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DESIGN BRIEF

FOR

CAIVAN (ORLEANS VILLAGE) LIMITED

PROPOSED RESIDENTIAL SITE PLAN

ORLEANS VILLAGE PHASE 4
CITY OF OTTAWA

PROJECT NO.: 24-1403

SUBMISSION 1 REVISION 1
DECEMBER 2024

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FOR
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1.0 INTRODUCTION

David Schaeffer Engineering Limited (DSEL) was retained to prepare a Design Brief for the site plan application of Orleans Village (OV) Phase 4, on behalf of Caivan (Orleans Village) Limited (COVL).

The property, located at 245 and 275 Lamarche Avenue in Ottawa's Innes Ward, is identified as Blocks 147 and 148 in the DSEL General Plan attached in ***Appendix A*** and previous Mplans for the property. The site plan covers approximately 4.5 hectares, situated south of Innes Road, east of Lamarche Avenue, and north of the existing Orleans Village Phases 1, 2,

This report aims to provide detailed information on the availability of site services to support the site plan control application.

1.1 Existing Conditions

The subject property includes 4.5 ha of undeveloped land, falling under the jurisdiction of the Rideau Valley Conservation Authority. Adjacent properties to the north and east are light industrial, while the west and south boundaries are shared with residential lots. The site's elevation ranges from 88m to 92m, with a gentle slope from north to south.

Vegetation is minimal, with the area primarily consisting of agricultural land and parking lots, with few trees. Caivan (Orleans Village) Ltd. retained Paterson Group to conduct a geotechnical investigation of the site. The soil profile typically consists of topsoil, fill, and crushed stone, followed by hard to very stiff brown silty clay. Bedrock lies at depths ranging from 1 to 7 meters. A groundwater survey in March 2021 found several boreholes were dry, with others measuring groundwater between 2.3m and 2.8m below the surface.

Existing infrastructure exists in the Lamarche Avenue ROW along the western boundary of the subject property. Plan and profiles are attached in ***Appendix A*** for reference.

1.2 Site Plan Layout

The proposed project includes a park block, residential stacked townhomes, and parking areas (refer to the site plan in ***Appendix A***). Predicted population figures for the site are outlined in Table 1**.**

Table 1: Development Statistics

Land Use	Total Area (ha)	Projected Residential Units	Residential Population per Unit *	Projected Population
Stacked Townhouses	1.41	476	2.3	1095
Municipal Park	0.45			
Walkways/Amenity Area	1.21			
Local Roads	1.45			
Total	**4.52**	**476**		**1095**

** NOTE: Population projections may differ from population estimates used in background Transportation Studies, Planning Rationale, and other studies.*

1.3 Consultation Summary

Consultation with the City of Ottawa was initiated by COVL in July 2024, under Site Plan Control and Plan of Condominium Application. The City of Ottawa submitted a set of relevant engineering comments from the pre-application consultation, which are provided in ***Appendix A***.

1.4 Required Permits / Approvals

The City of Ottawa must approve detailed engineering design drawings and reports prior to construction of the proposed infrastructure identified in this report.

The following additional approvals and permits listed in ***Table 2*** are expected to be required prior to construction of the municipal infrastructure detailed herein. Other permits and approvals may be required, as detailed in the other studies submitted as part of the Planning Act applications (e.g. *Tree Conservation Report, Phase 1 Environmental Site Assessment, etc*.).

Table 2: Potential Required Permits/Approvals

Agency	Permit/Approval Required	Trigger	Remarks
MECP / City of Ottawa	Environmental Compliance Approval	Construction of new sanitary & storm sewers.	MECP is expected to review the stormwater collection system and wastewater collection system by transfer of review.
MECP	Permit to Take Water	Construction of proposed land uses (e.g. basements for residential homes) and services.	Pumping of groundwater will be required during construction, given groundwater conditions and proposed land uses/ municipal infrastructure.
City of Ottawa	MOE Form 1 – Record of Watermains Authorized as a Future Alteration	Construction of watermains.	The City of Ottawa is expected to review the watermains on behalf of the MECP.

2.0 GUIDELINES, PREVIOUS STUDIES, AND REPORTS

2.1 Existing Studies, Guidelines, and Reports

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

- **Ottawa Sewer Design Guidelines**,
  City of Ottawa, *SDG002,* October 2012.
  (City Standards)

  - **Technical Bulletin ISDTB-2014-01, Revisions to Ottawa Design Guidelines – Sewer,**
    City of Ottawa, February 5, 2014.
    (*ISDTB-2014-01*)

  - **Technical Bulletin PIEDTB-2016-01, Revisions to Ottawa Design Guidelines – Sewer,**
    City of Ottawa, September 6, 2016.
    (*PIEDTB-2016-01*)

  - **Technical Bulletin ISTB-2018-01, Revisions to Ottawa Design Guidelines – Sewer,**
    City of Ottawa, March 21, 2018.
    (*ISTB-2018-01*)

  - **Technical Bulletin ISTB-2018-03, Revisions to Ottawa Design Guidelines – Sewer,**
    City of Ottawa, June, 2018.
    (*ISTB-2018-04*)

  - **Technical Bulletin ISTB-2019-02, Revisions to Ottawa Design Guidelines – Sewer,**
    City of Ottawa, July 8, 2019.
    (*ISTB-2019-02*)

- **Ottawa Design Guidelines – Water Distribution**
  City of Ottawa, July 2010.
  (Water Supply Guidelines)

  - **Technical Bulletin ISD-2010-2**
    City of Ottawa, December 15, 2010.
    (*ISD-2010-2*)

  - **Technical Bulletin ISDTB-2014-02**
    City of Ottawa, May 27, 2014.
    (*ISDTB-2014-02*)

  - **Technical Bulletin ISTB-2018-02**
    City of Ottawa, March 21, 2018.
    (*ISTB-2018-02*)

- **Technical Bulletin ISTB-2021-03**
  City of Ottawa, August 18, 2021
  (ISTB-2021-03)

- **Design Guidelines for Sewage Works,**
  Ministry of the Environment, 2008.
  (MOE* Design Guidelines*)

- **Stormwater Planning and Design Manual,**
  Ministry of the Environment, March 2003.
  (SWMP Design Manual)

- **Ontario Building Code Compendium**
  Ministry of Municipal Affairs and Housing Building Development Branch, January 1, 2010 Update.
  (OBC)

- **Mississippi-Rideau Source Water Protection Plan,**
  MVCA & RVCA, August 2014.

- **Erosion & Sediment Control Guidelines for Urban Construction,**
  Greater Golden Horseshoe Area Conservation Authorities, December 2006.

- **Geotechnical Investigation – Proposed Residential Development, 245 and 275 LaMarche Avenue, Ottawa, Ontario**
  Paterson Grounp, April 1, 2022 **(Geotechnical Report)**

- **Design Brief for Caivan (Orleans Village) Limited, 3490 Innes Road, Ottawa, Ontario**
  DSEL, November 2018 **(2018 Design Brief)**

- **Design Brief for Pond 1 East Urban Community**
  DSEL File No. 20-1191, February 2023 **(SWM Report)**

- **Functional Servicing Report for Proposed Residential Subdivision, Caivan (Orleans Village 2) Limited**
  DSEL File No. 22-1296, February 2023 **(FSR)**

- **Hydraulic Capacity and Modeling Analysis Orleans Village**
  GeoAdvice Engineering Inc., October 15, 2024

3.0 WATER SUPPLY SERVICING

3.1 Existing Water Supply Services

The subject property is within the 2E pressure zone, as indicated in the City of Ottawa Water Distribution Mapping in ***Appendix B***. The proposed site plan is located north of the City's current watermain network located in the existing Orleans Village. A 400mm diameter watermain runs along Innes Road, branching into a 300mm diameter watermain installed along Lamarche Avenue.

3.2 Water Supply Servicing Design

Drawings 5 and 6 illustrate the proposed watermain configuration for the site. The 200mm diameter mains are connected in a looped configuration to the existing 300mm watermain on Lamarche Avenue.

DSEL retained GeoAdvice to submit proposed domestic and fire flow demands to The City of Ottawa. In response, the City provided boundary conditions in October 2024, including anticipated minimum and maximum water pressures as well as estimated pressures during fire flow demand. **Table 3** summarizes the estimated water supply demands for the proposed site plan, as detailed in the ***Hydraulic Capacity and Modeling Analysis*** **(Appendix B),** along with the corresponding boundary conditions.

Table 3: Water Demand Proposed Conditions

Connection 1 – Lamarche North

Design Parameter	Estimated Demand[1] (L/min)	Boundary Condition[2] (m H_2O / kPa)
Average Daily Demand	212.9	130.8 / 393.0
Max Day + Fire Flow	532.3 + 11,000 = 11,532.3	126.6 / 352.3
Peak Hour	1171	127.2 / 358.5

1) Water demand calculation per ***Water Supply Guidelines***. See ***Appendix B*** for detailed calculations.
2) Boundary conditions supplied by the City of Ottawa for the demands indicated in the correspondence; assumed ground elevation 89-90. See ***Appendix B.***

Connection 2 – Lamarche Middle

Design Parameter	Estimated Demand[1] (L/min)	Boundary Condition[2] (m H_2O / kPa)
Average Daily Demand	212.9	130.8 / 404.0
Max Day + Fire Flow	532.3 + 11,000 = 11,532.3	125.3 / 350.3
Peak Hour	1171	127.2 / 368.9

1) Water demand calculation per ***Water Supply Guidelines***. See ***Appendix B*** for detailed calculations.
2) Boundary conditions supplied by the City of Ottawa for the demands indicated in the correspondence; assumed ground elevation 89-90. See ***Appendix B.***

Connection 3 – Lamarche South

Design Parameter	Estimated Demand[1] (L/min)	Boundary Condition[2] (m H_2O / kPa)
Average Daily Demand	212.9	130.8 / 410.1
Max Day + Fire Flow	532.3 + 11,000 = 11,532.3	124.9 / 350.9
Peak Hour	1171	127.2 / 373.7

1) Water demand calculation per ***Water Supply Guidelines***. See ***Appendix B*** for detailed calculations.
2) Boundary conditions supplied by the City of Ottawa for the demands indicated in the correspondence; assumed ground elevation 89-90. See ***Appendix B.***

GeoAdvice was also retained to perform hydraulic and fire flow capacity analyses to confirm the sizing of the internal distribution network and ensure adequate water pressures under all scenarios outlined in **Table 4**. Their findings support the site plan and are summarized in the report provided in ***Appendix B***.

Table 4: Water Supply Design Criteria

Design Parameter	Value
Residential Stacked Townhome	2.3 P/unit
Residential Average Daily Demand	280 L/d/P***
Residential Maximum Daily Demand	2.5 x Average Daily **
Residential Maximum Hourly	5.5 x Average Daily **
System Pressure	Minimum 140kPa at ground level under maximum day demands plus fire flow conditions
Pipe Diameters	For distribution systems designed to provide fire protection, the minimum diameter of watermains shall be 150 mm except beyond the last hydrant on cul-de-sacs where the minimum diameter of watermains may be 25 mm. Watermain diameters shall be such that a flushing velocity of 0.8 m/s can be achieved for cleaning and flushing procedures.
Service Pipes	The minimum diameter of service pipes shall be 19 mm
Fire Hydrants	Fire hydrants shall be dry-barrel type and shall conform to the latest edition of AWWA Standard C502: Dry-Barrel Fire Hydrants. Fire hydrants shall be provided with adequate thrust blocking to prevent movement caused by thrust forces. Fire hydrant leads shall be a minimum diameter of 150 mm. In areas where the water table will rise above the hydrant drain ports, the drain ports shall be plugged.

Minimum operating pressure during normal operation	275 kPa
Maximum operation pressure during normal operation	552 kPa
Desired operating pressure	350 kPa to 480 kPa

Daily average based on Appendix 4-A from **Water Supply Guidelines*
*** Residential Max. Daily and Max. Hourly peaking factors per MOE Guidelines for Drinking-Water Systems Table 3-3 for 0 to 500 persons. -Table updated to reflect ISD-2010-2*
****Daily consumption rate of 280 L/person/day to align with the revised wastewater rates identified by City of Ottawa Technical Bulletin ISTB-2018-03. As a result, DSEL is submitting for a deviation from the **Water Supply Guidelines**.*

3.3 Water Supply Conclusion

The proposed OV Phase 4 will be serviced by a network of local watermains that connects to existing infrastructure on Lamarche Avenue.

Hydraulic capacity modeling supports the site plan based on boundary conditions provided by the City of Ottawa.

The proposed water supply design will conform with all relevant City of Ottawa Guidelines and Policies.

4.0 WASTEWATER SERVICING

4.1 Existing Wastewater Services

Sanitary sewers are installed along Lamarche Avenue (refer to the sanitary drainage plan in ***Appendix C***). Two (2) stubs with control manholes were previously installed for the site, but it is proposed to decommission these.

The ***2018 Design Brief*** considered the subject site, Blocks 147 and 148. Block 147 was planned for a population of 1,039 within 2.16 hectares, and Block 148 for 1,222 within 2.54 hectares. The as-built design sheets for the subdivision are available in ***Appendix C***. With the original assumptions predicting a total population of 2,261, the residual capacity in the sanitary main is limited to 23.76 l/s at run 36A-44A.

4.2 Wastewater Design

The wastewater design proposes a single connection to the existing sanitary sewer within Lamarche Avenue and an extension of the mainline sewer towards the north in order to service units fronting Lamarche. Detailed layouts are shown in ***Drawings 5 and 6***, with the sanitary drainage area plan in ***Drawing 22***.

The subject property will be serviced by an internal gravity sewer system that follows the local road network. Sufficient depth exists for frost cover and gravity to support the subject development.

The Phase 4 site plan was estimated to have a population of 1095 and a peak flow of **12.32 *L/s***. Refer to calculations in ***Appendix C*** for details. Updated design sheets, also included in ***Appendix C***, indicate the residual capacity in the existing sewer is greater than originally anticipated with 33.12 L/s.

Table 5, below***,*** summarizes the ***City Standards*** to be employed in the design of the proposed wastewater sewer system.

Table 5: Wastewater Design Criteria

Design Parameter	Value
Residential – Condo / Stacked Town	2.3 P/unit
Average Daily Demand	280 L/d/per
Peaking Factor	Harmon's Peaking Factor. Max 4.0, Min 2.0 Harmon's Corrector Factor 0.8
Infiltration and Inflow Allowance	0.05 L/s/ha (Dry Weather) 0.28 L/s/ha (Wet Weather) 0.33 L/s/ha (Total)
Park Flows	0.33 L/s/ha
Parking Peaking Factor	9300 L/ha/d
Sanitary sewers are to be sized employing the Manning's Equation	$Q = \frac{1}{n} AR^{2/3} S^{1/2}$
Minimum Sewer Size	200 mm diameter
Minimum Manning's 'n'	0.013
Minimum Depth of Cover	2.5 m from crown of sewer to grade
Minimum Full Flowing Velocity	0.6 m/s
Maximum Full Flowing Velocity	3.0 m/s
Extracted from Sections 4 and 6 of the City of Ottawa Sewer Design Guidelines, October 2012, and recent residential subdivisions in City of Ottawa (including revisions per ISTB Sewer-2018-01)	

4.3 Wastewater Servicing Conclusions

The site is tributary to the Lamarche Avenue sewer. The subject property will be serviced by local sanitary sewers which will outlet to the existing infrastructure on Lamarche Avenue ROW. There is residual capacity in the downstream sewers and sufficient capacity within the existing infrastructure to accommodate the flow from the proposed development.

The proposed wastewater design conforms to all relevant ***City Standards***.

5.0 STORMWATER MANAGEMENT

5.1 Existing Stormwater Services

Stormwater runoff from the subject property is tributary to the City of Ottawa sewer system located on Lamarche Avenue. See the storm drainage area plan and associated storm sewer calculation sheet extracted from the ***2018 Design Brief*** in ***Appendix D***. The Lamarche Avenue storm sewer drains into the East Urban Community Pond 1 (EUC Pond 1). EUC Pond 1 has been subject to numerous background studies as summarized below.

- Gore and Storrie Limited, July 1992, East Urban Community Master Drainage Plan, City of Gloucester (Addendum 1993).
    - The City of Gloucester completed a Master Drainage Plan (MDP) study for the East Urban Community and satisfied Phases 1 and 2 of the Class Environmental Assessment. The recommended stormwater management plan was approved by the regulatory agencies. The proposed plan included the subject pond, EUC Pond 1, and identified the subject area as being tributary to the facility. The study identified 333ha of drainage area with an average imperviousness ratio of 55%. See ***Appendix D*** for an extract of the Drainage Area Plan.
- Stantec Consulting Ltd., Addendum to the East Urban Community MDP, April 2000.
    - The addendum addressed changes in the design criteria for stormwater management ponds based on updates to design guidelines introduced by the province in 1994. The addendum was completed in accordance with EA process for a schedule B project and a notice of completion was advertised in the Ottawa Citizen on April 5 and April 12, 2000. The subject property remained tributary to the facility per the 1992 Master Drainage Plan.
- Stantec Consulting Ltd., East Urban Community Pond No 1 – Design Brief, April 2008.
    - The City of Ottawa retained Stantec to complete detailed design of EUC Pond 1. Drainage areas to EUC Pond 1 were reviewed based on the Gloucester EUC Infrastructure Study Update (2005) and identified 326ha at 57% impervious ratio. The subject lands were included in the drainage area to EUC Pond 1. EUC Pond 1 was designed to provide 70% total suspended solids removal. EUC Pond 1 was constructed in 2011.
- JFSA, Trails Edge Subdivision / Stormwater Management Facility Reconstruction and Preliminary Stormwater Management Plan, April 2015
    - The EUC pond was modified in 2015 to accommodate an increase in impervious area tributary to the facility and updated to meet the City of Ottawa and MECP standards. The subject property was included as having a runoff coefficient of 0.83 under ultimate buildout conditions.
- DSEL, Servicing Report for Trails Edge and Orleans Business Park, July 2017
    - Refined drainage boundaries to EUC Pond 1 based on updated road networks and land uses. The subject property was identified as commercial lands and was shown to be tributary to EUC Pond 1.
- DSEL, Design Brief for Caivan (Orlean Village) Limited – 3490 Innes Road, May 2018

  - Further refined drainage areas tributary to EUC Pond 1 based on updated road networks and land uses. The subject area was contemplated as mixed-use having runoff coefficients of 0.85 for 2.54 ha and 0.75 for 2.16 ha.

- JFSA, East Urban Community / Preliminary Hydraulic Gradeline Analysis and Pond Design, June 2019.
  - Pond expansion recommendations as part of the EUC Phase 3
- DSEL, Master Servicing Study for East Urban Community Phase 3 Area Community Design Plan – Richcraft Homes, December 2020
  - Reviewed and summarized background information related to EUC Pond 1. Provided recommendations on Pond expansion in accordance with current design practices and updated land use and road network. Provided a Development Charge Recovery Estimate. Subject area was included as mixed use with consistent design parameters per the May 2018 Design Brief as described above. See ***Appendix D*** for an extract of the Drainage Area Plan.
- DSEL / JFSA, Design Brief for Pond 1 East Urban Community North Main Cell and North Forebay Modifications, February 2023
  - This report supports the proposed modifications to the East Urban Community (EUC) Pond 1 north main cell and north forebay to allow for the continued development outlined in the Community Design Plan (Fotenn, May 2020) and the Master Servicing Study for the East Urban Community Phase 3 Area Community Design Plan (DSEL, June 2020). See ***Appendix D*** for an extract of the Drainage Area Plan.

5.2 Post-Development Stormwater Management Target

Stormwater management requirements for the subject property have been carried forward from the ***2018 Design Brief***, ***SWM Report, and FSR***.

