERSIBLE VISTA SWITCHGEAR (NEW)
- DRAIN VAULT (NEW)
- EM ELECTRONIC MARKER BALL

REGIONAL WATERLOO
Transportation Division
APPROVED
For Location Only
PER
DATE Sept 2/15

WORK PERMIT TO BE OBTAINED FROM
Transportation Division
Regional Municipality
of Waterloo

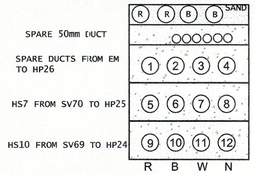
The Roadway Design and Municipal Service infrastructure shown on this drawing was provided by a third party on 2014.08.15. Waterloo North Hydro Inc. is responsible for the underground electrical distribution system design only.

SV69

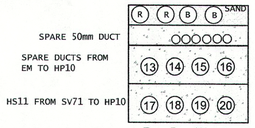
SV70

SV71

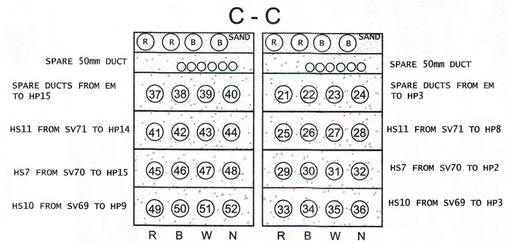
A - A



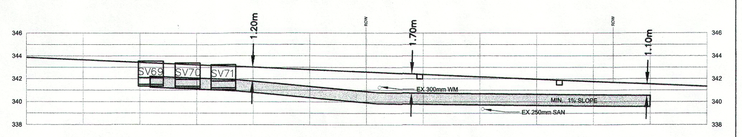
B - B



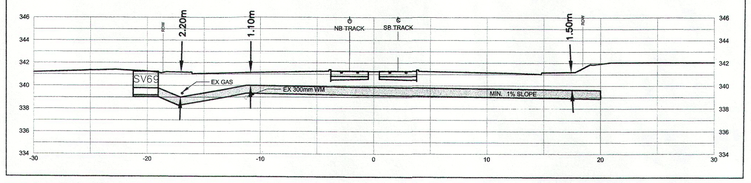
C - C



NORTHFIELD CROSSING CONESTOGO



Northfield Drive Crossing (A - A)



FOR OVERHEAD CONSTRUCTION DRAWING SEE DWG.# A1-3171
FOR CONSTRUCTION NOTES SEE DWG.# A1-3247

REV.NO.	DESCRIPTION	DATE	INITIALS

THIS DRAWING NOT TO BE REPRODUCED WITHOUT THE EXPRESS WRITTEN CONSENT OF WATERLOO NORTH HYDRO INC.

Waterloo North Hydro Inc.
Engineering Department

ISSUED
for

☒ approval ☐ review
☐ construction ☐ as built

signed: [signature]
date: 04/21/2016.

☐ Return to Eng ☐ Site Copy

MUNICIPAL CONSENT
FOR OFFSET LOCATION ONLY

SIGNATURE
PER
DATE

WATERLOO NORTH HYDRO INC.

CERTIFICATE OF APPROVAL

THE INSTALLATION WORK COVERED BY THIS DOCUMENT MEETS THE SAFETY REQUIREMENTS OF SECTION 4 OF REGULATION 22/04.

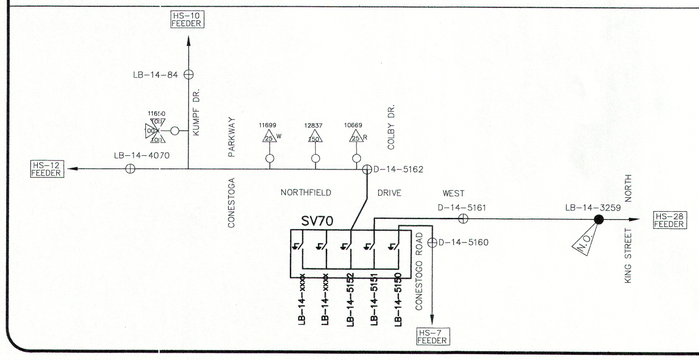
DUCT BANK CONSTRUCTION
NORTHFIELD DRIVE
CONESTOGO DRIVE CROSSING
WATERLOO

SCALE: HORIZONTAL: 1:250
VERTICAL: 1:250

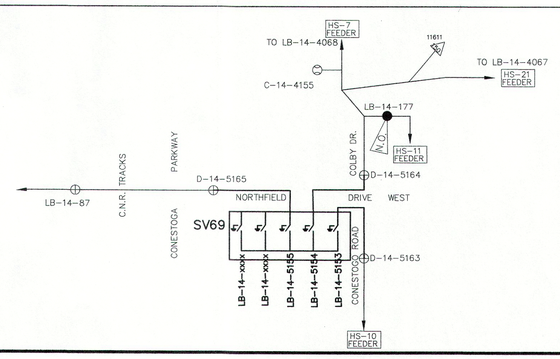
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DESIGNED	BRANDON COLVIN	2015.08.19
CHECKED	DL, DS, RK	
FILE #	014-DB-N001	

Dwg no. A1-3248
DWG: A1-3247

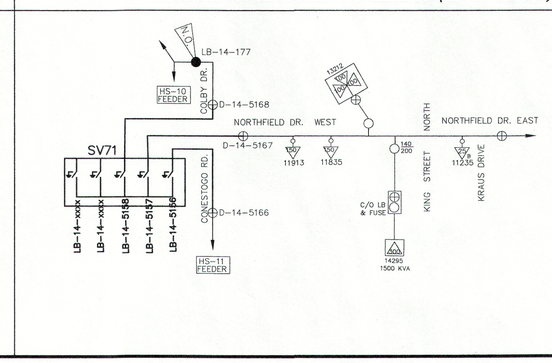
PROPOSED 13.8kV PRIMARY SCHEMATIC (HS-7 FEEDER) N.T.S

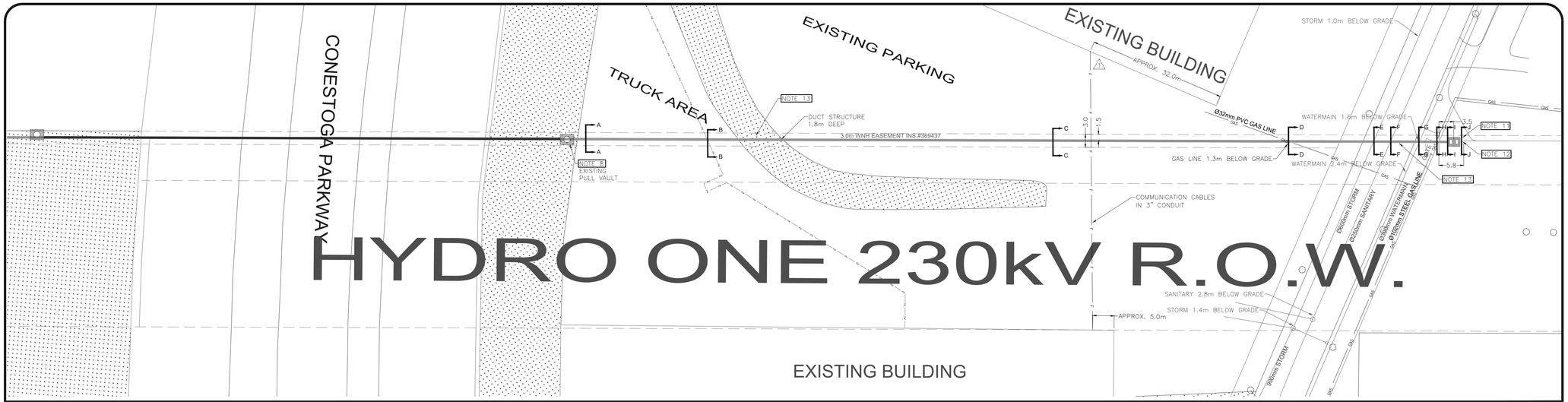


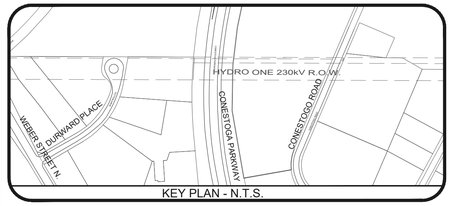
PROPOSED 13.8kV PRIMARY SCHEMATIC (HS-10 FEEDER) N.T.S



PROPOSED 13.8kV PRIMARY SCHEMATIC (HS-11 FEEDER) N.T.S







LEGEND

- DUCT (NEW)
- DUCT (EXISTING)
- ROAD CROSSING
- NUMBER OF ROAD CROSSING DUCTS
- UTILITY HOLE
- CATCH BASIN
- DOUBLE CATCH BASIN
- FIRE HYDRANT
- HYDRO POLE (EXISTING)
- 4" 120 PSI INSULATED STEAM PIPE
- COMMUNICATION WIRES
- GAS PIPE

STANDARD CONSTRUCTION NOTES:

1. CONTACT THE ENGINEERING DEPARTMENT BEFORE MAKING ANY CHANGES TO THIS DESIGN. ON COMPLETION OF THE PROJECT, RETURN DRAWING TO THE ENGINEERING DEPARTMENT INDICATING FIELD CHANGES.
2. ALL REFERENCES TO ELEVATIONS AND DIMENSIONS ARE IN METRES UNLESS SPECIFIED OTHERWISE.
3. CONTRACTOR IS RESPONSIBLE FOR ALL LOCATES INCLUDING HYDRO.
4. CONTRACTOR TO HAND DIG WITHIN 1.0m OF EXISTING UNDERGROUND SERVICES.
5. MAINTAIN A MINIMUM 1.0m CLEARANCE FROM ALL CATCH BASINS, FIRE HYDRANTS AND OTHER EXISTING SERVICES.

SITE SPECIFIC CONSTRUCTION NOTES:

6. ALL CHARGES ARE TO BE DISTRIBUTED AS FOLLOWS:

   ALL LABOUR, TRUCKING, MATERIALS PLUS OUTSIDE CHARGES RELATED TO LOCATING THE EXISTING PART OF THE STRUCTURE AND DESIGNING THE EXTENSION TO SCHEIFELE T.S.TO WORK ORDER #1375 AND THE FOLLOWING JOB ORDERS:
   1 - OH CAPITAL ENGINEERING (DESIGN)
   4 - OH CAPITAL LINES (WNH LABOUR AND LABOUR SAVING DEVICES)
   5 - OH CAPITAL ACQUISITION (CONTRACTOR'S LABOUR AND MATERIAL)

   ALL LABOUR, TRUCKING, MATERIALS PLUS OUTSIDE CHARGES RELATED TO CONSTRUCTION OF THE STRUCTURE FROM CONESTOGA EXPRESSWAY TO SCHEIFELE T.S.TO WORK ORDER #1545 JOB ORDER 1 - EG UNDERGROUND CAPITAL - ENGINEERING.

7. DUCT BANK TO BE INSTALLED AS PER WNH STANDARD U2-4.
8. CONTRACTOR TO EXCAVATE AROUND THE EXISTING PULL VAULT AT CONESTOGA PARKWAY. INSTALL 4-10FT GROUND RODS AND RUN 2/0 BARE COPPER CONDUCTOR BETWEEN EACH GROUND ROD FOR CONNECTION BY WNH CREWS.
9. CONTRACTOR TO SAW CUT 2.75m (9') WIDE AND DISPOSE OF ASPHALT ALONG THE TRENCH ROUTE.
10. ALL TRENCHING WITHIN THE PARKING AREA AND CONESTOGO ROAD TO BE CONSTRUCTED AS PER WNH STANDARD U2-3 AND THE CITY OF WATERLOO REQUIREMENTS.
11. INSTALL ICS192A PULL VAULT AS PER THE DESIGN.INSTALL 4-10FT GROUND RODS AND RUN 2/0 BARE COPPER CONDUCTOR BETWEEN EACH GROUND ROD FOR CONNECTION BY WNH CREWS.
12. LOCATE THE END OF THE EXISTING HS17 DUCTS 5.8m EAST OF CONESTOGO ROAD. EXTEND THE DUCTS INTO THE ICS192A. REFER TO A1-1694 FOR THE EXISTING INSTALLATION OF HS17 DUCTS.
13. USE 5˚BENDS AND 0.5m SECTIONS OF PIPE WHEN MAKING ELEVATION CHANGES.
14. NOTE: NONMETALLIC ROPE OR BANDING SHALL BE USED TO TIE DUCTS AND SPACERS EVERY 3.0m.
15. ANY OPEN SECTION OF THE TRENCH TO BE FENCED OFF AND BARRICADED AT ALL TIMES.

DUCT BANK CROSS SECTION - REFER TO U2-4 FOR INSTALLATION DETAILS.

A - A

B - B

DUCT BANK AT STEAM PIPE CROSSING TO BE PROTECTED AS PER STANTEC CONSULTING DRAWING 1610-00893, CERTIFIED JULY 17, 2006 BY R.E. BROOKE, P.ENG.

C - C

D - D

E - E

F - F

H - H

G - G

I - I
ICS -192A

J - J
ICS -192A

REV.NO.	DESCRIPTION	DATE	INITIALS
1	REVISED DUCT BANK CROSS SECTION C-C, D-D, E-E, F-F, G-G, AND H-H. ADDED DUCK BANK CROSS SECTION J-J.	MAR. 2, 2007	G.T

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WATERLOO NORTH HYDRO INC.

CERTIFICATE OF APPROVAL

THE INSTALLATION WORK COVERED BY THIS DOCUMENT MEETS THE SAFETY REQUIREMENTS OF SECTION 4 OF REGULATION 22/04.

