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Brown Lands

Serviceability and Conceptual Stormwater Management Report

Prepared for: Strathburn Almonte Regional Inc.

SERVICEABILITY AND CONCEPTUAL STORMWATER MANAGEMENT REPORT

BROWN LANDS

Municipality of Mississippi Mills, Ontario

Prepared For:

Strathburn Almonte Regional Inc.

Prepared By:

NOVATECH
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario
K2M 1P6

February 2023

Novatech File: 118178
Ref: R-2023-016

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February 10, 2023

Julie Stewart, MCIP RPP, County Planner
County of Lanark
Planning Department
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Perth, ON K7H 3C6

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Development Services and Engineering
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Reference: Brown Lands
Serviceability and Conceptual Stormwater Management Report
Our File No.: 118178

Please find enclosed the report entitled "Serviceability and Conceptual Stormwater Management Report" dated February 10, 2023 prepared for the proposed Brown Lands residential development.

The report outlines the preliminary servicing design for the proposed development with respect to water distribution, sanitary servicing and storm drainage, as well as a preliminary approach to stormwater management. This report is submitted in support of an application for a Draft Plan of Subdivision.

If you require any additional information, please contact the undersigned.

Yours truly,

NOVATECH

Trevor McKay, P.Eng.
Project Manager

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1.0 INTRODUCTION

1.1 Purpose

Novatech has been retained to prepare a serviceability and conceptual stormwater management report in support of an application for Draft Plan of Subdivision for lands located within the urban boundary of the ward of Almonte. The project is being advanced by Strathburn Almonte Regional Inc. (c/o Regional Group).

This report outlines the conceptual servicing design for the Brown Lands residential development (Subject Site) with respect to water distribution, sanitary servicing, storm drainage, and approach to stormwater management.

1.2 Site Location and Description

The Subject Site is a parcel approximately 17ha in size and is situated at the northwestern quadrant of Almonte, within the urban boundary, and fronts the north side of Strathburn Street and east side of County Road 29. Refer to **Figure 1** - Key Plan for the site location.

The Subject Site is an irregularly shaped parcel that is bound by County Road 29 to the west, Strathburn Street to the southwest, residential properties to the southeast, undeveloped lands owned by the Municipality of Mississippi Mills to the east, and agricultural use (cultivation and pasture) lands to the north which are owned by the proponent, Strathburn Almonte Regional Inc.

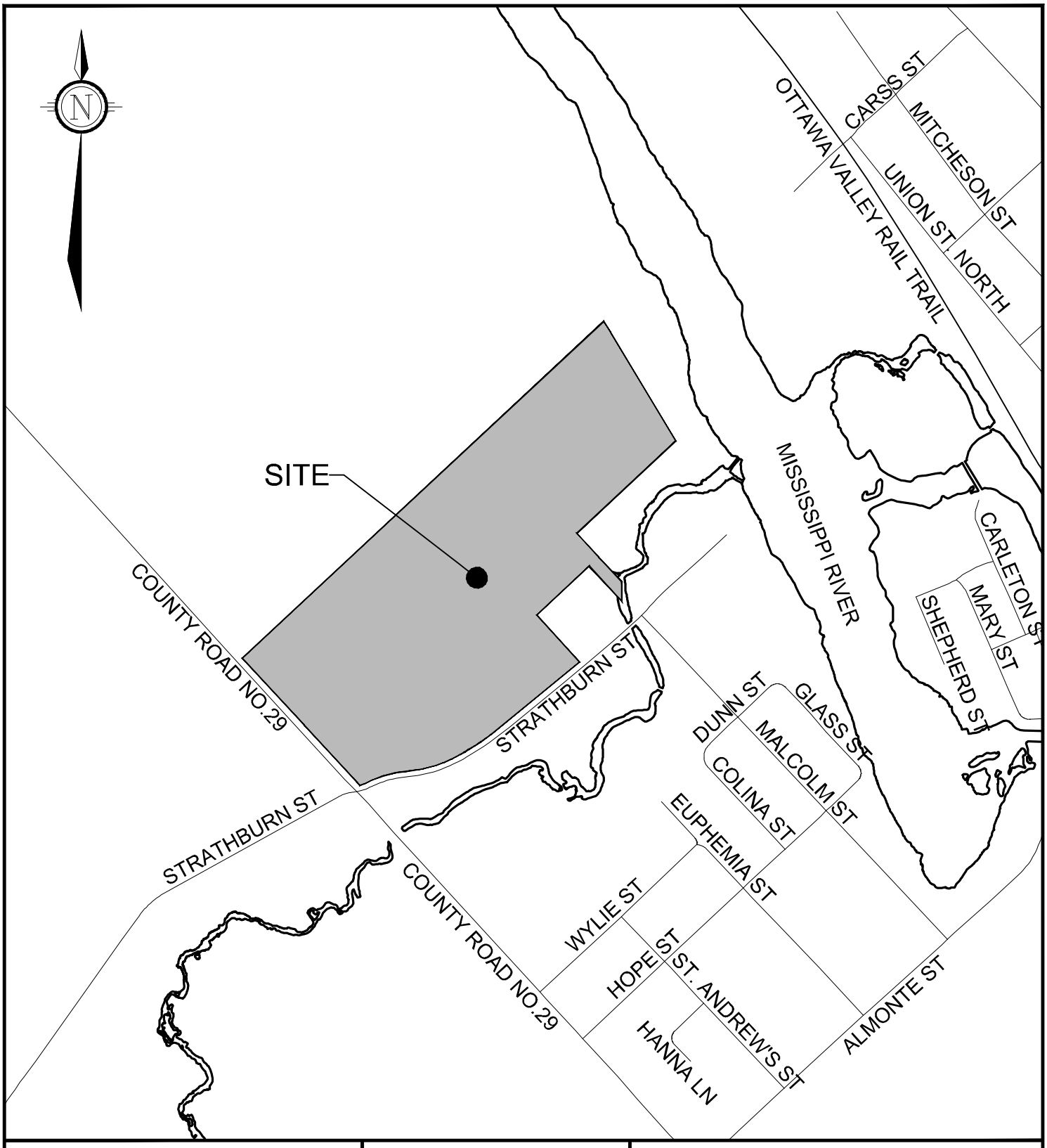
1.3 Existing Conditions and Topography

Currently, the western portion of the Subject Site is occupied by fields used for cultivation, while there are three (3) unused grain silos and a small structure at the east end of the site associated with a previous agricultural use, all of which are to be removed. Additionally, a portion of the Almonte Riverside Trail currently traverses the site from Strathburn Street to the Municipality-owned lands to the east where it then extends northward alongside the Mississippi River. Notably, a local wetland area is also present on the Subject Site, which generally extends across the central and northeastern portions of the site. The remainder of the lands are undeveloped and generally consist of open field areas with sparsely populated trees and vegetation, with the eastern areas of the site used for livestock grazing. Refer to **Figure 2** - Existing Conditions for an aerial image of the site.

The topography of the Subject Site is characterized by varying degrees of light-to-moderate sloping wherein the overall gradient of the property generally slopes downwards in a southeasterly direction. The most significant change in elevation occurs at a slope formation on the central portion of the site where the elevation drops from approximately 118 m above sea level to 112 m above sea level, and generally divides the property into a northwest highland area and a southeast lowland area. Part of an existing wetland is present on site, composed of two tributaries which feed into Wolf Grove Creek to the south of the Subject Site.

1.4 Proposed Development

The proposed development of the Subject Lands consists of a residential subdivision consisting of 133 single units, 4 semi-detached units, and 88 townhomes.



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MUNICIPALITY of MISSISSIPPI MILLS
BROWN LANDS

KEY PLAN

SCALE N.T.S

DATE FEB 2023 | JOB 118178 | FIGURE FIGURE 1

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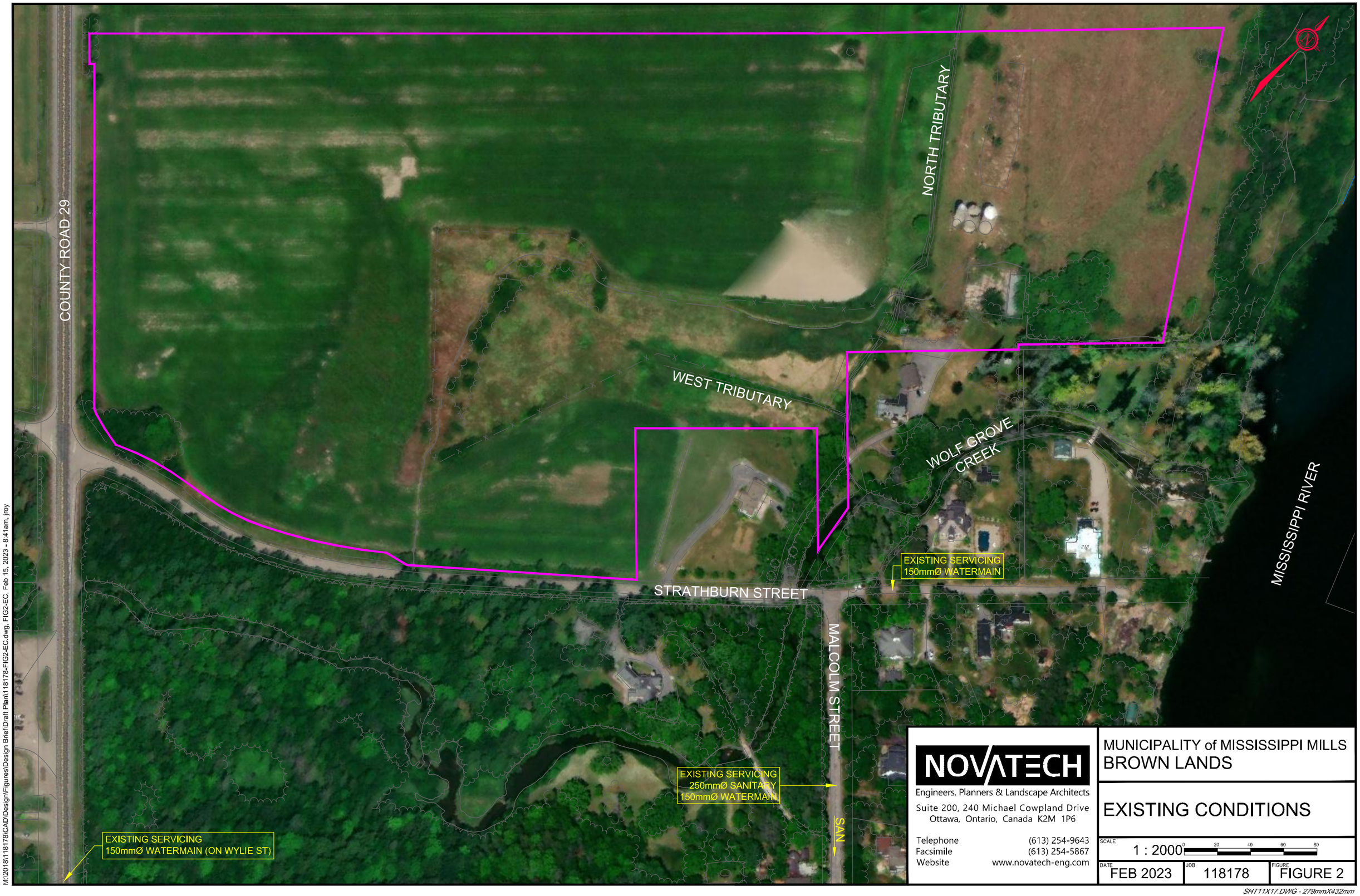

M:\2018\118178\CAD\Design\Figures\Design Brief\Draft Plan\118178-FIG2-EC.dwg, FIG2-EC, Feb 15, 2023 - 8:41am, jroy

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MUNICIPALITY of MISSISSIPPI MILLS
BROWN LANDS

EXISTING CONDITIONS

SCALE 1 : 2000 (0, 20, 40, 60, 80)
DATE FEB 2023 | JOB 118178 | FIGURE FIGURE 2

SHT11X17.DWG - 279mmX432mm

The development will include six (6) new roadways. Connections will be made to County Road 29 on the west side of the site and to Strathburn Street to the south. Refer to **Figure 3** - Concept Plan for the proposed layout.
The Subject Lands will be serviced from a combination of new and existing municipal infrastructure. Water distribution will be provided from the proposed 250mm dia. watermain extension on County Road 29 and the proposed 300mm dia. watermain crossing of the Mississippi River. Sanitary sewer servicing will be provided by on-site gravity sewers connected to a proposed on-site pump station outletting to an existing 250mm dia. sanitary sewer on Malcolm Street.

Stormwater from the Subject Lands will be conveyed with gravity sewers to the Mississippi River through two proposed outlets, one to Wolf Grove Creek and the second directly to the river.

Refer to **Figure 4** - On-Site Conceptual Servicing Layout and **Figure 5** - Off-Site Conceptual Servicing Layout for the conceptual site & servicing layouts of the Subject Site.

1.5 Geotechnical Investigation

Paterson Group conducted geotechnical investigations in support of the Brown Lands residential development. An investigation for the on-site development was completed through 2 separate field mobilizations (May 2022 & November 2022). A total of seventeen (17) boreholes, five (5) probeholes and two (2) hand-auger holes were advanced to a maximum depth of 10.2m. The principal findings of Paterson Group's geotechnical investigation for the on-site works are as follows:

- The site's existing ground surface on the western portion of the site slopes down from west to east between approximate geodetic elevations 124 to 112m.
- The eastern portion of the site is relatively flat.
- The slope of the site varies from 3H:1V to 10H:1V throughout the central portion of the site.
- Bedrock outcroppings were observed at the existing ground surface on the eastern half of the Subject Site.
- Subsurface conditions on the western side of the site (west of the North Tributary) were generally observed to consist of topsoil underlain by silty clay and/or glacial till.
- Subsurface conditions in the test holes on the eastern side of the site (east of the North Tributary) were generally observed to consist of topsoil, underlain by fill in the test holes located towards the south.
- Practical refusal to excavation on bedrock was encountered in all boreholes, hand auger-holes and probeholes at approximate depths ranging between 0.20m and 18.8m. The depth to bedrock on the eastern portion of the site ranged from 0.20m to 5.33m.
- The site is subjected to grade raise restrictions on the western portion of the site due to either the presence of a sensitive silty clay layer or the presence of existing slopes. The recommended permissible grade raises include:
    - 0m along the northern edge of the proposed park;
    - Up to 1m on the northwestern side of the wetland; and
    - 3.0m on the western portion of the site.

COUNTY ROAD 29

Street One

Street Two

Street Three

Street Four

Street Five

Street Six

MODEL ROW

PARK
AREA=0.97ha

PUMP STATION

FUTURE DEVELOPMENT LANDS

NORTH TRIBUTARY

WEST TRIBUTARY

WOLF GROVE CREEK

STRATHBURN STREET

LEGEND:

- 33' SINGLES
- 37' SINGLES
- 42' SINGLES
- 50' SINGLES
- BUNGALOW TOWNHOMES/SEMI-DETACHED
- TWO-STOREY TOWNHOME
- PARK
- PUMP STATION
- FUTURE DEVELOPMENT LANDS

- MVCA REGULATION LIMIT
- MVCA 1:100 YEAR FLOODPLAIN LIMIT
- WETLAND LIMIT
- SETBACK TO WETLAND
- EXISTING WATERCOURSE
- EXISTING BIKE PATH

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MUNICIPALITY of MISSISSIPPI MILLS
BROWN LANDS

CONCEPT PLAN

SCALE 1 : 2000 (0, 20, 40, 60, 80)

DATE FEB 2023 | JOB 118178 | FIGURE FIGURE 3

LEGEND

- CONCEPTUAL ON-SITE WATERMAIN
- OFFSITE FUTURE WATERMAIN (BY MUNICIPALITY)
- CONCEPTUAL ON-SITE STORM SEWER
- STM MH — CONCEPTUAL ON-SITE STORM MAINTENANCE HOLE
- CONCEPTUAL ON-SITE SANITARY SEWER
- SAN MH — CONCEPTUAL ON-SITE SANITARY MAINTENANCE HOLE
- WETLAND LIMIT
- SETBACK TO WETLAND

COUNTY ROAD 29

FUTURE DEVELOPMENT LANDS

NORTH TRIBUTARY

300mmØ WATERMAIN (BY MUNICIPALITY)

CONNECTION TO PROPOSED 300mmØ WATERMAIN CROSSING OF THE MISSISSIPPI RIVER (BY MUNICIPALITY).

2 storey

PARK
AREA=0.97ha

PUMP STATION

SANITARY EMERGENCY BYPASS

WEST TRIBUTARY

WOLF GROVE CREEK

MISSISSIPPI RIVER

STRATHBURN ST

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MUNICIPALITY of MISSISSIPPI MILLS
BROWN LANDS

ON-SITE CONCEPTUAL SERVICING LAYOUT

SCALE 1 : 2000 (0 20 40 60 80)

DATE FEB 2023 | JOB 118178 | FIGURE FIGURE 4

SHT11X17.DWG - 279mmX432mm

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LEGEND

- CONCEPTUAL OFFSITE-SITE WATERMAIN
- OFFSITE-SITE FUTURE WATERMAIN (BY MUNICIPALITY)
- CONCEPTUAL OFF-SITE STORM SEWER
- STM MH — CONCEPTUAL OFF-SITE STORM MAINTENANCE HOLE
- CONCEPTUAL OFF-SITE SANITARY FORCEMAIN

PARK
AREA=0.97ha

WEST TRIBUTARY

WOLF GROVE CREEK

SANITARY EMERGENCY BYPASS

PUMP STATION

5.0m-250mmØ SAN @ 1.00%

37.9m-200mmØ SAN @ 1.50%

11.4m-200mmØ SAN @ 1.60%

30.4m-200mmØ SAN @ 1.50%

PROPOSED STORM OUTLET TO WOLF GROVE CREEK. CONNECT TO EXISTING CONCRETE STRUCTURE

STRATHBURN ST

2x100mm HDPE (340m) SANITARY FORCEMAIN

EXISTING 150mmØ WM

MISSISSIPPI RIVER

MALCOLM STREET

CONNECT TO EXISTING SANITARY MAINTENANCE HOLE (MH 1-108)

EXISTING 250mmØ SAN

250mmØ WM

COUNTY ROAD 29

CONNECTION TO PROPOSED 250mmØ WATERMAIN ON COUNTY ROAD 29 (WELL 6 TO DUNN ST) TO BE INSTALLED BY MUNICIPALITY.

250mmØ WM (BY MUNICIPALITY)

DUNN STREET ROW

DUNN STREET

EUPHEMIA STREET

COLINA STREET

WYLIE STREET

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MUNICIPALITY of MISSISSIPPI MILLS
BROWN LANDS

OFF-SITE CONCEPTUAL SERVICING LAYOUT

SCALE 1 : 2000 (0 20 40 60 80)
DATE FEB 2023 | JOB 118178 | FIGURE FIGURE 5

SHT11X17.DWG - 279mmX432mm

- Refer to *Geotechnical Investigation – Proposed Residential Development – Brown Lands – County Road 29 and Strathburn Street - Almonte, Ontario, prepared by Paterson Group Inc. dated January 25, 2023 (PG6260-2, Revision 1)* for complete details and recommendations.

A second investigation was completed to assess the areas where there are off-site servicing requirements associated with the proposed development. This investigation was completed in December 2022 and consisted of eight (8) boreholes advanced to a maximum depth of 5.1m. The principal findings of Paterson Group's geotechnical investigation for the off-site works are as follows:

- The off-site existing ground surface consists of paved (asphalt) roads with gravel shoulders, generally observed to be in good to fair condition.
- Two water crossings along County Road 29 and one water crossing along Strathburn Street were observed below the road surface, facilitated via culverts.
- The off-site existing ground surface generally slopes from the southwest downward to the northeast from approximate geodetic elevations 125m to 112m.
- The subsurface profile along County Road 29 consists of fill underlain by hard to very stiff, brown silty clay or glacial till.
- The subsurface profile along Strathburn Street generally consists of fill over hard to very stiff, brown silty clay.
- The subsurface profile along Malcolm Street generally consists of crushed stone with sand and gravel underlain by a deposit of hard, brown silty clay. A layer of silty sand was observed below the silty clay layer and was further underlain by glacial till.
- Practical refusal to excavation on bedrock was encountered in boreholes BH-R01-22, BH-R05-22 and BH-R08-22 at depths of 3.6m, 3.9m and 1.6m, respectively.
- Based on the field observations and soil samples, the long-term groundwater table is expected to be located at a greater depth than the test holes advanced in this investigation but could be subject to seasonal fluctuations.
- The off-site area is suitable for the proposed municipal service installation and subsequent road reconstruction.
- Due to the presence of the silty clay deposit, the reconstruction of the roadway will be subject to a grade raise restriction of 3m above the existing roadway surface elevation.
- Bedrock removal may be required depending on municipal servicing depths, which may be possible by hoe-ramming.
- Refer to *Geotechnical Investigation – Proposed Off-Site Services, County Road No. 29, Strathburn Street and Malcolm Street, Almonte Ontario, prepared by Paterson Group Inc. dated January 25, 2023 (PG6260-LET.01, Revision 1)* for complete details and recommendations.

1.6 Additional Reports

This report provides information on the considerations and approach by which Novatech has designed and evaluated the proposed servicing for the Brown Lands Subdivision. This report should be read in conjunction with the following:

- Geotechnical Investigation, Proposed Residential Development, Brown Lands - County Road No. 29 and Strathburn Street, Almonte, Ontario, Report: PG6260-2 Revision 1 dated January 25, 2023, prepared by Paterson Group.
- Geotechnical Investigation – Proposed Off-Site Services, County Road No. 29, Strathburn Street and Malcolm Street, Almonte Ontario, Report: PG6260-LET.01 Revision 1 dated January 25, 2023, prepared by Paterson Group Inc.
- Planning Rationale in Support of Draft Plan of Subdivision and Zoning By-law Amendment Applications, Brown Lands, Almonte, Ontario, Ref: R-2023-002, dated February 10, 2023, prepared by Novatech.
- Brown Lands, Almonte, Ontario, Traffic Impact Study, Ref: R-2023-002, dated February 10, 2023, prepared by Novatech.
- Brown Lands, Almonte, Ontario, Traffic Impact Study, Ref: R-2023-002, dated February 10, 2023, prepared by Novatech.
- Master Plan Update Report - FINAL, Municipality of Mississippi Mills Almonte Ward, Mississippi Mills, Ontario, Report: 27456-01 dated February 2018, prepared by J.L. Richards & Associates Limited.

2.0 STORMWATER MANAGEMENT

The proposed storm servicing and stormwater management strategy for the Brown Lands development has been conceptually designed in consultation with the Municipality of Mississippi Mills and the Mississippi Valley Conservation Authority (MVCA).

2.1 Existing Drainage Conditions

Under existing conditions, storm runoff from the proposed development generally flows towards two outlets: Wolf Grove Creek and the Mississippi River. Refer to **Figure 2** - Existing Conditions Plan.

There is an unnamed tributary (North Tributary) of Wolf Grove Creek that flows southward through the site towards Wolf Grove Greek, as well as a small watercourse (West Tributary) that flows eastward to Wolf Grove Creek through the low-lying area in the central part of the site. Both tributaries are also considered wetlands.

Land Use

The lands west of the North Tributary are cultivated for agricultural uses, while the lands east of the tributary are mainly open fields with some small stands of trees used for livestock grazing. There are three unused grain silos and a small structure to the east of the tributary.

Topography

The portion of the site that is east of the North Tributary is gently sloped in an easterly direction towards the Mississippi River. There is a steep embankment to the east of the site along the Mississippi River within the municipally owned lands. The remainder of the site is gently sloped to the east and south to Wolf Grove Creek, whether via the north and west tributaries, flowing directly into the creek or by a culvert in the southwest corner of the site that crosses under Strathburn Street and ultimately outlets to the creek. There are steep embankments along the north side of the West Tributary.

2.2 Stormwater Management Criteria

The Brown Lands development is located within the jurisdiction of the Mississippi Valley Conservation Authority (MVCA). The stormwater management criteria for the development are based on the requirements of the MVCA, and the City of Ottawa Sewer Design Guidelines (October 2012) and associated Technical Bulletins.

2.2.1 Minor System (Storm Sewers)

- Storm sewers are to be designed using the Rational Method and sized for the 5-year storm event;
- Inlet control devices (ICDs) are to be installed in road and rearyard catchbasins to control inflows to the storm sewers;
- Ensure that the 100-year hydraulic grade line in the storm sewer is at least 0.3 m below the underside of footing (USF) elevations for the proposed development.

2.2.2 Major System (Overland Flow)

- Overland flows are to be confined within the right-of-way and/or defined drainage easements for all storms up to and including the 1:100-year event;
- Maximum depth of flow (static + dynamic) on local and collector streets shall not exceed 0.35 m during the 100-year event. The depth of flow may extend adjacent to the right-of-way provided that the water level must not touch any part of the building envelope and must remain below the lowest building opening during the stress test event;
- Runoff that exceeds the available storage in the right-of-way will be conveyed overland along defined major system flow routes towards the proposed major system outlet to the receiving watercourses. There must be at least 15cm of vertical clearance between the spill elevation on the street and the ground elevation at the front of the building envelope that is in the proximity of the flow route or ponding area;
- The product of the 100-year flow depth (m) and flow velocity (m/s) within the right-of-way shall not exceed 0.60;
- Furthermore, provide 30cm of vertical clearance between the spill elevation and the ground elevation at the rear of the building envelope.

2.2.3 Water Quality Control

- Provide a *'Enhanced'* (80% long-term total suspended solids removal) level of quality control.

2.2.4 Water Quantity Control

- Due to the location of the development at the downstream end of Wolf Grove Creek and adjacent to the Mississippi River, quantity control of storm runoff to pre-development levels is not required;
- Confirm that post-development flows will have no adverse impact on Wolf Grove Creek, and that all post-development runoff can be safely conveyed to the Mississippi River for all design storms up to and including the 100-year event;
- Implement lot level and conveyance Best Management Practices to promote infiltration and treatment of storm runoff.

2.3 Proposed Storm Servicing Design

Storm servicing for the subdivision will be provided using a dual drainage system; runoff from frequent events will be conveyed by gravity sewers (minor system), while flows from large storm events that exceed the capacity of the minor system will be conveyed along defined overland flow routes (major system). Refer to **Figure 6** - Post-Development Storm Drainage Area Plan for the preliminary storm sewer layout.

The minor and major storm systems will outlet in two places. Flows from the western portion of the site will flow via gravity sewers to the south, along Strathburn Drive and will discharge to Wolf Grove Creek and ultimately flow to the Mississippi River to the east (Outlet 1). Flows from the east side of the site will flow to the east and outlet into the Mississippi River (Outlet 2) across the adjacent municipally owned lands.

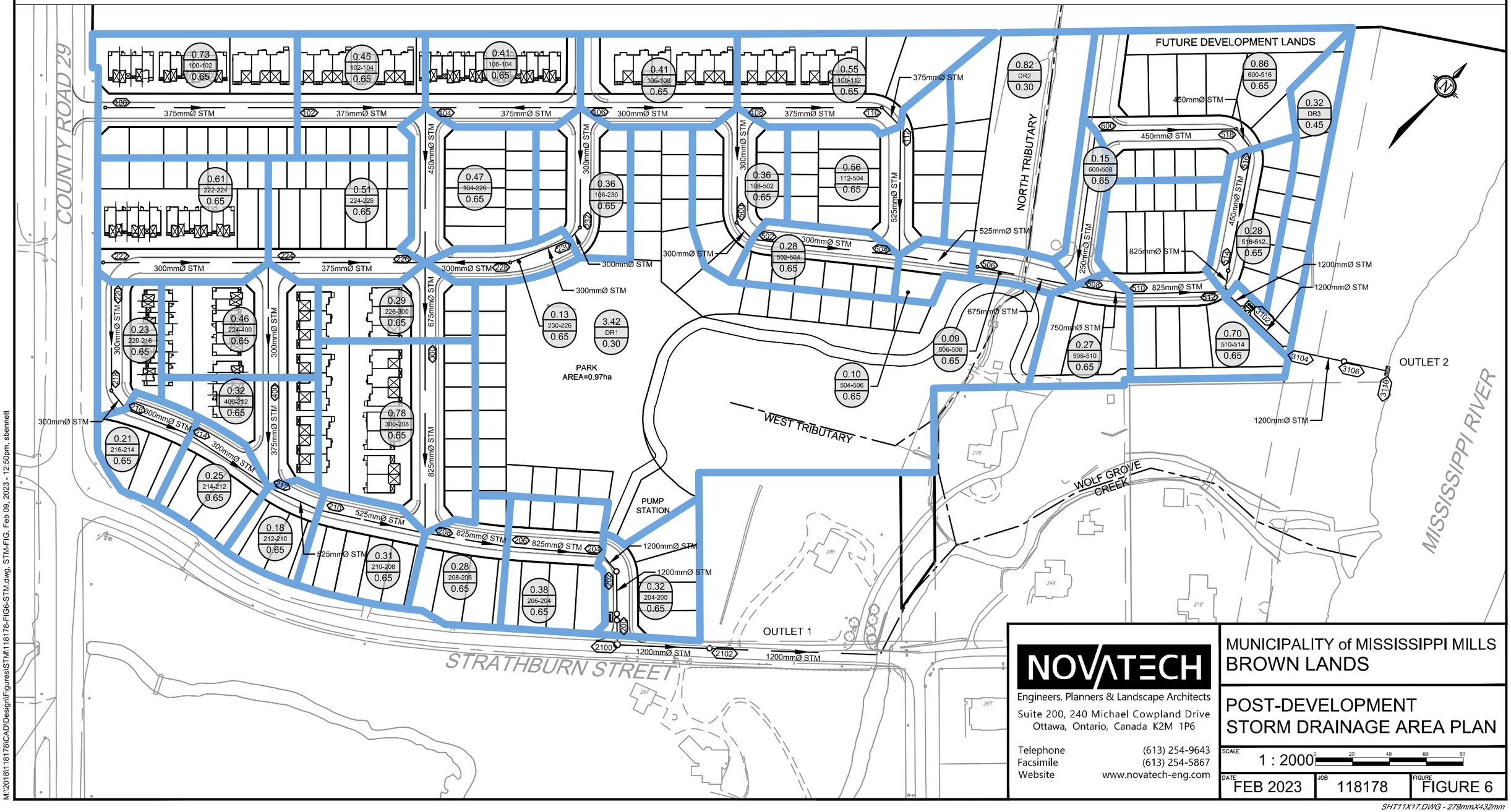
LEGEND

2-02 — AREA ID

0.10 / 116-114 / 0.65 — CATCHMENT AREA / MAINTENANCE HOLE TO MAINTENANCE HOLE / RUNOFF COEFFICIENT

DRAINAGE AREA BOUNDARY

100 — PROPOSED STORM SEWER



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MUNICIPALITY of MISSISSIPPI MILLS
BROWN LANDS

POST-DEVELOPMENT
STORM DRAINAGE AREA PLAN

SCALE 1 : 2000 (0 20 40 60 80)

DATE FEB 2023 | JOB 118178 | FIGURE FIGURE 6

SHT11X17.DWG - 279mmX432mm

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Quantity control is not required for the site due to the location of the development outlets at the downstream end of Wolf Grove Creek and adjacent to the Mississippi River. Direct runoff to the wetlands / tributaries and the Mississippi River will be maintained as close to pre-development levels as possible to prevent erosion of the banks and to maintain flows to the wetlands.

An "Enhanced" level of water quality control (80% long-term TSS removal) will be provided at both outlets by water quality treatment units on-site before discharging to existing watercourses.

2.3.1 Storm Sewers (Minor System)

The proposed storm sewers servicing the development have been designed using the Rational Method to convey peak flows associated with a 5-year return period. The development will have two minor system outlets:

- Strathburn Street at Wolf Grove Creek
- Mississippi River

The outlet storm sewers have been designed to convey the 100-year peak flows from the site in order to protect the Strathburn Street roadside ditch, the west tributary embankment and the Mississippi River embankment from erosion. The 100-year flows will be captured upstream of both outlets (immediately upstream of the water quality treatment units prior to leaving the development). The minor system inlets at these locations will be designed to ensure they provide sufficient capacity to capture the 100-year peak flows.

The topography of the site is quite varied, and the proposed centreline of road roughly follows this existing topography. This results in road grades between 0.5% and 5%, with many of the road grades falling in the 3-4% range. As such, on grade catch basins may not be able to fully capture the 5-year storm flows from each storm drainage area and some by-passing is to be expected. In order to capture the 100-year at the downstream end of the development, a row of catch basins will be installed and connected to the storm sewer between maintenance holes 202-204 and 512-514 (upstream of each of the two storm outlets) to intercept this additional flow. The sewer pipe between these maintenance holes and the downstream sewer pipes have been sized to convey the peak flows from the 100-year return period.

Refer to **Figure 6** - Post-Development Storm Drainage Area Plan and the Storm Sewer Design Sheet provided in **Appendix B** for details.

Storm Sewer Design Criteria

The following is the storm sewer design criteria were used:

- Rational Method (Q) = 2.78CIA, where
    - Q = peak flow (L/s)
    - C = runoff coefficient
        - C = 0.65
    - I = rainfall intensity for a 5-year and 100-year return period (mm/hr)
        - $I_{5yr} = 998.071 / [(Tc(min) + 6.053)]^{0.814}$
        - $I_{100yr} = 1735.688 / [(Tc(min) + 6.014)]^{0.820}$
    - A = site area (ha)
- Minimum Pipe Size = 250 mm; Minimum / Maximum Full Flow Velocity = 0.8 m/s / 3.0 m/s

Inlet Control Devices

Inlet control devices (ICDs) are to be installed in all catchbasins to limit inflows to the minor system capacity (5-year storm event except where the 100-year is being captured). Rear yard catch basins will be connected in series with an ICD installed at the outlet of the most downstream structure. Exact ICD sizes and catchbasin locations will be determined during the detailed design stage.

Foundation Drains

Foundation drains surrounding the dwellings would be connected to the storm sewers. Based on the preliminary review of the hydraulic grade line, it is anticipated that sump pumps will not be required to drain the foundations. Should sump pumps be required, they would connect to the storm sewer and would include backwater valves to prevent basement flooding in heavy rain events. The requirement for sump pumps will be confirmed as part of the detailed design phase.

2.3.2 Major System Drainage

During detailed design, the site will be graded to provide an overland flow route to the proposed outlets following the proposed roadway. The proposed storm sewer system would direct all minor storm runoff to the proposed outlets. All events up to and including the 100-year event will be captured by the minor system before the outlets. Runoff from the major system will only occur during storm events that exceed the 100-year storm. Emergency flows for Outlet 1 would be directed through the park block and to the west tributary. Emergency flows for Outlet 2 would be directed overland to the same location on the Mississippi River as the minor system outlet. Refer to **Figure 7** - Conceptual Grading Plan for the preliminary macro grading plan.

2.3.3 Quality Control

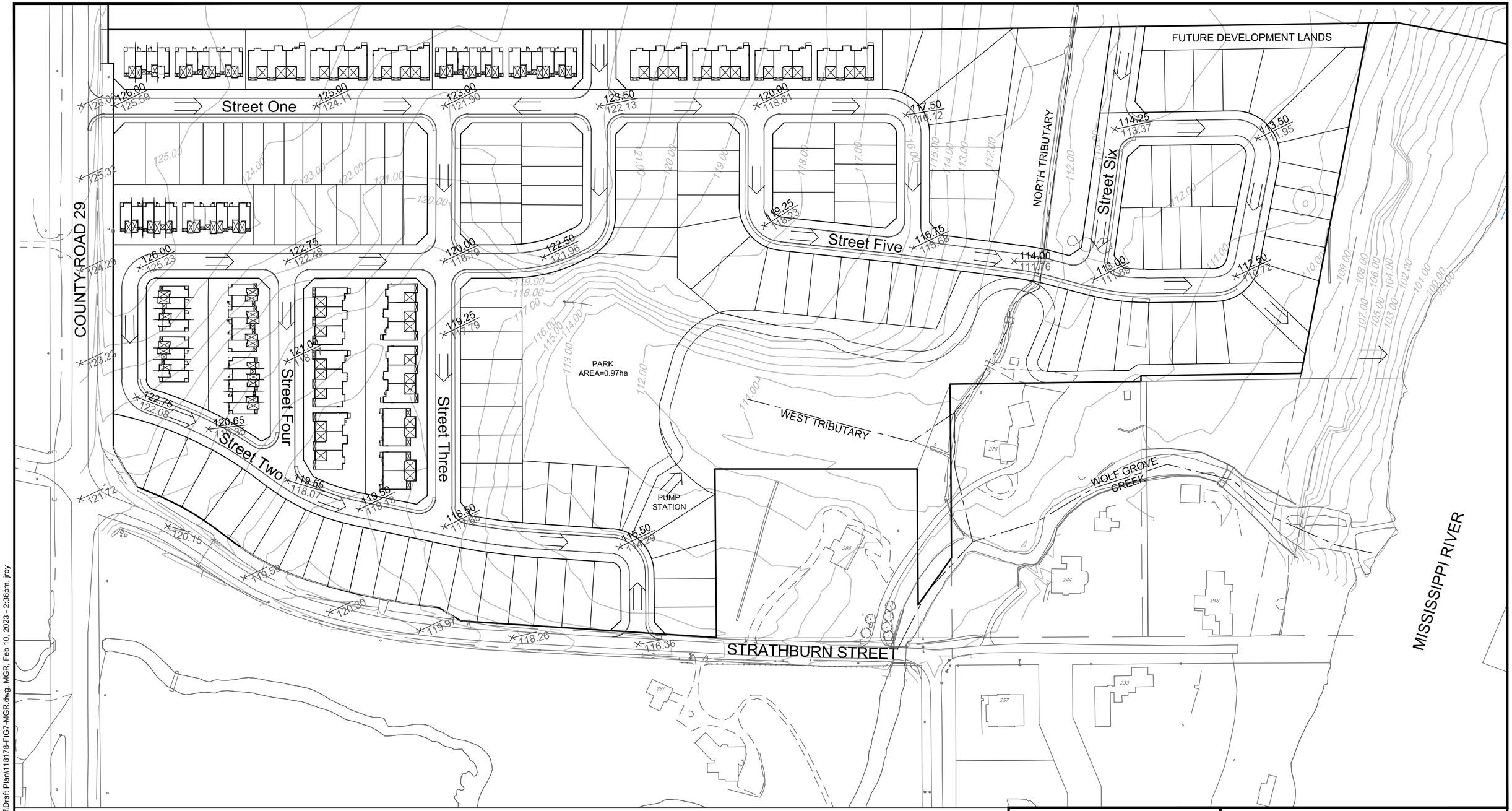
Water quality treatment will be required before discharging to the existing watercourses. This will be provided by a water quality treatment unit at each of the two outlets. An oil and grit separator (OGS) would be appropriately sized for each outlet to achieve 80% long-term TSS removal and would be installed upstream of the outlet. The OGS would be located within the right-of-way or easement and would be accessible for inspection and maintenance. The OGS unit and size will be confirmed at detailed design.

2.3.4 Quantity Control

The proposed development is located at the downstream end of the Wolf Grove Creek Subwatershed and adjacent to the Mississippi River. Based on the site location, peak flow control should not be required to mitigate any adverse impacts to the receiving watercourses associated with the development.

Wolf Grove Creek (Outlet 1)

Wolf Grove Creek is a smaller watercourse but still substantial in its cross-section. The proposed outlet from the development is less than 350m upstream from where Wolf Grove Creek outlets to the Mississippi River. The total drainage area of Wolf Grove Creek upstream of Strathburn Street is approximately 4160 ha (obtained from the Ontario Flow Information Tool). The total drainage area of the development and offsite drainage areas that will drain to Outlet 1 at Wolf Grove Creek is 8.7 ha. This equates to a 0.2% increase in drainage to Wolf Grove Creek at Strathburn Street which is a negligible increase. The peak of Wolf Grove Creek is also not going to occur at the same time as the peak from the proposed development due to the size and rural / agricultural land use of the Wolf Grove Creek subcatchment. The proposed storm sewer outlet to Wolf Grove



LEGEND

89.24 / 88.59 — PRELIMINARY GRADE / EXISTING GRADE

MAJOR OVERLAND (EMERGENCY) FLOW DIRECTION

100.00 — EXISTING CONTOUR AND ELEVATION

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

MUNICIPALITY of MISSISSIPPI MILLS
BROWN LANDS

CONCEPTUAL GRADING PLAN

SCALE 1 : 2000 (0, 20, 40, 60, 80)

DATE	JOB	FIGURE
FEB 2023	118178	FIGURE 7

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Creek will either tie into the existing box culvert crossing Strathburn Street or will outlet to the watercourse immediately downstream of the culvert. The existing erosion protection at this location will be reviewed and the requirement for any additional erosion protection measures will be determined as part of the detailed design.

Uncontrolled direct runoff (overland flow) to the wetlands / tributaries will be maintained as close to pre-development levels as possible to prevent erosion of the banks and to maintain flows to the wetlands.

Mississippi River (Outlet 2)

The Mississippi River is a large watercourse and will not be impacted by the runoff from the development. The additional runoff volume and peak flows associated with development is negligible compared to the total flow in the watercourse. The rear yards draining directly to the Mississippi River are smaller than the pre-development area and there will not be any increase in peak flow or erosion potential down the embankment. The storm sewer outlet will be designed to convey flows from storms up to and including the 100-year event in the pipe and will outlet to the Mississippi River at the base of the embankment. Erosion protection will be provided at the outfall using riprap and other energy dissipation measures to be determined at detailed design.

2.3.5 Best Management Practices and Low Impact Development

The proposed development will use the following stormwater best management practices (BMPs) and low impact development (LID) techniques to mitigate the reduction in groundwater infiltration/recharge resulting from development:

- Rearyard CB leads will use perforated pipes to promote infiltration of runoff from rearyard areas.
- Where feasible, eavestrough downspouts and roof leaders discharging to the ground surface should be directed to rearyard or grassed areas.

By implementing stormwater management BMPs and LIDs as part of the storm drainage design, the impacts of development on the hydrologic cycle can be reduced. Infiltration of clean runoff would improve the performance of the proposed OGS unit. At the conceptual design stage, the use of BMPs and LIDs have not been included in the SWM calculations to provide a conservative estimate of the runoff volumes and storage requirements. The implementation of BMPs and LIDs will be reviewed again during the detailed design process.

2.4 Preliminary SWM Modeling

The performance of the proposed storm drainage system for the Brown Lands development was evaluated using the dual drainage PCSWMM hydrologic/hydraulic model.

Pre-Development Modelling

A pre-development model of the Brown Lands development was completed using PCSWMM and is based on the existing conditions of the site. The purpose of this model was to determine the pre-development runoff from the site to the wetlands/tributaries and ensure that post-development conditions will not negatively impact these areas. The runoff to the Mississippi River in pre-development was also evaluated to ensure that the post-development runoff from the rear yards of lots backing onto the embankment along the river will be similar to pre-development so that there will be no increase in erosion potential.

Post-Development Modelling

A post-development model of the proposed subdivision was created using PCSWMM and includes the roadways (major system), storm sewers (minor system), and outlets to Wolf Grove Creek and the Mississippi River. The post-development model was used to:

- Simulate major and minor system runoff from the site; and
- Determine the storm sewer hydraulic grade line for the 100-year storm event.

Model parameters and schematics for both pre- and post-development models have been provided in **Appendix B**.

2.4.1 Design Storms

The hydrologic analysis was completed using the following synthetic design storms and historical storms. The IDF parameters used to generate the Chicago design storms were taken from the *Ottawa Design Guidelines - Sewer* (October 2012).

Chicago Distribution:
25mm 4-hour Event (Water Quality)
2-year 3-hour Event
2-year 3-hour Event
100-year 3-hour Event

SCS Distribution:
2-year 12-hour Event
2-year 12-hour Event
100-year 12-hour Event

The 3-hour Chicago distribution was found to be the critical design storm as it generated the highest peak flows and the highest HGL elevations.

2.4.2 Model Parameters

Storm Drainage Areas

For the pre-development model, the hydrologic parameters for each subcatchment were developed based on **Figure 8** - Pre-Development Storm Drainage Area Plan. The subcatchment boundaries have been developed based on the existing topography obtained from a site survey and the Digital Raster Acquisition Project Eastern Ontario (DRAPE) 2014 elevation data. Pre-development parameters were determined using aerial imagery and land use of the subcatchments. **Table 2.1** provides a summary of the pre-development model parameters, with further detail provided in **Appendix B**.

Table 2.1: Pre-Development Model Parameters

Area ID	Catchment Area (ha)	Flow Length (m)	Time of Concentration (min)	Weighted Curve Number	Weighted IA	Average Slope (%)
PRE-1	2.393	160	15	84	4.8	3.2%
PRE-2	9.881	530	17	83	5.2	2.9%
PRE-3	68.766	1255	48	81	6.1	1.5%
PRE-4	0.261	50	15	73	9.3	1.5%
PRE-5	2.343	130	15	68	11.9	2.0%

PRE-3
68.75
CN=81

PRE-4
0.26
CN=73

PRE-5
2.34
CN=68

PRE-1
2.39
CN=84

PRE-2
9.88
CN=83

COUNTY ROAD 29

NORTH TRIBUTARY

WEST TRIBUTARY

WOLF GROVE CREEK

MISSISSIPPI RIVER

STRATHBURN STREET

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

LEGEND

PRE-1 / 2.39 / CN=84 — AREA ID, AREA (HA.), SCS CURVE NUMBER

PRE-DEVELOPMENT DRAINAGE AREA BOUNDARY

FLOW DIRECTION

PROPERTY LIMIT

MVCA REGULATION LIMITS

EXISTING WATERCOURSE

MUNICIPALITY of MISSISSIPPI MILLS

BROWN LANDS

PRE-DEVELOPMENT STORM DRAINAGE AREA PLAN

SCALE 1 : 5000 (0, 50, 100, 150, 200)

DATE FEB 2023 | JOB 118178 | FIGURE FIGURE 8

SHT11X17.DWG - 279mmX432mm

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For the post-development model, the site has been divided into subcatchments based on the both the proposed land use and on a maintenance hole-to-maintenance hole basis. The subcatchments also correspond to the areas used in the Storm Sewer Design Sheet (**Appendix B**). The hydrologic parameters for each subcatchment were developed based on **Figure 6** - Post-Development Storm Drainage Area Plan. An overview of the modeling parameters is provided in **Table 2.2**. Off-site drainage information with further detail provided in **Appendix B**.

Table 2.2: Post-Development Model Parameters

Area ID	Catchment Area (ha)	Runoff Coefficient (C)	Percent Impervious (%)	No Depression (%)	Flow Path Length (m)	Equivalent Width (m)	Average Slope (%)
100-102	0.730	0.65	64.3%	40%	34	215	2.0%
102-104	0.450	0.65	64.3%	40%	32	139	2.0%
104-226	0.470	0.65	64.3%	40%	31	154	2.0%
106-104	0.410	0.65	64.3%	40%	24	167	2.0%
106-108	0.410	0.65	64.3%	40%	24	169	2.0%
106-230	0.360	0.65	64.3%	40%	27	134	2.0%
108-112	0.550	0.65	64.3%	40%	30	185	2.0%
108-502	0.360	0.65	64.3%	40%	25	143	2.0%
112-504	0.560	0.65	64.3%	40%	41	138	2.0%
204-200	0.320	0.65	64.3%	40%	28	116	2.0%
206-204	0.380	0.65	64.3%	40%	37	102	2.0%
208-206	0.280	0.65	64.3%	40%	31	90	2.0%
210-208	0.310	0.65	64.3%	40%	26	118	2.0%
212-210	0.180	0.65	64.3%	40%	29	62	2.0%
214-212	0.250	0.65	64.3%	40%	25	100	2.0%
216-214	0.210	0.65	64.3%	40%	26	80	2.0%
220-216	0.230	0.65	64.3%	40%	31	73	2.0%
222-224	0.610	0.65	64.3%	40%	33	183	2.0%
224-226	0.510	0.65	64.3%	40%	33	155	2.0%
224-400	0.460	0.65	64.3%	40%	40	115	2.0%
226-300	0.290	0.65	64.3%	40%	39	75	2.0%
230-226	0.130	0.65	64.3%	40%	9	140	2.0%
300-208	0.780	0.65	64.3%	40%	40	195	2.0%
400-212	0.320	0.65	64.3%	40%	37	87	2.0%
502-504	0.280	0.65	64.3%	40%	35	80	2.0%
504-506	0.100	0.65	64.3%	40%	13	79	2.0%
506-508	0.090	0.65	64.3%	40%	9	103	2.0%
508-510	0.270	0.65	64.3%	40%	39	70	2.0%
510-514	0.700	0.65	64.3%	40%	70	101	2.0%
516-512	0.280	0.65	64.3%	40%	35	79	2.0%
600-508	0.150	0.65	64.3%	40%	9	162	2.0%
600-516	0.860	0.65	64.3%	40%	33	263	2.0%

DR1	3.420	0.30	14.3%	100%	116	294	2.0%
DR2	0.820	0.30	14.3%	100%	71	115	2.0%
DR3	0.320	0.45	35.7%	100%	20	164	2.0%
TOTAL:	**16.85**						

Runoff Coefficient/ Impervious Values

Impervious (%IMP) values for each subcatchment area were calculated based on the Runoff Coefficients noted on **Figure 6** - Post-Development Storm Drainage Area Plan using the equation:

$$\%IMP = \frac{(C - 0.2)}{0.7}$$

Depression Storage

The default values for depression storage in the City of Ottawa were used for all catchments.

- Depression Storage (pervious areas): 4.67 mm
- Depression Storage (impervious areas): 1.57 mm

Residential rooftops are assumed to provide no depression storage and all rainfall is converted to runoff. The percentage of rooftop area to total impervious area is represented by the 'No Depression' column in **Table 2.2**.

Equivalent Width

'Equivalent Width' refers to the width of the sub-catchment flow path. This parameter is calculated as described in the *Sewer Design Guidelines, October 2012, Section 5.4.5.6.*

Major System

Since the major system has not yet been designed, the subcatchment areas are not based on a detailed grading plan. The grade drop across the site is such that it is anticipated that the major system will consist of mostly on-grade catchbasins. During events up to and including the 5-year, storm runoff will flow uncontrolled into the minor system. The major system connections to the minor system have been determined based on a pair of City of Ottawa standard sized inlet control devices (ICDs) and sized based on the 5-year approach flow. Due to the slopes of the road, it is assumed that there will be some bypassing flows in the 5-year event.

There will be two low points, one for each outlet, that will have catchbasins designed to capture the 100-year runoff and convey it in the storm sewers so there are no major system flows leaving the site for events up to and including the 100-year event. This is to prevent excess flows to Strathburn Street and to prevent erosion in the wetland / tributaries and along the Mississippi River. The storm sewers downstream of these low points have been designed to accommodate the 100-year flows from the site.

As the project is only at the Draft Plan stage, the detailed lot-level grading information is not yet available.

Modeling Files / Schematic

The PCSWMM model schematics are provided in **Appendix B**. Digital copies of the modeling files and model output for all storm events are provided with the digital report submission.

2.4.3 Boundary Condition (Water Levels at Storm Outlets)

Outlet 1 (Wolf Grove Creek)

The water level of Wolf Grove Creek was 109.72 in November 2022 at Outlet 1, however the water level during the 100-year event or during spring runoff is currently unknown. The 100-year boundary condition for Outlet 1 (Wolf Grove Creek) was set assuming the water level in Wolf Grove Creek at the outlet would be at the road elevation at the Strathburn Street crossing (112.15m). This is a very conservative assumption and represents a worst-case scenario. The Wolf Grove Creek watershed is mostly rural and agricultural land use and will likely have a peak much later than the proposed development.

The outlet boundary conditions for more frequent storm events were applied to the model as follows:

- The 2-year boundary condition was set based on the assumption that the Strathburn Street culvert would be flowing half full (110.65m).
- The 5-year boundary condition was set based on the assumption that the Strathburn Street culvert would be full (111.85m).

Outlet 2 (Mississippi River)

The 100-year water level at Outlet 2 to the Mississippi River was obtained from MVCA floodplain mapping. The 100-year water level in the Mississippi River near the outlet is 101.20m. The invert of the outlet pipe has been preliminarily set at the 100-year water level; therefore, there is a normal boundary condition for all storm events at Outlet 2.

2.4.4 Model Results

The results of the PCSWMM model are summarized in the following sections.

Peak Flow – Major System

Table 2.3 provides a comparison of the pre-development peak flows and the post-development overland flows. The model results demonstrate that the post-development major system flows will be very similar to the pre-development levels for all storms up to and including the 100-year design event to both the Mississippi River and to the North Tributary. The model also demonstrates a decrease in flows to the west tributary of greater than 50% for all storm events. Based on this assessment, there should be no increase in erosion potential or other adverse impacts resulting from the major system runoff to the Mississippi River and to the North Tributary. Further assessment of the impacts to the west tributary will be completed during the detail design of the subdivision and mitigation measures will be proposed if required to compensate for the decreased flows to associated wetland.

Table 2.3: Major System Flows

Outlet		Major System Flows (L/s) [1]			
		25mm	2yr	5yr	100yr
Mississippi River	*Pre*	6	17	43	160
	Post	18	25	47	122
	Diff	12	8	4	-39

North Tributary	*Pre*	471	909	1679	4408
	Post	464	886	1635	4311
	Diff	-7	-24	-44	-98
West Tributary	*Pre*	150	284	518	1349
	Post	86	123	208	558
	Diff	-64	-161	-310	-791

[1] All storm events used the 3-hour Chicago distribution, except for the 25mm event which used the 4-hour Chicago distribution.

Peak Flow – Minor System

Outlet 1 to Wolf Grove Creek will consist of a 1200mm diameter pipe. Details of the outlet configuration will be determined at detailed design. Outlet 2 to the Mississippi River will consist of a 1200mm diameter pipe with a headwall. The outlets will be designed to ensure no erosion or other adverse impacts to the receiving watercourses. Peak flows through the minor system outlets are summarized in **Table 2.4**.

Table 2.4: Minor System Flows

Outlet	Major System Flows (L/s) [1]			
	25mm	2yr	5yr	100yr
Mississippi River	459	626	911	1529
Wolf Grove Creek	770	1058	1543	2591

[1] All storm events used the 3-hour Chicago distribution, except for the 25mm event which used the 4-hour Chicago distribution.

Hydraulic Grade Line

The PCSWMM model was used to evaluate the 100-year hydraulic grade line (HGL) elevations within the proposed storm sewers. As the design is only at the draft plan stage, the underside of footing (USF) elevations have not yet been determined. The HGL analysis will be revised at the detailed design stage to reflect the controlled inflows at each inlet to the storm sewers. As such, the HGL within the sewers during the 100-year event has been compared against the obvert of the outlet pipe and the top of grate elevation for each maintenance hole to ensure any surcharging is at an acceptable level.

Table 2.5: 100-year HGL Elevations

Manhole ID	MH Invert Elevation (m)	T/G Elevation (m)	HGL Elevation - 100yr3hr (m)	Min USF (m)	WL Above Obvert (m)	Clearance from T/G (m)
MH100	123.57	125.96	123.57	123.87	0.00	2.39
MH102	122.64	125.01	122.82	123.12	0.00	2.19
MH104	119.65	123.04	119.98	120.28	0.00	3.06
MH106	120.78	123.49	120.78	121.08	0.00	2.71
MH108	117.69	120.06	117.82	118.12	0.00	2.24
MH110	115.30	117.69	115.44	115.74	0.00	2.25
MH112	114.78	117.44	115.08	115.38	0.00	2.36
MH200	112.05	116.07	113.50	113.80	0.25	2.57

MH200A	112.08	116.09	113.51	113.81	0.23	2.58
MH202	112.21	115.74	113.61	113.91	0.20	2.13
MH204	112.30	115.55	113.77	114.07	0.27	1.78
MH206	113.20	117.14	114.59	114.89	0.56	2.55
MH208	114.76	118.50	115.51	115.81	0.00	2.99
MH210	116.81	119.52	117.16	117.46	0.00	2.36
MH2100	111.92	116.34	112.99	113.29	0.00	3.35
MH2102	110.20	114.93	112.82	113.12	1.42	2.11
MH212	117.03	119.55	117.48	117.78	0.00	2.07
MH214	118.34	120.67	118.58	118.88	0.00	2.09
MH216	119.87	122.50	119.99	120.29	0.00	2.51
MH218	120.72	123.05	120.72	121.02	0.00	2.33
MH220	123.11	125.66	123.11	123.41	0.00	2.55
MH222	123.20	126.00	123.20	123.50	0.00	2.80
MH224	119.80	122.82	119.98	120.28	0.00	2.84
MH226	117.16	120.05	117.64	117.94	0.00	2.41
MH228	119.30	122.08	119.51	119.81	0.00	2.57
MH230	120.42	122.76	120.60	120.90	0.00	2.16
MH232	120.51	122.86	120.60	120.90	0.00	2.26
MH300	116.15	119.24	116.96	117.26	0.00	2.28
MH3100	107.92	111.97	108.48	108.78	0.00	3.49
MH3102	107.51	111.78	108.13	108.43	0.00	3.65
MH3104	102.84	110.39	103.42	103.72	0.00	6.97
MH3106	101.37	105.61	102.14	102.44	0.00	3.47
MH400	117.77	120.79	117.98	118.28	0.00	2.81
MH500	116.98	119.32	117.04	117.34	0.00	2.28
MH502	116.76	119.11	116.94	117.24	0.00	2.17
MH504	112.95	116.75	113.31	113.61	0.00	3.44
MH506	109.06	114.61	109.59	109.89	0.00	5.02
MH508	108.77	113.03	109.35	109.65	0.00	3.68
MH510	108.61	112.81	109.21	109.51	0.00	3.60
MH512	108.03	112.49	108.61	108.91	0.00	3.88
MH514	109.77	112.57	110.04	110.34	0.00	2.53
MH516	110.91	113.43	111.16	111.46	0.00	2.27
MH518	111.05	113.56	111.16	111.46	0.00	2.40
MH600	111.80	114.25	111.80	112.10	0.00	2.45

As shown in the above table, the HGL elevations are generally within the pipes at all manhole locations, with the exception of the pipe run near Outlet 1 (Wolf Grove Creek) where there is surcharging. This surcharging is mostly due to the conservative boundary condition and the 100-year flows being captured at MH204. Minimum USF elevations have also been determined to aid in the design of individual lots at the detailed design stage.

3.0 SANITARY SERVICING

3.1 Existing Sanitary Infrastructure & Master Plan Update Requirements

The sanitary outlet for the Subject Site is an existing 250mm sanitary sewer located within Malcolm Street, approximately 100m south on Malcolm Streat and 160m east on Strathburn Street from the Subject Site. This gravity sewer ultimately conveys the flows to the Gemmill Bay Pump Station, which pumps to the Municipal Wastewater Treatment Plant (WWTP).

As per the Master Plan Update Report (MPU) (J.L. Richards and Associates, 2018) all flows from these development areas are anticipated to be directed to this existing gravity sewer system. The peak flows anticipated from this development area that were anticipated in the MPU were 10.27L/s. The MPU anticipated that flows from this area would be pumped and would come online in the 2023-2028 time horizon.

The MPU identifies capacity issues with the collector on Malcolm Street between Hope Street (MH 1-102 to MH 1-100) and Almonte Street under the full build out scenario (2037+). The MPU identifies the need for upsizing of the existing sanitary sewer in this are to accommodate the full buildout of the development areas in the northwest quadrant.

Based on a review of information provided by J.L. Richards on the existing sanitary sewer system (see **Appendix C**), there is currently approximately 58% of the peak capacity (+/-24.2L/s) available in the critical pipe run (MH 1-101 to MH 1-100). Based on the MPU (J.L. Richards, 2018) and the additional information provided, the critical pipe runs will exceed the available capacity only when all the future development lands identified to the west of County Road 29 are developed and are contributing flows to the Malcolm Street sanitary sewer.

Refer to **Figure 5** – Offsite Conceptual Servicing for an illustration of the proposed sanitary connection and layout details.

3.2 Proposed Sanitary Sewer

Off-site works

The proposed off-site sanitary sewer works will consist of a twin forcemain from the on-site pump station block, along Street 2, Strathburn Street and Malcolm Street to the existing sanitary maintenance hole (MH 1-108) on Malcolm Street. Based on MOE criteria, a single forcemain (100mm dia. HDPE) is anticipated to be sufficient to convey the design flows, however twinning the forcemain (2 x 100mm dia. HDPE) is proposed to provide redundancy and future capacity should lands to the north of the proposed development be brought into the urban boundary in the future.

On-site works

The proposed development is anticipated to be serviced by a combination of 200mm diameter and 250mm diameter sanitary gravity sewers. The sewage flows from the site will be directed by gravity to the pump station at the south of the site, adjacent to the proposed park. Oversizing of the sanitary sewer has been proposed from the pump station block to Street 6 to provide sufficient future capacity if Municipality decides to expand the urban boundary to the north in the future. Due to significant grading constraints across the site, the eastern portion of the site will need to be serviced by a gravity sewer outletting directly to the proposed pump station. The sewer is alignment is proposed to be within the wetland setback limits but a minimum of 5m outside of the defined wetland limits.

3.3 Design Criteria

Population and sanitary flow estimates for the proposed development have been calculated using design criteria from the MPU (J.L. Richards, 2018) and the City of Ottawa Sewer Design Guidelines (October 2012, as amended). Preliminary sanitary flow analysis of the Brown Lands residential development has been completed based on the following design criteria:

Demand Values

- Residential Demand = 350 L/cap/day
- Population Density
  - Single Unit = 3.4 persons/unit
  - Semi-detached Unit = 2.7 persons/unit
  - Townhouse Unit = 2.7 persons/unit
- Park Demand = 3700 L/ha/day

Design Parameters

- Max. Residential Peak Factor 'P.F.' = 4.0 (based on Harmon Equation)
- Harmon Correction Factor 'K' = 0.8 (per City of Ottawa, *ISTB-2018-01*)
- Infiltration Flow Rate = 0.28 L/sec/ha
- Min. Sanitary Flow Velocity = 0.6 m/s
- Manning's Roughness Coefficient 'n' = 0.013

3.4 Sanitary Flow Analysis

The peak sanitary flow for the proposed development is **14.29 L/s**. Calculated peak flows for the proposed development are summarized below in **Table 3.1**.

Table 3.1: Peak Sanitary Flows Summary

Phase	Development Condition	Population	Area (ha)	Peak Res. / Park Flow (L/s)	Peak Extran. Flow (L/s)	Peak Design Flow (L/s)
Proposed	Residential	701	15.88	9.41	4.45	13.86
	Park	-	0.97	0.16	0.27	0.43
Totals		515	16.85	9.57	4.72	14.29

The proposed sanitary sewer network can accommodate the peak design flows calculated for proposed development. Refer to **Figure 9 -** Preliminary Sanitary Drainage Area Plan and the Sanitary Sewer Design Sheet provided in **Appendix C** for details.

Existing Infrastructure Capacity

The proposed peak sanitary sewer flows of 14.29L/s are greater than the 10.27L/s anticipated in the MPU (J.L. Richards, 2018), however, as discussed above, the critical section of the existing downstream sanitary sewer on Malcolm Street (Hope Street to Almonte Street) currently has approximately 24.2L/s of available capacity. The additional proposed flows from the development will not impact the downstream sanitary sewer in the short term, and the required municipal upgrades identified in the long term would be able to accommodate the additional 4L/s of additional peak flows from the proposed development.

LEGEND

AREA 401 | 721-719 | 0.73 | 62

- AREA ID
- MAINTENANCE HOLE TO MAINTENANCE HOLE
- POPULATION
- AREA (IN HECTARES)
- SANITARY DRAINAGE AREA BOUNDARY
- 101 — PROPOSED SANITARY SEWER

COUNTY ROAD 29

FUTURE DEVELOPMENT LANDS

NORTH TRIBUTARY

WEST TRIBUTARY

WOLF GROVE CREEK

MISSISSIPPI RIVER

STRATHBURN STREET

AREA 1 | 101-103 | 0.96 | 68
AREA 2 | 103-105 | 0.51 | 33
AREA 3 | 107-105 | 0.41 | 30
AREA 4 | 105-227 | 0.37 | 20
AREA 5 | 223-225 | 0.49 | 36
AREA 6 | 225-227 | 0.36 | 20
AREA 7 | 107-233 | 0.51 | 31
AREA 8 | 233-231 | 0.07 | 3
AREA 9 | 231-227 | 0.13 | 0
AREA 10 | 227-301 | 0.24 | 12
AREA 11 | 301-209 | 0.85 | 45
AREA 12 | 221-219 | 0.32 | 22
AREA 13 | 219-215 | 0.26 | 10
AREA 14 | 215-213 | 0.25 | 10
AREA 15 | 225-401 | 0.43 | 30
AREA 16 | 401-213 | 0.42 | 24
AREA 17 | 213-211 | 0.19 | 10
AREA 18 | 211-209 | 0.27 | 14
AREA 19 | 209-207 | 0.25 | 10
AREA 20 | 207-205 | 0.50 | 27
AREA 21 | 201-203 | 0.22 | 10
AREA 22 | 203-205 | 0.09 | 3
AREA 23 | 205-3007 | 0.05 | 0
AREA 24 | 107-109 | 0.41 | 16
AREA 25 | 109-111 | 0.41 | 20
AREA 26 | 111-113 | 0.28 | 7
AREA 27 | 113-505 | 0.54 | 31
AREA 28 | 109-501 | 0.46 | 27
AREA 29 | 501-503 | 0.21 | 7
AREA 30 | 503-505 | 0.41 | 20
AREA 31 | 505-507 | 0.13 | 3
AREA 32 | 601-509 | 0.85 | 0
AREA 33 | 601-519 | 0.63 | 31
AREA 34 | 519-517 | 0.34 | 7
AREA 35 | 517-515 | 0.44 | 20
AREA 36 | 515-513 | 0.19 | 3
AREA 37 | 513-511 | 0.40 | 24
AREA 38 | 511-509 | 0.24 | 10
AREA 39 | 509-507 | 0.17 | 3
AREA 40 | 507-3007 | 1.62 | 0
AREA 41 | 0-3007 | 0.97 | 0

PARK
AREA=0.97ha

EMERGENCY SANITARY BYPASS
(FROM MH 3007)

EMERGENCY SANITARY BYPASS

2x100mmØ HDPE SAN

200mmØ SAN

250mmØ SAN

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MUNICIPALITY of MISSISSIPPI MILLS
BROWN LANDS

PRELIMINARY SANITARY DRAINAGE AREA PLAN

SCALE 1 : 2000 (0 20 40 60 80)

DATE FEB 2023 | JOB 118178 | FIGURE FIGURE 9

M:\2018\118178\CAD\Design\Figures\SAN\118178-FIG9-SAN.dwg, SAN, Feb 10, 2023 - 3:00pm, jroy

SHT11X17.DWG - 279mmX432mm

4.0 SANITARY PUMP STATION

The sanitary pump station will be designed for the sanitary demands as discussed in Section 3 above and will be equipped with standby power designed in accordance with the City of Ottawa Sewer Design Guidelines (October 2012, as amended).

Refer to **Figure 10** - Preliminary Sanitary Pump Station Layout, which provides a preliminary layout for the pump station block, and **Figure 11** - Preliminary Sanitary Pump Station Elevation, which provides preliminary elevations for the pump station.

The sanitary pump station will consist of numerous components outlined in the following sections which will be detailed following draft plan approval.

4.1 Wet Well

The wet well will be a prefabricated station (FRP or reinforced concrete) with pump rails, ultrasonic level controls, MultiTrode backup level control, vents, access hatches, and piping. The wet well will be designed to provide a minimum 5-minute cycle time for the pumps under ultimate flow conditions.

The wet well base will be at approximately 9.0m below finish grade to provide working volume below the inlet sewer (to be confirmed as part of detailed design). Flows from the subdivision will enter the wet well through a 250mm sanitary sewer. The wet well will include an inlet basket screen to capture any large debris which could adversely affect pumps. The wet well should be operated in a manner that minimizes retention time and solids accumulation while minimizing pump starts to 5-minute intervals.

A review will be completed during detail design to determine if the wet well will require installation on a concrete base to provide uplift resistance.

4.2 Odour Attenuation

The lift station will be serving a small catchment area and is not expected to have significant odour production. Hydrogen sulphide is the primary source/ indicator of odour and is present in wastewater which has had time to significantly consume dissolved oxygen. The wet well operating levels will be detailed to minimize retention. The wet well ventilation pipes will be equipped with carbon filters as another layer of protection against local odors.

4.3 Sewage Pumps

The wet well will include two sewage pumps. One pump will be a duty pump and the second pump will be standby. The duty pump will cycle after each pump cycle. Each pump will be sized for peak flow. Pump calculations and pump selection will be provided during detailed design.

Pumps will discharge to a 340m length of 100mm diameter HDPE forcemain which will outlet to the existing sanitary gravity sewer on Malcolm Street.

81.1m-250mmØ SAN @ 0.40%

5.0m-250mmØ SAN @ 1.00%

EMERGENCY OVERFLOW

SURFACE OUTLET
INV = 111.62

WET WELL
(3000mm dia.)

38.4m-200mmØ SAN @ 1.00%
(FROM MH 3007)

37.9m-200mmØ SAN @ 1.50%

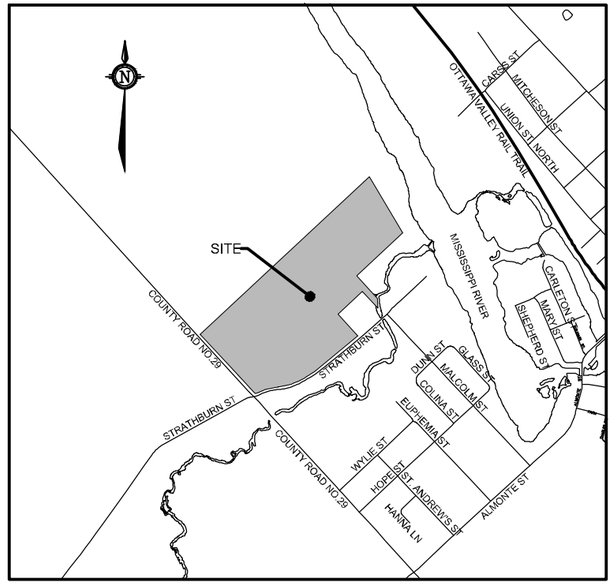
EMERGENCY GENERATOR

CONTROL PANEL
AND CANOPY

VALVE CHAMBER

11.4m-200mmØ SAN @ 1.60%

2x100mmØ HDPE SANITARY
FORCEMAIN (340m) TO CONNECT TO
EXISTING SANITARY MAINTENANCE
HOLE ON MALCOLM ST (MH 1-108).



LEGEND

- SANITARY PUMP STATION PROPERTY LIMITS
- 203 PROPOSED SANITARY MH & SEWER
- 204 PROPOSED STORM MH & SEWER
- PROPOSED CURB

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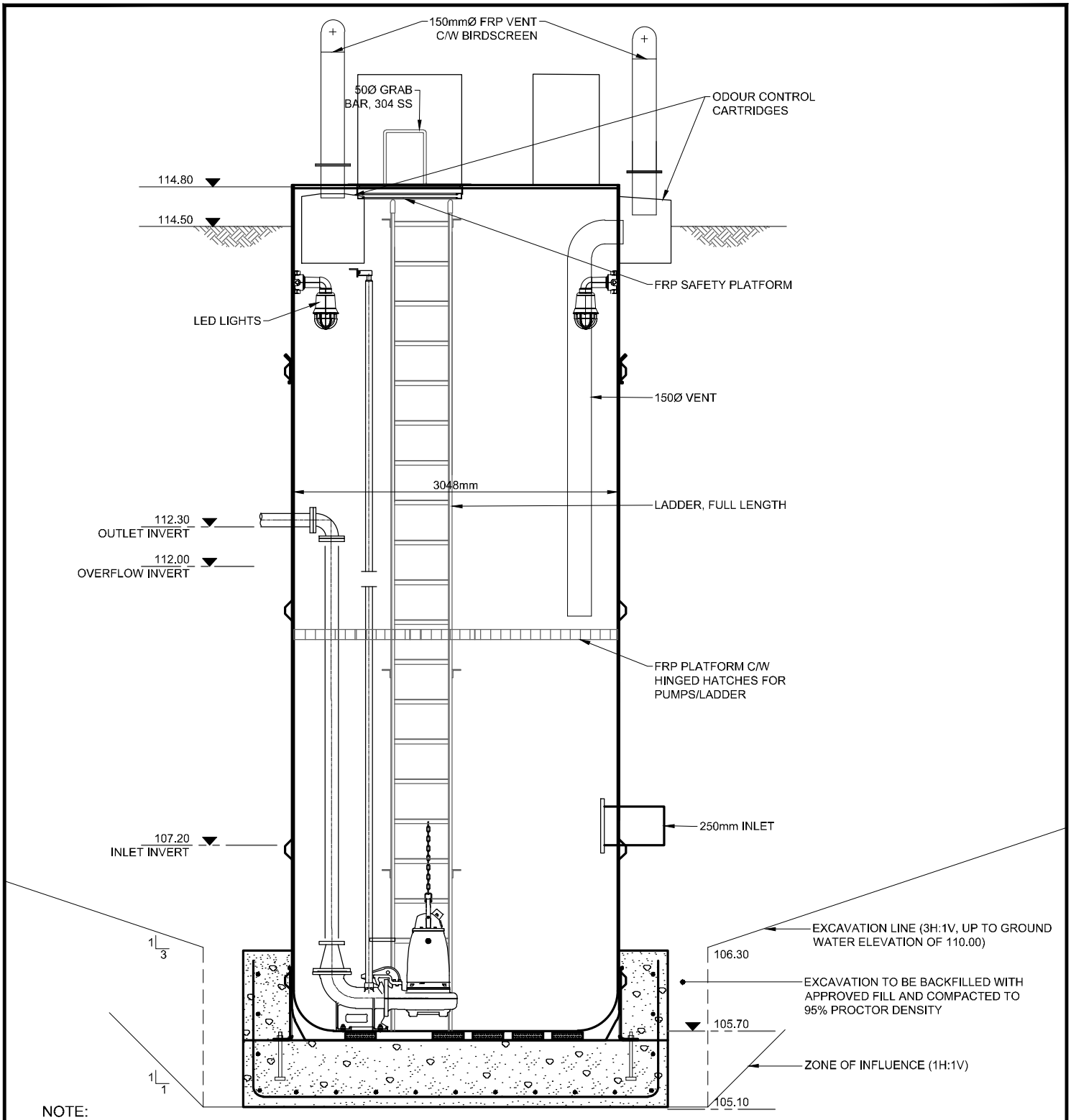
MUNICIPALITY of MISSISSIPPI MILLS
BROWN LANDS

PRELIMINARY PUMP STATION LAYOUT

SCALE 1 : 300 (0, 3, 6, 9, 12)
DATE FEB 2023
JOB 118178
FIGURE FIGURE 10

SHT11X17.DWG - 279mmX432mm



NOTE:
FIGURE PROVIDED FOR THE PURPOSE OF DEMONSTRATING PRELIMINARY ELEVATIONS. WET WELL DETAILS TO BE PROVIDED AS PART OF DETAILED DESIGN STAGE.

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PRELIMINARY PUMP STATION ELEVATION

SCALE		
N.T.S.		
DATE: FEB 2023	JOB: 118178	FIGURE: FIGURE 11

M:\2018\118178\CAD\Design\Figures\Design Brief\Draft Plan\118178-FIG10&11-PS.dwg, PS-ELEV, Feb 10, 2023 - 2:40pm, jroy

SHT8X11.DWG - 216mmx279mm

4.4 Sewage Flow Totalizer

The wet well include an ultrasonic level transmitter to provide continuous reading of wet well levels. The PLC will be programmed to record both incoming and pumped flow rates for each 1-hour interval based on rate of rise in wet well and number of pump cycles with associated on/ off levels.

4.5 Emergency Generator

An emergency generator will provide standby power in the event of a primary power failure for the lift station. The generator will be sized to power the complete station and will include a subbase double walled diesel tank with capacity for 24-hours of operation.

4.6 Bypass Manhole

The sanitary sewer will be designed to provide for an emergency overflow to the adjacent watercourses in the event of a catastrophic failure of the sanitary pump station. The bypasses will be designed to provide a minimum of 0.3m of clearance between the sanitary HGL and the upstream underside of footings (USFs).

The first emergency bypass will be provided from the maintenance hole immediately upstream of the wet well and will provide adequate protection for all units west of the north tributary. A second emergency overflow is anticipated to be required for later stages of the development and will provide protection for all units east of the north tributary. The second emergency bypass will be provided to storm sewer outlet 2, downstream of the proposed OGS unit.

All emergency overflow pipes will include a backflow preventer to provide protection against reverse flows. Ultrasonic level transmitter will be provided to monitor sewage levels and provide the PLC with level readings to allow emergency overflow volumes to be calculated based on sewage level relative to an overflow weir located at the emergency overflow pipe entrance as emergency overflow volumes will need to be reported to the MECP. A full reporting protocol and operational manual will be prepared for use by the lift station operators. A copy of this protocol will also be given to the other stakeholders, so people are informed and know what to do in the event of an overflow.

4.7 Electrical/Control Panels

The lift station will include control panels and a 3mx3m canopy. The canopy will house the electrical and control panels. Separate panels will be provided for electrical distribution and control wiring.

4.8 Communications Feed

The lift station will be provided with a high-speed internet feed for SCADA communications.

4.9 Process Control Narrative

A Process Control Narrative will be provided during detailed design. It will provide an overall summary of the pump station, its components, how its operation will be phased with development and other design components of the facility.

5.0 WATER SERVICING

5.1 Existing Watermain Infrastructure & Master Plan Update Requirements

The existing watermain infrastructure adjacent to the Subject Lands is limited. The existing watermain includes a 150mm diameter watermain at the corner of County Road 29 and Wylie Street and a 150mm diameter watermain on Malcolm Street at Strathburn Street. Based on boundary conditions supplied by J.L. Richards (see **Appendix D**) this existing infrastructure is unsuitable to support the required water demands of the Subject Lands.

The MPU (J.L. Richards, 2018) identifies the following three water distribution system upgrades to service residential development in the northwest quadrant of the Municipality where the Subject Lands are situated:

- County Road 29 Looping – Wylie to Dunn Street – 250mm dia. – Short Term (2018-2022)
- County Road 29 Well 6 to Wylie Street Upgrade – 250mm dia. – Mid-Term (2023-2028)
- Mississippi River Third Crossing (and associated upgrades on east side of River) – Carss Street to Brown Lands – 300mm dia. – Mid-Term (2023-2028)

The report also identifies that the County Road 29 watermain and the Mississippi River Third Crossing will operate in a separate pressure zone than the watermain servicing the existing residential units in the northwest (Malcolm Street, Wylie Street etc.). Previous correspondence from the Municipality (C. Smith, February 2022, **Appendix A**) indicated that a connection to the existing watermain on Malcolm Street at Strathburn Street would be required for the development. Based on the boundary conditions provided and that this watermain will be operating in a lower pressure zone, this connection is not required, and if provided would require a pressure reducing valve. The boundary conditions provided by J.L. Richards indicate that the County Road 29 watermain will operate at the ultimate system pressure zone from the commissioning of the watermain.

Based on the MPU (J.L. Richards, 2018) and correspondence from the Municipality (C. Smith, February 2022, **Appendix A**), it is anticipated the development will operate under two distinct hydraulic conditions:

- Interim Condition – Single Connection to the 250mm dia. on County Road 29 at Dunn Street (available in 2025). This condition will be able to provide sufficient pressures and flows for residential uses. It will have a limited fire flow capacity of 45L/s and lack redundancy (multiple connections).
- Ultimate Condition – Looped connection to the 300mm dia. Mississippi River Third Crossing in the northeast corner of the site (available in 2027) and the 250mm dia. on County Road 29 at Dunn Street. This condition will have sufficient pressures and flows for residential uses and fire flows (up to +/-148L/s) in addition to providing service redundancy with the multiple connection locations.

5.2 Proposed Watermain

The proposed development is anticipated to be serviced by a 250mm diameter backbone watermain combined with 200mm diameter, 150mm diameter and 50mm diameter distribution mains.

The backbone watermain will be extended from the southwest corner of the site (Street 2), along County Road 29 to connect to the proposed 250mm dia. watermain to be installed by the Municipality at Dunn Street. A second connection will be provided in the northeast corner of the site to the proposed 300mm dia. watermain (Mississippi River Third Crossing - To be installed by the Municipality) at a later stage in the development once the crossing has been constructed. The exact location and configuration of this connection will be determined once more details regarding the watermain river crossing location is available.

The watermain has been oversized along Street 6 to provide sufficient future capacity if Municipality decides to expand the urban boundary to the north in the future.

Refer to **Figure 12** - Preliminary Watermain Layout/Watermain Node Locations for the preliminary watermain layout.

5.3 Design Criteria

Design criteria for the Subject Lands is based on the MPU (J.L. Richards, 2018) and the City of Ottawa Design Guidelines for Water Distribution (July 2010, as amended). Design criteria including population density has been assumed from the City of Ottawa Design Guidelines. Preliminary watermain analysis of the proposed development was completed based on the following criteria:

Demands

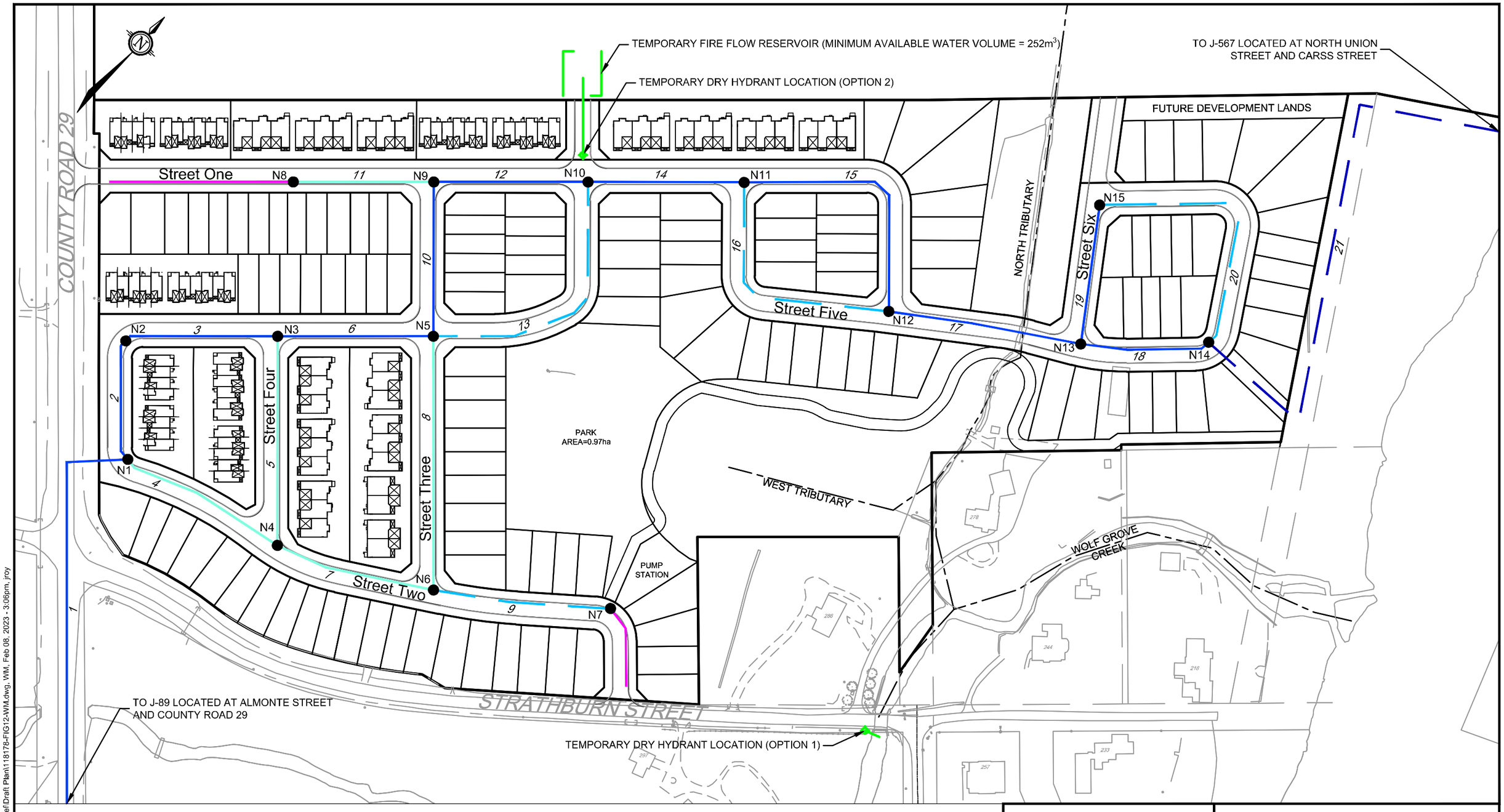
Average daily demand	=	350 L/day/cap
Single family unit density	=	3.4
Semi-Detached/Townhouse unit density	=	2.7
Apartments (Not Required)	=	2.1
Maximum Daily Demand	=	2.5 x Average Daily Demand
Peak Hour Demand	=	2.2 x Maximum Daily Demand

System Requirements

Maximum System Pressure (ROW)	<	690 kPa (100psi)
Maximum System Pressure (Services)	<	552 kPa (80psi)
Minimum System Pressure	>	690 kPa (40psi) excluding fire flows
Minimum System Pressure	>	690 kPa (20psi) including fire flows
Maximum Age	<	24 hours (onsite)

Friction Factors (C)

50mm copper/150mm PVC	=	100
200mm/250mm PVC	=	110
300mm PVC	=	120



LEGEND

- PROPOSED 50mmØ WATERMAIN
- PROPOSED 150mmØ WATERMAIN
- PROPOSED 200mmØ WATERMAIN
- PROPOSED 250mmØ WATERMAIN
- FUTURE 300mmØ WATERMAIN
- N12 — NODE ID
- 4 — PIPE ID
- PROPOSED TEMPORARY DRY HYDRANT (INSTALLED PER NFPA 1142)
- PROPOSED TEMPORARY FIRE FLOW RESERVOIR LIMITS

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MUNICIPALITY of MISSISSIPPI MILLS
BROWN LANDS

PRELIMINARY WATERMAIN LAYOUT/WATERMAIN NODE LOCATIONS

SCALE 1 : 2000 (0, 20, 40, 60, 80)

DATE FEB 2023 | JOB 118178 | FIGURE FIGURE 12

M:\2018\118178\CAD\Design\Figures\Design Brief\Draft Plan\118178-FIG12-WM.dwg, WM, Feb 08, 2023 - 3:06pm, jroy

SHT11X17.DWG - 279mmX432mm

Fire Flow Demands

Fire flow demands were calculated for the proposed building types and zoning setbacks using the Fire Underwriters Survey (FUS, 2020) method and compared to the fire flow values determined using the Ontario Building Code (OBC, 2012) method. Using the OBC method, the fire flows range from 45 L/s-60L/s for single home units, 75L/s for semi-detached units, and 105 L/s for townhome blocks of 5-units or less, and 150L/s for 6-unit townhome blocks. Using the FUS method the minimum required fire flow for this development would be 167L/s, which is based on the City of Ottawa Technical Bulletin ISDTB-2014-02 which limits the fire flow requirements under the FUS method for single units and traditional side-by-side townhomes.

Based on correspondence from J.L. Richards (Appendix D), the municipal system will only be able to supply approximately 45L/s under interim boundary conditions (single feed watermain) and less than 150L/s under ultimate conditions (looped watermain).

While the municipality has recently requested that the FUS method be utilized for modelling fire flows for the hydraulic calculations (see **Appendix A**), this is not possible as the municipal system is not capable of supplying the fire flows that are required utilizing FUS calculations. Based on a review of other similar new residential developments in the area, it appears the OBC method has primarily been used for fire flow analysis. Additionally, design criteria in the MPU (J.L. Richards, 2018) for fire flow demands where residential unit separation is less than 3m is 100 L/s in Table 10 (refer to **Appendix D**). This is consistent with the maximum 105 L/s calculated OBC fire flows for 5-unit townhouses within the Subject Lands. Correspondence with respect to utilizing the OBC method to determine fire flows has been submitted previously to the municipality for review regarding the Mills Lands project (**Appendix A**).

Based on the foregoing, fire flow demands utilized for the hydraulic analysis for the Subject Lands will be based on the OBC method. The maximum fire flows are 60L/s for single units, 75L/s for semi-detached units, and 105L/s for townhome blocks. Townhome blocks larger than 5-units will be require a 2-hour firewall to limit fire flow demands to 105L/s or less. Fire flow calculations can be found in **Appendix D**. The fire flow assumptions are to be confirmed and updated boundary conditions are to be obtained as part of detail design for the Brown Lands residential development.

5.4 Hydraulic Analysis

The hydraulic modelling software EPANET (v2.2) was used to analyze the performance of the proposed watermain configuration for three (3) theoretical conditions:

- Maximum HGL (Avg. Day)
- Peak Hour
- Maximum Day + Fire Flow Demand

Figure 12 - Preliminary Watermain Layout/Watermain Node Locations provides a schematic representation of the hydraulic network and depicts the node and pipe numbers used in the model. The hydraulic model is based on the boundary conditions provided by J.L. Richards & Associates Limited (2022). Where required, the boundary conditions were interpolated to provide approximated system pressures under different demand scenarios. The system was modelled for each of the 2 proposed scenarios, an interim condition based on a single offsite connection to the 250mm dia. watermain on County Road 29 and an ultimate condition based on two offsite connections, one to the 250mm dia. watermain on County Road 29 and the second to the 300mm dia. Mississippi River Third Crossing. All analyses were completed under a full build out scenario. Phased hydraulic analyses will be completed at detailed design as required. Refer to **Appendix D** for the boundary conditions, hydraulic demands and modeling results.

5.4.1 Interim Conditions

The hydraulic analysis of the proposed watermain network under interim conditions with a single offsite connection to the 250mm dia. watermain on County Road 29 was completed. The modeled fire flow demands were limited to 45L/s due to existing system constraints under this scenario. The results are presented in **Table 5.1**.

Table 5.1: Hydraulic Analysis Summary – Interim Conditions

Condition	Demand (L/s)	Min/Max Allowable Pressure (kPa/psi)	Min/Max Operating Pressure (kPa/psi)	Max. Age (hrs)
Maximum HGL (Avg. Day)	2.86	ROW - 689.5/100 (Max) Private - 551.6/80 (Max)	645.40/93.61 (Max)	29.0
Peak Hour	15.82	275.8/40.0 (Min)	469.51/68.10 (Min)	N/A
Max. Day Demand (& 45L/s Fire Flow)[1]	52.18	137.9/20.0 (Min)	155.19/22.51 (Min)	N/A

[1] – Fire Flow demand has been capped at 45L/s under the interim scenario due to existing system limitations.

Based on the analysis, the maximum pressure will exceed the allowable limit for private services. Pressure reducing valves will be required on an individual unit basis with the exact limits to be determined at detailed design. The maximum age of the water on-site exceeds the allowable (24hrs max.) in the eastern areas of the development. As these areas will be the last to be developed, the requirement for mitigation (flushing hydrants etc.) will be reviewed during detailed design based on phasing and the timing of the ultimate connection. Minimum system pressures under peak hour demands and during the critical fire flow event (45L/s) exceed the minimum requirements. Complete analysis results are provided in **Appendix D.**

Fire Flow Supply

Under the interim conditions, only 45L/s of fire flows are anticipated to be available through the municipal water system. As the Municipality is partially rural, it is understood that the Fire Department has the necessary equipment (pumper and tanker trucks) and expertise to provide firefighting services from non-municipal water sources (i.e. ponds, rivers, etc.). Based on this, it is proposed to supplement the municipal system fire flows with an on-site water source to supply the additional water volumes required to meet the fire flow demands of the development until the Mississippi River Third Crossing is installed (2027). Using OBC calculations the critical total Required Fire Protection Water Supply Volume for the development (5-unit townhome block) is 251,966L (refer to fire flow calculations, **Appendix D**). This required volume can be provide either from an existing watercourse with sufficient flows or from a pond sized to supply these flows. It is proposed to provide a dry hydrant in one of two locations, which would provide the supplemental fire flow volumes during the interim hydraulic conditions. The proposed locations are either a dry hydrant connected directly to Wolf Grove Creek on Strathburn Street immediately east of the development, or a dry hydrant located on the north side of Street 1 at Street 2 connected to a temporary water storage pond located directly north of the proposed development on lands owned by the proponent. Refer to **Figure 12** for the conceptual locations.

Alternative Configurations

Several alternative watermain configurations have been reviewed to determine if a more suitable solution to the interim watermain configuration is feasible. One option reviewed the possibility of upsizing the proposed 250mm dia. watermain on County Road 29 to a 300mm dia. watermain. The analysis showed a very minor (+/-5L/s) increase in available fire flows under the interim conditions. In addition, there was a negligible change to the hydraulic conditions in the ultimate configuration. As such, the upsizing costs were not considered justifiable based on the minimal overall benefit to the system in both the interim and in the ultimate configurations.

Another option considered consisted of providing an interim connection along Strathburn Street from Street 2 to the existing 150mm dia. watermain on Malcolm Street was reviewed. This option was considered in order to provide redundancy in the interim scenario. Based on the boundary conditions provided by J.L. Richards (2022) this connection would only be able to provide 45L/s of fire flow supply under Year 1 demands (+/-50 units). In addition, due to the future pressure zone, a pressure reducing valve would be required at the connection point, which is expensive and would result in additional infrastructure for the Municipality to maintain. The additional infrastructure costs to provide 2 years of backbone redundancy for a brand new watermain (County Road 29) are quite high and are not considered economically feasible for the short duration of the potential benefit.

Conclusion

While the proposed system lacks redundancy of the backbone watermain under the interim condition, the proposed configuration meets regulatory requirements and is considered suitable for a finite period (+/- 2 years). The Municipality currently has several existing developments which have a single backbone watermain, at least one of which is a permanent situation (White Tail Ridge).

The development phasing will provide on-site looping of the watermain under interim conditions. Although the interim hydraulic modelling has been completed for full development build out, it is estimated that development would take place over the 4 years, meaning that only 50% of the development would likely be completed by the time that the third river crossing is completed (2027).

The development can be adequately serviced on an interim basis with a single feed provided that the 250mm diameter watermain is installed by the Municipality from Well 6 along County Road 29 to Dunn Street as planned.

5.4.2 Ultimate Conditions

The hydraulic analysis of the proposed watermain network under ultimate conditions with two offsite connections, one to the 250mm dia. watermain on County Road 29 and the second to the 300mm dia. Mississippi River Third Crossing, was completed. The results are presented in **Table 5.2**.

Table 5.2: Hydraulic Analysis Summary – Ultimate Conditions

Condition	Demand (L/s)	Min/Max Allowable Pressure (kPa/psi)	Min/Max Operating Pressure (kPa/psi)	Max. Age (hrs)
Maximum HGL (Avg. Day)	2.86	ROW - 689.5/100 (Max) Private - 551.6/80 (Max)	658.2/95.46 (Max)	9.5
Peak Hour	15.82	275.8/40.0 (Min)	297.9/74.20 (Min)	N/A
Max. Day Demand (& 60L/s Fire Flow)[1]	67.18	137.9/20.0 (Min)	449.7/65.22 (Min)	N/A
Max. Day Demand (& 75L/s Fire Flow)[1]	82.18	137.9/20.0 (Min)	414.3/60.09 (Min)	N/A
Max. Day Demand (& 105L/s Fire Flow)[1]	112.18	137.9/20.0 (Min)	259.6/37.65 (Min)	N/A

[1] – Fire Flow demand is based on Ontario Building Code (OBC, 2012) calculations.

Based on the analysis, the maximum pressure will exceed the allowable limit for private services (80psi). Pressure reducing valves will be required on an individual unit basis with the exact limits to be determined at detailed design. Minimum system pressures under peak hour demands and during the critical fire flow event (up to and including 105L/s) exceed the minimum requirements. Complete analysis results are provided in **Appendix D.**

The development can ultimately be adequately serviced provided that the 250mm diameter watermain is installed from Well 6 along County Road 29 to Dunn Street and the Third Mississippi River Crossing and associated upgrades are completed as planned by the Municipality.

