Valecraft Homes Part of Lot 13, Concession 4 Functional Site Servicing and Stormwater Management Report

Job #160401328

Prepared for:
Valecraft Homes

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Sign-off Sheet

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Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

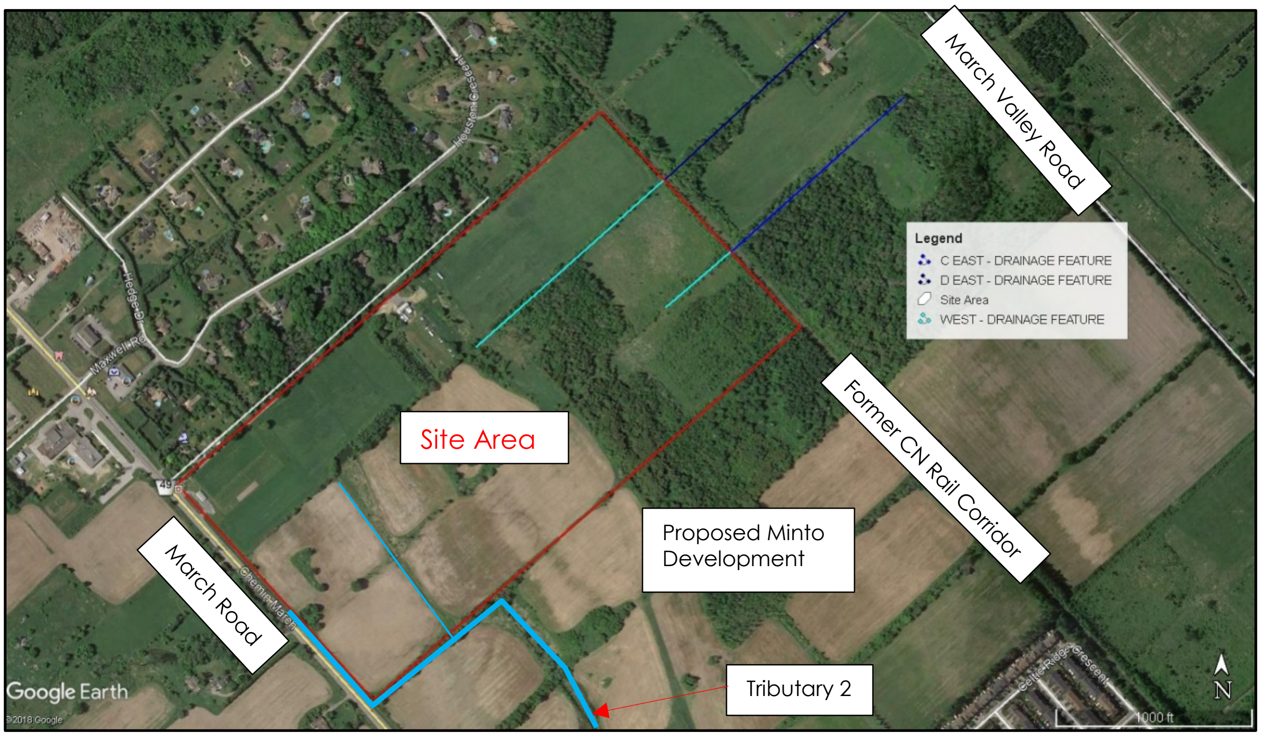
1.0 INTRODUCTION

Stantec Consulting Ltd. has been retained by Valecraft Homes to provide a functional servicing plan in support of their application for draft plan approval. The intent of this report is to provide a servicing scenario for the proposed development that is free of conflicts, includes external areas, and utilizes the existing/future infrastructure in accordance with the background studies.

Valecraft Homes is proposing a mixed use development located on Part of Lot 13, Concession 4 within the Kanata North Urban Expansion Area (KNUEA). The proposed development measures approximately 38.5 ha and is located east of March Road, west of a former CN rail corridor, south of the Hillsview Estates Subdivision, and north of a proposed residential development owned by Minto as shown in **Figure 1.**

The proposed draft of subdivision consists of 297 single detached units, 319 town-home units, a school block (Block 310), a designated park area (Block 309), two (2) commercial/mixed use blocks (Blocks 324 & 327), and a medium density block (Block 322). The roads proposed consist of 24 m wide right of way (ROW) collector roads and 18 m wide ROW local roads.

Figure 1: Approximate Location of Valecraft Homes Part of Lot 13, Concession 4 Development



1.1 BACKGROUND

The proposed development is within the Kanata North Community Design Plan (CDP) and servicing criteria for the site is outlined in the Kanata North Master Servicing Study (KNMSS) and the Kanata North Environmental Management Plan (KNEMP) prepared by Novatech Engineers, Planners & Landscape Architects (Novatech) in June 2016. The proposed development is referred to as the northeast quadrant of the KNUEA within the KNMSS and the KNEMP. The background reports describe the conceptual trunk sewers and watermains that will service all developments within the KNUEA, establish targets for site-specific stormwater management (SWM) plans, and identify required infrastructure upgrades to support growth within the KNUEA.

The KNEMP outlined an environmental compensation and mitigation plan for each quadrant within the KNUEA. The northeast quadrant environmental compensation and mitigation plan is summarized as follows.

- Realigned 40m corridor + 6m pathway for Shirley's Brook Tributary 2.
- Healthy and mature white cedars in the northwest corner of woodlot S20 should be retained as part of proposed parkland.
- Blanding's turtle compensation with shallow pans/pools and deep channel pockets.
- Rearyard flows from properties along the eastern boundary should be directed to culverts crossing the abandoned CN rail corridor to maintain flows in channels 'C' and 'D'.
- Re-grade ditch west of the former rail corridor to eliminate perched culverts and direct rearyard drainage to headwater channels east of the rail corridor.
- Replace headwater functions in protected stream corridors or other areas.

1.2 EXISTING CONDITIONS

The site is predominantly occupied by agricultural uses under existing conditions. An existing farmhouse is located in the middle of the northern property line. The lands to the west, south and east are also predominantly occupied by agricultural uses. A forested area exists in the southeast corner of the site. This forested area is part of the woodlot referred as S20 in the KNEMP.

The proposed development is located within the jurisdiction of the Mississippi Valley Conservation Authority (MVCA) and within the Shirley's Brook sub-watershed. Tributary 2 of Shirley's Brook borders the south-west corner of the site, while three headwater drainage channels identified as E, C-West and D-West in the KNEMP cross the site as shown in **Figure 1**. Drainage channel E crosses the site from north to south before discharging into Tributary 2, while drainage channels C-West and D-West cross the site from west to east before discharging into the existing ditch west of the former CN railway corridor.

The existing elevations within the site range from 82 m to 7 0m generally draining from west to east. The western portion of the site drains to Tributary 2, while the rest of the site drains into Shirley's Brook via existing drainage channels to the east.

A significant soil ridge, approximately 9 m high with a slope of 8H:1V, runs in a north-south direction in the middle of the site. As identified in the KNEMP, test pits and boreholes conducted in the area of the existing slope were analyzed and it was concluded that the slope is stable with slope stability factors of safety greater than1.5.

1.3 OBJECTIVE

This functional servicing report is being prepared in support of draft plan approval for the Valecraft Homes Part of Lot 13, Concession 4 Development. This report will provide a recommended servicing plan for the major municipal infrastructure needed to support development of the subject property. The review will be a macro level detail study with further details to be confirmed and provided during the detailed design process. This report will demonstrate how proposed municipal servicing is in conformance with the KNMSS and the KNEMP recommendations. Any deviation from the background documents will also be identified with rationalization for the change.

1.4 BACKGROUND RESOURCES

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

- *Kanata North Community Design Plan,* Novatech, June 28, 2016
- *Kanata North Master Servicing Study,* Novatech, June 28, 2016
- *Kanata North Environmental Management Plan,* Novatech, June 28, 2016
- *Kanata North Transportation Master Plan, Novatech, June 28, 2016*
- *Consolidated Preliminary Geotechnical Investigation Kanata North Urban Expansion Area Community Development Plan March Road, Ottawa, Ontario,* Paterson Group Inc., October 7, 2013
- *Briar Ridge Sanitary Pumping Station Pre-Design Report,* Cumming Cockburn Limited, March 2001

Additional documents referenced in designing the functional servicing plans for the proposed development include:

- *Erosion & Sediment Control Guidelines for Urban Construction*, Greater Golden Horseshoe Area Conservation Authorities, December 2006
- *Stormwater Management Planning and Design Manual*, Ministry of the Environment (Ontario), March 2003
- *Ottawa Design Guidelines – Water Distribution*, City of Ottawa, July 2010
    - *Technical Bulletin ISD-2010-2*, City of Ottawa, December 15, 2010
    - *Technical Bulletin ISDTB-2014-02*, City of Ottawa, May 27, 2014

    - *Technical Bulletin ISTB-2018-02*, City of Ottawa, March 21, 2018
- *City of Ottawa Sewer Design Guidelines*, 2nd Ed., City of Ottawa, October 2012
    - *Technical Bulletin ISDTB-2014-01*, Revisions to Ottawa Design Guidelines – Sewer, City of Ottawa, February 5, 2014. (ISDTB-2014-01)
    - *Technical Bulletin PIEDTB-2016-01*, Revisions to Ottawa Design Guidelines – Sewer, City of Ottawa, September 6, 2016. (PIEDTB-2016-01)
    - *Technical Bulletin ISTB-2018-01*, Revisions to Ottawa Design Guidelines – Sewer, City of Ottawa, March 21, 2018. (ISTB-2018-01)

2.0 POTABLE WATER

The KNUEA is located within the existing City of Ottawa 2W pressure zone. An existing 400 mm diameter watermain on March Road services the existing subdivisions south of Maxwell Bridge Road, while a network of 200 mm and 300 mm diameter trunk watermains services the residential subdivision south of the proposed Minto Development to the south.

The KNMSS completed a review of the existing water plan adjacent to the area and made recommendations for improvements and expansion to the City's water transmission and distribution system to support the Kanata North Urban Expansion Area (KNUEA). Excerpts from the KNMSS outlining the design criteria and indicating the limits of existing watermains in the vicinity of the subject property are included in **Appendix A.**

The proposed development will ultimately be serviced through two watermain connections: a connection to a future 400 mm diameter watermain on March Road, and a connection to the watermain network within the future Minto development south of the site as shown on **Drawing WTR-1**.

Novatech is currently working on the March Road watermain design and it is anticipated that construction of the March Road watermain extension will start in late spring/early summer of 2019, with an anticipated completion date of fall 2020 (see correspondence in **Appendix A**). Design of the proposed watermain connections to the future Minto development to the south is currently being coordinated with DSEL.

The proposed watermain network will be designed in accordance with City of Ottawa Design Guidelines and the recommendations provided in the KNMSS summarized as follows.

- Site grading should not exceed 93 m to maintain minimum pressures greater than 40 psi.
- Services installed in areas where the grade is less than 74 m will need pressure reducing valves to keep the maximum pressure below 80 psi.

At the detailed design stage, a complete hydraulic analysis will be prepared for the proposed development water distribution network to confirm that water supply is available within the required pressure range under the anticipated demands during average day, peak hour and fire flow conditions prior to full buildout of the KNUEA.

3.0 WASTEWATER SERVICING

3.1 BACKGROUND

Two existing sanitary sewer systems will service the KNUAE as outlined in the KNMSS (see report excerpts in **Appendix B.2**).

The existing Brookside Subdivision located immediately south of the future Minto Development to the south of the proposed development is serviced by the sanitary sewer network that conveys wastewater to the Briar Ridge Pump Station (BRPS), located south of Klondike Road and east of the former CN railway corridor. The BRPS discharges into the East March Trunk sanitary sewer. Two pumps are currently operating in the BRPS and a third is to be added when necessary per the Briar Ridge Sanitary Pumping Station Pre-Design Report. BRPS upgrades are included in the Infrastructure Master Plan (City of Ottawa, 2013) and the City of Ottawa 2014 Development Charges Background Study (October 27, 2017) with anticipated timing for construction between 2019 – 2031. The KNUEA owners' group is in the process of coordinating with the City to ensure that the BRPS upgrades are appropriately budgeted and scheduled to accommodate the buildout of the study area. The KNMSS assumed sewage from 19.80 ha within the proposed site would be directed to the BRPS outlet with a total peak flow of 26.4 L/s (see KNMSS excerpts in **Appendix B.2**).

The second sanitary sewer system consists of the future extension of the sanitary trunk sewer on March Road and the upgrade of the existing 375 mm diameter sanitary sewer on Shirley's Brook Drive to 600 mm diameter. The existing sanitary on Shirley's Brook Drive discharges into the East March Trunk sanitary sewer. The sanitary trunk sewer on March Road is in the latest stages of design and it is anticipated that construction of the March Road sanitary trunk sewer will start in late spring/early summer of 2019, with an anticipated completion date of fall 2020 (see correspondence in **Appendix A**). The KNMSS assumed sewage from 19.99 ha within the proposed site would be directed to the March Road outlet with a total peak flow of 28.7 L/s (see KNMSS excerpts in **Appendix B.2**).

As part of the KNMSS, a hydraulic grade line (HGL) analysis was completed on the BRPS to ensure that, when the future lands within the KNUEA are added to the system, there were no negative impacts to the existing developments. The existing BRPS has two existing overflow outlets to provide relief to the system in the event of failure. The analysis concluded that an additional overflow outlet discharging into the KNUEA SWM Pond 3 (Overflow invert of 67.50 m) would be required to minimize any negative impacts on the existing subdivision.

3.2 DESIGN CRITERIA

The conceptual sanitary sewer design sheet is included in **Appendix B.1**. The sewers are to be designed in conformance with all relevant City of Ottawa and MECP Guidelines and Policies. Per ISTB-2018-01, the City's current design parameters represent a flow reduction from the outdated standards used within the KNMSS. As a result, the revised sanitary sewer design criteria differs from the criteria previously used in the KNMSS as shown in the table below.

Table 1: Sanitary Sewer Design Criteria Comparison

Design Parameters	Revised Design Criteria (City Guidelines - 2018)	2016 KNMSS Criteria
Minimum Velocity (m/s)	0.6	
Maximum Velocity (m/s)	3.0	
Manning roughness coefficient for all smooth wall pipes	0.013	
Minimum size	200mm dia. for residential areas, 250mm for commercial areas	
Single Family Persons per unit	3.4	3.4
Townhouse Persons per unit	2.7	2.7
Average Apartment Persons per unit	1.8	1.8
Extraneous Flow Allowance (L/s/ha)	0.33	0.28
Manhole Spacing (m)	120 m	
Minimum Cover (m)	2.5 m	
Average Daily Discharge / Person (L/cap/day)	280	350
Harmon Correction Factor	0.8	1.0
Institutional Daily Flow (L/ha/day)	28,000	28,000
Commercial Daily Flow (L/ha/day)	50,000	50,000

3.3 PROPOSED SERVICING

The wastewater servicing strategy for the proposed site was considered within the KNMSS, with a portion of the study area draining to the south, connecting to the sanitary sewer system within the future Minto Development, and the remaining portion of the site draining to the west, connecting to the future 600 mm diameter trunk sanitary sewer on March Road.

Drawing SAN-1 illustrates the conceptual main trunk sewer alignment and sanitary drainage areas. As per the KNMSS, the proposed development sanitary sewer system is split between the future Minto Development sanitary sewers draining south toward the BRPS and the future March Road sanitary sewer, both currently in the design stages. The proposed location of the drainage split is approximately the top of the existing soil ridge, with all lands east of the split draining south to BRPS and lands west of the split draining to March Road.

The proposed development will be serviced by a network of gravity sewers, designed in accordance with the wastewater design parameters from ISTB-2018-01 and the Sewer Design

Guidelines, summarized in **Table 1**. These design parameters represent a flow reduction from the outdated wastewater design parameters used during the KNMSS design.

The conceptual sanitary sewer design sheet can be found in **Appendix B.1**. A breakdown of the estimated sewage peak flows that will be directed to each outlet is shown in **Table 2**.

Table 2: Estimated Wastewater Peak Flows

Outlet	Residential Population (persons)	Residential Peak Flow (L/s)	Institutional Area (ha)	Commercial Area (ha)	Commercial /Institutional Peak Flow (L/s)	Total Area (ha)	Extraneous Flow (L/s)	Total Peak Flow (L/s)
BRPS (via Minto Development)	1,270	13.1	N/A	N/A	N/A	21.05	6.9	20.1
March Road	863	9.2	2.92	3.54	3.1	17.46	5.8	18.1

As can be seen in the above table, the total estimated peak flows to the March Road outlet and BRPS outlet are less than the peak flows assumed in the KNMSS of 28.7 L/s and 26.4 L/s respectively.

It is anticipated that a sanitary HGL analysis will be completed for the proposed sanitary sewer system tributary to the BRPS at the detailed design stage, once design information on the sanitary overflow and KNUEA SWM Pond 3 have been finalized.

4.0 STORM DRAINAGE

The proposed development encompasses approximately 38.5 ha of land at 66% imperviousness and comprises a school block, two commercial/mixed use blocks, designated park land, a medium density residential block, and a mix of single family homes and town homes. The proposed development storm sewer system will be sized to convey runoff from a portion of urbanized March Road (1.14 ha at 71% imperviousness). Post development runoff from the development will be directed to the KNUEA SWM Pond 3 which is currently being designed as part of the Minto Development to the south. The KNUEA SWM Pond 3 will provide quantity and quality control (80% TSS removal) of runoff before discharging into Shirley's Brook. **Drawing STM-1** shows the overall major and minor system flow direction, storm drainage areas and extent of external areas.

The storm drainage objective is to complete a conceptual stormwater management plan for the proposed development that meets all relevant design criteria.

4.1 BACKGROUND

The study area is located within the Shirley's Brook sub-watershed. Under existing conditions the western portion of the study area drains into Shirley's Brook via Shirley's Brook Tributary 2. The eastern portion of the study area drains into Shirley's Brook to the east via existing drainage channels. See **Appendix C** for KNMSS excerpts showing existing drainage patterns for the site.

The KNMSS outlined the SWM criteria for the proposed development. Both the minor and major systems are to be directed towards the KNUEA SWM Pond 3.

Drawing STM-1 illustrates the proposed trunk storm sewer network, drainage areas and overland flow direction. The site trunk storm sewers will convey stormwater runoff from the study area and a portion of March Road. The storm sewer network ultimately drains towards the KNUEA SWM Pond 3 to the east. Local storm sewers will provide service to all roads and development blocks within the proposed development. Major flows from the portion of urbanized March Road north of the proposed Street 1 will be routed through the site to the designated outlet.

The KNMSS outlined that the proposed storm sewers be sized to convey the 5-year storm for local and collector roads and the 10-year storm for arterial roads. However, the proposed storm sewer system will be designed in accordance with the latest City of Ottawa SWM bulletins (see **Section 1.4**) which deviate from the design criteria used in the KNMSS. The proposed storm sewers and inlet control devices (ICDs) will be designed to convey/capture the 2-year runoff for local streets, 5-year runoff for collector roads, and 10-year runoff for arterial roads.

4.2 DESIGN CONSTRAINTS AND REGULATORY REQUIREMENTS

The following summarizes the SWM criteria and constraints that will govern the detailed design of the proposed development as per the governing background studies.

- Design using the dual drainage principle.
- 'Enhanced' level of treatment as per MECP recommendations which represent an equivalent 80% TSS removal to be provided in the KNUEA SWM Pond 3.
- Quantity control to be provided in the KNUEA SWM Pond 3.
- Maximum 100-year water depth of 0.35 m in road sags, including overflow spill depth.
- Proposed school block and commercial/mixed-use blocks to provide on-site storage for all storms up to the 100-year storm.
- Rear-yard storage is not to be included in calculations.
- Rearyard flows from properties along the eastern boundary should be directed to culverts crossing the abandoned CN rail corridor to maintain flows in channels 'C' and 'D'.
- Re-grade ditch west of the former rail corridor to eliminate perched culverts and direct rearyard drainage to headwater channels east of the rail corridor
- As per the KN MSS, parks are estimated to discharge up to 12 L/s/ha to the major system. No surface storage has been assumed for park areas at this stage, for conservatism.
- 100-year hydraulic grade line (HGL) to be a minimum 0.30 m below lowest building underside of footing elevation.
- Design inlets along local roadways to capture the 2-year peak flow.
- Design inlets within the school and commercial blocks, and along collector roadways to capture the 5-year peak flow.
- Design storm sewers along local and collector roadways to convey the 2-year and 5-year peak flow respectively under free-flow conditions using 2004 City of Ottawa I-D-F parameters and an inlet time of 10 minutes.
- Provide adequate emergency overflow conveyance as shown on **Drawing STM-1**.
- Design and submit a detailed erosion control plan.

4.3 PROPOSED CONDITIONS

As outlined in the KNMSS, major system peak flows from the proposed site and from the portion of March Road identified as area A211A on **Drawing STM-1** will be directed east the KNUEA SWM Pond 3. The proposed conceptual grading plan is outlined on **Drawing GP-1** which shows that the proposed development will have two major system flow outlets. One major system outlet along Street 1, through Block 306 which will discharge into the existing ditch west of the abandoned CN railway corridor. The second major system outlet will be provided along Street 6, through Block 303, which will also discharge into the existing ditch west of the abandoned CN railway corridor. The extent of regrading required along the existing ditch on the west side of the CN railway corridor will be confirmed at the detailed design stage to ensure positive drainage and sufficient conveyance capacity.

As per the MSS, the proposed outlet for the minor system from the proposed development is the KNUEA SWM Pond 3. Pond 3 is to be situated south-east of the proposed development and is currently being designed by DSEL as part of the Minto Development to the south. A preliminary storm sewer design sheet is provided in **Appendix C.1**.

The KNUEA SWM Pond 3 is intended to provide Enhanced Protection quality control (80% TSS removal), and operate at a permanent pool elevation of 65.5m, consistent with the preliminary design presented in the KNEMP and KNMSS. Similarly, the preliminary design for Pond 3 presented in the KNEMP anticipates a 100-year water level of 67.0m.

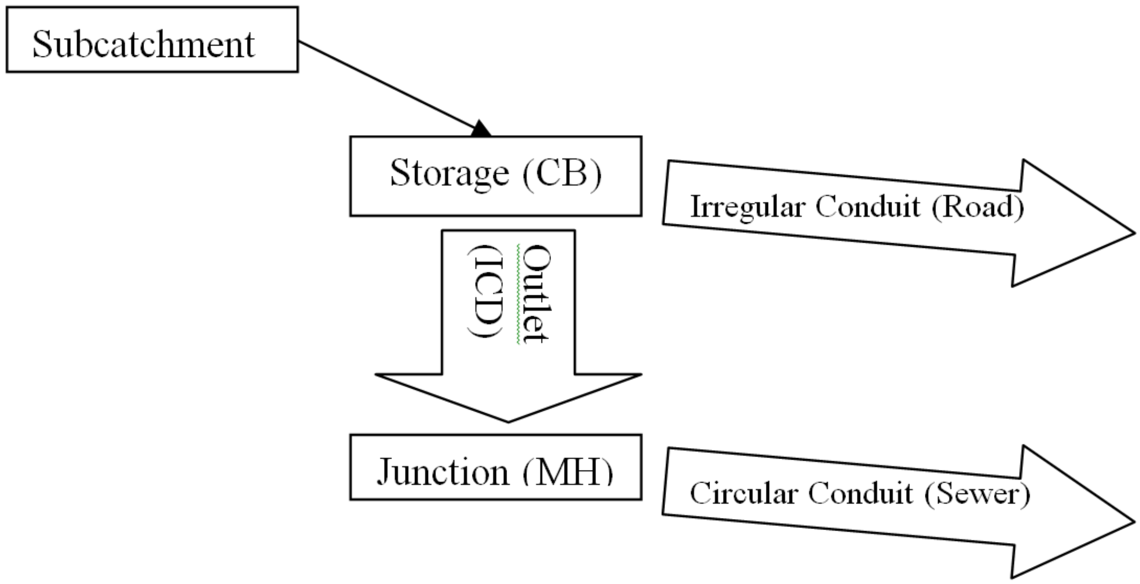
4.4 POST DEVELOPMENT CONCEPTUAL MODELING RATIONALE

Hydrologic and hydraulic modeling of the proposed storm sewer system was completed using PCSWMM modeling software which uses the EPA-SWMM 5.1.012 computational engine for analysis. The included models can also be opened and reviewed using the free EPA-SWMM GUI. PCSWMM model layout, input parameters, and example input file are provided in **Appendix C**. Electronic model files are provided on the enclosed CD. As previously noted, the site design is currently at a conceptual level and will be further refined at the detailed design stage. The following sections summarize the input parameters used in the conceptual post development model.

4.4.1 SWMM Dual Drainage Methodology

The proposed development is modeled in one modeling program as a dual conduit system (see **Figure 2**), with: 1) circular conduits representing the sewers & junction nodes representing manholes; 2) irregular conduits using street-shaped cross-sections to represent the approximate overland road network and storage nodes representing catchbasins. The dual drainage systems are connected via outlet link objects from storage node (i.e. CB) to junction (i.e. MH), and represent inlet control devices (ICDs). Subcatchments are linked to the storage node on the surface so that generated hydrographs are directed there firstly.

Figure 2 : Schematic Representing Model Object Roles



Storage nodes are used in the model to represent catchbasins. The invert of the storage node represents the invert of the CB and the rim of the storage node represents the top of the CB plus the allowable flow depth on the segment. For the purpose of this conceptual SWM plan, CB inverts have been assumed to be 2 m below the top of the CB and a flow depth of 0.60 m has been assumed on grassed swale segments and of 0.40 m on road segments.

Storage nodes on some street catchments were assigned a storage curve assuming a maximum storage of 30 m^3/ha, based on conceptual grading, while sufficient storage to contain the 100-year overflows was assumed for the school block and the commercial/mixed-use blocks. Storage curves in PCSWMM are required to be input as depth-area curves, as such an equivalent area was calculated at a depth of 2.35 m. All storage was assumed to occur between the top of the CB (2.0 m head) and a 0.35 m depth (2.35 m head) prior to spilling into the downstream segment. If the available storage volume in a storage node is exceeded, flows spill above the storage node and into the downstream irregular conduit (representing roads) and continue routing through the system until ultimately flows reach the outfall of the major system. No storage has been accounted for within storage nodes at park areas and some street catchments that are expected to have limited or no sags. Capture curves were defined for each catchment to restrict outlet link flows to the 2-year for local streets, 5-year rate for collector roads, the school and commercial blocks, and 10-year rate for arterial roads.

4.4.2 Land Use

The proposed site will be developed as a mixture of low and medium density residential areas with one park area, a school, and two commercial blocks. Runoff coefficients based on land use were obtained from the KNMSS as shown in the excerpts included in **Appendix C**.

4.4.3 Design Storms

The 3 hour Chicago distribution was selected to estimate the 2-year, 5-year and 10-year capture rates for the proposed and external subcatchments, and to assess the 100-year HGL across the proposed development. The Chicago distribution was selected due to its tendency to generate high peak flows in urban catchments, similar to the proposed development. The following storm events were used to evaluate the preliminary minor and major systems performance and assess the preliminary 100-year HGL across the development:

- 2-year, 3 hour Chicago storm, 10-minute time step (2yr3hrChicago)
- 5-year, 3 hour Chicago storm, 10-minute time step (5yr3hrChicago)
- 10-year, 3 hour Chicago storm, 10-minute time step (10yr3hrChicago)
- 100-year, 3 hour Chicago storm, 10-minute time step (100yr3hrChicago)

4.4.4 Boundary Conditions

A static backwater elevation of 67.00 m equal to the 100-year water level in the KNUEA SWM Pond 3 as outlined in the KNMSS was used to assess the preliminary 100-year HGL across the site.

4.4.5 Modeling Parameters

Table 3 presents the general subcatchment parameters used:

Table 3: General Subcatchment Parameters

Subcatchment Parameter	Value
Infiltration Method	Horton
Max. Infil. Rate (mm/hr)	76.2
Min. Infil. Rate (mm/hr)	13.2
Decay Constant (1/hr)	4.14
N Imperv	0.013
N Perv	0.25
Dstore Imperv (mm)	1.57
Dstore Perv (mm)	4.67
Zero Imperv (%)	0

Table 4 presents the individual parameters that vary for each of the proposed and external subcatchments.

Table 4: Conceptual Subcatchment Parameters

Area ID	Area (ha)	Width (m)	Slope (%)	% Impervious	Runoff Coefficient	Subarea Routing	% Routed
A211A	0.44	102.0	1.0	71.4%	0.70	OUTLET	100
A211B	0.70	169.0	1.0	71.4%	0.70	OUTLET	100
C203A	0.73	162.0	1.0	64.3%	0.65	OUTLET	100
C204A	1.90	725.0	2.0	64.3%	0.65	PERVIOUS	20
C204B	0.31	80.0	1.0	64.3%	0.65	OUTLET	100
C205A	2.92	657.0	1.0	64.3%	0.65	PERVIOUS	30
C205B	0.71	260.0	2.0	64.3%	0.65	OUTLET	100
C205C	0.87	255.0	2.0	64.3%	0.65	OUTLET	100
C205D	2.46	798.0	1.0	64.3%	0.65	PERVIOUS	20
C206A	1.22	274.5	1.0	92.9%	0.85	OUTLET	100
C206B	1.25	473.0	1.0	64.3%	0.65	OUTLET	100
C206C	1.93	434.3	1.0	92.9%	0.85	OUTLET	100
C206D	0.65	131.0	1.0	64.3%	0.65	OUTLET	100
C206E	0.63	223.0	1.0	64.3%	0.65	OUTLET	100
C209A	1.71	384.8	3.0	28.6%	0.40	PERVIOUS	100
C209B	0.39	66.0	2.0	64.3%	0.65	OUTLET	100
C209C	1.84	411.0	1.0	64.3%	0.65	OUTLET	100
L202A	5.07	2088.0	1.0	64.3%	0.65	PERVIOUS	20
L207A	2.12	734.0	1.0	64.3%	0.65	PERVIOUS	20
L207B	2.56	768.0	1.0	64.3%	0.65	PERVIOUS	20
L208A	2.33	865.0	1.0	71.4%	0.70	OUTLET	100
L209A	1.58	367.0	2.0	64.3%	0.65	OUTLET	100
L210A	5.33	1580.0	1.0	64.3%	0.65	PERVIOUS	20

1. The width parameter was estimated as twice the road/rear yard swale for two-sided catchments and equal to the length of the road/rear yard swale for one-sided catchments. The width parameter for the school and commercial blocks was defined as 225m/ha as per the City of Ottawa Sewer Design Guidelines.

Table 5 summarizes the storage node parameters used in the conceptual model.

Table 5: Storage Node Parameters

Storage Node	Invert Elevation (m)	Rim Elevation (m)	Total Depth (m)	Surface Storage (m^3)
A211A-S	80.70	83.10	2.40	0
A211B-S	81.04	83.44	2.40	0
C203A-S	69.85	72.90	3.05	0
C204A-S	71.33	74.38	3.05	57
C204B-S	70.66	73.06	2.40	0
C205A-S	72.68	75.73	3.05	310
C205B-S	72.89	75.94	3.05	21

Storage Node	Invert Elevation (m)	Rim Elevation (m)	Total Depth (m)	Surface Storage (m^3)
C205C-S	73.15	75.55	2.40	0
C205D-S	78.80	81.85	3.05	0
C206A-S	77.96	81.01	3.05	105
C206B-S	77.78	80.83	3.05	0
C206C-S	77.96	81.01	3.05	166
C206D-S	78.45	81.50	3.05	19
C206E-S	78.81	81.21	2.40	0
C209A-S	70.55	73.15	2.60	0
C209B-S	73.24	75.64	2.40	0
C209C-S	70.15	73.20	3.05	0
L202A-S	70.82	73.87	3.05	0
L207A-S	79.10	82.15	3.05	64
L207B-S	78.69	81.74	3.05	0
L208A-S	79.06	82.11	3.05	0
L209A-S	70.58	72.98	2.40	0
L210A-S	70.85	73.90	3.05	0
A211A-S	80.70	83.10	2.40	0

1. School and commercial blocks (storage nodes C205A-S, C206A-S and C206C-S) were assumed to provide on-site storage for up to the 100-year storm.

As per the Ottawa Sewer Design Guidelines (OSDG 2012), Manning's roughness values of 0.013 were used for sewer modeling and overland flow corridors representing roadways.

Table 6 summarizes the outlet link maximum flow rates for the 100-year, 3hr Chicago storm event.