HOWARD SCHEIFELE T.S. HS17 FEEDER EGRESS
CONESTOGA PARKWAY TO CONESTOGO ROAD
WATERLOO

SCALE: 1 : 500

dwg no. A1-2588

DRAWN	Chirs Sosnowski	2006.06.29
DESIGNED	Chris Sosnowski	2006.06.29
CHECKED	DM	2006.06.29
FILE #	O14-DB-C005	

APPENDIX B

Sanitary Demand Calculations

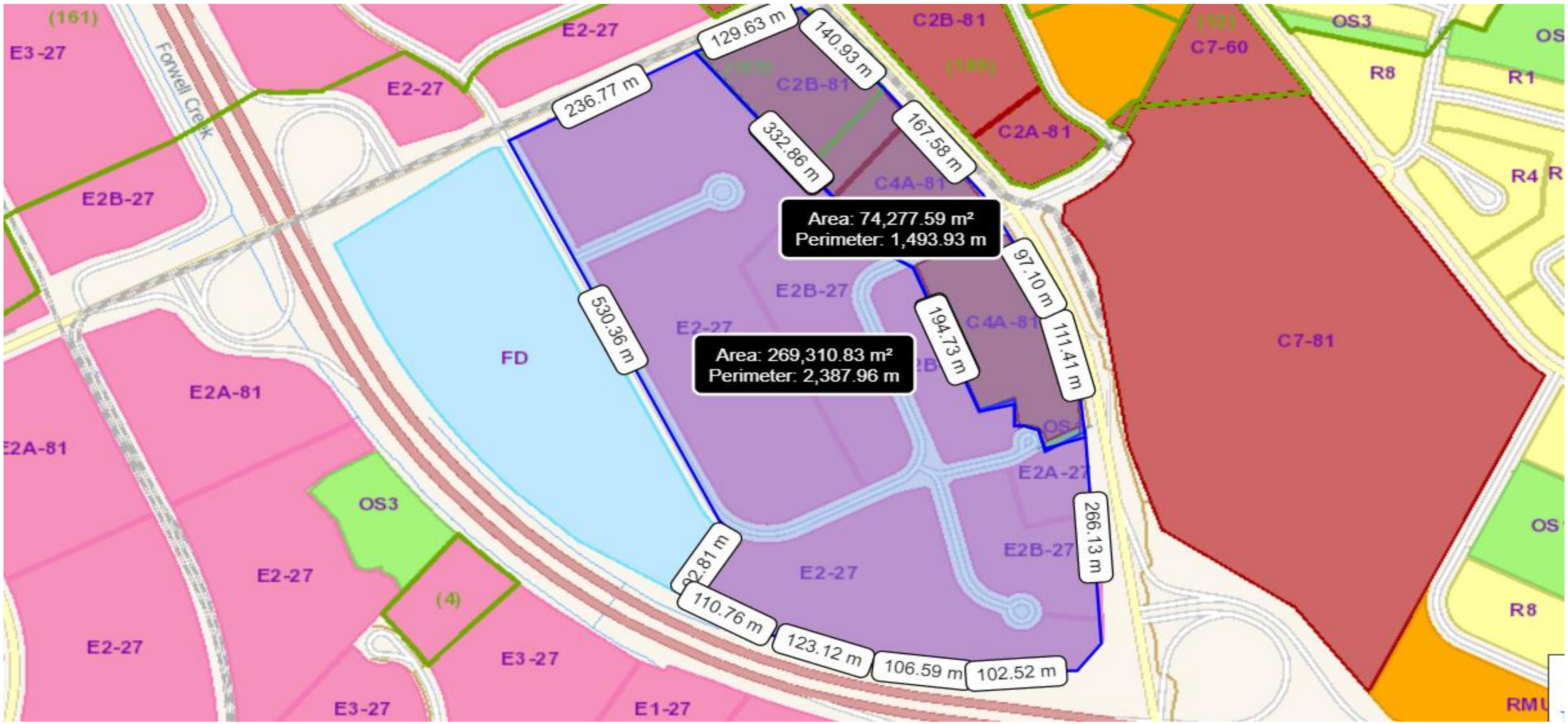
- Sanitary Sewer Design Sheet
- Sanitary Flow Network
- HGL - Conestogo North to LFCTSS
- HGL - Conestogo South to LFCTSS
- Excerpts from Sanitary Master Plan:
    - Evaluation of Lower Forwell Trunk Constraints
    - Figures illustrating downstream constraints.

Project:	Kraus Flooring - Redevelopment		Design Data		
Project No:	2019-0654-10		Min. Velocity	0.8	m/s
Date:	5/31/2021		Max. Velocity	3.0	m/s
Designed By:	LC	Checked By: RK	Manning's 'n'	0.013	
			Infiltration	0.25	l/s/ha

SANITARY SEWER DESIGN CALCULATIONS

Residential			Commercial			Industrial			Institutional		
Peaking Factor	Harmon		Peaking Factor	2.5		Peaking Factor	2		Peaking Factor	1	
Avg. Daily Flow	275	L/c/d	Avg. Daily Flow	0.5	L/s/ha	Avg. Daily Flow	0.4	L/s/ha	Avg. Daily Flow	0	L/s/ha

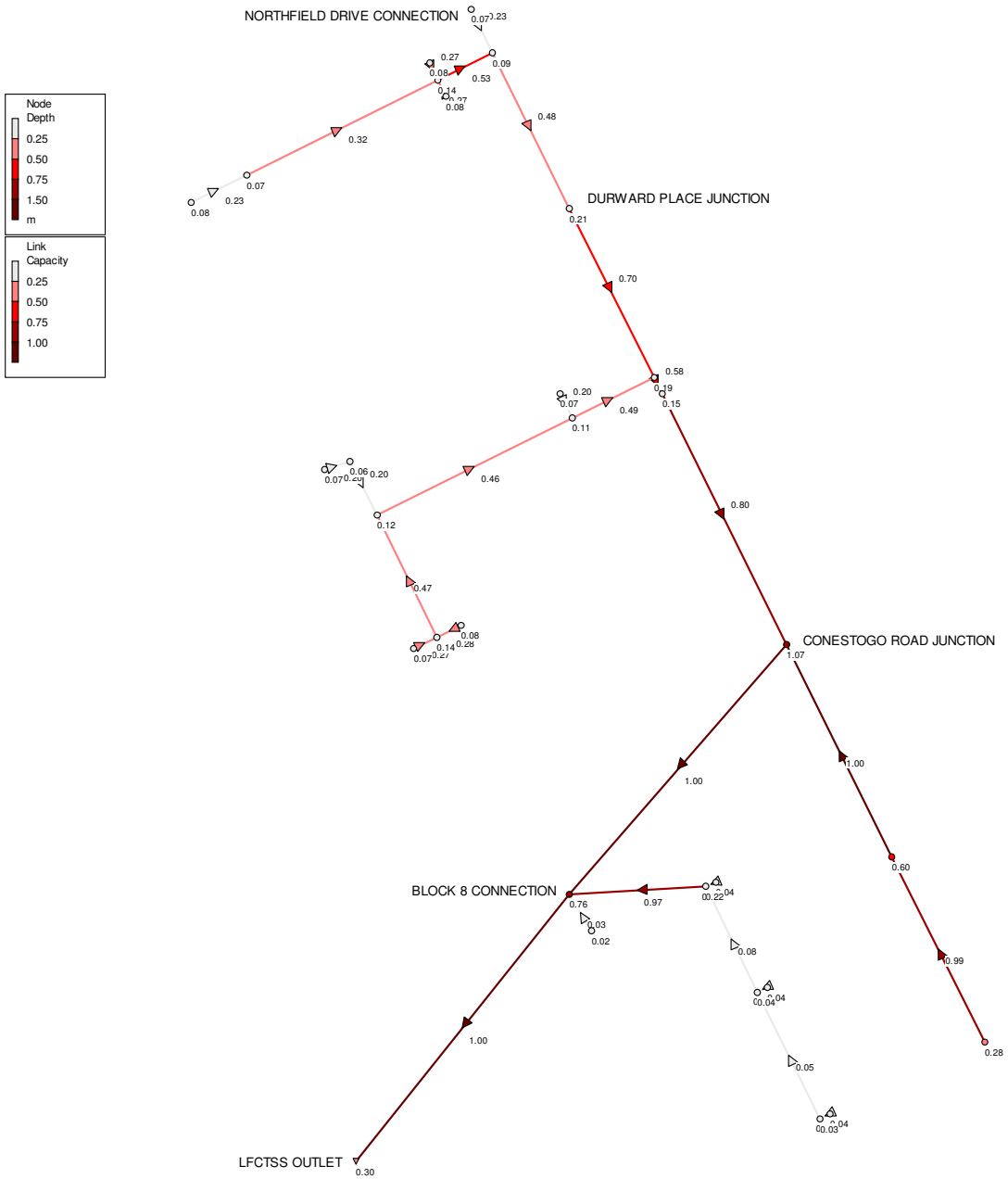
Pipe Data			Residential				Cumulative			Commercial		Industrial		Institutional		Infiltration		Total	Design Data			
From	To	Length	Area	Units	Density	Population	Area	Population	Peak Factor	Area	Total Area	Area	Total Area	Area	Total Area	Area	Total Area	Flow	Diameter	Slope	Q_{FULL}	V_{FULL}
PREVIOUS DEVELOPMENT CONCEPT		*(m)*	*(ha)*		*(ppu)*	*(people)*	*(ha)*	*(people)*		*(ha)*	*(ha)*	*(ha)*	*(ha)*	*(ha)*	*(ha)*	*(ha)*	*(ha)*	*(L/s)*	*(mm)*	*(%)*	*(L/s)*	*(m/s)*
Redeveloped Kraus Flooring Site			7.93	2534	1.76	**4460**	7.93	4460	**3.29**	2.79	2.79	0.00	0.00	0.00	0.00	10.72	10.72	**52.880**	250	1.00	**59.47**	**1.21**
External Drainage Area			0	0	1.76	**0**	0.00	0	**4.50**	7.43	7.43	26.93	26.93	0.00	0.00	34.36	34.36	**39.422**	300	0.61	**75.53**	**1.07**
Total Sanitary Drainage Upstream of ON-85			7.93	2177	1.76	**3832**	7.93	3832	**3.35**	10.22	10.22	26.93	26.93	0.00	0.00	45.08	45.08	**86.448**	300	0.61	**75.53**	**1.07**



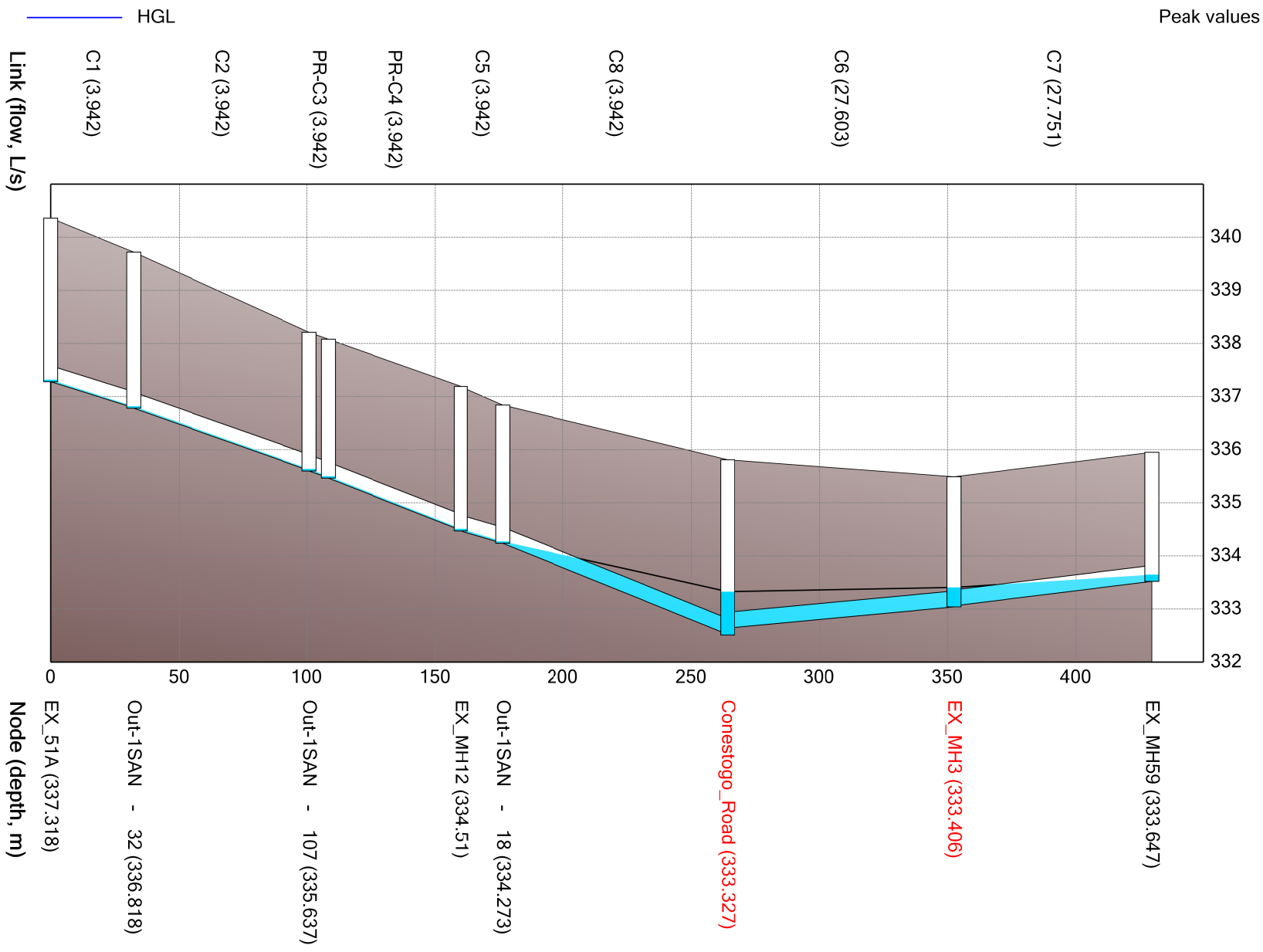
Project:	Kraus Flooring - Redevelopment			Design Data			SANITARY SEWER DESIGN CALCULATIONS											
Project No:	2019-0654-10			Min. Velocity	0.6	m/s												
Date:	2023-09-28			Max. Velocity	3.0	m/s		Residential			Commercial			Institutional				
Designed By:	ZS	Checked By:	RK	Manning's 'n'	0.013		Peaking Factor	Harmon		Peaking Factor	2.5		Peaking Factor	2.5				
				Infiltration	0.25	l/s/ha	Avg. Daily Flow	275	L/c/d	Avg. Daily Flow	0.5	L/s/ha	Avg. Daily Flow	0.5	L/s/ha			

