PUBLIC ATTACHMENT 11

Functional Servicing Study & Stormwater Management Report

Draft Plan of Subdivision & Re-Zoning Application

Residential Development at 15-23 Toryork Drive

City of Toronto

Prepared for: Berkshire Axis Development Inc.

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1.0 INTRODUCTION

fabian papa & partners has been retained by Berkshire Axis Development Inc. to prepare this Functional Servicing and Stormwater Management Report in support of the Draft Plan of Subdivision and Re-Zoning Applications for subject development. This report discusses the provision of municipal services for the development proposal, including the stormwater management servicing strategy.

The subject site consists of the properties municipally known as 15 to 23 Toryork Drive located near the southwest corner of Toryork Drive and Weston Road, in the City of Toronto. The property currently contains two industrial buildings (a one-storey and a two-storey) and previously contained an additional two one-storey industrial building surrounding these (which have since been demolished leaving behind vacant land). The pre-development land area of the subject site is approximately 15,688 m^2 (1.57 ha) in size. The property is bound by a gas station to the east, industrial buildings to the south, a future public road to the west and Toryork Drive to the north. Two aerial photographs of the site can be found in Appendix A; the first from 2013 illustrating all four buildings; and the second being a current view with only two buildings.

The subject site will be divided into three residential blocks (Blocks 1 – 3), with a new municipal roadway connecting to Toryork Drive (Street 'A'), and a new municipal City park (Block 4) at the south side of the site. Each residential block will contain a residential building with one or two towers, and multiple levels of underground parkings. The proposed buildings will range in height from 26-storey to 38-storey and the overall development will provide ±1,275 residential units. Furthermore, the City is currently undertaking a detailed design for a new municipal roadway that will connect Toryork Drive and Finch Avenue West, which will run along the west side of the subject development site. It is anticipated that the road will be constructed at the same time as the development and thus the new Street 'A' will tie into this new municipal road. An architectural site plan can be found in Appendix A, and excerpt copies of the City's plan and profile drawings for Toryork Drive, Weston Road, the sewer easement, and the new municipal roadway design (latest by RV Anderson Associated Limited (RVA)) can be found in Appendix B for reference.

2.0 WATER SUPPLY

The existing municipal infrastructure adjacent to the property consists of a 300 mm diameter watermain along the north side of Toryork Drive.

As part of this Draft Plan of Subdivision, a 200 mm diameter watermain is recommended within the proposed municipal road, Street 'A', which shall connect to the existing 300 mm diameter watermain within Toryork Drive at two locations to provide a reliable, looped system.

The first connection is proposed through the development's proposed Street 'A' at the east end of the site and the second is proposed through the City's future municipal road on the west side of the development to Toryork Drive. Design details for this watermain can be found in the Draft Plan Civil Engineering Drawing Set.

2.1 Surrounding Area PD4W Water Network Field Testing

A hydraulic field investigation and a hydraulic modelling analysis were conducted by HydraTek & Associates to study whether the City's existing local Pressure District 4 West (PD4W) water supply system in the vicinity of the subject site can support the proposed development under maximum day demand plus fire demand conditions. Pressures were recorded at three fire hydrant locations on 07 July 2021, and two hydrant flow tests were performed during that time frame. The results, analysis and written technical memorandum of this hydraulic field investigation can be found in Appendix C for reference.

The hydraulic modelling analysis concluded that a 200 mm looped system with two supplies from Toryork Drive or a 250 mm single point connection (with dead-end) are the minimum watermain sizes in order to meet (and exceed) the site's fire flow requirements.

Due to the overall advantage of a looped system from a water quality perspective (less water stagnation) and reliability perspective, a looped connection should be prioritized over single connection for development site at 15-23 Toryork Drive.

2.2 Supply Demands

In accordance with the City of Toronto demand criteria, the following *domestic water demands* were used in the analyses:

- Average Day Demand, residential: 190 Lpcd
- Maximum Day Demand Peaking Factor: 1.3 (residential), 1.10 (commercial)
- Maximum Hour Demand Peaking Factor: 2.5 (residential), 1.20 (commercial)

For purposes of estimating population, the following densities have been applied in accordance with the City's Engineering Design Criteria:

- 1 Bedroom: 1.4 persons per unit
- 2 Bedroom: 2.1 persons per unit
- 3 Bedroom: 3.1 persons per unit
- Commercial: 1.1 persons per 100 m^2

All buildings were studied as part of the water modelling analysis, and the relevant details for all the proposed buildings (for clarity purposes) are provided in the following table:

Table 1: Water supply demand parameters

Bldg.	Type of Construction	Stories	Max. Floor Area (m^2)	No. Units	Population	Avg Day Demand (L/s) All Bldgs	Peak Hour (L/s) All Bldgs	Max Day (L/s) All Bldgs
Bldg. A (Block 1)	Fire-Resistive	38	2,183	393	727			
Bldg. B (Block 2)	Fire-Resistive	36	916	300	534			
Bldg. C (Block 2)	Fire-Resistive	26	920	200	356			
Podium (Block 2)	Fire-Resistive	5	3,173	101	188			
Bldg. D (Block 3)	Fire-Resistive	29	1,466	281	516			
TOTAL	All Buildings				2,321	5.1	12.7	6.6

The detailed demand calculations, along with the hydraulic modelling analysis technical memorandum, can be found in Appendix C for reference. The above flow rates will be utilized to design the service connections to the blocks.

2.3 Fire Flow

The recommended fire flow demand is calculated using the criteria outlined in the Water Supply for Public Fire Protection Manual, 1999, by the Fire Underwriters Survey (FUS). It was found that the "worst case" scenario is the Podium in Block 2 due to the overall larger floor area. The corresponding fire flow demands have been calculated and are demonstrated below.

Appropriate reductions and increases have been applied to the calculation for such things as a coefficient of 0.6 for fire-resistant construction, a reduction for low-hazard occupancies (-15%; limited combustible), a reduction for a standard, adequately designed sprinkler protection system (- 40%), and an increase due to building proximity (+35%).

The fire flow is calculated as follows (further detailed calculations and summary tables can be found in Appendix C):

Podium Area (A) = Area of largest floor plus 25% of two adjoining floors

$A = 3{,}173\ m^2 + [(2{,}507\ m^2 + 2{,}632\ m^2) \times 0.25] = 4{,}458\ m^2$

$F = 220 \times C \times \sqrt{A} = [220 \times 0.6 \times \sqrt{(4{,}458\ m^2)}] = 8{,}813\ L/min$

$F = 9{,}000\ L/min$ (rounded to nearest 1,000)

$\text{Fire Flow} = 9{,}000 \times (1-0.15) - 7{,}650 \times 0.40 + 7{,}650 \times 0.35 = 7{,}268\ L/min$

Fire Flow = 7,000 L/min (rounded to nearest 1,000)

Fire Flow = 116.7 L/s

The design flows applied in the design of the service connections to the property are as follows:

- Domestic Supply Line (PHD): 1.0 L/s
- Total Fire Flow (MDD + Fire): 0.5 L/s + 116.7 L/s = 117.2 L/s

2.4 Proposed Connections and Layout

Based on the above demands, a 200 mm diameter watermain is proposed on the east and south sides of the new municipal road, Street 'A', in accordance with the City's Development Infrastructure Policy and Standards (DIPS) Public Road Cross-Section, and will loop back to Toryork Drive via the new City designed public road along the west side of the site. Although the current design set of plans (prepared by R.V. Anderson Associates Ltd. (RVA)) do not currently illustrate a watermain in the future right-of-way, it is recommended that one be placed there per DIPS for various advantageous reasons. Discussion between the development site Owner (Berkshire Axis Development), our office (fp&p), RVA and the City took place on 13 January 2023. The outcome of the meeting was that RVA will prepare a FSR Brief to review and confirm that the watermain can be physically installed in Road 2A per their design/plans in order to finalize this concept prior to final Draft Plan and Re-zoning approval. We are confident in the design of the infrastructure and anticipate a positive review by RVA. At the time of writing, RVA's FSR Brief has not been received and will be provided under a separate cover.

In accordance with current City policies, each building on the site must be provided with separate water connections. As such, 5 sets of water services will be provided; one for the single tower on Block 1, three for the two towers and single podium on Block 2, and one for the single tower on Block 3.

A new 150 mm diameter fire connection shall be provided for each building which shall be connected to the proposed 200 mm municipal watermain. Each fire connection will branch to create a 100 mm diameter domestic supply line within the City public right-of-way before crossing the property line. The valves and boxes will be installed directly adjacent to the property line as per City requirements. The meters and back-flow preventers required by the City will be installed within the mechanical room on the P1 parking level of each block, one for each connection, which is less than 30 m from the street line.

It is anticipated that the proposed City Park will only require a domestic water connection, and thus a 50 mm diameter copper water service has been proposed.

Given the types of buildings proposed, we understand that all building will be sprinklered. As such, siamese connections for these buildings will be proposed fronting the proposed municipal road, Street 'A'.

Two new public hydrants shall be installed along the proposed municipal right-of-way of Street 'A', and two new hydrants shall be located in the new City designed north-south public road (Road 2A) on the west side of the site. Per the Ontario Building Code, a hydrant must be located within 45 m of the siamese connection, and 90m to all building faces with municipal frontage. By placing the hydrants along the new municipal roads, as illustrated in the Draft Plan Civil Engineering Drawing Set, the requirements of the Ontario Building Code are satisfied with respect to fire protection.

In addition, the Ontario Building Code (clause 3.2.9.7.4) requires that any building above 84 m in height shall be protected by two separate fire service connections separated by an isolation valve. Since each tower contemplates heights in excess of 84 m, two fire connection services are required for each tower (i.e., excluding the podium). Furthermore, NFPA 14 (clause 7.12.2) classifies buildings greater than 23 m as high-rise and they require a second Siamese connection. Therefore, two siamese connections shall be provided for each tower to satisfy this requirement. Design details can be found in the Draft Plan Civil Engineering Drawing Set.

2.5 Water Network Analytical Results

As previously mentioned, a hydraulic modelling analysis was performed on the City's local Pressure District 4 West (PD4W) water supply system in the vicinity of the subject site. Owing largely to the City's design criteria for fire flow demands for high-rise buildings (i.e., 317 L/s), which is far more conservative than the maximum day demand plus fire flows per the FUS as previously calculated, the analysis recommended a 200 mm diameter looped watermain, in order to meet (and exceed) the site's fire flow requirements.

In summary, the results concluded that the existing water infrastructure on Toryork Drive can accommodate post-development conditions, even with additional fire flow demand from the proposed development. The maximum fire flow the system can accommodate at the podium on Block 2 (worst case) with a looped system design is approx. 403 L/s, well above required FUS flow of 118 L/s and the City criteria flow of 317 L/s, and thus well above the minimum City's minimum acceptable pressure of 20 psi (140 kPa) for 'Max-day + Fire' demand situations.

Therefore, the existing municipal water infrastructure and the proposed watermain network (i.e., on Street 'A' and the external works on Road 2A) can support the proposed development. Refer to the full report found in Appendix C for reference.

3.0 SANITARY DRAINAGE

Local sanitary infrastructure adjacent to the subject site consists of a 250 mm diameter sanitary sewer that flows westerly within the Toryork Drive right-of-way. The 250 mm diameter sanitary sewer drains to a 600 mm diameter sanitary sewer within an easement downstream of the development which ultimately drains to a 750 mm diameter trunk sewer at Finch Avenue West.

As part of this Draft Plan of Subdivision and Re-Zoning Applciation, two separate drainage outlets for a proposed 250 mm diameter sanitary sewer are indicated within the proposed municipal road, Street 'A'. One outlet shall connect to the existing 250 mm diameter sanitary sewer within Toryork Drive on the east side of the development via Street 'A' whereas the second outlet connection will be through the future City designed municipal right-of-way adjacent to the west portion of the site (Road 2A). The two outlet connections are proposed due to grading constraints and the necessity for adequate cover over the proposed municipal sewers. Similar to the proposed water supply, the current design set of plans (prepared by RVA) do not currently illustrate a proposed sanitary sewer in the future right-of-way. Since it is advantageous for this development (including a new municipal park), and potentially future development sites, it is recommended that a municipal sanitary sewer be designed and installed in this roadway per DIPS standard. Similar to the watermain review, RVA will review and confirm in their FSR Brief that the sanitary sewer can be physically installed in Road 2A per their design/plans in order to finalize this concept prior to final Draft Plan and Re-zoning approval. We are confident in the design of the infrastructure and anticipate a positive review by RVA. At the time of writing, RVA's FSR Brief has not been received and will be provided under a separate cover.

Design details can be found in the Draft Plan Civil Engineering Drawing Set.

3.1 Sanitary Design Flows

The sanitary design flows for each block were calculated using the City's current design criteria for sewage flow rates. The relevant design criteria are summarized below.

Design Flow:	250 Lpcd (for existing ICI sewer flow) 450 Lpcd (for proposed residential developments)
Infiltration Flow:	0.26 L/s/ha (for dry weather flow) 3.00 L/s/ha (for extreme wet weather flow up to 50 ha) 2.00 L/s/ha (for extreme wet weather flow >50 ha)
Peaking Factor:	Calculated using the Harmon Formula
Population Density:	0.0272 pers/m^2 GFA (industrial) 1.4 people/unit (1-Bedroom Residential Unit) 2.1 people/unit (2-Bedroom Residential Unit) 3.1 people/unit (3-Bedroom Residential Unit) 1.1 people/ 100 m^2 GFA (Commercial)

As previously mentioned, the subject site hosted four one and two storey industrial buildings with an estimated total gross floor area of 6,724 m² and a population of 185 people (6,724 m² × 0.0272 people/ m²).

The pre-development flow for the subject site is calculated as follows:

$$Q_{SAN,\ Pre} = \left(\frac{250\ \text{Lpcd} \times 185\ \text{pers} \times 4.30_{\text{Peaking}}}{86400\ \text{s / day}}\right) + 0.26\ \ \text{L/s/ha} \times 1.57\ \text{ha} = 2.7\ \text{L/s}$$

The post-development flow for each block is calculated as follows:

Block 1

$$Q_{SAN,\ Post} = \left(\frac{450\ \text{Lpcd} \times 727\ \text{pers} \times 3.89_{\text{Peaking}}}{86400\ \text{s / day}}\right) + 0.26\ \ \text{L/s/ha} \times 0.30\ \text{ha} + 0.62^{1}\ \text{L/s}\ = 15.4\ \text{L/s}$$

Block 2

$$Q_{SAN,\ Post} = \left(\frac{450\ \text{Lpcd} \times 1078\ \text{pers} \times 3.96_{\text{Peaking}}}{86400\ \text{s / day}}\right) + 0.26\ \ \text{L/s/ha} \times 0.57\ \text{ha} + 0.95^{1}\ \text{L/s}\ = 23.7\ \text{L/s}$$

Block 3

$$Q_{SAN,\ Post} = \left(\frac{450\ \text{Lpcd} \times 516\ \text{pers} \times 3.97_{\text{Peaking}}}{86400\ \text{s / day}}\right) + 0.26\ \ \text{L/s/ha} \times 0.27\ \text{ha} + 0.62^{1}\ \text{L/s}\ = 11.4\ \text{L/s}$$

City Park

$$Q_{SAN,\ Post} = \left(\frac{450\ \text{Lpcd} \times 2\ \text{pers} \times 4.46_{\text{Peaking}}}{86400\ \text{s / day}}\right) + 0.26\ \ \text{L/s/ha} \times 0.18\ \text{ha} = 0.1\ \text{L/s}$$

Municipal Road

$$Q_{SAN,\ Post} = 0.25\ \ \text{L/s/ha} \times 0.26\ \text{ha} = 0.1\ \text{L/s}$$

When reviewed as a whole, the combined peaking factor slightly lowers the post-development flow for the entire development which can be calculated as follows:

Subject Site

$$Q_{SAN,\ Post} = \left(\frac{450\ \text{Lpcd} \times 2323\ \text{pers} \times 3.53_{\text{Peaking}}}{86400\ \text{s / day}}\right) + 0.26\ \ \text{L/s/ha} \times 1.57\ \text{ha} + 2.2^{1}\ \text{L/s}\ = 45.4\ \text{L/s}$$

The sanitary sewer flow draining to Toryork Drive is calculated to be increased from 2.7 L/s to 45.4 L/s which is an increase of 42.6 L/s over the pre-development condition. Please refer to Appendix D for the detailed sanitary sewer design sheet.

[1] Maximum foundation groundwater sump pump discharge. See Section 3.2 for details.

3.2 Groundwater Discharge

A hydrogeological report, prepared by EXP Services Inc. (EXP), was completed to assess the existing groundwater levels in relation to the proposed development excavation and underside of footings both for short-term (construction dewatering) and long-term (permanent foundation drainage) conditions. Since the underside of the proposed buildings are below the groundwater table, testing was performed to determine the quantity and quality of the pumped foundation discharge. Please see Appendix F for an excerpt copy of the Hydrogeological report.

The quantity (long-term) of groundwater discharge is anticipated to be 60,000 L/day (0.7 L/s or 11 usgpm) for the entire development. The short-term discharge rate expected during construction is estimated to be 365,000 L/day (i.e., 4.2 L/s or 67 usgpm) for the entire development. The estimated long-term and short-term groundwater flow rates and anticipated maximum sump pump discharge rate for each block are summarized in the table below. The groundwater sump pump maximum discharge rates have been added to the total discharge from the site for the downstream sewer analysis.

Table 2: Summary of groundwater discharge

Bldg.	Area (m^2)	% of Total Site Area (A/15688)	Long-term inflow rate (L/s)	Long-term pump estimate (L/s / USGPM)	Short-term inflow rate (L/s)	Short-term pump estimate (L/s / USGPM)
Block 1	3,196	20.4	0.14	0.63 / 10	0.86	1.26 / 20
Block 2	5,548	35.4	0.25	0.95 / 15	1.49	2.52 / 40
Block 3	2,668	17.0	0.12	0.63 / 10	0.72	1.26 / 20

It should be noted that a Permit to Take Water (PTTW) application must be submitted to the Ministry of the Environment, Conservation and Parks (MECP) if the estimated dewatering rates exceed 50,000 L/day (0.58 L/s). It is further noted that the discharge of foundation drainage must be in accordance to Toronto Municipal Code, Chapter 681 Sewers, and all future Site Plan applicants must contact Toronto Water (Environmental Monitoring & Protection in order to apply for a Discharge Permit and enter into the necessary agreements with the City.

It was determined that the quality of the groundwater meets the sanitary and combined sewer parameters for discharge. It is proposed that the collected groundwater will be pumped to a monitoring and sampling port (in accordance with City standard T-709.020) for each block and then discharge via the sanitary control manhole to the new 250 mm diameter sanitary sewer on Street 'A' which ultimately discharges to the existing 250 mm diameter sanitary sewer on Toryork Drive. The short-term will also ultimately discharge to the existing 250 mm diameter sanitary sewer on Toryork Drive.

Details of the sample port, backwater valves, meters, etc., as well as confirmation of the sump pump size, will be designed and provided by the mechanical consultant during the Site Plan Application stage.

3.3 Receiving Sanitary Sewer Capacity (Downstream HGL Analysis)

This section focuses on understanding the impact of the increased flow from the proposed development to the receiving municipal infrastructure. It is important to note that the post-development sewage generation rate of 450 Lpcd (as calculated above) is utilized in the design of the proposed service connections and new municipal sewer only. However, while determining the capacity of the receiving sewers, a generation rate of 250 Lpcd (per City of Toronto directives) is used which yields a net flow increase of 23.7 L/s (i.e., post-development sanitary flow of 24.2 L/s plus 2.2 L/s of foundation discharge less pre-development flow of 2.7 L/s). Although the proposed development is residential (240 Lpcd), the surrounding area is industrial and so the 250 Lpcd value was used throughout for conservatism and simplicity.

This proposed development is located within the City's Basement Flooding Study (BFS) Area 61, for which a Municipal Class Environmental Assessment (EA) is still in progress, thus the detailed hydraulic dynamic model is not available. To ensure the existing municipal system can accommodate the proposed development, we have prepared a pre- and post-development static spreadsheet-based analysis of the sewer system to analyze the operating conditions of the system under dry- and wet-weather flow conditions.

The analysis included sewer segments starting from Steeles Avenue (north of the subject site), along Toryork Drive, and terminating at the trunk sewer in the easement between Toryork Drive and Finch Avenue West, since the proposed sanitary sewer connections will be made to Toryork Drive. The pre-development contributing flows have been estimated by accounting for each property use within individual drainage areas including all current development applications, if any, in the tributary area. This information was then used to calculate the contributing populations.

Under dry-weather flow (DWF) conditions (i.e., infiltration rate of 0.26 L/s/ha), the downstream sewers on Toryork Drive do not experience surcharging in pre- or post-development conditions. The sewers currently operate between 3.8% and 59.6% of their capacity. Additional flow from the proposed development increases the operating conditions of these sewers to 14.8% and 61.6% of their capacity. Since the sewers experience no surcharging under DWF conditions, an HGL analysis is typically not required.

Under wet-weather flow (WWF) conditions (i.e., infiltration rate of 3.0 L/s/ha for the first 50 ha and 2.0 L/s/ha for the balance), the downstream sewers experience surcharging in pre- and post-development conditions. The sewers currently operate between 8.6% and 156.9% of their capacity. Please bear in mind that the surcharged sections of sewer occur in the deep sewers within the easement, and not in the sewers along Toryork Drive. Additional flow from the proposed development increases the operating conditions of these sewers to 17.7% and 158.9% of their capacity. Since the sewers experience surcharging under WWF conditions, an HGL analysis is required.

Table 3 below is a summary of our pre- and post-development HGL downstream analysis for wet weather flow for the sanitary sewers along Toryork Drive and the Easement starting from the subject site to the trunk sewer just north of Finch Avenue West.

Table 3: Summary of HGL analysis results

Street	To	From	Inv. Elev. U/S (m)	Inv. Elev. D/S (m)	Manhole Rim U/s (m)	Pre U/S WWF HGL (m)	Post U/S WWF HGL (m)	Pre Dev. HGL Depth from Surface (m)	Post Dev. HGL Depth from Surface (m)
Toryork Dr	16A	15A	147.07	145.02	151.00	147.32	147.32	3.68	3.68
Toryork Dr	15A	14A	145.02	142.98	148.79	145.27	145.27	3.52	3.52
Easement	14A	15A	141.54	140.94	147.60	142.83	142.97	4.77	4.63
Easement	13A	12A	140.94	137.83	148.29	142.30	142.42	5.99	5.87
Easement	12A	11A	137.80	136.66	149.00	140.14	140.20	8.86	8.80
Connection to Trunk	11A	10A	136.63	132.76	147.30	137.24	137.24	10.06	10.06

The starting HGL at the downstream trunk was taken as the obvert of the pipe segment and the impact from the subject site was reviewed under the above scenarios. The HGL does not significantly rise due to the increase in flow (i.e., sanitary sewage plus wet weather flow) from the subject site to the trunk sewer.

Furthermore, the depth of the HGL also remains greater than the minimum required 1.8 m specified by the City. Thus, the proposed sanitary flows from the development are deemed acceptable, and it is an appropriate conclusion that the proposed development can proceed without any mitigation measures or sewer upgrades.

3.4 Sanitary Service Connections

Similar to the water service, individual 150 mm diameter sanitary service connections shall be provided for each building in each block. These services will connect to the proposed 250 mm diameter sanitary sewer that is to be installed within the new municipal right-of-way, Street 'A', as part of the Draft Plan of Subdivision development. It is anticipated that the proposed City Park will require the use of a sanitary connection, and thus a 150 mm diameter sanitary service has been provided for exclusive Park use.

The calculated design flows, nominal full flow capacities, and corresponding residual capacities for each service connection can be summarized as follows:

Table 4: Preliminary sanitary service sizing

	Preliminary Service Size (mm)	Slope (%)	Total Design Flow (L/s)	Full Flow Capacity (L/s)	**Percent Capacity**
Block 1 – Bldg A	150	2.0%	15.4	22.5	**69%**
Block 2 – Bldg B	150	2.0%	11.0	22.5	**49%**
Block 2 – Bldg C	150	2.2%	7.5	23.8	**32%**
Block 2 – Podium	150	2.0%	5.2	22.5	**23%**
Block 3 – Bldg D	150	2.1%	11.4	23.2	**49%**

Each proposed service will easily convey the preliminary sanitary flows from each development operating at only 69 % (or less) of full flow capacity (22.5 L/s or greater).

A control manhole shall be placed within each of the developments adjacent to the property line to allow for inspection and monitoring in order to satisfy the City of Toronto's Sewer Use By-Law.

It is anticipated that each sanitary connection will have adequate depth to service the ground floor (and above) for each development, however the underground parking levels will likely require grinder pumps to discharge to the connection. To prevent backup of sewage into the lower levels, we recommend that the Mechanical Consultant adequately design the internal system to operate under and withstand the potential for a surcharged municipal system.

3.5 Proposed Municipal Sanitary Sewer

The calculated design flows, nominal full flow capacities, and corresponding residual capacities for the proposed 250 mm municipal sanitary sewer within the proposed public road, Street 'A' as part of the Draft Plan of Subdivision can be summarized as follows:

Table 5: Preliminary sanitary sewer sizing

	Sanitary Sewer Size (mm)	Slope (%)	Design Flow (L/s)	Groundwater Flow (L/s)	Total Flow (L/s)	Full Flow Capacity (L/s)	**Percent Capacity**
MH4A to MH5A	250	2.6%	10.9	0.6	11.5	101	**11%**
MH5A to MH6A	250	1.0%	24.0	1.2	25.7	61	**42%**
MH6A to MH7A	250	0.5%	24.0	1.2	25.7	44	**59%**
MH3A to MH2A	250	0.8%	21.3	1.0	22.3	56	**40%**
MH2A to MH1A	250	0.5%	21.3	1.0	22.3	44	**50%**

Each segment of sanitary sewer can easily convey the preliminary sanitary flows for the master plan development operating at only 59 % (or less) of full flow capacity.

Based on the discussion in the previous sections, the proposed development can be adequately serviced from a sanitary sewerage perspective. The existing municipal sanitary infrastructure and the proposed sanitary network (i.e., on Street 'A' and the external works on Road 2A) can support the proposed development. Design details can be found in the Draft Plan Civil Engineering Drawing Set.

4.0 STORM DRAINAGE

4.1 Overview

Local storm infrastructure adjacent to the subject site consists of an existing 375 mm diameter storm sewer within the Toryork Drive right-of-way which flows in a westerly direction, and connects to an existing 1500 mm diameter trunk storm sewer within the easement located west of the subject site.

A 1200 mm diameter municipal storm sewer is also proposed in the future City designed road along the west property limit of the development (by RVA). The latest design set of plans can be found in Appendix B for reference.

As part of this Draft Plan of Subdivision and Re-Zoning Application, two separate drainage outlets for the proposed storm sewer are proposed within the proposed municipal road, Street 'A'. One outlet shall connect to the existing 375 mm diameter storm sewer within Toryork Drive on the east side of the development via Street 'A', whereas the second outlet connection will be through the future City designed municipal right-of-way adjacent to the west portion of the site (Road 2A). Similar to the sanitary servicing strategy, the two outlet connections are proposed due to grading constraints and the necessity for adequate cover over the proposed municipal sewers. As part of the FSR Brief, RVA will determine if any updates to the current Road 2A storm sewer design are required to suit.

4.2 Design Criteria

The stormwater management servicing strategy proposed for the development has been prepared in conjunction with City design standards and the Wet Weather Management Flow Guidelines (WWFMG). The relevant criteria are summarized below:

Water Quantity Management

- The allowable release rate from the developed site to the existing municipal storm sewer (minor system) during the occurrence of a 2-year storm event must not exceed the runoff rate equivalent to the peak runoff rate achieved by the site under pre-development flow conditions during the occurrence of a 2-year storm event (*Discharge Criteria to Municipal Infrastructure, Section 2.2.3.7 of the WWFMG*).
- Runoff which exceeds the allowable release rate defined above is allowed to discharge off-site via the overland flow route if a suitable overland flow route, of sufficient hydraulic capacities (up to a 100-year storm) and deemed acceptable to the City, exists. If no approved or adequate overland flow route exists, runoff generated by storms up to and including the 100-year event must be contained on-site and released at the allowable release rate defined above (*General Guidelines for On-Site Storage, Section 2.2.3.8(3) of the WWFMG*).
- An overland flow route (major system) shall be provided within the developed site to direct runoff in excess of the 100-year storm runoff to an approved overland flow outlet (*General Guidelines for Suitable Overland Flow, Section 2.2.3.8(4) of the WWFMG*).

Water Quality Management

- All runoff from the site shall achieve a long-term average removal of 80% of Total Suspended Solids (TSS) on an annual loading basis to meet the water quality targets (*TSS Removal Targets, Section 2.2.2.1 of the WWFMG*).

Water Balance Management

- To achieve the water balance targets, a minimum of the first 5 mm from each rainfall event must be retained on-site for rainwater reuse, infiltration and evapo-transpiration (*On-Site Stormwater Retention, Section 2.2.1.1 of the WWFMG*).