The following City standards are required for stormwater management within the subject property:

- Storm sewers on private roads are to be designed to provide a minimum 2-year level of service per the City's latest Technical Bulletin PIEDTB-2016-01;
- For less frequent storms (i.e. larger than 1:2 year minimum or 1:5 year minimum), the minor system sewer capture will be restricted with the use of inlet control devices to prevent excessive hydraulic surcharges;
- Under full flow conditions, the allowable velocity in storm sewers is to be no less than 0.80 m/s and no greater than 6.0 m/s;
- For the 100-year storm and for all roads and parking surfaces, the maximum depth of water (static and/or dynamic) on streets, rear yards, public space and parking areas shall not exceed 0.35 m;
- When catchbasins are installed in rear yards, safe overland flow routes are to be provided to allow the release of excess flows from such areas. A minimum of 30 cm of vertical clearance is required between the rear yard spill elevation and the ground elevation at the adjacent building envelope;

- The product of the maximum flow depths on streets and maximum flow velocity must be less than 0.60 m2/s on all roads;
- Quality Controls are addressed in the existing downstream stormwater management facility.

The design assumes that the park block will attenuate flows at the same rate as the rest of the site plan. On-site storage for the 100-year event is calculated to be 61 m³, with a release rate of 45.6 l/s, corresponding to the 2-year storm event.

5.3 Proposed Minor System

The subject property is proposed to be serviced by an internal gravity storm sewer system that is to follow the local road network. The site will have one connection to the existing storm main on Lamarche Avenue. All units have gravity connections to the proposed stormwater collection system. See ***Drawings 6 and 7*** for a detailed layout of the proposed stormwater servicing. ***Drawing 20*** illustrates the storm drainage area plan and design sheets are available for review in ***Appendix D***.

Street catch basins will collect drainage from the streets and front yards, while rear yard catch basins will capture drainage from backyards. Perforated catch basin leads will be provided in rear yards, except the last segment where it connects to the right-of-way which will be solid pipe, per City standards.

The following table summarizes the standards that will be employed in the detailed design of the storm sewer network.

Table 6: Storm Sewer Design Criteria

Design Parameter	Value
Minimum Minor System Design Return Period	2-Year (Private Streets; Park 2-year)
Major System Design Return Period	1:100 year
Intensity Duration Frequency Curve (IDF) 2-year storm event: A = 732.951; B = 6.199; C = 0.810 5-year storm event: A = 998.071; B = 6.053; C = 0.814	$i = \frac{A}{(t_c + B)^C}$
Minimum Time of Concentration	10 minutes
Rational Method	$Q = CiA$
Storm sewers are to be sized employing the Manning's Equation	$Q = \frac{1}{n} A R^{2/3} S^{1/2}$
Runoff coefficient for paved and roof areas	0.9
Runoff coefficient for landscaped areas	0.2
Minimum Sewer Size	250 mm diameter
Minimum Manning's 'n' for pipe flow	0.013
Minimum Depth of Cover	2.0m from crown of sewer to grade
Minimum Full Flowing Velocity	0.8 m/s

Maximum Full Flowing Velocity	6.0 m/s (where velocities in excess of 3.0 m/s are proposed, provision shall be made to protect against displacement of sewers by sudden movement)
Clearance from 100-Year Hydraulic Grade Line to Building Opening (USF)	0.30 m
Max. Allowable Flow Depth on Municipal Roads	35 cm above gutter (PIEDTB-2016-01)
Extent of Major System	Water levels must not touch any part of the building envelope and must remain below the lowest building opening during the stress test event (100-year + 20%) and 15cm vertical clearance is maintained between spill elevation on the street and the ground elevation at the nearest building envelope (PIEDTB-2016-01)
Stormwater Management Model	DDSWMM (release 2.1), SWMHYMO (v. 5.02) and XPSWMM (v. 10)
Model Parameters	Fo = 76.2 mm/hr, Fc = 13.2 mm/hr, DCAY = 4.14/hr, D.Stor.Imp. = 1.57 mm, D.Stor.Per. = 4.67 mm
Imperviousness	Based on runoff coefficient (C) where Percent Imperviousness = (C - 0.2) / 0.7 x 100%.
Design Storms	Chicago 3-hour Design Storms and 24-hour SCS Type II Design Storms. Maximum intensity averaged over 10 minutes.
Historical Events	July 1st, 1979, August 4th, 1988 and August 8th, 1996
Climate Change Street Test	20% increase in the 100-year, 3-hour Chicago storm
Extracted from City of Ottawa Sewer Design Guidelines, October 2012, and Technical Bulletins	

5.4 Hydraulic Grade Line Analysis

A detailed hydraulic grade line (HGL) modelling analysis has been completed for the proposed system based on the 100-year 3-hour Chicago, 12-hour SCS, and 24-hour SCS design storms, including historical design storms and climate change stress test as required. The HGL and freeboard clearances are tabled in ***Appendix D*** for reference.

5.5 Major System Design

Major system conveyance, or overland flow (OLF), is provided to accommodate flows in excess of the minor system capacity. OLF is accommodated by generally storing stormwater up to the 100-year design event in road sags then routing additional surface flow along the road network and rear yards towards a storm retention tank between Private Street 1 and Private Street 6, as shown in the ***Storm Drainage Plans***. Details of the storm retention tank are included in ***Appendix D*** for reference.

5.6 Grading and Drainage Design

The following additional grading criteria and guidelines are applied to detailed design, per ***City of Ottawa Guidelines*** and standard industry practices:

- Slope in grassed areas will be between 2% and 7%;
- Grades in excess of 7% will require terracing to a maximum of a 3:1 slope;
- Swales are to be 0.15m deep with 3:1 side slopes unless otherwise indicated on the drawings; and,
- Perforated pipe will be required for drainage swales if they are less than 1.5% in slope;
- Grades within the roads and parking stalls are limited to min 1% and max 5%.

Drawings 19 and 20 illustrate the proposed detailed grading. External areas north of the development will be captured by the proposed system in the interim condition. It is expected that once those parcels are redeveloped, stormwater will be attenuated on-site and directed toward Innes Road per City Standards. Where required, External lands to the east will be conveyed around the development in a cut of swale.

5.7 Stormwater Servicing Conclusions

The site is tributary to the Lamarche Avenue storm sewer. The subject property will be serviced by local storm sewers which will outlet to the existing infrastructure on Lamarche Avenue ROW.

The subject site was contemplated in the design of the receiving sewers and stormwater management facility.

There is residual capacity in the downstream sewers and there is sufficient capacity within the existing infrastructure to accommodate the flow from the proposed development.

The contemplated design conforms to all relevant ***City Standards***.

6.0 EROSION AND SEDIMENT CONTROL

Soil erosion occurs naturally and is a function of soil type, climate and topography. The extent of erosion losses is exaggerated during construction where vegetation has been removed and the top layer of soil becomes agitated. Prior to topsoil stripping, earthworks or construction, erosion and sediment controls will be implemented and will be maintained throughout construction.

Silt fencing will be installed around the perimeter of the active part of the site (and headwater features) and will be cleaned and maintained throughout construction. The silt fence will remain in place until the working areas have been stabilized and re-vegetated.

Catchbasins will have catchbasin inserts installed during construction to protect from silt entering the storm sewer system.

A mud mat will be installed at the construction access to prevent mud tracking onto adjacent roads.

The following additional recommendations to the Contractor will be included in contract documents:

- Limit extent of exposed soils at any given time.
- Re-vegetate exposed areas as soon as possible.
- Minimize the area to be cleared and grubbed.
- Protect exposed slopes with plastic or synthetic mulches.
- Install silt fence to prevent sediment from entering any existing ditches.
- No refueling or cleaning of equipment near existing watercourses.
- Provide sediment traps and basins during dewatering.

The Contractor will be required to complete regular inspections and guarantee proper performance. The inspection is to include:

- Verification that water is not flowing under silt barriers.
- Clean and change inserts at catch basins.

7.0 CONCLUSION AND RECOMMENDATIONS

David Schaeffer Engineering Ltd. (DSEL) has been retained by Caivan (Orleans Village) Limited to prepare a Design Brief in support of site plan application at 245 and 275 Lamarche Avenue. The preceding report outlines the following:

- Water – a 300mm diameter water main is available to support the subject lands, and hydraulic analysis supports the site plan.
- Wastewater – Sanitary sewers are available on Lamarche Avenue and were designed to sufficiently convey wastewater from the subject property.
- Stormwater – Block 147 and 148 were conceived with on-site storage and ultimately drain to the EUC pond. The receiving stormwater infrastructure have sufficient capacity to service the site plan.

The submitted materials demonstrate that the existing water, sanitary, and storm services can accommodate the contemplated development.

Prepared by,
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Per: Jeremy Chouinard, P.Eng.

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APPENDIX A

NOTE RE: PROPOSED CONNECTION ON EXISTING PAVEMENT

PROPOSED UNDERGROUND CONNECTIONS WITHIN EXISTING PAVEMENT TO BE CONSTRUCTED AS FOLLOWS:

1. PROPOSED UNDERGROUND CONNECTIONS TO BE CONSTRUCTED IN VERTICAL TRENCH AND BACKFILLED WITH UNSHRINKABLE FILL
2. CONTRACTOR TO VERIFY THE PRECISE LOCATIONS AND INVERT ELEVATIONS OF Ex. UNDERGROUND SERVICES AND Ex. UTILITIES PRIOR TO STARTING CONSTRUCTION
3. ANY DISTURBED AREAS, INCLUDING CURB, SIDEWALK AND BOULEVARD, TO BE RESTORED TO THE ORIGINAL CONDITION OR BETTER
4. ALL REMOVED ASPHALT PAVEMENT TO BE DEPOSITED OFF SITE
5. ALL WORKS INCLUDING REMOVAL AND RESTORATION TO THE SATISFACTION OF CITY OF OTTAWA

CONTRACTOR TO VERIFY THE PRECISE LOCATIONS AND INVERT ELEVATIONS OF Ex. UNDERGROUND SERVICES AND Ex. UTILITIES PRIOR TO STARTING CONSTRUCTION

ANY DISTURBED AREA DURING CONSTRUCTION TO BE RESTORED TO THE ORIGINAL CONDITION OR BETTER TO THE SATISFACTION OF THE AUTHORITIES HAVING JURISDICTION

NOTE RE: WATERMAIN / WATER SERVICE

1. INSULATION REQUIRED FOR WATERMAIN / WATER SERVICE WHERE THE SEPARATION BETWEEN WATERMAIN / WATER SERVICE AND OTHER SERVICES AND STRUCTURES IS LESS THAN 1.2m AND THE COVER IS LESS THAN 2.4m. REFER TO CITY STD. W23 FOR DETAIL.
2. FOR SERVICE INSTALLATION AT SEWER CROSSING, REFER TO CITY STD. W38 FOR DETAIL

NOTE:
THE COVER OF EX. MH, CB, CHAMBER AND OTHER ABOVEGROUND FEATURES TO BE ADJUSTED TO SUIT THE NEW FINISHED GRADE, WHERE APPLICABLE

NOTE RE: TEST PIT/BOREHOLE EXCAVATIONS
ANY DISTURBED MATERIAL ENCOUNTERED BELOW THE SUBGRADE LEVEL WITHIN A BUILDING FOOTPRINT TO BE SUB-EXCAVATED AND BACKFILLED WITH COMPACTED ENGINEERED FILL AS PER GEOTECHNICAL ENGINEERS RECOMMENDATION.

NOTE
FOR WATERMAIN CROSSING BELOW AND ABOVE SEWERS, REFER TO CITY STD. W25 AND W25.2, RESPECTIVELY, WHERE APPLICABLE

NOTE
FOR WATERMAIN STUBS, 2.4m MIN. COVER TO BE PROVIDED

NOTE
FOR HOUSE CONNECTIONS INSTALLED UNDER DRIVEWAYS, SLEEVE SHALL BE USED

NOTE:
ALL WATERMAIN CONNECTIONS AND DECOMMISSIONING OF EXISTING WATERMAINS TO BE COMPLETED BY CITY FORCES. TRENCH BACKFILL/REINSTATEMENT TO BE COMPLETED BY THE CONTRACTOR TO THE SATISFACTION OF THE CITY OF OTTAWA.

NOTE:
ALL EXISTING POST & WIRE FENCE, CULVERTS, UTILITY WIRE / POLES, TREES, SHRUBS ETC. WITHIN LOTS, BLOCKS AND ROADS TO BE REMOVED, UNLESS OTHERWISE NOTED

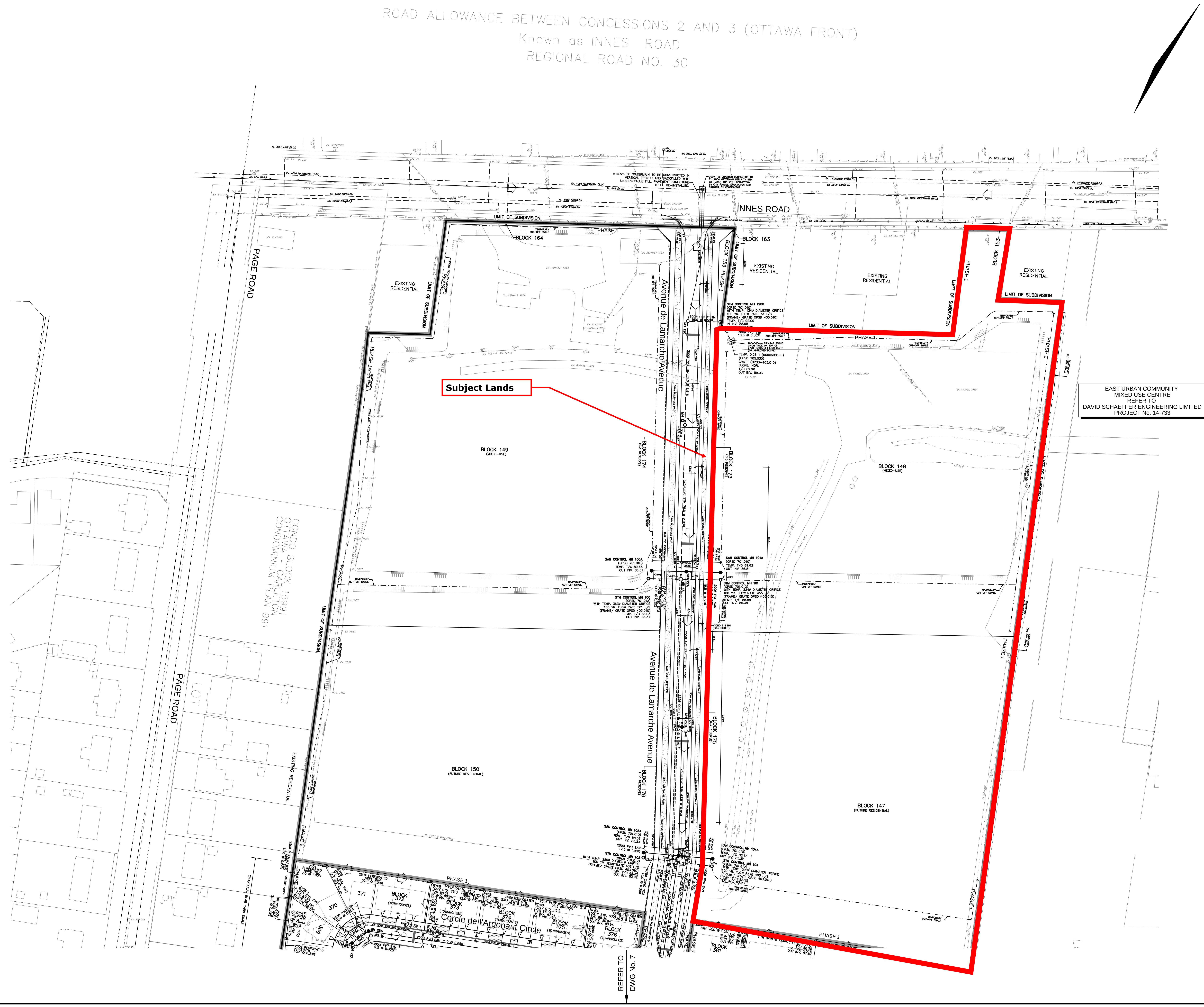
PERMISSION REQUIRED FOR WORK ON ADJACENT LANDS

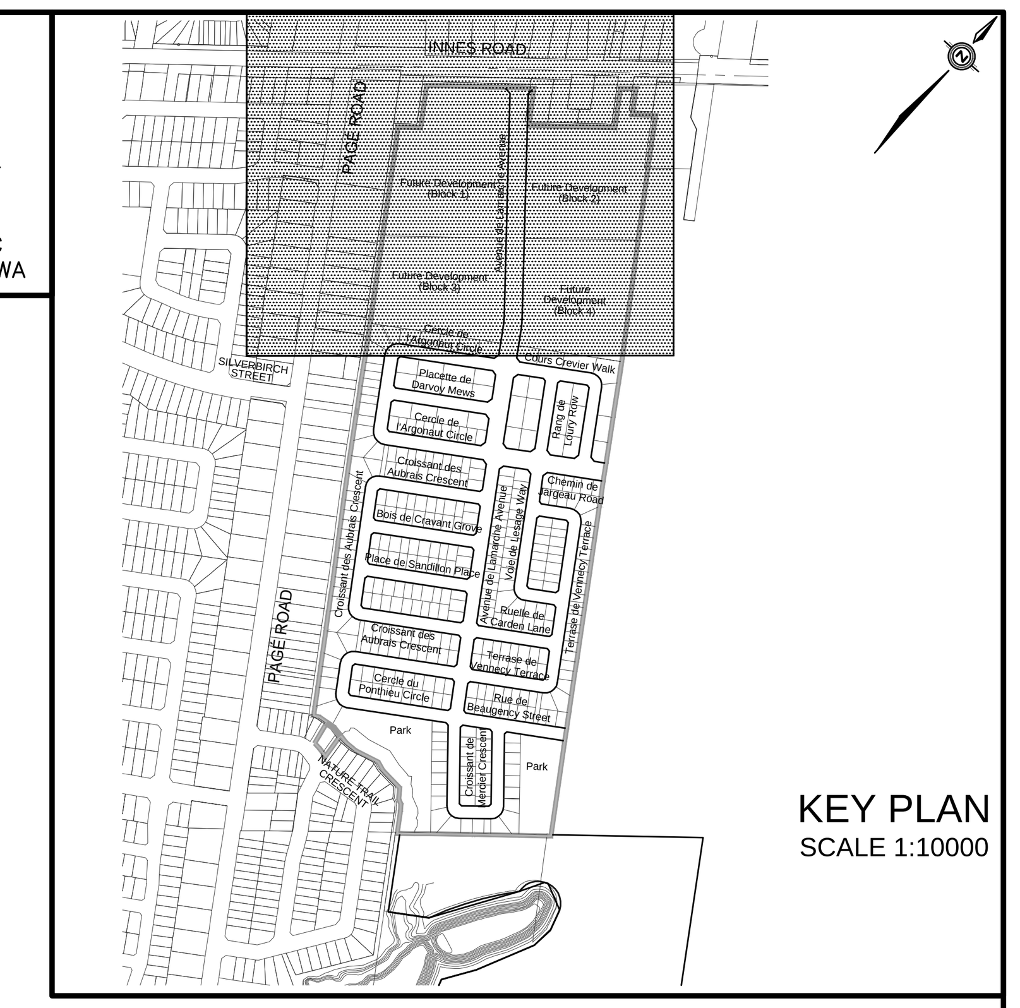
APPROVED ☐ REFUSED ☐

THIS ____ DAY OF __________, 20____

____

JOSHUA WHITE, P.ENG
PROJECT MANAGER – EAST BRANCH
PLANNING, INFRASTRUCTURE & ECONOMIC DEVELOPMENT DEPARTMENT, CITY OF OTTAWA





KEY PLAN
SCALE 1:10000

LEGEND

- CROSS
- 45° BEND
- LATERAL
- HYDRANT, VALVE & VB
- TEE
- VALVE & VC (V&C)
- VALVE & VB (V&B)
- 22.5° BEND
- 11.25° BEND
- REDUCER
- CAP
- 305mmø WM
- SANITARY MAINTENANCE HOLE (MH202A)
- 200mmø SAN
- CAP
- STREET CATCHBASIN & LEAD
- STREET CATCHBASIN WITH CLOSED LID & LEAD
- STORM MAINTENANCE HOLE (MH202)
- 375mmø ST
- CURB INLET CATCH-BASIN & LEAD
- CATCHBASIN/ MAINTENANCE HOLE (CBMH201)
- INTERCONNECTED CATCH BASIN & LEADS
- CAP
- TEE CATCHBASIN
- PERFORATED PIPE
- ELBOW CATCHBASIN
- SINGLE SERVICE LOCATION (ST, SAN & WM)
- SINGLE SERVICE LOCATION (SAN & WM)
- SINGLE SERVICE LOCATION (ST, SAN & WM)
- HYDRO SWITCHGEAR
- HYDRO TRANSFORMER
- STREET LIGHT STANDARD (L.S.)
- DITCH AND CULVERT (600ø CSP)
- CONCRETE SIDEWALK (1.8m CONC. SIDEWALK)
- CURB & DEPRESSED CURB (BARRIER, MOUNTABLE, DC)
- ASPHALT SIDEWALK (1.8m ASPH. SIDEWALK)
- CHAINLINK FENCE (1.5m UNLESS OTHERWISE NOTED)
- NOISE BARRIER (3.0m UNLESS OTHERWISE NOTED)
- DECORATIVE FENCE (SEE LANDSCAPE DWGS FOR DETAIL)
- WOOD PRIVACY BARRIER
- POST AND RAIL FENCE
- PHASING LIMITS
- PROPERTY BOUNDARY
- OVERLAND FLOW DIRECTION
- EXTERNAL OVERLAND FLOW DIRECTION
- EMERGENCY OVERLAND FLOW DIRECTION
- TACTILE WALKING SURFACE INDICATOR (AS PER CITY OF OTTAWA STD. SC6)
- EROSION SETBACK
- MEANDER BELT LIMIT

TOPOGRAPHIC INFORMATION

TOPOGRAPHIC INFORMATION PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16–10–116–00. SURVEYS DATED NOVEMBER 30, 2017.