Pipe Data			Residential				Cumulative			Commercial		Institutional		Infiltration		Total Domestic Flow	Total Dry Weather Flow
From	To	Length (m)	Area (ha)	Units	Density (ppu)	Population (people)	Area (ha)	Population (people)	Peak Factor	Area (ha)	Total Area (ha)	Area (ha)	Total Area (ha)	Area (ha)	Total Area (ha)	(L/s)	(L/s)
Northern ROW			0.372	0	0	**0**	0.372	0	**0.00**	0.000	0.000	0.000	0.000	0.372	0.372	**0.09**	**0.00**
Southern ROW			0.325	0	0	**0**	0.325	0	**0.00**	0.000	0.000	0.000	0.000	0.334	0.706	**0.18**	**0.00**
Block 1			0.644	225	1.76	**396**	0.644	396	**4.02**	0.105	0.105	0.000	0.000	0.644	1.350	**5.54**	**5.20**
Block 2			0.834	250	1.76	**440**	0.834	836	**3.85**	0.064	0.169	0.000	0.000	0.834	2.184	**11.00**	**10.45**
Block 3			1.160	676	1.76	**1190**	1.160	2026	**3.58**	0.000	0.169	0.000	0.000	1.160	3.344	**24.14**	**23.30**
Block 4					1.76	**0**	0.000	2026	**3.58**	0.000	0.169	0.000	0.000	0.000	3.344	**24.14**	**23.30**
Block 5			1.019	628	1.76	**1105**	1.019	3131	**3.43**	0.000	0.169	0.000	0.000	1.019	4.364	**35.45**	**34.36**
Block 6			0.625	270	1.76	**475**	0.625	3606	**3.37**	0.049	0.218	0.000	0.000	0.625	4.989	**40.24**	**38.99**
Block 7			0.400	126	1.76	**222**	0.400	3828	**3.35**	0.371	0.589	0.054	0.054	0.400	5.388	**42.97**	**41.62**
Block 8			1.124	618	1.76	**1088**	1.124	4916	**3.25**	0.000	0.589	0.000	0.054	1.124	6.513	**53.31**	**51.68**
Block 9			0.769	560	1.76	**986**	0.769	5901	**3.18**	0.000	0.589	0.000	0.054	0.769	7.281	**62.31**	**60.49**

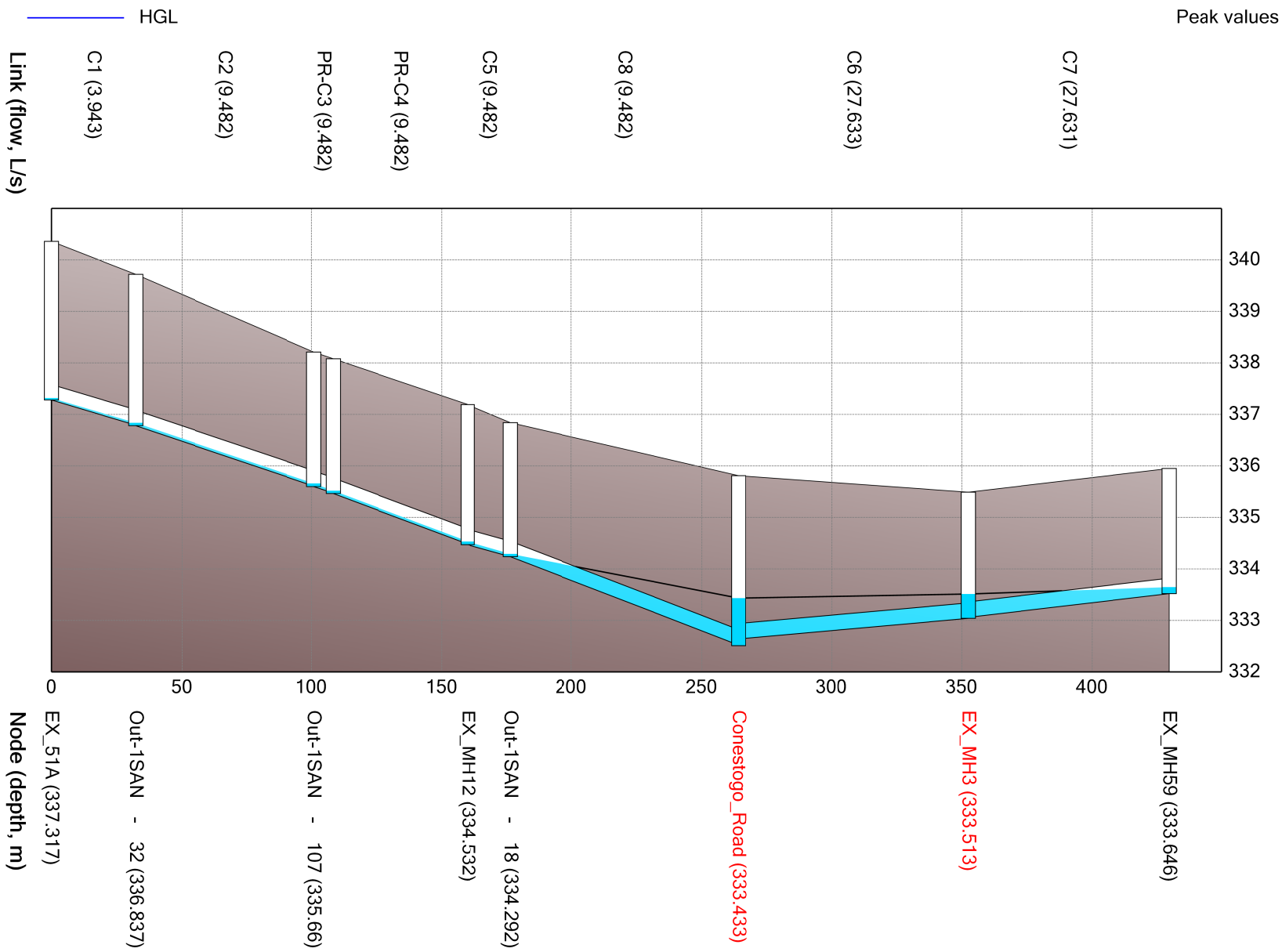
Sanitary Flow Network



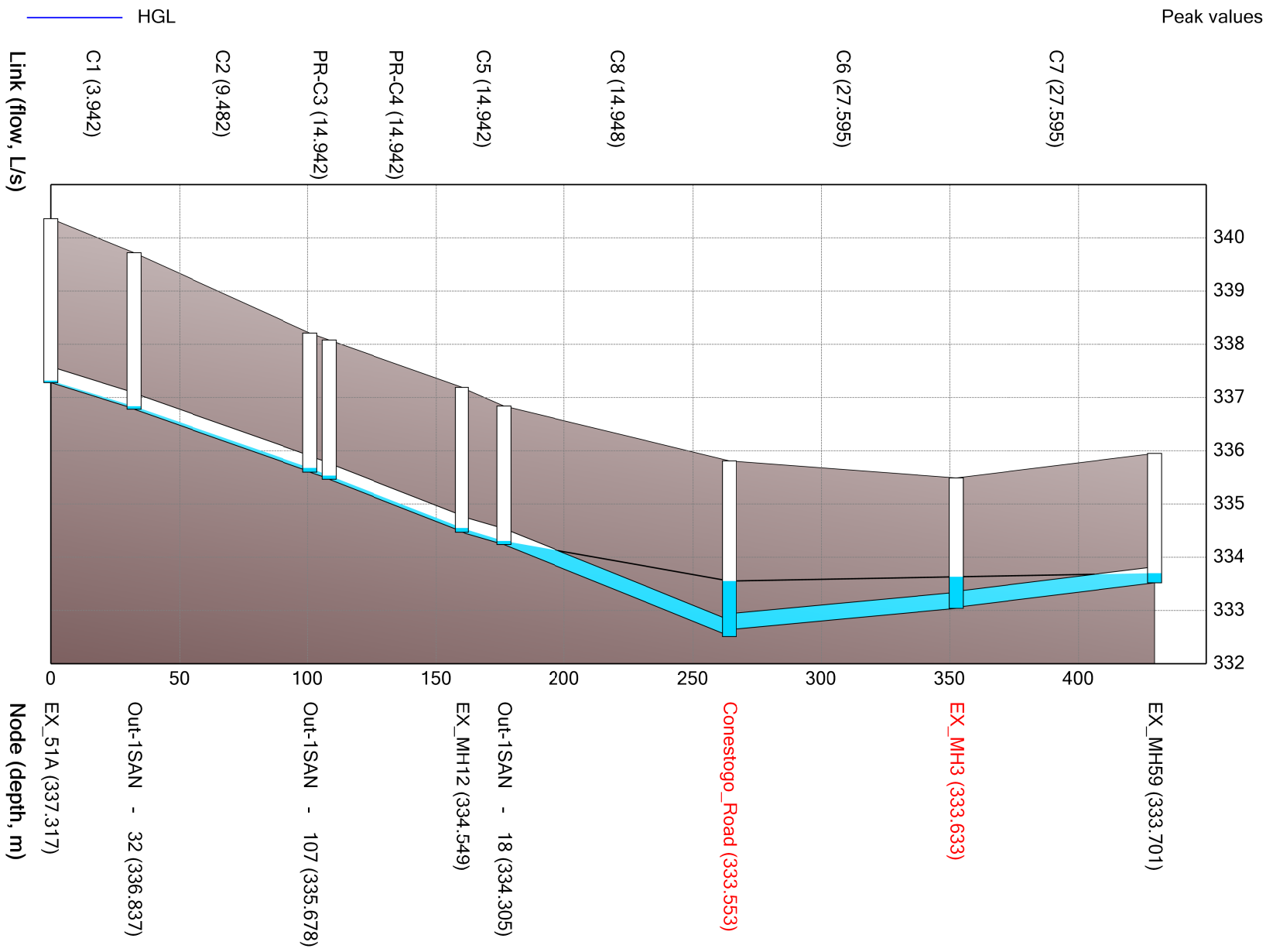
HYDRAULIC GRADE LINE: CONESTOGO ROAD - EXISTING CONDITIONS



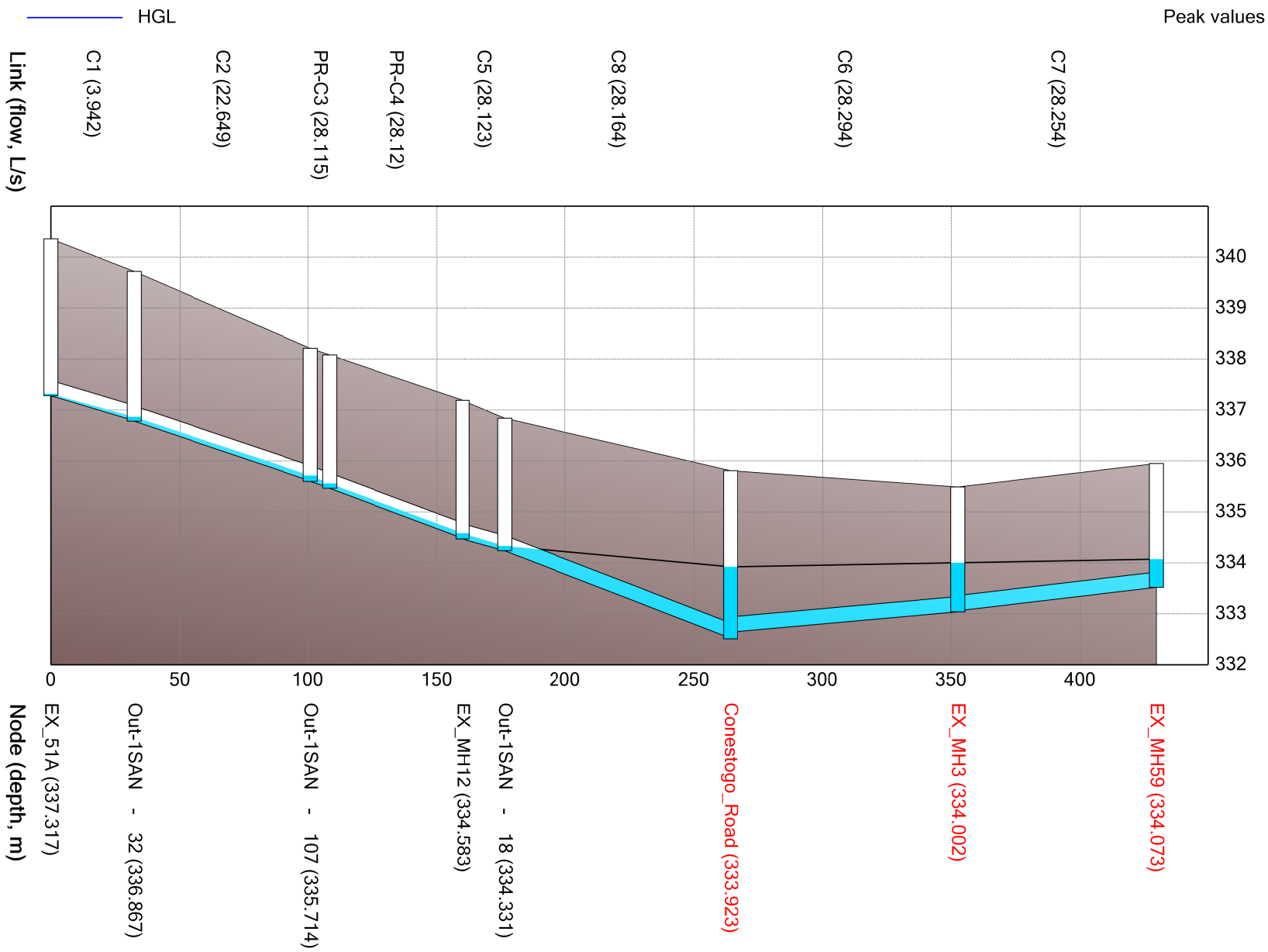
HYDRAULIC GRADE LINE: CONESTOGO ROAD - BLOCK 1 FLOW



HYDRAULIC GRADE LINE: CONESTOGO ROAD - BLOCK 2 FLOW



HYDRAULIC GRADE LINE: CONESTOGO ROAD - BLOCK 3 FLOW



6.2.3.3 Improving Downstream Frobisher SPS Capacity Constraint

The results of the evaluation of alternatives identified in Section 6.1.3.2 are presented in detail in Appendix B. Table 6-11 presents the results of the evaluation.