Table 6: Conceptual Minor System Capture Rates

Outlet Name	Drainage Area ID	Inlet Node	Outlet Node	Invert Elevation (m)	100-year Minor System Capture Rate (L/s)
A211A-IC	A211A	A211A-S	211	80.70	121.31
A211B-IC	A211B	A211B-S	211	81.04	218.85
C206B-IC	C206B	C206B-S	206	77.78	288.00
C206A-IC	C206A	C206A-S	206	77.96	373.00
C206C-IC	C206C	C206C-S	206	77.96	588.00
C206E-IC	C206E	C206E-S	206	78.81	134.35
C206D-IC	C206D	C206D-S	206	78.45	143.90
L207A-IC	L207A	L207A-S	207	79.10	284.00
L207B-IC	L207B	L207B-S	207A	78.69	338.00
L208A-IC	L208A	L208A-S	208	79.06	393.00
C205D-IC	C205D	C205D-S	205	78.80	526.50
C205C-IC	C205C	C205C-S	205	73.15	190.13
C204A-IC	C204A	C204A-S	204	71.33	444.00
C205A-IC	C205A	C205A-S	205	72.68	562.57

Outlet Name	Drainage Area ID	Inlet Node	Outlet Node	Invert Elevation (m)	100-year Minor System Capture Rate (L/s)
C205B-IC	C205B	C205B-S	205	72.89	167.80
L209A-IC	L209A	L209A-S	209	70.58	229.52
C209A-IC	C209A	C209A-S	209	70.55	141.31
C209C-IC	C209C	C209C-S	209	70.15	407.80
C209B-IC	C209B	C209B-S	209	73.24	79.15
L210A-IC	L210A	L210A-S	210	70.85	703.20
C204B-IC	C204B	C204B-S	204	70.66	65.10
C203A-IC	C203A	C203A-S	203	69.85	161.60
L202A-IC	L202A	L202A-S	202	70.82	689.60

Exit losses at manholes were set for all pipe segments based on the flow angle through the structure. Exit losses were assigned as per City guidelines (Appendix 6b), see **Table 7** below.

Table 7: Exit Loss Coefficients for Bends at Manholes

Degrees	Coefficient
11	0.060
22	0.140
30	0.210
45	0.390
60	0.640
90	1.320
180	0.020

4.5 CONCEPTUAL MODEL RESULTS AND DISCUSSION

The following section summarizes the key hydrologic and hydraulic conceptual model results. For detailed model results or inputs please refer to the example input file in **Appendix C.3** and the electronic model files on the enclosed CD.

4.5.1 Proposed Development Conceptual Hydraulic Grade Line Analysis

The preliminary 100-year hydraulic grade line (HGL) elevation across the proposed development was estimated using the functional post development PCSWMM model for the 100-year, 3 hour Chicago storm with the conceptual 100-year water level in the KNUEA SWM Pond 3 (67.00 m) as a fixed boundary condition. **Table 8** below presents the clearance between the trunk sewer 100-year HGL and the proposed road grade along the trunk sewer. The storm sewer design sheet is included in **Appendix C.1**.

Table 8: Valecraft Homes Part of Lot 13, Concession 4 Functional HGL Results

STM MH	Prop. Grade (m)	3 HR Chicago HGL (m)	Prop. Grade-HGL Clearance (m)
182	70.54	67.69	2.85
201	72.62	68.02	4.60
202	72.50	68.78	3.72
203	72.66	69.67	2.99
204	72.74	69.98	2.76
205	80.27	70.53	9.74
206	81.91	77.76	4.15
207	80.55	76.05	4.50
207A	80.14	76.02	4.12
208	80.29	75.87	4.42
209	72.58	70.34	2.24
210	72.49	69.96	2.53
211	82.12	78.19	3.93

The model results indicate that there is sufficient clearance between the preliminary 100-year HGL and the proposed road grades. Detailed grading of the proposed development will be completed based on the above results to ensure that a minimum clearance of 0.3 m is provided between all under side of footings (USFs) and the 100-year HGL, and that no basement flooding occurs in the climate change scenario.

4.5.2 Major Flow

Major system peak flows from the proposed site and from the portion of March Road identified as area A211A on **Drawing STM-1** will be directed east the KNUEA SWM Pond 3. Major flows from the northern half of the site will be directed along Street 1 to Block 306 and ultimately to the existing ditch west of the abandoned CN railway corridor. Major flows from the southern half of the site will be directed along Street 6 to Block 303 and ultimately to the existing ditch west of the abandoned CN railway corridor. The extent of regrading required along the existing ditch on the west side of the CN railway corridor will be confirmed at the detailed design stage to ensure positive drainage and sufficient conveyance capacity.

The PCSWMM model is based on lumped drainage areas with major system storage represented in storage nodes that overestimate the major system peak flows to the proposed major system outlets. It is anticipated that the actual major system peak flow contribution from the proposed development will be much lower once detailed grading is completed and the actual road configuration with available sag storage is included in the model during detailed design.

The northern major flow outlet through Block 306 was modeled in PCSWMM as a trapezoidal channel with a 3m-wide bottom, 3:1 side slopes, average longitudinal slope of 4.5%, and 0.6 m depth. Similarly, the southern major flow outlet through Block 303 was modeled as a trapezoidal channel with 2m-wide bottom, 3:1 side slopes, 4.9% longitudinal slope, and 0.4 m depth. The maximum flow depth, velocity and peak flow have been obtained from PCSWMM and the results are presented in **Table 9** below for the 100-year, 3 hour Chicago storm which is commonly used to evaluate the urban component of dual drainage, specifically on-site detention.

Table 9: 100-Year, 3hr Chicago Overland Flow Results

Location	Peak Flow (L/s)	Depth (m)
Northern Major System Outlet – Block 306	1,698	0.25
Northern Most Downstream Street – Street 1	1,048	0.20
Southern Major System Outlet – Block 303	1,852	0.29
Northern Most Downstream Street – Street 6	1,890	0.28

5.0 GEOTECHNICAL CONSIDERATIONS AND GRADING

A Geotechnical Report was prepared by Paterson Group in 2013 as part of the KNMSS to outline the geotechnical constraints for the KNUEA CDP. The report consolidated all existing geotechnical studies completed for individual properties. The proposed development lands were identified as 1020 March Road and 1070 March Road in the geotechnical investigation.

The geotechnical investigation concluded that the undeveloped parcel on 1070 March Road which represents the northern portion of the site consists of topsoil and compact silty sand or stiff silty clay. A glacial till layer was noted at all test pit locations. Practical refusal to excavation was encountered between 0.9 m and 4.6 m depth at all test pit locations.

The undeveloped parcel on 1020 March Road which represents most of the site consists of topsoil, compact silty sand, stiff silty clay and/or a glacial till layer. Practical refusal to excavation was encountered between 0.2 and 4 m depth at most test pit locations.

Groundwater levels measured in March 2013 showed levels that ranged between 1.4 m to 2.2 m for 1070 March Road and 1.2 m to 4.1 m for 1020 March Road.

Based on the information provided, no grade raise restriction exist for the northern edge of the site (1070 March Road), and up to 2 m grade raise restriction is expected for the rest of the site.

A Permit to Take Water (PTTW) was recommended to be obtained for the site servicing work due to the potential for groundwater inflow in areas of rock excavation (excerpts from the geotechnical report are included in **Appendix D**)

Preliminary grading for the proposed site has been provided as shown on **Drawing GP-1.** Grading design has been provided to direct overland flows from the proposed development and a section of March Road to the east to the existing ditch on the west side of the abandoned CN railway corridor. Proposed grades along March Road were obtained from the Kanata North MSS Master Grading Plan which assumes March Road will be fully urbanized. Proposed grading along the southern property line adjacent to the future Minto Development has been coordinated with DSEL.

6.0 EROSION CONTROL DURING CONSTRUCTION

Erosion and sediment controls must be in place during construction. The following recommendations to the contractor will be included in contract documents.

1. Until the local storm sewer and SWM pond are constructed, groundwater in trenches will be pumped into a filter mechanism prior to release to the environment. After construction of the SWM facility, any construction dewatering will be routed to the nearest storm sewer.
2. Seepage barriers to be constructed in any temporary drainage ditches.
3. Install a silt fence along the site perimeter.
4. Limit extent of exposed soils at any given time.
5. Re-vegetate exposed areas as soon as possible.
6. Minimize the area to be cleared and grubbed.
7. Protect exposed slopes with plastic or synthetic mulches.
8. Provide sediment traps and basins during dewatering.
9. Install sediment traps (such as SiltSack® by Terrafix) between catchbasins and frames.
10. Plan construction at proper time to avoid flooding.

The contractor will, at every rainfall, complete inspections and guarantee proper performance. The inspection is to include:

1. Verification that water is not flowing under silt barriers.
2. Clean and change silt traps at catchbasins.

7.0 UTILITIES

Utility services were consulted as part of the KNMSS process to provide information regarding their existing infrastructure, initial plans for servicing the KNUEA, and identify any known constraints.

Hydro Ottawa is reported to have overhead infrastructure running through the KNUEA on the east side of March Road. Per the KNMSS, the existing infrastructure on March Road will need to be upgraded in order to service the KNUEA.

Similarly, Enbridge Gas is reported to have service extended off the 6" high-pressure gas main within the west side of March Road near the site.

Bell and Rogers are reported to have services up to the intersection of March Road and Old Carp Road, southwest of the study area. Service to the KNUEA would extend off this location. Per the KNMSS, Rogers' existing infrastructure would require upgrading to service the KNUEA.

8.0 APPROVALS

The City of Ottawa will review and approve most development applications as they relate to provision of water supply, wastewater collection and disposal, and stormwater conveyance and treatment. The City of Ottawa will issue a commence work notification for construction of the sanitary and storm sewers once an Environmental Compliance Approvals (ECA) is issued by the Ontario Ministry of Environment, Conservation and Parks (MECP).

Ontario Ministry of Environment, Conservation and Parks (MECP) Environmental Compliance Approvals (ECA) will be required for the proposed subdivision works related to stormwater management, inlet control devices, storm sewers and sanitary sewers. The MECP is expected to review the proposed servicing works by transfer of review submission.

A Permit under Ontario Regulation 153/06, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation is expected to be required from the Mississippi Valley Conservation Authority (MVCA) due to alterations of existing watercourses through site as part of the proposed development.

An MECP Permit to Take Water (PTTW) may be required for the site. The geotechnical consultant shall confirm at the time of application that a PTTW is required.

9.0 CONCLUSIONS

9.1 WATER SERVICING

The KNUEA is located within the existing City of Ottawa 2Ww pressure zone. The proposed development will be serviced through two watermain connections: a connection to a future 400 mm diameter watermain on March Road, and a connection to the watermain network within the future Minto development south of the site.

At the detailed design stage, a complete hydraulic analysis will be prepared for the proposed development water distribution network to confirm that water supply is available within the required pressure range under the anticipated demands during average day, peak hour and fire flow conditions prior to full buildout of the KNUEA.

9.2 SANITARY SERVICING

The proposed development will be serviced by a network of gravity sewers. The wastewater servicing strategy for the proposed site was considered within the KNMSS, with a portion of the study area draining to the south, connecting to the sanitary sewer system within the future Minto Development, and the remaining portion of the site draining to the west, connecting to the future 600 mm diameter trunk sanitary sewer on March Road.

The total estimated peak flows to the March Road outlet and BRPS outlet are less than the peak flows assumed in the KNMSS of 28.7 L/s and 26.4 L/s respectively.

It is anticipated that a sanitary HGL analysis will be completed for the proposed sanitary sewer system tributary to the BRPS at the detailed design stage, once design information on the sanitary overflow and KNUEA SWM Pond 3 have been finalized.

9.3 STORMWATER SERVICING

The proposed stormwater management plan is in compliance with the requirements outlined in the background documents and the City of Ottawa Sewer Design Guidelines.

Capture curves were defined for each catchment to restrict inflow rates to the sewer to the 2-year runoff for local streets and the 5-year runoff for commercial/institutional blocks and for collector roads as per the City design criteria. Major system peak flows from the entire site will be directed towards the KNUEA SWM Pond 3.

Quantity and ‘Enhanced’ quality control will be provided in the KNUEA SWM Pond 3 to restrict peak flows to Shirley’s Brook to existing conditions and to achieve 80% TSS removal.

9.4 UTILITIES

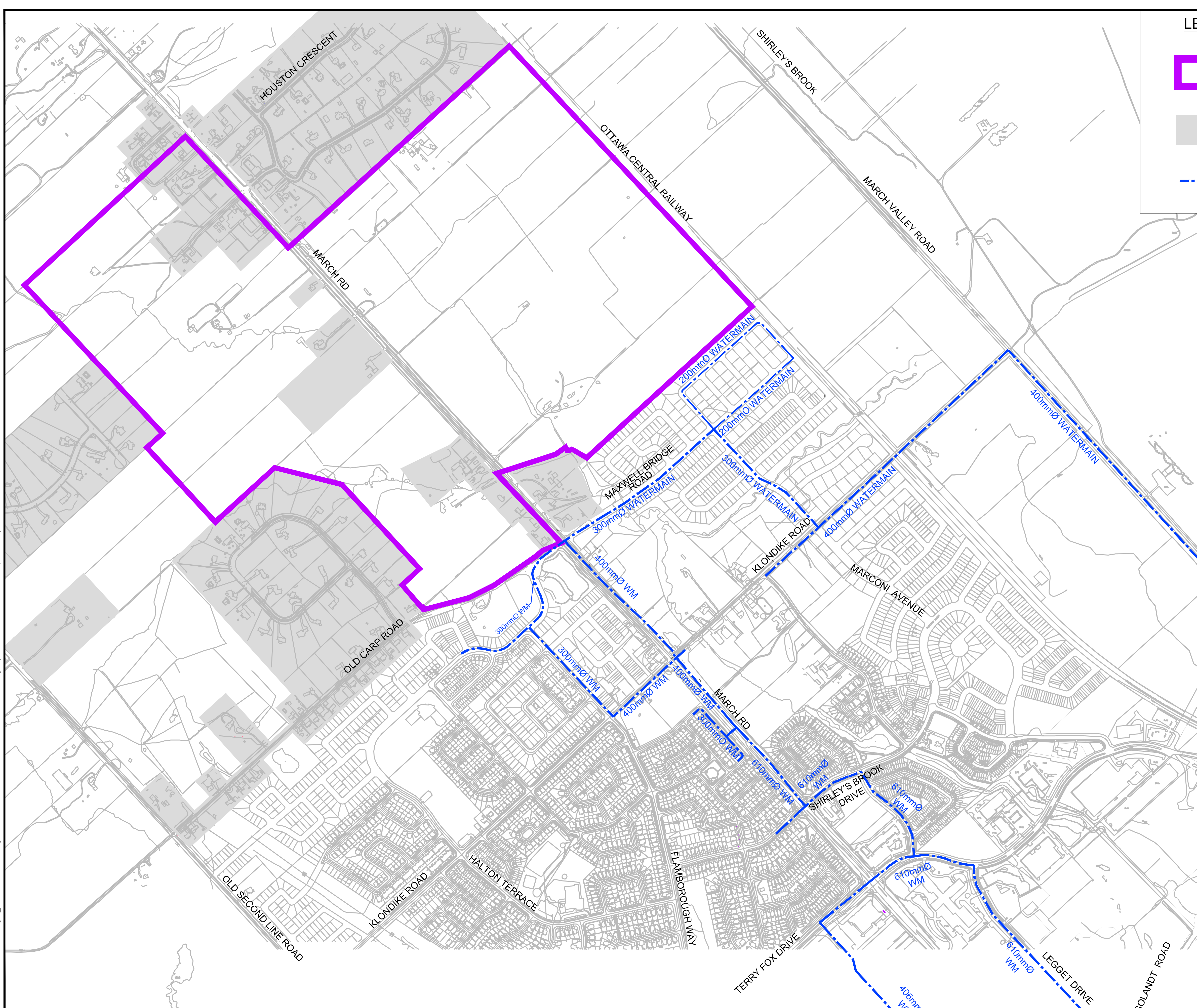
Hydro Ottawa is reported to have overhead infrastructure running through the KNUEA on the east side of March Road. Per the KNMSS, the existing infrastructure on March Road will need to be upgraded in order to service the KNUEA.

Similarly, Enbridge Gas is reported to have service extended off the 6” high-pressure gas main within the west side of March Road near the site.

Bell and Rogers are reported to have services up to the intersection of March Road and Old Carp Road, southwest of the study area. Service to the KNUEA would extend off this location. Per the KNMSS, Rogers’ existing infrastructure would require upgrading to service the KNUEA.

Exact size, location and routing of utilities will be finalized at the detailed design stage.

Appendix A POTABLE WATER SERVICING BACKGROUND AND CORRESPONDENCE



LEGEND

KANATA NORTH URBAN EXPANSION AREA (KNUEA)

EXISTING PROPERTIES SERVICED BY WELLS AND SEPTIC SYSTEMS

EXISTING MAINLINE WATERMAIN

KN

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 3.8

EXISTING CONDITIONS - WATERMAIN INFRASTRUCTURE

DATE	JOB
APR 2016	112117

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N.T.S.

NOVATECH
Engineers, Planners & Landscape Architects

M:\2012\112117\CADD\Design_MSS\FIGURES\Figure 3.8-WATERMAIN INFRASTRUCTURE.dwg, fig 3.8, Feb 23, 2016 - 12:29pm, lseely

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A north-south feedermain generally follows the Teron Road / March Road corridor towards North Kanata. Between Shirley's Brook Drive and Klondike Road, the water main is reduced to a 400mm pipe and continues north to the Zone 2Ww boundary at Old Carp Road.

The Morgan's Grant Pressure Zone is an isolated parcel located west of March Road and south of the Study Area. There is a small local pump station at the intersection of Klondike Road and Wimbledon Way to meet pressure servicing requirements in this area. The station is needed due to local high topography with ground elevations between 91m and 109m. The Morgan's Grant Pump Station (MGPS) operates with discharge HGL values from 138m to 151m.

An existing water distribution schematic taken from the 2013 Infrastructure Master Plan is attached in **Appendix C**, and depicts a skeletonized system for the entire City of Ottawa. Most of the features discussed above can be identified on this high-level drawing. Figure 3 from the Stantec Report highlights the North Kanata area and depicts the Morgan's Grant Pressure Zone and part of the 2Ww Pressure Zone, in relation to the Study Area.

7.3 Planned Water Infrastructure

The City has identified several projects in the 2013 Infrastructure Master Plan to reinforce the current water distribution system. Specific to the WUC, some of these projects will directly affect the KNUEA, and have been listed below:

March Road Pipe Upgrades: the March Road Watermain is predominantly a 600mm feedermain system with several short sections of 400mm pipe. These smaller pipe segments restrict capacity, and reduce system pressure in North Kanata. Replacement of the undersized pipes with 600mm conduit is proposed and construction is expected between 2019-2024 in the 2013 IMP. The timing of these upgrades is based on demand due to growth.

Morgan's Grant Secondary Supply and PRV: the objective of this project is to provide a secondary link between the 3W pressure zone and the Morgan's Grant pressure zone. This infrastructure would improve system reliability in the event of mechanical failure at the MGPS. Staff advises this project has not been scheduled. This project is only relevant to the Study Area if it's determined a connection is needed to this pressure zone.

Glen Cairn Pump Station Upgrades & Reservoir Expansion: these are two distinct projects. City staff advises some pump improvements were done recently at the same time as the Campeau Drive facility works. Additional upgrades are expected in the future, the timing and need for which will be strongly linked to growth in the WUC.

No work is currently scheduled on the reservoir expansion. City staff has indicated work on the reservoir will be needed around 2019.

It is proposed to extend the existing 406mm diameter watermain along March Road north to service the development. A secondary connection to the existing watermain along Old Carp Road at Halton or at Celtic Ridge can be made with a 305mm diameter watermain to provide redundancy in the system. Figure 2-1, from the Stantec Report, shows the preliminary proposed watermain system and connection points to the existing system.

Refer to **Figure 7.1** for proposed onsite watermain infrastructure. Detailed watermain drawings (112117-WM1 and 112117-WM2) are included in **Appendix D.** There are some watermain crossings proposed under Tributaries 2 and 3. The proposed trenches for these crossings will be in rock and will require a clay cap to prevent surface water in the tributaries from migrating into the underlying trenches. Details of the proposed crossings will be provided at detailed design.

Based on the modelling completed by Stantec, the following recommendations were made:

- The Kanata North Urban Expansion should be serviced entirely from the Zone 2Ww pressure zone due to topography and location.

- Site grading should not exceed 93m to maintain minimum pressures greater than 40 psi.

- Services installed in areas where the grade is less than 74m will need pressure reducing valves to keep the maximum pressure below 80 psi.

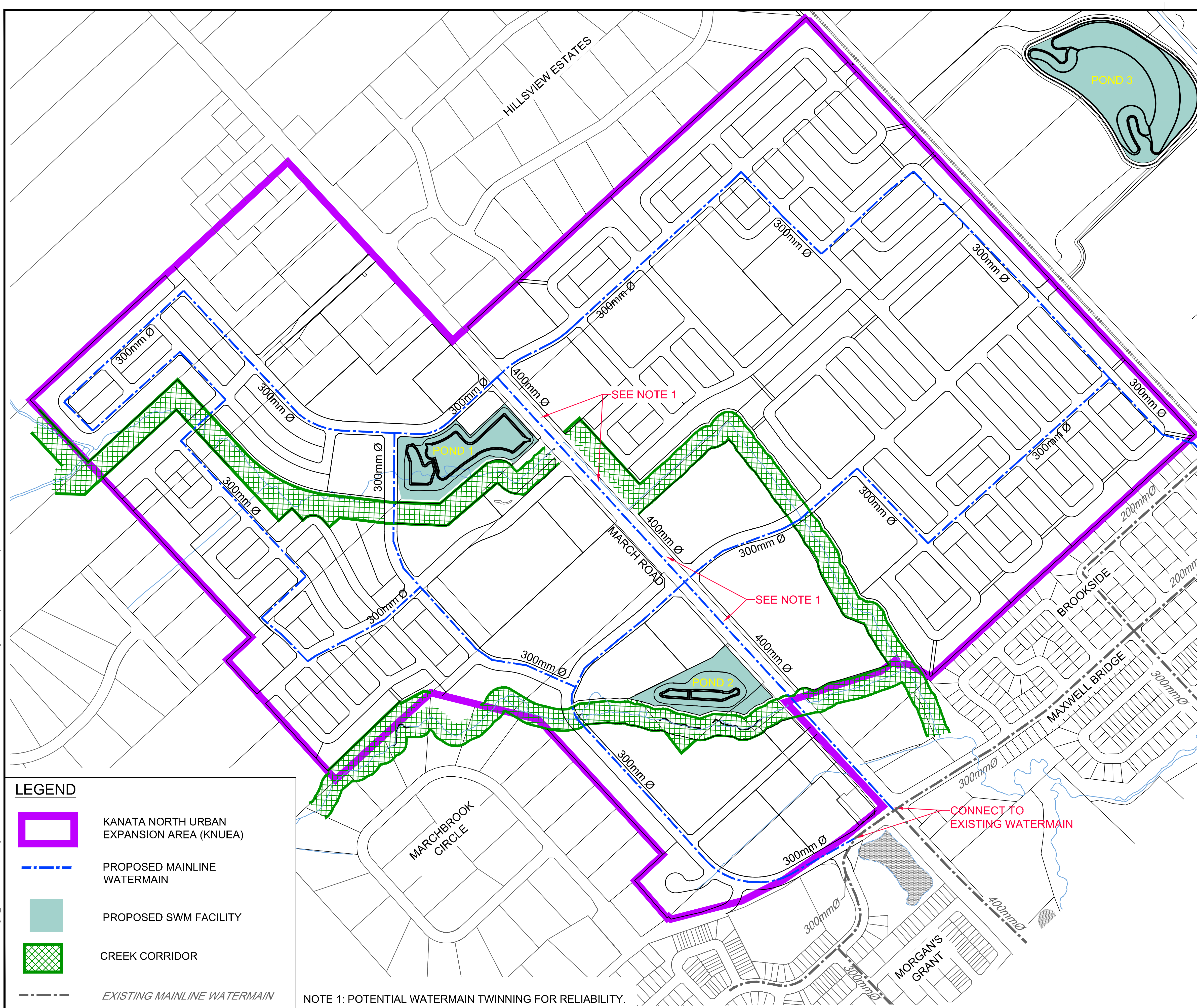
- To improve minimum pressures, two sections of off-site 406mm diameter watermain could be upgraded to reduce headloss from full buildout demands. In particular the upgrade along March Road and Solandt Drive would be required prior to any development within the KNUEA above the 93m elevation.

- A secondary connection from Old Carp Road is the preferred secondary connection over the Celtic Ridge connection. However, either connection will adequately service the development.

It should be noted that it is not anticipated that site grading within the KNUEA will be above the 93m elevation. Therefore, the two existing sections along March Road and Solandt Drive do not require upgrading to service the KNUEA. Also, in the ultimate, full build out scenario, both secondary connections should be completed.

The staging of development is unknown at this time. The City has agreed that a maximum of 200 units can be constructed and serviced with the single watermain connection along March Road. Once more than 200 units have been constructed a secondary connection is required for system reliability. This secondary connection can either be at the Old Carp Road location, the Celtic Ridge location or a second watermain within the March Road ROW (in the interim). Internal looping will also be required as development progresses. This will be reviewed at the subdivision stage on a case by case basis.

The on-site servicing was evaluated in order to confirm the preferred servicing alternative and to understand the impacts of the servicing scenario and provide any mitigation required. On-site servicing was determined based on factors such as optimum routing to the outlet/connection points, minimizing creek crossings, avoiding crossing conflicts with other



LEGEND

- KANATA NORTH URBAN EXPANSION AREA (KNUEA)
- PROPOSED MAINLINE WATERMAIN
- PROPOSED SWM FACILITY
- CREEK CORRIDOR
- *EXISTING MAINLINE WATERMAIN*

NOTE 1: POTENTIAL WATERMAIN TWINNING FOR RELIABILITY.

KN

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 7.1
PROPOSED WATERMAIN INFRASTRUCTURE

DATE
MAY 2016

JOB
112117

SCALE
N.T.S.

NOVATECH
Engineers, Planners & Landscape Architects

M:\2012\112117\CAD\Design_MSS\FIGURES\Figure 7.1 -PROP WATERMAIN INFRASTRUCTURE.dwg, 7.1, May 18, 2016 - 4:04pm, mhrehoriak

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7.5 Water Summary and Recommendations

The following conclusions are presented as a summary of the findings of this hydraulic analysis, as completed by Stantec, for the KNUEA:

- The Kanata North Urban Expansion should be serviced entirely from the Zone 2Ww pressure zone due to topography and location.

- Site grading should not exceed 93m to maintain minimum pressures greater than 40 psi.

- Services installed in areas where the grade is less than 74m will need pressure reducing valves to keep the maximum pressure below 80 psi.

- A secondary connection from Old Carp Road is the preferred secondary connection over the Celtic Ridge connection. However, either connection will adequately service the development.

- It is recommended that both secondary connections be completed prior to full build out of the KNUEA. As an interim measure, a second watermain within the March Road ROW could be provided.

- A servicing evaluation was completed and is summarized to document the results using the criteria and indicators as shown in **Section 7.4** on the preferred water servicing solution.

From:	Smadella, Karin
To:	Paerez, Ana
Subject:	FW: March Road
Date:	Thursday, May 23, 2019 3:56:15 PM
Attachments:	116132-FD.pdf 112117_PP PP-18.pdf 112117_PP PP-16.pdf 112117_PP PP-17.pdf

March Road and anticipated timing.

Karin Smadella, P.Eng.
Project Manager

Direct: 613 724-4371
Mobile: 613 698-8088
Karin.Smadella@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

From: Marc St.Pierre <m.stpierre@novatech-eng.com>
Sent: Friday, May 03, 2019 2:18 PM
To: Smadella, Karin <Karin.Smadella@stantec.com>
Subject: March Road

Karin,

As requested, please find attached the following information.

1. March Road sanitary and water profile design drawings adjacent to the Kanata North development lands. These drawings have been circulated to the City and we are awaiting comments. We are anticipating a 2019 late spring/early summer construction start date with an anticipated completion date of fall 2020.
2. Functional intersection design of March Road and Street 1.

As discussed with Danny Page, Novatech will be responsible for preparing the Road Modification Approval (RMA) application for the shared intersection along March Road. Please find attached a PDF and CADD of the proposed March Road intersection. The intersection includes:

- Left turn lanes on all approaches
- Northbound right turn lane
- Bi-directional cross-ride on the south leg
- 1.5m median along the east and west legs, per City request on our original

submission.

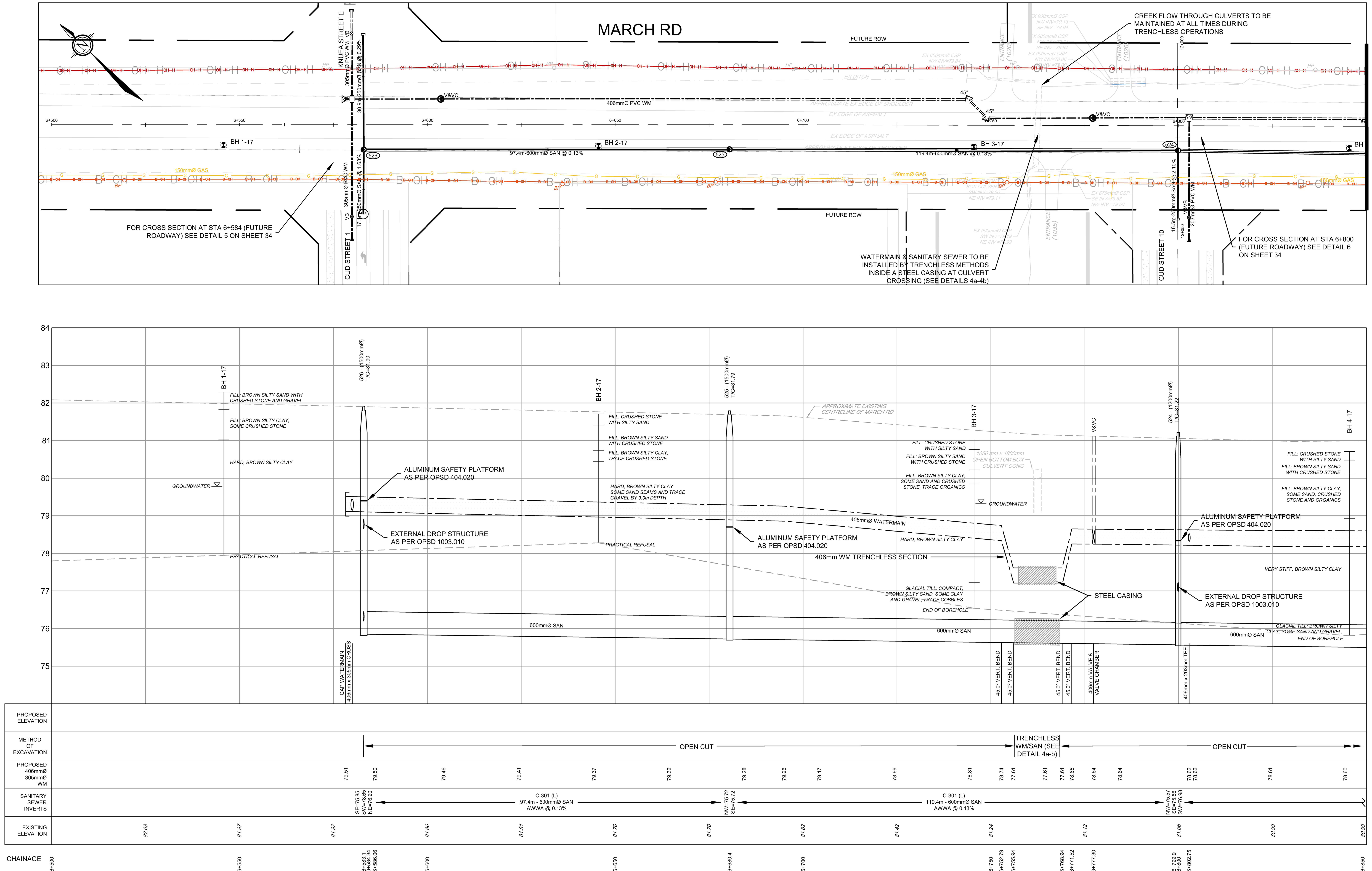
The storage length for the left turn lanes have been calculated using future traffic projections presented in the KNUEA Transportation master Plan.

Can you please share this information with Lauren O'Grady.

Please advise if you have any comments on the geometry for the intersection or for the sanitary and water designs.