LEGAL INFORMATION

CALCULATED M–PLAN PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16–10–116–00 (PHASE 1 & 2) DATED SEPTEMBER 14, 2018.

ELEVATION NOTE ELEVATION = 86.12 m

ELEVATIONS ARE GEODETIC AND ARE DERIVED FROM SITE BENCHMARK NCC CONTROL POINT 001196530229 HAVING A PUBLISHED ELEVATION OF 86.12m

No.	DATE	BY	DESCRIPTION
6.	18–10–30	M.Z.	REVISED M–PLAN
5.	18–07–27	M.Z.	REVISED WEST BOUNDARY STORM SYSTEM
4.	18–07–10	M.Z.	MYLARS FOR PHASE 1 COMMENCE WORK
3.	18–06–28	M.Z.	REVISED AS PER CITY AND UTILITY COMMENTS
2.	18–05–09	M.Z.	ISSUED FOR MOE APPROVAL
1.	18–01–24	M.Z.	1st SUBMISSION

Ottawa CITY OF OTTAWA

PROJECT No. 16–881

LICENSED PROFESSIONAL ENGINEER M.ZDRAVEVSKI 100130902 18-10-30 PROVINCE OF ONTARIO

GENERAL PLAN

CAIVAN (ORLEANS VILLAGE) LIMITED

ORLEANS VILLAGE

DSEL david schaeffer engineering ltd
120 Iber Road, Unit 103
Stittsville, ON K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

DRAWN BY:	M.Z.	CHECKED BY:	P.P.	DRAWING NO.	SHEET NO.
DESIGNED BY:	P.P.	CHECKED BY:	M.Z.		6
SCALE:	1:1000	DATE:	JANUARY 2018		

CITY PLAN No. 17675

CITY FILE No. D07-16-16-0022

PAVEMENT DESIGN

40mm HL–3 OR SUPERPAVE 12.5
50mm HL–8 OR SUPERPAVE 19.0
150mm GRANULAR "A"
600mm GRANULAR "B" TYPE II

PERMISSION REQUIRED FOR WORK ON ADJACENT LANDS

NOTE
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ANY DISTURBED AREA DURING CONSTRUCTION TO BE RESTORED TO THE ORIGINAL CONDITION OR BETTER TO THE SATISFACTION OF THE AUTHORITIES HAVING JURISDICTION

NOTE
FOR WATERMAIN STUBS, 2.4m MIN. COVER TO BE PROVIDED

NOTE: ICD
FOR ICD APPLICATION, REFER TO DRAWING 72 FOR DETAIL.

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NOTE:
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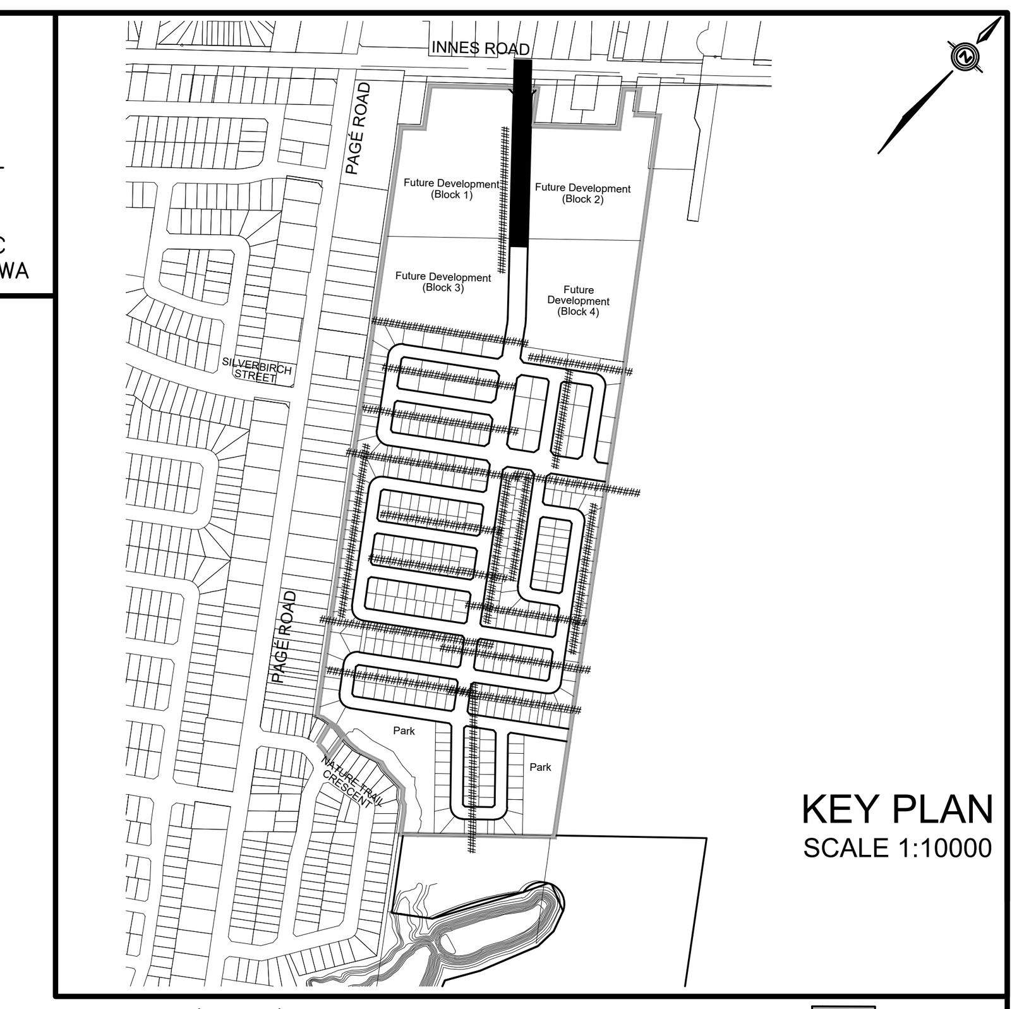
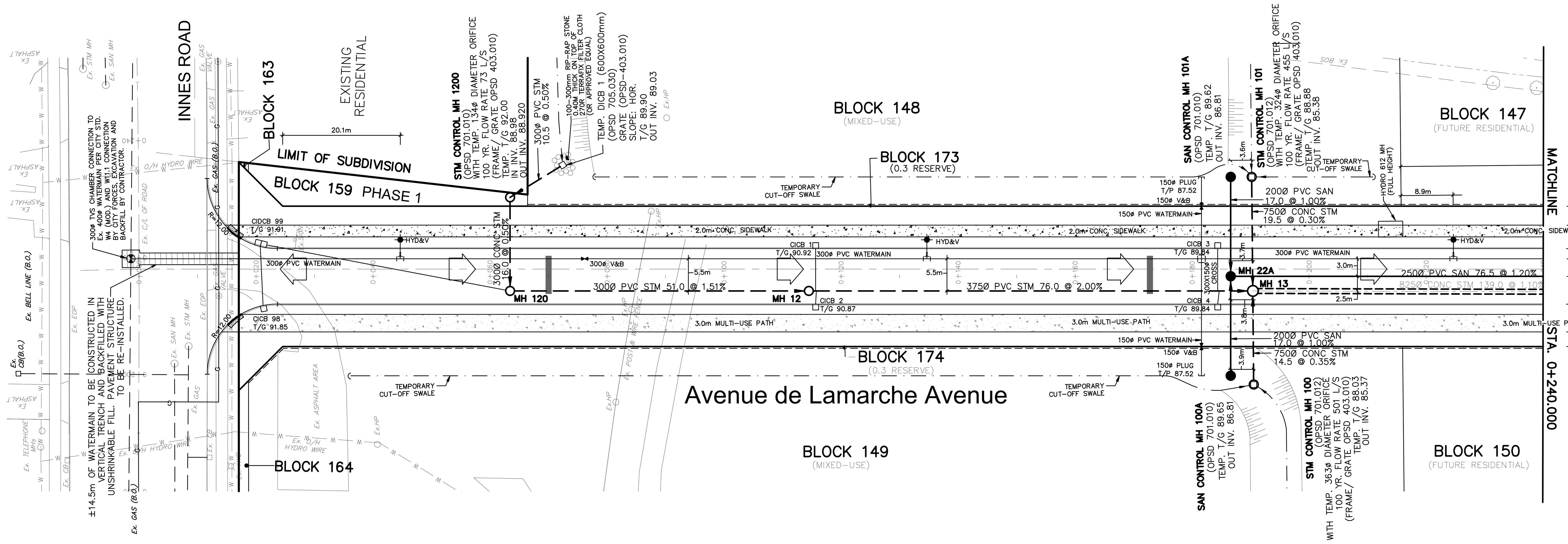
APPROVED ☐ REFUSED ☐
THIS ____ DAY OF__________, 20____

JOSHUA WHITE, P.ENG
PROJECT MANAGER – EAST BRANCH
PLANNING, INFRASTRUCTURE & ECONOMIC DEVELOPMENT DEPARTMENT, CITY OF OTTAWA



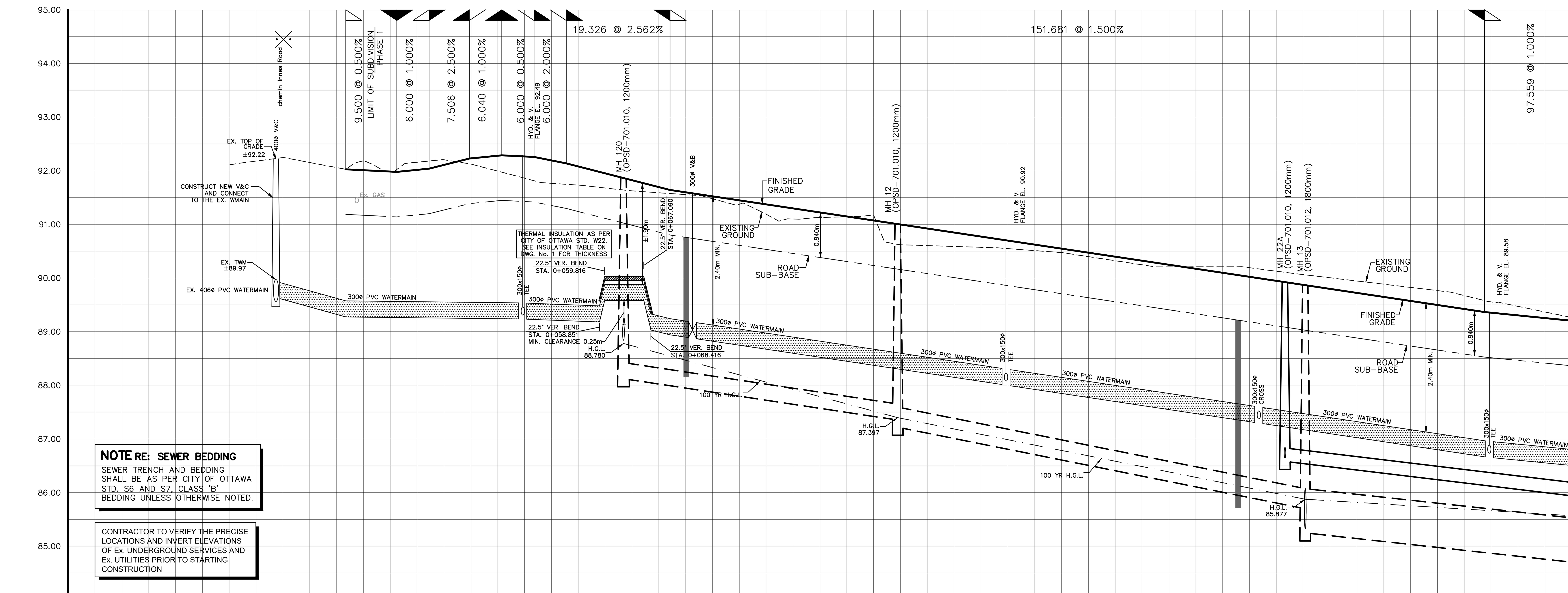
KEY PLAN
SCALE 1:10000



REFER TO DWG No. 11

LEGEND

CROSS	HYDRO SWITCHGEAR
45° BEND	HYDRO TRANSFORMER
LATERAL	STREET LIGHT STANDARD
HYDRANT, VALVE & VB	CONCRETE SIDEWALK
TEE	CURB & DEPRESSED CURB
VALVE & VC	ASPHALT WALKWAY
VALVE & VB	CHAINLINK FENCE (1.5m UNLESS OTHERWISE NOTED)
22.5° BEND	NOISE BARRIER (3.0m UNLESS OTHERWISE NOTED)
11.25° BEND	DECORATIVE FENCE (SEE LANDSCAPE DWGS FOR DETAIL)
REDUCER	WOOD PRIVACY BARRIER
CAP	POST AND RAIL FENCE
SANITARY MAINTENANCE HOLE	PROPERTY BOUNDARY
CAP	BOREHOLE (BH), TEST PIT (TP), AUGER HOLE (AH), MONITORING WELL LOCATION, CONCEPTUAL WELL LOCATION — AS PER GEOTECHNICAL REPORT
STREET CATCHBASIN & LEAD	TOP OF FOUNDATION ELEVATION
STREET CATCHBASIN WITH CLOSED LID & LEAD	FINISHED FLOOR ELEVATION
STORM MAINTENANCE HOLE	UNDERSIDE OF FOOTING ELEVATION
CURB INLET CATCHBASIN & LEAD	NUMBER OF RISERS
CATCHBASIN/ MAINTENANCE HOLE	UNITS REQUIRING PRESSURE REDUCING VALVES
INTERCONNECTED CATCH BASIN & LEADS	WALKOUT UNITS
CAP	SLAB ON GRADE
SINGLE SERVICE LOCATION (ST, SAN & WM)	OVERLAND FLOW DIRECTION
SINGLE SERVICE LOCATION (ST, SAN & WM)	EXTERNAL OVERLAND FLOW DIRECTION
TEE CATCHBASIN	EMERGENCY OVERLAND FLOW DIRECTION
PERFORATED PIPE	TACTILE WALKING SURFACE INDICATOR (AS PER CITY OF OTTAWA STD. SC6)
ELBOW CATCHBASIN	PHASE LINE
AS–BUILT ELEVATION 86.205	CLAY SEAL (REFER TO GENERAL NOTES AND GEOTECHNICAL REPORT)



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CONTRACTOR TO VERIFY THE PRECISE LOCATIONS AND INVERT ELEVATIONS OF Ex. UNDERGROUND SERVICES AND Ex. UTILITIES PRIOR TO STARTING CONSTRUCTION

TOP OF WATERMAIN	89.970 / 89.84 / 400ø V&C / 89.899; 89.575; 89.57; 89.542 HYD. 300x150ø TEE 89.60; 22.5° VER. BEND 89.49 89.89 22.5° VER. BEND; 22.5° VER. BEND 89.88 89.30 22.5° VER. BEND; 89.26; 300ø V&B 89.18; 89.12; 88.82; 88.523; HYD 300x150ø TEE 88.15; 88.22; 87.92; 87.62 87.595 300x150ø CROSS; 87.32; 87.02; 86.87 86.81 HYD 300x150ø TEE; 86.808
STORM INVERT	E 90.160 SE 90.140; 300Ø PVC STM 51.0 @ 2.333% SDR–35; NW 88.950 SE 87.200; 375Ø PVC STM 76.0 @ 1.921% SDR–35; W 85.280 E 85.320 NW 85.740 SE 85.239; 825Ø CONC STM 139.0 @ 1.122% 100–D
SANITARY INVERT	NE 86.650 SW 86.650 S 86.580; 250Ø PVC SAN 76.5 @ 1.204% SDR–35
PROPOSED GRADES	92.026; 91.985 91.979; 92.039; 92.226; 92.279 92.287; 92.257; 92.137; 91.951 STM MH 91.856; 91.642; 91.523; 91.223; STM MH 91.004; 90.923; 90.623; 90.323; 90.023; 89.922 STM MH 89.866; 89.723; 89.423; 89.367; 89.204
CENTERLINE CHAINAGE	–0+020.000; PI–0+010.000; 0–001.284 0–000.600 PI 0+000.000; 0+011.707 0+011.715; 0+020.000 0+021.215; 0+027.215; 0+034.721; 0+040.000 0+040.761; 0+044.660 0+046.761; 0+052.761; 0+058.958 0+059.923 0+060.000; 0+063.420; 0+067.197 0+068.523; 0+072.087; 0+076.277; 0+080.000; 0+100.000; 0+114.487; 0+120.000; 0+134.660; 0+140.000; 0+160.000; 0+180.000 0+181.734; 0+186.600; 0+190.375; 0+200.000; 0+220.000; 0+223.768 0+224.660; 0+240.000

TOPOGRAPHIC INFORMATION
TOPOGRAPHIC INFORMATION PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16–10–116–00. SURVEYS DATED NOVEMBER 30, 2017.

LEGAL INFORMATION
CALCULATED M–PLAN PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16–10–116–00 (PHASE 1 & 2) DATED SEPTEMBER 14, 2018.