From Table 6-11 it can be seen that the top ranked alternative is Alternative 5C. This is because it reduces operations and maintenance due to the removal of old infrastructure, and reduced risk of utility conflicts due to unchanged alignment.

6.2.3.4 Improving Lower Forwell Capacity Constraint

The results of the evaluation of alternatives identified in Section 6.1.3.3 are presented in detail in Appendix B. Table 6-12 presents the results of the evaluation.

From Table 6-12 it can be seen that the top ranked alternative is Alternative 6A which is the 'do nothing' alternative. This constraint is located through the Hillside Trail, adjacent to the WWTP. It is unlikely that surcharging in this area would cause basement flooding because there are no direct connections. The Hillside Trail is an environmentally sensitive area, and the 'do nothing' alternative avoids construction through this area.

Table 6-12: Detailed Evaluation of Lower Forwell Trunk Alternatives

Ranking



Good Neutral Poor

Ranking		Alternative		
		Lower Forwell Trunk		
		6A	6B	6C
Category	**Criteria**	Do Nothing	Twin Sewer	Replace Sewer Section
Technical	Hydraulic Improvements			
	Operations and Maintenance			
	System Resiliency			
Ease of Implementation	Constructability			
	Regulatory Considerations			
Social	Impact for Surrounding Residents			
System Suitability	Consistency with Planned Upgrades			
	Consistency with Operating Strategies			
Environment/ Sustainability	Carbon Footprint			
	Impact on Terrestrial/ Aquatic Systems			
Financial	Capital Cost			
	Operating and Maintenance Cost			
Total Score		7 1/4	5 1/4	6

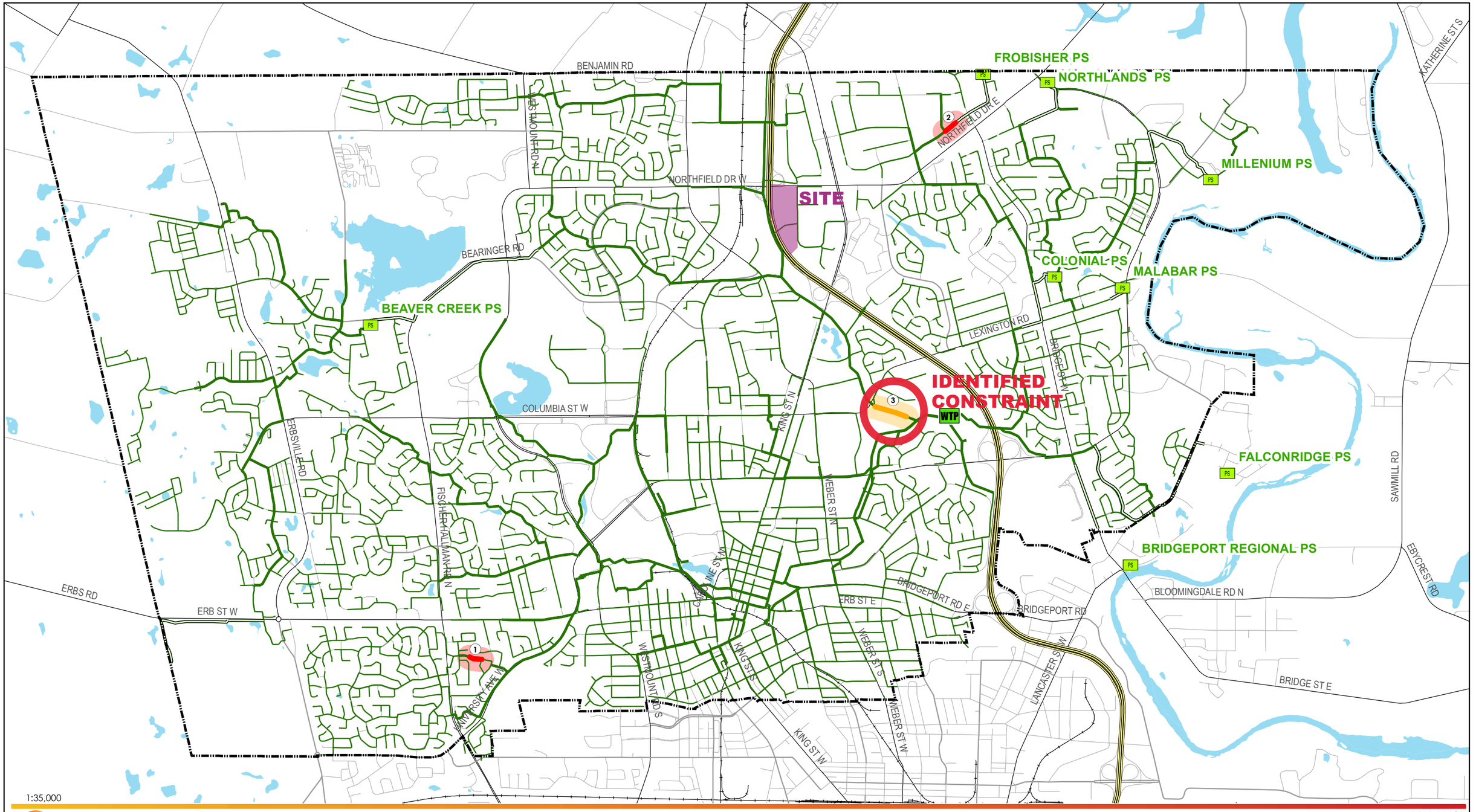
Table B4: Detailed Evaluation of Lower Forwell Alternatives

Ranking



Ranking		Alternative		
		Lower Forwell Trunk		
		6A	6B	6C
Category	**Criteria**	Do Nothing	Twin Sewer	Replace Sewer Section
Technical	Hydraulic Improvements			
	Operations and Maintenance			
	System Resiliency			
Ease of Implementation	Constructability			
	Regulatory Considerations			
Social	Impact for Surrounding Residents			
System Suitability	Consistency with Planned Upgrades			
	Consistency with Operating Strategies			
Environment/ Sustainability	Carbon Footprint			
	Impact on Terrestrial/ Aquatic Systems			
Financial	Capital Cost			
	Operating and Maintenance Cost			
Total Score		7 1/4	5 1/4	6

Comment		Alternative		
		Downstream of Beaver Creek SPS		
		6A	6B	6C
Category	**Criteria**	Do Nothing	Twin Sewer	Replace Sewer Section
Technical	Hydraulic Improvements	poor - continued capacity constraint; necessary for growth	good - address hydraulic constraint	good - Opportunity to increase slope
	Operations and Maintenance	poor - risk of surcharge	neutral - no change	good - removed old pipe from system
	System Resiliency	poor - capacity constraint identified under wet weather	good - address hydraulic constraint	good - address hydraulic constraint
Ease of Implementation	Constructability	good - no construction required	neutral - no change	neutral - less disruptive, less risk of utility conflicts
	Regulatory Considerations	Neutral	poor - environmentally sensitive area	poor - environmentally sensitive area
Social	Impact for Surrounding Residents	good - low risk of basement flooding	poorer - may impact use of trails	poorer - may impact use of trails
System Suitability	Consistency with Planned Upgrades	poor - capacity constraint identified	good - addresses capacity constraint	good - addresses capacity constraint
	Consistency with Operating Strategies	poor - capacity constraint identified	good - no changes to operations	good - no changes to operations
Environment/ Sustainability	Carbon Footprint	neutral - use of existing infrastructure	poorer - adding additional pipe	poorer - replace pipe section
	Impact on Terrestrial/ Aquatic Systems	good - low risk of spills to environment, no construction required	poor - environmentally sensitive area	poor - environmentally sensitive area
Financial	Capital Cost	good - no capital cost	poor - capital cost of twinned sewer	poor - capital cost of replacement
	Operating and Maintenance Cost	neutral - no change	poor - additional pipe to maintain	neutral - no change



1611-11191

Stantec

Stantec Consulting Ltd.
49 Frederick Street
Kitchener, Ontario, Canada
N2H 6M7
Tel: (519) 579-4410
Fax: (519) 579-6733
www.stantec.com

Legend

- PS — Sewage Pump Station
- Forcemain
- WTP — Wastewater Treatment Plant

Sanitary Sewers

- Local Sewers
- Trunk Sewers

Capacity Constraints

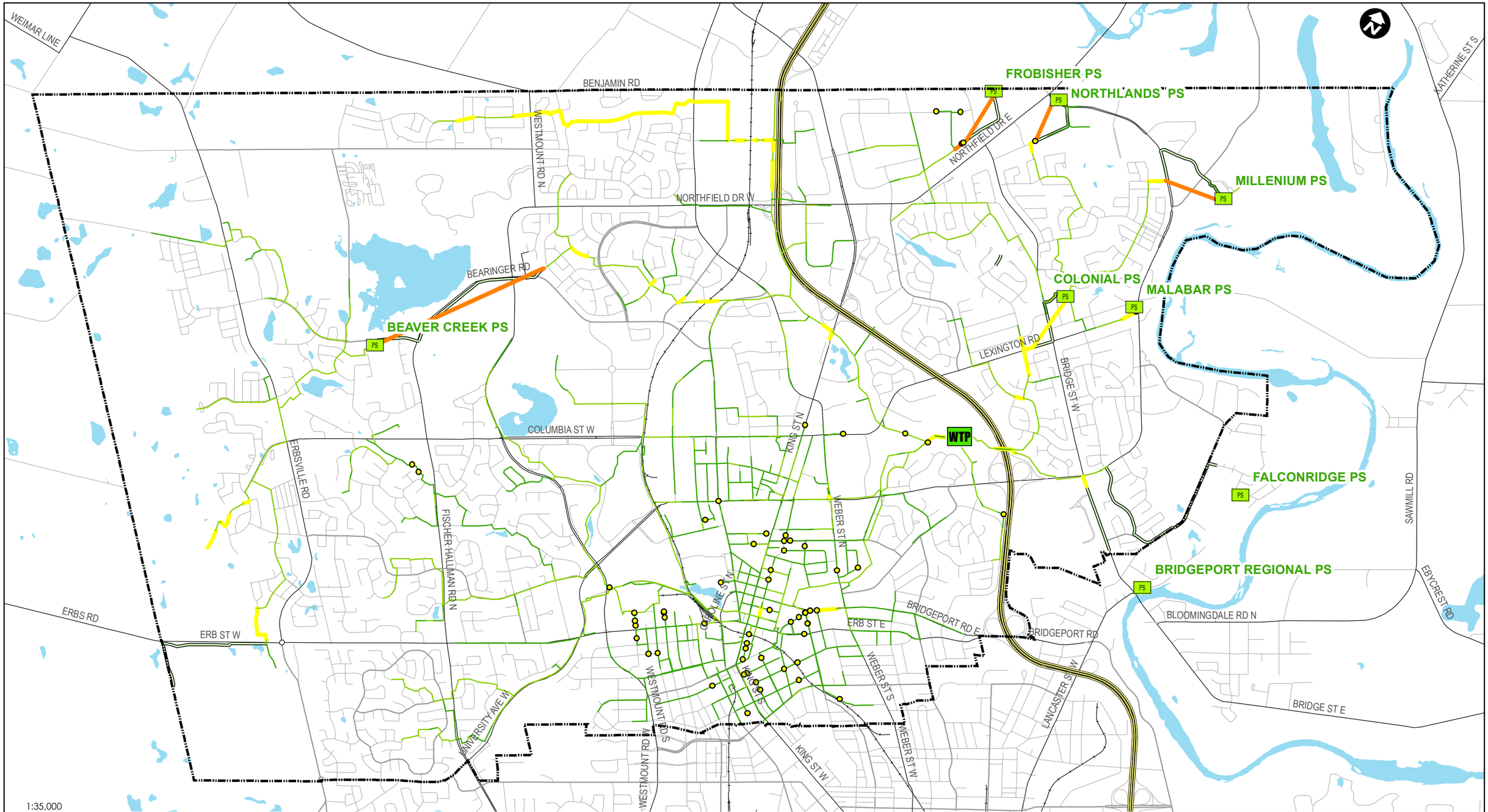
- Existing Conditions Constraint
- 2029 WWF Constraint

Constraint		Details
1	Maple Hill Trunk	Existing conditions wet weather flow constraint
2	Downstream of Frobisher SPS	Existing conditions dry weather flow and wet weather flow constraint
3	Lower Forwell Trunk	2029 wet weather flow constraint

Figure No. FIGURE 6-5

Title **CAPACITY CONSTRAINTS EXISTING & FUTURE CONDITIONS**

Client/Project CITY OF WATERLOO SANITARY SERVICING MASTER PLAN UPDATE



1:35,000

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Stantec
Stantec Consulting Ltd.
49 Frederick Street
Kitchener, Ontario, Canada
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Tel: (519) 579-4410
Fax: (519) 579-6733
www.stantec.com

Legend

Transportation Network
- Arterial
- Collector
- Highway
- Local
- CityBoundary

- Water Body
- PS Existing Pump Station
- Forcemain
- WTP Wastewater Treatment Plant