6.0 UTILITY INFRASTRUCTURE

The development will be serviced by hydro (Ottawa River Power Corporation), communications (Bell, Rogers and Cogeco), gas (Enbridge), as per the Municipality of Mississippi Mills approved utility standard right-of-way cross-sections. Engagement with the respective utility companies is anticipated to be undertaken during and following the draft plan of subdivision approval process.

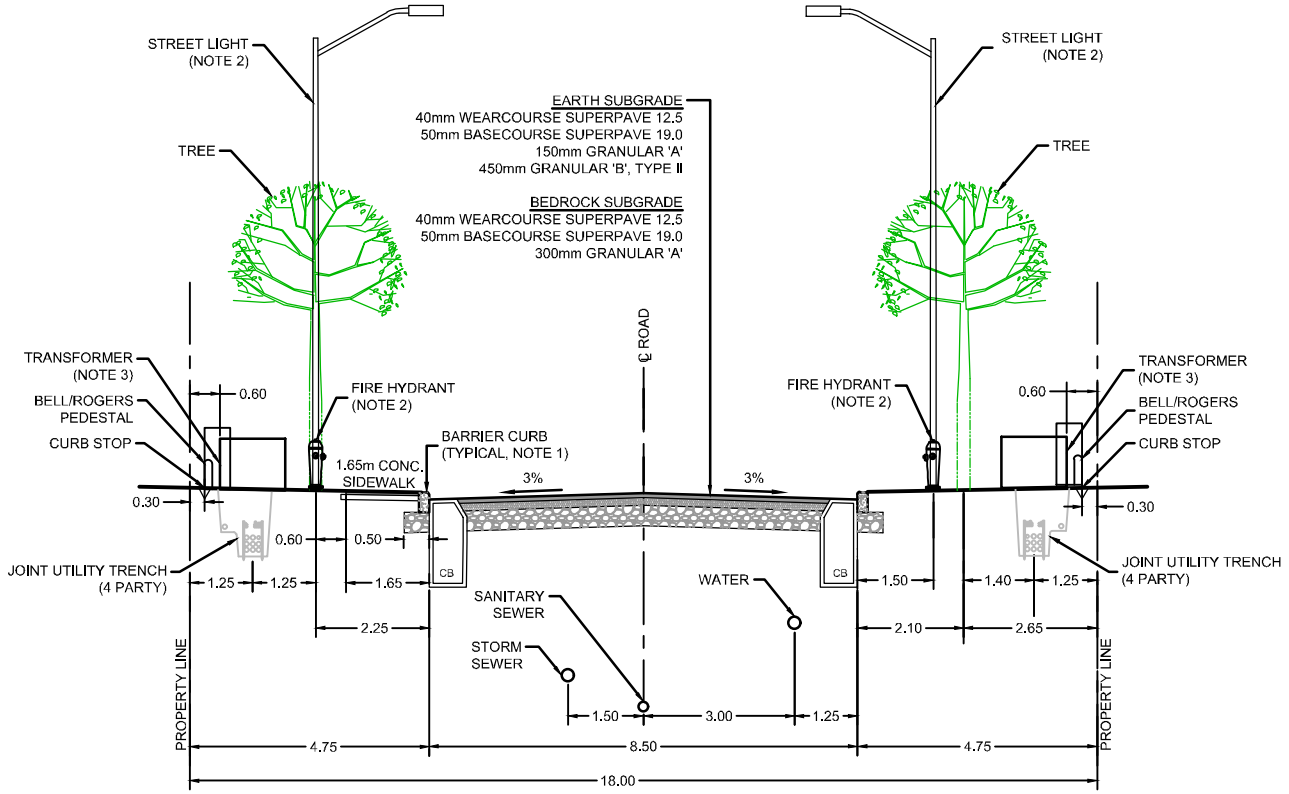
7.0 PHASING

The Brown Lands residential development is anticipated to be constructed in multiple phases, commencing in the southwestern portion of the site (Street 2, Strathburn Street to Country Road 29), and advancing to the north and then east.

8.0 ROADWAYS

The internal subdivision roads will be constructed in accordance with the typical road cross-sections as shown in **Figure 13** - Typical Road Cross Section - With Sidewalk and **Figure 14** - Typical Road Cross Section - No Sidewalk. All roads will have an 18-metre right-of-way with an 8.5-metre asphalt width and curbs. Refer to **Figure 15** - Network and Pathways Plan for sidewalk locations. Preliminary grading for the Subject Lands is shown on **Figure 7** – Conceptual Grading Plan.

Any disturbances to existing streets (County Road 29, Strathburn Street and Malcolm Street) to facilitate the installation of required infrastructure is anticipated to be reinstated back to existing conditions. There are no modifications or changes to the existing roadways proposed.



NOTES:

1. MOUNTABLE CURB TO BE INSTALLED IN FRONT OF TOWNS. TRANSITION LOCATIONS TO BE NOTED ON GRADING PLANS.
2. FIRE HYDRANTS TO BE LOCATED ON WATERMAIN SIDE OF STREET. STREET LIGHTS TO BE ON OPPOSITE SIDE.
3. TRANSFORMERS TO BE LOCATED ON THE OPPOSITE SIDE OF THE SIDEWALK WHEREVER POSSIBLE.

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MUNICIPALITY of MISSISSIPPI MILLS
BROWN LANDS

TYPICAL ROAD CROSS SECTION - WITH SIDEWALK

SCALE 1 : 150 (0 2 4 6)

DATE FEB 2023 | JOB 118178 | FIGURE FIGURE 13

SHT8X11.DWG - 216mmx279mm

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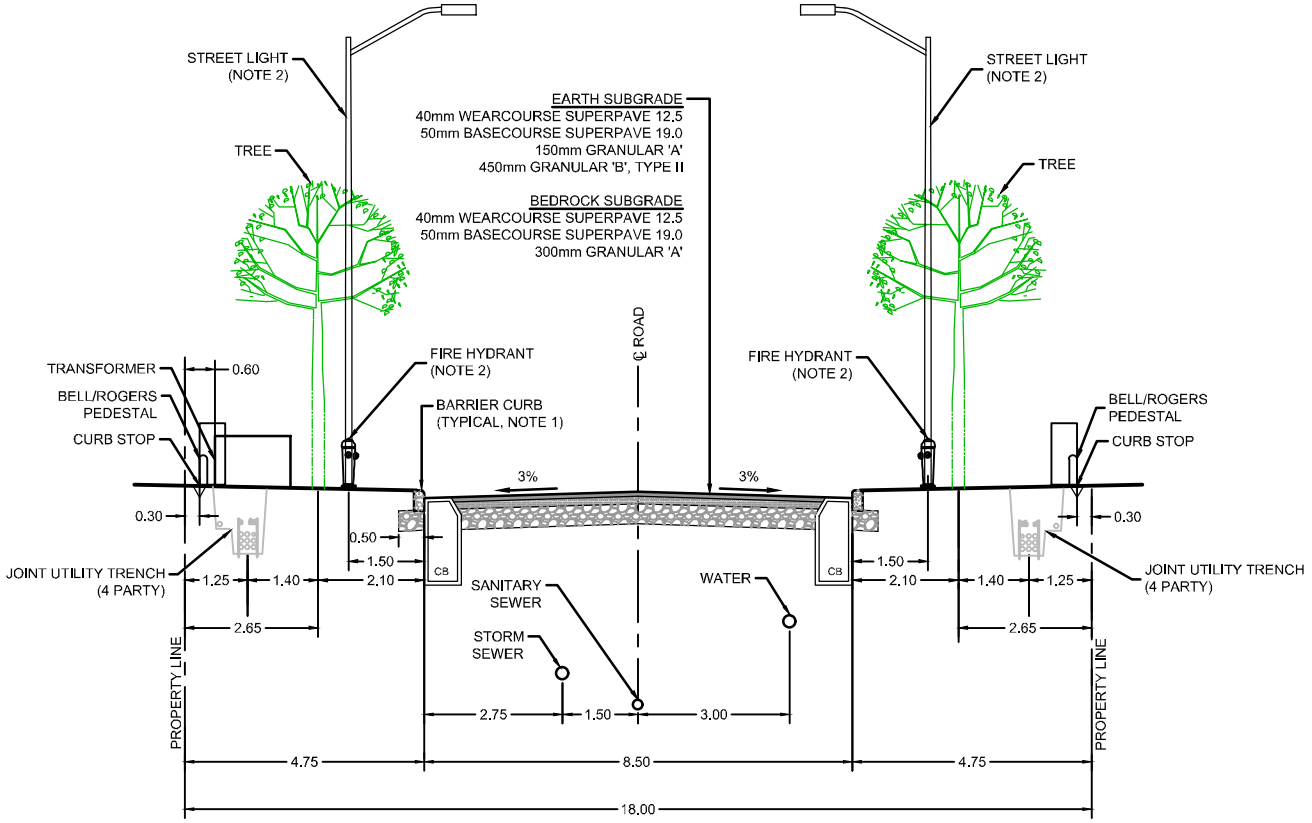

NOTES:

1. MOUNTABLE CURB TO BE INSTALLED IN FRONT OF TOWNS. TRANSITION LOCATIONS TO BE NOTED ON GRADING PLANS.
2. FIRE HYDRANTS TO BE LOCATED ON WATERMAIN SIDE OF STREET. STREET LIGHTS TO BE ON OPPOSITE SIDE.

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MUNICIPALITY of MISSISSIPPI MILLS
BROWN LANDS

TYPICAL ROAD CROSS SECTION - NO SIDEWALK

SCALE 1 : 150 (0 2 4 6)

DATE FEB 2023 | JOB 118178 | FIGURE FIGURE 14

SHT8X11.DWG - 216mmx279mm

M:\2018\118178\CAD\Design\Figures\Design Brief\Draft Plan\118178-FIG13&14-XS.dwg, XS2, Feb 01, 2023 - 8:44am, jroy

COUNTY ROAD 29

Street One

Street Two

Street Three

Street Four

Street Five

Street Six

FUTURE DEVELOPMENT LANDS

NORTH TRIBUTARY

WEST TRIBUTARY

PARK
AREA=0.97ha

PUMP
STATION

WOLF GROVE
CREEK

MISSISSIPPI RIVER

STRATHBURN STREET

LEGEND

- PROPOSED CONCRETE SIDEWALK
- PROPOSED FUTURE CONCRETE SIDEWALK
- EXISTING MOUNTAIN BIKE TRAIL (TO REMAIN)
- EXISTING MOUNTAIN BIKE TRAIL (TO BE REALIGNED)
- PROPOSED MOUNTAIN BIKE TRAIL REALIGNMENT
- PROPOSED MULTI-USE PATHWAY & RIVER LOOKOUT
- VEHICLE CONNECTIONS TO FUTURE DEVELOPMENT LANDS
- PROPOSED STOP SIGNS

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
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MUNICIPALITY of MISSISSIPPI MILLS
BROWN LANDS

NETWORK AND PATHWAYS PLAN

SCALE 1 : 2000 (0, 20, 40, 60, 80)

DATE FEB 2023 | JOB 118178 | FIGURE FIGURE 15

M:\2018\118178\CAD\Design\Figures\Traffic\118178-FIG15-NPP.dwg, FIGX-NPP, Feb 10, 2023 - 2:30pm, jroy

SHT11X17.DWG - 279mmX432mm

9.0 EROSION AND SEDIMENT CONTROL

9.1 Temporary Measures

The following erosion and sediment control measures will be implemented during construction in accordance with the "Guidelines on Erosion and Sediment Control for Urban Construction Sites" (Government of Ontario, May 1987).

To mitigate erosion and to prevent sediment from entering the storm sewer system, temporary erosion and sediment control measures will be implemented on-site during construction in accordance with the Best Management Practices for Erosion and Sediment Control. This includes the following temporary measures:

- Sediment control bags will be placed under the grates of on-site and nearby catchbasins and maintenance holes and will remain in place until vegetation has been established and construction is completed;
- Silt fencing will be placed around the construction limits;
- Straw bale barriers and/or rock flow check dams will be placed within any drainage ditches until vegetation has been established and construction is completed;
- Street sweeping and cleaning will be performed as required to suppress dust and to provide safe and clean roadways adjacent to the construction site;
- Minimize the extent of exposed soil during construction and re-establish vegetation as soon as possible; and
- After construction is complete, all sewers are to be inspected and cleaned.

The proposed temporary erosion and sediment control measures would be implemented prior to construction, remain in place throughout each phase of construction, and should be inspected regularly. No control measure is to be permanently removed without prior authorization from the Engineer.

9.2 Permanent Measures

The following will provide permanent erosion and sediment control measures:

- Grass swales along the rear and side yard property lines.
- The oil and grit separator units will be designed to provide quality control for stormwater runoff prior to entering the surrounding watercourses.
- Rearyard drainage systems will be designed with a perforated pipe and clear stone surround to promote infiltration.
- Locations of major system flows will be reviewed during detailed design and appropriate erosion control measures will be implemented for those locations.
- Slopes on finished lot grades will be minimized where possible to slow the runoff of water.

10.0 CONCLUSIONS AND RECOMMENDATIONS

This report has been prepared in support of a draft plan of subdivision application for the proposed Brown Lands residential development.

- Stormwater runoff from the site will be captured by an onsite storm sewer system via a series of rear-yard swales and roadside catchbasins.
- The storm sewer system will direct runoff to two outlets. Flows from the western portion of the site will be directed to Outlet 1 (Wolf Grove Creek) on south side of the site and ultimately end up in the Mississippi River. Flows from the eastern portion of the site will be directed to the Mississippi River.
- Quality control of stormwater runoff will be provided by two oil and grit separators, positioned upstream of the two stormwater outlets.
- The development will be serviced by gravity sanitary sewers flowing to an on-site pumping station. Flows will be conveyed via a forcemain outletting to the existing sanitary sewer on Malcolm Street.
- Under interim hydraulic conditions, the development can be adequately serviced by a single feed connection to the proposed 250m watermain upgrade by the Municipality on County Road 29. Pressure reducing valves will be required for some units within the development. An accessible water source to supplement the fire flow volumes (in excess of 45L/s) will be required to be provided adjacent to the site under interim conditions. Further assessment at detailed design will be required to determine phasing requirements related to water age.
- Under ultimate hydraulic conditions, the proposed watermain network can adequately service the development based on Ontario Building Code (OBC) fire flow demands. Pressure reducing valves will be required for some units within the development. Two offsite connections will be provided. The first to the proposed 250m watermain upgrade on County Road 29 at Dunn Street and the second to the proposed 300mm dia. Mississippi River Third Crossing.
- The development will be serviced by hydro, communication and gas as per Municipality of Mississippi Mills approved utility standard right-of-way cross-sections.
- The roadways will consist of typical 18.0m cross sections.
- Temporary and permanent erosion and sediment control measures will be provided.

NOVATECH

Prepared by:

Trevor McKay, P.Eng
Project Manager | Land Development

Prepared by:

Melanie Schroeder, B.A.Sc., E.I.T.
E.I.T. | Water Resources

APPENDIX A
Correspondence

Water and Wastewater Calculation Factors, Email from David Shen, Municipality of Mississippi Mills, January 31, 2023, 2 Pages

Mills Extension Watermain Boundary Condition Request, Email from David Shen, Municipality of Mississippi Mills, January 31, 2023, 4 Pages

Brown Lands – Pre-consultation Notes – Clarification Request / Response, Email from Trevor McKay, Novatech, November 22, 2022, 2 Pages

Pre-Consultation Meeting Notes, by Julie Stewart, County of Lanark, received November 4, 2022, 2 Pages

Brown – Strathburn Lands – Review of Concept Plan 5, Letter by Melanie Knight, Municipality of Mississippi Mills, October 24, 2022, 5 Pages

Plans of Subdivision Pre-Consultation Checklist – Brown Lands, Lanark County, received December 13, 2022, 2 Pages

Servicing Requirements for the Development Area known as the Brown Lands, Memorandum by Cory Smith, Municipality of Mississippi Mills, February 10, 2022, 2 Pages

From: David Shen <dshen@mississippimills.ca>
Sent: Tuesday, January 31, 2023 11:34 AM
To: Drew Blair
Cc: Trevor McKay; Melanie Riddell; Mark Bowen
Subject: RE: Water and Wastewater Calculation Factors

See my response highlighted below.

Hello David,

We are currently working on a few projects in Mississippi Mills and would like to confirm some items for our water and wastewater calculations moving forward:

1. What are the accepted population density values for different types of dwelling units to be used for water and wastewater calculations? For Mill Run, the densities utilized were: 3.8 persons/unit for singles, 3.8 persons/unit for semi's, 3.5 persons/unit for towns and 3.0 persons/unit for apartments but this project was started in 2010. The City of Ottawa uses 3.4 persons/unit for singles and 2.7 persons/unit for semis/towns and 2-bedroom apartment average at 2.1 persons/unit. Would these lower population densities be acceptable to use?

Yes use the City of Ottawa Table 4.2, your numbers above are good.

2. From the 2018 Water and Wastewater Master Plan Update Report for MM, the average residential daily flow was set to 350 L/capita/day. Does this value still apply and for both water and wastewater calculations?

Yes 350 l/cap/d

3. The correction factor (K) for the Harmon Formula Peaking Factor is assumed to be 1.0 however the City of Ottawa has revised the residential correction factor to be 0.8 in 2018. Will the municipality consider using this correction factor?

Yes you can see k=0.8, please attach the COO 2018 guideline addendum for reference since some of our staff might not be aware of the change.

4. Under a separate submission (attached), we have recommended using OBC calculations to determine the water demand for fire flows versus using the FUS method. The OBC calculations provided fire flow demands that appear in-line with the 2018 Master Plan Update values. Can you please confirm that using OBC for fire flows is acceptable.

Answered in an early email.

Please let us know. We're happy to discuss further.

Thanks,

Drew

Drew Blair, P.Eng., 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 x 236 | Fax: 613.254.5867

From: David Shen <dshen@mississippimills.ca>
Sent: Tuesday, January 31, 2023 8:40 AM
To: Mark Bowen <M.Bowen@novatech-eng.com>
Cc: Drew Blair <D.Blair@novatech-eng.com>; Billy McEwen <b.mcewen@novatech-eng.com>; Robert Smith <smithr@mississippimills.ca>; Melanie Riddell <m.riddell@novatech-eng.com>
Subject: RE: Mills Extension Watermain Boundary Condition Request

Sorry for the delay.

Again, to me it is a question of being consistent vs considering history. Within the Municipality, we have had some debates as well.

For consistence, we will treat your FUS calculation result as an official calculation result of fire flow in your submission, because it is what the guideline says so (you know we mostly follow the City of Ottawa) and what other consultants use.

However, when we ask J.L.Richards (our water/wastewater models keeper) to do modelling check, we will consider a loose criterion (such as using OBC method) regarding any engineering judgement on capacity constraints and capital project requirement.

I used to do infrastructure planning and design. I believe this is an appropriate decision. If you have question, please let me know.

Thanks!
David Shen

From: Mark Bowen <M.Bowen@novatech-eng.com>
Sent: January 12, 2023 9:57 AM
To: David Shen <dshen@mississippimills.ca>
Cc: Drew Blair <D.Blair@novatech-eng.com>; Billy McEwen <b.mcewen@novatech-eng.com>; Robert Smith <smithr@mississippimills.ca>; Melanie Riddell <m.riddell@novatech-eng.com>
Subject: RE: Mills Extension Watermain Boundary Condition Request

Hi David,

Did you have any questions or concerns about the memo included in the previous email? Do you know when do you expect to complete your review? We are early in the process so there is no rush; we are just following up.

Mark Bowen, B. Eng
Project Manager – Land Development Engineering

NOVATECH
Engineers, Planners & Landscape Architects

240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 x 231 | Fax: 613.254.5867

From: Mark Bowen
Sent: Wednesday, January 4, 2023 8:41 AM
To: David Shen <dshen@mississippimills.ca>
Cc: Drew Blair <D.Blair@novatech-eng.com>; Billy McEwen <b.mcewen@novatech-eng.com>; Robert Smith <smithr@mississippimills.ca>; Melanie Riddell <m.riddell@novatech-eng.com>
Subject: RE: Mills Extension Watermain Boundary Condition Request

Hi David,

Happy new year. Attached is a memo outlining Novatech's option to consider the OBC fire flow calculations.

Mark Bowen, B. Eng
Project Manager – Land Development Engineering

NOVATECH
Engineers, Planners & Landscape Architects

240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 x 231 | Fax: 613.254.5867

From: David Shen <dshen@mississippimills.ca>
Sent: Monday, December 19, 2022 10:21 AM
To: Mark Bowen <M.Bowen@novatech-eng.com>
Cc: Drew Blair <D.Blair@novatech-eng.com>; Billy McEwen <b.mcewen@novatech-eng.com>; Robert Smith <smithr@mississippimills.ca>
Subject: RE: Mills Extension Watermain Boundary Condition Request

This is a tricky question to me because I need balance the history and correctness.

Other consultants, nowadays dealing with Mississippi Mills, use Fire Underwriters Survey (FUS) method, which is a sounder method, what I prefer, and what I will request down the road.

The OBC method is allowed sometimes, for infill/intensification cases. But your case is a "greenfield" one.

I would suggest, if the results between FUS method and OBC method are somewhat close, why not use FUS method. The tricky thing is that if the result of the OBC method is significantly lower than that of FUS method, you need let me know. We may have to do a deep dive.

Thanks!
David Shen, P.Eng.
Director, Development Services and Engineering
Municipality of Mississippi Mills
dshen@mississippimills.ca
613-880-5996
Website: www.mississippimills.ca

From: Mark Bowen <M.Bowen@novatech-eng.com>
Sent: December 19, 2022 9:48 AM
To: David Shen <dshen@mississippimills.ca>
Cc: Drew Blair <D.Blair@novatech-eng.com>; Billy McEwen <b.mcewen@novatech-eng.com>; Cory Smith <csmith@mississippimills.ca>
Subject: RE: Mills Extension Watermain Boundary Condition Request

Hi David,

Can you please confirm if the Ontario Building Code (OBC) should be used to confirm the required fire flows in the next phase of the Mill Run development. The OBC was used to calculate fire flows in all previous phases. We are preparing the requested information and will provide once confirmed.

Mark Bowen, B. Eng
Project Manager – Land Development Engineering

NOVATECH
Engineers, Planners & Landscape Architects

240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 x 231 | Fax: 613.254.5867

From: David Shen <dshen@mississippimills.ca>
Sent: Friday, December 16, 2022 11:25 AM
To: Mark Bowen <M.Bowen@novatech-eng.com>
Cc: Drew Blair <D.Blair@novatech-eng.com>; Billy McEwen <b.mcewen@novatech-eng.com>; Cory Smith <csmith@mississippimills.ca>
Subject: RE: Mills Extension Watermain Boundary Condition Request

Good morning,

I attended the pre-consultation meeting regarding this development. Assuming you already knew our regular practice, I may repeat here if you don't mind.

Step 1, you submit calculations to me. Water/Wastewater only:

For water, ADD, MDD, PHD, FF calculations, proposed connection description, proposed looping consideration.
For wastewater, Peak flow, proposed connection description, connection elevation.
Using City of Ottawa design parameters.

You will need submit your calculation sheets.

Note that your proposed units and density number are at very conceptual level. If you change these numbers in your planning application, I reserve a right to ask you redo the calculation if I deem there is noticeable flow impact .

Step 2, Once I review/approve the calculations, we can do the second step. The second step is using the approved calculation results as inputs to check the system capacity and performance in the Municipal water/wastewater models. Since J.L.Richards helps the Municipality keep/maintain/update the models, you will pay J.L.Richards to do this step.

I will also review stormwater and traffic reports either at this stage or at application stage.

Also for this Mill Run development, how many further phases in the future? (I can see potential future 9 on your figure). I understand it will depend on development plans and land purchase. However for infrastructure planning purpose, I need see your overall development plan with phasing and capacity in a systematic way, not requesting servicing capacities piece by piece, as it may mess up our potential capital project scoping and looping redundancy consideration.

Thanks!

David Shen, P.Eng.
Director, Development Services and Engineering
Municipality of Mississippi Mills
dshen@mississippimills.ca
613-880-5996
Website: www.mississippimills.ca

From:	Trevor McKay
Sent:	Tuesday, November 22, 2022 10:41 AM
To:	jstewart@lanarkcounty.ca
Cc:	Ken Kelly; mknight@mississippimills.ca; Cory Smith (csmith@mississippimills.ca); dreid@mvc.on.ca; Steve Pentz; Melanie Riddell; John Riddell
Subject:	Brown Lands - Pre-consultation Notes - Clarification Request / Response
Attachments:	Pre-Consultation Meeting Notes September 19 2022 Brown Lands.pdf; MM Comments to County - Brown-Strathburn Lands.pdf

Julie,

Thank you very much for preparing and circulating the attached pre-consultation minutes for the property on the north east corner of County Road 29 and Strathburn Road, currently being referred to as the Brown Lands.

After discussion with our client, we have prepared the following comments/requests for clarification regarding the notes provided.

Pre-consultation Meeting Notes September 19, 2022 Brown Lands – County of Lanark

- No issues/comments

MM Comments to County – Municipality of Mississippi Mills

1. Comment 1 – We are requesting clarification to this comment, specifically the use of the phrase "… as opposed to ***any*** noise mitigation measures". It was our understanding from the meeting that noise mitigation measures would be allowed provided they were reasonable (typically 2.5m max height noise walls are allowable), otherwise a window street may need to be explored.
2. Comments 2, 3, 8 and 9 – Please note that we believe further discussion is required between the developer and the municipality regarding future land ownership and the location and routing of the existing bike trail.
3. Comment 10 – We are requesting further discussion/clarification on the provided servicing comments.
    a. At no time has the developer indicated that 2 pump stations were being considered. Currently it is anticipated that the development will be serviced with one sanitary pump station.
    b. Please clarify the comment that servicing is to remain outside the limits of any defined wetland. Our interpretation and intent is that some servicing will be provided outside of the defined wetland limits but within the development setback limits.
    c. We would like to reserve the right to review the OGS location requirements during the draft plan process (and possibly during detailed design) – specifically if the opportunity presents to locate the OGS within the ROW *but* outside of the roadway limits (traveled portion).

Finally, a formal list of required reports and studies was not included with these meeting notes. Are you able to provide a list of the required studies?

Thank you to everyone for your time and input during the pre-consultation meeting. We are looking forward to working with everyone on this exciting project.

Trevor McKay, B.Eng., E.I.T., 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: 291 | Cell: 613.263.9113

From: Julie Stewart <jstewart@lanarkcounty.ca>
Date: November 4, 2022 at 10:38:57 AM EDT
To: "Evan Garfinkel (egarfinkel@regionalgroup.com)" <egarfinkel@regionalgroup.com>, John Riddell <j.riddell@novatech-eng.com>, Melanie Riddell <m.riddell@novatech-eng.com>, Steve Pentz <s.pentz@novatech-eng.com>, Ken Kelly <kkelly@mississippimills.ca>, Melanie Knight <mknight@mississippimills.ca>, Cory Smith <csmith@mississippimills.ca>, dreid@mvc.on.ca
Subject: Brown Lands

Please see the attached pre-consultation meeting notes and comments from the Municipality of Mississippi Mills.

Any questions, please advise.

Thank you,
Julie

Julie Stewart, MCIP RPP
County Planner
99 Christie Lake Road
Perth, ON K7H 3C6
(613)267-4200 ext. 1520
jstewart@lanarkcounty.ca
www.lanarkcounty.ca

Pre-Consultation Meeting Notes
Virtual zoom meeting – September 19, 2022
Prepared By: Julie Stewart

In Attendance
Evan Garfinkel – Regional Group
John Riddell – Regional Group
Melanie Riddell – Regional Group
Erin O'Connor
Steve Pentz – Planner, Novatech
Trevor McKay – Engineer, Novatech
Alex Zeller -
Diane Reid – Planner, MVCA
Kelly Stiles - Biologist, MVCA
Ken Kelly – CAO, Mississippi Mills
Cory Smith – Public Works, Mississippi Mills
Melanie Knight – Senior Planner, Mississippi Mills
Julie Stewart – County Planner, County of Lanark

Steve Pentz provided an overview of the proposed conceptual plan.
Propose a low-medium density development, singles with different lot sizes, semi-s and town's.
An existing mountain bike trail through the site to the Mississippi River is proposed to be maintained.

The site has previously been used for agricultural uses.

MVCA
Diane Reid noted that there had bene a pre-consultation meeting with the Conservation Authority and the Township a few months ago

Diane noted that the key element is the ENvironmentla Impact Assessment, to assess and refine the boundary, the boundary needs to be understood firs.
The subdivision will have an impact on the wetland.

Water balance – need to understand input, a water balance may be necessary but not sure yet.

There can not be a change on the impact to the wetlands.

- 30m setback for lots
- Watercourse – there is an established creek to the Mississippi River
- Understand there are no plans to alter the creek.
- There may or may not need to be a fisheries assessment
- May or may not need to be a Headwater Drainage Assessment

Stormwater Management – enhanced level quantity control. Permits may be required for outlet.

Kelly has fish information which can be shared with the consultants.

Please refer to the attached comments from the Municipality of Mississippi Mills, dated October 24, 2022.

CORPORATION OF THE MUNICIPALITY OF MISSISSIPPI MILLS
3131 OLD PERTH ROAD · PO BOX 400 · RR 2 · ALMONTE ON · K0A 1A0

PHONE: 613-256-2064
FAX:613-256-4887
WEBSITE: www.mississippimills.ca

October 24, 2022

Julie Stewart
County Planner
jstewart@lanarkcounty.ca

Dear Ms. Stewart:

RE: BROWN – STRATHBURN LANDS
REVIEW OF CONCEPT PLAN 5
FILE: TBD

Please see attached the Planning and Engineering comments regarding the Brown-Strathburn Lands – Concept Plan for Plan of Subdivision. Comments on the submitted Concept Plan relating to the below are also provided.

Planning

Planning Comments:

1. Noise Study is required for the adjacency of County Road 29. As noted, staff prefer a window street as opposed to any noise mitigation measures such as a noise wall along County Road 29.

2. Transportation Study (Multi-modal) is required. Some specific issues to be addressed:
    - Access to the existing mountain biking trails along the Mississippi River (see notes below)

3. Wetland – EIS :
    - It is noted that an EIS is required to evaluate the wetland on the subject lands and may impact the design/layout of the subdivision.
    - Staff note that the Municipality does not wish to receive any lands which are evaluated as wetlands.

4. Density - The applicant has indicated that the proposed density is approximately 15 units per hectare. Staff note that this density is notable less than the average density of 25 units per hectare as part of Official Plan Amendment 22. The applicant is encouraged to examine design solutions that increase the overall density of the subdivision and note that the 70/30 ratio of low density residential to medium density residential has recently been updated as part of Official Plan Amendment 22 to

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60/40. The applicant should confirm that the proposed development meets this new housing ratio target as during the meeting it was communicated that the ratio is currently 66/34.

5. Design of Subdivision:
    - The remnant triangular shaped property fronting onto Strathburn Street needs to be resolved in terms of uses and intent of the land. Further discussions should occur as the design of the subdivision evolves.
    - As County Road 29 is a County Road, confirmation with the County should be obtained regarding the proposed intersection along County Road 29.

6. FYI – Any road stubs to the lands to the north will be Blocks to be conveyed to the Municipality

7. FYI - Any Blocks for future road connections and Parkland will require appropriate signage (ie. 'future street connection' and 'future park location')

Parks Comments (including mountain bike trail):

8. The available parkland in the area is currently limited and so parkland conveyance should be included as part of the Concept Plan once the boundaries of the wetland are defined. Please note that the Municipality will not accept parkland conveyance that is within any defined wetland.

9. With respect to the existing mountain biking trail, the following comments are provided:
    - The Municipality prefers that mountain biking access be located at the northeast portion of the subdivision and not as currently planned with a mountain biking trail traversing the subdivision. The Municipality would be agreeable, as part of the conveyance of parkland, that the area of parkland provided be a parking lot for public access to a future mountain biking trailhead and so the location of parkland should be aligned with a trailhead location.
    - It is also noted that access to a trailhead can be accommodated by on-road cycling and a separate trail traversing the subdivision is not required nor desired by the Municipality.
    - Alternatively, it is the Municipality's understanding that the lands to the immediate north, outside of the current urban boundary, are also owned by the applicant. Consideration should be given to locating a trailhead for mountain biking on the applicant's lands to the north.

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Engineering

The applicant has met directly with Mississippi Mills Public Works staff regarding the engineering requirements for the proposed subdivision. Some preliminary comments are also noted below:

10. Servicing – the preference of the Municipality is that any servicing remain outside of the limits of any defined wetland.
    - Full servicing capacity will need to be obtained in the future once the river crossing infrastructure improvements are in place. Two pump stations will be required, one in Phase 1 and one in Phase 2.
    - The existing capacity to service any part of the lands is limited until the infrastructure improvements have taken place
    - 18 metre right of way cross section is preferred (similar to Mill Run subdivision)
    - Oil grit separators will be required and are to be located within a Block on the plan, not in a right of way (travelled portion of a right of way).
    - There is a forcemain down Strathburn connecting to Malcolm

11. Coming out of the EIS mentioned above in the Planning Comments, the boundary of stormwater catchment and drainage pattern will need to be reviewed.
    - A stormwater management report will be required to establish pre- and post-hydrologic conditions. The Municipality understands the MVCA will review floodplain, regulated area, setback and other environmental and engineering requirements. The Municipality will review the stormwater minor system and gradings design within the subdivision.
    - It is assumed that all the future stormwater/drainage will be toward west boundary to Mississippi River. If it is not the case, The County shall be engaged to review and approve any flow toward the County Road 29 ditch.
    - The developer will obtain advice from MVCA or municipality to meet DFO requirement. The construction is subject to the Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses and a permit is required. Erosion and sediment control will be required in design and for construction activities.

12. A geotechnical analysis is required for slope stability.

13. The transportation study mentioned in the Planning Comments will need address traffic impact, any need of road widening and intersection improvements.

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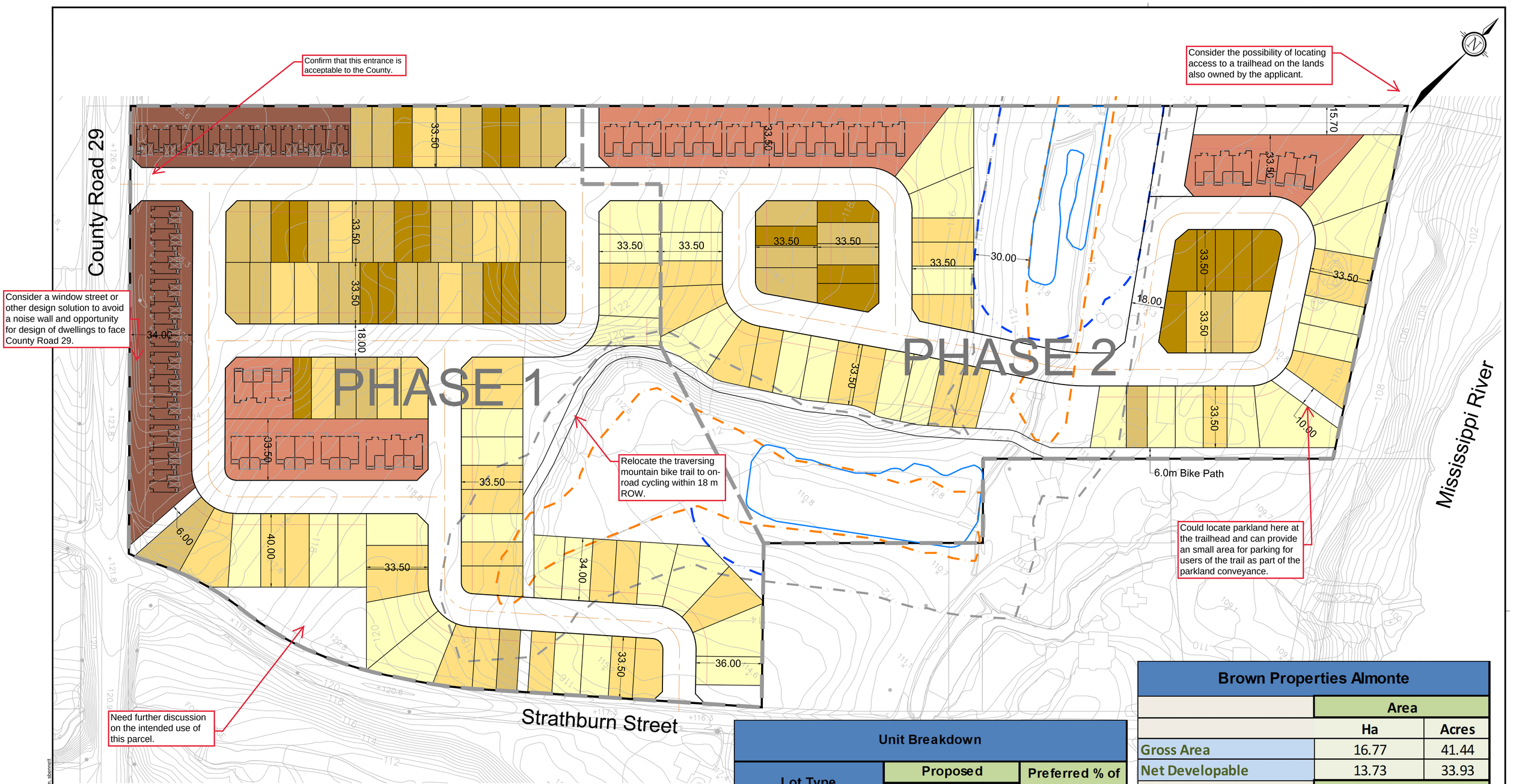
FAX:613-256-4887
WEBSITE: www.mississippimills.ca

I trust the above will assist you. If you have any further questions regarding this matter, please feel free to contact me at your convenience.

Respectfully yours,

Melanie Knight, MCIP, RPP
Senior Planner
Municipality of Mississippi Mills



ZONING SETBACK **ASSUMPTIONS:**
BASED ON R3 - "EXEMPTION" (SEE MILL RUN)

Front Yard:	6.0m
Rear Yard:	7.5m
Interior Side Yard:	1.2m
Exterior Side Yard:	3.0m

SOURCE REFERENCE:
Legal & Topographic Information: *Town Mapping Town of Almonte / 2008 / MTM Zone 9, NAD83 (ORIG)*

LEGEND:

- 31' SINGLES
- 35' SINGLES
- 42' SINGLES
- 50' SINGLES
- BUNGALOW TOWNHOMES
- TWO-STOREY TOWNHOMES
- MVCA NON-EVALUATED WETLAND
- MVCA REGULATION LIMIT
- 30m WETLAND SETBACK
- OPEN WATER LIMITS

Unit Breakdown

Lot Type	Proposed # Units	Proposed % of Total	Preferred % of Total (EQ)
31'	22	10%	10%
35'	34	16%	15%
42'	48	22%	20%
50'	40	18%	20%
Bungalow Townhomes	33	15%	15%
Two-Storey Townhomes	42	19%	20%
Total	**219**	**100%**	**100%**

Brown Properties Almonte

	Area	
	Ha	Acres
Gross Area	16.77	41.44
Net Developable	13.73	33.93
	Saleable Frontage	
	m	ft
Low Density	2510.35	8236.03
Total Frontage	2510.35	8236.03
Road Lengths:		
	m	ft
18m ROW	1931.39	6336.56
Total Road Lengths	**1931.39**	**6336.56**

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 DISCUSSION	SEPT 8/22	TJM

SCALE: 1:1000 (A1) / 1:2000 (11x17)
1:1000 (0 10 20 30 40)

DESIGN XXX
CHECKED XXX
DRAWN XXX
CHECKED XXX
APPROVED XXX

FOR REVIEW ONLY

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

TOWN of ALMONTE
BROWN PROPERTIES
DRAWING NAME: CONCEPT PLAN 5
PROJECT No. 118178-00
REV REV #1
DRAWING No. 118178-CP5

M:\2018\118178\CAD\Planning\Concept Plans\118178-CP5.dwg, Concept Plan - Dual Scale - A1, Sep 07, 2022 - 11:19am, sbennett
PLAN1.DWG - 841mmx594mm

LANARK COUNTY

PLANS OF SUBDIVISION

PRE-CONSULTATION – checklist Brown lands

Report	Comments	Required Yes/No
Planning Rationale	Include justification Must have regard for PPS Lanark County Official Plan compatibility Local Official Plan compatibility	Yes Yes Yes Yes
Hydrogeological Study, Terrain Analysis	Availability and suitability of water and waste water MOE – D-5-4 Guidelines MOE – D-5-5 Guidelines ODWSOG Checklist Summary & Sign-off	
Environment Impact Study	SAR & Significant Habitat Wetlands Organic Soils Natural Heritage Features & Systems Significant Wetlands Significant Woodlands Significant Valleylands Significant Wildlife ANSI Fish Habitat	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes
Servicing Options Statement	Guidelines – MOE D-5-3	Yes
Stormwater Drainage Plan	Guidelines - MOE-2003 / MNR-2001 Checklist Summary & Sign-off	Yes
Grading Plan	Sloping land within lot to direct flow of surface water away from foundations & abutting properties.	Yes

LANARK COUNTY

PLANS OF SUBDIVISION

PRE-CONSULTATION – checklist Brown lands

Report	Comments	Required Yes/No
Sediment and Erosion Control Hazardous Sites	Flooding, erosion hazard Slope and Soil Stability Organic Soils Karst Topography	Yes Yes Yes
Archeological Investigation	Standards & Guidelines 2011	Yes
Tree Preservation Plan or Tree Conservation Plan	Check with local municipality	
Other	See attached	
Draft Plan	To include: Planning Act 50(17) Ont. Reg. 544/06 Lot and block configuration Compatibility with adjacent uses Road access, street layout & Pedestrian amenities Parks & Open Space amenities Easement and right-of-way requirements	Yes

Mississippi Mills

The Corporation of the Municipality of Mississippi Mills

Municipal Office
3131 Old Perth Road
RR2, P.O. Box 400
Almonte, ON
K0A 1A0

Tel: (613) 256-2064
Fax: (613) 256-4887

February 10, 2022

Memo

By: Cory Smith, A/Director of Public Works

Re: Servicing requirements for the development area known as the Brown Lands

This memo has been prepared as a general overview of servicing requirements for the development area know as the Brown Lands. This memo is based on information in the Water and Wastewater master plan. Additional works may be required based on the density of the development and other changes to the existing system.

The requirements for water servicing provide limitations. At this time no servicing is extended to these lands. In order for full servicing of these lands it is anticipated that there will be three service connections for the water. There will be a connection along County Road 29, a connection along Malcolm Street and a connection along the northeast boundary along the Mississippi River where the Municipality will be installing a third river crossing for the water system. It would be the developer's responsibility to extend water mains to Along County Road 29 from the development to Dunn Street. The developer would also be responsible to extend watermains on Malcolm Street from the development to Dunn Street.

The water and Wastewater Master Plan also identifies works required to upgrade or expand our existing system that the Municipality will be completing. These works include upgrades on the water system along County Road 29 between Well 6 and Dunn Street. These works are scheduled as mid term works with an expected completion date of 2025. A third River Crossing is expected to be in place by 2027 and creation of Pressure zone 2 is expected to be completed by 2027 as well. The timing of these works are expected to be refined during our update of the water and waste water master plan in 2022. It should be noted that appropriate hydraulic modeling would still be required for the development lands which may determine additional requirements.

The requirements for wastewater servicing is anticipated to be through a pump station and force main that would be extended by the developer from the development to connect to the existing sanitary main at the intersection of Malcolm and Dunn Street. For full build out of the proposed lands, upgrades to the sanitary main on Malcolm would be required. The timing of these works is subject to the timing of buildout of the subdivision but is currently in the long term/buildout timeline for our water and wastewater master plan with a timeline of beyond 2028 for construction. Modeling would be required to determine if there is capacity for partial

phasing of the subdivision. In addition, upgrades to the Gemmill's Bay Pump station may be required. This is currently dependent on the density of the proposed development and timing of other developments coming online and will be further reviewed in the update of the water and wastewater master plan. Once again modeling specific to the proposed development will provide clarity on this issue.

Dates and timelines of in this memo are subject to change based on future updates to our master plans and approved budgetary funding.

Cory Smith
A/Director of Roads and Public Works
Mississippi Mills
613 256-2064 ext. 229.

APPENDIX B
Storm Drainage and Stormwater Management

Storm Sewer Design Sheet, Novatech, February 10, 2023, 2 Pages

Stormwater Design Model Parameters, Novatech, February 2023, 11 Pages

PCSWMM Model Schematics, Novatech, February 2023, 7 Pages

Pre-Development PCSWMM Model Output, Novatech, February 2023, 2 Pages

Post-Development PCSWMM Model Output, Novatech, February 2023, 17 Pages

STORM SEWER DESIGN SHEET (5 YEAR DESIGN EVENT)
Brown Lands
Developer: Strathburn Almonte Regional Inc.

NOVATECH
Engineers, Planners & Landscape Architects

PROJECT #: 118178
DESIGNED BY : SAB
CHECKED BY : TJM
DATE PREPARED : 10-Feb-23

LOCATION											PROPOSED SEWER								
STREET	FROM M.H.	TO M.H.	AREA #	INDIV AREA (ha)	INDIV R	INDIV. 2.78 AR	ACCUM. 2.78 AR	TIME OF CONC. (min)	RAINFALL INTENSITY 5-Year (mm/hr)	PEAK FLOW Q (L/s)	TYPE OF PIPE	PIPE SIZE (mm)	PIPE ID (mm)	GRADE (%)	LENGTH (m)	CAPACITY (L/s)	FULL FLOW VELOCITY	TIME OF FLOW (min)	CAPACITY (%)
STREET 1	100	102	100-102	0.73	0.65	1.32	1.32	10.00	104	**137.4**	DR 35	375	381	0.90	103.9	173.5	1.52	1.14	79%
STREET 1	102	104	102-104	0.45	0.65	0.81	2.13	11.14	99	**210.1**	DR 35	375	381	2.85	69.5	308.8	2.71	0.43	68%
STREET 1	106	104	106-104	0.41	0.65	0.74	0.74	10.00	104	**77.2**	DR 35	375	381	0.55	84.0	135.7	1.19	1.18	57%
STREET 3	104	226	104-226	0.47	0.65	0.85	3.72	11.57	97	**359.6**	CONC	450	457	2.45	84.0	465.6	2.84	0.49	77%
STREET 2	106	232	106-230	0.36	0.65	0.64	0.64	10.00	104	**67.0**	DR 35	300	305	1.00	65.0	100.9	1.38	0.78	66%
STREET 2	232	230					0.64	10.78	100	**64.4**	DR 35	300	305	0.75	8.6	87.4	1.20	0.12	74%
STREET 2	230	228	230-226	0.13	0.65	0.23	0.88	10.90	100	**87.4**	DR 35	300	305	1.90	34.3	139.1	1.91	0.30	63%
STREET 2	228	226					0.88	11.20	98	**86.2**	DR 35	300	305	3.50	46.3	188.7	2.59	0.30	46%
STREET 2	222	224	222-224	0.61	0.65	1.11	1.11	10.00	104	**115.3**	DR 35	300	305	3.00	89.3	174.7	2.39	0.62	66%
STREET 2	224	226	224-226	0.51	0.65	0.92	2.03	10.62	101	**204.9**	DR 35	375	381	2.50	85.0	289.2	2.54	0.56	71%
STREET 3	226	300	226-300	0.29	0.65	0.52	7.15	12.06	94	**675.4**	CONC	675	686	1.40	42.4	1037.6	2.81	0.25	65%
STREET 3	300	208	300-208	0.78	0.65	1.41	8.56	12.31	93	**799.5**	CONC	825	838	0.45	104.2	1004.6	1.82	0.95	80%
STREET 4	224	400	224-400	0.46	0.65	0.83	0.83	10.00	104	**86.6**	DR 35	300	305	3.25	62.3	181.9	2.49	0.42	48%
STREET 4	400	212	400-212	0.32	0.65	0.58	1.41	10.42	102	**143.8**	DR 35	375	381	1.00	59.4	182.9	1.60	0.62	79%
STREET 2	220	218	220-216	0.23	0.65	0.42	0.42	10.00	104	**43.3**	DR 35	300	305	4.00	59.0	201.8	2.77	0.36	21%
STREET 2	218	216					0.42	10.36	102	**42.5**	DR 35	300	305	4.05	12.9	203.0	2.78	0.08	21%
STREET 2	216	214	216-214	0.21	0.65	0.38	0.80	10.43	102	**81.1**	DR 35	300	305	4.00	37.5	201.8	2.77	0.23	40%
STREET 2	214	212	214-212	0.25	0.65	0.45	1.25	10.66	101	**125.7**	DR 35	300	305	2.15	50.9	147.9	2.03	0.42	85%
STREET 2	212	210	212-210	0.18	0.65	0.33	2.98	11.08	99	**294.7**	CONC	525	533	0.60	30.1	347.5	1.56	0.32	85%
STREET 2	210	208	210-208	0.31	0.65	0.56	3.54	11.40	97	**344.7**	CONC	525	533	1.45	58.9	540.3	2.42	0.41	64%
STREET 2	208	206	208-206	0.28	0.65	0.51	12.61	13.26	90	**1130.0**	CONC	825	838	1.00	44.8	1497.5	2.71	0.28	75%
STREET 2	206	204	206-204	0.38	0.65	0.69	13.30	13.54	89	**1177.9**	CONC	825	838	1.00	52.0	1497.5	2.71	0.32	79%
STREET 2[1]	204	202	204-200	0.32	0.65	0.58	13.87	13.86	87	**1213.0**	CONC	1200	1219	0.50	11.8	2876.0	2.46	0.08	42%
STREET 2[1]	202	200A					13.87	13.94	87	**1209.1**	CONC	1200	1219	0.50	23.1	2876.0	2.46	0.16	42%
STREET 2[1]	200A	200					13.87	14.10	87	**1201.5**	CONC	1200	1219	0.50	3.4	2876.0	2.46	0.02	42%
STREET 2[1]	200	2100					13.87	14.12	87	**1200.3**	CONC	1200	1219	0.50	13.3	2876.0	2.46	0.09	42%
STRATHBURN[1]	2100	2102					13.87	14.21	86	**1196.0**	CONC	1200	1219	0.50	50.2	2876.0	2.46	0.34	42%
STRATHBURN[1]	2102	OUTLET					13.87	14.55	85	**1179.9**	CONC	1200	1219	0.50	90.7	2876.0	2.46	0.61	41%
OUTLET 1								***15.16***		***1179.9***									

STORM SEWER DESIGN SHEET (5 YEAR DESIGN EVENT)
Brown Lands
Developer: Strathburn Almonte Regional Inc.

NOVATECH
Engineers, Planners & Landscape Architects

PROJECT #: 118178
DESIGNED BY : SAB
CHECKED BY : TJM
DATE PREPARED : 10-Feb-23

LOCATION											PROPOSED SEWER								
STREET	FROM M.H.	TO M.H.	AREA #	INDIV AREA (ha)	INDIV R	INDIV. 2.78 AR	ACCUM. 2.78 AR	TIME OF CONC. (min)	RAINFALL INTENSITY 5-Year (mm/hr)	PEAK FLOW Q (L/s)	TYPE OF PIPE	PIPE SIZE (mm)	PIPE ID (mm)	GRADE (%)	LENGTH (m)	CAPACITY (L/s)	FULL FLOW VELOCITY	TIME OF FLOW (min)	CAPACITY (%)
STREET 1	106	108	106-108	0.41	0.65	0.74	0.74	10.00	104	**77.2**	DR 35	300	305	3.55	85.0	190.1	2.60	0.54	41%
STREET 1	108	110	108-112	0.55	0.65	0.99	1.73	10.54	101	**175.9**	DR 35	375	381	3.00	78.3	316.8	2.78	0.47	56%
STREET 1	110	112					1.73	11.01	99	**172.0**	DR 35	375	381	2.65	14.2	297.8	2.61	0.09	58%
STREET 1	112	504	112-504	0.56	0.65	1.01	2.75	11.10	99	**271.1**	CONC	525	533	0.80	69.9	401.3	1.80	0.65	68%
STREET 5	108	500	108-502	0.36	0.65	0.65	0.65	10.00	104	**67.8**	DR 35	300	305	1.20	62.4	110.5	1.51	0.69	61%
STREET 5	500	502					0.65	10.69	101	**65.5**	DR 35	300	305	1.40	12.2	119.4	1.64	0.12	55%
STREET 5	502	504	502-504	0.28	0.65	0.51	1.16	10.81	100	**115.8**	DR 35	300	305	2.90	80.1	171.8	2.35	0.57	67%
STREET 5	504	506	504-506	0.10	0.65	0.18	4.08	11.75	96	**391.1**	CONC	525	533	2.00	42.8	634.5	2.84	0.25	62%
STREET 5	506	508	506-508	0.09	0.65	0.16	4.25	12.00	95	**402.2**	CONC	675	686	0.40	53.6	554.6	1.50	0.59	73%
STREET 6	600	508	600-508	0.15	0.65	0.27	0.27	10.00	104	**28.2**	DR 35	250	254	1.45	84.6	74.7	1.47	0.96	38%
STREET 5	508	510	508-510	0.27	0.65	0.49	5.01	12.60	92	**461.7**	CONC	750	762	0.30	30.1	636.1	1.39	0.36	73%
STREET 5	510	512	510-512	0.70	0.65	1.26	6.27	12.96	91	**569.4**	CONC	825	838	0.30	51.8	820.2	1.49	0.58	69%
STREET 5	600	518	600-516	0.86	0.65	1.55	1.55	10.00	104	**161.9**	CONC	450	457	0.95	76.2	289.9	1.77	0.72	56%
STREET 5	518	516					1.55	10.72	101	**156.2**	CONC	450	457	0.75	14.0	257.6	1.57	0.15	61%
STREET 5	516	514	516-512	0.28	0.65	0.51	2.06	10.87	100	**205.6**	CONC	450	457	1.15	66.9	319.0	1.94	0.57	64%
STREET 5[1]	514	512					2.06	11.44	97	**200.1**	CONC	825	838	1.15	11.4	1605.9	2.91	0.07	12%
SERVICE EASEMENT[1]	512	3100					8.33	13.54	89	**738.2**	CONC	1200	1219	0.70	13.3	3402.9	2.91	0.08	22%
SERVICE EASEMENT[1]	3100	3102					8.33	13.62	88	**735.8**	CONC	1200	1219	0.70	3.8	3402.9	2.91	0.02	22%
SERVICE EASEMENT[1]	3102	3104					8.33	13.64	88	**735.2**	CONC	1200	1219	0.70	27.9	3402.9	2.91	0.16	22%
SERVICE EASEMENT[1]	3104	3106					8.33	13.80	88	**730.4**	CONC	1200	1219	0.70	32.9	3402.9	2.91	0.19	21%
SERVICE EASEMENT[1]	3106	3108 (OUTLET)					8.33	13.98	87	**724.8**	CONC	1200	1219	0.70	23.9	3402.9	2.91	0.14	21%
OUTLET 2								***14.12***		***724.8***									

Definitions:
Q = Peak Flow in Litres per Second (L/s)
Q = 2.78 AIR, where
A = Area in hectares (ha)
I = Rainfall Intensity (mm/hr)
R = Runoff Coefficient

NOTES:
1. Pipe has been sized to accommodate the 100-year design flows.

Notes:
1) Rainfall Intensity Curves are City of Ottawa IDF Curves I(5-year) = 998.071/ [(Tc(min)+6.053)]^0.814
2) Minumum Tc is 10min as per the City of Ottawa Sewer Design Guidelines.
3) Roughness Coefficient 'n' in Manning's formula shall be 0.13 for Concrete & PVC pipes as per the City of Ottawa Sewer Design Guidelines.
4) MinImum diameter for on street sewers is 250mm.

LICENSED PROFESSIONAL ENGINEER
T. J. MCKAY
100195434
February 10, 2023
PROVINCE OF ONTARIO

Brown Lands (118178)
Pre-Development Model Parameters

NOVATECH
Engineers, Planners & Landscape Architects

Curve Number & Initial Abstraction

Area ID	Catchment Area (ha)	Land use		Soil Type			CN	S (mm)	IA (mm)
PRE-1	2.393	Impervious	0.0%	-	0%	98	**84**	48	4.8
		Row Crop	90.2%	B	0%	75			
				D	100%	85			
		Grass / Pasture	0.6%	B	0%	61			
				D	100%	80			
		Woods	9.2%	B	0%	55			
				D	100%	77			
		Wetland	0.0%	B	0%	56			
				D	0%	77			
PRE-2	9.881	Impervious	0.9%	-	100%	98	**83**	52	5.2
		Row Crop	67.1%	B	0%	75			
				D	100%	85			
		Grass / Pasture	16.8%	B	0%	61			
				D	100%	80			
		Woods	3.1%	B	0%	55			
				D	100%	77			
		Wetland	12.1%	B	0%	56			
				D	100%	77			
PRE-3	68.766	Impervious	2.4%	-	100%	98	**81**	61	6.1
		Row Crop	60.2%	B	0%	75			
				D	100%	85			
		Grass / Pasture	17.4%	B	25%	61			
				D	75%	80			
		Woods	11.4%	B	55%	55			
				D	45%	77			
		Wetland	8.6%	B	0%	56			
				D	100%	77			
PRE-4	0.261	Impervious	18.4%	-	100%	98	**73**	93	9.3
		Row Crop	0.0%	B	0%	75			
				D	0%	85			
		Grass / Pasture	57.4%	B	57%	61			
				D	43%	80			
		Woods	16.1%	B	91%	55			
				D	9%	77			
		Wetland	8.1%	B	0%	56			
				D	100%	77			
PRE-5	2.343	Impervious	2.1%	-	100%	98	**68**	119	11.9
		Row Crop	0.0%	B	0%	75			
				D	0%	85			
		Grass / Pasture	85.1%	B	57%	61			
				D	43%	80			
		Woods	12.8%	B	91%	55			
				D	9%	77			
		Wetland	0.0%	B	0%	56			
				D	0%	77			

Time of Concentration (Upland's Method)

Area ID	Catchment Area (ha)	% Imperv.	Runoff Coefficient	Overland Flow				Shallow Concentrated Flow				Open Channel Flow				Overall		
				Length (m)	Slope (%)	Velocity (m/s)	Travel Time (min)	Length (m)	Slope (%)	Velocity (m/s)	Travel Time (min)	Length (m)	Slope (%)	Velocity (m/s)	Travel Time (min)	Time of Concentration (min)	Min. Time of Concentration (min)	Time to Peak (min)
PRE-1	2.393	0.0%	0.20	50	5.9%	0.38	2	110	2.0%	0.63	3	0	-	-	0	5	15	3
PRE-2	9.881	0.9%	0.21	50	1.0%	0.16	5	280	4.5%	0.96	5	200	1.1%	0.48	7	17	17	11
PRE-3	68.766	2.4%	0.22	50	1.3%	0.17	5	525	2.8%	0.77	11	680	0.6%	0.36	31	48	48	32
PRE-4	0.261	18.4%	0.33	50	1.5%	0.18	5	0	-	-	0	0	-	-	0	5	15	3
PRE-5	2.343	2.1%	0.21	50	1.5%	0.18	5	80	2.3%	0.70	2	0	-	-	0	7	15	4

*Add overland flow & shallow concentrated flow travel time + creek flow travel time through subcatchment

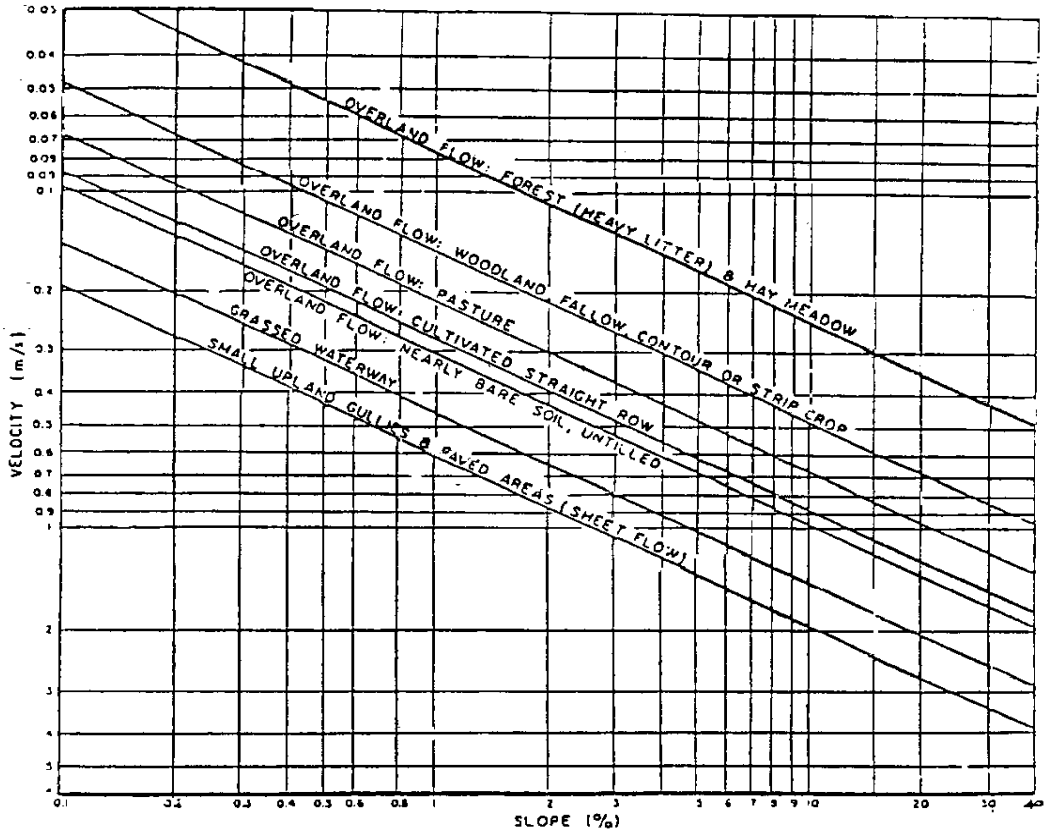


Figure A.5.2: Upland Method for Estimating Time of Concentration
(SCS National Engineering Handbook, 1971)

Brown Lands (118178)
Post-Development Model Parameters

Area ID	Catchment Area (ha)	Runoff Coefficient (C)	Percent Impervious (%)	No Depression (%)	Flow Path Length (m)	Equivalent Width (m)	Average Slope (%)
100-102	0.730	0.65	64.3%	40%	34	215	2.0%
102-104	0.450	0.65	64.3%	40%	32	139	2.0%
104-226	0.470	0.65	64.3%	40%	31	154	2.0%
106-104	0.410	0.65	64.3%	40%	24	167	2.0%
106-108	0.410	0.65	64.3%	40%	24	169	2.0%
106-230	0.360	0.65	64.3%	40%	27	134	2.0%
108-112	0.550	0.65	64.3%	40%	30	185	2.0%
108-502	0.360	0.65	64.3%	40%	25	143	2.0%
112-504	0.560	0.65	64.3%	40%	41	138	2.0%
204-200	0.320	0.65	64.3%	40%	28	116	2.0%
206-204	0.380	0.65	64.3%	40%	37	102	2.0%
208-206	0.280	0.65	64.3%	40%	31	90	2.0%
210-208	0.310	0.65	64.3%	40%	26	118	2.0%
212-210	0.180	0.65	64.3%	40%	29	62	2.0%
214-212	0.250	0.65	64.3%	40%	25	100	2.0%
216-214	0.210	0.65	64.3%	40%	26	80	2.0%
220-216	0.230	0.65	64.3%	40%	31	73	2.0%
222-224	0.610	0.65	64.3%	40%	33	183	2.0%
224-226	0.510	0.65	64.3%	40%	33	155	2.0%
224-400	0.460	0.65	64.3%	40%	40	115	2.0%
226-300	0.290	0.65	64.3%	40%	39	75	2.0%
230-226	0.130	0.65	64.3%	40%	9	140	2.0%
300-208	0.780	0.65	64.3%	40%	40	195	2.0%
400-212	0.320	0.65	64.3%	40%	37	87	2.0%
502-504	0.280	0.65	64.3%	40%	35	80	2.0%
504-506	0.100	0.65	64.3%	40%	13	79	2.0%
506-508	0.090	0.65	64.3%	40%	9	103	2.0%
508-510	0.270	0.65	64.3%	40%	39	70	2.0%
510-514	0.700	0.65	64.3%	40%	70	101	2.0%
516-512	0.280	0.65	64.3%	40%	35	79	2.0%
600-508	0.150	0.65	64.3%	40%	9	162	2.0%
600-516	0.860	0.65	64.3%	40%	33	263	2.0%
DR1	3.420	0.30	14.3%	100%	116	294	2.0%
DR2	0.820	0.30	14.3%	100%	71	115	2.0%
DR3	0.320	0.45	35.7%	100%	20	164	2.0%
TOTAL:	**16.85**						

Brown Lands (118178)
Post-Development Offsite Model Parameters

NOVATECH
Engineers, Planners & Landscape Architects

Curve Number & Initial Abstraction

Area ID	Catchment Area (ha)	Land use		Soil Type			CN	S (mm)	IA (mm)
EXT-1	0.986	Impervious	2.6%	-	100%	98	**85**	45	4.5
		Row Crop	90.8%	B	0%	75			
				D	100%	85			
		Grass / Pasture	0.0%	B	0%	61			
				D	0%	80			
		Woods	6.6%	B	0%	55			
				D	100%	77			
		Wetland	0.0%	B	0%	56			
				D	0%	77			
EXT-2	65.061	Impervious	2.6%	-	100%	98	**81**	61	6.1
		Row Crop	59.4%	B	0%	75			
				D	100%	85			
		Grass / Pasture	17.7%	B	24%	61			
				D	76%	80			
		Woods	12.1%	B	55%	55			
				D	45%	77			
		Wetland	8.2%	B	0%	56			
				D	100%	77			
EXT-3	0.647	Impervious	7.3%	-	100%	98	**82**	55	5.5
		Row Crop	29.2%	B	0%	75			
				D	100%	85			
		Grass / Pasture	46.5%	B	0%	61			
				D	100%	80			
		Woods	9.3%	B	0%	55			
				D	100%	77			
		Wetland	7.7%	B	0%	56			
				D	100%	77			

Time of Concentration (Upland's Method)

Area ID	Catchment Area (ha)	% Imperv.	Runoff Coefficient	Overland Flow				Shallow Concentrated Flow				Open Channel Flow				Overall		
				Length (m)	Slope (%)	Velocity (m/s)	Travel Time (min)	Length (m)	Slope (%)	Velocity (m/s)	Travel Time (min)	Length (m)	Slope (%)	Velocity (m/s)	Travel Time (min)	Time of Concentration (min)	Min. Time of Concentration (min)	Time to Peak (min)
EXT-1	0.986	2.6%	0.22	50	1.8%	0.20	4	100	1.4%	0.32	5	0	-	-	0	9	15	6
EXT-2*	65.061	2.6%	0.22	50	1.3%	0.17	5	525	2.8%	0.77	11	680	0.6%	0.36	31	48	48	32
EXT-3	0.647	7.3%	0.25	50	2.9%	0.25	3	90	2.6%	0.72	2	0	-	-	0	5	15	4

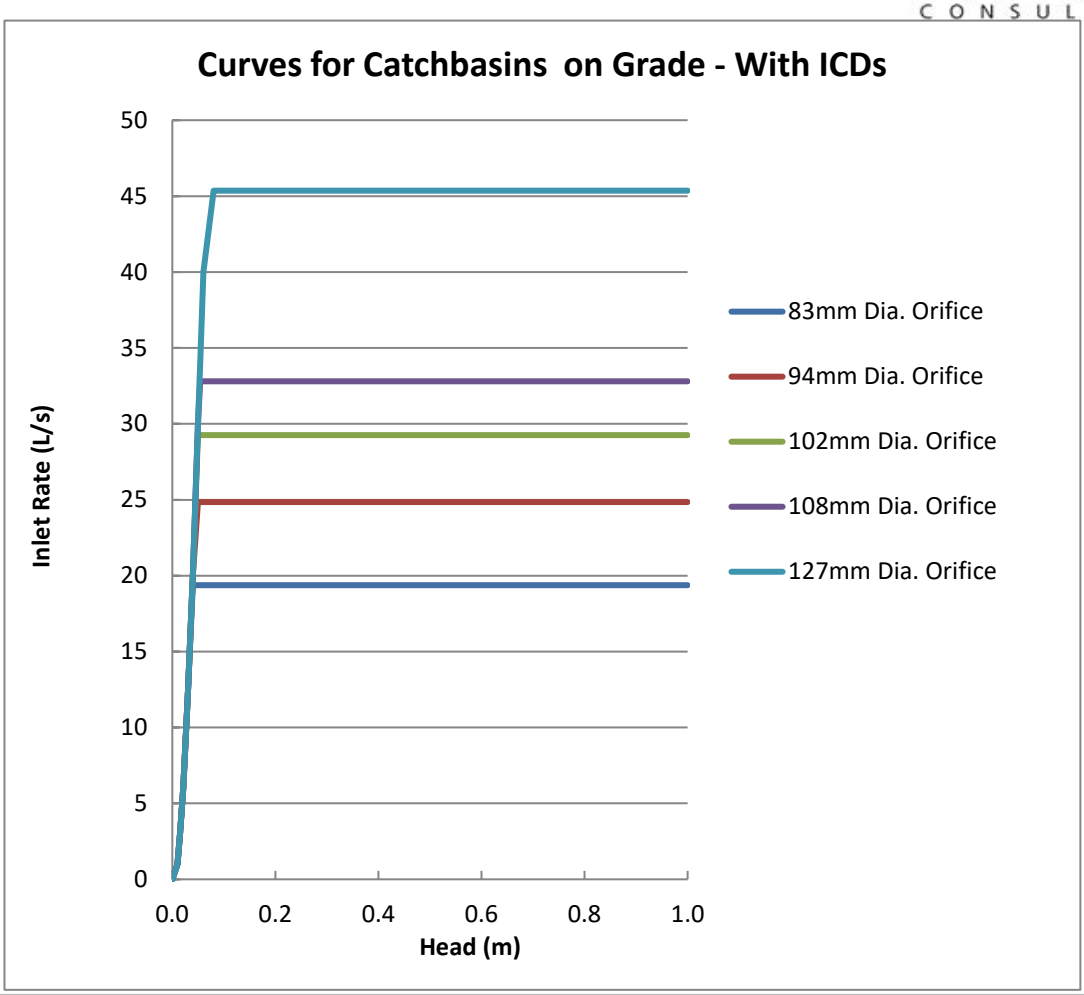
*Add overland flow & shallow concentrated flow travel time + creek flow travel time through subcatchment

Brown Lands (118178)
HGL Elevations

NOVATECH
Engineers, Planners & Landscape Architects

Manhole ID	Pipe / MH / USF Information				HGL Information[1]		Surcharge Depth		Clearance to T/G		Minimum USF Elevation
	D/S Pipe Size (mm)	D/S Pipe Invert Elev. (m)	D/S Pipe Obvert Elev. (m)	MH T/G Elev. (m)	100-year (m)	100-year (+20%) (m)	100-year (m)	100-year (+20%) (m)	100-year (m)	100-year (+20%) (m)	(m)
MH100	375	123.57	123.95	125.96	123.57	123.57	0.00	0.00	2.39	2.39	123.87
MH102	375	122.64	123.02	125.01	122.82	122.82	0.00	0.00	2.19	2.19	123.12
MH104	450	119.65	120.10	123.04	119.98	119.98	0.00	0.00	3.06	3.06	120.28
MH106	300	120.78	121.08	123.49	120.78	120.78	0.00	0.00	2.71	2.71	121.08
MH108	375	117.69	118.07	120.06	117.82	117.82	0.00	0.00	2.24	2.24	118.12
MH110	375	115.30	115.68	117.69	115.44	115.44	0.00	0.00	2.25	2.25	115.74
MH112	525	114.78	115.31	117.44	115.08	115.08	0.00	0.00	2.36	2.36	115.38
MH200	1200	112.05	113.25	116.07	113.50	113.55	0.25	0.30	2.57	2.52	113.80
MH200A	1200	112.08	113.28	116.09	113.51	113.56	0.23	0.28	2.58	2.53	113.81
MH202	1200	112.21	113.41	115.74	113.61	113.67	0.20	0.26	2.13	2.07	113.91
MH204	1200	112.30	113.50	115.55	113.77	113.84	0.27	0.34	1.78	1.71	114.07
MH206	825	113.20	114.03	117.14	114.59	114.69	0.56	0.66	2.55	2.45	114.89
MH208	825	114.76	115.59	118.50	115.51	115.52	0.00	0.00	2.99	2.98	115.81
MH210	525	116.81	117.34	119.52	117.16	117.17	0.00	0.00	2.36	2.35	117.46
MH2100	1200	111.92	113.12	116.34	112.99	113.06	0.00	0.00	3.35	3.28	113.29
MH2102	1200	110.20	111.40	114.93	112.82	112.86	1.42	1.46	2.11	2.07	113.12
MH212	525	117.03	117.56	119.55	117.48	117.49	0.00	0.00	2.07	2.06	117.78
MH214	300	118.34	118.64	120.67	118.58	118.61	0.00	0.00	2.09	2.06	118.88
MH216	300	119.87	120.17	122.50	119.99	120.00	0.00	0.00	2.51	2.50	120.29
MH218	300	120.72	121.02	123.05	120.72	120.72	0.00	0.00	2.33	2.33	121.02
MH220	300	123.11	123.41	125.66	123.11	123.11	0.00	0.00	2.55	2.55	123.41
MH222	300	123.20	123.50	126.00	123.20	123.20	0.00	0.00	2.80	2.80	123.50
MH224	375	119.80	120.18	122.82	119.98	119.98	0.00	0.00	2.84	2.84	120.28
MH226	675	117.16	117.84	120.05	117.64	117.64	0.00	0.00	2.41	2.41	117.94
MH228	300	119.30	119.60	122.08	119.51	119.53	0.00	0.00	2.57	2.55	119.81
MH230	300	120.42	120.72	122.76	120.60	120.62	0.00	0.00	2.16	2.14	120.90
MH232	300	120.51	120.81	122.86	120.60	120.62	0.00	0.00	2.26	2.24	120.90
MH300	825	116.15	116.98	119.24	116.96	116.98	0.00	0.00	2.28	2.26	117.26
MH3100	1200	107.92	109.12	111.97	108.48	108.49	0.00	0.00	3.49	3.48	108.78
MH3102	1200	107.51	108.71	111.78	108.13	108.14	0.00	0.00	3.65	3.64	108.43
MH3104	1200	102.84	104.04	110.39	103.42	103.43	0.00	0.00	6.97	6.96	103.72
MH3106	1200	101.37	102.57	105.61	102.14	102.16	0.00	0.00	3.47	3.45	102.44
MH400	375	117.77	118.15	120.79	117.98	117.98	0.00	0.00	2.81	2.81	118.28
MH500	300	116.98	117.28	119.32	117.04	117.04	0.00	0.00	2.28	2.28	117.34
MH502	300	116.76	117.06	119.11	116.94	116.94	0.00	0.00	2.17	2.17	117.24
MH504	525	112.95	113.48	116.75	113.31	113.31	0.00	0.00	3.44	3.44	113.61
MH506	675	109.06	109.74	114.61	109.59	109.59	0.00	0.00	5.02	5.02	109.89
MH508	750	108.77	109.52	113.03	109.35	109.35	0.00	0.00	3.68	3.68	109.65
MH510	825	108.61	109.44	112.81	109.21	109.21	0.00	0.00	3.60	3.60	109.51
MH512	1200	108.03	109.23	112.49	108.61	108.62	0.00	0.00	3.88	3.87	108.91
MH514	825	109.77	110.60	112.57	110.04	110.04	0.00	0.00	2.53	2.53	110.34
MH516	450	110.91	111.36	113.43	111.16	111.16	0.00	0.00	2.27	2.27	111.46
MH518	450	111.05	111.50	113.56	111.16	111.16	0.00	0.00	2.40	2.40	111.46
MH600	450	111.80	112.25	114.25	111.80	111.80	0.00	0.00	2.45	2.45	112.10

Brown Lands (118178)
Major Flow



Curb Inlet Catchbasins on Continuous Grade

Depth vs. Captured Flow Curve

A standard depth vs. captured flow curve for catch basins on a continuous grade was provided to Novatech by City staff for use in a dual-drainage model of an existing residential neighbourhood. This standard curve was derived using the inlet curves in Appendix 7A of the Ottawa Sewer Design Guidelines.

Novatech reviewed the methodology used to create this standard curve (described below) and determined that it was suitable for general use in other dual-drainage models.

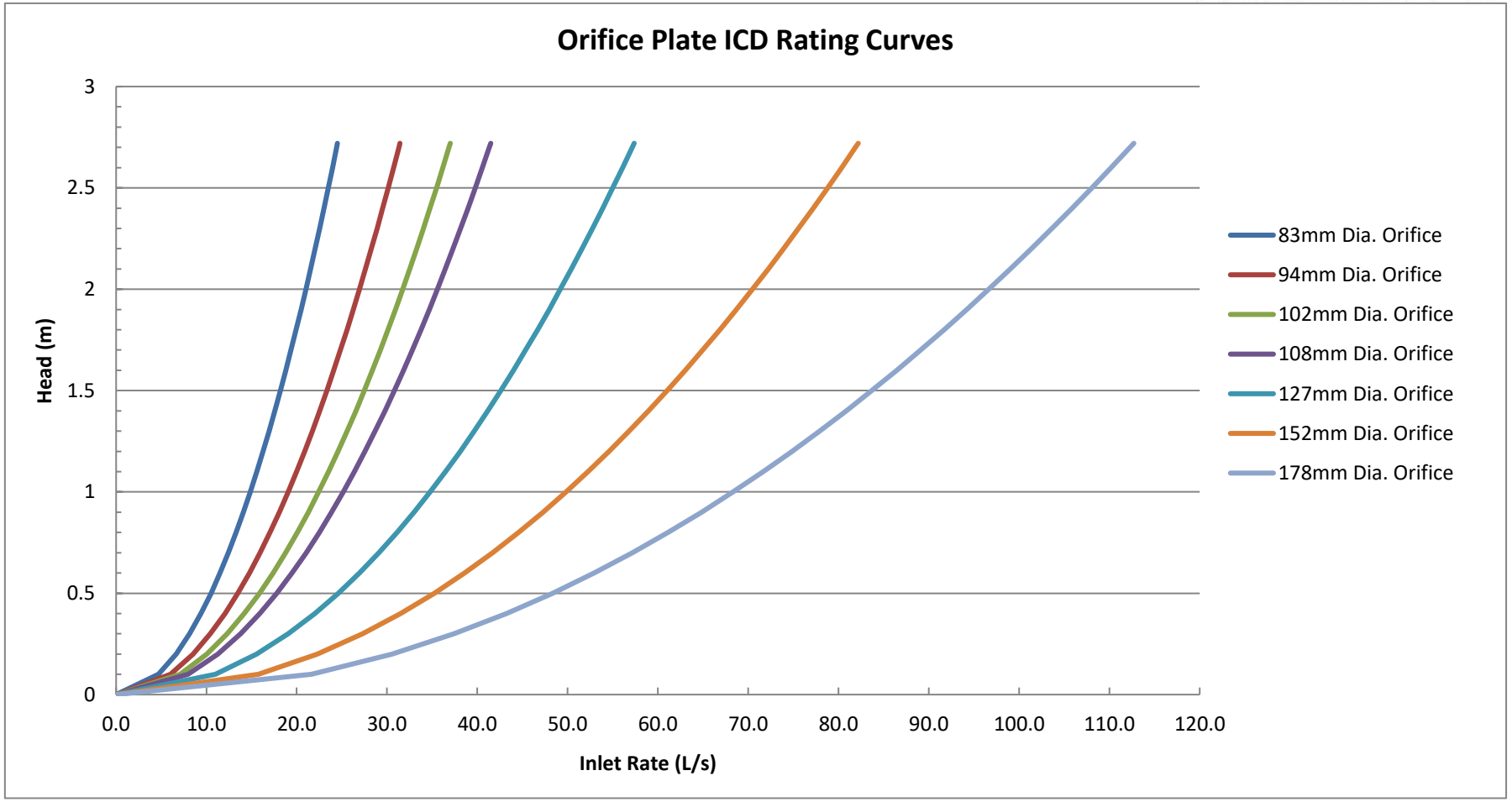
- MTO Design Chart 4.04 provides the relationship between the gutter flow rate (Q_t) and flow spread (T) for Barrier Curb.
- MTO Design Chart 4.12 provides the relationship between flow spread (T) and flow depth (D).
- The relationship between the gutter flow rate (Q_t) and flow depth (D) was determined for different road slopes using the above charts and Manning's equation (refer to pages 58-60 of the MTO Drainage Management Manual – Part 2);
- The relationship between approach flow (Q_t) and captured flow (Q_c) was determined for different road slopes using the design chart for Barrier Curb with Gutter (Appendix 7-A.2).
- Using the above information, a family of curves was developed to characterize the relationship between flow depth and captured flow for curb inlet catchbasins on different road slopes. The results of this exercise can be summarized as follows:
    - For a given flow depth, the gutter flow rate (Q_t) increases as the road slope increases.
    - The capture efficiency (Q_c) of curb inlet catchbasins decrease as the road slope increases.
    - The net result is that the relationship between flow depth and capture rate is largely independent of road slope: While approach flow vs. captured flow (Q_t vs. Q_c) varies significantly with road grade, flow depth vs. captured flow (D vs. Q_c) does not.

Since there was very little difference in the flow depth vs. captured flow curves for different road slopes, this family of curves was averaged to create a single standard curve for use in dual-drainage models.

Inlet Control Devices

The standard depth vs. capture flow curve was modified to account for the installation of ICDs in curb inlet catchbasins on continuous grade. Separate inlet curves were created for each standard ICD orifice size by capping the inlet rate on the depth vs. capture flow curve at the maximum flow rate through the ICD at a head of 1.2m (depth from centerline of CB lead to top of CICB frame).