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No.	DATE	BY	DESCRIPTION
7.	21–03–03	L.M.	AS–BUILT SERVICING INFORMATION ADDED
6.	18–10–30	M.Z.	REVISED M–PLAN
5.	18–07–27	M.Z.	REVISED WEST BOUNDARY STORM SYSTEM
4.	18–07–10	M.Z.	MYLARS FOR PHASE 1 COMMENCE WORK
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2.	18–05–09	M.Z.	ISSUED FOR MOE APPROVAL
1.	18–01–24	M.Z.	1st SUBMISSION

Ottawa CITY OF OTTAWA

AS-BUILT
PROJECT No. 16–881

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PLAN AND PROFILE OF
Avenue de Lamarche Avenue
(FROM STA. 0+000.000 TO STA. 0+240.000)

CAIVAN (ORLEANS VILLAGE) LIMITED

ORLEANS VILLAGE

DSEL david schaeffer engineering ltd
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SCALE: H=1:500/V=1:50	DATE: JANUARY 2018		

CITY FILE No. D07-16-16-0022 CITY PLAN No. 17675

PAVEMENT DESIGN

40mm HL-3 OR SUPERPAVE 12.5
50mm HL-8 OR SUPERPAVE 19.0
150mm GRANULAR "A"
600mm GRANULAR "B" TYPE II

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APPROVED ☐ REFUSED ☐
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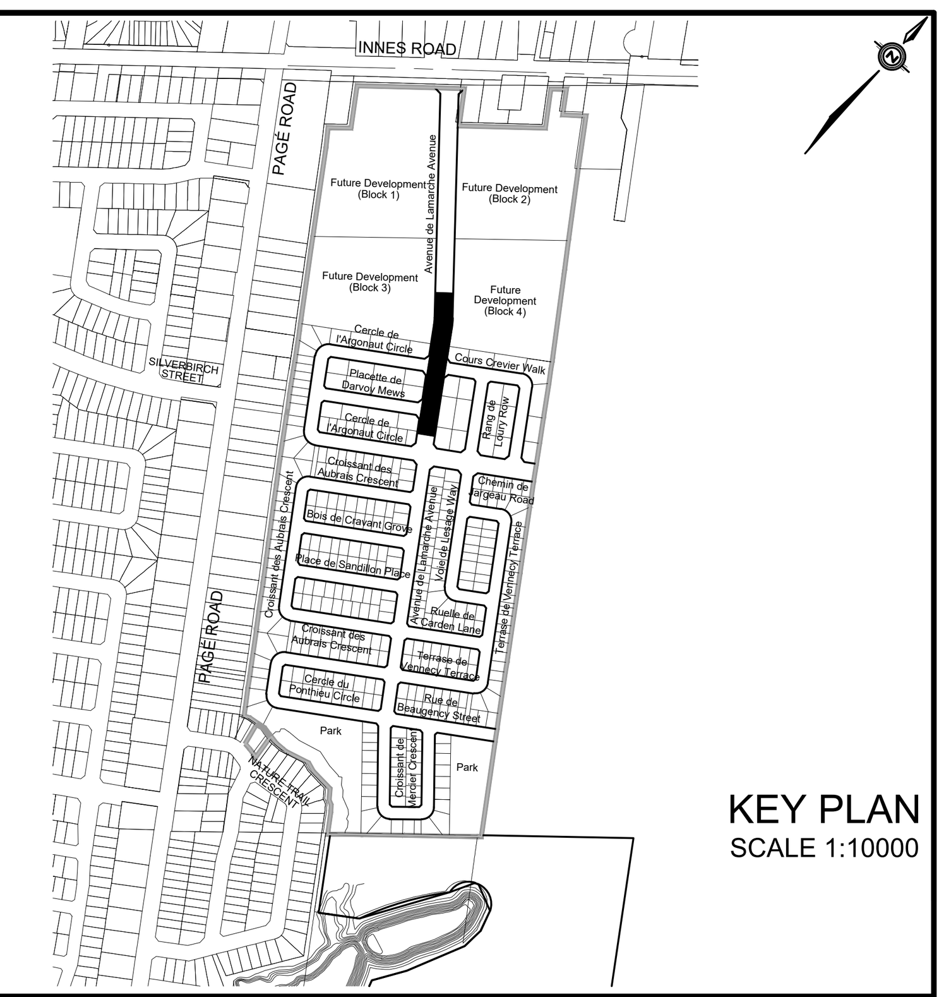
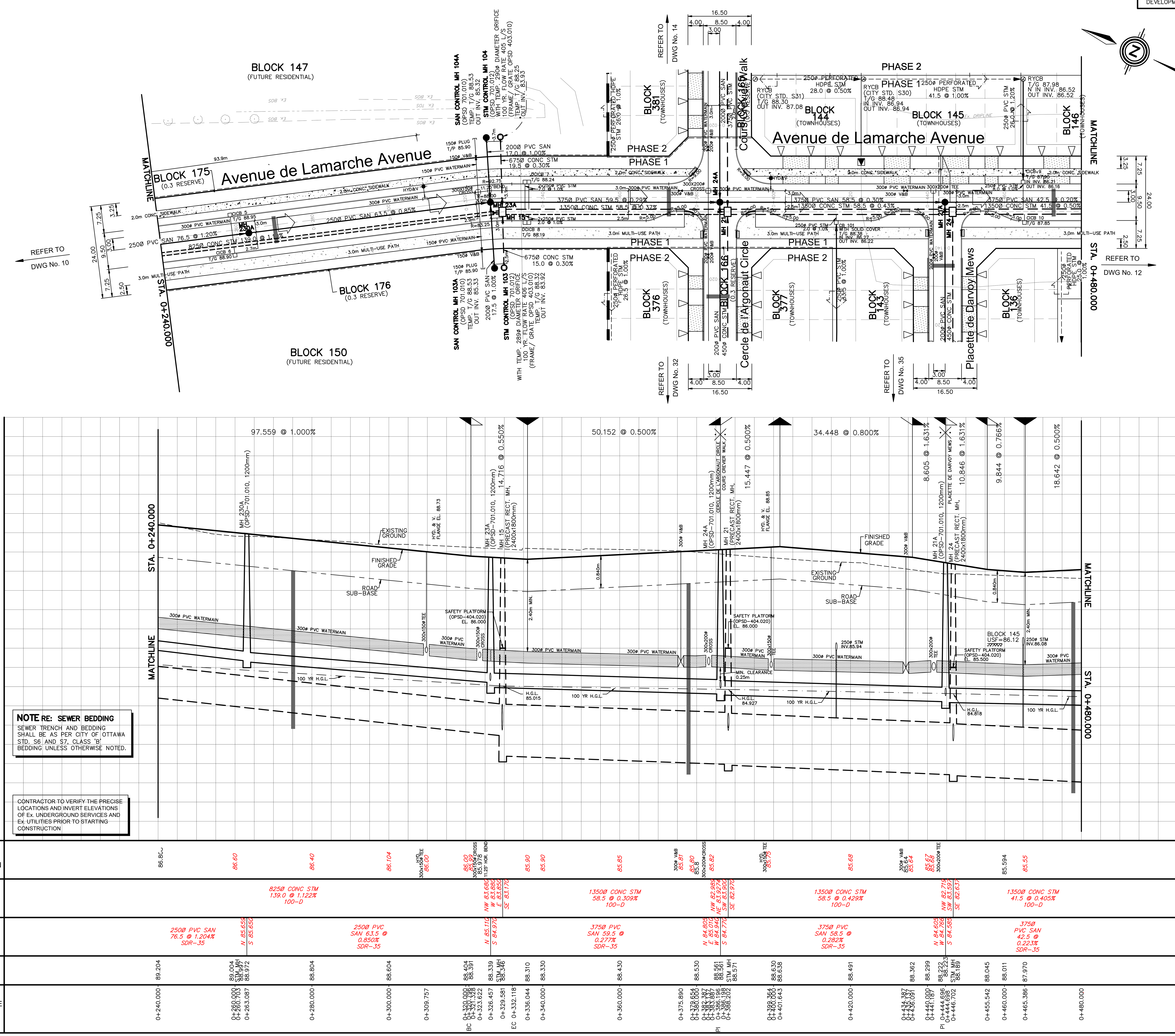


KEY PLAN
SCALE 1:10000



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CROSS
45° BEND
LATERAL
HYDRANT, VALVE & VB
TEE
VALVE & VC
VALVE & VB
22.5° BEND
11.25° BEND
REDUCER
CAP
SANITARY MAINTENANCE HOLE
CAP
STREET CATCHBASIN & LEAD
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WOOD PRIVACY BARRIER
POST AND RAIL FENCE
PROPERTY BOUNDARY
BOREHOLE (BH)
TEST PIT (TP)
AUGER HOLE (AH)
MONITORING WELL LOCATION
CONCEPTUAL WELL LOCATION
AS PER GEOTECHNICAL REPORT
TOP OF FOUNDATION ELEVATION
FINISHED FLOOR ELEVATION
UNDERSIDE OF FOOTING ELEVATION
NUMBER OF RISERS
UNITS REQUIRING PRESSURE REDUCING VALVES
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OVERLAND FLOW DIRECTION
EXTERNAL OVERLAND FLOW DIRECTION
EMERGENCY OVERLAND FLOW DIRECTION
TACTILE WALKING SURFACE INDICATOR (AS PER CITY OF OTTAWA STD. SC6)
PHASE LINE
CLAY SEAL (REFER TO GENERAL NOTES AND GEOTECHNICAL REPORT)

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No.	DATE	BY	DESCRIPTION
8.	21-03-03	L.M.	AS-BUILT SERVICING INFORMATION ADDED
7.	19-05-14	M.Z.	FENCES ADDED AS PER LANDSCAPE DESIGN, NAK DESIGN STRATEGIES
6.	18-10-30	M.Z.	REVISED M-PLAN
5.	18-07-27	M.Z.	REVISED WEST BOUNDARY STORM SYSTEM
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Ottawa CITY OF OTTAWA

AS-BUILT
PROJECT No. 16-881

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SCALE: H=1:500/V=1:50	DATE: JANUARY 2018		

CITY PLAN No. 17675
D07-16-16-0022
CITY FILE No.

SITE AREA	45,201.6318 m^2 (4.52 ha)
PAVED AREA	13,895.1753 m^2 (30.7%)
LANDSCAPED AREA	19,936.709 m^2 (44.1%)
TOTAL BUILDING COVERAGE	11,369.7445 m^2 (25.2%)
TOTAL GROSS FLOOR AREA	45,819.4504m^2
DENSITY (UPH)	UPH
ZONE CATEGORY	R4(Z)

DWELLING BLOCK	DWELLING TYPE	GROSS FLOOR AREA (m^2)	UNITS
BLOCKS 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10 - 13 - 14 - 19	24 UNITS STACKED DWELLING	(per Block)	312
BLOCKS 11 - 12 - 16 - 17 - 21	20 UNITS STACKED DWELLING	(per Block)	100
BLOCKS 15 - 18 - 20 - 22	16 UNITS STACKED DWELLING	(per Block)	64
	TOTAL		476

	ZONE PROVISION - PLANNED UNIT DEVELOPMENT	REQUIRED	PROPOSED
162A(table)(Z)	MIN. LOT AREA (m^2)	1,400m2	m^2
162A(table)(Z)	MIN. LOT WIDTH (m)	18m	m
162A(table)(Z)	MIN. FRONT YARD SETBACK (m)	3.0m	VARIES
2798 (By-law 2022-235)	MIN. INTERIOR SIDE YARD SETBACK: NORTH WEST SOUTH EAST	 VARIES VARIES	 6.0m 5.0m
2798 (By-law 2022-235)	MIN. REAR YARD SETBACK (m) NORTH-EAST	VARIES	5.0m
162A(table)(Z)	MAX. BUILDING HEIGHT (m)	AS PER TYPE	12.10m (3 storeys)
101(Table)	RESIDENT PARKING - 1 spaces/unit	476	476
102(Table)	VISITOR PARKING - 0.1 spaces/unit	45.6	36 (0.079)
111A(Table)	MIN. BICYCLE PARKING - 0.5 spaces/unit	238	TBD
131(Table)(1)	MIN. WIDTH OF PRIVATE WAY/ PARKING AISLE (m)	6.0m	6.0m
131(Table)(2)	MIN. SETBACK FOR ANY WALL OF A RESIDENTIAL USE BUILDING TO A PRIVATE WAY (m)	1.8m	m
131(Table)(4)	MIN. SEPARATION DISTANCE BETWEEN BUILDINGS WITHIN A PLANNED UNIT DEVELOPMENT (m)	1.2m	VARIES1.2m
137(Table)	AMENITY AREA: TOTAL MIN. AMENITY AREA (6m^2 per unit) MIN. COMMUNAL AMENITY AREA (min. 50% area)	 2856 m^2 1428 m^2	 6141.18 M^2 1616.31 M^2

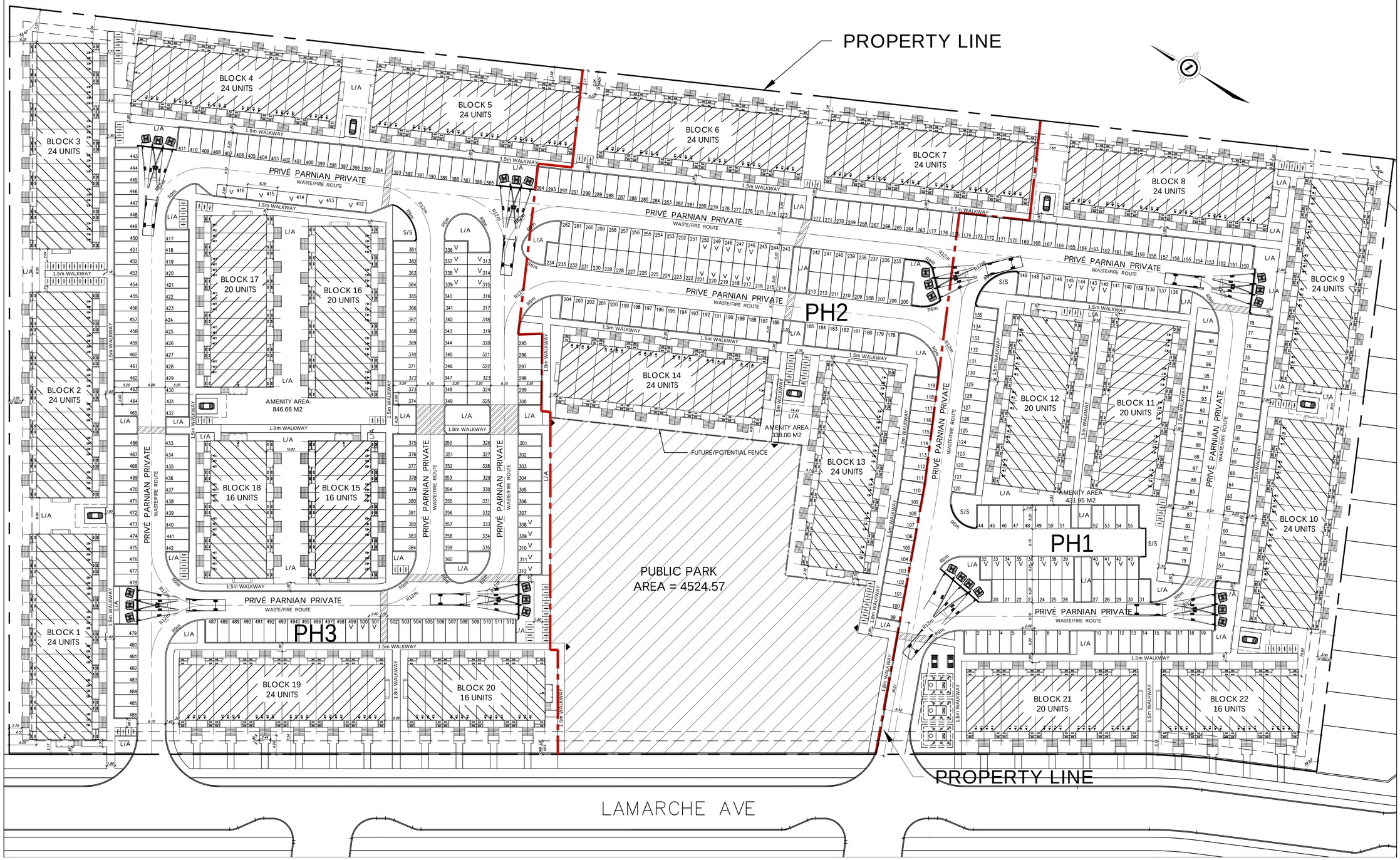
*Individual amenity areas are provided on the balconies

	ADDITIONAL PROVISIONS	REQUIRED	PROPOSED
65(Table)	PERMITTED PROJECTIONS INTO REQUIRED YARDS:		
65(Table)(5)	FIRE ESCAPES, OPEN STAIRWAYS, STOOP (m)	>0.6m to lot line	VARIES m
65(Table)(6)	COVERED OR UNCOVERED BALCONY, PORCH, DECK	>1m to lot line	VARIES m
106(1)(a)	MIN. PERPENDICULAR PARKING SPACE SIZE (m)	2.6m x 5.2m	2.6m x 5.2m
106(2)	MIN. BARRIER FREE PARKING** TYPE A PARKING SPACE SIZE (m) TYPE B PARKING SPACE SIZE (m) ACCESS AISLE (m)	 3.4m wide 2.4m wide 1.5m	 3.4m wide 2.4m wide 1.5m
1118(Table)	MIN. BICYCLE PARKING SPACE DIMENSION, HORIZONTAL (m)	Width: 0.6m Length: 1.8m	Width: 0.6m Length: 1.8m
111(9)	MIN. BICYCLE PARKING SPACE ACCESS AISLE WIDTH (m)	1.5m	1.8m
109(3)(b)	MAX. WALKWAY WIDTH PERMITTED IN YARD (m)	1.8m	1.8m
110(1)	MIN. % OF PARKING LOT LANDSCAPED	15%	%
110(table)(IV)	LANDSCAPED AREA SURROUNDING PARKING LOT ABUTTING A STREET (m) NOT ABUTTING A STREET (m)	 3.0m 3.0m	 m
110(3)	REFUSE COLLECTION AREAS:		
110(3)(b)	MIN. WASTE COLLECTION SETBACK TO LOT LINE (m)	3.0m	3.0m
110(3)(c)	OPAQUE SCREEN MIN. HEIGHT (m)	2.0m***	2.0m***

**Per the 2014 Guide to the Integrated Accessibility Standards Regulation - Design of Public Spaces Standard, 4% of parking spaces provided for public use must be accessible. 2 of the provided 46 vistor spaces have been designed to be barrier-free, one each of Type A and Type B sizes.
***Section 110(3)(d) where an in-ground refuse container is provide, the screening requirement of Section (3)(c) above may be achieved with soft landscaping (Bylaw 2020-299)

GARBAGE:

REQUESTED BY ZONING:	PH XX
GARBAGE: 0.231 CUBIC YARD /UNIT	0.231 X 476= 109.9 CUBIC YARD (17 BINS)
RECYCLING 0.062 CUBIC YARD /UNIT	0.018 X 476 = 8.56 CUBIC YARDS (2 BIN)
+ 0.062 CUBIC YARD /UNIT	0.062 X 476 = 29.51 CUBIC YARDS (5 BINS)
ORGANIC 240L PER 50 UNITS	240 L X 9.52 = 2284.8 L (1 BIN)



Q4A ARCHITECTS

Q4 ARCHITECTS INC.

4110 YONGE STREET
Suite 602, Toronto ON.
M2P 2B7

T. 416.322.6334
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E. info@q4architects.com

The contractor / builder must verify all dimensions on the job and report any discrepancy to the designer before proceeding with the work.

Drawings are NOT to be scaled. All drawings and specifications are instruments of service and the copyright property of the designer and must be returned upon request.

12	SPI -PLANNERS COMMENTS	2024.08.14CT/JM
11	SPI -PRE-CONSULT COMMENTS	2024.08.14CT/JM
10	SPI -TREE ZONES COMMENTS UPDATE	2024.08.06CT/JM
9	SPI - CITY COMMENTS UPDATE	2024.07.17CT/JM
8	SPI W/ PHASES AND LRL COMMENTS	2024.06.27CT/JM
7	FIRE ROUTE, Q4A SK 5b	2024.06.24CT/JM
6	Q4A SK 5a	2024.06.18CT/JM
5	Q4A SK 4A	2024.06.06CT/JM
4	Q4A SK 4	2024.05.30CT/JM
3	Q4A SK 3	2024.05.29CT/JM
2	Q4A SK 2	2024.05.27CT/JM
1	Q4A SK 1	2024.05.23CT/JM

Issued / Revision Chart

Location ORLEANS

Client CAIVAN

Project No.

Scale

Drawn By CT

Checked By CT

OVERALL SITE PLAN

SP1

File No.: PC2024-0272

July 19, 2024

Colin Haskin
Caivan
Via email: colin.haskin@caivan.com

Subject: **Pre-Consultation: Meeting Feedback**
Proposed Zoning By-Law Amendment, Site Plan Control and Plan of Condominium Application – 245 & 275 Lamarche Avenue

Please find below information regarding next steps as well as consolidated comments from the above-noted pre-consultation meeting held on July 11, 2024.

Pre-Consultation Preliminary Assessment

1 ☒	**2** ☐	**3** ☐	**4** ☐	**5** ☐

One (1) indicates that considerable major revisions are required while five (5) suggests that the proposal appears to meet the City's key land use policies and guidelines. This assessment is purely advisory and does not consider technical aspects of the proposal or in any way guarantee application approval.