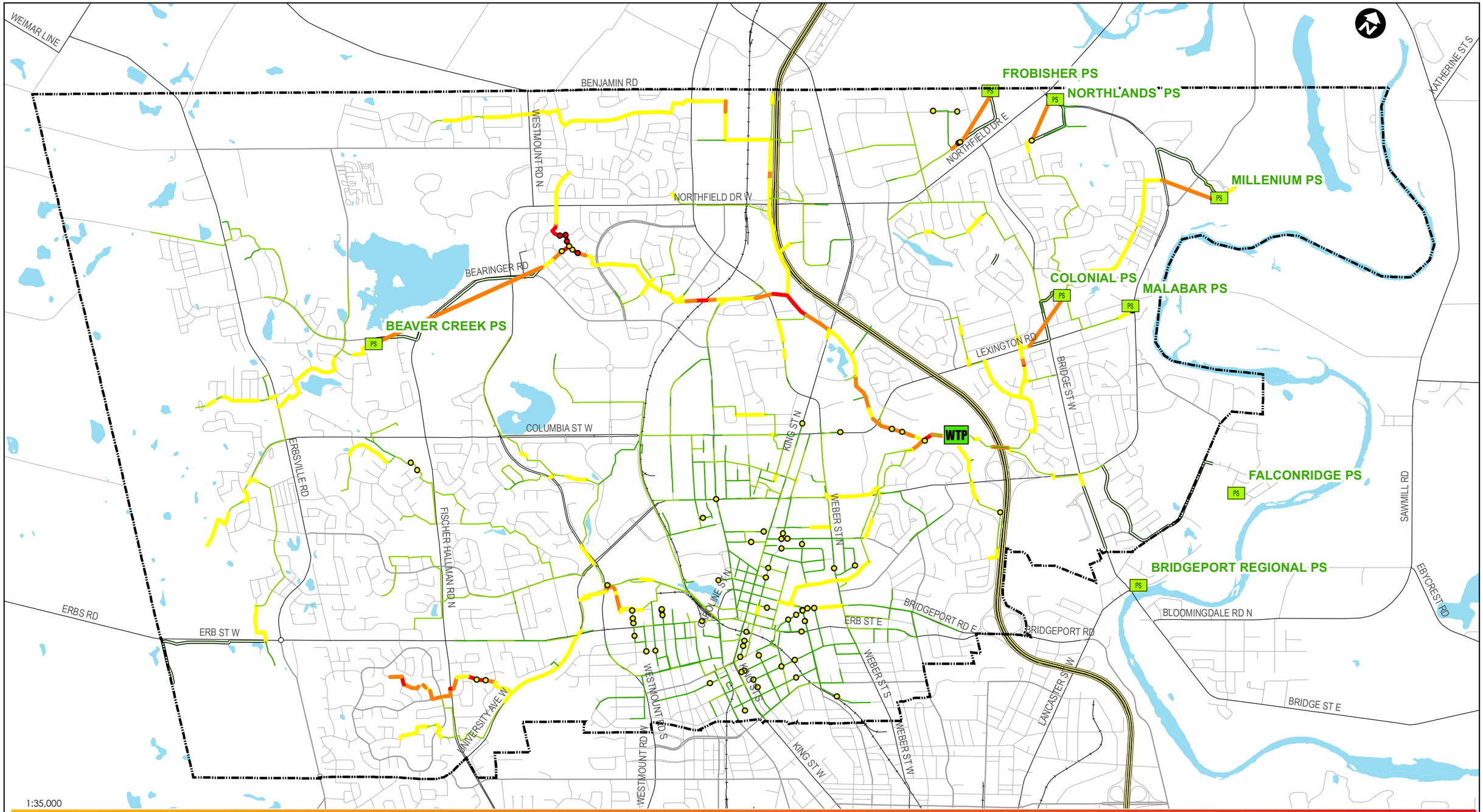
HGL Freeboard
- Above Ground
- Basement Depth (<1.8m)

d/D Ratio
- 0% - 20%
- 21% - 50%
- 51% - 80%
- 81% - 99%
- 100%

Figure No. FIGURE 4-1

Title **DWF MODELING RESULTS FOR FUTURE 2029 CONDITIONS**

Client/Project CITY OF WATERLOO SANITARY SERVICING MASTER PLAN UPDATE



1:35,000

1611-11191

Stantec
Stantec Consulting Ltd.
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Kitchener, Ontario, Canada
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Tel: (519) 579-4410
Fax: (519) 579-6733
www.stantec.com

Legend

Transportation Network
- Arterial
- Collector
- Highway
- Local
- CityBoundary

- Water Body
- PS Existing Pump Station
- Forcemain
- WTP Wastewater Treatment Plant

HGL Freeboard
- Above Ground
- Basement Depth (<1.8m)

d/D Ratio
- 0% - 20%
- 21% - 50%
- 51% - 80%
- 81% - 99%
- 100%

Figure No. FIGURE 4-2

Title **WWF MODELING RESULTS FOR FUTURE 2029 CONDITIONS (10 YR, 3 HR, CHICAGO STORM)**

Client/Project CITY OF WATERLOO SANITARY SERVICING MASTER PLAN UPDATE

APPENDIX C

Water Demand Calculations

- Domestic Water Demand
- Network Configuration
- Fire Water Demand
- Region Modelling Information
- Average Day Results
- Maximum Day Results
- Maximum Flow at Node
- EPANET Water Model

TABLE C-1 - DOMESTIC WATER DEMAND

DGSSMS 2023, Water Supply and Distribution Optimization Master Plan and ONTARIO BUILDING CODE

WALTERFEDY

Project	525-565 Conestogo Road W., Plan of Subdivision
Project #	2019-0654-10
Designer	Zack Schnurr
Address	Waterloo, Ontario
Description	Overall Domestic Flows

Building Description	Area (ha) / Units	Density (ppu)	Population	Operating Hours	Demand	Max Daily Peak Factor	Max Hourly Peak Factor	Max Daily Demand (L/s)	Peak Hour Demand (L/s)	Average Day Demand (L/s)	Node
Block 1											
Residential	225	1.76	396	-	225 L/cap/day	1.42	3.0	1.464	3.094	1.031	
Commercial	0.105			16	42000 L/ha/day	1.42	3.0	0.072	0.153	0.051	
Total Block 1				-				1.537	3.247	1.082	Block1
Block 2											
Residential	250	1.76	440	-	225 L/cap/day	1.42	3.0	1.627	3.438	1.146	
Commercial	0.064			16	42000 L/ha/day	1.42	3.0	0.044	0.093	0.031	
Total Block 2				-				1.671	3.531	1.177	Block2
Block 3											
Residential	676	1.76	1190	-	225 L/cap/day	1.42	3.0	4.401	9.297	3.099	
Total Block 3				-				4.401	9.297	3.099	Block3
Block 4											
Residential		1.76	0	-	225 L/cap/day	1.42	3.0	0.000	0.000	0.000	
Total Block 4				-				0.000	0.000	0.000	Block4
Block 5											
Residential	628	1.76	1105	-	225 L/cap/day	1.42	3.0	4.086	8.633	2.878	
Total Block 5				-				4.086	8.633	2.878	Block5
Block 6											
Residential	270	1.76	475	-	225 L/cap/day	1.42	3.0	1.757	3.711	1.237	
Commercial	0.049			16	42000 L/ha/day	1.42	3.0	0.034	0.071	0.024	
Total Block 6				-				1.790	3.782	1.261	Block6
Block 7											
Residential	126	1.76	222	-	225 L/cap/day	1.42	3.0	0.821	1.734	0.578	
Institutional - Day-Care	0.371			16	42000 L/ha/day	1.42	3.0	0.256	0.541	0.180	
Total Block 7				-				1.077	2.275	0.758	Block7
Block 8											
Residential	618	1.76	1088	-	225 L/cap/day	1.42	3.0	4.023	8.500	2.833	
Total Block 8				-				4.023	8.500	2.833	Block8
Block 9											
Residential	560	1.76	986	-	225 L/cap/day	1.42	3.0	3.646	7.703	2.568	
Total Block 9				-				3.646	7.703	2.568	Block9

APPENDIX C2 – NETWORK CONFIGURATION

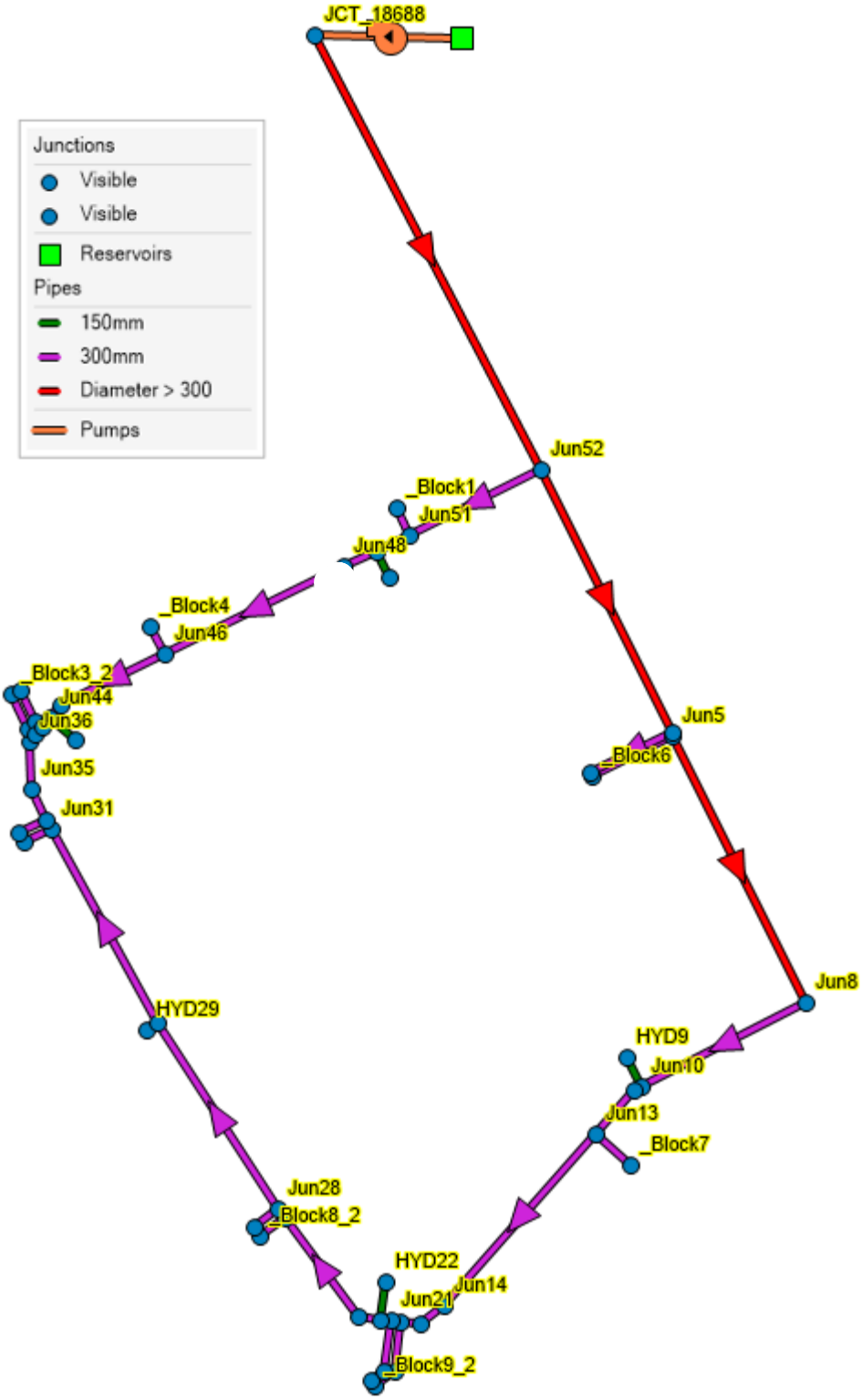


TABLE C-3 - FIRE WATER DEMAND

WALTERFEDY

DGSSMS 2021, Water Supply and Distribution Optimization Master Plan and ONTARIO BUILDING CODE

Project	525-565 Conestogo Road W., Plan of Subdivision
Project #	2019-0654-10
Designer	Rushin Khakharia
Address	Kitchener, Ontario
Description	Overall Domestic Flows

Building Description	Required Fire Flow (L/s)	Maximum Day Domestic Demand (L/s)	Total Demand (L/s)	Pipe Size (mm)	Velocity (m/s)
Block 1	200.00	1.537	201.54	300	2.85
Block 2	200.00	1.671	201.67	300	2.85
Block 3	200.00	4.401	204.40	300	2.89
Block 4			0.00	300	0.00
Block 5	200.00	4.086	204.09	300	2.89
Block 6	200.00	1.790	201.79	300	2.85
Block 7	200.00	1.077	201.08	300	2.84
Block 8	200.00	4.023	204.02	300	2.89
Block 9	200.00	3.646	203.65	300	2.88

Region of Waterloo

TRANSPORTATION AND
ENVIRONMENTAL SERVICES
Water Services

150 Frederick Street
Kitchener ON Canada N2G 4J3
Telephone: (519) 575-4426
Fax: (519) 575-4452
www.region.waterloo.on.ca

Date: June 25, 2020
File #: E18-10/WA

Rushin Khakharia, P. Eng.
WalterFedy
675 Queen St S., Suite 111
Kitchener, ON N2M 1A1
t. 519.576.2150 ext 469
e.rkhakharia@walterfedy.com

Dear: Rushin

Re: Kraus Flooring
525-565 Conestogo Rd W., Waterloo

Please find the results of the modeling simulations for boundary conditions requested on May 14, 2020. The results included a figure showing the locations of the nodes from the Region's model. Attached are a series of spreadsheets containing results for Average Day, Maximum Day demands and available fire flows at Northfield Dr and Conestogo Rd.

The diurnal 24 hour demand distribution accounts for the minimum hour and peak hour peaking factors. The minimum hourly demand on the average day represents the minimum hour, and the maximum hourly demand on the maximum day represents the peak hour.

Demands applied to the request as noted:

Node	Elevation (mASL)	Res Dmd		Emp Dmd		Fire Flow Results	
		ADD (L/s)	MDD (L/s)	ADD (L/s)	MDD (L/s)	Design Flow (L/s)	Design Pressure (m)
JCT_18688	341.00	9.98	14.17	1.68	2.38	798.9	15.9

A fire flow analysis shows the maximum flow available at a node with an associated design pressure during the maximum day scenario while maintaining the minimum design pressure of 14 m (140 kPa) at all nodes within the pressure zone.

If you have any questions, please contact me.