4.3 Pre-Development Conditions

As previously mentioned, the subject site was formerly comprised of four industrial buildings and surface parking. Refer to the aerial photographs in Appendix A for reference. Although portions of the site drained south, an internal storm sewer network collected the drainage by catchbasins and storm service laterals which discharge to the existing storm sewers on Toryork Drive.

The existing buildings and surface parking area cover a significant portion of the subject site resulting in an estimated runoff coefficient for the tributary area of 0.88 (refer to the Pre-Development Drainage Area Plan in Appendix E). However, the City's WWFMG limits the maximum permissible pre-development condition to a runoff coefficient of 0.50 to minimize potential for flooding and reduce erosion risk. As such, this value is what governs for estimating target post-development release rate to the storm sewer.

Herein it is assumed that the existing municipal sewer network was designed to convey the 2-year return period design storm. Any storms greater than the 2-year event are assumed to be directed uncontrolled via overland sheet drainage to Toryork Drive under existing conditions. On-site storage was not previously provided because it was not a common practice at the time.

The 2-year return period design rainfall intensity is calculated per City standards as follows:

$$I_{2yr} = \frac{21.8}{(T)^{0.78}} = \frac{21.8}{(10/60)^{0.78}} = 88.2\ \text{mm / hr}$$

Therefore, the total allowable site discharge for the subject development and each individual block shall be limited to the WWFMG with the limiting run-off coefficient of 0.5 as this is less than the capacity of the existing trunk storm sewer.

The corresponding 2-year target post-development peak flow for the subject site is calculated as follows:

$$Q_{2\text{-Yr Pre}} = \frac{(A \times R) \times I_2}{360} = \frac{(1.57 \times 0.50) \times 88.2}{360} \times 1000 = 192.1\ \text{L/s}$$

Therefore, the allowable drainage from the site to the existing storm infrastructure network for all storms up to the 100-year storm event is calculated to be 192.1 L/s.

The corresponding allowable site discharge for each block (based on the 2-year pre-development peak flow on an area pro-rata basis) is as follows:

Table 6: Allowable storm discharge

Entity	Area (ha)	Percentage of Area	Allowable Release Rate (L/s)
Block 1	0.30	19.2%	37.0
Block 2	0.57	36.4%	69.9
Block 3	0.27	17.0%	32.7
Park	0.18	11.5%	22.1
Road (East-West)	0.15	9.3%	17.9
Road (North-South)	0.10	6.6%	12.6

As previously mentioned, the total allowable site discharge for the overall subject site is calculated and shall be limited to be **192.1 L/s**. Please refer to the detailed storm sewer design sheet which can be found in Appendix E.

4.4 Post-Development Conditions

The post-development hydrologic conditions for the site were established using the City's design standards, which include the 2-year and 100-year IDF data, a recommended entry time of 10 minutes, and the following storm drainage run-off coefficients:

Table 7: Storm drainage runoff coefficients

Site Area	Coefficient
Bare Roof	0.90
Green Roof	0.50
Landscaped Areas	0.25
Hard Surfaces	0.90

These design parameters shall be used to determine specific on-site storage requirements to meet the target release rate for each individual site and the overall site.

The 100-year return period design rainfall intensity is calculated per City standards as follows:

$$I_{100} = \frac{59.7}{(T)^{0.80}} = \frac{59.7}{(10/60)^{0.80}} = 250.3 \text{ mm / hr}$$

The corresponding 100-year uncontrolled post-development peak flow for each block and the overall development is calculated as follows:

Block 1

$$Q_{\text{100-Yr Block 1}} = \frac{(A \times R) \times I_{100}}{360} = \frac{(0.30 \times 0.85) \times 250.3}{360} \times 1000 = 178.5 \text{ L/s}$$

Block 2

$$Q_{\text{100-Yr Block 2}} = \frac{(A \times R) \times I_{100}}{360} = \frac{(0.57 \times 0.85) \times 250.3}{360} \times 1000 = 337.5 \text{ L/s}$$

Road (North-South)

$$Q_{\text{100-Yr Road N-S}} = \frac{(A \times R) \times I_{100}}{360} = \frac{(0.10 \times 0.90) \times 250.3}{360} \times 1000 = 64.5 \text{ L/s}$$

Block 3

$$Q_{\text{100-Yr Block 3}} = \frac{(A \times R) \times I_{100}}{360} = \frac{(0.27 \times 0.85) \times 250.3}{360} \times 1000 = 157.7 \text{ L/s}$$

Park

$$Q_{\text{100-Yr Park}} = \frac{(A \times R) \times I_{100}}{360} = \frac{(0.18 \times 0.50) \times 250.3}{360} \times 1000 = 62.9 \text{ L/s}$$

Road (East-West)

$$Q_{100\text{-Yr Road E-W}} = \frac{(A \times R) \times I_{100}}{360} = \frac{(0.15 \times 0.90) \times 250.3}{360} \times 1000 = 91.4\ L/s$$

Overall Development

$$Q_{100\text{-Yr Block 1}} = \frac{(A \times R) \times I_{100}}{360} = \frac{(1.57 \times 0.82) \times 250.3}{360} \times 1000 = 892.5\ L/s$$

To ensure the design criteria in Section 4.2 is met, it is proposed that drainage from each block be collected and controlled to 2-year pre-development allowable levels prior to being released to the proposed municipal right-of-way which will contain an oversized pipe and orifice to further attenuate the 100-year storm discharge.

As previously mentioned, the total allowable site discharge for the entire subject site area shall be limited to be **192.1 L/s**. Please refer to the detailed storm sewer design sheet which can be found in Appendix E.

4.4.1 Underground Storage

To attenuate flows from each Block, an underground stormwater storage tank, complete with either an orifice tube/plate or a City approved vortex valve, is proposed within the underground P1 level. All storm run-off generated on each site will be collected and directed to the proposed tank within each Block. It is noted that the detailed orifice calculations and sizing of the stormwater tank for each Block shall be determined during the Site Plan Application stage, however, a from a preliminary perspective, values have been displayed in Table 8 below for reference.

In order to further control flows to equal to or less than the pre-development rate for the overall site, orifice plates are proposed on the outlet side of the proposed stormwater control manholes (MH.3 and MH.5). As previously noted, due to grading constraints, two storm outlets are proposed.

Each orifice has been designed to achieve the desired discharge and head for the proposed storage element.

For the north-south road, with the invert of the orifice set at an elevation of 147.90 m and the 100-year depth in the being 0.85 m, the capacity of the orifice plate is calculated as follows:

$$Q_{Orifice} = K \times A \sqrt{2 \times g \times h} = N \times K \times \frac{\pi \times D^2}{4} \sqrt{2 \times g \times h}$$

$$Q_{Orifice} = (0.60) \times \frac{\pi \times (0.25)^2}{4} \sqrt{2 \times (9.81) \times (0.85 - (\frac{0.25}{2})} = 0.111\ m^3/s = 111.0\ L/s$$

For the east-west road, with the invert of the orifice set at an elevation of 145.85 m and the 100-year depth in the being 0.72 m, the capacity of the orifice plate is calculated as follows:

$$Q_{Orifice} = K \times A\sqrt{2 \times g \times h} = N \times K \times \frac{\pi \times D^2}{4}\sqrt{2 \times g \times h}$$

$$Q_{Orifice} = (0.60) \times \frac{\pi \times (0.20)^2}{4}\sqrt{2 \times (9.81) \times (0.72 - (\frac{0.20}{2})} = 0.0658\,m^3/s = 65.8\ L/s$$

Using the City's IDF curve parameters for the 100-year storm event and the calculated orifice discharge rate, the storage requirements are summarized as follows:

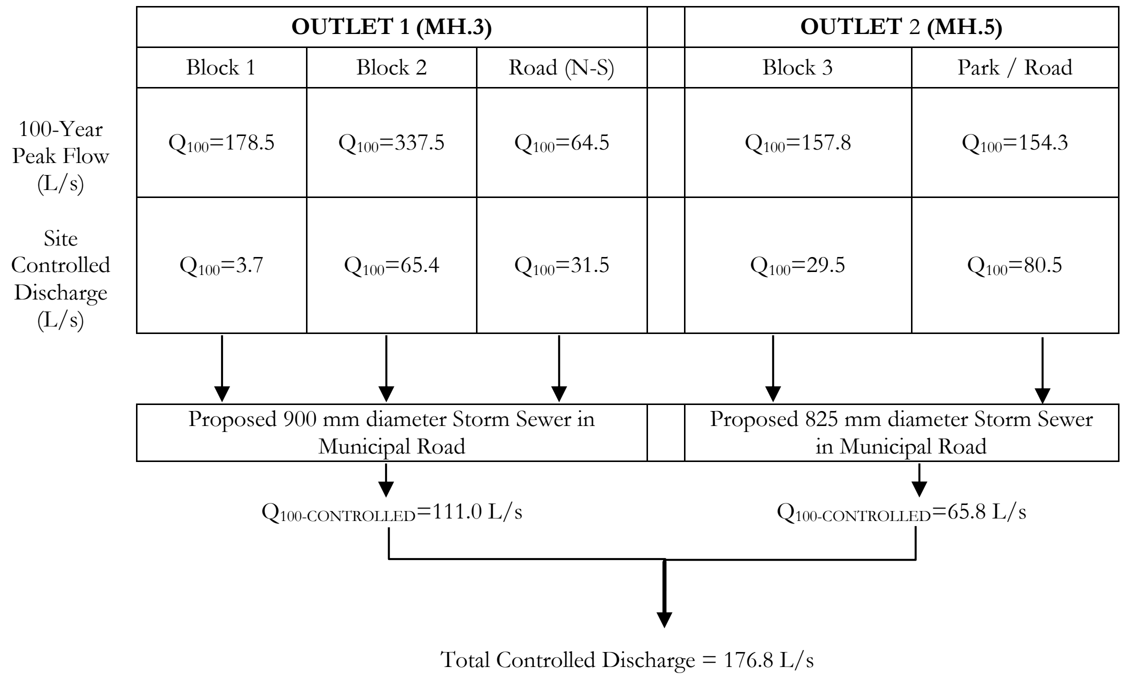
Table 8: Storm volume control parameters

Entity	Orifice Size (mm)	100-yr Depth (m)	Storage Volume Required (m^3)	Storage Volume Provided (m^3)
OUTLET 1 (MH.3)				
Block 1	125	1.13	86.9	100.1
Block 2	175	1.13	163.3	201.6
Road (North-South)	250	0.85	31.5	31.5
OUTLET 2 (MH.5)				
Block 3	120	1.03	77.0	90.0
Park	75	1.61	28.9	36.0
Road (East-West)	200	0.72	41.9	41.9

It is proposed that ±47.2 m of 900 mm oversized storm sewer be installed along the north-south stretch of the proposed municipal road, Street 'A', to contain the storage volume necessary to meet its portion of the allowable release rate. In addition, it is proposed that ±76.9 m of 825 mm oversized storm sewer be installed along the east-west stretch of the proposed municipal road, Street 'A', to contain the storage volume of its portion of the allowable release rate. The 100-Year stormwater storage volume calculations can be found in Appendix E, and design details can be found in the Draft Plan Civil Engineering Drawing Set.

It is important to note that regular maintenance inspections of the oversize pipe and orifice should be conducted to ensure that there are no blockages or other conditions which would prevent the proper functioning of this design element. The recommended minimum frequency of such inspections is annually.

A schematic representation of the proposed stormwater management system is provided as follows:



$$Q_{\text{SITE RELEASE}} \leq Q_{\text{ALLOWABLE DISCHARGE}}$$
$$176.8 \text{ L/s} \leq 192.1 \text{ L/s}$$

Based on the above, the total release rate from the subject site (i.e., discharge from the stormwater supersized pipe) is calculated to **176.8 L/s** for the 100-year storm event, which is less than the allowable pre-development 2-Year release rate of **192.1 L/s** and thus is deemed acceptable.

4.5 Water Quality Management

Pursuant to the City's WWFMG, stormwater quality controls are required to be implemented on-site to achieve a minimum of 80% long-term total suspended solid (TSS) removal. For the purposes of determining the quality control achieved on the site, the following TSS removal rates will be applied for the various areas:

Table 9: TSS Removal Rates

Site Area	TSS Removal Rate
Bare Roof	80%
Green Roof	80%
Landscape	80%
Hard Surface	0%

Based on the above considerations, the following chart summarizes the subject site's inferred TSS removal rate:

Table 10: Estimated TSS Removals on Subject Site

BLOCK 1	Area (m²)	% of total	TSS Removal Rate	Overall
Bare Roof	1,824	60.4%	80%	48.3%
Green Roof	350	11.0%	80%	9.3%
Landscaped Areas	0	0%	80%	0%
Hard Surface	846	28.0%	0%	0%
Total	3,020	100%		**57.6%**

BLOCK 2	Area (m²)	% of total	TSS Removal Rate	Overall
Bare Roof	3,130	54.8%	80%	43.9%
Green Roof	440	7.7%	80%	6.2%
Landscaped Areas	150	2.6%	80%	2.1%
Hard Surface	1,990	34.9%	0%	0%
Total	5,710	100%		**52.1%**

BLOCK 3	Area (m²)	% of total	TSS Removal Rate	Overall
Bare Roof	1,557	58.3%	80%	46.7%
Green Roof	50	1.9%	80%	1.5%
Landscaped Areas	160	6.0%	80%	4.8%
Hard Surface	902	33.8%	0%	0%
Total	2,669	100%		**53.0%**

ROAD (N-S)	Area (m²)	% of total	TSS Removal Rate	Overall
Landscaped Areas	198	19.2%	80%	15.4%
Hard Surface	832	80.8%	0%	0%
Total	1,030	100%		**15.4%**

PARK	Area (m²)	% of total	TSS Removal Rate	Overall
Landscaped Areas	1,100	60.8%	80%	48.6%
Hard Surfaces	710	39.2%	0%	0%
Total	1,810	100%		**48.6%**

ROAD (E-W)	Area (m2)	% of total	TSS Removal Rate	Overall
Landscaped Areas	289.1	19.8%	80%	15.8%
Hard Surfaces	1,171	100%	0%	0%
Total	1,460	100%		**15.8%**

As can be seen, the City's quality criteria for quality control (i.e., minimum 80% TSS removal) would not be met if left untreated. Therefore, in order to achieve the required TSS removal targets, each block and the municipal roadway in the subject site requires supplemental treatment

Therefore, we propose the installation of oil/grit separators within the new municipal roadway and media filtration devices within each block. The specific design details for these elements shall be considered during the detailed Subdivision Design process as well as the Site Plan Applications for each Block.

It is further noted that the City is already proposing an oil/grit separator on their municipal road design, for which the east-west portion of the proposed municipal Street 'A' is tributary to. Discussions between all parties can be taken place to ensure consideration is given to the City's oil/grit separator design to accommodate the proposed east-west road drainage.

4.6 Water Balance Management

In order to promote preservation of the site's natural hydrological water balance, the City's Wet Weather Flow Management Guidelines (WWFMG) recommend that a minimum volume of 5 mm over the total site area be retained.

Per Section 2.4 of the City's WWFMG, the acceptable methods for water balance reuse include:

- irrigation of landscaped areas (including evapo-transpiration),
- groundwater infiltration, or
- greywater systems (i.e., flushing toilets)

Since the underground parking level footprint on each block covers the entire property, the opportunity to implement an infiltration system is not feasible, and therefore it is proposed that a sump be installed within the stormwater management tanks in order to retain the required water balance volume and store it for irrigation of landscaped areas on the property or greywater systems.

The following initial abstraction rates will be applied for the various site areas:

Table 11: Initial Abstraction Rates

Site Area	Initial Abstraction
Bare Roof	1 mm
Green Roof	5 mm
Landscape	5 mm
Hard Surface	1 mm

Based on the inferred initial abstraction rates for the various site surfaces, the total abstraction and corresponding volume to be retained for each site is calculated as follows:

BLOCK 1	Area (m^2)	% of total	Initial Abstraction	Overall
Bare Roof	1,824	60.4%	1 mm	0.6
Green Roof	350	11.0%	5 mm	0.6
Landscaped Areas	0	0%	5 mm	0
Hard Surface	846	28.0%	1 mm	0.3
Total	3,020	100%		**1.5 mm**

Therefore, an additional 3.5 mm of rainfall (i.e., 5.0 mm – 1.5 mm) needs to be collected and retained within Block 1. The total volume is calculated as follows:

$$V_{Required} = Depth \times A_{B1} = 3.5\ mm \times 3{,}020\ m^2\ /\ 1000\ mm = 10.7\ m^3$$

The volume available for rainwater harvesting is calculated as follows:

$$V_{Provided} = A_{Tank} \times Depth = 77\ m^2 \times 0.30\ m = \mathbf{23.1\ m^3} > 10.7\ m^3$$

BLOCK 2	Area (m²)	% of total	Initial Abstraction	Overall
Bare Roof	3,130	54.8%	1 mm	0.5
Green Roof	440	7.7%	5 mm	0.4
Landscaped Areas	150	2.6%	5 mm	0.1
Hard Surface	1,990	34.9%	1 mm	0.3
Total	5,710	100%		**1.4 mm**

Therefore, an additional 3.6 mm of rainfall (i.e., 5.0 mm – 1.4 mm) needs to be collected and retained within Block 2. The total volume is calculated as follows:

$$V_{Required} = Depth \times A_{B2} = 3.6\ mm \times 5{,}471\ m^2\ /\ 1000\ mm = 20.5\ m^3$$

The volume available for rainwater harvesting is calculated as follows:

$$V_{Provided} = A_{Tank} \times Depth = 144\ m^2 \times 0.30\ m = \mathbf{43.2\ m^3} > 20.5\ m^3$$

BLOCK 3	Area (m²)	% of total	Initial Abstraction	Overall
Bare Roof	1,557	58.3%	1 mm	0.6
Green Roof	50	1.9%	5 mm	0.1
Landscaped Areas	160	6.0%	5 mm	0.3
Hard Surface	902	33.8%	1 mm	0.3
Total	2,669	100%		**1.3 mm**

Therefore, an additional 3.7 mm of rainfall (i.e., 5.0 mm – 1.3 mm) needs to be collected and retained within Block 3. The total volume is calculated as follows:

$$V_{Required} = Depth \times A_{B3} = 3.7\ mm \times 2{,}669\ m^2\ /\ 1000\ mm = 9.8\ m^3$$

The volume available for rainwater harvesting is calculated as follows:

$$V_{Provided} = A_{Tank} \times Depth = 75\ m^2 \times 0.30\ m = \mathbf{22.5\ m^3} > 9.8\ m^3$$

ROAD (N-S)	Area (m²)	% of total	Initial Abstraction	Overall
Landscaped Areas	198	19.2%	5 mm	1.0
Hard Surface	832	80.8%	1 mm	0.8
Total	1,030	100%		**1.8 mm**

Therefore, an additional 3.2 mm of rainfall (i.e., 5.0 mm – 1.8 mm) needs to be collected and retained. The total volume is calculated as follows:

$$V_{Required} = Depth \times A_{ROAD(N\text{-}S)} = 3.2\ mm \times 1{,}030\ m^2 / 1000\ mm = 3.3\ m^3$$

The water balance storage volume can be achieved through boulevard landscaped-area infiltration and passive irrigation for street trees. Assuming a soil void ratio of 20%, the storage volume is calculated as follows.

$$V_{Provided} = Length \times Width \times Depth \times Void\ Ratio \times 2\ Blvds$$

$$V_{Provided} = 48.5\ m \times 2.4\ m \times 0.4\ m \times 20\% \times 2 = \mathbf{18.6\ m^3} > 3.3\ m^3$$

PARK	Area (m^2)	% of total	Initial Abstraction	Overall
Landscaped Areas	1,100	60.8%	5 mm	3.0
Hard Surfaces	710	39.2%	1 mm	0.4
Total	1,810	100%		**3.4 mm**

Therefore, an additional 1.6 mm of rainfall (i.e., 5.0 mm – 3.4 mm) needs to be collected and retained. The total volume is calculated as follows:

$$V_{Required} = Depth \times A_{PARK} = 1.6\ mm \times 1{,}810\ m^2 / 1000\ mm = 2.8\ m^3$$

The water balance storage volume can be achieved through landscaped-area infiltration and passive irrigation throughout the park.

ROAD (E-W)	Area (m^2)	% of total	Initial Abstraction	Overall
Landscaped Areas	289.1	19.8%	5 mm	1.0
Hard Surfaces	1,171	100%	1 mm	0.8
Total	1,460	100%		**1.8 mm**

Therefore, an additional 3.2 mm of rainfall (i.e., 5.0 mm – 1.8 mm) needs to be collected and retained. The total volume is calculated as follows:

$$V_{Required} = Depth \times A_{ROAD(E\text{-}W)} = 3.2\ mm \times 1{,}460\ m^2 / 1000\ mm = 4.7\ m^3$$

The water balance storage volume can be achieved through boulevard landscaped-area infiltration and passive irrigation for street trees. Assuming a soil void ratio of 20%, the storage volume is calculated as follows.

$$V_{Provided} = Length \times Width \times Depth \times Void\ Ratio \times 2\ Blvds$$

$$V_{Provided} = 60.2\ m \times 2.4\ m \times 0.4\ m \times 20\% \times 2 = \mathbf{23.1\ m^3} > 4.7\ m^3$$

4.7 Private Storm Service Connections

As previously mentioned, each Block will have on-site storm controls to attenuate the 100-year storm. Each individual storm service shall also include a control manhole within the private property but adjacent to the municipal right-of-way which will allow for City testing, monitoring and inspection.

The calculated design flows, nominal full flow capacities, and corresponding residual capacities for each storm service can be summarized as follows:

Table 12: Preliminary storm service sizing

Entity	Preliminary Service Size (mm)	Slope (%)	Total Design Flow 100-Yr (L/s)	Full Flow Capacity (L/s)	**Percent Capacity**
Block 1	250	2.2%	33.7	91.8	**37%**
Block 2	300	2.8%	65.4	169.1	**39%**
Block 3	250	3.0%	29.5	54.1	**27%**
Park	200	2.5%	14.7	54.1	**27%**

The various proposed storm service connections can easily handle the post-development storm flows, operating at only 39 % of full flow capacity (or less). Please refer to Appendix E for the detailed design calculations.

4.8 Municipal Storm Sewer

All attenuated storm design flows from each development blocks and municipal park will be directed to the proposed 825 mm and 900 mm diameter storm sewers that will be installed within the new proposed municipal right-of-way as part of this Draft Plan of Subdivision. The proposed storm sewer will be used for stormwater storage (for the roadway portion only), and will include an additional orifice control to further attenuate the 100-year storm.

Outlet 1 (MH.3)

All storm flows from Block 1, Block 2, and the north-south portion of the new municipal road, Street 'A', shall be directed to the proposed 900 mm diameter sewer which will connect to the existing 375 mm diameter storm sewer within Toryork Drive.

The calculated design flow, nominal full flow capacity, and corresponding residual capacity for each proposed municipal storm sewer segment is summarized as follows:

Table 13: Preliminary storm sewer sizing (Outlet 1)

From	To	Storm Sewer Size (mm)	Slope	Total Design Flow (L/s)	Full Flow Capacity (L/s)	Percent Capacity
MH.4	MH.3	900	0.53%	16.4	1375	12%
MH.3	MH.2	375	2.13%	111.0	267	42%
MH.2	MH.1	375	0.91%	111.0	174	64%

The proposed municipal storm sewers can easily handle the post-development storm flows, operating at only 64% of full flow capacity (or less). Please refer to Appendix E for the detailed design calculations.

Outlet 2 (MH.5)

All storm flows from Block 3, the municipal park, and the east-west portion of the new municipal road, Street 'A', shall be directed to the proposed 825 mm diameter sewer which will connect to the 1200 mm diameter storm sewer within the future City designed municipal road (by RVA).

The calculated design flow, nominal full flow capacity, and corresponding residual capacity for each proposed municipal storm sewer segment is summarized as follows:

Table 14: Preliminary storm sewer sizing (Outlet 2)

From	To	Storm Sewer Size (mm)	Slope	Total Design Flow (L/s)	Full Flow Capacity (L/s)	Percent Capacity
MH.6	MH.5	825	0.36%	135.2	898	15%
MH.5	Sewer	375	0.86%	65.8	170	39%

The proposed municipal storm sewers can easily handle the post-development storm flows, operating at only 39% of full flow capacity (or less). Please refer to Appendix E for the detailed design calculations.

The existing municipal storm infrastructure and the proposed storm network (i.e., on Street 'A', Toryork Drive and the external works on Road 2A) can support the proposed development.

4.9 Emergency Overflow

The area surrounding the perimeter of all buildings shall be designed with positive drainage (away from the building). Other areas, namely terraces, shall be directed to area drains which shall be connected to the proposed stormwater management storage facilities for each site. Should these area drains become clogged, stormwater will overflow to the adjacent boulevards. The maximum ponding depths shall not exceed 0.30 m per City requirements. All building roof areas shall be provided with rooftop scuppers to ensure a safe emergency overflow should any rooftop drains become blocked or clogged.

To provide a relief point for any proposed stormwater management tanks, all tanks shall be fitted with an emergency overflow (open grate) lid, located within the applicable subject site and adjacent to the municipal right-of-way.

Should any Block experience a storm greater than the 100-year event or should any orifices become clogged, surplus water will overflow through the emergency overflow and be released into the proposed municipal right-of-way where it can safely be conveyed to the proposed municipal road, Street 'A', and to Toryork Drive. To prevent basement flooding, we recommend that all incoming pipes connecting to underground storage be fitted with one-way flap gate valves (i.e., backflow preventers) to prevent surcharging into the internal plumbing systems.

Should the oversized pipe within the municipal road experience a storm greater than the 100-year event or should the orifice become clogged, surplus water will overflow through the two double catch basins at Station 0+135.5 (Grate Elevations=150.54) and Station 0+011 (Grate Elevations=147.97) and be released into the proposed municipal right-of-way where it can safely be conveyed to Toryork Drive.

The exact location and details of these safety overflow measures will be determined during the Site Plan Application stage and/or Detailed Subdivision design.

4.10 Sediment and Erosion Control

In accordance with the Erosion and Sediment Control Guidelines for Urban Construction, temporary erosion and sediment control measures are required for any development application. Each entity shall install appropriate measures such as a sediment control fence per the City of Toronto standard drawing T-219.130-1. Any existing / adjacent catch basins shall be protected with a Terrafix 360R geotextile fabric (or approved equal). In addition, mud mats shall be installed for the construction of the new municipal road, and for each individual entity to prevent any mud tracking onto the Toryork Drive.

5.0 CONCLUSIONS

This report illustrates that the proposed development area is feasible from municipal servicing and stormwater management perspectives.

Proposed fire and domestic water demands are within acceptable ranges and can be accommodated by the existing municipal water supply infrastructure within Toryork Drive.

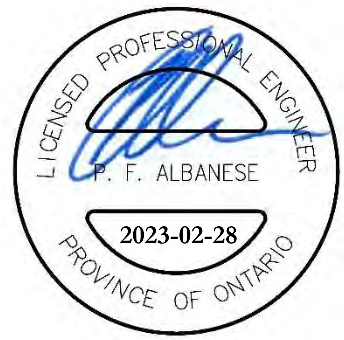
The proposed sanitary sewer network within the proposed Municipal Road, Street 'A' can accommodate each proposed development, and the existing sanitary sewer network within Toryork Drive has been analyzed (i.e., downstream hydraulic grade line analysis) and was found to be acceptable.

Each development entity shall incorporate on-site storage, and the controlled discharge release rate for the overall development shall be attenuated and released to Toryork Drive at the 2-year pre-development discharge rate, and therefore satisfies the City's stormwater management objectives.

We trust that this satisfies your current needs. Should you have any questions, or require additional information, please do not hesitate to contact the undersigned.

Respectfully Submitted,

fabian papa & partners
(A Division of FP&P HydraTek Inc.)



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APPENDIX A


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Toryork Dr
SUBJECT SITE
(2013)
Weston Rd
Finch Ave W
Google Earth
Image © 2021 First Base Solutions
100 m

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Toryork Dr
SUBJECT SITE
(CURRENT)
Weston Rd
Finch Ave W
Google Earth
© 2021 Google
100 m

GENERAL NOTES

1. PROPOSED PROPERTY LINE.
2. FIRE ROUTE LOCATION WITHIN 3 TO 15 METRES OF BUILDING.
3. TURNING RADIUS: FIRE ACCESS ROUTES SHALL HAVE A CENTRELINE RADIUS OF NOT LESS THAN 12 METRES.