Brown Lands (118178)
Major Flow

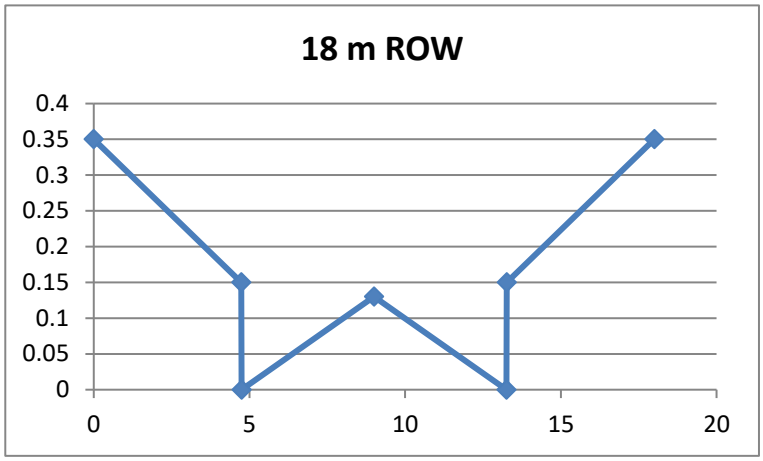


Brown Lands (118178)
Roadway Cross-Sections

Engineers, Planners & Landscape Architects

18m - ROW

Station (m)	Elevation (m)
0	0.35
4.74	0.15
4.75	0
9	0.13
13.25	0
13.26	0.15
18	0.35



Brown Lands (118178)
Design Storm Time Series Data
Chicago Design Storms

NOVATECH
Engineers, Planners & Landscape Architects

C25mm-4.stm		C2-3.stm		C5-3.stm	
Duration	Intensity	Duration	Intensity	Duration	Intensity
min	mm/hr	min	mm/hr	min	mm/hr
0:00	0	0:00	0	0:00	0
0:10	1.51	0:10	2.81	0:10	3.68
0:20	1.75	0:20	3.5	0:20	4.58
0:30	2.07	0:30	4.69	0:30	6.15
0:40	2.58	0:40	7.3	0:40	9.61
0:50	3.46	0:50	18.21	0:50	24.17
1:00	5.39	1:00	76.81	1:00	104.19
1:10	13.44	1:10	24.08	1:10	32.04
1:20	56.67	1:20	12.36	1:20	16.34
1:30	17.77	1:30	8.32	1:30	10.96
1:40	9.12	1:40	6.3	1:40	8.29
1:50	6.14	1:50	5.09	1:50	6.69
2:00	4.65	2:00	4.29	2:00	5.63
2:10	3.76	2:10	3.72	2:10	4.87
2:20	3.17	2:20	3.29	2:20	4.3
2:30	2.74	2:30	2.95	2:30	3.86
2:40	2.43	2:40	2.68	2:40	3.51
2:50	2.18	2:50	2.46	2:50	3.22
3:00	1.98	3:00	2.28	3:00	2.98
3:10	1.81				
3:20	1.68				
3:30	1.56				
3:40	1.47				
3:50	1.38				
4:00	1.31				

Brown Lands (118178)
Design Storm Time Series Data
Chicago Design Storms

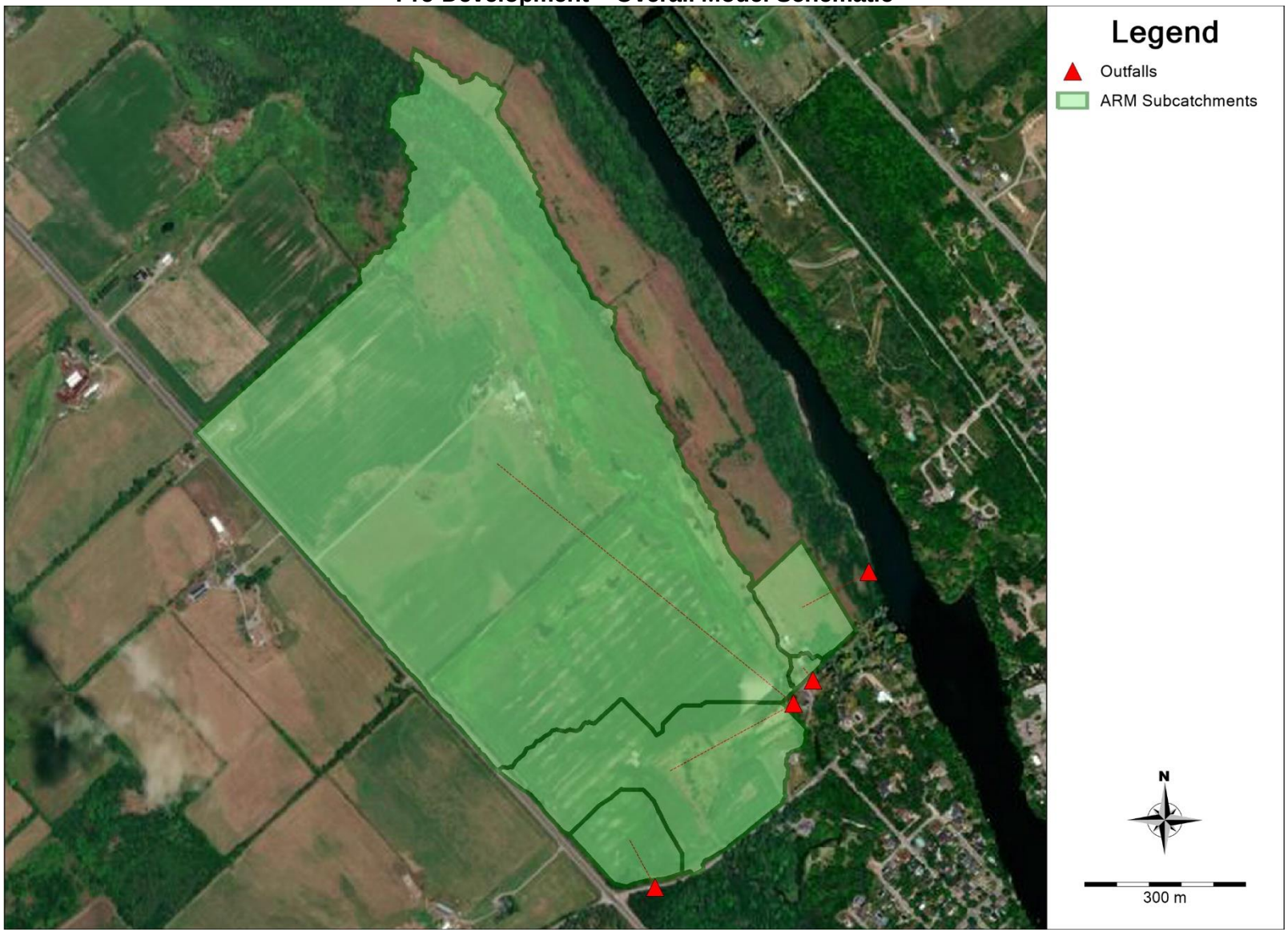
C100-3.stm		C100-3+20%.stm	
Duration	Intensity	Duration	Intensity
min	mm/hr	min	mm/hr
0:00	0	0:00	0
0:10	6.05	0:10	6:14
0:20	7.54	0:20	9.05
0:30	10.16	0:30	12.19
0:40	15.97	0:40	19.16
0:50	40.65	0:50	48.78
1:00	178.56	1:00	214.27
1:10	54.05	1:10	64.86
1:20	27.32	1:20	32.78
1:30	18.24	1:30	21.89
1:40	13.74	1:40	16.49
1:50	11.06	1:50	13.27
2:00	9.29	2:00	11.15
2:10	8.02	2:10	9.62
2:20	7.08	2:20	8.5
2:30	6.35	2:30	7.62
2:40	5.76	2:40	6.91
2:50	5.28	2:50	6.34
3:00	4.88	3:00	5.86

Brown Lands (118178)
Design Storm Time Series Data
SCS Design Storms

NOVATECH
Engineers, Planners & Landscape Architects

S2-12.stm		S5-12.stm		S100-12.stm	
Duration	Intensity	Duration	Intensity	Duration	Intensity
min	mm/hr	min	mm/hr	min	mm/hr
0:00	0.00	0:00	0	0:00	0
0:30	1.27	0:30	1.69	0:30	2.82
1:00	0.59	1:00	0.79	1:00	1.31
1:30	1.10	1:30	1.46	1:30	2.44
2:00	1.10	2:00	1.46	2:00	2.44
2:30	1.44	2:30	1.91	2:30	3.19
3:00	1.27	3:00	1.69	3:00	2.82
3:30	1.69	3:30	2.25	3:30	3.76
4:00	1.69	4:00	2.25	4:00	3.76
4:30	2.29	4:30	3.03	4:30	5.07
5:00	2.88	5:00	3.82	5:00	6.39
5:30	4.57	5:30	6.07	5:30	10.14
6:00	36.24	6:00	48.08	6:00	80.38
6:30	9.23	6:30	12.25	6:30	20.47
7:00	4.06	7:00	5.39	7:00	9.01
7:30	2.71	7:30	3.59	7:30	6.01
8:00	2.37	8:00	3.15	8:00	5.26
8:30	1.86	8:30	2.47	8:30	4.13
9:00	1.95	9:00	2.58	9:00	4.32
9:30	1.27	9:30	1.69	9:30	2.82
10:00	1.02	10:00	1.35	10:00	2.25
10:30	1.44	10:30	1.91	10:30	3.19
11:00	0.93	11:00	1.24	11:00	2.07
11:30	0.85	11:30	1.12	11:30	1.88
12:00	0.85	12:00	1.12	12:00	1.88

Pre-Development – Overall Model Schematic



Date: 2023-02-08
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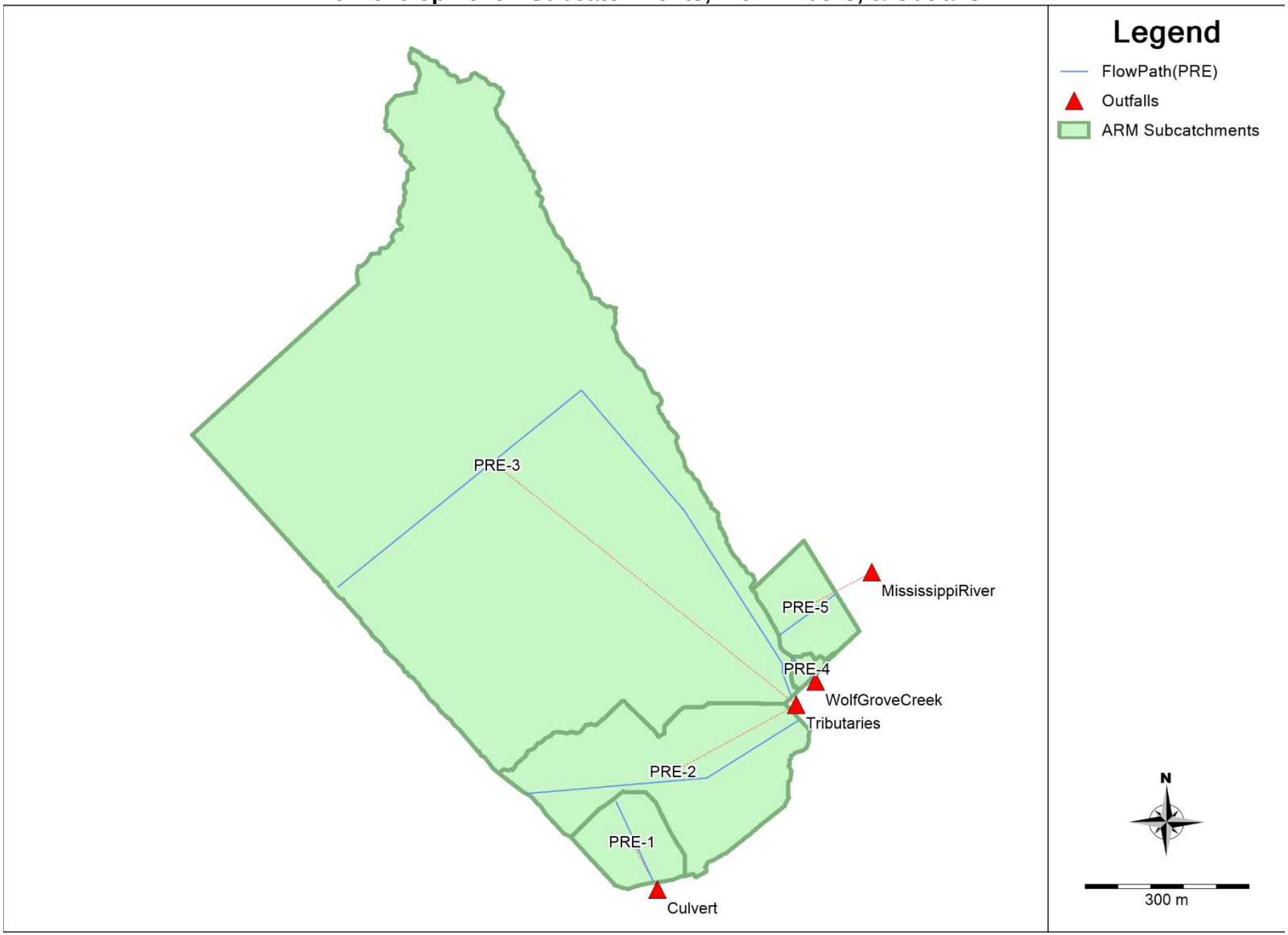
Brown Lands (118178)
PCSWMM Model Schematics

Pre-Development – Subcatchments, Flow Widths, & Outfalls



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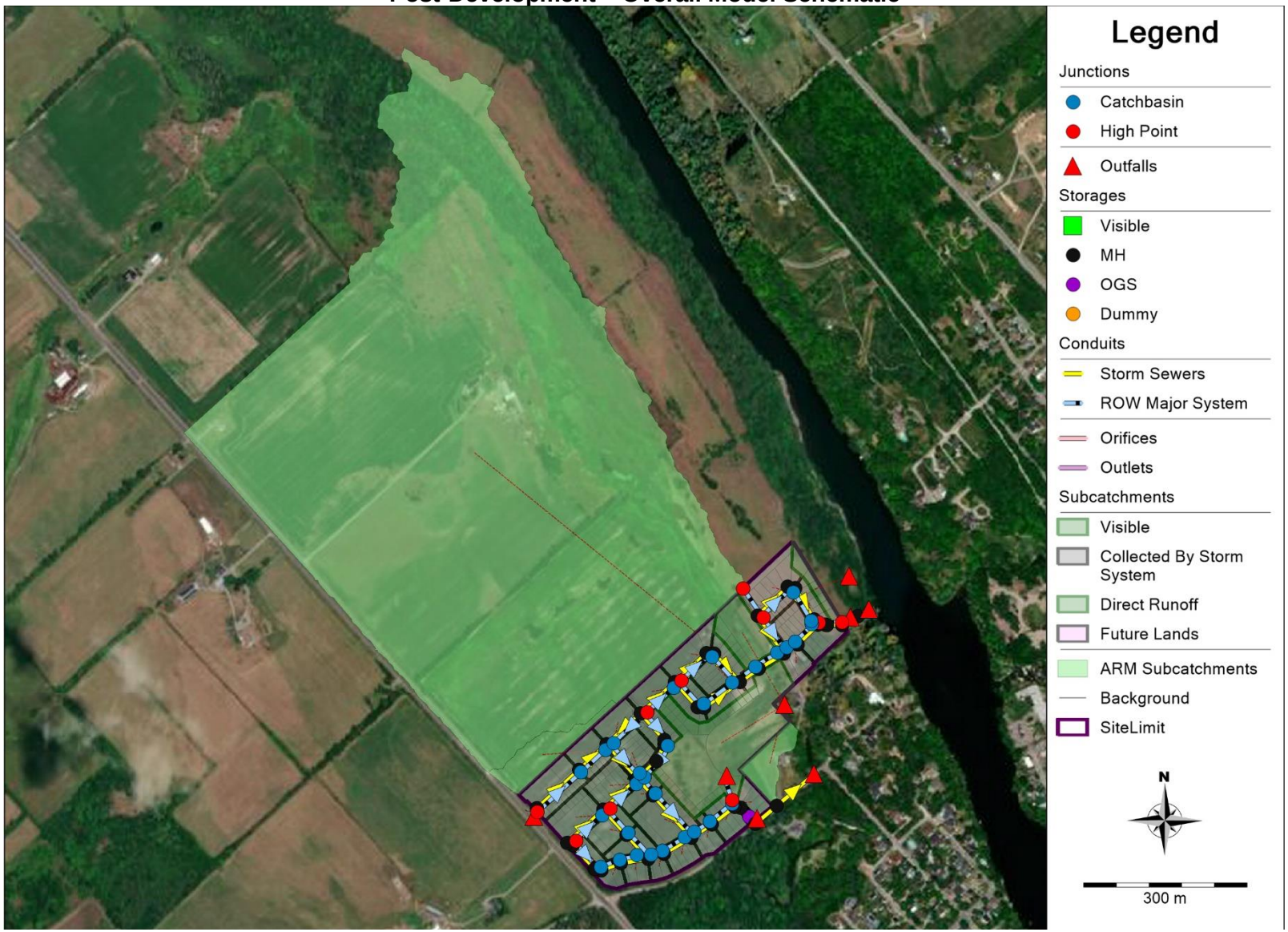
Post-Development – Overall Model Schematic



Date: 2023-02-08
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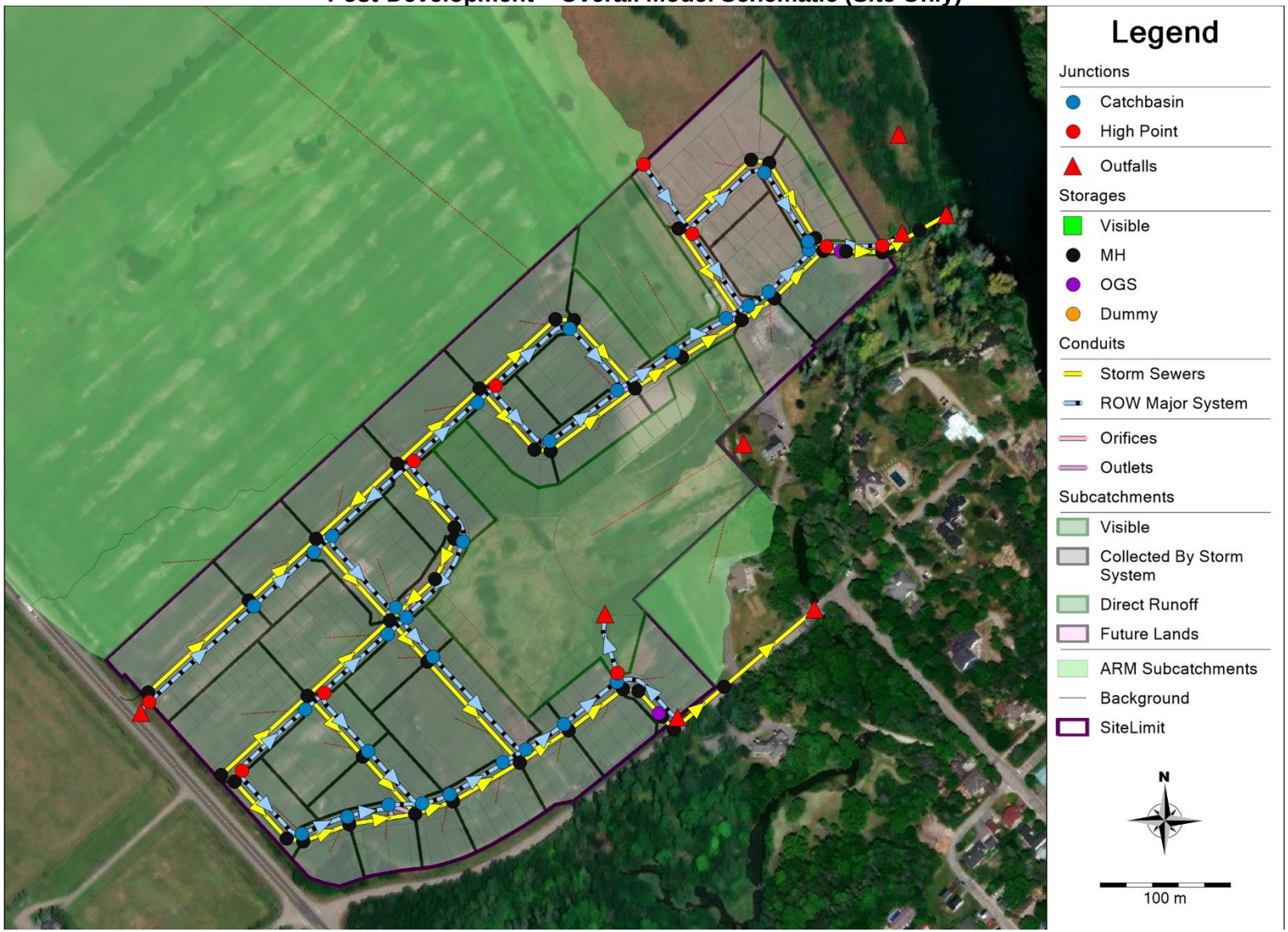
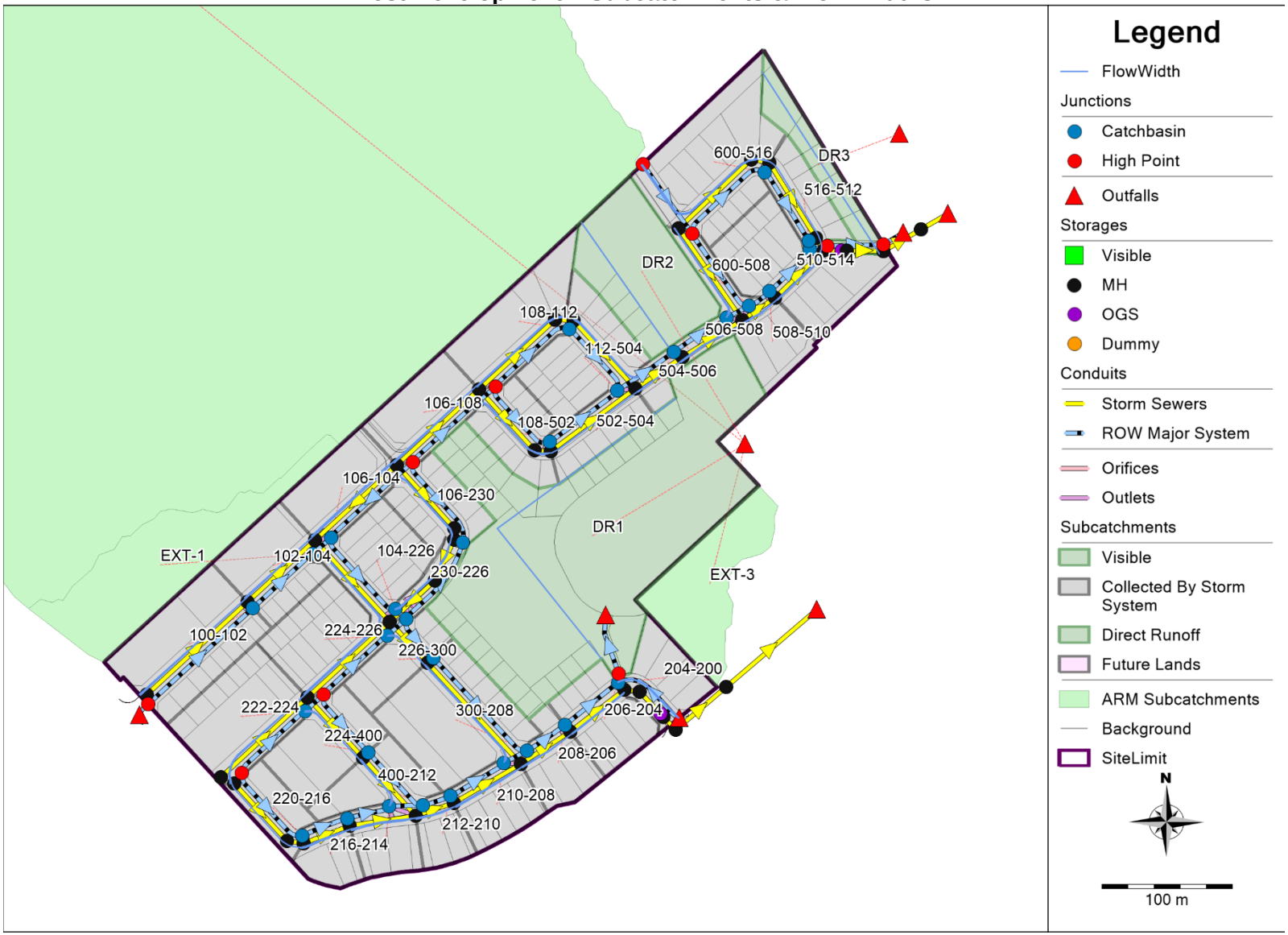
Post-Development – Overall Model Schematic (Site Only)



Brown Lands (118178)
PCSWMM Model Schematics

NOVATECH
Engineers, Planners & Landscape Architects

Post-Development – Subcatchments & Flow Widths



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Brown Lands (118178)
PCSWMM Model Schematics

NOVATECH
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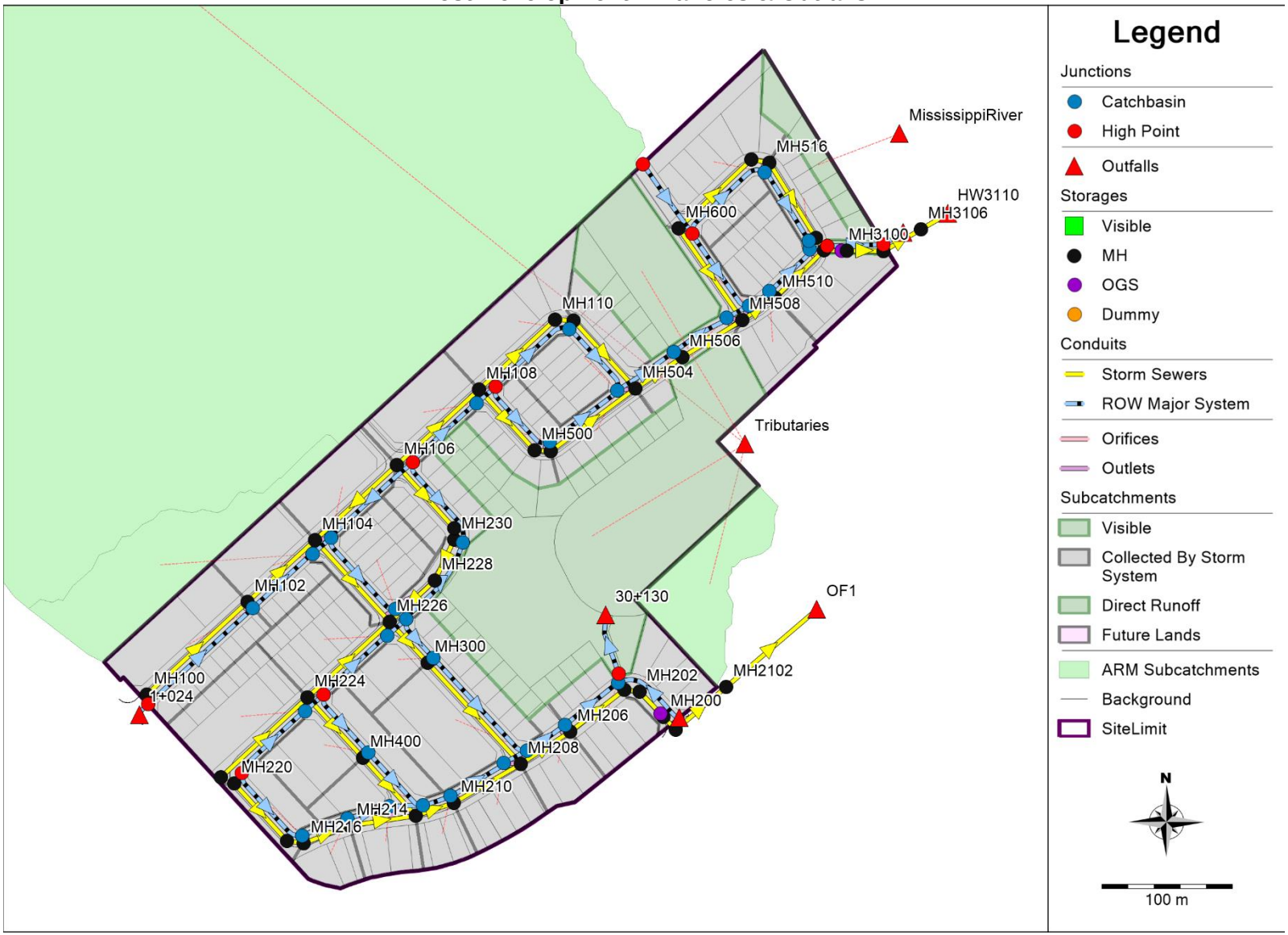
Post-Development – Maholes & Outfalls



Date: 2023-02-08
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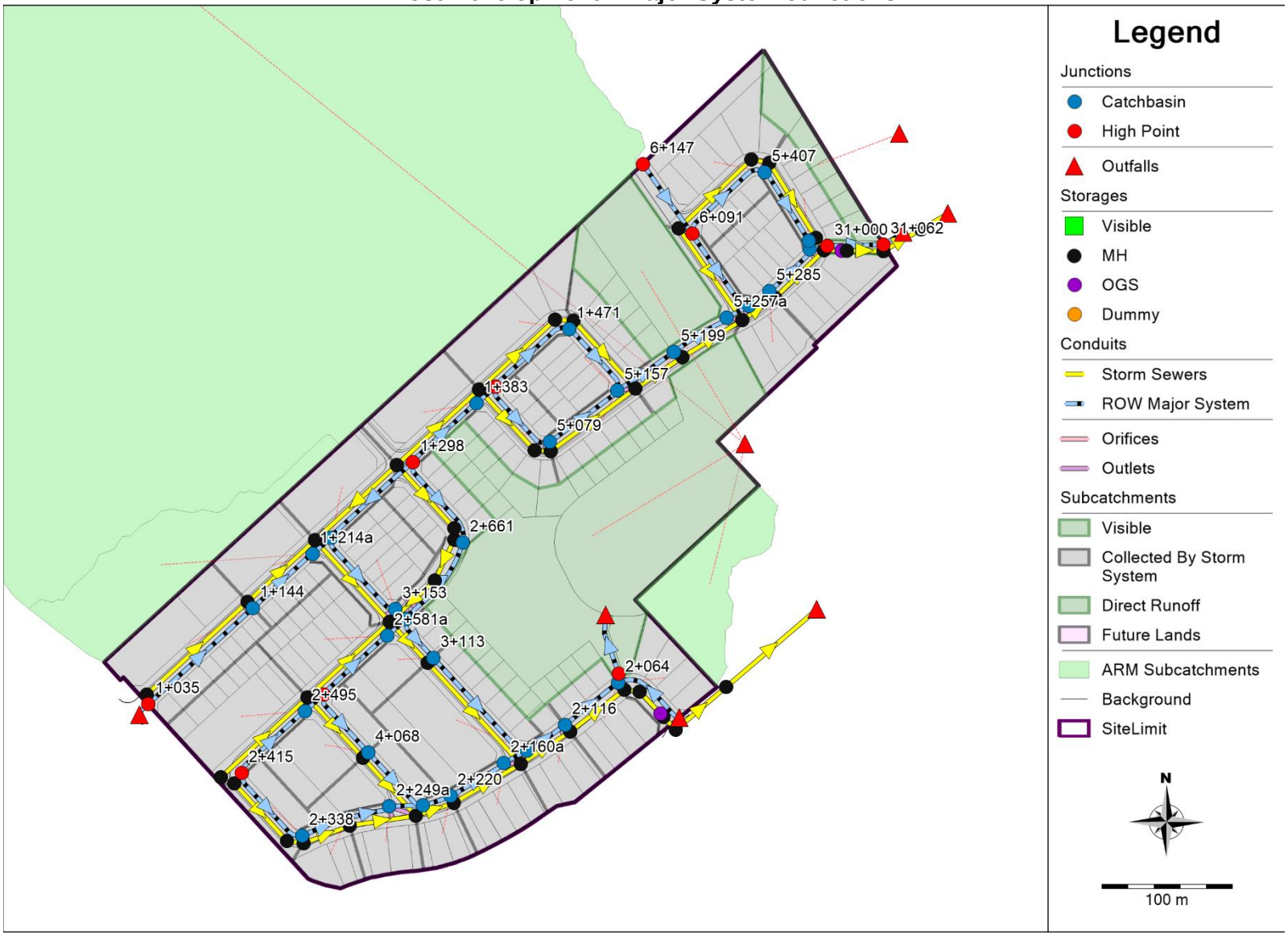
Brown Lands (118178)
PCSWMM Model Schematics

NOVATECH
Engineers, Planners & Landscape Architects

Post-Development – Major System Junctions



Date: 2023-02-08
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Brown Lands (118178)
Pre-Development PCSWMM Model Output (100-year 3-hour Chicago)

```
  ALTERNATIVE RUNOFF METHOD (ARM) - PCSWMM VERSION 7.5.3406
  ---------------------------------------------------------

  This is a new version of ARM - your feedback and suggestions are solicited.
  Create a ticket, post on the PCSWMM feature request forum, or email us directly!

  Simulation start time:                  09/21/2022 00:00:00
  Simulation end time:                    09/22/2022 00:00:00
  Runoff wet weather time steps:          300 seconds
  Report time steps:                      60 seconds
  Number of data points:                  1441


  ******************************
  Unit Hydrographs Runoff Method
  ******************************

  ------------------------------------------------------------------------------------------------------------------------
                                                                                  Area   Time of Concentration  Time to Peak
  Subcatchment         Peak UH Flow    UH Depth
                            Runoff Method             Raingage                   (ha)   (min)                 (min)
(min)                (m³/s/mm)       (mm)
  ------------------------------------------------------------------------------------------------------------------------
  PRE-5                     Nash IUH                  Raingage                   2.343  15                    10
65                   0.02114         0.996
  PRE-4                     Nash IUH                  Raingage                   0.261  15                    10
50                   0.00235         0.995
  PRE-3                     Nash IUH                  Raingage                   68.766 48                    32
233                  0.19388         1
  PRE-2                     Nash IUH                  Raingage                   9.881  17                    11.33
83.67                0.07866         0.998
  PRE-1                     Nash IUH                  Raingage                   2.393  15                    10
65                   0.02159         0.996


  ******************
  ARM Runoff Summary
  ******************

  ------------------------------------------------------------------------------------------
```

Subcatchment	Total Precip (mm)	Total Losses (mm)	Total Runoff (mm)	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff (fraction)
PRE-5	71.667	51.744	19.842	0.465	160.387	0.277
PRE-4	71.667	46.783	24.755	0.065	23.576	0.345
PRE-3	71.667	37.315	34.348	23.62	4408.315	0.479
PRE-2	71.667	34.383	37.193	3.675	1348.874	0.519
PRE-1	71.667	32.871	38.642	0.925	368.92	0.539

```
  EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
  --------------------------------------------------------------


  *************
  Element Count
  *************
  Number of rain gages ...... 1
  Number of subcatchments ... 0
  Number of nodes ........... 4
  Number of links ........... 0
  Number of pollutants ...... 0
  Number of land uses ....... 0


  ****************
  Raingage Summary
  ****************
                                                    Data       Recording
  Name                 Data Source                  Type       Interval
  ----------------------------------------------------------------------
  Raingage             03-C100yr-3hr                INTENSITY   10 min.


  ************
  Node Summary
  ************
                                     Invert      Max.    Ponded    External
```

Brown Lands (118178)
Pre-Development PCSWMM Model Output (100-year 3-hour Chicago)

Name	Type	Elev.	Depth	Area	Inflow
Culvert	OUTFALL	0.00	0.00	0.0	
MississippiRiver	OUTFALL	0.00	0.00	0.0	
Tributaries	OUTFALL	0.00	0.00	0.0	
WolfGroveCreek	OUTFALL	0.00	0.00	0.0	

```
**********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
**********************************************************

***************
Analysis Options
***************
Flow Units ..... LPS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ................ NO
  Snowmelt ............ NO
  Groundwater ......... NO
  Flow Routing ........ NO
  Water Quality ....... NO
Surcharge Method ..... EXTRAN
Starting Date ........ 09/21/2022 00:00:00
Ending Date .......... 09/22/2022 00:00:00
Antecedent Dry Days .. 0.0
Report Time Step ..... 00:01:00
```

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.000	0.000
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	2.875	28.751
External Outflow	2.875	28.751
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.000
Continuity Error (%)	0.000	

```
Analysis begun on:  Wed Feb  8 14:27:53 2023
Analysis ended on:  Wed Feb  8 14:27:53 2023
Total elapsed time: < 1 sec
```

Brown Lands (118178)
Post-Development PCSWMM Model Output (100-year 3-hour Chicago)

```
  ALTERNATIVE RUNOFF METHOD (ARM) - PCSWMM VERSION 7.5.3406
  ---------------------------------------------------------

  This is a new version of ARM - your feedback and suggestions are solicited.
  Create a ticket, post on the PCSWMM feature request forum, or email us directly!

  Simulation start time:                  09/21/2022 00:00:00
  Simulation end time:                    09/22/2022 00:00:00
  Runoff wet weather time steps:          300 seconds
  Report time steps:                      60 seconds
  Number of data points:                  1441


  ******************************
  Unit Hydrographs Runoff Method
  ******************************

  ------------------------------------------------------------------------------------------------------------------------
-------------------------------------------
                                                                                  Area   Time of Concentration  Time to Peak
Time after Peak    Peak UH Flow    UH Depth
  Subcatchment         Runoff Method             Raingage                       (ha)   (min)                  (min)
(min)              (m³/s/mm)       (mm)
  ------------------------------------------------------------------------------------------------------------------------
-------------------------------------------
  EXT-2                Nash IUH                  Raingage                       65.061 48                     32
233                0.18344         1
  EXT-3                Nash IUH                  Raingage                       0.647  15                     10
55                 0.00584         0.996
  EXT-1                Nash IUH                  Raingage                       0.986  15                     10
60                 0.0089          0.996


  ******************
  ARM Runoff Summary
  ******************

  ----------------------------------------------------------------------------------------------
                       Total       Total       Total       Total       Peak        Runoff
                       Precip      Losses      Runoff      Runoff      Runoff      Coeff
  Subcatchment         (mm)        (mm)        (mm)        10^6 ltr    LPS         (fraction)
  ----------------------------------------------------------------------------------------------
```

```
  EXT-2                71.667      37.315      34.352      22.35       4170.802    0.479
  EXT-3                71.667      35.758      35.75       0.231       91.012      0.499
  EXT-1                71.667      31.383      40.122      0.396       158.906     0.56


  EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
  --------------------------------------------------------------

  Boundary at Mississppi = normal (minor invert at 100yr WL in Mississippi)
  Boundary Condition at Wolf Grove Creek (assumed)
  2 year = 110.65 (assume culvert half full)

  WARNING 04: minimum elevation drop used for Conduit Street1-D
  WARNING 04: minimum elevation drop used for Conduit Street1-G
  WARNING 04: minimum elevation drop used for Conduit Street2-D
  WARNING 04: minimum elevation drop used for Conduit Street2-G
  WARNING 04: minimum elevation drop used for Conduit Street2-L
  WARNING 04: minimum elevation drop used for Conduit Street2-N
  WARNING 04: minimum elevation drop used for Conduit Street3-C
  WARNING 04: minimum elevation drop used for Conduit Street5-E
  WARNING 02: maximum depth increased for Node 5+333

  *************
  Element Count
  *************
  Number of rain gages ...... 1
  Number of subcatchments ... 35
  Number of nodes ........... 92
  Number of links ........... 163
  Number of pollutants ...... 0
  Number of land uses ....... 0


  ***************
  Raingage Summary
  ***************
                                                      Data       Recording
  Name                 Data Source                    Type       Interval
  ------------------------------------------------------------------------
```

Brown Lands (118178)
Post-Development PCSWMM Model Output (100-year 3-hour Chicago)

Raingage 03-C100yr-3hr INTENSITY 10 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
100-102	0.73	215.49	64.30	2.0000	Raingage	1+144
102-104	0.45	138.52	64.30	2.0000	Raingage	1+214a
104-226	0.47	153.53	64.30	2.0000	Raingage	3+153
106-104	0.41	167.45	64.30	2.0000	Raingage	1+214b
106-108	0.41	169.23	64.30	2.0000	Raingage	1+383
106-230	0.36	133.76	64.30	2.0000	Raingage	2+661
108-112	0.55	184.58	64.30	2.0000	Raingage	1+471
108-502	0.36	143.46	64.30	2.0000	Raingage	5+079
112-504	0.56	137.64	64.30	2.0000	Raingage	5+157
204-200	0.32	115.92	64.30	2.0000	Raingage	2+064
206-204	0.38	101.55	64.30	2.0000	Raingage	2+064
208-206	0.28	90.22	64.30	2.0000	Raingage	2+116
210-208	0.31	117.77	64.30	2.0000	Raingage	2+160a
212-210	0.18	61.88	64.30	2.0000	Raingage	2+220
214-212	0.25	100.21	64.30	2.0000	Raingage	2+249a
216-214	0.21	80.45	64.30	2.0000	Raingage	2+300
220-216	0.23	73.44	64.30	2.0000	Raingage	2+338
222-224	0.61	183.39	64.30	2.0000	Raingage	2+495
224-226	0.51	155.43	64.30	2.0000	Raingage	2+581a
224-400	0.46	115.39	64.30	2.0000	Raingage	4+068
226-300	0.29	75.11	64.30	2.0000	Raingage	3+113
230-226	0.13	140.43	64.30	2.0000	Raingage	2+581b
300-208	0.78	195.03	64.30	2.0000	Raingage	2+160b
400-212	0.32	87.39	64.30	2.0000	Raingage	2+249b
502-504	0.28	80.34	64.30	2.0000	Raingage	5+157
504-506	0.10	78.98	64.30	2.0000	Raingage	5+199
506-508	0.09	103.48	64.30	2.0000	Raingage	5+257a
508-510	0.27	69.79	64.30	2.0000	Raingage	5+285
510-514	0.70	100.72	64.30	2.0000	Raingage	5+333
516-512	0.28	79.43	64.30	2.0000	Raingage	5+338
600-508	0.15	162.02	64.30	2.0000	Raingage	5+257b
600-516	0.86	262.78	64.30	2.0000	Raingage	5+407
DR1	3.42	294.28	14.30	2.0000	Raingage	Tributaries
DR2	0.82	115.41	14.30	2.0000	Raingage	Tributaries
DR3	0.32	163.90	35.70	2.0000	Raingage	MississippiRiver

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
1+035	JUNCTION	126.00	0.35	0.0	
1+144	JUNCTION	125.00	0.35	0.0	
1+214a	JUNCTION	123.00	0.35	0.0	
1+214b	JUNCTION	123.00	0.35	0.0	
1+298	JUNCTION	123.50	0.35	0.0	
1+383	JUNCTION	120.00	0.35	0.0	
1+383b	JUNCTION	120.00	0.35	0.0	
1+471	JUNCTION	117.44	0.35	0.0	
2+064	JUNCTION	114.15	1.75	0.0	
2+116	JUNCTION	117.14	0.35	0.0	
2+160a	JUNCTION	118.50	0.35	0.0	
2+160b	JUNCTION	118.50	0.35	0.0	
2+220	JUNCTION	119.52	0.35	0.0	
2+249a	JUNCTION	119.55	0.35	0.0	
2+249b	JUNCTION	119.55	0.35	0.0	
2+300	JUNCTION	120.65	0.35	0.0	
2+338	JUNCTION	122.50	0.35	0.0	
2+415	JUNCTION	126.00	0.35	0.0	
2+495	JUNCTION	122.75	0.35	0.0	
2+495b	JUNCTION	122.75	0.35	0.0	
2+581a	JUNCTION	120.00	0.35	0.0	
2+581b	JUNCTION	120.00	0.35	0.0	
2+661	JUNCTION	122.76	0.35	0.0	
3+113	JUNCTION	119.25	0.35	0.0	
3+153	JUNCTION	120.00	0.35	0.0	
30+000	JUNCTION	115.85	0.35	0.0	
31+000	JUNCTION	112.80	0.35	0.0	
31+062	JUNCTION	110.32	0.35	0.0	
4+068	JUNCTION	120.79	0.35	0.0	
5+079	JUNCTION	119.11	0.35	0.0	
5+157	JUNCTION	116.75	0.35	0.0	

5+199	JUNCTION	114.61	0.35	0.0
5+257a	JUNCTION	113.00	0.35	0.0
5+257b	JUNCTION	113.00	0.35	0.0
5+285	JUNCTION	112.81	0.35	0.0
5+333	JUNCTION	111.10	1.75	0.0
5+338	JUNCTION	112.57	0.35	0.0
5+407	JUNCTION	113.43	0.35	0.0
6+091	JUNCTION	114.25	0.35	0.0
6+147	JUNCTION	114.53	0.35	0.0
1+024	OUTFALL	125.84	0.35	0.0
2+007	OUTFALL	116.36	0.35	0.0
30+130	OUTFALL	113.00	0.35	0.0
31+080	OUTFALL	108.14	0.35	0.0
HW3110	OUTFALL	101.20	1.20	0.0
MississippiRiver	OUTFALL	101.00	0.00	0.0
OF1	OUTFALL	109.75	1.20	0.0
Tributaries	OUTFALL	111.00	0.00	0.0
MH100	STORAGE	123.57	2.39	0.0
MH102	STORAGE	122.64	2.37	0.0
MH104	STORAGE	119.65	3.39	0.0
MH106	STORAGE	120.78	2.71	0.0
MH108	STORAGE	117.69	2.37	0.0
MH110	STORAGE	115.30	2.39	0.0
MH112	STORAGE	114.78	2.66	0.0
MH200	STORAGE	112.05	4.02	0.0
MH200A	STORAGE	112.08	4.01	0.0
MH202	STORAGE	112.21	3.53	0.0
MH204	STORAGE	112.30	3.25	0.0
MH206	STORAGE	113.20	3.94	0.0
MH208	STORAGE	114.76	3.74	0.0
MH210	STORAGE	116.81	2.71	0.0
MH2100	STORAGE	111.92	4.42	0.0
MH2102	STORAGE	110.20	4.73	0.0
MH212	STORAGE	117.03	2.52	0.0
MH214	STORAGE	118.34	2.33	0.0
MH216	STORAGE	119.87	2.63	0.0
MH218	STORAGE	120.72	2.33	0.0
MH220	STORAGE	123.11	2.55	0.0
MH222	STORAGE	123.20	2.80	0.0
MH224	STORAGE	119.80	3.02	0.0
MH226	STORAGE	117.16	2.89	0.0
MH228	STORAGE	119.30	2.78	0.0
MH230	STORAGE	120.42	2.34	0.0
MH232	STORAGE	120.51	2.35	0.0
MH300	STORAGE	116.15	3.09	0.0
MH3100	STORAGE	107.92	4.05	0.0
MH3102	STORAGE	107.51	4.27	0.0
MH3104	STORAGE	102.84	7.55	0.0
MH3106	STORAGE	101.37	4.24	0.0
MH400	STORAGE	117.77	3.02	0.0
MH500	STORAGE	116.98	2.34	0.0
MH502	STORAGE	116.76	2.35	0.0
MH504	STORAGE	112.95	3.80	0.0
MH506	STORAGE	109.06	5.55	0.0
MH508	STORAGE	108.77	4.26	0.0
MH510	STORAGE	108.61	4.20	0.0
MH512	STORAGE	108.03	4.46	0.0
MH514	STORAGE	109.77	2.80	0.0
MH516	STORAGE	110.91	2.52	0.0
MH518	STORAGE	111.05	2.51	0.0
MH600	STORAGE	111.80	2.45	0.0

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
Easement-30a	30+000	2+064	CONDUIT	7.0	4.2897	0.0130
Easement-30b	30+000	30+130	CONDUIT	46.3	6.1672	0.0130
Easement-31a	31+000	5+333	CONDUIT	13.6	2.2064	0.0150
Easement-31b	31+000	31+062	CONDUIT	42.4	5.8591	0.0150
Easement-31c	31+062	31+080	CONDUIT	18.0	12.2009	0.0150
MH100-102	MH100	MH102	CONDUIT	103.9	0.8951	0.0130
MH102-104	MH102	MH104	CONDUIT	69.5	2.8501	0.0130
MH104-226	MH104	MH226	CONDUIT	84.0	2.4531	0.0130
MH106-104	MH106	MH104	CONDUIT	84.0	0.5595	0.0130
MH106-108	MH106	MH108	CONDUIT	85.1	3.5510	0.0130
MH106-232	MH106	MH232	CONDUIT	65.0	1.0001	0.0130
MH108-110	MH108	MH110	CONDUIT	78.4	2.9988	0.0130
MH108-500	MH108	MH500	CONDUIT	62.4	1.2020	0.0130
MH110-112	MH110	MH112	CONDUIT	14.2	2.6770	0.0130

Brown Lands (118178)
Post-Development PCSWMM Model Output (100-year 3-hour Chicago)

MH112-504	MH112	MH504	CONDUIT	69.9	0.8012	0.0130
MH200-2100	MH200	MH2100	CONDUIT	13.3	0.5263	0.0130
MH200A-200	MH200A	MH200	CONDUIT	3.4	0.5882	0.0130
MH202-200A	MH202	MH200A	CONDUIT	23.1	0.4762	0.0130
MH204-202	MH204	MH202	CONDUIT	11.8	0.5085	0.0130
MH206-204	MH206	MH204	CONDUIT	52.0	1.0001	0.0130
MH208-206	MH208	MH206	CONDUIT	44.8	0.9822	0.0130
MH2100-2102	MH2100	MH2102	CONDUIT	50.2	0.4980	0.0130
MH210-208	MH210	MH208	CONDUIT	58.9	1.4433	0.0130
MH2102-OF1	MH2102	OF1	CONDUIT	90.7	0.4961	0.0130
MH212-210	MH212	MH210	CONDUIT	30.1	0.6312	0.0130
MH214-212	MH214	MH212	CONDUIT	50.9	2.1419	0.0130
MH216-214	MH216	MH214	CONDUIT	37.5	4.0032	0.0130
MH218-216	MH218	MH216	CONDUIT	12.9	4.0343	0.0130
MH220-218	MH220	MH218	CONDUIT	59.0	4.0032	0.0130
MH222-224	MH222	MH224	CONDUIT	89.4	2.9991	0.0130
MH224-226	MH224	MH226	CONDUIT	85.0	2.4949	0.0130
MH224-400	MH224	MH400	CONDUIT	62.3	3.2441	0.0130
MH226-300	MH226	MH300	CONDUIT	42.4	1.3916	0.0130
MH228-226	MH228	MH226	CONDUIT	46.4	3.4935	0.0130
MH230-228	MH230	MH228	CONDUIT	34.3	1.8954	0.0130
MH232-230	MH232	MH230	CONDUIT	8.6	0.6977	0.0130
MH300-208	MH300	MH208	CONDUIT	104.2	0.4511	0.0130
MH3100-3102	MH3100	MH3102	CONDUIT	3.8	0.7895	0.0130
MH3102-3104	MH3102	MH3104	CONDUIT	27.9	0.7169	0.0130
MH3104-3106	MH3104	MH3106	CONDUIT	32.9	0.6991	0.0130
MH3106-3110	MH3106	HW3110	CONDUIT	23.9	0.7113	0.0130
MH400-212	MH400	MH212	CONDUIT	59.4	0.9933	0.0130
MH500-502	MH500	MH502	CONDUIT	12.2	1.3936	0.0130
MH502-504	MH502	MH504	CONDUIT	80.2	2.8940	0.0130
MH504-506	MH504	MH506	CONDUIT	42.8	1.9864	0.0130
MH506-508	MH506	MH508	CONDUIT	53.6	0.4105	0.0130
MH508-510	MH508	MH510	CONDUIT	30.1	0.2990	0.0130
MH510-512	MH510	MH512	CONDUIT	51.8	0.3089	0.0130
MH512-3100	MH512	MH3100	CONDUIT	13.3	0.6767	0.0130
MH514-512	MH514	MH512	CONDUIT	11.4	1.2282	0.0130
MH516-514	MH516	MH514	CONDUIT	66.9	1.1510	0.0130
MH518-516	MH518	MH516	CONDUIT	14.0	0.7143	0.0130
MH600-508	MH600	MH508	CONDUIT	84.6	1.4541	0.0130
MH600-518	MH600	MH518	CONDUIT	76.2	0.9449	0.0130
Street1-A	1+035	1+024	CONDUIT	10.7	1.4955	0.0150
Street1-B	1+035	1+144	CONDUIT	108.1	0.9251	0.0150
Street1-C	1+144	1+214a	CONDUIT	61.3	3.2644	0.0150
Street1-D	1+214a	1+214b	CONDUIT	18.7	0.0016	0.0150
Street1-E	1+298	1+214b	CONDUIT	84.5	0.5917	0.0150
Street1-F	1+298	1+383	CONDUIT	66.2	5.2944	0.0150
Street1-G	1+383	1+383b	CONDUIT	19.1	0.0016	0.0150
Street1-H	1+383b	1+471	CONDUIT	73.8	3.4709	0.0150
Street1-I	1+471	5+157	CONDUIT	61.0	1.1312	0.0150
Street2-A	2+007	2+064	CONDUIT	58.0	1.3967	0.0150
Street2-B	2+116	2+064	CONDUIT	51.6	3.0829	0.0150
Street2-C	2+160b	2+116	CONDUIT	35.0	3.8887	0.0150
Street2-D	2+160a	2+160b	CONDUIT	19.9	0.0015	0.0150
Street2-E	2+220	2+160a	CONDUIT	47.8	2.1344	0.0150
Street2-F	2+249b	2+220	CONDUIT	22.1	0.1357	0.0150
Street2-G	2+249a	2+249b	CONDUIT	25.6	0.0012	0.0150
Street2-H	2+300	2+249a	CONDUIT	33.3	3.3051	0.0150
Street2-I	2+338	2+300	CONDUIT	37.0	5.0063	0.0150
Street2-J	2+415	2+338	CONDUIT	69.0	5.0790	0.0150
Street2-K	2+415	2+495	CONDUIT	67.6	4.8133	0.0150
Street2-L	2+495	2+495b	CONDUIT	19.1	0.0016	0.0150
Street2-M	2+495b	2+581a	CONDUIT	66.2	4.1577	0.0150
Street2-N	2+581a	2+581b	CONDUIT	19.1	0.0016	0.0150
Street2-O	2+661	2+581b	CONDUIT	73.4	3.7629	0.0150
Street2-P	1+298	2+661	CONDUIT	75.0	0.9867	0.0150
Street3-A	3+113	2+160b	CONDUIT	101.4	0.7397	0.0150
Street3-B	2+581b	3+113	CONDUIT	37.6	1.9951	0.0150
Street3-C	3+153	2+581b	CONDUIT	11.3	0.0027	0.0150
Street3-D	1+214b	3+153	CONDUIT	75.6	3.9714	0.0150
Street4-A	4+068	2+249b	CONDUIT	58.3	2.1274	0.0150
Street4-B	2+495b	4+068	CONDUIT	57.3	3.4226	0.0150
Street5-A	1+383b	5+079	CONDUIT	63.6	1.3995	0.0150
Street5-B	5+079	5+157	CONDUIT	64.7	3.6500	0.0150
Street5-C	5+157	5+199	CONDUIT	52.0	4.1189	0.0150
Street5-D	5+199	5+257a	CONDUIT	48.0	3.3561	0.0150
Street5-E	5+257a	5+257b	CONDUIT	19.3	0.0016	0.0150
Street5-F	5+257b	5+285	CONDUIT	19.2	0.9896	0.0150
Street5-G	5+285	5+333	CONDUIT	44.7	0.6935	0.0150
Street5-H	5+338	5+333	CONDUIT	6.6	1.0607	0.0150
Street5-I	5+407	5+338	CONDUIT	62.0	1.3872	0.0150
Street5-J	6+091	5+407	CONDUIT	77.2	1.0622	0.0150
Street6-A	6+091	5+257b	CONDUIT	71.0	1.7608	0.0150

Street6-B	6+147	6+091	CONDUIT	64.7	0.4328	0.0150
OR1	2+064	MH204	ORIFICE			
OR10	5+333	MH512	ORIFICE			
OR2	2+064	MH204	ORIFICE			
OR3	2+064	MH204	ORIFICE			
OR4	2+064	MH204	ORIFICE			
OR5	2+064	MH204	ORIFICE			
OR6	2+064	MH204	ORIFICE			
OR7	5+333	MH512	ORIFICE			
OR8	5+333	MH512	ORIFICE			
OR9	5+333	MH512	ORIFICE			
OL01	2+116	MH206	OUTLET			
OL02	2+116	MH206	OUTLET			
OL03	2+160a	MH208	OUTLET			
OL04	2+160a	MH208	OUTLET			
OL05	2+160b	MH208	OUTLET			
OL06	2+160b	MH208	OUTLET			
OL07	2+220	MH210	OUTLET			
OL08	2+220	MH210	OUTLET			
OL09	2+249a	MH212	OUTLET			
OL10	2+249a	MH212	OUTLET			
OL11	2+249b	MH212	OUTLET			
OL12	2+249b	MH212	OUTLET			
OL13	2+300	MH214	OUTLET			
OL14	2+300	MH214	OUTLET			
OL15	2+338	MH216	OUTLET			
OL16	2+338	MH216	OUTLET			
OL17	2+495	MH224	OUTLET			
OL18	2+495	MH224	OUTLET			
OL19	2+581a	MH226	OUTLET			
OL20	2+581a	MH226	OUTLET			
OL21	2+581b	MH228	OUTLET			
OL22	2+581b	MH228	OUTLET			
OL23	2+661	MH230	OUTLET			
OL24	2+661	MH230	OUTLET			
OL25	3+153	MH226	OUTLET			
OL26	3+153	MH226	OUTLET			
OL27	3+113	MH300	OUTLET			
OL28	3+113	MH300	OUTLET			
OL29	4+068	MH400	OUTLET			
OL30	4+068	MH400	OUTLET			

OL31	1+144	MH102	OUTLET
OL32	1+144	MH102	OUTLET
OL33	1+214a	MH104	OUTLET
OL34	1+214a	MH104	OUTLET
OL35	1+214b	MH104	OUTLET
OL36	1+214b	MH104	OUTLET
OL37	1+383	MH108	OUTLET
OL38	1+383	MH108	OUTLET
OL39	1+471	MH112	OUTLET
OL40	1+471	MH112	OUTLET
OL41	5+079	MH502	OUTLET
OL42	5+079	MH502	OUTLET
OL43	5+157	MH504	OUTLET
OL44	5+157	MH504	OUTLET
OL45	5+199	MH506	OUTLET
OL46	5+199	MH506	OUTLET
OL47	5+257a	MH508	OUTLET
OL48	5+257a	MH508	OUTLET
OL49	5+257b	MH508	OUTLET
OL50	5+257b	MH508	OUTLET
OL51	5+285	MH510	OUTLET
OL52	5+285	MH510	OUTLET
OL53	5+338	MH514	OUTLET
OL54	5+338	MH514	OUTLET
OL55	5+407	MH516	OUTLET
OL56	5+407	MH516	OUTLET

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
Easement-30a	RECT_OPEN	0.35	1.05	0.28	3.00	1	7224.51
Easement-30b	RECT_OPEN	0.35	1.05	0.28	3.00	1	8662.46
Easement-31a	RECT_OPEN	0.35	1.05	0.28	3.00	1	4490.49
Easement-31b	RECT_OPEN	0.35	1.05	0.28	3.00	1	7317.53
Easement-31c	RECT_OPEN	0.35	1.05	0.28	3.00	1	10559.55
MH100-102	CIRCULAR	0.38	0.11	0.09	0.38	1	165.89
MH102-104	CIRCULAR	0.38	0.11	0.09	0.38	1	296.01

MH104-226	CIRCULAR	0.45	0.16	0.11	0.45	1	446.57
MH106-104	CIRCULAR	0.38	0.11	0.09	0.38	1	131.16
MH106-108	CIRCULAR	0.30	0.07	0.07	0.30	1	182.23
MH106-232	CIRCULAR	0.30	0.07	0.07	0.30	1	96.71
MH108-110	CIRCULAR	0.38	0.11	0.09	0.38	1	303.64
MH108-500	CIRCULAR	0.30	0.07	0.07	0.30	1	106.03
MH110-112	CIRCULAR	0.38	0.11	0.09	0.38	1	286.89
MH112-504	CIRCULAR	0.53	0.22	0.13	0.53	1	384.96
MH200-2100	CIRCULAR	1.20	1.13	0.30	1.20	1	2828.63
MH200A-200	CIRCULAR	1.20	1.13	0.30	1.20	1	2990.40
MH202-200A	CIRCULAR	1.20	1.13	0.30	1.20	1	2690.56
MH204-202	CIRCULAR	1.20	1.13	0.30	1.20	1	2780.27
MH206-204	CIRCULAR	0.82	0.53	0.21	0.82	1	1435.56
MH208-206	CIRCULAR	0.82	0.53	0.21	0.82	1	1422.68
MH2100-2102	CIRCULAR	1.20	1.13	0.30	1.20	1	2751.50
MH210-208	CIRCULAR	0.53	0.22	0.13	0.53	1	516.69
MH2102-OF1	CIRCULAR	1.20	1.13	0.30	1.20	1	2746.34
MH212-210	CIRCULAR	0.53	0.22	0.13	0.53	1	341.71
MH214-212	CIRCULAR	0.30	0.07	0.07	0.30	1	141.53
MH216-214	CIRCULAR	0.30	0.07	0.07	0.30	1	193.49
MH218-216	CIRCULAR	0.30	0.07	0.07	0.30	1	194.24
MH220-218	CIRCULAR	0.30	0.07	0.07	0.30	1	193.49
MH222-224	CIRCULAR	0.30	0.07	0.07	0.30	1	167.48
MH224-226	CIRCULAR	0.38	0.11	0.09	0.38	1	276.95
MH224-400	CIRCULAR	0.30	0.07	0.07	0.30	1	174.18
MH226-300	CIRCULAR	0.68	0.36	0.17	0.68	1	991.68
MH228-226	CIRCULAR	0.30	0.07	0.07	0.30	1	180.75
MH230-228	CIRCULAR	0.30	0.07	0.07	0.30	1	133.14
MH232-230	CIRCULAR	0.30	0.07	0.07	0.30	1	80.78
MH300-208	CIRCULAR	0.82	0.53	0.21	0.82	1	964.11
MH3100-3102	CIRCULAR	1.20	1.13	0.30	1.20	1	3464.38
MH3102-3104	CIRCULAR	1.20	1.13	0.30	1.20	1	3301.17
MH3104-3106	CIRCULAR	1.20	1.13	0.30	1.20	1	3260.02
MH3106-3110	CIRCULAR	1.20	1.13	0.30	1.20	1	3288.37
MH400-212	CIRCULAR	0.38	0.11	0.09	0.38	1	174.75
MH500-502	CIRCULAR	0.30	0.07	0.07	0.30	1	114.16
MH502-504	CIRCULAR	0.30	0.07	0.07	0.30	1	164.51
MH504-506	CIRCULAR	0.53	0.22	0.13	0.53	1	606.16
MH506-508	CIRCULAR	0.68	0.36	0.17	0.68	1	538.57
MH508-510	CIRCULAR	0.75	0.44	0.19	0.75	1	608.79
MH510-512	CIRCULAR	0.82	0.53	0.21	0.82	1	797.82
MH512-3100	CIRCULAR	1.20	1.13	0.30	1.20	1	3207.38
MH514-512	CIRCULAR	0.82	0.53	0.21	0.82	1	1590.88
MH516-514	CIRCULAR	0.45	0.16	0.11	0.45	1	305.90
MH518-516	CIRCULAR	0.45	0.16	0.11	0.45	1	240.98
MH600-508	CIRCULAR	0.25	0.05	0.06	0.25	1	71.71
MH600-518	CIRCULAR	0.45	0.16	0.11	0.45	1	277.16
Street1-A	18mROW	0.35	3.38	0.19	18.00	1	9075.69
Street1-B	18mROW	0.35	3.38	0.19	18.00	1	7138.12
Street1-C	18mROW	0.35	3.38	0.19	18.00	1	13408.73
Street1-D	18mROW	0.35	3.38	0.19	18.00	1	299.62
Street1-E	18mROW	0.35	3.38	0.19	18.00	1	5708.84
Street1-F	18mROW	0.35	3.38	0.19	18.00	1	17076.40
Street1-G	18mROW	0.35	3.38	0.19	18.00	1	296.47
Street1-H	18mROW	0.35	3.38	0.19	18.00	1	13826.43
Street1-I	18mROW	0.35	3.38	0.19	18.00	1	7893.34
Street2-A	18mROW	0.35	3.38	0.19	18.00	1	8770.76
Street2-B	18mROW	0.35	3.38	0.19	18.00	1	13030.59
Street2-C	18mROW	0.35	3.38	0.19	18.00	1	14634.80
Street2-D	18mROW	0.35	3.38	0.19	18.00	1	290.45
Street2-E	18mROW	0.35	3.38	0.19	18.00	1	10842.34
Street2-F	18mROW	0.35	3.38	0.19	18.00	1	2734.34
Street2-G	18mROW	0.35	3.38	0.19	18.00	1	256.08
Street2-H	18mROW	0.35	3.38	0.19	18.00	1	13492.12
Street2-I	18mROW	0.35	3.38	0.19	18.00	1	16605.20
Street2-J	18mROW	0.35	3.38	0.19	18.00	1	16725.40
Street2-K	18mROW	0.35	3.38	0.19	18.00	1	16281.97
Street2-L	18mROW	0.35	3.38	0.19	18.00	1	296.47
Street2-M	18mROW	0.35	3.38	0.19	18.00	1	15132.55
Street2-N	18mROW	0.35	3.38	0.19	18.00	1	296.47
Street2-O	18mROW	0.35	3.38	0.19	18.00	1	14396.19
Street2-P	18mROW	0.35	3.38	0.19	18.00	1	7371.96
Street3-A	18mROW	0.35	3.38	0.19	18.00	1	6382.71
Street3-B	18mROW	0.35	3.38	0.19	18.00	1	10482.56
Street3-C	18mROW	0.35	3.38	0.19	18.00	1	385.44
Street3-D	18mROW	0.35	3.38	0.19	18.00	1	14789.66
Street4-A	18mROW	0.35	3.38	0.19	18.00	1	10824.63
Street4-B	18mROW	0.35	3.38	0.19	18.00	1	13729.83
Street5-A	18mROW	0.35	3.38	0.19	18.00	1	8779.61
Street5-B	18mROW	0.35	3.38	0.19	18.00	1	14178.68
Street5-C	18mROW	0.35	3.38	0.19	18.00	1	15061.79
Street5-D	18mROW	0.35	3.38	0.19	18.00	1	13595.71

```
Street5-E        18mROW              0.35     3.38     0.19    18.00        1   294.93
Street5-F        18mROW              0.35     3.38     0.19    18.00        1  7382.85
Street5-G        18mROW              0.35     3.38     0.19    18.00        1  6180.44
Street5-H        18mROW              0.35     3.38     0.19    18.00        1  7643.23
Street5-I        18mROW              0.35     3.38     0.19    18.00        1  8741.01
Street5-J        18mROW              0.35     3.38     0.19    18.00        1  7648.88
Street6-A        18mROW              0.35     3.38     0.19    18.00        1  9847.97
Street6-B        18mROW              0.35     3.38     0.19    18.00        1  4882.21


***************
Transect Summary
***************

Transect 18mROW
Area:
           0.0005    0.0019    0.0043    0.0076    0.0119
           0.0171    0.0233    0.0304    0.0385    0.0475
           0.0575    0.0685    0.0804    0.0932    0.1070
           0.1217    0.1374    0.1541    0.1716    0.1892
           0.2069    0.2247    0.2431    0.2622    0.2819
           0.3024    0.3236    0.3454    0.3679    0.3911
           0.4151    0.4397    0.4649    0.4909    0.5176
           0.5449    0.5729    0.6017    0.6311    0.6612
           0.6920    0.7234    0.7556    0.7884    0.8220
           0.8562    0.8911    0.9267    0.9630    1.0000
Hrad:
           0.0179    0.0358    0.0537    0.0716    0.0895
           0.1074    0.1252    0.1431    0.1610    0.1789
           0.1968    0.2147    0.2326    0.2505    0.2684
           0.2863    0.3042    0.3221    0.3474    0.3825
           0.4176    0.4526    0.4862    0.5180    0.5481
           0.5768    0.6040    0.6300    0.6547    0.6783
           0.7008    0.7223    0.7430    0.7628    0.7818
           0.8000    0.8176    0.8345    0.8508    0.8666
           0.8818    0.8966    0.9109    0.9247    0.9381
           0.9512    0.9639    0.9762    0.9883    1.0000
Width:
           0.0255    0.0510    0.0764    0.1019    0.1274
           0.1529    0.1784    0.2038    0.2293    0.2548
```

```
           0.2803    0.3058    0.3312    0.3567    0.3822
           0.4077    0.4331    0.4586    0.4732    0.4733
           0.4733    0.4839    0.5023    0.5207    0.5392
           0.5576    0.5760    0.5945    0.6129    0.6313
           0.6498    0.6682    0.6866    0.7051    0.7235
           0.7419    0.7604    0.7788    0.7972    0.8157
           0.8341    0.8525    0.8710    0.8894    0.9078
           0.9263    0.9447    0.9631    0.9816    1.0000

*****************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*****************************************************

***************
Analysis Options
***************
Flow Units ..... LPS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... HORTON
Flow Routing Method ..... DYNWAVE
Surcharge Method ..... EXTRAN
Starting Date ..... 09/21/2022 00:00:00
Ending Date ..... 09/22/2022 00:00:00
Antecedent Dry Days ..... 0.0
Report Time Step ..... 00:01:00
Wet Time Step ..... 00:05:00
Dry Time Step ..... 00:05:00
Routing Time Step ..... 2.00 sec
Variable Time Step ..... YES
Maximum Trials ..... 8
Number of Threads ..... 8
```

Brown Lands (118178)
Post-Development PCSWMM Model Output (100-year 3-hour Chicago)

```
  Head Tolerance ........... 0.001500 m


  *************************        Volume         Depth
  Runoff Quantity Continuity     hectare-m            mm
  *************************     ---------       -------
  Total Precipitation ......         1.208        71.667
  Evaporation Loss .........         0.000         0.000
  Infiltration Loss ........         0.389        23.071
  Surface Runoff ...........         0.821        48.743
  Final Storage ............         0.007         0.442
  Continuity Error (%) .....        -0.822


  *************************        Volume        Volume
  Flow Routing Continuity        hectare-m      10^6 ltr
  *************************     ---------      ---------
  Dry Weather Inflow .......         0.000         0.000
  Wet Weather Inflow .......         0.821         8.213
  Groundwater Inflow .......         0.000         0.000
  RDII Inflow ..............         0.000         0.000
  External Inflow ..........         2.301        23.007
  External Outflow .........         3.122        31.223
  Flooding Loss ............         0.000         0.000
  Evaporation Loss .........         0.000         0.000
  Exfiltration Loss ........         0.000         0.000
  Initial Stored Volume ....         0.013         0.129
  Final Stored Volume ......         0.013         0.129
  Continuity Error (%) .....        -0.012


  ************************
  Highest Continuity Errors
  ************************
  Node 2+064 (-1.16%)


  ***************************
  Time-Step Critical Elements
  ***************************
  Link MH200A-200 (20.20%)
```

```
  Link MH3100-3102 (2.57%)


  ********************************
  Highest Flow Instability Indexes
  ********************************
  All links are stable.


  ************************
  Routing Time Step Summary
  ************************
  Minimum Time Step           :     0.41 sec
  Average Time Step           :     1.77 sec
  Maximum Time Step           :     2.00 sec
  Percent in Steady State     :    -0.00
  Average Iterations per Step :     2.00
  Percent Not Converging      :     0.00
  Time Step Frequencies       :
      2.000 -  1.516 sec      :    78.30 %
      1.516 -  1.149 sec      :     7.23 %
      1.149 -  0.871 sec      :     6.21 %
      0.871 -  0.660 sec      :     3.65 %
      0.660 -  0.500 sec      :     4.61 %


  ***************************
  Subcatchment Runoff Summary
  ***************************

  ------------------------------------------------------------------------------------------------------------------------
-------------
                           Total      Total      Total      Total     Imperv       Perv      Total       Total
Peak  Runoff
                          Precip      Runon       Evap      Infil     Runoff     Runoff     Runoff      Runoff
Runoff   Coeff
  Subcatchment                mm         mm         mm         mm         mm         mm         mm    10^6 ltr
LPS
  ------------------------------------------------------------------------------------------------------------------------
-------------
  100-102                  71.67       0.00       0.00      16.02      45.66      10.05      55.71        0.41
316.29   0.777
```

102-104	71.67	0.00	0.00	16.01	45.65	10.08	55.73	0.25
195.81	0.778							
104-226	71.67	0.00	0.00	15.98	45.64	10.13	55.77	0.26
205.71	0.778							
106-104	71.67	0.00	0.00	15.91	45.61	10.29	55.89	0.23
183.05	0.780							
106-108	71.67	0.00	0.00	15.91	45.60	10.29	55.90	0.23
183.20	0.780							
106-230	71.67	0.00	0.00	15.94	45.62	10.22	55.84	0.20
159.45	0.779							
108-112	71.67	0.00	0.00	15.97	45.64	10.14	55.78	0.31
241.35	0.778							
108-502	71.67	0.00	0.00	15.92	45.61	10.27	55.88	0.20
160.40	0.780							
112-504	71.67	0.00	0.00	16.10	45.70	9.91	55.61	0.31
237.89	0.776							
204-200	71.67	0.00	0.00	15.95	45.62	10.20	55.82	0.18
141.41	0.779							
206-204	71.67	0.00	0.00	16.06	45.68	9.97	55.66	0.21
162.92	0.777							
208-206	71.67	0.00	0.00	15.99	45.65	10.11	55.76	0.16
122.39	0.778							
210-208	71.67	0.00	0.00	15.93	45.62	10.23	55.85	0.17
137.57	0.779							
212-210	71.67	0.00	0.00	15.97	45.63	10.16	55.80	0.10
79.17	0.779							
214-212	71.67	0.00	0.00	15.91	45.61	10.27	55.88	0.14
111.44	0.780							
216-214	71.67	0.00	0.00	15.93	45.62	10.24	55.86	0.12
93.26	0.779							
220-216	71.67	0.00	0.00	15.99	45.65	10.11	55.76	0.13
100.44	0.778							
222-224	71.67	0.00	0.00	16.01	45.66	10.06	55.72	0.34
264.79	0.778							
224-226	71.67	0.00	0.00	16.01	45.66	10.07	55.73	0.28
221.69	0.778							
224-400	71.67	0.00	0.00	16.09	45.69	9.93	55.62	0.26
195.85	0.776							
226-300	71.67	0.00	0.00	16.08	45.69	9.95	55.64	0.16
123.91	0.776							
230-226	71.67	0.00	0.00	15.72	45.53	10.98	56.51	0.07
60.71	0.788							
300-208	71.67	0.00	0.00	16.09	45.70	9.92	55.62	0.43
331.98	0.776							

400-212	71.67	0.00	0.00	16.05	45.68	9.99	55.67	0.18
137.52	0.777							
502-504	71.67	0.00	0.00	16.03	45.67	10.03	55.70	0.16
120.96	0.777							
504-506	71.67	0.00	0.00	15.76	45.54	10.76	56.29	0.06
46.34	0.786							
506-508	71.67	0.00	0.00	15.71	45.52	11.03	56.55	0.05
42.07	0.789							
508-510	71.67	0.00	0.00	16.08	45.69	9.95	55.64	0.15
115.34	0.776							
510-514	71.67	0.00	0.00	16.42	45.81	9.45	55.25	0.39
278.68	0.771							
516-512	71.67	0.00	0.00	16.04	45.67	10.02	55.69	0.16
120.82	0.777							
600-508	71.67	0.00	0.00	15.72	45.53	10.98	56.51	0.08
70.05	0.788							
600-516	71.67	0.00	0.00	16.01	45.66	10.08	55.73	0.48
373.93	0.778							
DR1	71.67	0.00	0.00	43.42	10.28	18.21	28.48	0.97
466.57	0.397							
DR2	71.67	0.00	0.00	41.62	10.27	20.11	30.38	0.25
139.78	0.424							
DR3	71.67	0.00	0.00	28.88	25.61	18.05	43.66	0.14
121.60	0.609							

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
1+035	JUNCTION	0.00	0.00	126.00	0 00:00	0.00
1+144	JUNCTION	0.01	0.07	125.07	0 01:10	0.07
1+214a	JUNCTION	0.01	0.14	123.14	0 01:10	0.14
1+214b	JUNCTION	0.00	0.08	123.08	0 01:10	0.08
1+298	JUNCTION	0.00	0.00	123.50	0 00:00	0.00
1+383	JUNCTION	0.01	0.09	120.09	0 01:10	0.09
1+383b	JUNCTION	0.00	0.04	120.04	0 01:10	0.04

Brown Lands (118178)
Post-Development PCSWMM Model Output (100-year 3-hour Chicago)

1+471	JUNCTION	0.01	0.08	117.52	0	01:10	0.08
2+064	JUNCTION	0.05	1.69	115.84	0	01:14	1.69
2+116	JUNCTION	0.01	0.14	117.28	0	01:11	0.14
2+160a	JUNCTION	0.01	0.17	118.67	0	01:11	0.17
2+160b	JUNCTION	0.01	0.13	118.63	0	01:11	0.13
2+220	JUNCTION	0.00	0.09	119.61	0	01:11	0.09
2+249a	JUNCTION	0.01	0.14	119.69	0	01:10	0.14
2+249b	JUNCTION	0.01	0.13	119.68	0	01:10	0.13
2+300	JUNCTION	0.00	0.04	120.69	0	01:10	0.04
2+338	JUNCTION	0.00	0.03	122.53	0	01:10	0.03
2+415	JUNCTION	0.00	0.00	126.00	0	00:00	0.00
2+495	JUNCTION	0.01	0.11	122.86	0	01:10	0.11
2+495b	JUNCTION	0.00	0.05	122.80	0	01:10	0.05
2+581a	JUNCTION	0.01	0.14	120.14	0	01:10	0.14
2+581b	JUNCTION	0.01	0.12	120.12	0	01:11	0.12
2+661	JUNCTION	0.00	0.04	122.80	0	01:10	0.04
3+113	JUNCTION	0.01	0.14	119.39	0	01:11	0.14
3+153	JUNCTION	0.01	0.16	120.16	0	01:11	0.16
30+000	JUNCTION	0.00	0.00	115.85	0	00:00	0.00
31+000	JUNCTION	0.00	0.00	112.80	0	00:00	0.00
31+062	JUNCTION	0.00	0.00	110.32	0	00:00	0.00
4+068	JUNCTION	0.00	0.07	120.86	0	01:10	0.07
5+079	JUNCTION	0.00	0.05	119.16	0	01:10	0.05
5+157	JUNCTION	0.01	0.09	116.84	0	01:10	0.09
5+199	JUNCTION	0.01	0.09	114.70	0	01:10	0.09
5+257a	JUNCTION	0.01	0.17	113.17	0	01:11	0.17
5+257b	JUNCTION	0.01	0.11	113.11	0	01:11	0.11
5+285	JUNCTION	0.01	0.12	112.93	0	01:11	0.12
5+333	JUNCTION	0.06	1.68	112.78	0	01:13	1.66
5+338	JUNCTION	0.01	0.20	112.77	0	01:14	0.20
5+407	JUNCTION	0.01	0.08	113.51	0	01:10	0.08
6+091	JUNCTION	0.00	0.00	114.25	0	00:00	0.00
6+147	JUNCTION	0.00	0.00	114.53	0	00:00	0.00
1+024	OUTFALL	0.00	0.00	125.84	0	00:00	0.00
2+007	OUTFALL	0.00	0.00	116.36	0	00:00	0.00
30+130	OUTFALL	0.00	0.00	113.00	0	00:00	0.00
31+080	OUTFALL	0.00	0.00	108.14	0	00:00	0.00
HW3110	OUTFALL	0.05	0.58	101.78	0	01:12	0.57
MississippiRiver	OUTFALL	0.00	0.00	101.00	0	00:00	0.00
OF1	OUTFALL	2.40	2.40	112.15	0	00:00	2.40
Tributaries	OUTFALL	0.00	0.00	111.00	0	00:00	0.00

MH100	STORAGE	0.00	0.00	123.57	0	00:00	0.00
MH102	STORAGE	0.02	0.18	122.82	0	01:13	0.18
MH104	STORAGE	0.04	0.33	119.98	0	01:13	0.33
MH106	STORAGE	0.00	0.00	120.78	0	00:00	0.00
MH108	STORAGE	0.01	0.13	117.82	0	01:13	0.13
MH110	STORAGE	0.02	0.14	115.44	0	01:13	0.14
MH112	STORAGE	0.03	0.30	115.08	0	01:13	0.30
MH200	STORAGE	0.19	1.45	113.50	0	01:13	1.45
MH200A	STORAGE	0.16	1.43	113.51	0	01:13	1.43
MH202	STORAGE	0.10	1.40	113.61	0	01:13	1.40
MH204	STORAGE	0.10	1.47	113.77	0	01:13	1.47
MH206	STORAGE	0.09	1.39	114.59	0	01:12	1.39
MH208	STORAGE	0.07	0.75	115.51	0	01:11	0.75
MH210	STORAGE	0.03	0.35	117.16	0	01:11	0.35
MH2100	STORAGE	0.27	1.07	112.99	0	01:13	1.07
MH2102	STORAGE	1.97	2.62	112.82	0	01:13	2.62
MH212	STORAGE	0.04	0.45	117.48	0	01:10	0.45
MH214	STORAGE	0.02	0.24	118.58	0	01:10	0.24
MH216	STORAGE	0.01	0.12	119.99	0	01:10	0.12
MH218	STORAGE	0.00	0.00	120.72	0	00:00	0.00
MH220	STORAGE	0.00	0.00	123.11	0	00:00	0.00
MH222	STORAGE	0.00	0.00	123.20	0	00:00	0.00
MH224	STORAGE	0.02	0.18	119.98	0	01:14	0.18
MH226	STORAGE	0.05	0.48	117.64	0	01:10	0.48
MH228	STORAGE	0.02	0.21	119.51	0	01:10	0.21
MH230	STORAGE	0.02	0.18	120.60	0	01:10	0.18
MH232	STORAGE	0.00	0.09	120.60	0	01:10	0.09
MH300	STORAGE	0.07	0.81	116.96	0	01:11	0.81
MH3100	STORAGE	0.05	0.56	108.48	0	01:11	0.56
MH3102	STORAGE	0.05	0.62	108.13	0	01:12	0.62
MH3104	STORAGE	0.05	0.58	103.42	0	01:12	0.58
MH3106	STORAGE	0.06	0.77	102.14	0	01:12	0.77
MH400	STORAGE	0.02	0.21	117.98	0	01:14	0.21
MH500	STORAGE	0.00	0.06	117.04	0	01:13	0.06
MH502	STORAGE	0.01	0.18	116.94	0	01:10	0.18
MH504	STORAGE	0.03	0.36	113.31	0	01:10	0.36
MH506	STORAGE	0.05	0.53	109.59	0	01:10	0.53
MH508	STORAGE	0.05	0.58	109.35	0	01:11	0.58
MH510	STORAGE	0.06	0.60	109.21	0	01:11	0.60
MH512	STORAGE	0.05	0.58	108.61	0	01:11	0.58
MH514	STORAGE	0.03	0.27	110.04	0	01:10	0.27

Brown Lands (118178)
Post-Development PCSWMM Model Output (100-year 3-hour Chicago)

MH516	STORAGE	0.02	0.25	111.16	0	01:10	0.25	
MH518	STORAGE	0.00	0.11	111.16	0	01:10	0.11	
MH600	STORAGE	0.00	0.00	111.80	0	00:00	0.00	

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Node Inflow Summary
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Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent	
1+035	JUNCTION	0.00	0.00	0 00:00	0	0	0.000	ltr
1+144	JUNCTION	316.29	316.29	0 01:10	0.407	0.407	-0.254	
1+214a	JUNCTION	286.03	476.44	0 01:10	0.646	0.805	0.135	
1+214b	JUNCTION	183.05	458.04	0 01:10	0.229	0.413	-0.035	
1+298	JUNCTION	0.00	0.00	0 00:00	0	0	0.000	ltr
1+383	JUNCTION	183.20	183.20	0 01:10	0.229	0.229	-0.038	
1+383b	JUNCTION	0.00	86.49	0 01:10	0	0.044	1.002	
1+471	JUNCTION	241.35	290.22	0 01:10	0.307	0.333	-0.049	
2+064	JUNCTION	304.34	1418.71	0 01:11	0.39	1.04	-1.151	
2+116	JUNCTION	122.39	1250.14	0 01:11	0.156	0.81	0.864	
2+160a	JUNCTION	137.57	436.70	0 01:10	0.173	0.342	0.081	
2+160b	JUNCTION	331.98	1297.24	0 01:11	0.434	0.961	-0.051	
2+220	JUNCTION	79.17	369.46	0 01:10	0.1	0.255	-0.128	
2+249a	JUNCTION	111.44	162.51	0 01:10	0.14	0.187	0.088	
2+249b	JUNCTION	137.52	373.70	0 01:10	0.178	0.323	0.156	
2+300	JUNCTION	93.26	131.39	0 01:10	0.117	0.155	-0.159	
2+338	JUNCTION	100.44	100.44	0 01:10	0.128	0.128	-0.018	
2+415	JUNCTION	0.00	0.00	0 00:00	0	0	0.000	ltr
2+495	JUNCTION	264.79	264.79	0 01:10	0.34	0.34	-0.045	
2+495b	JUNCTION	0.00	140.47	0 01:10	0	0.0676	0.420	
2+581a	JUNCTION	221.69	291.37	0 01:10	0.284	0.319	-0.060	
2+581b	JUNCTION	60.71	718.20	0 01:10	0.0735	0.453	0.103	
2+661	JUNCTION	159.45	159.45	0 01:10	0.201	0.201	-0.313	
3+113	JUNCTION	123.91	769.35	0 01:10	0.161	0.521	0.152	
3+153	JUNCTION	205.71	542.74	0 01:10	0.262	0.475	-0.001	
30+000	JUNCTION	0.00	0.00	0 00:00	0	0	0.000	ltr
31+000	JUNCTION	0.00	0.00	0 00:00	0	0	0.000	ltr
31+062	JUNCTION	0.00	0.00	0 00:00	0	0	0.000	ltr
4+068	JUNCTION	195.85	259.08	0 01:10	0.256	0.288	-0.220	
5+079	JUNCTION	160.40	191.44	0 01:10	0.201	0.218	-0.096	
5+157	JUNCTION	358.85	606.11	0 01:10	0.467	0.644	-0.027	
5+199	JUNCTION	46.34	453.91	0 01:10	0.0563	0.351	-0.162	
5+257a	JUNCTION	42.07	447.26	0 01:10	0.0509	0.304	0.211	
5+257b	JUNCTION	70.05	462.16	0 01:11	0.0848	0.286	0.000	
5+285	JUNCTION	115.34	511.76	0 01:11	0.15	0.363	0.654	
5+333	JUNCTION	278.68	1086.03	0 01:11	0.387	0.785	-0.332	
5+338	JUNCTION	120.82	561.30	0 01:11	0.156	0.342	0.715	
5+407	JUNCTION	373.93	373.93	0 01:10	0.479	0.479	-0.427	
6+091	JUNCTION	0.00	0.00	0 00:00	0	0	0.000	ltr
6+147	JUNCTION	0.00	0.00	0 00:00	0	0	0.000	ltr
1+024	OUTFALL	0.00	0.00	0 00:00	0	0	0.000	ltr
2+007	OUTFALL	0.00	0.00	0 00:00	0	0	0.000	ltr
30+130	OUTFALL	0.00	0.00	0 00:00	0	0	0.000	ltr
31+080	OUTFALL	0.00	0.00	0 00:00	0	0	0.000	ltr
HW3110	OUTFALL	0.00	1529.05	0 01:12	0	2.57	0.000	
MississippiRiver	OUTFALL	121.60	121.60	0 01:10	0.14	0.14	0.000	
OF1	OUTFALL	0.00	2590.76	0 01:13	0	4.74	0.000	
Tributaries	OUTFALL	4344.65	4344.65	0 01:49	23.8	23.8	0.000	
MH100	STORAGE	0.00	0.00	0 00:00	0	0	0.000	ltr
MH102	STORAGE	0.00	117.00	0 01:04	0	0.249	0.001	
MH104	STORAGE	0.00	397.80	0 01:13	0	1.07	0.000	
MH106	STORAGE	0.00	0.00	0 00:00	0	0	0.000	ltr
MH108	STORAGE	0.00	90.80	0 01:05	0	0.185	-0.000	
MH110	STORAGE	0.00	80.46	0 01:13	0	0.176	-0.002	
MH112	STORAGE	0.00	197.46	0 01:13	0	0.404	0.001	
MH200	STORAGE	0.00	2591.70	0 01:13	0	4.69	0.002	
MH200A	STORAGE	0.00	2592.04	0 01:13	0	4.69	-0.005	
MH202	STORAGE	0.00	2592.49	0 01:12	0	4.68	-0.005	
MH204	STORAGE	0.00	2593.43	0 01:12	0	4.68	-0.013	
MH206	STORAGE	0.00	1605.20	0 01:11	0	3.63	0.024	
MH208	STORAGE	0.00	1539.50	0 01:11	0	3.48	0.001	
MH210	STORAGE	0.00	411.11	0 01:10	0	0.783	-0.000	
MH2100	STORAGE	0.00	2591.53	0 01:13	0	4.71	-0.003	
MH2102	STORAGE	0.00	2590.30	0 01:13	0	4.74	0.002	
MH212	STORAGE	0.00	361.72	0 01:10	0	0.696	-0.092	
MH214	STORAGE	0.00	138.66	0 01:10	0	0.202	0.305	
MH216	STORAGE	0.00	61.34	0 01:10	0	0.0906	0.011	

Brown Lands (118178)
Post-Development PCSWMM Model Output (100-year 3-hour Chicago)

MH218	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
MH220	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
MH222	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
MH224	STORAGE	0.00	117.00	0	01:02	0	0.272	0.002	
MH226	STORAGE	0.00	842.45	0	01:10	0	2.05	0.000	
MH228	STORAGE	0.00	127.79	0	01:10	0	0.232	0.000	
MH230	STORAGE	0.00	89.49	0	01:10	0	0.14	0.002	
MH232	STORAGE	0.00	2.06	0	01:05	0	0.00053	0.251	
MH300	STORAGE	0.00	933.30	0	01:11	0	2.22	0.001	
MH3100	STORAGE	0.00	1528.45	0	01:11	0	2.57	-0.000	
MH3102	STORAGE	0.00	1528.60	0	01:11	0	2.57	-0.002	
MH3104	STORAGE	0.00	1528.78	0	01:12	0	2.57	-0.003	
MH3106	STORAGE	0.00	1528.63	0	01:12	0	2.57	-0.001	
MH400	STORAGE	0.00	99.40	0	01:05	0	0.186	0.036	
MH500	STORAGE	0.00	10.34	0	01:13	0	0.00942	0.026	
MH502	STORAGE	0.00	109.74	0	01:10	0	0.156	0.000	
MH504	STORAGE	0.00	488.36	0	01:10	0	0.91	0.001	
MH506	STORAGE	0.00	527.19	0	01:10	0	1.01	0.131	
MH508	STORAGE	0.00	604.80	0	01:11	0	1.18	0.079	
MH510	STORAGE	0.00	682.12	0	01:11	0	1.33	0.008	
MH512	STORAGE	0.00	1527.74	0	01:11	0	2.57	-0.000	
MH514	STORAGE	0.00	245.60	0	01:10	0	0.481	0.000	
MH516	STORAGE	0.00	180.73	0	01:10	0	0.333	-0.000	
MH518	STORAGE	0.00	5.21	0	01:04	0	0.001	0.308	
MH600	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr

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Node Surcharge Summary
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No nodes were surcharged.

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Node Flooding Summary
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No nodes were flooded.

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Storage Volume Summary
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Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
MH100	0.000	0	0	0	0.000	0	0 00:00	0.00
MH102	0.000	1	0	0	0.000	7	0 01:13	117.00
MH104	0.000	1	0	0	0.000	10	0 01:13	397.80
MH106	0.000	0	0	0	0.000	0	0 00:00	0.00
MH108	0.000	1	0	0	0.000	6	0 01:13	90.80
MH110	0.000	1	0	0	0.000	6	0 01:13	80.46
MH112	0.000	1	0	0	0.000	11	0 01:13	197.46
MH200	0.001	5	0	0	0.007	36	0 01:13	2591.53
MH200A	0.001	4	0	0	0.006	36	0 01:13	2591.70
MH202	0.000	3	0	0	0.006	40	0 01:13	2592.04
MH204	0.000	3	0	0	0.007	45	0 01:13	2592.49
MH206	0.000	2	0	0	0.002	35	0 01:12	1602.81
MH208	0.000	2	0	0	0.002	20	0 01:11	1539.60
MH210	0.000	1	0	0	0.000	13	0 01:11	411.08
MH2100	0.002	6	0	0	0.008	24	0 01:13	2590.30
MH2102	0.009	42	0	0	0.012	55	0 01:13	2590.76
MH212	0.000	2	0	0	0.001	18	0 01:10	361.51
MH214	0.000	1	0	0	0.000	10	0 01:10	138.12
MH216	0.000	0	0	0	0.000	4	0 01:10	61.26
MH218	0.000	0	0	0	0.000	0	0 00:00	0.00
MH220	0.000	0	0	0	0.000	0	0 00:00	0.00
MH222	0.000	0	0	0	0.000	0	0 00:00	0.00
MH224	0.000	1	0	0	0.000	6	0 01:14	117.00
MH226	0.000	2	0	0	0.001	17	0 01:10	842.50
MH228	0.000	1	0	0	0.000	8	0 01:10	127.65
MH230	0.000	1	0	0	0.000	8	0 01:10	89.28
MH232	0.000	0	0	0	0.000	4	0 01:10	2.43
MH300	0.000	2	0	0	0.001	26	0 01:11	931.97
MH3100	0.000	1	0	0	0.003	14	0 01:11	1528.60
MH3102	0.000	1	0	0	0.003	14	0 01:12	1528.78
MH3104	0.000	1	0	0	0.003	8	0 01:12	1528.63
MH3106	0.000	1	0	0	0.003	18	0 01:12	1529.05

Brown Lands (118178)
Post-Development PCSWMM Model Output (100-year 3-hour Chicago)

MH400	0.000	1	0	0	0.000	7	0	01:14	100.44
MH500	0.000	0	0	0	0.000	3	0	01:13	10.34
MH502	0.000	1	0	0	0.000	8	0	01:10	109.50
MH504	0.000	1	0	0	0.000	9	0	01:10	488.39
MH506	0.000	1	0	0	0.001	10	0	01:10	527.20
MH508	0.000	1	0	0	0.001	14	0	01:11	604.72
MH510	0.000	1	0	0	0.002	14	0	01:11	681.97
MH512	0.000	1	0	0	0.003	13	0	01:11	1528.45
MH514	0.000	1	0	0	0.000	10	0	01:10	245.62
MH516	0.000	1	0	0	0.000	10	0	01:10	180.32
MH518	0.000	0	0	0	0.000	4	0	01:10	6.95
MH600	0.000	0	0	0	0.000	0	0	00:00	0.00

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Outfall Loading Summary
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Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
1+024	0.00	0.00	0.00	0.000
2+007	0.00	0.00	0.00	0.000
30+130	0.00	0.00	0.00	0.000
31+080	0.00	0.00	0.00	0.000
HW3110	37.33	208.23	1529.05	2.566
MississippiRiver	23.67	18.39	121.60	0.140
OF1	93.68	150.55	2590.76	4.739
Tributaries	36.91	1318.36	4344.65	23.806
System	23.95	1695.53	5735.02	31.251

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Link Flow Summary
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Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
Easement-30a	CONDUIT	0.00	0	00:00	0.00	0.00	0.42
Easement-30b	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
Easement-31a	CONDUIT	0.00	0	00:00	0.00	0.00	0.39
Easement-31b	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
Easement-31c	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
MH100-102	CONDUIT	0.00	0	00:00	0.00	0.00	0.24
MH102-104	CONDUIT	117.00	0	01:13	2.40	0.40	0.45
MH104-226	CONDUIT	397.80	0	01:13	3.17	0.89	0.74
MH106-104	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
MH106-108	CONDUIT	0.00	0	00:00	0.00	0.00	0.11
MH106-232	CONDUIT	0.00	0	00:00	0.00	0.00	0.11
MH108-110	CONDUIT	80.46	0	01:13	2.30	0.26	0.35
MH108-500	CONDUIT	10.34	0	01:13	0.95	0.10	0.21
MH110-112	CONDUIT	80.46	0	01:13	2.07	0.28	0.40
MH112-504	CONDUIT	197.46	0	01:13	1.66	0.51	0.54
MH200-2100	CONDUIT	2591.53	0	01:13	2.38	0.92	0.92
MH200A-200	CONDUIT	2591.70	0	01:13	2.29	0.87	1.00
MH202-200A	CONDUIT	2592.04	0	01:13	2.29	0.96	1.00
MH204-202	CONDUIT	2592.49	0	01:12	2.29	0.93	1.00
MH206-204	CONDUIT	1602.81	0	01:12	3.00	1.12	1.00
MH208-206	CONDUIT	1539.60	0	01:11	3.05	1.08	0.90
MH2100-2102	CONDUIT	2590.30	0	01:13	2.51	0.94	0.92
MH210-208	CONDUIT	411.08	0	01:11	2.65	0.80	0.67
MH2102-OF1	CONDUIT	2590.76	0	01:13	2.29	0.94	1.00
MH212-210	CONDUIT	361.51	0	01:10	1.91	1.06	0.82
MH214-212	CONDUIT	138.12	0	01:10	2.27	0.98	0.80
MH216-214	CONDUIT	61.26	0	01:10	1.57	0.32	0.55
MH218-216	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
MH220-218	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
MH222-224	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
MH224-226	CONDUIT	117.00	0	01:15	2.31	0.42	0.47
MH224-400	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
MH226-300	CONDUIT	842.50	0	01:11	3.11	0.85	0.71
MH228-226	CONDUIT	127.65	0	01:10	2.56	0.71	0.66
MH230-228	CONDUIT	88.99	0	01:10	1.99	0.67	0.61
MH232-230	CONDUIT	2.43	0	01:13	0.14	0.03	0.41
MH300-208	CONDUIT	931.97	0	01:11	1.94	0.97	0.84
MH3100-3102	CONDUIT	1528.60	0	01:11	2.97	0.44	0.47

Brown Lands (118178)
Post-Development PCSWMM Model Output (100-year 3-hour Chicago)

MH3102-3104	CONDUIT	1528.78	0	01:12	2.73	0.46	0.50
MH3104-3106	CONDUIT	1528.63	0	01:12	2.84	0.47	0.48
MH3106-3110	CONDUIT	1529.05	0	01:12	2.34	0.46	0.56
MH400-212	CONDUIT	100.44	0	01:05	1.41	0.57	0.67
MH500-502	CONDUIT	10.34	0	01:13	0.76	0.09	0.32
MH502-504	CONDUIT	109.50	0	01:10	2.49	0.67	0.60
MH504-506	CONDUIT	488.39	0	01:10	3.12	0.81	0.68
MH506-508	CONDUIT	527.20	0	01:11	1.79	0.98	0.77
MH508-510	CONDUIT	604.72	0	01:11	1.73	0.99	0.74
MH510-512	CONDUIT	681.97	0	01:11	1.80	0.85	0.67
MH512-3100	CONDUIT	1528.45	0	01:11	2.80	0.48	0.49
MH514-512	CONDUIT	245.62	0	01:10	1.86	0.15	0.29
MH516-514	CONDUIT	180.00	0	01:10	2.00	0.59	0.55
MH518-516	CONDUIT	6.95	0	01:14	0.21	0.03	0.35
MH600-508	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
MH600-518	CONDUIT	0.00	0	00:00	0.00	0.00	0.09
Street1-A	CHANNEL	0.00	0	00:00	0.00	0.00	0.00
Street1-B	CHANNEL	0.00	0	00:00	0.00	0.00	0.10
Street1-C	CHANNEL	191.49	0	01:10	0.69	0.01	0.29
Street1-D	CHANNEL	290.25	0	01:10	0.75	0.97	0.31
Street1-E	CHANNEL	0.00	0	00:00	0.00	0.00	0.12
Street1-F	CHANNEL	0.00	0	00:00	0.00	0.00	0.13
Street1-G	CHANNEL	86.49	0	01:10	0.62	0.29	0.19
Street1-H	CHANNEL	51.18	0	01:10	0.44	0.00	0.17
Street1-I	CHANNEL	162.42	0	01:10	0.72	0.02	0.24
Street2-A	CHANNEL	0.00	0	00:00	0.00	0.00	0.42
Street2-B	CHANNEL	1181.09	0	01:11	1.79	0.09	0.60
Street2-C	CHANNEL	1154.25	0	01:11	2.00	0.08	0.38
Street2-D	CHANNEL	362.52	0	01:11	0.50	1.25	0.43
Street2-E	CHANNEL	315.94	0	01:11	0.57	0.03	0.37
Street2-F	CHANNEL	298.76	0	01:11	0.74	0.11	0.32
Street2-G	CHANNEL	92.21	0	01:10	0.15	0.36	0.39
Street2-H	CHANNEL	51.54	0	01:10	0.34	0.00	0.26
Street2-I	CHANNEL	38.20	0	01:10	0.80	0.00	0.11
Street2-J	CHANNEL	0.00	0	00:00	0.00	0.00	0.05
Street2-K	CHANNEL	0.00	0	00:00	0.00	0.00	0.15
Street2-L	CHANNEL	140.47	0	01:10	0.74	0.47	0.22
Street2-M	CHANNEL	72.17	0	01:10	0.26	0.00	0.26
Street2-N	CHANNEL	169.36	0	01:10	0.31	0.57	0.37
Street2-O	CHANNEL	66.86	0	01:10	0.63	0.00	0.23
Street2-P	CHANNEL	0.00	0	00:00	0.00	0.00	0.06

Street3-A	CHANNEL	665.04	0	01:11	1.09	0.10	0.39
Street3-B	CHANNEL	661.73	0	01:11	1.18	0.06	0.38
Street3-C	CHANNEL	426.85	0	01:10	0.70	1.11	0.39
Street3-D	CHANNEL	349.79	0	01:10	0.75	0.02	0.34
Street4-A	CHANNEL	152.20	0	01:10	0.47	0.01	0.29
Street4-B	CHANNEL	65.48	0	01:10	0.63	0.00	0.16
Street5-A	CHANNEL	32.50	0	01:10	0.49	0.00	0.13
Street5-B	CHANNEL	88.13	0	01:10	0.57	0.01	0.20
Street5-C	CHANNEL	409.87	0	01:10	1.59	0.03	0.25
Street5-D	CHANNEL	409.20	0	01:10	0.79	0.03	0.37
Street5-E	CHANNEL	402.95	0	01:11	0.62	1.37	0.40
Street5-F	CHANNEL	416.01	0	01:11	0.89	0.06	0.34
Street5-G	CHANNEL	430.09	0	01:11	0.69	0.07	0.56
Street5-H	CHANNEL	647.86	0	01:16	0.82	0.08	0.65
Street5-I	CHANNEL	184.81	0	01:10	0.77	0.02	0.38
Street5-J	CHANNEL	0.00	0	00:00	0.00	0.00	0.11
Street6-A	CHANNEL	0.00	0	00:00	0.00	0.00	0.16
Street6-B	CHANNEL	0.00	0	00:00	0.00	0.00	0.00
OR1	ORIFICE	167.17	0	01:14			1.00
OR10	ORIFICE	107.25	0	01:13			1.00
OR2	ORIFICE	167.17	0	01:14			1.00
OR3	ORIFICE	167.17	0	01:14			1.00
OR4	ORIFICE	167.17	0	01:14			1.00
OR5	ORIFICE	167.17	0	01:14			1.00
OR6	ORIFICE	167.17	0	01:14			1.00
OR7	ORIFICE	166.25	0	01:13			1.00
OR8	ORIFICE	166.25	0	01:13			1.00
OR9	ORIFICE	166.25	0	01:13			1.00
OL01	DUMMY	32.80	0	01:03			
OL02	DUMMY	32.80	0	01:03			
OL03	DUMMY	32.80	0	01:02			
OL04	DUMMY	32.80	0	01:02			
OL05	DUMMY	65.60	0	01:03			
OL06	DUMMY	65.60	0	01:03			
OL07	DUMMY	24.80	0	01:05			
OL08	DUMMY	24.80	0	01:05			
OL09	DUMMY	29.30	0	01:02			
OL10	DUMMY	29.30	0	01:02			
OL11	DUMMY	32.80	0	01:03			
OL12	DUMMY	32.80	0	01:03			
OL13	DUMMY	38.70	0	01:08			

OL14	DUMMY	38.70	0	01:08
OL15	DUMMY	30.67	0	01:10
OL16	DUMMY	30.67	0	01:10
OL17	DUMMY	58.50	0	01:02
OL18	DUMMY	58.50	0	01:02
OL19	DUMMY	50.00	0	01:04
OL20	DUMMY	50.00	0	01:04
OL21	DUMMY	19.40	0	01:02
OL22	DUMMY	19.40	0	01:02
OL23	DUMMY	44.74	0	01:10
OL24	DUMMY	44.74	0	01:10
OL25	DUMMY	50.00	0	01:03
OL26	DUMMY	50.00	0	01:03
OL27	DUMMY	45.40	0	01:06
OL28	DUMMY	45.40	0	01:06
OL29	DUMMY	49.70	0	01:05
OL30	DUMMY	49.70	0	01:05
OL31	DUMMY	58.50	0	01:04
OL32	DUMMY	58.50	0	01:04
OL33	DUMMY	90.70	0	01:04
OL34	DUMMY	90.70	0	01:04
OL35	DUMMY	49.70	0	01:05
OL36	DUMMY	49.70	0	01:05
OL37	DUMMY	45.40	0	01:05
OL38	DUMMY	45.40	0	01:05
OL39	DUMMY	58.50	0	01:04
OL40	DUMMY	58.50	0	01:04
OL41	DUMMY	49.70	0	01:10
OL42	DUMMY	49.70	0	01:10
OL43	DUMMY	90.70	0	01:07
OL44	DUMMY	90.70	0	01:07
OL45	DUMMY	19.40	0	01:02
OL46	DUMMY	19.40	0	01:02
OL47	DUMMY	19.40	0	01:02
OL48	DUMMY	19.40	0	01:02
OL49	DUMMY	19.40	0	01:04
OL50	DUMMY	19.40	0	01:04
OL51	DUMMY	38.70	0	01:04
OL52	DUMMY	38.70	0	01:04
OL53	DUMMY	32.80	0	01:03
OL54	DUMMY	32.80	0	01:03
OL55	DUMMY	90.36	0	01:10
OL56	DUMMY	90.36	0	01:10

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Flow Classification Summary
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	Adjusted	Fraction of Time in Flow Class								
	/Actual		Up	Down	Sub	Sup	Up	Down	Norm	Inlet
Conduit	Length	Dry	Dry	Dry	Crit	Crit	Crit	Crit	Ltd	Ctrl
Easement-30a	1.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Easement-30b	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Easement-31a	1.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Easement-31b	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Easement-31c	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH100-102	1.00	0.01	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH102-104	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH104-226	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH106-104	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH106-108	1.00	0.93	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH106-232	1.00	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH108-110	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH108-500	1.00	0.93	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00
MH110-112	1.00	0.01	0.00	0.00	0.00	0.03	0.00	0.97	0.00	0.00
MH112-504	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH200-2100	1.00	0.00	0.00	0.00	0.86	0.00	0.00	0.14	0.00	0.00
MH200A-200	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH202-200A	1.00	0.00	0.01	0.00	0.86	0.05	0.00	0.08	0.86	0.00
MH204-202	1.00	0.01	0.00	0.00	0.06	0.02	0.00	0.91	0.00	0.00
MH206-204	1.00	0.01	0.00	0.00	0.03	0.00	0.00	0.97	0.00	0.00
MH208-206	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH2100-2102	1.00	0.00	0.00	0.00	0.99	0.01	0.00	0.00	0.02	0.00
MH210-208	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH2102-OF1	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
MH212-210	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH214-212	1.00	0.01	0.00	0.00	0.00	0.01	0.00	0.99	0.00	0.00
MH216-214	1.00	0.01	0.00	0.00	0.00	0.08	0.00	0.91	0.03	0.00
MH218-216	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

MH220-218	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH222-224	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH224-226	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH224-400	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH226-300	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH228-226	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH230-228	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH232-230	1.00	0.79	0.09	0.00	0.12	0.00	0.00	0.00	0.94	0.00
MH300-208	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH3100-3102	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH3102-3104	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH3104-3106	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH3106-3110	1.00	0.01	0.00	0.00	0.75	0.24	0.00	0.00	0.84	0.00
MH400-212	1.00	0.01	0.00	0.00	0.02	0.02	0.00	0.95	0.01	0.00
MH500-502	1.00	0.04	0.00	0.00	0.08	0.01	0.00	0.87	0.03	0.00
MH502-504	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH504-506	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH506-508	1.00	0.01	0.00	0.00	0.04	0.00	0.00	0.96	0.00	0.00
MH508-510	1.00	0.01	0.00	0.00	0.04	0.00	0.00	0.96	0.00	0.00
MH510-512	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH512-3100	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH514-512	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH516-514	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
MH518-516	1.00	0.79	0.11	0.00	0.10	0.00	0.00	0.00	0.94	0.00
MH600-508	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MH600-518	1.00	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street1-A	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street1-B	1.00	0.62	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street1-C	1.00	0.59	0.03	0.00	0.32	0.06	0.00	0.00	0.98	0.00
Street1-D	1.00	0.64	0.00	0.00	0.35	0.01	0.00	0.00	0.00	0.00
Street1-E	1.00	0.69	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street1-F	1.00	0.65	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street1-G	1.00	0.01	0.00	0.00	0.98	0.01	0.00	0.00	0.00	0.00
Street1-H	1.00	0.01	0.01	0.00	0.92	0.07	0.00	0.00	0.92	0.00
Street1-I	1.00	0.57	0.09	0.00	0.32	0.02	0.00	0.00	0.99	0.00
Street2-A	1.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street2-B	1.00	0.65	0.00	0.00	0.01	0.01	0.00	0.33	0.01	0.00
Street2-C	1.00	0.58	0.03	0.00	0.14	0.24	0.00	0.00	0.02	0.00
Street2-D	1.00	0.58	0.00	0.00	0.42	0.00	0.00	0.00	0.00	0.00
Street2-E	1.00	0.63	0.05	0.00	0.31	0.01	0.00	0.00	0.99	0.00
Street2-F	1.00	0.61	0.02	0.00	0.36	0.01	0.00	0.00	0.00	0.00
Street2-G	1.00	0.60	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.00
Street2-H	1.00	0.66	0.05	0.00	0.29	0.00	0.00	0.00	0.99	0.00
Street2-I	1.00	0.66	0.02	0.00	0.08	0.23	0.00	0.00	0.12	0.00
Street2-J	1.00	0.68	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street2-K	1.00	0.64	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street2-L	1.00	0.01	0.00	0.00	0.97	0.02	0.00	0.00	0.00	0.00
Street2-M	1.00	0.01	0.01	0.00	0.95	0.04	0.00	0.00	0.13	0.00
Street2-N	1.00	0.61	0.00	0.00	0.39	0.00	0.00	0.00	0.00	0.00
Street2-O	1.00	0.67	0.01	0.00	0.13	0.19	0.00	0.00	0.12	0.00
Street2-P	1.00	0.67	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street3-A	1.00	0.57	0.07	0.00	0.32	0.04	0.00	0.00	0.98	0.00
Street3-B	1.00	0.63	0.10	0.00	0.18	0.09	0.00	0.00	0.99	0.00
Street3-C	1.00	0.62	0.00	0.00	0.38	0.00	0.00	0.00	0.00	0.00
Street3-D	1.00	0.60	0.09	0.00	0.31	0.00	0.00	0.00	0.99	0.00
Street4-A	1.00	0.59	0.06	0.00	0.34	0.01	0.00	0.00	0.99	0.00
Street4-B	1.00	0.01	0.01	0.00	0.93	0.06	0.00	0.00	0.13	0.00
Street5-A	1.00	0.01	0.01	0.00	0.92	0.07	0.00	0.00	0.91	0.00
Street5-B	1.00	0.58	0.11	0.00	0.30	0.02	0.00	0.00	0.99	0.00
Street5-C	1.00	0.59	0.00	0.00	0.17	0.24	0.00	0.00	0.01	0.00
Street5-D	1.00	0.72	0.01	0.00	0.08	0.19	0.00	0.00	0.04	0.00
Street5-E	1.00	0.72	0.00	0.00	0.28	0.00	0.00	0.00	0.00	0.00
Street5-F	1.00	0.66	0.07	0.00	0.22	0.06	0.00	0.00	0.97	0.00
Street5-G	1.00	0.66	0.00	0.00	0.02	0.00	0.00	0.31	0.01	0.00
Street5-H	1.00	0.65	0.00	0.00	0.02	0.00	0.00	0.33	0.00	0.00
Street5-I	1.00	0.58	0.04	0.00	0.16	0.22	0.00	0.00	0.01	0.00
Street5-J	1.00	0.62	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street6-A	1.00	0.73	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Street6-B	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
MH200-2100	0.01	0.21	0.01	0.01	0.01
MH200A-200	0.20	0.20	0.21	0.01	0.01

Brown Lands (118178)
Post-Development PCSWMM Model Output (100-year 3-hour Chicago)

MH202-200A	0.19	0.19	0.20	0.01	0.01
MH204-202	0.19	0.20	0.19	0.01	0.19
MH206-204	0.20	0.23	0.20	0.18	0.20
MH208-206	0.01	0.01	0.01	0.17	0.01
MH2102-OF1	24.00	24.00	24.00	0.01	0.20
MH212-210	0.01	0.01	0.01	0.11	0.01
Street2-D	0.01	0.01	0.01	0.07	0.01
Street3-C	0.01	0.01	0.01	0.04	0.01
Street5-E	0.01	0.01	0.01	0.09	0.01

Analysis begun on: Mon Feb 13 14:31:26 2023
Analysis ended on: Mon Feb 13 14:31:45 2023
Total elapsed time: 00:00:19

APPENDIX C
Sanitary Sewer

Sanitary Sewer Design Sheet, Novatech, February 10, 2023, 2 Pages

Future Wastewater Collection Requirements, Excerpt from Master Plan Update Report, pages 31-32, J.L. Richards & Associates Limited, February 2018, 2 Pages

Wastewater System Figures, Excerpts from Master Plan Update Report, Figures 19-25, J.L. Richards & Associates Limited, February 2018, 7 Pages

Wastewater System Model Figures, J.L. Richards & Associates Limited, Received August 2022, 6 Pages

SANITARY SEWER DESIGN SHEET
Brown Lands
Developer: Strathburn Almonte Regional Inc.