Next Steps

1. A review of the proposal and materials submitted for the above-noted pre-consultation has been undertaken. As of June 6, 2024, planning pre-consultations are no longer mandatory as per the Province of Ontario's Bill 185. However, given staff's comments and suggestions on the provided development concept, the applicant is greatly encouraged to proceed with the phased pre-consultation process.

   If the applicant chooses to proceed with further pre-consultation, please complete a Phase 3 Pre-consultation Application Form and submit it together with the necessary studies and/or plans to planningcirculations@ottawa.ca.

2. In your subsequent pre-consultation submission, please ensure that all comments or issues detailed herein are addressed. A detailed cover letter stating how each issue has been addressed must be included with the submission materials. Please coordinate the numbering of your responses within the cover letter with the comment number(s) herein.

3. Please note, if your development proposal changes significantly in scope, design, or density before the Phase 3 pre-consultation, it is recommended that you complete the Phase 2 pre-consultation process.

Submission Requirements and Fees

1. Fees related to planning applications can be found here.
2. The attached **Study and Plan Identification List** outlines the information and material that has been identified as either required (R) or advised (A) as part of a future complete application submission.
    a. The required plans and studies must meet the City's Terms of Reference (ToR) and/or Guidelines, as available on Ottawa.ca. These ToR and Guidelines outline the specific requirements that must be met for each plan or study to be deemed adequate.
3. All of the below comments or issues should be addressed to ensure the effectiveness of the application submission review.

Consultation with Technical Agencies

1. You are encouraged to consult with technical agencies early in the development process and throughout the development of your project concept. A list of technical agencies and their contact information is enclosed.

Planning

Comments:

1. The site is within the Suburban Transect of the City of Ottawa's Official Plan (2022) and is designated Neighbourhood. A large portion of 245 Lamarche is subject to the Evolving Neighbourhood Overlay due to the proximity of the Mainstreet Corridor on Innes Road. The site is zoned Development Reserve (DR).

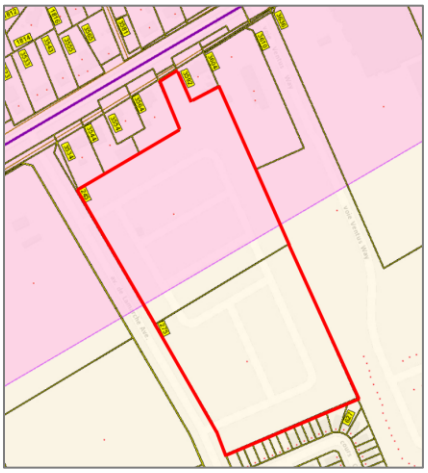


Figure 1: Site boundaries outlined in red. The pink layer in the top half of the image represents the Evolving Neighbourhood Overlay (see section 5.6.1 of the Official Plan).

a. A Planning Rationale is required for the Zoning By-law Amendment application. The report shall demonstrate how the proposed development is consistent with the vision, goals, and objectives of the Official Plan. The report must clearly identify and provide justification for any requested relief from the Zoning provisions. Please note that development on lands with an Evolving Neighborhood Overlay should generally include built form and site design attributes that meet most of the urban characteristics described in Table 6 in Section 5 of the Official Plan.

b. A Zoning Confirmation Report is required for both the Zoning By-law Amendment and Site Plan Control applications. The Zoning Confirmation Report must clearly identify the requested zone and any requested relief from the Zoning provisions.

    i. Stacked dwellings are generally not permitted in a R3 zone. A R4 zone would be better suited to this development.

c. An Impact Assessment Study – Waste Disposal Site is required at the Zoning By-law Amendment stage since the site is within 3km of an active waste disposal site.

2. The Site Plan Control application can be submitted concurrently with the requested Zoning By-law Amendment; however, approval of the zoning amendment must precede prior to the approval of the site plan. It is recommended that the applicant submit an application for a pre-application meeting to discuss the proposed zoning changes ahead of submitting a formal application.

3. The Plan of Condominium application should be clear on what type of condominium is being requested, if any common elements are being included, and whether there will be any phasing of the development. Will there be any remnant lands created?

    a. Site plan approval should be obtained prior to condominium approval.

4. Provide a complete list of the easements required to facilitate the development and an accompanying draft reference plan showing all of the Parts subject to easements.

5. Opportunities to provide trees on the site must be explored early in the site design process. A simplified Landscape Plan is required for the Zoning By-law Amendment and Plan of Condominium applications that demonstrates sufficient room for utilities and tree space. A full Landscape Plan is required for the Site Plan Control application.

6. The site plan should show driveways, private and public walkways, projections, soft landscaping areas, outdoor waste storage, bicycle parking, snow storage,

etc. and should be fully dimensioned. Please refer to the City's Site Plan Terms of Reference.

7. Under the Affordable Housing Community Improvement Plan, a Tax Increment Equivalent Grant (TIEG) program was created to incentivize the development of affordable rental units. It provides a yearly fixed grant for 20 years. The grant helps offset the revenue loss housing providers experience when incorporating affordable units in their developments.

    a. To be eligible for the TIEG program, the following criteria must be met:
        i. The greater of five units OR 1 % of the total number of units within the development must be made affordable;
        ii. Provide a minimum of 15% of each unit type in the development as affordable;
        iii. Enter into an agreement with the city to ensure the units maintain affordable for a minimum period of 20 years at or below the city-wide average market rent for the entire housing stock based on building form and unit type, as defined by the Canada Mortgage and Housing Corporation;
        iv. Must apply after a formal Site Plan Control submission, or Building Permit submission for projects not requiring Site Plan Control, and prior to Occupancy Permit issuance.

    b. Please refer to the TIEG information at Affordable housing community improvement plan / Plan d'améliorations communautaires pour le logement abordable for more details or contact the TIEG coordinator via email at affordablehousingcip@ottawa.ca.

Site-Specific Comments on Concept Plan:

8. Staff appreciate the stacked dwelling building form as a contribution to the diversity of available housing options within this neighbourhood.

9. The Planned Unit Development (PUD) should be designed carefully to integrate the development within the wider Orléans Village community. Avoid rear lotting of all stacked dwellings by orientating the front entrances towards Lamarche Avenue and connecting entrances to the public right-of-way. Where the sides of buildings abut Lamarche Avenue their elevations should be designed to address both Lamarche Avenue and the internal roads within the site.

10. The site must be designed to make pedestrian access the most convenient option from the surrounding neighbourhood, transit stops and from existing public streets (OP section 4.3.2).

11. Active pathway connections must be developed that connects the PUD to Lamarche Avenue, Innes Road, the park space being developed on site as well

as the park within the adjacent subdivision to the east (see below parkland comments).

a. A pedestrian access easement should be provided across the entire site.

12. Staff appreciate the proposed reduction in parking for the site shown on the concept plan, which appears to translate to a rate of 1.0 per dwelling unit with 49 visitor parking spaces. Given that a large portion of the site is within the Evolving Neighbourhood Overlay, however, there are still concerns that the amount of hardscaping being used by vehicle parking. The applicant could also consider an underground parking area for the site.

    a. The site plan must show the full dimensions of a standard parking spot, as well as identify visitor and accessible parking spaces.

    b. Vehicular circulation should strive to eliminate dead end aisles. The parking area at the south end of the site should have landscaping screening from the adjacent lands.

    c. The “caps” of parking areas should be larger and designed with landscaping and tree planting. Large expanses of parking should be broken up with more landscaping and pedestrian crossings. The proposed waste disposal areas should be designed with the same principles to screen them with landscaping from the residents.

    d. The Zoning By-law requires a minimum rate of 0.5 bicycle parking spaces per dwelling unit (244 spaces).

        i. Bike parking facilities should be provided in convenient, well-lit locations throughout the PUD. It would be ideal if the spaces are sheltered from the elements.

13. There is a very small amount of landscaping and green space located on the proposed private lands in this development. Significantly more landscaping, tree planting, and amenity space must be provided to be consistent with Official Plan policy.

14. Section 4.8.2 of the Official Plan states that the City shall pursue an urban forest canopy cover target of 40 percent with subsection (3) providing specific policies for implementation. Demonstrate that such a canopy cover can be achieved.

    a. Large canopy trees are supported by soil conditions in the northern portion of the site. Large canopy tree planting should be prioritized in this area, with a demonstration on the Landscape Plan there are soil volumes that support those trees.

    b. More trees should be planted along Lamarche Avenue.

15. Staff are not supportive of the public park counting as communal amenity space for this site through an exception to the Zoning By-law. The total amenity area required by Section 137 of the Zoning By-law for 488 units is 2,928m^2. A minimum of 50% of the amenity area must be communal.

    a. The Noise Study submitted with the previous Plan of Subdivision application identified a need for sound barriers between the site and the adjacent Halo Car Wash. Noise levels need to be a consideration when designing private and communal amenity areas on the site.

16. Outdoor refuse collection and refuse loading areas must be screened from view by an opaque screen with a minimum height of 2 metres. Where an in-ground refuse container is provided, the screening may be achieved with soft landscaping.

17. There may be an opportunity to optimize the proposed public park space with the adjacent subdivision by relocating the park to the south-east corner of the site. Joining the two park spaces would result in more opportunities for programming and activation of the space compared to two smaller parks between the sites.

    a. If joining the park with the adjacent subdivision is unfeasible, the public park will be required to have more frontage along Lamarche Avenue.

18. The applicant should be aware of the City's Urban Design Guidelines for Greenfield Neighbourhoods as well as the City's study on Building Better and Smarter Suburbs.

Please contact Jerrica Gilbert, Planner II, for questions related to planning policy and the application process.

Urban Design

Comments:

19. Staff require an Urban Design Brief, architectural plans (Site Plan, Building Elevations, etc.), and a Landscape Plan. Please refer to the attached Urban Design Brief Terms of Reference.

20. As submitted, staff have concerns about the intensity of the proposed development. The submission must demonstrate that the proposal will function well in terms of servicing (garbage, snow storage, etc.) and landscaping, as well as provide a strong rationale for how the proposal addresses the public realm. A reduction in unit count may be required to achieve these ends.

21. Please explore working with the adjacent landowner and determine the potential for an east-west public road alongside the park through the adjacent site onto

Ventus Way. This change would create broader connections through the community and give the park two public frontages.

22. The site needs to be redesigned to have buildings face out onto Lamarche Avenue. Consider introducing Caivan's rear lane townhome product or a back-to-back product.

23. Consider reorienting blocks to allow the pedestrian mews lead to the public park instead of parking areas, as seen in the conceptual plan below.

Figure 2: Depiction of preferred site flow, where red lines indicate pedestrian movement.

24. Please ensure that separation distances between buildings are appropriate. There appears to be several areas of concern on the proposed plan. Suggested 11 metres facing distance preferred for front-to-front or back-to-back and 5.5 metres for front to side.

25. Please demonstrate that individual walkways and tree plantings can be provided at each unit – including internally to the site.

26. Please demonstrate where utilities, such as gas meters, air conditioners and more will be provided.

27. This development should reflect the characteristics of a cohesive community. Staff have concerns with units facing out onto large surface parking lots. Please endeavor to redesign all units facing out onto one private road with parking. The two images shown below are better examples of private roadways with parking.

Figure 3: Example of private roadways with better integration of parking in Stittsville.

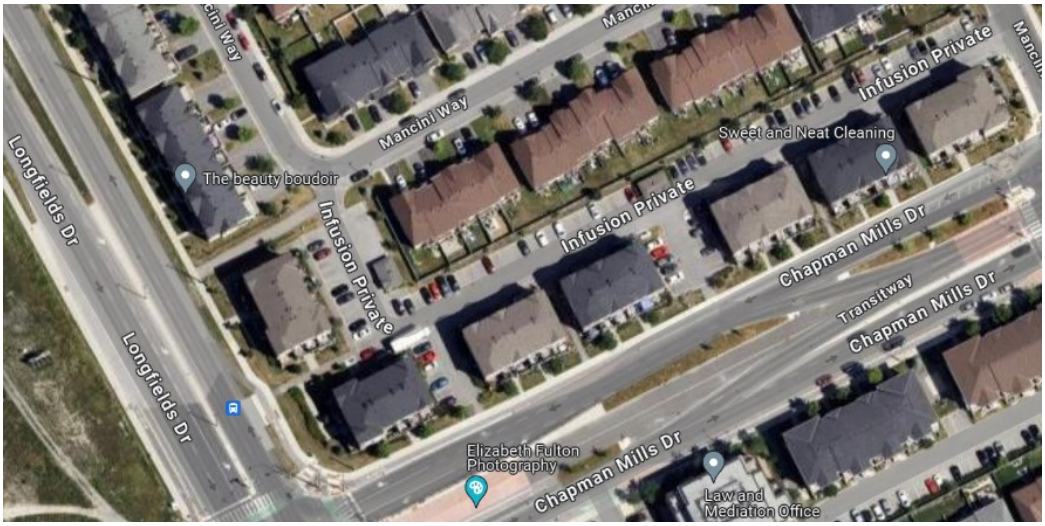


Figure 4: Example of private roadways with better integration of parking in Nepean.

28. Private amenity space is needed to enhance the community and reduce the amount of hardscaping on site.

29. Waste areas should not line public parkland or public streets and should be heavily screened. Please refer to Planning comments above and consider one community waste building.

30. Consider ways to incorporate green infrastructure into parking areas.

Please contact Nader Kadri, Planner III, for questions related to urban design.

Engineering

Comments:

31. Water:

    a. Frontage charges do not apply.

    b. Location of Accessible Water Main: 305mm PVC municipal watermain on Lamarche Avenue.

    a. Submission documents must include:
        i. Boundary Conditions - civil consultant to request boundary conditions from the City's assigned Project Manager, Development Review. Water boundary conditions request must include the location of the service and the expected loads required by the proposed development. Please provide all the following information:

            1. Location of service (show on a plan or map).

            2. Type of development.

            3. Average daily demand: ___ l/s.

            4. Maximum daily demand: ___l/s.

            5. Maximum hourly daily demand: ___ l/s.

            6. Required fire flow and completed FUS Design Declaration (if applicable).

            7. Supporting Calculations for all demands listed above and required fire flow as per Ontario Building Code or Fire Underwriter Surveys (See technical Bulletin ISTB-2021-03)

        ii. Watermain system analysis demonstrating adequate pressure as per Section 4.2.2 of the Water Distribution Guidelines.

        iii. Demonstrate adequate hydrant coverage for fire protection. Please review Technical Bulletin ISTB-2018-02, Appendix I Table 1 – maximum flow to be considered from a given hydrant.

        iv. Any proposed emergency route (to be satisfactory to Fire Services).

        v. Service areas with a basic demand greater than 50 m3/day shall be connected with a minimum of two water services, separated by an isolation valve, to avoid creation of vulnerable service area.

vi. A District Metering Area Chamber (DMA) is required for services 150mm or greater in diameter.

32. Sanitary Sewers:

    a. Location of Accessible Sanitary Sewer: 250mm PVC municipal sanitary sewer on Lamarche Avenue.

    b. A monitoring maintenance hole shall be required just inside the property line for all non-residential and multi residential building connections from a private sewer to a public sewer. See the Sewer Use By-law for details.

    c. Please apply the wastewater design flow parameters in Technical Bulletin PIEDTB-2018-01.

    d. For laterals connecting to main with 50% pipe diameter or over, provide a manhole.

    e. Provide the proposed peak wet weather sanitary flow rate, along with supporting calculations, to our Asset Management team for analysis to demonstrate that there is adequate residual capacity in the receiving and downstream wastewater system to accommodate the proposed development. This information can be provided in an email to the Project Manager, and we will circulate internally.

    f. The designer must demonstrate that the proposed development is within the sanitary capacity that was allocated as part of the Orleans Village detail design servicing report:

        i. Design Brief for Caivan (Orleans Village) Ltd 340 Innes Road, prepared by DSEL, project 15-881, dated Nov 2018, rev 3.

33. Storm Sewers:

    a. Location of Accesible Storm Sewer: 250mm PVC municipal storm sewer on Lamarche Avenue.

    b. A monitoring maintenance hole shall be required just inside the property line for all non-residential and multi residential building connections from a private sewer to a public sewer. See the Sewer Use By-law for details.

    c. For laterals connecting to main with 50% pipe diameter or over, provide a manhole.

34. Stormwater Management:

    a. Quality Control

i. Suspended Solids: Provide Enhanced level of protection (80%) for suspended solids removal. Demonstrate ISO 14034 Environmental Technology Verification (ETV) protocol if OGS units are used.

ii. Provide a water balance analysis as per the conservation authority guidelines for development applications. Control the recharge to meet pre-development conditions on subject property.

b. Quantity Control

i. Site is located within the EUC expansion lands and the Mud (Green's) Creek Area Subwatershed Study Area draining to the Ottawa River.

ii. Allowable release rate: The existing subdivision servicing and EUC Pond 1 expansion reports should be referenced for permitted release rates and LID features to be incorporated

iii. When both underground and above ground storage is utilized, the release rate from the system will significantly differ than when solely one level storage is being used (i.e. greater range of head vs smaller change of head during storm event). If both levels of storage are to be accounted for then there are two options for SWM calculations: 1) use a dynamic computer model or 2) use an assumed average flow rate of 50% of the controlled peak flow rate of the area(s) utilizing two levels of storage.

iv. Ponding Notes

1. Permissible ponding of 350mm for the 100-year storm event. No spilling to adjacent sites.

2. Beyond the 100-year ponding elevation, all drainage must be spilled to the Right-of-Way.

3. 100-year spill elevation must be 300mm lower than any building opening or ramp.

4. Demonstrate that the stress test spill elevation (100-year +20% event) does not spill onto any permanent structures.

35. MECP ECA Requirements:

a. Required for shared sewers (municipal works). Please reach out to the MECP for details on initiating the process and the request for Transfer of Review process from the City.

36. Additional Notes:

a. No Capital Work Project that would impact the application has been identified at this time.

b. No road moratorium that would impact the application has been identified.

c. Any easement identified should be shown on all plans.

d. For any proposed exterior light fixtures, please provide certification from a licensed professional engineer confirming lighting has been designed only using fixtures that meet the criteria for full cut-off classification as recognized by the Illuminating Engineering Society of North America and result in minimal light spillage onto adjacent properties (maximum allowable spillage is 0.5 fc). Additionally, include in the submission the location of the fixtures, fixture type (make, model, part number and mounting height.

e. Sensitive Marine Clay (SMC) is widely found across Ottawa - geotechnical reports should include Atterberg Limits, consolidation testing, sensitivity values, and vane shear testing.

f. The site is subject to the Development Charges for the Gloucester Urban Center Stormwater Management Facilities.

37. For ease of reference, please see the following list of required supporting plans and studies required for the infrastructure component of your application:

Site Plan Control Approval

- Servicing & Stormwater Management Report, including:
  a. Demonstrated servicing capacity for all of water, sanitary and storm.
  b. Pre-development and post-development drainage area plans for both sanitary and storm.
  c. Ponding Plan
  d. Roadway Cross-Sections
  e. Plan & Profile Drawings
  f. Modeling as needed.
- Geotechnical Investigation
- Environmental Site Assessment(s)
- Water Budget Assessment
- Grading & Drainage Plan
- Servicing Plan
- Erosion & Sediment Control Plan

Please contact Cam Elsby, Project Manager, for follow-up questions related to Engineering.

Noise

Comments:

38. Noise Impact Studies required for the following:

    a. Road.

    b. Stationary, due to the proximity to neighboring stationary noise sources and if there will be any exposed mechanical equipment due to the proximity to neighboring noise sensitive land uses.

Please contact Josiane Gervais, Transportation Project Manager, for follow-up questions related to noise.

Transportation

Comments:

39. Follow Transportation Impact Assessment Guidelines:

    a. Note that the TIA Guidelines have been updated, the changes are available on the City's website.

    b. An update to the Transportation Impact Assessment is required due to the change in number of units proposed. The Strategy Report must be submitted with the formal submission to deem complete. The applicant is strongly encouraged to submit the Strategy Repot to the TMP prior to formal submission and allow for a 14 day circulation period.

    c. If a Roadway Modification Application (RMA) is required to support the proposed development, the functional plan and/or RMA plans must be submitted with the formal submission to deem complete. Request base mapping asap if RMA is required, contact Engineering Services.