Kevin Dolishny P.Eng.
Senior Project Engineer, Servicing and Development Planning
t. 519.575.4757 x 3862
e-mail: kdolishny@regionofwaterloo.ca

cc John Holowackyj. Region of Waterloo

Wat 4 Infowater Intersection of Northfield at Conestogo Rd

JCT_18688 Average Day 24 Hour Simulation

Time	Demand (L/s)	Head (m)	Pressure (m)
00:00 hrs	7.35	379.48	38.48
01:00 hrs	5.77	379.91	38.91
02:00 hrs	6.17	382.24	41.24
03:00 hrs	6.43	382.42	41.42
04:00 hrs	5.80	382.94	41.94
05:00 hrs	5.02	383.21	42.21
06:00 hrs	7.43	382.41	41.41
07:00 hrs	14.28	380.41	39.41
08:00 hrs	17.44	379.31	38.31
09:00 hrs	15.39	378.23	37.23
10:00 hrs	15.17	378.01	37.01
11:00 hrs	14.83	377.75	36.75
12:00 hrs	14.20	377.60	36.60
13:00 hrs	13.53	377.53	36.53
14:00 hrs	12.72	377.50	36.50
15:00 hrs	11.92	377.56	36.56
16:00 hrs	12.38	377.54	36.54
17:00 hrs	12.86	378.34	37.34
18:00 hrs	14.29	378.50	37.50
19:00 hrs	15.15	378.60	37.60
20:00 hrs	15.02	378.75	37.75
21:00 hrs	14.03	378.97	37.97
22:00 hrs	12.59	379.22	38.22
23:00 hrs	10.33	379.55	38.55

Average Day HGL:	379.42
Minimum Hour:	383.21

JCT_18688 Maximum Day 24 Hour Simulation

Time	Demand (L/s)	Head (m)	Pressure (m)
00:00 hrs	8.94	379.96	38.96
01:00 hrs	6.30	382.23	41.23
02:00 hrs	6.79	382.30	41.30
03:00 hrs	7.73	379.30	38.30
04:00 hrs	7.62	379.48	38.48
05:00 hrs	6.74	379.69	38.69
06:00 hrs	12.02	378.93	37.93
07:00 hrs	22.01	377.46	36.46
08:00 hrs	25.24	377.90	36.90
09:00 hrs	20.18	379.12	38.12
10:00 hrs	16.78	379.47	38.47
11:00 hrs	15.97	379.54	38.54
12:00 hrs	14.82	378.66	37.66
13:00 hrs	16.49	377.53	36.53
14:00 hrs	18.81	377.43	36.43
15:00 hrs	16.83	377.39	36.39
16:00 hrs	20.56	378.17	37.17
17:00 hrs	21.22	376.86	35.86
18:00 hrs	24.47	377.33	36.33
19:00 hrs	26.39	375.73	34.73
20:00 hrs	26.34	376.46	35.46
21:00 hrs	23.96	377.45	36.45
22:00 hrs	17.52	377.71	36.71
23:00 hrs	13.17	378.32	37.32

Maximum Day HGL:	378.52
Peak Hour:	375.73

Wat 4 Infowater

Intersection of Northfield at Conestogo Rd

Available Flow (L/s)	Residual Pressure (m)
0.0	37.8
25.0	37.6
50.0	37.3
75.0	37.0
100.0	36.6
125.0	36.3
150.0	35.9
175.0	35.5
200.0	35.0
225.0	34.5
250.0	34.0
275.0	33.4
300.0	32.8
325.0	32.2
350.0	31.6
375.0	30.9
400.0	30.2
425.0	29.5
450.0	28.8
475.0	28.0
500.0	27.2
525.0	26.4
550.0	25.6
575.0	24.7
600.0	23.8
625.0	22.9
650.0	22.0
675.0	21.0
700.0	20.0
725.0	19.0
750.0	18.0
775.0	16.9
798.9	15.9

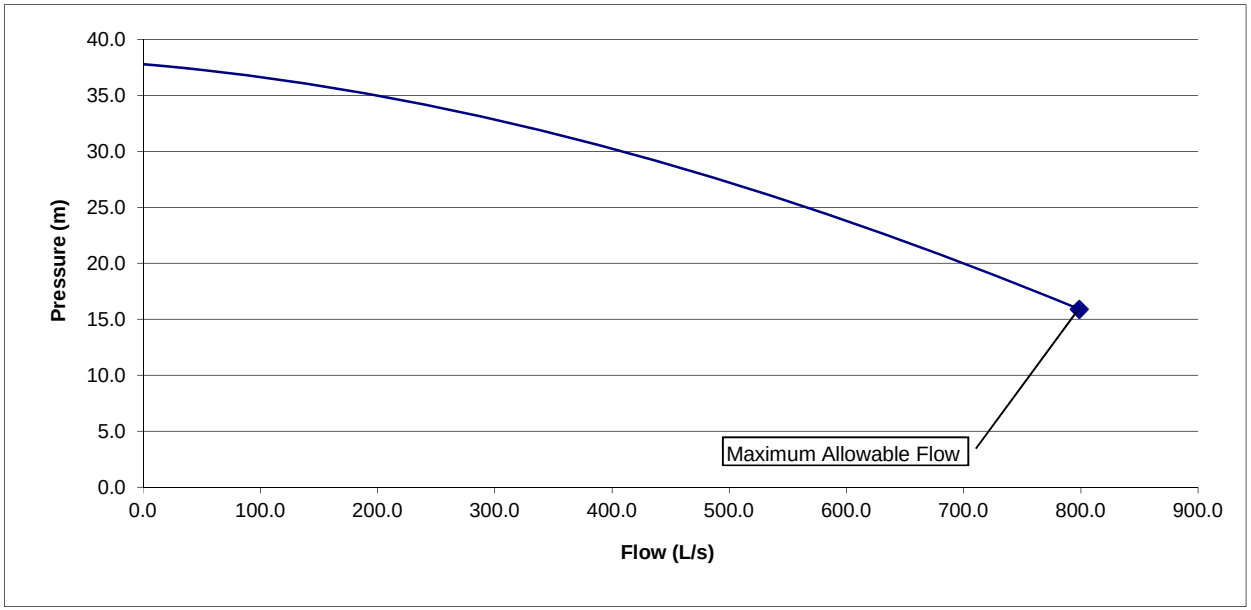
Fire Flow Analysis

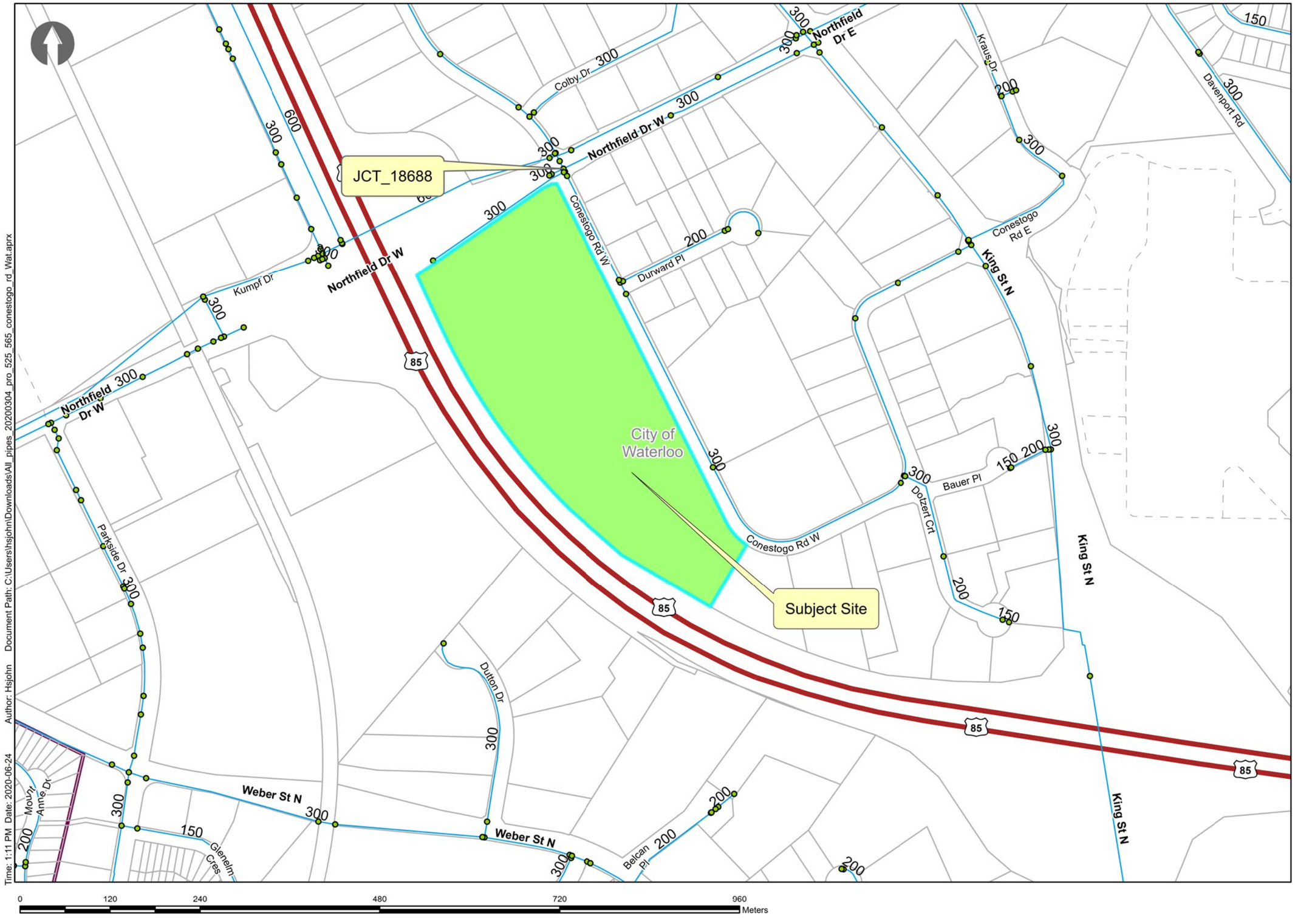
Fire Flow Node:	JCT_18688
Design Flow (L/s):	798.9
	15.9

The final adjusted flow at the node to maintain the minimum design pressure (14m (140 kPa)) at ALL locations within the pressure zone.

The lowest allowable pressure at the node to maintain the minimum design pressure (14m (140 kPa)) at ALL locations within the pressure zone.

The constraining node within the pressure zone that drops to the minimum design pressure of (14m (140 kPa)) during the design flow.





Time: 1:11 PM Date: 2020-06-24 Author: Hsjohn Document Path: C:\Users\hsjohn\Downloads\All_pipes_20200304_pro_525_565_conestogo_rd_Wat.aprx

Region of Waterloo

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Water Services

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Legend

- Junction
  - TYPE
    - Active
    - Domain
- Tank
  - TYPE
    - Active
    - Domain
- Reservoir
  - TYPE
    - Active
    - Domain
- Pump
  - TYPE
    - Active
    - Domain
- Valve
  - TYPE
    - Active
    - Domain
- Pipe
  - TYPE
    - Active
    - Domain
    - Subject Site
    - Assessment Parcels (MPAC)
- Roads
  - Roads
    - Highway
    - Arterial/Collector
    - Local
    - Private
    - Proposed Roads
- Pressure Zones
  - Pressure Zone
- Non modelling data Layer
  - Regional Municipal Boundaries
  - Assessment Parcels (MPAC)

525-565 Conestogo Rd W, Waterloo

Appendix C5 - Average Day Results

Network Table - Nodes

Node ID	Elevation (m)	Demand (LPS)	Head (m)	Pressure (m)
_Block1	337.745	1.194	378.652	40.907
_Block2	336.612	1.422	378.653	42.041
_Block3	337.006	3.255	378.648	41.642
_Block3_2	337.007	0	378.648	41.641
_Block4	337.018	1.099	378.649	41.631
_Block5	336.833	2.865	378.648	41.815
_Block5_2	336.821	0	378.648	41.827
_Block6	336.592	1.422	378.653	42.061
_Block7	335.300	0.979	378.651	43.351
_Block8	336.033	2.865	378.648	42.615
_Block8_2	336.016	0	378.648	42.632
_Block9	335.840	3.227	378.648	42.808
_Block9_2	335.845	0	378.649	42.804
HYD22	335.672	0	378.649	42.977
HYD29	336.325	0	378.648	42.323
HYD43	336.917	0	378.648	41.731
HYD49	337.586	0	378.651	41.065
HYD9	335.102	0	378.651	43.549
JCT_18688	341.000	0	378.653	37.653
Jun10	334.926	0	378.651	43.725
Jun11	334.946	0	378.651	43.705
Jun13	335.047	0	378.651	43.604
Jun14	335.441	0	378.649	43.208
Jun15	335.454	0	378.649	43.195
Jun17	335.761	0	378.649	42.888
Jun18	335.510	0	378.649	43.139
Jun20	335.782	0	378.648	42.866
Jun21	335.530	0	378.649	43.119
Jun23	335.545	0	378.649	43.104
Jun24	335.552	0	378.648	43.096
Jun26	335.798	0	378.648	42.85
Jun28	335.816	0	378.648	42.832
Jun30	336.206	0	378.648	42.442
Jun31	336.593	0	378.648	42.055
Jun34	336.611	0	378.648	42.037
Jun35	336.662	0	378.648	41.986
Jun36	336.714	0	378.648	41.934
Jun39	336.703	0	378.648	41.945
Jun40	336.730	0	378.648	41.918
Jun41	336.744	0	378.648	41.904
Jun42	336.769	0	378.648	41.879
Jun44	336.792	0	378.648	41.856
Jun45	336.811	0	378.649	41.838
Jun46	337.018	0	378.649	41.631
Jun48	337.368	0	378.651	41.283
'Jun5	336.490	0	378.653	42.163
Jun50	337.432	0	378.651	41.219
Jun51	337.495	0	378.652	41.157
Jun52	337.824	0	378.653	40.829
Jun7	336.514	0	378.653	42.139
Jun8	334.780	0	378.653	43.873