NOVATECH
Engineers, Planners & Landscape Architects

PROJECT # : 118178
DESIGNED BY : SAB/JMR
CHECKED BY : TJM
DATE PREPARED : 10/02/2023

LOCATION				INDIVIDUAL				CUMULATIVE		PEAK FACTOR M	POPULATION FLOW Q(p) (L/s)	PEAK EXTRAN. FLOW Q(i) (L/s)	PARK FLOW Q(i) (L/s)	PEAK DESIGN FLOW Q(d) (L/s)	PROPOSED SEWER							
STREET	FROM MH	TO MH	Area	Single Units	Townhome Units	Population (in 1000's)	AREA (ha.)	Population (in 1000's)	AREA (ha.)						LENGTH (m)	PIPE SIZE (mm)	PIPE ID (mm)	TYPE OF PIPE	GRADE %	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)	Qpeak/ Qcap
Street 1	101	103	1	9	14	0.0684	0.96	0.068	0.960	3.6	1.01	0.27		1.27	103.9	200	203.20	DR 35	0.90	32.5	1.00	4%
Street 1	103	105	2	5	6	0.0332	0.51	0.102	1.470	3.6	1.48	0.41		1.89	69.6	200	203.20	DR 35	2.70	56.2	1.73	3%
Street 1	107	105	3		11	0.0297	0.41	0.030	0.410	3.7	0.44	0.11		0.56	84.0	200	203.20	DR 35	0.50	24.2	0.75	2%
Street 3	105	227	4	6		0.0204	0.37	0.152	2.250	3.6	2.18	0.63		2.81	84.0	200	203.20	DR 35	2.45	53.6	1.65	5%
Street 2	223	225	5	2	11	0.0365	0.49	0.037	0.490	3.7	0.54	0.14		0.68	89.5	200	203.20	DR 35	2.95	58.8	1.81	1%
Street 2	225	227	6	6		0.0204	0.36	0.057	0.850	3.6	0.84	0.24		1.08	85.0	200	203.20	DR 35	2.65	55.7	1.72	2%
Street 2	107	233	7	9		0.0306	0.51	0.031	0.510	3.7	0.46	0.14		0.60	64.8	200	203.20	DR 35	0.50	24.2	0.75	2%
Street 2	233	231	8	1		0.0034	0.07	0.034	0.580	3.7	0.51	0.16		0.67	9.4	200	203.20	DR 35	0.75	29.6	0.91	2%
Street 2	231	229	9			0.0000	0.13	0.034	0.710	3.7	0.51	0.20		0.71	33.7	200	203.20	DR 35	0.50	24.2	0.75	3%
Street 2	229	227				0.0000	0.00	0.034	0.710	3.7	0.51	0.20		0.71	46.4	200	203.20	DR 35	2.90	58.3	1.80	1%
Street 3	227	301	10	2	2	0.0122	0.24	0.255	4.050	3.5	3.60	1.13		4.73	39.5	200	203.20	DR 35	1.35	39.8	1.23	12%
Street 3	301	209	11	7	8	0.0454	0.85	0.300	4.900	3.5	4.21	1.37		5.58	104.2	200	203.20	DR 35	0.45	23.0	0.71	24%
Street 2	221	219	12		8	0.0216	0.32	0.022	0.320	3.7	0.32	0.09		0.41	56.3	200	203.20	DR 35	4.20	70.1	2.16	1%
Street 2	219	217	13			0.0000	0.26	0.022	0.580	3.7	0.32	0.16		0.49	13.5	200	203.20	DR 35	4.20	70.1	2.16	1%
Street 2	217	215		3		0.0102	0.00	0.032	0.580	3.7	0.47	0.16		0.64	37.5	200	203.20	DR 35	4.00	68.4	2.11	1%
Street 2	215	213	14	3		0.0102	0.25	0.042	0.830	3.7	0.62	0.23		0.86	50.2	200	203.20	DR 35	2.15	50.2	1.55	2%
Street 4	225	401	15		11	0.0297	0.43	0.030	0.430	3.7	0.44	0.12		0.56	59.4	200	203.20	DR 35	3.40	63.1	1.95	1%
Street 4	401	213	16		9	0.0243	0.42	0.054	0.850	3.6	0.80	0.24		1.04	59.4	200	203.20	DR 35	1.00	34.2	1.06	3%
Street 2	213	211	17	3		0.0102	0.19	0.106	1.870	3.6	1.54	0.52		2.07	30.8	200	203.20	DR 35	0.75	29.6	0.91	7%
Street 2	211	209	18	4		0.0136	0.27	0.120	2.140	3.6	1.74	0.60		2.34	58.2	200	203.20	DR 35	1.80	45.9	1.42	5%
Street 2	209	207	19	3		0.0102	0.25	0.430	7.290	3.4	5.93	2.04		7.98	44.3	200	203.20	DR 35	1.00	34.2	1.06	23%
Street 2	207	205	20	8		0.0272	0.50	0.457	7.790	3.4	6.29	2.18		8.47	54.2	200	203.20	DR 35	1.00	34.2	1.06	25%
Street 2	201	203	21	3		0.0102	0.22	0.010	0.220	3.7	0.15	0.06		0.22	30.4	200	203.20	DR 35	1.50	41.9	1.29	1%
Street 2	203	205	22	1		0.0034	0.09	0.014	0.310	3.7	0.20	0.09		0.29	11.4	200	203.20	DR 35	1.60	43.3	1.33	1%
Outlet 1	205	3007	23			0.0000	0.05	0.471	8.150	3.4	6.47	2.28		8.75	37.9	200	203.20	DR 35	1.50	41.9	1.29	21%

SANITARY SEWER DESIGN SHEET
Brown Lands
Developer: Strathburn Almonte Regional Inc.

NOVATECH
Engineers, Planners & Landscape Architects

PROJECT # : 118178
DESIGNED BY : SAB/JMR
CHECKED BY : TJM
DATE PREPARED : 10/02/2023

LOCATION				INDIVIDUAL				CUMULATIVE		PEAK FACTOR M	POPULATION FLOW Q(p) (L/s)	PEAK EXTRAN. FLOW Q(i) (L/s)	PARK FLOW Q(i) (L/s)	PEAK DESIGN FLOW Q(d) (L/s)	PROPOSED SEWER							
STREET	FROM MH	TO MH	Area	Single Units	Townhome Units	Population (in 1000's)	AREA (ha.)	Population (in 1000's)	AREA (ha.)						LENGTH (m)	PIPE SIZE (mm)	PIPE ID (mm)	TYPE OF PIPE	GRADE %	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)	Qpeak/ Qcap
Street 1	107	109	24		6	0.0162	0.41	0.016	0.410	3.7	0.24	0.11		0.36	85.0	200	203.20	DR 35	3.50	64.0	1.97	1%
Street 1	109	111	25	1	6	0.0196	0.41	0.036	0.820	3.7	0.53	0.23		0.76	75.5	200	203.20	DR 35	3.10	60.2	1.86	1%
Street 1	111	113	26	2		0.0068	0.28	0.043	1.100	3.7	0.63	0.31		0.94	13.1	200	203.20	DR 35	2.75	56.7	1.75	2%
Street 1	113	505	27	9		0.0306	0.54	0.073	1.640	3.6	1.07	0.46		1.53	67.8	200	203.20	DR 35	1.00	34.2	1.06	4%
Street 5	109	501	28	8		0.0272	0.46	0.027	0.460	3.7	0.41	0.13		0.54	59.0	200	203.20	DR 35	1.20	37.5	1.16	1%
Street 5	501	503	29	2		0.0068	0.21	0.034	0.670	3.7	0.51	0.19		0.69	13.4	200	203.20	DR 35	1.10	35.9	1.11	2%
Street 5	503	505	30	6		0.0204	0.41	0.054	1.080	3.6	0.80	0.30		1.11	76.1	200	203.20	DR 35	2.95	58.8	1.81	2%
Street 5	505	507	31	1		0.0034	0.13	0.131	2.850	3.6	1.89	0.80		2.69	42.9	200	203.20	DR 35	2.00	48.4	1.49	6%
Street 6	601	509	32			0.0000	0.85	0.000	0.850	3.8	0.00	0.24		0.24	82.0	250	254.00	DR 35	0.40	39.2	0.77	0.61%
Street 5	601	519	33	9		0.0306	0.63	0.031	0.630	3.7	0.46	0.18		0.63	73.5	200	203.20	DR 35	1.00	34.2	1.06	2%
Street 5	519	517	34	2		0.0068	0.34	0.037	0.970	3.7	0.56	0.27		0.83	13.4	200	203.20	DR 35	0.75	29.6	0.91	3%
Street 5	517	515	35	6		0.0204	0.44	0.058	1.410	3.6	0.85	0.39		1.25	67.3	200	203.20	DR 35	1.00	34.2	1.06	4%
Street 5	515	513	36	1		0.0034	0.19	0.061	1.600	3.6	0.90	0.45		1.35	12.8	200	203.20	DR 35	0.70	28.6	0.88	5%
Street 5	513	511	37	7		0.0238	0.40	0.085	2.000	3.6	1.24	0.56		1.80	41.9	200	203.20	DR 35	0.40	21.6	0.67	8%
Street 5	511	509	38	3		0.0102	0.24	0.095	2.240	3.6	1.39	0.63		2.02	28.5	200	203.20	DR 35	0.40	21.6	0.67	9%
Street 5	509	507	39	1		0.0034	0.17	0.099	3.260	3.6	1.44	0.91		2.35	56.7	250	254.00	DR 35	0.40	39.2	0.77	6%
Outlet 2	507	3001	40			0.0000	1.62	0.230	7.730	3.5	3.26	2.16		5.42	43.9	250	254.00	DR 35	0.40	39.2	0.77	14%
Outlet 2	3001	3003				0.0000	0.00	0.230	7.730	3.5	3.26	2.16		5.42	78.7	250	254.00	DR 35	0.40	39.2	0.77	14%
Outlet 2	3003	3005				0.0000	0.00	0.230	7.730	3.5	3.26	2.16		5.42	61.6	250	254.00	DR 35	0.40	39.2	0.77	14%
Outlet 2	3005	3007				0.0000	0.00	0.230	7.730	3.5	3.26	2.16		5.42	81.1	250	254.00	DR 35	0.40	39.2	0.77	14%
Park		3007	41			0.0000	0.97	0.000	0.970	3.8	0.00	0.27	0.16	0.43								
Pump Station (Outlet 1+2)	3007	3009				0.0000	0.00	0.701	16.850	3.3	9.41	4.72	0.16	14.29	5.0	250	254.00	DR 35	1.00	62.0	1.22	23%

Notes:

1. **Q(d) = Q(p) + Q(i)**
2. **Q(i) = 0.28 L/sec/ha**
3. **Q(p) = (PxqxM/86,400)**
4. **Q(park) = (A*q*M)/86,400**
5. **M=1+(14/(4+(P/1000)$^{0.5}$))*K**

Definitions:

Q(d) = Design Flow (L/sec)
Q(p) = Population Flow (L/sec)
Q(i) = Extraneous Flow (L/sec)
Q(park) = Population Flow (L/sec), Park

P = Population (3.4 persons/single, 2.7 persons/townhome & semi-detached, 2.1 persons/apartment unit)
q = Average per capita flow = 350 L/cap/day - Residential
q = Average per gross ha. flow = 3700 L/gross ha/day - Park (20L/day/person, 185 persons/ha - as per Appendix 4-A of the City of Ottawa Sewer Design Guidelines)
M = Residential Peak Factor, based on Harmon Equation (maximum of 4.0)
K = Harmon Equation Correction Factor = 0.8
Minimum pipe size 200mm @ min. slope 0.32%
Mannings n = 0.013

LICENSED PROFESSIONAL ENGINEER
T. J. MCKAY
100195434
February 10, 2023
PROVINCE OF ONTARIO

Orchard View community centre, that Novatech had accounted for in the Spring Street SPS ultimate projected flow of 55.2L/s (5.97L/s was reserved for the community centre).

5.5.3 Wastewater Collection

In order to assess the wastewater collection system, the hydraulic model of major collectors within the system was updated based on current wastewater flow data. The model was configured to simulate a peak flow scenario and a discussion of the results is presented in Table 32.

Table 32: Future Wastewater Collection Requirements

Study Period	Peak Wastewater Flows			
Existing	Reference Figure 19			
	Street	Length (m)	Diameter (mm)	Capacity (%)
	Easement (Between Clyde St. and Martin St.)	60.0	300	156
Short-Term (2018 – 2022)	Reference Figure 20			
	Street	Length (m)	Diameter (mm)	Capacity (%)
	State Street	96.8	300	91
	Martin Street N	41.3	225	94
	Little Bridge	10.6	450	121
	Ottawa Street	475.3	300	108 to 134
	Easement (Between Clyde St. and Martin St.)	60.0	300	201
Mid-Term (2023 – 2027)	Reference Figure 21			
	Street	Length (m)	Diameter (mm)	Capacity (%)
	State Street	96.8	300	92
	Martin Street N	41.3	225	95
	Ottawa Street	104	300	104
	Little Bridge	10.6	450	136
	Ottawa Street	475.3	300	131 to 163
	Easement (Between Clyde St. and Martin St.)	60.0	300	202
Long-Term (2028 - 2037)	Reference Figure 22			
	Street	Length (m)	Diameter (mm)	Capacity (%)
	State Street	96.8	300	92
	Martin Street N	41.3	225	95
	Union Street	145	225	92 to 98
	Ottawa Street	104	300	110
	Little Bridge	10.6	450	146
	Ottawa Street	475.3	300	139 to 173
	Easement (Between Clyde St. and Martin St.)	60.0	300	202

Build-Out (2037+)	Reference Figure 23			
	Street	Length (m)	Diameter (mm)	Capacity (%)
	State Street	96.8	300	92
	Martin Street N	41.3	225	95
	Martin Street N	15.7	300	109
	Martin Street N	26.8	450	115
	Mill Street	28.5	525	96
	Union Street	145	225	92 to 98
	Little Bridge	10.6	450	188
	Ottawa Street	760.5	300	110 to 249
	Easement (Between Clyde St. and Martin St.)	60.0	300	202
	Malcolm Street	166.7	300	111 to 120
	Ann Street	258.4	200	71 to 136
	Country Street	478.6	225 to 250	79 to 136

5.6 Wastewater Treatment Servicing Strategies

As previously noted, the existing rated capacity of the WWTP is sufficient to service the Almonte Ward over the updated long term planning period (i.e., the next 20 years). This is consistent with the 2012 Master Plan report. As such, no alternate servicing strategies were identified. It is noted that an expansion would ultimately be required beyond the long-term planning period.

5.7 Wastewater Pumping Servicing Strategies

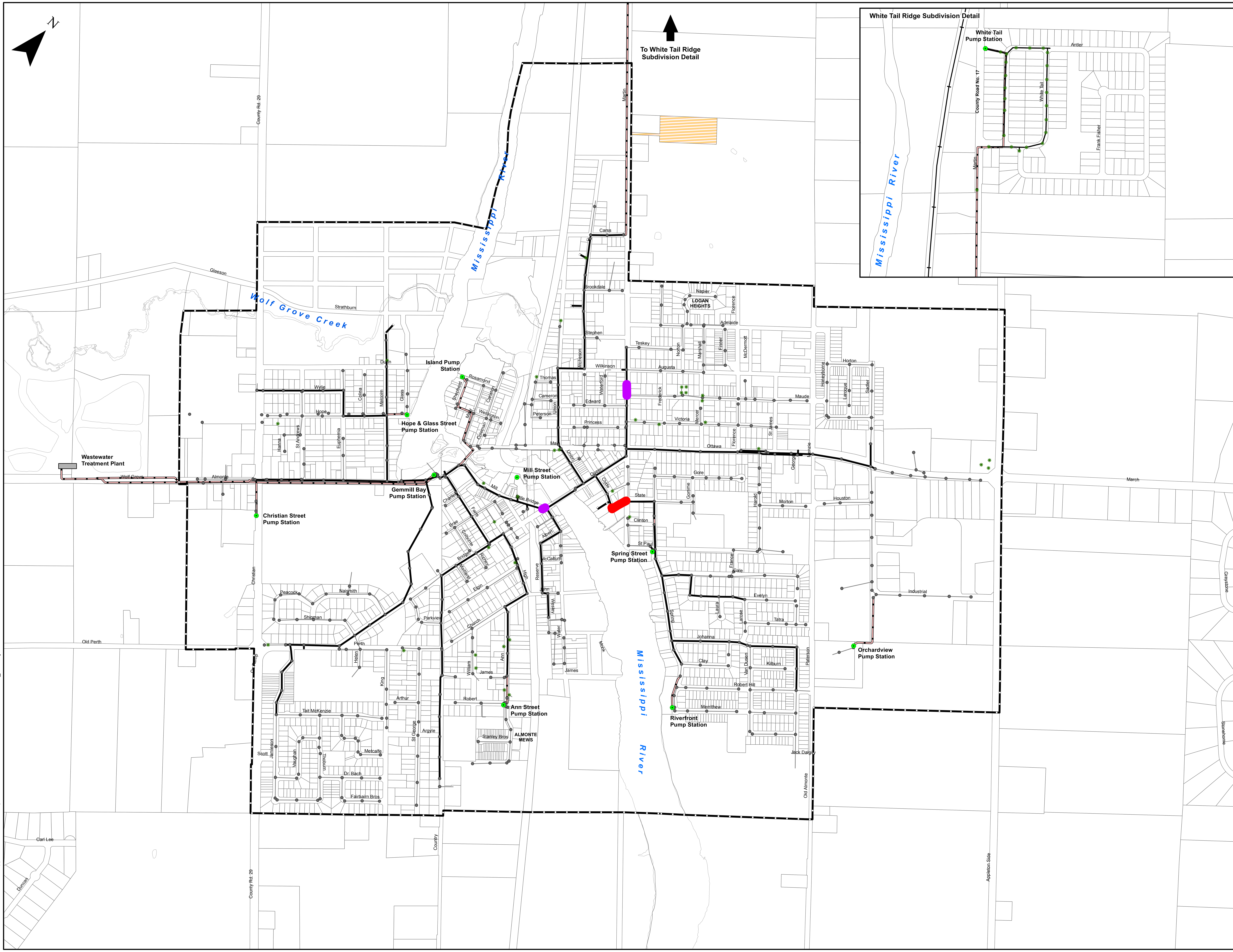
As outlined in previous Sections, the Gemmill's Bay SPS and the Spring Street SPS will require additional capacity over the short and mid-term planning periods.

5.7.1 Gemmill's Bay SPS

Given recent bypass events at the Gemmill's Bay SPS, it is likely that the pump station is already operating at or near its existing firm capacity, suggesting a capacity upgrade may be required in the immediate or short-term timeframe. Based on projected peak flows, and a design capacity of 326L/s, a long-term deficit of 48L/s is predicted. It is noted that this deficit may be higher than this, as it is suspected that the actual firm capacity of the station is less than 326L/s, which is equal to the summation of the individual capacity of two pumps. It is recommended that the station be upgraded to ultimately meet the long-term deficit of 48L/s (or higher). Since bypass volumes are not measured, and the firm capacity of the station is unknown, it is recommended that additional flow monitoring and a preliminary pump capacity investigation be completed to better define the station's long-term requirements. A preliminary opinion of probable cost to upgrade the pumping system only (i.e., replace existing pumps with higher capacity pumps) at Gemmill's Bay SPS is $500,000. Additional costing requirements to include the full extent of required upgrades (e.g., new/upgraded wet well, screening upgrades, building expansion and/or new building) to be confirmed during the associated Class EA.

5.7.2 Spring Street SPS

As previously noted, a short-term capacity deficit of 13.5L/s is predicted for the Spring Street SPS, which corresponds to the completion of Phase 5 of the Riverfront Estates project. Since



File: R:\27000\27456-01 Mississippi Mills - Master Plan Update\JLR DWG\Plan\27456-01 AlmonteGrowth Ex_Sanitary.mxd

Sanitary Sewer
- Over Capacity
- 90 to 100% Capacity
- Trunk Sewer Functioning Properly

Infrastructure
- Cleanout
- Sanitary Manhole
- Private Forecmain
- Forcemain
- Existing Sewers

Land Use
- Almonte Ward Limits
- Existing Lots
- Closed Waste Disposal Site

No.	ISSUE / REVISION	DD/MM/YY

VERIFY SHEET SIZE AND SCALES. BAR TO THE RIGHT IS 25mm IF THIS IS A FULL SIZE DRAWING. 0 25mm

SCALE: 0 50 100 200 300 400 Meters

CLIENT:

CONSULTANT: J.L.Richards ENGINEERS · ARCHITECTS · PLANNERS www.jlrichards.ca

CONSULTANT:

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PROJECT:

MUNICIPALITY OF MISSISSIPPI MILLS ALMONTE WARD WATER AND WASTEWATER INFRASTRUCTURE MASTER PLAN UPDATE

MISSISSIPPI MILLS, ONTARIO

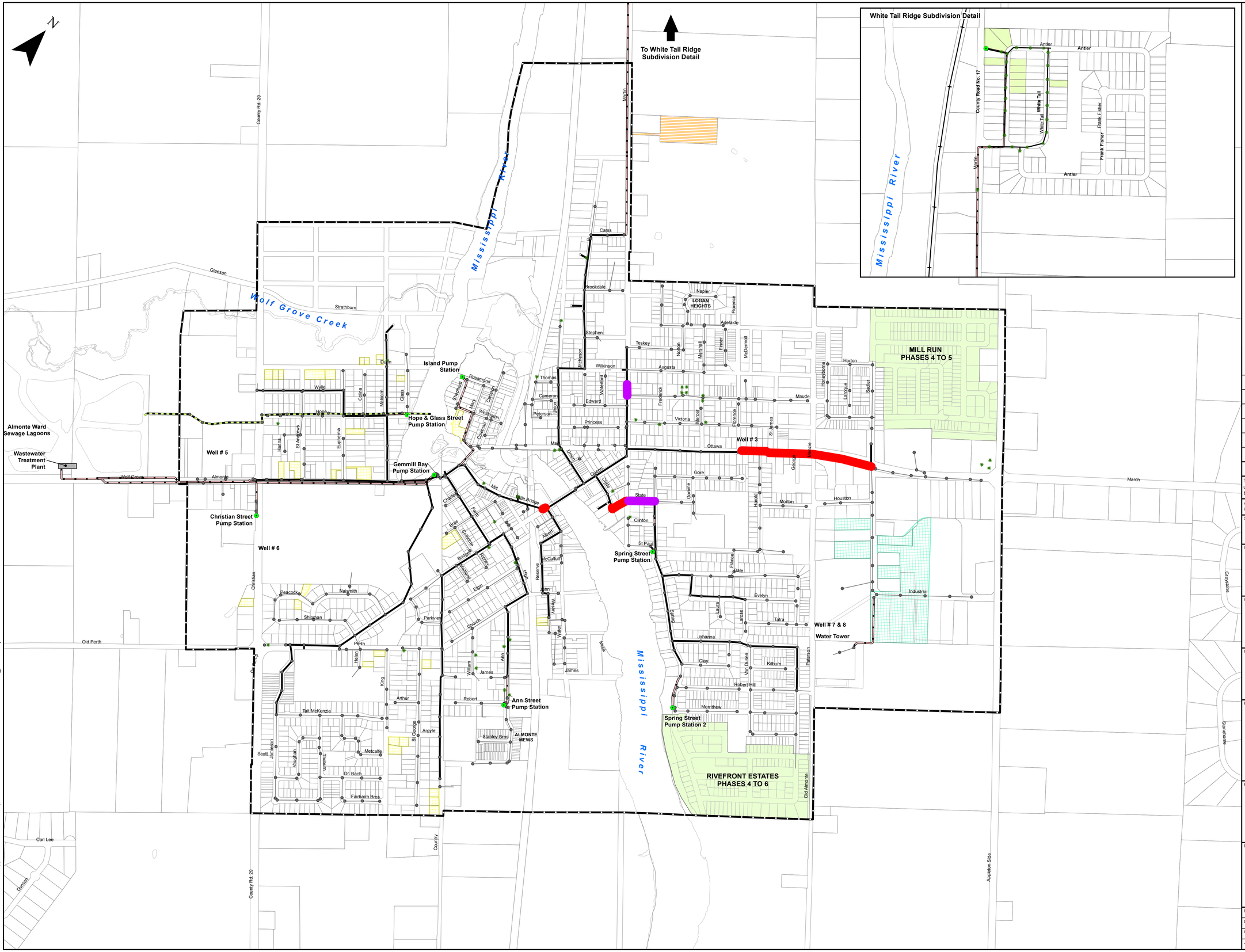
DRAWING:

ALMONTE WARD WASTEWATER SYSTEM EXISTING

DESIGN: MB
DRAWN: KTK
CHECKED: SG
JLR #: 27456-01

DRAWING #: **FIGURE 19**

PLOT DATE: January 5, 2018 10:08:58 AM



No. | ISSUE / REVISION | DD/MM/YY

VERIFY SHEET SIZE AND SCALES. BAR TO THE RIGHT IS 25mm IF THIS IS A FULL SIZE DRAWING. 0 25mm

SCALE: 0 50 100 200 300 400 Meters

CLIENT:

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PROJECT:

MUNICIPALITY OF MISSISSIPPI MILLS
ALMONTE WARD WATER AND WASTEWATER INFRASTRUCTURE MASTER PLAN UPDATE

MISSISSIPPI MILLS, ONTARIO

DRAWING:

ALMONTE WARD WASTEWATER SYSTEM 0 TO 5 YEARS (2018 TO 2022)

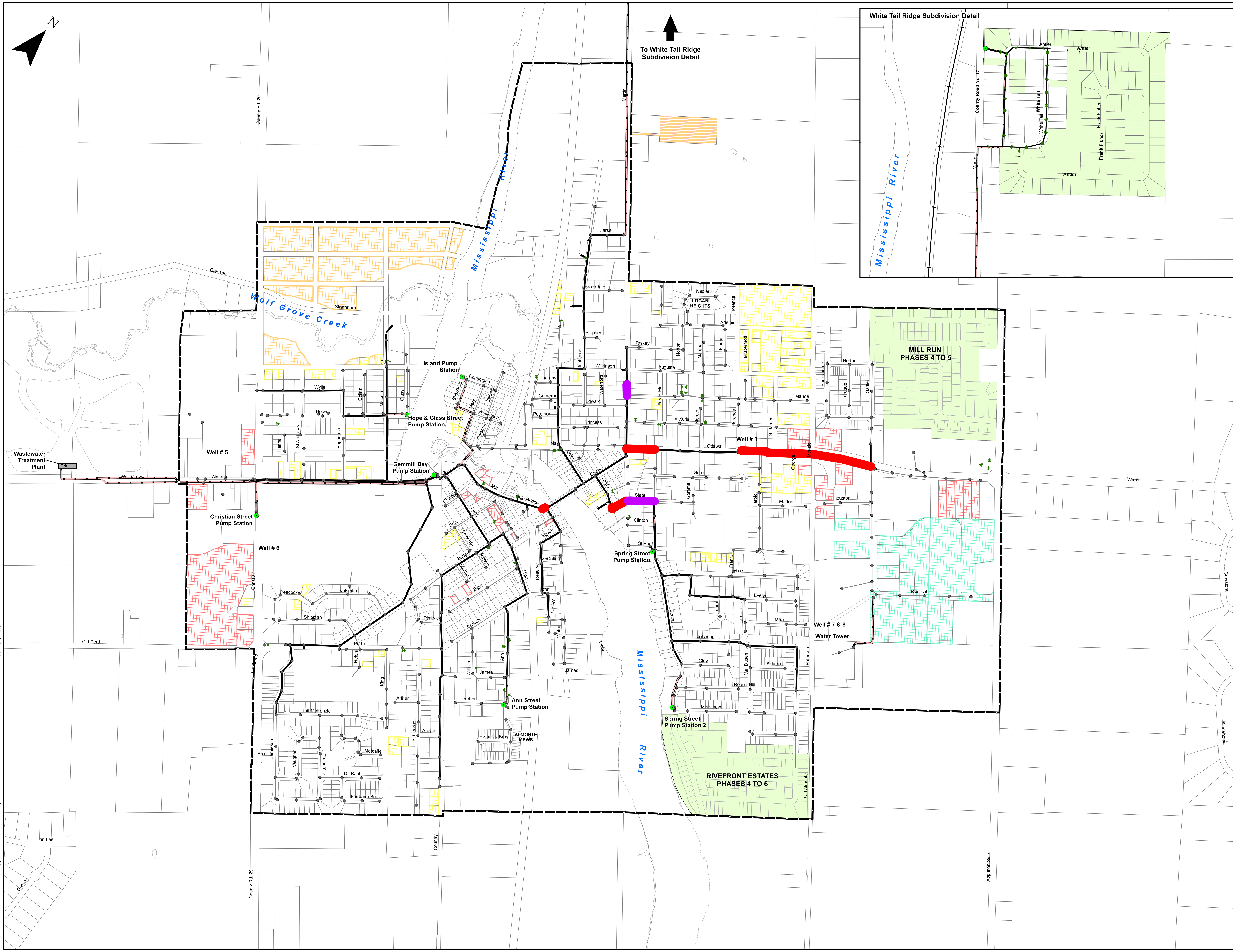
DESIGN:	MB
DRAWN:	KTK
CHECKED:	SG
JLR #:	27456-01

DRAWING #:

FIGURE 20

File: R:\27000\27456-01 Mississippi Mills - Master Plan Update\JLR DWG\Plan\27456-01 AlmonteGrowth 1to5_FutSanitary.mxd

PLOT DATE: January 5, 2018 10:14:03 AM



No.	ISSUE / REVISION	DD/MM/YY

VERIFY SHEET SIZE AND SCALES. BAR TO THE RIGHT IS 25mm IF THIS IS A FULL SIZE DRAWING. 0 25mm

SCALE: 0 50 100 200 300 400 Meters

CLIENT:

CONSULTANT: J.L.Richards ENGINEERS · ARCHITECTS · PLANNERS www.jlrichards.ca

CONSULTANT:

PROFESSIONAL STAMP

PROFESSIONAL STAMP

PROJECT:

MUNICIPALITY OF MISSISSIPPI MILLS ALMONTE WARD WATER AND WASTEWATER INFRASTRUCTURE MASTER PLAN UPDATE

MISSISSIPPI MILLS, ONTARIO

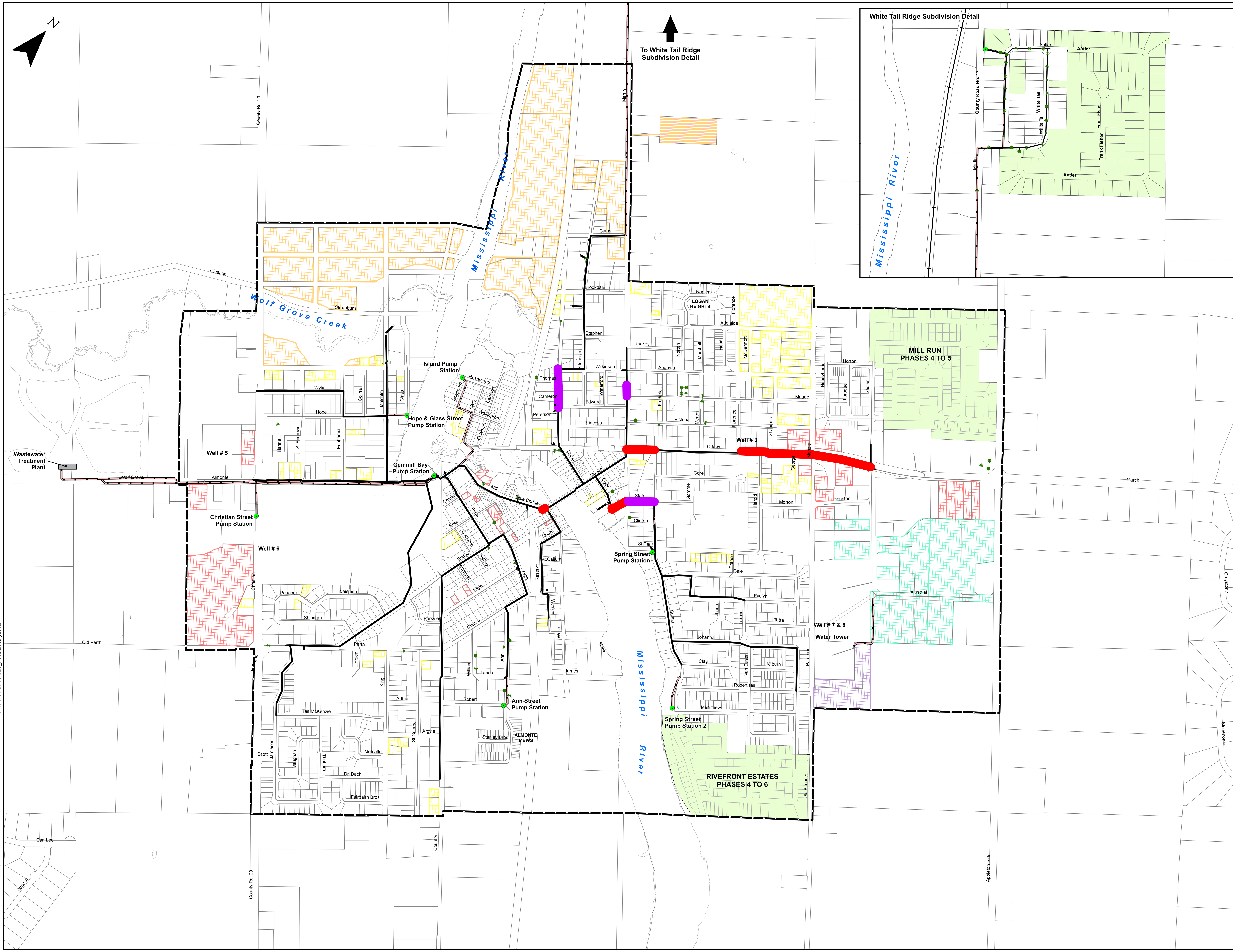
DRAWING:

ALMONTE WARD WASTEWATER SYSTEM 5 TO 10 YEARS (2023 TO 2028)

DESIGN:	MB	
DRAWN:	KTK	DRAWING #:
CHECKED:	SG	**FIGURE 21**
JLR #:	27456-01	

PLOT DATE: January 5, 2018 10:22:28 AM

File: R:\27000\27456-01 Mississippi Mills - Master Plan Update\JLR DWG\Plan\27456-01 AlmonteGrowth 5to10_FutSanitary.mxd



File: R:\27000\27456-01 Mississippi Mills - Master Plan Update\JLR DWG\Plan\27456-01 AlmonteGrowth 10to20_FutSanitary.mxd

Sanitary Sewer

- Over Capacity
- 90 to 100% Capacity
- Trunk Sewer Functioning Properly

Infrastructure

- Pumping Station
- Cleanout
- Sanitary Manhole
- Private Forecmain
- Forcemain
- Existing Sewers

Land Use

- Almonte Ward Limits
- Existing Lots
- Future Lots
- Closed Waste Disposal Site
- Registered Subdivision
- Business Park (17.0 ha)
- Community Facility (3.1 ha)
- Commercial (15.6 ha)
- Residential - Geenfield (34.2 ha)
- Residential - Infill (16.0 ha)

No.	ISSUE / REVISION	DD/MM/YY

VERIFY SHEET SIZE AND SCALES. BAR TO THE RIGHT IS 25mm IF THIS IS A FULL SIZE DRAWING. 0 25mm

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PROJECT:

MUNICIPALITY OF MISSISSIPPI MILLS ALMONTE WARD WATER AND WASTEWATER INFRASTRUCTURE MASTER PLAN UPDATE

MISSISSIPPI MILLS, ONTARIO

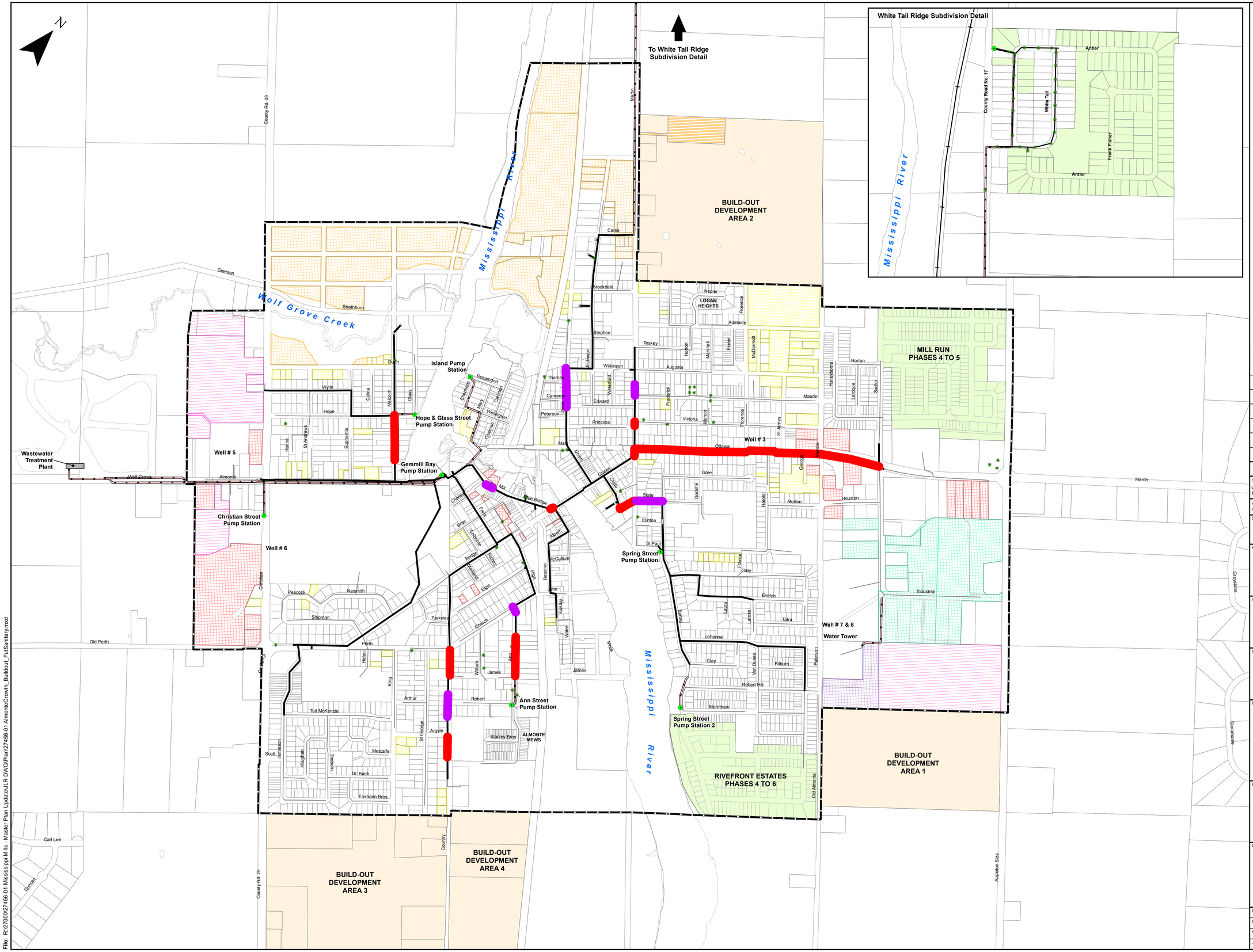
DRAWING:

ALMONTE WARD GROWTH WASTEWATER SYSTEM 10 TO 20 YEARS (2029 TO 2037)

DESIGN: MB
DRAWN: KTK
CHECKED: SG
JLR #: 27456-01

DRAWING #: **FIGURE 22**

PLOT DATE: January 5, 2018 10:24:52 AM



Sanitary Sewer
- Over Capacity
- 90 to 100% Capacity
- Trunk Sewer Functioning Properly

Infrastructure
- Pumping Station
- Cleanout
- Sanitary Manhole
- Private Forecmain
- Forcemain
- Existing Sewers

Land Use
- Almonte Ward Limits
- Existing Lots
- Future Lots
- Closed Waste Disposal Site
- Registered Subdivision
- Build Out
- Business Park (17.0 ha)
- Community Facility (3.1 ha)
- Commercial (15.6 ha)
- Industrial (24.1 ha)
- Residential - Geenfield (34.2 ha)
- Residential - Infill (16.0 ha)

No.	ISSUE / REVISION	DD/MM/YY

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MUNICIPALITY OF MISSISSIPPI MILLS
ALMONTE WARD WATER AND WASTEWATER INFRASTRUCTURE MASTER PLAN UPDATE

MISSISSIPPI MILLS, ONTARIO

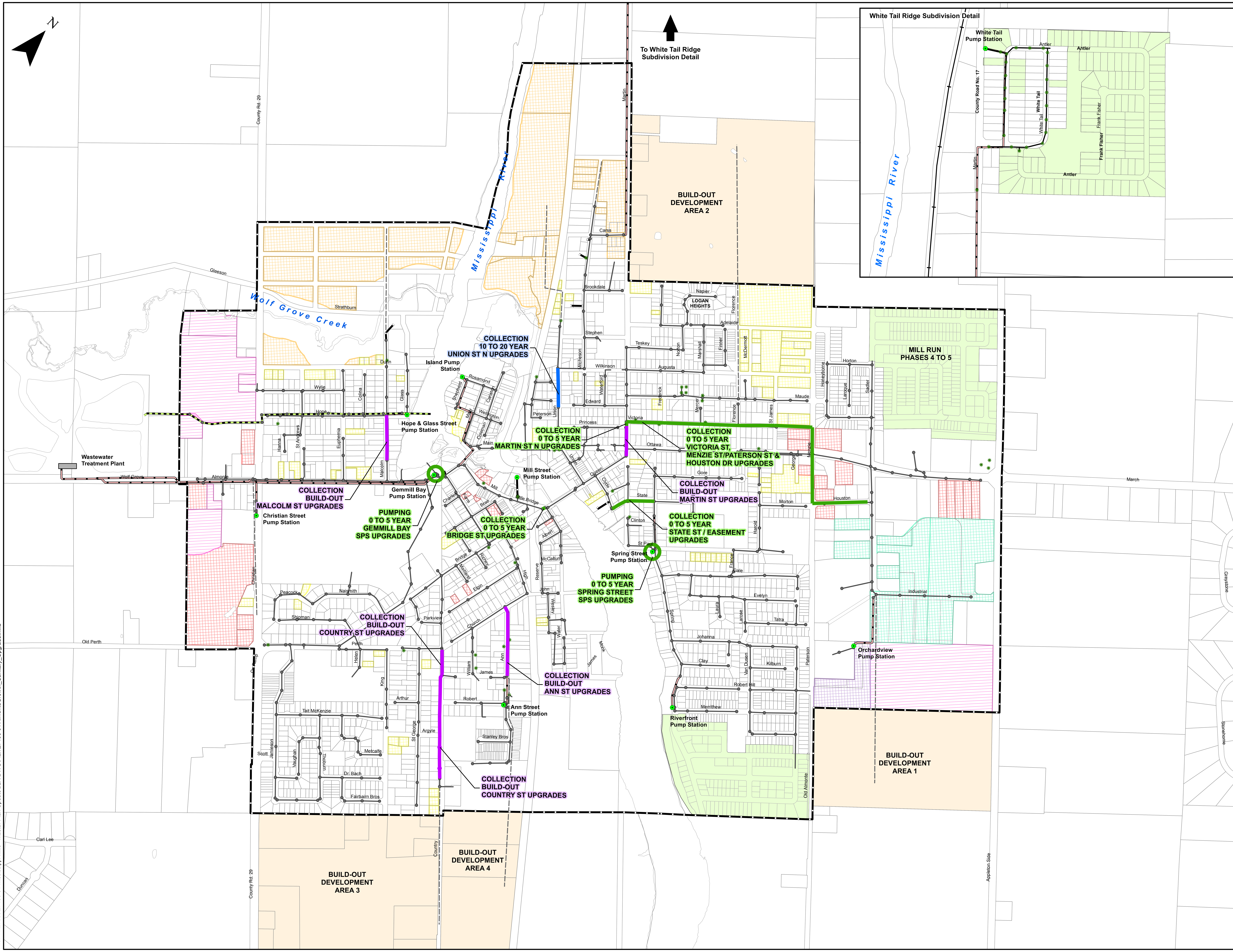
DRAWING:

ALMONTE WARD GROWTH WASTEWATER SYSTEM BUILD-OUT (2037+)

DESIGN: MB	
DRAWN: KTK	DRAWING #:
CHECKED: SG	**FIGURE 23**
JLR #: 27456-01	

File: R:\27000\27456-01 Mississippi Mills - Master Plan Update\JLR DWG\Plan\27456-01 AlmonteGrowth_Buildout_FullSanitary.mxd

PLOT DATE: January 5, 2018 10:27:42 AM



White Tail Ridge Subdivision Detail
White Tail Pump Station
Antler
County Road No. 17
White Tail
Frank Fisher
Martin
Mississippi River
To White Tail Ridge Subdivision Detail
BUILD-OUT DEVELOPMENT AREA 2
BUILD-OUT DEVELOPMENT AREA 1
BUILD-OUT DEVELOPMENT AREA 3
BUILD-OUT DEVELOPMENT AREA 4
MILL RUN PHASES 4 TO 5
Wolf Grove Creek
Wastewater Treatment Plant
COLLECTION 10 TO 20 YEAR UNION ST N UPGRADES
Island Pump Station
Hope & Glass Street Pump Station
COLLECTION 0 TO 5 YEAR MARTIN ST N UPGRADES
COLLECTION 0 TO 5 YEAR VICTORIA ST, MENZIE ST/PATERSON ST & HOUSTON DR UPGRADES
COLLECTION BUILD-OUT MARTIN ST N UPGRADES
Mill Street Pump Station
Gemmill Bay Pump Station
COLLECTION BUILD-OUT MALCOLM ST UPGRADES
Christian Street Pump Station
PUMPING 0 TO 5 YEAR GEMMILL BAY SPS UPGRADES
COLLECTION 0 TO 5 YEAR BRIDGE ST UPGRADES
COLLECTION 0 TO 5 YEAR STATE ST / EASEMENT UPGRADES
Spring Street Pump Station
PUMPING 0 TO 5 YEAR SPRING STREET SPS UPGRADES
COLLECTION BUILD-OUT COUNTRY ST UPGRADES
COLLECTION BUILD-OUT ANN ST UPGRADES
Ann Street Pump Station
Riverfront Pump Station
Orchardview Pump Station
COLLECTION BUILD-OUT COUNTRY ST UPGRADES

Sanitary Sewer Upgrades

- 0 to 5 Years
- 10 to 20 Years
- Build-out
- Future Servicing

Infrastructure

- Pumping Station
- Cleanout
- Sanitary Manhole
- Lagoon Outfall
- Saniatry Sewer
- Private Forecmain
- Forcemain

Land Use

- Almonte Ward Limits
- Existing Lots
- Future Lots
- Registered Subdivision
- Build Out
- Business Park (17.0 ha)
- Community Facility (3.1 ha)
- Commercial (15.6 ha)
- Industrial (24.1 ha)
- Residential - Geenfield (34.2 ha)
- Residential - Infill (16.0 ha)

No.	ISSUE / REVISION	DD/MM/YY

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MUNICIPALITY OF MISSISSIPPI MILLS ALMONTE WARD WATER AND WASTEWATER INFRASTRUCTURE MASTER PLAN UPDATE

MISSISSIPPI MILLS, ONTARIO

DRAWING:

ALMONTE WARD WASTEWATER SERVICING STRATEGIES

DESIGN: MB
DRAWN: KTK
CHECKED: SG
JLR #: 27456-01

DRAWING #: **FIGURE 24**

PLOT DATE: January 5, 2018 10:29:59 AM

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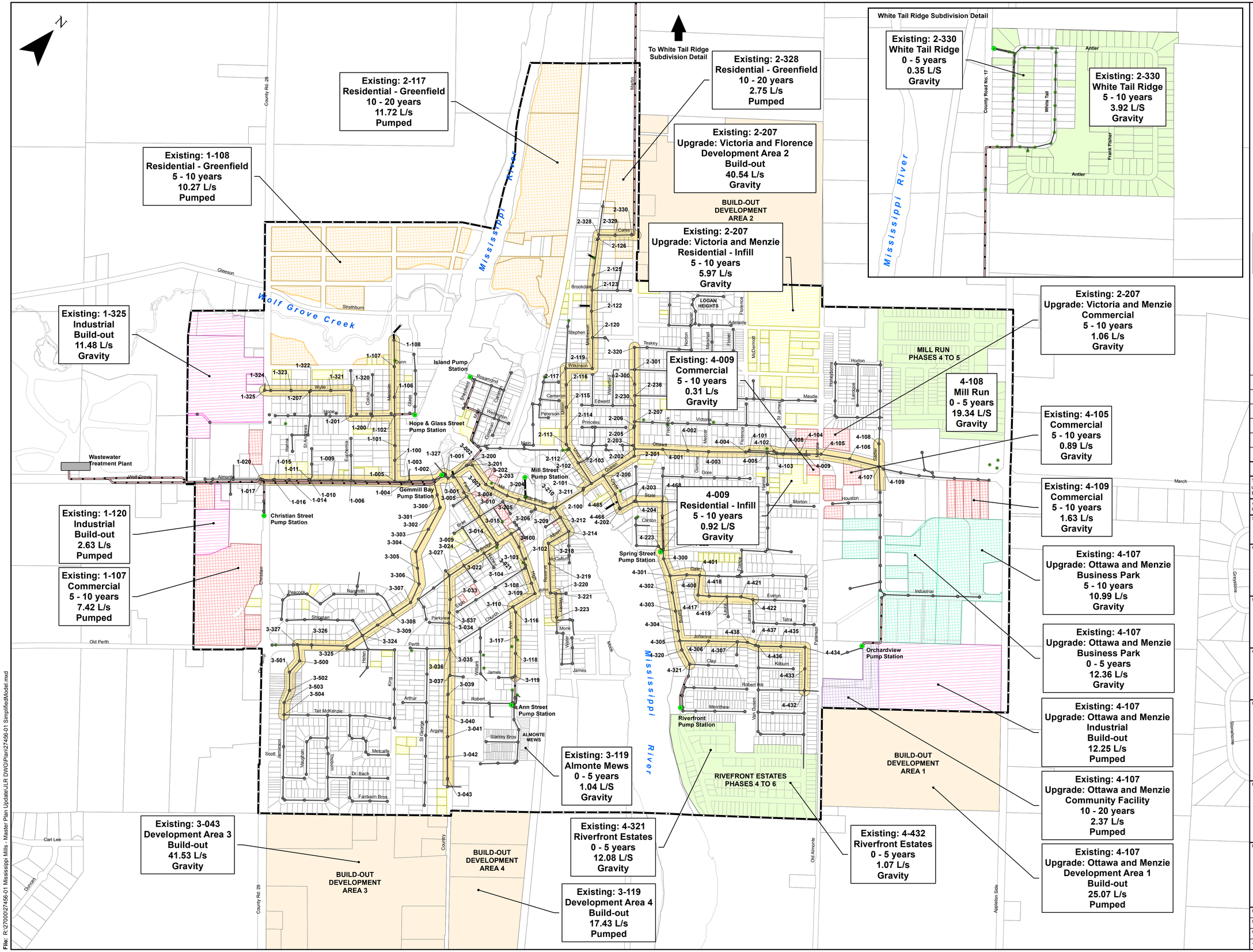

No.	ISSUE / REVISION	DD/MM/YY

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SCALE: 0 50 100 200 300 400 Meters

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PROJECT:
MUNICIPALITY OF MISSISSIPPI MILLS
ALMONTE WARD WATER AND WASTEWATER INFRASTRUCTURE MASTER PLAN UPDATE
MISSISSIPPI MILLS, ONTARIO

DRAWING:
WASTEWATER HYDRAULIC MODEL DEMAND ALLOCATION

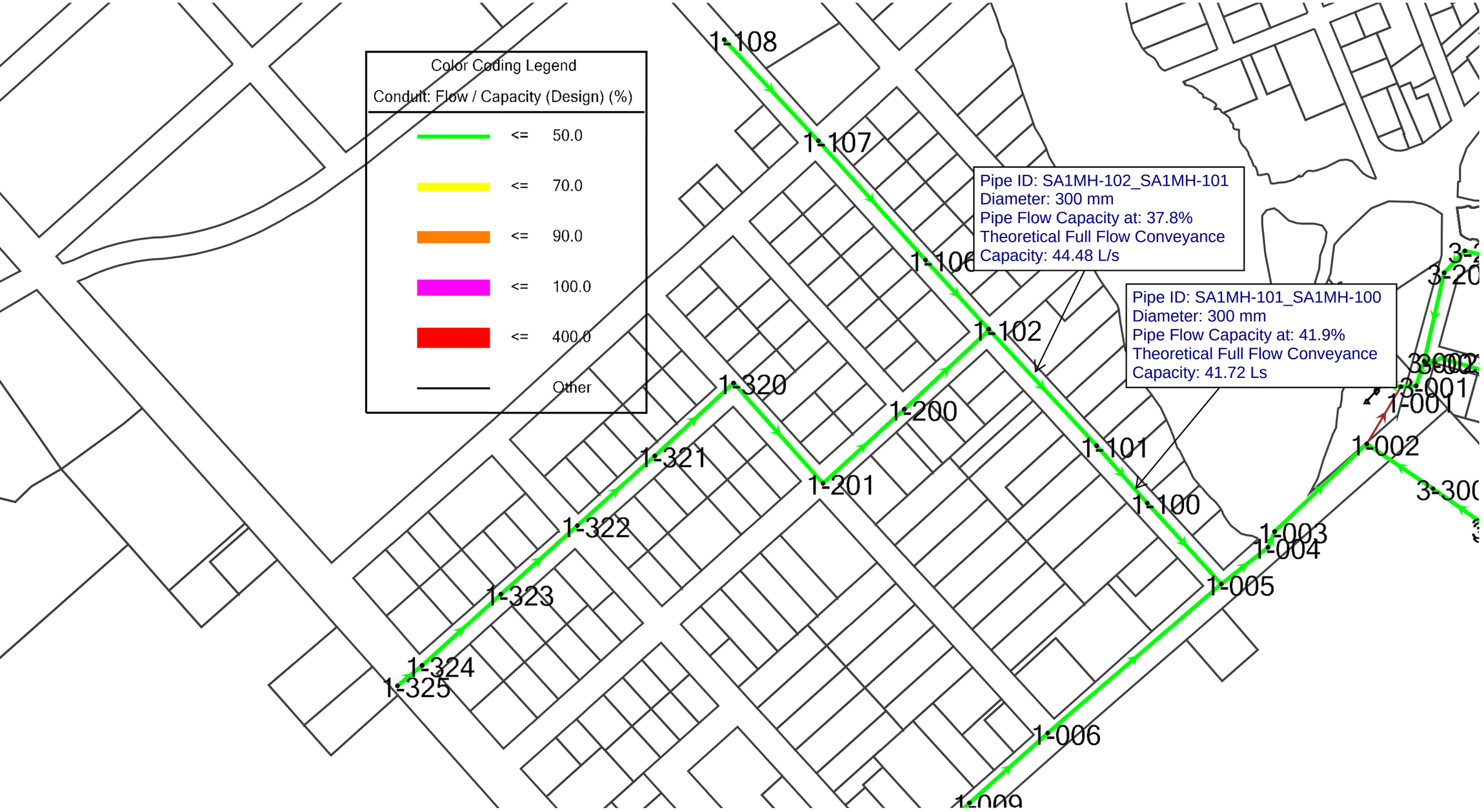
DESIGN: MB	
DRAWN: KTK	DRAWING #:
CHECKED: SG	**FIGURE 25**
JLR #: 27456-01	

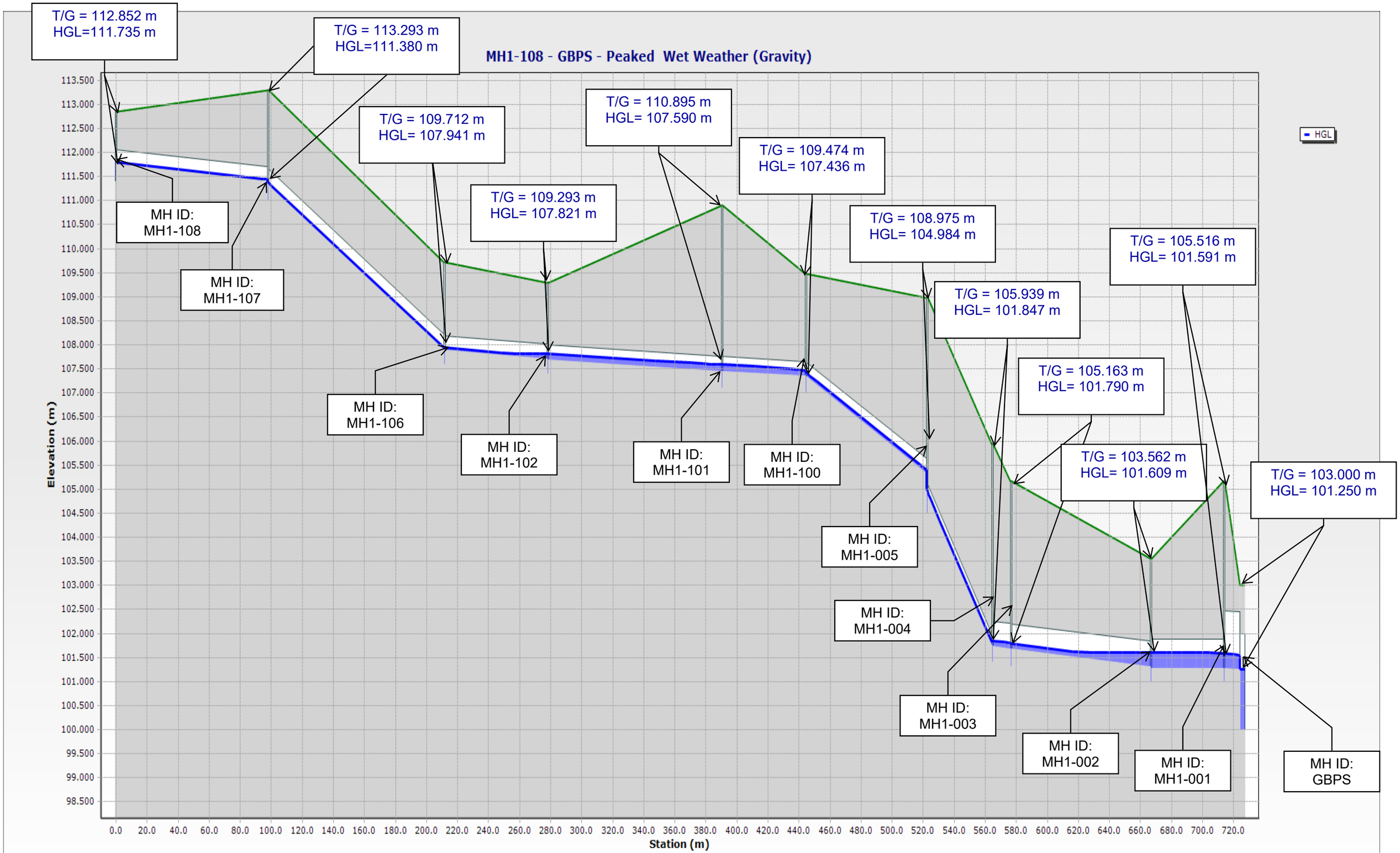
PLOT DATE: January 5, 2018 10:32:24 AM

File: R:\27000\27456-01 Mississippi Mills - Master Plan Update\JLR DWG\Plan\27456-01 SimplifiedModel.mxd

Mississippi Mills Master Plan Update 2017.stsw

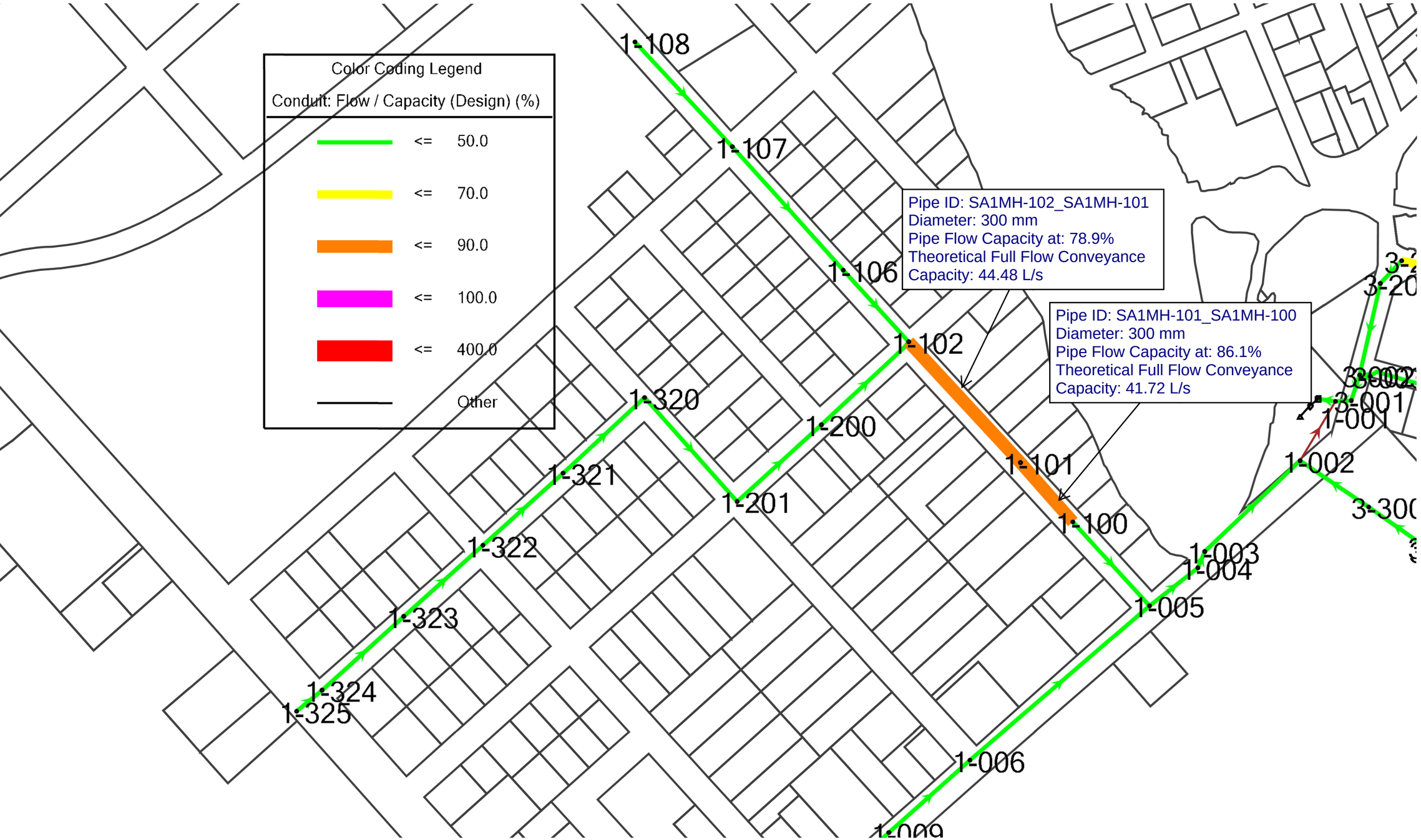
Active Scenario: Peaked Wet Weather (Gravity)

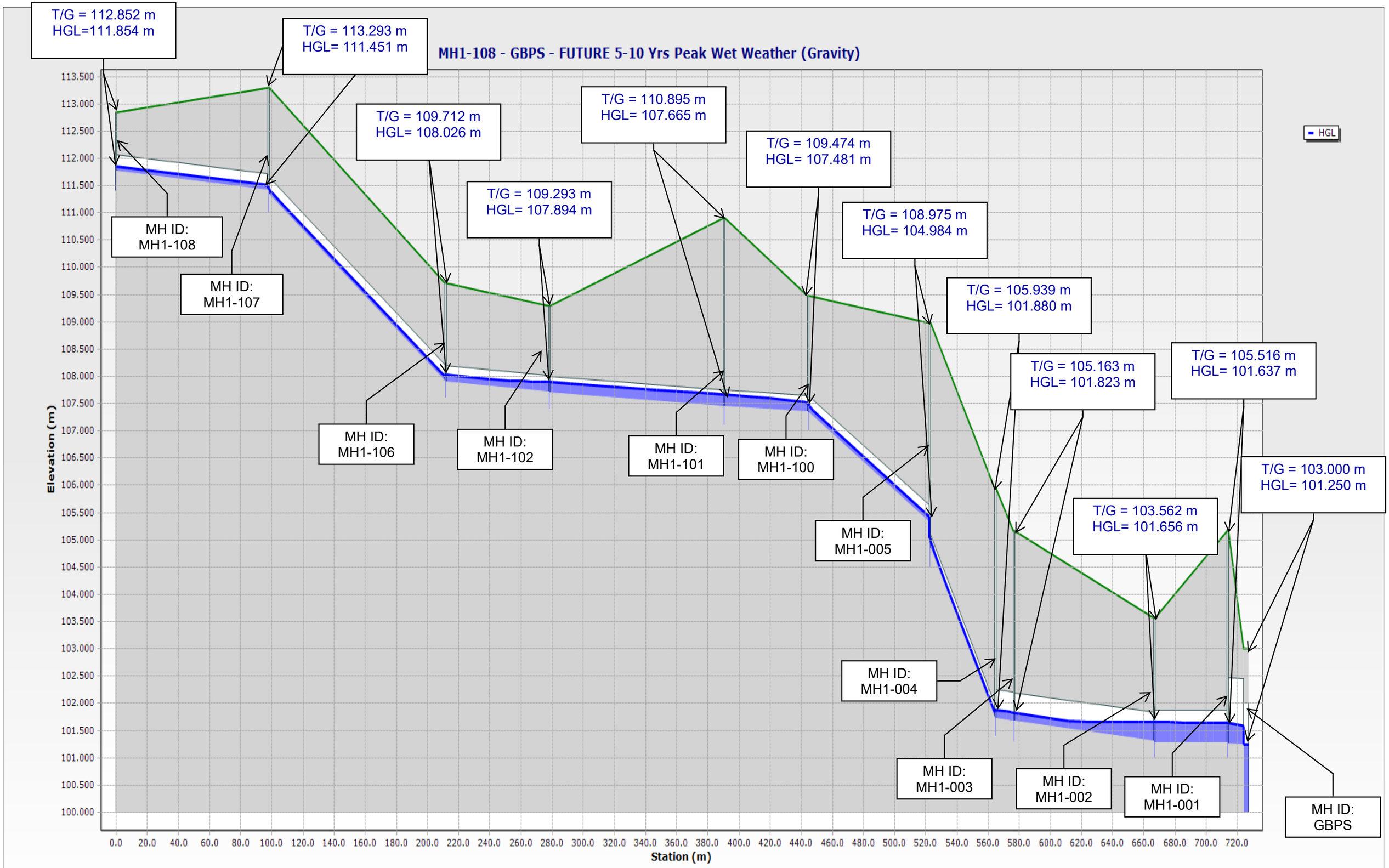



MH1-108 - GBPS - Peaked Wet Weather (Gravity)
T/G = 112.852 m
HGL=111.735 m
T/G = 113.293 m
HGL=111.380 m
T/G = 109.712 m
HGL= 107.941 m
T/G = 110.895 m
HGL= 107.590 m
T/G = 109.474 m
HGL= 107.436 m
T/G = 109.293 m
HGL= 107.821 m
T/G = 108.975 m
HGL= 104.984 m
T/G = 105.516 m
HGL= 101.591 m
T/G = 105.939 m
HGL= 101.847 m
T/G = 105.163 m
HGL= 101.790 m
T/G = 103.562 m
HGL= 101.609 m
T/G = 103.000 m
HGL= 101.250 m
MH ID: MH1-108
MH ID: MH1-107
MH ID: MH1-106
MH ID: MH1-102
MH ID: MH1-101
MH ID: MH1-100
MH ID: MH1-005
MH ID: MH1-004
MH ID: MH1-003
MH ID: MH1-002
MH ID: MH1-001
MH ID: GBPS
HGL
Elevation (m)
Station (m)

Mississippi Mills Master Plan Update 2017.stsw

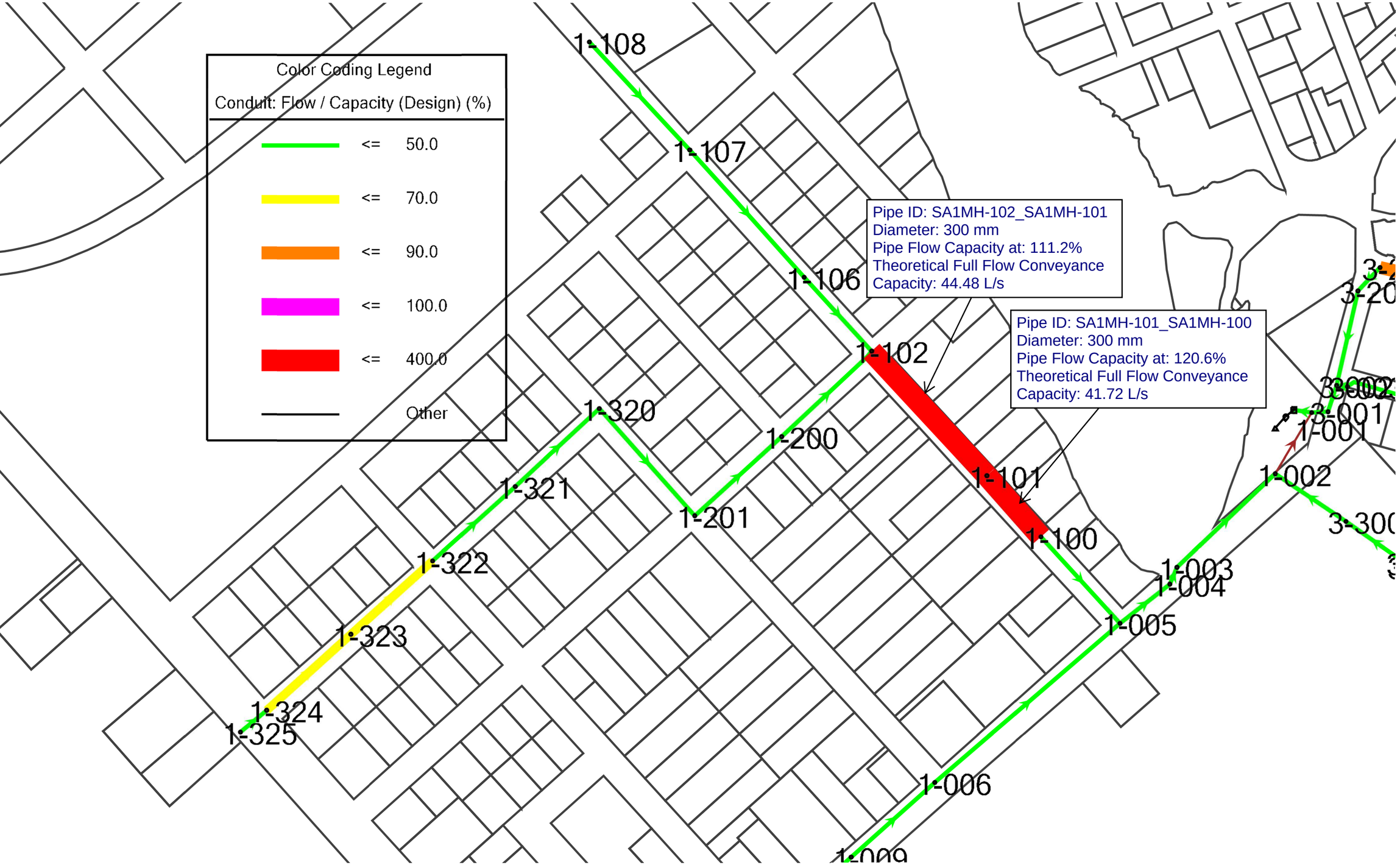
Active Scenario: FUTURE 5-10 Yrs Peak Wet Weather (Gravity)

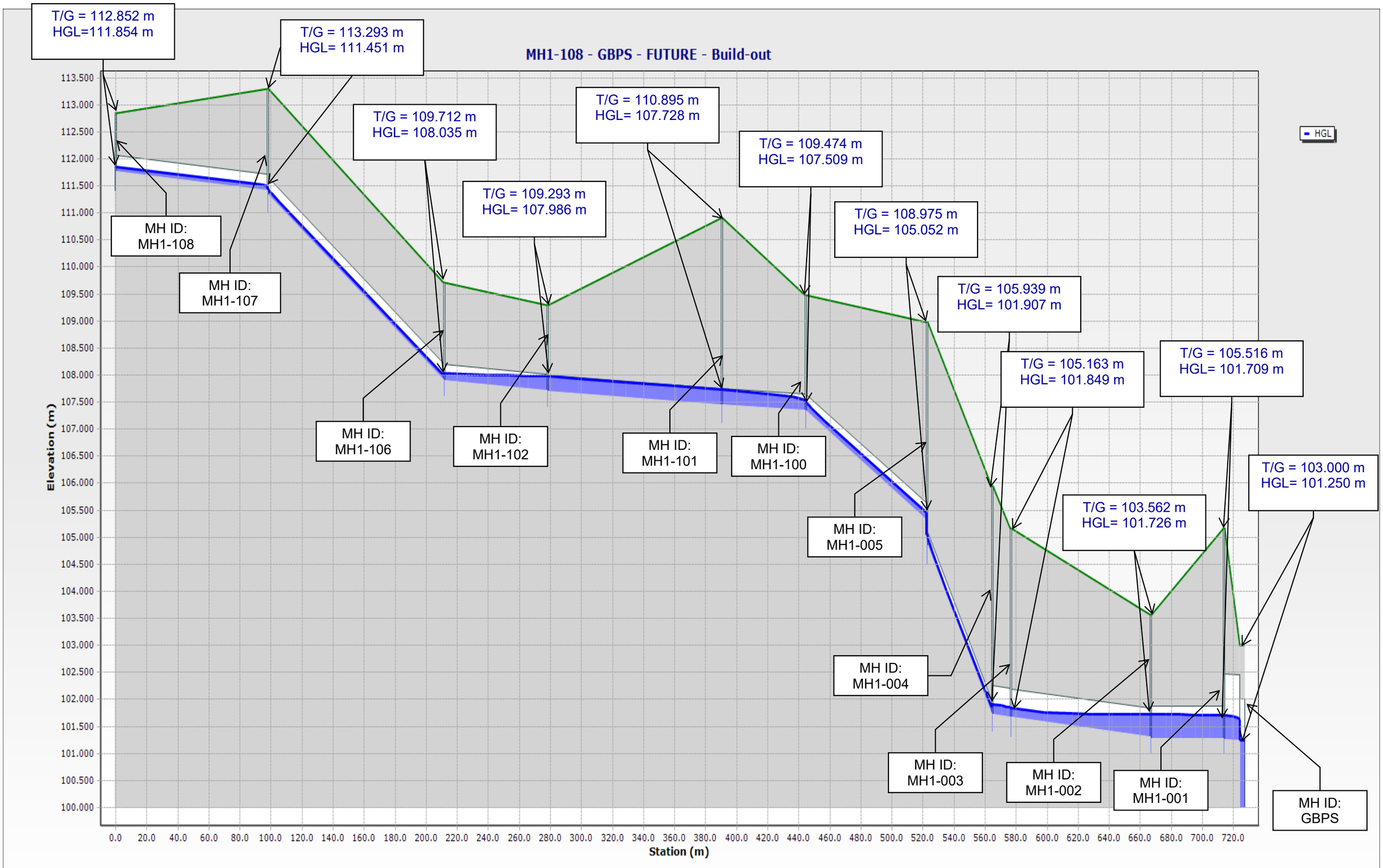



MH1-108 - GBPS - FUTURE 5-10 Yrs Peak Wet Weather (Gravity)
HGL
Elevation (m)
Station (m)
T/G = 112.852 m
HGL=111.854 m
T/G = 113.293 m
HGL= 111.451 m
T/G = 109.712 m
HGL= 108.026 m
T/G = 110.895 m
HGL= 107.665 m
T/G = 109.474 m
HGL= 107.481 m
T/G = 109.293 m
HGL= 107.894 m
T/G = 108.975 m
HGL= 104.984 m
T/G = 105.939 m
HGL= 101.880 m
T/G = 105.163 m
HGL= 101.823 m
T/G = 105.516 m
HGL= 101.637 m
T/G = 103.000 m
HGL= 101.250 m
T/G = 103.562 m
HGL= 101.656 m
MH ID: MH1-108
MH ID: MH1-107
MH ID: MH1-106
MH ID: MH1-102
MH ID: MH1-101
MH ID: MH1-100
MH ID: MH1-005
MH ID: MH1-004
MH ID: MH1-003
MH ID: MH1-002
MH ID: MH1-001
MH ID: GBPS

Mississippi Mills Master Plan Update 2017.stsw

Active Scenario: FUTURE - Build-out




MH1-108 - GBPS - FUTURE - Build-out
HGL
Elevation (m)
Station (m)
T/G = 112.852 m
HGL=111.854 m
T/G = 113.293 m
HGL= 111.451 m
T/G = 109.712 m
HGL= 108.035 m
T/G = 110.895 m
HGL= 107.728 m
T/G = 109.474 m
HGL= 107.509 m
T/G = 109.293 m
HGL= 107.986 m
T/G = 108.975 m
HGL= 105.052 m
T/G = 105.939 m
HGL= 101.907 m
T/G = 105.163 m
HGL= 101.849 m
T/G = 105.516 m
HGL= 101.709 m
T/G = 103.000 m
HGL= 101.250 m
T/G = 103.562 m
HGL= 101.726 m
MH ID: MH1-108
MH ID: MH1-107
MH ID: MH1-106
MH ID: MH1-102
MH ID: MH1-101
MH ID: MH1-100
MH ID: MH1-005
MH ID: MH1-004
MH ID: MH1-003
MH ID: MH1-002
MH ID: MH1-001
MH ID: GBPS

APPENDIX D
Watermain

Almonte - Updated Hydraulic Boundary Conditions and Truck Sewer Capacity, Email from Mark Buchanan, J.L. Richards & Associates, August 17, 2022, 34 Pages

Re: Almonte - Updated Hydraulic Boundary Conditions and Truck Sewer Capacity, Email from Mahad Musse, J.L. Richards & Associates, February 2, 2022, 32 Pages

Watermain Boundary Conditions Equations, Novatech, February 10, 2023, 2 Pages

OBC Water Supply for Firefighting Calculations, Novatech, February 10, 2023, 11 Pages

Watermain Demand Sheet & Hydraulic Analysis Results – Single Connection, Novatech, February 10, 2023, 36 Pages

Watermain Demand Sheet & Hydraulic Analysis Results – Dual Connection, Novatech, February 10, 2023, 36 Pages

Water Distribution Servicing Strategies, Excerpt from Master Plan Update Report, pages 19-20, J.L. Richards & Associates Limited, February 2018, 2 Pages

Water System Figures, Excerpts from Master Plan Update Report, Figures 7-17, J.L. Richards & Associates Limited, February 2018, 11 Pages

Trevor McKay

From: Mark Buchanan <mbuchanan@jlrichards.ca>
Sent: Wednesday, August 17, 2022 8:49 AM
To: Trevor McKay
Cc: Melanie Riddell; Cory Smith; Annie Williams; Mahad Musse
Subject: Almonte - Updated Hydraulic Boundary Conditions and Trunk Sewer Capacity
Attachments: Attachment 1 - Brown Lands BC Results.pdf; Pages from ALMONTE Master Plan Update Report_Final_02.pdf; Attachment No. 2 - Wastewater Model Outputs.pdf

Hello Trevor,

Further to my voicemail, we updated the below summary email (Table 2) consistent with the attached the hydraulic boundary conditions for the water distribution system scenarios and the theoretical conveyance capacity of the critical downstream sanitary sewers.

Water Distribution System

The boundary conditions below are for the following three scenarios, as requested by the Developer's Engineer:

1) Scenario 1 Boundary Conditions – Existing Conditions:
- 2 Connections: Boundary conditions to be provided at County Road 29 / Wylie Street, and at Malcolm / Strathburn.
- Existing Conditions: MaxDay+FF, Peak Hour under Year 1 demands only. JLR to confirm existing available fire flow.

2) Scenario 2 Boundary Conditions – 250 mm Upgrade Along County Road 29:
- 1 Connection: Boundary conditions to be provided at County Road 29 / Wylie Street.
- 250mm Watermain Upgrade along County Road 29 (full length from Well #6 to Wylie Street): Average Day, MaxDay+FF, Peak Hour under all 4 Years' demands. If not feasible, will note as such.

3) Scenario 3 Boundary Conditions – 250 mm Upgrade Along County Road 29 and 300 mm Mississippi River Crossing:
- 2 Connections: Boundary conditions to be provided at County Road 29 / Wylie Street, and at Carss Street on the east side of the river.
- 250mm Watermain Upgrade along County Road 29 AND 300mm Mississippi River Crossing: Average Day, MaxDay+FF, Peak Hour under all 4 Years' demands. If not feasible, will note as such.

The proposed development located on the Brown Lands within the Municipality of Mississippi Mills (Municipality), was simulated using the Municipality's existing hydraulic water model (2017) to determine hydraulic boundary conditions based on theoretical water demands and fire flows provided by the Developer's Engineer (refer to attached). The 300 mm diameter watermain upgrade on Victoria Street between Martin Street North and Menzie Street was included in the model. Table 1 summarizes the theoretical water demands that were included in the model at junction node J-573. It is noted that a hydraulic boundary conditions for maximum day + fire flow could only be provided for Year 1 of Max Daily + FF1 (45L/s) under existing conditions and only under Year 1-4 of Max Daily + FF1 (45 L/s) for the 250 mm upgrade along County Road 29.

Table 1: Theoretical Water Demands

	High Pressure	Max Daily + FF1 (45L/s)	Max Daily + FF2 (75L/s)	Peak Hour
Year 1	0.99	46.98	76.98	4.35
Year 2	1.98	48.96	78.96	8.71
Year 3	2.97	50.94	80.94	13.06
Year 4	4.11	53.23	83.23	18.10

The hydraulic boundary conditions have been generated at the connection points noted above with results summarized in Table 2 to Table 4 (refer to Attachment 1 for WaterCAD model outputs). Connection points are labelled in the model as follows:

- Junction nodes J-477 and J-556 for Scenario 1;
- Junction nodes J-89 for Scenario 2; and
- Junction nodes J-89 and J-567 for Scenario 3.

The maximum day + fire flow and peak hour scenarios assume a maximum elevated tank level of 180.00m with all well pumps on and the new booster PUMP-A turned off. The average day scenario assumes all pumps are turned off. Demands were placed within the Brown Lands on junction node J-573, the elevation of this node was approximated as 117.44 m based on the surrounding elevations found within the model and information from Google Earth.

Table 2: Scenario 1 Boundary Conditions – Existing Conditions

Demand Case	Connection at County Road 29 / Wylie Street (J-477, Elev. 119.00m)		Connection at Malcolm / Strathburn (J-556, Elev. 113.14m)	
	Pressure (kPa)	HGL (m)	Pressure (kPa)	HGL (m)
Year 1 – Max Daily + Fire Flow Available (39.63 L/s)	185	137.92	236	137.29
Year 1 - Peak Hour (4.35 L/s)	380	157.79	437	157.78

Table 3: Scenario 2 Boundary Conditions – 250 mm Upgrade Along County Road 29

Demand Case	Connection at County Road 29 / Almonte Street (J-89, Elev. 124.46m)	
	Pressure (kPa)	HGL (m)
Year 1 – Average Day Demand	532	178.86
Year 2 – Average Day Demand	530	178.60
Year 3 – Average Day Demand	527	178.31
Year 4 – Average Day Demand	523	177.93
Year 1 - Max Daily + FF1 (46.98 L/s)	301	155.22
Year 2 - Max Daily + FF1 (48.96 L/s)	278	152.92
Year 3 - Max Daily + FF1 (50.94 L/s)	255	150.52
Year 4 - Max Daily + FF1 (53.23 L/s)	227	147.64
Year 1 – Peak Hour	531	178.76
Year 2 – Peak Hour	517	177.26
Year 3 – Peak Hour	501	175.67
Year 4 – Peak Hour	479	173.42

Table 4: Scenario 3 Boundary Conditions – 250 mm Upgrade Along County Road 29 and 300 mm Mississippi River Crossing

Demand Case	Connection at County Road 29 / Almonte Street (J-89, Elev. 124.46m)		Connection at Union Street N. / Carss Street (J-567, Elev. 132.80)	
	Pressure (kPa)	HGL (m)	Pressure (kPa)	HGL (m)
Year 1 – Average Day Demand	540	179.61	459	179.69

Year 2 – Average Day Demand	**539**	**179.56**	**458**	**179.65**
Year 3 – Average Day Demand	**539**	**179.51**	**458**	**179.61**
Year 4 – Average Day Demand	**538**	**179.46**	**458**	**179.56**
Year 1 - Max Daily + FF1 (46.98 L/s)	**510**	**176.56**	**432**	**176.98**
Year 2 - Max Daily + FF1 (48.96 L/s)	**507**	**176.30**	**430**	**176.76**
Year 3 - Max Daily + FF1 (50.94 L/s)	**505**	**176.03**	**428**	**176.55**
Year 4 - Max Daily + FF1 (53.23 L/s)	**502**	**175.71**	**426**	**176.28**
Year 1 - Max Daily + FF2 (76.98 L/s)	**461**	**171.62**	**394**	**173.02**
Year 2 - Max Daily + FF1 (78.96 L/s)	**458**	**171.22**	**390**	**172.70**
Year 3 - Max Daily + FF1 (80.94 L/s)	**454**	**170.80**	**387**	**172.38**
Year 4 - Max Daily + FF1 (83.23 L/s)	**449**	**170.32**	**384**	**172.00**
Year 1 – Peak Hour	**535**	**179.13**	**453**	**179.10**
Year 2 – Peak Hour	**532**	**178.84**	**450**	**178.83**
Year 3 – Peak Hour	**529**	**178.48**	**447**	**178.52**
Year 4 – Peak Hour	**524**	**178.00**	**444**	**178.12**

Trunk Wastewater Model Outputs

Trunk wastewater model outputs were generated for the proposed development area from the existing Master Plan that included an expected peak flow of 10.27 L/s connected at MH 1-108 (refer to attached master plan Figure 25). The model results of the critical sewers sections and corresponding HGL profile are attached for the following scenarios.

1) Existing Conditions
2) Future Development 5-10 years, that includes the proposed development area
3) Building that includes the proposed development and commercial areas as shown on the attached Master Plan Report Figure 25.

Note that the foregoing model results are for current conditions and are based on computer model simulation. We have not reviewed the adequacy of the domestic demand nor the fire flow requirements for the proposed development, which remains the responsibility of the Developer's Engineer.

Disclaimer: The model results are based on current simulated operation of the Municipality's water distribution system and sewer collection system. The computer model simulations are based on the best information available at this time. The operation of the systems can change on a regular basis, resulting in a variation in the boundary conditions. It is further noted that the operational characteristics of the water supply and wastewater collection systems and physical properties of the watermains and sewers can change and/or deteriorate over time. These changes may affect the supply and collection characteristics of the systems and the assumptions made in developing the models, which in turn could lead to variations in the simulation results. This should be considered by any third party undertaking simulation of system upgrades.

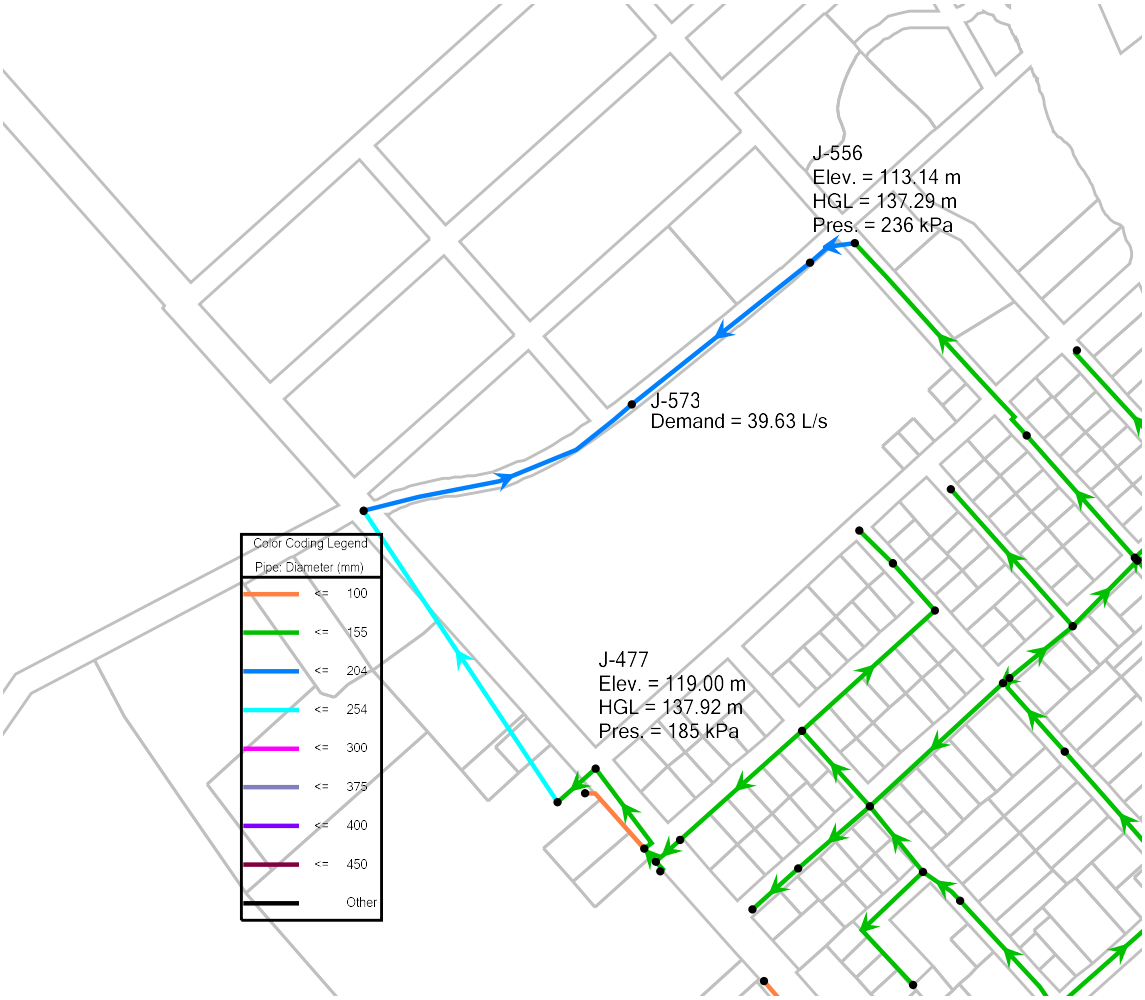
Should have any questions or require anything further, please do not hesitate to contact us.
Regards,

Mark Buchanan, P.Eng.