40. ROW Protection:

    a. Ensure that the development proposal complies with the Right-of-Way protection requirements of the Official Plan's Schedule C16.

    b. Any requests for exceptions to ROW protection requirements must be discussed with Transportation Planning and concurrence provided by Transportation Planning management.

    c. ROW and corner triangles, where applicable, must be unincumbered and conveyed at no cost to the City. Note that conveyance of the ROW/corner triangle will be required prior to registration of the SP agreement.

Additional information on the conveyance process can be provided upon request.

41. Clear throat requirements for a collector is 25m. Ensure this length is provided. The clear throat length is measured from the ends of the driveway curb return radii at the roadway and the point of first conflict on-site.

42. Signalization of Innes Road and Lamarche Street is identified on the DC list.

43. TMP depicts Innes Road as a Transit Priority Corridor (Isolated Measures) (Affordable Network)

44. Provide a bus stop along the property frontage. Communications with OC Transpo's Transit Planners will be required to confirm location and design.

45. As the site proposed is residential, AODA legislation applies for all areas accessible to the public (i.e. outdoor pathways, visitor parking, etc.).

    a. Crosswalks located internally on the site should provide a TWSI at the depressed curb, per requirements of the Integrated Accessibility Standards Regulation under the AODA.

    b. Accessible parking stalls should include an access aisle next to the parking stall and a pedestrian curb ramp at the end of the access aisle.

    c. Please consider using the City's Accessibility Design Standards, which provide a summary of AODA requirements.

46. On site plan:

    a. Ensure site accesses meet the City's Private Approach Bylaw.

    b. Show all details of the roads abutting the site; include such items as pavement markings, accesses and/or sidewalks.

    c. Turning movement diagrams required for all accesses showing the largest vehicle to access/egress the site (as needed).

    d. Turning movement diagrams required for internal movements (loading areas, garbage) (as needed).

    e. Show dimensions for site elements (i.e. lane/aisle widths, access width and throat length, parking stalls, sidewalks, pedestrian pathways, etc.)

    f. Sidewalk is to be continuous across access as per City Specification 7.1.

Please contact Josiane Gervais, Transportation Project Manager, for follow-up questions related to transportation.

Environment

Comments:

47. There are no natural heritage features, surface water features, or species-at-risk habitat on or near the site that would trigger the need for an Environmental Impact Statement (EIS). An EIS is not required as part of this submission.

48. The City has strong policies towards tree planting to help reduce the impacts of climate change and the urban heat island effect. The large amount of impervious surface area on the site causes concern with regard to these matters. Additional tree plantings, especially within the parking areas, are strongly recommended.

    a. Some plantings around the garbage receptacles, especially those bordering the park, would also be recommended.

49. Should the hydrogeological conditions permit it, the applicant is *encouraged* to consider the use of low-impact design (LID) elements such as rain gardens, bioswales, or other green infrastructure features. This may help alleviate stormwater runoff concerns as well as introduce additional greenery to the site.

50. Please note that the City prefers that all plantings be of native and non-invasive species.

Please contact Mark Elliott, Environmental Planner, for follow-up questions.

Forestry

Comments:

51. Please confirm the current condition of the site and whether there are any protected trees on or adjacent to the site (all trees 10 cm in diameter or greater on the subject site, boundary trees and adjacent trees with a critical root zone extending into the development site). If protected trees are present, a Tree Conservation Report is required. Provide evidence if there are no protected trees impacted by the development.

52. Adequate space and soil volume must be provided for trees, especially through out the residential area and parking lots. The City is also working towards a 40% canopy cover target. The plans must align with sections 4.8.2 and 4.1.4 of the Official Plan. The City prefers large canopy, native species wherever feasible. Group utilities (such as lamp posts, hydrants, transformers, etc.) to optimize space for trees along road/aisle frontages.

53. Identify tree planting restrictions in the Geotechnical Report as this will influence site design. Trees must be incorporated into the development.

54. The following Tree Conservation Report (TCR) requirements have been adapted from the Schedule E of the Urban Tree Protection Guidelines – for more information on these requirements please contact Planning Forestry.

    a. A Tree Conservation Report (TCR) must be supplied for review along with the suite of other plans/reports required by the City

    b. Any tree 10 cm in diameter or greater and City-owned trees of any diameter requires a tree permit issued under the Tree Protection Bylaw (Bylaw 2020 – 340); the permit will be based on an approved TCR and made available at or near plan approval.

    c. The TCR must contain 2 separate plans/maps:

        i. Plan/Map 1 - show existing conditions with tree cover information.
        ii. Plan/Map 2 - show proposed development with tree cover information.

    d. The TCR must list all trees on site, as well as off-site trees if the CRZ (critical root zone) extends into the developed area, by species, diameter, and health condition. Please note that averages can be used if there are forested areas.

    e. Please identify trees by ownership – private onsite, private on adjoining site, city owned, co-owned (trees on a property line)

    f. If trees are to be removed, the TCR must clearly show where they are, and document the reason they cannot be retained.

    g. The removal of trees on a property line will require the permission of both property owners.

    h. All retained trees must be shown, and all retained trees within the area impacted by the development process must be protected as per City guidelines available at Tree Protection Specification or by searching Ottawa.ca.

    i. The city encourages the retention of healthy trees; if possible, please seek opportunities for retention of trees that will contribute to the design/function of the site.

    j. Removal of a City tree is not permitted unless justified. If justified, monetary compensation for the value of the tree must be paid before a tree removal permit is issued.

55. Landscape Plan (LP) requirements:

a. Landscape Plan Terms of Reference must be adhered to for all tree planting: Landscape Plan Terms of Reference. For more information on these requirements please contact Planning Forestry.

56. Additional Elements for Tree Planting in the Right of Way:

a. Please ensure any retained trees are shown on the LP

b. Sensitive Marine Clay - Please follow the City's 2017 Tree Planting in Sensitive Marine Clay guidelines.

c. Soil Volume - Please demonstrate as per the Landscape Plan Terms of Reference that the available soil volumes for new plantings will meet or exceed the minimum soil volumes requested.

d. The city requests that consideration be given to planting native species wherever there is a high probability of survival to maturity.

e. Efforts shall be made to provide as much future canopy cover as possible at a site level, through tree planting and tree retention. The Landscape Plan shall show/document that the proposed tree planting and retention will contribute to the City's overall canopy cover over time. Please provide a projection of the future canopy cover for the site to 40 years

f. Minimum Setbacks

i. Maintain 1.5m from sidewalk or MUP/cycle track or water service laterals.
ii. Maintain 2.5m from curb
iii. Coniferous species require a minimum 4.5m setback from curb, sidewalk, or MUP/cycle track/pathway.
iv. Maintain 7.5m between large growing trees, and 4m between small growing trees. Park or open space planting should consider 10m spacing, except where otherwise approved in naturalization / afforestation areas.
v. Adhere to Ottawa Hydro's planting guidelines (species and setbacks) when planting around overhead primary conductors.

g. Tree specifications

i. Minimum stock size: 50mm tree caliper for deciduous, 200cm height for coniferous.

ii. Maximize the use of large deciduous species wherever possible to maximize future canopy coverage.

iii. Tree planting on city property shall be in accordance with the City of Ottawa's Tree Planting Specification; and if possible, include watering and warranty as described in the specification.

iv. No root barriers, dead-man anchor systems, or planters are permitted.

v. No tree stakes unless necessary (and only 1 on the prevailing winds side of the tree)

57. Hard surface planting

i. If there are hard surface plantings, a planting detail must be provided.

ii. Curb style planters are highly recommended.

iii. No grates are to be used and if guards are required, City of Ottawa standard (which can be provided) shall be used.

iv. Trees are to be planted at grade.

Please contact Hayley Murray, Planning Forester, for follow-up questions related to trees.

Parkland

Comments:

58. Parkland dedication

    a. Parkland Dedication By-law No. 2022-280

59. Confirm lot area to allow staff to confirm the required park size.

60. The Park Development Manual requires that park blocks have 50% frontage on a public road. This requirement, along with the requirements for street trees and sidewalks within the right of way ensure that the park block may be serviced, accessible and well connected to all parts of the community. The proposed park configuration cannot be supported by staff, additional frontage and connectivity is required.

61. Please explore working with the adjacent landowner and determine the potential for an east-west public road alongside the park through the adjacent site onto Ventus Way. This modification would create broader connections through the community and give the park two public frontages.

62. If the park cannot be combined, additional road frontage combined with pedestrian connections to the adjacent community should be explored.

63. The location of garbage storage, parking and electrical boxes block access to the park and limit views and connectivity. Another location is required for these features. Should private lands abut the park, this should be treated as a street frontage with sidewalks and tree planting, or with appropriate delineation from private amenity space.

64. Private amenity space is required for residents, the park fulfills a separate community need.

65. On future submissions, confirm lot area to allow staff to confirm the required park size and clearly delineate the boundary of the park block within the plan. All pathways / setbacks / bike parking must be accommodated on private property.

Please contact Jessica Button, Parks Planner, for follow-up questions.

Other

66. The High Performance Development Standard (HPDS) is a collection of voluntary and required standards that raise the performance of new building projects to achieve sustainable and resilient design and will be applicable to Site Plan Control and Plan of Subdivision applications.

    a. The HPDS was passed by Council on April 13, 2022, but is not in effect at this time, as Council has referred the 2023 HPDS Update Report back to staff with the direction to bring forward an updated report to Committee at a later date. Please be advised that this is expected to occur in Q3 2024.

    b. Please refer to the HPDS information at ottawa.ca/HPDS for more information.

Should there be any questions, please do not hesitate to contact myself or the contact identified for the above areas / disciplines.

Yours Truly,
Jerrica Gilbert, Planner II

Encl. Urban Design Terms of Reference

c.c. Kelly Livingstone, Senior Planner (Development Review)
Zoha Rashid, Planner (Development Review)
Justin Armstrong, Senior IPM (Infrastructure Approvals)
Derek Unrau, IPM (Infrastructure Approvals)
Cam Elsby, IPM (Infrastructure Approvals)
Josiane Gervais, TPM (Transportation)
Nader Kadri, Planner (Urban Design)

Jessica Button, Planner (Parks and Recreation)
Hayley Murray, Planner (Forestry)
Mark Elliott, Planner (Environment)

Hugo Lalonde (Caivan)
Leah Vapper (Caivan)
Adam Fobert (DSEL)
Jeremy Chouinard (DSEL)

SUPPLEMENTARY DEVELOPMENT INFORMATION

The following details have been compiled to provide additional information on matters for consideration throughout the application approval and development process. Please note, this document is updated from time to time and should be reviewed for each project proposed to be undertaken.

General

- Refer to Planning application submission information and materials and fees for further information on preparing for application submission. Be aware that other fees and permits may be required, outside of the development review process.
- Additional information is available related to building permits, development charges, and the Accessibility Design Standards.
- You may obtain background drawings by contacting geoinformation@ottawa.ca.
- Plans are to be standard A1 size (594 mm x 841 mm) or Arch D size (609.6 mm x 914.4 mm) sheets, dimensioned in metric and utilizing an appropriate Metric scale (1:200, 1:250, 1:300, 1:400 or 1:500).
- All PDF submitted documents are to be unlocked, flattened and not saved as a portfolio file.
- Where private roads are proposed:
    - Submit a Private Roadway Street Naming application to Building Code Services Branch for any internal private road network.
    - Applications are available at all Client Service Centres and the private roadway approval process takes three months.

Servicing and Site Works

Servicing and site works shall be in accordance with the following documents:

- Ottawa Sewer Design Guidelines (October 2012)
- Ottawa Design Guidelines – Water Distribution (2010)
- Geotechnical Investigation and Reporting Guidelines for Development Applications in the City of Ottawa (2007)
- City of Ottawa Slope Stability Guidelines for Development Applications (revised 2012)
- City of Ottawa Environmental Noise Control Guidelines (January, 2016)
- City of Ottawa Park and Pathway Development Manual (2012)
- City of Ottawa Accessibility Design Standards (2012)
- Ottawa Standard Tender Documents (latest version)

- Ontario Provincial Standards for Roads & Public Works (2013)

Exterior Site Lighting

Where proposed, requires certification by an acceptable professional engineer, licensed in the Province of Ontario, which states that the exterior site lighting has been designed to meet the following criteria:

- It uses only fixtures that meet the criteria for Full Cut-Off (Sharp cut-off) classification, as recognized by the Illuminating Engineering Society of North America (IESNA or IES), and
- It results in minimal light spillage onto adjacent properties. As a guideline, 0.5 foot-candle is normally the maximum allowable spillage.

The location of the fixtures, fixture type (make, model, part number and the mounting height) must be shown on one of the approved plans.

City Surveyor Direction

- The determination of property boundaries, minimum setbacks and other regulatory constraints are a critical component of development. An Ontario Land Surveyor (O.L.S.) needs to be consulted at the outset of a project to ensure properties are properly defined and can be used as the geospatial framework for the development.
- Topographic details may also be required for a project and should be either carried out by the O.L.S. that has provided the Legal Survey or done in consultation with the O.L.S. to ensure that the project is integrated to the appropriate control network.

  Questions regarding the above requirements can be directed to the City's Surveyor, Andre Roy, at Andre.Roy1@ottawa.ca.

Waste Management

- New multi-unit residential development, defined as containing six (6) or more units, intending to receive City waste collection services will be required, as of June 1, 2022, to participate in the City's Green Bin program in accordance with Council's approval of the multi-residential waste diversion strategy. The development must include adequate facilities for the proper storage of allocated garbage, recycling, and green bin containers and such facilities built in accordance with the approved site design. Questions regarding this change and requirements can be directed to Andre.Laplante@ottawa.ca.

- For sites containing:
  - One or more buildings with a total GFA greater than 2000 square metres;

- Retail shopping complexes with a total GFA greater than 10,000 square metres;
- Sites containing office buildings with total GFA greater than 10,000 square metres;
- Hotels and motels with more than 75 units;
- Hospitals (human);
- Educational institutions with more than 350 students; or
- Manufacturing establishments working more than 16,000 person-hours in a month

A Waste Reduction Workplan Summary is required for the construction project as required by O.Reg. 102/94, being "Waste Audits and Waste Reduction Work Plans" made under the Environmental Protection Act, RSO 1990, c E.19, as amended.

Fire Routes

- Fire routes are required to be designated by By-law for Fire Services to establish them as a legal fire route. Where a development proposes to establish a fire route, an Application for Fire Route Designation is to be made. Questions regarding the designation of fire routes and required process can be directed to fireroutes@ottawa.ca.

Dewatering Activities

- Project contractors and/or your engineers are required to contact the Sewer Use Program to arrange for the proper agreements or approvals to allow for the discharge of water from construction dewatering activities to the City's sanitary or storm sewer system. Please contact the Sewer Use Duty Officer at 613-580-2424 ext. 23326 and/or suppue@ottawa.ca.

Backflow Prevention Devices for Premise Isolation

- Buildings or facilities installing a backflow preventer for premise isolation of the drinking water system must register with the City's Backflow Prevention Program where a moderate or severe hazard may be caused in accordance with CSA B64.10 "Selection and Installation of Backflow Preventers". Please contact the Backflow Prevention Program at 613-580-2424 ext. 22299 or backflow@ottawa.ca to submit a Premise Isolation Survey.

Energy Considerations

- Are you considering harvesting thermal energy from the wastewater infrastructure or harvesting geothermal energy?

- Additional information can be found on the City website or by contacting Melissa Jort-Conway.

Flood Plain Mapping and Climate Change

- An interactive map, for informational purposes only, showing the results of on-going flood plain mapping work completed by the Conservation Authorities in partnership with the City is now available. This mapping may be used to identify known riverine flood hazards for a property or area. The map and additional related information can be found on Ottawa.ca.

Blasting

- Where blasting may take place:
  - Blasting activities will be required to conform to the City's Standard S.P. No. F-1201 entitled Use of Explosives, as amended.
  - To avoid future delays in process, including the Municipal Consent process for shoring, ensure communication with necessary entities, including utilities, is undertaken early.
- Blasting and pile driving activities in the vicinity of Enbridge Gas Distribution and Storage (GDS) facilities require prior approval by GDS. The Blasting and Pile Driving Form, referenced in Enbridge's Third Party Requirements in the Vicinity of Natural Gas Facilities Standard, must be provided to mark-ups@enbridge.com by the Owner of the proposed work for all blasting and pile driving operations. In addition, a licensed blasting consultant's stamped validation report must be submitted to GDS for review if blasting is to occur within thirty (30) metres of GDS facilities. The request must be submitted a minimum of four weeks prior to the beginning of work to allow sufficient time for review.

Archaeological

- Archaeological Resources
  - Should potential archaeological resources be encountered during excavation activities, all Work in the area must stop immediately and the Owner shall contact a provincially licensed archaeologist.
  - If during the process of development deeply buried/undetected archaeological remains are uncovered, the Owner shall immediately notify the Archaeology Section of the Ontario Ministry of Tourism, Culture and Sport.
  - In the event that human remains are encountered during construction, the Owner shall immediately contact the police, the Ministry of Tourism, Culture and Sport and the Registrar of Cemeteries, Cemeteries Regulation Unit, Ministry of Consumer and Business Services, Consumer Protection Branch.

Trees

- The City's Tree Protection Bylaw, being By-Law No. 2020-340, as amended, requires that any trees to be removed shall be removed in accordance with an approved Tree Permit and Tree Conservation Report and that all retained trees will be protected in accordance with an approved Tree Conservation Report.

Limiting Distance and Parks

- A Limiting Distance Agreement may be required by Building Code Services before building permit(s) can be issued with respect to the proximity of the building to a park block. The City will consider entering into a Limiting Distance Agreement with the Owner with such Agreement to be confirmed through the City's Reality Initiatives & Development Branch. A Limiting Distance Agreement is at the expense of the Owner.

Development Constructability

How a development is constructed, its constructability, is being looked at earlier in the development review process to raise awareness of potential impacts to the City's right of way and facilitate earlier issue resolution with stakeholders. Where a construction management plan is required as part of the site plan or subdivision application approval, conditions will be included that set out the specific parameters to be addressed for the specific project. However, please note the following construction and traffic management requirements and considerations in the development of your project.

- **Open Lane (includes all vehicular lanes, transit lanes and cycling lanes) Requirements**
    - Unless specified in the site-specific conditions to be provided by City of Ottawa Traffic Management at the time of approval, the following requirements must be adhered to and accommodated as part of any proposed encroachments and construction management plan. The standard requirements outlined in this section shall further apply to cycling facilities and Transit.
        - All lanes are to function uninterrupted at all times.
        - No interruption or blockage of traffic is permitted.
        - No loading or unloading from an open lane is permitted.
        - All vehicular travel lanes are to be a minimum of 3.5 metres in width.
        - All cycling lanes are to be a minimum of 1.5 metres.
- **Pedestrian Requirements**
    - Unless specified in the site-specific conditions provided by City of Ottawa Traffic Management at the time of approval, the contractor is required to

maintain a minimum width of 1.5 metres for a pedestrian facility on one side of the corridor at all times; even in instances where a pedestrian facility was not present prior to construction.

- The facility shall include a free and unobstructed hard surface acceptable for the use of all pedestrians including those with accessibility challenges and shall maintain access to all buildings and street crossings.
- The facility must always be maintained in a clean condition and in a good state of repair to the satisfaction of the City.
- Any change of level which is over 13 millimetres in height is to be provided with a smooth non-tripping transition.
- Any temporary barriers or fencing shall include a cane detectable boundary protection with edge or barrier at least 75 millimetres high above the ground surface.
- If works overhead are required, a 2.1 metre minimum clear headroom must be provided.
- If overhead protection is required above the pedestrian facility, it is to be offset a minimum of 600 millimetres from any travel lane.