Regards

Marc St. Pierre, Senior Project Manager | Land Development Engineering
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 Ext: 247 | Cell: 613.229.9714 | Fax: 613.254.5867



NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	REVISION	DATE	BY
1.	ISSUED FOR CITY REVIEW/COMMENT	MARCH 8/19	FM

SCALE
1:500 HORIZONTAL
1:50 VERTICAL

DESIGN
CHECKED
DRAWN
CHECKED
APPROVED

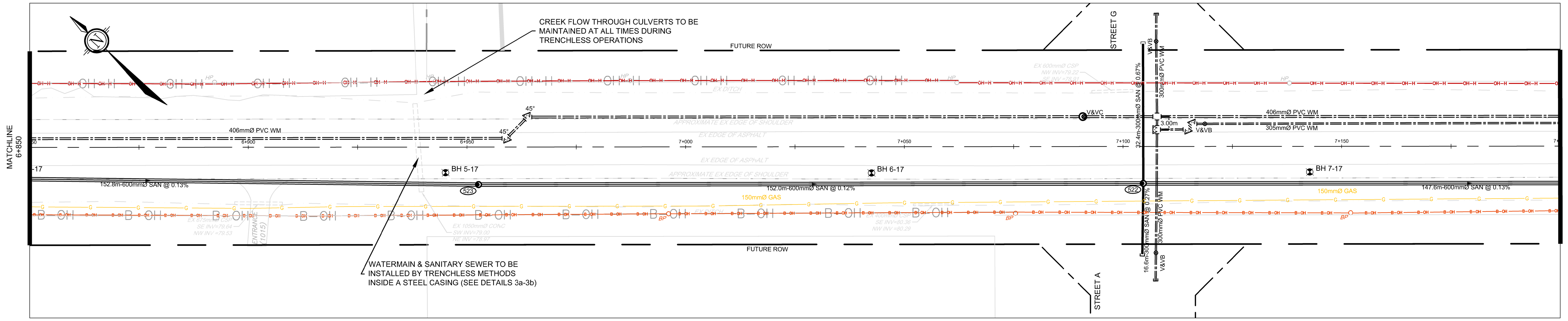
FOR REVIEW ONLY

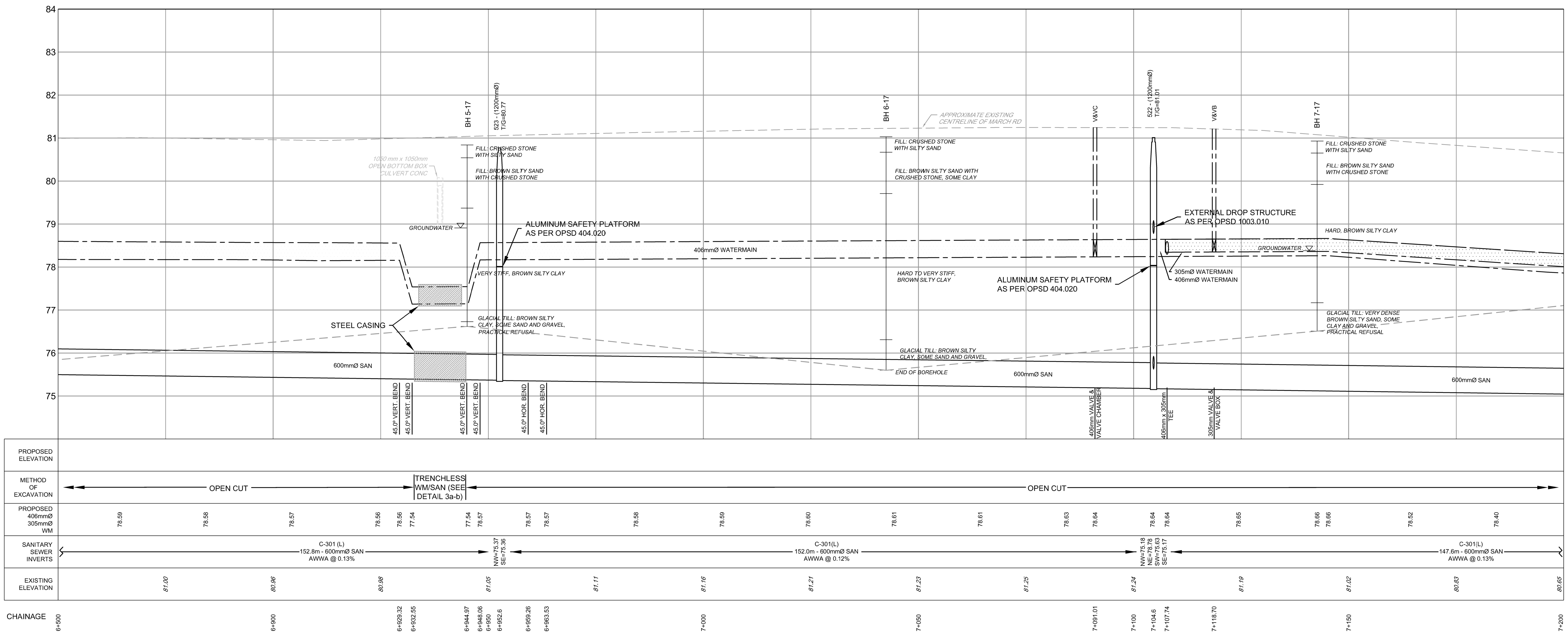
NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
MARCH ROAD SANITARY AND WATERMAIN UPGRADES

DRAWING NAME
PLAN AND PROFILE
MARCH ROAD - 6+500 TO 6+850

PROJECT No. 112117
REV
DRAWING No. 112117-PP-16





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NOTE:
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No.	REVISION	DATE	BY
1.	ISSUED FOR CITY REVIEW/COMMENT	MARCH 8/19	FM

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1:50 — 0 0.5 1.0 1.5 2.0 — VERTICAL

DESIGN
CHECKED
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APPROVED

FOR REVIEW ONLY

NOVATECH
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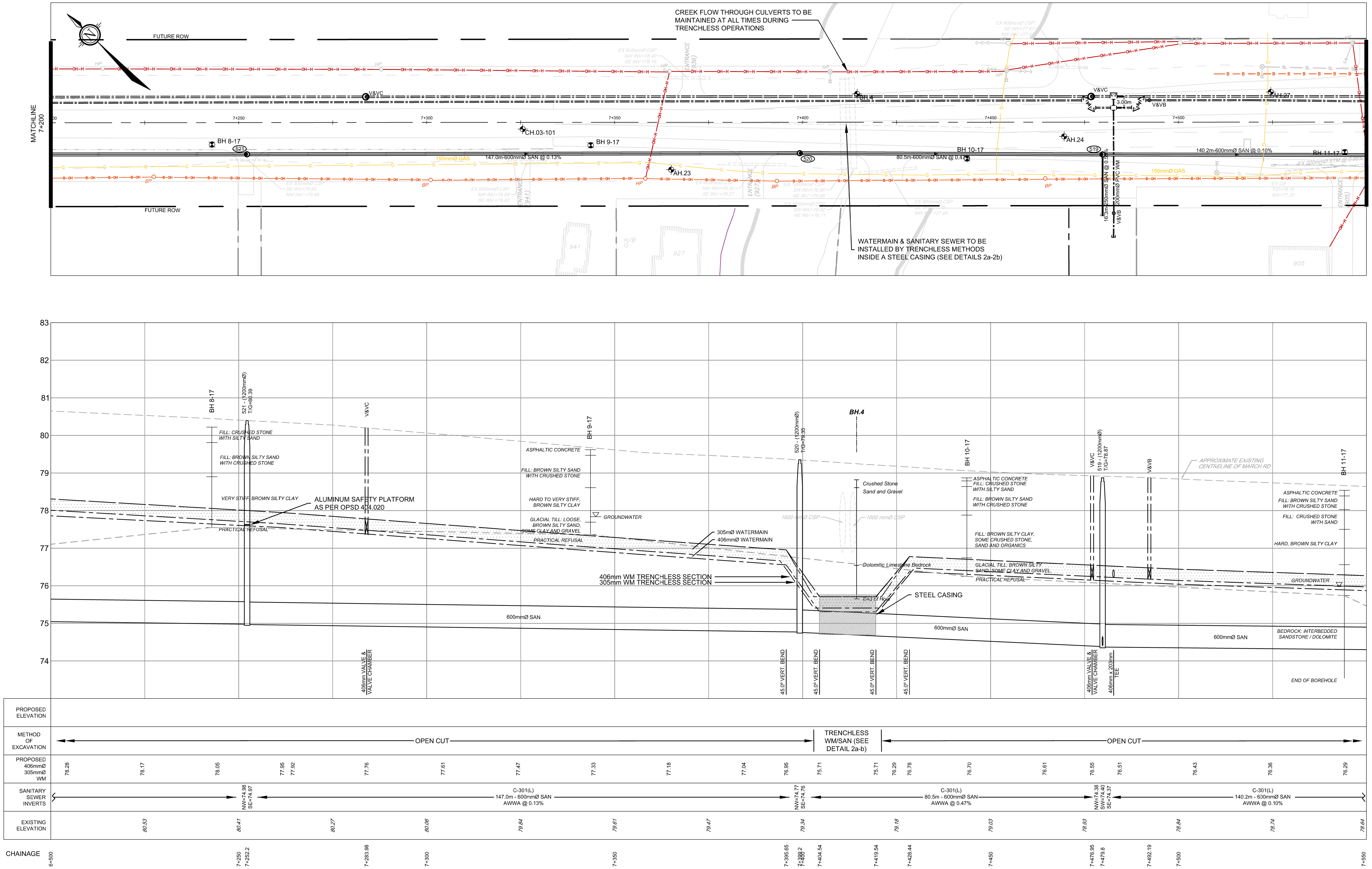
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
MARCH ROAD SANITARY AND WATERMAIN UPGRADES

DRAWING NAME
PLAN AND PROFILE
MARCH ROAD - 6+850 TO 7+200

PROJECT No. 112117
REV
DRAWING No. 112117-PP-17



NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	REVISION	DATE	BY
1.	ISSUED FOR CITY REVIEW/COMMENT	MARCH 8/19	FM

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1:500 HORIZONTAL (0 5 10 15 20)
1:50 VERTICAL (0 0.5 1.0 1.5 2.0)

DESIGN
CHECKED
DRAWN
CHECKED
APPROVED

FOR REVIEW ONLY

NOVATECH
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Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
MARCH ROAD SANITARY AND WATERMAIN UPGRADES

DRAWING NAME
PLAN AND PROFILE
MARCH ROAD - 7+200 TO 7+550

PROJECT No. 112117
REV
DRAWING No. 112117-PP-18

M:\2012\112117_MARCH RD\CAD\March Road\Level 3\112117 PP.dwg, PP-18, Apr 25, 2019 - 8:12am, rgifford

Appendix B SANITARY SEWER CALCULATIONS

B.1 CONCEPTUAL SANITARY SEWER DESIGN SHEET

Stantec	SUBDIVISION: **Valecraft Homes Part of Lot 13, Cocession 4**	**SANITARY SEWER DESIGN SHEET** (City of Ottawa)
	DATE: 7/31/2019	
	REVISION: 1	
	DESIGNED BY: AJ	**FILE NUMBER:** 160401328
	CHECKED BY: AMP	
		Draft Plan Approval Preliminary Design

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	280 l/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	28,000 l/ha/day	MAXIMUM VELOCITY	3.00 m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000 l/ha/day	MANNINGS n	0.013
PEAKING FACTOR (ICI >20%):	1.5	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B
PERSONS / SINGLE	3.4	INSTITUTIONAL	28,000 l/ha/day	MINIMUM COVER	2.50 m
PERSONS / TOWNHOME	2.7	INFILTRATION	0.33 l/s/Ha	HARMON CORRECTION FACTOR	0.8
PERSONS / APARTMENT	1.8				

LOCATION			RESIDENTIAL AREA AND POPULATION								
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS SINGLE	UNITS TOWN	UNITS APT	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)
I108B, R108A	108	107	2.38	0	74	0	200	2.38	200	3.52	2.3
R107C, R107B	107	110	4.37	43	69	0	333	6.74	532	3.37	5.8
R109A	109	110	4.26	10	110	0	331	4.26	331	3.45	3.7
C110A	110	110A	0.00	0	0	0	0	11.00	863	3.27	9.2
	110A	777	0.00	0	0	0	0	11.00	863	3.27	9.2
Total to March Road Outlet:			11.00	53	253	0	863				
R102A	102	104	2.15	34	12	0	148	2.15	148	3.55	1.7
R107A	107	106	1.33	10	14	0	72	1.33	72	3.62	0.8
R106A, R106B, G106C	106	104	4.56	69	15	0	275	5.89	347	3.44	3.9
	104	100	0.00	0	0	0	0	8.04	495	3.38	5.4
R105A	105	101	4.28	62	24	0	276	4.28	276	3.48	3.1
R101A	101	100	1.69	29	0	0	99	5.97	374	3.43	4.2
R100A	100	198	5.32	41	97	0	401	19.33	1270	3.18	13.1
Total to Briar Ridge Pump Station Outlet:			19.33	245	162	0	1270				

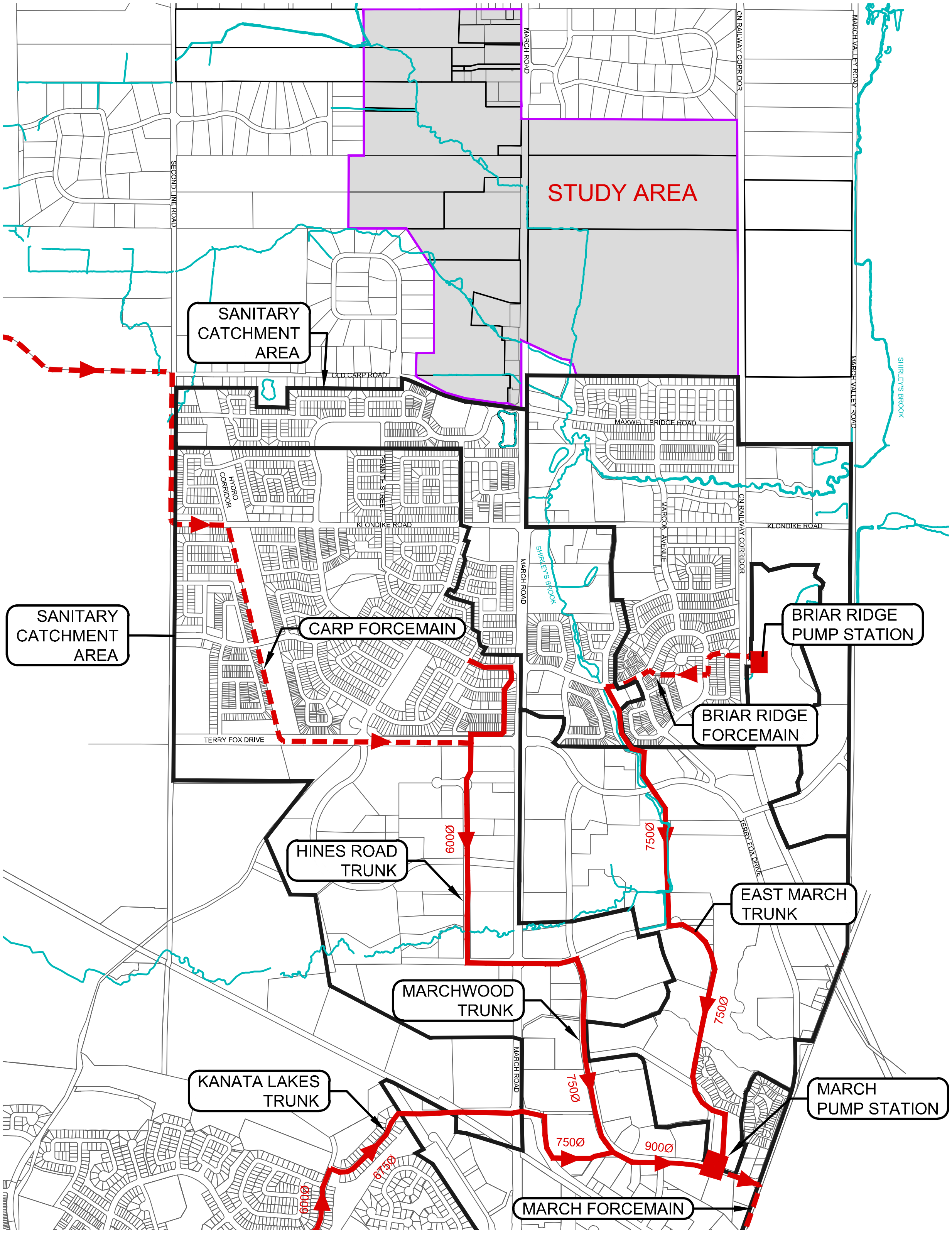
LOCATION			COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	FLOW (l/s)
I108B, R108A	108	107	0.00	0.00	0.00	0.00	0.00	0.00	2.92	2.92	0.00	0.00	1.4	5.30	5.30	1.7	5.4
R107C, R107B	107	110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.92	0.00	0.00	1.4	4.37	9.66	3.2	10.4
R109A	109	110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	4.26	4.26	1.4	5.1
C110A	110	110A	3.54	3.54	0.00	0.00	0.00	0.00	0.00	2.92	0.00	0.00	3.1	3.54	17.46	5.8	18.1
	110A	777	0.00	3.54	0.00	0.00	0.00	0.00	0.00	2.92	0.00	0.00	3.1	0.00	17.46	5.8	18.1
Total to March Road Outlet:			3.54		0.00		0.00		2.92		0.00			17.46			
R102A	102	104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	2.15	2.15	0.7	2.4
R107A	107	106	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	1.33	1.33	0.4	1.3
R106A, R106B, G106C	106	104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.71	1.71	0.0	6.27	7.60	2.5	6.4
	104	100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.71	0.0	0.00	9.75	3.2	8.6
R105A	105	101	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	4.28	4.28	1.4	4.5
R101A	101	100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	1.69	5.97	2.0	6.1
R100A	100	198	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.71	0.0	5.32	21.05	6.9	20.1
Total to Briar Ridge Pump Station Outlet:			0.00		0.00		0.00		0.00		1.71			21.05			

LOCATION			PIPE								
AREA ID NUMBER	FROM M.H.	TO M.H.	LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
I108B, R108A	108	107	291.2	300	PVC	SDR 35	0.20	42.9	**12.68%**	0.61	0.35
R107C, R107B	107	110	160.0	300	PVC	SDR 35	0.20	42.9	**24.26%**	0.61	0.42
R109A	109	110	266.8	300	PVC	SDR 35	0.20	42.9	**11.88%**	0.61	0.34
C110A	110	110A	161.0	300	PVC	SDR 35	0.20	42.9	**42.05%**	0.61	0.50
	110A	777	36.2	300	PVC	SDR 35	0.20	42.9	**42.05%**	0.61	0.50
				300							
Total to March Road Outlet:				300							
R102A	102	104	119.9	200	PVC	SDR 35	0.32	18.9	**12.77%**	0.60	0.34
R107A	107	106	253.6	200	PVC	SDR 35	3.00	57.9	**2.21%**	1.82	0.63
R106A, R106B, G106C	106	104	212.9	200	PVC	SDR 35	0.32	18.9	**33.71%**	0.60	0.45
	104	100	225.2	200	PVC	SDR 35	0.35	19.7	**43.94%**	0.62	0.51
R105A	105	101	195.5	200	PVC	SDR 35	0.32	18.9	**23.87%**	0.60	0.40
R101A	101	100	99.9	200	PVC	SDR 35	0.32	18.9	**32.40%**	0.60	0.45
R100A	100	198	180.1	375	PVC	SDR 35	0.20	72.6	**27.63%**	0.69	0.49
				375							
Total to Briar Ridge Pump Station Outlet:											

NOTES:

1. The following summarizes the peak flow and drainage area assumptions made in the Kanata North MSS (Novatech, 2016) for the proposed development.
   a. March Road Outlet = 19.99ha Total Peak Flow = 28.7 L/s
   b. Briar Ridge Pump Station Outlet = 19.80ha Total Peak Flow = 26.4 L/s
2. Medium density units for areas R107B and R108A are assumed to be 6m-wide back to back units for a total of 32 units per block.

B.2 SANITARY DESIGN BACKGROUND REPORT EXCERPTS AND CORRESPONDENCE



KANATA NORTH
COMMUNITY DESIGN PLAN

NOVATECH
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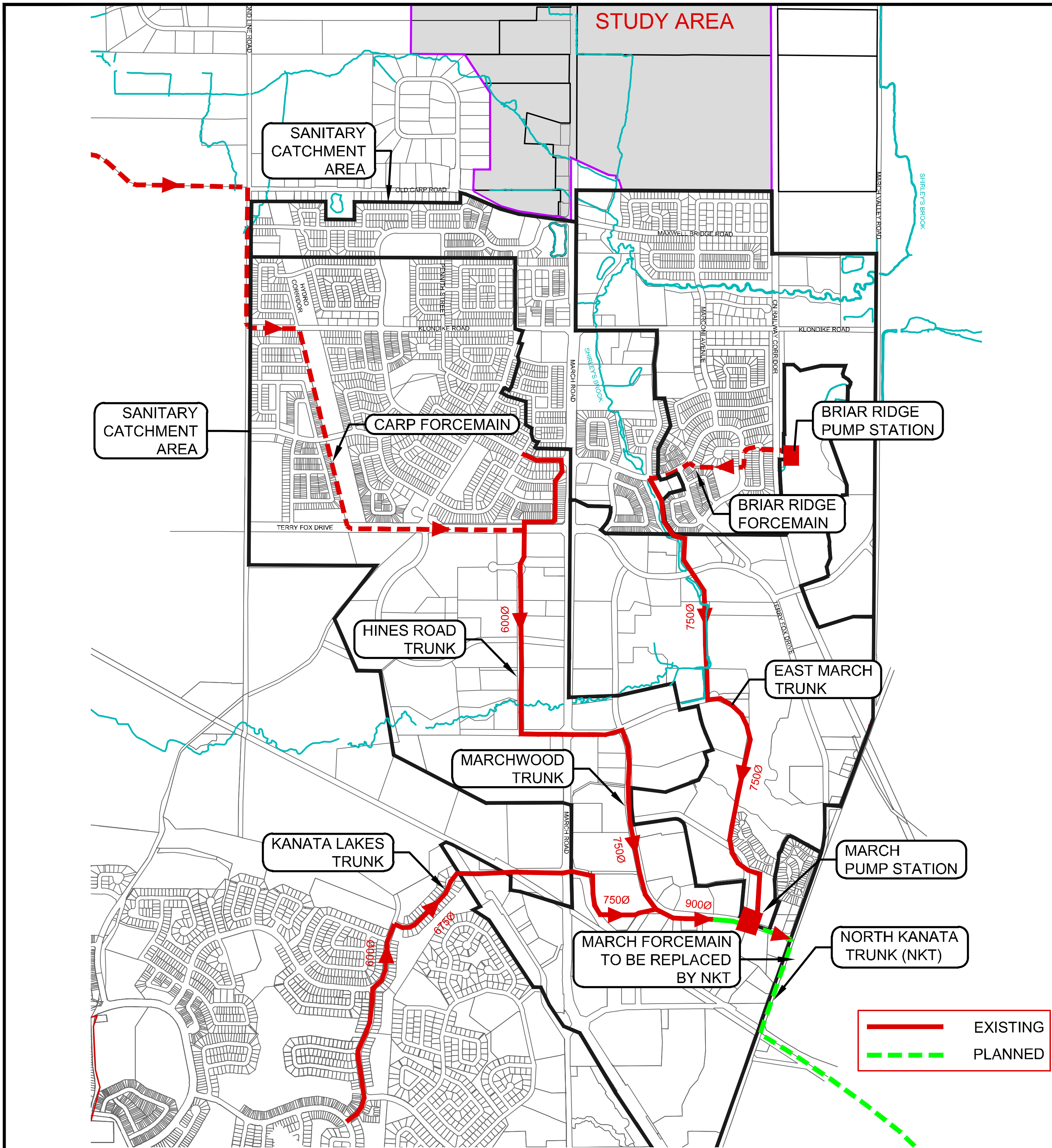
FIGURE NO. 6.2

NORTH KANATA WASTEWATER TRUNK INFRASTRUCTURE

DATE	JOB
FEB 2016	112117
SCALE	
N.T.S.	



M:\2012\112117\CAD\Design_MSS\FIGURES\FIGURE 7.3 - PLANNED WASTEWATER INFRASTRUCTURE.dwg, PWW COLL, Feb 11, 2016 - 9:37am, lseely

KANATA NORTH

COMMUNITY DESIGN PLAN

NOVATECH

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FIGURE NO. 6.3

NORTH KANATA PLANNED WASTEWATER TRUNK INFRASTRUCTURE

DATE
FEB 2016

JOB
112117

SCALE
N.T.S.

SHT8x11.DWG - 216mmx279mm

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 6.4.1
EXISTING WASTEWATER CATCHMENT AREAS - EAST MARCH TRUNK

DATE APR 2016
JOB 112117
SCALE AS SHOWN

NOVATECH
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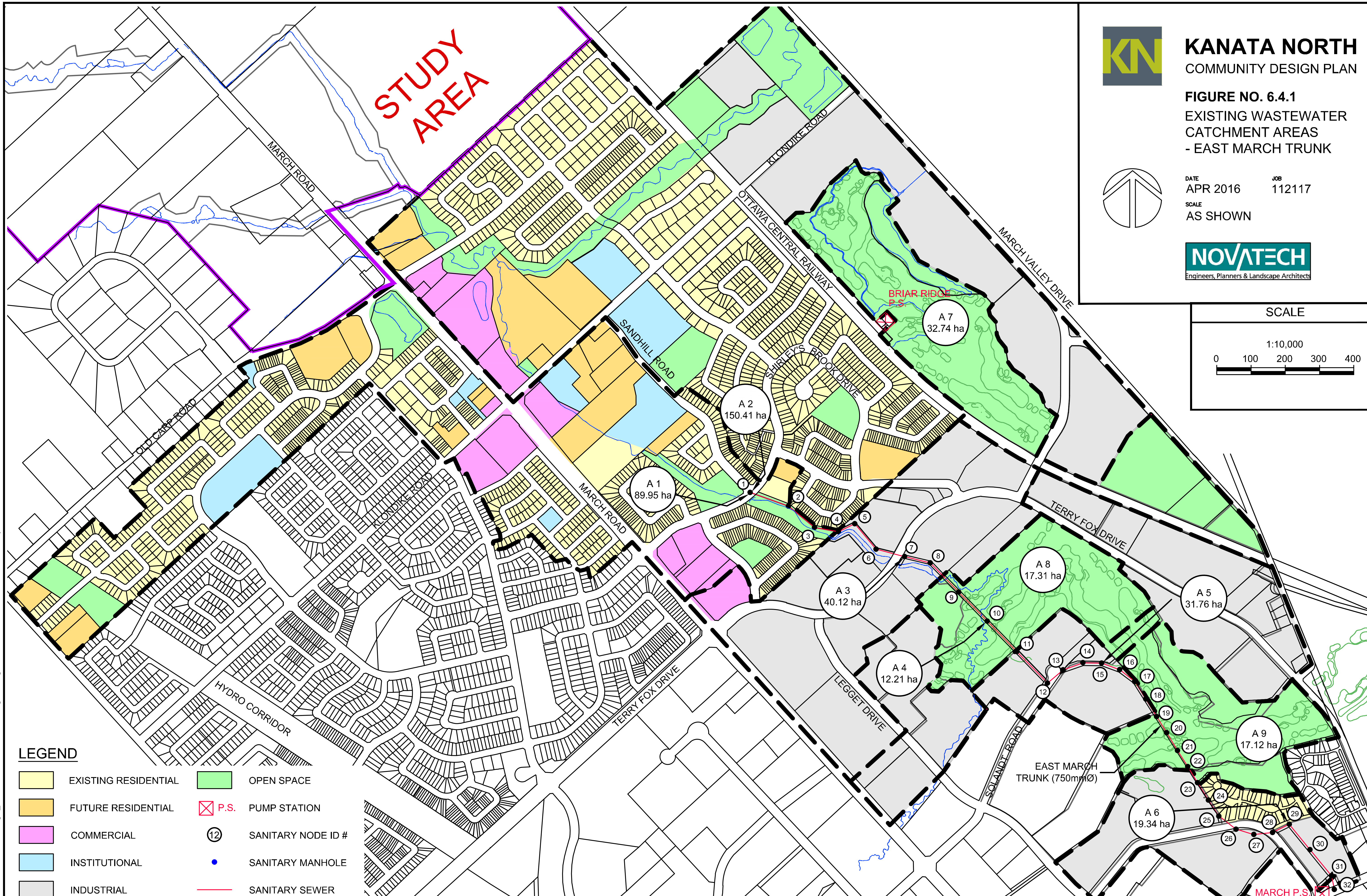


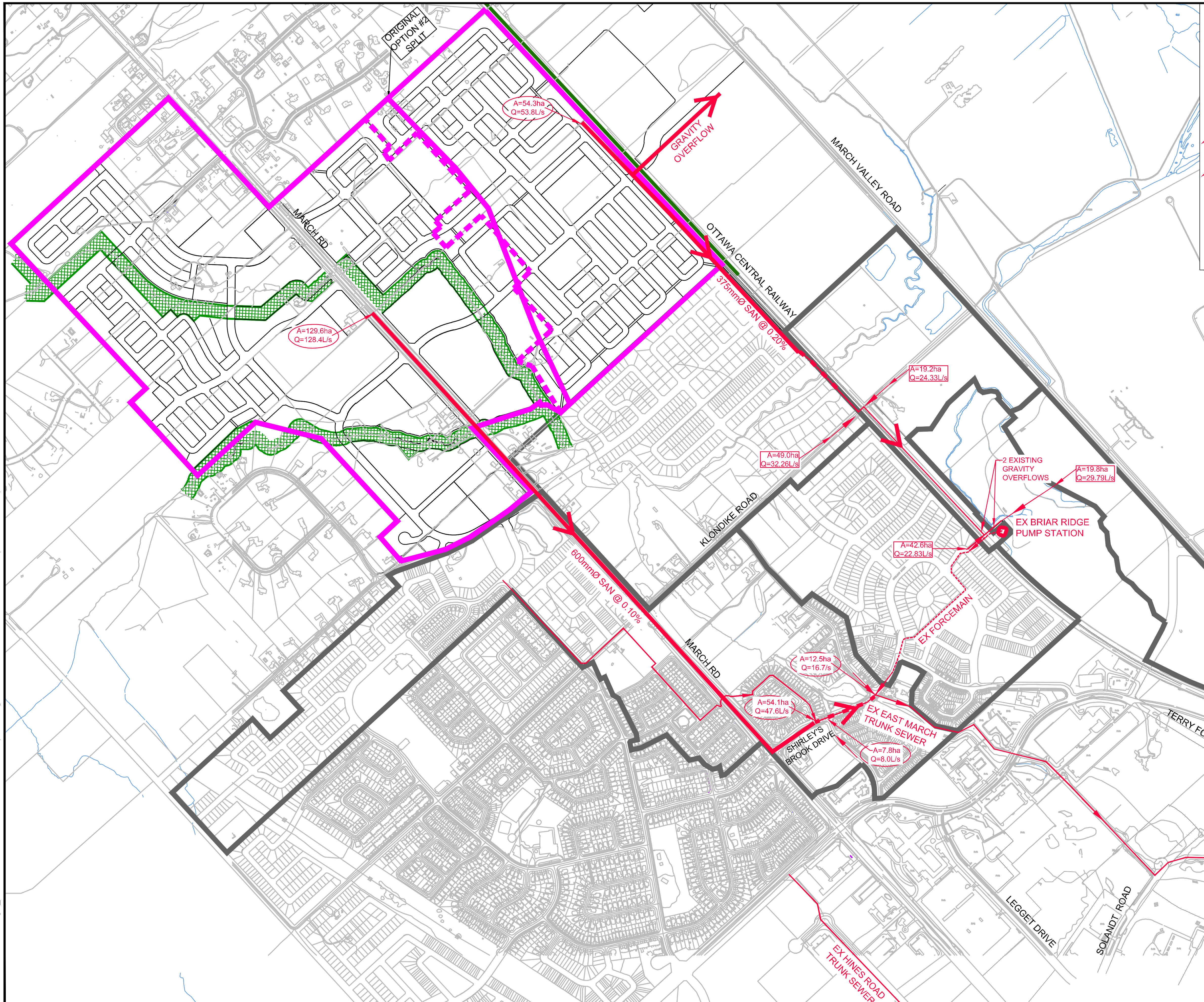
6.6 Detailed Wastewater Servicing Evaluation

6.6.1 Onsite Servicing

6.6.1.1 Design Criteria

The proposed development will be serviced by a gravity sanitary sewer network within the road right-of-ways. A proposed trunk sanitary sewer (preferred wastewater Option 2) and associated drainage areas are shown on **Figure 6.6.1.1** and in more detail in the Onsite & Offsite Sanitary Drainage Area Plans (112117-SAN1 & 112117-SAN2.) for the KNUEA. Sanitary sewers, for the proposed development, are designed based on criteria established in Section 4.0 of the *City of Ottawa Sewer Design Guidelines* (October 2012) and are summarized as follows:

Commercial/Institutional flows = 50,000 L/ha/day
Industrial flows = 35,000 L/ha/day
Population Flow = 350 L/capita/day
Infiltration = 0.28 L/s/ha
Single Family Home = 3.4 persons per unit
Townhouse = 2.7 persons per unit
Apartment = 1.8 persons per unit
Maximum Residential Peak Factor = 4.0
Commercial/Institutional Peak Factor = 1.5
Industrial Peak Factor = per MOE/City of Ottawa graph (included in **Appendix C-6**)
Minimum velocity = 0.6m/s
Manning's n = 0.013



KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 6.6.1.1
PREFERRED WASTEWATER OPTION #2 - DETAILED

DATE MAY 2016
JOB 112117
SCALE N.T.S.