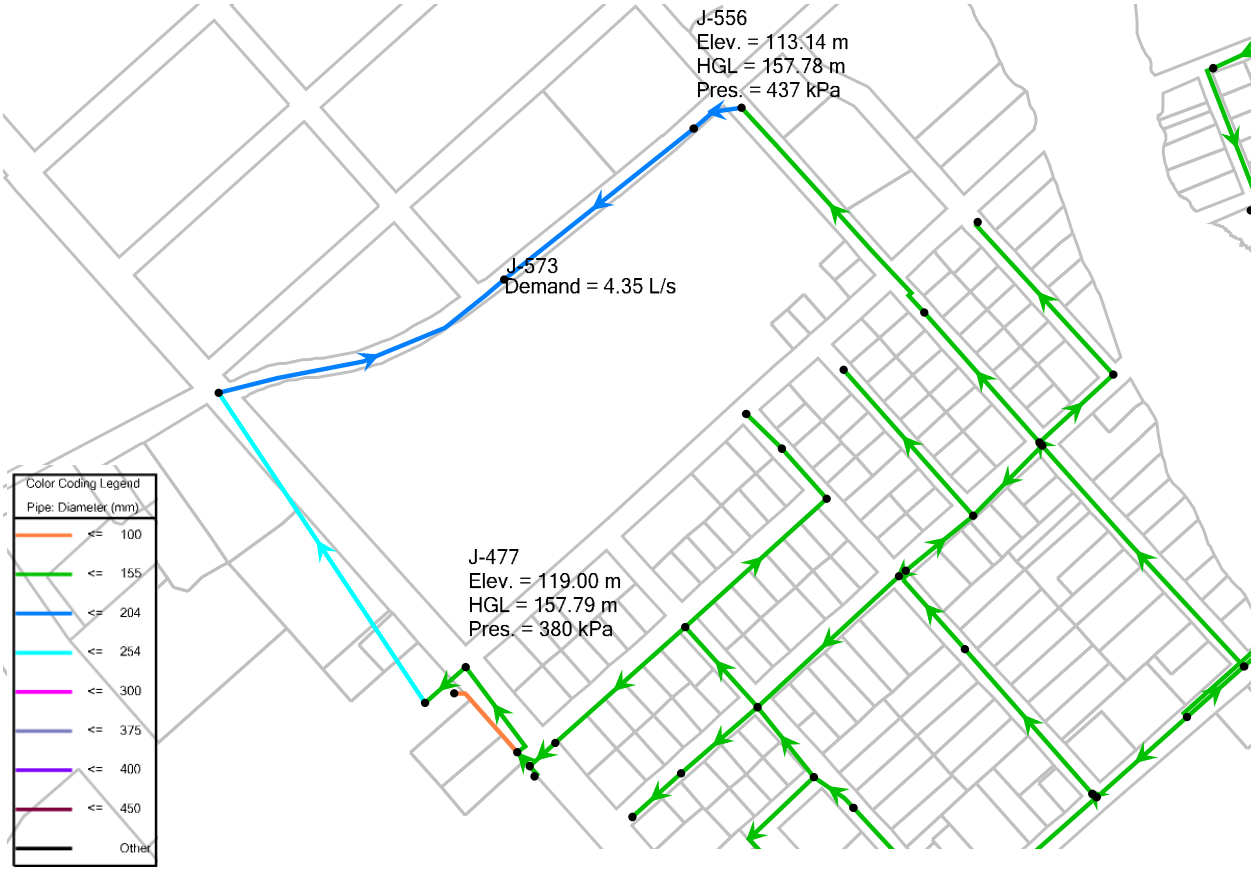
Associate
Senior Civil Engineer

J.L. Richards & Associates Limited
1000-343 Preston Street, Ottawa, ON K1S 1N4
Direct: 343-804-5349

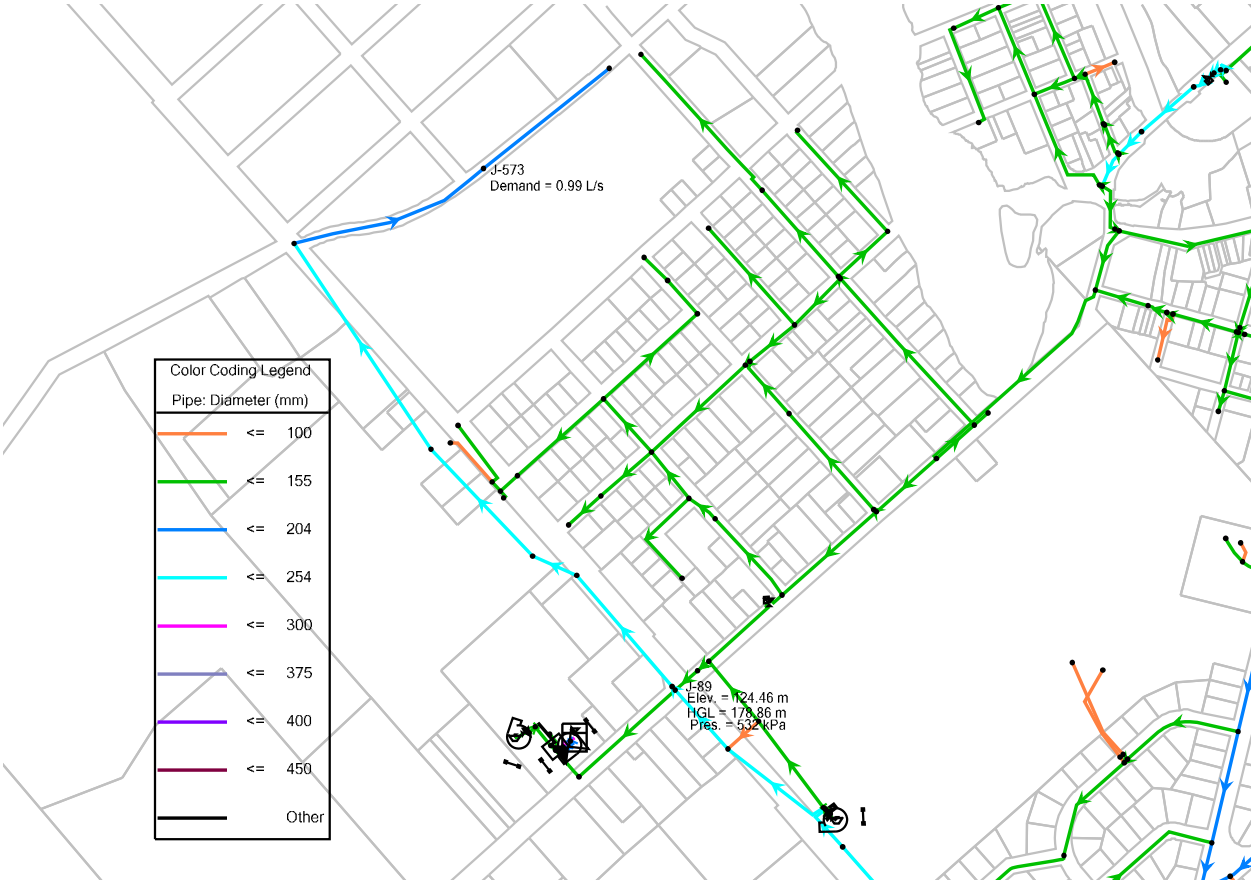
Brown Lands Boundary Condition
Existing Conditions
MDD (Year 1)



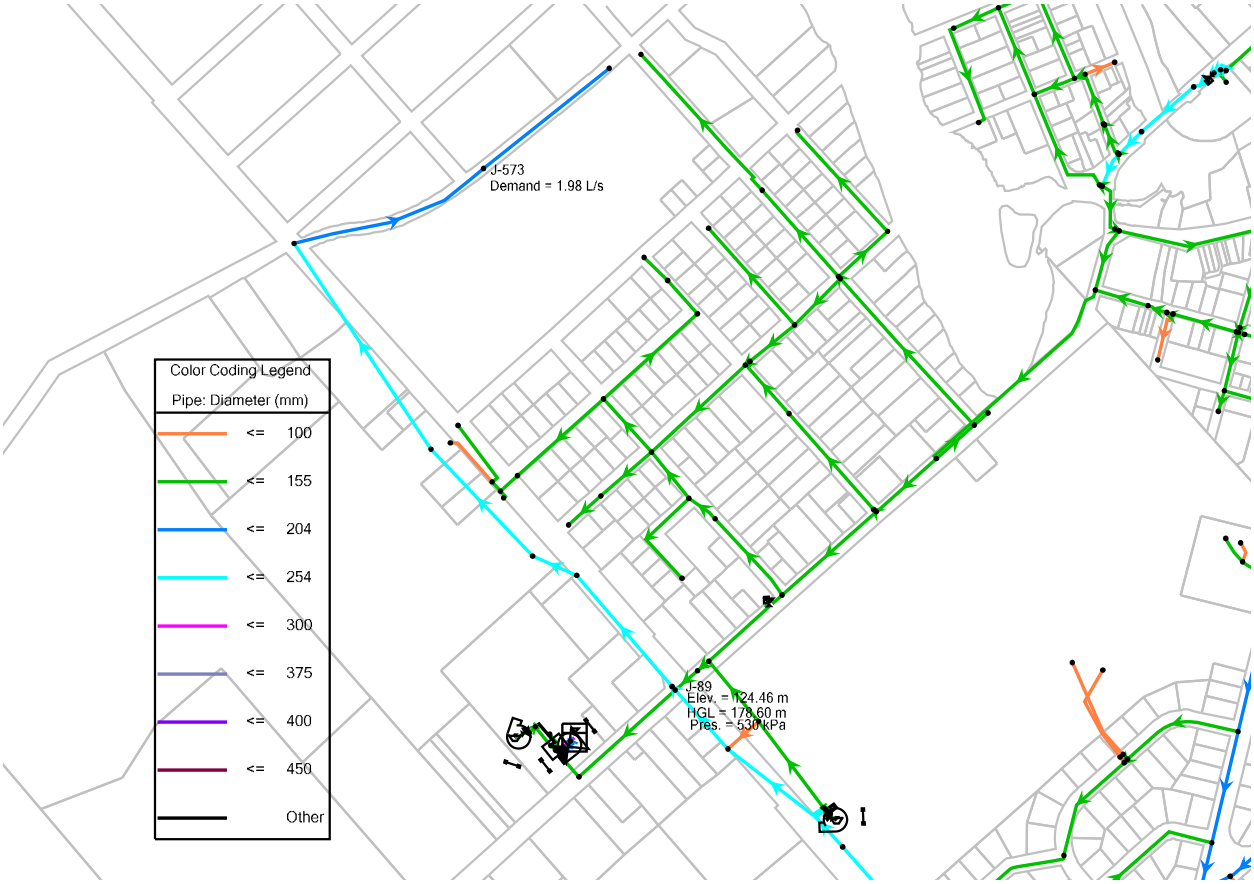
Brown Lands Boundary Condition
Existing Conditions
PHD (Yr 1)



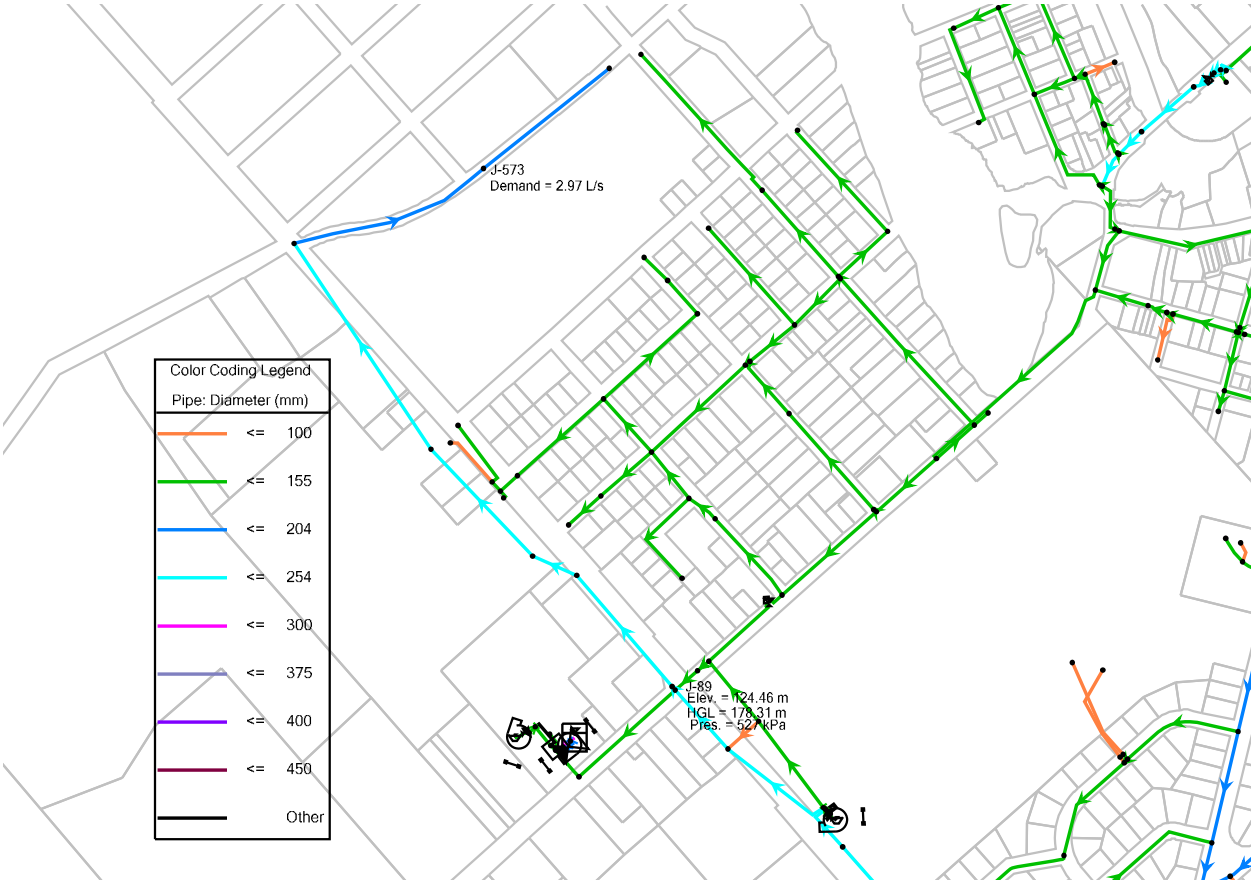
Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29
ADD (Yr 1)



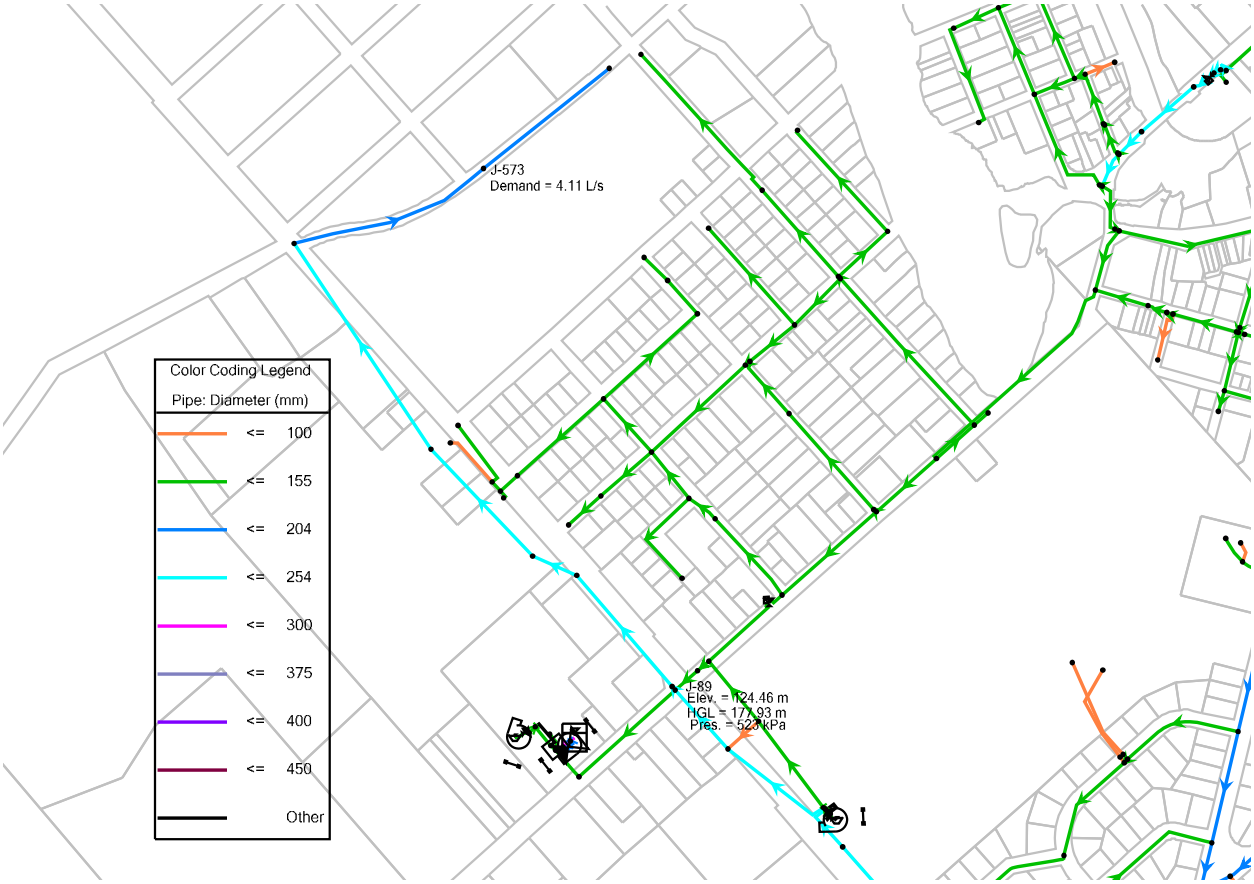
Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29
ADD (Yr 2)



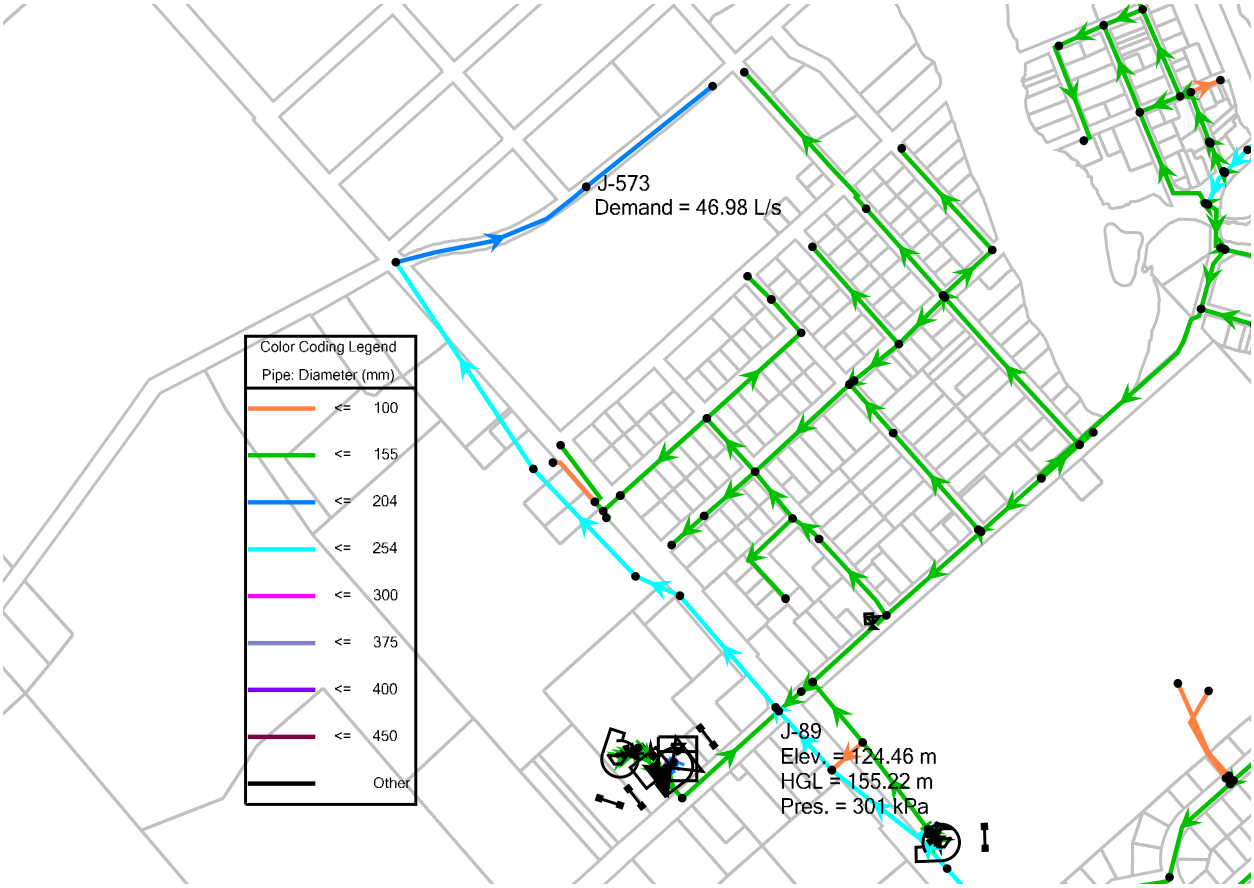
Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29
ADD (Yr 3)



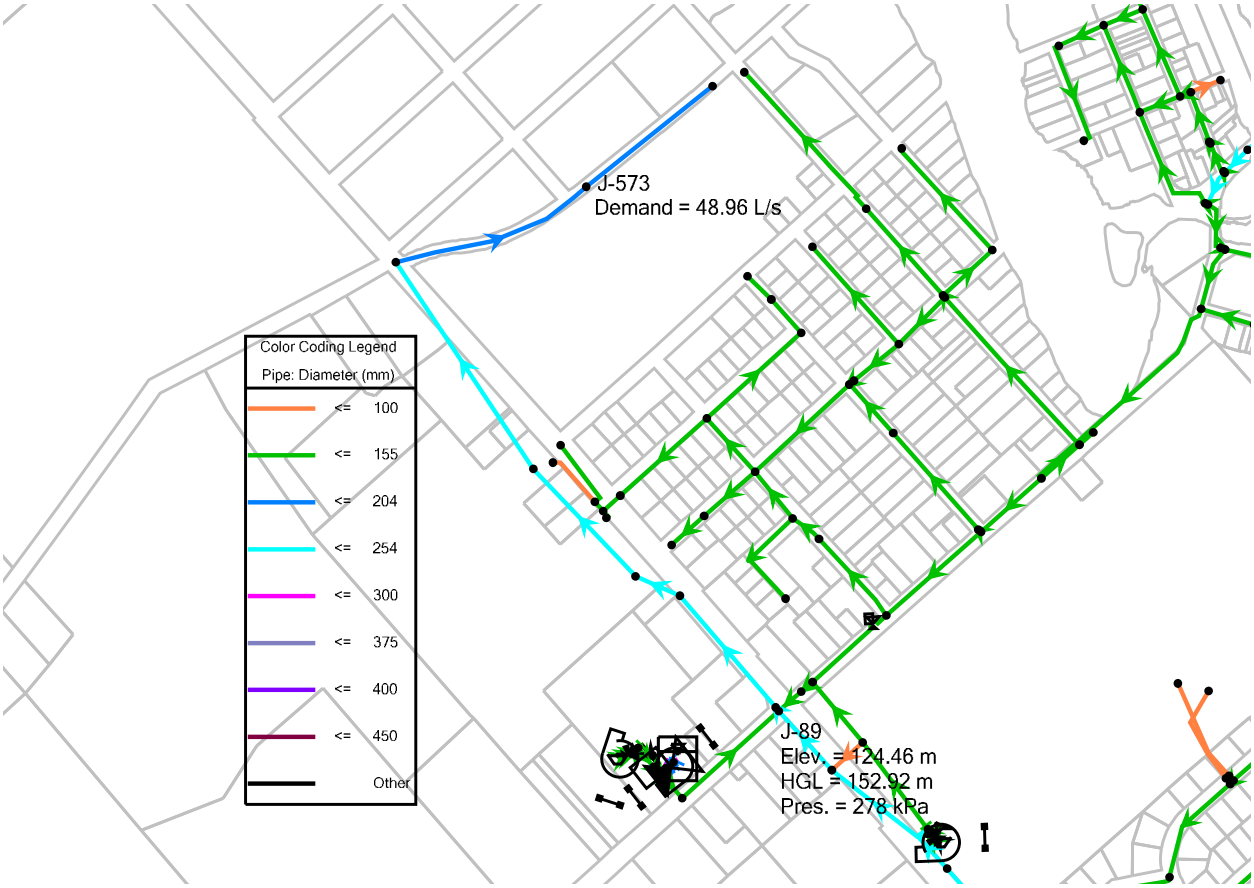
Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29
ADD (Yr 4)



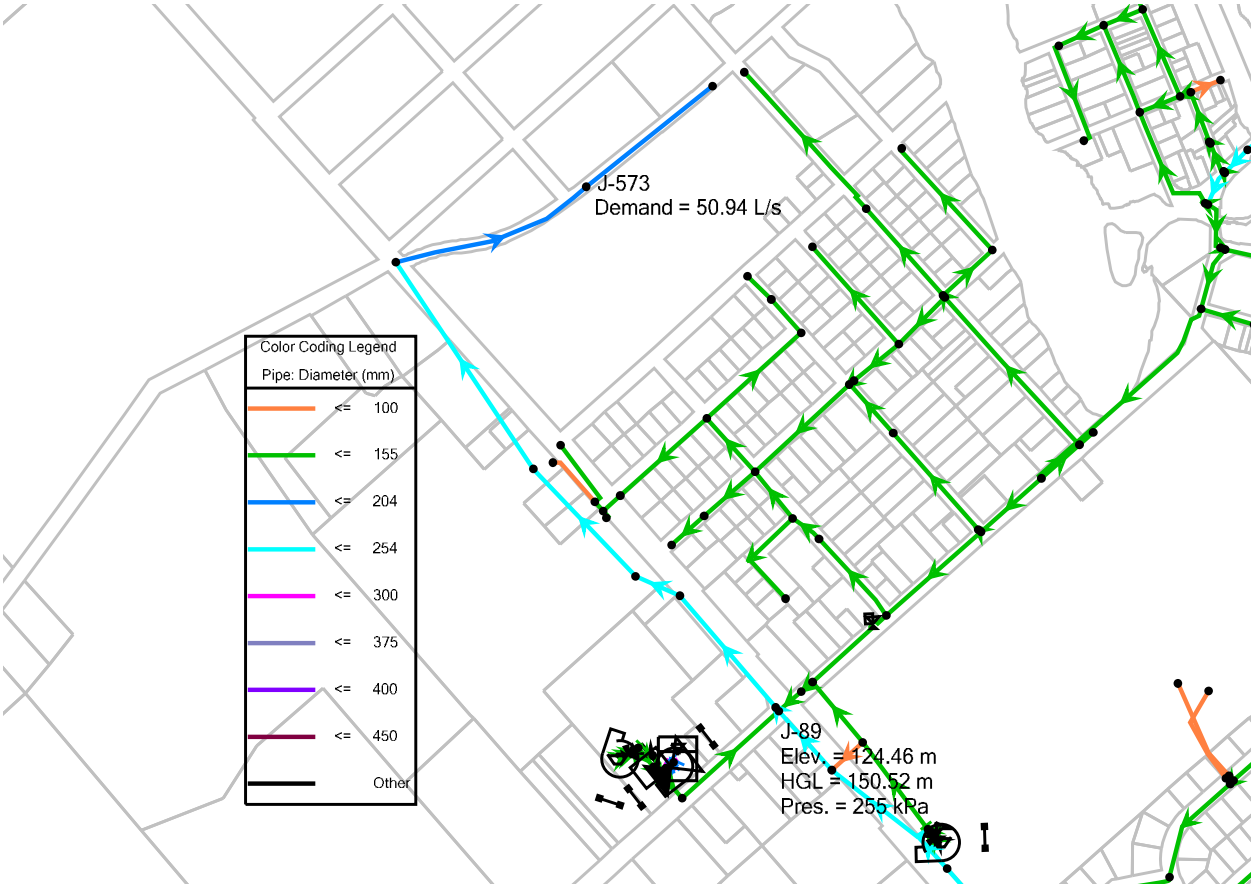
Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29
MDD+FF (Yr 1)



Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29
MDD+FF (Yr 2)

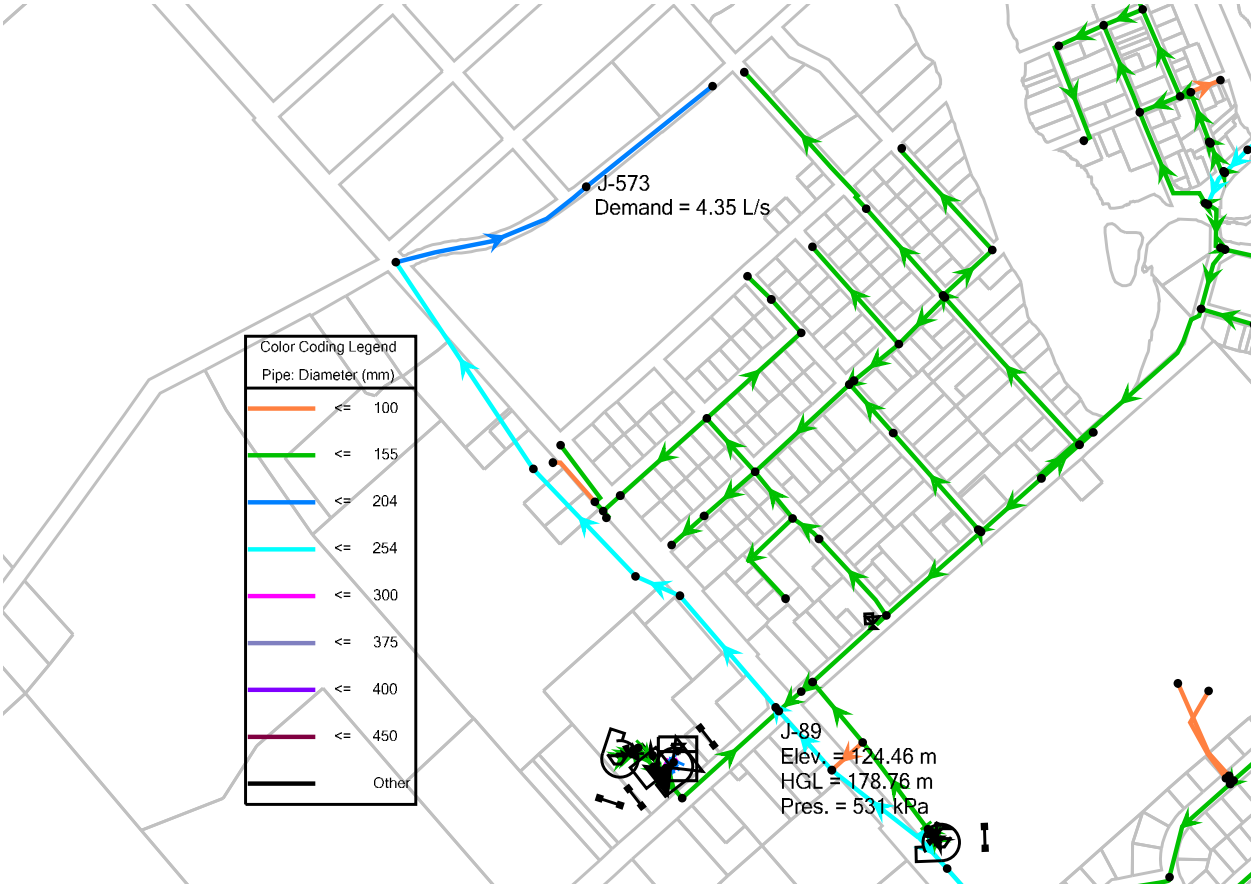


Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29
MDD+FF (Yr 3)

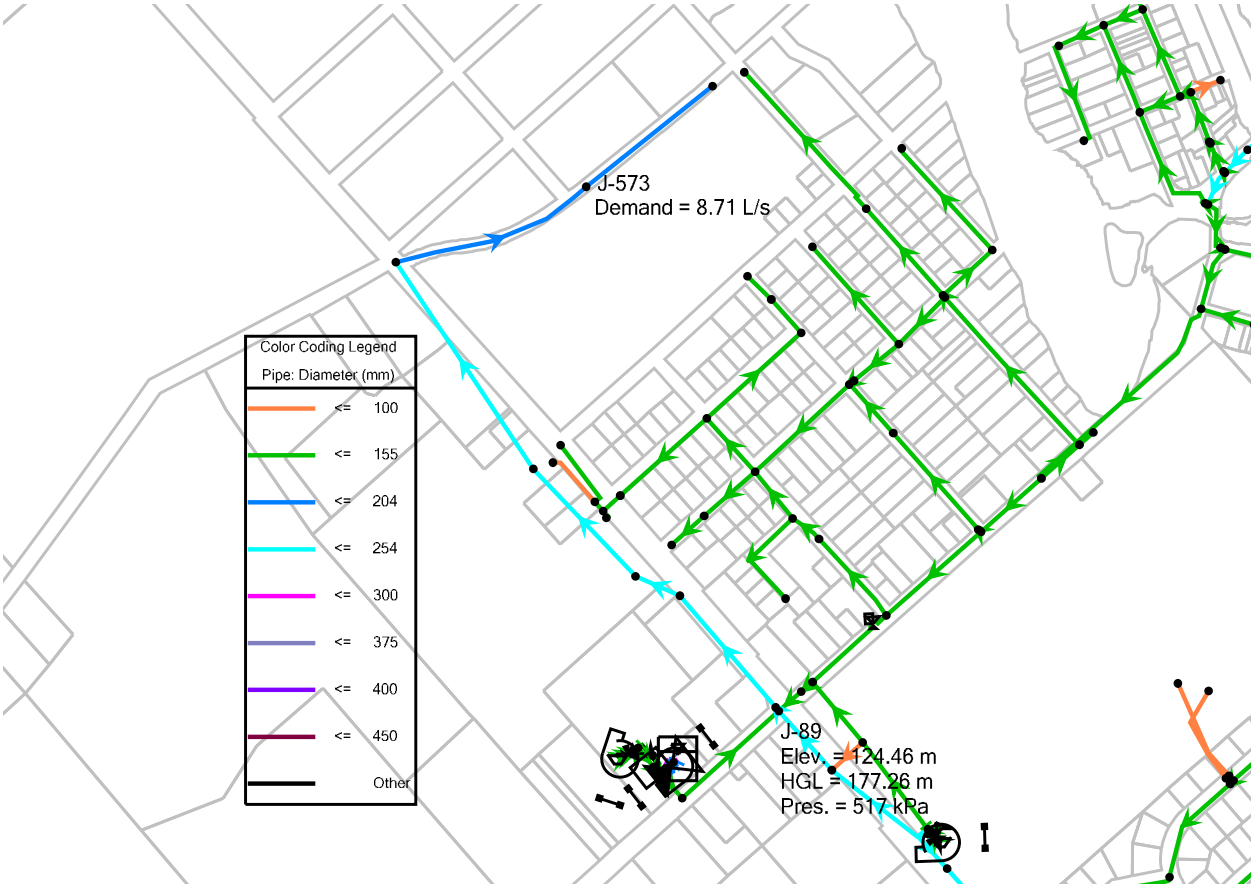


Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29
MDD+FF (Yr 4)

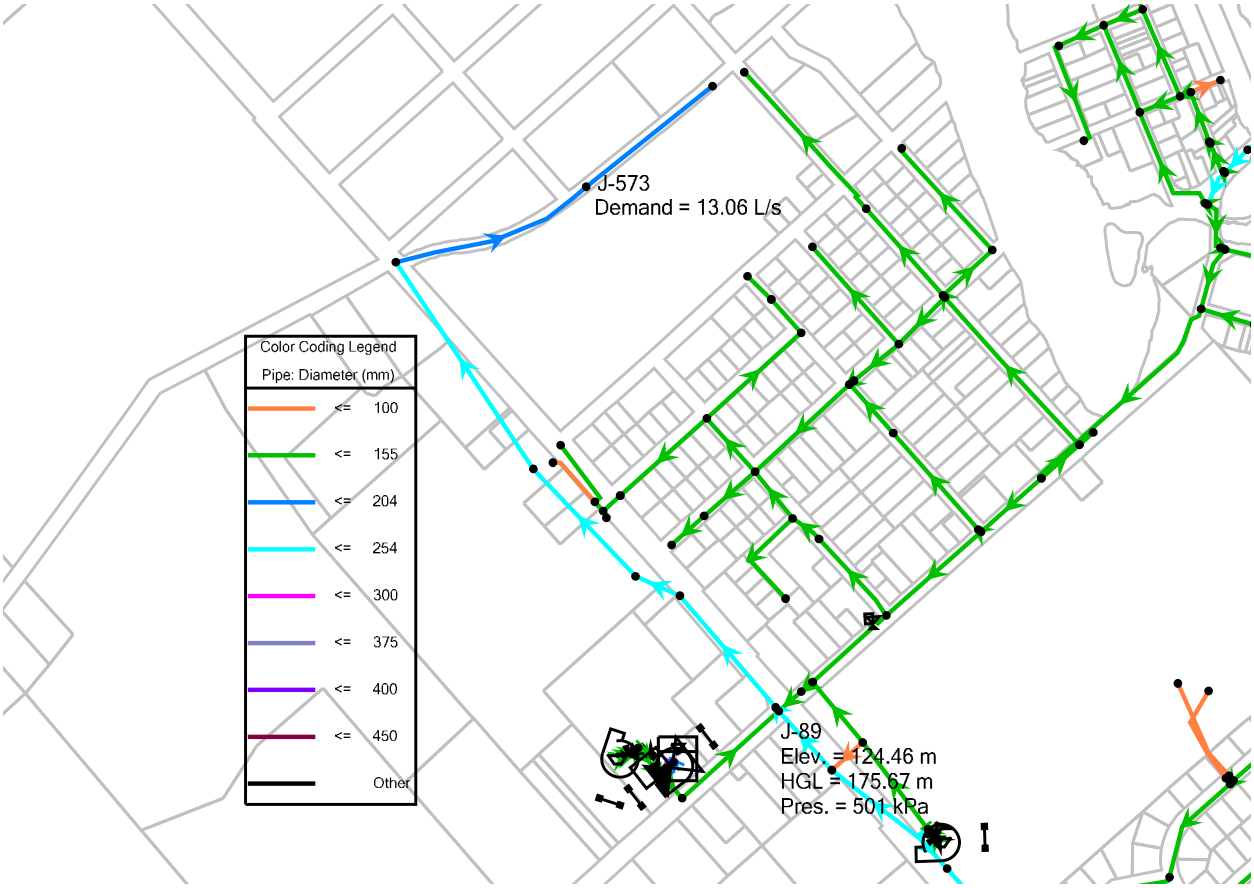
Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29
PHD (Yr 1)



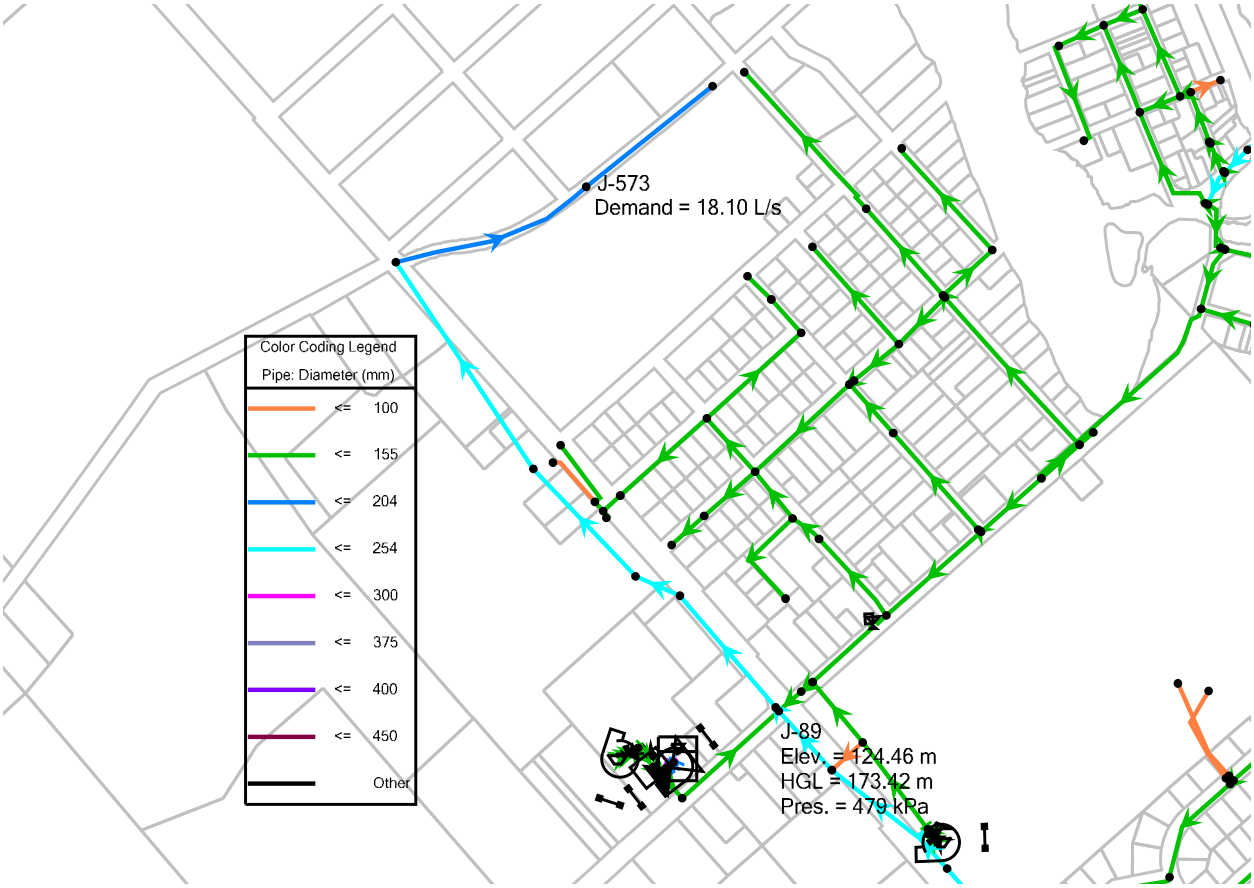
Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29
PHD (Yr 2)



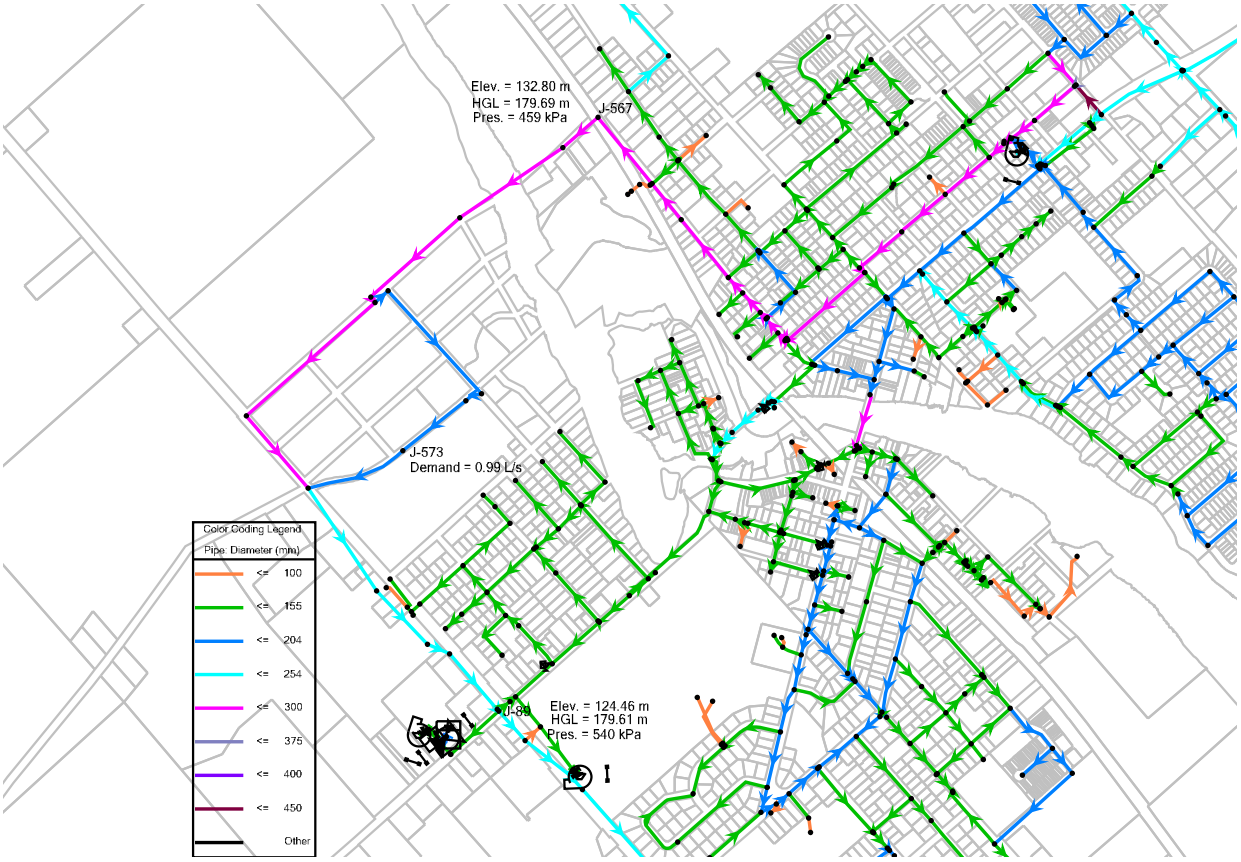
Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29
PHD (Yr 3)



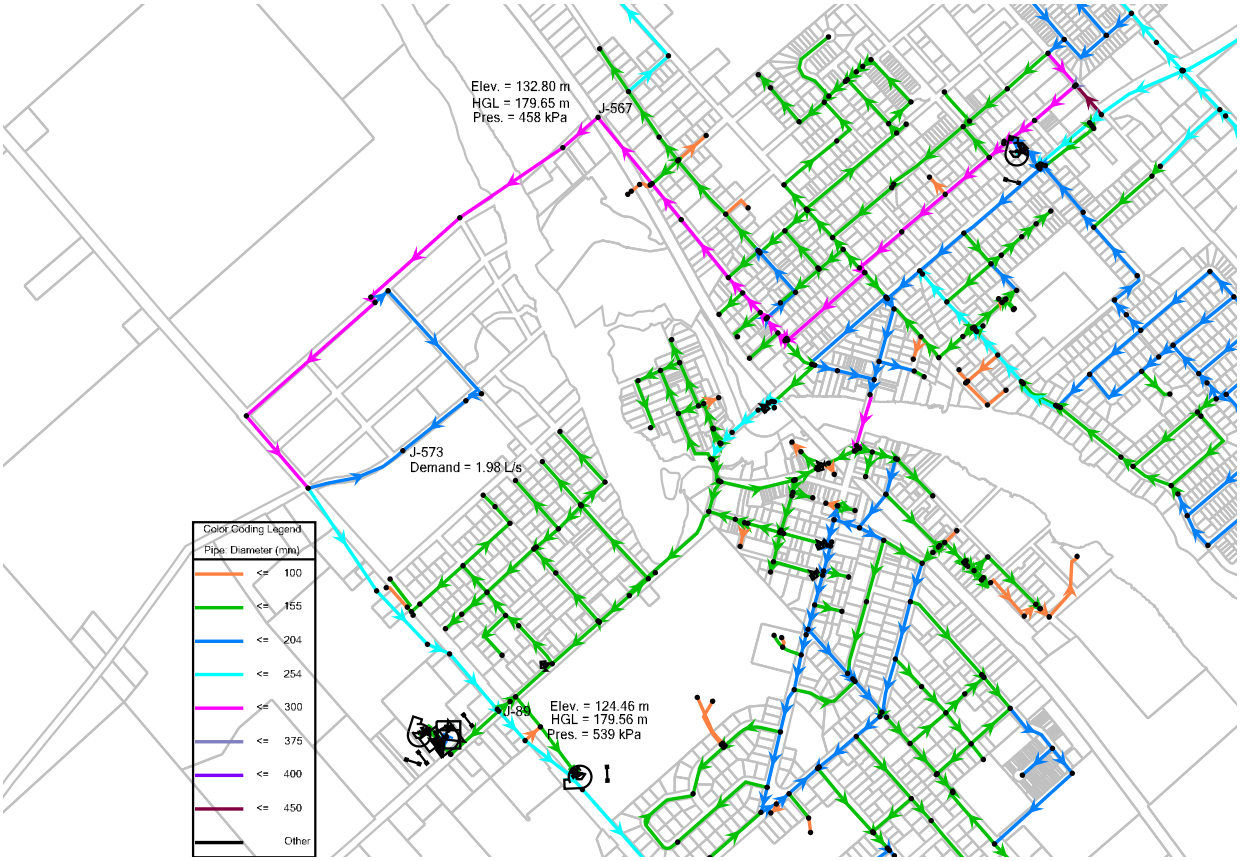
Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29
PHD (Yr 4)



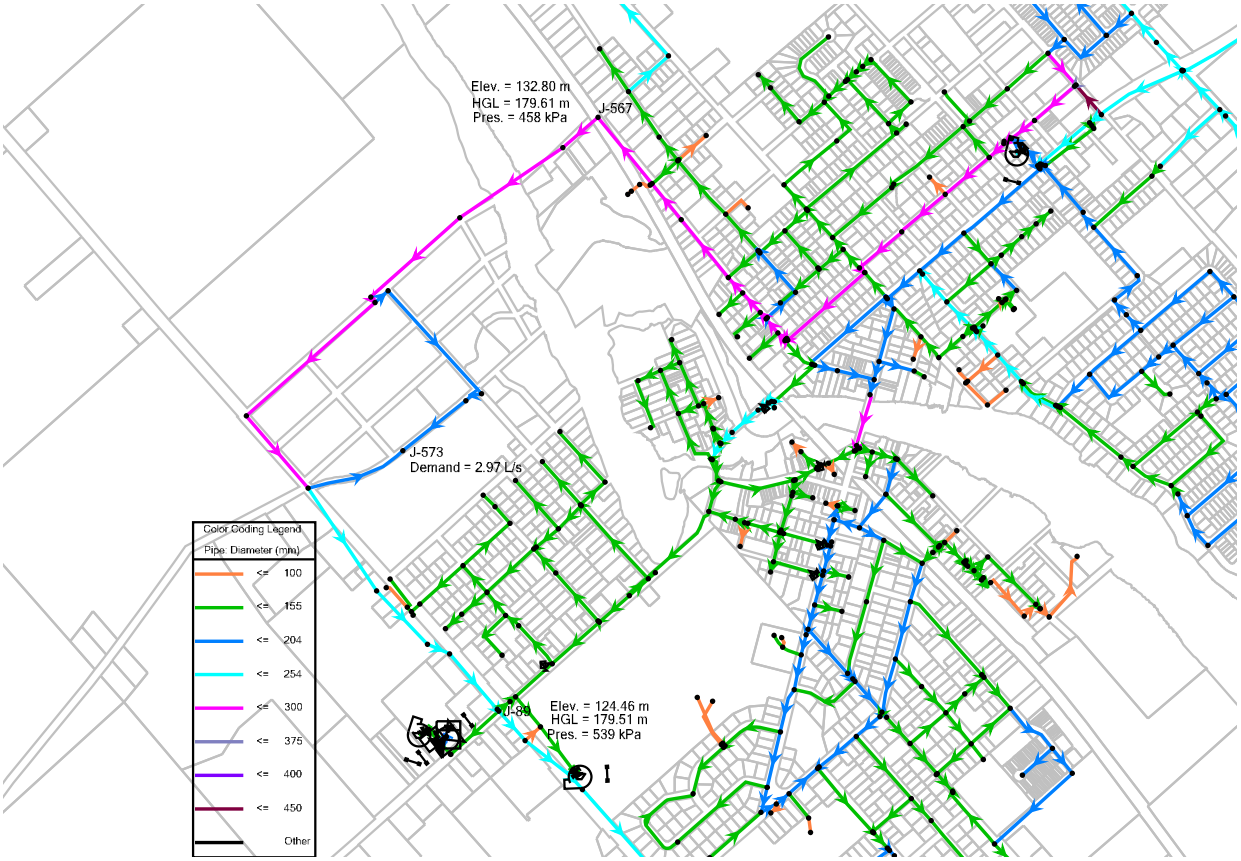
Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29 and 300 mm Mississippi River Crossing
ADD (Yr 1)



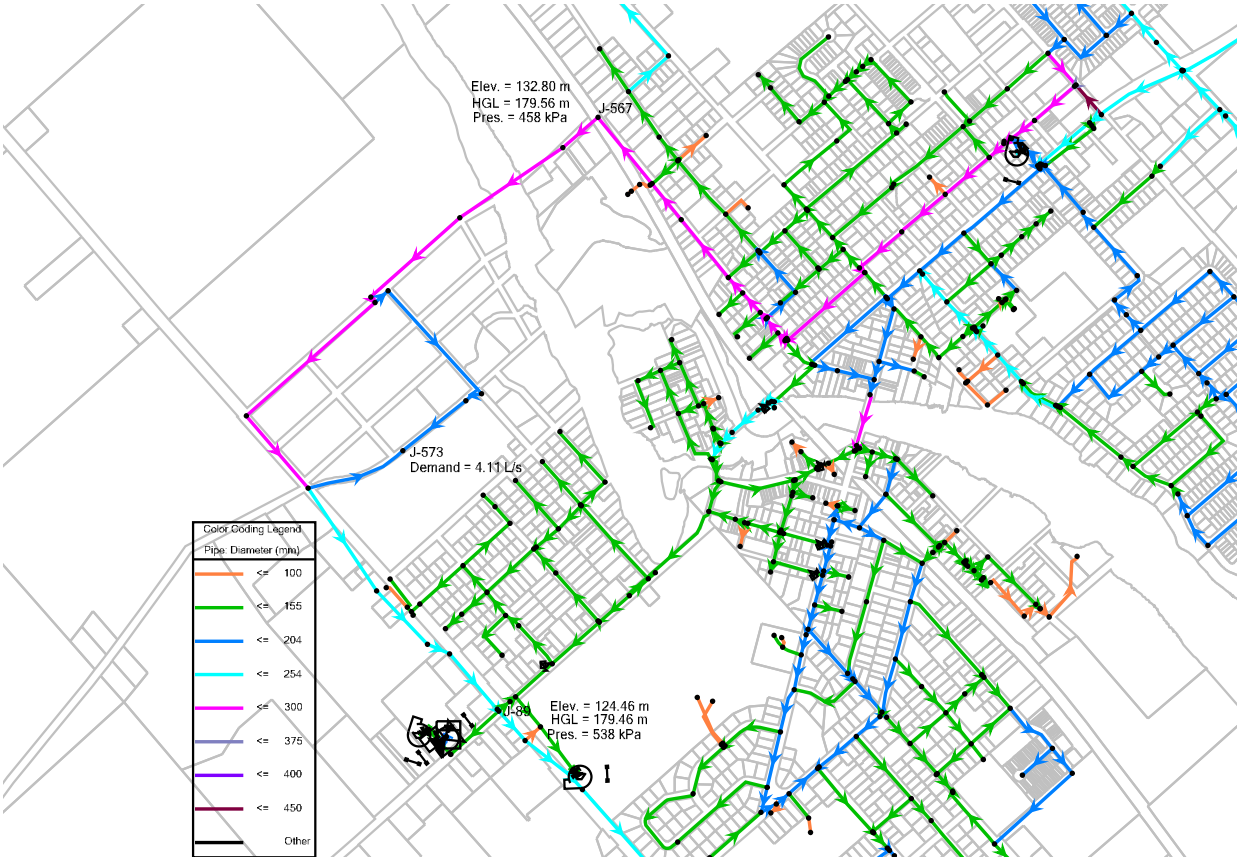
Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29 and 300 mm Mississippi River Crossing
ADD (Yr 2)



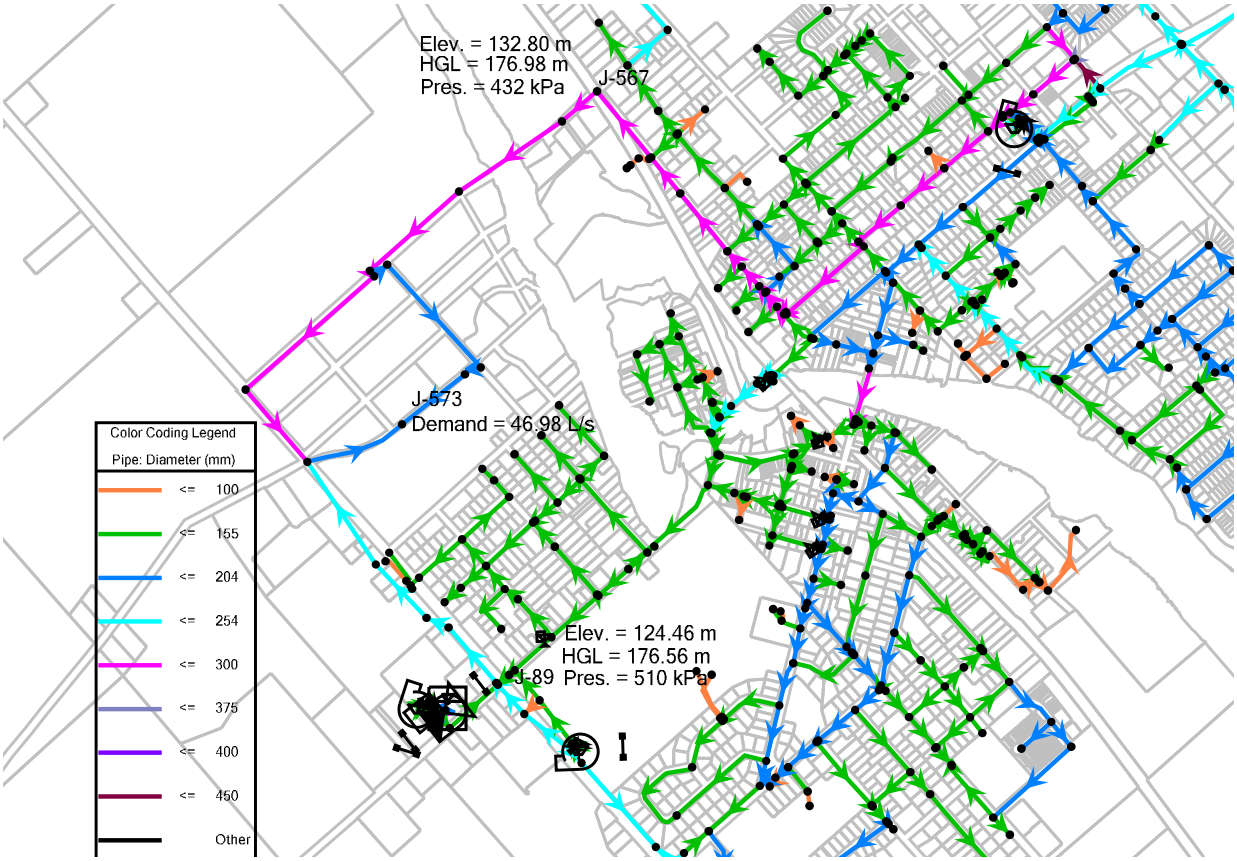
Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29 and 300 mm Mississippi River Crossing
ADD (Yr 3)



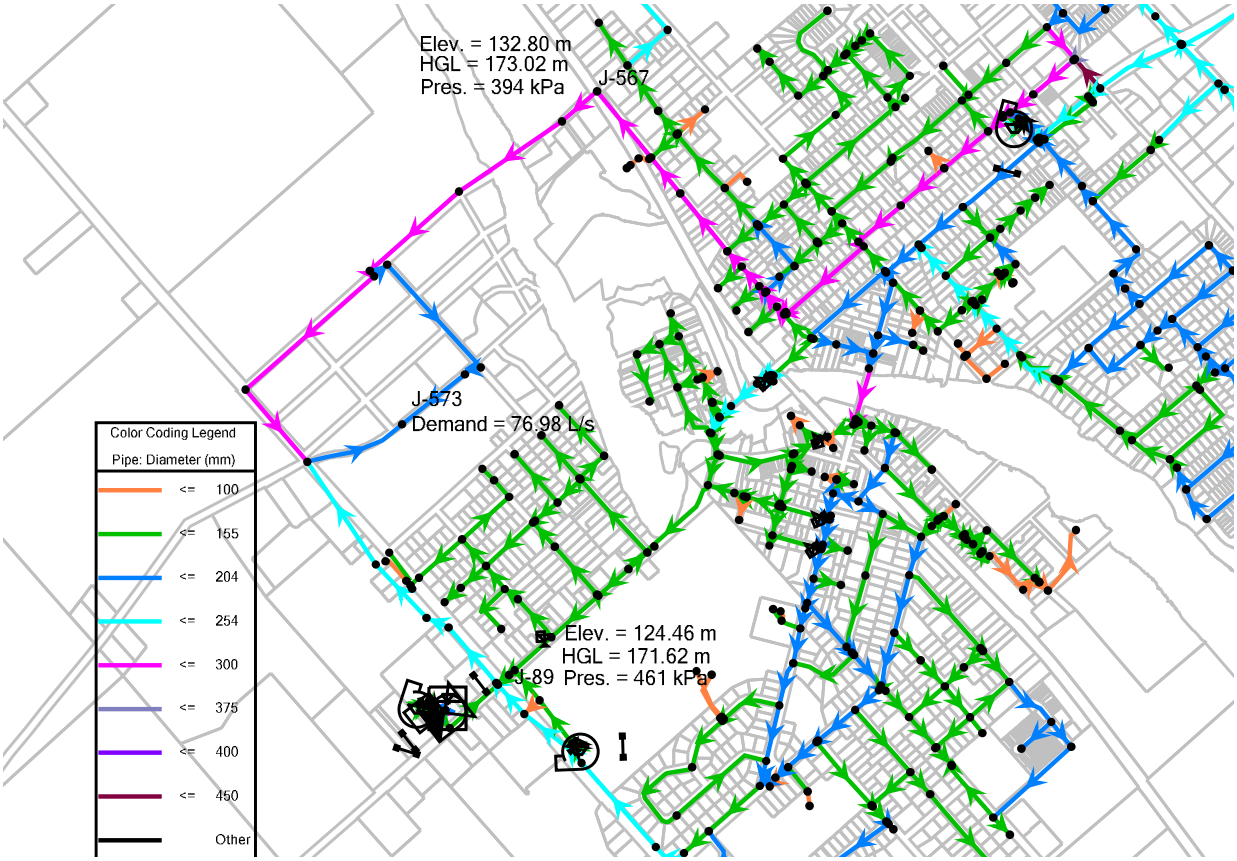
Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29 and 300 mm Mississippi River Crossing
ADD (Yr 4)



Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29 and 300 mm Mississippi River Crossing
MDD+FF (Year 1, RFF=45 L/s)



Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29 and 300 mm Mississippi River Crossing
MDD+FF (Year 1, RFF=75 L/s)



Brown Lands Boundary Condition
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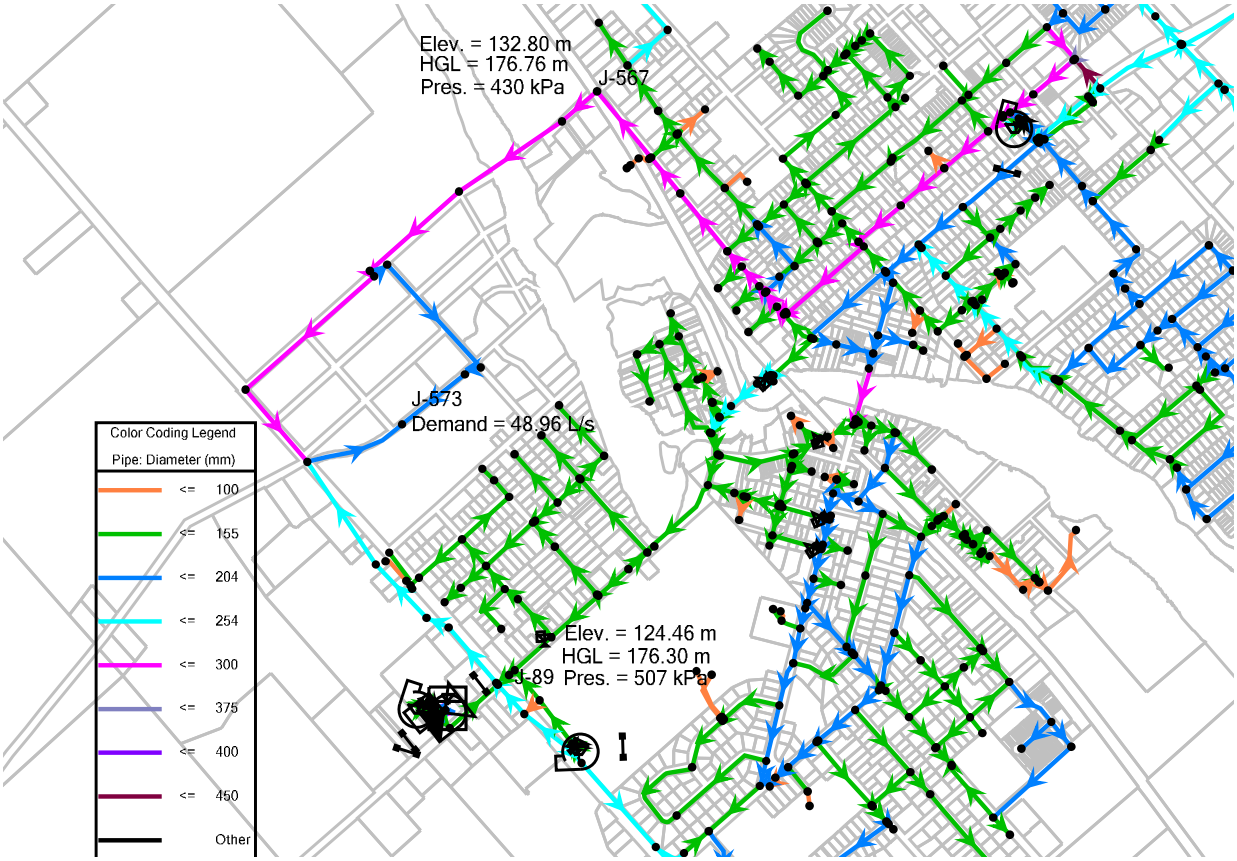
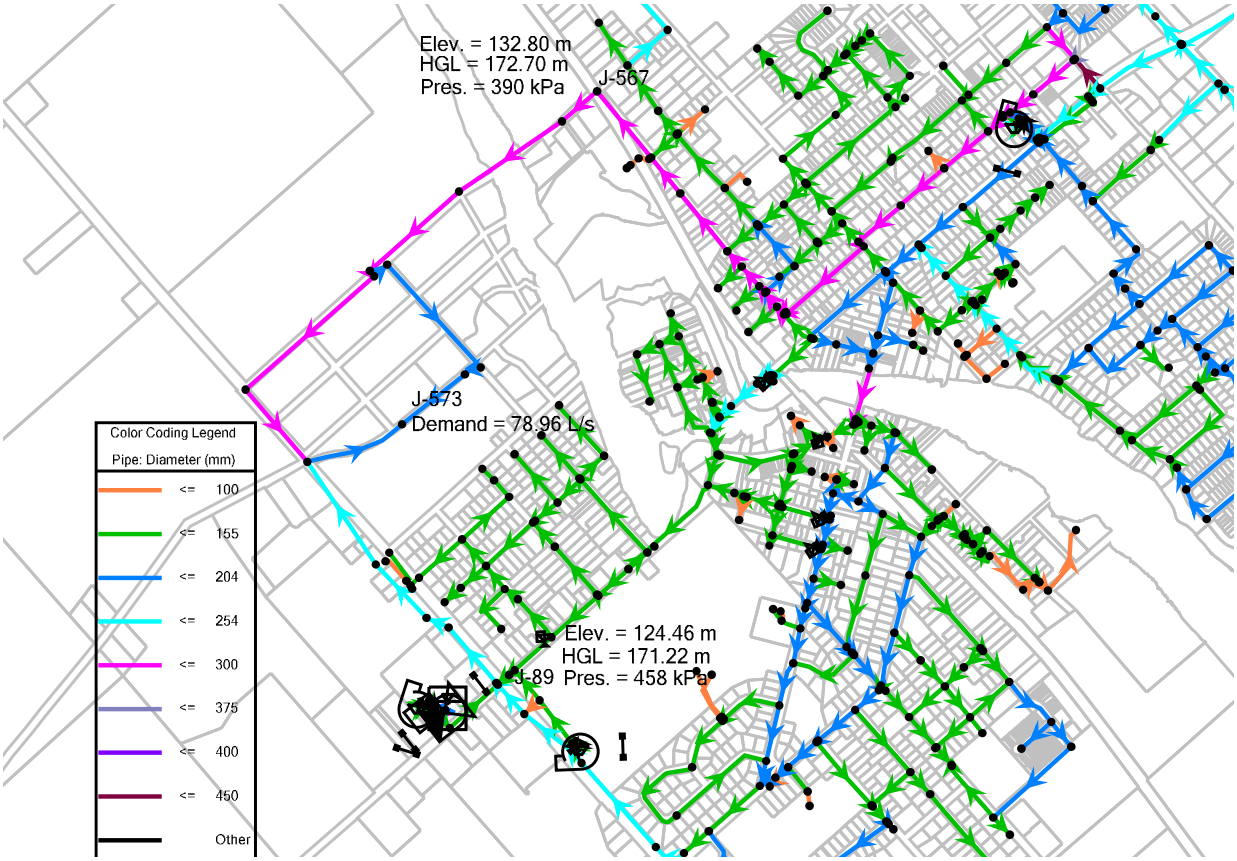
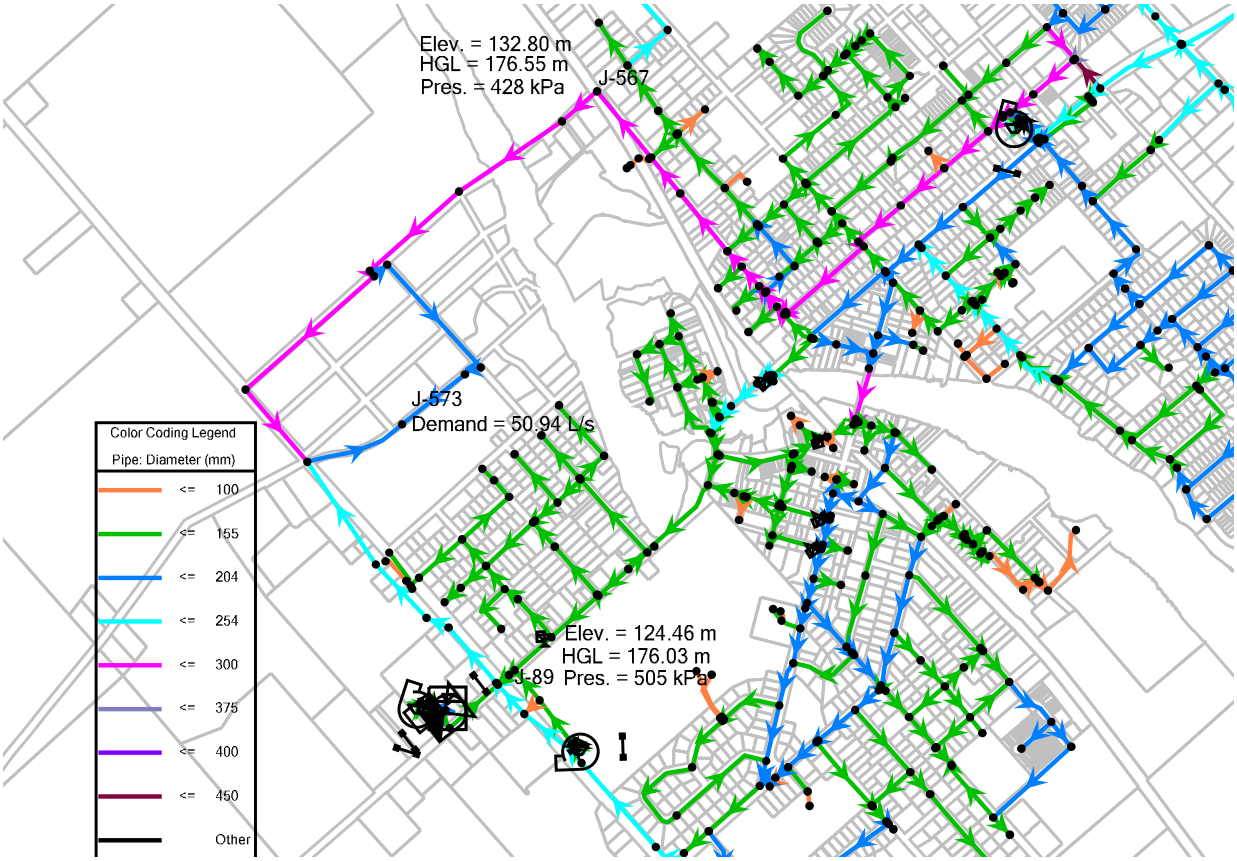
MDD+FF (Year 2, RFF=45 L/s)



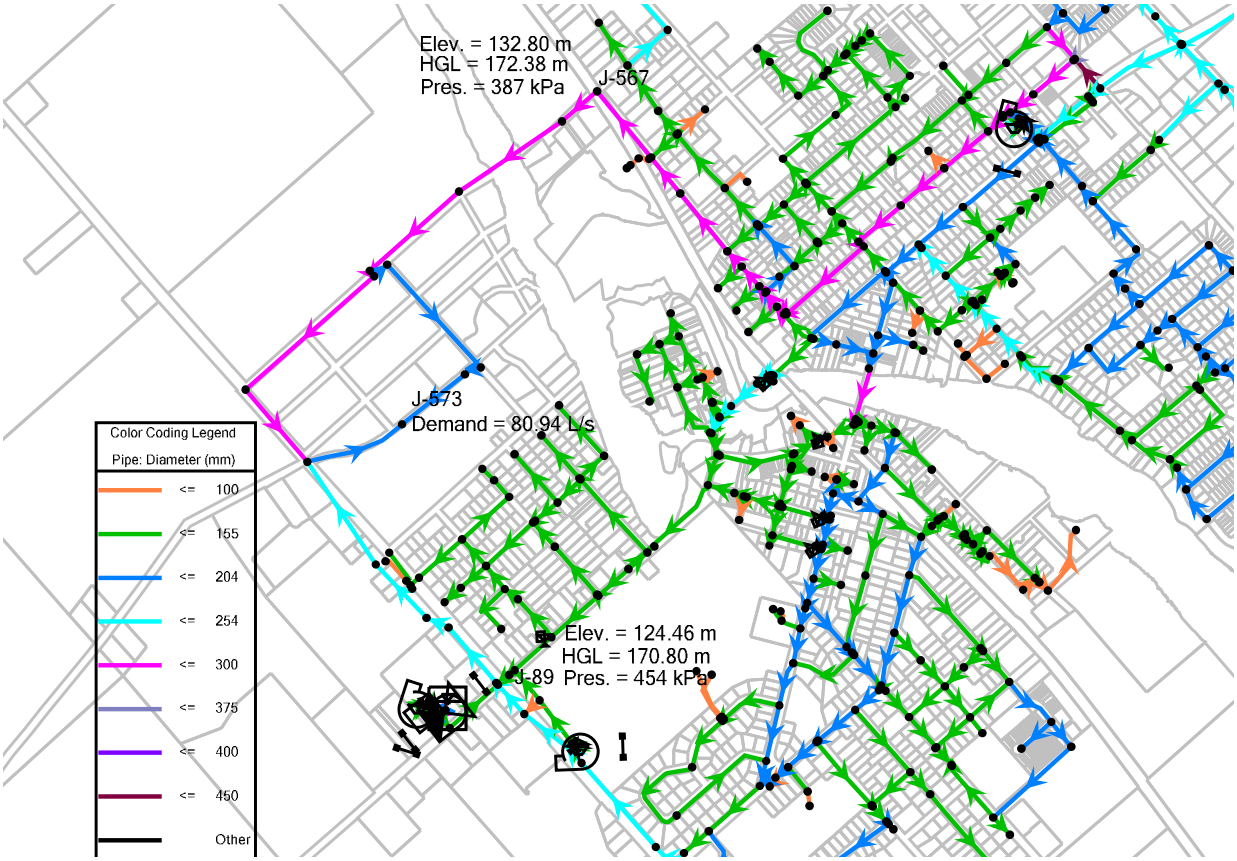
Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29 and 300 mm Mississippi River Crossing
MDD+FF (Year 2, RFF=75 L/s)



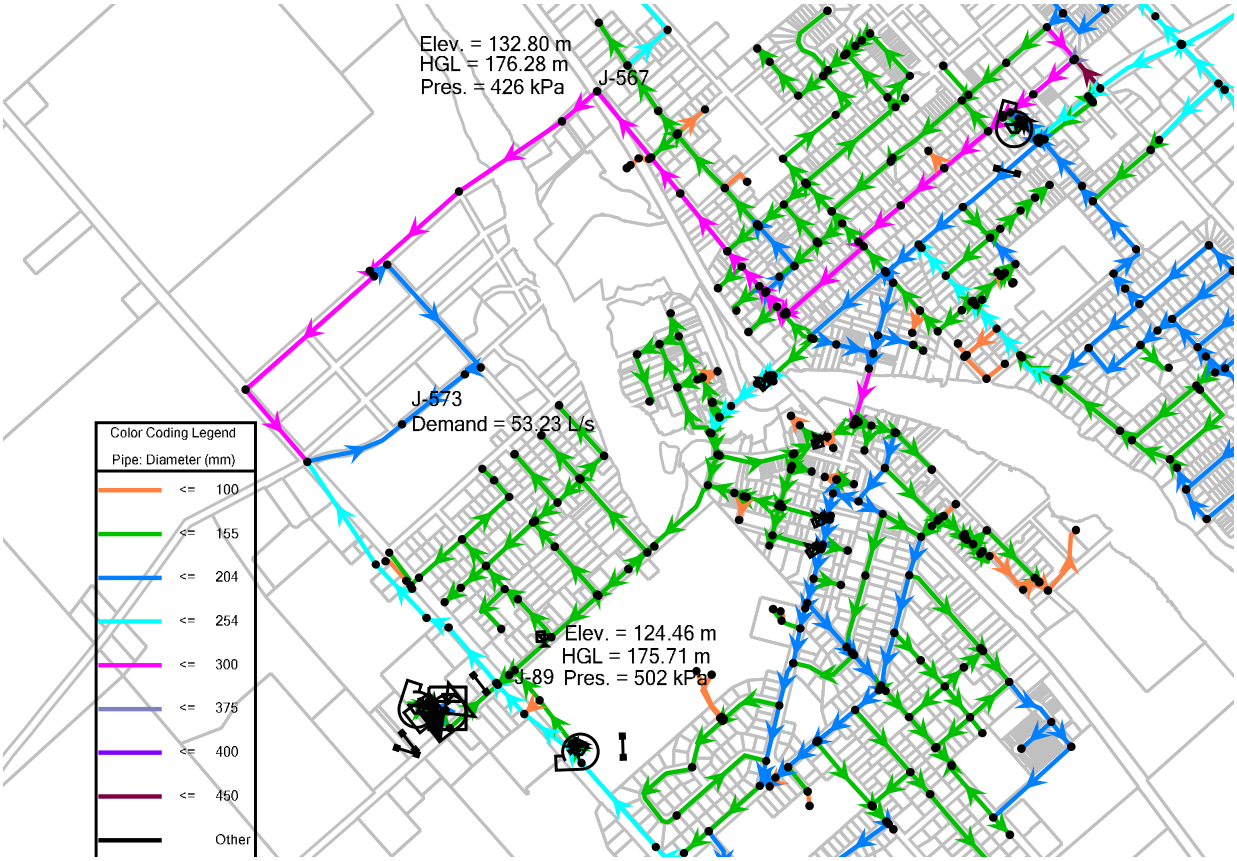
Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29 and 300 mm Mississippi River Crossing
MDD+FF (Year 3, RFF=45 L/s)



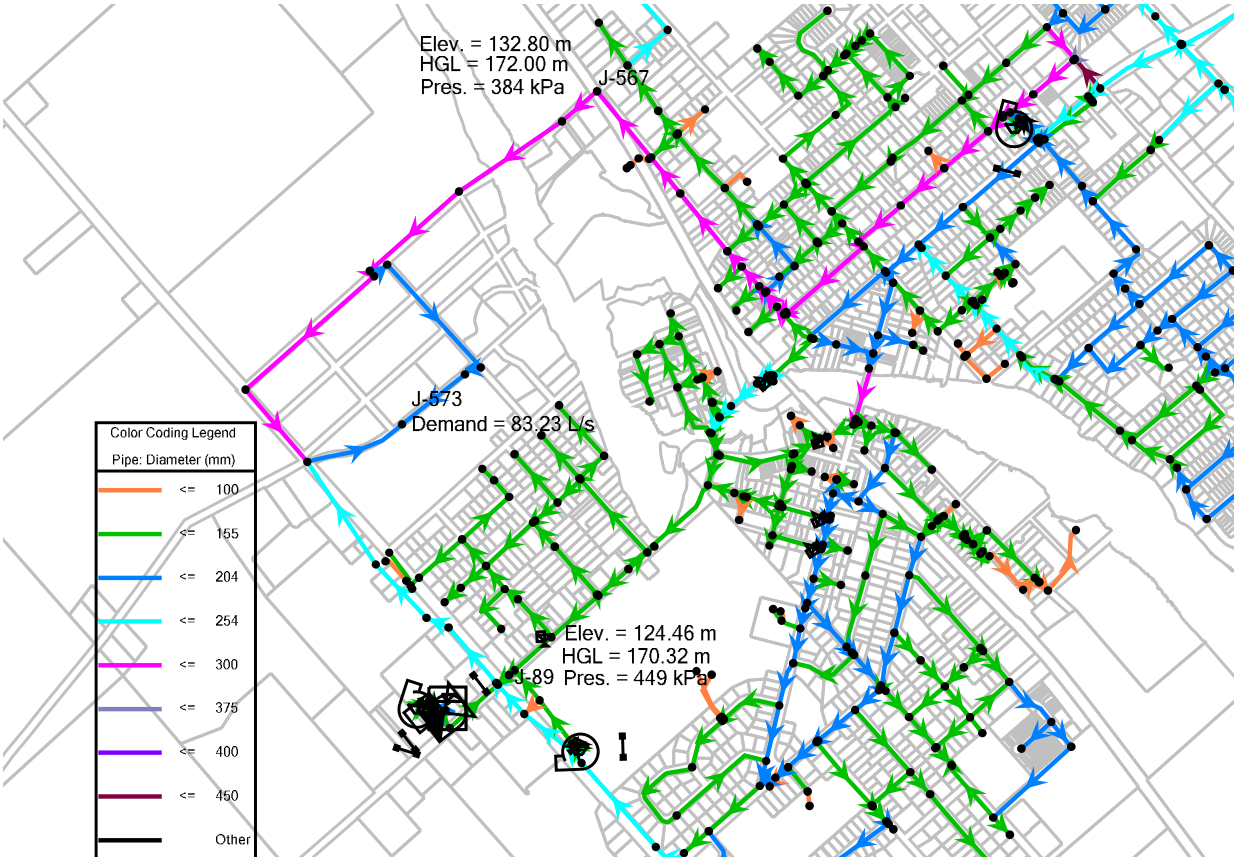
Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29 and 300 mm Mississippi River Crossing
MDD+FF (Year 3, RFF=75 L/s)



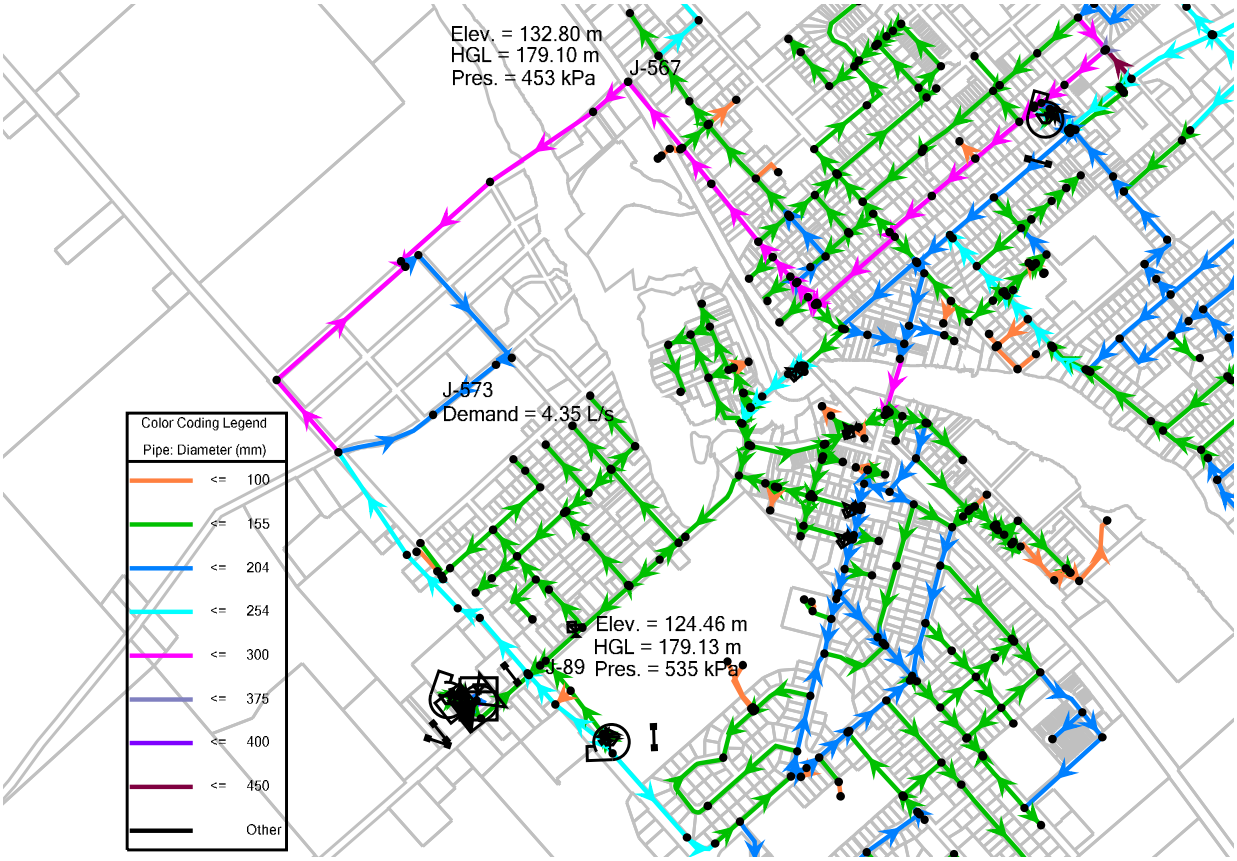
Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29 and 300 mm Mississippi River Crossing
MDD+FF (Year 4, RFF=45 L/s)



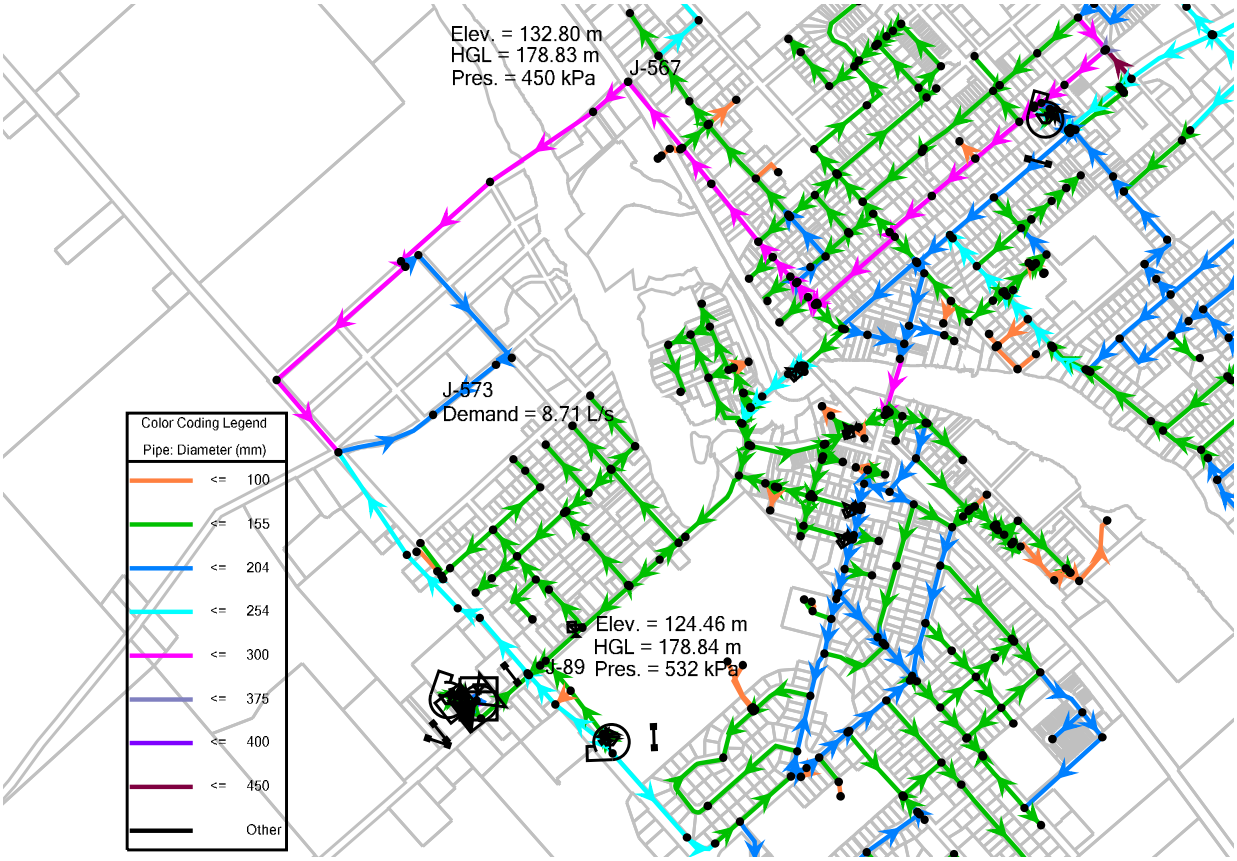
Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29 and 300 mm Mississippi River Crossing
MDD+FF (Year 4, RFF=75 L/s)



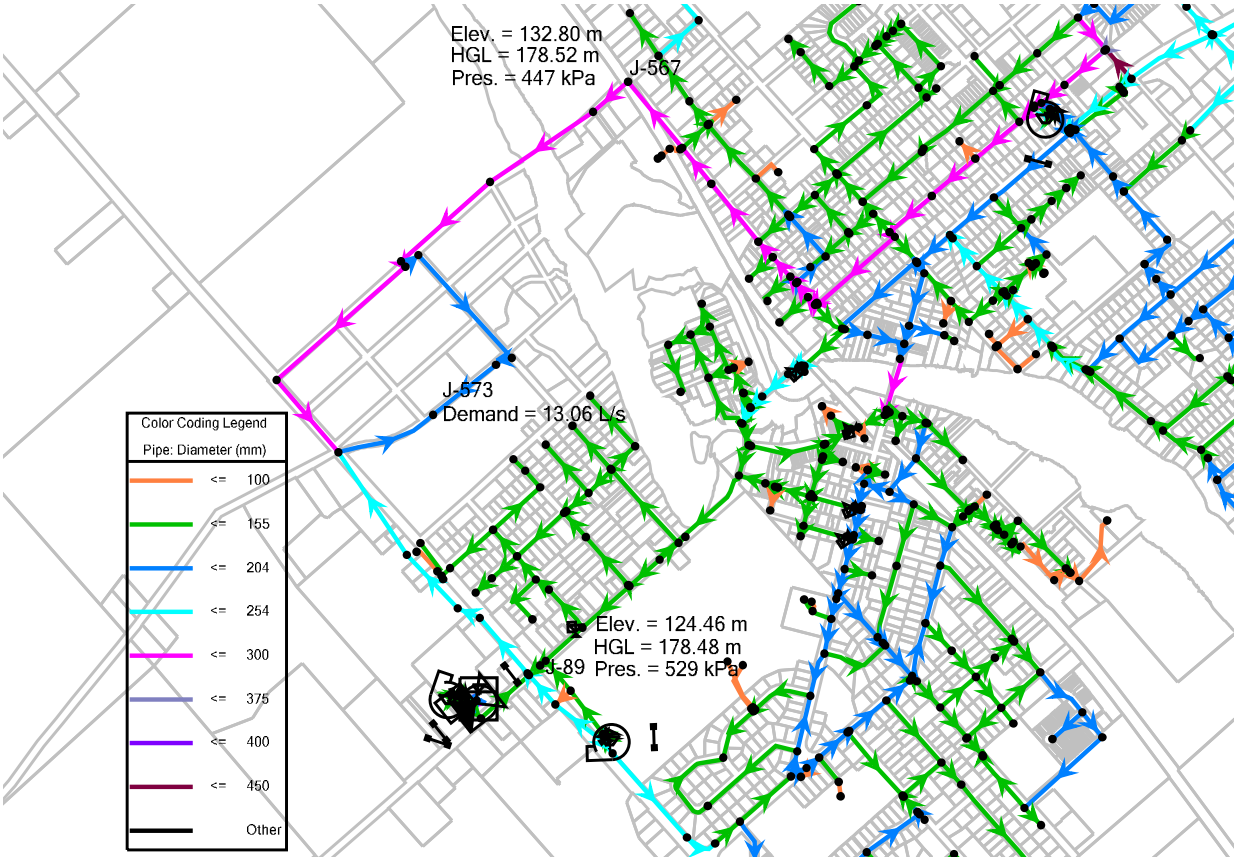
Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29 and 300 mm Mississippi River Crossing
PHD (Year 1)



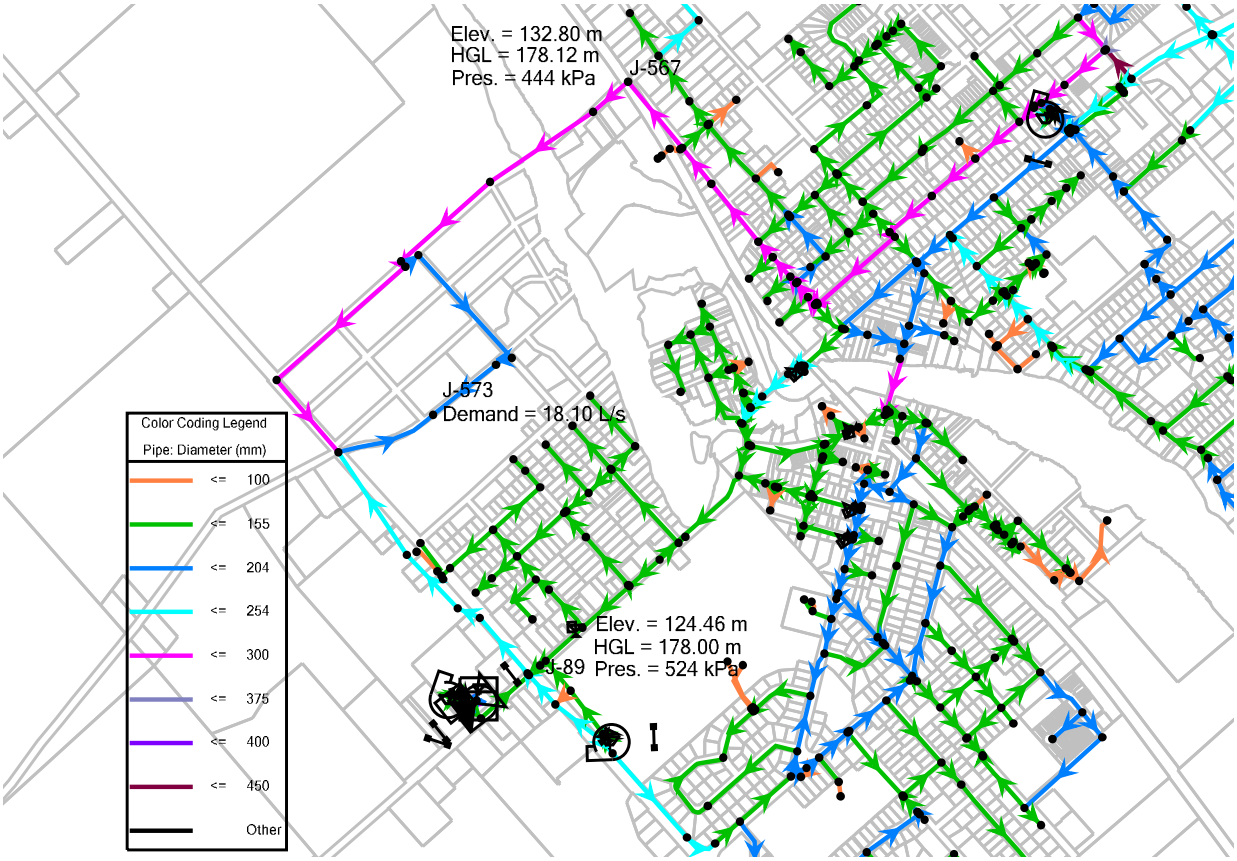
Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29 and 300 mm Mississippi River Crossing
PHD (Year 2)



Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29 and 300 mm Mississippi River Crossing
PHD (Year 3)



Brown Lands Boundary Condition
250 mm Upgrade Along County Road 29 and 300 mm Mississippi River Crossing
PHD (Year 4)



From: Mahad Musse <mmusse@jlrichards.ca>
Sent: Thursday, February 2, 2023 4:29 PM
To: Trevor McKay
Cc: Melanie Riddell; 'Evan Garfinkel'; 'David Shen'; 'Cory Smith'; Annie Williams; Mark Buchanan
Subject: RE: Almonte - Updated Hydraulic Boundary Conditions and Trunk Sewer Capacity
Attachments: Attachment 1 - Brown Lands BC Results - Jan2023.pdf

Good Afternoon Trevor,

Please find attached the requested hydraulic boundary conditions for the following two (2) revised scenarios, as requested by the Developer's Engineer:

1) Revised Scenario 2 Boundary Conditions – 300 mm Upgrade Along County Road 29 (from Well 6 to Strathburn Street):
- 1 Connection: Boundary conditions to be provided at County Road 29 / Wylie Street.
- 300mm Watermain Upgrade along County Road 29 (full length from Well #6 to Strathburn Street): Average Day and Max Day + FF under all 4 Years' demands. If not feasible, will note as such below.