Appendix C6 - Maximum Day Results

Network Table - Nodes

Node ID	Elevation (m)	Demand (LPS)	Head (m)	Pressure (m)
_Block1	337.745	1.695	378.584	40.839
_Block2	336.612	2.019	378.588	41.976
_Block3	337.006	4.623	378.578	41.572
_Block4	337.018	1.561	378.58	41.562
_Block5	336.833	4.068	378.578	41.745
_Block5_2	336.821	0	378.578	41.757
_Block6	336.592	2.019	378.588	41.996
_Block7	335.3	1.391	378.583	43.283
_Block8	336.033	4.068	378.578	42.545
_Block8_2	336.016	0	378.578	42.562
_Block9	335.84	4.582	378.578	42.738
_Block9_2	335.845	0	378.579	42.734
Block3_2	337.007	0	378.578	41.571
HYD22	335.672	0	378.578	42.906
HYD29	336.325	0	378.578	42.253
HYD43	336.917	0	378.578	41.661
HYD49	337.586	0	378.584	40.998
HYD9	335.102	0	378.584	43.482
JCT_18688	341	0	378.588	37.588
Jun10	334.926	0	378.584	43.658
Jun11	334.946	0	378.584	43.638
Jun13	335.047	0	378.583	43.536
Jun14	335.441	0	378.579	43.138
Jun15	335.454	0	378.579	43.125
Jun17	335.761	0	378.579	42.818
Jun18	335.51	0	378.579	43.069
Jun20	335.782	0	378.578	42.796
Jun21	335.53	0	378.578	43.048
Jun23	335.545	0	378.578	43.033
Jun24	335.552	0	378.578	43.026
Jun26	335.798	0	378.578	42.78
Jun28	335.816	0	378.578	42.762
Jun30	336.206	0	378.578	42.372
Jun31	336.593	0	378.578	41.985
Jun34	336.611	0	378.578	41.967
Jun35	336.662	0	378.578	41.916
Jun36	336.714	0	378.578	41.864
Jun39	336.703	0	378.578	41.875
Jun40	336.73	0	378.578	41.848
Jun41	336.744	0	378.578	41.834
Jun42	336.769	0	378.578	41.809
Jun44	336.792	0	378.578	41.786
Jun45	336.811	0	378.578	41.767
Jun46	337.018	0	378.58	41.562
Jun48	337.368	0	378.583	41.215
Jun5	336.49	0	378.588	42.098
Jun50	337.432	0	378.584	41.152
Jun51	337.495	0	378.584	41.089
Jun52	337.824	0	378.588	40.764
Jun7	336.514	0	378.588	42.074
Jun8	334.78	0	378.588	43.808

Appendix C7 - Maximum Available Flows

Analysis Node	Domestic Flow (LPS)	Available Fire Flow (LPS)	Elevation (m)	Residual Pressure at Needed Fire Flow (m)	Minimum Pressure (m)	Node with Minimum Pressure
_Block1	1.695	738.2	378.58	37.1	14.1	_Block1
_Block2	2.019	795.3	378.59	38.5	14.1	_Block2
_Block3	4.623	646.7	378.58	37.1	14.1	_Block3
_Block3_2	0.000	644.1	378.58	37.1	14.1	_Block3_2
_Block4	1.561	673.1	378.58	37.3	14.1	_Block4
_Block5	4.068	647.3	378.58	37.3	14.1	_Block5
_Block5_2	0.000	647.2	378.58	37.3	14.1	_Block5_2
_Block6	2.019	795.6	378.59	38.5	14.1	_Block6
_Block7	1.391	728.1	378.58	39.3	14.1	_Block7
_Block8	4.068	656.2	378.58	38.1	14.1	_Block8
_Block8_2	0.000	657.3	378.58	38.1	14.1	_Block8_2
_Block9	4.582	651.4	378.58	38.2	14.1	_Block9
_Block9_2	0.000	649.2	378.58	38.2	14.1	_Block9_2
HYD22	0.000	387.6	335.67	33.6	14.1	HYD22
HYD29	0.000	509.5	336.33	36.1	14.1	HYD29
HYD43	0.000	398.1	336.92	33.0	14.1	HYD43
HYD49	0.000	427.3	337.59	33.4	14.1	HYD49
HYD9	0.000	434.0	335.10	35.5	14.1	HYD9
JCT_18688	0.000	815.8	341.00	34.5	14.1	JCT_18688
Jun10	0.000	795.9	334.93	40.0	14.1	HYD9
Jun11	0.000	792.8	334.95	40.0	14.1	_Block7
Jun13	0.000	765.0	335.05	39.7	14.1	_Block7
Jun14	0.000	707.3	335.44	39.0	14.1	_Block9_2
Jun15	0.000	699.2	335.45	38.9	14.1	_Block9_2
Jun17	0.000	662.9	335.76	38.4	14.1	_Block9_2
Jun18	0.000	694.4	335.51	38.9	14.1	_Block9_2
Jun20	0.000	661.3	335.78	38.3	14.1	_Block9
Jun21	0.000	693.2	335.53	38.8	14.1	_Block9
Jun23	0.000	694.3	335.55	38.8	14.1	HYD22
Jun24	0.000	693.3	335.55	38.8	14.1	Jun24
Jun26	0.000	675.6	335.80	38.4	14.1	Jun26
Jun28	0.000	674.7	335.82	38.4	14.1	_Block8
Jun30	0.000	664.4	336.21	38.0	14.1	HYD29
Jun31	0.000	665.1	336.59	37.7	14.1	_Block5_2
Jun34	0.000	665.7	336.61	37.6	14.1	_Block5
Jun35	0.000	671.0	336.66	37.6	14.1	Jun35
Jun36	0.000	672.8	336.71	37.6	14.1	Jun36
Jun39	0.000	665.7	336.70	37.6	14.1	_Block3_2
Jun40	0.000	667.2	336.73	37.6	14.1	_Block3
Jun41	0.000	671.4	336.74	37.6	14.1	_Block3_2
Jun42	0.000	672.5	336.77	37.6	14.1	_Block3
Jun44	0.000	675.0	336.79	37.5	14.1	_Block3
Jun45	0.000	679.0	336.81	37.5	14.1	Jun45
Jun46	0.000	694.0	337.02	37.5	14.1	Jun46
Jun48	0.000	741.7	337.37	37.5	14.1	Jun48
Jun5	0.000	815.8	336.49	39.0	14.1	Jun5
Jun50	0.000	752.2	337.43	37.5	14.1	HYD49
Jun51	0.000	766.4	337.50	37.5	14.1	_Block1
Jun52	0.000	815.8	337.82	37.7	14.1	JCT_18688
Jun7	0.000	815.8	336.51	39.0	14.1	JCT_18688
Jun8	0.000	815.8	334.78	40.7	14.1	JCT_18688

```
[TITLE]
[JUNCTIONS]
;ID              Elev         Demand       Pattern
;--------------- ------------ ------------ ----------------
JCT_18688        341          0
_Block4          337.018      1.561
_Block1          337.745      1.695
_Block6          336.592      2.019
Jun5             336.49       0
_Block2          336.612      2.019
Jun7             336.514      0
Jun8             334.78       0
HYD9             335.102      0
Jun10            334.926      0
Jun11            334.946      0
_Block7          335.3        1.391
Jun13            335.047      0
Jun14            335.441      0
Jun15            335.454      0
_Block9_2        335.845      0
Jun17            335.761      0
Jun18            335.51       0
_Block9          335.84       4.582
Jun20            335.782      0
Jun21            335.53       0
HYD22            335.672      0
Jun23            335.545      0
Jun24            335.552      0
_Block8_2        336.016      0
Jun26            335.798      0
_Block8          336.033      4.068
Jun28            335.816      0
HYD29            336.325      0
Jun30            336.206      0
Jun31            336.593      0
_Block5_2        336.821      0
_Block5          336.833      4.068
Jun34            336.611      0
Jun35            336.662      0
Jun36            336.714      0
Block3_2         337.007      0
_Block3          337.006      4.623
Jun39            336.703      0
Jun40            336.73       0
Jun41            336.744      0
Jun42            336.769      0
HYD43            336.917      0
Jun44            336.792      0
```

```
Jun45             336.811      0
Jun46             337.018      0
Jun48             337.368      0
HYD49             337.586      0
Jun50             337.432      0
Jun51             337.495      0
Jun52             337.824      0

[RESERVOIRS]
;ID               Head         Pattern
;---------------- ------------ ----------------
WAT4              341

[TANKS]
;ID               Elevation    InitLevel    MinLevel     MaxLevel     Diameter
MinVol       VolCurve         Overflow
;---------------- ------------ ------------ ------------ ------------ ------------
------------ ---------------- --------

[PIPES]
;ID               Node1            Node2            Length       Diameter
Roughness    MinorLoss    Status
;---------------- ---------------- ---------------- ------------ ------------
------------ ------------ ------
Pi1               JCT_18688        Jun52            124.482      3000         150
      0            Open
Pi2               Jun10            Jun8             46.862       300          150
      0            Open
Pi3               HYD9             Jun10            8.248        150          150
      0            Open
Pi4               Jun11            Jun10            1.92         300          150
      0            Open
Pi5               Jun13            Jun11            15.178       300          150
      0            Open
Pi6               _Block7          Jun13            11.544       300          150
      0            Open
Pi7               Jun14            Jun13            57.941       300          150
      0            Open
Pi8               Jun15            Jun14            7.946        300          150
      0            Open
Pi9               Jun20            _Block9          4.442        300          150
      0            Open
Pi10              Jun17            _Block9_2        6.137        300          150
      0            Open
Pi11              Jun18            Jun17            12.779       300          150
      0            Open
Pi12              Jun21            Jun20            12.779       300          150
      0            Open
```

```
Pi13            Jun18           Jun15           4.982       300         150
     0            Open
Pi14            Jun21           Jun18           2.5         300         150
     0            Open
Pi15            Jun23           Jun21           2.649       300         150
     0            Open
Pi16            HYD22           Jun23           9.816       150         150
     0            Open
Pi17            Jun24           Jun23           5.862       300         150
     0            Open
Pi18            Jun26           Jun24           31.233      300         150
     0            Open
Pi19            Jun26           _Block8_2       7.801       300         150
     0            Open
Pi20            Jun28           _Block8         7.801       300         150
     0            Open
Pi21            Jun30           Jun28           56.708      300         150
     0            Open
Pi22            Jun28           Jun26           2.5         300         150
     0            Open
Pi23            Jun30           HYD29           3.352       150         150
     0            Open
Pi24            Jun31           Jun30           56.191      300         150
     0            Open
Pi25            Jun31           _Block5_2       7.796       300         150
     0            Open
Pi26            Jun34           Jun31           2.5         300         150
     0            Open
Pi27            Jun34           _Block5         7.801       300         150
     0            Open
Pi28            Jun35           Jun34           8.6         300         150
     0            Open
Pi29            Jun36           Jun35           12.248      300         150
     0            Open
Pi30            Jun41           Jun36           2.453       300         150
     0            Open
Pi31            HYD43           Jun44           8.408       150         150
     0            Open
Pi32            Jun39           Block3_2        9.42        300         150
     0            Open
Pi33            Jun41           Jun39           2.305       300         150
     0            Open
Pi34            Jun42           Jun41           2.501       300         150
     0            Open
Pi35            Jun40           _Block3         8.652       300         150
     0            Open
Pi36            Jun42           Jun40           2.107       300         150
     0            Open
```

```
Pi37             Jun44            Jun42            2.807        300          150
      0            Open
Pi38             Jun45            Jun44            4.489        300          150
      0            Open
Pi39             Jun45            Jun46            29.283       300          150
      0            Open
Pi40             _Block4          Jun46            7.8          300          150
      0            Open
Pi41             _Block1          Jun51            7.727        300          150
      0            Open
Pi42             Jun5             Jun8             75.558       3000         150
      0            Open
Pi43             Jun52            Jun7             74.765       3000         150
      0            Open
Pi44             Jun7             Jun5             1            3000         150
      0            Open
Pi45             Jun5             _Block6          22.808       300          150
      0            Open
Pi46             Jun7             _Block2          22.756       300          150
      0            Open
Pi48             Jun48            Jun46            50.789       300          150
      0            Open
Pi49             Jun50            Jun48            9.296        300          150
      0            Open
Pi50             Jun50            HYD49            7.448        150          150
      0            Open
Pi51             Jun51            Jun50            9.235        300          150
      0            Open
Pi52             Jun52            Jun51            37.447       300          150
      0            Open

[PUMPS]
;ID              Node1            Node2            Parameters
;---------------- ---------------- ---------------- ------------
Pu1              WAT4             JCT_18688        HEAD Curve1 SPEED 1

[VALVES]
;ID              Node1            Node2            Diameter     Type Setting
MinorLoss
;---------------- ---------------- ---------------- ------------ ---- ------------
------------

[DEMANDS]
;Junction        Demand       Pattern          Category
;---------------- ------------ ---------------- ----------------

[STATUS]
;ID              Status/Setting
```

```
;--------------- ----------------

[PATTERNS]
;ID              Multipliers
;--------------- ----------------

[CURVES]
;ID              X-Value      Y-Value
;--------------- ------------ ------------
;PUMP:           Headloss from JCT_18688
Curve1           0            37.8
Curve1           25           37.6
Curve1           50           37.3
Curve1           75           37
Curve1           100          36.6
Curve1           125          36.3
Curve1           150          35.9
Curve1           175          35.5
Curve1           200          35
Curve1           225          34.5
Curve1           250          34
Curve1           275          33.4
Curve1           300          32.8
Curve1           325          32.2
Curve1           350          31.6
Curve1           375          30.9
Curve1           400          30.2
Curve1           425          29.5
Curve1           450          28.8
Curve1           475          28
Curve1           500          27.2
Curve1           525          26.4
Curve1           550          25.6
Curve1           575          24.7
Curve1           600          23.8
Curve1           625          22.9
Curve1           650          22
Curve1           675          21
Curve1           700          20
Curve1           725          19
Curve1           750          18
Curve1           775          16.9
Curve1           798.9        15.9

[ENERGY]
Global Efficiency   75
Global Price        0
Demand Charge       0
```

```
[EMITTERS]
;Junction        Coefficient
;--------------- ----------------

[QUALITY]
;Node            InitQual
;--------------- ----------------

[SOURCES]
;Node            Type         Quality      Pattern
;--------------- ------------ ------------ ----------------

[REACTIONS]
Order Bulk             1
Order Tank             1
Order Wall             1
Global Bulk            0
Global Wall            0
Limiting Potential     0
Roughness Correlation  0

[REACTIONS]
;Type     Pipe/Tank        Coefficient
;-------- ---------------- ----------------

[MIXING]
;Tank            Model
;--------------- ------------

[OPTIONS]
Units               LPS
Headloss            H-W
Specific Gravity    1
Viscosity           1
Trials              40
Accuracy            0.001
CHECKFREQ           2
MAXCHECK            10
DAMPLIMIT           0
Unbalanced          Continue 10
Pattern             1
Demand Multiplier   1.0
Emitter Exponent    0.5
Quality             None mg/L
Diffusivity         1.0
Tolerance           0.01
```

```
[REPORT]
Status              No
Summary             No
Page                0

[TIMES]
Duration            00:00
Hydraulic Timestep  01:00
Quality Timestep    00:05
Pattern Timestep    01:00
Pattern Start       00:00
Report Timestep     01:00
Report Start        00:00
Start ClockTime     12 am
Statistic           NONE

[TAGS]

[COORDINATES]
;Node            X-Coord          Y-Coord
;--------------- ---------------- ----------------
JCT_18688        537386.044       4816452.374
_Block4          537344.208       4816301.828
_Block1          537406.495       4816332.251
_Block6          537456.488       4816263.969
Jun5             537476.982       4816273.978
_Block2          537456.089       4816264.887
Jun7             537476.537       4816274.873
Jun8             537510.732       4816206.377
HYD9             537465.184       4816192.611
Jun10            537468.903       4816185.249
Jun11            537467.189       4816184.384
_Block7          537465.861       4816165.36
Jun13            537457.182       4816172.972
Jun14            537418.98        4816129.409
Jun15            537412.676       4816124.572
_Block9_2        537401.2         4816108.816
Jun17            537406.069       4816112.552
Jun18            537407.737       4816125.222
_Block9          537400.066       4816110.174
Jun20            537403.59        4816112.878
Jun21            537405.258       4816125.548
HYD22            537403.913       4816135.626
Jun23            537402.632       4816125.894
Jun24            537396.82        4816126.659
_Block8_2        537371.864       4816147.205
Jun26            537378.21        4816151.742
_Block8          537370.41        4816149.239
```

```
Jun28            537376.756       4816153.776
HYD29            537342.971       4816199.476
Jun30            537345.793       4816201.285
Jun31            537318.886       4816250.615
_Block5_2        537311.881       4816247.194
_Block5          537310.746       4816249.422
Jun34            537317.756       4816252.845
Jun35            537313.965       4816260.564
Jun36            537313.207       4816272.789
Block3_2         537308.97        4816284.618
_Block3          537311.113       4816285.671
Jun39            537313.104       4816276.154
Jun40            537314.908       4816277.896
Jun41            537314.831       4816274.627
Jun42            537316.487       4816276.501
HYD43            537324.854       4816273.28
Jun44            537318.346       4816278.604
Jun45            537321.318       4816281.968
Jun46            537347.631       4816294.819
Jun48            537393.268       4816317.108
HYD49            537404.877       4816314.519
Jun50            537401.609       4816321.212
Jun51            537409.886       4816325.308
Jun52            537443.448       4816341.917
WAT4             537423.415       4816451.596

[VERTICES]
;Link            X-Coord          Y-Coord
;--------------- ---------------- ----------------
```