Cycling Infrastructure	Required	Proposed	Proposed %
Number of short-term bicycle parking spaces (residential)	20	20	100
Number of short-term bicycle parking spaces (all other uses)			
Number of male shower and change facilities (non-residential)			
Number of female shower and change facilities (non-residential)			

Tree Planting & Soil Volume	Required	Proposed	Proposed %
Total Soil Volume (40% of the site area x 66 m² x 30 m³)	2075 m3	1508 m3	73%

SITE PLAN 1
1 : 500

Revision	Date

"WITHOUT PREJUDICE AND CONFIDENTIAL"

NOT FOR CONSTRUCTION

RE-ISSUED FOR ZBA	23.03.03
ISSUED FOR ZBA	21.09.02
Revision	Date

TRUE NORTH PROJECT NORTH

giannone petricone associates

Giannone Petricone Associates Inc. Architects
462 Wellington Street West, Toronto, Canada M5V 1E3,
T 416.591.7788 F 416.591.1293 E mail@gpaia.com

IN ASSOCIATION WITH

Architect Inc.
GIOVANNI A. TASSONE

WESTON HEIGHTS
15-23 TORYORK DR
TORONTO, ON

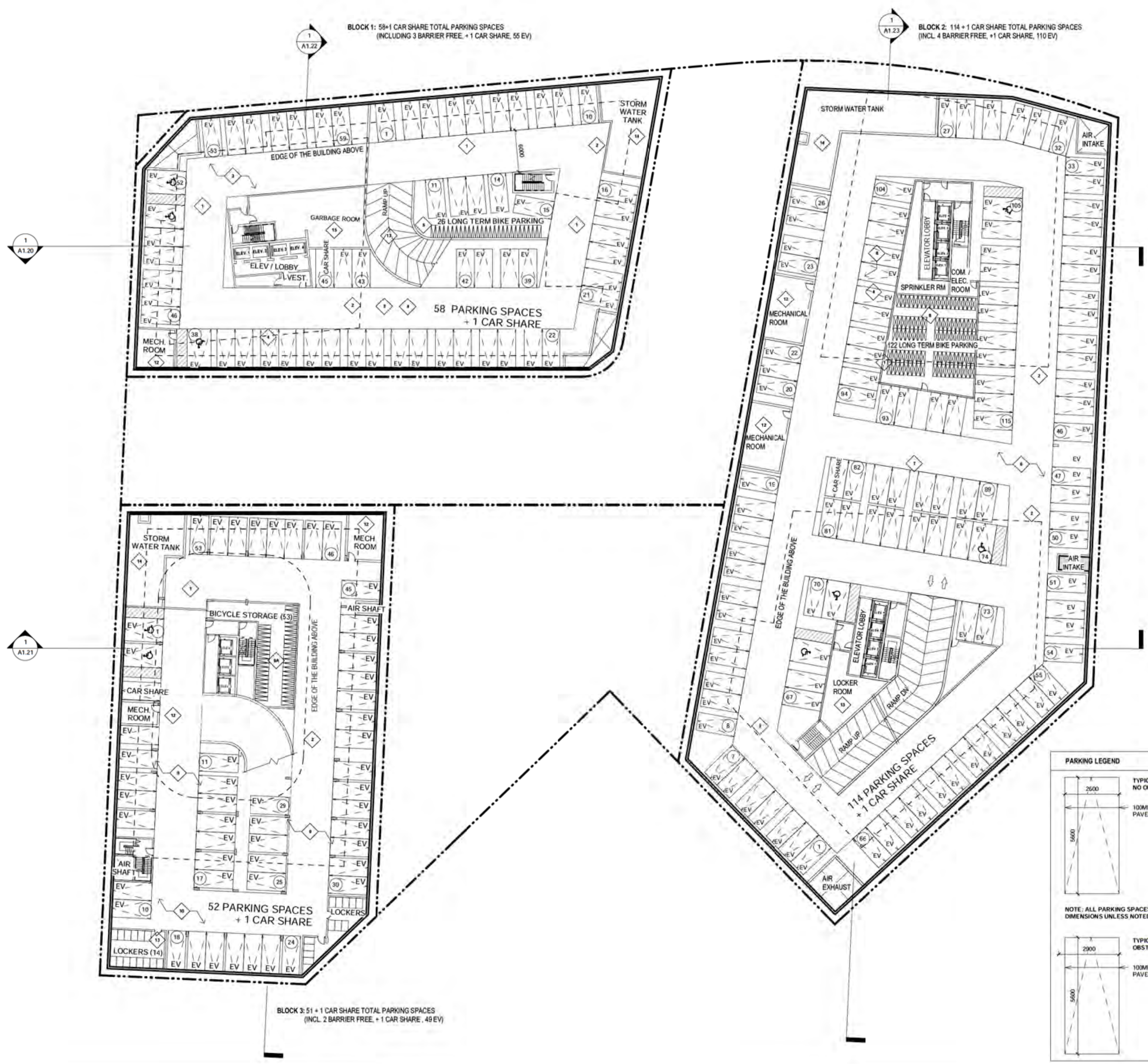
SHEET TITLE

CONCEPT SITE PLAN & T.G.S.

DRAWN BY:	HA / VM
CHECKED BY:	KG
PROJECT START DATE:	08/11/21
PROJECT NO.:	21016
SHEET NUMBER	

A0.11

PLOT DATE: 2023-02-28 1:44:46 PM



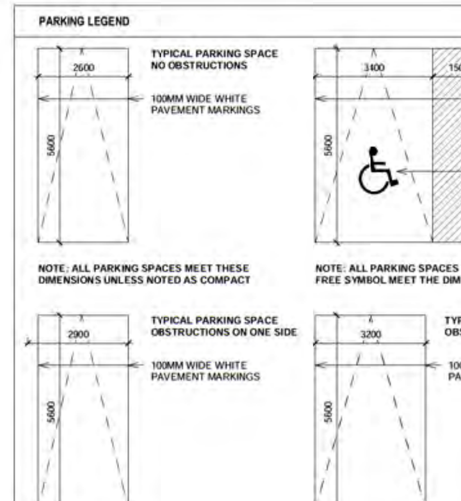
GENERAL NOTES:

1. BLOCK 1: ALL RESIDENTIAL PARKING SPACES TO BE PROVIDED WITH ENERGIZED OUTLET CAPABLE OF PROVIDING LEVEL 2 CHARGING OR HIGHER (EV).
2. DASHED LINE INDICATES EXTENT OF BUILDING ABOVE.
3. BLOCK 1: 200 (+1 CAR SHARE) TOTAL PARKING SPACES PROVIDED BELOW GRADE (58 + 1 CAR SHARE SPACES THIS FLOOR).
4. BLOCK 1: 25% (12) OF NON-RES. PARKING SPACES (48) TO BE PROVIDED WITH ENERGIZED OUTLET CAPABLE OF PROVIDING LEVEL 2 CHARGING OR HIGHER (EV), THE REMAINING NON-RES. PARKING SPACES TO HAVE ROUGH-IN (EV-RI)
5. BLOCK 1: BICYCLE STORAGE ROOM (26 LONG TERM SPACES) C/W ENERGIZED OUTLET (120V)
6. BLOCK 2: 420 + 1 CAR SHARE TOTAL PARKING SPACES PROVIDED BELOW GRADE (114 + 1 CAR SHARE SPACES THIS FLOOR).
7. BLOCK 2: 115 TOTAL PARKING SPACES TO BE PROVIDED WITH ENERGIZED OUTLET CAPABLE OF PROVIDING LEVEL 2 CHARGING OR HIGHER (EV).
8. BLOCK 2: BICYCLE STORAGE ROOM (122 LONG TERM SPACES)
9. BLOCK 3: 199 + 1 CAR SHARE TOTAL PARKING SPACES PROVIDED BELOW GRADE (51 + 1 CAR SHARE SPACES THIS FLOOR).

9A. BLOCK 3: 24 STACKED BICYCLE PARKING SPACES, 29 HORIZONTAL BICYCLE PARKING SPACES C/W ENERGIZED OUTLET (120V) = TOTAL 53 SPACES

10. BLOCK 3: 45 TOTAL PARKING SPACES TO BE PROVIDED WITH ENERGIZED OUTLET CAPABLE OF PROVIDING LEVEL 2 CHARGING OR HIGHER (EV).
11. RESERVED
12. MECHANICAL ROOM.
13. LOCKER STORAGE ROOM.
14. STORM WATER TANK
15. GARBAGE ROOM

PARKING LEGEND



TYPICAL PARKING SPACE NO OBSTRUCTIONS
100MM WIDE WHITE PAVEMENT MARKINGS

NOTE: ALL PARKING SPACES MEET THESE DIMENSIONS UNLESS NOTED AS COMPACT

TYPICAL PARKING SPACE BARRIER-FREE - TYPE 'A'
100MM WIDE WHITE PAVEMENT MARKINGS
100MM WIDE WHITE PAVEMENT MARKING OF SYMBOL OF INTERNATIONAL SYMBOL OF ACCESSIBILITY

NOTE: ALL PARKING SPACES MARRKED WITH BARRIER FREE SYMBOL MEET THE DIMENSIONS ABOVE

TYPICAL PARKING SPACE OBSTRUCTIONS ON ONE SIDE
100MM WIDE WHITE PAVEMENT MARKINGS

TYPICAL PARKING SPACE OBSTRUCTIONS ON TWO SIDES
100MM WIDE WHITE PAVEMENT MARKINGS

P1 UNDERGROUND GARAGE FLOOR PLANS (1)
1 : 300

Revision	Date

"WITHOUT PREJUDICE AND CONFIDENTIAL"

NOT FOR CONSTRUCTION

RE-ISSUED FOR ZBA	23.03.03
ISSUED FOR ZBA	21.09.02
Revision	Date

TRUE NORTH
PROJECT NORTH

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IN ASSOCIATION WITH

GIOVANNI A. TASSONE Architect Inc.

WESTON HEIGHTS
15-23 TORYORK DR
TORONTO, ON

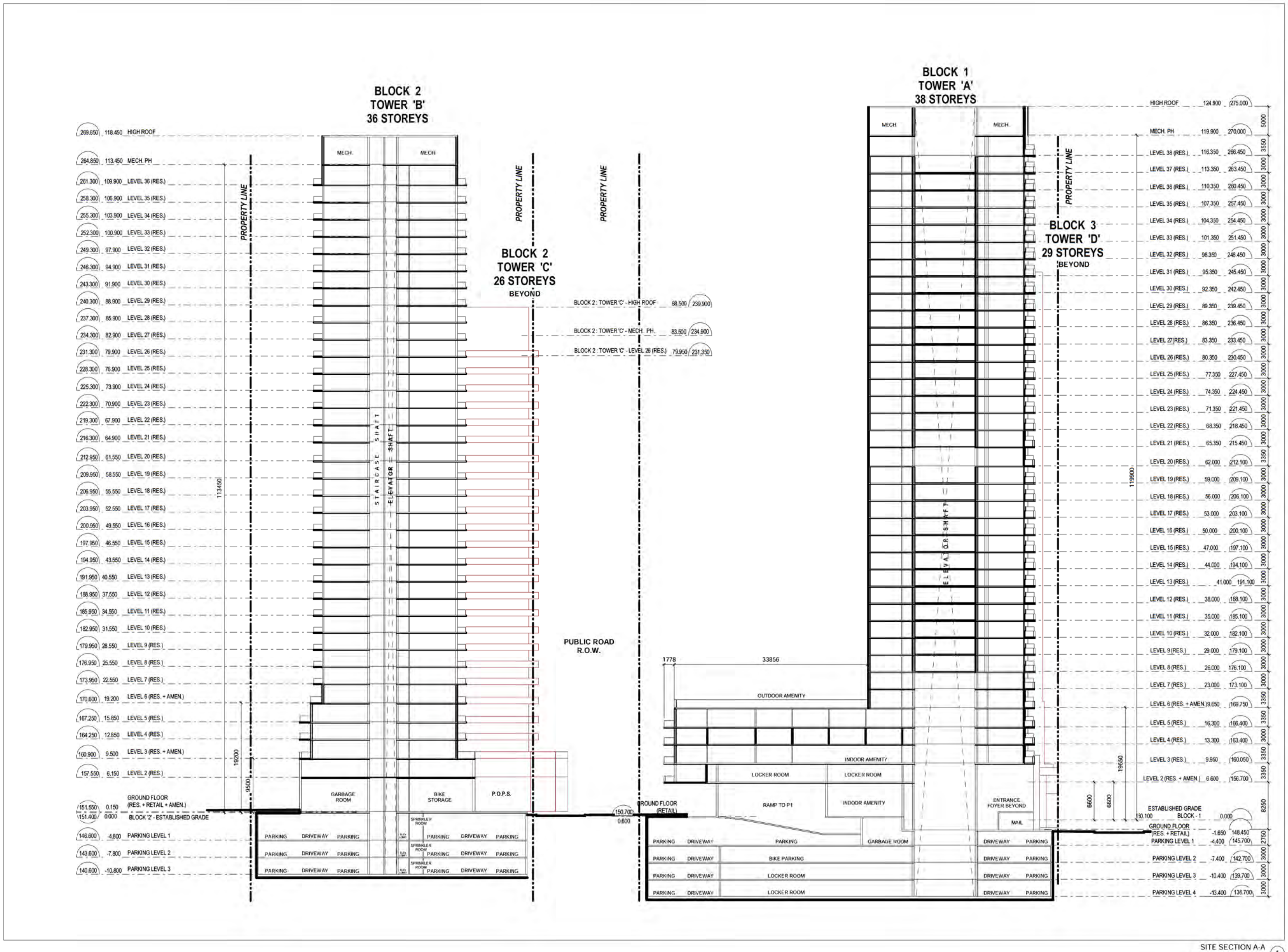
SHEET TITLE

P1 UNDERGROUND GARAGE PARKING PLAN

DRAWN BY:	HA / VM
CHECKED BY:	KG
PROJECT START DATE:	07/30/21
PROJECT NO.:	21016
SHEET NUMBER	

A1.02

PLOT DATE: [illegible]



Revision	Date

"WITHOUT PREJUDICE AND CONFIDENTIAL"

NOT FOR CONSTRUCTION

RE-ISSUED FOR ZBA	23.03.03
ISSUED FOR ZBA	21.09.02
Revision	Date

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IN ASSOCIATION WITH
Architect Inc.
GIOVANNI A. TASSONE

WESTON HEIGHTS
15-23 TORYORK DR
TORONTO, ON

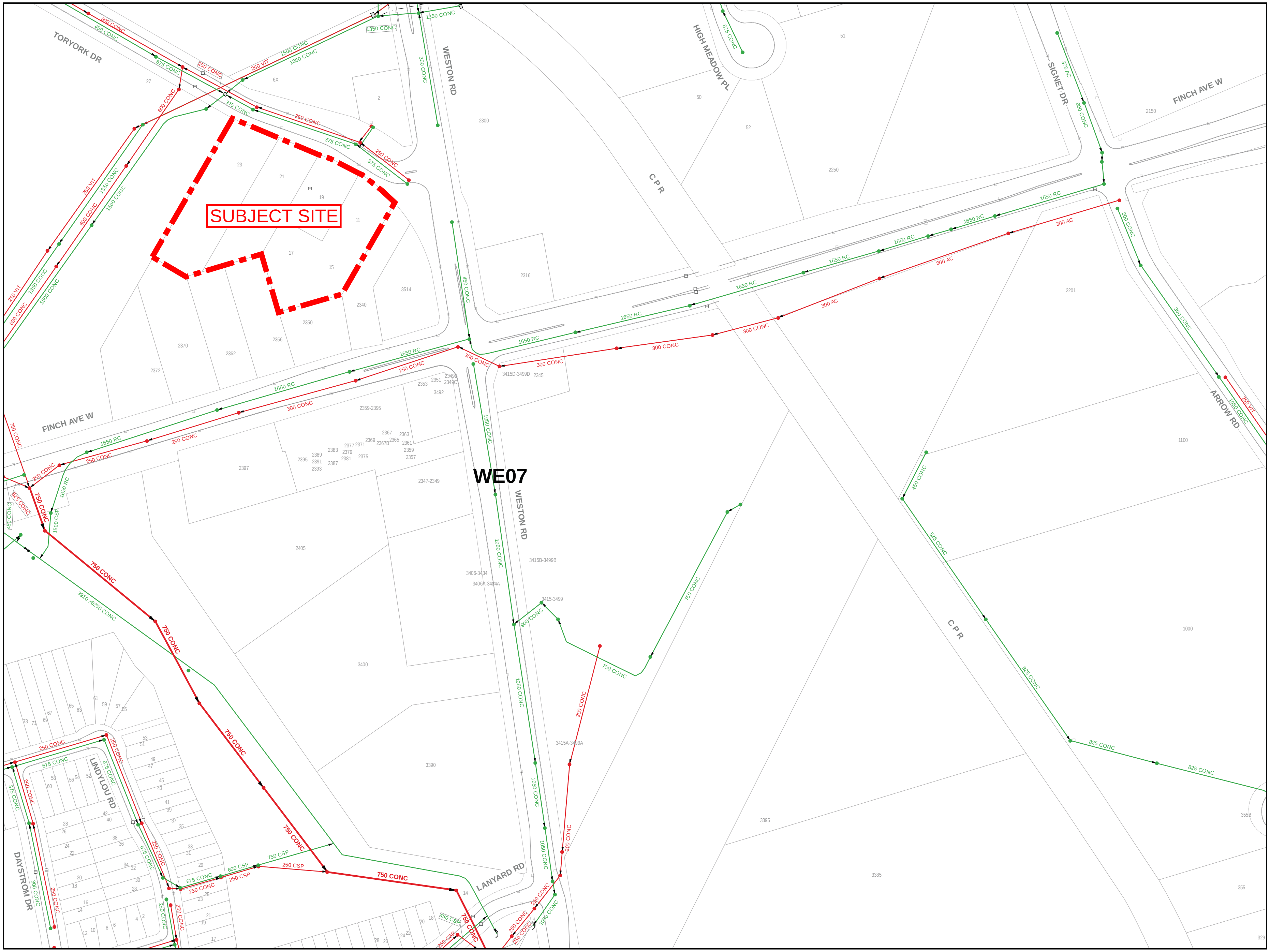
SHEET TITLE

SITE SECTION - AA

DRAWN BY:	VM
CHECKED BY:	KG
PROJECT START DATE:	05/04/21
PROJECT NO.:	21016
SHEET NUMBER	

A1.20

APPENDIX B



Toronto Sewer Atlas

Large Chamber

Manhole
- Combined
- Dual
- Sanitary
- Storm
- Foundation

Control Manhole
- Combined
- Dual
- Sanitary
- Storm

Outfall
- Outfall

Sewer Pump Station
- Sewer Pump Station

Catchbasin
- Other
- Twin Inlet Catchbasin

Sewer
- Foundation Drain
- Combined
- Sanitary
- Storm
- Combined Trunk
- Sanitary Trunk
- Storm Trunk
- Abandoned Sewer
- River
- Highway
- Curb
- Wards Boundary

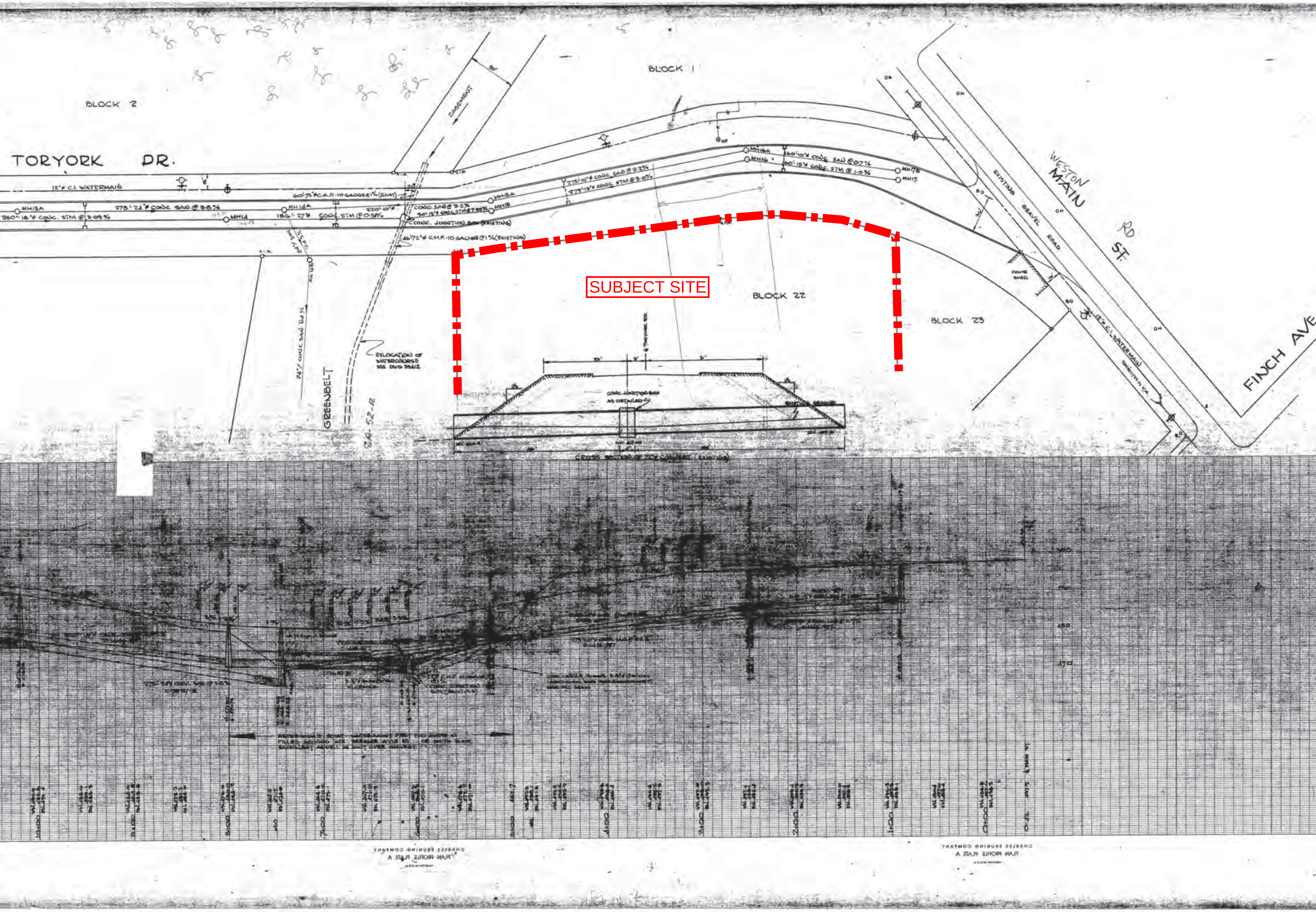
0 50 100 150 200 Metres

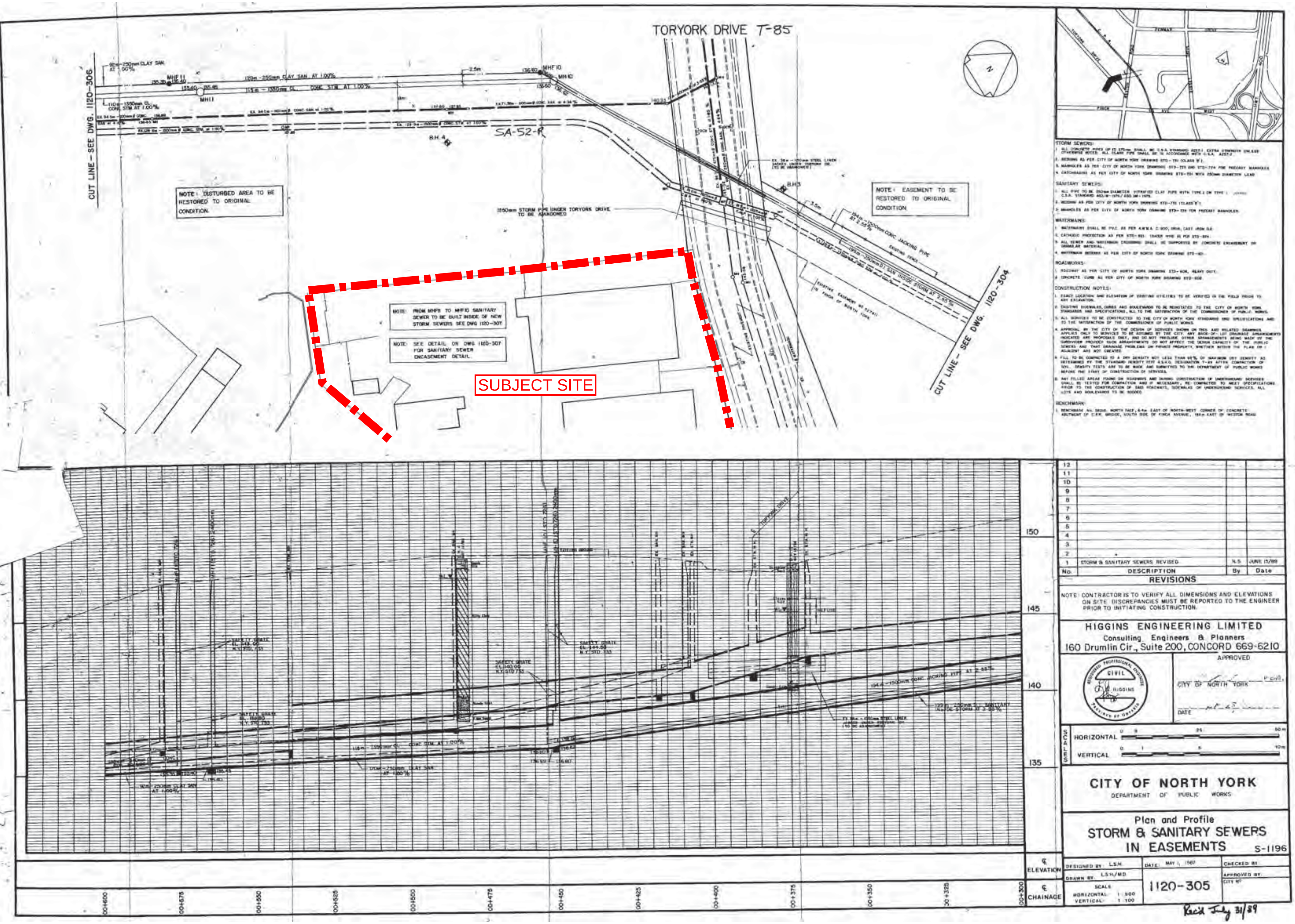
Third Edition
Date: 01/09/2010

General Notes:
- The maps were prepared based on the most current data available to Toronto Water as of the Map Source Date.
- These maps are for planning purpose only and must not be used for construction, or as a replacement for a utility locate.
- This drawing is not to be reproduced in whole or in part without the express written permission of the City.
- Any discrepancies, inaccuracies, errors and/or omissions in the maps should be reported to Toronto Water, Water Infrastructure Management. (18th Floor, Metro Hall, 55 John St, Toronto, ON, M5V 3C6) (Tel: 416-392-3957)

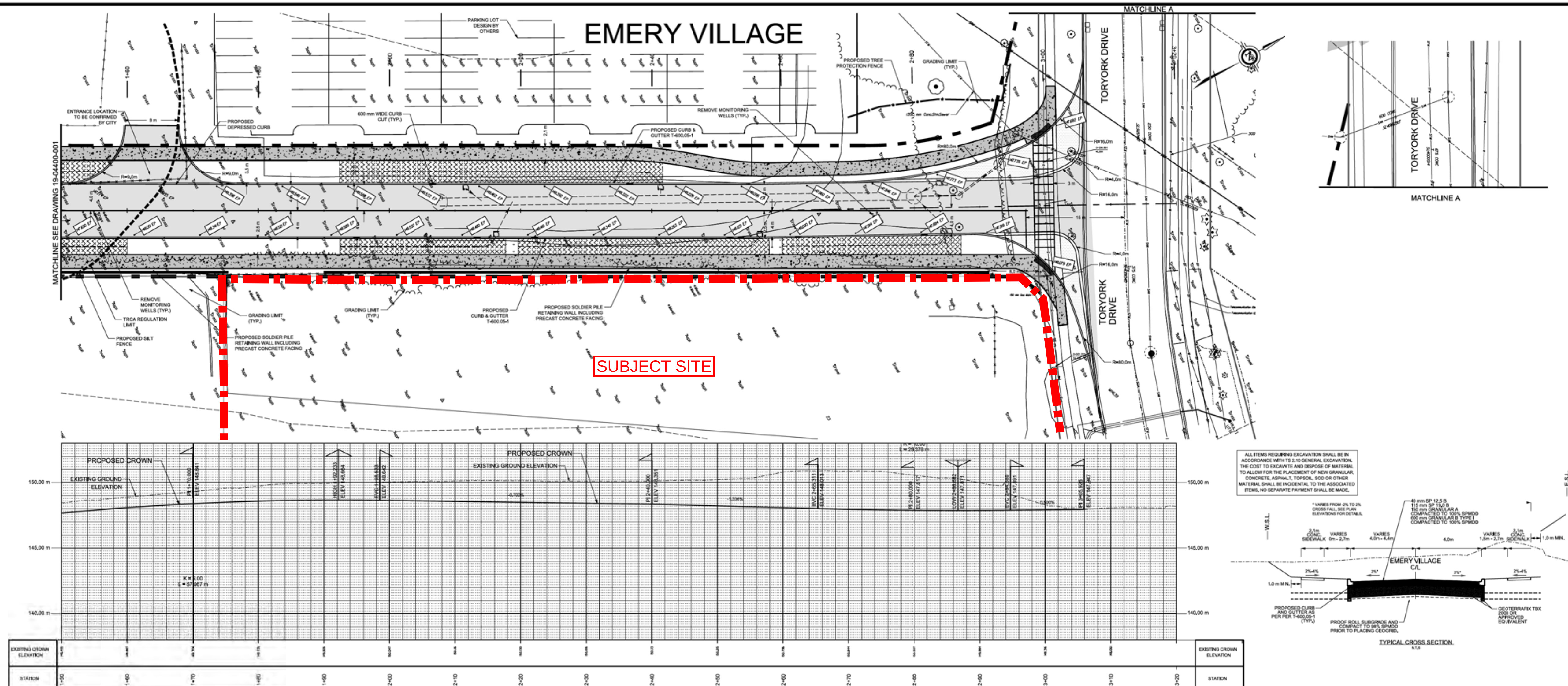
N S W E

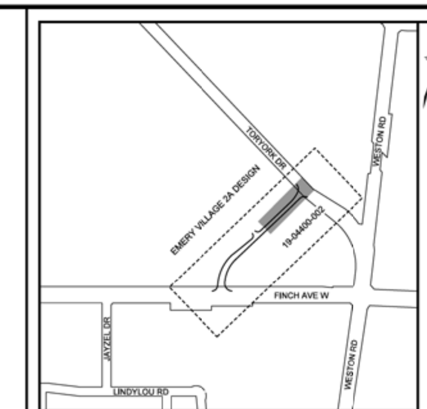
142	176	211
143	177	212
144	178	213


BLOCK 2
BLOCK 1
TORYORK DR.
12" C.I. WATERMAIN
EASEMENT
SUBJECT SITE
BLOCK 22
BLOCK 23
EXISTING GRAVEL ROAD
WESTON MAIN RD ST.
FINCH AVE
12" C.I. WATERMAIN
GREENBELT
RELOCATION OF WATERCOURSE SEE DWG 35612