2) Revised Scenario 3 Boundary Conditions – 300 mm Upgrade Along County Road 29 (from Well 6 to Strathburn Street) and 300 mm Mississippi River Crossing:
- 2 Connections: Boundary conditions to be provided at County Road 29 / Wylie Street, and at Carss Street on the east side of the river.
- 300mm Watermain Upgrade along County Road 29 (full length from Well #6 to Strathburn Street) AND 300mm Mississippi River Crossing: Average Day and Max Day + FF under all 4 Years' demands. If not feasible, will note as such.

The proposed development located on the Brown Lands within the Municipality of Mississippi Mills (Municipality), was simulated using the Municipality's existing hydraulic water model (2017) to determine hydraulic boundary conditions based on theoretical water demands and fire flows provided by the Developer's Engineer (refer to attached). The 300 mm diameter watermain upgrade on Victoria Street between Martin Street North and Menzie Street was included in the model.

Table 1 summarizes the theoretical water demands that were included in the model at junction node J-573. As an addition request by the developer, a fire flow requirement (Max Daily + FF3) of 150 L/s was modelled. It is noted that hydraulic boundary conditions for maximum day + fire flow under the revised Scenario 2 could only be provided for Year 1 to 4 of Max Daily + FF1 (45 L/s). Furthermore, results the Max Daily + FF3 (150 L/s) for the revised Scenario 3 could only be provided for Years 1 and 2. Results for the maximum available fire flow are provided in Table 2.

Table 1: Theoretical Water Demands

	High Pressure	Max Daily + FF1 (45L/s)	Max Daily + FF2 (75L/s)	Max Daily + FF3 (150 L/s)	Peak Hour
Year 1	0.99	46.98	76.98	151.98	4.35
Year 2	1.98	48.96	78.96	153.96	8.71
Year 3	2.97	50.94	80.94	155.94	13.06
Year 4	4.11	53.23	83.23	158.23	18.10

The hydraulic boundary conditions have been generated at the connection points noted above with results summarized in Table 2 and Table 3 (refer to Attachment 1 for WaterCAD model outputs). Connection points are labelled in the model as follows:

- Junction nodes J-89 for Revised Scenario 2; and
- Junction nodes J-89 and J-567 for Revised Scenario 3.

The maximum day + fire flow and peak hour scenarios assume a maximum elevated tank level of 180.00m with all well pumps on and the new booster PUMP-A turned off. The average day scenario assumes all pumps are turned off. Demands were placed within the Brown Lands on junction node J-573, the elevation of this node was approximated as 117.44 m based on the surrounding elevations found within the model and information from Google Earth.

Table 2: Revised Scenario 2 Boundary Conditions – 300 mm Upgrade Along County Road 29 (from Well 6 to Strathburn)

Demand Case	Connection at County Road 29 / Almonte Street (J-89, Elev. 124.46m)	
	Pressure (kPa)	HGL (m)
Year 1 – Average Day Demand	532	178.87
Year 2 – Average Day Demand	530	178.61
Year 3 – Average Day Demand	527	178.32
Year 4 – Average Day Demand	523	177.95
Year 1 - Max Daily + FF1 (46.98 L/s)	306	155.69
Year 2 - Max Daily + FF1 (48.96 L/s)	283	153.43
Year 3 - Max Daily + FF1 (50.94 L/s)	260	151.07
Year 4 - Max Daily + FF1 (53.23 L/s)	233	148.23
Year 1 - Max Daily + Avail. FF (58.98 L/s)	157	140.56
Year 2 - Max Daily + Avail. FF (58.96 L/s)	158	140.58
Year 3 - Max Daily + Avail. FF (58.94 L/s)	158	140.61
Year 4 - Max Daily + Avail. FF (58.23 L/s)	168	141.60

Table 3: Revised Scenario 3 Boundary Conditions – 300 mm Upgrade Along County Road 29 (from Well 6 to Strathburn) and 300 mm Mississippi River Crossing

Demand Case	Connection at County Road 29 / Almonte Street (J-89, Elev. 124.46m)		Connection at Union Street N. / Carss Street (J-567, Elev. 132.80)	
	Pressure (kPa)	HGL (m)	Pressure (kPa)	HGL (m)
Year 1 – Average Day Demand	540	179.63	459	179.68
Year 2 – Average Day Demand	539	179.58	458	179.65

Year 3 – Average Day Demand	539	179.53	458	179.61
Year 4 – Average Day Demand	538	179.47	458	179.56
Year 1 - Max Daily + FF1 (46.98 L/s)	508	176.40	433	177.01
Year 2 - Max Daily + FF1 (48.96 L/s)	506	176.13	431	176.80
Year 3 - Max Daily + FF1 (50.94 L/s)	503	175.85	429	176.59
Year 4 - Max Daily + FF1 (53.23 L/s)	500	175.51	426	176.33
Year 1 - Max Daily + FF2 (76.98 L/s)	458	171.25	394	173.09
Year 2 - Max Daily + FF2 (78.96 L/s)	454	170.84	391	172.77
Year 3 - Max Daily + FF2 (80.94 L/s)	450	170.41	388	172.45
Year 4 - Max Daily + FF2 (83.23 L/s)	445	169.91	384	172.08
Year 1 - Max Daily + FF3 (151.98 L/s)	242	149.24	235	156.78
Year 2 - Max Daily + FF3 (153.96 L/s)	235	148.49	229	156.23
Year 3 - Max Daily + FF3 (154.94 L/s)	231	148.12	227	155.96
Year 4 - Max Daily + FF3 (155.23 L/s)	230	148.01	226	155.88

Based on the foregoing results, 150 L/s fire flow target is not available under scenario 2. In scenario 3, 150 L/s is expected under maximum day demand under Years 1 and 2 but limited to 149 L/s in Year 3 and 147 L/s in Year 4 while maintaining 140 kPa in the water distribution system.

Note that the foregoing model results are for current conditions and are based on computer model simulation. We have not reviewed the adequacy of the domestic demand nor the fire flow requirements for the proposed development, which remains the responsibility of the Developer's Engineer.

Disclaimer: The model results are based on current simulated operation of the Town's water distribution system. The computer model simulation is based on the best information available at this time. The operation of the water distribution system can change on a regular basis, resulting in a variation in the boundary conditions. It is further noted that the operational characteristics of the water supply system and physical properties of the watermains can change and/or deteriorate over time. These changes may affect the supply characteristics of the system and the assumptions made in developing the model, which

in turn could lead to variations in the simulation results. This should be considered by any third party undertaking simulation of system upgrades.

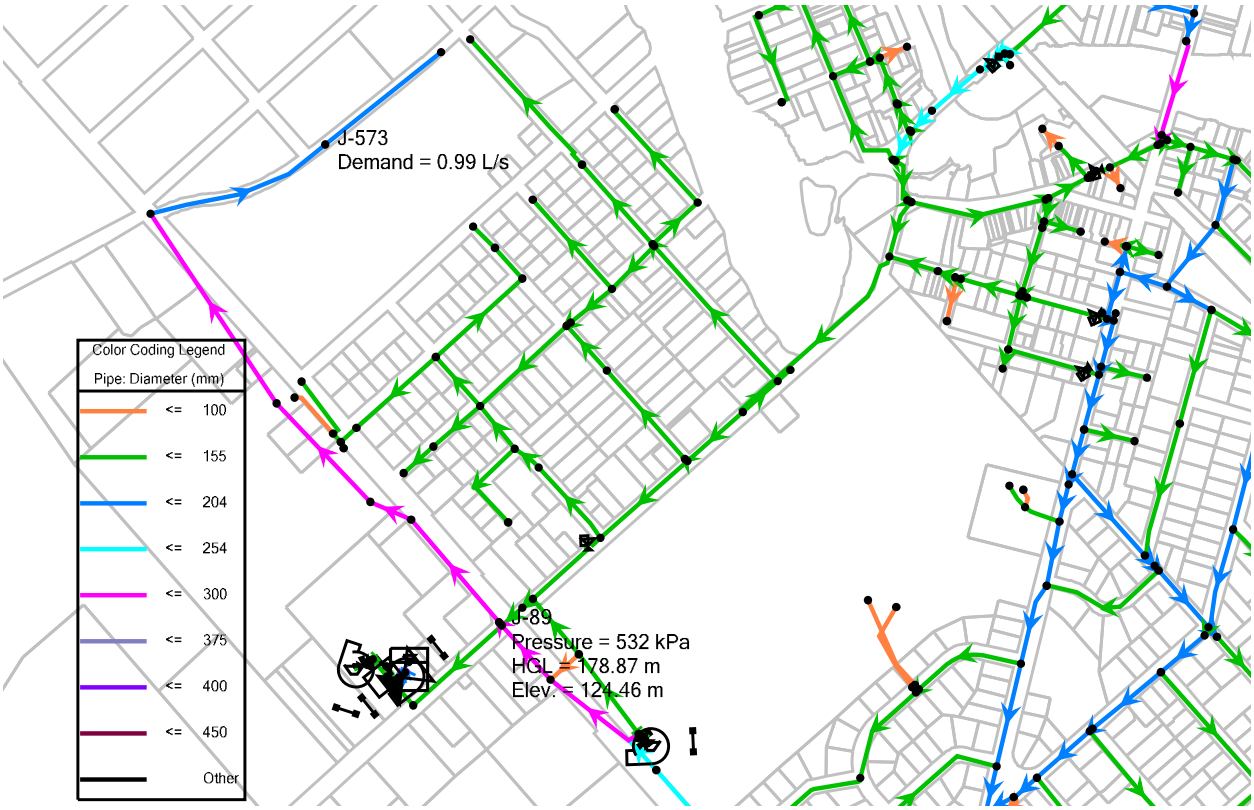
Please do not hesitate to contact us should you have any questions regarding the foregoing.

Best regards,
Mahad

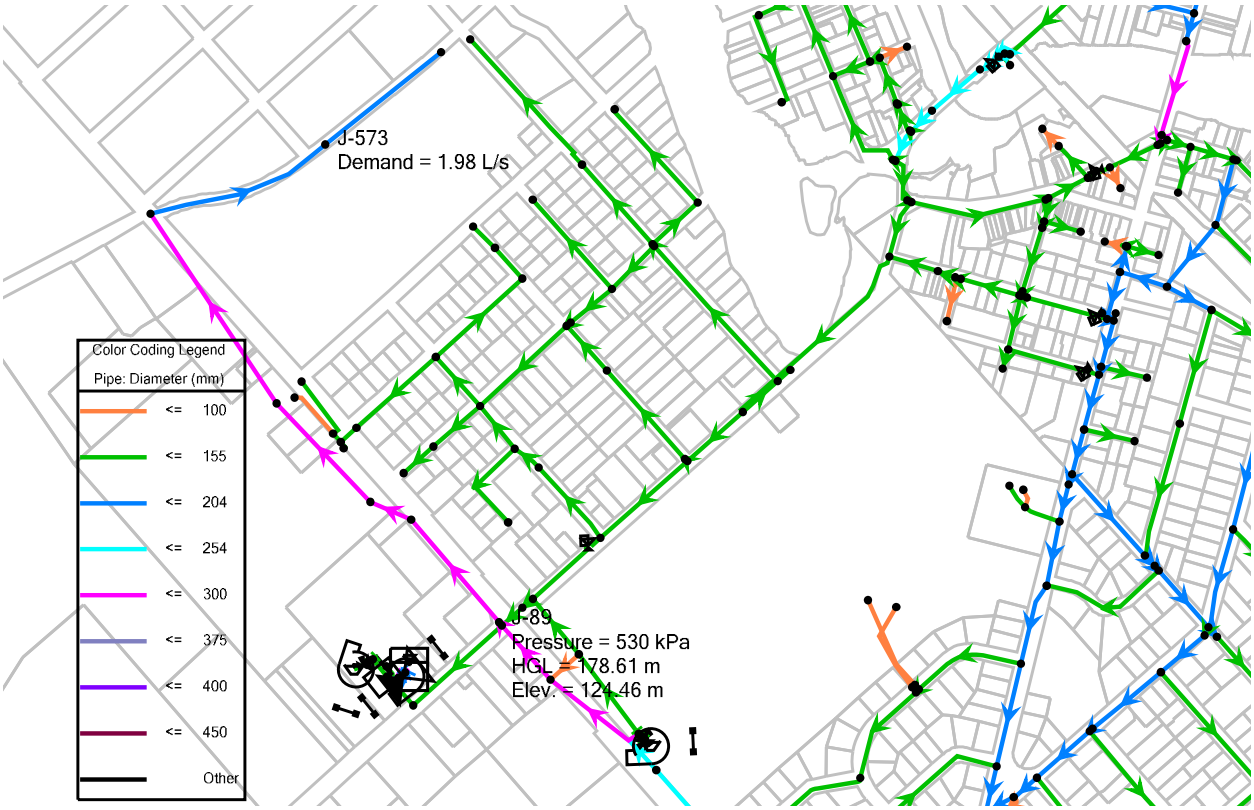
Mahad Musse, EIT
Civil Engineering Intern

J.L. Richards & Associates Limited
1000-343 Preston Street, Ottawa, ON K1S 1N4
Direct: 343-633-1501

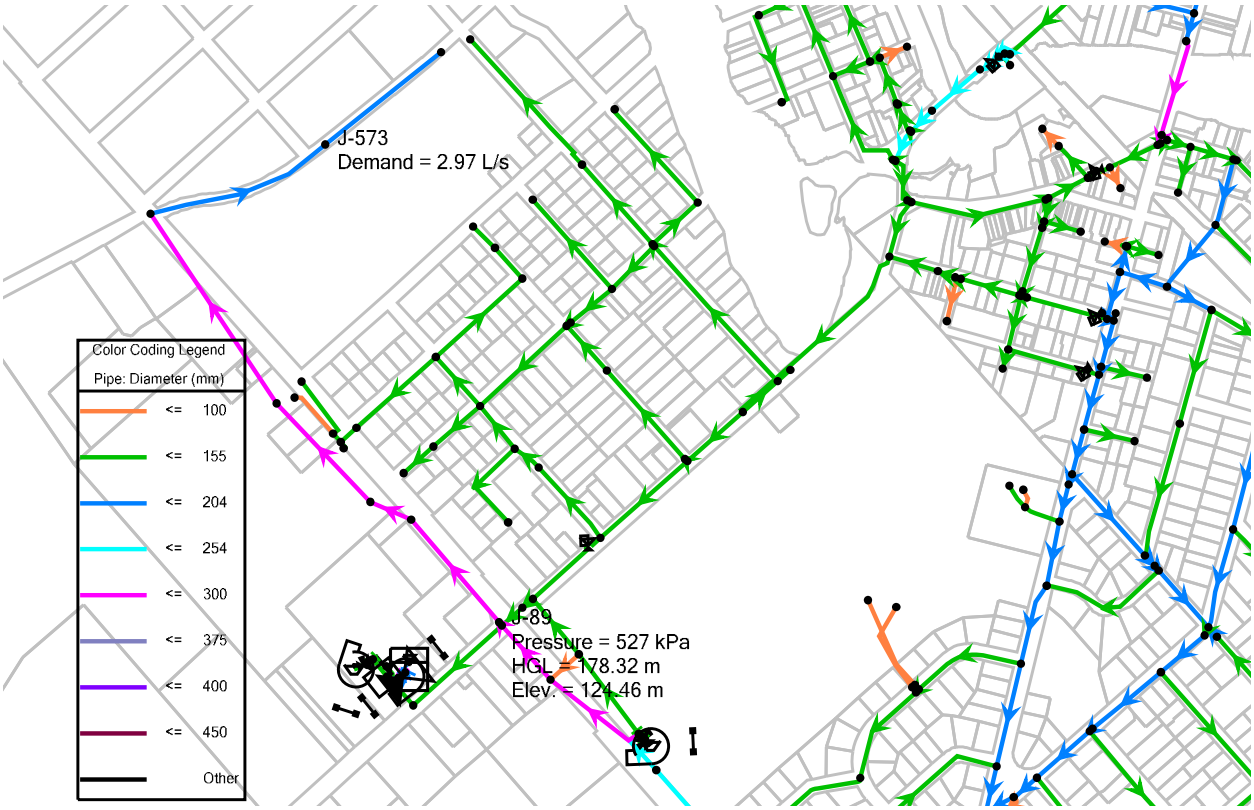
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
ADD (Year 1)



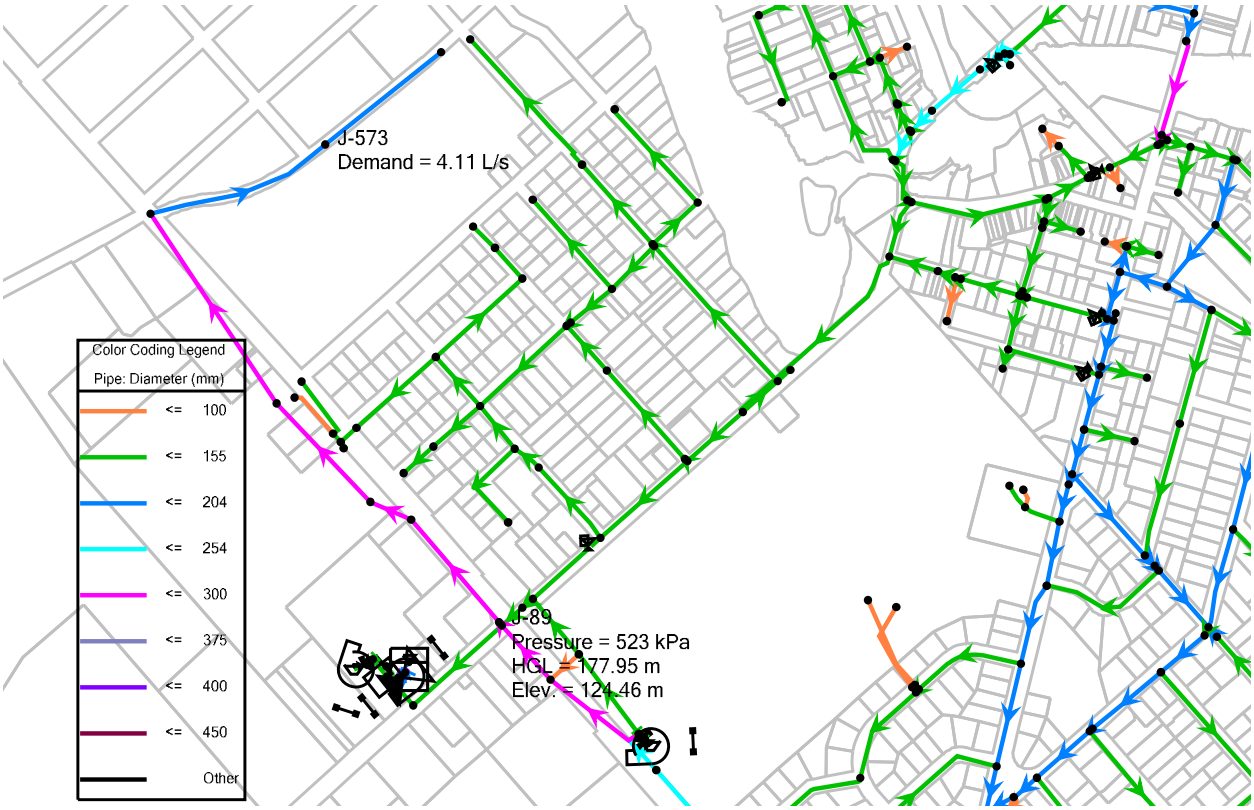
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
ADD (Year 2)



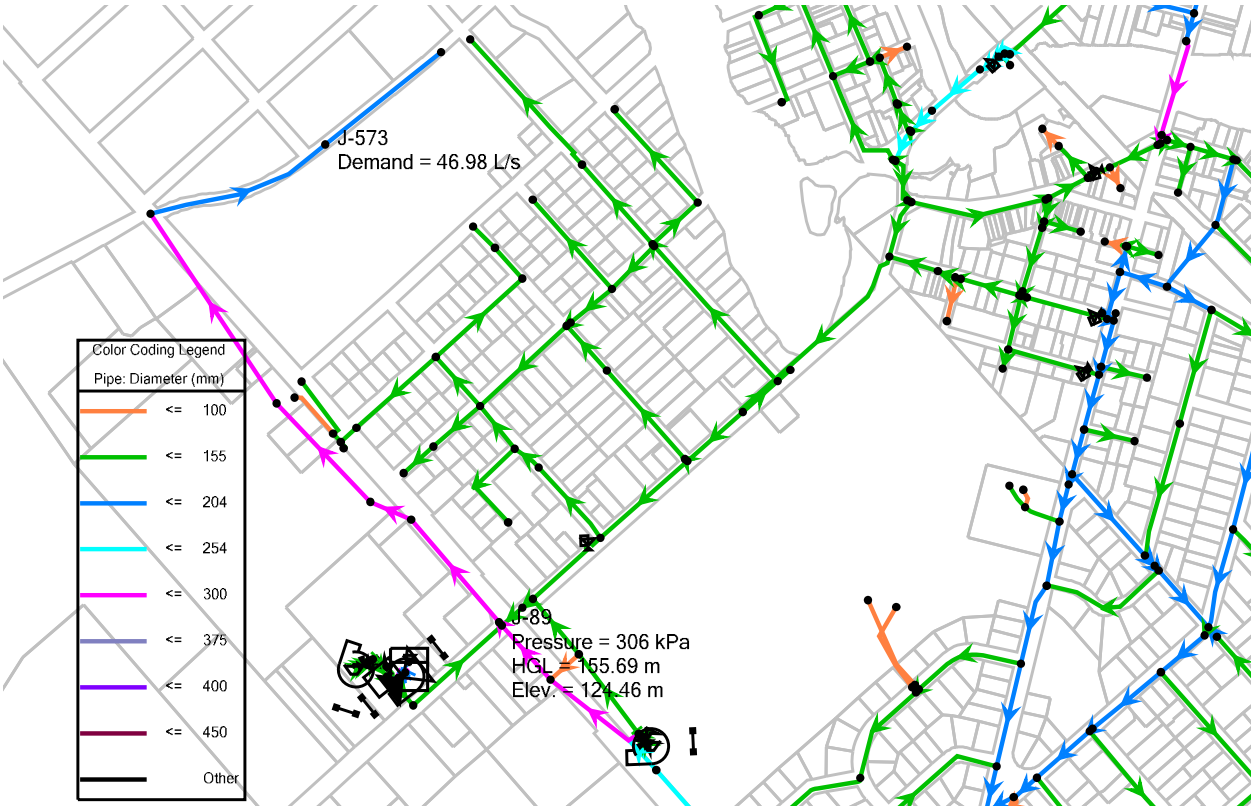
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
ADD (Year 3)



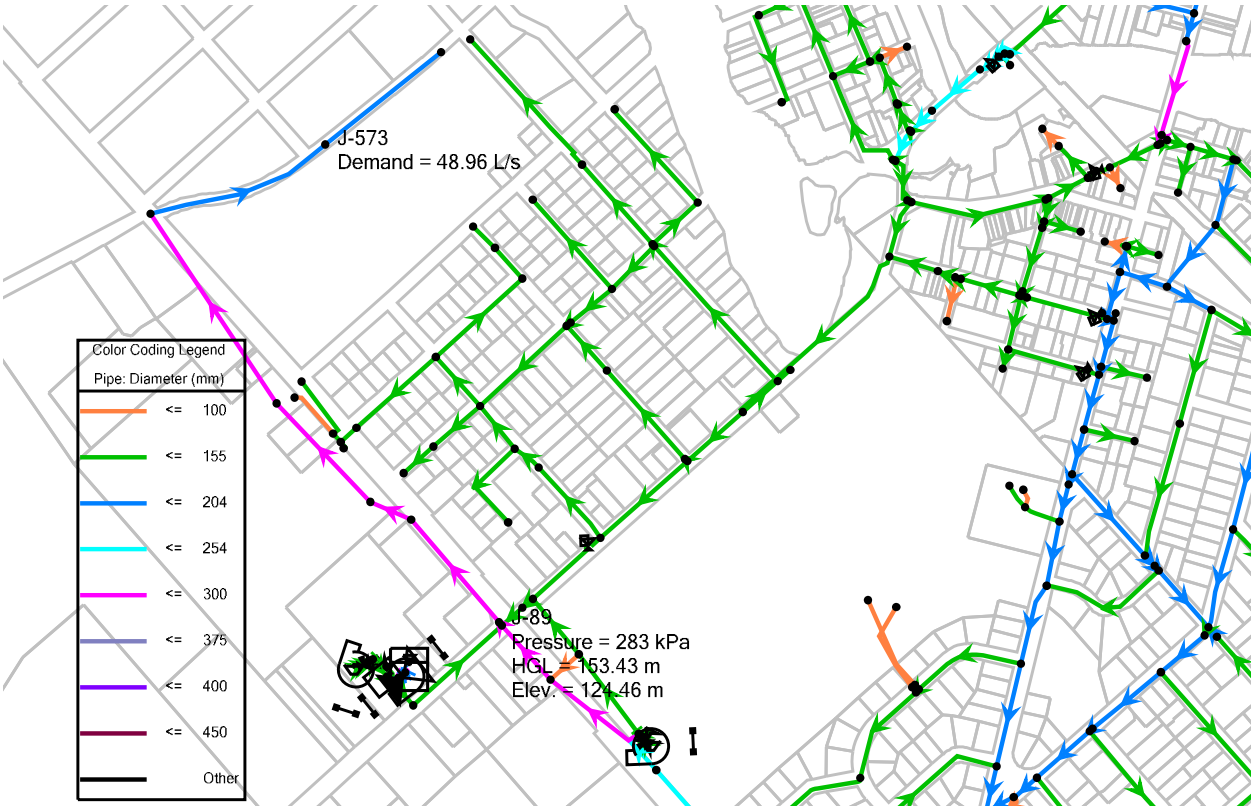
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
ADD (Year 4)



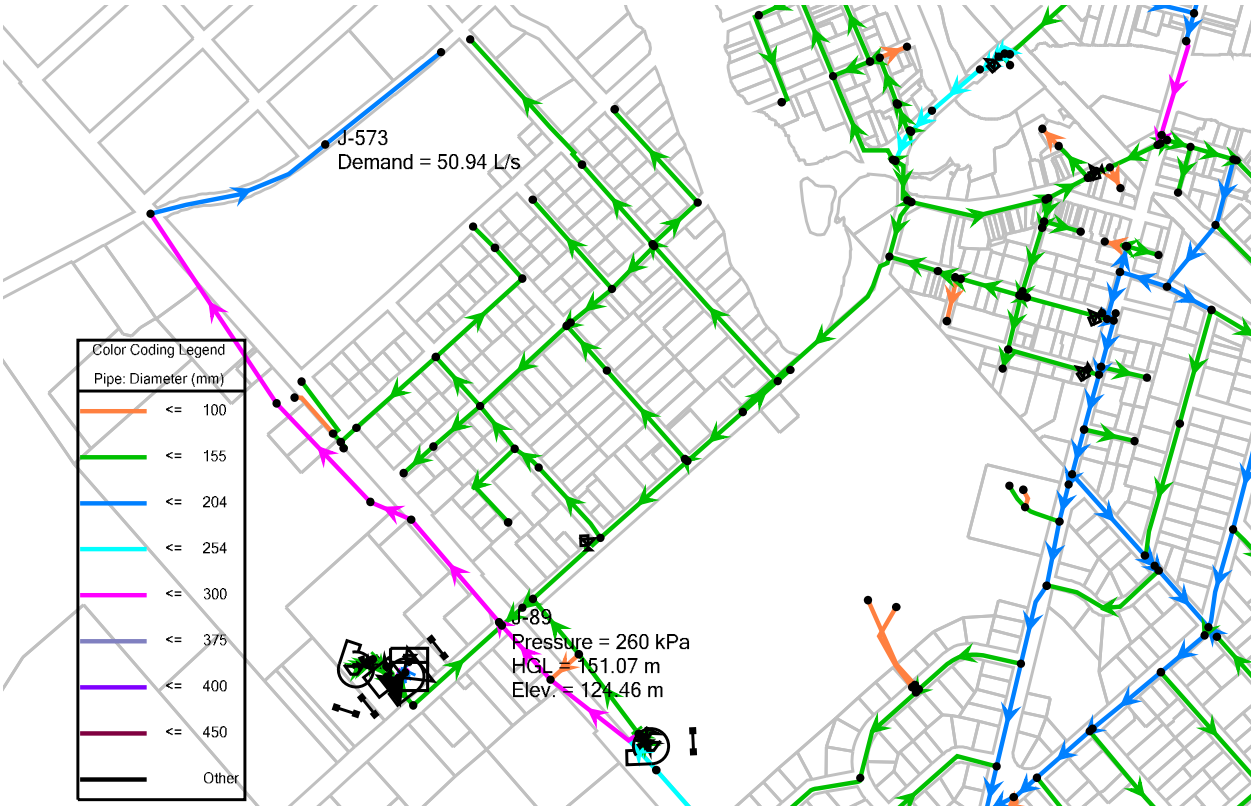
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
MDD+FF (RFF = 45 L/s, Year 1)



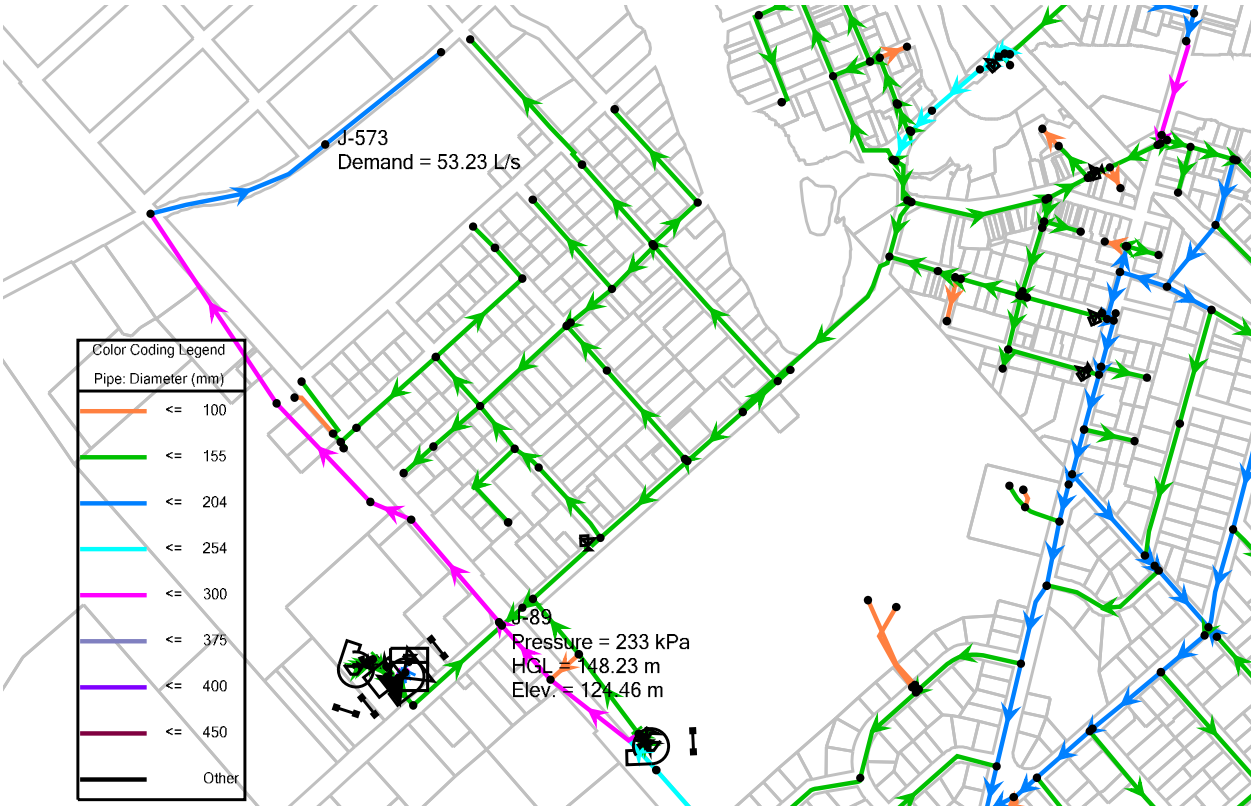
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
MDD+FF (RFF = 45 L/s, Year 2)



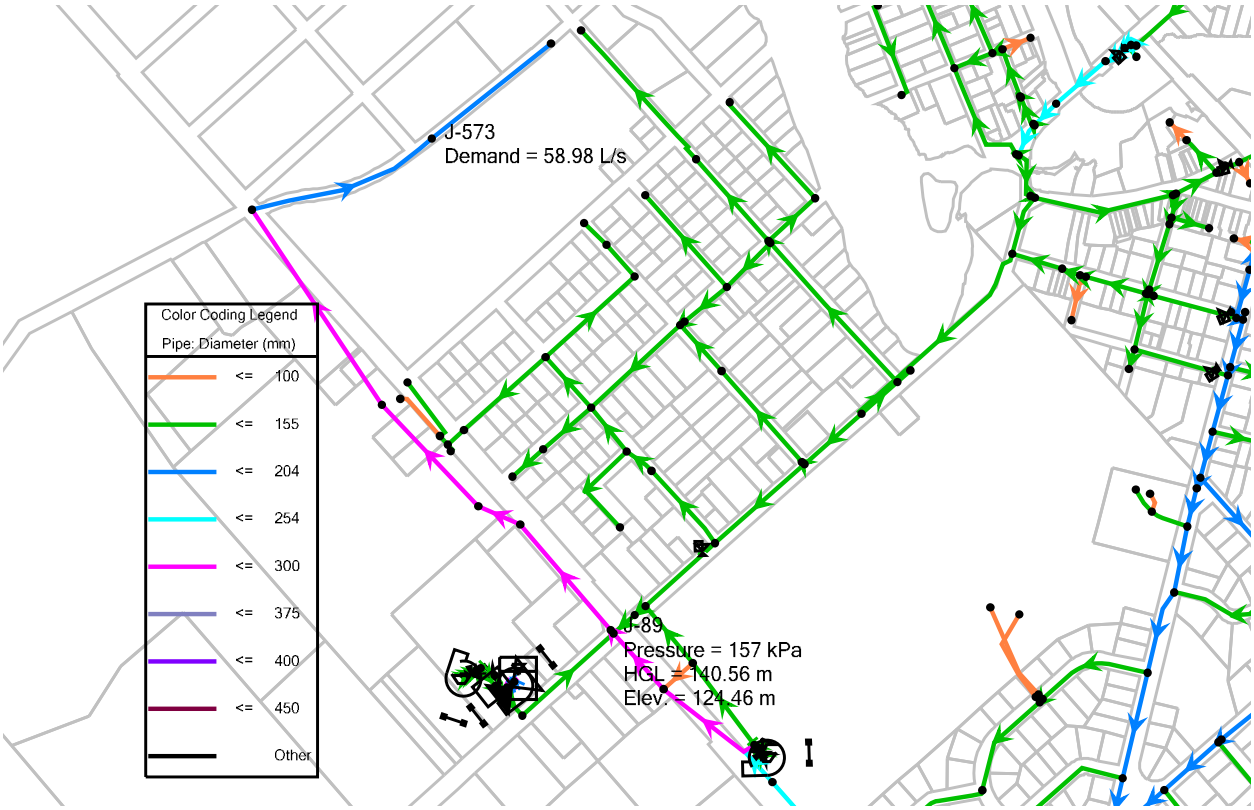
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
MDD+FF (RFF = 45 L/s, Year 3)



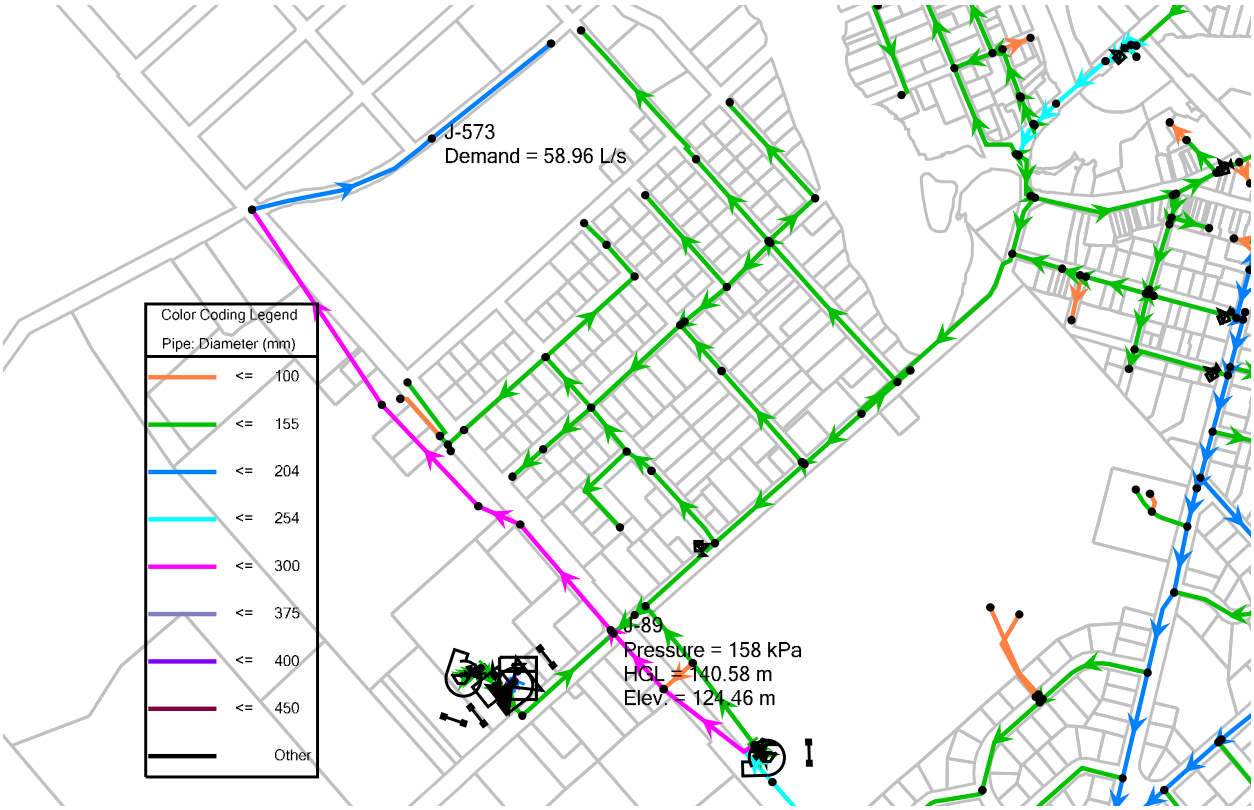
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
MDD+FF (RFF = 45 L/s, Year 4)



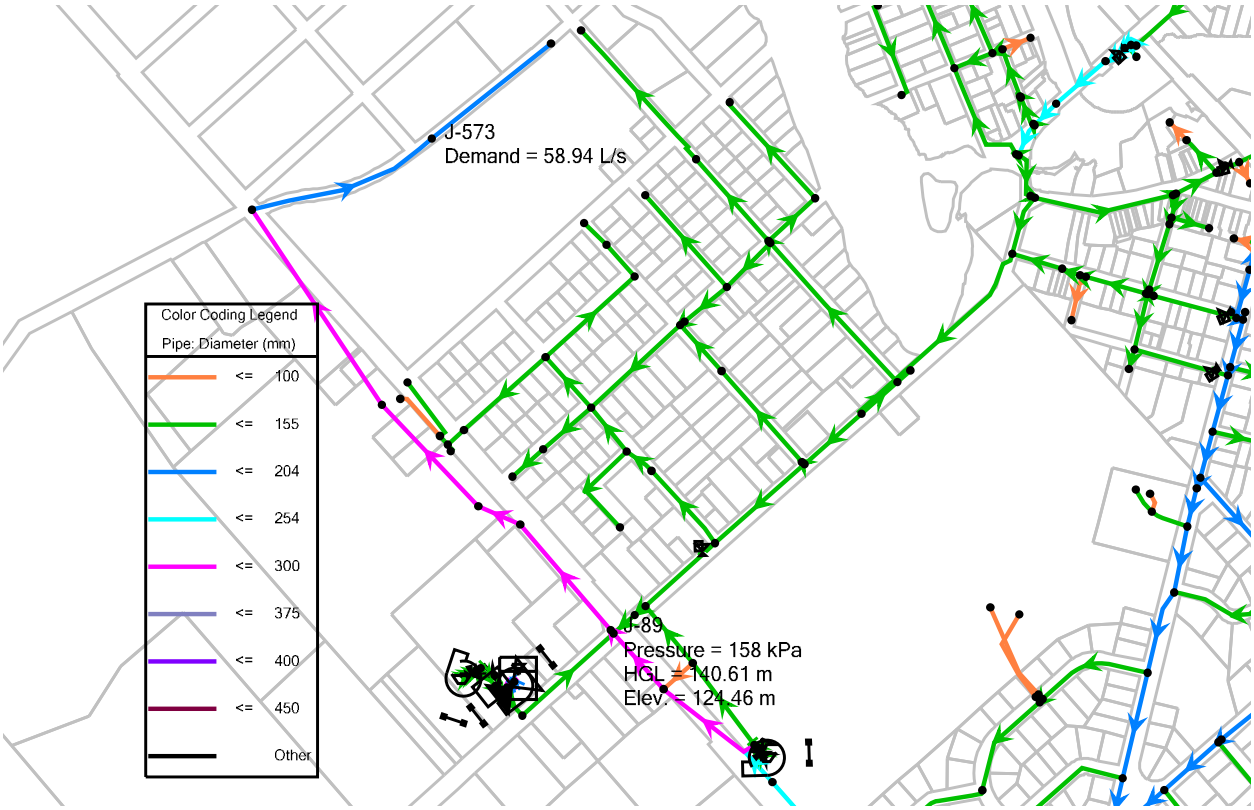
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
MDD+FF (FF= 57 L/s, Year 1)



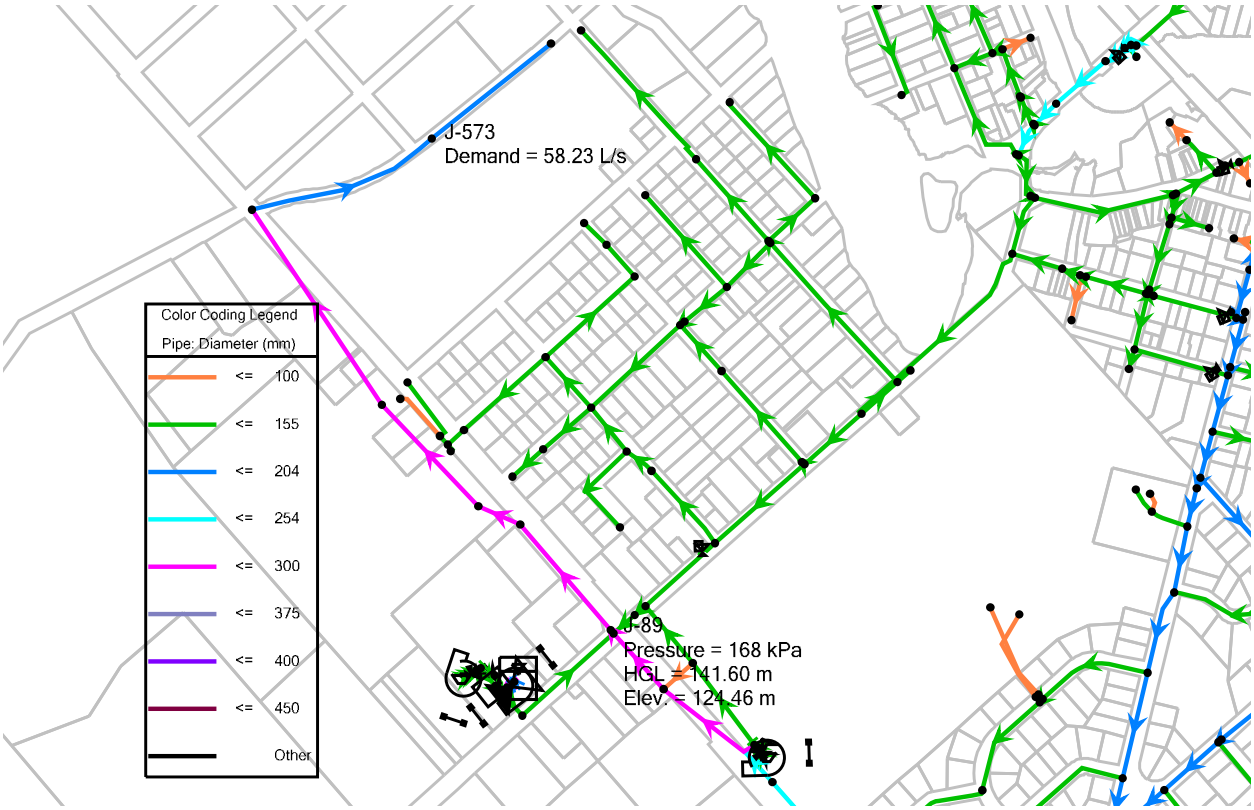
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
MDD+FF (FF= 55 L/s, Year 2)



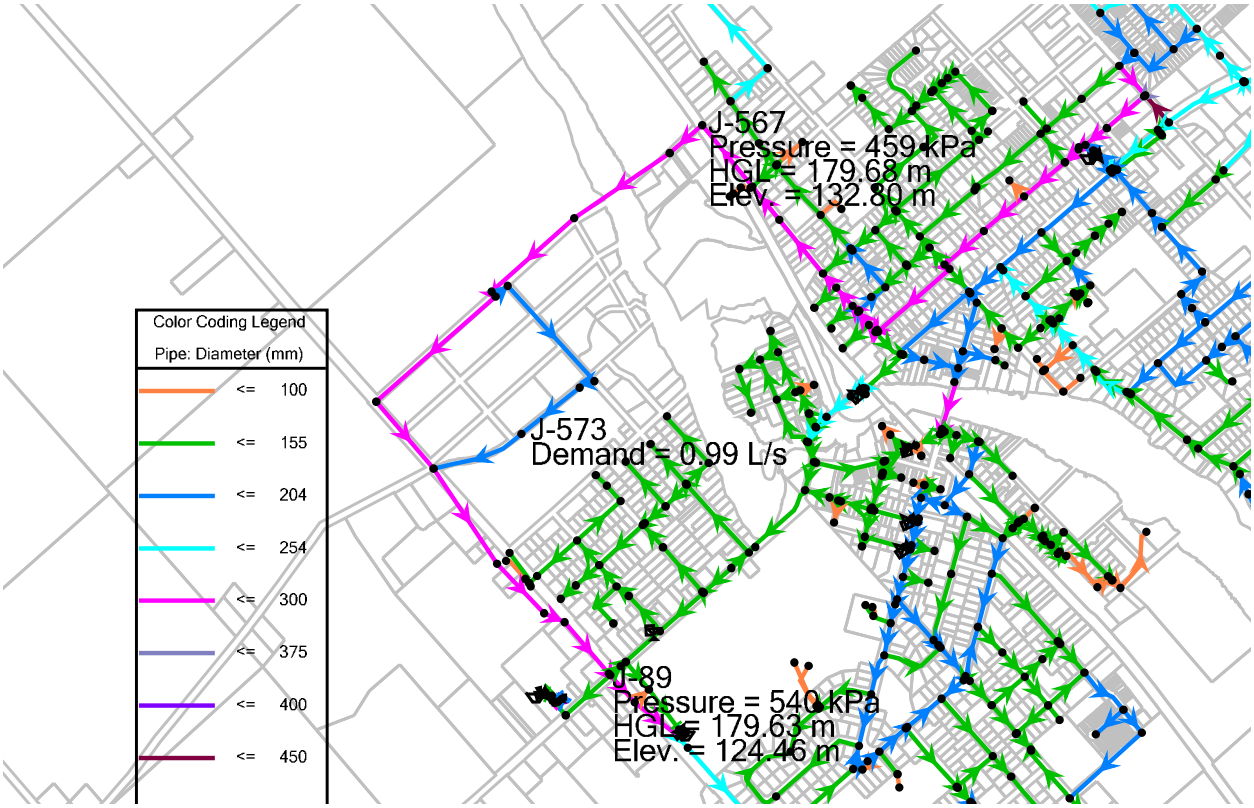
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
MDD+FF (FF= 53 L/s, Year 3)



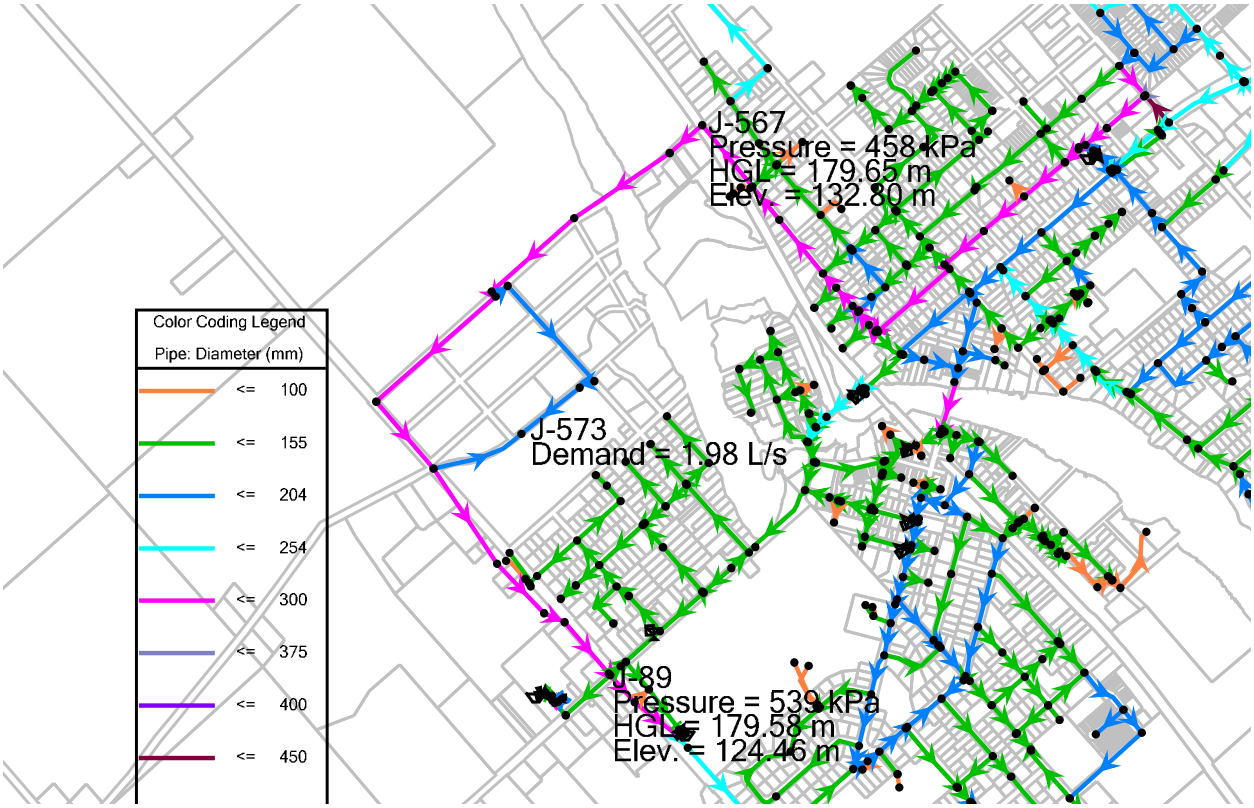
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
MDD+FF (FF= 50 L/s, Year 4)



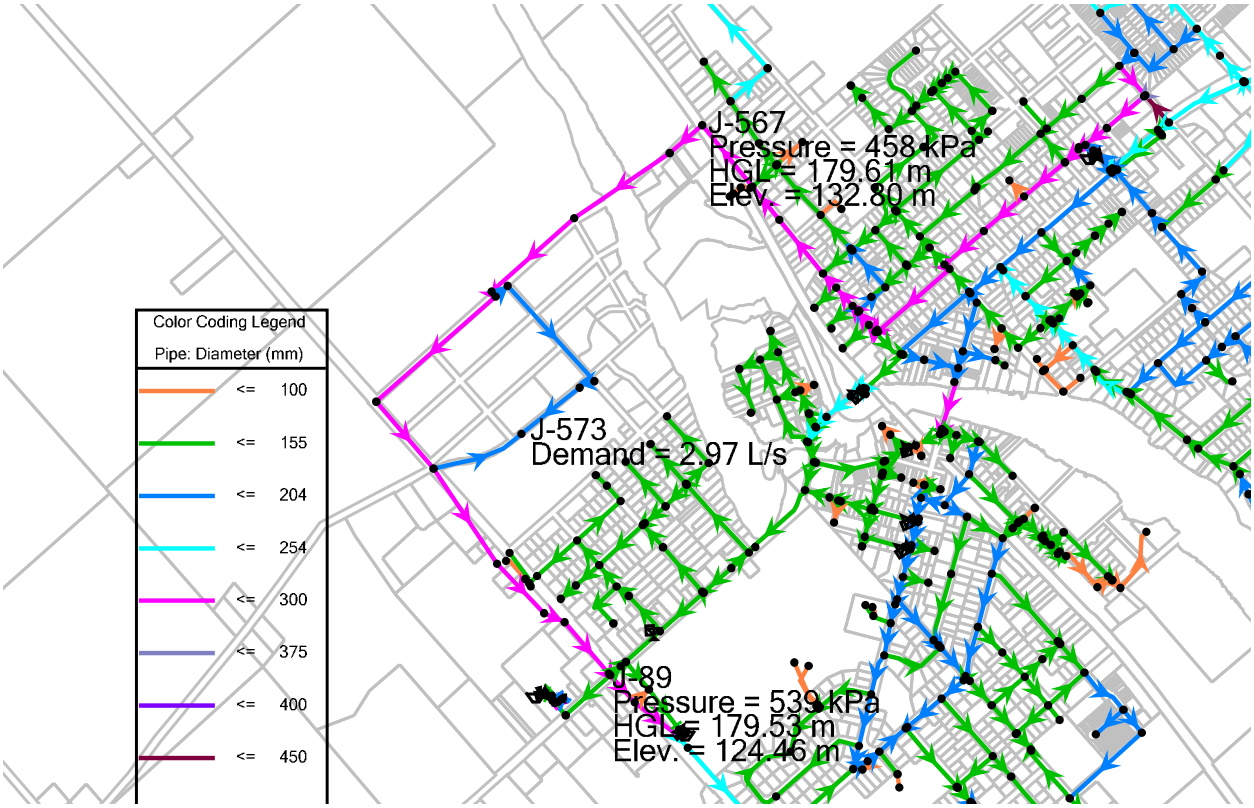
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
300mm Mississippi River Crossing
ADD (Year 1)



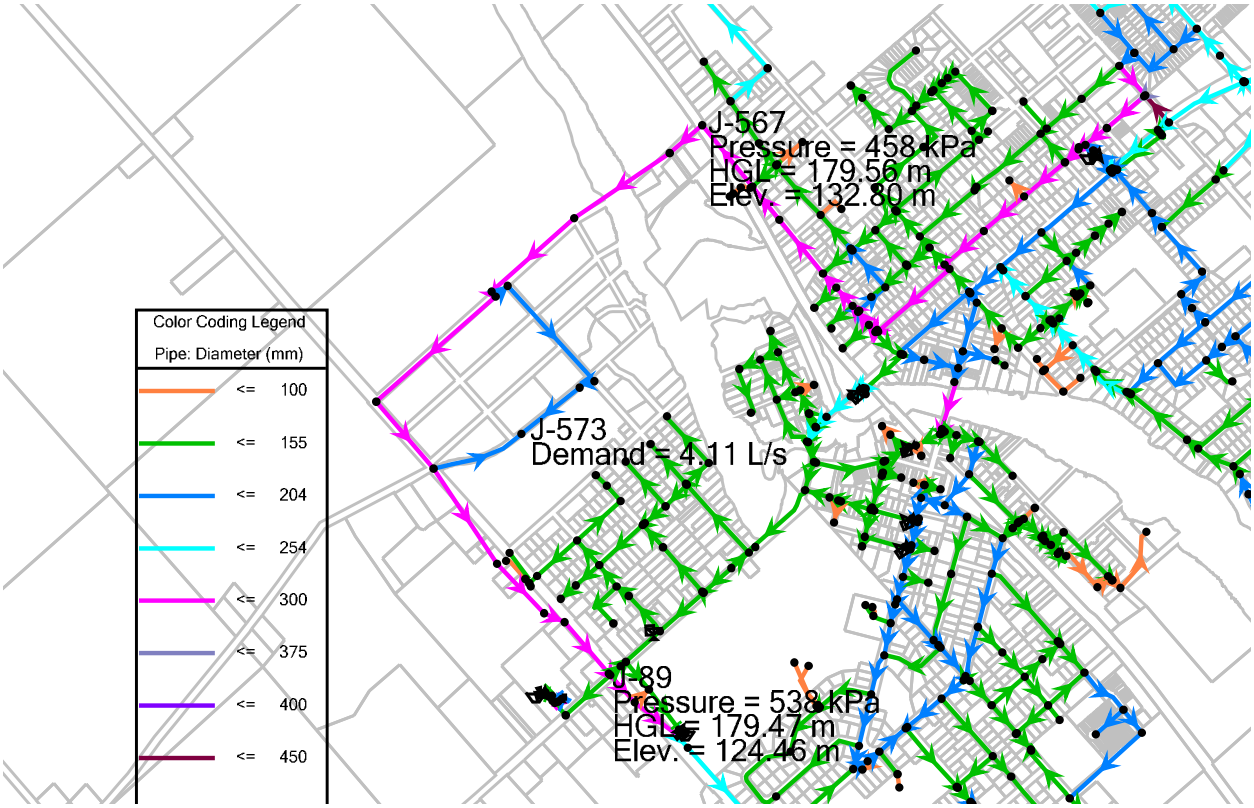
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
300mm Mississippi River Crossing
ADD (Year 2)



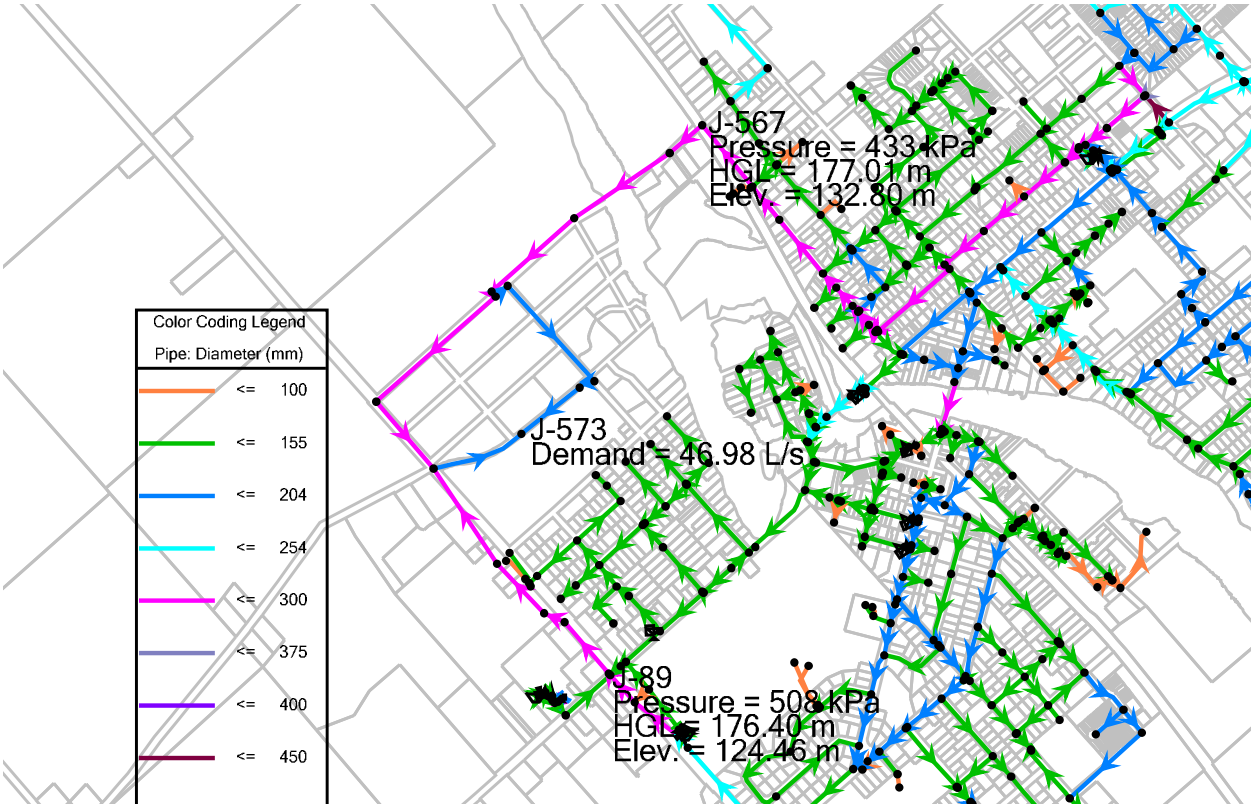
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
300mm Mississippi River Crossing
ADD (Year 3)



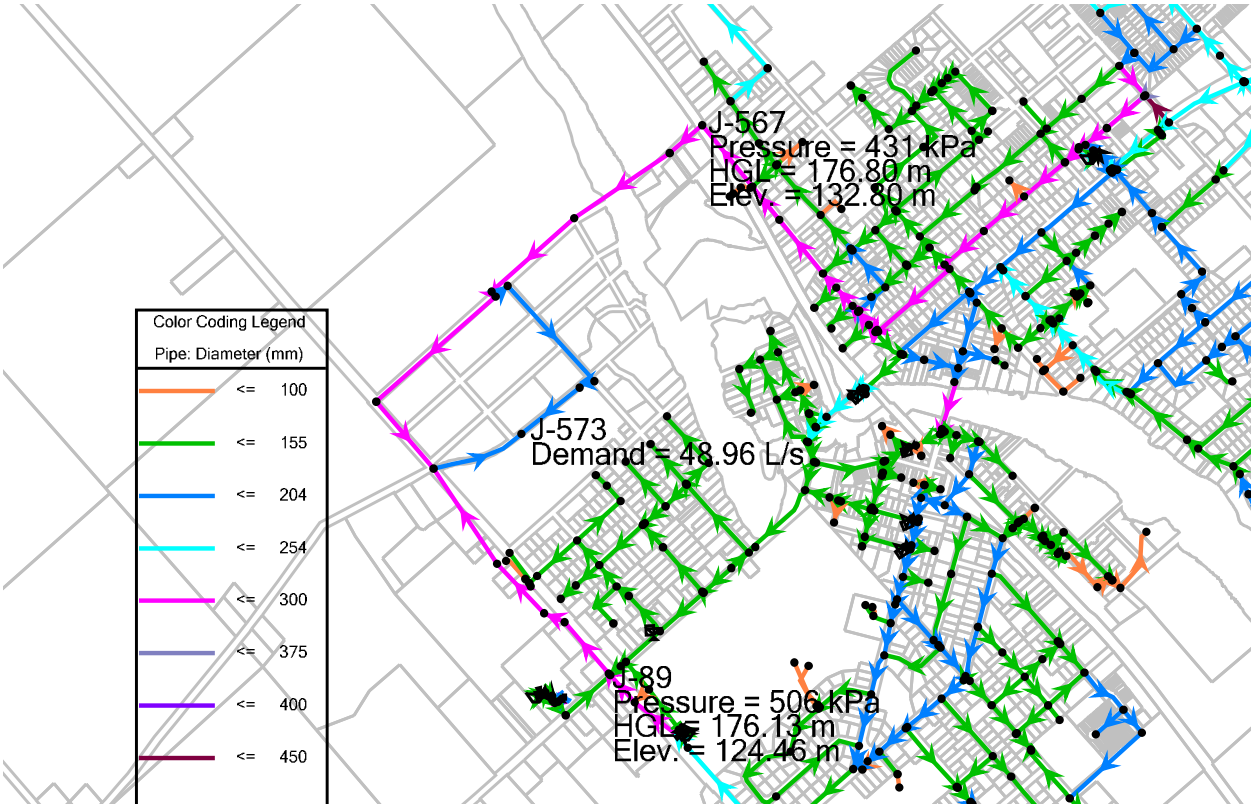
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
300mm Mississippi River Crossing
ADD (Year 4)



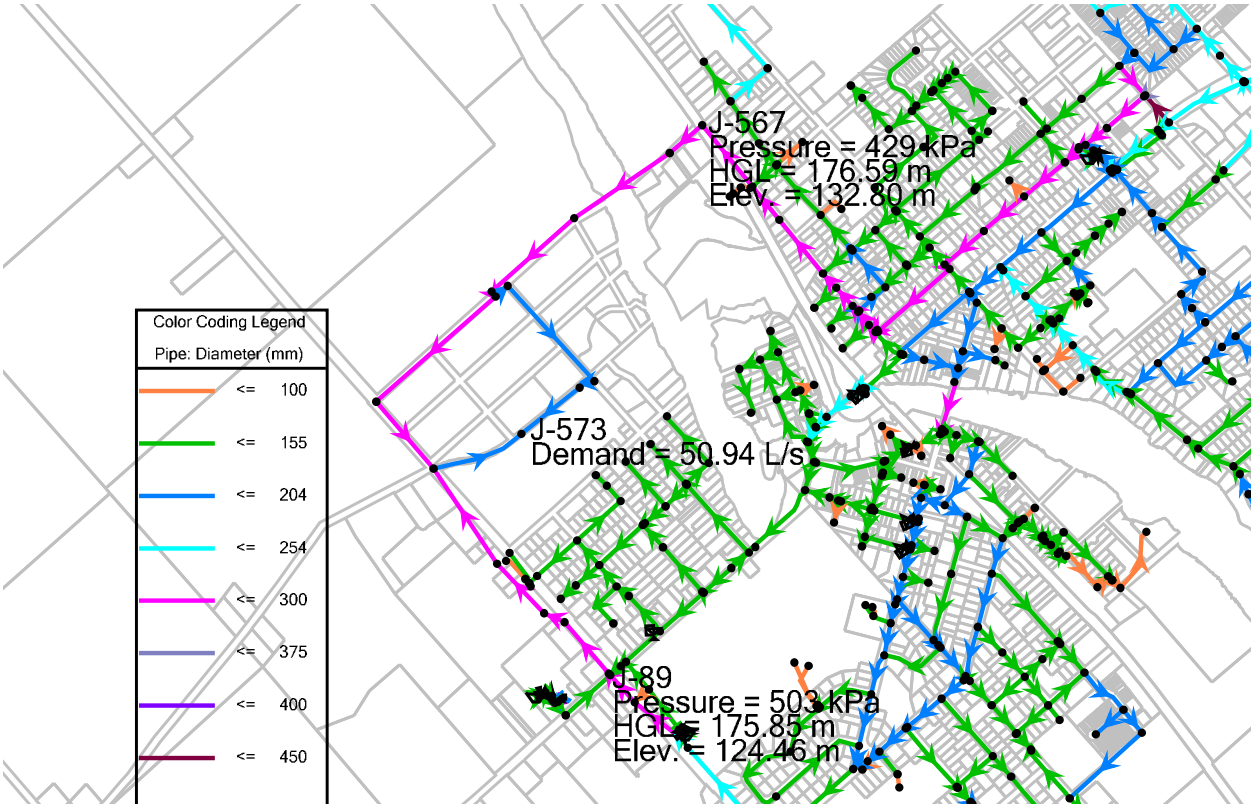
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
300mm Mississippi River Crossing
MDD+FF (RFF = 45 L/s, Year 1)



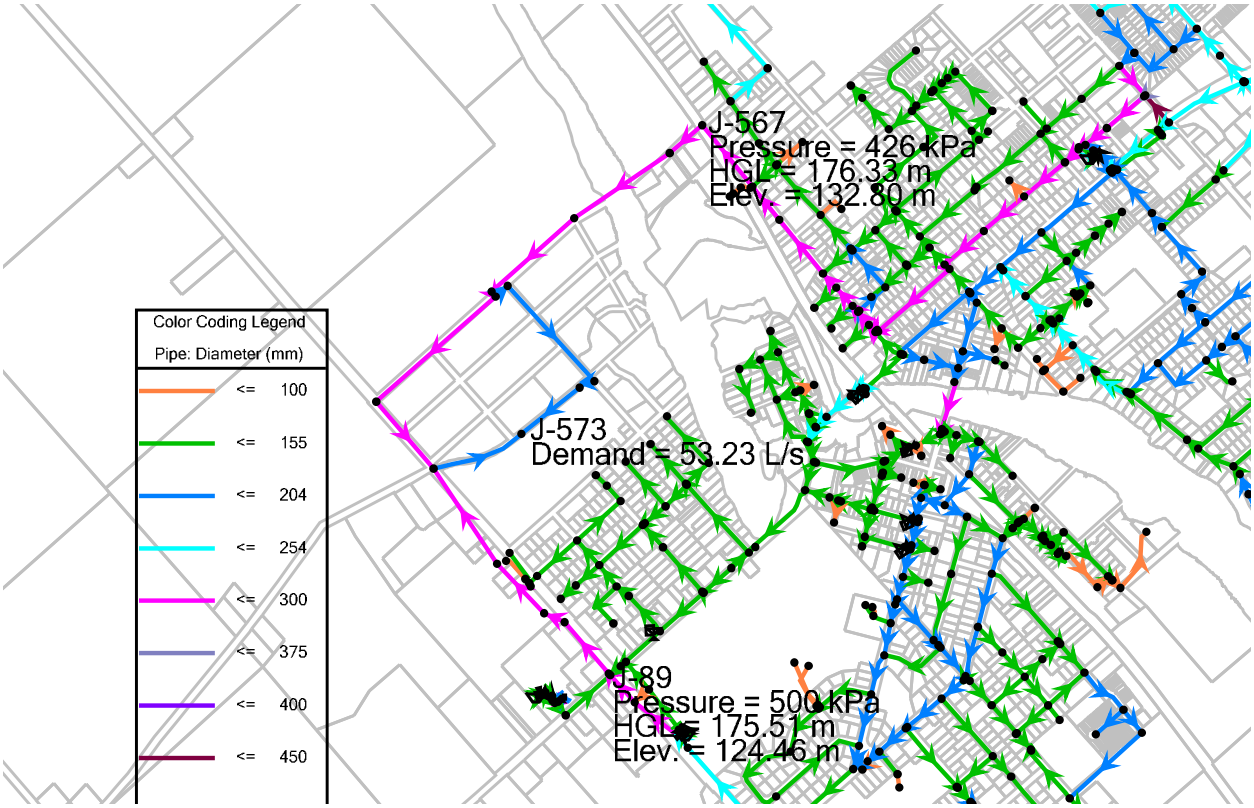
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
300mm Mississippi River Crossing
MDD+FF (RFF = 45 L/s, Year 2)



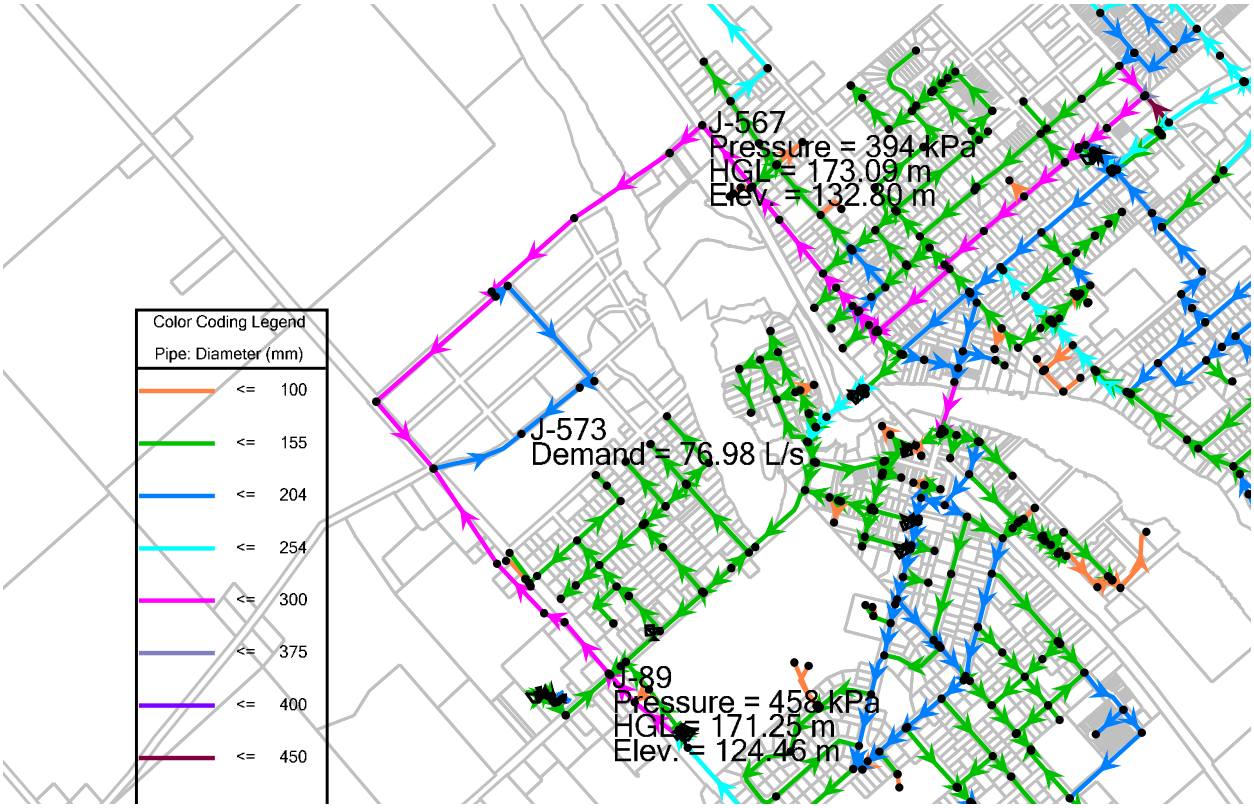
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
300mm Mississippi River Crossing
MDD+FF (RFF = 45 L/s, Year 3)



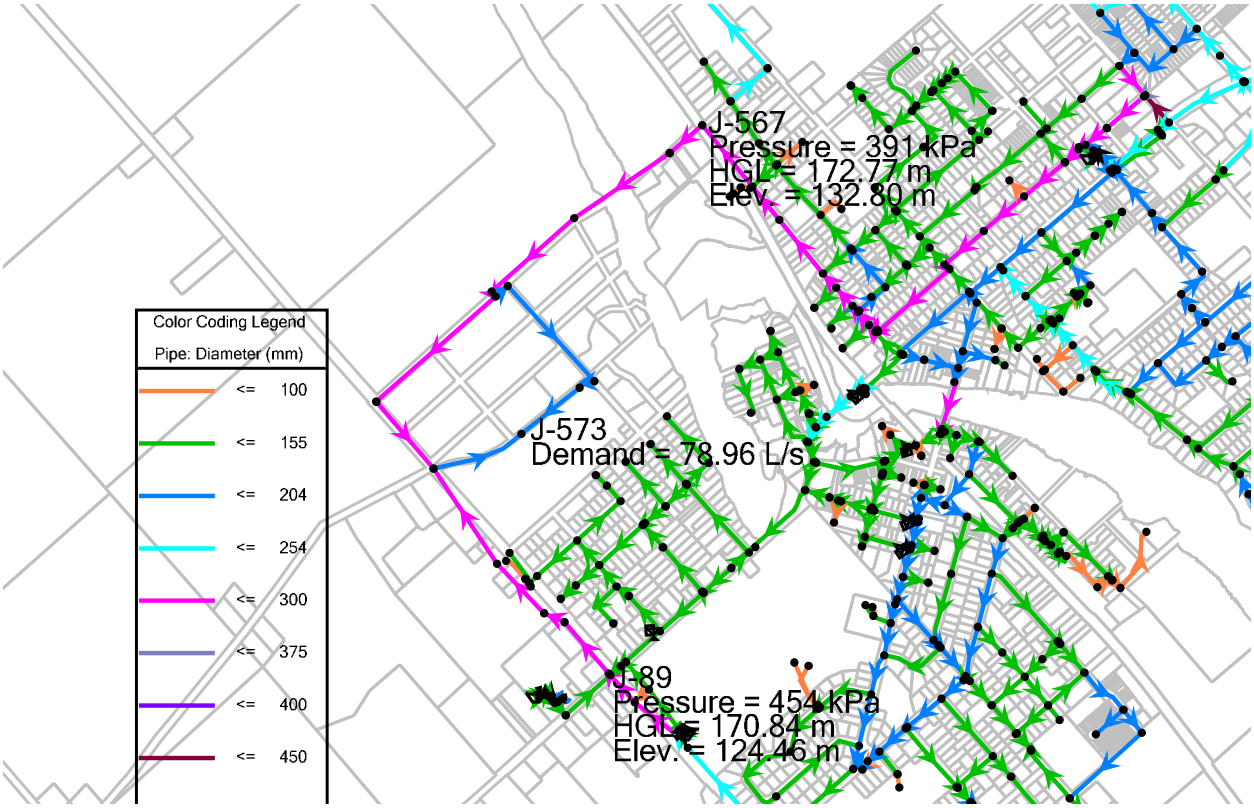
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
300mm Mississippi River Crossing
MDD+FF (RFF = 45 L/s, Year 4)



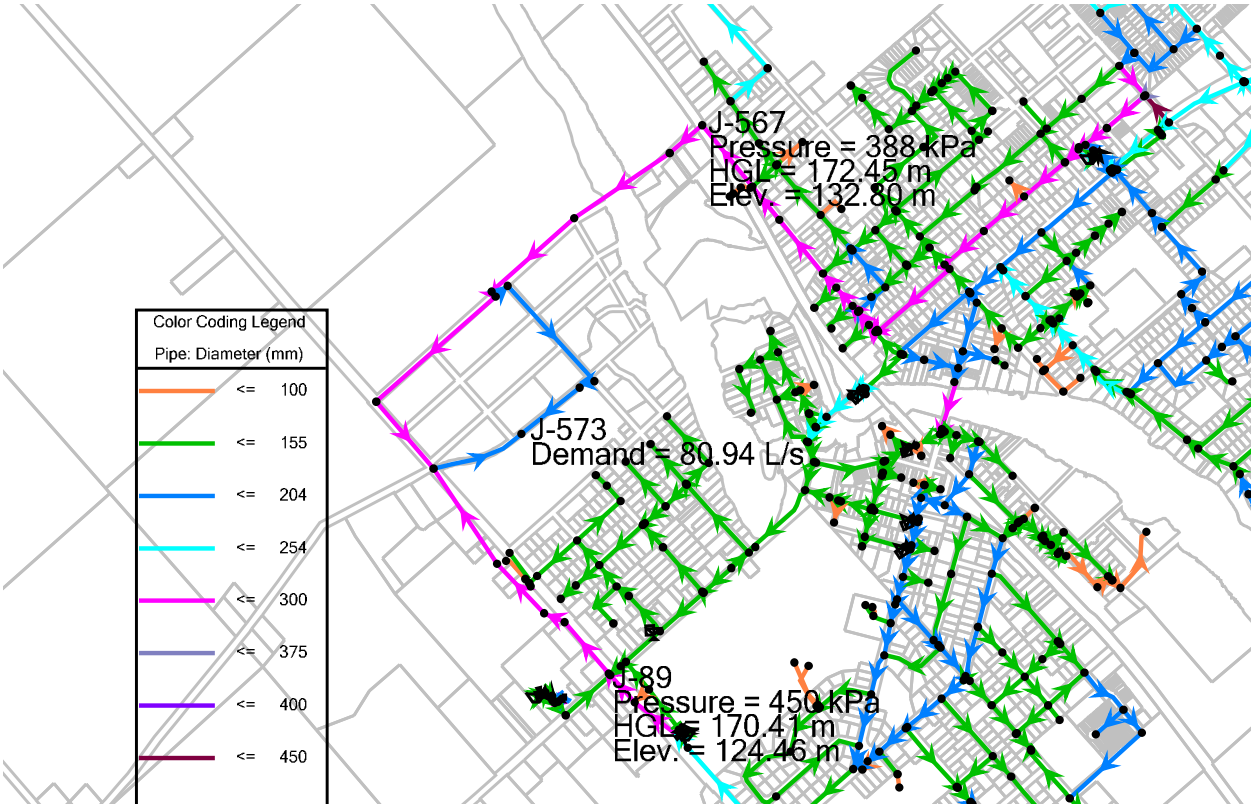
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
300mm Mississippi River Crossing
MDD+FF (RFF = 75 L/s, Year 1)



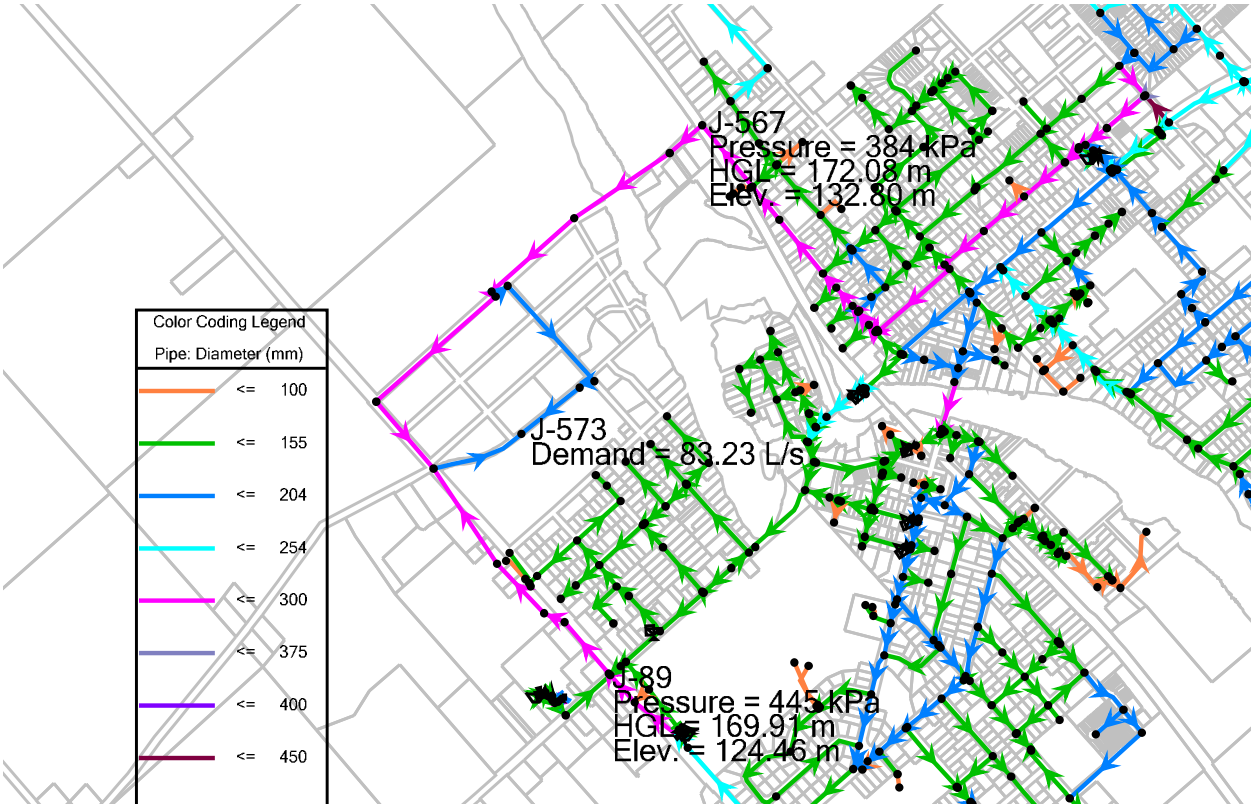
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
300mm Mississippi River Crossing
MDD+FF (RFF = 75 L/s, Year 2)



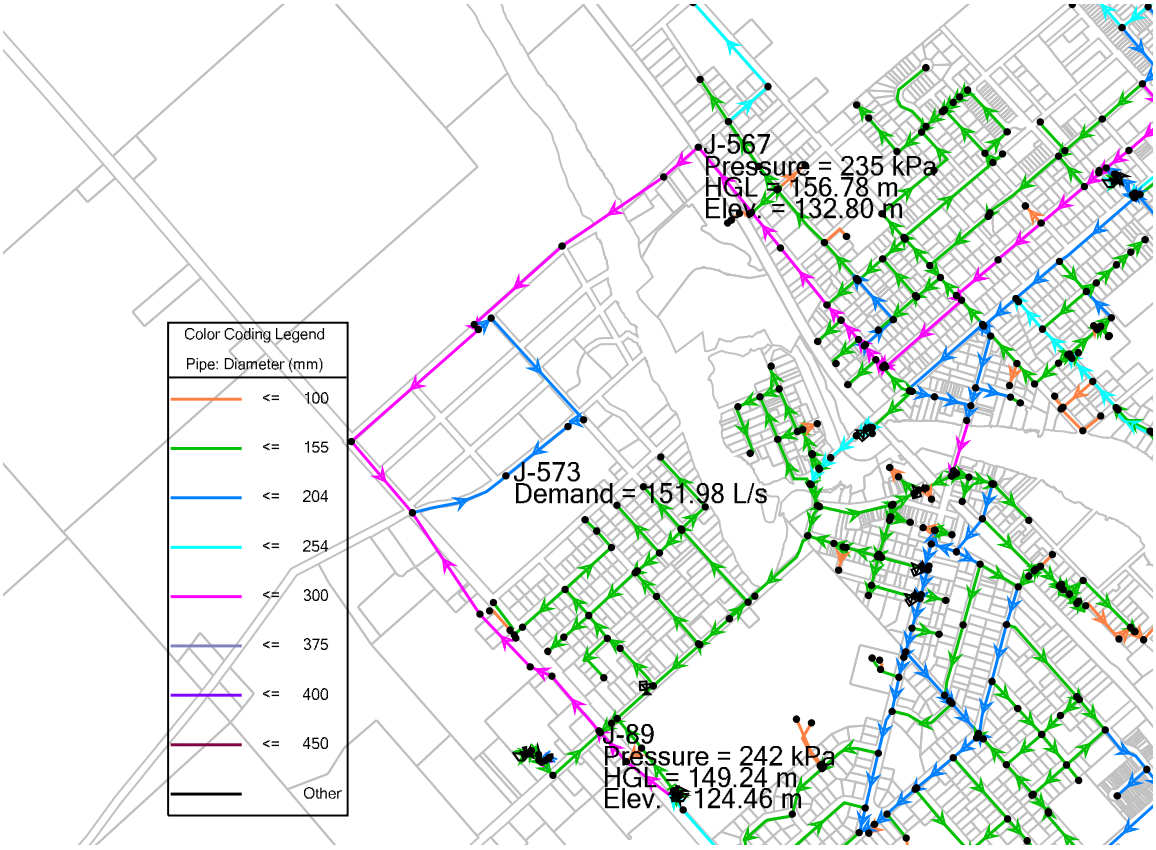
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
300mm Mississippi River Crossing
MDD+FF (RFF = 75 L/s, Year 3)



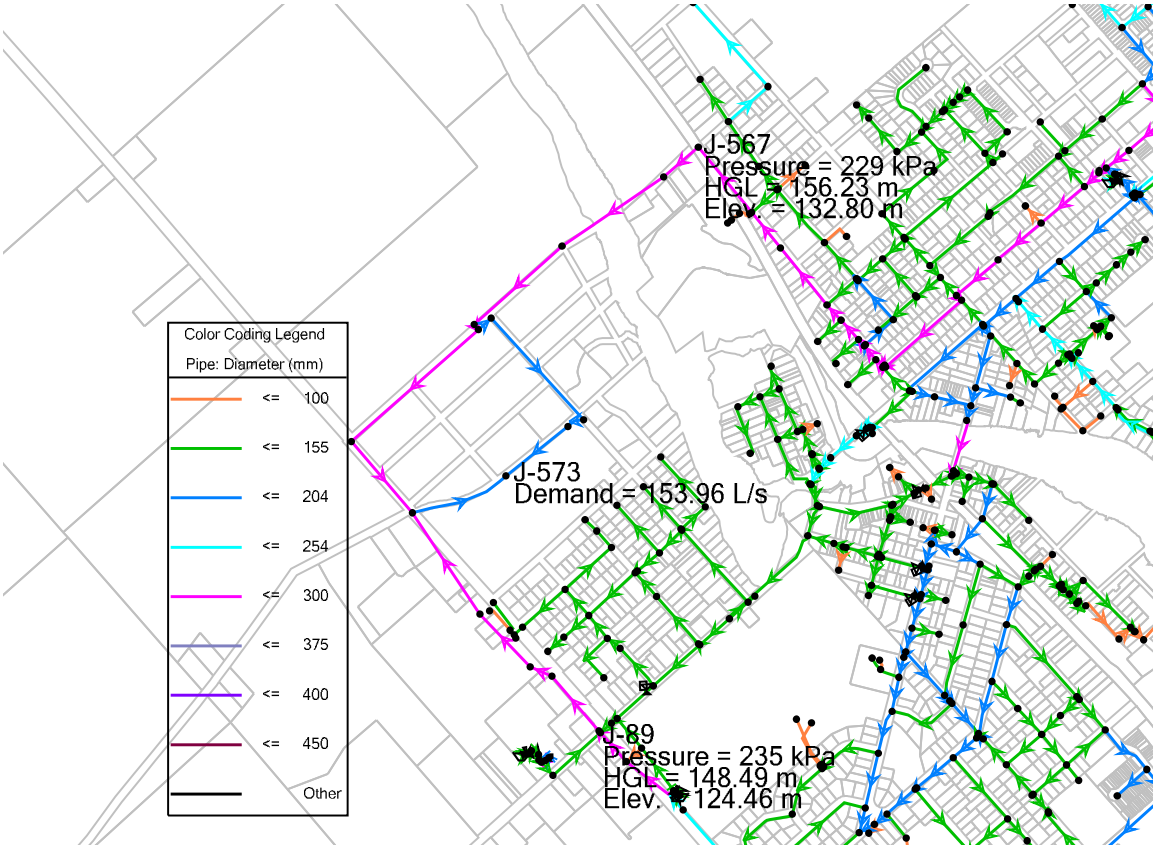
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
300mm Mississippi River Crossing
MDD+FF (RFF = 75 L/s, Year 4)



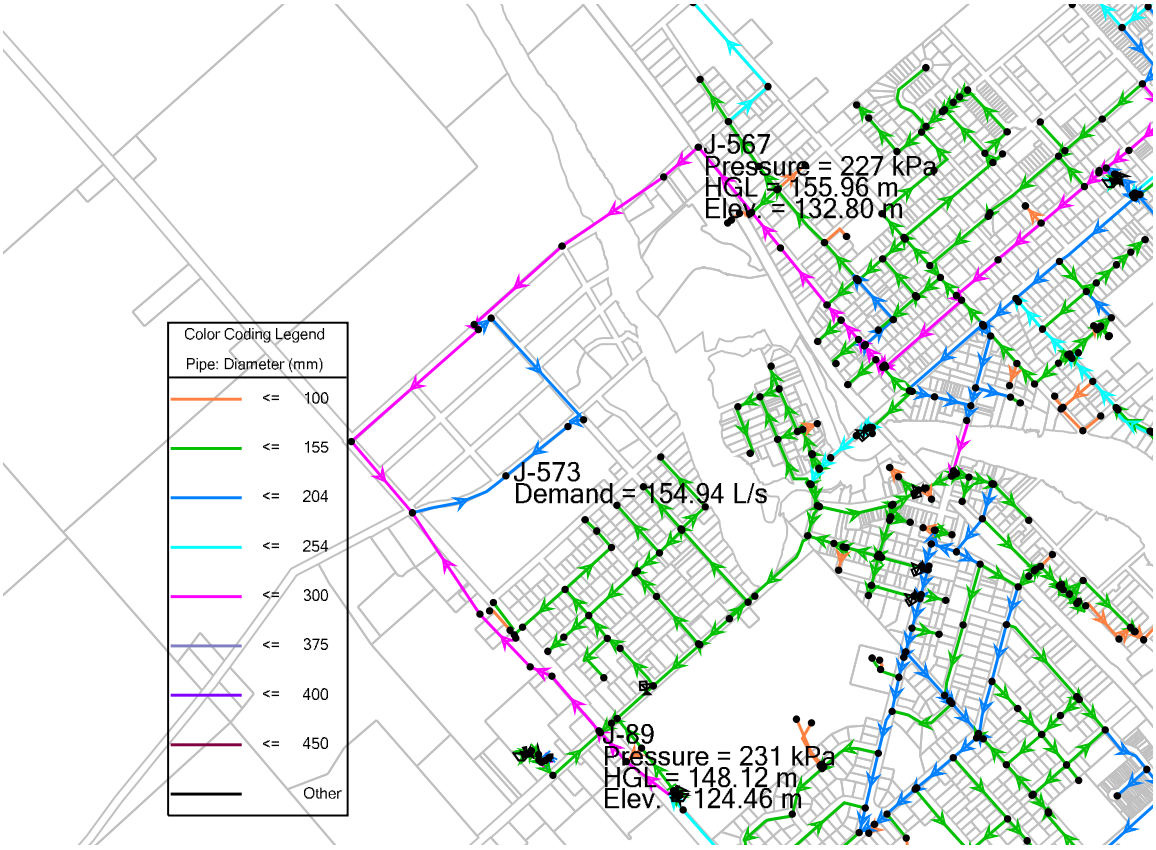
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
300mm Mississippi River Crossing
MDD+FF (RFF = 150 L/s, Year 1)