NOVATECH
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M:\2012\112117\CAD\Design_MSS\FIGURES\FIGURE 6.5.1 - 6.5.5 SAN Options.dwg, FIG 6.6.1.1 PREFERRED SAN OPT, May 16, 2016 - 3:22pm, mhrehoriak

SHT11x17.DWG - 279mmx432mm

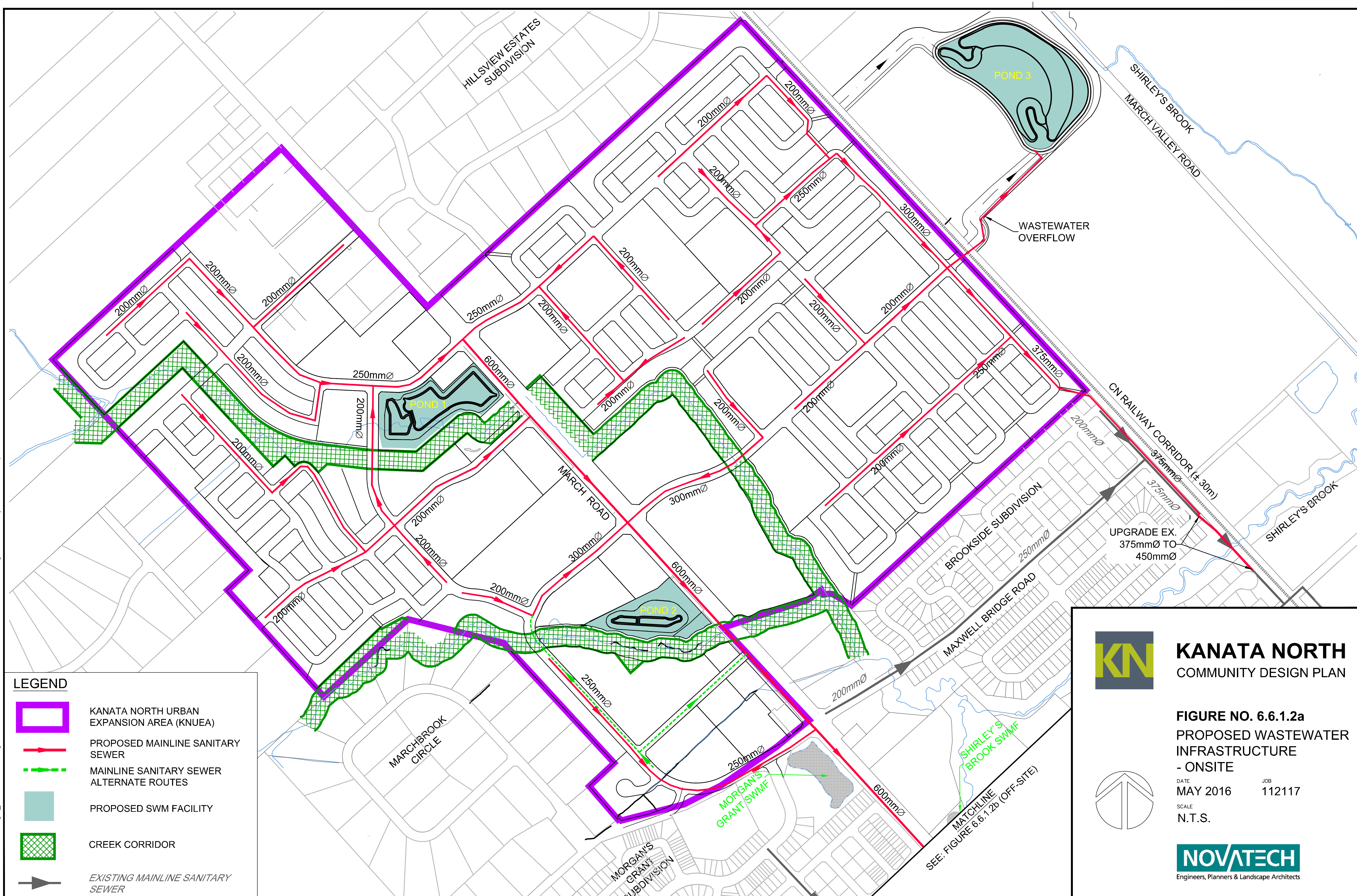
6.6.1.2 Probable Wastewater Flow

Based on the land uses proposed in the Demonstration Plan (**Figure 4.2**) the following flow rates were calculated. Detailed flow calculations are included in **Appendix C-6**.

Table 6.6.1 – Land Use and Probable Flow

	Area (ha)	Units*	Population**	Population Flow (L/s)	Peak Factor	Infiltration (L/s)	Total Sanitary Flow (L/s)
Schools	11.12			9.7	1.5	3.1	12.8
Creek Corridor	12.22			0.0	0.0	0.0	0.0
SWM Blocks	4.08			0.0	0.0	0.0	0.0
Parks	10.65			0.0	0.0	0.0	0.0
Commercial - Mixed Use	15.91			13.8	1.5	4.5	18.3
Park and Ride	2.54			0.0	0.0	0.7	0.7
Misc. Ex. Lands (School)	5.70			4.9	1.5	1.6	6.5
Fire Hall	0.83			0.7	1.5	0.2	1.0
Residential	80.10					22.4	22.4
Singles	64.14	1056	3590	43.6	3.0	0.0	0.0
Street Townhouse		1045	2822	34.3	3.0	0.0	0.0
Multi-Unit Residential	15.96	1144	2574	31.3	3.0	0.0	0.0
Roads	40.21			0.0	0.0	11.3	11.3
Total	**183.36**	**3339**	**8986**	**138.4**		**43.8**	**182.2**

* Based on May 13, 2016 Novatech Memo (included in **Appendix C-6**) + 10%
** Population calculated based on the following:
Singles = 3.4 persons per unit
Street Townhouse = 2.7 persons per unit
Multi-Unit Residential = 50% Towns @ 2.7 persons per unit & 50% Apartments @ 1.8 persons per unit



LEGEND

- KANATA NORTH URBAN EXPANSION AREA (KNUEA)
- PROPOSED MAINLINE SANITARY SEWER
- MAINLINE SANITARY SEWER ALTERNATE ROUTES
- PROPOSED SWM FACILITY
- CREEK CORRIDOR
- *EXISTING MAINLINE SANITARY SEWER*

KANATA NORTH

COMMUNITY DESIGN PLAN

FIGURE NO. 6.6.1.2a

PROPOSED WASTEWATER INFRASTRUCTURE - ONSITE

DATE: MAY 2016
JOB: 112117
SCALE: N.T.S.

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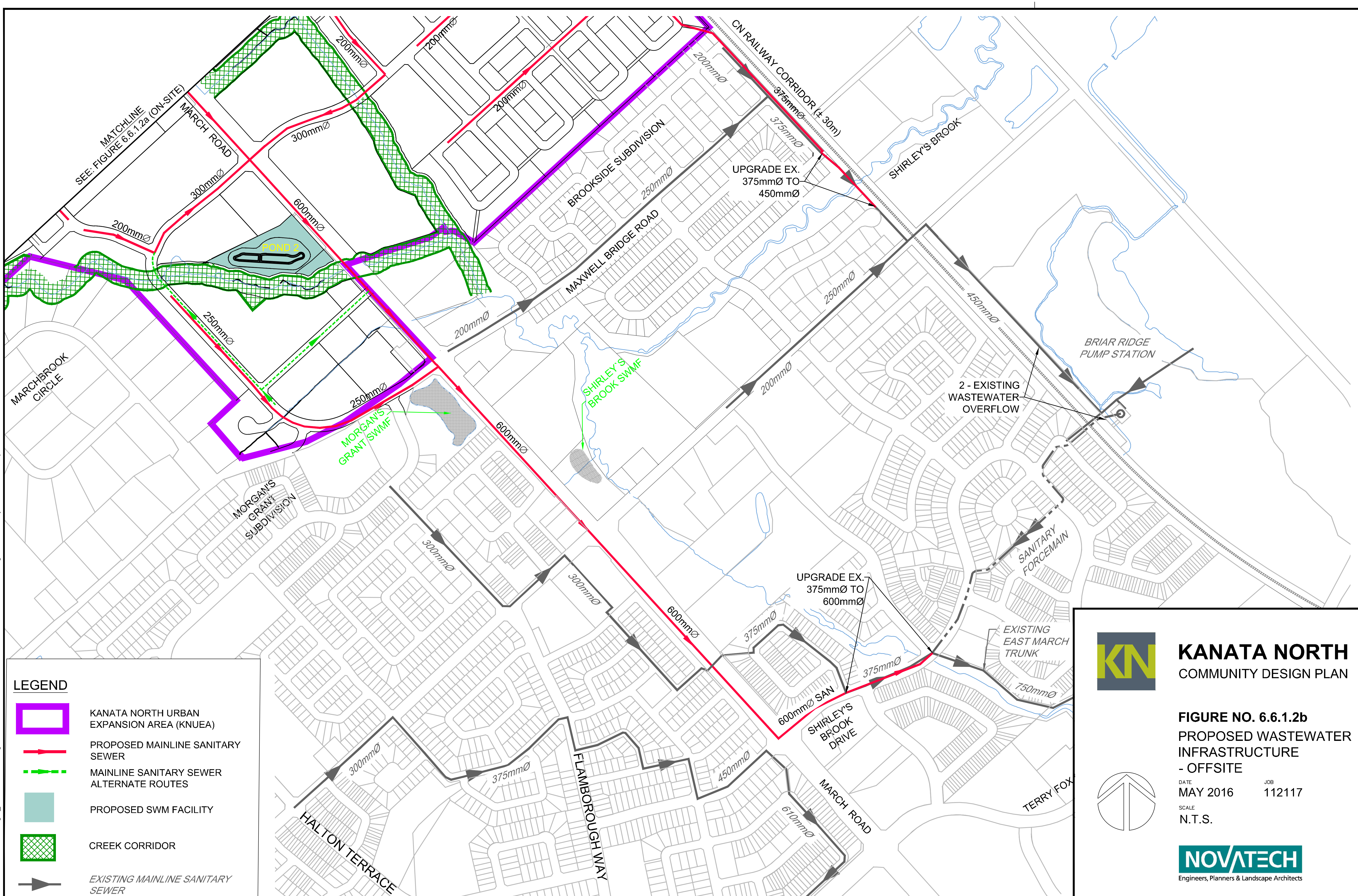
M:\2012\112117\CAD\Design_MSS\FIGURES\Figure 6.6.1.2 -PROP WASTEWATER INFRASTRUCTUE.dwg, 6.6.1.2a, May 18, 2016 - 1:26pm, mhrehoriak



KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 6.6.1.2b
PROPOSED WASTEWATER INFRASTRUCTURE
- OFFSITE

DATE MAY 2016
JOB 112117
SCALE N.T.S.

NOVATECH
Engineers, Planners & Landscape Architects

M:\2012\112117\CAD\Design_MSS\FIGURES\Figure 6.6.1.2 -PROP WASTEWATER INFRASTRUCTUE.dwg, 6.6.1.2b, May 17, 2016 - 12:31pm, mhrehoriak

SHT11x17.DWG - 279mmx432mm

6.6.3 Hydraulic Grade Line Analysis

A Hydraulic Grade Line (HGL) analysis should be performed on wastewater trunk sewers to determine if surcharged conditions may be present. If the HGL is analysed and determined to be above the obvert of the sanitary sewers then measures such as overflows may be required to protect buildings/basements. These measures may include establishing minimum underside of footing elevations for all proposed buildings to be above the HGL, per City Design Guidelines. In addition, sanitary sewer overflows may be provided to allow relief of the system prior to potential flooding of basements.

Based on the information provided by the City with respect to the EMT and any future trunk sewer works (i.e., NKT Phase 2 works) it is assumed that there are free flow conditions within the EMT and MPS. As such, no HGL analysis was performed on the EMT.

An HGL analysis is required to be completed on the BRPS to ensure that, when the future lands are added to the system, there are no negative impacts to the existing developments. The existing BRPS has two existing overflow outlets to provide relief to the system in the event of failure. With the additional flows generated by the KNUEA, an additional overflow outlet would be required to minimize any negative impacts on the existing subdivision.

The HGL in the Trunk sewer, along the existing rail corridor to the BRPS, was analysed using Autodesk Storm and Sanitary Analysis (SSA). This model was used to determine the elevation and location of an additional sanitary overflow. Based on *City of Ottawa Sewer Design Guidelines*, the overflow must outlet to a Stormwater Management Facility, and be located 0.5m above the 100 year water level. This is to ensure that the overflow outlet is able to operate under free flow conditions during major storm events. A flow monitoring system will be required on the wastewater overflow to the SWM Facility to alert City staff if a wastewater overflow occurs. This system will need to be specified during the detailed design phase of the wastewater and SWM Facility.

The HGL is governed by the overflow elevation provided. The BRPS contains a primary over flow at an elevation of 67.29. The design of the Brookside subdivision proposed a secondary overflow at an invert elevation of 67.30. The resultant HGL for the sanitary sewer upstream of this secondary overflow is 67.44. This is the starting point for the HGL model. Four scenarios were modelled and summarized in an email to City Staff. A copy of the email and a plan and profile drawing showing the hydraulic grade lines for the scenarios is included in **Appendix C-7**. The scenarios evaluated are as follows:

Scenario #1 ï Original HGL resulting from the development of the Brookside Subdivision.

Scenario #2 ï KNUEA flow of 52 L/s added to original HGL resulting from development of the Brookside Subdivision

Scenario #3 ï KNUEA flow of 52L/s added to original HGL resulting from development of Brookside Subdivision and upgraded trunk sewers downstream (approx. 900m of ex 375mm and 450mm upgraded to 600mm)

Scenario #4 ï KNUEA flow of 52 L/s added to original HGL resulting from the development of the Brookside Subdivision with proposed tertiary (third) overflow to the proposed KNUEA SWM pond. Elevation of overflow is 67.50 and resultant HGL is 67.67

Scenario #2 shows the increase in the HGL which is not a reasonable option since it impacts the existing subdivision. Scenario #3 is the most expensive since it requires approximately 900m of sewer to be upgraded. Scenario #4 is the preferred option because it has no impact on the existing subdivision with reasonable costs to provide the third overflow.

The model for the preferred scenario was then updated using design flows calculated using the Demonstration Plan. The updated SSA model indicates that an overflow outlet elevation of 67.50 will be able to provide relief to the existing trunk sewer along the rail corridor and not raise the HGL in the existing sanitary sewers tributary to the BRPS. The Autodesk SSA Modeling information has been provided in **Appendix C-7**, and the proposed overflow outlet has been shown on the Onsite Sanitary Drainage Area Plan (112117-SAN1). A summary of the SSA model is provided in **Table 6.6.3** below.

Table 6.6.3 – Summary of HGL SSA Model

	Node ID	**HGL (m)**				
		Previous BRPS HGL Analysis	**KNUEA Analysis**	**KNUEA minus Previous**	**Preliminary Underside of Footings**	**Freeboard (0.3m Minimum)**
Existing	201	67.44	67.44	0.00		
	201A	67.50	67.50	0.00		
	201B	67.56	67.55	-0.01		
	202	67.63	67.62	-0.01		
	203	67.69	67.67	-0.02		
	204	67.73	67.71	-0.02		
	205	67.78	67.74	-0.04		
	206	67.79	67.76	-0.03		
	207	67.82	67.77	-0.05		
	208	67.88	67.79	-0.09		
	209	67.90	67.80	-0.10		
Proposed	KNCDP-9		67.80		69.0	1.2
	KNCDP-OUT		67.51		69.3	2.2

KANATA NORTH URBAN EXPANSION AREA
COMMUNITY DESIGN PLAN

TABLE C-6b:
SANITARY SEWER DESIGN SHEET

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LOCATION				RESIDENTIAL AREA AND POPULATION										ICI								INFILTRATION				FLOW	PIPE					
									Cumulative					IND			COMM		INST													
Street	From	To	Total	Dwellings		Density (Net ha)		Pop.	Residential			Peak	Peak	Area	Accu.	Peak	Area	Accu.	Area	Accu.	Peak	Total	Accu. Area		Infiltration	Total	Dia	Dia	Slope	Velocity	Capacity	Ratio
	Node	Node	Area	SFH	SD/TH	Low[3]	High[4]		Area	Pop.		Factor	Flow		Area	Factor		Area		Area	Flow	Area	New	Exist	Flow	Flow	Act	Nom		(Full)	(Full)	Q/Qfull
			(ha)	3.4	2.7	101	161		(ha)	New	Exist		(l/s)	(ha)	(ha)		(ha)	(ha)	(ha)	(ha)	(l/s)	(ha)	(ha)		(l/s)	(l/s)	(mm)	(mm)	(%)	(m/s)	(l/s)	(%)
				pers/ea	pers/ea	pers/ha	per/ha																									
EAST KNCDP																																
E-1	E-1	E-3	4.47			3.00		303.0	3.00	**303**		4.00	4.9								0.0	4.47	4.47		1.3	6.2	203	200	0.40	0.67	21.6	28%
E-2	E-2	E-3	5.91			4.29		433.3	7.29	**736**		3.88	11.6								0.0	5.91	10.38		2.9	14.5	203	200	0.35	0.62	20.2	72%
E-3	E-3	E-6	9.42			6.51		657.5	13.80	**1394**		3.70	20.9								0.0	9.42	19.80		5.5	26.4	254	250	0.40	0.77	39.2	67%
E-4	E-4	E-5	6.89			3.12	1.36	534.1	3.12	**534**		3.96	8.6								0.0	6.89	6.89		1.9	10.5	203	200	1.00	1.05	34.2	31%
E-5	E-5	E-9	4.70			1.46		147.5	4.58	**682**		3.90	10.8						**2.29**	2.29	2.0	4.70	11.59		3.2	16.0	203	200	0.35	0.62	20.2	79%
E-6	E-6	E-9	3.28			2.32		234.3	16.12	**1628**		3.65	24.1								0.0	3.28	23.08		6.5	30.6	305	300	0.25	0.69	50.4	61%
E-7	E-7	E-8	10.04			7.21		728.2	7.21	**728**		3.88	11.5								0.0	10.04	10.04		2.8	14.3	203	200	0.40	0.67	21.6	66%
E-8	E-8	E-9	4.05			2.94		296.9	10.15	**1025**		3.79	15.8								0.0	4.05	14.09		3.9	19.7	254	250	0.30	0.67	33.9	58%
E-9	E-9	MH 209	3.98			3.06		309.1	33.91	**3644**		3.37	49.7							2.29	2.0	3.98	52.74		14.8	66.5	381	375	0.22	0.75	85.7	78%
Total Flows From East KNUEA			**52.74**					**3644**	**33.91**	**3644**		**3.37**	**49.7**							**2.29**	**1.99**		**52.74**		**14.77**	**66.49**						
X-1 (Brookside Subdivision)*		MH 209	32.80					2216.1	26.04		2216	3.55	18.2				6.76	6.76			2.3	32.80		32.80	11.5	32.0						
				*Population from Novatech #103106 Sanitary Sewer Design Sheet																												
	MH 209	MH 208						0.0	59.95	**3644**	2216	3.18	63.3					6.76		2.29	7.9	0.00	**52.74**	32.80	26.2	97.4	457	450	0.20	0.81	132.9	73%
	MH 208	MH 207						0.0	59.95	**3644**	2216	3.18	63.3					6.76		2.29	7.9	0.00	**52.74**	32.80	26.2	97.4	457	450	0.20	0.81	132.9	73%
X-2 (Brookside Subdivision)	MH 207	MH 206	3.12		44			118.8	63.07	**3644**	2335	3.17	64.0					6.76		2.29	7.9	3.12	**52.74**	35.92	27.3	99.2	457	450	0.20	0.81	132.9	75%
X-3 (Brookside Subdivision)**	MH 206	MH 205	9.81		244			658.8	72.88	**3644**	2994	3.13	67.9					6.76		2.29	7.9	9.81	**52.74**	45.73	30.8	106.5	457	450	0.21	0.83	136.2	78%
				**244 TH units = 107 Units from Novatech #103106 Sanitary Sewer Design Sheet, plus future 137 units North of Klondike and West of Marconi (5.67ha @ 65pers/ha)																												
X-13 (Future Industrial Lands)	Future	MH 205	20.99											15.85	15.85	3.6					13.2	20.99	**20.99**		5.9	19.1						
Briar Ridge Pump Station Access Road	MH 205	MH 204							72.88	**3644**	2994	3.13	67.9		15.85	3.6		6.76		2.29	21.1	0.00	**73.73**	45.73	36.6	125.6	457	450	0.20	0.81	132.9	94%
Briar Ridge Pump Station Access Road	MH 204	MH 203							72.88	**3644**	2994	3.13	67.9		15.85	3.6		6.76		2.29	21.1	0.00	**73.73**	45.73	36.6	125.6	457	450	0.20	0.81	132.9	94%
Briar Ridge Pump Station Access Road	MH 203	MH 202							72.88	**3644**	2994	3.13	67.9		15.85	3.6		6.76		2.29	21.1	0.00	**73.73**	45.73	36.6	125.6	457	450	0.25	0.91	148.6	85%
Briar Ridge Pump Station Access Road	MH 202	MH 201A							72.88	**3644**	2994	3.13	67.9		15.85	3.6		6.76		2.29	21.1	0.00	**73.73**	45.73	36.6	125.6	457	450	0.26	0.92	151.6	83%
Briar Ridge Pump Station Access Road	MH 201A	MH 201							72.88	**3644**	2994	3.13	67.9		15.85	3.6		6.76		2.29	21.1	0.00	**73.73**	45.73	36.6	125.6	457	450	0.25	0.91	148.6	85%
Briar Ridge Pump Station Access Road	MH 201	MH 200							72.88	**3644**	2994	3.13	67.9		15.85	3.6		6.76		2.29	21.1	0.00	**73.73**	45.73	36.6	125.6	457	450	0.25	0.91	148.6	85%
Briar Ridge Pump Station Access Road	MH 200	EXMH1							72.88	**3644**	2994	3.13	67.9		15.85	3.6		6.76		2.29	21.1	0.00	**73.73**	45.73	36.6	125.6	457	450	0.23	0.87	142.5	88%
RIDDELL VILLAGE (X-4)* **		EXMH1	42.42					3100			3100	3.43	24.6						2.96	2.96	1.0	42.42		42.42	14.8	40.5						
				***Population from Novatech #103106 Sanitary Sewer Design Sheet																												
	EXMH1	EXMH2							72.88	**3644**	6094	2.97	85.6		15.85	3.6		6.76		5.25	23.6	0.00	**73.73**	88.15	51.5	160.8	457	450	0.30	0.99	162.8	99%
	EXMH2	EXMH4							72.88	**3644**	6094	2.97	85.6		15.85	3.6		6.76		5.25	23.6	0.00	**73.73**	88.15	51.5	160.8	457	450	0.30	0.99	162.8	99%
X-14 (Future Industrial Lands east of Marshes Golf Course)	EXMH4	EXMH5	19.23						72.88	**3644**	6094	2.97	85.6	19.23	35.08	3.1		6.76		5.25	35.6	19.23	**92.96**	88.15	56.9	178.1	457	450	0.44	1.20	197.2	90%
	EXMH5	PS							72.88	**3644**	6094	2.97	85.6		35.08	3.1		6.76		5.25	35.6	0.00	**92.96**	88.15	56.9	178.1	457	450	0.40	1.14	188.0	95%
Briar Ridge Pump Station									72.88	**3644**	6094	2.97	85.6		35.08	3.1		6.76		5.25	35.6	0.00	**92.96**	88.15	56.9	178.1						
WEST KNUEA / MARCH ROAD																																
W-1	W-1	W-3	7.51			5.14		519.1	5.14	**519**		3.97	8.3								0.0	7.51	7.51		2.1	10.4	203	200	0.40	0.67	21.6	48%
													0.0																			
W-2	W-2	W-3	8.94			2.36		238.4	2.36	**238**		4.00	3.9						**4.32**	4.32	3.8	8.94	8.94		2.5	10.1	203	200	0.35	0.62	20.2	50%
													0.0																			
W-3	W-3	W-4	6.52			1.97	2.16	546.7	11.63	**1304**		3.72	19.7								0.0	6.52	22.97		6.4	26.1	254	250	0.70	1.02	51.9	50%
W-5	W-5	W-6	4.20			2.74		276.7	2.74	**277**		4.00	4.5								0.0	4.20	4.20		1.2	5.7	203	200	0.35	0.62	20.2	28%
W-6	W-6	W-8	4.29			3.04		307.0	5.78	**584**		3.94	9.3								0.0	4.29	8.49		2.4	11.7	203	200	0.35	0.62	20.2	58%
													0.0																			
W-7	W-7	W-8	7.39			4.24		428.2	4.24	**428**		4.00	6.9								0.0	7.39	7.39		2.1	9.0	203	200	1.60	1.33	43.2	21%
W-8	W-8	W-9	2.85			1.02	0.55	191.6	11.59	**1204**		3.75	18.3								0.0	2.85	18.73		5.2	23.5	254	250	0.35	0.72	36.7	64%
W-4	W-4	MR-1	3.10					0.0	23.22	**2508**		3.51	35.6				**0.35**	0.35	**0.83**	5.15	4.8	3.10	26.07		7.3	47.7	254	250	1.00	1.22	62.0	77%
													0.0																			
W-14	W-14	W-15	3.79			0.36		36.4	0.36	**36**		4.00	0.6						**2.89**	2.89	2.5	3.79	3.79		1.1	4.2	203	200	0.35	0.62	20.2	21%
W-15	W-15	W-17	3.17			2.20		222.2	2.56	**259**		4.00	4.2								0.0	3.17	6.96		1.9	6.1	203	200	0.35	0.62	20.2	30%

KANATA NORTH URBAN EXPANSION AREA
COMMUNITY DESIGN PLAN

TABLE C-6b:
SANITARY SEWER DESIGN SHEET

NOVATECH
Engineers, Planners & Landscape Architects

LOCATION: Street	From Node	To Node	Total Area (ha)	RESIDENTIAL: Dwellings SFH 3.4	Dwellings SD/TH 2.7	Density (Net ha) Low[3] 101	Density (Net ha) High[4] 161	Pop.	Cumulative Residential Area (ha)	Cumulative Pop. New	Cumulative Pop. Exist	Peak Factor	Peak Flow (l/s)	ICI: IND Area (ha)	IND Accu. Area (ha)	IND Peak Factor	COMM Area (ha)	COMM Accu. Area (ha)	INST Area (ha)	INST Accu. Area (ha)	Peak Flow (l/s)	INFILTRATION: Total Area (ha)	Accu. Area New (ha)	Accu. Area Exist	Infiltration Flow (l/s)	FLOW: Total Flow (l/s)	PIPE: Dia Act (mm)	Dia Nom (mm)	Slope (%)	Velocity (Full) (m/s)	Capacity (Full) (l/s)	Ratio Q/Qfull (%)
W-16	W-16	W-17	6.55			3.17	1.78	606.8	4.95	**607**		3.93	9.7								0.0	6.55	6.55		1.8	11.5	203	200	0.35	0.62	20.2	57%
W-17	W-17	MR-1	3.43					0.0	7.51	**865**		3.84	13.5				**3.05**	3.05		8.04	9.6	6.48	19.99		5.6	28.7	254	250	0.30	0.67	33.9	84%
MR-1 (MARCH ROAD)	MR-1	MR-2	1.36					0.0	30.73	**3373**		3.40	46.4					3.40		8.04	9.9	1.36	47.42		13.3	69.6	610	600	0.10	0.69	202.4	34%
W-9	W-9	MR-2	7.17				1.13	181.9	1.13	**182**		4.00	2.9				**1.38**	1.38	**3.77**	3.77	4.5	7.17	25.90		7.3	14.7	203	200	1.20	1.15	37.4	39%
MR-2 (MARCH ROAD)	MR-2	MR-3	1.37					0.0	33.23	**3555**		3.38	48.7					4.78		11.81	14.4	1.37	74.69		20.9	84.0	610	600	0.10	0.69	202.4	41%
W-10	W-10	W-11	1.53				0.78	125.6	0.78	**126**		4.00	2.0								0.0	1.53	1.53		0.4	2.5	203	200	0.70	0.88	28.6	9%
W-11	W-11	MR-3	3.55				1.64	264.0	2.42	**390**		4.00	6.3				**1.08**	1.08			0.9	3.55	5.08		1.4	8.7	203	200	0.70	0.88	28.6	30%
W-18	W-18	W-19	3.90			1.21	1.82	415.2	3.03	**415**		4.00	6.7								0.0	3.90	3.90		1.1	7.8	203	200	0.35	0.62	20.2	39%
W-19	W-19	MR-3	9.23					0.0	3.03	**415**		4.00	6.7				**8.83**	8.83			7.7	9.23	13.13		3.7	18.1	254	250	0.25	0.61	31.0	58%
MR-3 (MARCH ROAD)	MR-3	MR-4	4.74					0.0	38.68	**4360**		3.30	58.3				2.06	16.75		11.81	24.8	4.74	97.64		27.3	110.4	610	600	0.10	0.69	202.4	55%
W-12	W-12	X-12	11.62			2.24	6.98	1350.0	9.22	**1350**		3.71	20.3						**2.01**	2.01	1.7	11.62	11.62		3.3	25.3	254	250	0.30	0.67	33.9	75%
X-12 (BIDGOOD / HALTON TERRACE)	X-12	MR-4	3.54				0.79	127.2	10.01	**1477**		3.68	22.0								0.0	3.54	15.16		4.2	26.3	254	250	1.00	1.22	62.0	42%
X-5 (760 & 788 March Road)	X-5	MR-4	1.76				1.76	283.4	1.76	**283**		4.00	4.6								0.0	1.76	1.76		0.5	5.1						
MR-4 (MARCH ROAD)	MR-4	*MH 186*	4.71					0.0	50.45	**6120**		3.16	78.4					16.75		13.82	26.5	4.71	119.27		33.4	138.3	610	600	0.10	0.69	202.4	68%
*X-6 (750 March Road, Blue Heron Co-op Homes)**** *	*X-6*	*X-8*	*1.29*		*83*			*224.1*	*1.29*		*224*	*4.00*	*2.1*								*0.0*	*1.29*		*1.29*	*0.5*	*2.5*						
			**** 83 units obtained from Co-op website (http://www.chaseo.ca/member/blue-heron-co-op/)																													
*X-7 (Morgans Grant) ***** *	*X-7*	*X-8*	*48.45*					*3188.0*	*49.74*		*3188*	*3.42*	*25.2*								*0.0*	*48.45*		*49.74*	*17.4*	*42.6*						
			***** Information obtained from JL Richards #24566, Sanitary Design Sheet, July 2012																													
X-8 (Inverary Drive)	*X-8*	*MH 186*	*4.31*	*39*	*49*			*264.9*	*54.05*		*3677*	*3.37*	*28.6*								*0.0*	*4.31*		*54.05*	*18.9*	*47.6*						
Shirley's Brooke Drive	*MH 186*	*MH 184*	*0.00*					*0.0*	*104.50*	**6120**	*3677*	*2.96*	*98.7*					*16.75*		*13.82*	*26.5*	*0.00*	*119.27*	*54.05*	*52.3*	*177.5*	610	600	0.10	0.69	202.4	88%
X-9 (Mckinley Drive)	*X-9*	*MH 184*	*7.84*		*117*			*315.9*			*316*	*4.00*	*2.9*				*2.73*	*2.73*			*2.4*	*7.84*		*7.84*	*2.7*	*8.0*						
Shirleys Brooke Drive	*MH 184*	*MH 182*	*0.00*					*0.0*	*104.50*	**6120**	*3993*	*2.95*	*100.4*					*19.48*		*13.82*	*28.9*	*0.00*	*119.27*	*61.89*	*55.1*	*184.4*	610	600	0.10	0.69	202.4	91%
Shirleys Brooke Drive	*MH 182*	*MH 1*	*0.00*					*0.0*	*104.50*	**6120**	*3993*	*2.95*	*100.4*					*19.48*		*13.82*	*28.9*	*0.00*	*119.27*	*61.89*	*55.1*	*184.4*	610	600	0.10	0.69	202.4	91%
X-10 (Sandhill Road)		*MH 1*	*11.62*	*9*	*60*		*5.32*	*1049.1*	*11.62*		*1049*	*3.79*	*9.2*						*2.11*	*2.11*	*1.8*	*11.62*		*11.62*	*4.1*	*15.1*						
X-11		*MH 1*	*0.87*				*0.87*	*140.1*	*0.87*		*140*	*4.00*	*1.3*								*0.0*	*0.87*		*0.87*	*0.3*	*1.6*						
Briar Ridge Pump Station	*PS*	*MH 1*							72.88	**3644**	6094	2.97	85.623	0	35.08	3.1	0.00	6.76	0.00	5.25	35.6	0.00	92.96	88.15	56.9	178.1						
EAST MARCH TRUNK	*MH 1*	*EMT*	0.00					0.0	189.87	**9764**	11276	2.63	172.7		35.08	3.1		26.24		21.18	66.3	0.00	212.23	162.53	116.3	355.3	762	750	0.10	0.80	367.1	97%

DESIGN PARAMETERS

Average Daily Flow (Future)=	350	L/cap/day
Average Daily Flow (Existing)=	200	L/cap/day
Indust/Comm/Inst Flow (Future)=	50000	L/ha/day
Indust/Comm/Inst Flow (Existing)=	20000	L/ha/day
Max Res Peak Factor=	4.00	
Comm/Inst Peak Factor=	1.50	

Industrial Peak Factor= per MOE graph		
Extraneous Flow (Future)=	0.28	L/s/ha
Extraneous Flow (Existing)=	0.35	L/s/ha (Jan 2008 monitored event)
Minimum Velocity=	0.60	m/s
Manning's n=	0.013	

Designed:	Alex McAuley	PROJECT:	Kanata North Community Design Plan
Checked:	CJR	CLIENT:	Kanata North Land Owners
Dwg. Reference:	112117-SAN1 112117-SAN2	Date:	May, 2016

Notes:
1. Existing sanitary sewers tributary to, and not receiving flow from the KNUEA Trunk sewer have not been analysed for capacity
2. Existing unit counts obtained from City of Ottawa geoOttawa (2014) parcel counts, unless otherwise indicated
3. Low Density based on (16.6 Singles/net ha * 3.4pers/unit) + (16.5 Towns/net ha * 2.7pers/unit)
4. High Density based on (35.8 Towns/net ha * 2.7pers/unit) + (35.8 Apartments/net ha * 1.8pers/unit)
5. Overall unit counts for the KNCDP are based on Demonstration Plan "A-24", plus 10% to allow for flexibility in unit type distribution

Upgraded Existing Sanitary Sewers

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	REVISION	DATE	BY
3.	ISSUED WITH DRAFT MASTER SERVICING STUDY	MAY 20/16	JLS
2.	ISSUED WITH DRAFT MASTER SERVICING STUDY	APR 4/16	JLS
1.	ISSUED WITH DRAFT MASTER SERVICING STUDY	FEB 26/16	JLS

SCALE 1:3000

1:3000
0 30 60 90 120

DESIGN	ARM / TB
CHECKED	ARM
DRAWN	TB
CHECKED	CJR
APPROVED	JLS

FOR REVIEW ONLY

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LOCATION
KANATA NORTH URBAN EXPANSION AREA
COMMUNITY DESIGN PLAN

DRAWING NAME
ONSITE SANITARY
DRAINAGE AREA PLAN

PROJECT No. 112117-04
REV REV # 3
DRAWING No. 112117-SAN1

From:	Matt Wingate
To:	Smadella, Karin
Cc:	Thiffault, Dustin; Johnston, Anthony
Subject:	RE: Kanata North Valecraft & Minto Lands
Date:	Tuesday, May 28, 2019 5:33:33 PM
Attachments:	image001.png 2019-05-23_982_San_markup.pdf p&p10.pdf

Hi Karin,

Thanks for your feedback. We will need to work closely to confirm that the proposed sanitary trunk best meets Valecraft's needs.