TORYORK DRIVE T-85
SA-52-R
CUT LINE - SEE DWG. 1120-306
CUT LINE - SEE DWG. 1120-304
NOTE: DISTURBED AREA TO BE RESTORED TO ORIGINAL CONDITION.
NOTE: EASEMENT TO BE RESTORED TO ORIGINAL CONDITION.
1350mm STORM PIPE UNDER TORYORK DRIVE TO BE ABANDONED
NOTE: FROM MHF8 TO MHF10 SANITARY SEWER TO BE BUILT INSIDE OF NEW STORM SEWERS SEE DWG 1120-307
NOTE: SEE DETAIL ON DWG 1120-307 FOR SANITARY SEWER ENCASEMENT DETAIL.
SUBJECT SITE
150
145
140
135
REVISIONS
| No. | DESCRIPTION | By | Date |
| 1 | STORM & SANITARY SEWERS REVISED | N.S. | JUNE 15/89 |
NOTE: CONTRACTOR IS TO VERIFY ALL DIMENSIONS AND ELEVATIONS ON SITE. DISCREPANCIES MUST BE REPORTED TO THE ENGINEER PRIOR TO INITIATING CONSTRUCTION.
HIGGINS ENGINEERING LIMITED
Consulting Engineers & Planners
160 Drumlin Cir., Suite 200, CONCORD 669-6210
APPROVED
CITY OF NORTH YORK
DATE
SCALES
HORIZONTAL
VERTICAL
CITY OF NORTH YORK
DEPARTMENT OF PUBLIC WORKS
Plan and Profile
STORM & SANITARY SEWERS IN EASEMENTS
S-1196
DESIGNED BY: L.S.H.
DATE: MAY 1, 1987
CHECKED BY
DRAWN BY: L.S.H./M.D.
APPROVED BY
SCALE HORIZONTAL 1:500 VERTICAL 1:100
1120-305
℄ ELEVATION
℄ CHAINAGE
Rec'd July 31/89





RELATED DRAWINGS: P-/U- NOT TO SCALE

NOTES:

1. THE LOCATION OF ALL UNDER/ABOVE GROUND MUNICIPAL SERVICES, UTILITIES AND STRUCTURES ARE APPROXIMATE ONLY WHERE SHOWN ON THE DRAWING(S). THE COMPLETENESS AND ACCURACY OF THE LOCATION OF SUCH SERVICES, UTILITIES AND STRUCTURES ARE NOT GUARANTEED. THE CONTRACTOR SHALL DETERMINE THE LOCATION OF ALL SUCH SERVICES, UTILITIES AND STRUCTURES BY CONSULTING THE APPROPRIATE AUTHORITIES OR UTILITY COMPANIES CONCERNED BEFORE COMMENCEMENT OF THE WORK. THE CONTRACTOR SHALL PROVE THE LOCATION AND DEPTH OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE OR RESTORATION TO SAME.
2. THE CONTRACTOR SHALL INSTALL "TACTILE WALKING SURFACE INDICATORS" AS PER THE CITY'S STANDARDS T-310.030-7, T-310.030-8, T-310.030-9, T-310.030-10 AND T-310.030-11, ON ALL THE SIDEWALK CROSSINGS.
3. THE CONTRACTOR SHALL INSTALL "CATCH BASIN INDICATOR ARROW MARKINGS" AS PER THE CITY'S STANDARD T-216.02-25

LEGEND:

- PAVEMENT TO BE RECONSTRUCTED
- PAVEMENT TO BE RESURFACED
- SIDEWALK TO BE RECONSTRUCTED — TO BE RESTORED AS PER CITY STANDARD (T-310.010-2)
- NEW SIDEWALK TO BE CONSTRUCTED — AS PER CITY STANDARD (T-310.010-2)
- CONCRETE TRUCK APPRON
- COMMERCIAL ASPHALT DRIVEWAY CONSTRUCTION — 80 mm - SP19.0B, 150 mm - GRANULAR A
- RESIDENTIAL ASPHALT DRIVEWAY CONSTRUCTION — 80 mm - SP12.5B (2 LIFTS), 150 mm - GRANULAR A
- RESIDENTIAL CONCRETE DRIVEWAY CONSTRUCTION — 150 mm - 32 MPa PORTLAND CEMENT CONCRETE 150 mm - GRANULAR A
- RESIDENTIAL INTERLOCK DRIVEWAY CONSTRUCTION — TO BE RESTORED AS PER TS-3.80

arva R.V. Anderson Associates Limited
engineering • environment • infrastructure

No.	DATE	REVISIONS	INITIAL	SIGNED
5	08-23-2021	ISSUED FOR REVISED 95% DETAILED DESIGN SUBMISSION	M.L.	
4	03-04-2020	ISSUED FOR 95% DETAILED DESIGN SUBMISSION	M.L.	
3	01-10-2020	ISSUED FOR 50%/70% DETAILED DESIGN SUBMISSION	M.L.	
2	11-22-2019	ISSUED FOR 90%/100% PRELIMINARY DESIGN SUBMISSION	M.L.	
1	10-23-2019	ISSUED FOR 60% PRELIMINARY DESIGN SUBMISSION	M.L.	

DIGITAL INFORMATION

TORONTO Engineering & Construction Services

MICHAEL D'ANDREA, P.ENG
CHIEF ENGINEER and EXECUTIVE DIRECTOR
Engineering & Construction Services

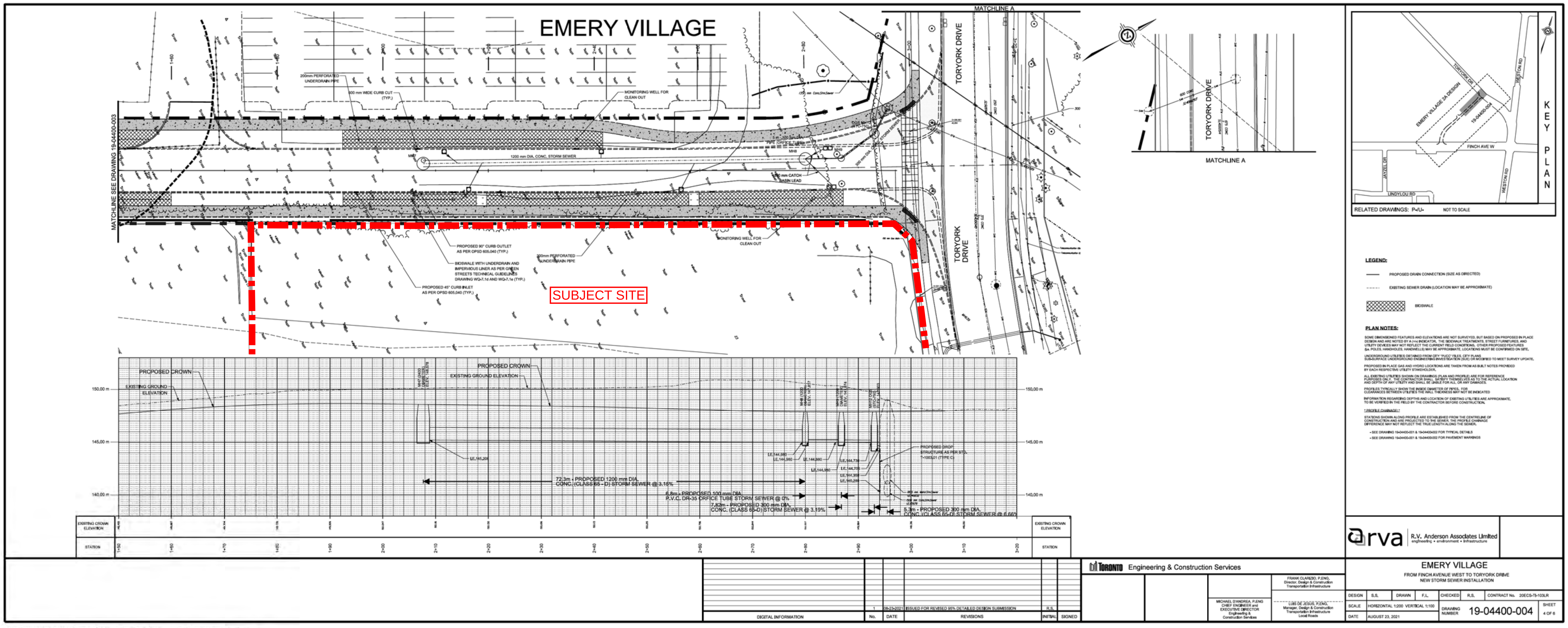
FRANK CLARIZIO, P.ENG.
Director, Design & Construction
Transportation Infrastructure

LUIS DE JESUS, P.ENG.
Manager, Design & Construction
Transportation Infrastructure
Local Roads

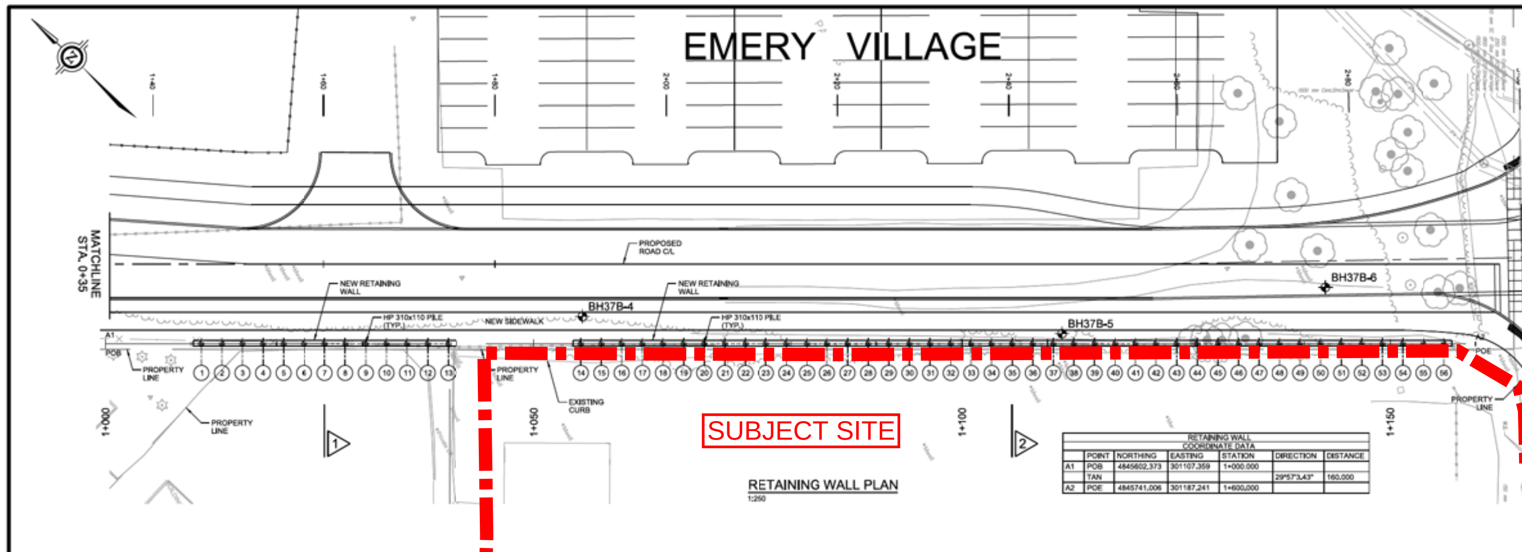
EMERY VILLAGE

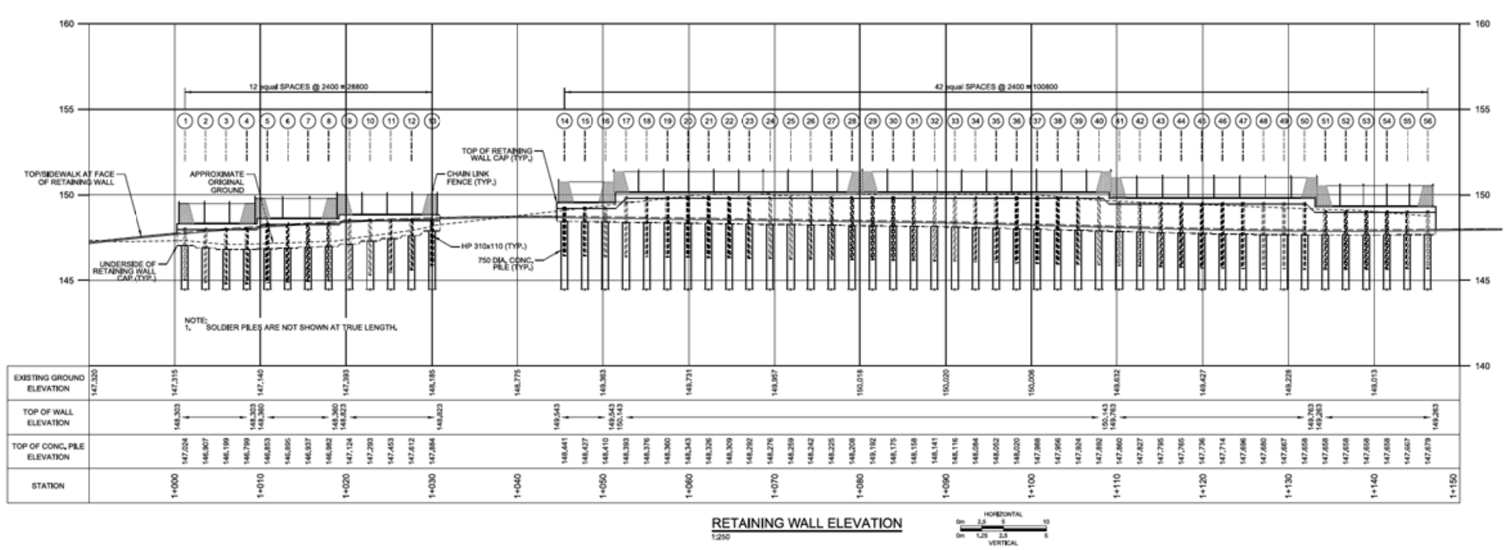
FROM FINCH AVENUE WEST TO TORYORK DRIVE
NEW ROAD CONSTRUCTION

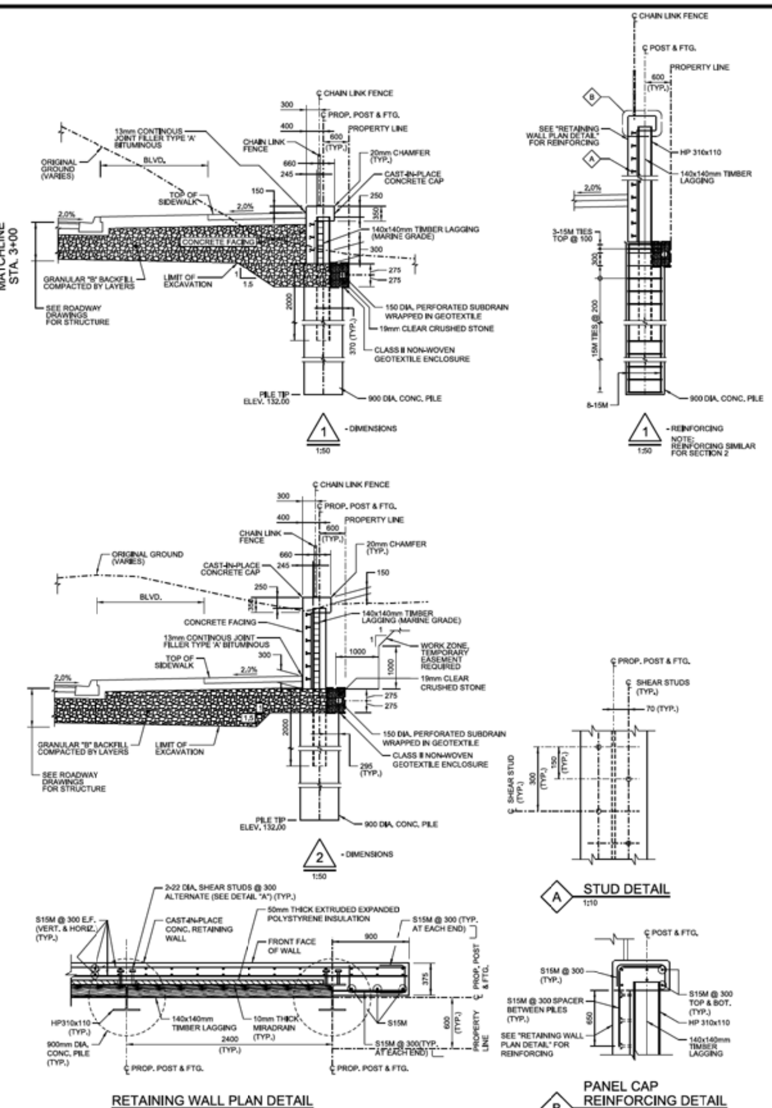
DESIGN	M.L./A.D.	DRAWN	A.D.	CHECKED	M.L.	CONTRACT No. 20ECS-TI-103LR
SCALE	HORIZONTAL 1:200 VERTICAL 1:100			DRAWING NUMBER	19-04400-002	SHEET 2 OF 6
DATE	AUGUST 23, 2021					



EMERY VILLAGE
SUBJECT SITE
MATCHLINE SEE DRAWING 19-04400-003
MATCHLINE A
TORYORK DRIVE
200mm PERFORATED UNDERDRAIN PIPE
600 mm WIDE CURB CUT (TYP.)
MONITORING WELL FOR CLEAN OUT
1200 mm DIA. CONC. STORM SEWER
PROPOSED 90° CURB OUTLET AS PER OPSD 605.040 (TYP.)
BIOSWALE WITH UNDERDRAIN AND IMPERVIOUS LINER AS PER GREEN STREETS TECHNICAL GUIDELINES DRAWING WQ-7.1d AND WQ-7.1e (TYP.)
PROPOSED 45° CURB INLET AS PER OPSD 605.040 (TYP.)
PROPOSED CROWN
EXISTING GROUND ELEVATION
150.00 m
145.00 m
140.00 m
72.3m - PROPOSED 1200 mm DIA. CONC. (CLASS 65 - D) STORM SEWER @ 3.16%
6.8m - PROPOSED 100 mm DIA. P.V.C. DR-35 ORFICE TUBE STORM SEWER @ 0%
7.82m - PROPOSED 300 mm DIA. CONC. (CLASS 65-D) STORM SEWER @ 3.19%
5.3m - PROPOSED 300 mm DIA. CONC. (CLASS 65-D) STORM SEWER @ 6.66%
PROPOSED DROP STRUCTURE AS PER STD. T-1003.01 (TYPE C)
EXISTING CROWN ELEVATION
STATION
1+50
1+60
1+70
1+80
1+90
2+00
2+10
2+20
2+30
2+40
2+50
2+60
2+70
2+80
2+90
3+00
3+10
3+20
KEY PLAN
FINCH AVE W
WESTON RD
TORYORK DR
EMERY VILLAGE 2A DESIGN
LINDYLOU RD
JAYZEL DR
RELATED DRAWINGS: P-/U-
NOT TO SCALE
LEGEND:
PROPOSED DRAIN CONNECTION (SIZE AS DIRECTED)
EXISTING SEWER DRAIN (LOCATION MAY BE APPROXIMATE)
BIOSWALE
PLAN NOTES:
SOME DIMENSIONED FEATURES AND ELEVATIONS ARE NOT SURVEYED, BUT BASED ON PROPOSED IN PLACE DESIGN AND ARE NOTED BY A (+/-) INDICATOR. THE SIDEWALK TREATMENTS, STREET FURNITURES, AND UTILITY DEVICES MAY NOT REFLECT THE CURRENT FIELD CONDITIONS. OTHER PROPOSED FEATURES (i.e. POLES, HANDHOLES, HANDWELLS) MAY BE APPROXIMATE, LOCATIONS MUST BE CONFIRMED ON SITE.
UNDERGROUND UTILITIES OBTAINED FROM CITY "PUCC" FILES, CITY PLANS SUB-SURFACE UNDERGROUND ENGINEERING INVESTIGATION (SUE) OR MODIFIED TO MEET SURVEY UPDATE.
PROPOSED IN PLACE GAS AND HYDRO LOCATIONS ARE TAKEN FROM AS BUILT NOTES PROVIDED BY EACH RESPECTIVE UTILITY STAKEHOLDER.
ALL EXISTING UTILITIES SHOWN ON DRAWINGS (PLAN AND PROFILE) ARE FOR REFERENCE PURPOSES ONLY. THE CONTRACTOR SHALL SATISFY THEMSELVES AS TO THE ACTUAL LOCATION AND DEPTH OF ANY UTILITY AND SHALL BE LIABLE FOR ALL, OR ANY DAMAGES.
PROFILES TYPICALLY SHOW THE INSIDE DIAMETER OF PIPES. FOR CLEARANCES BETWEEN UTILITIES THE WALL THICKNESS MAY NOT BE INDICATED
INFORMATION REGARDING DEPTHS AND LOCATION OF EXISTING UTILITIES ARE APPROXIMATE, TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR BEFORE CONSTRUCTION.
* PROFILE CHAINAGE! *
STATIONS SHOWN ALONG PROFILE ARE ESTABLISHED FROM THE CENTRELINE OF CONSTRUCTION AND ARE PROJECTED TO THE SEWER. THE PROFILE CHAINAGE DIFFERENCE MAY NOT REFLECT THE TRUE LENGTH ALONG THE SEWER.
- SEE DRAWING 19-04400-001 & 19-04400-002 FOR TYPICAL DETAILS
- SEE DRAWING 19-04400-001 & 19-04400-002 FOR PAVEMENT MARKINGS
R.V. Anderson Associates Limited
engineering • environment • infrastructure
TORONTO Engineering & Construction Services
FRANK CLARIZIO, P.ENG. Director, Design & Construction Transportation Infrastructure
MICHAEL D'ANDREA, P.ENG CHIEF ENGINEER and EXECUTIVE DIRECTOR Engineering & Construction Services
LUIS DE JESUS, P.ENG. Manager, Design & Construction Transportation Infrastructure Local Roads
EMERY VILLAGE
FROM FINCH AVENUE WEST TO TORYORK DRIVE
NEW STORM SEWER INSTALLATION
DESIGN S.S.
DRAWN F.L.
CHECKED R.S.
CONTRACT No. 20ECS-TI-103LR
SCALE HORIZONTAL 1:200 VERTICAL 1:100
DATE AUGUST 23, 2021
DRAWING NUMBER 19-04400-004
SHEET 4 OF 6
1 08-23-2021 ISSUED FOR REVISED 95% DETAILED DESIGN SUBMISSION R.S.
DIGITAL INFORMATION
No.
DATE
REVISIONS
INITIAL
SIGNED







GENERAL NOTES

1. THE STRUCTURAL DRAWINGS ARE TO BE READ INCONJUNCTION WITH THE CIVIL DRAWINGS xxx.
2. DESIGN CODE: CHBDC CA/CSA-S6-19
   DESIGN LOAD: CL-625-ONT

CLASS OF CONCRETE

C.I.P. WALL AND FOOTING........................= 35 MPa
CAISSON..= 30 MPa
ALL OTHE COMPONENTS (UNLESS NOTED OTHERWISE)..........= 35 MPa

CLEAR COVER TO REINFORCING STEEL

FOOTING CAISSON........ 70±20
PANEL.................. 70±20
CAP.................... 70±20

REINFORCING STEEL

1. REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED.
2. STAINLESS REINFORCING STEEL SHALL BE TYPE 316LN OR DUPLEX 2205 AND HAVE A MINIMUM YIELD STRENGTH OF 500 MPa, UNLESS OTHERWISE SPECIFIED.
3. BARS ARE MARKED WITH PREFIX "S" DENOTES STAINLESS STEEL.
4. UNLESS SHOWN OTHERWISE, TENSION LAP SPLICES SHALL BE CLASS 'B'.
5. BAR HOOKS SHALL HAVE STANDARD HOOK DIMENSIONS USING MINIMUM BEND DIAMETRES, WHILE STIRRUPS AND TIES SHALL HAVE MINIMUM HOOK DIMENSIONS, ALL HOOKS SHALL BE IN ACCORDANCE WITH THE STRUCTURAL STANDARD DRAWINGS SS12-1, UNLESS INDICATED OTHERWISE.

CONSTRUCTION NOTES

1. ALL STRUCTURAL STEEL SECTIONS AND PLATES SHALL CONFORM TO CAN/CSA-G40.21-M92, GRADE 350 W.
2. ALL SPLICE IN SOLDIER PILES SHALL BE IN CONFORMANCE WITH OPSD 3000.020.
3. ALL PILES SHALL BE HP 310x110.
4. ALL WELDING SHALL BE CARRIED OUT IN ACCORDANCE WITH CSA-W-59-M1989, THE FABRICATOR SHALL BE FULLY APPROVED BY THE CANADIAN WELDING BUREAU IN CONFORMANCE WITH THE CSA W47.1-92.
5. THE CONTRACTOR SHALL CHECK AND VERIFY ALL EXISTING SITE DIMENSIONS AND DETAILS AND REPORT ANY DISCREPANCIES TO THE ENGINEER PRIOR TO PROCEEDING WITH THE WORK.
6. IT IS SOLEY THE RESPONSIBILITY OF THE CONTRACTOR RETAINED TO COMPLETE THE WORKS, TO ENSURE THAT THE WORKS ARE COMPLETED IN SUCH A MANNER THAT THE COLLAPSE OF SOLDIER PILE AUGER HOLES AND/OR EXCESSIVE MOVEMENT OF THE ADJACENT SURROUNDINGS DOES NOT OCCURE.
7. THE LOCATION OF ALL UNDER/ABOVE GROUND MUNICIPAL SERVICES, UTILITIES AND STRUCTURES ARE APPROXIMATE ONLY WHERE SHOWN ON THE DRAWING(S). THE COMPLETENESS AND ACCURACY OF THE LOCATION OF SUCH SERVICES, UTILITIES AND STRUCTURES ARE NOT GUARANTEED. THE CONTRACTOR SHALL DETERMINE THE LOCATION OF ALL SUCH SERVICES, UTILITIES AND STRUCTURES BY CONSULTING THE APPROPRIATE AUTHORITIES OR UTILITY COMPANIES CONCERNED BEFORE COMMENCEMENT OF THE WORK, THE CONTRACTOR SHALL PROVE THE LOCATION AND DEPTH OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE OR RESTORATION TO SAME.
8. ANY DAMAGE DURING CONSTRUCTION TO THE EXISITNG STRUCTURE NOT DESIGNATED FOR REPAIR, UTILITIES AND ADJACENT PROPERTIES SHALL BE REPAIRED BY THE CONTRACTOR TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR AT NO COST TO THE OWNER.
9. THE CONTRACTOR IS FULLY RESPONSIBLE FOR ADEQUATE PROTECTION OF ALL UTILITIES, SERVICES, ROADWAYS, ETC., DURING CONSTRUCTION OPERATIONS.
10. PROTECTION SYSTEM SHALL MEET REQUIREMENTS FOR PERFORMANCE LEVEL 2 (OPSS, PROV 539, NOV. 2014). LIMITS AND LOCATIONS SHALL BE DETERMINED BY THE CONTRACTOR.