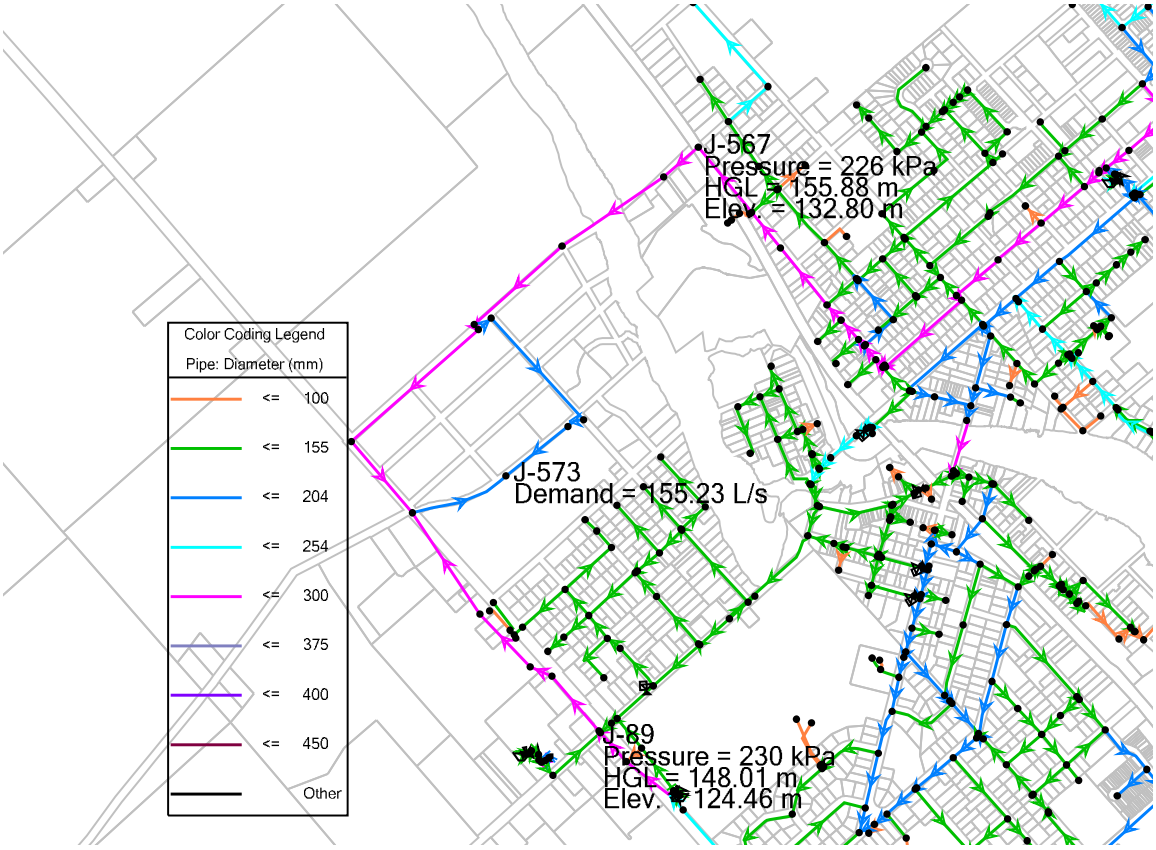
Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
300mm Mississippi River Crossing
MDD+FF (RFF = 150 L/s, Year 2)



Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
300mm Mississippi River Crossing
MDD+FF (FF = 149 L/s, Year 3)



Brown Lands Boundary Condition (Jan 2023)
300mm Upgrade Along County Road 29 (from Well 6 to Strathburn)
300mm Mississippi River Crossing
MDD+FF (FF = 147 L/s, Year 4)



WATERMAIN BOUNDARY CONDITIONS EQUATIONS

Single Connection (250mm dia. - County Road 29)

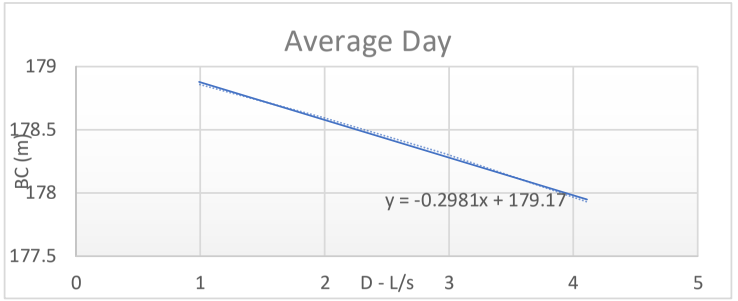
Adjusted Boundary Conditions

**Boundary Conditions provided by JL Richards & Associates on August 17, 2022*

Average Day

Theoretical Demand - D (L/s)	Boundary Condition - BC (@ J-89)* (m)
0.99	*178.86*
1.98	*178.6*
2.97	*178.31*
4.11	*177.93*

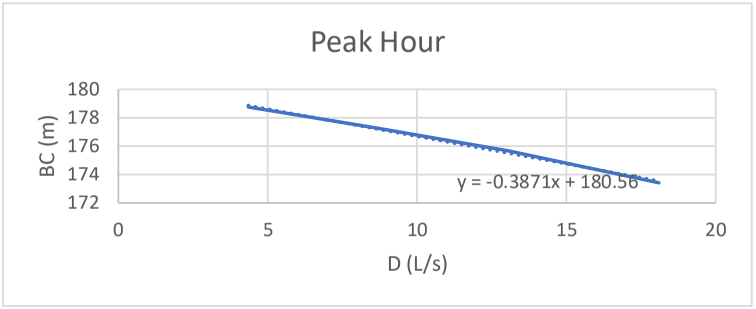
Boundary Condition Formula (Approximation): BC=-0.2981D+179.17



Peak Hour

Theoretical Demand - D (L/s)	Boundary Condition - BC (@ J-89)* (m)
4.35	*178.76*
8.71	*177.26*
13.06	*175.67*
18.1	*173.42*

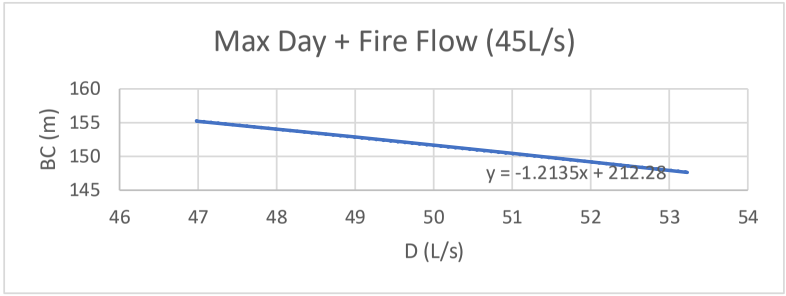
Boundary Condition Formula (Approximation): BC=-0.3871D+180.56



Max Day + Fire Flow (45L/s)

Theoretical Demand - D (L/s)	Boundary Condition - BC (@ J-89)* (m)
46.98	*155.22*
48.96	*152.92*
50.94	*150.52*
53.23	*147.64*

Boundary Condition Formula (Approximation): BC=-1.2135D+212.28



Calculated Boundary Conditions Based on Draft Plan Demands (February 10, 2023)

Condition	Theoretical Demand - D (L/s)	Boundary Condition - BC (@ J-89) (m)
Average Day Demand	2.86	178.32
Peak Hour	15.82	174.44
Max Day + Fire Flow (45L/s)	52.18	148.96

WATERMAIN BOUNDARY CONDITIONS EQUATIONS

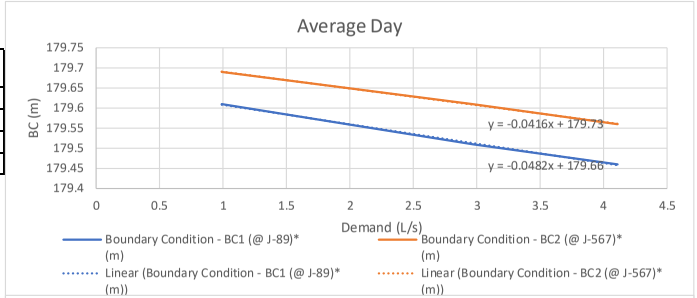
Dual Connection (250mm dia. - County Road 29 and 300mm dia. - Mississippi River Crossing)

Adjusted Boundary Conditions

**Boundary Conditions provided by JL Richards & Associates on August 17, 2022*

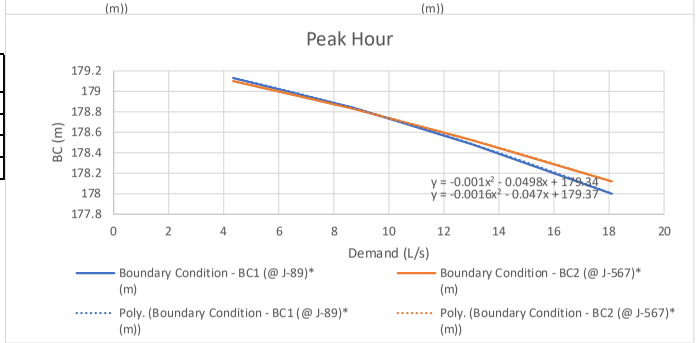
Average Day

Theoretical Demand - D (L/s)	Boundary Condition - BC1 (@ J-89)* (m)	Boundary Condition - BC2 (@ J-567)* (m)
0.99	*179.61*	*179.69*
1.98	*179.56*	*179.65*
2.97	*179.51*	*179.61*
4.11	*179.46*	*179.56*
Boundary Condition Formula (Approximation):	BC1 = -0.0482D+179.68	BC2 = -0.0416D+179.73



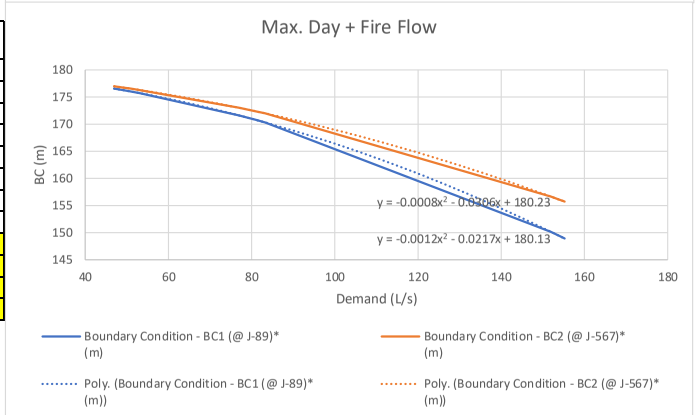
Peak Hour

Theoretical Demand - D (L/s)	Boundary Condition - BC1 (@ J-89)* (m)	Boundary Condition - BC2 (@ J-567)* (m)
4.35	*179.13*	*179.1*
8.71	*178.84*	*178.83*
13.06	*178.48*	*178.52*
18.1	*178*	*178.12*
Boundary Condition Formula (Approximation):	BC1 = -0.0016D^2-0.047D+179.37	BC2 = -0.001D^2-0.0498D+179.34



Max Day + Fire Flow (45L/s & 75L/s)

Theoretical Demand - D (L/s)	Boundary Condition - BC1 (@ J-89)* (m)	Boundary Condition - BC2 (@ J-567)* (m)
46.98	*176.56*	*176.98*
48.96	*176.3*	*176.76*
50.94	*176.03*	*176.55*
53.23	*175.71*	*176.28*
76.98	*171.62*	*173.02*
78.96	*171.22*	*172.7*
80.94	*170.8*	*172.38*
83.23	*170.32*	*172*
151.98	*150.13*	*156.63*
153.96	*149.40*	*156.08*
154.94	*149.03*	*155.81*
155.23	*148.93*	*155.73*
Boundary Condition Formula (Approximation):	BC1 = -0.0012D^2-0.0217D+180.13	BC2 = -0.0008D^2-0.0306D+180.23



Calculated Boundary Conditions Based on Draft Plan Demands (February 10, 2023)

Condition	Theoretical Demand - D (L/s)	Boundary Condition - BC1 (@ J-89) (m)	Boundary Condition - BC2 (@ J-567) (m)
Average Day Demand	2.86	179.54	179.61
Peak Hour	15.82	178.23	178.30
Max Day + Fire Flow (60L/s)	67.18	173.26	174.56
Max Day + Fire Flow (75L/s)	82.18	170.24	172.31
Max Day + Fire Flow (105L/s)	112.18	162.59	166.73

Extrapolated Values Based on Boundary Conditions provided by JL Richards for a 300mm dia. Pipe on Cty Rd 29 (February 1, 2023)

OBC Water Supply for Firefighting Calculation

Based on OBC 2012 (Div. B, Article 3.2.5.7)

References: Ontario Fire Marshal - OBC Fire Fighting Water Supply
Ontario Building Code 2012, Appendix A, Vol 2., A-3.2.5.7

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 118178
Project Name: Brown Lands
Date: 2/10/2023
Input By: Trevor McKay
Reviewed By: Trevor McKay

Legend
Input by User
No Input Required

Building Description: 2-storey Townhome, 6-Unit Block with 1-2-hr firewall
(Divided into 4 units and 2 units)

Unsprinklered

Step		Calculation Inputs		Calculation Notes	Value
Minimum Fire Protection Water Supply Volume					
1	**Water Supply Coefficient**				
	Building Classification =	C		From Table 3.1.2.1	
	Water Supply Coefficient - K =			From Table 1 (A3.2.5.7)	**23**
2	**Total Building Volume**				
	Building Width - W	max. 24.45	m		
	Building Length - L	max. 18.75	m	Area (W * L) = ***396*** m2	
	Building Height - H	11.6	m		
	Total Building Volume - V =			W * L * H	**4589 m³**
3	**Spatial Coefficient Value**				
	Exposure Distances: (Exterior building face to property/lot line, to street centre, or to mid-point between proposed building and another building on same lot)			**Spatial Coefficients:** From Figure 1 (Spatial Coefficient vs Exposure Distance)	
	North	7.50	m	Sside 1 = **0.25**	
	East	1.20	m	Sside 2 = **0.50**	
	South	15.00	m	Sside 3 = **0.00**	
	West	1.20	m	Sside 4 = **0.50**	
	Total of Spacial Coefficient Values - S-Tot as obtained from the formula =			1.0 + (Sside 1 + Sside 2 + Sside 3 + Sside 4) (Max. value = 2.0)	**2.00**
4	**Minimum Fire Protection Water Supply Volume**				
	Q =			$K * V * S_{Tot}$	**211,092 L**
Required Minimum Water Supply Flow Rate					
5	**Minimum Water Supply Flow Rate =**			From Table 2 (For water supply from a municipal or industrial water supply system, min. pressure is 140 kPa)	**6,300 L/min** or **105 L/s**
Minimum Fire Protection Water Supply Volume for 30 minutes					
6	**Q =**			= Minimum Water Supply Flow Rate (L/min) * 30 minutes	**189,000 L**
Required Fire Protection Water Supply Volume					
7	**Q =**			Highest volume out of (4) and (6)	**211,092 L**
Notes					

OBC Water Supply for Firefighting Calculation

Based on OBC 2012 (Div. B, Article 3.2.5.7)

References: Ontario Fire Marshal - OBC Fire Fighting Water Supply
Ontario Building Code 2012, Appendix A, Vol 2., A-3.2.5.7

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 118178
Project Name: Brown Lands
Date: 2/10/2023
Input By: Trevor McKay
Reviewed By: Trevor McKay

Legend
Input by User
No Input Required

Building Description: 2-storey Townhome, 6-Unit Block

Unsprinklered

Step		Calculation Inputs		Calculation Notes		Value
Minimum Fire Protection Water Supply Volume						
1	**Water Supply Coefficient**					
	Building Classification =	C		From Table 3.1.2.1		
	Water Supply Coefficient - K =			From Table 1 (A3.2.5.7)		**23**
2	**Total Building Volume**					
	Building Width - W	max. 36.66	m			
	Building Length - L	max. 18.75	m	Area (W * L) =	***585*** m2	
	Building Height - H	11.6	m			
	Total Building Volume - V =			W * L * H		**6791 m³**
3	**Spatial Coefficient Value**					
	Exposure Distances: (Exterior building face to property/lot line, to street centre, or to mid-point between proposed building and another building on same lot)			**Spatial Coefficients:** From Figure 1 (Spatial Coefficient vs Exposure Distance)		
	North	7.50	m	Sside 1 =	**0.25**	
	East	1.20	m	Sside 2 =	**0.50**	
	South	15.00	m	Sside 3 =	**0.00**	
	West	1.20	m	Sside 4 =	**0.50**	
	Total of Spacial Coefficient Values - S-Tot as obtained from the formula =			1.0 + (Sside 1 + Sside 2 + Sside 3 + Sside 4) (Max. value = 2.0)		**2.00**
4	**Minimum Fire Protection Water Supply Volume**					
	Q =			$K * V * S_{Tot}$		**312,369 L**
Required Minimum Water Supply Flow Rate						
5	**Minimum Water Supply Flow Rate =**			From Table 2 (For water supply from a municipal or industrial water supply system, min. pressure is 140 kPa)		**9,000 L/min** or **150 L/s**
Minimum Fire Protection Water Supply Volume for 30 minutes						
6	**Q =**			= Minimum Water Supply Flow Rate (L/min) * 30 minutes		**270,000 L**
Required Fire Protection Water Supply Volume						
7	**Q =**			Highest volume out of (4) and (6)		**312,369 L**
Notes						

OBC Water Supply for Firefighting Calculation

Based on OBC 2012 (Div. B, Article 3.2.5.7)

References: Ontario Fire Marshal - OBC Fire Fighting Water Supply
Ontario Building Code 2012, Appendix A, Vol 2., A-3.2.5.7

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 118178
Project Name: Brown Lands
Date: 2/10/2023
Input By: Trevor McKay
Reviewed By: Trevor McKay

Legend
Input by User
No Input Required

Building Description: 2-storey Townhome, 5-Unit Block

Unsprinklered

Step		Calculation Inputs		Calculation Notes		Value
Minimum Fire Protection Water Supply Volume						
1	**Water Supply Coefficient**					
	Building Classification =	C		From Table 3.1.2.1		
	Water Supply Coefficient - K =			From Table 1 (A3.2.5.7)		**23**
2	**Total Building Volume**					
	Building Width - W	max. 30.72	m			
	Building Length - L	max. 18.12	m	Area (W * L) =	***472*** m2	
	Building Height - H	11.6	m			
	Total Building Volume - V =			W * L * H		**5478 m³**
3	**Spatial Coefficient Value**					
	Exposure Distances: (Exterior building face to property/lot line, to street centre, or to mid-point between proposed building and another building on same lot)			**Spatial Coefficients:** From Figure 1 (Spatial Coefficient vs Exposure Distance)		
	North	7.50	m	Sside 1 =	**0.25**	
	East	1.20	m	Sside 2 =	**0.50**	
	South	15.00	m	Sside 3 =	**0.00**	
	West	1.20	m	Sside 4 =	**0.50**	
	Total of Spacial Coefficient Values - S-Tot as obtained from the formula =			1.0 + (Sside 1 + Sside 2 + Sside 3 + Sside 4) (Max. value = 2.0)		**2.00**
4	**Minimum Fire Protection Water Supply Volume**					
	Q =			$K * V * S_{Tot}$		**251,966 L**
Required Minimum Water Supply Flow Rate						
5	**Minimum Water Supply Flow Rate =**			From Table 2 (For water supply from a municipal or industrial water supply system, min. pressure is 140 kPa)		**6,300 L/min** or **105 L/s**
Minimum Fire Protection Water Supply Volume for 30 minutes						
6	**Q =**			= Minimum Water Supply Flow Rate (L/min) * 30 minutes		**189,000 L**
Required Fire Protection Water Supply Volume						
7	**Q =**			Highest volume out of (4) and (6)		**251,966 L**
Notes						

OBC Water Supply for Firefighting Calculation

Based on OBC 2012 (Div. B, Article 3.2.5.7)

References: Ontario Fire Marshal - OBC Fire Fighting Water Supply
Ontario Building Code 2012, Appendix A, Vol 2., A-3.2.5.7

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 118178
Project Name: Brown Lands
Date: 2/10/2023
Input By: Trevor McKay
Reviewed By: Trevor McKay

Legend
Input by User
No Input Required

Building Description: 2-storey Townhome, 4-Unit Block

Unsprinklered

Step		Calculation Inputs		Calculation Notes		Value
Minimum Fire Protection Water Supply Volume						
1	**Water Supply Coefficient**					
	Building Classification =	C		From Table 3.1.2.1		
	Water Supply Coefficient - K =			From Table 1 (A3.2.5.7)		**23**
2	**Total Building Volume**					
	Building Width - W	24.46	m			
	Building Length - L	18.21	m	Area (W * L) =	445 m2	
	Building Height - H	11.6	m			
	Total Building Volume - V =			W * L * H		**5167 m³**
3	**Spatial Coefficient Value**					
	Exposure Distances: (Exterior building face to property/lot line, to street centre, or to mid-point between proposed building and another building on same lot)			**Spatial Coefficients:** From Figure 1 (Spatial Coefficient vs Exposure Distance)		
	North	7.50	m	Sside 1 =	**0.25**	
	East	1.20	m	Sside 2 =	**0.50**	
	South	15.00	m	Sside 3 =	**0.00**	
	West	1.20	m	Sside 4 =	**0.50**	
	Total of Spacial Coefficient Values - S-Tot as obtained from the formula =			1.0 + (Sside 1 + Sside 2 + Sside 3 + Sside 4) (Max. value = 2.0)		**2.00**
4	**Minimum Fire Protection Water Supply Volume**					
	Q =			$K * V * S_{Tot}$		**237,674 L**
Required Minimum Water Supply Flow Rate						
5	**Minimum Water Supply Flow Rate =**			From Table 2 (For water supply from a municipal or industrial water supply system, min. pressure is 140 kPa)		**6,300 L/min** or **105 L/s**
Minimum Fire Protection Water Supply Volume for 30 minutes						
6	**Q =**			= Minimum Water Supply Flow Rate (L/min) * 30 minutes		**189,000 L**
Required Fire Protection Water Supply Volume						
7	**Q =**			Highest volume out of (4) and (6)		**237,674 L**
Notes						

OBC Water Supply for Firefighting Calculation

Based on OBC 2012 (Div. B, Article 3.2.5.7)

References: Ontario Fire Marshal - OBC Fire Fighting Water Supply
Ontario Building Code 2012, Appendix A, Vol 2., A-3.2.5.7

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 118178
Project Name: Brown Lands
Date: 2/10/2023
Input By: Trevor McKay
Reviewed By: Trevor McKay

Legend
Input by User
No Input Required

Building Description: Bungalow Townhome, 3-Unit Block

Unsprinklered

Step		Calculation Inputs		Calculation Notes	Value
Minimum Fire Protection Water Supply Volume					
1	**Water Supply Coefficient**				
	Building Classification =	C		From Table 3.1.2.1	
	Water Supply Coefficient - K =			From Table 1 (A3.2.5.7)	**23**
2	**Total Building Volume**				
	Building Width - W	30.70	m		
	Building Length - L	18.05	m	Area (W * L) = 554 m2	
	Building Height - H	8.7	m		
	Total Building Volume - V =			W * L * H	**4821 m³**
3	**Spatial Coefficient Value**				
	Exposure Distances: (Exterior building face to property/lot line, to street centre, or to mid-point between proposed building and another building on same lot)			**Spatial Coefficients:** From Figure 1 (Spatial Coefficient vs Exposure Distance)	
	North	7.50	m	Sside 1 = **0.25**	
	East	1.20	m	Sside 2 = **0.50**	
	South	15.00	m	Sside 3 = **0.00**	
	West	1.20	m	Sside 4 = **0.50**	
	Total of Spacial Coefficient Values - S-Tot as obtained from the formula =			1.0 + (Sside 1 + Sside 2 + Sside 3 + Sside 4) (Max. value = 2.0)	**2.00**
4	**Minimum Fire Protection Water Supply Volume**				
	Q =			$K * V * S_{Tot}$	**221,765 L**
Required Minimum Water Supply Flow Rate					
5	**Minimum Water Supply Flow Rate =**			From Table 2 (For water supply from a municipal or industrial water supply system, min. pressure is 140 kPa)	**6,300 L/min** or **105 L/s**
Minimum Fire Protection Water Supply Volume for 30 minutes					
6	**Q =**			= Minimum Water Supply Flow Rate (L/min) * 30 minutes	**189,000 L**
Required Fire Protection Water Supply Volume					
7	**Q =**			Highest volume out of (4) and (6)	**221,765 L**
Notes					

OBC Water Supply for Firefighting Calculation

Based on OBC 2012 (Div. B, Article 3.2.5.7)

References: Ontario Fire Marshal - OBC Fire Fighting Water Supply
Ontario Building Code 2012, Appendix A, Vol 2., A-3.2.5.7

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 118178
Project Name: Brown Lands
Date: 2/10/2023
Input By: Trevor McKay
Reviewed By: Trevor McKay

Legend
Input by User
No Input Required

Building Description: Bungalow Townhome, 2-Unit Block (Semi-Detached)

Unsprinklered

Step		Calculation Inputs		Calculation Notes		Value
Minimum Fire Protection Water Supply Volume						
1	**Water Supply Coefficient**					
	Building Classification =	C		From Table 3.1.2.1		
	Water Supply Coefficient - K =			From Table 1 (A3.2.5.7)		**23**
2	**Total Building Volume**					
	Building Width - W	20.48	m			
	Building Length - L	18.05	m	Area (W * L) =	370 m2	
	Building Height - H	8.7	m			
	Total Building Volume - V =			W * L * H		**3216 m³**
3	**Spatial Coefficient Value**					
	Exposure Distances: (Exterior building face to property/lot line, to street centre, or to mid-point between proposed building and another building on same lot)			**Spatial Coefficients:** From Figure 1 (Spatial Coefficient vs Exposure Distance)		
	North	7.50	m	Sside 1 =	**0.25**	
	East	1.20	m	Sside 2 =	**0.50**	
	South	15.00	m	Sside 3 =	**0.00**	
	West	1.20	m	Sside 4 =	**0.50**	
	Total of Spacial Coefficient Values - S-Tot as obtained from the formula =			1.0 + (Sside 1 + Sside 2 + Sside 3 + Sside 4) (Max. value = 2.0)		**2.00**
4	**Minimum Fire Protection Water Supply Volume**					
	Q =			$K * V * S_{Tot}$		**147,940 L**
Required Minimum Water Supply Flow Rate						
5	**Minimum Water Supply Flow Rate =**			From Table 2 (For water supply from a municipal or industrial water supply system, min. pressure is 140 kPa)		**4,500 L/min** or **75 L/s**
Minimum Fire Protection Water Supply Volume for 30 minutes						
6	**Q =**			= Minimum Water Supply Flow Rate (L/min) * 30 minutes		**135,000 L**
Required Fire Protection Water Supply Volume						
7	**Q =**			Highest volume out of (4) and (6)		**147,940 L**
Notes						

OBC Water Supply for Firefighting Calculation

Based on OBC 2012 (Div. B, Article 3.2.5.7)

References: Ontario Fire Marshal - OBC Fire Fighting Water Supply
Ontario Building Code 2012, Appendix A, Vol 2., A-3.2.5.7

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 118178
Project Name: Brown Lands
Date: 2/10/2023
Input By: Trevor McKay
Reviewed By: Trevor McKay

Legend
Input by User
No Input Required

Building Description: Single detached home, 2-storey, 50' Unit

Unsprinklered

Step		Calculation Inputs		Calculation Notes		Value
Minimum Fire Protection Water Supply Volume						
1	**Water Supply Coefficient**					
	Building Classification =	C		From Table 3.1.2.1		
	Water Supply Coefficient - K =			From Table 1 (A3.2.5.7)		**23**
2	**Total Building Volume**					
	Building Width - W	12.50	m			
	Building Length - L	18.50	m	Area (W * L) =	231 m2	
	Building Height - H	11.6	m			
	Total Building Volume - V =			W * L * H		**2683 m³**
3	**Spatial Coefficient Value**					
	Exposure Distances: (Exterior building face to property/lot line, to street centre, or to mid-point between proposed building and another building on same lot)			**Spatial Coefficients:** From Figure 1 (Spatial Coefficient vs Exposure Distance)		
	North	7.50	m	Sside 1 =	**0.25**	
	East	1.20	m	Sside 2 =	**0.50**	
	South	15.00	m	Sside 3 =	**0.00**	
	West	1.20	m	Sside 4 =	**0.50**	
	Total of Spacial Coefficient Values - S-Tot as obtained from the formula =			1.0 + (Sside 1 + Sside 2 + Sside 3 + Sside 4) (Max. value = 2.0)		**2.00**
4	**Minimum Fire Protection Water Supply Volume**					
	Q =			$K * V * S_{Tot}$		**123,395 L**
Required Minimum Water Supply Flow Rate						
5	**Minimum Water Supply Flow Rate =**			From Table 2 (For water supply from a municipal or industrial water supply system, min. pressure is 140 kPa)		**3,600 L/min** or **60 L/s**
Minimum Fire Protection Water Supply Volume for 30 minutes						
6	**Q =**			= Minimum Water Supply Flow Rate (L/min) * 30 minutes		**108,000 L**
Required Fire Protection Water Supply Volume						
7	**Q =**			Highest volume out of (4) and (6)		**123,395 L**
Notes						

OBC Water Supply for Firefighting Calculation

Based on OBC 2012 (Div. B, Article 3.2.5.7)

References: Ontario Fire Marshal - OBC Fire Fighting Water Supply
Ontario Building Code 2012, Appendix A, Vol 2., A-3.2.5.7

Novatech Project #: 118178
Project Name: Brown Lands
Date: 2/10/2023
Input By: Trevor McKay
Reviewed By: Trevor McKay

Legend
Input by User
No Input Required

Building Description: Single detached home, Bungalow, 50' Unit

Unsprinklered

Step		Calculation Inputs		Calculation Notes		Value
Minimum Fire Protection Water Supply Volume						
1	**Water Supply Coefficient**					
	Building Classification =	C		From Table 3.1.2.1		
	Water Supply Coefficient - K =			From Table 1 (A3.2.5.7)		**23**
2	**Total Building Volume**					
	Building Width - W	12.60	m			
	Building Length - L	19.70	m	Area (W * L) =	248 m2	
	Building Height - H	8.7	m			
	Total Building Volume - V =			W * L * H		**2160 m³**
3	**Spatial Coefficient Value**					
	Exposure Distances: (Exterior building face to property/lot line, to street centre, or to mid-point between proposed building and another building on same lot)			**Spatial Coefficients:** From Figure 1 (Spatial Coefficient vs Exposure Distance)		
	North	7.50	m	Sside 1 =	**0.25**	
	East	1.20	m	Sside 2 =	**0.50**	
	South	15.00	m	Sside 3 =	**0.00**	
	West	1.20	m	Sside 4 =	**0.50**	
	Total of Spacial Coefficient Values - S-Tot as obtained from the formula =			1.0 + (Sside 1 + Sside 2 + Sside 3 + Sside 4) (Max. value = 2.0)		**2.00**
4	**Minimum Fire Protection Water Supply Volume**					
	Q =			$K * V * S_{Tot}$		**99,338 L**
Required Minimum Water Supply Flow Rate						
5	**Minimum Water Supply Flow Rate =**			From Table 2 (For water supply from a municipal or industrial water supply system, min. pressure is 140 kPa)		**2,700 L/min** or **45 L/s**
Minimum Fire Protection Water Supply Volume for 30 minutes						
6	**Q =**			= Minimum Water Supply Flow Rate (L/min) * 30 minutes		**81,000 L**
Required Fire Protection Water Supply Volume						
7	**Q =**			Highest volume out of (4) and (6)		**99,338 L**
Notes						

OBC Water Supply for Firefighting Calculation

Based on OBC 2012 (Div. B, Article 3.2.5.7)

References: Ontario Fire Marshal - OBC Fire Fighting Water Supply
Ontario Building Code 2012, Appendix A, Vol 2., A-3.2.5.7

Novatech Project #: 118178
Project Name: Brown Lands
Date: 2/10/2023
Input By: Trevor McKay
Reviewed By: Trevor McKay

Legend
Input by User
No Input Required

Building Description: Single detached home, 2-storey, 50' Unit

Unsprinklered

Step		Calculation Inputs		Calculation Notes		Value
Minimum Fire Protection Water Supply Volume						
1	**Water Supply Coefficient**					
	Building Classification =	C		From Table 3.1.2.1		
	Water Supply Coefficient - K =			From Table 1 (A3.2.5.7)		**23**
2	**Total Building Volume**					
	Building Width - W	10.20	m			
	Building Length - L	18.00	m	Area (W * L) =	184 m2	
	Building Height - H	11.6	m			
	Total Building Volume - V =			W * L * H		**2130 m³**
3	**Spatial Coefficient Value**					
	Exposure Distances: (Exterior building face to property/lot line, to street centre, or to mid-point between proposed building and another building on same lot)			**Spatial Coefficients:** From Figure 1 (Spatial Coefficient vs Exposure Distance)		
	North	7.50	m	Sside 1 =	**0.25**	
	East	1.20	m	Sside 2 =	**0.50**	
	South	15.00	m	Sside 3 =	**0.00**	
	West	1.20	m	Sside 4 =	**0.50**	
	Total of Spacial Coefficient Values - S-Tot as obtained from the formula =			1.0 + (Sside 1 + Sside 2 + Sside 3 + Sside 4) (Max. value = 2.0)		**2.00**
4	**Minimum Fire Protection Water Supply Volume**					
	Q =			$K * V * S_{Tot}$		**97,969 L**
Required Minimum Water Supply Flow Rate						
5	**Minimum Water Supply Flow Rate =**			From Table 2 (For water supply from a municipal or industrial water supply system, min. pressure is 140 kPa)		**2,700 L/min** or **45 L/s**
Minimum Fire Protection Water Supply Volume for 30 minutes						
6	**Q =**			= Minimum Water Supply Flow Rate (L/min) * 30 minutes		**81,000 L**
Required Fire Protection Water Supply Volume						
7	**Q =**			Highest volume out of (4) and (6)		**97,969 L**
Notes						

OBC Water Supply for Firefighting Calculation

Based on OBC 2012 (Div. B, Article 3.2.5.7)

References: Ontario Fire Marshal - OBC Fire Fighting Water Supply
Ontario Building Code 2012, Appendix A, Vol 2., A-3.2.5.7

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 118178
Project Name: Brown Lands
Date: 2/10/2023
Input By: Trevor McKay
Reviewed By: Trevor McKay

Legend
Input by User
No Input Required

Building Description: Single detached home, 2-storey, 37' Unit

Unsprinklered

Step		Calculation Inputs		Calculation Notes		Value
Minimum Fire Protection Water Supply Volume						
1	**Water Supply Coefficient**					
	Building Classification =	C		From Table 3.1.2.1		
	Water Supply Coefficient - K =			From Table 1 (A3.2.5.7)		**23**
2	**Total Building Volume**					
	Building Width - W	8.90	m			
	Building Length - L	18.60	m	Area (W * L) =	166 m2	
	Building Height - H	11.6	m			
	Total Building Volume - V =			W * L * H		**1920 m³**
3	**Spatial Coefficient Value**					
	Exposure Distances: (Exterior building face to property/lot line, to street centre, or to mid-point between proposed building and another building on same lot)			**Spatial Coefficients:** From Figure 1 (Spatial Coefficient vs Exposure Distance)		
	North	7.50	m	Sside 1 =	**0.25**	
	East	1.20	m	Sside 2 =	**0.50**	
	South	15.00	m	Sside 3 =	**0.00**	
	West	1.20	m	Sside 4 =	**0.50**	
	Total of Spacial Coefficient Values - S-Tot as obtained from the formula =			1.0 + (Sside 1 + Sside 2 + Sside 3 + Sside 4) (Max. value = 2.0)		**2.00**
4	**Minimum Fire Protection Water Supply Volume**					
	Q =			$K * V * S_{Tot}$		**88,332 L**
Required Minimum Water Supply Flow Rate						
5	**Minimum Water Supply Flow Rate =**			From Table 2 (For water supply from a municipal or industrial water supply system, min. pressure is 140 kPa)		**2,700 L/min** or **45 L/s**
Minimum Fire Protection Water Supply Volume for 30 minutes						
6	**Q =**			= Minimum Water Supply Flow Rate (L/min) * 30 minutes		**81,000 L**
Required Fire Protection Water Supply Volume						
7	**Q =**			Highest volume out of (4) and (6)		**88,332 L**
Notes						

OBC Water Supply for Firefighting Calculation

Based on OBC 2012 (Div. B, Article 3.2.5.7)

References: Ontario Fire Marshal - OBC Fire Fighting Water Supply
Ontario Building Code 2012, Appendix A, Vol 2., A-3.2.5.7

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 118178
Project Name: Brown Lands
Date: 2/10/2023
Input By: Trevor McKay
Reviewed By: Trevor McKay

Legend
Input by User
No Input Required

Building Description: Single detached home, 2-storey, 33' Unit

Unsprinklered

Step		Calculation Inputs		Calculation Notes		Value
Minimum Fire Protection Water Supply Volume						
1	**Water Supply Coefficient**					
	Building Classification =	C		From Table 3.1.2.1		
	Water Supply Coefficient - K =			From Table 1 (A3.2.5.7)		**23**
2	**Total Building Volume**					
	Building Width - W	7.50	m			
	Building Length - L	18.80	m	Area (W * L) =	141 m2	
	Building Height - H	11.6	m			
	Total Building Volume - V =			W * L * H		**1636 m³**
3	**Spatial Coefficient Value**					
	Exposure Distances: (Exterior building face to property/lot line, to street centre, or to mid-point between proposed building and another building on same lot)			**Spatial Coefficients:** From Figure 1 (Spatial Coefficient vs Exposure Distance)		
	North	7.50	m	Sside 1 =	**0.25**	
	East	1.20	m	Sside 2 =	**0.50**	
	South	15.00	m	Sside 3 =	**0.00**	
	West	1.20	m	Sside 4 =	**0.50**	
	Total of Spacial Coefficient Values - S-Tot as obtained from the formula =			1.0 + (Sside 1 + Sside 2 + Sside 3 + Sside 4) (Max. value = 2.0)		**2.00**
4	**Minimum Fire Protection Water Supply Volume**					
	Q =			$K * V * S_{Tot}$		**75,238 L**
Required Minimum Water Supply Flow Rate						
5	**Minimum Water Supply Flow Rate =**			From Table 2 (For water supply from a municipal or industrial water supply system, min. pressure is 140 kPa)		**2,700 L/min** or **45 L/s**
Minimum Fire Protection Water Supply Volume for 30 minutes						
6	**Q =**			= Minimum Water Supply Flow Rate (L/min) * 30 minutes		**81,000 L**
Required Fire Protection Water Supply Volume						
7	**Q =**			Highest volume out of (4) and (6)		**81,000 L**
Notes						

WATERMAIN DESIGN SHEET

Single Connection (County Road 29)

Population and Consumption Rate Calculations - Full Build Out

Node	Elevation	Number of Units			Population	Consumption Rates (L/s)			Maximum Fire Flow (OBC)
		Singles	2-Storey Townhomes	Bungalow Towns/Semis		Average Daily	Maximum Daily	Maximum Hourly	
J-89	124.46								
N1	122.75	3	4		21	0.09	0.23	0.51	105.00
N2	126.00		15		41	0.16	0.40	0.88	105.00
N3	122.75	5	6	3	41	0.17	0.43	0.95	105.00
N4	119.55	7	5	6	54	0.22	0.55	1.21	105.00
N5	120.00	11		6	54	0.22	0.55	1.21	105.00
N6	118.50	10		4	45	0.18	0.45	0.99	75.00
N7	115.50	12			41	0.17	0.43	0.95	60.00
N8	125.50	11	10	6	81	0.33	0.83	1.83	105.00
N9	123.00	6	6	3	45	0.18	0.45	0.99	105.00
N10	125.50	10	6	3	58	0.24	0.60	1.32	105.00
N11	120.00	10		9	58	0.24	0.60	1.32	105.00
N12	116.75	19			65	0.26	0.65	1.43	60.00
N13	113.00	7			24	0.10	0.25	0.55	60.00
N14	112.50	8			27	0.11	0.28	0.62	60.00
N15	114.25	14			48	0.19	0.48	1.06	60.00
		133	**52**	**40**	**701**	**2.86**	**7.18**	**15.82**	

Water Demand Parameters

1. Population density (as per City of Ottawa):

Single Units	3.4 people/unit
Semi- Detached Units	2.7 people/unit
Townhome Units	2.7 people/unit
Apartments	2.1 people/unit

2. Total Population at each node rounded to nearest whole number.
3. Population demand = 350L/s/d/c (Average Demand, as per 2018 MSS by JL Richards)
4. Water Demand (as per City of Ottawa):

Average Day Demand (Avg. Day) = Population*350L/s/d/person/86400s/day
Maximum Day Demand (Max. Day) = 2.5*Avg. Day
Peak Hour Demand = 2.2*Max. Day

5. Fire Flows (as per OBC 2012):

2-Storey Townhome Units: 4-unit Block 105L/s; 5-unit Block 105L/s; 6-unit Block 150L/s; 6-unit Block with a 2hr Firewall 105L/s

Bungalow Townhome/Semi Units: 2-unit Block 75L/s; 3-unit Block 105L/s; Singles: 33', 37' & 42' 45L/s; Singles: 50' 60L/s

NOTE: The maximum fire flow available under the single 250mm dia. watermain connection is +/- ***45L/s*** *(JL Richards, August 2022).*

6. Calculated Boundary Conditions at J-89:

Average Day (@ 2.86L/s) = 178.32
Peak Hour (@ 15.82L/s) = 174.44
Max. Day + 45L/s Fire flow (@ 52.18L/s) = 148.96

NOTE: 1. Model a maximum available fire flow of 45L/s (Total Demand = 52.15L/s - consistent with maximum flow available as reported by JL Richards (Year 4 Demand for FF1 Boundary Conditions - 53.23L/s - August 2022)

2. Under the interim scenario where there is only 45L/s of FF available from the domestic pipe system, a minimum fire proptection water supply volume of 252m^3 is required as per OBC (based on critical FF - 5-unit 2-storey TH block).

AVERAGE DAY DEMAND / HIGH PRESSURE CHECK

Single Connection (County Road 29)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi	Age hours
J-89	178.32	-2.86	178.32	0.00	0.00	0.00	0.0
N1	122.75	0.09	178.30	55.55	0.00	0.00	3.9
N2	126.00	0.16	178.30	52.30	513.06	74.41	4.4
N3	122.75	0.17	178.29	55.54	544.85	79.02	5.6
N4	119.55	0.22	178.29	58.74	576.24	83.58	4.8
N5	120.00	0.22	178.29	58.29	571.82	82.94	7.0
N6	118.50	0.18	178.29	59.79	586.54	85.07	6.0
N7	115.50	0.17	178.29	62.79	615.97	89.34	9.0
N8	125.50	0.33	178.29	52.79	517.87	75.11	10.9
N9	123.00	0.18	178.29	55.29	542.39	78.67	7.8
N10	125.50	0.24	178.29	52.79	517.87	75.11	9.4
N11	120.00	0.24	178.29	58.29	571.82	82.94	10.6
N12	116.75	0.26	178.29	61.54	603.71	87.56	14.9
N13	113.00	0.10	178.29	65.29	640.49	92.90	18.3
N14	112.50	0.11	178.29	65.79	645.40	93.61	27.3
N15	114.25	0.19	178.29	64.04	628.23	91.12	29.0

Maximum Pressure
Maximum Age

NOTE:
Pressure reducing valves will be required for portions of the development (average day pressures > 80psi).

AVERAGE DAY DEMAND / HIGH PRESSURE CHECK

Single Connection (County Road 29)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	2.86	0.06	0.03	0.043
Pipe 2	65.00	250	110	1.71	0.03	0.01	0.045
Pipe 3	70.00	250	110	1.55	0.03	0.01	0.047
Pipe 4	110.00	204	110	1.06	0.03	0.01	0.048
Pipe 5	115.00	204	110	-0.12	0.00	0.00	0.046
Pipe 6	85.00	250	110	1.51	0.03	0.01	0.047
Pipe 7	90.00	204	110	0.71	0.02	0.01	0.050
Pipe 8	140.00	204	110	-0.36	0.01	0.00	0.056
Pipe 9	100.00	155	100	0.17	0.01	0.00	0.070
Pipe 10	85.00	250	110	1.35	0.03	0.01	0.048
Pipe 11	110.00	204	110	-0.33	0.01	0.00	0.053
Pipe 12	85.00	250	110	0.84	0.02	0.00	0.051
Pipe 13	160.00	155	100	0.30	0.02	0.01	0.067
Pipe 14	85.00	250	110	0.90	0.02	0.00	0.051
Pipe 15	150.00	250	110	0.52	0.01	0.00	0.054
Pipe 16	140.00	155	100	0.14	0.01	0.00	0.074
Pipe 17	100.00	250	110	0.40	0.01	0.00	0.055
Pipe 18	85.00	250	110	0.13	0.00	0.00	0.000
Pipe 19	80.00	250	110	0.17	0.00	0.00	0.000
Pipe 20	150.00	155	100	0.02	0.00	0.00	0.000

MAXIMUM HOUR DEMAND
Single Connection (County Road 29)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	174.44	-15.76	174.44	0.00	0.00	0.00
N1	122.75	0.50	173.88	51.13	501.59	72.75
N2	126.00	0.88	173.86	47.86	469.51	68.10
N3	122.75	0.94	173.84	51.09	501.19	72.69
N4	119.55	1.21	173.84	54.29	532.58	77.24
N5	120.00	1.21	173.83	53.83	528.07	76.59
N6	118.50	0.99	173.83	55.33	542.79	78.72
N7	115.50	0.94	173.83	58.33	572.22	82.99
N8	125.50	1.82	173.81	48.31	473.92	68.74
N9	123.00	0.99	173.81	50.81	498.45	72.29
N10	125.50	1.32	173.81	48.31	473.92	68.74
N11	120.00	1.32	173.80	53.80	527.78	76.55
N12	116.75	1.43	173.79	57.04	559.56	81.16
N13	113.00	0.55	173.79	60.79	596.35	86.49
N14	112.50	0.61	173.79	61.29	601.25	87.20
N15	114.25	1.05	173.79	59.54	584.09	84.71

Minimum Pressure

MAXIMUM HOUR DEMAND

Single Connection (County Road 29)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	15.76	0.32	0.69	0.033
Pipe 2	65.00	250	110	9.44	0.19	0.27	0.036
Pipe 3	70.00	250	110	8.56	0.17	0.22	0.036
Pipe 4	110.00	204	110	5.82	0.18	0.30	0.037
Pipe 5	115.00	204	110	-0.68	0.02	0.01	0.051
Pipe 6	85.00	250	110	8.30	0.17	0.21	0.036
Pipe 7	90.00	204	110	3.93	0.12	0.14	0.040
Pipe 8	140.00	204	110	-2.00	0.06	0.04	0.044
Pipe 9	100.00	155	100	0.94	0.05	0.05	0.056
Pipe 10	85.00	250	110	7.44	0.15	0.17	0.037
Pipe 11	110.00	204	110	-1.82	0.06	0.03	0.044
Pipe 12	85.00	250	110	4.63	0.09	0.07	0.040
Pipe 13	160.00	155	100	1.65	0.09	0.13	0.052
Pipe 14	85.00	250	110	4.96	0.10	0.08	0.039
Pipe 15	150.00	250	110	2.87	0.06	0.03	0.043
Pipe 16	140.00	155	100	0.77	0.04	0.03	0.058
Pipe 17	100.00	250	110	2.21	0.05	0.02	0.044
Pipe 18	85.00	250	110	0.71	0.01	0.00	0.051
Pipe 19	80.00	250	110	0.95	0.02	0.00	0.049
Pipe 20	150.00	155	100	0.10	0.01	0.00	0.077

MAXIMUM DAY + FIRE FLOW DEMAND AT N1

Single Connection (County Road 29)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	148.96	-52.18	148.96	0.00	0.00	0.00
N1	122.75	45.23	143.79	21.04	206.40	29.94
N2	126.00	0.40	143.79	17.79	174.52	25.31
N3	122.75	0.43	143.78	21.03	206.30	29.92
N4	119.55	0.55	143.78	24.23	237.70	34.47
N5	120.00	0.55	143.78	23.78	233.28	33.83
N6	118.50	0.45	143.78	25.28	248.00	35.97
N7	115.50	0.43	143.78	28.28	277.43	40.24
N8	125.50	0.83	143.78	18.28	179.33	26.01
N9	123.00	0.45	143.78	20.78	203.85	29.57
N10	125.50	0.60	143.78	18.28	179.33	26.01
N11	120.00	0.60	143.77	23.77	233.18	33.82
N12	116.75	0.65	143.77	27.02	265.07	38.44
N13	113.00	0.25	143.77	30.77	301.85	43.78
N14	112.50	0.28	143.77	31.27	306.76	44.49
N15	114.25	0.48	143.77	29.52	289.59	42.00

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N1

Single Connection (County Road 29)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	52.18	1.06	6.38	0.028
Pipe 2	65.00	250	110	4.30	0.09	0.06	0.040
Pipe 3	70.00	250	110	3.90	0.08	0.05	0.041
Pipe 4	110.00	204	110	2.65	0.08	0.07	0.042
Pipe 5	115.00	204	110	-0.31	0.01	0.00	0.058
Pipe 6	85.00	250	110	3.78	0.08	0.05	0.041
Pipe 7	90.00	204	110	1.79	0.05	0.03	0.044
Pipe 8	140.00	204	110	-0.91	0.03	0.01	0.049
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.063
Pipe 10	85.00	250	110	3.39	0.07	0.04	0.041
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.050
Pipe 12	85.00	250	110	2.11	0.04	0.02	0.045
Pipe 13	160.00	155	100	0.75	0.04	0.03	0.058
Pipe 14	85.00	250	110	2.26	0.05	0.02	0.044
Pipe 15	150.00	250	110	1.31	0.03	0.01	0.048
Pipe 16	140.00	155	100	0.35	0.02	0.01	0.065
Pipe 17	100.00	250	110	1.01	0.02	0.00	0.050
Pipe 18	85.00	250	110	0.33	0.01	0.00	0.061
Pipe 19	80.00	250	110	0.43	0.01	0.00	0.059
Pipe 20	150.00	155	100	0.05	0.00	0.00	0.093

MAXIMUM DAY + FIRE FLOW DEMAND AT N2

Single Connection (County Road 29)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	148.96	-52.18	148.96	0.00	0.00	0.00
N1	122.75	0.23	143.79	21.04	206.40	29.94
N2	126.00	45.40	143.56	17.56	172.26	24.98
N3	122.75	0.43	143.57	20.82	204.24	29.62
N4	119.55	0.55	143.63	24.08	236.22	34.26
N5	120.00	0.55	143.57	23.57	231.22	33.54
N6	118.50	0.45	143.60	25.10	246.23	35.71
N7	115.50	0.43	143.60	28.10	275.66	39.98
N8	125.50	0.83	143.57	18.07	177.27	25.71
N9	123.00	0.45	143.57	20.57	201.79	29.27
N10	125.50	0.60	143.57	18.07	177.27	25.71
N11	120.00	0.60	143.57	23.57	231.22	33.54
N12	116.75	0.65	143.57	26.82	263.10	38.16
N13	113.00	0.25	143.57	30.57	299.89	43.50
N14	112.50	0.28	143.57	31.07	304.80	44.21
N15	114.25	0.48	143.57	29.32	287.63	41.72

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N2

Single Connection (County Road 29)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	52.18	1.06	6.38	0.028
Pipe 2	65.00	250	110	38.04	0.77	3.55	0.029
Pipe 3	70.00	250	110	-7.36	0.15	0.17	0.037
Pipe 4	110.00	204	110	13.91	0.43	1.48	0.033
Pipe 5	115.00	204	110	-7.61	0.23	0.49	0.036
Pipe 6	85.00	250	110	-0.18	0.00	0.00	0.039
Pipe 7	90.00	204	110	5.75	0.18	0.29	0.037
Pipe 8	140.00	204	110	-4.87	0.15	0.21	0.038
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.064
Pipe 10	85.00	250	110	3.39	0.07	0.04	0.041
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.050
Pipe 12	85.00	250	110	2.11	0.04	0.02	0.045
Pipe 13	160.00	155	100	0.75	0.04	0.03	0.058
Pipe 14	85.00	250	110	2.26	0.05	0.02	0.044
Pipe 15	150.00	250	110	1.31	0.03	0.01	0.048
Pipe 16	140.00	155	100	0.35	0.02	0.01	0.065
Pipe 17	100.00	250	110	1.01	0.02	0.00	0.050
Pipe 18	85.00	250	110	0.33	0.01	0.00	0.061
Pipe 19	80.00	250	110	0.43	0.01	0.00	0.059
Pipe 20	150.00	155	100	0.05	0.00	0.00	0.093

MAXIMUM DAY + FIRE FLOW DEMAND AT N3

Single Connection (County Road 29)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	148.96	-52.18	148.96	0.00	0.00	0.00
N1	122.75	0.23	143.79	21.04	206.40	29.94
N2	126.00	0.40	143.61	17.61	172.75	25.06
N3	122.75	45.43	143.42	20.67	202.77	29.41
N4	119.55	0.55	143.52	23.97	235.15	34.10
N5	120.00	0.55	143.42	23.42	229.75	33.32
N6	118.50	0.45	143.47	24.97	244.96	35.53
N7	115.50	0.43	143.47	27.97	274.39	39.80
N8	125.50	0.83	143.41	17.91	175.70	25.48
N9	123.00	0.45	143.42	20.42	200.32	29.05
N10	125.50	0.60	143.41	17.91	175.70	25.48
N11	120.00	0.60	143.41	23.41	229.65	33.31
N12	116.75	0.65	143.41	26.66	261.53	37.93
N13	113.00	0.25	143.41	30.41	298.32	43.27
N14	112.50	0.28	143.41	30.91	303.23	43.98
N15	114.25	0.48	143.41	29.16	286.06	41.49

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N3

Single Connection (County Road 29)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	52.18	1.06	6.38	0.028
Pipe 2	65.00	250	110	33.48	0.68	2.81	0.030
Pipe 3	70.00	250	110	33.08	0.67	2.74	0.030
Pipe 4	110.00	204	110	18.47	0.56	2.51	0.031
Pipe 5	115.00	204	110	-10.33	0.32	0.86	0.034
Pipe 6	85.00	250	110	-2.01	0.04	0.02	0.045
Pipe 7	90.00	204	110	7.58	0.23	0.48	0.036
Pipe 8	140.00	204	110	-6.70	0.21	0.38	0.037
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.063
Pipe 10	85.00	250	110	3.39	0.07	0.04	0.042
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.049
Pipe 12	85.00	250	110	2.11	0.04	0.02	0.045
Pipe 13	160.00	155	100	0.75	0.04	0.03	0.058
Pipe 14	85.00	250	110	2.26	0.05	0.02	0.044
Pipe 15	150.00	250	110	1.31	0.03	0.01	0.048
Pipe 16	140.00	155	100	0.35	0.02	0.01	0.065
Pipe 17	100.00	250	110	1.01	0.02	0.00	0.050
Pipe 18	85.00	250	110	0.33	0.01	0.00	0.061
Pipe 19	80.00	250	110	0.43	0.01	0.00	0.059
Pipe 20	150.00	155	100	0.05	0.00	0.00	0.093

MAXIMUM DAY + FIRE FLOW DEMAND AT N4

Single Connection (County Road 29)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	148.96	-52.18	148.96	0.00	0.00	0.00
N1	122.75	0.23	143.79	21.04	206.40	29.94
N2	126.00	0.40	143.66	17.66	173.24	25.13
N3	122.75	0.43	143.52	20.77	203.75	29.55
N4	119.55	45.55	143.35	23.80	233.48	33.86
N5	120.00	0.55	143.48	23.48	230.34	33.41
N6	118.50	0.45	143.39	24.89	244.17	35.41
N7	115.50	0.43	143.39	27.89	273.60	39.68
N8	125.50	0.83	143.47	17.97	176.29	25.57
N9	123.00	0.45	143.48	20.48	200.91	29.14
N10	125.50	0.60	143.47	17.97	176.29	25.57
N11	120.00	0.60	143.47	23.47	230.24	33.39
N12	116.75	0.65	143.47	26.72	262.12	38.02
N13	113.00	0.25	143.47	30.47	298.91	43.35
N14	112.50	0.28	143.47	30.97	303.82	44.06
N15	114.25	0.48	143.47	29.22	286.65	41.57

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N4

Single Connection (County Road 29)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	52.18	1.06	6.38	0.028
Pipe 2	65.00	250	110	28.11	0.57	2.03	0.030
Pipe 3	70.00	250	110	27.71	0.56	1.98	0.030
Pipe 4	110.00	204	110	23.84	0.73	4.03	0.030
Pipe 5	115.00	204	110	14.00	0.43	1.50	0.033
Pipe 6	85.00	250	110	13.28	0.27	0.51	0.034
Pipe 7	90.00	204	110	-7.71	0.24	0.50	0.036
Pipe 8	140.00	204	110	8.59	0.26	0.61	0.035
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.063
Pipe 10	85.00	250	110	3.39	0.07	0.04	0.041
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.050
Pipe 12	85.00	250	110	2.11	0.04	0.02	0.045
Pipe 13	160.00	155	100	0.75	0.04	0.03	0.058
Pipe 14	85.00	250	110	2.26	0.05	0.02	0.044
Pipe 15	150.00	250	110	1.31	0.03	0.01	0.048
Pipe 16	140.00	155	100	0.35	0.02	0.01	0.065
Pipe 17	100.00	250	110	1.01	0.02	0.00	0.050
Pipe 18	85.00	250	110	0.33	0.01	0.00	0.061
Pipe 19	80.00	250	110	0.43	0.01	0.00	0.059
Pipe 20	150.00	155	100	0.05	0.00	0.00	0.093

MAXIMUM DAY + FIRE FLOW DEMAND AT N5

Single Connection (County Road 29)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	148.96	-52.18	148.96	0.00	0.00	0.00
N1	122.75	0.23	143.79	21.04	206.40	29.94
N2	126.00	0.40	143.62	17.62	172.85	25.07
N3	122.75	0.43	143.45	20.70	203.07	29.45
N4	119.55	0.55	143.48	23.93	234.75	34.05
N5	120.00	45.55	143.16	23.16	227.20	32.95
N6	118.50	0.45	143.34	24.84	243.68	35.34
N7	115.50	0.43	143.34	27.84	273.11	39.61
N8	125.50	0.83	143.16	17.66	173.24	25.13
N9	123.00	0.45	143.16	20.16	197.77	28.68
N10	125.50	0.60	143.16	17.66	173.24	25.13
N11	120.00	0.60	143.16	23.16	227.20	32.95
N12	116.75	0.65	143.16	26.41	259.08	37.58
N13	113.00	0.25	143.15	30.15	295.77	42.90
N14	112.50	0.28	143.15	30.65	300.68	43.61
N15	114.25	0.48	143.15	28.90	283.51	41.12

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N5

Single Connection (County Road 29)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	52.18	1.06	6.38	0.028
Pipe 2	65.00	250	110	32.10	0.65	2.59	0.030
Pipe 3	70.00	250	110	31.70	0.65	2.53	0.030
Pipe 4	110.00	204	110	19.85	0.61	2.87	0.031
Pipe 5	115.00	204	110	-5.48	0.17	0.26	0.038
Pipe 6	85.00	250	110	36.75	0.75	3.33	0.029
Pipe 7	90.00	204	110	13.82	0.42	1.47	0.033
Pipe 8	140.00	204	110	-12.94	0.40	1.30	0.033
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.063
Pipe 10	85.00	250	110	3.39	0.07	0.04	0.041
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.050
Pipe 12	85.00	250	110	2.11	0.04	0.02	0.045
Pipe 13	160.00	155	100	0.75	0.04	0.03	0.058
Pipe 14	85.00	250	110	2.26	0.05	0.02	0.044
Pipe 15	150.00	250	110	1.31	0.03	0.01	0.048
Pipe 16	140.00	155	100	0.35	0.02	0.01	0.065
Pipe 17	100.00	250	110	1.01	0.02	0.00	0.050
Pipe 18	85.00	250	110	0.33	0.01	0.00	0.061
Pipe 19	80.00	250	110	0.43	0.01	0.00	0.059
Pipe 20	150.00	155	100	0.05	0.00	0.00	0.093

MAXIMUM DAY + FIRE FLOW DEMAND AT N6

Single Connection (County Road 29)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	148.96	-52.18	148.96	0.00	0.00	0.00
N1	122.75	0.23	143.79	21.04	206.40	29.94
N2	126.00	0.40	143.64	17.64	173.05	25.10
N3	122.75	0.43	143.47	20.72	203.26	29.48
N4	119.55	0.55	143.43	23.88	234.26	33.98
N5	120.00	0.55	143.35	23.35	229.06	33.22
N6	118.50	45.45	142.98	24.48	240.15	34.83
N7	115.50	0.43	142.98	27.48	269.58	39.10
N8	125.50	0.83	143.34	17.84	175.01	25.38
N9	123.00	0.45	143.34	20.34	199.54	28.94
N10	125.50	0.60	143.34	17.84	175.01	25.38
N11	120.00	0.60	143.34	23.34	228.97	33.21
N12	116.75	0.65	143.34	26.59	260.85	37.83
N13	113.00	0.25	143.34	30.34	297.64	43.17
N14	112.50	0.28	143.34	30.84	302.54	43.88
N15	114.25	0.48	143.34	29.09	285.37	41.39

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N6

Single Connection (County Road 29)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	52.18	1.06	6.38	0.028
Pipe 2	65.00	250	110	30.71	0.63	2.39	0.030
Pipe 3	70.00	250	110	30.31	0.62	2.33	0.030
Pipe 4	110.00	204	110	21.24	0.65	3.25	0.031
Pipe 5	115.00	204	110	6.25	0.19	0.34	0.037
Pipe 6	85.00	250	110	23.63	0.48	1.47	0.031
Pipe 7	90.00	204	110	26.94	0.82	5.05	0.030
Pipe 8	140.00	204	110	18.94	0.58	2.63	0.031
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.063
Pipe 10	85.00	250	110	3.39	0.07	0.04	0.042
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.050
Pipe 12	85.00	250	110	2.11	0.04	0.02	0.045
Pipe 13	160.00	155	100	0.75	0.04	0.03	0.058
Pipe 14	85.00	250	110	2.26	0.05	0.02	0.044
Pipe 15	150.00	250	110	1.31	0.03	0.01	0.048
Pipe 16	140.00	155	100	0.35	0.02	0.01	0.065
Pipe 17	100.00	250	110	1.01	0.02	0.00	0.050
Pipe 18	85.00	250	110	0.33	0.01	0.00	0.061
Pipe 19	80.00	250	110	0.43	0.01	0.00	0.051
Pipe 20	150.00	155	100	0.05	0.00	0.00	0.062

MAXIMUM DAY + FIRE FLOW DEMAND AT N7

Single Connection (County Road 29)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	148.96	-52.18	148.96	0.00	0.00	0.00
N1	122.75	0.23	143.79	21.04	206.40	29.94
N2	126.00	0.40	143.64	17.64	173.05	25.10
N3	122.75	0.43	143.47	20.72	203.26	29.48
N4	119.55	0.55	143.43	23.88	234.26	33.98
N5	120.00	0.55	143.35	23.35	229.06	33.22
N6	118.50	0.45	142.98	24.48	240.15	34.83
N7	115.50	45.43	136.94	21.44	210.33	30.51
N8	125.50	0.83	143.34	17.84	175.01	25.38
N9	123.00	0.45	143.34	20.34	199.54	28.94
N10	125.50	0.60	143.34	17.84	175.01	25.38
N11	120.00	0.60	143.34	23.34	228.97	33.21
N12	116.75	0.65	143.34	26.59	260.85	37.83
N13	113.00	0.25	143.34	30.34	297.64	43.17
N14	112.50	0.28	143.34	30.84	302.54	43.88
N15	114.25	0.48	143.34	29.09	285.37	41.39

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N7

Single Connection (County Road 29)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	52.18	1.06	6.38	0.028
Pipe 2	65.00	250	110	30.71	0.63	2.39	0.030
Pipe 3	70.00	250	110	30.31	0.62	2.33	0.030
Pipe 4	110.00	204	110	21.24	0.65	3.25	0.031
Pipe 5	115.00	204	110	6.25	0.19	0.34	0.037
Pipe 6	85.00	250	110	23.63	0.48	1.47	0.031
Pipe 7	90.00	204	110	26.94	0.82	5.05	0.030
Pipe 8	140.00	204	110	18.94	0.58	2.63	0.031
Pipe 9	100.00	155	100	45.43	2.41	60.44	0.032
Pipe 10	85.00	250	110	3.39	0.07	0.04	0.042
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.050
Pipe 12	85.00	250	110	2.11	0.04	0.02	0.045
Pipe 13	160.00	155	100	0.75	0.04	0.03	0.058
Pipe 14	85.00	250	110	2.26	0.05	0.02	0.044
Pipe 15	150.00	250	110	1.31	0.03	0.01	0.048
Pipe 16	140.00	155	100	0.35	0.02	0.01	0.065
Pipe 17	100.00	250	110	1.01	0.02	0.00	0.050
Pipe 18	85.00	250	110	0.33	0.01	0.00	0.061
Pipe 19	80.00	250	110	0.43	0.01	0.00	0.051
Pipe 20	150.00	155	100	0.05	0.00	0.00	0.062

MAXIMUM DAY + FIRE FLOW DEMAND AT N8

Single Connection (County Road 29)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	148.96	-52.18	148.96	0.00	0.00	0.00
N1	122.75	0.23	143.79	21.04	206.40	29.94
N2	126.00	0.40	143.62	17.62	172.85	25.07
N3	122.75	0.43	143.45	20.70	203.07	29.45
N4	119.55	0.55	143.48	23.93	234.75	34.05
N5	120.00	0.55	143.16	23.16	227.20	32.95
N6	118.50	0.45	143.34	24.84	243.68	35.34
N7	115.50	0.43	143.34	27.84	273.11	39.61
N8	125.50	45.83	141.32	15.82	155.19	22.51
N9	123.00	0.45	142.81	19.81	194.34	28.19
N10	125.50	0.60	142.81	17.31	169.81	24.63
N11	120.00	0.60	142.81	22.81	223.77	32.45
N12	116.75	0.65	142.81	26.06	255.65	37.08
N13	113.00	0.25	142.81	29.81	292.44	42.41
N14	112.50	0.28	142.81	30.31	297.34	43.13
N15	114.25	0.48	142.81	28.56	280.17	40.64

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N8

Single Connection (County Road 29)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	52.18	1.06	6.38	0.028
Pipe 2	65.00	250	110	32.10	0.65	2.59	0.030
Pipe 3	70.00	250	110	31.70	0.65	2.53	0.030
Pipe 4	110.00	204	110	19.85	0.61	2.87	0.031
Pipe 5	115.00	204	110	-5.48	0.17	0.26	0.038
Pipe 6	85.00	250	110	36.75	0.75	3.33	0.029
Pipe 7	90.00	204	110	13.82	0.42	1.47	0.033
Pipe 8	140.00	204	110	-12.94	0.40	1.30	0.033
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.063
Pipe 10	85.00	250	110	41.57	0.85	4.19	0.029
Pipe 11	110.00	204	110	-45.83	1.40	13.51	0.028
Pipe 12	85.00	250	110	-4.71	0.10	0.07	0.040
Pipe 13	160.00	155	100	7.57	0.40	2.19	0.041
Pipe 14	85.00	250	110	2.26	0.05	0.02	0.044
Pipe 15	150.00	250	110	1.31	0.03	0.01	0.048
Pipe 16	140.00	155	100	0.35	0.02	0.01	0.065
Pipe 17	100.00	250	110	1.01	0.02	0.00	0.050
Pipe 18	85.00	250	110	0.33	0.01	0.00	0.061
Pipe 19	80.00	250	110	0.43	0.01	0.00	0.059
Pipe 20	150.00	155	100	0.05	0.00	0.00	0.093

MAXIMUM DAY + FIRE FLOW DEMAND AT N9

Single Connection (County Road 29)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	148.96	-52.18	148.96	0.00	0.00	0.00
N1	122.75	0.23	143.79	21.04	206.40	29.94
N2	126.00	0.40	143.62	17.62	172.85	25.07
N3	122.75	0.43	143.45	20.70	203.07	29.45
N4	119.55	0.55	143.48	23.93	234.75	34.05
N5	120.00	0.55	143.16	23.16	227.20	32.95
N6	118.50	0.45	143.34	24.84	243.68	35.34
N7	115.50	0.43	143.34	27.84	273.11	39.61
N8	125.50	0.83	142.81	17.31	169.81	24.63
N9	123.00	45.45	142.81	19.81	194.34	28.19
N10	125.50	0.60	142.81	17.31	169.81	24.63
N11	120.00	0.60	142.81	22.81	223.77	32.45
N12	116.75	0.65	142.81	26.06	255.65	37.08
N13	113.00	0.25	142.81	29.81	292.44	42.41
N14	112.50	0.28	142.81	30.31	297.34	43.13
N15	114.25	0.48	142.81	28.56	280.17	40.64

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N9

Single Connection (County Road 29)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	52.18	1.06	6.38	0.028
Pipe 2	65.00	250	110	32.10	0.65	2.59	0.030
Pipe 3	70.00	250	110	31.70	0.65	2.53	0.030
Pipe 4	110.00	204	110	19.85	0.61	2.87	0.031
Pipe 5	115.00	204	110	-5.48	0.17	0.26	0.038
Pipe 6	85.00	250	110	36.75	0.75	3.33	0.029
Pipe 7	90.00	204	110	13.82	0.42	1.47	0.033
Pipe 8	140.00	204	110	-12.94	0.40	1.30	0.033
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.063
Pipe 10	85.00	250	110	41.57	0.85	4.19	0.029
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.050
Pipe 12	85.00	250	110	-4.71	0.10	0.07	0.040
Pipe 13	160.00	155	100	7.57	0.40	2.19	0.041
Pipe 14	85.00	250	110	2.26	0.05	0.02	0.044
Pipe 15	150.00	250	110	1.31	0.03	0.01	0.048
Pipe 16	140.00	155	100	0.35	0.02	0.01	0.065
Pipe 17	100.00	250	110	1.01	0.02	0.00	0.050
Pipe 18	85.00	250	110	0.33	0.01	0.00	0.061
Pipe 19	80.00	250	110	0.43	0.01	0.00	0.059
Pipe 20	150.00	155	100	0.05	0.00	0.00	0.093

MAXIMUM DAY + FIRE FLOW DEMAND AT N10

Single Connection (County Road 29)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	148.96	-52.18	148.96	0.00	0.00	0.00
N1	122.75	0.23	143.79	21.04	206.40	29.94
N2	126.00	0.40	143.62	17.62	172.85	25.07
N3	122.75	0.43	143.45	20.70	203.07	29.45
N4	119.55	0.55	143.48	23.93	234.75	34.05
N5	120.00	0.55	143.16	23.16	227.20	32.95
N6	118.50	0.45	143.34	24.84	243.68	35.34
N7	115.50	0.43	143.34	27.84	273.11	39.61
N8	125.50	0.83	142.85	17.35	170.20	24.69
N9	123.00	0.45	142.85	19.85	194.73	28.24
N10	125.50	45.60	142.55	17.05	167.26	24.26
N11	120.00	0.60	142.55	22.55	221.22	32.08
N12	116.75	0.65	142.55	25.80	253.10	36.71
N13	113.00	0.25	142.55	29.55	289.89	42.04
N14	112.50	0.28	142.55	30.05	294.79	42.76
N15	114.25	0.48	142.55	28.30	277.62	40.27

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N10

Single Connection (County Road 29)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	52.18	1.06	6.38	0.028
Pipe 2	65.00	250	110	32.10	0.65	2.59	0.030
Pipe 3	70.00	250	110	31.70	0.65	2.53	0.030
Pipe 4	110.00	204	110	19.85	0.61	2.87	0.031
Pipe 5	115.00	204	110	-5.48	0.17	0.26	0.038
Pipe 6	85.00	250	110	36.75	0.75	3.33	0.029
Pipe 7	90.00	204	110	13.82	0.42	1.47	0.033
Pipe 8	140.00	204	110	-12.94	0.40	1.30	0.033
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.063
Pipe 10	85.00	250	110	38.91	0.79	3.71	0.029
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.049
Pipe 12	85.00	250	110	37.63	0.77	3.48	0.029
Pipe 13	160.00	155	100	10.23	0.54	3.82	0.040
Pipe 14	85.00	250	110	2.26	0.05	0.02	0.044
Pipe 15	150.00	250	110	1.31	0.03	0.01	0.048
Pipe 16	140.00	155	100	0.35	0.02	0.01	0.065
Pipe 17	100.00	250	110	1.01	0.02	0.00	0.050
Pipe 18	85.00	250	110	0.33	0.01	0.00	0.061
Pipe 19	80.00	250	110	0.43	0.01	0.00	0.059
Pipe 20	150.00	155	100	0.05	0.00	0.00	0.093

MAXIMUM DAY + FIRE FLOW DEMAND AT N11

Single Connection (County Road 29)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	148.96	-52.18	148.96	0.00	0.00	0.00
N1	122.75	0.23	143.79	21.04	206.40	29.94
N2	126.00	0.40	143.62	17.62	172.85	25.07
N3	122.75	0.43	143.45	20.70	203.07	29.45
N4	119.55	0.55	143.48	23.93	234.75	34.05
N5	120.00	0.55	143.16	23.16	227.20	32.95
N6	118.50	0.45	143.34	24.84	243.68	35.34
N7	115.50	0.43	143.34	27.84	273.11	39.61
N8	125.50	0.83	142.85	17.35	170.20	24.69
N9	123.00	0.45	142.85	19.85	194.73	28.24
N10	125.50	0.60	142.55	17.05	167.26	24.26
N11	120.00	45.60	142.10	22.10	216.80	31.44
N12	116.75	0.65	142.10	25.35	248.68	36.07
N13	113.00	0.25	142.10	29.10	285.47	41.40
N14	112.50	0.28	142.10	29.60	290.38	42.12
N15	114.25	0.48	142.10	27.85	273.21	39.63

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N11

Single Connection (County Road 29)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	52.18	1.06	6.38	0.028
Pipe 2	65.00	250	110	32.10	0.65	2.59	0.030
Pipe 3	70.00	250	110	31.70	0.65	2.53	0.030
Pipe 4	110.00	204	110	19.85	0.61	2.87	0.031
Pipe 5	115.00	204	110	-5.48	0.17	0.26	0.038
Pipe 6	85.00	250	110	36.75	0.75	3.33	0.029
Pipe 7	90.00	204	110	13.82	0.42	1.47	0.033
Pipe 8	140.00	204	110	-12.94	0.40	1.30	0.033
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.063
Pipe 10	85.00	250	110	38.91	0.79	3.71	0.029
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.049
Pipe 12	85.00	250	110	37.63	0.77	3.48	0.029
Pipe 13	160.00	155	100	10.23	0.54	3.82	0.040
Pipe 14	85.00	250	110	47.26	0.96	5.31	0.028
Pipe 15	150.00	250	110	1.31	0.03	0.01	0.048
Pipe 16	140.00	155	100	0.35	0.02	0.01	0.065
Pipe 17	100.00	250	110	1.01	0.02	0.00	0.050
Pipe 18	85.00	250	110	0.33	0.01	0.00	0.061
Pipe 19	80.00	250	110	0.43	0.01	0.00	0.059
Pipe 20	150.00	155	100	0.05	0.00	0.00	0.093

MAXIMUM DAY + FIRE FLOW DEMAND AT N12

Single Connection (County Road 29)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	148.96	-52.18	148.96	0.00	0.00	0.00
N1	122.75	0.23	143.79	21.04	206.40	29.94
N2	126.00	0.40	143.62	17.62	172.85	25.07
N3	122.75	0.43	143.45	20.70	203.07	29.45
N4	119.55	0.55	143.48	23.93	234.75	34.05
N5	120.00	0.55	143.16	23.16	227.20	32.95
N6	118.50	0.45	143.34	24.84	243.68	35.34
N7	115.50	0.43	143.34	27.84	273.11	39.61
N8	125.50	0.83	142.85	17.35	170.20	24.69
N9	123.00	0.45	142.85	19.85	194.73	28.24
N10	125.50	0.60	142.55	17.05	167.26	24.26
N11	120.00	0.60	142.10	22.10	216.80	31.44
N12	116.75	45.65	141.60	24.85	243.78	35.36
N13	113.00	0.25	141.60	28.60	280.57	40.69
N14	112.50	0.28	141.60	29.10	285.47	41.40
N15	114.25	0.48	141.60	27.35	268.30	38.91

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N12

Single Connection (County Road 29)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	52.18	1.06	6.38	0.028
Pipe 2	65.00	250	110	32.10	0.65	2.59	0.030
Pipe 3	70.00	250	110	31.70	0.65	2.53	0.030
Pipe 4	110.00	204	110	19.85	0.61	2.87	0.031
Pipe 5	115.00	204	110	-5.48	0.17	0.26	0.038
Pipe 6	85.00	250	110	36.75	0.75	3.33	0.029
Pipe 7	90.00	204	110	13.82	0.42	1.47	0.033
Pipe 8	140.00	204	110	-12.94	0.40	1.30	0.033
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.063
Pipe 10	85.00	250	110	38.91	0.79	3.71	0.029
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.049
Pipe 12	85.00	250	110	37.63	0.77	3.48	0.029
Pipe 13	160.00	155	100	10.23	0.54	3.82	0.040
Pipe 14	85.00	250	110	47.26	0.96	5.31	0.028
Pipe 15	150.00	250	110	36.79	0.75	3.34	0.029
Pipe 16	140.00	155	100	9.87	0.52	3.58	0.040
Pipe 17	100.00	250	110	1.01	0.02	0.00	0.051
Pipe 18	85.00	250	110	0.33	0.01	0.00	0.049
Pipe 19	80.00	250	110	0.43	0.01	0.00	0.051
Pipe 20	150.00	155	100	0.05	0.00	0.00	0.093

MAXIMUM DAY + FIRE FLOW DEMAND AT N13

Single Connection (County Road 29)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	148.96	-52.18	148.96	0.00	0.00	0.00
N1	122.75	0.23	143.79	21.04	206.40	29.94
N2	126.00	0.40	143.62	17.62	172.85	25.07
N3	122.75	0.43	143.45	20.70	203.07	29.45
N4	119.55	0.55	143.48	23.93	234.75	34.05
N5	120.00	0.55	143.16	23.16	227.20	32.95
N6	118.50	0.45	143.34	24.84	243.68	35.34
N7	115.50	0.43	143.34	27.84	273.11	39.61
N8	125.50	0.83	142.85	17.35	170.20	24.69
N9	123.00	0.45	142.85	19.85	194.73	28.24
N10	125.50	0.60	142.55	17.05	167.26	24.26
N11	120.00	0.60	142.10	22.10	216.80	31.44
N12	116.75	0.65	141.60	24.85	243.78	35.36
N13	113.00	45.25	141.09	28.09	275.56	39.97
N14	112.50	0.28	141.09	28.59	280.47	40.68
N15	114.25	0.48	141.09	26.84	263.30	38.19

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N13

Single Connection (County Road 29)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	52.18	1.06	6.38	0.028
Pipe 2	65.00	250	110	32.10	0.65	2.59	0.030
Pipe 3	70.00	250	110	31.70	0.65	2.53	0.030
Pipe 4	110.00	204	110	19.85	0.61	2.87	0.031
Pipe 5	115.00	204	110	-5.48	0.17	0.26	0.038
Pipe 6	85.00	250	110	36.75	0.75	3.33	0.029
Pipe 7	90.00	204	110	13.82	0.42	1.47	0.033
Pipe 8	140.00	204	110	-12.94	0.40	1.30	0.033
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.063
Pipe 10	85.00	250	110	38.91	0.79	3.71	0.029
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.049
Pipe 12	85.00	250	110	37.63	0.77	3.48	0.029
Pipe 13	160.00	155	100	10.23	0.54	3.82	0.040
Pipe 14	85.00	250	110	47.26	0.96	5.31	0.028
Pipe 15	150.00	250	110	36.79	0.75	3.34	0.029
Pipe 16	140.00	155	100	9.87	0.52	3.58	0.040
Pipe 17	100.00	250	110	46.01	0.94	5.05	0.028
Pipe 18	85.00	250	110	0.33	0.01	0.00	0.061
Pipe 19	80.00	250	110	0.43	0.01	0.00	0.059
Pipe 20	150.00	155	100	0.05	0.00	0.00	0.093

MAXIMUM DAY + FIRE FLOW DEMAND AT N14

Single Connection (County Road 29)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	148.96	-52.18	148.96	0.00	0.00	0.00
N1	122.75	0.23	143.79	21.04	206.40	29.94
N2	126.00	0.40	143.62	17.62	172.85	25.07
N3	122.75	0.43	143.45	20.70	203.07	29.45
N4	119.55	0.55	143.48	23.93	234.75	34.05
N5	120.00	0.55	143.16	23.16	227.20	32.95
N6	118.50	0.45	143.34	24.84	243.68	35.34
N7	115.50	0.43	143.34	27.84	273.11	39.61
N8	125.50	0.83	142.85	17.35	170.20	24.69
N9	123.00	0.45	142.85	19.85	194.73	28.24
N10	125.50	0.60	142.55	17.05	167.26	24.26
N11	120.00	0.60	142.10	22.10	216.80	31.44
N12	116.75	0.65	141.60	24.85	243.78	35.36
N13	113.00	0.25	141.09	28.09	275.56	39.97
N14	112.50	45.28	140.79	28.29	277.52	40.25
N15	114.25	0.48	141.08	26.83	263.20	38.17

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N14

Single Connection (County Road 29)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	52.18	1.06	6.38	0.028
Pipe 2	65.00	250	110	32.10	0.65	2.59	0.030
Pipe 3	70.00	250	110	31.70	0.65	2.53	0.030
Pipe 4	110.00	204	110	19.85	0.61	2.87	0.031
Pipe 5	115.00	204	110	-5.48	0.17	0.26	0.038
Pipe 6	85.00	250	110	36.75	0.75	3.33	0.029
Pipe 7	90.00	204	110	13.82	0.42	1.47	0.033
Pipe 8	140.00	204	110	-12.94	0.40	1.30	0.033
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.063
Pipe 10	85.00	250	110	38.91	0.79	3.71	0.029
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.049
Pipe 12	85.00	250	110	37.63	0.77	3.48	0.029
Pipe 13	160.00	155	100	10.23	0.54	3.82	0.040
Pipe 14	85.00	250	110	47.26	0.96	5.31	0.028
Pipe 15	150.00	250	110	36.79	0.75	3.34	0.029
Pipe 16	140.00	155	100	9.87	0.52	3.58	0.040
Pipe 17	100.00	250	110	46.01	0.94	5.05	0.028
Pipe 18	85.00	250	110	38.20	0.78	3.58	0.029
Pipe 19	80.00	250	110	7.56	0.15	0.18	0.037
Pipe 20	150.00	155	100	-7.08	0.38	1.93	0.042

MAXIMUM DAY + FIRE FLOW DEMAND AT N15

Single Connection (County Road 29)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	148.96	-52.18	148.96	0.00	0.00	0.00
N1	122.75	0.23	143.79	21.04	206.40	29.94
N2	126.00	0.40	143.62	17.62	172.85	25.07
N3	122.75	0.43	143.45	20.70	203.07	29.45
N4	119.55	0.55	143.48	23.93	234.75	34.05
N5	120.00	0.55	143.16	23.16	227.20	32.95
N6	118.50	0.45	143.34	24.84	243.68	35.34
N7	115.50	0.43	143.34	27.84	273.11	39.61
N8	125.50	0.83	142.85	17.35	170.20	24.69
N9	123.00	0.45	142.85	19.85	194.73	28.24
N10	125.50	0.60	142.55	17.05	167.26	24.26
N11	120.00	0.60	142.10	22.10	216.80	31.44
N12	116.75	0.65	141.60	24.85	243.78	35.36
N13	113.00	0.25	141.09	28.09	275.56	39.97
N14	112.50	0.28	141.08	28.58	280.37	40.66
N15	114.25	45.48	140.80	26.55	260.46	37.78

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N15

Single Connection (County Road 29)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	52.18	1.06	6.38	0.028
Pipe 2	65.00	250	110	32.10	0.65	2.59	0.030
Pipe 3	70.00	250	110	31.70	0.65	2.53	0.030
Pipe 4	110.00	204	110	19.85	0.61	2.87	0.031
Pipe 5	115.00	204	110	-5.48	0.17	0.26	0.038
Pipe 6	85.00	250	110	36.75	0.75	3.33	0.029
Pipe 7	90.00	204	110	13.82	0.42	1.47	0.033
Pipe 8	140.00	204	110	-12.94	0.40	1.30	0.033
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.063
Pipe 10	85.00	250	110	38.91	0.79	3.71	0.029
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.049
Pipe 12	85.00	250	110	37.63	0.77	3.48	0.029
Pipe 13	160.00	155	100	10.23	0.54	3.82	0.040
Pipe 14	85.00	250	110	47.26	0.96	5.31	0.028
Pipe 15	150.00	250	110	36.79	0.75	3.34	0.029
Pipe 16	140.00	155	100	9.87	0.52	3.58	0.040
Pipe 17	100.00	250	110	46.01	0.94	5.05	0.028
Pipe 18	85.00	250	110	7.20	0.15	0.16	0.037
Pipe 19	80.00	250	110	38.56	0.79	3.64	0.029
Pipe 20	150.00	155	100	6.92	0.37	1.85	0.042

MAXIMUM DAY + FIRE FLOW DEMAND SUMMARY

Single Connection (County Road 29)

Maximum day plus fire flow demand was modeled for select nodes
The following is a summary of the minimum pressures that occurred for each operating condition.

	Demand (L/s)				Minimum Pressure			
Fire at Junction	Maximum Daily	Actual Fire Flow	Restricted Fire Flow	Max Day + Fire	(m)	kPa	psi	Node
N1	0.23	90.00	45.00	45.23	17.79	174.52	25.31	N2
N2	0.40	150.00	45.00	45.40	17.56	172.26	24.98	N2
N3	0.43	150.00	45.00	45.43	17.61	172.75	25.06	N2
N4	0.55	105.00	45.00	45.55	17.66	173.24	25.13	N2
N5	0.55	90.00	45.00	45.55	17.62	172.85	25.07	N2
N6	0.45	60.00	45.00	45.45	17.64	173.05	25.10	N2
N7	0.43	45.00	45.00	45.43	17.64	173.05	25.10	N2
N8	0.83	150.00	45.00	45.83	15.82	155.19	22.51	N8
N9	0.45	150.00	45.00	45.45	17.31	169.81	24.63	N8/N10
N10	0.60	150.00	45.00	45.60	17.05	167.26	24.26	N10
N11	0.60	90.00	45.00	45.60	17.05	167.26	24.26	N10
N12	0.65	45.00	45.00	45.65	17.05	167.26	24.26	N10
N13	0.25	45.00	45.00	45.25	17.05	167.26	24.26	N10
N14	0.28	45.00	45.00	45.28	17.05	167.26	24.26	N10
N15	0.48	45.00	45.00	45.48	17.05	167.26	24.26	N10

Note: Only 45L/s Fire Flow available under interim conditions (single 250mm dia. connection on Cty. Rd. 29), as per JLR. Additional required fire flows (up to 105L/s equivalent) proposed to be supplied by on-site dry hydrant and storage pond.

WATERMAIN DESIGN SHEET

Dual Connection (County Road 29 and Mississippi River Crossing)

Population and Consumption Rate Calculations - Full Build Out

Node	Elevation	Number of Units			Population	Consumption Rates (L/s)			Maximum Fire Flow (OBC)
		Singles	2-Storey Townhomes	Bungalow Towns/Semis		Average Daily	Maximum Daily	Maximum Hourly	
J-89	124.46								
J-567	132.80								
N1	122.75	3	4		21	0.09	0.23	0.51	105.00
N2	126.00		15		41	0.16	0.40	0.88	105.00
N3	122.75	5	6	3	41	0.17	0.43	0.95	105.00
N4	119.55	7	5	6	54	0.22	0.55	1.21	105.00
N5	120.00	11		6	54	0.22	0.55	1.21	105.00
N6	118.50	10		4	45	0.18	0.45	0.99	75.00
N7	115.50	12			41	0.17	0.43	0.95	60.00
N8	125.50	11	10	6	81	0.33	0.83	1.83	105.00
N9	123.00	6	6	3	45	0.18	0.45	0.99	105.00
N10	125.50	10	6	3	58	0.24	0.60	1.32	105.00
N11	120.00	10		9	58	0.24	0.60	1.32	105.00
N12	116.75	19			65	0.26	0.65	1.43	60.00
N13	113.00	7			24	0.10	0.25	0.55	60.00
N14	112.50	8			27	0.11	0.28	0.62	60.00
N15	114.25	14			48	0.19	0.48	1.06	60.00
		133	**52**	**40**	**701**	**2.86**	**7.18**	**15.82**	

Water Demand Parameters

1. Population density (as per City of Ottawa):

Single Units	3.4 people/unit
Semi- Detached Units	2.7 people/unit
Townhome Units	2.7 people/unit
Apartments	2.1 people/unit

2. Total Population at each node rounded to nearest whole number.
3. Population demand = 350L/s/d/c (Average Demand, as per 2018 MSS by JL Richards)
4. Water

Average Day Demand (Avg. Day) = Population*350L/s/d/person/86400s/day
Maximum Day Demand (Max. Day) = 2.5*Avg. Day
Peak Hour Demand = 2.2*Max. Day

5. Fire Flows (as per OBC 2012):

2-Storey Townhome Units: 4-unit Block 105L/s; 5-unit Block 105L/s; 6-unit Block 150L/s; 6-unit Block with a 2hr Firewall 105L/s

Bungalow Townhome/Semi Units: 2-unit Block 75L/s; 3-unit Block 105L/s

Singles: 33', 37' & 42' 45L/s; Singles: 50' 60L/s

NOTE: Maximum available fireflow is +/- ***147L/s*** *(JL Richards, February 2023).*

6. Calculated Boundary Conditions:

J-89:
Average Day (@ 2.86L/s) = 179.54
Peak Hour (@ 15.82L/s) = 178.41
Max. Day + 60L/s Fire flow (@ 67.18L/s) = 173.26
Max. Day + 75L/s Fire flow (@ 72.18L/s) = 170.25
Max. Day + 105L/s Fire flow (@ 112.18L/s) = 162.60

J-567:
Average Day (@ 2.86L/s) = 179.61
Peak Hour (@ 15.82L/s) = 178.46
Max. Day + 60L/s Fire flow (@ 67.18L/s) = 174.57
Max. Day + 75L/s Fire flow (@ 72.18L/s) = 172.32
Max. Day + 105L/s Fire flow (@ 112.18L/s) = 166.74

AVERAGE DAY DEMAND / HIGH PRESSURE CHECK

Dual Connection (County Road 29 and Mississippi River Crossing)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi	Age hours
J-89	179.54	2.29	179.54	0.00	0.00	0.00	0.0
J-567	179.61	-5.15	179.61	0.00	0.00	0.00	0.0
N1	122.75	0.09	179.56	56.81	557.31	80.83	7.5
N2	126.00	0.16	179.56	53.56	525.42	76.21	6.2
N3	122.75	0.17	179.56	56.81	557.31	80.83	5.6
N4	119.55	0.22	179.56	60.01	588.70	85.38	7.7
N5	120.00	0.22	179.56	59.56	584.28	84.74	5.1
N6	118.50	0.18	179.56	61.06	599.00	86.88	6.4
N7	115.50	0.17	179.56	64.06	628.43	91.15	9.5
N8	125.50	0.33	179.56	54.06	530.33	76.92	7.6
N9	123.00	0.18	179.56	56.56	554.85	80.47	4.6
N10	125.50	0.24	179.56	54.06	530.33	76.92	4.2
N11	120.00	0.24	179.57	59.57	584.38	84.76	4.0
N12	116.75	0.26	179.58	62.83	616.36	89.40	3.3
N13	113.00	0.10	179.58	66.58	653.15	94.73	3.1
N14	112.50	0.11	179.59	67.09	658.15	95.46	2.5
N15	114.25	0.19	179.58	65.33	640.89	92.95	3.5

Maximum Pressure
Maximum Age

NOTE:
Pressure reducing valves will be required for portions of the development (average day pressures > 80psi).