An option to lower the sanitary sewer in the NE corner of the Valecraft site would be to provide a more direct sewer alignment from the connection to Celtic Ridge, similar to the MSS (screenshot below), by creating a servicing easement near the eastern boundary between the two properties. This could lower the sewer by ~1m, compared to following the collector.

Please note that we are still working out the sanitary design, based on information available for the downstream Celtic Ridge sewer. In our January prelim design we had used the downstream Celtic Ridge sanitary obvert information from the MSS. Drawings more recently collected from the City's records department indicate that the Celtic Ridge sanitary sewer is ~0.5m higher than shown in the MSS. See attached. We're working with Minto to arrange for as-built survey to confirm the actual existing sewer invert elevations, and also coordinating with Novatech to find out if they have final as-built info for Celtic Ridge that is different than shown on the drawings received from the City. The final design elevation of the sanitary sewer that will service both Minto and Valecraft will be based on the available depth at the receiving sewer. We'll be investigating options to maximize the depth.

I'll send you modified servicing info for coordination as soon as we've made some progress with the plan and survey of existing sewer.

Feel free to give me a call if you would like to discuss.

regards

Matt Wingate, P.Eng.

DSEL
david schaeffer engineering ltd.

120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

phone: (613) 836-0856 ext 522
direct: (613) 836-1522
cell: (613) 858-4975
e-mail: mwingate@DSEL.ca

From: Smadella, Karin [mailto:Karin.Smadella@stantec.com]
Sent: May 28, 2019 3:31 PM
To: Matt Wingate <MWingate@dsel.ca>
Cc: Thiffault, Dustin <Dustin.Thiffault@stantec.com>; Johnston, Anthony <Anthony.Johnston@stantec.com>
Subject: RE: Kanata North Valecraft & Minto Lands

Hi Matt

We have cover issues based on the sanitary sewer invert you provided for the collector road at the P/L for Minto's previous draft plan. The grade provided is significantly higher than MSS and we can't get sufficient cover over the sanitary sewer in the NE section of the Valecraft lands. The MSS shows an obvert of 69.29 at the property line boundary which will still be tight for cover.

Have you revised your sanitary design and can you match the proposed MSS obvert grade?

Please let us know asap and give us a call should it be more effective to discuss over the phone.

Thanks,

Karin

Karin Smadella, P.Eng.
Project Manager

Direct: 613 724-4371
Mobile: 613 698-8088
Karin.Smadella@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

From: Matt Wingate <MWingate@dsel.ca>
Sent: Friday, May 03, 2019 8:51 AM
To: Smadella, Karin <Karin.Smadella@stantec.com>
Cc: Johnston, Anthony <Anthony.Johnston@stantec.com>
Subject: RE: Kanata North Valecraft & Minto Lands

Hi Karin,
Minto has just updated their proposed draft plan (attached). The north-south leg of the collector road is now 24m. My understanding is that Minto will also be proceeding with the x-section from the CDP.
Do you have any concerns/comments related to the connection points, etc?
Are you able to share Valecraft's plan for coordination with our preliminary design?

thanks

Matt Wingate, P.Eng.

DSEL
david schaeffer engineering ltd.

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cell: (613) 858-4975
e-mail: mwingate@DSEL.ca

From: Smadella, Karin [mailto:Karin.Smadella@stantec.com]
Sent: May 1, 2019 3:33 PM
To: Matt Wingate <MWingate@dsel.ca>
Cc: Johnston, Anthony <Anthony.Johnston@stantec.com>
Subject: RE: Kanata North Valecraft & Minto Lands

Hi Matt,

Can you advise what you are proposing for the 26m ROW shown on Minto's draft plan? Valecraft will be proceeding with the 24m collector ROW and x-section as outlined in the CDP. There will have to be a transition from the 26 to the 24 that we will have to coordinate.

Thanks,

Karin

Karin Smadella, P.Eng.
Project Manager

Direct: 613 724-4371
Mobile: 613 698-8088
Karin.Smadella@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

From: Matt Wingate <MWingate@dsel.ca>
Sent: Tuesday, April 30, 2019 10:43 AM
To: Smadella, Karin <Karin.Smadella@stantec.com>
Cc: Johnston, Anthony <Anthony.Johnston@stantec.com>
Subject: RE: Kanata North Valecraft & Minto Lands

Hi Karen,

Unfortunately we don't have a CAD copy of the MSS pond concept. We've simply imported a PDF copy of the MSS pond concept into our base drawing for comparison to our preliminary pond design. 1st attachment is a PDF copy of the pond overlay plan that we reviewed at our meeting last week. CAD to follow by separate email.

Our functional servicing and grading design are a work in progress. We're expecting a revised draft plan from Minto this week, to use for our functional design modifications to address the City's feedback related to Minto's 1st draft plan submission. I've attached copies of our 1st submission storm/sanitary/water/grading figures that were prepared to support Minto's draft plan application. Note that the 1st submission engineering was prepared with the intention of gathering City feedback and advancing the overall development concept. We will be making modifications to the design in the coming weeks, but I expect that major servicing alignments will remain consistent with those shown in the 1st submission figures.

regards

Matt Wingate, P.Eng.

DSEL
david schaeffer engineering ltd.

120 Iber Road, Unit 103
Stittsville, ON K2S 1E9

phone: (613) 836-0856 ext 522
direct: (613) 836-1522
cell: (613) 858-4975
e-mail: mwingate@DSEL.ca

From: Smadella, Karin [mailto:Karin.Smadella@stantec.com]
Sent: April 29, 2019 12:43 PM
To: Matt Wingate <MWingate@dsel.ca>
Cc: Johnston, Anthony <Anthony.Johnston@stantec.com>
Subject: Kanata North Valecraft & Minto Lands

Hi Matt,

Further to our meeting last week, please send us your servicing and grading functional design so that we can tie in to your works. Also – it was noted that you have cad of the conceptual pond from the MSS. Can you also please send that file to us. If the servicing isn't ready yet, we would like to receive the cad for the conceptual pond right away.

Thanks and let me know if you have any questions.

Karin

Karin Smadella, P.Eng.
Project Manager

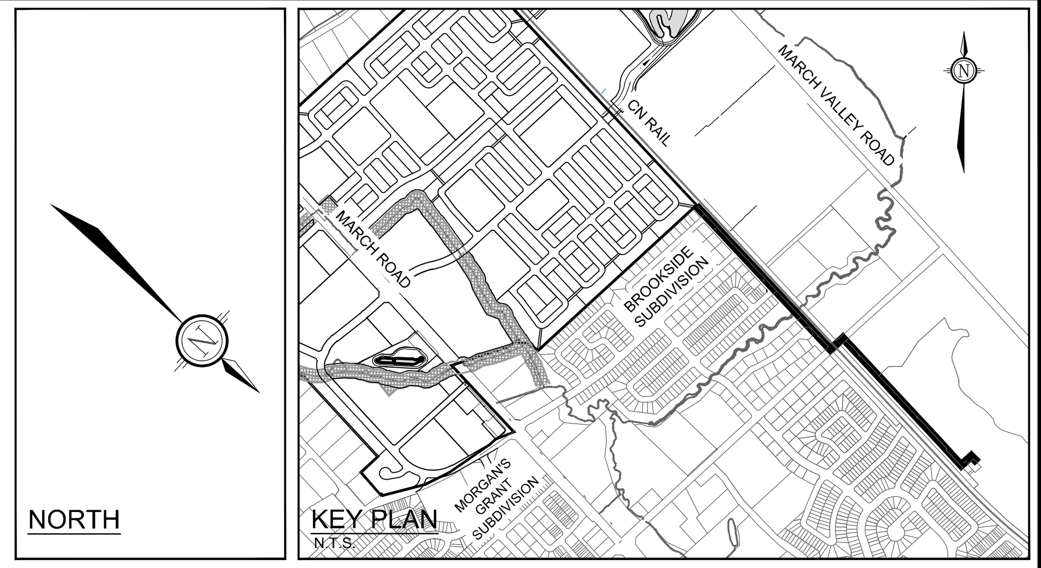
Direct: 613 724-4371
Mobile: 613 698-8088
Karin.Smadella@stantec.com

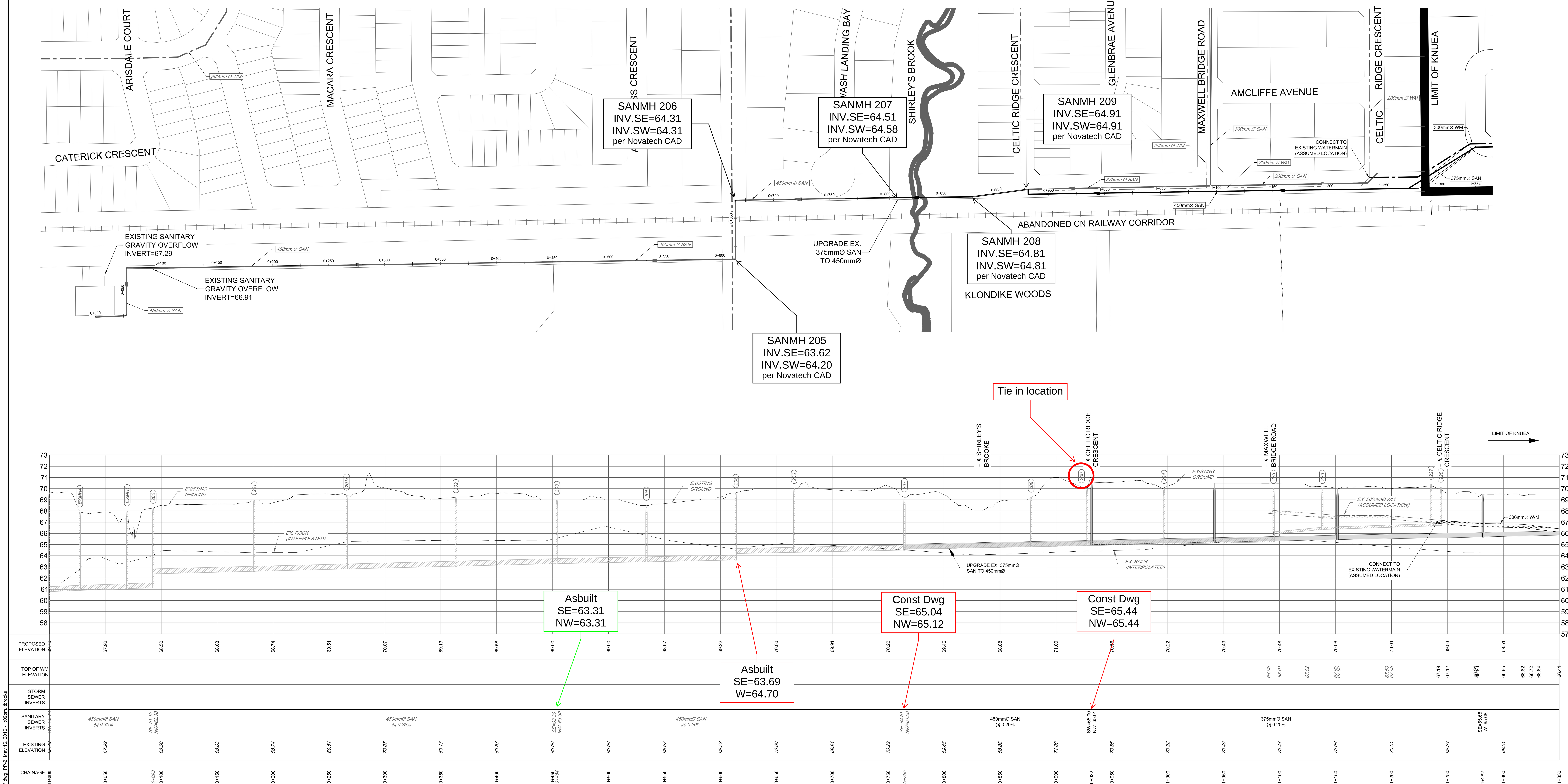
Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

SAN INVERT MARKUP
Prepared by DSEL
May 23, 2019

LEGEND

PROPOSED STORM SEWER & FLOW DIRECTION (PLAN VIEW)
PROPOSED STORM SEWER (PROFILE VIEW)
EXISTING STORM SEWER & FLOW DIRECTION (PLAN VIEW)
EXISTING STORM SEWER (PROFILE VIEW)
PROPOSED SANITARY SEWER & FLOW DIRECTION (PLAN VIEW)
PROPOSED SANITARY SEWER (PROFILE VIEW)
EXISTING SANITARY SEWER & FLOW DIRECTION (PLAN VIEW)
EXISTING SANITARY SEWER (PROFILE VIEW)
PROPOSED WATERMAIN (PLAN VIEW)
PROPOSED WATERMAIN (PROFILE VIEW)
EXISTING WATERMAIN (PLAN VIEW)
EXISTING WATERMAIN (PROFILE VIEW)





NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	REVISION	DATE	BY
3.	ISSUED WITH DRAFT MASTER SERVICING STUDY	MAY 20/16	JLS
2.	ISSUED WITH DRAFT MASTER SERVICING STUDY	APR 4/16	JLS
1.	ISSUED WITH DRAFT MASTER SERVICING STUDY	FEB 26/16	JLS

SCALE 1:1500

DESIGN ARM / TB
CHECKED ARM
DRAWN TB
CHECKED CJR
APPROVED JLS

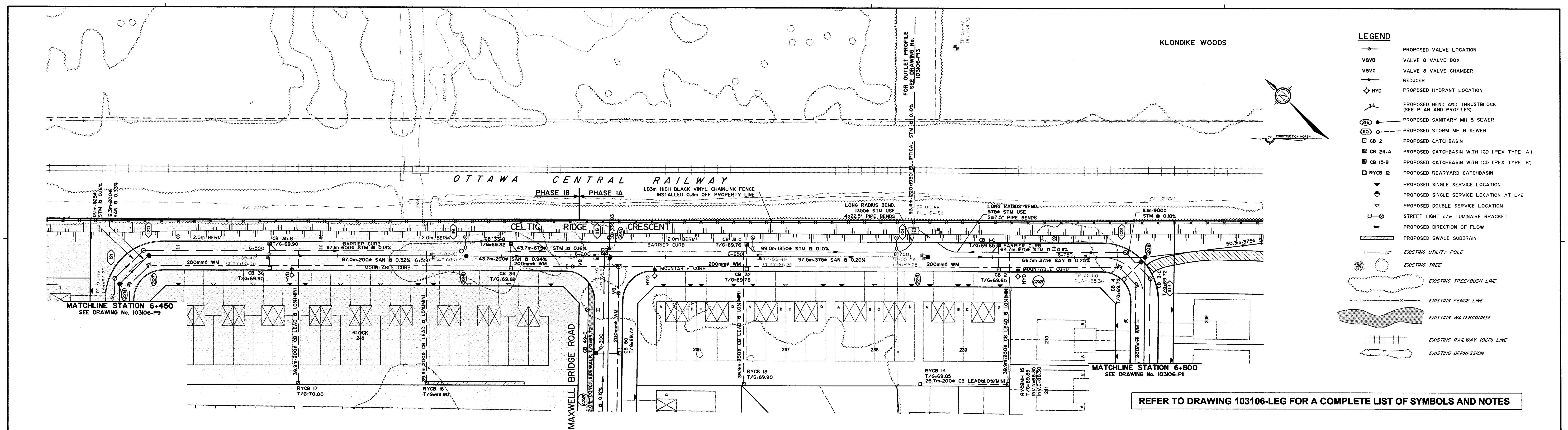
FOR REVIEW ONLY

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
KANATA NORTH URBAN EXPANSION AREA
COMMUNITY DESIGN PLAN

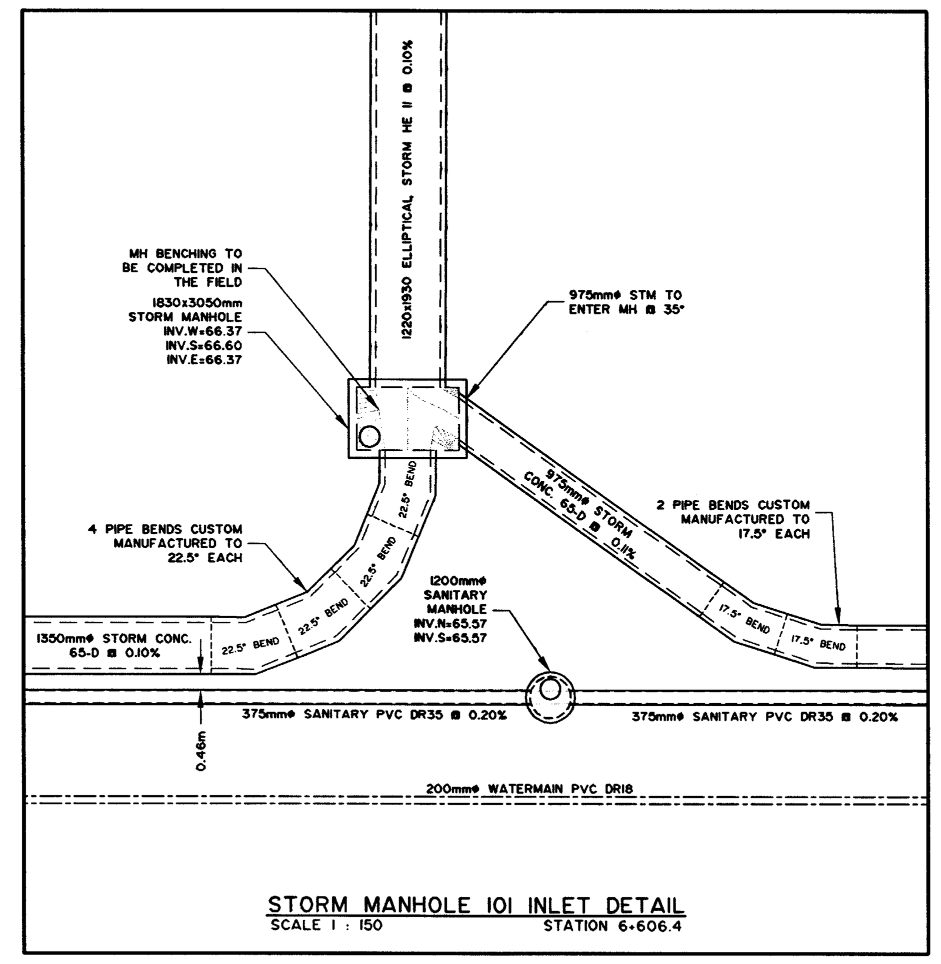
DRAWING NAME
KNUEA TO BRIAR RIDGE
PUMP STATION
PLAN AND PROFILE

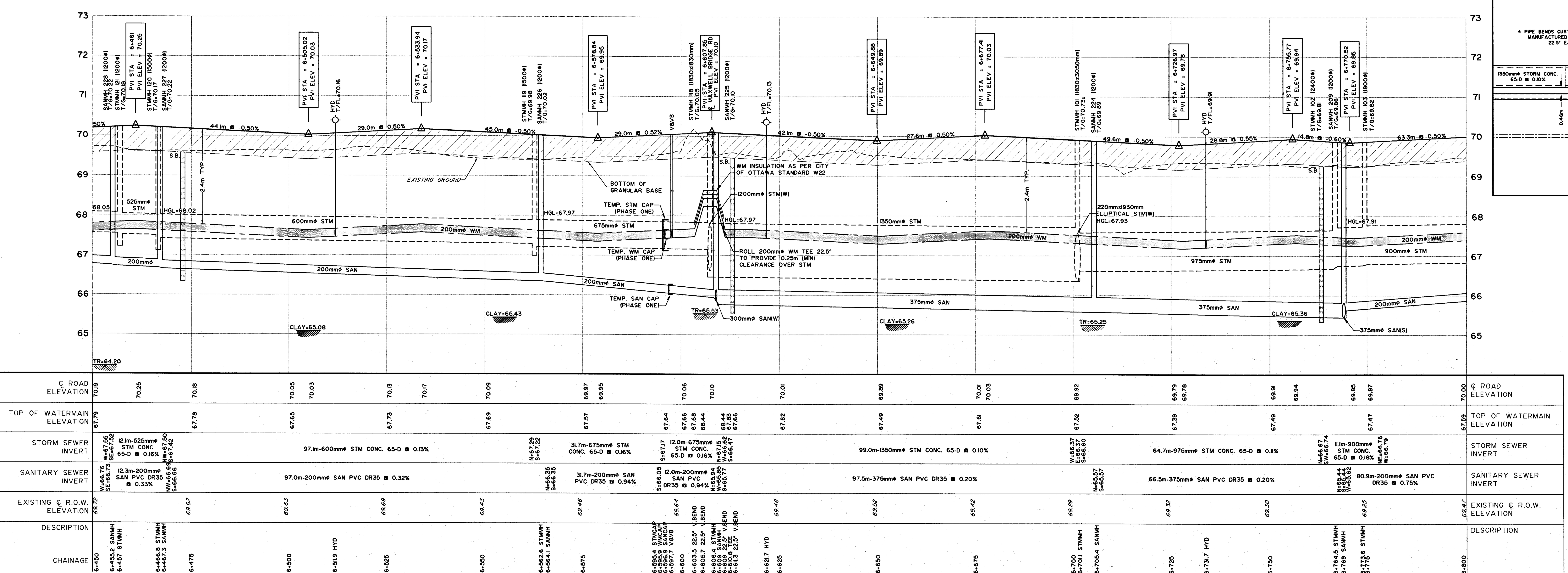
PROJECT No. 112117-04
REV # 3
DRAWING No. 112117-PP2



REFER TO DRAWING 103106-LEG FOR A COMPLETE LIST OF SYMBOLS AND NOTES

CELTIC RIDGE CRESCENT





Conforms to City of Ottawa Standards
Conforme aux standards de la Ville d'Ottawa
Plan 14070 11 of 17
Date 02/08/06
Ottawa

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	REVISION	DATE	BY
8.	ISSUED FOR CONSTRUCTION	JULY 31/06	MAB

No.	REVISION	DATE	BY
7.	ISSUED FOR TENDER	MAY 26/06	MAB
6.	ISSUED FOR MOE APPROVAL	MAY 01/06	MAB
5.	REVISED PER CITY COMMENTS	APR 24/06	MAB
4.	ISSUED TO CITY FOR REVIEW	MAR 20/06	MAB
3.	ISSUED TO CITY FOR REVIEW	FEB 22/06	MAB
2.	ISSUED TO CITY FOR REVIEW	JAN 20/06	MAB
1.	ISSUED TO CITY FOR REVIEW	NOV 11/05	MAB

LICENSED PROFESSIONAL ENGINEER M.A. BISSETT PROVINCE OF ONTARIO
REGISTERED PROFESSIONAL ENGINEER J.G. RIDDELL PROVINCE OF ONTARIO

NOVATECH ENGINEERING CONSULTANTS LTD.
ENGINEERS & PLANNERS
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Email: novainfo@novatech-eng.com

DESIGN: MAB	SCALE	CITY OF OTTAWA
CHECKED: SAY	1:500 HORIZONTAL	BROOKSIDE SUBDIVISION
DRAWN: SM		PLAN AND PROFILE
CHECKED: MAB	1:50 VERTICAL	CELTIC RIDGE CRESCENT
APPROVED: JGR		STA. 6+450 TO STA. 6+800

PROJECT No. 103106-0
DATE AUGUST 2005
DRAWING No. 103106-P10

14070

Appendix C STORMWATER MANAGEMENT CALCULATIONS

C.1 CONCEPTUAL STORM SEWER DESIGN SHEET

Stantec

Valecraft Homes Part of Lot 13, Cocession 4

DATE: 2019-07-31
REVISION: 1
DESIGNED BY: AJ
CHECKED BY: AMP

STORM SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401328

Draft Plan Approval Preliminary Design

DESIGN PARAMETERS

$I = a / (t+b)^c$ (As per City of Ottawa Guidelines, 2012)

	1:2 yr	1:5 yr	1:10 yr	1:100 yr
a =	732.951	998.071	1174.184	1735.688
b =	6.199	6.053	6.014	6.014
c =	0.810	0.814	0.816	0.820

MANNING'S n = 0.013 BEDDING CLASS = B
MINIMUM COVER: 2.00 m
TIME OF ENTRY 10 min

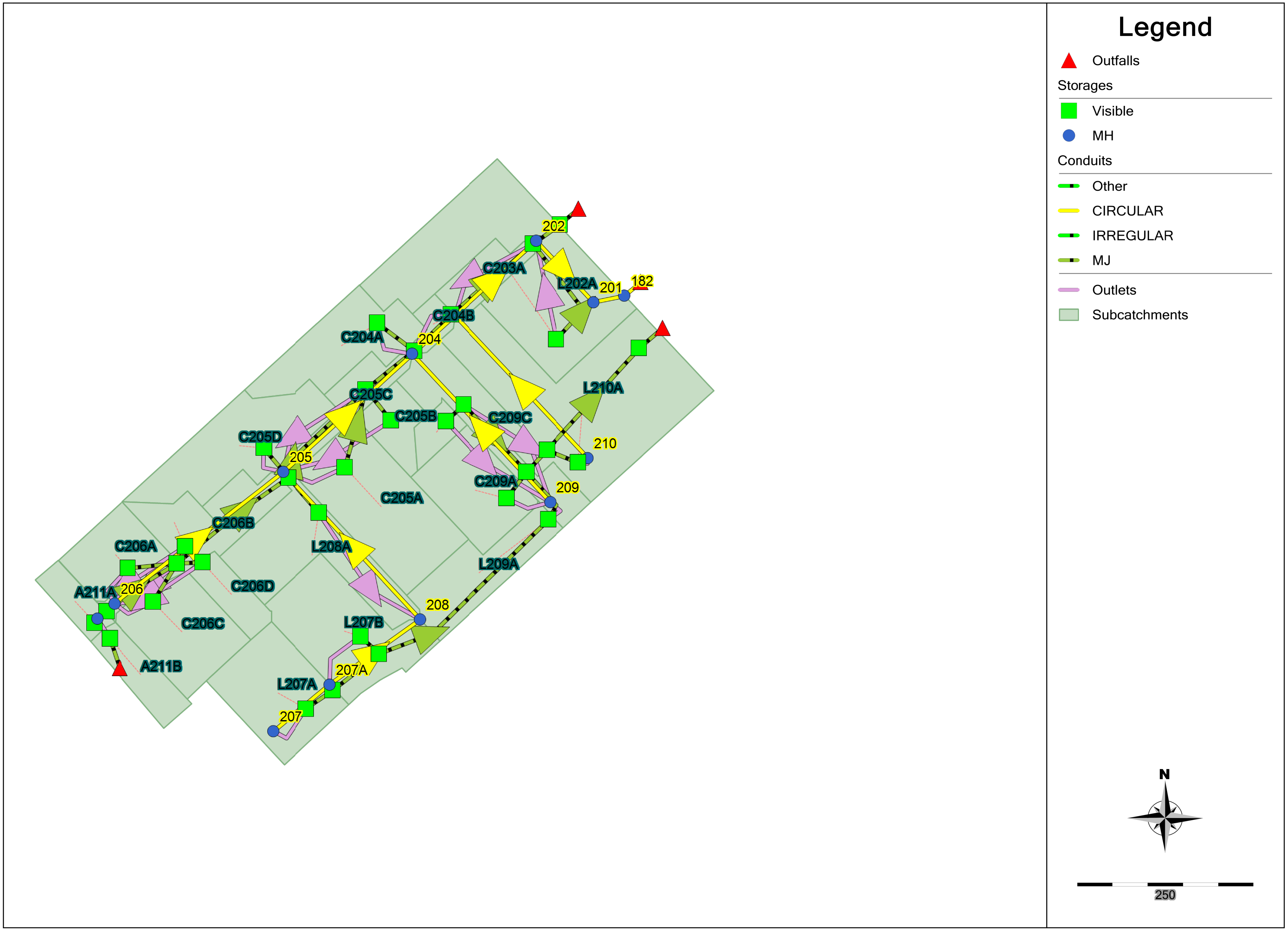
LOCATION / DRAINAGE AREA

AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)
C209C, C209A, L209A, C209B	209	204	1.58	3.94	0.00	0.00	0.00	0.65	0.54	0.00	0.00	1.025	1.025	2.133	2.133	0.000	0.000	0.000	0.000
A211B, A211A	211	206	0.00	0.00	1.14	0.00	0.00	0.00	0.00	0.70	0.00	0.000	0.000	0.000	0.000	0.800	0.800	0.000	0.000
C206B, C206D, C206C, C206A, C206	206	205	0.00	5.69	0.00	0.00	0.00	0.00	0.76	0.00	0.00	0.000	0.000	4.331	4.331	0.000	0.800	0.000	0.000
L207A, L207B	207	208	4.68	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	3.044	3.044	0.000	0.000	0.000	0.000	0.000	0.000
L208A	208	205	2.33	0.00	0.00	0.00	0.00	0.70	0.00	0.00	0.00	1.633	4.677	0.000	0.000	0.000	0.000	0.000	0.000
C205D, C205C, C205A, C205B	205	204	0.00	6.95	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.000	4.677	4.520	8.851	0.000	0.800	0.000	0.000
C204B, C204A	204	203	0.00	2.20	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.000	5.702	1.431	12.415	0.000	0.800	0.000	0.000
L210A	210	203	5.33	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	3.467	3.467	0.000	0.000	0.000	0.000	0.000	0.000
C203A	203	202	0.00	0.73	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.000	9.169	0.475	12.890	0.000	0.800	0.000	0.000
L202A	202	201	5.07	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	3.293	12.462	0.000	12.890	0.000	0.800	0.000	0.000
	201	182	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	12.462	0.000	12.890	0.000	0.800	0.000	0.000
	182	182A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	12.462	0.000	12.890	0.000	0.800	0.000	0.000
	182A	#1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	12.462	0.000	12.890	0.000	0.800	0.000	0.000