SOLDIER PILE NOTES

MAXIMUM DESIGN LOAD AT ULS = 960 KN/PILE
MAXIMUM DESIGN LOAD AT SLS = 800 KN/PILE

FOR THE SOLDIER PILES RETAINING WALL, THE CAISON FOUNDATIONS TO BE DRILLED TO THE ELEVATION OF 132.0 METRES.

HELICAL PILE NOTES

FOR PRELIMINARY PLANNING AND CONCEPT DESIGN PURPOSES, PRELIMINARY BEARING RESISTANCE VALUE AT SERVICEABILITY LIMIT STATES (SLS) AND FACTORED ULTIMATE LIMIT STATES (ULS) TOGETHER WITH THE CORRESPONDING APPROXIMATE FOUNDING ELEVATION AT THE BOREHOLE LOCATIONS ARE PROVIDED IN THE FOLLOWING TABLE.

BH No.	BEARING RESISTANCE AT SLS (kN)	FACTORED GEOTECHNICAL RESISTANCE AT ULS (kN)	FOUNDING ELEVATION AT / OR BELOW (m)	EXPECTED SOIL CONDITION
BH37B-1	200 TO 350	240 TO 420	130.0	DENSE FINE SANDY SILT
BH37B-4	150 TO 350	180 TO 360	131.5	DENSE SANDY SILT TILL
BH37B-5	200 TO 350	240 TO 420	132.0	VERY DENSE SANDY SILT
BH37B-6	80 TO 150	95 TO 180	131.5	COMPACT SANDY SILT
BH37B-5	200 TO 350	240 TO 420	127.0	VERY DENSE SILT TO FINE SANDY SILT
BH37B-7	200 TO 350	240 TO 420	126.0	VERY DENSE SANDY SILT

FIELD LOAD TESTING OF PILES SHALL BE PROVIDED TO CONFIRM THE DESIGN BEARING CAPACITY AS PER THE REQUIREMENTS OF SPECIFICATIONS PROVIDED IN THE CONTRACT DOCUMENT.

APPLICABLE STANDARDS

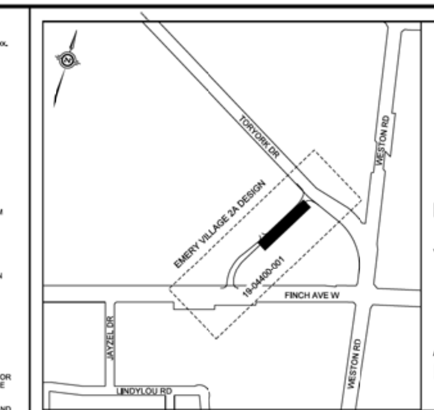
OPSD 0972.130 FENCE, CHAIN-LINK, INSTALLATION - ROADWAY

LIST OF DRAWINGS

S01 RETAINING WALL DETAILS
S02 SEWER SUPPORT SYSTEM DETAIL I
S03 SEWER SUPPORT SYSTEM DETAIL II
S04 BOREHOLE LOCATION AND SOIL STRATA

DRAFT

ALL ITEMS REQUIRING EXCAVATION SHALL BE IN ACCORDANCE WITH TS 2.10 GENERAL EXCAVATION. THE COST TO EXCAVATE AND DISPOSE OF MATERIAL TO ALLOW FOR THE PLACEMENT OF NEW GRANULAR, CONCRETE, ASPHALT, TOPSOIL, SOD OR OTHER MATERIAL SHALL BE INCIDENTAL TO THE ASSOCIATED ITEMS. NO SEPARATE PAYMENT SHALL BE MADE.



RELATED DRAWINGS: P-/U- NOT TO SCALE

R.V. Anderson Associates Limited
engineering • environment • infrastructure

No.	DATE	REVISIONS	INITIAL	SIGNED
1	10-25-2021	ISSUED FOR 30% SUBMISSION	R.M.	

DIGITAL INFORMATION

TORONTO Engineering & Construction Services

FRANK CLARIZIO, P.ENG.
Director, Design & Construction
Transportation Infrastructure

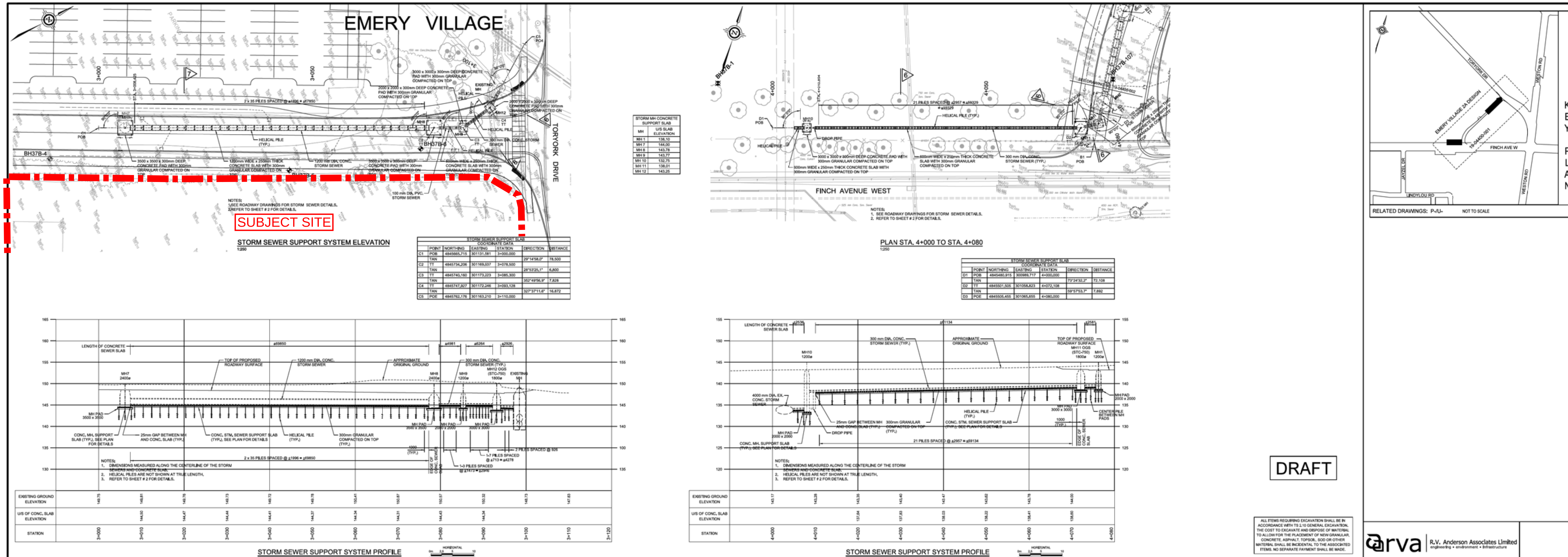
MICHAEL D'ANDREA, P.ENG
CHIEF ENGINEER and EXECUTIVE DIRECTOR
Engineering & Construction Services

LUIS DE JESUS, P.ENG.
Manager, Design & Construction
Transportation Infrastructure
Local Roads

EMERY VILLAGE

FROM FINCH AVENUE WEST TO TORYORK DRIVE
NEW ROAD CONSTRUCTION
RETAINING WALL DETAILS

DESIGN	R.M.	DRAWN	R.R.G.	CHECKED	R.M.	CONTRACT No. 20ECS-TI-103LR
SCALE	HORIZONTAL 1:250 VERTICAL 1:125			DRAWING NUMBER	19-04400-001	SHEET 1 OF 3
DATE	OCTOBER 25, 2021					



STORM SEWER SUPPORT SLAB COORDINATE DATA						
	POINT	NORTHING	EASTING	STATION	DIRECTION	DISTANCE
C1	POB	4845665.715	301131.581	3+000.000		
	TAN				29°14'58.0"	78.500
C2	TT	4845734.206	301169.937	3+078.500		
	TAN				28°53'25.1"	6.800
C3	TT	4845740.160	301173.223	3+085.300		
	TAN				352°49'56.9"	7.828
C4	TT	4845747.927	301172.246	3+093.128		
	TAN				327°37'11.6"	16.872
C5	POE	4845762.176	301163.210	3+110.000		

STORM MH CONCRETE SUPPORT SLAB	
MH	U/S SLAB ELEVATION
MH 1	138.10
MH 7	144.00
MH 8	143.78
MH 9	143.77
MH 10	132.75
MH 11	138.01
MH 12	143.25

STORM SEWER SUPPORT SLAB COORDINATE DATA						
	POINT	NORTHING	EASTING	STATION	DIRECTION	DISTANCE
D1	POB	4845480.915	300989.717	4+000.000		
	TAN				73°24'32.2"	72.108
D2	TT	4845501.505	301058.823	4+072.108		
	TAN				59°57'53.7"	7.892
D3	POE	4845505.455	301065.655	4+080.000		

ALL ITEMS REQUIRING EXCAVATION SHALL BE IN ACCORDANCE WITH TS 2.10 GENERAL EXCAVATION. THE COST TO EXCAVATE AND DISPOSE OF MATERIAL TO ALLOW FOR THE PLACEMENT OF NEW GRANULAR, CONCRETE, ASPHALT, TOPSOIL, SOD OR OTHER MATERIAL SHALL BE INCIDENTAL TO THE ASSOCIATED ITEMS. NO SEPARATE PAYMENT SHALL BE MADE.

DIGITAL INFORMATION

No.	DATE	REVISIONS	INITIAL	SIGNED
1	10-25-2021	ISSUED FOR 30% SUBMISSION	R.M.	

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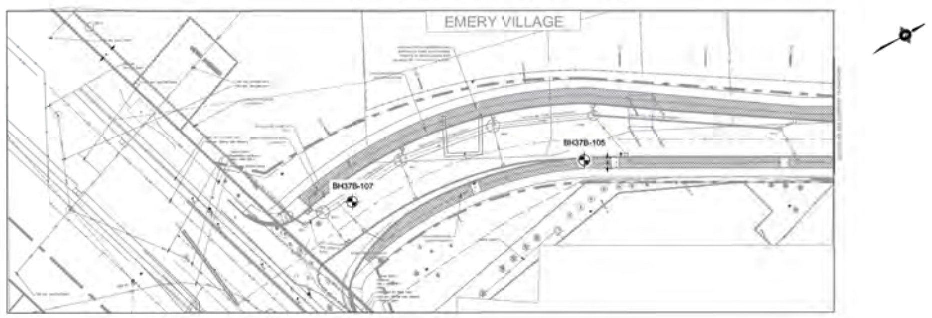
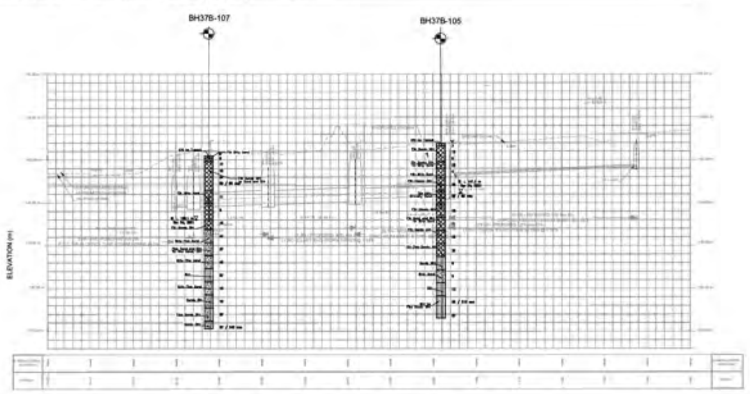
EMERY VILLAGE

FROM FINCH AVENUE WEST TO TORYORK DRIVE
NEW ROAD CONSTRUCTION
SEWER SUPPORT DETAIL 2

DESIGN	R.M.	DRAWN	R.R.G.	CHECKED	R.M.	CONTRACT No. 20ECS-TI-103LR
SCALE	HORIZONTAL 1:250 VERTICAL 1:250			DRAWING NUMBER	19-04400-003	SHEET 3 OF 4
DATE	JANUARY 21, 2022					

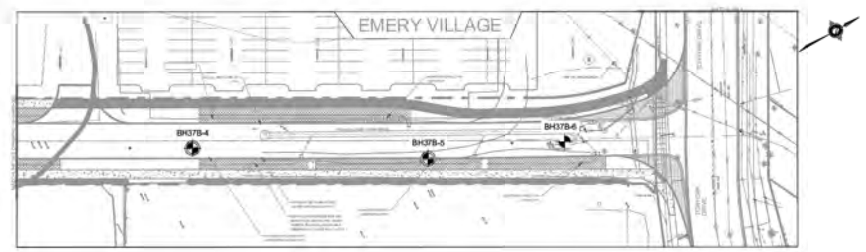
Plan (STA. 0+00 to STA. 1+50)

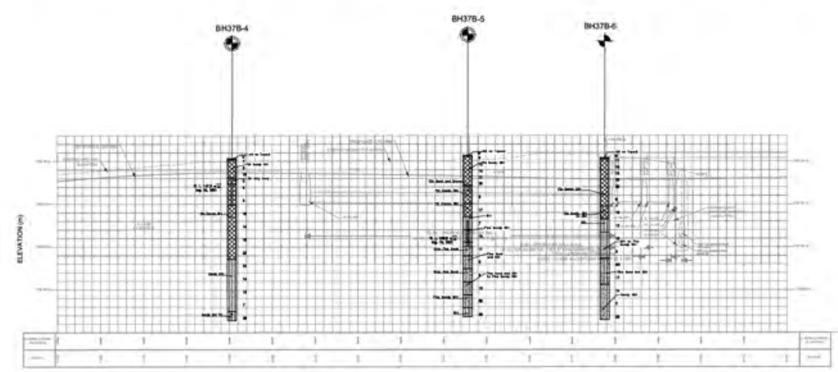




Profile (STA. 0+00 to STA. 1+50)

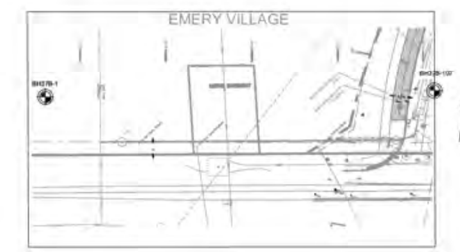
Plan (STA. 1+50 to STA. 3+20)

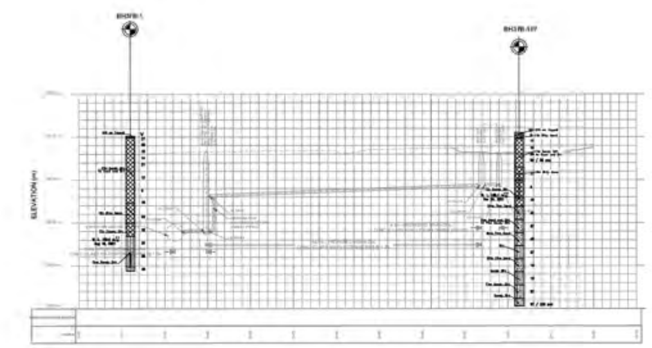




Profile (STA. 1+50 to STA. 3+20)

Plan (STA. 1+10 to STA. 0+10)





Profile (STA. 1+10 to STA. 0+10)

LEGEND

- Borehole
- Monitoring Well
- Groundwater level
- Monitoring Well Screen

GeoPro Consulting Limited

Notes:

1. The profiles are prepared according to the inferred site stratigraphy based on the information obtained from the limited number of boreholes. The subsurface soil between and beyond the boreholes may differ significantly from those encountered at the borehole locations. The inferred boundary between the different soil strata should be considered as approximate and for reference only.

2. The groundwater levels shown on the profiles were measured in limited number of monitoring wells at different screen depths. The groundwater levels between and beyond the monitoring wells may differ significantly from those encountered at the monitoring well locations and screen depths. Groundwater levels were measured on a specific date and may change due to the seasonal fluctuation.

DIGITAL INFORMATION	No.	DATE	REVISIONS	INITIAL	SIGNED
	1	05-11-2022	ISSUED FOR SUBMISSION	D.X.	

Toronto Engineering & Construction Services

FRANK CLARIZIO, P.ENG.
Director, Design & Construction
Transportation Infrastructure

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Local Roads

EMERY VILLAGE

FROM FINCH AVENUE WEST TO TORYORK DRIVE
NEW ROAD CONSTRUCTION
BOREHOLE LOCATION AND SOIL STRATA

DESIGN	N/A	DRAWN	N.L.	CHECKED	D.X.	CONTRACT No. 20ECS-TI-103LR
SCALE	N.T.S.	DRAWING NUMBER	19-04400-004			SHEET 4 OF 4
DATE	May 11, 2022					

APPENDIX C

TECHNICAL MEMORANDUM

Date:	24 February 2023
Revision:	Version 2
To:	Joshua Marlow, Berkshire Axis Development Inc.
CC:	Angela Mokin & Paolo Albanese (fp&p)
From:	Nikola Tomic and Fabian Papa (HydraTek)
Subject:	Water System Analysis 15-23 Toryork Drive, Toronto

INTRODUCTION

HydraTek & Associates (HydraTek) has been retained by fabian papa & partners (fp&p) on behalf of The Berkshire Axis Development, the "Client", to conduct a water system analysis in support of a Draft Plan of Subdivision and Re-Zoning Application for the proposed development at 15-23 Toryork Drive in Toronto, Ontario. This report presents and discusses the results of a hydraulic field investigation of the City of Toronto's (City's) local Pressure District 4 West (PD4W) water supply system in the vicinity of the site. Pressures were recorded at three fire hydrants on 07 July 2021 from 08:20 AM to 09:45 AM, and two hydrant flow tests were performed during that period. The objective of this work is to explore if the City's existing PD4W water system can support the proposed development under fire demand conditions.

BACKGROUND

Located at 15-23 Toryork Drive in Toronto, the site is currently occupied by industrial properties. It contains one one-storey and one two-storey industrial buildings. Figure 1 shows a site location map. The site comprises approximately 15,688 m^2 (1.57 ha) of land area and makes up the entire Draft Plan of Subdivision and Re-Zoning Application. The development on 15-23 Toryork Drive contemplates the construction of a residential complex with 38-storey tower (Block 1), 36-storey tower and 26-storey tower on a common 5-storey podium (Block 2), 29-storey tower (Block 3), a Public Park, and a new municipal roadway (Street "A"). The site is bounded by Toryork Drive to the north, gas station and Weston Road to the east, residential building and plaza (with potential for residential developments) to the south, and industrial property (and proposed new city designed public road) to the west.

Based on the Fire Underwriter's Survey (FUS) criteria for calculation of fire flow demands, the greatest required fire design demand for proposed constructions is calculated to be 118 L/s for Block 2 podium. Additionally, in accordance with the City's design criteria for fire flow demands for high-rise residential buildings, the required fire design demand is 19,000 L/min (317 L/s). Water supply for the building will be supplied by the existing 300 mm watermain on Toryork Drive, and the analysis considers two options for water supply for the proposed development as shown in Figure 1:

(i) Supply from single line from Toryork watermain (i.e., dead-end);
(ii) Supply from looped connection from Toryork watermain.

To assess these scenarios, a hydraulic model of the local water supply network was developed.

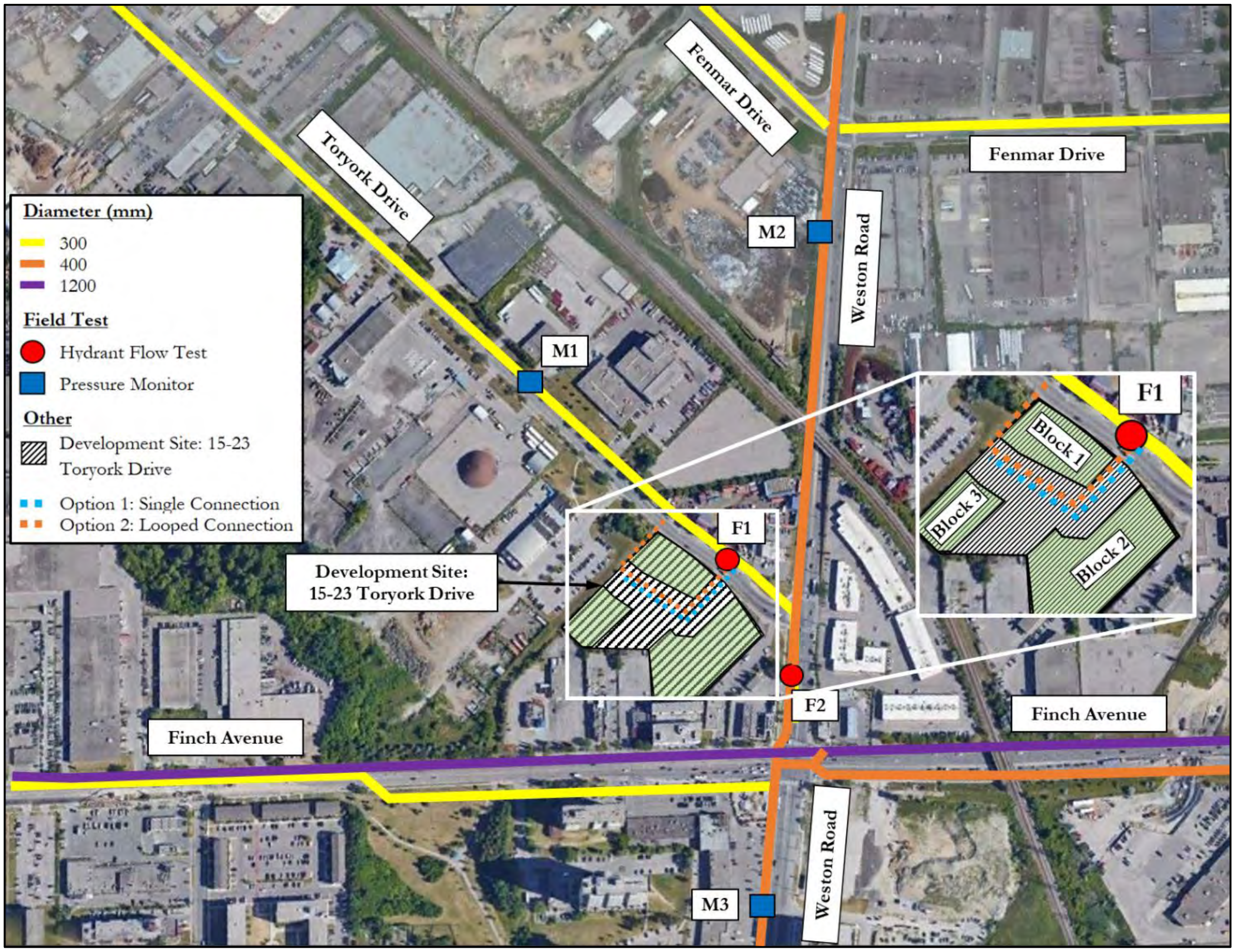


Figure 1: Location map of site, monitoring hydrants, and flow hydrants

METHODOLOGY

As noted, the site is located within the City's PD4W water system. This part of the system is primarily supplied by Richview PS and William H. Johnston PS, and the pressure district floats on storage from Keele PD4W Reservoir with top water level of 210.31 m and West Woodbridge Tank with top water level of 210.30 m. In order to develop a baseline level of performance for the existing system and to assess the available fire flow from the system at the connection point, a field monitoring exercise was conducted. During the investigation, two hydrant flow tests were performed to observe the system response curve.

Two pressure loggers were supplied and installed by HydraTek on a single port at each of the three monitoring hydrants. During the monitoring period, flow tests were completed (as per NFPA 291) at two flow hydrants. Figure 1 above shows the monitoring hydrant and flow hydrant locations relative to the site, while Table 1 on the following page reports the hydrant details. The flow test and monitoring locations were selected based on their proximity to the site and on which mains the hydrants are connected. All hydrants are within the City's PD4W water system.

Table 1: List of hydrant locations

Hydrant ID	Hydrant Type	Pressure District	Address	Watermain Diameter (mm)
M1	Monitoring	PD4W	40 Toryork Drive	300
M2	Monitoring	PD4W	3605 Weston Road	400
M3	Monitoring	PD4W	3466 Weston Road	400
F1	Flow	PD4W	21 Toryork Drive	300
F2	Flow	PD4W	3514 Weston Road	400

Table 2 lists the pressure logger details for the monitoring hydrants. Pressures were recorded at an interval of once every 3 seconds. Data was recorded successfully for the duration of the field investigation from all three monitoring locations.

Table 2: List of pressure monitoring dates, logger details, and recording intervals

Hydrant ID	Time Period		Logger Type	Recording Interval (s)
	Start	End		
M1	08:20:00	09:30:00	Cla-Val e-Log	3
M2	08:15:00	09:45:00	Cla-Val e-Log	3
M3	08:40:00	09:40:00	Cla-Val e-Log	3

RESULTS AND DISCUSSION

Appendix A contains time series plots of the pressure monitoring data. Figure 6 in Appendix A plots the recorded pressures and Figure 7 plots the hydraulic grade line (HGL) at monitoring locations. Both plots in Appendix A show the pressure data during the hydrant flow tests.

Operating Pressures

Table 3 (below) summarizes statistics of the field data collected for the monitoring period. An estimated average HGL at all locations is between 208 m and 209 m, which is the normal HGL operating range for PD4W.

Table 3: Summary statistics for pressure monitoring data during the monitoring period

Monitoring Location	Pressure District	Average Operating Pressure (psi)	Average HGL (m)
M1	PD4W	86	208.7
M2	PD4W	74	208.5
M3	PD4W	85	208.9

Hydrant Flow Tests

Results for the hydrant flow tests are summarized in Table 4 which lists the tested flows from hydrants F1 and F2, along with the residual pressures recorded at monitoring hydrants M1, M2 and M3. Table 5 reports the drop in pressure at the monitoring hydrants during the hydrant flow tests, while Figure 2 compares the residual hydrant pressure v. flow curves. The hydrant flow test data is subsequently used in the modelling exercise to estimate maximum fire flow available for the watermain on Toryork Drive as well as to predict the impact of the proposed development on the PD4W system under design (maximum day demand plus fire flow) conditions.

Table 4: Hydrant flow test results and residual hydrant pressures

Hydrant ID	No. Hydrant Ports*	Total Tested Flow (L/s)	Time		Residual Pressures (psi)		
			Start	End	M1	M2	M3
F1	0 (Initial)	0.0	8:42:10	8:50:10	86	74	85
	1	79	8:52:40	8:56:40	85	74	85
	2	132	8:58:40	9:01:40	83	73	84
	0 (Final)	0.0	9:06:40	9:14:40	86	74	85
F2	0 (Initial)	0.0	9:06:40	9:14:40	86	74	85
	1	87	9:16:40	9:18:58	85	74	84
	2	135	9:20:28	9:22:16	85	73	84
	0 (Final)	0.0	9:27:16	9:31:16	86	74	85

* All hydrant flow tests used 2.5" port diffusers

Table 5: Monitoring hydrant pressure drops during hydrant flow tests

Hydrant ID	No. Hydrant Ports*	Total Tested Flow (L/s)	Time		Pressure Drop (psi)		
			Start	End	M1	M2	M3
F1	0 (Initial)	0.0	8:42:10	8:50:10	0.0	0.0	0.0
	1	79	8:52:40	8:56:40	1.0	0.5	0.0
	2	132	8:58:40	9:01:40	2.7	1.0	0.3
	0 (Final)	0.0	9:06:40	9:14:40	0.0	0.0	0.0
F2	0 (Initial)	0.0	9:06:40	9:14:40	0.0	0.0	0.0
	1	87	9:16:40	9:18:58	0.6	0.6	0.2
	2	135	9:20:28	9:22:16	0.8	0.9	0.3
	0 (Final)	0.0	9:27:16	9:31:16	0.0	0.0	0.0

* All hydrant flow tests used 2.5" port diffusers

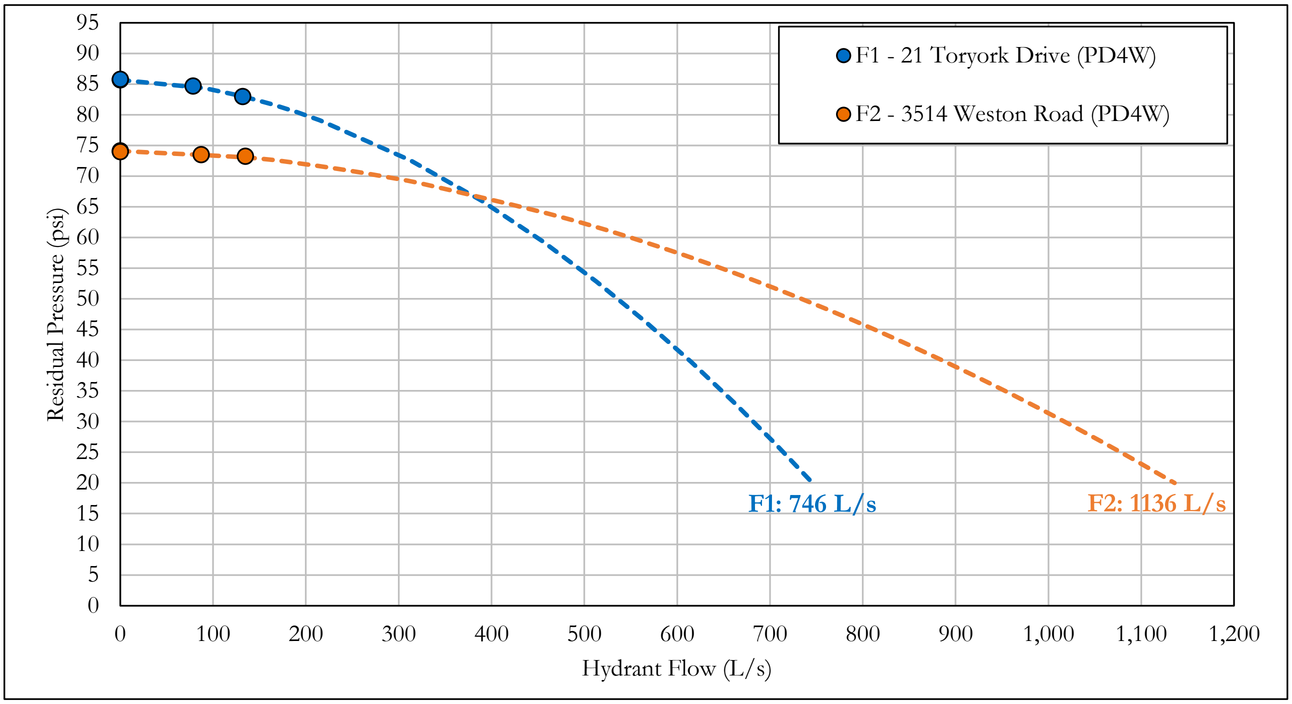


Figure 2: Plot of hydrant flow test results

Hydraulic Model

A hydraulic model of the study area was created in order to estimate the maximum fire flow available to the development site for the various scenarios. The steady-state numerical model for the study area (Figure 3) was created using Bentley Hammer. In attempting to replicate the test conditions numerically, the following assumptions were made in addition to those expressed in the previous sections of this report:

- Head losses are modelled as a combination of friction losses along pipes and local losses in the water system. For the former, pipes of a common diameter and material are assumed to have the same roughness (C-factor).
- The hydrant elevations are estimated based on available plan and profile drawings for Toryork Drive, Weston Avenue and Finch Avenue.