- **Transit Requirements**
  - Travel lanes accommodating OC Transpo must be a minimum of 3.5 metres in width and have a minimum 4.5 metre vertical clearance at all times.
  - Should access to a bus stop be impacted, the developer will be required to email TOPConstructionandDetours@ottawa.ca a minimum of 20 working days prior to work commencing to coordinate any site-specific conditions as part of the work. This includes temporary relocation of transit stops, removal of bus shelters or stops and transit detour routes.
  - The contractor may be required to relocate and provide a suitable alternative to OC Transpo's bus stop to the satisfaction of OC Transpo
  - The Contractor shall provide OC Transpo with a minimum of ten (10) working days' notice to coordinate temporary relocation of bus stops. When a bus stop and/or shelter must be temporarily relocated, the contractor may be required to provide stop infrastructure (i.e. bench, bus and/or shelter pads), to the satisfaction of OC Transpo.
  - All temporary stop locations including infrastructure are to be fully accessible in accordance with City of Ottawa Accessibility Design Standards and to the satisfaction of the OC Transpo.
  - Temporary bus stops are to be constructed and ready for use prior to the start of any works that would impact the regular bus stop location(s).
- **Public Consultation**
  - May include, but not be limited to, proponent lead public meeting(s), letter notification(s) and information dissemination via print, electronic means or

social media, to impacted properties above and beyond the notification requirements specified in the Road Activity By-law.

- **General Considerations for all Applications**
  - A comprehensive construction management plan should include and consider the following:
    - The proposed stages of construction and the anticipated durations of each stage and any impact to existing travel lanes, pedestrian facilities, cycling facilities and/or transit facilities. Any proposed encroachment should be identified and dimensioned on the site plan for review of feasibility.
    - The proposed constructability methods being used as part of the proposed development (ie: fly forming, Peri forming etc.) and any additional traffic impacts/interruptions anticipated with proposed methods. If a crane is being placed on site, the location should be identified, and show the overhead impacts of the crane.
    - Consideration that any tie-backs and/or shoring within the City of Ottawa Right of Way are subject to Municipal Consent in advance of commencement of the project. Approval for encroachments is not guaranteed if impacts to transportation facilities cannot be addressed to the City's satisfaction.
    - Identify any truck hauling routes to and from the proposed development site and any proposed accesses. Designated heavy truck routes are to be followed at all times, however, if a deviation is required from the existing heavy truck route network, then a structural review may be required as part of an Over-dimensional Vehicle Project Permit.
    - Identify the location of any site trailers and the location. Note, if placing a site trailer above any walk-through scaffolding or on the second floor (or above), an engineering drawing must be submitted to building code services for review. More information can be found on the Building Permit Approval process.
    - Identify equipment and/or materials storage locations as required. Storage is not permitted on the road or the roadway shoulders or boulevards, unless the storage areas are identified in the traffic control plan and appropriate traffic control devices protect the equipment or materials.
  - Any work as part of the development that requires a road cut, road closure or encroachment will be subject to the Road Activity By-law and potential site-specific conditions identified at site plan or subdivision approval which will be noted on the subsequent Permit(s). Information about construction in the right-of-way including applying for permits and associated fees can be found on the City's website.

List of Technical Agencies to Consult

Proposed Zoning By-law Amendment, Site Plan Control, Plan of Condominium Application – 245 & 275 Lamarche Avenue – PC2024-0272

☒	Zayo	Utility.Circulations@Zayo.com
☒	Bell Canada	circulations@wsp.com
☒	Telus Communications	Engineering.Requests@telus.com / jovica.stojanovski@telus.com
☒	Rogers Communications	OPE.Ottawa@rci.rogers.com
☒	Enbridge Gas Distribution	municipalplanning@enbridge.com
☒	Hydro Ottawa (Local Distribution)	ExternalCirculations@HydroOttawa.com

Urban Design Brief

Terms of Reference

1. Description

An Urban Design Brief is intended to illustrate how a development proposal represents high-quality and context sensitive design that implements policies of the Official Plan, relevant secondary plans, and Council approved plans and guidelines. The Urban Design Brief should not replace or replicate the Planning Rationale, it is intended to be a highly graphic document that is complimentary to the Planning Rationale. The purpose of this Terms of Reference is to assist the applicant to organize and substantiate the design approach and considerations in support of the proposed development and to assist in the review of the proposal.

2. Authority To Request / When Required

An Urban Design Brief will be required for the following development applications:

Official Plan Amendments:

Per *Planning Act*, Section 22 (4) and (5) for information or materials required by the City to review an Official Plan Amendment Application if the official plan contains provisions relating to requirements under this subsection, which propose increases in height or density.

Zoning By-law Amendments:

Per *Planning Act*, Section 34 (10.2) for information or materials required by the City to review a Zoning By-law Amendment Application to permit the extension or enlargement of any land, building or structure used for any purpose prohibited by the by-law, which propose increases in height or density.

Site Plan Control Applications:

Per *Planning Act*, Section 41 (3.4) for information or materials required by the City to review a Site Plan Control Application and Section 41 (4) and 41 (4.1.1) for elements, facilities and works where the appearance impacts matters of health, safety, accessibility, sustainable design or the protection of adjoining lands.

An Urban Design Brief is a requirement for all Site Plan Control Application thresholds in accordance with the City of Ottawa Site Plan Control By-law as amended; with the exception of a “Rural Small” Site Plan Control application.

For residential buildings with 25 or more residential units, the City has authority under Section 41 (4) paragraph 2 to require. For residential buildings with less than 25 residential units, the City has authority to require for such buildings based on 11.1 (3) of the Official Plan and 41 (5) of the *Planning Act* if the units are within the Urban area or the High-performance Development Standard threshold in the rural area, as per the Site Plan Control By-law.

For all other uses (non-residential and mixed-use) the City has authority under Section 41 (4) paragraph 2 to require.

Plan of Subdivision

Per *Planning Act*, Section 51 (18) for information or materials required by the City to review Plan of Subdivision applications, which include multiple blocks of development planned for medium and/or high-rise development and a mix of land uses.

3. Content

The content for an Urban Design Brief is itemized in the following checklist. Each required item must be discussed and/or illustrated to the appropriate level of detail, commensurate with the complexity of the proposal. Required item(s) are determined by the lead City Urban Designer at the pre-consultation meeting and will be selected from the checklist below:

PROJECT DESCRIPTION

- ☐ Brief description of the design intent behind the development proposal. This description should be more design detailed, and not replicate the description within the Planning Rationale.
- ☐ Project statistics, including gross floor area, the breakdown of floor area for different uses, total number and detailed breakdown of units, total number and detailed breakdown of vehicle and bike parking, building heights, lot coverage, etc. Project statistics should be illustrated in a table.
- ☐ Rendering of the proposal.

DESIGN DIRECTIVE(S)

- ☐ A concise summary and response to the applicable City's design policies, including from the Official Plan, and City urban design guidelines. A more

detailed response shall be provided for any applicable urban design criteria that are not being met by the proposal.

- ☐ A response to urban design directions provided at the various pre-consultation meetings with City staff.

SITE, CONTEXT, AND ANALYSIS

Photographs, maps, diagrams, and images may be utilized along with brief explanatory text to document and analyze condition and context of the site. The requested information should cover area within a 100 metre radius of a development site. A larger radius may be requested for larger / more complex projects.

- ☐ Photographs of existing site conditions and surrounding area, including a numbered map pinpointing where each photo is taken. Correspond these numbers with the site photos and include arrows illustrating the direction of the photograph.
- ☐ Perspective images to and / or from the site.
- ☐ Protected view corridors or views of interest that may be impacted by the proposed development.
- ☐ Built and natural heritage assets on site and adjacent area.
- ☐ Microclimate conditions of the site.
- ☐ Key uses, destinations, and spatial elements in the surrounding area such as focal points/nodes, gateways, parks/open spaces, and public arts.
- ☐ Urban pattern (streets, blocks).
- ☐ Characteristics of adjacent streets and public realm.
- ☐ Mobility networks, such as transit stations, street networks, cycling facilities, pedestrian routes and connections, and parking.
- ☐ Future and current development proposals on adjacent properties.
- ☐ The planned functions of the adjacent properties, such as the permitted building envelope under current zoning.

DESIGN RESEARCH

Diagrams, 3D images and other tools may be utilized to explain and illustrate design aspirations, alternatives and proposed outcomes.

- ☐ Parti diagrams, sketches, and precedent images.
- ☐ Alternative site plan options.
- ☐ Alternative massing options.
- ☐ Design evolution.
- ☐ Massing of the proposed development in the existing context.
- ☐ Massing of the proposed development in the planned context. The planned context may be represented by the current zoning permissions OR policy criteria if zoning is not in keeping with Official Plan direction.
- ☐ Block Plan illustrating potential future development in the area in which the proposed site is situated.
- ☐ Built form transition between the proposed development and the surrounding area.
- ☐ Response to abutting public realm conditions beyond the boundaries of the site.
- ☐ Street cross sections that show the building wall to building wall conditions of the adjacent streets.
- ☐ Approach to sustainable design as it relates to the City's High-performance Development Standards or any other accredited system such as LEED.
- ☐ Approach to bird-safe design as it relates to the City's Bird-Safe Design Guidelines

ADDITIONAL MATERIALS – APPENDIX

The following appendix of additional materials is only required when an application is subject to review by the City's Urban Design Review Panel as the Urban Design Brief will be used as the Urban Design Review Panel Presentation. The requirement for the submission of the following drawing(s) and studies are made separately at the pre-consultation by the Lead Planner and are the subject of other Terms of Reference. The lead City Urban Designer will indicate the required item(s) from the checklist below to be provided as an appendix to the Urban Design Brief.

- ☐ Site Plan
- ☐ Landscape Plan

- ☐ Plan of Subdivision
- ☐ Grading and Drainage Plan
- ☐ Site Servicing Plan
- ☐ Building elevation(s) of the proposed building(s). Conceptual drawings may suffice in support of a Zoning By-law and/or Official Plan Amendment.
- ☐ Floor Plan(s) of the proposed building(s). Conceptual drawings may suffice in support of a Zoning By-law and/or Official Plan Amendment
- ☐ Wind Analysis
- ☐ Shadow Analysis
- ☐ High-performance Development Standards Checklist
- ☐ Heritage Impact Statement

4. Roles and Responsibilities / Qualifications

The Urban Design Brief is required to be signed by a member holding a professional membership with the OAA, OALA, OPPI, and/or CIP, or equivalent professional organization; and should include materials prepared by urban designer(s), licensed architect(s), licensed landscape architect(s), and registered planner(s).

5. Submission Requirements

- 8.5x11 or 11x17 package (landscape orientation preferred)
- Electronic copies of all required studies and plans must be supplied in Adobe .PDF format and are to be unlocked and flattened.
- Supporting Georeferenced Digital CAD/BIM/GIS files for 3D Building Massing Model (in accordance with the City's 3D Massing Submission Requirements) is required for all development applications associated with a mid-rise and/or high-rise building where a design brief is a requirement of a complete application.

What is the High Performance Development Standard?

The High Performance Development Standard (HPDS) is a collection of mandatory and voluntary standards or "metrics" that raise the performance of new building projects to achieve "sustainable and resilient design" objectives. The HPDS consists of three tiers of performance. The standards, also known as 'metrics' in Tier 1 are mandatory. Tiers 2 and 3 contain higher level voluntary standards.

"Sustainable and resilient design is defined as "*Principles in site and building design to protect against the depletion of critical resources like energy, water, land, and raw materials, reduce greenhouse gas emissions, prevent environmental degradation throughout its life cycle, and create built environments that are liveable and comfortable while being safe and resilient to the impacts of a changing climate" (see new Official Plan, Section 13).*

What is the purpose of the HPDS?

Buildings are a major source of greenhouse gas emissions in Ottawa. Designing new buildings to be energy efficient from the outset will help reduce greenhouse gas emissions and save on costly retrofits in the future. The HPDS will also help build resiliency to our changing climate through tree canopy, ecology and urban heat island mitigation strategies.

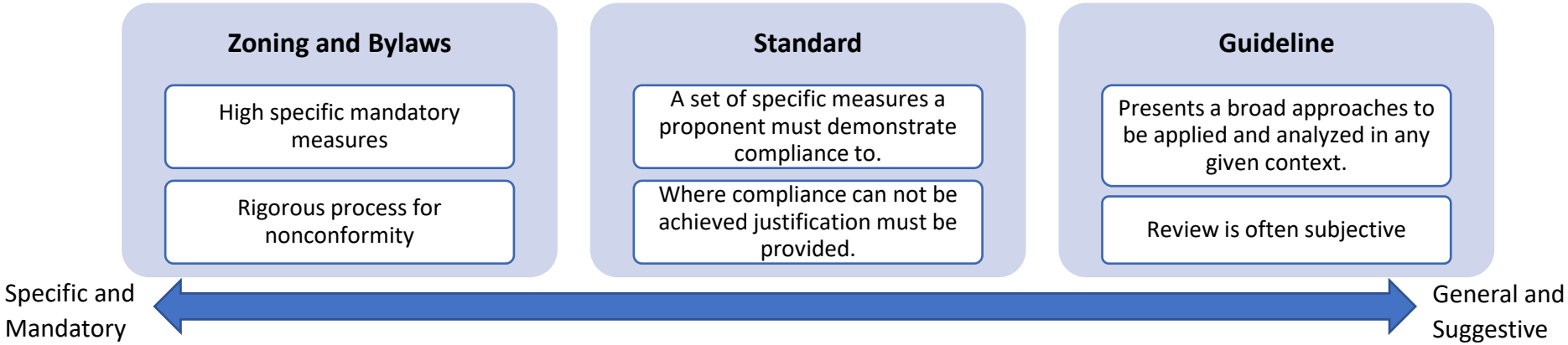
Collectively, the metrics aim to advance the climate change mitigation and adaption priorities of the Climate Change Master Plan, Energy Evolution and the Climate Resiliency Strategy as well as the City's objectives related to public health, ecology and accessibility.

Tier 1 Metrics

Category	Energy	Health	Ecology	Resiliency	Waste	Transportation
Site Plan Tier 1	• Energy Efficiency	• Accessibility • Fresh Air Intake Location	• Tree Planting • Plant Species • Exterior Lighting • Bird Safe Design	• Sustainable Roofing • Cool Landscape and Paving	• Common Area Waste Storage	• Electric Vehicle Charging • Bike Parking
Plan of Subdivision Tier 1	• Community Energy Plan	N/A	• Tree Planting • Plant Species	• Community Energy Plan	N/A	N/A

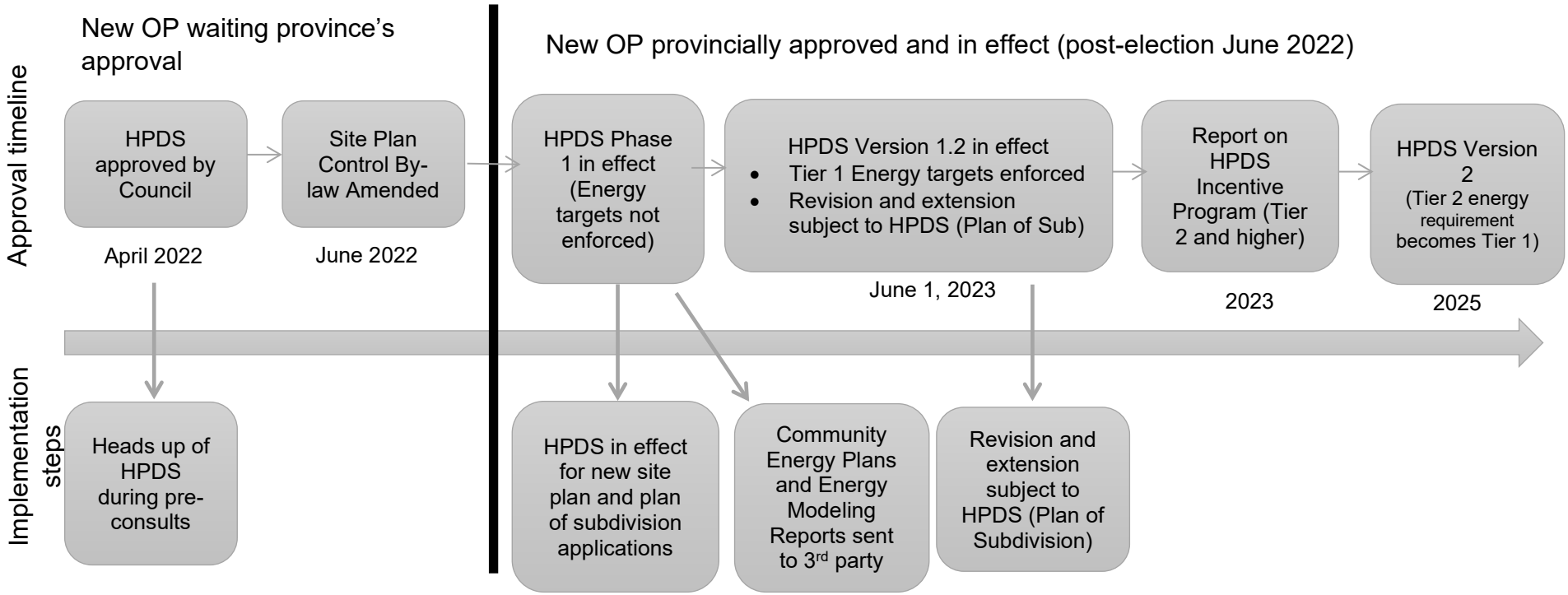
What is the difference between a standard and other planning tools?

- A standard is a set of specific measures to which a proponent must implement to the fullest extent.
- Whereas a guideline is suggestive and general in nature, a standard is prescriptive and mandatory.
- Whereas the Zoning By-law sets out a separate process to review nonconformity through the Committee of Adjustment, relief from a standard is subject to the review and approval by the Department based on justification provided by the applicant through the development approval process.



Some design elements may have criteria that are covered in all these tools where there are associated guidelines or bylaws the HPDS will reference these

Timing of requirements coming into effect



Frequently Asked Questions

1. When will the HPDS be fully implemented?

The HPDS is being rolled out in a phased approach as follows:

- Tier 1 (mandatory) building energy efficiency metrics will not apply until June 1, 2023 (i.e. Energy Modeling Reports will be "Report-Only" – see FAQ below)
- Tier 1 metrics will apply to applications for extension and revision of plan of subdivision effective June 1, 2023

- Tier 1 requirements for bike and electric vehicle parking will be proposed as part of the new Zoning By-law (post Official Plan adoption)
- The mandatory metrics are expected to be updated in 2025 and will come into effect in 2026.

2. What about ongoing applications?

We encourage projects, including those that have already been through pre-consultation or submitted an application, to comply with the HPDS. The HPDS will not apply to projects that have been through pre-consultation where the HPDS was not introduced OR are submitting an application prior to the new Official Plan receiving provincial approval. The HPDS will apply to applications for an extension or revision of draft plan approval (Plan of Subdivision) that are submitted on or after June 1, 2023.

3. How will the HPDS impact the Development Review process?

The HPDS will impact the development review process steps as follows:

	Site Plan applications	**Plan of Subdivision applications**
Pre-application Consultation	The HPDS will be flagged during the pre-application consultation for awareness. For Complex Site Plan applications, it is recommended that applicants engage an energy consultant at the same time as the building architectural drawings are being developed.	The HPDS will be flagged during the pre-application consultation for awareness. A new requirement is that a completed Community Energy Plan be submitted as a condition of draft approval. As indicated in the Terms of Reference, a letter is required at application submission which outlines the energy commitments and proposed energy strategy as well as confirmation of an established working group (as applicable).
Application Submission:	A completed HPDS Checklist is required at submission.	A completed HPDS Checklist is required at submission. Where a complete Community Energy Plan Report or Brief is not complete at time of application submission, projects are permitted to provide a letter which identifies the following project elements: • project partners, joint working group and key stakeholders • qualified professional completing the Community Energy Plan • proposed Community Energy Plan compliance pathway, prescriptive or a complete plan;

		• intended target level of performance for the community
Issue Resolution:	The File Lead will identify issues of non-conformity to the HPDS as part of the circulation comments. Following circulation, all resubmission packages shall include an updated HPDS Checklist. For Complex Site Plan applications, the resubmission package shall also include a draft Energy Modeling Report (EMR), which is to be sent for review by a third-party consultant.	The File Lead will identify issues of non-conformity to the HPDS as part of the circulation comments. Following circulation, all resubmission packages shall include an updated HPDS Checklist.
Approval / Post-approval:	The final EMR is submitted once the Delegated Authority Report (DAR) is prepared. The DAR will include conditions pertaining to the HPDS.	A completed Community Energy Plan is to be submitted as a condition of draft approval. The Delegated Authority Report (DAR) will include conditions pertaining to the HPDS.