DRAINAGE AREA (continued) / PIPE SELECTION

FROM M.H.	TO M.H.	T of C (min)	$I_{2\text{-YEAR}}$ (mm/h)	$I_{5\text{-YEAR}}$ (mm/h)	$I_{10\text{-YEAR}}$ (mm/h)	$I_{100\text{-YEAR}}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETE (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
209	204	10.00	76.81	104.19	122.14	178.56	0.0	0.0	836.1	292.8	975	975	CIRCULAR	CONCRETE	-	0.30	1280.5	**65.30%**	1.66	1.54	3.16
		13.16																			
211	206	10.00	76.81	104.19	122.14	178.56	0.0	0.0	271.4	32.5	600	600	CIRCULAR	CONCRETE	-	0.50	452.9	**59.91%**	1.55	1.40	0.39
206	205	10.39	75.35	102.19	119.79	175.10	0.0	0.0	1495.6	311.9	1200	1200	CIRCULAR	CONCRETE	-	0.50	2876.0	**52.00%**	2.46	2.13	2.44
		12.83																			
207	208	10.00	76.81	104.19	122.14	178.56	0.0	0.0	649.5	268.9	975	975	CIRCULAR	CONCRETE	-	0.15	905.5	**71.73%**	1.17	1.12	3.99
208	205	13.99	64.26	86.96	101.86	148.78	0.0	0.0	834.8	291.2	1050	1050	CIRCULAR	CONCRETE	-	0.15	1103.3	**75.66%**	1.23	1.19	4.06
		18.05																			
205	204	18.05	55.39	74.83	87.60	127.85	0.0	0.0	2754.1	253.6	1650	1650	CIRCULAR	CONCRETE	-	0.15	3682.6	**74.79%**	1.67	1.61	2.62
		20.67																			
204	203	20.67	50.98	68.81	80.52	117.47	0.0	0.0	3359.4	83.0	1650	1650	CIRCULAR	CONCRETE	-	0.20	4252.4	**79.00%**	1.93	1.89	0.73
		21.40																			
210	203	10.00	76.81	104.19	122.14	178.56	0.0	0.0	739.6	283.2	975	975	CIRCULAR	CONCRETE	-	0.15	905.5	**81.68%**	1.17	1.16	4.05
		14.05																			
203	202	21.40	49.88	67.31	78.76	114.89	0.0	0.0	3855.5	160.0	1800	1800	CIRCULAR	CONCRETE	-	0.26	6114.7	**63.05%**	2.33	2.13	1.25
202	201	22.66	48.12	64.91	75.94	110.76	0.0	0.0	4158.6	121.8	1800	1800	CIRCULAR	CONCRETE	-	0.26	6114.6	**68.01%**	2.33	2.18	0.93
201	182	23.59	46.90	63.25	73.99	107.90	0.0	0.0	4052.3	42.9	1800	1800	CIRCULAR	CONCRETE	-	0.30	6568.2	**61.70%**	2.50	2.27	0.32
182	182A	23.90	46.50	62.71	73.35	106.96	0.0	0.0	4017.7	16.0	1800	1800	CIRCULAR	CONCRETE	-	0.30	6568.2	**61.17%**	2.50	2.27	0.12
182A	#1	24.02	46.35	62.51	73.12	106.62	0.0	0.0	4005.0	28.3	1800	1800	CIRCULAR	CONCRETE	-	0.30	6568.2	**60.98%**	2.50	2.27	0.21

C.2 PCSWMM LAYOUT


202
C203A
L202A
201
182
C204B
C204A
204
L210A
C205C
C205B
C209C
C205D
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C209A
209
C205A
C206B
C206A
L208A
L209A
C206D
A211A
206
208
C206C
L207B
A211B
207A
L207A
207
Legend
Outfalls
Storages
Visible
MH
Conduits
Other
CIRCULAR
IRREGULAR
MJ
Outlets
Subcatchments
N
250

C.3 POST DEVELOPMENT PCSWMM MODEL INPUT EXAMPLE

```
[TITLE]


[OPTIONS]
;;Options            Value
;;------------------ ------------
FLOW_UNITS           LPS
INFILTRATION         HORTON
FLOW_ROUTING         DYNWAVE
START_DATE           09/14/2011
START_TIME           00:00:00
REPORT_START_DATE    09/14/2011
REPORT_START_TIME    00:00:00
END_DATE             09/14/2011
END_TIME             12:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:05:00
DRY_STEP             00:05:00
ROUTING_STEP         5
ALLOW_PONDING        NO
INERTIAL_DAMPING     PARTIAL
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
NORMAL_FLOW_LIMITED  BOTH
SKIP_STEADY_STATE    NO
FORCE_MAIN_EQUATION  D-W
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              4

[FILES]
USE HOTSTART "C:\ana's\valecraft-KN\PCSWMM\100CHI.HSF"

[EVAPORATION]
;;Type          Parameters
;;------------- ----------
CONSTANT     0.0
DRY_ONLY     NO

[RAINGAGES]
;;               Rain      Time   Snow   Data
;;Name           Type      Intrvl Catch  Source
;;-------------- --------- ------ ------ ----------
RG1              INTENSITY 0:10   1.0    TIMESERIES 100yr3hrChicago

[SUBCATCHMENTS]
;;                                                 Total    Pcnt.             Pcnt.
  Curb     Snow
;;Name           Raingage         Outlet           Area     Imperv   Width    Slope
  Length   Pack
;;-------------- ---------------- ---------------- -------- -------- --------
-------- -------- --------
A211A            RG1              A211A-S          0.44     71.4     102      1
  0
```

```
A211B                RG1                A211B-S            0.7      71.4     169      1
 0
;0.65
C203A                RG1                C203A-S            0.730021 64.3     162      1
 0
;0.65
C204A                RG1                C204A-S            1.895291 64.3     725      2
 0
;0.65
C204B                RG1                C204B-S            0.306321 64.3     80       1
 0
;0.8
C205A                RG1                C205A-S            2.920322 64.3     657      1
 0
;0.65
C205B                RG1                C205B-S            0.706147 64.3     260      2
 0
;0.65
C205C                RG1                C205C-S            0.869825 64.3     255      2
 0
;0.65
C205D                RG1                C205D-S            2.457139 64.3     798      1
 0
;0.8
C206A                RG1                C206A-S            1.224666 92.9     274.5    1
 0
;0.65
C206B                RG1                C206B-S            1.249479 64.3     473      1
 0
;0.8
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;0.65
C206D                RG1                C206D-S            0.654697 64.3     131      1
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;0.65
C206E                RG1                C206E-S            0.630928 64.3     223      1
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;0.4
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;0.65
C209B                RG1                C209B-S            0.386506 64.3     66       2
 0
;0.65
C209C                RG1                C209C-S            1.841795 64.3     411      1
 0
;0.65
L202A                RG1                L202A-S            5.065552 64.3     2088     1
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;0.65
L207A                RG1                L207A-S            2.121042 64.3     734      1
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;0.65
L207B                RG1                L207B-S            2.562324 64.3     768      1
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;0.65
L208A                RG1                L208A-S            2.332445 71.4     865      1
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;0.65
L209A                RG1                L209A-S            1.577251 64.3     367      2
 0
;0.65
```

```
L210A            RG1              L210A-S          5.333627 64.3     1580     1
  0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo
PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ----------
----------
A211A            0.013      0.25       1.57       4.67       0          OUTLET
A211B            0.013      0.25       1.57       4.67       0          OUTLET
C203A            0.013      0.25       1.57       4.67       0          OUTLET
C204A            0.013      0.25       1.57       4.67       0          PERVIOUS
20
C204B            0.013      0.25       1.57       4.67       0          OUTLET
C205A            0.013      0.25       1.57       4.67       0          PERVIOUS
30
C205B            0.013      0.25       1.57       4.67       0          OUTLET
C205C            0.013      0.25       1.57       4.67       0          OUTLET
C205D            0.013      0.25       1.57       4.67       0          PERVIOUS
20
C206A            0.013      0.25       1.57       4.67       0          OUTLET
C206B            0.013      0.25       1.57       4.67       0          OUTLET
C206C            0.013      0.25       1.57       4.67       0          OUTLET
C206D            0.013      0.25       1.57       4.67       0          OUTLET
C206E            0.013      0.25       1.57       4.67       0          OUTLET
C209A            0.013      0.25       1.57       4.67       0          PERVIOUS
100
C209B            0.013      0.25       1.57       4.67       0          OUTLET
C209C            0.013      0.25       1.57       4.67       0          OUTLET
L202A            0.013      0.25       1.57       4.67       0          PERVIOUS
20
L207A            0.013      0.25       1.57       4.67       0          PERVIOUS
20
L207B            0.013      0.25       1.57       4.67       0          PERVIOUS
20
L208A            0.013      0.25       1.57       4.67       0          OUTLET
L209A            0.013      0.25       1.57       4.67       0          OUTLET
L210A            0.013      0.25       1.57       4.67       0          PERVIOUS
20

[INFILTRATION]
;;Subcatchment   MaxRate    MinRate    Decay      DryTime    MaxInfil
;;-------------- ---------- ---------- ---------- ---------- ----------
A211A            76.2       13.2       4.14       7          0
A211B            76.2       13.2       4.14       7          0
C203A            76.2       13.2       4.14       7          0
C204A            76.2       13.2       4.14       7          0
C204B            76.2       13.2       4.14       7          0
C205A            76.2       13.2       4.14       7          0
C205B            76.2       13.2       4.14       7          0
C205C            76.2       13.2       4.14       7          0
C205D            76.2       13.2       4.14       7          0
C206A            76.2       13.2       4.14       7          0
C206B            76.2       13.2       4.14       7          0
C206C            76.2       13.2       4.14       7          0
C206D            76.2       13.2       4.14       7          0
C206E            76.2       13.2       4.14       7          0
C209A            76.2       13.2       4.14       7          0
C209B            76.2       13.2       4.14       7          0
C209C            76.2       13.2       4.14       7          0
L202A            76.2       13.2       4.14       7          0
L207A            76.2       13.2       4.14       7          0
L207B            76.2       13.2       4.14       7          0
```

```
L208A            76.2       13.2       4.14       7          0
L209A            76.2       13.2       4.14       7          0
L210A            76.2       13.2       4.14       7          0

[OUTFALLS]
;;               Invert     Outfall      Stage/Table      Tide
;;Name           Elev.      Type         Time Series      Gate Route To
;;-------------- ---------- ------------ ---------------- ---- ----------------
MJ-OF1           70.23      FREE                          YES
MJ-OF2           70.32      FREE                          NO
MN-OF            66.23      FIXED        67               NO
OF1              82.12      FREE                          NO

[STORAGE]
;;               Invert   Max.     Init.    Storage    Curve
Ponded   Evap.
;;Name           Elev.    Depth    Depth    Curve      Params
Area     Frac.    Infiltration parameters
;;-------------- -------- -------- -------- ---------- -------- -------- --------
-------- -------- -----------------------
182              66       4.54     0        FUNCTIONAL 0        0        1.13     0
     0
;3600mm
201              66.05    6.57     0        FUNCTIONAL 0        0        1.13     0
     0
202              66.5     6        0        FUNCTIONAL 0        0        1.13     0
     0
;3600mm
203              67       5.66     0        FUNCTIONAL 0        0        1.13     0
     0
;3600mm
204              67.3     5.44     0        FUNCTIONAL 0        0        1.13     0
     0
;3600mm
205              67.217   13.048   0        FUNCTIONAL 0        0        1.13     0
     0
;2400mm
206              76.726   5.18     0        FUNCTIONAL 0        0        1.13     0
     0
206B-S1          82.12    0.4      0        FUNCTIONAL 0        0        0        0
     0
207              75.23    5.32     0        FUNCTIONAL 0        0        1.13     0
     0
207A             75       5.14     0        FUNCTIONAL 0        0        1.13     0
     0
;2400mm
208              74.603   5.687    0        FUNCTIONAL 0        0        1.13     0
     0
;1800mm
209              69       3.58     0        FUNCTIONAL 0        0        1.13     0
     0
;1800mm
210              68.2     4.29     0        FUNCTIONAL 0        0        1.13     0
     0
;2400mm
211              77.8     4.32     0        FUNCTIONAL 0        0        1.13     0
     0
A211A-S          80.7     2.4      0        FUNCTIONAL 0        0        0        0
     0
A211B-S          81.04    2.4      0        FUNCTIONAL 0        0        0        0
     0
C203A-S          69.85    3.05     0        FUNCTIONAL 0        0        0        0
     0
```

```
C204A-S          71.33    3.05     0        TABULAR    C204A-S                         0
     0
C204B-S          70.66    2.4      0        FUNCTIONAL 0        0        0        0
     0
C204B-S1         72.74    0.4      0        FUNCTIONAL 0        0        0        0
     0
C205A-S          72.68    3.05     0        TABULAR    C205A-S                         0
     0
C205B-S          72.89    3.05     0        TABULAR    C205B-S                         0
     0
C205C-S          73.15    2.4      0        FUNCTIONAL 0        0        0        0
     0
C205C-S1         80.27    0.4      0        FUNCTIONAL 0        0        0        0
     0
C205D-S          78.8     3.05     0        FUNCTIONAL 0        0        0        0
     0
C206A-S          77.96    3.05     0        TABULAR    C206A-S                         0
     0
C206B-S          77.78    3.05     0        FUNCTIONAL 0        0        0        0
     0
C206C-S          77.96    3.05     0        TABULAR    C206C-S                         0
     0
C206D-S          78.45    3.05     0        TABULAR    C206D-S                         0
     0
C206E-S          78.81    2.4      0        FUNCTIONAL 0        0        0        0
     0
C209A-S          70.55    2.6      0        FUNCTIONAL 0        0        0        0
     0
C209B-S          73.24    2.4      0        FUNCTIONAL 0        0        0        0
     0
C209C-S          70.15    3.05     0        FUNCTIONAL 0        0        0        0
     0
C209C-S1         72.5     0.4      0        FUNCTIONAL 0        0        0        0
     0
L202A-S          70.82    3.05     0        FUNCTIONAL 0        0        0        0
     0
L207A-S          79.1     3.05     0        TABULAR    L207A-S                         0
     0
L207B-S          78.69    3.05     0        FUNCTIONAL 0        0        0        0
     0
L207B-S1         80.45    0.4      0        FUNCTIONAL 0        0        0        0
     0
L208A-S          79.06    3.05     0        FUNCTIONAL 0        0        0        0
     0
L209A-S          70.58    2.4      0        FUNCTIONAL 0        0        0        0
     0
L210A-S          70.85    3.05     0        FUNCTIONAL 0        0        0        0
     0
L210A-S1         72.26    0.4      0        FUNCTIONAL 0        0        0        0
     0
L210A-S2         72.42    0.4      0        FUNCTIONAL 0        0        0        0
     0
MJ-OUT           70.45    0.6      0        FUNCTIONAL 0        0        0        0
     0
SU10             80.37    0.4      0        FUNCTIONAL 0        0        0        0
     0

[CONDUITS]
;;               Inlet            Outlet                      Manning    Inlet
Outlet     Init.     Max.
;;Name           Node             Node             Length     N          Offset
Offset     Flow      Flow
;;-------------- ---------------- ---------------- ---------- ---------- ----------
```

```
---------- ---------- ----------
C1              A211A-S         206B-S1         116         0.013       82.7
82.12       0       0
C10             C205D-S         C205C-S1        350         0.013       81.45
80.27       0       0
C11             L208A-S         C205C-S1        450         0.013       81.71
80.27       0       0
C12             C205A-S         C205C-S         5           0.013       75.33
75.3        0       0
C13             C205C-S         C204B-S1        83.9        0.013       75.15
72.74       0       0
C14             C204B-S1        C204B-S         83          0.013       72.74
72.66       0       0
C15             C204A-S         C204B-S1        254         0.013       73.98
72.74       0       0
C16             C205B-S         C205C-S         77.4        0.013       75.54
75.15       0       0
C17             C204B-S         C203A-S         32          0.013       72.66
72.5        0       0
C19             C203A-S         MJ-OUT          45.3        0.035       72.5
70.45       0       0
C2              A211B-S         OF1             184         0.013       83.04
82.12       0       0
C20             L210A-S         L210A-S2        610         0.013       73.5
72.42       0       0
C21             L202A-S         C203A-S         450         0.013       73.47
72.5        0       0
C22             C209B-S         C209C-S         77.5        0.013       75.24
72.8        0       0
C23             C209C-S1        L210A-S2        100         0.013       72.5
72.42       0       0
C24             L209A-S         C209C-S1        16          0.013       72.58
72.5        0       0
C25             C209C-S         C209C-S1        24          0.013       72.8
72.5        0       0
C26             C209A-S         C209C-S1        5           0.035       72.55
72.5        0       0
C27             L207A-S         L207B-S1        259         0.013       81.75
80.45       0       0
C28             L207B-S1        SU10            80.8        0.013       80.45
80.37       0       0
C29             SU10            L209A-S         337.9       0.013       80.37
72.58       0       0
C3              206B-S1         C206B-S         169         0.013       82.12
80.43       0       0
C30             L207B-S         SU10            250         0.013       81.34
80.37       0       0
C31             MJ-OUT          MJ-OF1          10          0.035       70.45
70.23       0       0
C32             207             207A            106.4       0.013       75.53
75.37       0       0
C33             201             182             45.3        0.013       66.48
66.36       0       0
C34             182             MN-OF           32.8        0.013       66.33
66.23       0       0
C35             L210A-S2        L210A-S1        100         0.013       72.42
72.26       0       0
C36             L210A-S1        MJ-OF2          40          0.035       72.26
70.32       0       0
C4              C206B-S         C205C-S1        32          0.013       80.43
80.27       0       0
C5              C206A-S         C206B-S         5           0.013       80.61
80.58       0       0
```

```
C6               C206C-S          C206B-S          5          0.013      80.61
80.58      0          0
C7               C206E-S          C206B-S          75         0.013      80.81
80.43      0          0
C8               C206D-S          C206B-S          134        0.013      81.1
80.43      0          0
C9               C205C-S1         C205C-S          171        0.013      80.27
75.15      0          0
Pipe_138         211              206              32.5       0.013      77.79
77.63      0          0
Pipe_81          202              201              121.8      0.013      66.84
66.51      0          0
Pipe_82          203              202              159.962    0.013      67.32
66.89      0          0
Pipe_82_(1)      204              203              83.028     0.013      67.628
67.462     0          0
Pipe_83          209              204              292.8      0.013      69.256
68.31      0          0
Pipe_86          210              203              283.016    0.013      68.57
68.14      0          0
Pipe_87          205              204              253.6      0.013      68.02
67.64      0          0
Pipe_87_(1)      206              205              311.9      0.013      77.03
75.47      0          0
Pipe_89          208              205              291.819    0.013      75.05
74.62      0          0
Pipe_90          207A             208              161.737    0.013      75.37
75.13      0          0

[OUTLETS]
;;               Inlet            Outlet           Outflow    Outlet
Qcoeff/                     Flap
;;Name           Node             Node             Height     Type
QTable           Qexpon     Gate
;;-------------- ---------------- ---------------- ---------- ----------------
---------------- ---------- ----
A211A-IC         A211A-S          211              80.7       TABULAR/HEAD
A211A-IC                    NO
A211B-IC         A211B-S          211              81.04      TABULAR/HEAD
A211B-IC                    NO
C203A-IC         C203A-S          203              69.85      TABULAR/HEAD
C203A-IC                    NO
C204A-IC         C204A-S          204              71.33      TABULAR/HEAD
C204A-IC                    NO
C204B-IC         C204B-S          204              70.66      TABULAR/HEAD
C204B-IC                    NO
C205A-IC         C205A-S          205              72.68      TABULAR/HEAD
C205A-IC                    NO
C205B-IC         C205B-S          205              72.89      TABULAR/HEAD
C205B-IC                    NO
C205C-IC         C205C-S          205              73.15      TABULAR/HEAD
C205C-IC                    NO
C205D-IC         C205D-S          205              78.8       TABULAR/HEAD
C205D-IC                    NO
C206A-IC         C206A-S          206              77.96      TABULAR/HEAD
C206A-IC                    NO
C206B-IC         C206B-S          206              77.78      TABULAR/HEAD
C206B-IC                    NO
C206C-IC         C206C-S          206              77.96      TABULAR/HEAD
C206C-IC                    NO
C206D-IC         C206D-S          206              78.45      TABULAR/HEAD
C206D-IC                    NO
C206E-IC         C206E-S          206              78.81      TABULAR/HEAD
```

```
C206E-IC                       NO
C209A-IC          C209A-S            209              70.55      TABULAR/HEAD
C209A-IC                       NO
C209B-IC          C209B-S            209              73.24      TABULAR/HEAD
C209B-IC                       NO
C209C-IC          C209C-S            209              70.15      TABULAR/HEAD
C209C-IC                       NO
L202A-IC          L202A-S            202              70.82      TABULAR/HEAD
L202A-IC                       NO
L207A-IC          L207A-S            207              79.1       TABULAR/HEAD
L207A-IC                       NO
L207B-IC          L207B-S            207A             78.69      TABULAR/HEAD
L207B-IC                       NO
L208A-IC          L208A-S            208              79.06      TABULAR/HEAD
L208A-IC                       NO
L209A-IC          L209A-S            209              70.58      TABULAR/HEAD
L209A-IC                       NO
L210A-IC          L210A-S            210              70.85      TABULAR/HEAD
L210A-IC                       NO

[XSECTIONS]
;;Link            Shape        Geom1            Geom2      Geom3      Geom4
Barrels
;;-------------- ------------ ---------------- ---------- ---------- ----------
----------
C1                IRREGULAR    24mROW           0          0          0          1

C10               IRREGULAR    18mROW           0          0          0          1

C11               IRREGULAR    18mROW           0          0          0          1

C12               IRREGULAR    18mROW           0          0          0          1

C13               IRREGULAR    24mROW           0          0          0          1

C14               IRREGULAR    24mROW           0          0          0          1

C15               IRREGULAR    18mROW           0          0          0          1

C16               IRREGULAR    18mROW           0          0          0          1

C17               IRREGULAR    24mROW           0          0          0          1

C19               TRAPEZOIDAL  0.6              3          3          3          1

C2                IRREGULAR    24mROW           0          0          0          1

C20               IRREGULAR    18mROW           0          0          0          1

C21               IRREGULAR    18mROW           0          0          0          1

C22               IRREGULAR    18mROW           0          0          0          1

C23               IRREGULAR    18mROW           0          0          0          1

C24               IRREGULAR    24mROW           0          0          0          1

C25               IRREGULAR    24mROW           0          0          0          1

C26               TRIANGULAR   0.6              3.6        0          0          1

C27               IRREGULAR    18mROW           0          0          0          1
```

C28	IRREGULAR	18mROW	0	0	0	1
C29	IRREGULAR	18mROW	0	0	0	1
C3	IRREGULAR	24mROW	0	0	0	1
C30	IRREGULAR	18mROW	0	0	0	1
C31	TRAPEZOIDAL	0.6	3	3	3	1
C32	CIRCULAR	0.975	0	0	0	1
C33	CIRCULAR	1.8	0	0	0	1
C34	CIRCULAR	1.8	0	0	0	1
C35	IRREGULAR	18mROW	0	0	0	1
C36	TRAPEZOIDAL	0.4	2	3	3	1
C4	IRREGULAR	24mROW	0	0	0	1
C5	IRREGULAR	18mROW	0	0	0	1
C6	IRREGULAR	18mROW	0	0	0	1
C7	IRREGULAR	18mROW	0	0	0	1
C8	IRREGULAR	18mROW	0	0	0	1
C9	IRREGULAR	24mROW	0	0	0	1
Pipe_138	CIRCULAR	0.6	0	0	0	1
Pipe_81	CIRCULAR	1.8	0	0	0	1
Pipe_82	CIRCULAR	1.8	0	0	0	1
Pipe_82_(1)	CIRCULAR	1.65	0	0	0	1
Pipe_83	CIRCULAR	0.975	0	0	0	1
Pipe_86	CIRCULAR	0.975	0	0	0	1
Pipe_87	CIRCULAR	1.65	0	0	0	1
Pipe_87_(1)	CIRCULAR	1.2	0	0	0	1
Pipe_89	CIRCULAR	1.05	0	0	0	1
Pipe_90	CIRCULAR	0.975	0	0	0	1

```
[TRANSECTS]

;Full street, width = 10m, curb = 0.15m , cross-slope = 0.02m/m, bank-slope = 
0.02m/m, bank-height = 0.23m.
NC 0.025    0.025    0.013
X1 10mROW           7         4         14        0.0        0.0        0.0       0.0
0.0
GR 0.23     0        0.15     4          0         4         0.1       9         0
14
GR 0.15     14       0.23     18
```

```
;Full street, width = 8.5m, curb = 0.15m , cross-slope = 0.02m/m, bank-slope =
0.02m/m, bank-height = 0.23m.
NC 0.025    0.025    0.013
X1 16.5mROW          8        4        12.5     0.0       0.0       0.0      0.0
0.0
GR 0.35     0        0.19     2.2      0.15     4         0         4        0.13
8.25
GR 0        12.5     0.15     12.5     0.35     16.5

;Half street, width = 4.25m, curb = 0.15m , cross-slope = 0.03m/m
NC 0.025    0.025    0.013
X1 16.5mROW_half    4        0.0      4.25     0.0       0.0       0.0      0.0
0.0
GR 0.13     0        0        4.25     0.15     4.25      0.35      8.25

NC 0.025    0.025    0.013
X1 16.5mROW_mountable_half 5        7        11.25    0.0       0.0       0.0
0.0      0.0
GR 0.22     0        0.16     3        0.08     7         0         7        0.13
11.25

NC 0.025    0.013    0.013
X1 16.5mROW_sidewalk_half 5        2.2      8.25     0.0       0.0       0.0
0.0      0.0
GR 0.35     0        0.19     2.2      0.15     4         0         4        0.13
8.25

;Full street, width = 8.5m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.4m.
NC 0.025    0.025    0.013
X1 18mROW            7        12.5     21       0.0       0.0       0.0      0.0
0.0
GR 0.4      0        0.15     12.5     0        12.5      0.13      16.75    0
21
GR 0.15     21       0.4      33.5

;Half street, width = 4.25m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.245m.
NC 0.025    0.025    0.013
X1 18mROW_half      4        0.0      4.25     0.0       0.0       0.0      0.0
0.0
GR 0.13     0        0        4.25     0.15     4.25      0.25      9

;Full street, width = 8.5m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.27m.
NC 0.025    0.025    0.013
X1 20mROW            7        5.75     14.25    0.0       0.0       0.0      0.0
0.0
GR 0.27     0        0.15     5.75     0        5.75      0.13      10       0
14.25
GR 0.15     14.25    0.27     20.5

;Half street, width = 4.25m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.27m.
NC 0.025    0.025    0.013
X1 20mROW_half      4        0.0      4.25     0.0       0.0       0.0      0.0
0.0
GR 0.13     0        0        4.25     0.15     4.25      0.27      10

;Full street, width =11m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.23m.
NC 0.025    0.025    0.013
```

```
X1 24mROW           7        12.5     23.5     0.0       0.0       0.0      0.0
0.0
GR 0.4      0        0.15     12.5     0        12.5     0.17     18       0
23.5
GR 0.15     23.5     0.4      36

;Half street, width = 5.5m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.28m.
NC 0.025    0.025    0.013
X1 24mROW_half      4        0.0      5.5      0.0       0.0       0.0      0.0
0.0
GR 0.17     0        0        5.5      0.15     5.5      0.28     12

;Full street, width = 5.5m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.23m.
NC 0.02     0.02     0.013
X1 8.5mROW          7        1.5      7        0.0       0.0       0.0      0.0
0.0
GR 0.18     0        0.15     1.5      0        1.5      0.08     4.25     0
7
GR 0.15     7        0.18     8.5

NC 0.025    0.025    0.013
X1 8.5mROW_half     4        1.25     4.25     0.0       0.0       0.0      0.0
0.0
GR 0.35     0        0.15     1.25     0        1.25     0.09     4.25

NC 0.025    0.025    0.013
X1 8.5mROW_mountable_half 5        1.9      4.9      0.0       0.0       0.0
0.0      0.0
GR 0.12     0        0.11     0.65     0.08     1.9      0        1.9      0.09
4.9

[LOSSES]
;;Link           Inlet      Outlet     Average    Flap Gate  SeepageRate
;;-------------- ---------- ---------- ---------- ---------- ----------
C32              0          0.06       0          NO         0
C33              0          0.21       0          NO         0
Pipe_138         0          0.06       0          NO         0
Pipe_81          0          0.64       0          NO         0
Pipe_82          0          1.32       0          NO         0
Pipe_82_(1)      0          0.06       0          NO         0
Pipe_83          0          0.02       0          NO         0
Pipe_86          0          0.02       0          NO         0
Pipe_87          0          0.06       0          NO         0
Pipe_87_(1)      0          0.06       0          NO         0
Pipe_89          0          0.02       0          NO         0
Pipe_90          0          0.02       0          NO         0

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
A211A-IC         Rating     0          0
A211A-IC                    2          119.2
A211A-IC                    2.4        131.1

A211B-IC         Rating     0          0
A211B-IC                    2          215.2
A211B-IC                    2.4        236.7

C203A-IC         Rating     0          0
C203A-IC                    2          146.9
C203A-IC                    2.35       161.6
```

```
C203A-IC                      3           161.6

C204A-IC          Rating      0           0
C204A-IC                      2           403.5
C204A-IC                      2.35        444
C204A-IC                      3           444

C204B-IC          Rating      0           0
C204B-IC                      2           62.4
C204B-IC                      2.4         68.6

C205A-IC          Rating      0           0
C205A-IC                      2           512.4
C205A-IC                      2.35        563
C205A-IC                      3           563

C205B-IC          Rating      0           0
C205B-IC                      2           152.5
C205B-IC                      2.35        167.8
C205B-IC                      3           167.8

C205C-IC          Rating      0           0
C205C-IC                      2           183.9
C205C-IC                      2.4         202.3

C205D-IC          Rating      0           0
C205D-IC                      2           478.6
C205D-IC                      2.35        526.5
C205D-IC                      3           526.5

C206A-IC          Rating      0           0
C206A-IC                      2           339.2
C206A-IC                      2.35        373
C206A-IC                      3           373

C206B-IC          Rating      0           0
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C206B-IC                      2.35        288
C206B-IC                      3           288

C206C-IC          Rating      0           0
C206C-IC                      2           535.2
C206C-IC                      2.35        588
C206C-IC                      3           588

C206D-IC          Rating      0           0
C206D-IC                      2           130.8
C206D-IC                      2.35        143.9
C206D-IC                      3           143.9

C206E-IC          Rating      0           0
C206E-IC                      2           131.6
C206E-IC                      2.4         144.8

C209A-IC          Rating      0           0
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C209A-IC                      2.6         147.2

C209B-IC          Rating      0           0
C209B-IC                      2           78.2
C209B-IC                      2.4         86.0

C209C-IC          Rating      0           0
```

C209C-IC		2	370.7
C209C-IC		2.35	407.8
C209C-IC		3	407.8
L202A-IC	Rating	0	0
L202A-IC		2	626.9
L202A-IC		2.35	689.6
L202A-IC		3	689.6
L207A-IC	Rating	0	0
L207A-IC		2	257.9
L207A-IC		2.35	284
L207A-IC		3	284
L207B-IC	Rating	0	0
L207B-IC		2	307.5
L207B-IC		2.35	338
L207B-IC		3	338
L208A-IC	Rating	0	0
L208A-IC		2	357.3
L208A-IC		2.35	393
L208A-IC		3	393
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L209A-IC		2.35	239.4
L209A-IC		3	239.4
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L210A-IC		2.35	703.2
L210A-IC		3	703.2
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C203A-S		2.35	122
C203A-S		2.36	0
C203A-S		3.05	0
C204A-S	Storage	0	0
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C204A-S		2.35	316
C204A-S		2.36	0
C204A-S		3.05	0
C205A-S	Storage	0	0
C205A-S		2	0
C205A-S		2.35	1800
C205A-S		2.36	0
C205A-S		3.05	0
C205B-S	Storage	0	0
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C205B-S		2.35	119
C205B-S		2.36	0
C205B-S		3.05	0
C205D-S	Storage	0	0
C205D-S		2	0

C205D-S		2.35	410
C205D-S		2.36	0
C205D-S		3.05	0
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C206A-S		2.35	600
C206A-S		2.36	0
C206A-S		3.05	0
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C206B-S		2.35	208
C206B-S		2.36	0
C206B-S		3.05	0
C206C-S	Storage	0	0
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L207A-S		3.05	0
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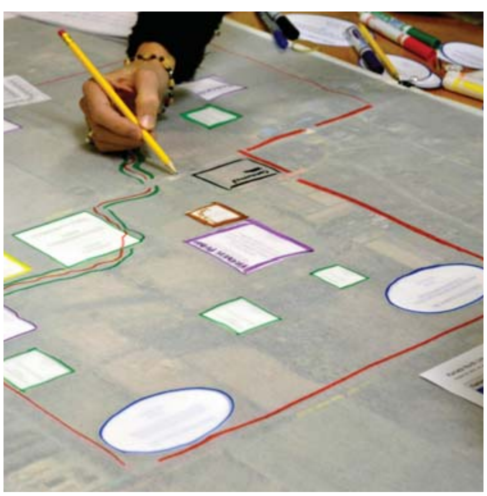
C.4 STORM DESIGN BACKGROUND REPORT EXCERPTS AND CORRESPONDENCE