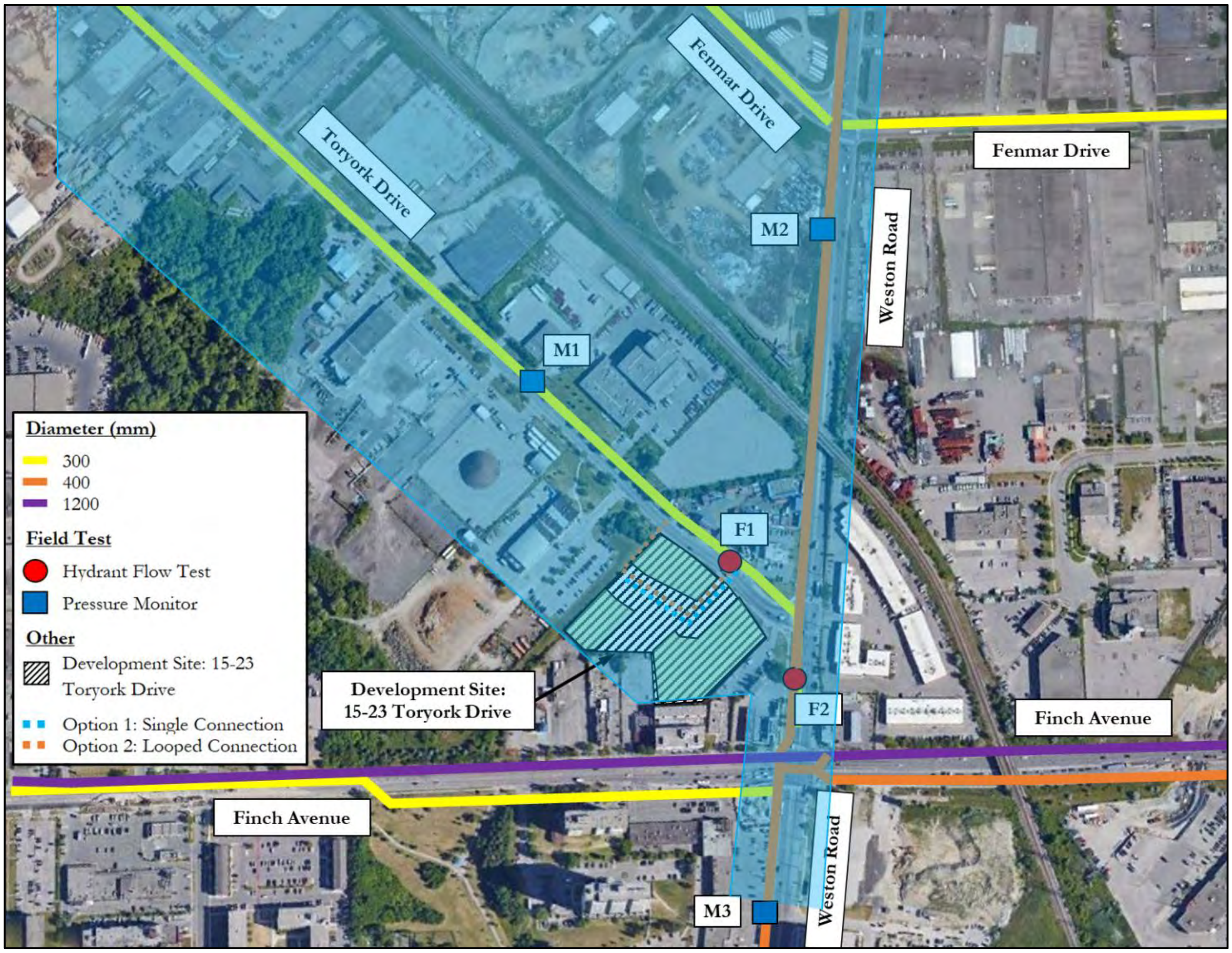


Figure 3: Study area for the hydraulic model

The model was calibrated against field data from three hydrant flow tests (hydrants F1 and F2) conducted on 07 July 2021. Copies of the hydrant flow test reports are provided in Appendix B for reference. The model was calibrated by adjusting the boundary reservoir level, boundary supply local loss coefficients, and pipe roughness values. Figure 4, and Figure 5 on the following pages compare the hydrant flow curves against the responses predicted by the model for the three monitoring locations (M1, M2 and M3). Minor discrepancies between the model and field data are likely due to localized factors, such as (i) unknown condition mains, (ii) leaks, and/or (iii) partially closed valves. These cannot be accurately accounted for based on available information and are difficult to consider, specifically without more intensive field investigations and testing, the value of which would be rather small relative to the cost to obtain this information. Altogether, the hydraulic model is considered to provide a reasonable representation of the local PD4W water system for the purposes of this analysis.

All modeling results are provided in tabular format in Appendix C.

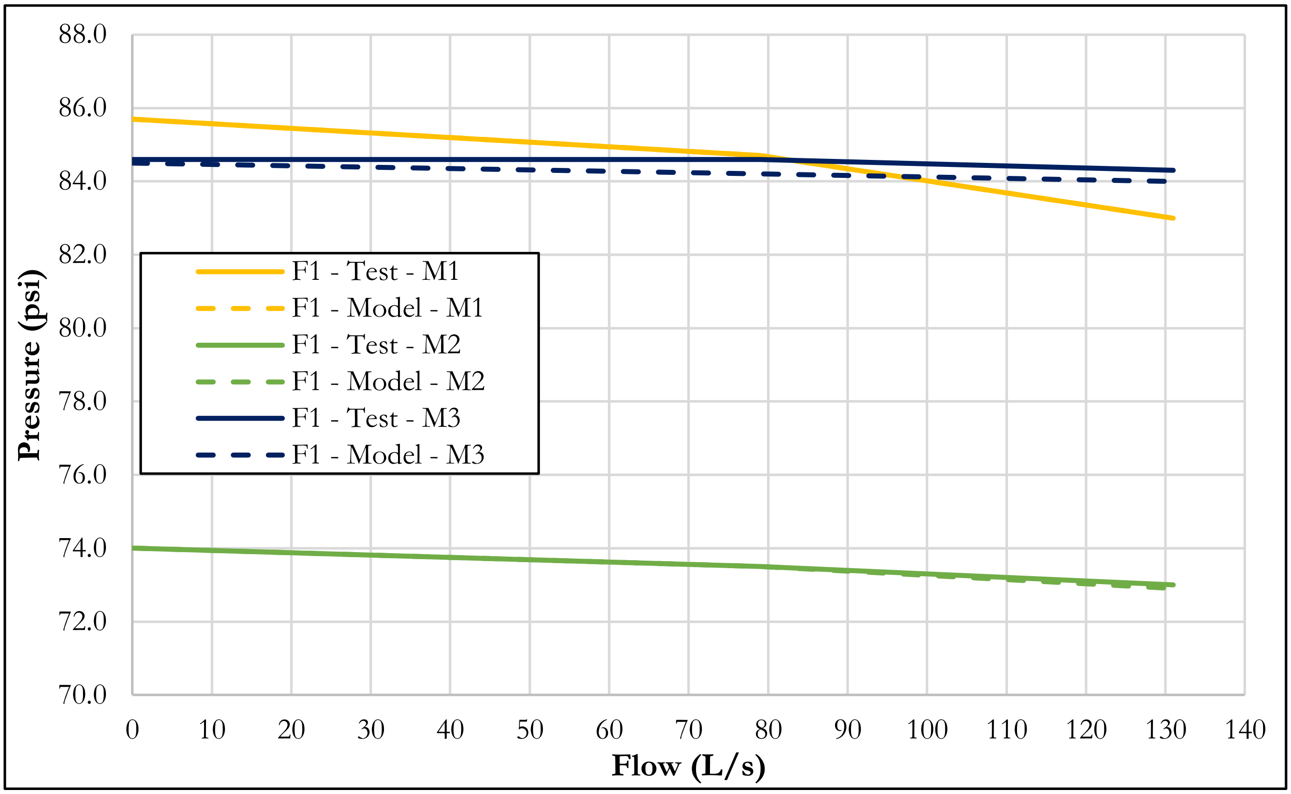


Figure 4: Comparison of hydrant flow test results and calibrated model results for F1 test

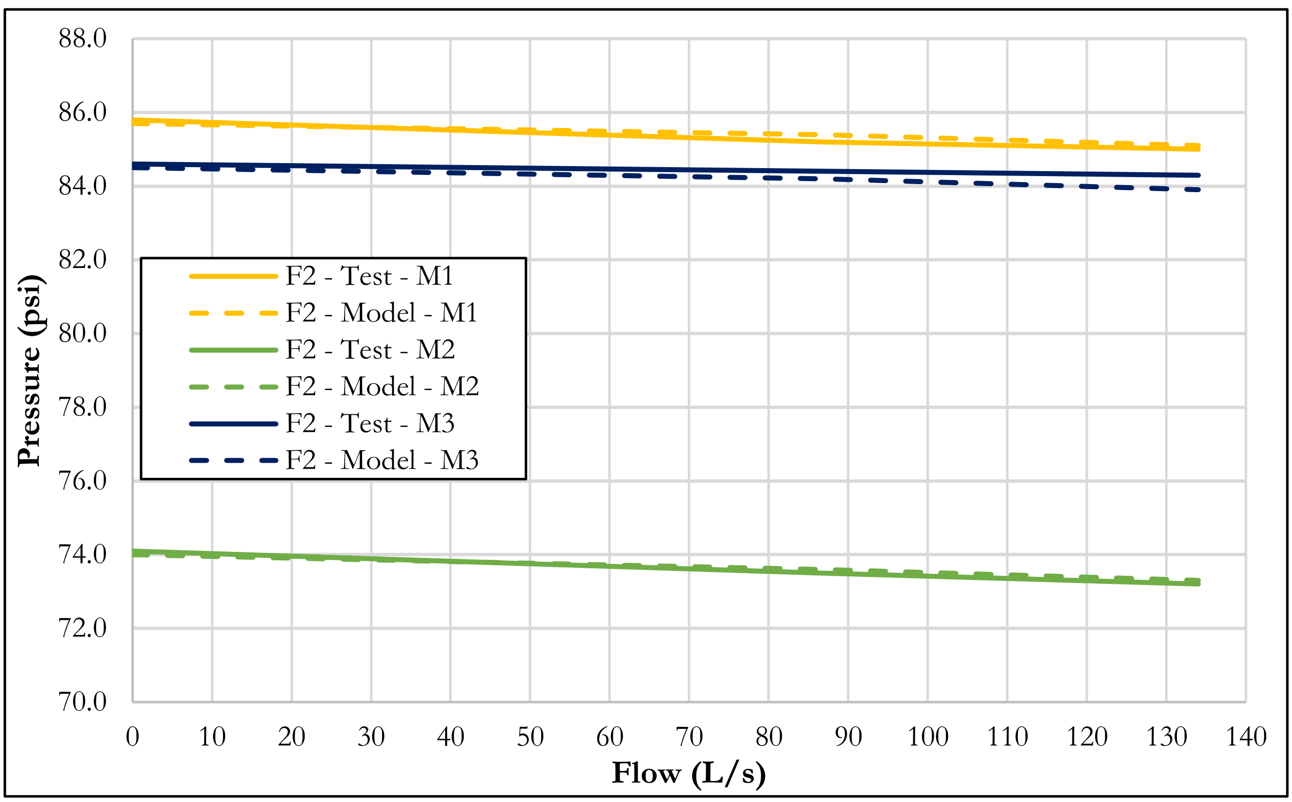


Figure 5: Comparison of hydrant flow test results and calibrated model results for F2 test

Table 6: Comparison of hydrant flow test results and calibrated model results

Hydrant ID	No. Hydrant Ports	Total Tested Flow (L/s)	Pressure (psi)								
			Field Test Results			Model Results			Pressure Drop Difference		
			M1	M2	M3	M1	M2	M3	M1	M2	M3
F1	0	0	85.7	74.0	84.6	85.7	74.0	84.5	0.0	0.0	0.1
	1	79	84.7	73.5	84.6	84.7	73.5	84.2	0.0	0.0	0.4
	2	131	83.0	73.0	84.3	83.0	72.9	84.0	0.0	0.1	0.3
F2	0	0	85.8	74.1	84.6	85.7	74.0	84.5	0.1	0.1	0.1
	1	87	85.2	73.5	84.4	85.4	73.6	84.2	0.2	0.1	0.2
	2	134	85.0	73.2	84.3	85.1	73.3	83.9	0.1	0.1	0.4

Fire Flow Analysis

The model was used to estimate the pressure drops at local PD4W water system for a fire demand for the site using the two previously mentioned options: a single connection to Toryork watermain; and looped system with two connections to Toryork watermain. Also, the size (diameter) of the connecting pipe is varied from 150 mm to 300 mm, and the results are summarized in Table 7. In all cases, the residual pressure in local PD4W water system is expected to remain well above that required under emergency conditions (20 psi).

Table 7: Estimated residual pressures at PD4W monitoring hydrants for maximum and designed fire flows

Scenario ID	Connection		Max Fire Flow (L/s)	Estimated Pressures (psi)					
				At Site Connection			At Local PD4W System		
	Type	Size (mm)		Average Static Pressure	Pressure Drop	Residual Pressure	Min Static Pressure	Max Static Pressure	Min Residual Pressure
1A	Single	150	96	80.8	61	20.1	70.0	85.7	69.4
1B		200	214	81.5	61.1	20.4			67.5
1C		250	**118***	81.6	8.3	73.3			69.1
1D		250	**317^**	81.6	52.2	29.4			65.0
1E		250	346	81.6	61.5	20.1			63.7
1F		300	488	81.6	61.6	20.0			48.5
2A	Looped	150	209	81.5	61.5	20.0			67.6
2B		200	**118***	81.6	6.2	75.4			69.1
2C		200	**317^**	81.6	39.3	42.3			64.9
2D		200	403	81.6	61.4	20.2			58.6
2E		250	537	81.6	61.5	20.1			42.9

*** Design flow as per FUS criteria for podium on Block 2**
^ Design fire flow as per City's design criteria

CONCLUSIONS

A hydraulic field investigation was conducted for the City's existing PD4W water system in vicinity of proposed development at 15-23 Toryork Drive on 07 July 2021. The purpose of the field investigation was to develop a baseline level of performance for the existing system and to develop a hydraulic model informed by the field data for determining future performance with the proposed development in place.

Based on the modelling analyses, the existing water supply infrastructure in the vicinity of the site is estimated to have capacity to supply required fire flows of 118 L/s (worst case fire flow for Block 2 podium based on FUS requirements) and 317 L/s (based on City's design criteria) to the development's proposed point of connection. Furthermore, in order to meet the requirements for designed fire flows, the minimum size of the proposed municipal watermain on the new municipal roadway, Street "A", based on the considered Toryork connection options are:

Option 1:	Single supply from Toryork watermain (i.e., dead-end)	250 mm
Option 2:	Looped system with supply from Toryork watermain	200 mm

Due to overall advantage of the looped system from water quality perspective (less water stagnation) and given the potential future developments south of the 15-23 Toryork Drive, which can be supplied from the watermain along new city designed public road west of the site, a looped connection should be prioritized over single connection for the development site at 15-23 Toryork Drive.

APPENDIX A: PLOTS OF PRESSURE MONITORING DATA)

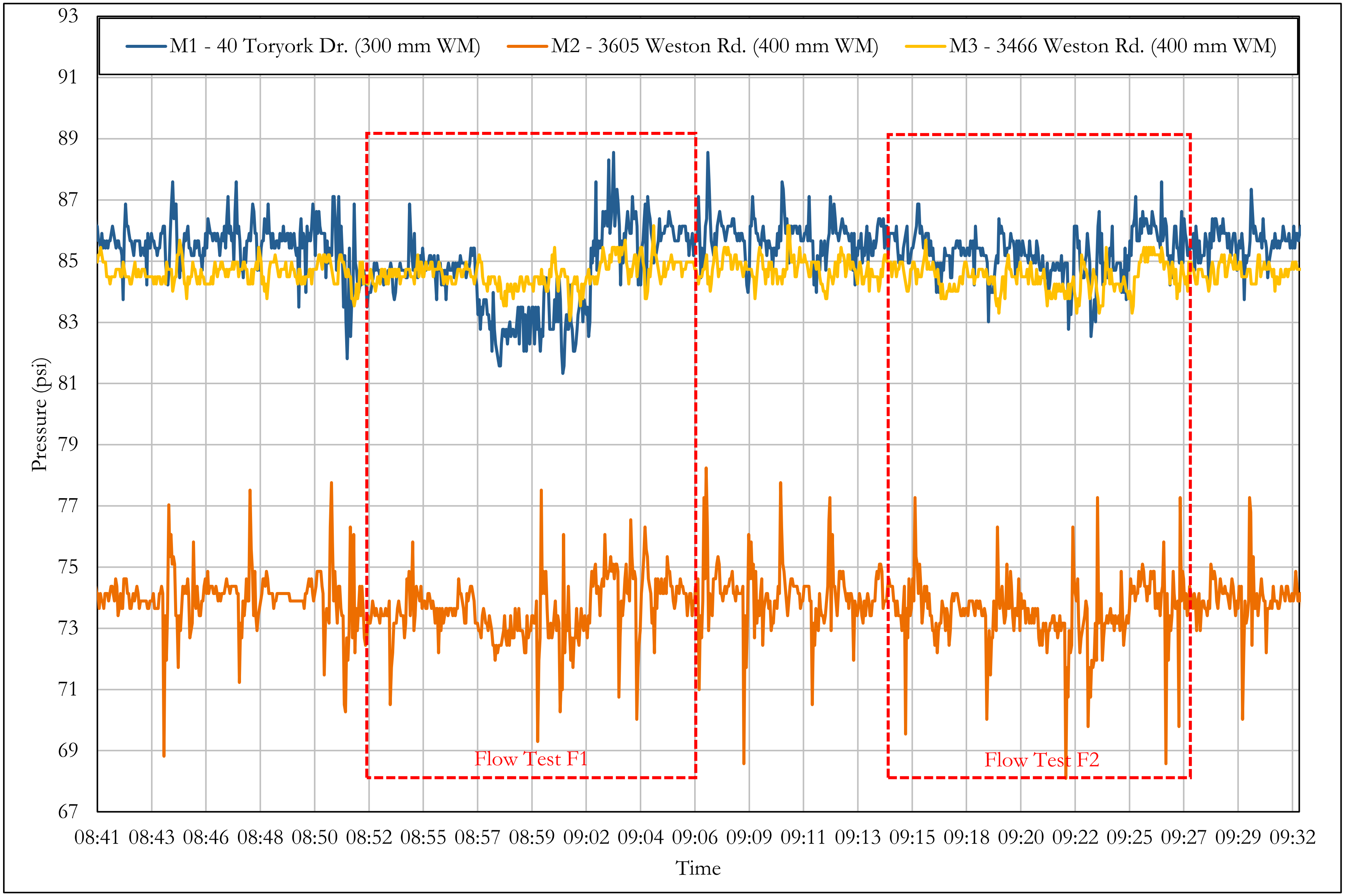


Figure 6: Pressure monitoring results during monitoring period on 07 July 2021 from 08:30 AM to 09:45 PM

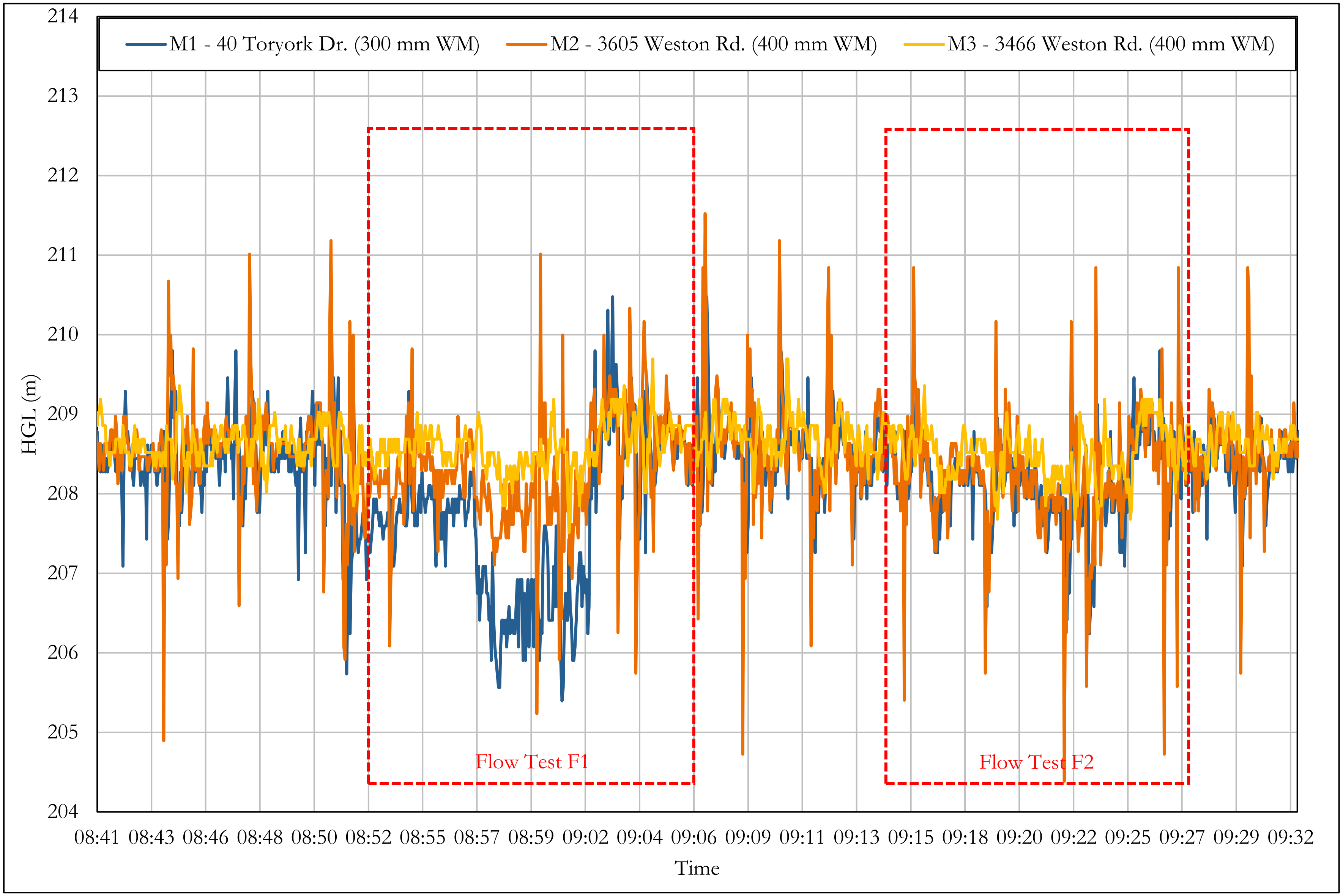


Figure 7: Pressure monitoring results (HGL) during monitoring period on 07 July 2021 from 08:30 AM to 09:45 PM

APPENDIX B: HYDRANT FLOW TEST REPORTS

HYDRANT FLOW TEST REPORT

07 July 2021

HydraTek & Associates

PROJECT INFORMATION

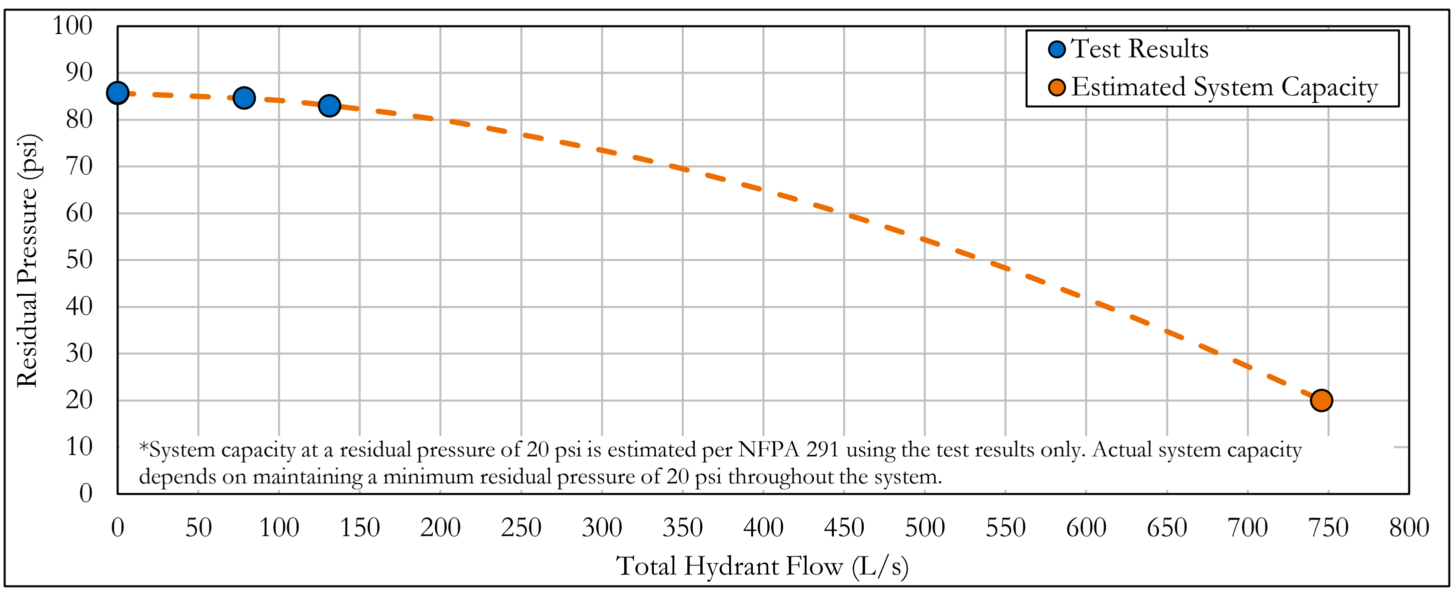
HydraTek Project No.:	20131
Project Name:	15-23 Toryork Drive Development, City of Toronto
Client/Owner Name:	Berkshire Axis Development
Date and Time of Test:	07 July 2021 at 08:40 AM
Fire Hydrant Use Permit:	9133136-1116
Test Conducted By:	B. Jenks and N. Tomic
Design Flow:	n/a
Municipality:	City of Toronto
Zone:	Pressure District 4W (PD4W)

TEST INFORMATION

Location Description:	21 Toryork Drive, City of Toronto
Residual Hydrant:	40 Toryork Drive, 2nd W of Weston Road, N side, ID HY4020387
Flow Hydrant No. 1:	21 Toryork Drive, 1st W of Weston Road, N side, ID HY4020395
Flow Hydrant No. 2:	-
Watermain Size:	300 mm (12-in)

TEST RESULTS

Test No.	No. Ports and Size	Pitot Pressure (psi)				Total Flow (L/s)	Residual Pressure (psi)
		Flow Hydrant 1		Flow Hydrant 2			
		Port 1	Port 2	Port 1	Port 2		
1	Init. Static	-	-	-	-	0	85.7
2	1× 2.5-in	55	-	-	-	79	84.7
3	2× 2.5-in	33	45	-	-	131	83.0
4	Final Static	-	-	-	-	0	85.8
Estimated system capacity (L/s):						746	20



TEST COMMENTS

-With one flow hydrant, the test was unable to achieve a minimum 25% drop in residual pressure per NFPA 291 test requirements due to the high capacity of the local water system.