APPENDIX D

Stormwater Management

- Stormceptor Sizing, Details and Specifications

Stormceptor®

Rinker MATERIALS™

Stormceptor® EF Sizing Report

Imbrium® Systems
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

09/29/2023

Province:	Ontario
City:	Waterloo
Nearest Rainfall Station:	WATERLOO WELLINGTON AP
Climate Station Id:	6149387
Years of Rainfall Data:	34

Site Name:	Kraus Fine

Drainage Area (ha):	3.635
% Imperviousness:	90.00

Runoff Coefficient 'c': 0.84

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0

Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	115.69
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Influent TSS Concentration (mg/L):	200
Estimated Average Annual Sediment Load (kg/yr):	3706
Estimated Average Annual Sediment Volume (L/yr):	3013

Project Name:	Kraus Flooring
Project Number:	2019-0654
Designer Name:	Rushin Khakharia
Designer Company:	WalterFedy
Designer Email:	rkhakharia@walterfedy.com
Designer Phone:	226-929-4607
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	47
EFO6	63
EFO8	74
EFO10	81
EFO12	86

Recommended Stormceptor EFO Model: EFO10

Estimated Net Annual Sediment (TSS) Load Reduction (%): 81

Water Quality Runoff Volume Capture (%): > 90

imbrium

THIRD-PARTY TESTING AND VERIFICATION

►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterwavs.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

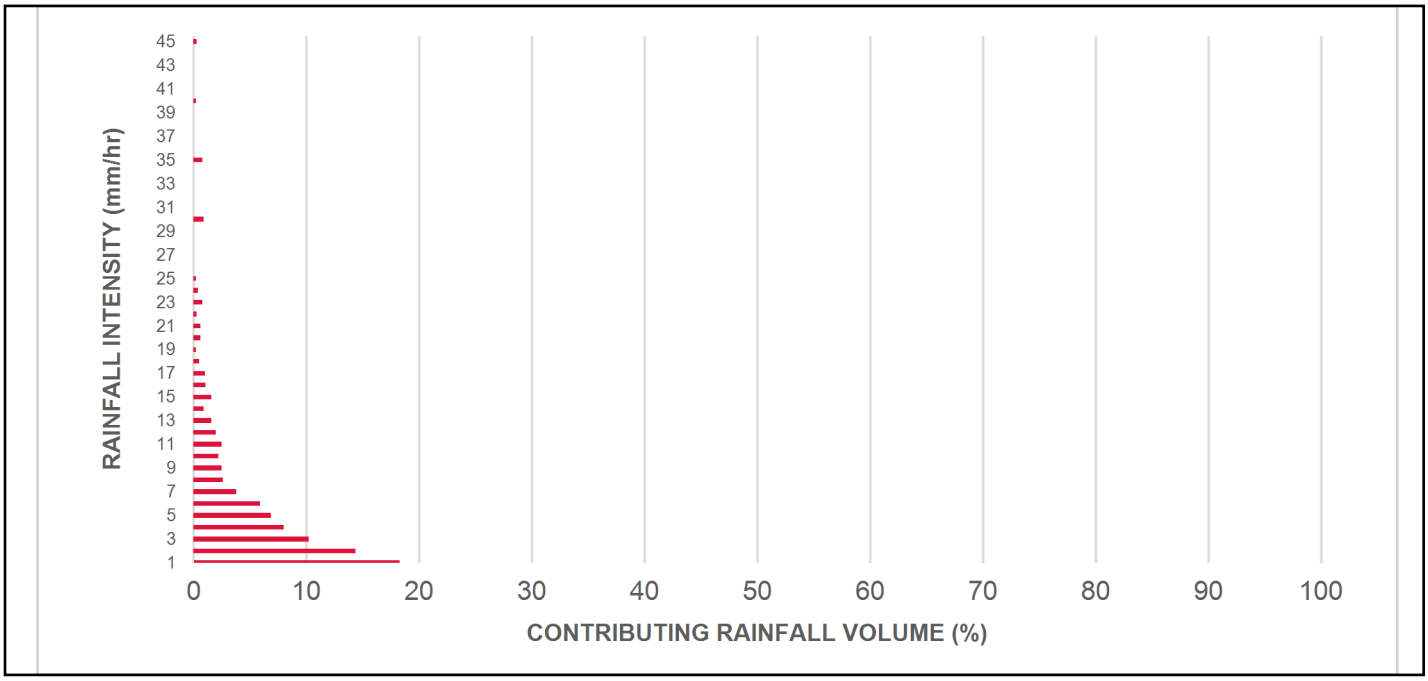
Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Stormceptor® EF Sizing Report

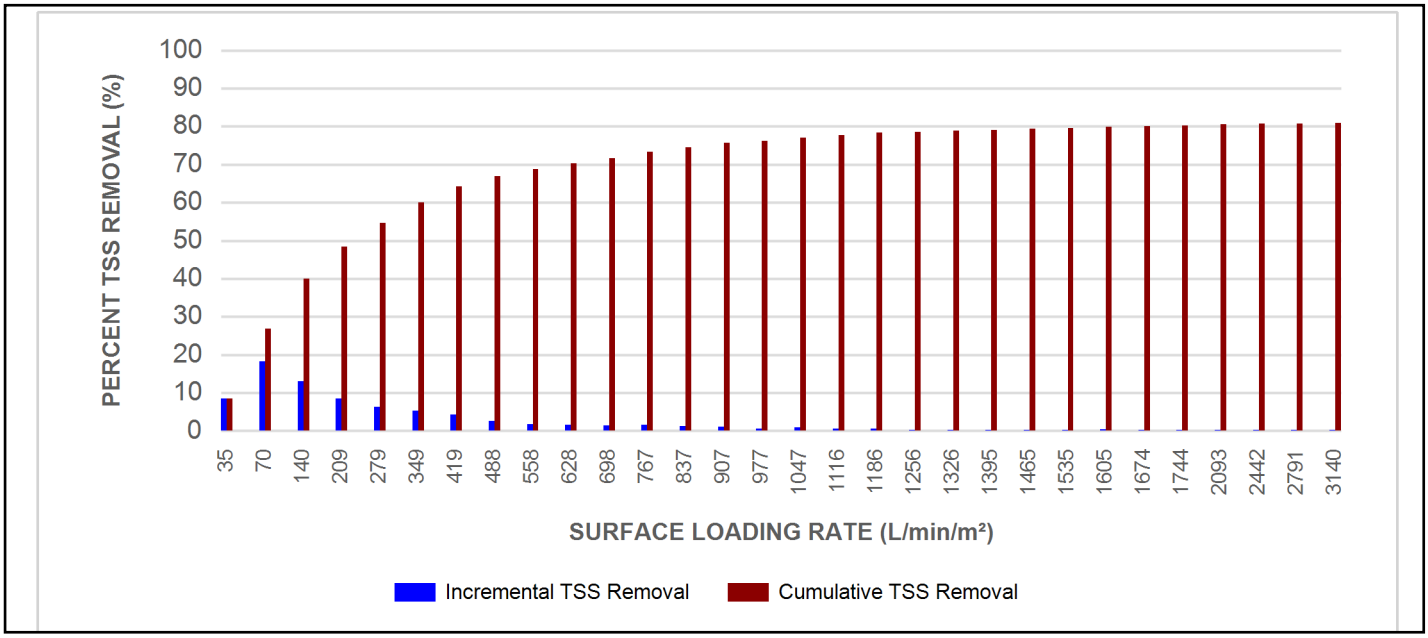
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	8.5	8.5	4.24	255.0	35.0	100	8.5	8.5
1.00	18.3	26.8	8.49	509.0	70.0	100	18.3	26.8
2.00	14.4	41.3	16.98	1019.0	140.0	91	13.1	39.9
3.00	10.2	51.5	25.47	1528.0	209.0	83	8.4	48.4
4.00	8.0	59.5	33.95	2037.0	279.0	79	6.4	54.7
5.00	6.9	66.4	42.44	2547.0	349.0	77	5.3	60.0
6.00	5.9	72.3	50.93	3056.0	419.0	73	4.3	64.3
7.00	3.8	76.1	59.42	3565.0	488.0	70	2.7	67.0
8.00	2.6	78.7	67.91	4074.0	558.0	67	1.7	68.7
9.00	2.5	81.1	76.40	4584.0	628.0	64	1.6	70.3
10.00	2.2	83.3	84.88	5093.0	698.0	64	1.4	71.7
11.00	2.5	85.8	93.37	5602.0	767.0	63	1.6	73.3
12.00	2.0	87.8	101.86	6112.0	837.0	63	1.3	74.5
13.00	1.6	89.4	110.35	6621.0	907.0	62	1.0	75.6
14.00	0.9	90.4	118.84	7130.0	977.0	62	0.6	76.1
15.00	1.6	91.9	127.33	7640.0	1047.0	61	0.9	77.1
16.00	1.1	93.0	135.82	8149.0	1116.0	59	0.6	77.7
17.00	1.0	94.0	144.30	8658.0	1186.0	57	0.6	78.3
18.00	0.5	94.6	152.79	9168.0	1256.0	56	0.3	78.6
19.00	0.2	94.8	161.28	9677.0	1326.0	54	0.1	78.8
20.00	0.6	95.4	169.77	10186.0	1395.0	53	0.3	79.1
21.00	0.6	96.1	178.26	10695.0	1465.0	50	0.3	79.4
22.00	0.3	96.4	186.75	11205.0	1535.0	48	0.1	79.5
23.00	0.8	97.2	195.23	11714.0	1605.0	46	0.4	79.9
24.00	0.4	97.6	203.72	12223.0	1674.0	44	0.2	80.1
25.00	0.2	97.8	212.21	12733.0	1744.0	42	0.1	80.2
30.00	0.9	98.7	254.65	15279.0	2093.0	35	0.3	80.5
35.00	0.8	99.5	297.10	17826.0	2442.0	30	0.3	80.7
40.00	0.2	99.7	339.54	20372.0	2791.0	27	0.1	80.8
45.00	0.3	100.0	381.98	22919.0	3140.0	24	0.1	80.9
Estimated Net Annual Sediment (TSS) Load Reduction =								**81 %**

Climate Station ID: 6149387 *Years of Rainfall Data*: 34

RAINFALL DATA FROM WATERLOO WELLINGTON AP RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

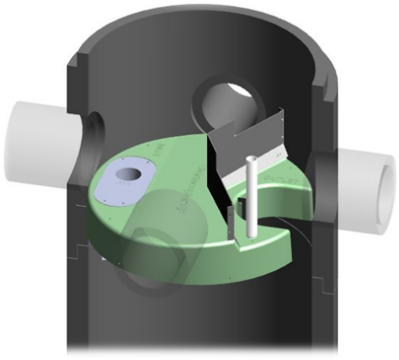
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

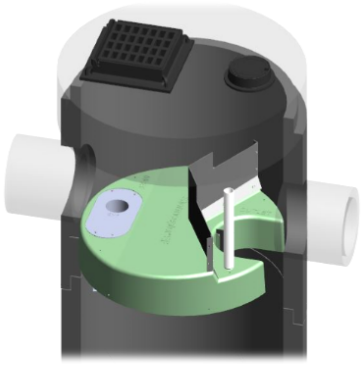
DESIGN FLEXIBILITY

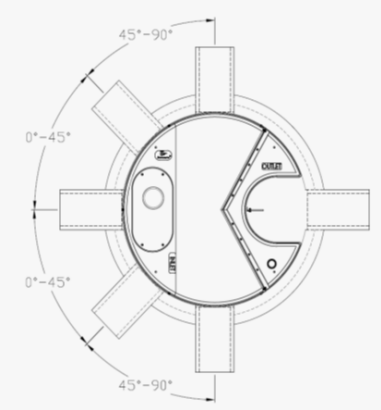
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.
0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.
45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft^3)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity
** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft^3)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit** S**eparators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall

remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to

assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m^2 to 2600 L/min/m^2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.