AVERAGE DAY DEMAND / HIGH PRESSURE CHECK

Dual Connection (County Road 29 and Mississippi River Crossing)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	-2.29	0.05	0.02	0.044
Pipe 2	65.00	250	110	-1.49	0.03	0.01	0.047
Pipe 3	70.00	250	110	-1.65	0.03	0.01	0.046
Pipe 4	110.00	204	110	-0.89	0.03	0.01	0.050
Pipe 5	115.00	204	110	0.47	0.01	0.00	0.053
Pipe 6	85.00	250	110	-2.30	0.05	0.02	0.044
Pipe 7	90.00	204	110	-0.64	0.02	0.00	0.052
Pipe 8	140.00	204	110	0.99	0.03	0.01	0.048
Pipe 9	100.00	155	100	0.17	0.01	0.00	0.077
Pipe 10	85.00	250	110	-2.71	0.06	0.03	0.043
Pipe 11	110.00	204	110	-0.33	0.01	0.00	0.060
Pipe 12	85.00	250	110	-3.22	0.07	0.04	0.042
Pipe 13	160.00	155	100	-0.79	0.04	0.03	0.058
Pipe 14	85.00	250	110	-4.25	0.09	0.06	0.040
Pipe 15	150.00	250	110	-3.54	0.07	0.04	0.041
Pipe 16	140.00	155	100	-0.95	0.05	0.05	0.056
Pipe 17	100.00	250	110	-4.75	0.10	0.08	0.040
Pipe 18	85.00	250	110	-4.25	0.09	0.06	0.040
Pipe 19	80.00	250	110	-0.61	0.01	0.00	0.052
Pipe 20	150.00	155	100	0.80	0.04	0.03	0.058
Pipe 21	660.00	297	120	5.15	0.07	0.03	0.034

MAXIMUM HOUR DEMAND

Dual Connection (County Road 29 and Mississippi River Crossing)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	178.23	-5.23	178.23	0.00	0.00	0.00
J-567	178.30	-10.53	178.30	0.00	0.00	0.00
N1	122.75	0.50	178.16	55.41	543.57	78.84
N2	126.00	0.88	178.15	52.15	511.59	74.20
N3	122.75	0.94	178.15	55.40	543.47	78.82
N4	119.55	1.21	178.15	58.60	574.87	83.38
N5	120.00	1.21	178.15	58.15	570.45	82.74
N6	118.50	0.99	178.15	59.65	585.17	84.87
N7	115.50	0.94	178.15	62.65	614.60	89.14
N8	125.50	1.82	178.15	52.65	516.50	74.91
N9	123.00	0.99	178.15	55.15	541.02	78.47
N10	125.50	1.32	178.16	52.66	516.59	74.93
N11	120.00	1.32	178.17	58.17	570.65	82.77
N12	116.75	1.43	178.18	61.43	602.63	87.40
N13	113.00	0.55	178.20	65.20	639.61	92.77
N14	112.50	0.61	178.22	65.72	644.71	93.51
N15	114.25	1.05	178.20	63.95	627.35	90.99

Minimum Pressure

MAXIMUM HOUR DEMAND

Dual Connection (County Road 29 and Mississippi River Crossing)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	5.23	0.11	0.09	0.039
Pipe 2	65.00	250	110	2.97	0.06	0.03	0.043
Pipe 3	70.00	250	110	2.09	0.04	0.02	0.045
Pipe 4	110.00	204	110	1.76	0.05	0.03	0.045
Pipe 5	115.00	204	110	0.49	0.01	0.00	0.052
Pipe 6	85.00	250	110	0.66	0.01	0.00	0.053
Pipe 7	90.00	204	110	1.04	0.03	0.01	0.048
Pipe 8	140.00	204	110	0.89	0.03	0.01	0.049
Pipe 9	100.00	155	100	0.94	0.05	0.05	0.056
Pipe 10	85.00	250	110	-0.76	0.02	0.00	0.054
Pipe 11	110.00	204	110	-1.82	0.06	0.03	0.044
Pipe 12	85.00	250	110	-3.57	0.07	0.04	0.041
Pipe 13	160.00	155	100	-0.68	0.04	0.02	0.059
Pipe 14	85.00	250	110	-5.57	0.11	0.10	0.039
Pipe 15	150.00	250	110	-5.43	0.11	0.10	0.039
Pipe 16	140.00	155	100	-1.46	0.08	0.10	0.053
Pipe 17	100.00	250	110	-8.32	0.17	0.21	0.036
Pipe 18	85.00	250	110	-8.34	0.17	0.21	0.036
Pipe 19	80.00	250	110	-0.53	0.01	0.00	0.058
Pipe 20	150.00	155	100	1.58	0.08	0.12	0.052
Pipe 21	660.00	297	120	10.53	0.15	0.12	0.031

MAXIMUM DAY + FIRE FLOW DEMAND AT N1

Dual Connection (County Road 29 and Mississippi River Crossing)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	162.59	-44.14	162.59	0.00	0.00	0.00
J-567	166.73	-68.04	166.73	0.00	0.00	0.00
N1	122.75	105.23	158.80	36.05	353.65	51.29
N2	126.00	0.40	159.03	33.03	324.02	47.00
N3	122.75	0.43	159.28	36.53	358.36	51.98
N4	119.55	0.55	159.22	39.67	389.16	56.44
N5	120.00	0.55	159.71	39.71	389.56	56.50
N6	118.50	0.45	159.40	40.90	401.23	58.19
N7	115.50	0.43	159.40	43.90	430.66	62.46
N8	125.50	0.83	160.22	34.72	340.60	49.40
N9	123.00	0.45	160.22	37.22	365.13	52.96
N10	125.50	0.60	160.75	35.25	345.80	50.15
N11	120.00	0.60	161.58	41.58	407.90	59.16
N12	116.75	0.65	162.54	45.79	449.20	65.15
N13	113.00	0.25	163.56	50.56	495.99	71.94
N14	112.50	0.28	164.20	51.70	507.18	73.56
N15	114.25	0.48	163.58	49.33	483.93	70.19

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N1

Dual Connection (County Road 29 and Mississippi River Crossing)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	44.14	0.90	4.68	0.028
Pipe 2	65.00	250	110	-37.80	0.77	3.51	0.029
Pipe 3	70.00	250	110	-38.20	0.78	3.58	0.029
Pipe 4	110.00	204	110	-23.29	0.71	3.86	0.030
Pipe 5	115.00	204	110	7.53	0.23	0.48	0.036
Pipe 6	85.00	250	110	-46.16	0.94	5.08	0.028
Pipe 7	90.00	204	110	-16.31	0.50	1.99	0.032
Pipe 8	140.00	204	110	17.19	0.53	2.20	0.032
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.053
Pipe 10	85.00	250	110	-50.29	1.02	5.96	0.028
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.050
Pipe 12	85.00	250	110	-51.57	1.05	6.24	0.028
Pipe 13	160.00	155	100	-13.61	0.72	6.48	0.038
Pipe 14	85.00	250	110	-65.78	1.34	9.80	0.027
Pipe 15	150.00	250	110	-52.33	1.07	6.41	0.028
Pipe 16	140.00	155	100	-14.05	0.74	6.87	0.038
Pipe 17	100.00	250	110	-67.03	1.37	10.15	0.027
Pipe 18	85.00	250	110	-57.12	1.16	7.54	0.027
Pipe 19	80.00	250	110	-10.16	0.21	0.31	0.035
Pipe 20	150.00	155	100	10.64	0.56	4.11	0.039
Pipe 21	660.00	297	120	68.04	0.98	3.84	0.023

MAXIMUM DAY + FIRE FLOW DEMAND AT N2

Dual Connection (County Road 29 and Mississippi River Crossing)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	162.59	-43.02	162.59	0.00	0.00	0.00
J-567	166.73	-69.16	166.73	0.00	0.00	0.00
N1	122.75	0.23	158.97	36.22	355.32	51.53
N2	126.00	105.40	158.56	32.56	319.41	46.33
N3	122.75	0.43	159.02	36.27	355.81	51.61
N4	119.55	0.55	159.05	39.50	387.50	56.20
N5	120.00	0.55	159.49	39.49	387.40	56.19
N6	118.50	0.45	159.21	40.71	399.37	57.92
N7	115.50	0.43	159.21	43.71	428.80	62.19
N8	125.50	0.83	160.01	34.51	338.54	49.10
N9	123.00	0.45	160.01	37.01	363.07	52.66
N10	125.50	0.60	160.56	35.06	343.94	49.88
N11	120.00	0.60	161.42	41.42	406.33	58.93
N12	116.75	0.65	162.41	45.66	447.92	64.97
N13	113.00	0.25	163.46	50.46	495.01	71.80
N14	112.50	0.28	164.12	51.62	506.39	73.45
N15	114.25	0.48	163.49	49.24	483.04	70.06

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N2

Dual Connection (County Road 29 and Mississippi River Crossing)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	43.02	0.88	4.46	0.029
Pipe 2	65.00	250	110	52.18	1.06	6.38	0.028
Pipe 3	70.00	250	110	-53.22	1.08	6.62	0.028
Pipe 4	110.00	204	110	-9.38	0.29	0.72	0.035
Pipe 5	115.00	204	110	-5.45	0.17	0.26	0.038
Pipe 6	85.00	250	110	-48.21	0.98	5.51	0.028
Pipe 7	90.00	204	110	-15.38	0.47	1.79	0.032
Pipe 8	140.00	204	110	16.26	0.50	1.98	0.032
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.053
Pipe 10	85.00	250	110	-51.17	1.04	6.15	0.028
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.049
Pipe 12	85.00	250	110	-52.45	1.07	6.44	0.028
Pipe 13	160.00	155	100	-13.84	0.73	6.69	0.038
Pipe 14	85.00	250	110	-66.90	1.36	10.11	0.027
Pipe 15	150.00	250	110	-53.21	1.08	6.62	0.028
Pipe 16	140.00	155	100	-14.28	0.76	7.09	0.038
Pipe 17	100.00	250	110	-68.15	1.39	10.46	0.027
Pipe 18	85.00	250	110	-58.06	1.18	7.78	0.027
Pipe 19	80.00	250	110	-10.34	0.21	0.32	0.035
Pipe 20	150.00	155	100	10.82	0.57	4.24	0.039
Pipe 21	660.00	297	120	69.16	1.00	3.95	0.023

MAXIMUM DAY + FIRE FLOW DEMAND AT N3

Dual Connection (County Road 29 and Mississippi River Crossing)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	162.59	-42.09	162.59	0.00	0.00	0.00
J-567	166.73	-70.09	166.73	0.00	0.00	0.00
N1	122.75	0.23	159.12	36.37	356.79	51.75
N2	126.00	0.40	158.94	32.94	323.14	46.87
N3	122.75	105.43	158.74	35.99	353.06	51.21
N4	119.55	0.55	159.05	39.50	387.50	56.20
N5	120.00	0.55	159.31	39.31	385.63	55.93
N6	118.50	0.45	159.14	40.64	398.68	57.82
N7	115.50	0.43	159.14	43.64	428.11	62.09
N8	125.50	0.83	159.84	34.34	336.88	48.86
N9	123.00	0.45	159.84	36.84	361.40	52.42
N10	125.50	0.60	160.41	34.91	342.47	49.67
N11	120.00	0.60	161.29	41.29	405.05	58.75
N12	116.75	0.65	162.31	45.56	446.94	64.82
N13	113.00	0.25	163.38	50.38	494.23	71.68
N14	112.50	0.28	164.06	51.56	505.80	73.36
N15	114.25	0.48	163.40	49.15	482.16	69.93

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N3

Dual Connection (County Road 29 and Mississippi River Crossing)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	42.09	0.86	4.29	0.029
Pipe 2	65.00	250	110	33.44	0.68	2.80	0.030
Pipe 3	70.00	250	110	33.04	0.67	2.74	0.030
Pipe 4	110.00	204	110	8.42	0.26	0.59	0.035
Pipe 5	115.00	204	110	-19.17	0.59	2.69	0.031
Pipe 6	85.00	250	110	-53.22	1.08	6.62	0.028
Pipe 7	90.00	204	110	-11.30	0.35	1.01	0.034
Pipe 8	140.00	204	110	12.18	0.37	1.16	0.033
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.053
Pipe 10	85.00	250	110	-51.91	1.06	6.32	0.028
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.049
Pipe 12	85.00	250	110	-53.19	1.08	6.61	0.028
Pipe 13	160.00	155	100	-14.04	0.74	6.87	0.038
Pipe 14	85.00	250	110	-67.83	1.38	10.37	0.027
Pipe 15	150.00	250	110	-53.95	1.10	6.79	0.028
Pipe 16	140.00	155	100	-14.48	0.77	7.27	0.038
Pipe 17	100.00	250	110	-69.08	1.41	10.73	0.027
Pipe 18	85.00	250	110	-58.84	1.20	7.97	0.027
Pipe 19	80.00	250	110	-10.48	0.21	0.33	0.035
Pipe 20	150.00	155	100	10.96	0.58	4.34	0.039
Pipe 21	660.00	297	120	70.09	1.01	4.05	0.023

MAXIMUM DAY + FIRE FLOW DEMAND AT N4

Dual Connection (County Road 29 and Mississippi River Crossing)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	162.59	-42.30	162.59	0.00	0.00	0.00
J-567	166.73	-69.88	166.73	0.00	0.00	0.00
N1	122.75	0.23	159.09	36.34	356.50	51.71
N2	126.00	0.40	159.08	33.08	324.51	47.07
N3	122.75	0.43	159.08	36.33	356.40	51.69
N4	119.55	105.55	157.99	38.44	377.10	54.69
N5	120.00	0.55	159.35	39.35	386.02	55.99
N6	118.50	0.45	158.50	40.00	392.40	56.91
N7	115.50	0.43	158.50	43.00	421.83	61.18
N8	125.50	0.83	159.88	34.38	337.27	48.92
N9	123.00	0.45	159.88	36.88	361.79	52.47
N10	125.50	0.60	160.44	34.94	342.76	49.71
N11	120.00	0.60	161.32	41.32	405.35	58.79
N12	116.75	0.65	162.33	45.58	447.14	64.85
N13	113.00	0.25	163.40	50.40	494.42	71.71
N14	112.50	0.28	164.07	51.57	505.90	73.37
N15	114.25	0.48	163.42	49.17	482.36	69.96

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N4

Dual Connection (County Road 29 and Mississippi River Crossing)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	42.30	0.86	4.33	0.029
Pipe 2	65.00	250	110	3.18	0.06	0.04	0.042
Pipe 3	70.00	250	110	2.78	0.06	0.03	0.043
Pipe 4	110.00	204	110	38.89	1.19	9.97	0.028
Pipe 5	115.00	204	110	37.89	1.16	9.49	0.028
Pipe 6	85.00	250	110	-35.53	0.72	3.13	0.029
Pipe 7	90.00	204	110	-28.78	0.88	5.71	0.029
Pipe 8	140.00	204	110	29.66	0.91	6.03	0.029
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.053
Pipe 10	85.00	250	110	-51.74	1.05	6.28	0.028
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.049
Pipe 12	85.00	250	110	-53.02	1.08	6.57	0.028
Pipe 13	160.00	155	100	-14.00	0.74	6.83	0.038
Pipe 14	85.00	250	110	-67.62	1.38	10.31	0.027
Pipe 15	150.00	250	110	-53.78	1.10	6.75	0.028
Pipe 16	140.00	155	100	-14.43	0.76	7.23	0.038
Pipe 17	100.00	250	110	-68.87	1.40	10.67	0.027
Pipe 18	85.00	250	110	-58.67	1.20	7.93	0.027
Pipe 19	80.00	250	110	-10.45	0.21	0.32	0.035
Pipe 20	150.00	155	100	10.93	0.58	4.32	0.039
Pipe 21	660.00	297	120	69.88	1.01	4.03	0.023

MAXIMUM DAY + FIRE FLOW DEMAND AT N5

Dual Connection (County Road 29 and Mississippi River Crossing)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	162.59	-40.46	162.59	0.00	0.00	0.00
J-567	166.73	-71.72	166.73	0.00	0.00	0.00
N1	122.75	0.23	159.36	36.61	359.14	52.09
N2	126.00	0.40	159.26	33.26	326.28	47.32
N3	122.75	0.43	159.15	36.40	357.08	51.79
N4	119.55	0.55	159.17	39.62	388.67	56.37
N5	120.00	105.55	158.98	38.98	382.39	55.46
N6	118.50	0.45	159.09	40.59	398.19	57.75
N7	115.50	0.43	159.08	43.58	427.52	62.01
N8	125.50	0.83	159.54	34.04	333.93	48.43
N9	123.00	0.45	159.54	36.54	358.46	51.99
N10	125.50	0.60	160.13	34.63	339.72	49.27
N11	120.00	0.60	161.05	41.05	402.70	58.41
N12	116.75	0.65	162.11	45.36	444.98	64.54
N13	113.00	0.25	163.23	50.23	492.76	71.47
N14	112.50	0.28	163.94	51.44	504.63	73.19
N15	114.25	0.48	163.26	49.01	480.79	69.73

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N5

Dual Connection (County Road 29 and Mississippi River Crossing)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	40.46	0.82	3.98	0.029
Pipe 2	65.00	250	110	24.85	0.51	1.61	0.031
Pipe 3	70.00	250	110	24.45	0.50	1.57	0.031
Pipe 4	110.00	204	110	15.38	0.47	1.79	0.032
Pipe 5	115.00	204	110	-4.13	0.13	0.16	0.039
Pipe 6	85.00	250	110	28.15	0.57	2.03	0.030
Pipe 7	90.00	204	110	10.69	0.33	0.91	0.034
Pipe 8	140.00	204	110	-9.81	0.30	0.78	0.035
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.052
Pipe 10	85.00	250	110	-53.20	1.08	6.61	0.028
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.049
Pipe 12	85.00	250	110	-54.48	1.11	6.91	0.028
Pipe 13	160.00	155	100	-14.39	0.76	7.18	0.038
Pipe 14	85.00	250	110	-69.46	1.42	10.84	0.027
Pipe 15	150.00	250	110	-55.24	1.13	7.09	0.027
Pipe 16	140.00	155	100	-14.83	0.79	7.60	0.037
Pipe 17	100.00	250	110	-70.71	1.44	11.20	0.026
Pipe 18	85.00	250	110	-60.23	1.23	8.32	0.027
Pipe 19	80.00	250	110	-10.74	0.22	0.34	0.035
Pipe 20	150.00	155	100	11.22	0.59	4.53	0.039
Pipe 21	660.00	297	120	71.72	1.04	4.23	0.023

MAXIMUM DAY + FIRE FLOW DEMAND AT N6

Dual Connection (County Road 29 and Mississippi River Crossing)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	170.24	-31.16	170.24	0.00	0.00	0.00
J-567	172.31	-51.02	172.31	0.00	0.00	0.00
N1	122.75	0.23	168.25	45.50	446.36	64.74
N2	126.00	0.40	168.23	42.23	414.28	60.09
N3	122.75	0.43	168.21	45.46	445.96	64.68
N4	119.55	0.55	167.91	48.36	474.41	68.81
N5	120.00	0.55	168.24	48.24	473.23	68.64
N6	118.50	75.45	166.99	48.49	475.69	68.99
N7	115.50	0.43	166.99	51.49	505.12	73.26
N8	125.50	0.83	168.52	43.02	422.03	61.21
N9	123.00	0.45	168.52	45.52	446.55	64.77
N10	125.50	0.60	168.82	43.32	424.97	61.64
N11	120.00	0.60	169.30	49.30	483.63	70.15
N12	116.75	0.65	169.86	53.11	521.01	75.57
N13	113.00	0.25	170.45	57.45	563.58	81.74
N14	112.50	0.28	170.82	58.32	572.12	82.98
N15	114.25	0.48	170.46	56.21	551.42	79.98

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N6

Dual Connection (County Road 29 and Mississippi River Crossing)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	31.16	0.63	2.45	0.030
Pipe 2	65.00	250	110	10.10	0.21	0.30	0.035
Pipe 3	70.00	250	110	9.70	0.20	0.28	0.036
Pipe 4	110.00	204	110	20.83	0.64	3.14	0.031
Pipe 5	115.00	204	110	19.04	0.58	2.65	0.031
Pipe 6	85.00	250	110	-9.77	0.20	0.29	0.036
Pipe 7	90.00	204	110	39.31	1.20	10.17	0.028
Pipe 8	140.00	204	110	36.57	1.12	8.89	0.028
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.052
Pipe 10	85.00	250	110	-36.86	0.75	3.35	0.029
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.049
Pipe 12	85.00	250	110	-38.14	0.78	3.57	0.029
Pipe 13	160.00	155	100	-10.02	0.53	3.68	0.040
Pipe 14	85.00	250	110	-48.76	0.99	5.63	0.028
Pipe 15	150.00	250	110	-38.92	0.79	3.71	0.029
Pipe 16	140.00	155	100	-10.45	0.55	3.97	0.039
Pipe 17	100.00	250	110	-50.01	1.02	5.90	0.028
Pipe 18	85.00	250	110	-42.77	0.87	4.41	0.029
Pipe 19	80.00	250	110	-7.49	0.15	0.18	0.037
Pipe 20	150.00	155	100	7.97	0.42	2.41	0.041
Pipe 21	660.00	297	120	51.02	0.74	2.25	0.024

MAXIMUM DAY + FIRE FLOW DEMAND AT N7

Dual Connection (County Road 29 and Mississippi River Crossing)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	173.26	-25.87	173.26	0.00	0.00	0.00
J-567	174.56	-41.31	174.56	0.00	0.00	0.00
N1	122.75	0.23	171.85	49.10	481.67	69.86
N2	126.00	0.40	171.84	45.84	449.69	65.22
N3	122.75	0.43	171.82	49.07	481.38	69.82
N4	119.55	0.55	171.62	52.07	510.81	74.09
N5	120.00	0.55	171.83	51.83	508.45	73.74
N6	118.50	0.45	171.01	52.51	515.12	74.71
N7	115.50	60.43	162.41	46.91	460.19	66.74
N8	125.50	0.83	172.02	46.52	456.36	66.19
N9	123.00	0.45	172.02	49.02	480.89	69.75
N10	125.50	0.60	172.22	46.72	458.32	66.47
N11	120.00	0.60	172.54	52.54	515.42	74.75
N12	116.75	0.65	172.91	56.16	550.93	79.91
N13	113.00	0.25	173.30	60.30	591.54	85.80
N14	112.50	0.28	173.56	61.06	599.00	86.88
N15	114.25	0.48	173.31	59.06	579.38	84.03

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N7

Dual Connection (County Road 29 and Mississippi River Crossing)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	25.87	0.53	1.74	0.031
Pipe 2	65.00	250	110	8.79	0.18	0.24	0.036
Pipe 3	70.00	250	110	8.39	0.17	0.22	0.036
Pipe 4	110.00	204	110	16.86	0.52	2.12	0.032
Pipe 5	115.00	204	110	15.26	0.47	1.76	0.032
Pipe 6	85.00	250	110	-7.31	0.15	0.17	0.037
Pipe 7	90.00	204	110	31.57	0.97	6.77	0.029
Pipe 8	140.00	204	110	29.31	0.90	5.90	0.029
Pipe 9	100.00	155	100	60.43	3.20	85.93	0.025
Pipe 10	85.00	250	110	-29.19	0.59	2.18	0.030
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.049
Pipe 12	85.00	250	110	-30.47	0.62	2.36	0.030
Pipe 13	160.00	155	100	-7.97	0.42	2.41	0.041
Pipe 14	85.00	250	110	-39.05	0.80	3.73	0.029
Pipe 15	150.00	250	110	-31.26	0.64	2.47	0.030
Pipe 16	140.00	155	100	-8.39	0.44	2.65	0.041
Pipe 17	100.00	250	110	-40.30	0.82	3.95	0.029
Pipe 18	85.00	250	110	-34.58	0.70	2.98	0.029
Pipe 19	80.00	250	110	-5.97	0.12	0.12	0.038
Pipe 20	150.00	155	100	6.45	0.34	1.63	0.042
Pipe 21	660.00	297	120	41.31	0.60	1.52	0.025

MAXIMUM DAY + FIRE FLOW DEMAND AT N8

Dual Connection (County Road 29 and Mississippi River Crossing)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	162.59	-38.20	162.59	0.00	0.00	0.00
J-567	166.73	-73.98	166.73	0.00	0.00	0.00
N1	122.75	0.23	159.69	36.94	362.38	52.56
N2	126.00	0.40	159.60	33.60	329.62	47.81
N3	122.75	0.43	159.50	36.75	360.52	52.29
N4	119.55	0.55	159.51	39.96	392.01	56.86
N5	120.00	0.55	159.34	39.34	385.93	55.97
N6	118.50	0.45	159.44	40.94	401.62	58.25
N7	115.50	0.43	159.44	43.94	431.05	62.52
N8	125.50	105.83	151.96	26.46	259.57	37.65
N9	123.00	0.45	158.96	35.96	352.77	51.16
N10	125.50	0.60	159.73	34.23	335.80	48.70
N11	120.00	0.60	160.71	40.71	399.37	57.92
N12	116.75	0.65	161.84	45.09	442.33	64.15
N13	113.00	0.25	163.02	50.02	490.70	71.17
N14	112.50	0.28	163.77	51.27	502.96	72.95
N15	114.25	0.48	163.05	48.80	478.73	69.43

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N8

Dual Connection (County Road 29 and Mississippi River Crossing)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	38.20	0.78	3.58	0.029
Pipe 2	65.00	250	110	23.45	0.48	1.45	0.031
Pipe 3	70.00	250	110	23.05	0.47	1.41	0.031
Pipe 4	110.00	204	110	14.51	0.44	1.61	0.033
Pipe 5	115.00	204	110	-3.87	0.12	0.14	0.040
Pipe 6	85.00	250	110	26.50	0.54	1.82	0.031
Pipe 7	90.00	204	110	10.09	0.31	0.82	0.034
Pipe 8	140.00	204	110	-9.21	0.28	0.69	0.035
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.053
Pipe 10	85.00	250	110	43.18	0.88	4.49	0.028
Pipe 11	110.00	204	110	-105.83	3.24	63.64	0.024
Pipe 12	85.00	250	110	-63.10	1.29	9.07	0.027
Pipe 13	160.00	155	100	-8.02	0.42	2.43	0.041
Pipe 14	85.00	250	110	-71.72	1.46	11.50	0.026
Pipe 15	150.00	250	110	-57.02	1.16	7.52	0.027
Pipe 16	140.00	155	100	-15.30	0.81	8.06	0.037
Pipe 17	100.00	250	110	-72.97	1.49	11.87	0.026
Pipe 18	85.00	250	110	-62.13	1.27	8.81	0.027
Pipe 19	80.00	250	110	-11.09	0.23	0.36	0.035
Pipe 20	150.00	155	100	11.57	0.61	4.80	0.039
Pipe 21	660.00	297	120	73.98	1.07	4.48	0.023

MAXIMUM DAY + FIRE FLOW DEMAND AT N9

Dual Connection (County Road 29 and Mississippi River Crossing)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	162.59	-38.20	162.59	0.00	0.00	0.00
J-567	166.73	-73.98	166.73	0.00	0.00	0.00
N1	122.75	0.23	159.69	36.94	362.38	52.56
N2	126.00	0.40	159.60	33.60	329.62	47.81
N3	122.75	0.43	159.50	36.75	360.52	52.29
N4	119.55	0.55	159.51	39.96	392.01	56.86
N5	120.00	0.55	159.34	39.34	385.93	55.97
N6	118.50	0.45	159.44	40.94	401.62	58.25
N7	115.50	0.43	159.44	43.94	431.05	62.52
N8	125.50	0.83	158.96	33.46	328.24	47.61
N9	123.00	105.45	158.96	35.96	352.77	51.16
N10	125.50	0.60	159.73	34.23	335.80	48.70
N11	120.00	0.60	160.71	40.71	399.37	57.92
N12	116.75	0.65	161.84	45.09	442.33	64.15
N13	113.00	0.25	163.02	50.02	490.70	71.17
N14	112.50	0.28	163.77	51.27	502.96	72.95
N15	114.25	0.48	163.05	48.80	478.73	69.43

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N9

Dual Connection (County Road 29 and Mississippi River Crossing)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	38.20	0.78	3.58	0.029
Pipe 2	65.00	250	110	23.45	0.48	1.45	0.031
Pipe 3	70.00	250	110	23.05	0.47	1.41	0.031
Pipe 4	110.00	204	110	14.51	0.44	1.61	0.033
Pipe 5	115.00	204	110	-3.87	0.12	0.14	0.040
Pipe 6	85.00	250	110	26.50	0.54	1.82	0.031
Pipe 7	90.00	204	110	10.09	0.31	0.82	0.034
Pipe 8	140.00	204	110	-9.21	0.28	0.69	0.035
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.053
Pipe 10	85.00	250	110	43.18	0.88	4.49	0.028
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.050
Pipe 12	85.00	250	110	-63.10	1.29	9.07	0.027
Pipe 13	160.00	155	100	-8.02	0.42	2.43	0.041
Pipe 14	85.00	250	110	-71.72	1.46	11.50	0.026
Pipe 15	150.00	250	110	-57.02	1.16	7.52	0.027
Pipe 16	140.00	155	100	-15.30	0.81	8.06	0.037
Pipe 17	100.00	250	110	-72.97	1.49	11.87	0.026
Pipe 18	85.00	250	110	-62.13	1.27	8.81	0.027
Pipe 19	80.00	250	110	-11.09	0.23	0.36	0.035
Pipe 20	150.00	155	100	11.57	0.61	4.80	0.039
Pipe 21	660.00	297	120	73.98	1.07	4.48	0.023

MAXIMUM DAY + FIRE FLOW DEMAND AT N10

Dual Connection (County Road 29 and Mississippi River Crossing)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	162.59	-36.16	162.59	0.00	0.00	0.00
J-567	166.73	-76.02	166.73	0.00	0.00	0.00
N1	122.75	0.23	159.97	37.22	365.13	52.96
N2	126.00	0.40	159.88	33.88	332.36	48.21
N3	122.75	0.43	159.80	37.05	363.46	52.72
N4	119.55	0.55	159.81	40.26	394.95	57.28
N5	120.00	0.55	159.66	39.66	389.06	56.43
N6	118.50	0.45	159.74	41.24	404.56	58.68
N7	115.50	0.43	159.74	44.24	433.99	62.95
N8	125.50	0.83	159.50	34.00	333.54	48.38
N9	123.00	0.45	159.51	36.51	358.16	51.95
N10	125.50	105.60	159.37	33.87	332.26	48.19
N11	120.00	0.60	160.40	40.40	396.32	57.48
N12	116.75	0.65	161.58	44.83	439.78	63.79
N13	113.00	0.25	162.83	49.83	488.83	70.90
N14	112.50	0.28	163.62	51.12	501.49	72.73
N15	114.25	0.48	162.86	48.61	476.86	69.16

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N10

Dual Connection (County Road 29 and Mississippi River Crossing)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	36.16	0.74	3.23	0.029
Pipe 2	65.00	250	110	22.19	0.45	1.31	0.031
Pipe 3	70.00	250	110	21.79	0.44	1.27	0.032
Pipe 4	110.00	204	110	13.74	0.42	1.45	0.033
Pipe 5	115.00	204	110	-3.64	0.11	0.12	0.040
Pipe 6	85.00	250	110	25.00	0.51	1.63	0.031
Pipe 7	90.00	204	110	9.55	0.29	0.74	0.035
Pipe 8	140.00	204	110	-8.67	0.27	0.62	0.035
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.053
Pipe 10	85.00	250	110	26.27	0.54	1.79	0.031
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.049
Pipe 12	85.00	250	110	24.99	0.51	1.63	0.031
Pipe 13	160.00	155	100	6.85	0.36	1.82	0.042
Pipe 14	85.00	250	110	-73.76	1.50	12.11	0.026
Pipe 15	150.00	250	110	-58.63	1.19	7.92	0.027
Pipe 16	140.00	155	100	-15.73	0.83	8.48	0.037
Pipe 17	100.00	250	110	-75.01	1.53	12.50	0.026
Pipe 18	85.00	250	110	-63.85	1.30	9.27	0.027
Pipe 19	80.00	250	110	-11.41	0.23	0.38	0.035
Pipe 20	150.00	155	100	11.89	0.63	5.05	0.039
Pipe 21	660.00	297	120	76.02	1.10	4.71	0.023

MAXIMUM DAY + FIRE FLOW DEMAND AT N11

Dual Connection (County Road 29 and Mississippi River Crossing)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	162.59	-32.41	162.59	0.00	0.00	0.00
J-567	166.73	-79.77	166.73	0.00	0.00	0.00
N1	122.75	0.23	160.45	37.70	369.84	53.64
N2	126.00	0.40	160.38	34.38	337.27	48.92
N3	122.75	0.43	160.31	37.56	368.46	53.44
N4	119.55	0.55	160.32	40.77	399.95	58.01
N5	120.00	0.55	160.20	40.20	394.36	57.20
N6	118.50	0.45	160.27	41.77	409.76	59.43
N7	115.50	0.43	160.27	44.77	439.19	63.70
N8	125.50	0.83	160.07	34.57	339.13	49.19
N9	123.00	0.45	160.08	37.08	363.75	52.76
N10	125.50	0.60	159.97	34.47	338.15	49.04
N11	120.00	105.60	159.80	39.80	390.44	56.63
N12	116.75	0.65	161.10	44.35	435.07	63.10
N13	113.00	0.25	162.47	49.47	485.30	70.39
N14	112.50	0.28	163.33	50.83	498.64	72.32
N15	114.25	0.48	162.50	48.25	473.33	68.65

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N11

Dual Connection (County Road 29 and Mississippi River Crossing)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	32.41	0.66	2.64	0.030
Pipe 2	65.00	250	110	19.87	0.40	1.07	0.032
Pipe 3	70.00	250	110	19.47	0.40	1.03	0.032
Pipe 4	110.00	204	110	12.30	0.38	1.18	0.033
Pipe 5	115.00	204	110	-3.21	0.10	0.10	0.041
Pipe 6	85.00	250	110	22.25	0.45	1.32	0.031
Pipe 7	90.00	204	110	8.55	0.26	0.60	0.035
Pipe 8	140.00	204	110	-7.67	0.23	0.49	0.036
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.052
Pipe 10	85.00	250	110	23.31	0.47	1.43	0.031
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.050
Pipe 12	85.00	250	110	22.03	0.45	1.29	0.031
Pipe 13	160.00	155	100	6.06	0.32	1.45	0.043
Pipe 14	85.00	250	110	27.49	0.56	1.95	0.030
Pipe 15	150.00	250	110	-61.58	1.25	8.67	0.027
Pipe 16	140.00	155	100	-16.53	0.88	9.29	0.037
Pipe 17	100.00	250	110	-78.76	1.60	13.68	0.026
Pipe 18	85.00	250	110	-67.01	1.37	10.14	0.027
Pipe 19	80.00	250	110	-12.00	0.24	0.42	0.034
Pipe 20	150.00	155	100	12.48	0.66	5.52	0.038
Pipe 21	660.00	297	120	79.77	1.15	5.15	0.023

MAXIMUM DAY + FIRE FLOW DEMAND AT N12

Dual Connection (County Road 29 and Mississippi River Crossing)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	173.26	-18.20	173.26	0.00	0.00	0.00
J-567	174.56	-48.98	174.56	0.00	0.00	0.00
N1	122.75	0.23	172.52	49.77	488.24	70.81
N2	126.00	0.40	172.50	46.50	456.17	66.16
N3	122.75	0.43	172.48	49.73	487.85	70.76
N4	119.55	0.55	172.48	52.93	519.24	75.31
N5	120.00	0.55	172.44	52.44	514.44	74.61
N6	118.50	0.45	172.46	53.96	529.35	76.78
N7	115.50	0.43	172.46	56.96	558.78	81.04
N8	125.50	0.83	172.41	46.91	460.19	66.74
N9	123.00	0.45	172.41	49.41	484.71	70.30
N10	125.50	0.60	172.38	46.88	459.89	66.70
N11	120.00	0.60	172.33	52.33	513.36	74.46
N12	116.75	60.65	172.29	55.54	544.85	79.02
N13	113.00	0.25	172.84	59.84	587.03	85.14
N14	112.50	0.28	173.18	60.68	595.27	86.34
N15	114.25	0.48	172.85	58.60	574.87	83.38

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N12

Dual Connection (County Road 29 and Mississippi River Crossing)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	18.20	0.37	0.91	0.032
Pipe 2	65.00	250	110	11.10	0.23	0.36	0.035
Pipe 3	70.00	250	110	10.70	0.22	0.34	0.035
Pipe 4	110.00	204	110	6.88	0.21	0.40	0.036
Pipe 5	115.00	204	110	-1.57	0.05	0.03	0.045
Pipe 6	85.00	250	110	11.84	0.24	0.41	0.035
Pipe 7	90.00	204	110	4.75	0.15	0.20	0.038
Pipe 8	140.00	204	110	-3.87	0.12	0.14	0.040
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.052
Pipe 10	85.00	250	110	12.10	0.25	0.43	0.034
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.049
Pipe 12	85.00	250	110	10.82	0.22	0.35	0.035
Pipe 13	160.00	155	100	3.07	0.16	0.41	0.047
Pipe 14	85.00	250	110	13.28	0.27	0.51	0.034
Pipe 15	150.00	250	110	10.00	0.20	0.30	0.035
Pipe 16	140.00	155	100	2.68	0.14	0.32	0.048
Pipe 17	100.00	250	110	-47.97	0.98	5.46	0.028
Pipe 18	85.00	250	110	-41.04	0.84	4.09	0.029
Pipe 19	80.00	250	110	-7.17	0.15	0.16	0.037
Pipe 20	150.00	155	100	7.65	0.41	2.23	0.041
Pipe 21	660.00	297	120	48.98	0.71	2.09	0.024

MAXIMUM DAY + FIRE FLOW DEMAND AT N13

Dual Connection (County Road 29 and Mississippi River Crossing)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	173.26	-14.71	173.26	0.00	0.00	0.00
J-567	174.56	-52.47	174.56	0.00	0.00	0.00
N1	122.75	0.23	172.76	50.01	490.60	71.16
N2	126.00	0.40	172.75	46.75	458.62	66.52
N3	122.75	0.43	172.73	49.98	490.30	71.11
N4	119.55	0.55	172.73	53.18	521.70	75.67
N5	120.00	0.55	172.71	52.71	517.09	75.00
N6	118.50	0.45	172.72	54.22	531.90	77.15
N7	115.50	0.43	172.72	57.22	561.33	81.41
N8	125.50	0.83	172.69	47.19	462.93	67.14
N9	123.00	0.45	172.69	49.69	487.46	70.70
N10	125.50	0.60	172.67	47.17	462.74	67.11
N11	120.00	0.60	172.65	52.65	516.50	74.91
N12	116.75	0.65	172.62	55.87	548.08	79.49
N13	113.00	60.25	172.60	59.60	584.68	84.80
N14	112.50	0.28	173.00	60.50	593.51	86.08
N15	114.25	0.48	172.61	58.36	572.51	83.04

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N13

Dual Connection (County Road 29 and Mississippi River Crossing)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	14.71	0.30	0.61	0.033
Pipe 2	65.00	250	110	8.94	0.18	0.24	0.036
Pipe 3	70.00	250	110	8.54	0.17	0.22	0.036
Pipe 4	110.00	204	110	5.54	0.17	0.27	0.038
Pipe 5	115.00	204	110	-1.17	0.04	0.02	0.047
Pipe 6	85.00	250	110	9.28	0.19	0.26	0.036
Pipe 7	90.00	204	110	3.82	0.12	0.14	0.040
Pipe 8	140.00	204	110	-2.94	0.09	0.08	0.041
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.053
Pipe 10	85.00	250	110	9.34	0.19	0.26	0.036
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.049
Pipe 12	85.00	250	110	8.06	0.16	0.20	0.037
Pipe 13	160.00	155	100	2.33	0.12	0.25	0.049
Pipe 14	85.00	250	110	9.79	0.20	0.29	0.035
Pipe 15	150.00	250	110	7.25	0.15	0.16	0.037
Pipe 16	140.00	155	100	1.94	0.10	0.18	0.051
Pipe 17	100.00	250	110	8.54	0.17	0.22	0.036
Pipe 18	85.00	250	110	-43.99	0.90	4.65	0.028
Pipe 19	80.00	250	110	-7.72	0.16	0.19	0.037
Pipe 20	150.00	155	100	8.20	0.43	2.54	0.041
Pipe 21	660.00	297	120	52.47	0.76	2.37	0.024

MAXIMUM DAY + FIRE FLOW DEMAND AT N14

Dual Connection (County Road 29 and Mississippi River Crossing)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	173.26	-11.82	173.26	0.00	0.00	0.00
J-567	174.56	-55.36	174.56	0.00	0.00	0.00
N1	122.75	0.23	172.93	50.18	492.27	71.40
N2	126.00	0.40	172.92	46.92	460.29	66.76
N3	122.75	0.43	172.91	50.16	492.07	71.37
N4	119.55	0.55	172.91	53.36	523.46	75.92
N5	120.00	0.55	172.90	52.90	518.95	75.27
N6	118.50	0.45	172.90	54.40	533.66	77.40
N7	115.50	0.43	172.90	57.40	563.09	81.67
N8	125.50	0.83	172.88	47.38	464.80	67.41
N9	123.00	0.45	172.88	49.88	489.32	70.97
N10	125.50	0.60	172.87	47.37	464.70	67.40
N11	120.00	0.60	172.86	52.86	518.56	75.21
N12	116.75	0.65	172.85	56.10	550.34	79.82
N13	113.00	0.25	172.84	59.84	587.03	85.14
N14	112.50	60.28	172.83	60.33	591.84	85.84
N15	114.25	0.48	172.84	58.59	574.77	83.36

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N14

Dual Connection (County Road 29 and Mississippi River Crossing)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	11.82	0.24	0.41	0.035
Pipe 2	65.00	250	110	7.16	0.15	0.16	0.037
Pipe 3	70.00	250	110	6.76	0.14	0.14	0.038
Pipe 4	110.00	204	110	4.44	0.14	0.18	0.039
Pipe 5	115.00	204	110	-0.84	0.03	0.01	0.050
Pipe 6	85.00	250	110	7.17	0.15	0.16	0.037
Pipe 7	90.00	204	110	3.05	0.09	0.09	0.041
Pipe 8	140.00	204	110	-2.17	0.07	0.05	0.043
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.063
Pipe 10	85.00	250	110	7.06	0.14	0.16	0.037
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.049
Pipe 12	85.00	250	110	5.78	0.12	0.11	0.038
Pipe 13	160.00	155	100	1.72	0.09	0.14	0.052
Pipe 14	85.00	250	110	6.90	0.14	0.15	0.037
Pipe 15	150.00	250	110	4.97	0.10	0.08	0.039
Pipe 16	140.00	155	100	1.33	0.07	0.09	0.053
Pipe 17	100.00	250	110	5.65	0.12	0.10	0.038
Pipe 18	85.00	250	110	4.17	0.08	0.06	0.040
Pipe 19	80.00	250	110	1.23	0.03	0.01	0.049
Pipe 20	150.00	155	100	-0.75	0.04	0.03	0.058
Pipe 21	660.00	297	120	55.36	0.80	2.62	0.024

MAXIMUM DAY + FIRE FLOW DEMAND AT N15

Dual Connection (County Road 29 and Mississippi River Crossing)

Junction Report

Node ID	Elevation m	Demand LPS	Total Head m	Pressure m	Pressure kPa	Pressure psi
J-89	173.26	-14.32	173.26	0.00	0.00	0.00
J-567	174.56	-52.86	174.56	0.00	0.00	0.00
N1	122.75	0.23	172.79	50.04	490.89	71.20
N2	126.00	0.40	172.77	46.77	458.81	66.55
N3	122.75	0.43	172.76	50.01	490.60	71.16
N4	119.55	0.55	172.76	53.21	521.99	75.71
N5	120.00	0.55	172.74	52.74	517.38	75.04
N6	118.50	0.45	172.75	54.25	532.19	77.19
N7	115.50	0.43	172.75	57.25	561.62	81.46
N8	125.50	0.83	172.72	47.22	463.23	67.19
N9	123.00	0.45	172.72	49.72	487.75	70.74
N10	125.50	0.60	172.70	47.20	463.03	67.16
N11	120.00	0.60	172.68	52.68	516.79	74.95
N12	116.75	0.65	172.66	55.91	548.48	79.55
N13	113.00	0.25	172.63	59.63	584.97	84.84
N14	112.50	0.28	172.97	60.47	593.21	86.04
N15	114.25	60.48	172.19	57.94	568.39	82.44

Minimum Pressure

MAXIMUM DAY + FIRE FLOW DEMAND AT N15

Dual Connection (County Road 29 and Mississippi River Crossing)

Pipe Report

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 1	810.00	250	110	14.32	0.29	0.58	0.034
Pipe 2	65.00	250	110	8.70	0.18	0.23	0.036
Pipe 3	70.00	250	110	8.30	0.17	0.21	0.036
Pipe 4	110.00	204	110	5.39	0.16	0.26	0.038
Pipe 5	115.00	204	110	-1.13	0.03	0.01	0.048
Pipe 6	85.00	250	110	8.99	0.18	0.25	0.036
Pipe 7	90.00	204	110	3.72	0.11	0.13	0.040
Pipe 8	140.00	204	110	-2.84	0.09	0.08	0.042
Pipe 9	100.00	155	100	0.43	0.02	0.01	0.063
Pipe 10	85.00	250	110	9.03	0.18	0.25	0.036
Pipe 11	110.00	204	110	-0.83	0.03	0.01	0.050
Pipe 12	85.00	250	110	7.75	0.16	0.19	0.037
Pipe 13	160.00	155	100	2.25	0.12	0.23	0.050
Pipe 14	85.00	250	110	9.40	0.19	0.27	0.036
Pipe 15	150.00	250	110	6.94	0.14	0.15	0.037
Pipe 16	140.00	155	100	1.86	0.10	0.16	0.051
Pipe 17	100.00	250	110	8.15	0.17	0.20	0.036
Pipe 18	85.00	250	110	-40.48	0.82	3.99	0.029
Pipe 19	80.00	250	110	48.38	0.99	5.55	0.028
Pipe 20	150.00	155	100	12.10	0.64	5.22	0.039
Pipe 21	660.00	297	120	52.86	0.76	2.40	0.024

MAXIMUM DAY + FIRE FLOW DEMAND SUMMARY

Dual Connection (County Road 29 and Mississippi River Crossing)

Maximum day plus fire flow demand was modeled for select nodes.
The following is a summary of the minimum pressures that occurred for each operating condition.

	Demand (L/s)			Minimum Pressure			
Fire at Junction	Maximum Daily	Fire Flow	Max Day + Fire	(m)	kPa	psi	Node
N1	0.23	105.00	105.23	33.03	324.02	47.00	N2
N2	0.40	105.00	105.40	32.56	319.41	46.33	N2
N3	0.43	105.00	105.43	32.94	323.14	46.87	N2
N4	0.55	105.00	105.55	33.08	324.51	47.07	N2
N5	0.55	105.00	105.55	33.26	326.28	47.32	N2
N6	0.45	75.00	75.45	42.23	414.28	60.09	N2
N7	0.43	60.00	60.43	45.84	449.69	65.22	N2
N8	0.83	105.00	105.83	26.46	259.57	37.65	N8
N9	0.45	105.00	105.45	33.46	328.24	47.61	N8
N10	0.60	105.00	105.60	33.87	332.26	48.19	N10
N11	0.60	105.00	105.60	34.38	337.27	48.92	N2
N12	0.65	60.00	60.65	46.50	456.17	66.16	N2
N13	0.25	60.00	60.25	46.75	458.62	66.52	N2
N14	0.28	60.00	60.28	46.92	460.29	66.76	N2
N15	0.48	60.00	60.48	46.77	458.81	66.55	N2

Table 17: Opinion of Probable Costs Short-Term Water Distribution

Option	Diameter (mm)	Length (m)	Rate ($/m)[1]	Engineering and Contingency (27%)	Rounded Total[3]
Victoria Street Upgrade[2]	300	690	$470	$88,000	$410,000
County Road 29 Looping Wylie Street to Dunn Street	250	88	$1,100	$26,000	$125,000

1. Rates based on City of Ottawa 2015 Unit Rates for watermain, restoration of road (granulars, base and wear) and curb, and other past experience.
2. Victoria Street road reinstatement costs carried under wastewater collection servicing strategies and not included herein.
3. Rounded to the nearest $5,000.

4.8.2 Mid-Term (5 to 10 Years): Water Distribution

The mid-term water distribution system servicing options identified to address the required fire flow and system pressures include:

- County Road 29 Well 6 to Wylie Upgrade: Watermain upgrade will service residential development in the northwest quadrant.
- Pressure Zone 2 Optimization: Reducing the size of PZ-2 will improve existing water service and facilitate development of the northwest quadrant. This upgrade includes 2 new pressure reducing valves (PRVs) at Almonte Street and Hope Street, and decommissioning of the existing Almonte Street PRV. This was generally considered in the 2012 Master Plan for the 10 to 20 year timeframe.
- Martin Street North, from Teskey Street to Carss Street: This will improve servicing for expansion of the White Tail Subdivision. This upgrade was originally envisioned in the 2012 Master Plan for the 0 to 5 year timeframe.
- Princess Street and Martin Street North Upgrades: This rehabilitation and upgrades will service residential development in the northwest quadrant.
- Union Street North, from Princess Street to Carss Street: This rehabilitation and upgrades will service residential development in the northwest quadrant.
- Adelaide and Brookdale Street Looping: This will improve water servicing for expansion of the White Tail Subdivision. This upgrade was originally envisioned in the 2012 Master Plan for the 0 to 5 year timeframe.
- Carss Street, from Mitcheson Street to Union Street North: This watermain extension will service residential development in the northwest quadrant.
- Carss Street, from Union Street North to Mississippi River: This watermain extension will service residential development in the northwest quadrant.

- Mississippi River Third Crossing: This watermain extension will service residential development in the northwest quadrant.

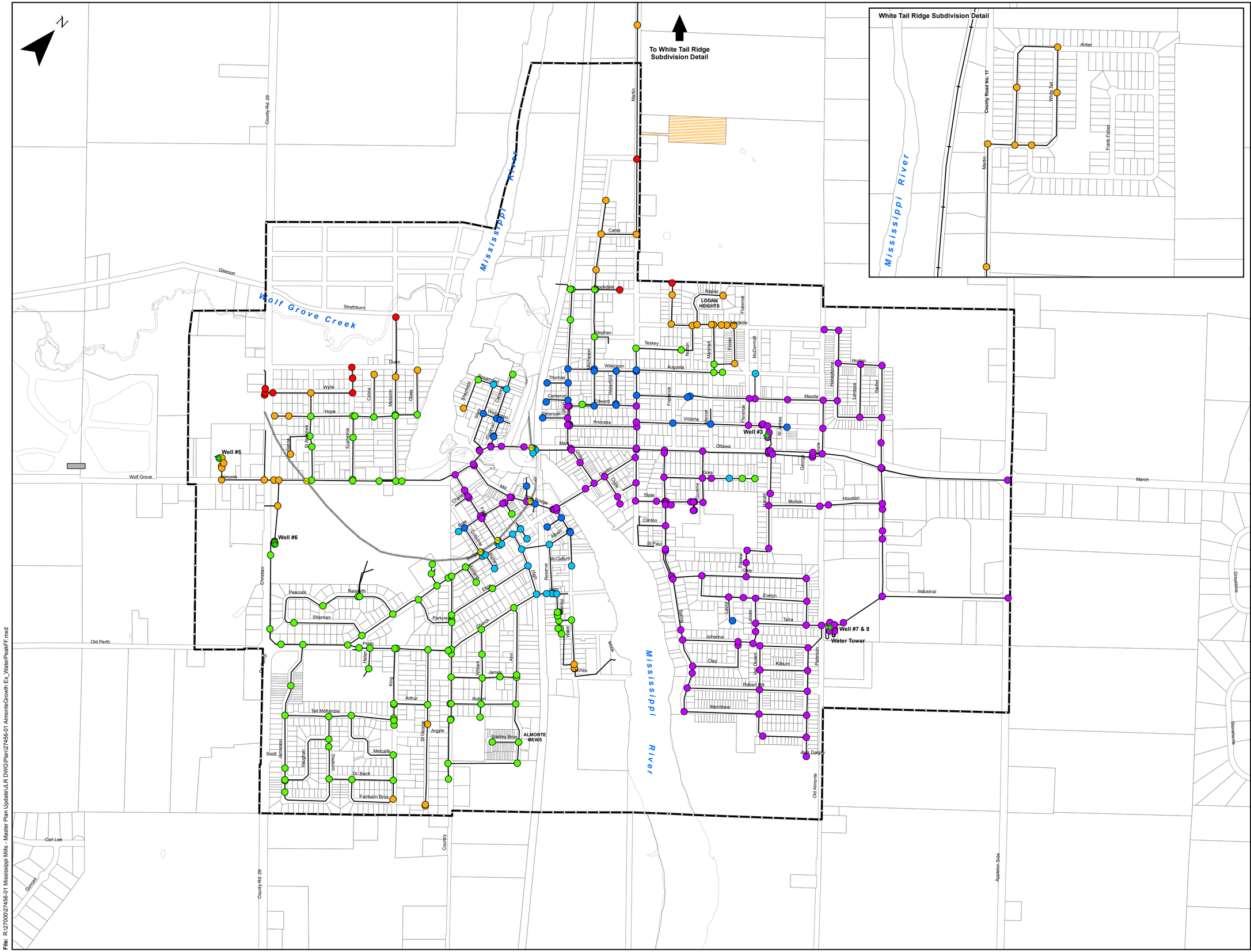
It is noted that the 2012 Master Plan also envisioned mid-term upgrades for Ottawa Street to service the Mill Run development. Since 2012, this work was undertaken by the related developer.

The opinions of probable costs associated with the mid-term water distribution servicing strategies are summarized in Table 18.

Table 18: Opinion of Probable Costs Mid-Term Water Distribution

Option	Diameter (mm)	Length (m)	Rate ($/m)(1)	Engineering and Contingency (27%)	Rounded Total(5)
County Road 29 Well 6 to Wylie Street Upgrade	250	570	$1,100	$169,000	$795,000
Pressure Zone 2 Optimization	$150,000(2)			$37,500	$188,000
Martin Street North, from Teskey Street to Carss Street	200	441	$1,030	$123,000	$575,000
Princess Street and Martin Street North Upgrades(3)	300	281	$470	$36,000	$170,000
Union Street North, from Princess Street to Carss Street(3)	300	710	$470	$90,000	$425,000
Adelaide and Brookdale Street Looping	200	199	$1,030	$55,000	$260,000
Carss Street, from Mitcheson Street to Union Street North	200	97	$1,030	$27,000	$125,000
Carss Street, from Union Street North to Mississippi River	300	160	$1,090	$47,000	$220,000
Mississippi River Third Crossing	300	200	$10,000(4)	$540,000	$2,540,000

1. Rates based on City of Ottawa 2015 Unit Rates for watermain, restoration of road (granulars, base and wear) and curb, and other past experience.
2. Allowance.
3. Road reinstatement costs carried under wastewater collection servicing strategies and so not included herein.
4. High level estimate for rock boring below Mississippi River.
5. Rounded to the nearest $5,000.



Max Day + Fire Flow

- < 32 L/s
- 33 to 50 L/s
- 51 to 67 L/s
- 68 to 75 L/s
- 76 to 100 L/s
- 100 to 300 L/s

Infrastructure

- Pressure Reducing Valve
- Well
- Water Tower
- Pressure Zone
- Watermain

Land Use

- Almonte Ward Limits
- Existing Lots
- Closed Waste Disposal Site

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MISSISSIPPI MILLS, ONTARIO

DRAWING:

ALMONTE WARD WATER SYSTEM EXISTING MAX DAY DEMAND / FIRE FLOW

DESIGN: MB	
DRAWN: KTK	DRAWING #:
CHECKED: SG	**FIGURE 7**
JLR #: 27456-01	

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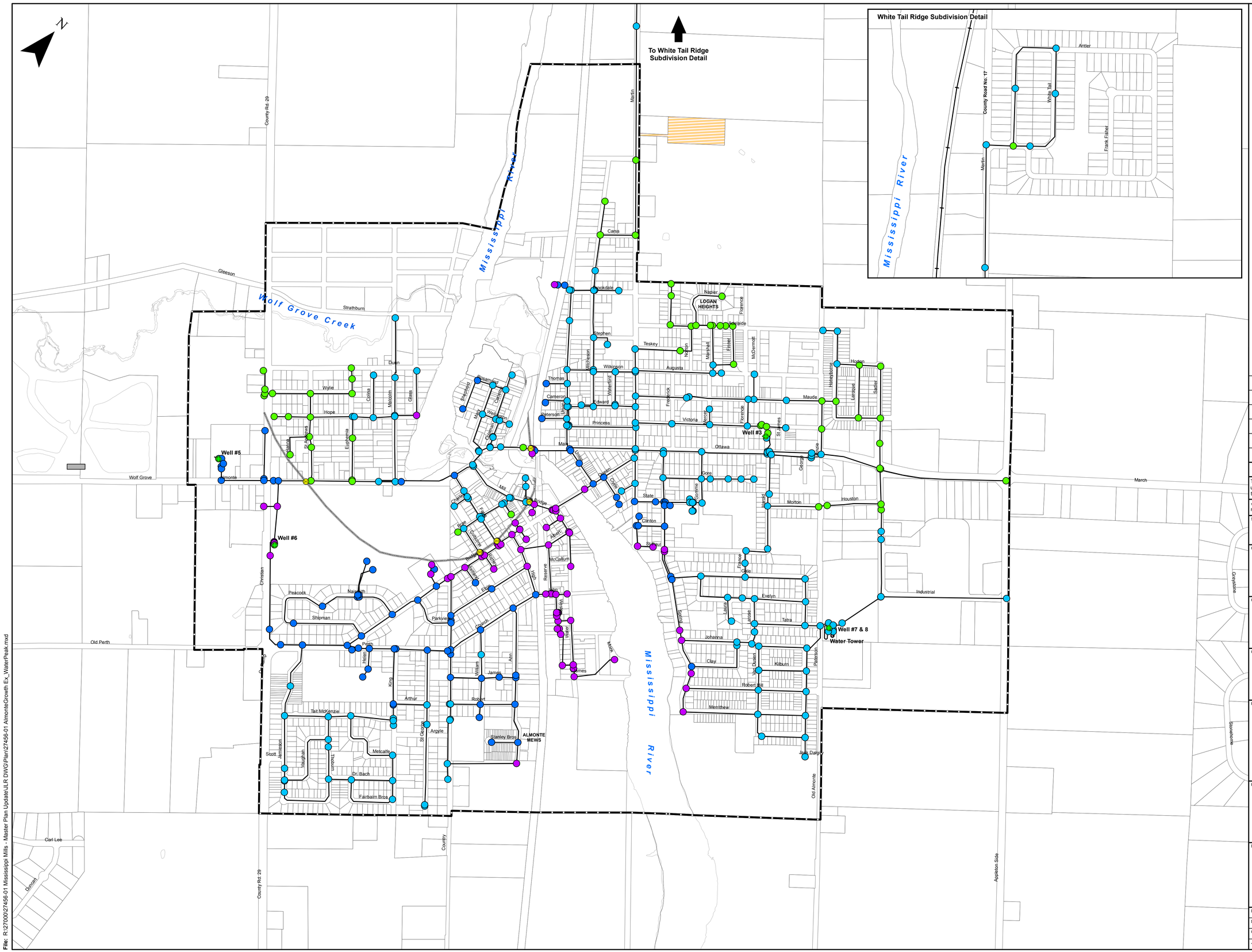

Peak Hour

- < 274 kPa
- 275 to 300 kPa
- 301 to 400 kPa
- 401 to 500 kPa
- 501 to 550 kPa
- > 550 kPa

Infrastructure

- Pressure Reducing Valve
- Well
- Water Tower
- Pressure Zone
- Watermain

Land Use

- Almonte Ward Limits
- Existing Lots
- Closed Waste Disposal Site

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MISSISSIPPI MILLS, ONTARIO

DRAWING:

ALMONTE WARD WATER SYSTEM EXISTING PEAK HOUR

DESIGN: MB	
DRAWN: KTK	DRAWING #:
CHECKED: SG	**FIGURE 8**
JLR #: 27456-01	

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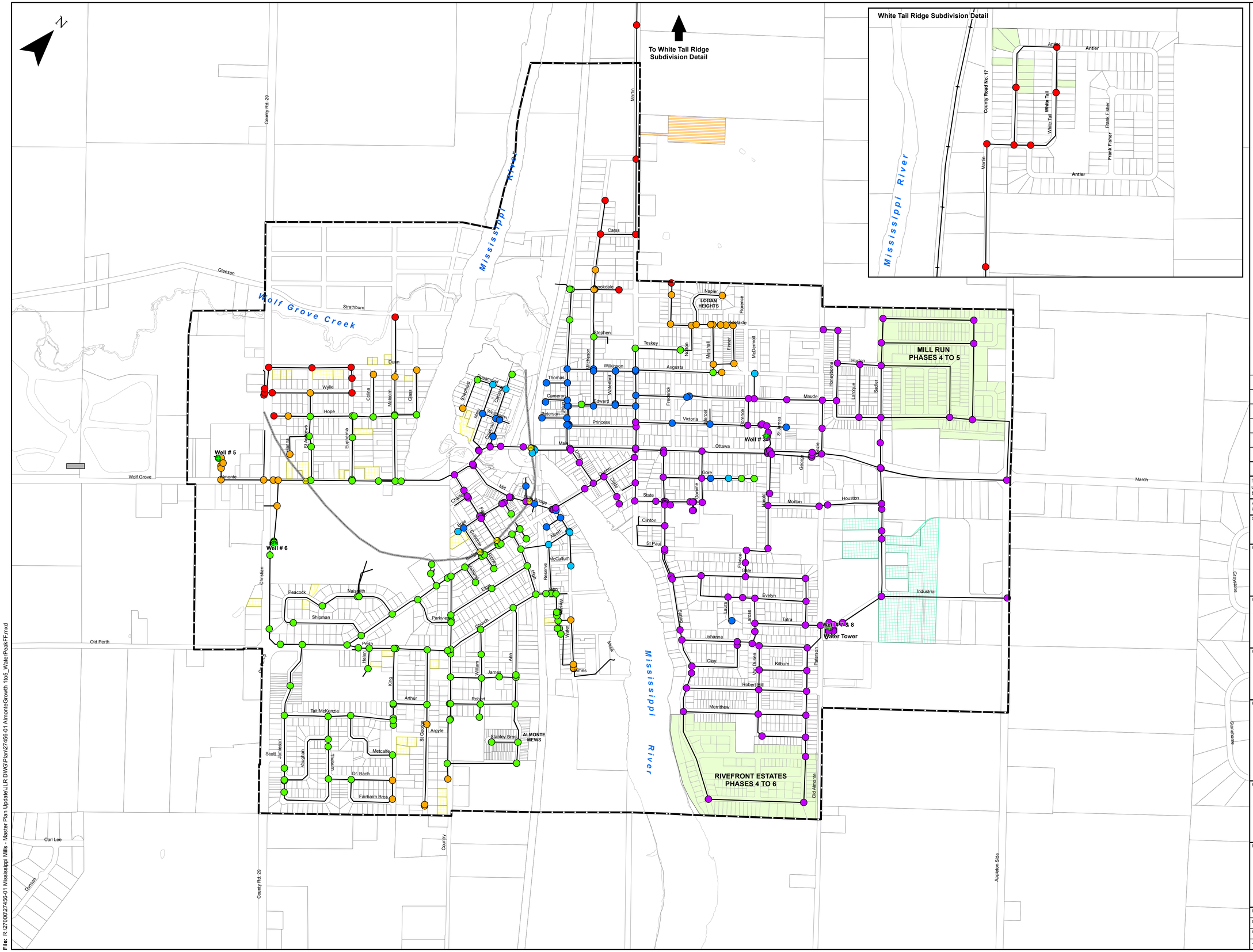

Max Day + Fire Flow

- < 32 L/s
- 33 to 50 L/s
- 51 to 67 L/s
- 68 to 75 L/s
- 76 to 100 L/s
- 100 to 300 L/s

Infrastructure

- Pressure Reducing Valve
- Well
- Water Tower
- Pressure Zone
- Watermain

Land Use

- Almonte Ward Limits
- Existing Lots
- Future Lots
- Closed Waste Disposal Site
- SUBDIVISION
- Business Park (9.0 ha)
- Residential - Infill (3.8 ha)

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MISSISSIPPI MILLS, ONTARIO

DRAWING:

ALMONTE WARD WATER SYSTEM
0 TO 5 YEARS (2018 TO 2022)
MAX DAY DEMAND / FIRE FLOW

DESIGN: MB	
DRAWN: KTK	DRAWING #:
CHECKED: SG	**FIGURE 9**
JLR #: 27456-01	

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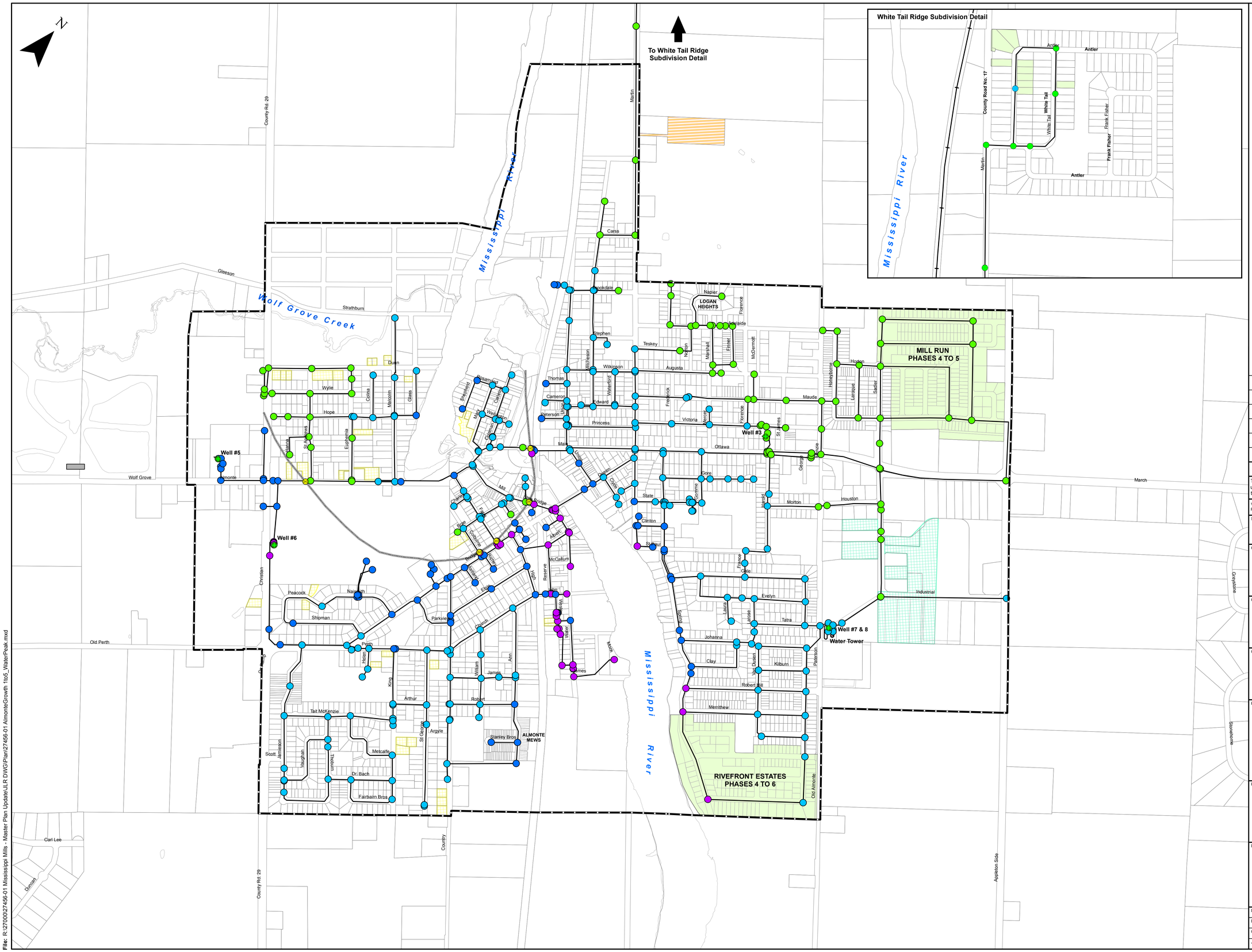

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DRAWING:

ALMONTE WARD WATER SYSTEM
0 TO 5 YEARS (2018 TO 2022)
PEAK HOUR

DESIGN: MB	
DRAWN: KTK	DRAWING #:
CHECKED: SG	**FIGURE 10**
JLR #: 27456-01	

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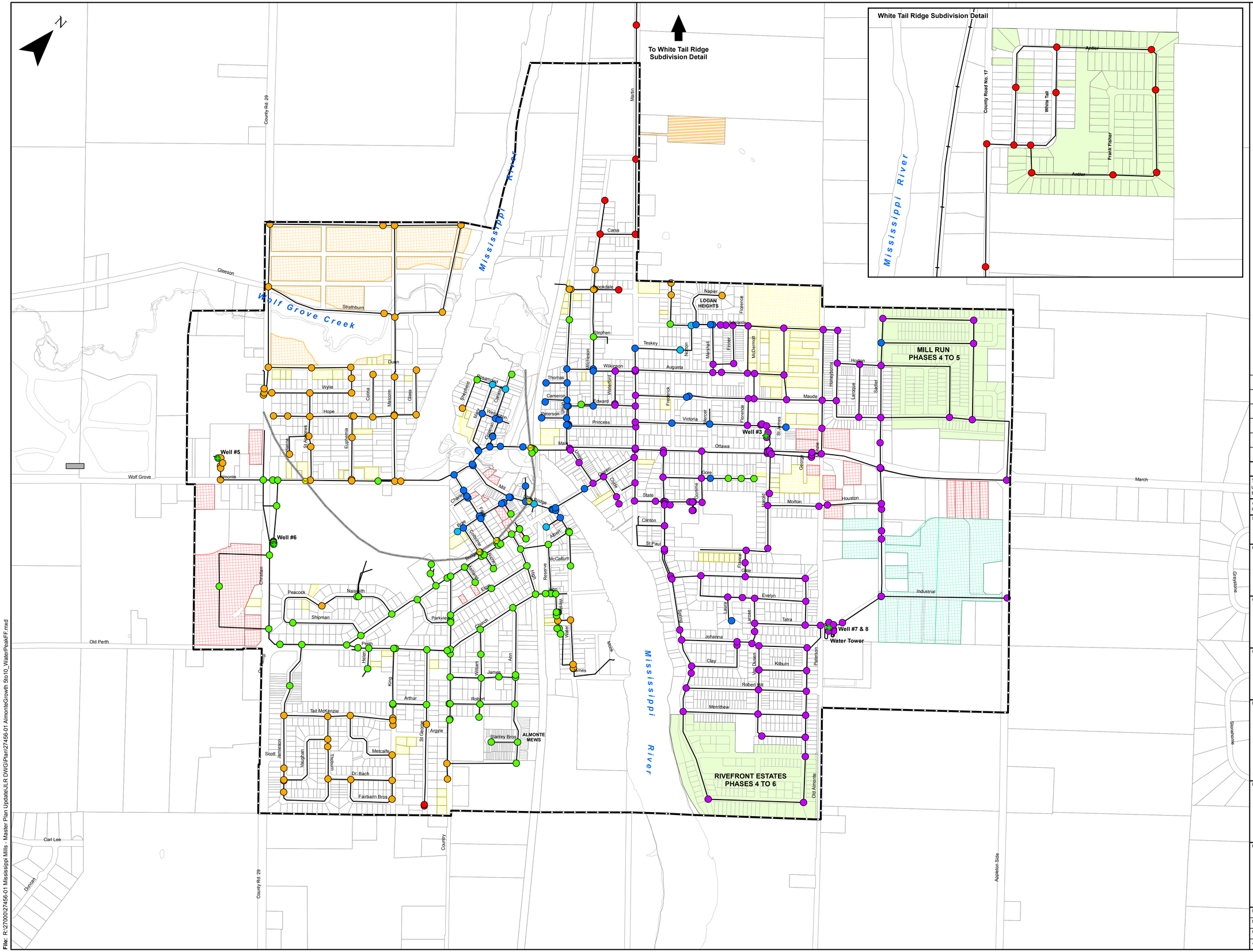

Max Day + Fire Flow

- < 32 L/s
- 33 to 50 L/s
- 51 to 67 L/s
- 68 to 75 L/s
- 76 to 100 L/s
- 100 to 300 L/s

Infrastructure

- Pressure Reducing Valve
- Well
- Water Tower
- Pressure Zone
- Watermain

Land Use

- Almonte Ward Limits
- Existing Lots
- Future Lots
- Closed Waste Disposal Site
- Registered Subdivision
- Business Park (17.0 ha)
- Commercial (15.6 ha)
- Residential - Geenfield (14.2 ha)
- Residential - Infill (16.0 ha)

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DRAWING:

ALMONTE WARD WATER SYSTEM
5 TO 10 YEARS (2023 TO 2028)
MAX DAY DEMAND / FIRE FLOW

DESIGN: MB	
DRAWN: KTK	DRAWING #:
CHECKED: SG	**FIGURE 11**
JLR #: 27456-01	

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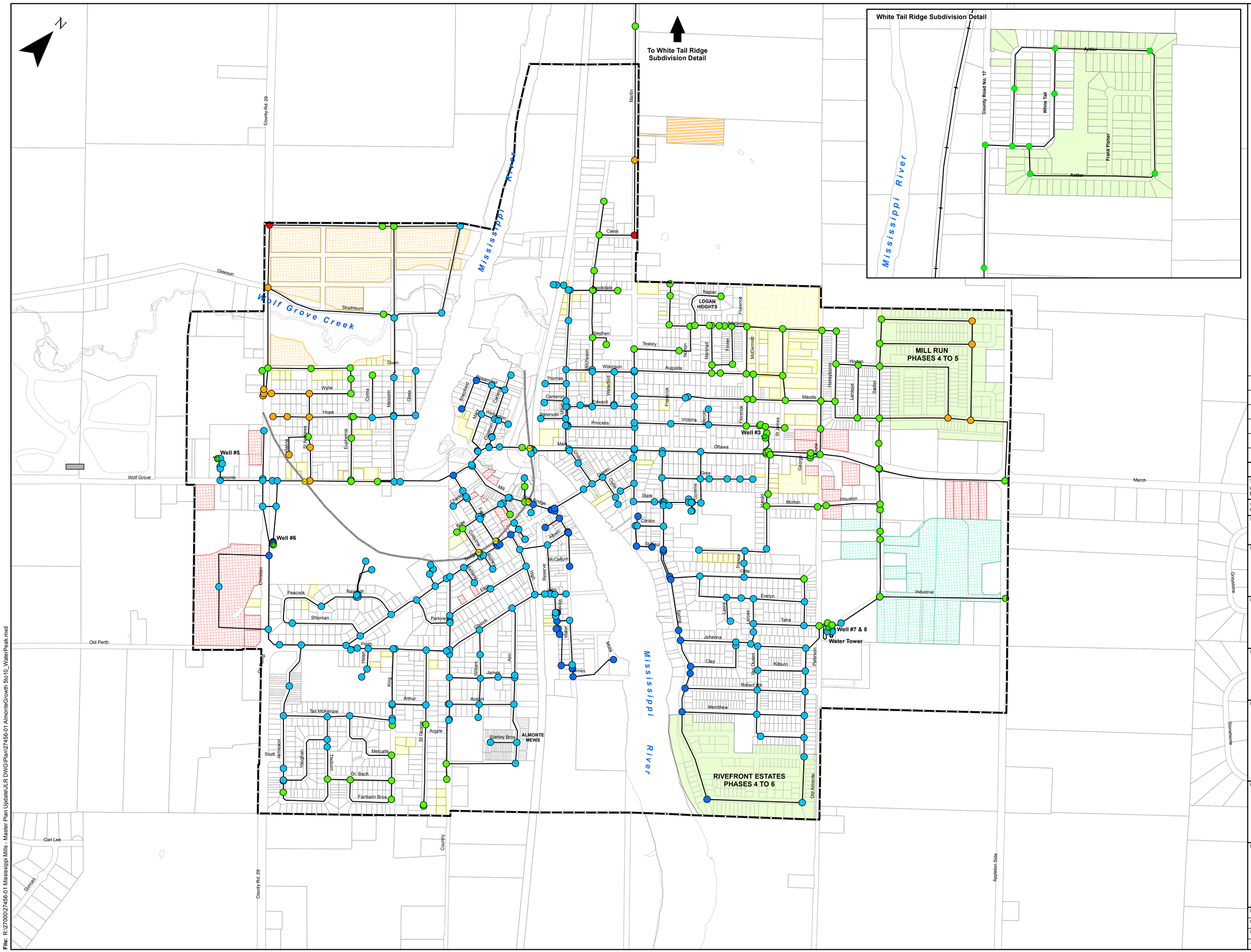

Peak Hour

- < 274 kPa
- 275 to 300 kPa
- 301 to 400 kPa
- 401 to 500 kPa
- 501 to 550 kPa
- > 550 kPa

Infrastructure

- Pressure Reducing Valve
- Well
- Water Tower
- Pressure Zone
- Watermain

Land Use

- Almonte Ward Limits
- Existing Lots
- Future Lots
- Closed Waste Disposal Site
- Registered Subdivision
- Business Park (17.0 ha)
- Commercial (15.6 ha)
- Residential - Geenfield (14.2 ha)
- Residential - Infill (16.0 ha)

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DRAWING:

ALMONTE WARD WATER SYSTEM 5 TO 10 YEARS (2023 TO 2028) PEAK HOUR

DESIGN: MB	
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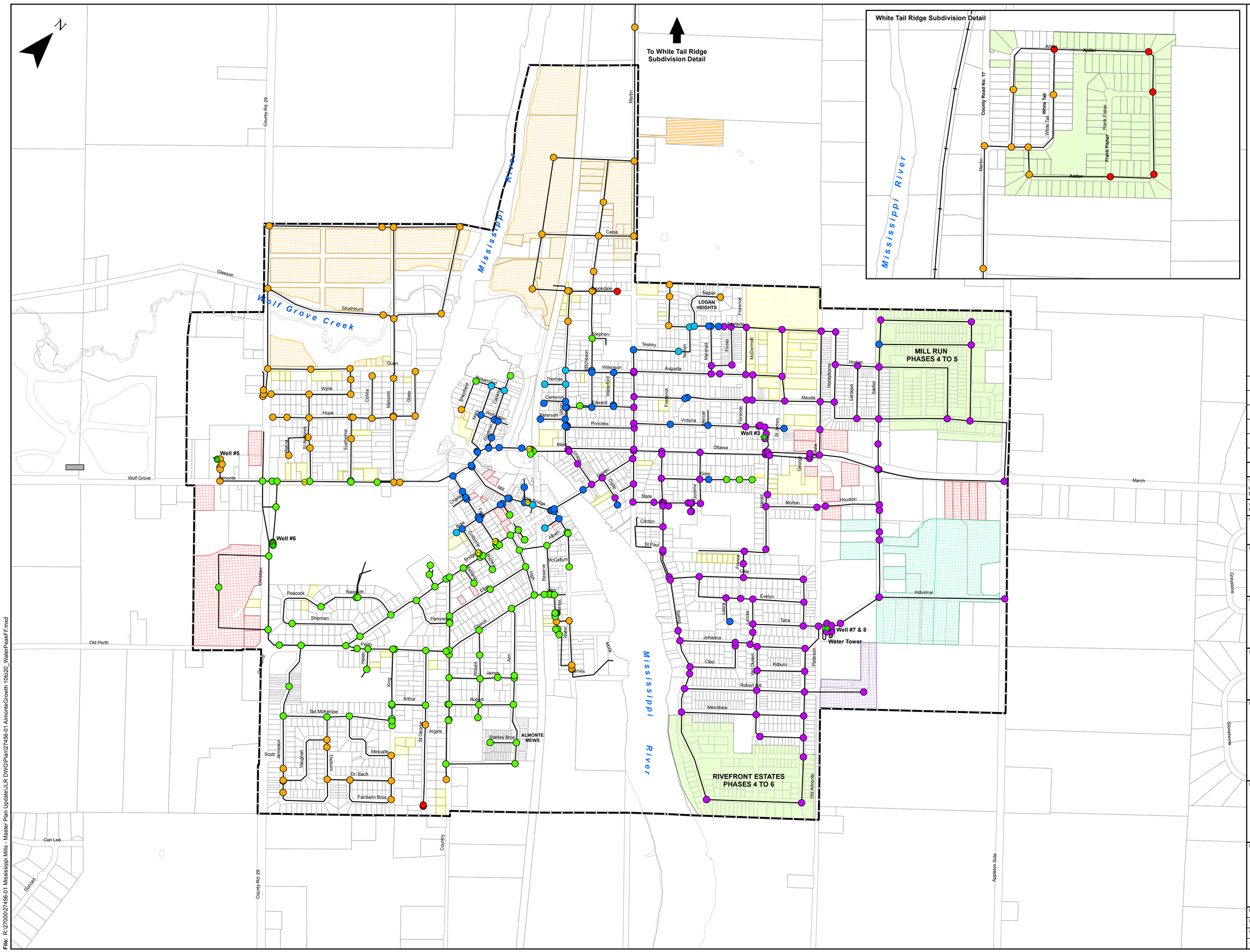

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DRAWING:

ALMONTE WARD WATER SYSTEM
10 TO 20 YEARS (2029 TO 2037)
MAX DAY DEMAND / FIRE FLOW

DESIGN:	MB
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CHECKED:	SG
JLR #:	27456-01

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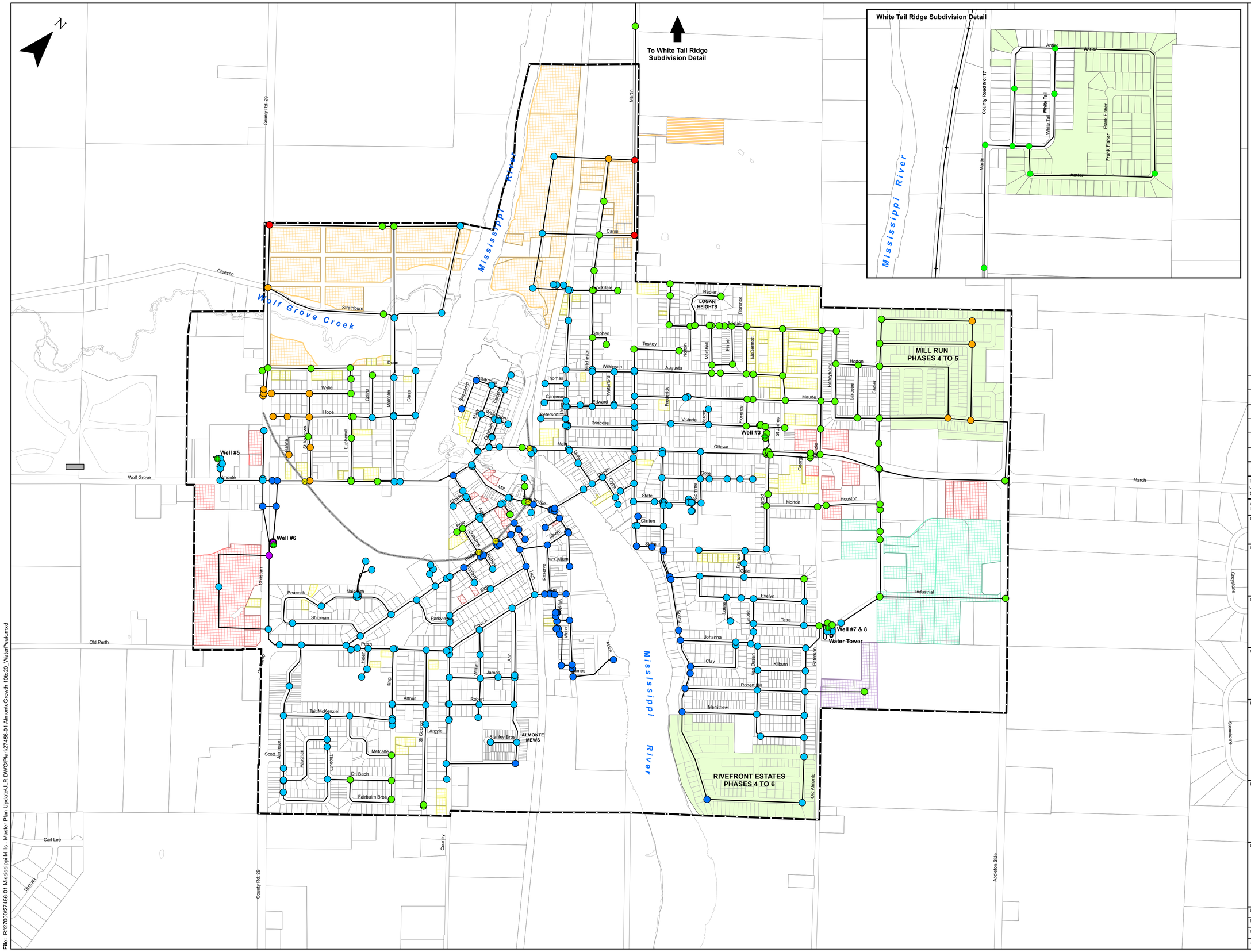
FIGURE 13



Peak Hour

- < 274 kPa
- 275 to 300 kPa
- 301 to 400 kPa
- 401 to 500 kPa
- 501 to 550 kPa
- > 550 kPa

Infrastructure

- Pressure Reducing Valve
- Well
- Water Tower
- Pressure Zone
- Watermain

Land Use

- Almonte Ward Limits
- Existing Lots
- Future Lots
- Closed Waste Disposal Site
- Registered Subdivision
- Business Park (17.0 ha)
- Community Facility (3.1 ha)
- Commercial (15.6 ha)
- Residential - Geenfield (34.2 ha)
- Residential - Infill (16.0 ha)

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DRAWING:

ALMONTE WARD WATER SYSTEM
10 TO 20 YEARS (2029 TO 2037)
PEAK HOUR

DESIGN: MB	DRAWING #:
DRAWN: KTK	**FIGURE 14**
CHECKED: SG	
JLR #: 27456-01	

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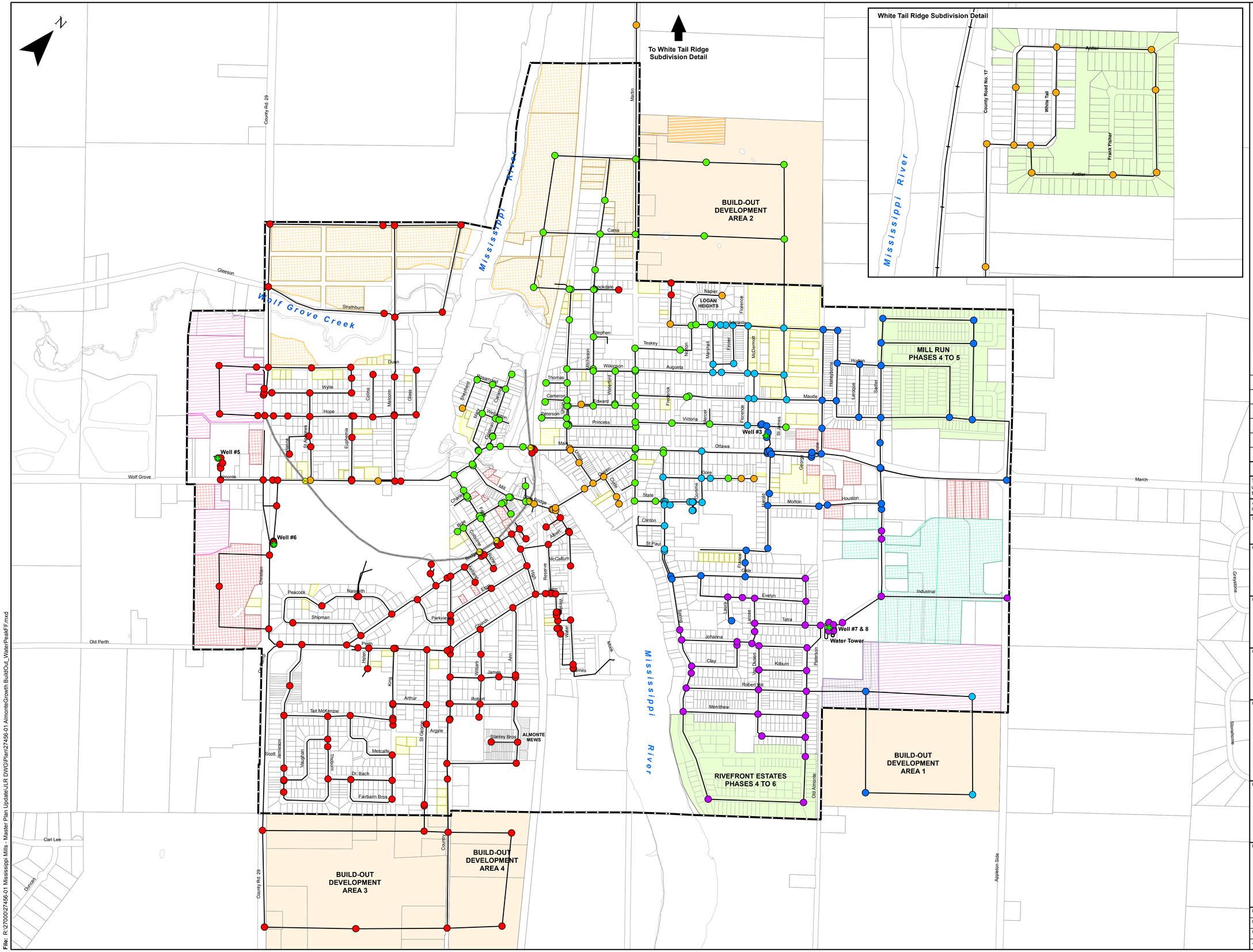

Max Day + Fire Flow

- < 32 L/s
- 33 to 50 L/s
- 51 to 67 L/s
- 68 to 75 L/s
- 76 to 100 L/s
- 100 to 300 L/s

Infrastructure

- Pressure Reducing Valve
- Well
- Water Tower
- Pressure Zone
- Watermain

Land Use

- Almonte Ward Limits
- Existing Lots
- Future Lots
- Closed Waste Disposal Site
- Registered Subdivision
- Build Out
- Business Park (17.0 ha)
- Community Facility (3.1 ha)
- Commercial (15.6 ha)
- Industrial (24.1 ha)
- Residential - Geenfield (34.2 ha)
- Residential - Infill (16.0 ha)

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MISSISSIPPI MILLS, ONTARIO

DRAWING:

ALMONTE WARD WATER SYSTEM
BUILD-OUT (2037+)
MAX DAY DEMAND / FIRE FLOW

DESIGN: MB	
DRAWN: KTK	DRAWING #:
CHECKED: SG	**FIGURE 15**
JLR #: 27456-01	

PLOT DATE: January 5, 2018 2:34:35 PM

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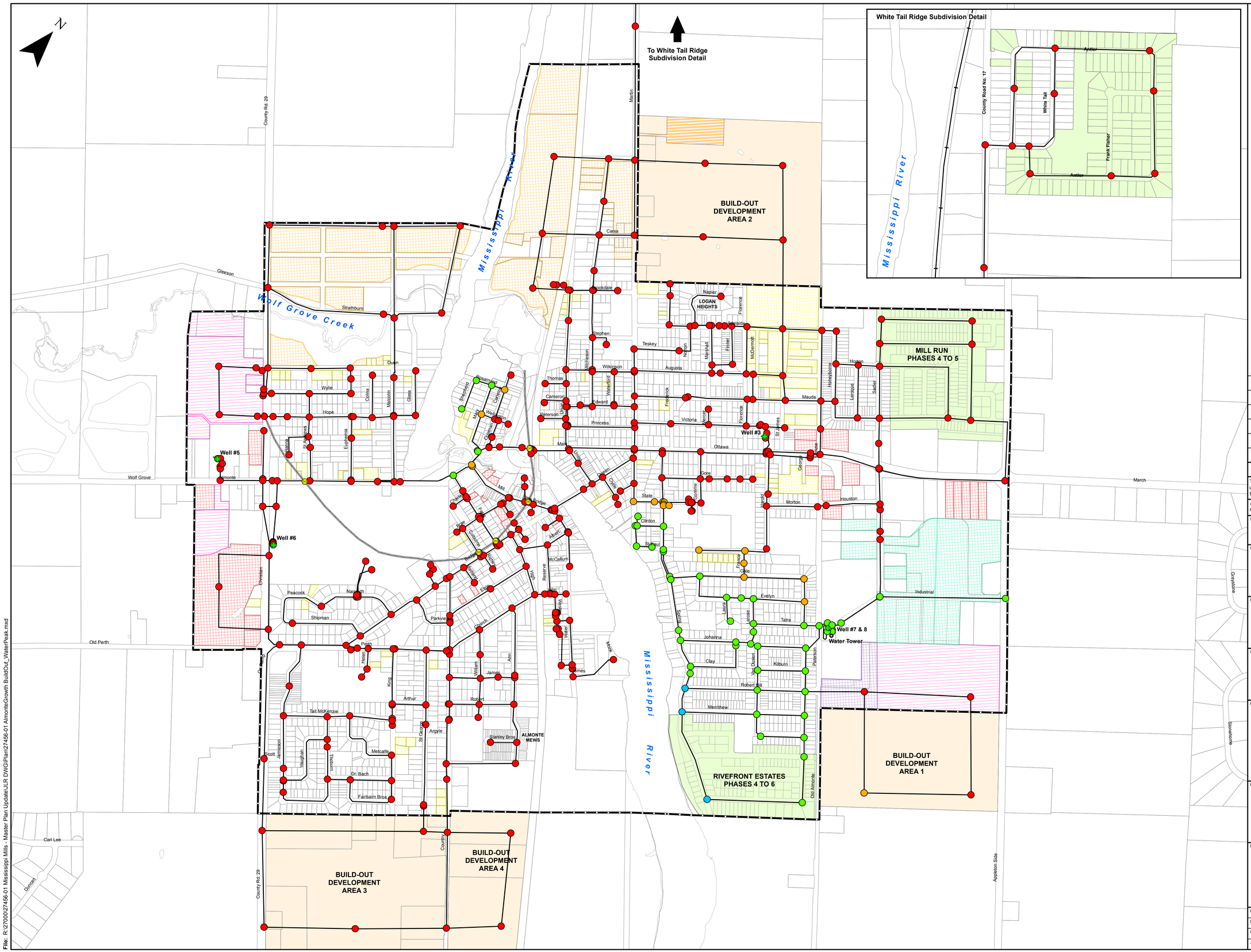

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MISSISSIPPI MILLS, ONTARIO

DRAWING:

ALMONTE WARD WATER SYSTEM BUILD-OUT (2037+) PEAK HOUR

DESIGN: MB	
DRAWN: KTK	DRAWING #:
CHECKED: SG	**FIGURE 16**
JLR #: 27456-01	

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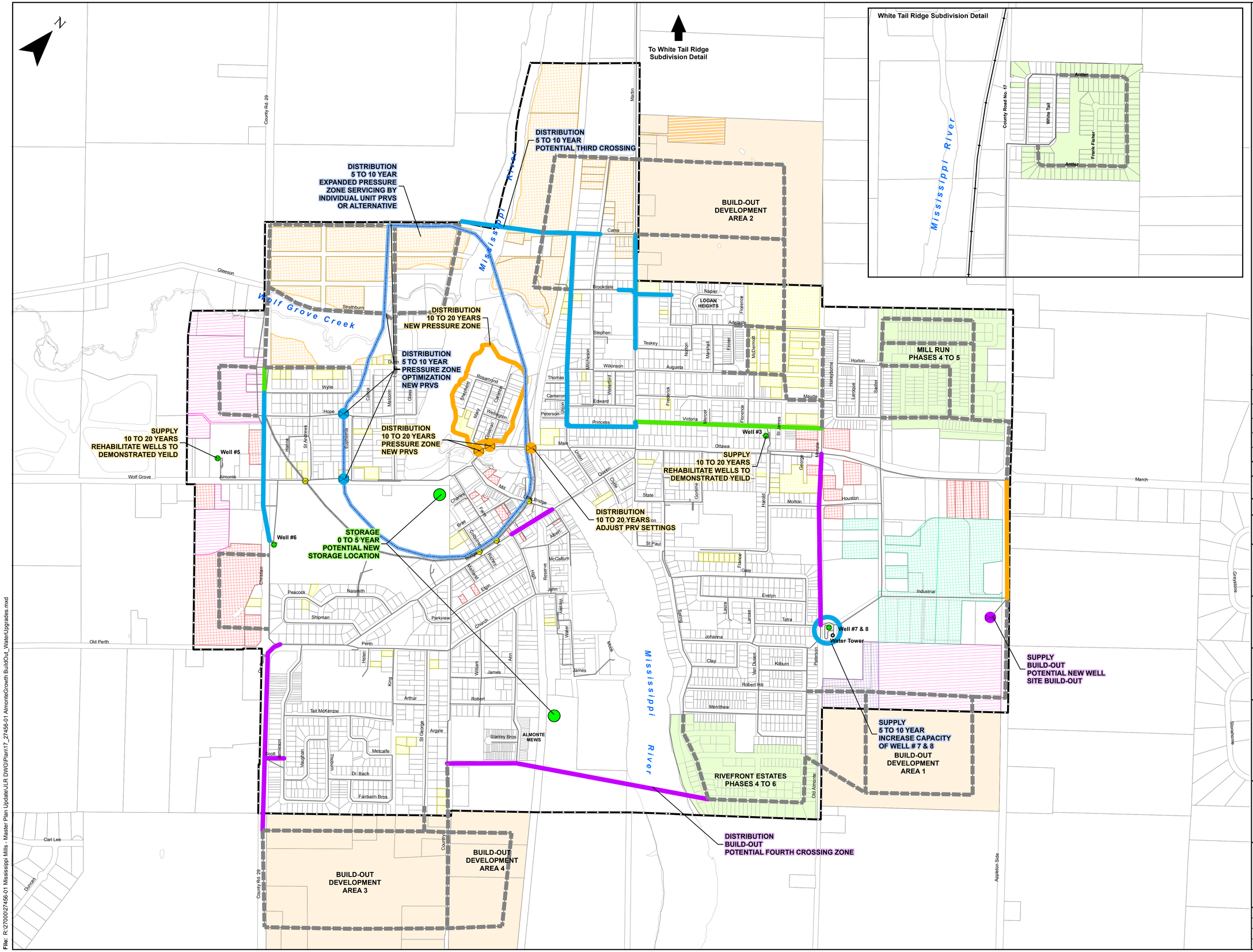

Watermain Upgrades

- Future Pressure Zone
- 0 to 5 Years
- 5 to 10 Years
- 10 to 20 Years
- Future Watermain
- Simulated Watermain Routing (conceptual) to be finalized during development stage

Infrastructure

- Pressure Reducing Valve
- Well
- Water Tower
- Existing Pressure Zone
- Watermain

Land Use

- Almonte Ward Limits
- Existing Lots
- Future Lots
- Closed Waste Disposal Site
- Registered Subdivision
- Build Out
- Business Park (17.0 ha)
- Community Facility (3.1 ha)
- Commercial (15.6 ha)
- Industrial (24.1 ha)
- Residential - Geenfield (34.2 ha)
- Residential - Infill (16.0 ha)

No.	ISSUE / REVISION	DD/MM/YY

VERIFY SHEET SIZE AND SCALES. BAR TO THE RIGHT IS 25mm IF THIS IS A FULL SIZE DRAWING. 0 25mm

SCALE: 0 50 100 200 300 400 Meters

CLIENT:

CONSULTANT:
J.L.Richards
ENGINEERS · ARCHITECTS · PLANNERS
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CONSULTANT:

PROFESSIONAL STAMP

PROFESSIONAL STAMP

PROJECT:
MUNICIPALITY OF MISSISSIPPI MILLS ALMONTE WARD WATER AND WASTEWATER INFRASTRUCTURE MASTER PLAN UPDATE
MISSISSIPPI MILLS, ONTARIO

DRAWING:
ALMONTE WARD WATER SYSTEM SERVICING STRATEGIES SUPPLY STORAGE DISTRIBUTION

DESIGN: MB	
DRAWN: KTK	DRAWING #:
CHECKED: SG	**FIGURE 17**
JLR #: 27456-01	

File: R:\27000\27456-01 Mississippi Mills - Master Plan Update\JLR DWG\Plan17_27456-01 AlmonteGrowth BuildOut_WaterUpgrades.mxd

PLOT DATE: January 26, 2018 11:13:39 AM