KANATA NORTH

COMMUNITY DESIGN PLAN

MASTER SERVICING STUDY

REPORT



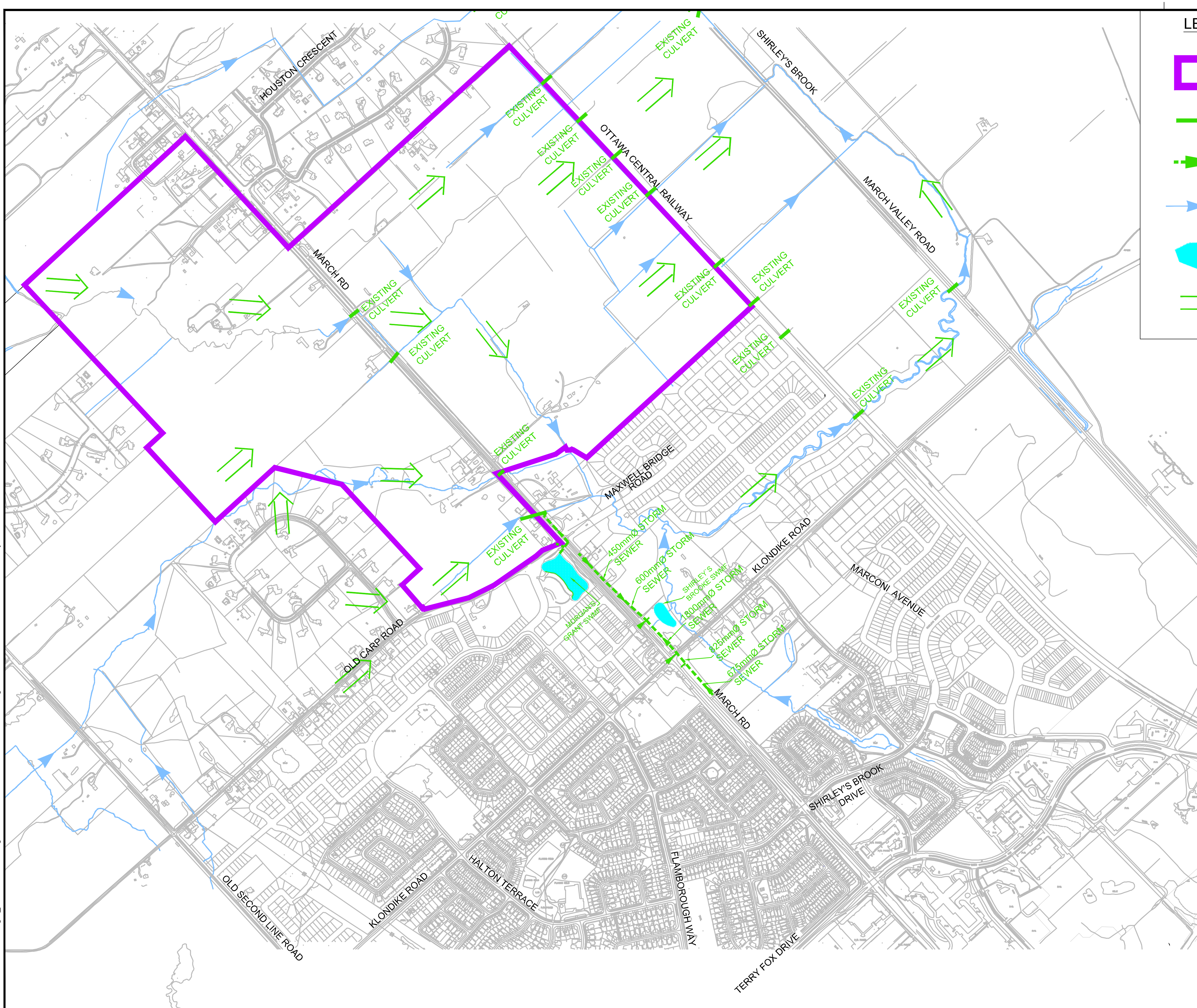
FINAL

JUNE 28, 2016

Engineers, Planners & Landscape Architects

Storm Drainage

- The EMP evaluates the stormwater management servicing options for the KNUEA and recommends servicing the development using three stormwater management ponds. The EMP also outlines design criteria for the stormwater management system.
- The storm drainage design includes a dual-drainage approach and design criteria are provided which provides guidance for future draft plan and site plan applications.
- A preliminary trunk sewer network was designed based on the Demonstration Plan to confirm feasibility of servicing the KNUEA.
- The preliminary trunk sewer network was modelled and adjusted to ensure the HGL for the storm sewer system is no more than 0.6m above the obvert of the storm sewer at any given point.
- A preliminary grading plan was prepared and used to develop overland flow catchment areas.
- Allowable release rates were developed based on land use for the minor and major storm systems. These allowable release rates should be used in future detailed designs for the development.
- A storm sewer servicing evaluation was completed and is summarized to document the results using the criteria and indicators as shown in Section 5.5 on the preferred storm servicing solution.
- Additional capacity has been incorporated into the storm sewer system which permits design flexibility for a moderate degree of intensification within KNUEA and suggests the system can readily accommodate moderate change and minor adjustments to the land use plan are readily accommodated.
- Drainage solutions for two off-site, upstream drainage areas are provided and incorporated into the storm servicing design.
- The existing ditch and culverts within the abandoned rail corridor have the capacity to convey the major system flows from the proposed development to Pond 3.



LEGEND

- KANATA NORTH URBAN EXPANSION AREA (KNUEA)
- EXISTING CULVERTS
- EXISTING MAINLINE STORM SEWER
- EXISTING DRAINAGE CHANNELS
- EXISTING SWM FACILITY
- MAJOR OVERLAND FLOW

KANATA NORTH

COMMUNITY DESIGN PLAN

FIGURE NO. 3.6

EXISTING CONDITIONS
- STORM INFRASTRUCTURE

DATE	JOB
FEB 2016	112117

SCALE
N.T.S.

NOVATECH
Engineers, Planners & Landscape Architects

M:\2012\112117\CAD\Design_MSS\FIGURES\Figure 3.6-STORM INFRASTRUCTURE.dwg, FIG 3-6, Feb 23, 2016 - 10:04am, lseely

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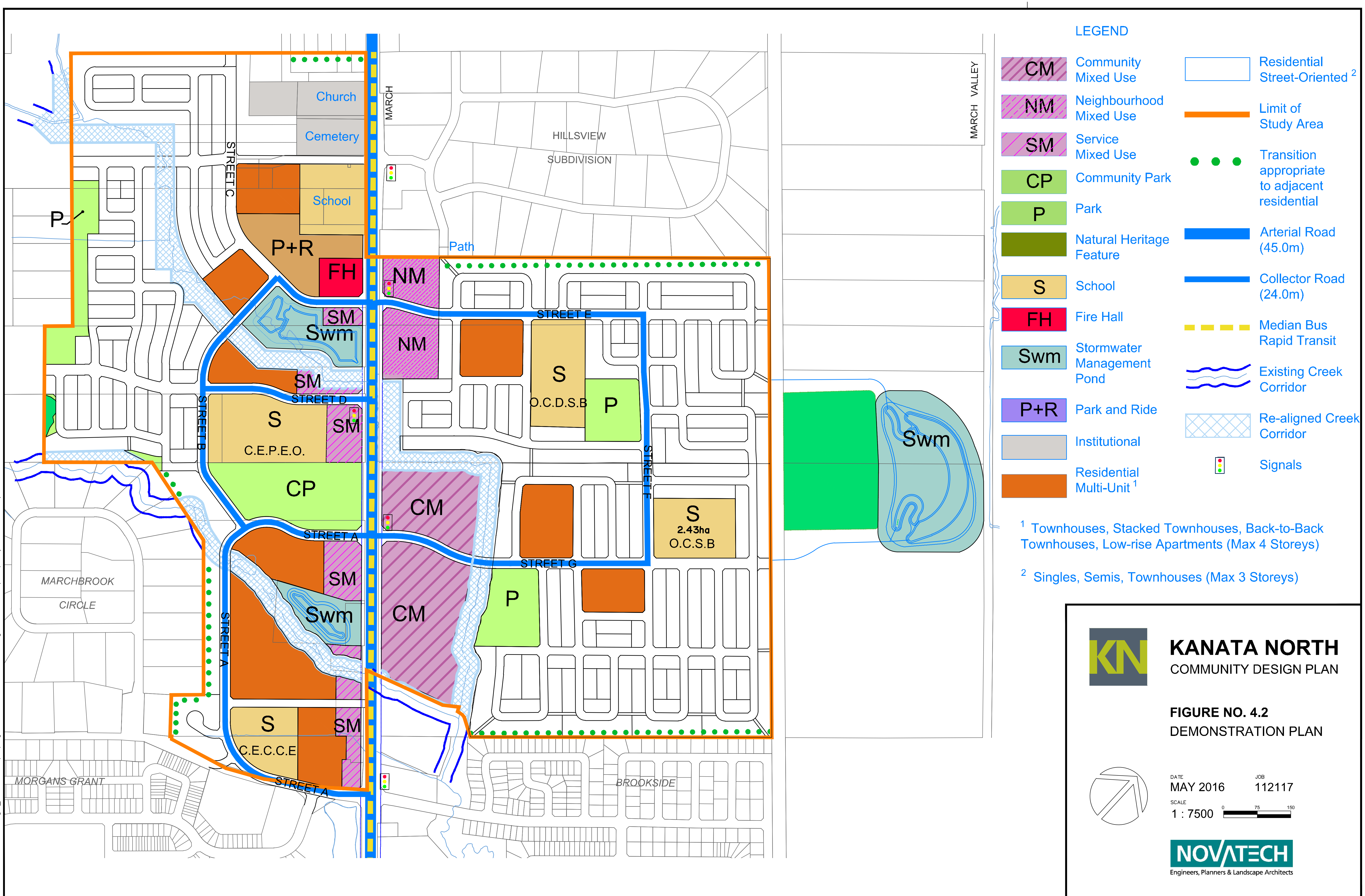


M:\2012\112117\CAD\Design_EMP\MEMO (CS)\Figure 9.1 Demonstration Plan.dwg, DEMO PLAN (MSS), May 26, 2016 - 3:56pm, tbrooks

5.0 STORM DRAINAGE & SERVICING

The Environmental Management Plan (EMP), prepared by Novatech, evaluates the stormwater management servicing options for the KNUEA. The EMP recommends servicing the proposed development with three stormwater management (SWM) ponds to provide water quality, erosion and peak flow control for the proposed development. The conceptual SWM facility design and analysis are provided in the EMP. The location of the SWM ponds and their associated contributing drainage areas are shown on **Figure 5.1**.

5.1 Stormwater Management Criteria

Stormwater management criteria have been established and are outlined in the EMP. The SWM criteria have been developed on the basis of aquatic habitat protection and the sensitivity of the downstream erosion regime. Quality control objectives have been developed based on the recommendations of the Shirleyö Brook and Wattö Creek Subwatershed Study. Quantity control objectives have been developed to ensure there is no adverse impact on the downstream watercourses resulting from the proposed development. A summary of the stormwater management criteria presented in the EMP is provided below.

Quantity Control

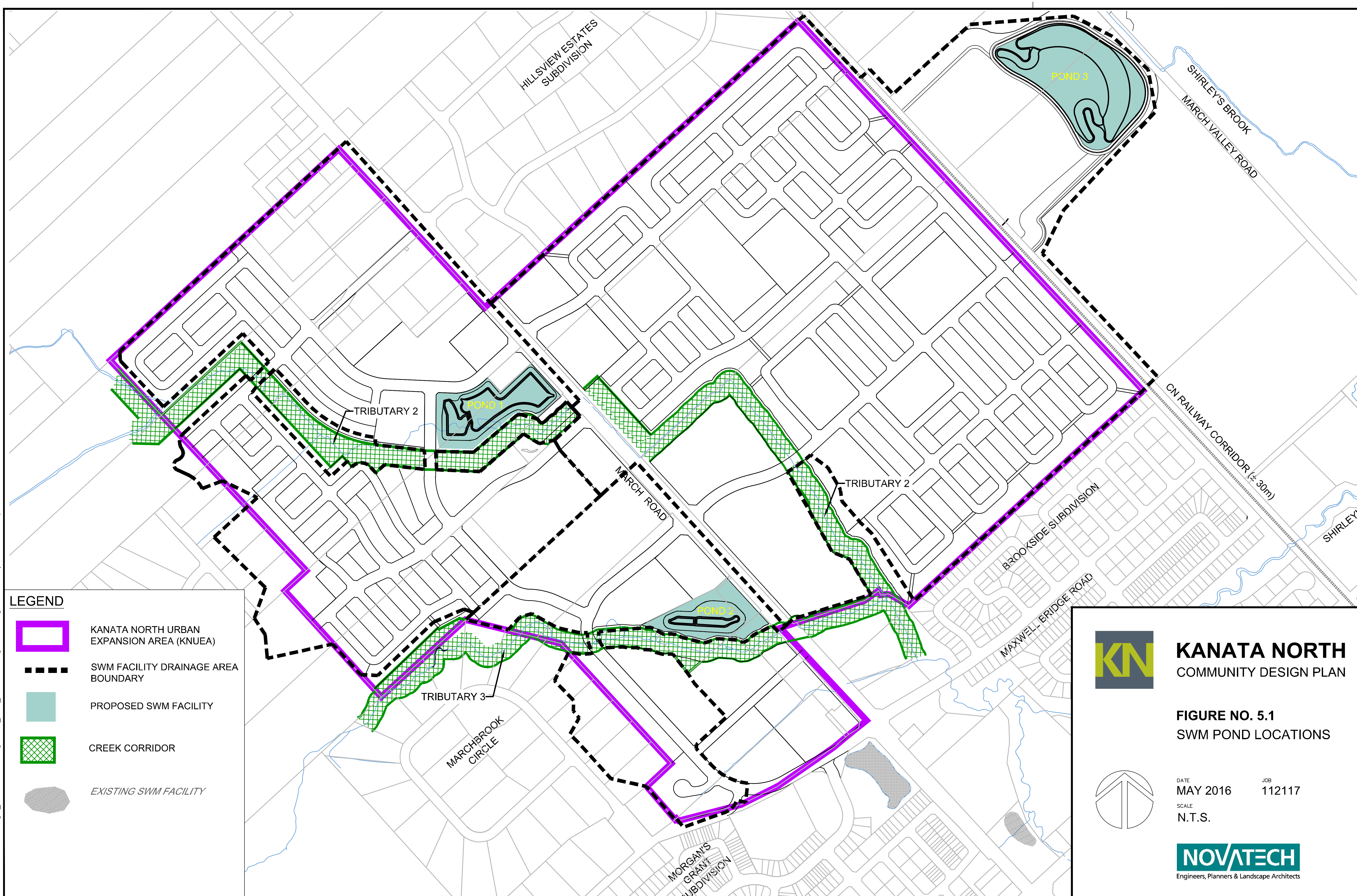
- West of March Road, quantity control storage is to be designed to ensure no increase in peak flow in the receiving watercourses (Tributaries 2 & 3) downstream of the KNUEA;
- East of March Road, post-development peak flows from the development area are to be controlled to pre-development rates for all storms up to and including the 100-year event.
- Ensure no adverse impacts on erosion in the watercourses resulting from future development within the KNUEA.

Quality Control

- An *Enhanced* level of water quality treatment (80% long-term TSS removal) is required for all development within the Shirleyö Brook subwatershed.

Storm Drainage

- Storm drainage within the urban area will be provided using storm sewers sized to convey the uncontrolled 5-year post-development peak flow (10-year for March Road right-of-way).
- Major system flows are to be conveyed within the rights-of-way and/or along defined overland flow routes with no encroachment onto private property.
- Major system flows must not flow overland across arterial roads (March Road).



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KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 5.1
SWM POND LOCATIONS

DATE
MAY 2016

JOB
112117

SCALE
N.T.S.

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Engineers, Planners & Landscape Architects

Watercourse Crossings (Culverts)

- Watercourse crossings are to be sized to convey the 100-year peak flow without overtopping the roadways.
- Watercourse crossings should be designed in accordance with geomorphology principles.
- Watercourse crossings should be designed to ensure they meet any additional requirements for terrestrial and aquatic habitat.

SWM Facilities

- All proposed SWM facilities are to be designed in accordance with the following guidelines and manuals:
    - City of Ottawa Stormwater Management Facility Design Guidelines.
    - MOE SWM Planning and Design Manual.
- The normal water level (permanent pool) in wet ponds should ideally be above the 2-year water level in the receiving watercourse.
- Where possible, sanitary overflows are to be directed to SWM facilities. City design standards for overflows are currently in development. The following sanitary overflow criteria have been applied to the KNUEA:
    - Sanitary overflows are to operate by gravity and be directed to a SWM facility.
    - The sanitary overflow must be above the 100-year elevation in the SWM facility.
- SWM facilities should be integrated into the community through the use of pathways or other linkages.

Geotechnical / Rock Elevation

The proposed stormwater strategies are to be designed to minimize the extent of bedrock excavation as much as possible. The depth to bedrock is relatively shallow in some areas, and some bedrock excavation will be required.

Low Impact Development / Green Stormwater Infrastructure

Low impact development (LID) represents a design philosophy which attempts to minimize the impacts on the hydrologic cycle resulting from development. Green stormwater infrastructure represents the stormwater management technologies used to achieve this objective. The City of Ottawa has recently implemented several LID pilot projects to evaluate the performance and maintenance requirements of LID designs, with the expectation that LID designs will become more prevalent in the near future. The EMP provides general guidance for areas and opportunities where LID techniques could be considered at the plan of subdivision / site plan stage.

5.2 Storm Drainage Design

The MSS has built upon the recommendations of the EMP to develop a preliminary storm servicing design. The conceptual design of the SWM ponds included establishing contributing drainage areas for each SWM pond. These drainage areas were used to establish a conceptual layout of trunk sewers based on the road network shown on the Demonstration Plan (**Figure 4.2**). Factors such as optimizing routing to the outlet location (SWM ponds), minimizing creek crossings, and collection of runoff from upstream drainage areas have been considered as part of the conceptual storm drainage design.

In accordance with City of Ottawa Sewer Design Guidelines (October 2012) a dual drainage approach was applied to the design of the KNUEA storm drainage system, which includes:

- Storm sewers (minor system) will be used for conveyance of runoff up to the 5-year return period (10-year for March Road);
- An overland flow network (major system) consisting of the road network and other defined overland flow routes will be designed to provide safe conveyance of runoff from larger storm events when peak flows exceed the inlet capacity to the minor system.

5.3 Storm Drainage Design – Minor System

5.3.1 Minor System Criteria

The storm sewers servicing the KNUEA are to be designed based on the criteria outlined in the *City of Ottawa Sewer Design Guidelines*, as summarized below:

Return Period

- 5 year - Local and Collector Roads
- 10 year - Arterial Roads and Transitways

Design Flows

- Storm Sewer Design Sheets created using Rational Method
- IDF Rainfall Data as per *City of Ottawa Sewer Design Guidelines*
- Initial Time of Concentration T_c = 15 minutes (trunk sewers only)
- Runoff Coefficients
    - Mixed Use / Commercial C = 0.85
    - Arterial Roads / Transitway C = 0.65
    - Parks C = 0.40
    - Open Space C = 0.20
    - Schools / Church C = 0.65
    - Street Oriented Residential C = 0.65
    - Multi / Unit Residential C = 0.70
    - Park and Ride C = 0.85

Inlet Control Devices

Inlet control devices (ICD) are proposed within the roadways to ensure inflows to the storm sewer system are regulated to the 5-year peak flow (10-year peak flow for arterial roads and transitway). Inlet control devices in catchbasins are to be vertical sliding type for removal and cleaning. ICDs should be selected from the sizes/types listed in Section 13.1.19 of the *Ottawa Sewer Materials Specifications* (March 2014). Final specifications to be provided at detail design.

5.3.2 Trunk Sewer Sizing

The preliminary design of the trunk sewers is based on the road patterns shown on the Demonstration Plan and is intended to provide a preliminary design of the required storm drainage infrastructure. The proposed trunk storm sewer system is shown on **Figure 5.3.2** and drainage areas are shown on the Storm Drainage Area Plan ï Minor System Drainage (112117-STM1) in **Appendix B**. Storm sewer design sheets for the drainage areas tributary to each of the proposed SWM facilities are also provided in **Appendix B**. Prior to Draft Plan Approval the routing of sub-drainage areas tributary to Pond 1 will need to be confirmed once more information on the proposed development is available. Consideration will need to be given to elements including but not limited to grade raise restrictions, rock, any existing storm drainage plans and storm sewer crossings under existing Tributaries. The overall drainage area (sewershed) to Pond 1 will remain unchanged.

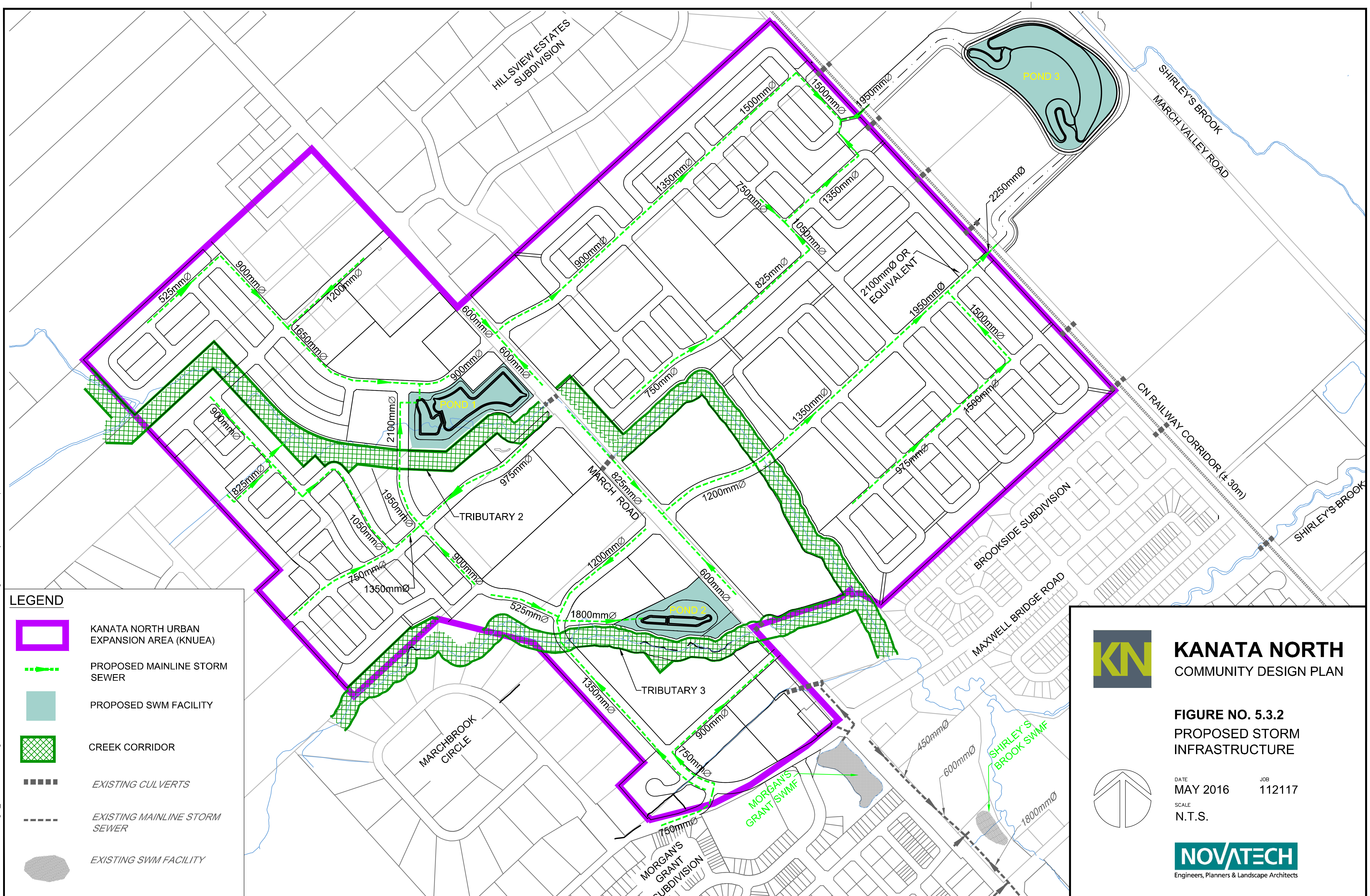
The storm sewer design prepared for the MSS is based on the Demonstration Plan and intended to demonstrate the feasibility of the overall storm servicing strategy. Refinements to the design and layout of the trunk storm sewer system will be made as plans of subdivision are developed. Development plans within the KNUEA should make an effort to maintain the drainage boundaries shown on the above noted drainage area plan since the SWM facility blocks have been sized to accommodate those areas.

It is not anticipated that the grade raise restrictions, as indicated in the various geotechnical investigations, will be a constraining factor in the trunk storm sewer design. The geotechnical information is summarized on **Figure 3.3**.

The preliminary design of trunk sewers includes some rock removal. In particular, there is a portion of the trunk storm sewer in the northwest quadrant that requires some deep rock removal. Refer to the Preliminary Plan and Profiles (Drawings 112117-PP5 and 112117-PP11 in **Appendix E**). This section of sewer has been designed to collect drainage from a low area, through the KNUEA and outlet to Pond 1. **Figure 5.3.3** shows this area. Another option would be to drain this low area to a sewer along March Road which would still outlet to Pond 1. This option still requires rock removal and overall more storm sewer. When the type of housing and final road patterns are more defined, a cost benefit analysis could be completed to determine which option is preferable.

5.3.3 Hydraulic Grade Line Analysis - Trunk Storm Sewers

A preliminary hydraulic grade line (HGL) analysis of the trunk storm sewers was undertaken using the Autodesk Storm and Sanitary Analysis (SSA) model. This model is based on EPA SWMM 5.0 and can be exported to a generic SWMM5 file, which can then be used in PCSWMM or any other modelling software based on the EPA SWMM engine. The HGL generated as part of this study is preliminary in nature and was used only to confirm feasibility of the proposed storm sewer sizing. Prior to any draft plan approvals, the HGL



M:\2012\112117\CAD\Design_MSS\FIGURES\Figure 5.3.2-PROP STORM INFRASTRUCTURE.dwg, FIG 5, May 18, 2016 - 3:15pm, mhrehoriak

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5.4 Storm Drainage Design - Major System

A conceptual analysis of the major system was completed to evaluate the conveyance of overland flows exceeding the capacity of the minor system during the 100-year storm event.

5.4.1 Major System Criteria

Design of the major system will adhere to the design standards outlined in Section 5.5 of the *City of Ottawa Sewer Design Guidelines*. Criteria used in the major system design are summarized below:

Major System Flow Outlets
Major system flow must be directed to either:

- One of the proposed SWM facilities; or
- An outlet watercourse.

Maximum Flow/Velocity on Streets
For overland flow the product of the Velocity (m/s) x Depth (m) should not be greater than 0.6.

Cross-Street Flow
No cross-street flow is permitted for the minor (5-year) storm event, and there is to be only minimal ponding within the roadways. Major system flow from local streets can be conveyed to other local or collector roads, or to a SWM facility or watercourse.

Major System Flow Depths
For events exceeding the minor system design storm and up to the 100 year design storm, flow depth is permitted in the right of way up to the following maximum water depths:

- Local: 300mm at edge of pavement
- Collector: 250mm at edge of pavement
- Arterial: No barrier curbs overtopping. Flow spread must leave at least one lane free of water in each direction

It should also be noted that during detailed design, where possible, it is desirable to promote overland sheet drainage directly to the tributaries from primarily vegetated open spaces (i.e. School yards, parks, and low density residential rear yards). These mainly pervious areas will generally have ócleanôrunoff, and as such do not require quality or quantity treatment. Allowing these vegetated areas to sheet drain will help distribute major system flows along the tributaries, which will reduce the flows directed along the proposed rights-of-way, and to the SWM ponds.

Where on-site storage is provided up to the 100-year event and if locations permit, major system flows in excess of the 100-year storm event may be allowed to flow overland directly to the tributaries.

Culverts

There are various culverts proposed to service the KNUEA. These culverts include:

- Existing culverts crossing March Road. These existing culverts have been evaluated in terms of condition and capacity in the EMP.
- Existing culverts crossing the abandoned rail corridor. These existing culverts have been evaluated in the MSS to confirm there is capacity to convey major flows from the proposed development.
- Proposed culverts for the road crossings proposed along Tributary 2 and 3. Supporting calculations for these proposed culverts are included in the EMP.

It should be noted that there will be services located at the tributary crossings including storm sewer, sanitary sewer and watermain. The proposed trenches for these crossings will be in rock and will require a clay cap to prevent surface water in the tributaries from migrating into the underlying trenches. Prior to Draft Plan Approval the details of the crossings will need to be confirmed to ensure City requirements have been met.

5.4.2 Major System Drainage Areas

A preliminary grading plan was developed using the Demonstration Plan. This Preliminary Grading Plan provides preliminary grades at key points such as intersections and defines the major system overland flow routes within the KNUEA. A major system drainage area plan was developed based on this preliminary macro-grading plan that subdivides the site into overland flow catchment areas. The macro-grading is shown on the Preliminary Grading Plan (112117-PGR) in **Appendix E**. Prior to Draft Plan Approval the routing of sub-drainage areas in the northwest quadrant tributary to Pond 1 and specifically the Park and Ride block will need to be confirmed once more information on the proposed development is available. Consideration will need to be given to elements including grade raise restrictions, shallow rock, overland flow routes and any existing storm drainage plans. The overall drainage area (sewershed) to Pond 1 will remain unchanged.

The northwest quadrant of the KNUEA, including portions of March Road will be graded to direct the major system drainage to Pond 1. The southwest quadrant will be graded, where possible, to direct the major system drainage to Pond 2. Some areas of the southwest quadrant are at a lower elevation and the major system flow will be directed either along March Road directly to Tributary 3, or to cross under March Road to Pond 3.

East of March Road, the major system drainage will be directed along collector roads, and cross through existing and proposed culverts (if required) along the abandoned rail corridor and outlet into the proposed drainage swales leading to Pond 3. The existing culverts have been evaluated and have capacity to convey the proposed flows. However, there may be more preferable locations for culverts to cross the abandoned rail corridor therefore, new culverts may be proposed during the detail design. It is also anticipated that the existing abandoned rail corridor drainage ditch will be used to provide rear yard drainage for lots adjacent to the rail corridor, as well as provide conveyance for the major system from the proposed subdivision to the various culverts crossing the abandoned rail corridor. The existing ditch has also been evaluated and has capacity to convey the major flows from the proposed development. A figure showing the ditch sections and culvert locations, and capacity calculations are included in **Appendix B.**

Prior to Draft Plan Approval, the assumptions and calculations made will need to be confirmed and the following requirements will need to be addressed:

- Grade raise restrictions;
- Property limits identified;
- Major system flow encroachment onto private property;
- Adequate maintenance access.

The major system drainage areas are shown on the Storm Drainage Area Plan ï Major System Drainage (112117-STM2) in **Appendix B**. The major and minor system drainage boundaries may differ due to site topography and should be confirmed during detail design.

5.4.3 Major System Design Flows

Conceptual major system design flows were determined based on land use and are summarized in **Table 5.4.3**. The anticipated flow rates shown in the table are cumulative for a given site.

- Example: During a 100-year event, a collector road is assumed to discharge 145 L/s/ha into the minor drainage system (storm sewers) and an additional 125 L/s/ha into the major drainage system (overland flow).

Storage in Roadways

Storage within road sags has not been included in the analysis of the major overland system given the general topography of the site. The conceptual grading design does not include any road sags on collector roads, except at the major system inlets to the SWM facilities.

Storage in roads is not precluded, and during the detailed design stage road sag storage could be implemented where appropriate.

Low / Medium Density Residential Areas

The KNUEA is comprised mainly of low and medium density residential development and the stormwater management methodology is different than for larger, single outlet sites (i.e. commercial/institutional). The routing of major system flows through local streets and rear yards of residential areas attenuates peak flows in the major system. The total flow will still increase as the upstream area increases, but the per hectare rate will gradually decrease. This concept is similar to the minor system design where a greater time of concentration for a given catchment area will reduce unit (per hectare) flows.

The attenuation of major system flows has been accounted for in the major system analysis by using SWMHYMO to simulate major and minor system runoff from generic residential drainage areas ranging in size from 5 hectares to 25 hectares ï refer to **Figure 5.4.3**.

- Example: During a 100-year event, a 10ha medium density residential area will generate 90L/s/ha of major system runoff. If this runoff is routed through another 10ha medium density residential area, the total major system flow from the combined 20ha area will have been attenuated to approximately 70 L/s/ha.