-Estimated system capacity is based on NFPA 291 using the test results only. Actual system capacity depends on the maximum flow that can be withdrawn subject to maintaining a minimum residual pressure of 20 psi (14.3 m; 140 kPa) at the test location and throughout the rest of the water system.

PREPARED BY:

Name: Nikola Tomic   Signature:

HYDRANT FLOW TEST REPORT

07 July 2021

PROJECT INFORMATION

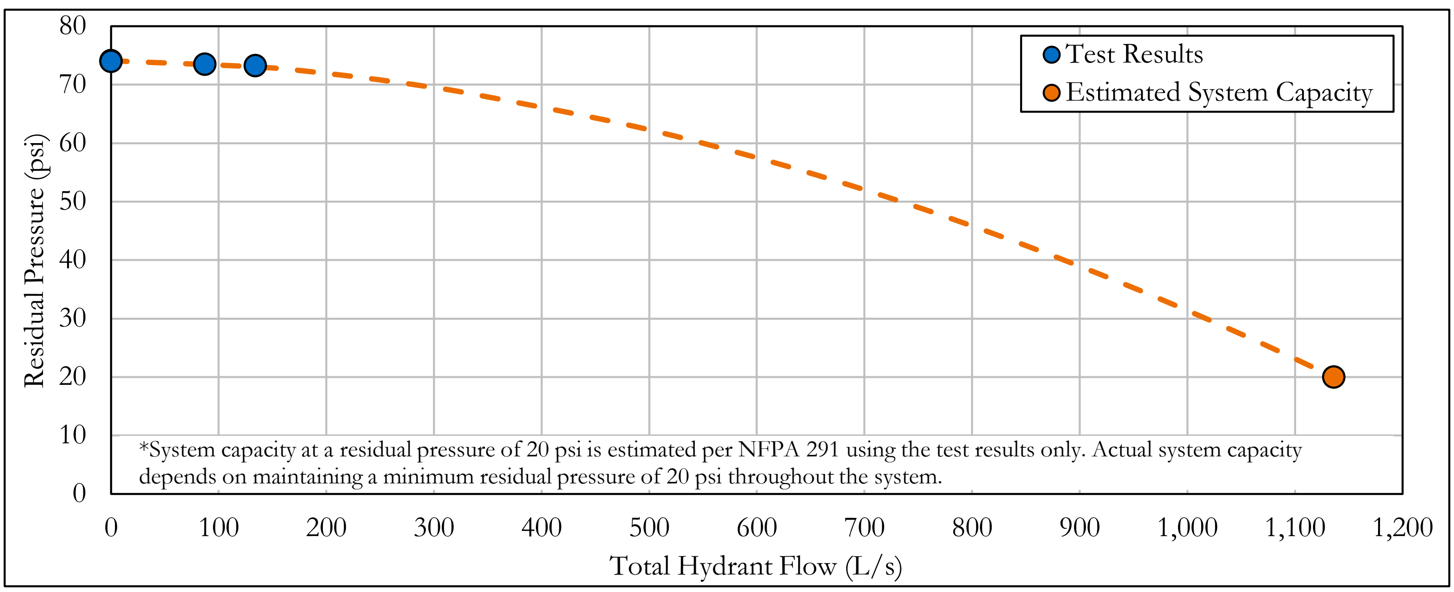
HydraTek Project No.:	20131
Project Name:	15-23 Toryork Drive Development, City of Toronto
Client/Owner Name:	Berkshire Axis Development
Date and Time of Test:	07 July 2021 at 09:00 AM
Fire Hydrant Use Permit:	9133136-1116
Test Conducted By:	B. Jenks and N. Tomic
Design Flow:	n/a
Municipality:	City of Toronto
Zone:	Pressure District 4W (PD4W)

TEST INFORMATION

Location Description:	3514 Weston Road, City of Toronto
Residual Hydrant:	3605 Weston Road, 1st S of Fenmar Drive, W side, ID HY30913
Flow Hydrant No. 1:	3514 Weston Road, 1st N of Finch Avenue West, W side, ID HY4004364
Flow Hydrant No. 2:	-
Watermain Size:	300 mm (12-in)

TEST RESULTS

Test No.	No. Ports and Size	Pitot Pressure (psi)				Total Flow (L/s)	Residual Pressure (psi)
		Flow Hydrant 1		Flow Hydrant 2			
		Port 1	Port 2	Port 1	Port 2		
1	Init. Static	-	-	-	-	0	74.1
2	1× 2.5-in	68	-	-	-	87	73.5
3	2× 2.5-in	38	43	-	-	134	73.2
4	Final Static	-	-	-	-	0	74.0
Estimated system capacity (L/s):						1,135	20



TEST COMMENTS

-With one flow hydrant, the test was unable to achieve a minimum 25% drop in residual pressure per NFPA 291 test requirements due to the high capacity of the local water system.

-Estimated system capacity is based on NFPA 291 using the test results only. Actual system capacity depends on the maximum flow that can be withdrawn subject to maintaining a minimum residual pressure of 20 psi (14.3 m; 140 kPa) at the test location and throughout the rest of the water system.

PREPARED BY:

Name: Nikola Tomic   Signature: [signature]

APPENDIX C: TABULAR MODELLING RESULTS

Table 8 – Pipe properties and hydraulic modeling results for pipe flows

Label	Length (m)	Diameter (mm)	Hazen-Williams C	Flow (L/s)															
				w/o Fire Flow	F1 Test - 79 L/s	F1-Test - 131 L/s	F2 Test - 87 L/s	F1-Test - 134 L/s	Scenario 1A - Max Fire Flow - 96 L/s	Scenario 1B - Max Fire Flow - 214 L/s	Scenario 1C - Max Fire Flow - 346 L/s	Scenario 1D - Required Fire Flow - 118 L/s	Scenario 1E - Required Fire Flow - 317 L/s	Scenario 1F - Max Fire Flow - 488 L/s	Scenario 2A - Max Fire Flow - 209 L/s	Scenario 2B - Max Fire Flow - 403 L/s	Scenario 2C - Required Fire Flow - 118 L/s	Scenario 2D - Required Fire Flow - 317 L/s	Scenario 2E - Max Fire Flow - 537 L/s
P-1	14	1200	130	15	79	131	87	134	96	214	346	118	317	488	209	403	118	317	537
P-2	146	400	120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P-3	396	400	120	3	13	22	0	0	16	36	59	19	54	84	38	74	21	58	99
P-4	2631	300	120	3	13	22	0	0	16	36	59	19	54	84	38	74	21	58	99
P-5	30	400	120	15	79	131	87	134	96	214	346	118	317	488	209	403	118	317	537
P-6	81	300	120	15	79	131	0	0	96	214	346	118	317	488	209	403	118	317	537
P-7	76	300	120	12	66	109	0	0	81	178	287	99	263	404	171	329	97	259	438
P-8	91	300	120	6	13	22	0	0	16	36	59	19	54	84	79	149	44	118	192
P-9	90	300	120	3	13	22	0	0	16	36	59	19	54	84	38	74	21	58	99
P-10	29	1200	130	15	79	131	87	134	96	214	346	118	317	488	209	403	118	317	537
P-11	15	400	120	15	79	131	87	134	96	214	346	118	317	488	209	403	118	317	537
P-12	37	400	120	15	79	131	87	134	96	214	346	118	317	488	209	403	118	317	537
P-13	80	150-300^	100-120^	7	n/a	n/a	n/a	n/a	96	214	346	118	317	488	92	180	53	142	246
P-14	83	150-300^	100-120^	8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	117	223	65	175	291
P-15	73	150-300^	100-120^	8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	117	223	65	175	291
P-17	131	400	120	3	13	22	0	0	16	36	59	19	54	84	38	74	21	58	99

^ C-factor is 100, 110 and 120 for pipe diameters 150 mm, 200-250 mm, 300 mm respectively

Table 9 – Node properties and hydraulic modeling results for nodal pressure heads

Label	Elevation (m)	Pressure (psi)															
		w/o Fire Flow	F1 Test - 79 L/s	F1-Test - 131 L/s	F2 Test - 87 L/s	F1-Test - 134 L/s	Scenario 1A - Max Fire Flow - 96 L/s	Scenario 1B - Max Fire Flow - 214 L/s	Scenario 1C - Max Fire Flow - 346 L/s	Scenario 1D - Required Fire Flow - 118 L/s	Scenario 1E - Required Fire Flow - 317 L/s	Scenario 1F - Max Fire Flow - 488 L/s	Scenario 2A - Max Fire Flow - 209 L/s	Scenario 2B - Max Fire Flow - 403 L/s	Scenario 2C - Required Fire Flow - 118 L/s	Scenario 2D - Required Fire Flow - 317 L/s	Scenario 2E - Max Fire Flow - 537 L/s
F-1	151.8	80.6	79.5	77.8	80.3	80.0	79.0	73.7	63.7	78.3	66.3	48.5	74.1	58.6	78.4	66.5	42.9
F-2	152.2	80.1	79.8	79.4	79.7	79.4	79.7	78.6	76.9	79.5	77.3	74.3	78.7	75.9	79.5	77.3	73.3
J-1	151.2	81.5	81.3	81.2	81.3	81.2	81.3	80.9	80.4	81.2	80.5	79.7	80.9	80.1	81.2	80.5	79.5
J-2	151.2	81.5	81.2	81.0	81.2	81.0	81.2	80.4	79.1	81.0	79.4	77.2	80.4	78.4	81.0	79.4	76.5
J-3	152.1	80.2	79.8	79.2	79.9	79.5	79.6	77.9	74.9	79.4	75.7	70.5	78.0	73.3	79.4	75.7	68.7
J-4	151.2	81.5	81.3	81.1	81.3	81.1	81.3	80.8	80.0	81.2	80.2	79.0	80.8	79.6	81.2	80.2	78.7
J-5	151.1	n/a	n/a	n/a	n/a	n/a	20.1	20.4	20.1	73.3	29.4	20.0	20.0	20.2	75.4	42.3	20.1
J-6	149.9	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	33.8	30.2	77.9	49.3	26.4
J-7	159.3	70.0	69.5	68.9	69.7	69.3	69.4	67.5	64.2	69.1	65.0	59.3	67.6	62.3	69.1	64.9	57.2
J-8	149.5	83.9	82.8	81.2	83.6	83.2	82.4	77.3	67.7	81.7	70.1	53.1	76.9	60.4	81.5	68.8	43.9
M-1	148.2	85.7	84.7	83.0	85.4	85.1	84.2	79.0	69.2	83.5	71.7	54.3	78.6	61.7	83.3	70.3	44.8
M-2	156.5	74.0	73.5	72.9	73.6	73.3	73.3	71.5	68.3	73.1	69.1	63.5	71.6	66.5	73.1	69.0	61.5
M-3	149.1	84.5	84.2	84.0	84.2	83.9	84.1	83.4	82.0	84.0	82.4	80.2	83.4	81.4	84.0	82.4	79.5

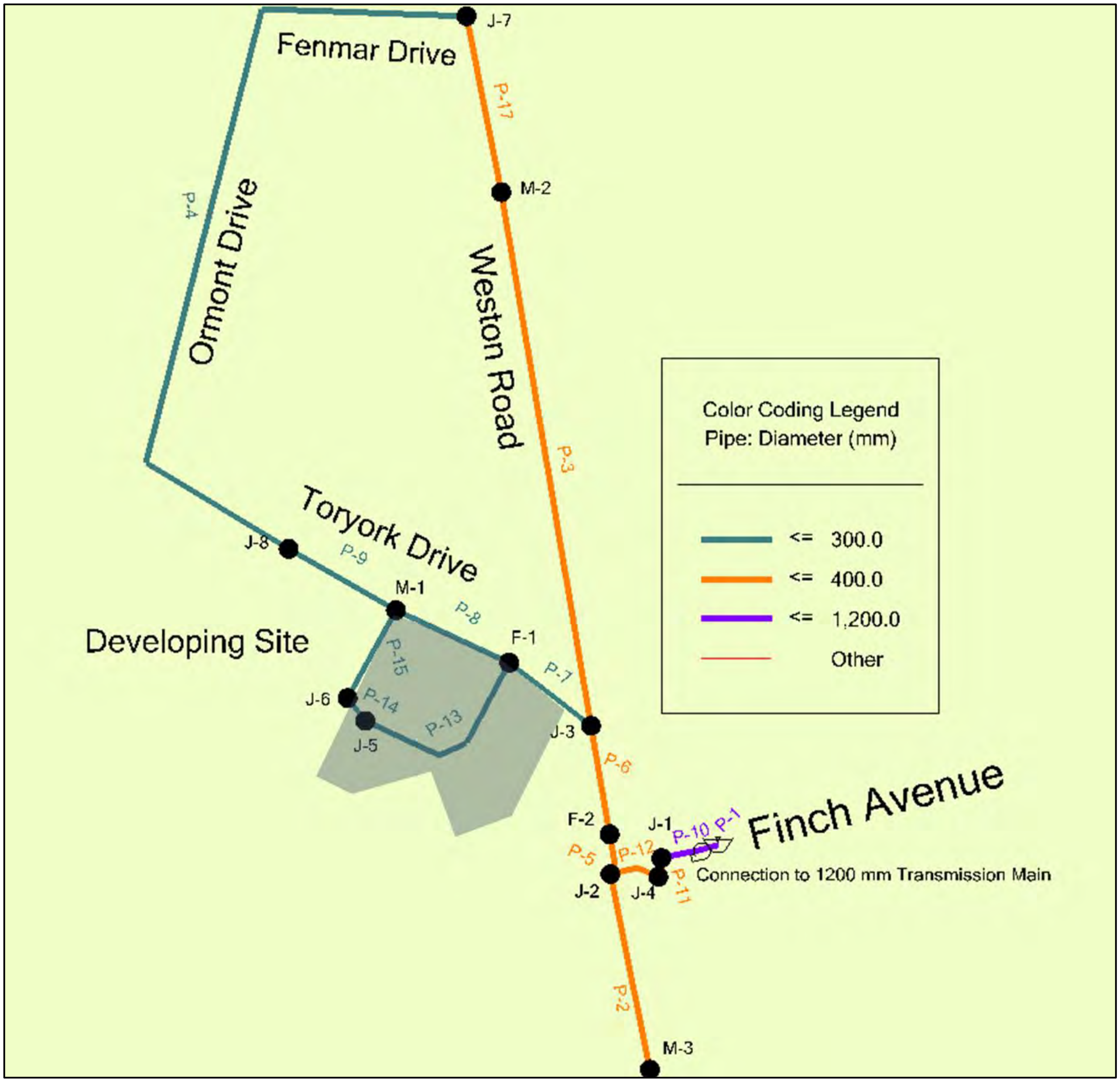


Figure 8: Model layout (not to scale)

15-23 Toryork Drive - Residential Development

Water Demand Calculations

Designed By:	**Angela Mokin**, P.Eng.
Checked By:	**Paolo Albanese**, P.Eng.
File No.:	20131
Date:	28 February 2023

BLOCK 1 - TOWER A

Domestic Water Supply Demands:

Per City of Toronto Design Criteria for Water Distribution Systems

- assume Average Day demand is 190 L/capita/day for multi-unit residential uses
- assume Population Density (see chart)

Unit Type	Population Density
Townhouses	2.7 Pers / Unit
1-Bed	1.4 Pers / Unit
2-Bed	2.1 Pers / Unit
3-Bed	3.1 Pers / Unit

Building	Building Data		Population	Ave. Day Flow	Peak Hour, ADxPH [1]	Max. Day, ADxMD [2]
	Units	(sq.m)	pers	(L/s)	(L/s)	(L/s)
1-Bed	219	n/a	307	0.67	1.69	0.88
2-Bed	126	n/a	265	0.58	1.45	0.76
3-Bed	48	n/a	149	0.33	0.82	0.43
Retail	n/a	598	7	0.01	0.02	0.02
Total	393		727	1.60	3.98	2.07

[1] Peak Hour Factor, PH, is 2.5 for residential and 1.20 for commercial

[2] Max Day Factor, MD, is 1.3 for residential and 1.10 for commercial

Fire Protection Supply Demands:

Per Water Supply for Public Fire Protection Manual, 1999, by the Fire Underwriters Survey

STEP 1: Calculate Fire Flow

$$F = 220 \cdot C \cdot \sqrt{A} \cdot \left(\text{various adjustments}\right)\ \mathrm{L/min}$$

C = Coefficient related to type of construction:
= 1.5 for wood frame construction (Structure essentially all combustible)
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
= 0.8 for non combustible construction (unprotected metal structure components, masonry or metal walls)
= 0.6 for fire resistive construction (fully protected frame, floors, roof)

C =	0.6		
Largest Floor Area =	2183	m^2	2^{nd}
Floor Area Above =	2183	m^2	
Floor Area Below =	2051	m^2	
A =	3,242	m^2	Largest Floor + 25% x (Floor Above + Floor Below)
F =	7,515	L/min	
F =	8,000	L/min	Round to the nearest 1000

STEP 2: Adjust for building occupancy (Note: Number shall not be less then 2000 L/min)

= - 25% (Non-Combustible)
= - 15% (Limited Combustible)
= 0 (Combustible)
= + 15% (Free Burning)
= + 25% (Rapid Burning)

Factor =	-15%	
F1 = F x Factor =	6,800	L/min

15-23 Toryork Drive - Residential Development
Water Demand Calculations

STEP 3: Decrease F1 if building contains fire suppression system
= - 50% (Automatic Sprinklers)
= - 30% (Adequately Designed System)
= Additional -10% if the water supply is standard for the system and the fire department hose lines required
= Additional -10% if the system is fully supervised

Factor =	40%	
F2 = F1 x Factor =	2,720	L/min

STEP 4: Increase F1 due to exposure / close proximity to other buildings (Note: Total shall not exceed 75%)

= 25% (0m to 3m)	Distances =	N >45m / E 34.7m / S 24.5m / W >45m	
= 20% (3.1m to 10m)	Factors =	0% + 5% + 10% + 0%	
= 15% (10.1m to 20m)			
= 10% (20.1m to 30.1m)	Factor =	15%	(max 75%)
= 5% (30.1m to 45m)	F3 = F1 x Factor =	1,020	L/min
= 0% (Greater then 45m)			

STEP 5: Calculate Fire Flow (Note: Fire flow shall not be less then 2000 L/min or greater then 45,000 L/min)

Fire Flow =	F1 - F2 + F3		
F1 =	6,800	L/min	
- F2 =	2,720	L/min	
+ F3 =	1,020	L/min	
Fire Flow =	5,100	L/min	
Fire Flow =	5,000	L/min	Round to the nearest 1000
Fire Flow =	83.3	L/s	

STEP 6: Calculate Total Water Demand (Max Day Demand + Fire Flow)

Recall Max Day Demand (from chart above) =	2.07	L/s
TOTAL Fire Demand =	85.4	L/s

15-23 Toryork Drive - Residential Development

Water Demand Calculations

Designed By: **Angela Mokin**, P.Eng.
Checked By: **Paolo Albanese**, P.Eng.
File No.: 20131
Date: 28 February 2023

BLOCK 2 - PODIUM

Domestic Water Supply Demands:
Per City of Toronto Design Criteria for Water Distribution Systems
- assume Average Day demand is 190 L/capita/day for multi-unit residential uses
- assume Population Density (see chart)

Unit Type	Population Density
Townhouses	2.7 Pers / Unit
1-Bed	1.4 Pers / Unit
2-Bed	2.1 Pers / Unit
3-Bed	3.1 Pers / Unit

Building	Building Data		Population	Ave. Day Flow	Peak Hour, ADxPH [1]	Max. Day, ADxMD [2]
	Units	(sq.m)	pers	(L/s)	(L/s)	(L/s)
1-Bed	56	n/a	78	0.17	0.43	0.22
2-Bed	35	n/a	74	0.16	0.40	0.21
3-Bed	10	n/a	31	0.07	0.17	0.09
Retail	n/a	426	5	0.01	0.01	0.01
Total	101		188	0.41	1.02	0.53

[1] Peak Hour Factor, PH, is 2.5 for residential and 1.20 for commercial
[2] Max Day Factor, MD, is 1.3 for residential and 1.10 for commercial

Fire Protection Supply Demands:
Per Water Supply for Public Fire Protection Manual, 1999, by the Fire Underwriters Survey

STEP 1: Calculate Fire Flow

$$F = 220 \cdot C \cdot \sqrt{A} \cdot (\text{various adjustments}) \ \text{L/min}$$

C = Coefficient related to type of construction:
= 1.5 for wood frame construction (Structure essentially all combustible)
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
= 0.8 for non combustible construction (unprotected metal structure components, masonry or metal walls)
= 0.6 for fire resistive construction (fully protected frame, floors, roof)

C =	0.6		
Largest Floor Area =	3173	m^2	3^{rd}
Floor Area Above =	2507	m^2	
Floor Area Below =	2632	m^2	
A =	4,458	m^2	Largest Floor + 25% x (Floor Above + Floor Below)
F =	8,813	L/min	
F =	9,000	L/min	Round to the nearest 1000

STEP 2: Adjust for building occupancy (Note: Number shall not be less then 2000 L/min)

= - 25% (Non-Combustible)
= - 15% (Limited Combustible) Factor = -15%
= 0 (Combustible) F1 = F x Factor = 7,650 L/min
= + 15% (Free Burning)
= + 25% (Rapid Burning)

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15-23 Toryork Drive - Residential Development
Water Demand Calculations

STEP 3: Decrease F1 if building contains fire suppression system

= - 50% (Automatic Sprinklers)
= - 30% (Adequately Designed System)
= Additional -10% if the water supply is standard for the system and the fire department hose lines required
= Additional -10% if the system is fully supervised

Factor =	40%	
F2 = F1 x Factor =	3,060	L/min

STEP 4: Increase F1 due to exposure / close proximity to other buildings (Note: Total shall not exceed 75%)

= 25% (0m to 3m)	Distances =	N >45m / E 29.7m / S 7.0m / W 34.7m	
= 20% (3.1m to 10m)	Factors =	0% + 10% + 20% + 5%	
= 15% (10.1m to 20m)			
= 10% (20.1m to 30.1m)	Factor =	35%	(max 75%)
= 5% (30.1m to 45m)	F3 = F1 x Factor =	2,678	L/min
= 0% (Greater then 45m)			

STEP 5: Calculate Fire Flow (Note: Fire flow shall not be less then 2000 L/min or greater then 45,000 L/min)

Fire Flow =	F1 - F2 + F3		
F1 =	7,650	L/min	
- F2 =	3,060	L/min	
+ F3 =	2,678	L/min	
Fire Flow =	7,268	L/min	
Fire Flow =	7,000	L/min	Round to the nearest 1000
Fire Flow =	116.7	L/s	

STEP 6: Calculate Total Water Demand (Max Day Demand + Fire Flow)

Recall Max Day Demand (from chart above) =	0.53	L/s
TOTAL Fire Demand =	117.2	L/s

15-23 Toryork Drive - Residential Development

Water Demand Calculations

Designed By: **Angela Mokin**, P.Eng.
Checked By: **Paolo Albanese**, P.Eng.
File No.: 20131
Date: 28 February 2023

BLOCK 2 - TOWER B

Domestic Water Supply Demands:
Per City of Toronto Design Criteria for Water Distribution Systems
- assume Average Day demand is 190 L/capita/day for multi-unit residential uses
- assume Population Density (see chart)

Unit Type	Population Density
Townhouses	2.7 Pers / Unit
1-Bed	1.4 Pers / Unit
2-Bed	2.1 Pers / Unit
3-Bed	3.1 Pers / Unit

Building	Building Data		Population	Ave. Day Flow	Peak Hour, ADxPH [1]	Max. Day, ADxMD [2]
	Units	(sq.m)	pers	(L/s)	(L/s)	(L/s)
Townhouses	0	n/a	0	0.00	0.00	0.00
1-Bed	180	n/a	252	0.55	1.39	0.72
2-Bed	90	n/a	189	0.42	1.04	0.54
3-Bed	30	n/a	93	0.20	0.51	0.27
Retail	n/a	0	0	0.00	0.00	0.00
Total	300		534	1.17	2.94	1.53

[1] Peak Hour Factor, PH, is 2.5 for residential and 1.20 for commercial
[2] Max Day Factor, MD, is 1.3 for residential and 1.10 for commercial

Fire Protection Supply Demands:
Per Water Supply for Public Fire Protection Manual, 1999, by the Fire Underwriters Survey

STEP 1: Calculate Fire Flow

$$F = 220 \cdot C \cdot \sqrt{A} \cdot (\text{various adjustments})\ \text{L/min}$$

C = Coefficient related to type of construction:
= 1.5 for wood frame construction (Structure essentially all combustible)
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
= 0.8 for non combustible construction (unprotected metal structure components, masonry or metal walls)
= 0.6 for fire resistive construction (fully protected frame, floors, roof)

C =	0.6		
Largest Floor Area =	916	m^2	7^{th}
Floor Area Above =	916	m^2	
Floor Area Below =	916	m^2	
A =	1,374	m^2	Largest Floor + 25% x (Floor Above + Floor Below)
F =	4,892	L/min	
F =	5,000	L/min	Round to the nearest 1000

STEP 2: Adjust for building occupancy (Note: Number shall not be less then 2000 L/min)

= - 25% (Non-Combustible)
= - 15% (Limited Combustible)
= 0 (Combustible)
= + 15% (Free Burning)
= + 25% (Rapid Burning)

Factor = -15%
F1 = F x Factor = 4,250 L/min

15-23 Toryork Drive - Residential Development
Water Demand Calculations

STEP 3: Decrease F1 if building contains fire suppression system

= - 50% (Automatic Sprinklers)
= - 30% (Adequately Designed System)
= Additional -10% if the water supply is standard for the system and the fire department hose lines required
= Additional -10% if the system is fully supervised

Factor =	40%	
F2 = F1 x Factor =	1,700	L/min

STEP 4: Increase F1 due to exposure / close proximity to other buildings (Note: Total shall not exceed 75%)

= 25% (0m to 3m)	Distances =	N >45m / E 29.7m / S 30.0m / W 34.7m	
= 20% (3.1m to 10m)	Factors =	0% + 10% + 10% + 5%	
= 15% (10.1m to 20m)			
= 10% (20.1m to 30.1m)	Factor =	25%	(max 75%)
= 5% (30.1m to 45m)	F3 = F1 x Factor =	1,063	L/min
= 0% (Greater then 45m)			

STEP 5: Calculate Fire Flow (Note: Fire flow shall not be less then 2000 L/min or greater then 45,000 L/min)

Fire Flow =	F1 - F2 + F3		
F1 =	4,250	L/min	
- F2 =	1,700	L/min	
+ F3 =	1,063	L/min	
Fire Flow =	3,613	L/min	
Fire Flow =	4,000	L/min	Round to the nearest 1000
Fire Flow =	66.7	L/s	

STEP 6: Calculate Total Water Demand (Max Day Demand + Fire Flow)

Recall Max Day Demand (from chart above) =	1.53	L/s
TOTAL Fire Demand =	68.2	L/s

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15-23 Toryork Drive - Residential Development
Water Demand Calculations

Designed By: **Angela Mokin**, P.Eng.
Checked By: **Paolo Albanese**, P.Eng.
File No.: 20131
Date: 28 February 2023

BLOCK 2 - TOWER C

Domestic Water Supply Demands:
Per City of Toronto Design Criteria for Water Distribution Systems
- assume Average Day demand is 190 L/capita/day for multi-unit residential uses
- assume Population Density (see chart)

Unit Type	Population Density
Townhouses	2.7 Pers / Unit
1-Bed	1.4 Pers / Unit
2-Bed	2.1 Pers / Unit
3-Bed	3.1 Pers / Unit

Building	Building Data		Population	Ave. Day Flow	Peak Hour, ADxPH [1]	Max. Day, ADxMD [2]
	Units	(sq.m)	pers	(L/s)	(L/s)	(L/s)
1-Bed	120	n/a	168	0.37	0.92	0.48
2-Bed	60	n/a	126	0.28	0.69	0.36
3-Bed	20	n/a	62	0.14	0.34	0.18
Retail	n/a	0	0	0.00	0.00	0.00
Total	200		356	0.78	1.96	1.02

[1] Peak Hour Factor, PH, is 2.5 for residential and 1.20 for commercial
[2] Max Day Factor, MD, is 1.3 for residential and 1.10 for commercial

Fire Protection Supply Demands:
Per Water Supply for Public Fire Protection Manual, 1999, by the Fire Underwriters Survey

STEP 1: Calculate Fire Flow

$$F = 220 \cdot C \cdot \sqrt{A} \cdot (\text{various adjustments})\ \text{L/min}$$

C = Coefficient related to type of construction:
= 1.5 for wood frame construction (Structure essentially all combustible)
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
= 0.8 for non combustible construction (unprotected metal structure components, masonry or metal walls)
= 0.6 for fire resistive construction (fully protected frame, floors, roof)

C =	0.6		
Largest Floor Area =	920	m^2	7th
Floor Area Above =	920	m^2	
Floor Area Below =	920	m^2	
A =	1,380	m^2	Largest Floor + 25% x (Floor Above + Floor Below)
F =	4,903	L/min	
F =	5,000	L/min	Round to the nearest 1000

STEP 2: Adjust for building occupancy (Note: Number shall not be less then 2000 L/min)

= - 25% (Non-Combustible)
= - 15% (Limited Combustible)
= 0 (Combustible)
= + 15% (Free Burning)
= + 25% (Rapid Burning)

Factor = -15%
F1 = F x Factor = 4,250 L/min

15-23 Toryork Drive - Residential Development
Water Demand Calculations

STEP 3: Decrease F1 if building contains fire suppression system
= - 50% (Automatic Sprinklers)
= - 30% (Adequately Designed System)
= Additional -10% if the water supply is standard for the system and the fire department hose lines required
= Additional -10% if the system is fully supervised

Factor =	40%	
F2 = F1 x Factor =	1,700	L/min

STEP 4: Increase F1 due to exposure / close proximity to other buildings (Note: Total shall not exceed 75%)

= 25% (0m to 3m)	Distances =	N 30.0m / E 29.7m / S 7.0m / W >45m	
= 20% (3.1m to 10m)	Factors =	10% + 10% + 20% + 0%	
= 15% (10.1m to 20m)			
= 10% (20.1m to 30.1m)	Factor =	40%	(max 75%)
= 5% (30.1m to 45m)	F3 = F1 x Factor =	1,700	L/min
= 0% (Greater then 45m)			

STEP 5: Calculate Fire Flow (Note: Fire flow shall not be less then 2000 L/min or greater then 45,000 L/min)

Fire Flow =	F1 - F2 + F3		
F1 =	4,250	L/min	
- F2 =	1,700	L/min	
+ F3 =	1,700	L/min	
Fire Flow =	4,250	L/min	
Fire Flow =	4,000	L/min	Round to the nearest 1000
Fire Flow =	66.7	L/s	

STEP 6: Calculate Total Water Demand (Max Day Demand + Fire Flow)

Recall Max Day Demand (from chart above) =	1.02	L/s
TOTAL Fire Demand =	67.7	L/s

15-23 Toryork Drive - Residential Development
Water Demand Calculations

BLOCK 3 - TOWER D

Designed By: **Angela Mokin**, P.Eng.
Checked By: **Paolo Albanese**, P.Eng.
File No.: 20131
Date: 28 February 2023

Domestic Water Supply Demands:
Per City of Toronto Design Criteria for Water Distribution Systems
- assume Average Day demand is 190 L/capita/day for multi-unit residential uses
- assume Population Density (see chart)

Unit Type	Population Density
Townhouses	2.7 Pers / Unit
1-Bed	1.4 Pers / Unit
2-Bed	2.1 Pers / Unit
3-Bed	3.1 Pers / Unit

Building	Building Data		Population	Ave. Day Flow	Peak Hour, ADxPH [1]	Max. Day, ADxMD [2]
	Units	(sq.m)	pers	(L/s)	(L/s)	(L/s)
1-Bed	149	n/a	209	0.46	1.15	0.60
2-Bed	107	n/a	225	0.49	1.24	0.64
3-Bed	28	n/a	87	0.19	0.48	0.25
Retail	n/a	0	0	0.00	0.00	0.00
Total	284		521	1.14	2.86	1.49

[1] Peak Hour Factor, PH, is 2.5 for residential and 1.20 for commercial
[2] Max Day Factor, MD, is 1.3 for residential and 1.10 for commercial

Fire Protection Supply Demands:
Per Water Supply for Public Fire Protection Manual, 1999, by the Fire Underwriters Survey

STEP 1: Calculate Fire Flow

$$F = 220 \cdot C \cdot \sqrt{A} \cdot (\text{various adjustments})\ \text{L/min}$$

C = Coefficient related to type of construction:
= 1.5 for wood frame construction (Structure essentially all combustible)
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
= 0.8 for non combustible construction (unprotected metal structure components, masonry or metal walls)
= 0.6 for fire resistive construction (fully protected frame, floors, roof)

C =	0.6		
Largest Floor Area =	1466	m^2	3rd
Floor Area Above =	976	m^2	
Floor Area Below =	1033	m^2	
A =	1,968	m^2	Largest Floor + 25% x (Floor Above + Floor Below)
F =	5,856	L/min	
F =	6,000	L/min	Round to the nearest 1000

STEP 2: Adjust for building occupancy (Note: Number shall not be less then 2000 L/min)

= - 25% (Non-Combustible)
= - 15% (Limited Combustible)
= 0 (Combustible)
= + 15% (Free Burning)
= + 25% (Rapid Burning)

Factor = -15%
F1 = F x Factor = 5,100 L/min

15-23 Toryork Drive - Residential Development

Water Demand Calculations

STEP 3: Decrease F1 if building contains fire suppression system

= - 50% (Automatic Sprinklers)
= - 30% (Adequately Designed System)
= Additional -10% if the water supply is standard for the system and the fire department hose lines required
= Additional -10% if the system is fully supervised

Factor =	40%	
F2 = F1 x Factor =	2,040	L/min

STEP 4: Increase F1 due to exposure / close proximity to other buildings (Note: Total shall not exceed 75%)

= 25% (0m to 3m)	Distances =	N 24.5m / E >45m / S >45m / W >45m	
= 20% (3.1m to 10m)	Factors =	10% + 0% + 0% + 0%	
= 15% (10.1m to 20m)			
= 10% (20.1m to 30.1m)	Factor =	10%	(max 75%)
= 5% (30.1m to 45m)	F3 = F1 x Factor =	510	L/min
= 0% (Greater then 45m)			

STEP 5: Calculate Fire Flow (Note: Fire flow shall not be less then 2000 L/min or greater then 45,000 L/min)

Fire Flow =	F1 - F2 + F3		
F1 =	5,100	L/min	
- F2 =	2,040	L/min	
+ F3 =	510	L/min	
Fire Flow =	3,570	L/min	
Fire Flow =	4,000	L/min	Round to the nearest 1000
Fire Flow =	66.7	L/s	

STEP 6: Calculate Total Water Demand (Max Day Demand + Fire Flow)

Recall Max Day Demand (from chart above) =	1.49	L/s
TOTAL Fire Demand =	68.2	L/s

15-23 Toryork Drive - Residential Development

Supply Line Head Loss Calculations

Designed By: Angela Mokin, P.Eng.
Checked By: Paolo Albanese, P.Eng.
File No.: 20131
Date: 23 February 2023

BLOCK 2 - PODIUM

Recall Total Fire Demand = 117.2 L/s (Taken From Fire Flow Spreadsheet)

Hydrant Flow Test Results

Flow (gpm)	Flow (L/s)	Pressure (psi)	Pressure (kPa)
0	0.0	85.7	591
1252	79.0	84.7	584
2076	131.0	83	572
1,858	117.2	84	576

2021 07 07 - Toryork Drive Hydrant Flow Test Results

calculated using:

$$Q_R = Q_F \times \frac{h_r^{0.54}}{h_f^{0.54}}$$

Hazen-Williams formula for watermain head loss:

$h_L = (10.675 * L * Q^{1.85}) / (C^{1.85} * D^{4.8655})$

where
- h_L = pressure drop (m)
- L = length of pipe (m)
- Q = flow rate (m^3/s)
- C = roughness coefficient
- D = inside hydraulic diameter (m)

New 100 mm Domestic Watermain

L= 3 m; D= 100 mm; C= 100

L= 2.6 m; D= 150 mm; C= 100

Peak Hour Flow		Head Loss, h_L				Residual Pressure [1]		Residual Pressure	
Q (L/s)	Q (m3/s)	(m)	(in)	(psi)	(kPa)	(psi)	(kPa)	(psi)	(kPa)
2.9	0.00	0.0	0.4	0.02	0.11	85.7	591	**85.6**	**591**

[1] Residual pressure taken from above

New 150 mm Fire Line

L= 4.6 m; D= 150 mm; C= 100

Total Fire Flow (Max Day + Fire Flow)		Head Loss, h_L				Residual Pressure [1]		Residual Pressure	
Q (L/s)	Q (m3/s)	(m)	(in)	(psi)	(kPa)	(psi)	(kPa)	(psi)	(kPa)
117.2	0.12	1.89	74.6	2.69	18.57	83.5	575	**80.8**	**557**

[1] Residual pressure taken from above

APPENDIX D

15-23 Toryork Drive - Residential Development

City of Toronto - Engineering & Construction Services

SANITARY SEWER DESIGN SHEET

NOTES

Pre-development residential sewage flow based upon 240 Lpcd (residential) and 250 Lpcd (industrial/commercial).
Pre-development industrial population density of 0.0272 people/100m^2 GFA.
Post-development domestic sewage flow based upon a unit flow of 450.0 Lpcd.
Infiltration flow based upon a unit flow of 0.26 L/s/ha.
Maximum flow velocity for pipe flowing full = 3.0 m/s.
Minimum flow velocity for pipe flowing partially full (actual flow) = 0.6 m/s.

Designed By: **Angela Mokin**, P.Eng.
Checked By: **Paolo Albanese**, P.Eng.
File No.: 20131
Date: 28 February 2023

			DESIGN FLOW CALCULATIONS										SEWER DESIGN & ANALYSIS							
	from M.H.	to M.H.	Area (ha) or No. Units	Density (p/m^2) (p/unit)	Population	Cumulative Area (ha)	Cumulative Population	Peaking Factor M	Sewage Flow (1) (L/s)	Infiltration Flow (2) (L/s)	Foundation Drain (3) (L/s)	Total Flow, Qd (1)+(2)+(3) (L/s)	Nominal Diameter (mm)	Pipe Slope (%)	Pipe Length (m)	Nominal Full Flow Capacity, Qf (L/s)	Nominal Full Flow Velocity (m/s)	Percent of Full Flow (Qd/Qf)	Actual Flow Velocity V (m/s)	Remarks
DESIGN FLOWS																				
PRE-DEVELOPMENT (TO TORYORK ROAD)																				
15 Toryork Drive	Ex. Industrial		2153	0.0272	59	0.737	59	4.30	0.73	0.19		0.9								
19 Toryork Drive	Ex. Industrial		675	0.0272	19	0.030	19	4.38	0.24	0.01		0.2								
21 Toryork Drive	Ex. Industrial		1700	0.0272	47	0.349	47	4.32	0.59	0.09		0.7								
23 Toryork Drive	Ex. Industrial		2196	0.0272	60	0.453	60	4.30	0.75	0.12		0.9								
	Total Site					**1.569**	**185**					**2.7**								
POST-DEVELOPMENT (Services)																				
Block 1	Tower A		219	1.4	307															
			126	2.1	265															
			48	3.1	149															
			598	0.011	7															
		MH.5A	393		727	0.302	727	3.89	14.71	0.08	0.6	**15.4**	150	2.0%	7.5	22.5	1.23	69%	1.3	Self Cleansing Ok
Block 2	Tower B		180	1.4	252															
			90	2.1	189															
			30	3.1	93															
			0	0.011	0															
		MH.3A	300		534	0.000	534	3.96	11.01	0.00	0.0	**11.0**	150	2.0%	12.3	22.5	1.23	49%	1.2	Self Cleansing Ok
	Tower C		120	1.4	168															
			60	2.1	126															
			20	3.1	62															
			0	0.011	0															
		MH.3A	200		356	0.000	356	4.05	7.50	0.00	0.0	**7.5**	150	2.2%	11.2	23.8	1.30	32%	1.2	Self Cleansing Ok
	Podium		56	1.4	78															
			35	2.1	74															
			10	3.1	31															
			426	0.011	5															
		MH.3A	101		188	0.571	188	4.16	4.07	0.15	1.0	**5.2**	150	2.0%	12.3	22.5	1.23	23%	1.0	Self Cleansing Ok
Block 3	Tower D		146	1.4	204															
			107	2.1	225															
			28	3.1	87															
			0	0.011	0															
		MH.4A	281		516	0.267	516	3.97	10.66	0.07	0.6	**11.4**	150	2.1%	11.8	23.2	1.27	49%	1.3	Self Cleansing Ok
	Park	MH.4A	0.181	10	2	0.181	2	4.46	0.05	0.05		**0.1**								
	Road (E-W)	MH.4A	0.146			0.146				0.04		**0.0**								
	Road (N-S)	MH.3A	0.103			0.103				0.03		**0.0**								
			1275			**1.569**	**2323**	3.53	42.76	0.41	2.2	**45.4**	Total Flow							
										Total Increase in Flow		42.6								

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15-23 Toryork Drive - Residential Development

City of Toronto - Engineering & Construction Services

SANITARY SEWER DESIGN SHEET

NOTES

Pre-development residential sewage flow based upon 240 Lpcd (residential) and 250 Lpcd (industrial/commercial).
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Infiltration flow based upon a unit flow of 0.26 L/s/ha.
Maximum flow velocity for pipe flowing full = 3.0 m/s.
Minimum flow velocity for pipe flowing partially full (actual flow) = 0.6 m/s.

Designed By: **Angela Mokin**, P.Eng.
Checked By: **Paolo Albanese**, P.Eng.
File No.: 20131
Date: 28 February 2023

			DESIGN FLOW CALCULATIONS										SEWER DESIGN & ANALYSIS							
	from M.H.	to M.H.	Area (ha) or No. Units	Density (p/m^2) (p/unit)	Population	Cumulative Area (ha)	Cumulative Population	Peaking Factor M	Sewage Flow (1) (L/s)	Infiltration Flow (2) (L/s)	Foundation Drain (3) (L/s)	Total Flow, Qd (1)+(2)+(3) (L/s)	Nominal Diameter (mm)	Pipe Slope (%)	Pipe Length (m)	Nominal Full Flow Capacity, Qf (L/s)	Nominal Full Flow Velocity (m/s)	Percent of Full Flow (Qd/Qf)	Actual Flow Velocity V (m/s)	Remarks
POST-DEVELOPMENT (Public Sewer)																				
Block 2, Road	MH.3A	MH.2A	0.103		1078	0.673	1078	3.78	21.22	0.18	1.0	**22.3**	250	0.8%	45.8	55.8	1.10	40%	1.0	Self Cleansing Ok
	MH.2A	MH.1A	0.000		0	0.673	1078	3.78	21.22	0.18	1.0	**22.3**	250	0.5%	19.6	44.3	0.87	50%	0.9	Self Cleansing Ok
Road & Park, B3	MH.4A	MH.5A	0.146		518	0.595	518	3.97	10.70	0.15	0.6	**11.5**	250	2.6%	41.8	100.6	1.99	11%	1.3	Self Cleansing Ok
Block 1	MH.5A	MH.6A	0.000		727	0.896	1245	3.74	24.23	0.23	1.2	**25.7**	250	1.0%	9.8	61.4	1.21	42%	1.2	Self Cleansing Ok
	MH.6A	MH.7A	0.000		0	0.896	1245	3.74	24.23	0.23	1.2	**25.7**	250	0.5%	60.5	43.9	0.87	59%	0.9	Self Cleansing Ok

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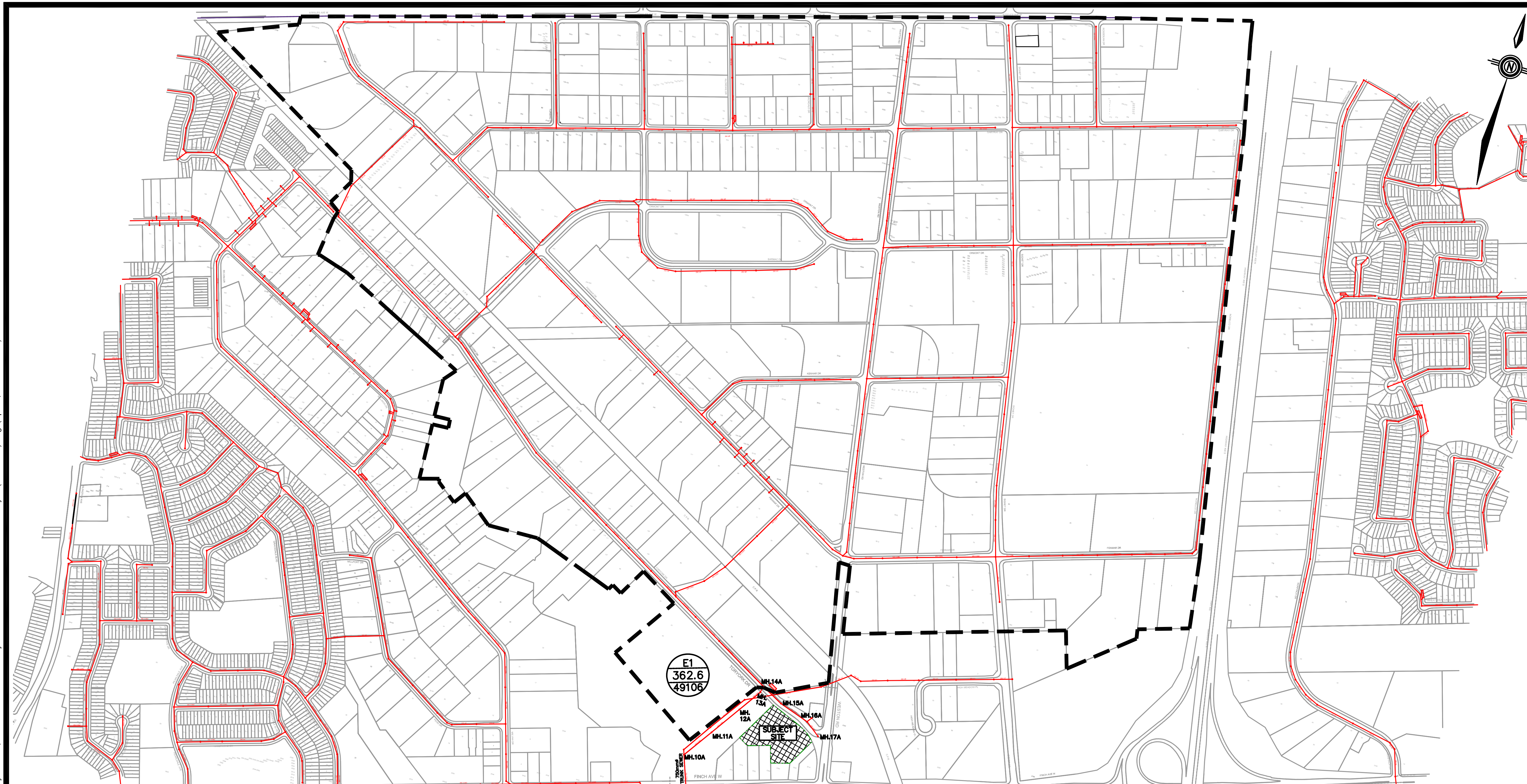

LEGEND

SANITARY SEWER AND FLOW DIRECTION

SANITARY DRAINAGE AREA BOUNDARY

SUBJECT SITE

A01 — SANITARY DRAINAGE AREA ID

1.000 — SANITARY DRAINAGE AREA (ha)

100 — SANITARY DRAINAGE AREA POPULATION

DWN. BY:	A.M.
DESIGNED BY:	A.M.
CHECKED BY:	P.F.A.
SCALE:	1:10000
DATE:	FEB 2023
SHEET NO:	1 OF 3

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PROJECT NO:	DWG NO:	REV NO:
20131	EXT–1	1

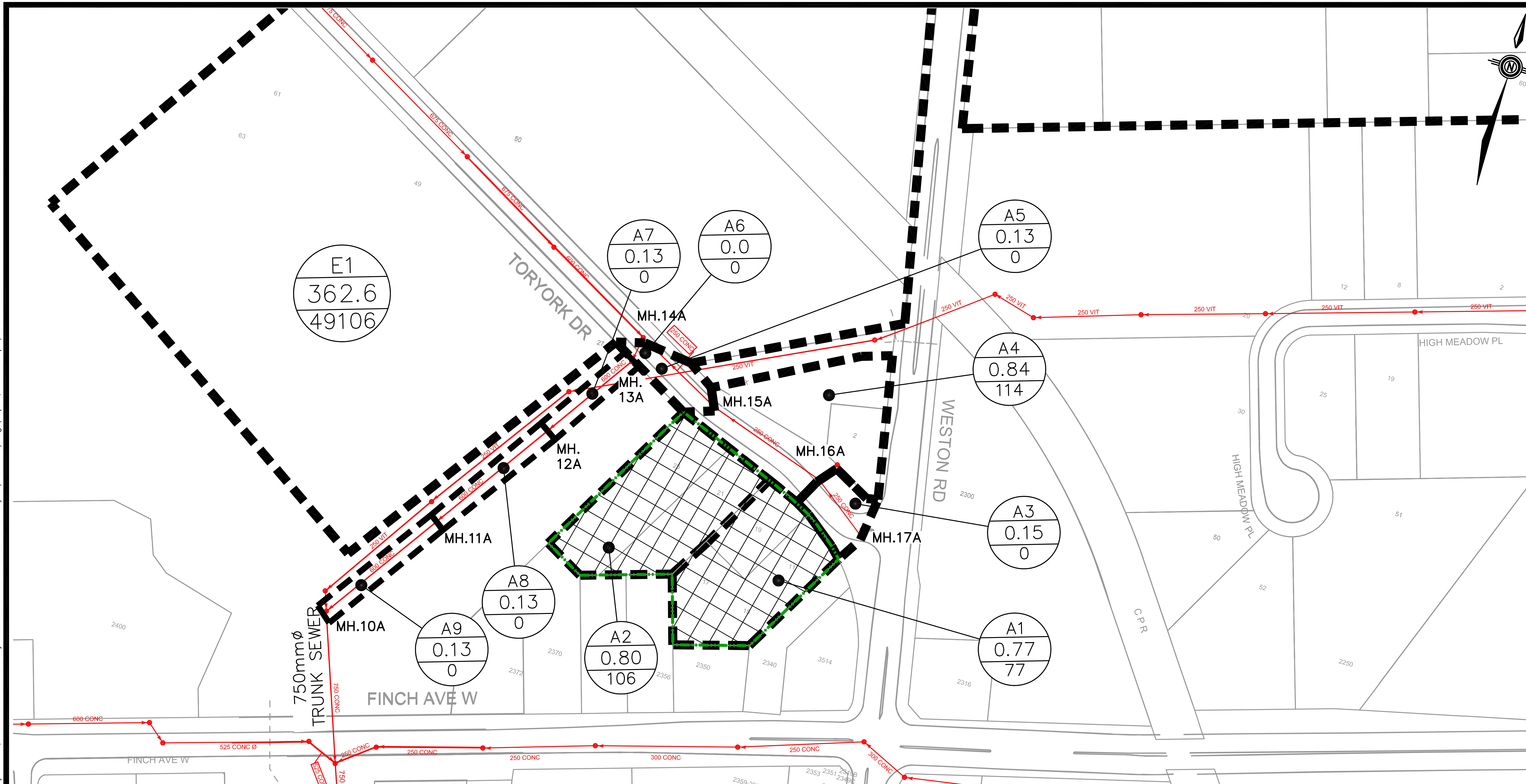
PROJECT NAME:

15–23 TORYORK DR

RESIDENTIAL DEVELOPMENT

DRAWING TITLE:

SANITARY SEWER DOWNSTREAM CAPACITY ANALYSIS SCHEMATIC (EXTERNAL AREAS)



LEGEND

SANITARY SEWER AND FLOW DIRECTION
SANITARY DRAINAGE AREA BOUNDARY
SUBJECT SITE

A01 — SANITARY DRAINAGE AREA ID
1.000 — SANITARY DRAINAGE AREA (ha)
100 — SANITARY DRAINAGE AREA POPULATION

DWN. BY:	A.M.
DESIGNED BY:	A.M.
CHECKED BY:	P.F.A.
SCALE:	1:2500
DATE:	AUG 2021
SHEET NO:	2 OF 3

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PROJECT NO:	DWG NO:	REV NO:
20131	DS-1	0

PROJECT NAME:

15-23 TORYORK DR
RESIDENTIAL DEVELOPMENT

DRAWING TITLE:
SANITARY SEWER DOWNSTREAM CAPACITY ANALYSIS SCHEMATIC (PRE-DEVELOPMENT POPULATION INDICATED)

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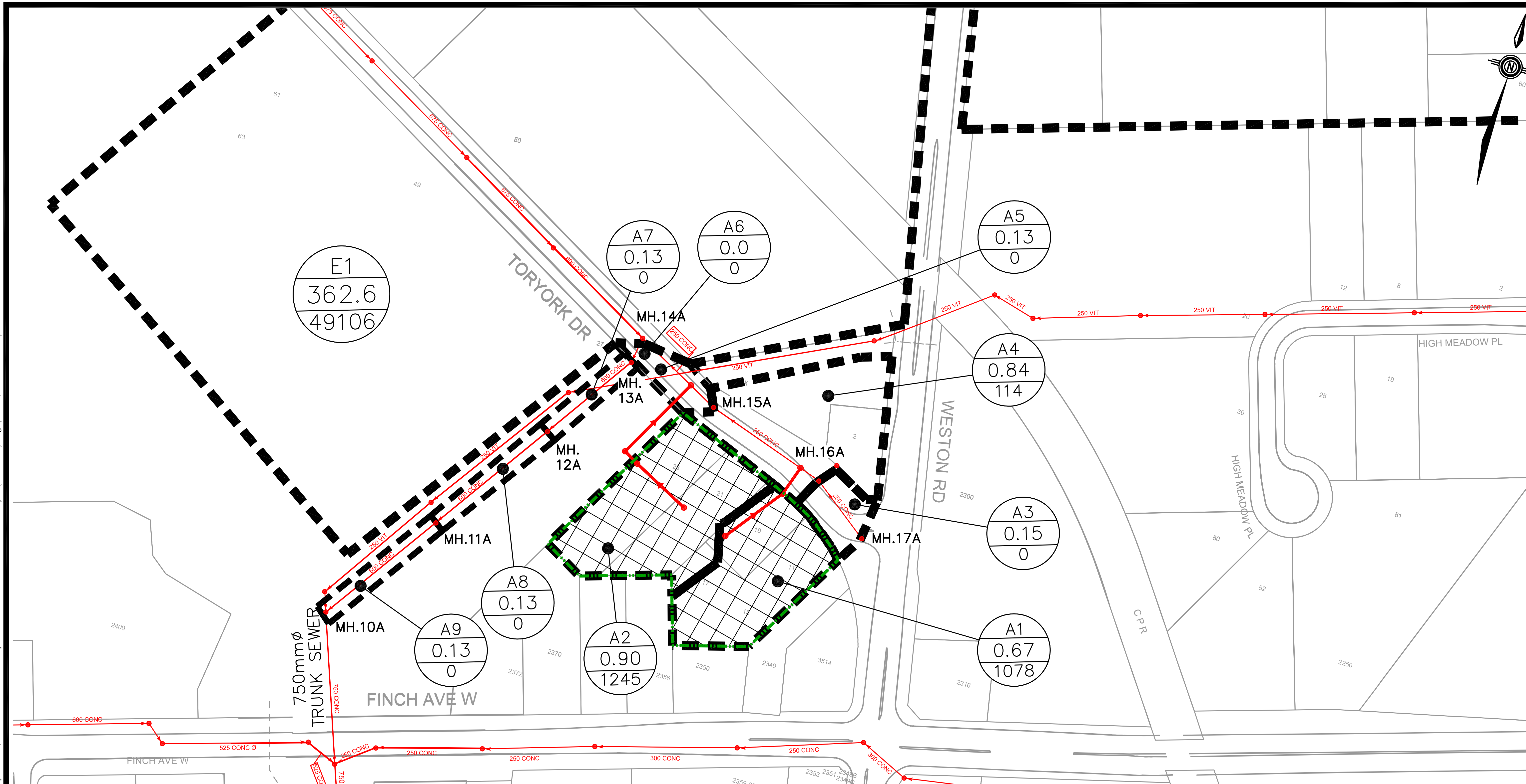

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LEGEND

- SANITARY SEWER AND FLOW DIRECTION
- SANITARY DRAINAGE AREA BOUNDARY
- SUBJECT SITE
- A01 — SANITARY DRAINAGE AREA ID
- 1.000 — SANITARY DRAINAGE AREA (ha)
- 100 — SANITARY DRAINAGE AREA POPULATION

DWN. BY:	A.M.
DESIGNED BY:	A.M.
CHECKED BY:	P.F.A.
SCALE:	1:10000
DATE:	FEB 2023
SHEET NO:	3 OF 3

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PROJECT NO:	DWG NO:	REV NO:
20131	DS–2	1

PROJECT NAME:

15–23 TORYORK DR
RESIDENTIAL DEVELOPMENT

DRAWING TITLE:
SANITARY SEWER DOWNSTREAM CAPACITY ANALYSIS SCHEMATIC
(POST–DEVELOPMENT POPULATION INDICATED)