Commercial / Institutional / Multi-Unit Residential Areas

The major system analysis also assumes that on-site storage will be provided for commercial, institutional, and multi-unit residential areas for storms greater than the 5-year and up to the 100-year event, and that no major system flows will be generated for these areas. The overall site grading does provide major drainage outlets from these areas in the event that the available on-site storage is exceeded.

Table 5.4.3: Estimated Major System Peak Flows and Runoff Volumes

Land Use	'C'	% Imperv	Minor System Inlet Rate (L/s/ha)	Major System Discharge Rate (L/s/ha)
Arterial Roads / Transitway	0.65	64%	185	101
Collector Roads	0.70	71%	145	125
Mixed Use / Commercial	0.85	93%	150	0
Schools/Church	0.65	64%	115	130
Parks	0.40	29%	70	12
Open Space	0.20	0%	50	26
Street Oriented Residential	0.65	64%	100	Varies, see Figure 5.4.3
Multi Unit Residential	0.70	71%	115	Varies, see Figure 5.4.3
Park and Ride	0.85	93%	185	0

5.8 Storm Summary and Recommendations

Following is a summary of the storm sewer system findings for the Kanata North Urban Expansion Area Lands:

- The EMP evaluates the stormwater management servicing options for the KNUEA and recommends servicing the development using three stormwater management ponds. The EMP also outlines design criteria for the stormwater management system.
- The storm drainage design includes a dual-drainage approach and design criteria are provided which provides guidance for future draft plan and site plan applications.
- A preliminary trunk sewer network was designed based on the Demonstration Plan to confirm feasibility of servicing the KNUEA.
- The preliminary trunk sewer network was modelled and adjusted to ensure the HGL for the storm sewer system is no more than 0.6m above the obvert of the storm sewer at any given point.
- A preliminary grading plan was prepared and used to develop overland flow catchment areas.
- Allowable release rates were developed based on land use for the minor and major storm systems. These allowable release rates should be used in future detailed designs for the development.
- A storm sewer servicing evaluation was completed and is summarized to document the results using the criteria and indicators as shown in Section 5.5 on the preferred storm servicing solution.
- Additional capacity has been incorporated into the storm sewer system which permits design flexibility for a moderate degree of intensification within KNUEA and suggests the system can readily accommodate moderate change and minor adjustments to the land use plan are readily accommodated.
- Drainage solutions for two off-site, upstream drainage areas are provided and incorporated into the storm servicing design.
- The existing ditch and culverts within the abandoned rail corridor have the capacity to convey the major system flows from the proposed development to Pond 3.

Appendix D GEOTECHNICAL INVESTIGATION EXCERPTS

Geotechnical Engineering

Environmental Engineering

Archaeological Studies

Hydrogeology

Geological Engineering

Materials Testing

Archaeological Studies

patersongroup

Consolidated Preliminary Geotechnical Investigation

Kanata North Urban Expansion Area
Community Development Plan
March Road
Ottawa, Ontario

Prepared For

Novatech Engineering Consultants

October 7, 2013

Report PG2878-1R

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4.0 OBSERVATIONS

4.1 Surface and Subsurface Observations

The subject site currently covers an area of approximately 194 hectares. The majority of the site is undeveloped (tilled agricultural or treed) areas. Observations at the subject properties are presented below.

927 March Road

The vacant property located at 927 March Road is relatively flat, grass covered agricultural farm land. Several mature trees follow the 1.5 to 2.5 m deep creek that meanders diagonally through the subject site. It was observed during out field investigation that the shallow creek is flowing on the bedrock surface in several locations across the site.

The subsoil conditions at the test hole locations consist of a surficial topsoil layer underlain by a very stiff silty clay deposit followed by a glacial till layer and sound bedrock encountered at all test holes on the two parcels of land located on 927 March Road.

936 March Road

The vacant property located at 936 March Road consists of mostly undeveloped land. Dense bush was noted in the northwestern portion of the site. The site is bisected by an existing rail track. The remainder of the site consists of agricultural land or an existing fam house. A significant slope was noted to exist north of the residential house, but south of the existing rail tracks.

The subsoil conditions at the test hole locations consist of topsoil, agricultural soil or fill underlain by a stiff to very stiff silty clay deposit. Glacial till was noted below the silty clay in the southern portion of the property. Practical refusal to excavation was also noted in the southern portion of the site.

1015 and 1035 March Road

1015 and 1035 March Road is currently grass covered with several large trees bordering the property. The site slopes gradually downward to the east toward to the meandering creek located within the east portion of the subject site.

Generally, the subsoil conditions at the test hole locations consist of topsoil underlain by very stiff brown silty clay or bedrock. Glacial till was encountered below the silty clay at TP 1,TP 3, TP 4, TP 5, TP 9, TP 10 and TP 11 at depths varying between 1.1 m and 2.1 m below ground surface. Practical refusal to excavation was encountered at all test hole locations between ground surface to 3.2 m depth.

1020 March Road

1020 March Road is divided into two parcels by a railway line easement. The portion of the site located to the east of the railway line easement is heavily wooded, whereas the remainder of the subject site is grass covered with some young tree growth. An approximately 9 m high slope running in a north-south direction crosses the central portion of the subject site.

The subsurface profile encountered at the test pit locations, consists of topsoil, compact silty sand, stiff silty clay and/or a glacial till layer. Practical refusal to excavation was encountered between 0.2 and 4 m depth at all test pit locations, except TP 1, TP 3, TP 4, TP 7 to TP 12.

1070 March Road

1070 March Road consists of a berry farm. The majority of the site is agricultural fields with associated outbuildings and a residential dwelling located within the central portion of the site. Based on available topographic mapping, the west portion of the site is relatively flat and approximately at grade with neighbouring properties and the east portion of the site slopes gradually downward to the east. An approximately 4 to 5 m high slope running in a north-south direction located within the central portion of the site divides the east and west portions of the subject site.

The subsurface profile encountered at the test pit locations, consists of topsoil and compact silty sand or stiff silty clay. A glacial till layer was noted at all test pit locations. Practical refusal to excavation was encountered between 0.9 and 4.6 m depth at all test pit locations, except TP 6, which extended to a 4.6 m depth.

1075 March Road

1075 March Road consists of undeveloped, agricultural land. The ground surface across the site is relatively flat and a shallow ditch was noted to bisect the subject site.

Generally, the subsoil conditions at the test hole locations consist of topsoil underlain by very stiff brown silty clay, glacial till and/or bedrock.

1145 March Road

1145 March Road is undeveloped and grass covered. The site slopes gradually downward to the east.

The subsoil conditions at the test hole locations consist of topsoil underlain by very stiff brown silty clay, silty sand/sandy silt, glacial till and/or bedrock. Practical refusal to excavation was encountered between 0.7 to 3.2 m below surface at all test hole locations.

Based on available geological mapping, the bedrock below the majority of the subject site consists of interbedded sandstone and dolomite of the March formation. Below the east portion of the site, bedrock consists of either dolomite of the Oxford formation or sandstone of the Nepean formation. The overburden thickness varies from 0 to 10 m depth throughout the proposed development area, with shallow bedrock encountered within the west portion of the site.

4.2 Groundwater

Groundwater levels (GWL) were measured in the test pits upon completion of the field program. The results are summarized in Table 1. It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater levels could vary at the time of construction.

Table 1 - Summary of Groundwater Level Readings

Test Pit Number	Ground Surface Elevation (m)	Groundwater Level (m)	Groundwater Depth (m)	Recording Date
PG1626 - 927 March Road				
TP 1	--	1.60	--	February 25, 2008
TP 2	--	0.70	--	February 25, 2008
TP 3	--	dry	--	February 25, 2008
TP 4	--	1.00	--	February 25, 2008
TP 5	--	1.60	--	February 25, 2008
PG1716 - 1015 and 1035 March Road				
TP 1	81.70	1.75	79.95	July 9, 2008
TP 2	83.10	dry	--	July 9, 2008
TP 3	83.80	1.75	82.05	July 9, 2008
TP 4	86.20	1.20	85.00	July 9, 2008
TP 5	86.80	1.10	85.70	July 9, 2008

Table 1 - Summary of Groundwater Level Readings

Test Pit Number	Ground Surface Elevation (m)	Groundwater Level (m)	Groundwater Depth (m)	Recording Date
PG1716 - 1015 and 1035 March Road				
TP 6	90.70	dry	--	July 9, 2008
TP 7	89.40	dry	--	July 9, 2008
TP 8	88.80	dry	--	July 9, 2008
TP 9	81.90	1.50	80.40	July 9, 2008
TP 10	88.40	2.65	85.75	July 9, 2008
TP 11	89.50	dry	--	July 9, 2008
PG1823 - 1145 March Road				
TP 1	88.10	dry	--	February 9, 2009
TP 2	88.57	1.40	87.17	February 9, 2009
TP 3	85.48	dry	--	February 9, 2009
TP 4	88.13	dry	--	February 9, 2009
TP 5	88.50	dry	--	February 9, 2009
TP 6	89.10	dry	--	February 9, 2009
TP 7	88.06	1.80	86.26	February 9, 2009
TP 8	89.86	1.10	88.76	February 9, 2009
TP 9	91.42	1.90	89.52	February 9, 2009
TP 10	90.76	2.50	88.26	February 9, 2009
TP 11	90.22	1.00	89.22	February 9, 2009
TP 12	89.26	dry	--	February 9, 2009
PG2256 - 1070 March Road				
TP 1	--	1.80	--	November 4, 2010
TP 2	--	2.40	--	November 4, 2010
TP 3	--	1.40	--	November 4, 2010
TP 4	--	1.80	--	November 4, 2010
TP 5	--	1.70	--	November 4, 2010
TP 6	--	dry	--	November 4, 2010
TP 7	--	dry	--	November 4, 2010
TP 8	--	2.10	--	November 4, 2010
TP 9	--	dry	--	November 4, 2010
TP 10	--	1.80	--	November 4, 2010

Table 1 - Summary of Groundwater Level Readings

Test Pit Number	Ground Surface Elevation (m)	Groundwater Level (m)	Groundwater Depth (m)	Recording Date
PG2256 - 1070 March Road				
TP 11	--	1.10	--	November 4, 2010
TP 12	--	2.00	--	November 4, 2010
TP 13	--	2.20	--	November 4, 2010
PG2878 - 936 and 1075 March Road				
TP 1	78.55	dry	--	March 11, 2013
TP 2	77.89	1.70	76.19	March 11, 2013
TP 3	78.58	dry		March 11, 2013
TP 4	78.91	1.80	77.11	March 11, 2013
TP 5	78.22	1.20	77.02	March 11, 2013
TP 6	79.28	1.80	77.48	March 11, 2013
TP 7	78.81	dry	--	March 11, 2013
TP 8	78.84	dry	--	March 11, 2013
TP 9	78.71	dry	--	March 11, 2013
TP 10	70.43	0.76	69.67	March 20, 2013
TP 11	70.02	0.38	69.64	March 20, 2013
TP 12	69.71	2.30	67.41	March 20, 2013
TP 13	69.87	2.70	67.17	March 20, 2013
TP 14	69.90	dry	--	March 20, 2013
TP 15	68.82	dry	--	March 20, 2013
TP 16	69.61	3.30	66.31	March 21, 2013
TP 17	69.25	dry	--	March 21, 2013
TP 18	67.12	1.22	65.90	March 20, 2013
TP 19	66.43	1.50	64.93	March 20, 2013
TP 20	66.31	2.70	63.61	March 20, 2013
TP 21	65.90	2.10	63.80	March 20, 2013
TP 22	66.83	2.70	64.13	March 20, 2013
TP 23	66.94	1.80	65.14	March 20, 2013
TP 24	75.76	dry	--	March 21, 2013
TP 25	89.66	dry	--	March 21, 2013
TP 26	89.74	dry	--	March 21, 2013

Table 1 - Summary of Groundwater Level Readings

Test Pit Number	Ground Surface Elevation (m)	Groundwater Level (m)	Groundwater Depth (m)	Recording Date
PG2878 - 936 and 1075 March Road				
TP 27	88.96	dry	--	March 21, 2013
TP 28	86.85	dry	--	March 21, 2013
TP 29	86.13	dry	--	March 21, 2013
TP 30	86.42	dry	--	March 21, 2013
TP 31	88.37	dry	--	March 21, 2013
TP 32	86.81	dry	--	March 21, 2013
TP 33	84.00	dry	--	March 21, 2013
TP 34	84.02	dry	--	March 21, 2013
TP 35	82.99	2.70	80.29	March 21, 2013
TP 36	84.76	2.60	82.16	March 21, 2013
Test Holes by Others - 1020 March Road				
TP 1	81.35	3.00	78.35	December 10, 2012
TP 2	79.06	1.50	77.56	December 10, 2012
TP 3	78.49	1.50	76.99	December 10, 2012
TP 4	79.62	4.10	75.52	December 10, 2012
TP 5	79.42	2.70	76.72	December 10, 2012
TP 6	78.40	1.50	76.90	December 10, 2012
TP 7	79.41	4.00	75.41	December 10, 2012
TP 8	79.41	dry	--	December 10, 2012
TP 9	79.59	dry	--	December 10, 2012
TP 10	79.21	4.00	75.21	December 10, 2012
TP 11	78.57	0.80	77.77	December 10, 2012
TP 12	80.02	3.40	76.62	December 10, 2012
TP 13	72.12	dry	--	December 10, 2012
TP 14	70.57	1.80	68.77	December 10, 2012
TP 15	70.32	3.90	66.42	December 10, 2012
TP 16	70.73	1.20	69.53	December 10, 2012
TP 17	70.77	1.20	69.57	December 10, 2012
TP 18	70.96	2.00	68.96	December 10, 2012
TP 19	70.36	dry	--	December 10, 2012

5.0 DISCUSSION

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is adequate for the anticipated development. It is expected that low rise wood framed buildings or mid to high rise buildings could be founded on conventional shallow footings placed on an undisturbed, stiff silty clay, compact silty sand, compact glacial till or surface-sounded bedrock bearing surface.

A permissible grade raise restriction is required for the proposed residential development where the silty clay layer is present below the proposed buildings. Areas effected by a permissible grade raise restriction due to the presence of a silty clay deposit are indicated in Drawing PG2878-2 - Permissible Grade Raise Areas - Housing in Appendix 2.

The above and other considerations are discussed in the following paragraphs.

5.2 Site Grading and Preparation

Stripping Depth

Topsoil, and any deleterious fill, such as those containing organic materials, should be stripped from under any buildings and other settlement sensitive structures. Other settlement sensitive structures include, but are not limited to, underground services and paved areas.

Existing foundation walls and other construction debris should be entirely removed from within the building perimeter. Under paved areas, existing construction remnants such as foundation walls should be excavated to a minimum of 1 m below final grade.

Bedrock Removal

It is expected that line-drilling in conjunction with hoe-ramming or controlled blasting may required to remove the bedrock. In areas of weathered bedrock and where only a small quantity of bedrock is to be removed, bedrock removal may be possible by hoe-ramming.

7.0 RECOMMENDATIONS

It is a requirement for the foundation design data provided herein to be applicable that a materials testing and observation services program including the following aspects be performed by the geotechnical consultant.

❑ A detailed geotechnical investigation should be completed to City of Ottawa standards for the subject site.

❑ Observation of all bearing surfaces prior to the placement of concrete.

❑ Sampling and testing of the concrete and fill materials used.

❑ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.

❑ Observation of all subgrades prior to backfilling

❑ Field density tests to determine the level of compaction achieved.

❑ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued, upon request, following the completion of a satisfactory materials testing and observation program by the geotechnical consultant.

NO.	REVISIONS	DATE	INITIAL

patersongroup
consulting engineers
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SCALE: 1:3000
DESIGN: SB
DRAWN: MPG
CHECKED: DG
DATE: 04/2013

CONSOLIDATED PRELIMINARY GEOTECHNICAL INVESTIGATION
KANATA NORTH URBAN EXPANSION AREA
COMMUNITY DEVELOPMENT PLAN - MARCH ROAD
OTTAWA, ONTARIO

DWG. NO. PG2878-1

NOVATECH ENGINEERING CONSULTANTS LTD.

TEST HOLE LOCATION PLAN

PERMISSIBLE GRADE RAISE:

UP TO 2m

LEGEND:

- TEST PIT LOCATION, CURRENT INVESTIGATION
- TEST PIT LOCATION, PREVIOUS INVESTIGATION PATERSON GROUP REPORT PG2256, 2011
- TEST PIT LOCATION, PREVIOUS INVESTIGATION PATERSON GROUP REPORT PG1823, 2009
- TEST PIT LOCATION, PREVIOUS INVESTIGATION PATERSON GROUP REPORT PG1716, 2008
- TEST PIT LOCATION, PREVIOUS INVESTIGATION PATERSON GROUP REPORT PG1626, 2008
- TEST PIT LOCATION BY OTHERS
- 78.55 GROUND SURFACE ELEVATION (m)
- [76.39] BEDROCK SURFACE ELEVATION (m)
- (64.10) PRACTICAL REFUSAL TO EXCAVATION ELEV. (m)
- (3.4) DEPTH TO PRACTICAL REFUSAL (m)

BASE PLAN, TEST HOLE LOCATIONS (CURRENT INVESTIGATION) AND GROUND SURFACE ELEVATIONS AT TEST HOLE LOCATIONS PROVIDED BY ANNIS, O'SULLIVAN, VOLLEBEKK LIMITED.

SCALE = 1:3000

0 50 100 200m

NO.	REVISIONS	DATE	INITIAL

patersongroup
consulting engineers
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SCALE:	1:3000
DESIGN:	SB
DRAWN:	MPG
CHECKED:	DG
DATE:	04/2013

CONSOLIDATED PRELIMINARY GEOTECHNICAL INVESTIGATION
KANATA NORTH URBAN EXPANSION AREA
COMMUNITY DEVELOPMENT PLAN - MARCH ROAD
OTTAWA, ONTARIO

DWG. NO. PG2878-2

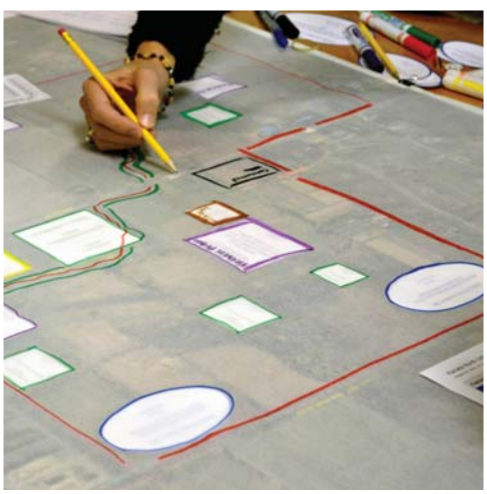
NOVATECH ENGINEERING CONSULTANTS LTD.

PERMISSIBLE GRADE RAISE PLAN - HOUSING

KN

KANATA NORTH
COMMUNITY DESIGN PLAN

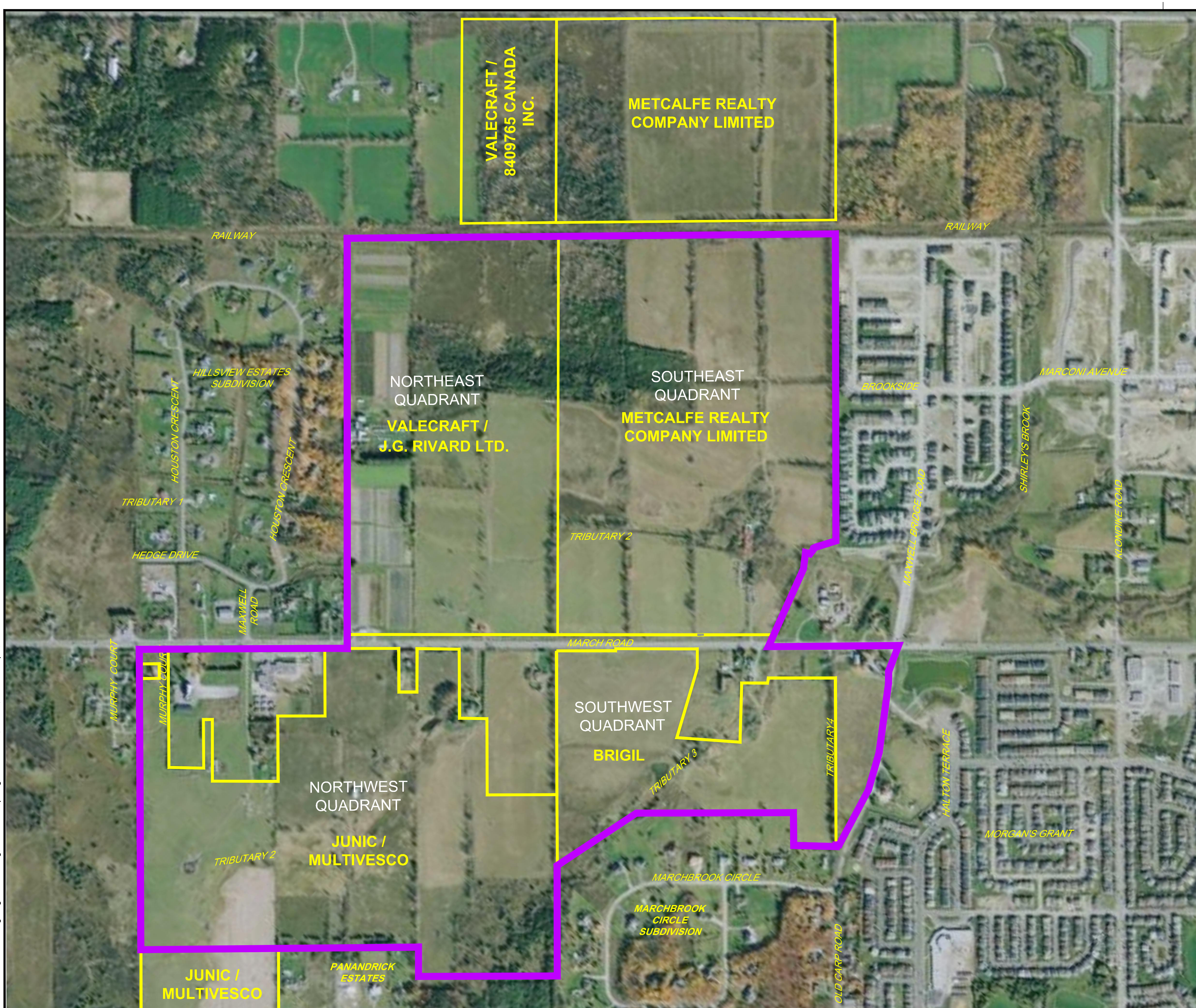
MASTER SERVICING STUDY **REPORT**



FINAL
JUNE 28, 2016

Ottawa

NOVATECH
Engineers, Planners & Landscape Architects



LEGEND

KANATA NORTH URBAN EXPANSION AREA (KNUEA)

LAND OWNED BY SPONSORING LANDOWNERS

KN

KANATA NORTH

COMMUNITY DESIGN PLAN

FIGURE NO. 3.1

OWNERSHIP PLAN

DATE: APRIL 2016

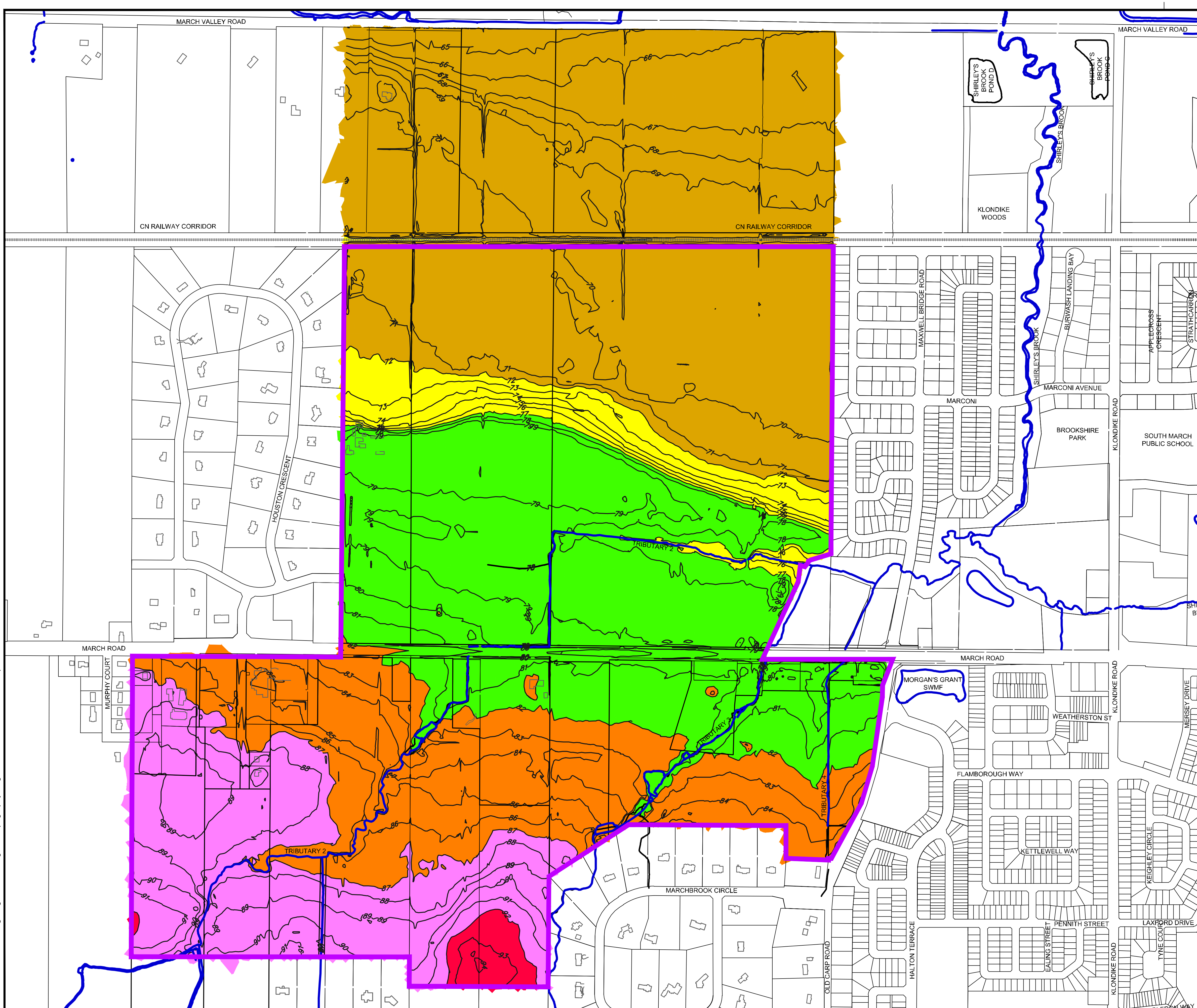
JOB: 112117

SCALE: N.T.S.

NOVATECH

Engineers, Planners & Landscape Architects

M:\2012\112117\CAD\Design\Figures\MSS\Fig 3.1-Ownership.dwg, FIGURE 3.1, Mar 31, 2016 - 2:31pm, tbrooks



LEGEND

KANATA NORTH URBAN EXPANSION AREA (KNUEA)

CONTOUR LINE AND ELEVATION

Elevations Table

Number	Minimum Elevation	Maximum Elevation	Colour
1	64.00	72.00	
2	72.00	77.00	
3	77.00	82.00	
4	82.00	87.00	
5	87.00	92.00	
6	92.00	94.00	

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 3.2
EXISTING TOPOGRAPHY

DATE FEB 2016

JOB 112117

SCALE N.T.S.

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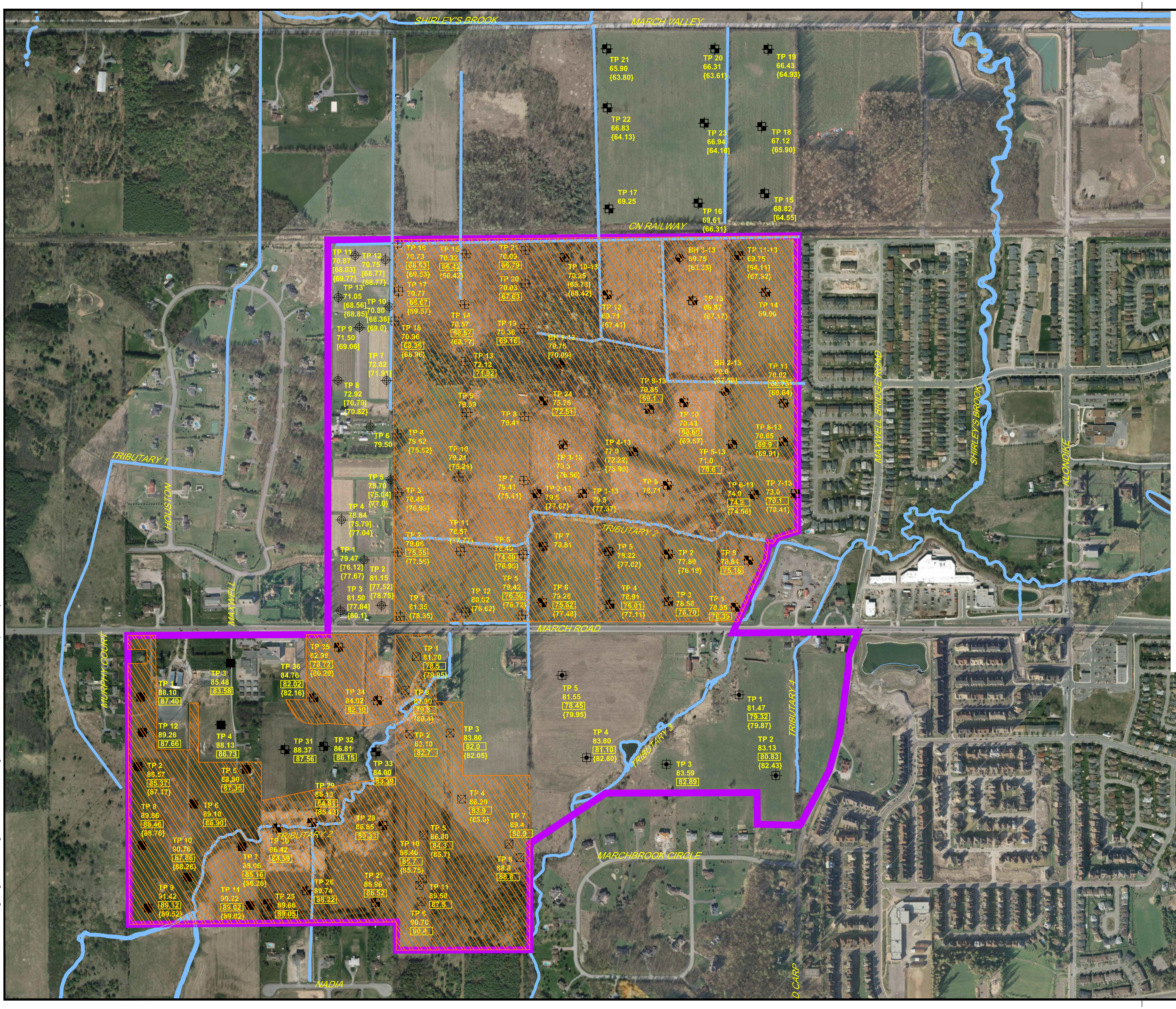
M:\2012\112117\CAD\Design\Figures\MSS\Fig 3.2-Topography.dwg, FIG 3.2, Feb 23, 2016 - 2:34pm, tbrooks



LEGEND

	KANATA NORTH URBAN EXPANSION AREA (KNUEA)
	EXISTING DRAINAGE CHANNEL
	IDENTIFIED MAXIMUM PERMISSIBLE GRADE RAISE LESS THAN 1.5m TO 3.0m
	TEST PIT LOCATION, CURRENT INVESTIGATION PATTERSON GROUP REPORT PG2878
	TEST PIT LOCATION, PREVIOUS INVESTIGATION PATERSON GROUP REPORT PG2256, 2011
	TEST PIT LOCATION, PREVIOUS INVESTIGATION PATERSON GROUP REPORT PG1823, 2009
	TEST PIT LOCATION, PREVIOUS INVESTIGATION PATERSON GROUP REPORT PG1716, 2008
	TEST PIT LOCATION, PREVIOUS INVESTIGATION PATERSON GROUP REPORT PG1626, 2008
	TEST PIT LOCATION BY OTHERS
78.55	GROUND ELEVATION (m)
76.39	BEDROCK ELEVATION (m)
[64.10]	PRACTICAL REFUSAL TO EXCAVATION ELEV. (m)
{76.19}	GROUNDWATER ELEVATION (m)

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 3.3
GEOTECHNICAL INFORMATION

DATE FEB 2016
JOB 112117
SCALE N.T.S.

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M:\2012\112117\CAD\Design\Figures\MSS\Fig 3.3-Geotechnical.dwg, FIGURE 3.3, Mar 30, 2016 - 2:29pm, lseely

SHT11x17.DWG - 279mmx432mm

Appendix E DRAWINGS