4. What is the timing on incentives for Tier 2 projects?

There are currently no financial or process related incentives available to be implemented. Staff have been directed to investigate incentive options and report back to Council in 2023.

5. What does "Report Only" mean for Energy Modeling Reports submitted before June 1, 2023?

The term "Report Only" describes an interim period until June 1, 2023 when Tier 1 energy targets must be met. The "Report Only" period will help staff and industry become more familiar with energy modeling reports and how energy efficiency is to be reviewed during the approval process. It is also for industry to gain a better understanding of the types measures projects can apply to achieve energy targets.

6. Are deviations from the mandatory metrics permitted?

The expectation is for projects to demonstrate full compliance with the HPDS metrics. Where full compliance cannot be achieved, documentation will be required that provides sufficient justification why a deviation from the HPDS is necessary. Permission to deviate from the HPDS shall be subject to the review and approval of the GM, Planning, Real Estate and Economic Development Department. Example: A project has several separate roof spaces and is treating most of podium roof area which nearly meets the sustainable roofing requirement of the HPDS but to become in full compliance would have to treat the entire other roof area, resulting in significant cost.

7. Will the City provide training to the community on the HPDS?

Yes. More details are to be provided on training in Q3 2022. Until that time, specific questions should be directed to: hpds@ottawa.ca

1. Accessible Parking Spaces

The terms Type A and Type B Parking Spaces have the same meaning as within O. Reg 191/11

This section applies to:

1) *Parking garages and related structures*
2) *Surface parking*
3) *On-street parking*

Standard Ref.	Requirements	Compliance	Comments
3.1.1.	**Provision:** 1 Type A accessible parking space must be provided where there are 12 or fewer spaces (see Table 3 for a complete list)	Y N N/A	
3.1.2	**Provision:** 4% of the total number of parking spaces should be accessible	Y N N/A	
3.1.2	**Provision:** if the total number of spaces is greater than 1001, provide 11 accessible parking spaces plus an addition 1% of the total number of spaces	Y N N/A	
3.1.3	**Access Aisle:** minimum of 1.5 m (see Figure 25)	Y N N/A	
3.1.3	**Location:** a maximum of 30 m from nearest accessible entrance	Y N N/A	
3.1.3	**Surface:** firm, stable and slip resistant	Y N N/A	
3.1.3	**Running slope:** maximum of 1:50 (2%)	Y N N/A	
3.1.3	**Cross slope:** maximum of 1:50 (2%)	Y N N/A	
3.1.3	**Type A spaces:** Length 5.2 m Width 3.4 m Type B spaces Length: 5.2 m Width: 2.4 m	Y N N/A	
3.1.3	**Overhead clearance:** minimum of 2.1 m	Y N N/A	
3.1.3	**Access Aisle:** minimum of 1.5 m. Must be clearly marked and adjacent to accessible parking space	Y N N/A	
3.1.4.1	**Vertical Signage:** **Width:** 0.3 m **Height:** 0.6 m (minimums)	Y N N/A	

Note – this Checklist must be read in conjunction with the City of Ottawa's Accessible Design Standards Document, 2015. All figures referenced in this document can be found in the City's Accessible Design Standards document.

	Mounted: 1.5 m to 2.0 m high at centre • Marked with International Symbol of Accessibility (see Figure 25)		
3.1.4.2	**Pavement Markings** • Marked with the International Symbol of Accessibility • 15.25 m wide by 15.25 m deep • Locate near the back of the space for 90 degree or angled parking spaces • Locate in the centre for parallel parking spaces (see Figure 27)	Y N N/A	

2. Passenger Loading Zone

Standard Ref.	Requirements	Compliance	Comments
3.2.1	**Location:** maximum of 30 m from nearest accessible entrance	Y N N/A	
3.2.1	**Side Access Aisle** **Length:** 7.4 m **Width:** 2.4 m (minimums) (see Figure 28)	Y N N/A	
3.2.1	**Vertical Clearance:** 3.6 m	Y N N/A	
3.2.1	**Path of Travel:** minimum of 1.8 m wide to nearest accessible entrance	Y N N/A	
3.2.1.1	**Vertical Signage** **Width**: 0.3 m by 0.6 m **Mount:** 1.5 m to 2.0 m high at centre (see Figure 29)	Y N N/A	

Note – this Checklist must be read in conjunction with the City of Ottawa's Accessible Design Standards Document, 2015. All figures referenced in this document can be found in the City's Accessible Design Standards document.

3. Exterior Paths of Travel

Where stairs are located on an accessible Exterior route or walkway, an alternative Accessible route is to be provided immediately adjacent to the stairs

This section applies to:

1) *Pedestrian routes that serve facility entrances*
2) *Pedestrian routes that serve as a connection between a site boundary and entrance into the site*
3) *Public Rights-of-Way*
4) *Ramps and Curb Ramps*

Standard Ref.	Requirements	Compliance	Comments
3.3.1	**Surface:** firm, stable and slip resistant	Y N N/A	
3.3.1	**Lighting**: Provide in accordance with Section 5.7 (Lighting)	Y N N/A	
3.3.2	**Path of travel:** minimum 1.8 m wide	Y N N/A	
3.3.3.1	**Running Slope:** 1:20 (5%) (maximum)	Y N N/A	
3.3.3.2	**Cross Slope:** 1:20 (2%) (maximum) where surface is concrete or asphalt. 1:10 (10%) in all other cases.	Y N N/A	
3.3.1	**Rest Area:** If width is less than 1.8 m, provided every 30 m along path of travel. Rest area to be 1.8 m by 1.8 m (minimums)	Y N N/A	
3.3.4	**Guards:** Provide when change in level is more than 0.6 m	Y N N/A	
2.1.4	**Gratings or Openings:** 13 mm (maximum) wide in direction of travel. Longest side, if rectangular, must be perpendicular with the direction of travel	Y N N/A	

4. Curb Ramps

A curb ramp provides a transition where there is a change in level between exterior path of travel and adjacent vehicular route

This section applies to:

1) *Pedestrian crossings at intersections*
2) *Parking spaces, passenger loading zones and related access aisles*
3) *Any other exterior route where there is a grade change.*

Standard Ref.	Requirements	Compliance	Comments
3.4.1	**Surface:** firm, stable and slip resistant	Y N N/A	
3.4.2	**Clear width:** 1.5 m (minimum), exclusive of flares	Y N N/A	
3.4.3	**Running Slope**: 1:12 (8.33%) (maximum)	Y N N/A	
3.4.3	**Cross Slope:** 1:50 (2%) (maximum) (see Figure 33b)	Y N N/A	
3.4.6	**Tactile Surface Walking Indicators (TWSI):** minimum depth of 610mm, at 150 mm to 200 mm from edge of curb (see 33b)	Y N N/A	
3.4.2.2	**Flared Side:** 1m wide; slope 1:15 to 1:10.	Y N N/A	

5. Ramps

Ramps are provided when the slope of a path of travel exceeds a gradient of 1:20 (5%)

Refer to the Ontario Building Code for all applied requirements for ramps.

For all ramp standards, see Figure 3

Standard Ref.	Requirements	Compliance	Comments
2.2.1.1	**Running Slope:** 1:15 (6.67%)	Y N N/A	
2.2.1.2	**Cross-Slope:** 1:50 (2%)	Y N N/A	
2.2.1	**Surface:** firm, stable and slip-resistant	Y N N/A	
2.2.1	**Clear Width:** 1.1 m (minimum)	Y N N/A	
2.2.1.4	**Colour Contrasting Strip:** to be provided at slope changes. 50 mm wide colour-contrasted and slip resistant strip equal to the width of the ramp	Y N N/A	
2.2.1	**Lighting:** provide in accordance with Section 5.7 (Lighting)	Y N N/A	
2.2.2	**Length:** 9 m, or less, or provide landing	Y N N/A	
2.2.2	**Landing:** to be provided at top, bottom or intermediate level, or where there is directional change. **(**see Figure 5)	Y N N/A	
2.2.3.1	**Handrail:** 865 to 965 mm high on both sides. **Clear width**: 1.1 m between handrails (see Figure 8)	Y N N/A	

Note – this Checklist must be read in conjunction with the City of Ottawa's Accessible Design Standards Document, 2015. All figures referenced in this document can be found in the City's Accessible Design Standards document.

6. Stairs

This section applies to stairs provided for exterior or interior environments

Refer to the Ontario Building Code for all applied requirements for stairs.

For all stair standards, see Figure 10

Standard Ref.	Requirements	Compliance	Comments
2.3	**Stairs:** where provided, an alternative accessible route is to be provided immediately adjacent, and may include a ramp or other accessible means of negotiating grade change	Y N N/A	Note which alternative to stairs is provided.
2.3.1	**Surface:** firm, stable and slip-resistant	Y N N/A	
2.3.1.1	**Tread:** 280 mm to 355 mm deep	Y N N/A	
2.3.1.1	**Riser:** 125 mm to 180 mm high	Y N N/A	
2.3.1	**Open Riser:** not permitted	Y N N/A	
2.3.1.2	**Nosing Projection:** 38 mm (maximum) (see Figure 10)	Y N N/A	
2.3.1.2	**Nosing Strip**: 50 mm deep, colour contrasted, at leading edge of tread and extending the full length of the tread	Y N N/A	
2.3.1.3	**Tactile Surface Walking Indicators (TWSI):** minimum of 610 mm deep, one tread back (see Figure 11)	Y N N/A	
2.3.1	**Lighting:** to be provided in accordance with Section 5.7	Y N N/A	
2.3.2.2	**Handrail:** 865 mm to 965 mm high on both sides. (see Figure 12)	Y N N/A	

7. Building Entrance			This section does not apply ☐
Standard Ref	Requirements	Compliance	Comments
4.1.1	**Provision:** at least one (1) accessible entrance 50% of the total number of building entrances (see Figure 36)	Y N N/A	
4.1.1	**Provision:** 50% of the total number of building entrances must be accessible (see Figure 36)	Y N N/A	
4.1.1	**Provision:** 30 m or less from nearest accessible parking space, or passenger loading or drop off zones	Y N N/A	

8. Benches and Seats

This section applies to
1) Rest areas and accessible routes
2) Outdoor public use eating areas
3) Waiting areas

Standard Ref	Requirements	Compliance	Comments
2.10.1	Seat height between 450 mm and 500 mm above finished floor (see Figure 23)	Y N N/A	
2.10.1	Seat depth between 330 mm and 510 mm	Y N N/A	
2.10.1	Back support extending 320 mm (minimum) above seat surface	Y N N/A	
2.10.1	Provide at least one (1) armrest at a height between 220 mm and 300 mm from the seat for additional support	Y N N/A	

High Performance Development Standard
Tier 1 Site Plan Checklist
Example

General Project Description

Project Name	
Contact	
Site Plan Control Application Subtype	
Proposed Total Gross Floor Area (m2)	
Total number residential units	
Building Use	
Total number residential units	

This document is for illustrative purposes only to provide projects context of the information that will be required to be submitted on the HPDS Checklist

1.1 **Energy Use**

Is the project a Complex Site Plan? (if no energy requirements are not required)	

	EUI	TEDI	GHGI
Residential Building	147	62	19
Office Building	142	42	19
Retail Building	132	52	12
Energy Intensity Required* (area weighted average in a mixed use building)			
Energy Intensity of Proposed Building			

Energy thresholds become mandatory June 1, 2023.

OR

	Required	Proposed
Proposed Building Energy Use		
Reference Building Energy Use		
Percent Improvement	25%	0

OR

Commitment to pursue certification program	
Reference to Drawing, Plans, or Report	

1.2 **Site Plan Accessibility**

Are the main entrances equally accessible to all users?	
Brief Description of how accessibility is achieve on the site	
Reference to Drawing, Plans, or Report	

Accessible Grate Design

	Maximum grate	Number of grates
Grates located on path of travel	13mm diameter	
Grates located away from path of travel	20x20mm or 10x40	
Has the requirement been met and identified on the plan?		
Reference to Drawing, Plans, or Report		

Alternately grates may be screened

High Performance Development Standard
Tier 1 Site Plan Checklist
Example

1.3 **Fresh Air Intake**

Is the project located within:

150 metres of a road with an average of 50,000 vehicles or more per day	
100 metres of road with an average of 15,000 vehicles or more per day	
100 metres of idling areas (this includes onsite idling areas)	
If answered yes to any of the above provide a brief description of how the site will protect outdoor amenity and fresh air intakes from these sources of air pollution.	
Reference to Drawing, Plans, or Report	

1.4 **Tree Planting**

	Required	Proposed
Total site area (m^2)		
Total Soil Volume (m3)	0	
Total number of planting areas (minimum of $30m^3$ soil)		
Total number of trees planted		

Requirement to come in effect with the release of tree planting guidelines.

Reference to Drawing, Plans, or Report

1.5

Plant Species	Required (m^2)	Proposed (m^2)	Proposed %
Total landscaped site area			
Landscaped site area planted with drought-tolerant plants (minimum 50%)	0		
Total number of plants			
Total number of native plants and % of total plants planted (minimum 50%)	0		

Reference to Drawing, Plans, or Report

1.6 **Exterior Lighting**

All exterior lighting fixtures Dark Sky compliant	
Reference to Drawing, Plans, or Report	

1.7 **Bird Safe Design**

	Required (m^2)	Proposed (m^2)	Proposed %
Total area of glazing of all elevations within 12m above grade (including glass balcony railings)			
Total area of treated glazing (minimum 85% of total area of glazing within 12m above grade)	0		
Percentage of glazing within 12m above grade treated with:			
a) Low reflectance opaque materials			
b) Visual markers			
c) Shading			

Reference to Drawing, Plans, or Report

1.8 **Sustainable Roofing**

Does the project have a flat roof over 500 m2? If no project is not subject to cool roof requirement	Y/N

	Required (m^2)	Proposed (m^2)	Proposed %
Available Roof Space			
Available Roof Space provided as Green Roof			
Available Roof Space provided as Reflective Roof			
Available Roof Space designated Solar Ready If reflective roof path is chosen and roof area is over 2,500m2, Minimum 1,000m2 of solar ready area must be provided	1000		
Available Roof Space provided as Solar Panels			
Available Roof Space provided as Accessible Green Roof This is counted at 120% of area provided			
Available Roof Space provided as Food growing space This includes entire garden area included pathways and adjacent terraces			
Metric requirement met? (50% green, 90% white, or a combination of strategies amounting to 75%)	yes/no		
Reference to Drawing, Plans, or Report			

1.9 **Cool Landscape and Paving**

Industrial work yards or similar areas that limit the available options for shading or reflective surfaces may be excluded from the hard surface area calculation.

Projects must meet one of the following

	Required by Zoning (m2)	Proposed (m^2)	Proposed exceeding minimum %
Total non roof soft landscape area (minimum 20%)			

OR

	Required (m^2)	Proposed (m^2)	Proposed %
Total non-roof hardscape area			
Total non-roof hardscape area treated for Urban Heat Island (minimum 50%)			
Area of non-roof hardscape treated with:			
a) high-albedo surface material			
b) open-grid pavement			
c) shade from tree canopy			
d) shade from high-albedo structures			
e) shade from energy generation structures			
f) At grade parking lot area with more than 1 tree per 5 parking spaces			

Reference to Drawing, Plans, or Report	

1.10. **Common Area Waste Storage**

	Required	Proposed
Total Waste Storage Area		
Garbage		
Recycling Paper		
Recycling Plastic Metal Glass		
Compost		
Reference to Drawing, Plans, or Report		

Construction Waste Management Plan Provided	
Reference to Drawing, Plans, or Report	

1.11 **Electric Vehicle Parking**

	None Required	Proposed
Number of Resident Parking Spaces		
Number of Visitor Parking Spaces		
Number of Commercial Parking Spaces		

Number of EV Ready Parking Spaces		

Reference to Drawing, Plans, or Report	

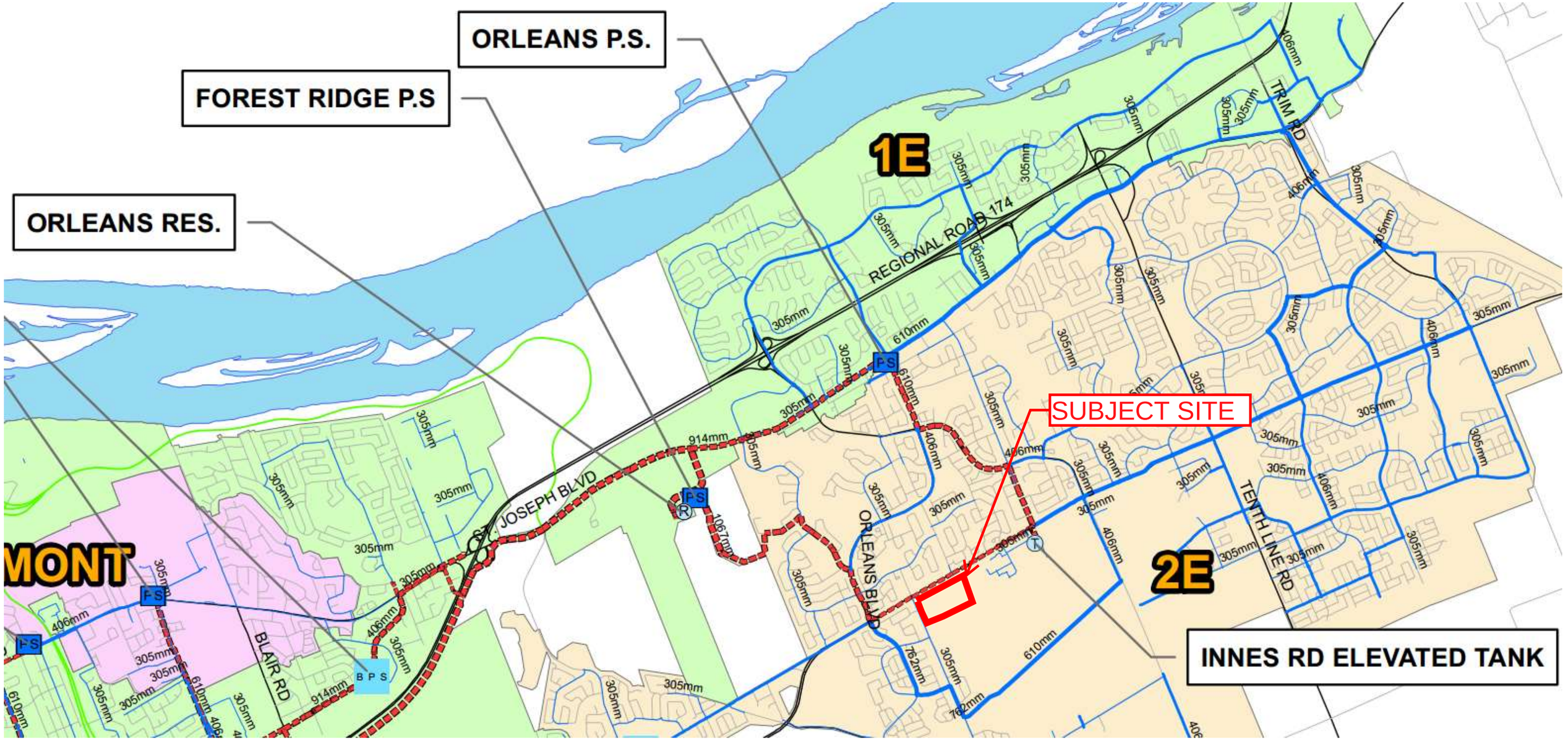
1.12 **Bike Access and Storage**

	Required by Zoning	Proposed
Number of Resident Bike Parking Spaces		
Number of Visitor Bike Parking Spaces		
Number of Commercial Bike Parking Spaces		

Does the bike parking plan meet accessibility, safety and proximity requirements?	
Reference to Drawing, Plans, or Report	

David Schaeffer Engineering Ltd.
120 Iber Road, Suite 103
Stittsville, ON K2S 1E9
613-836-0856
dsel.ca

APPENDIX B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ORLEANS RES.
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2E
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JOSEPH BLVD
BLAIR RD
ORLEANS BLVD
TENTH LINE RD
SUBJECT SITE
INNES RD ELEVATED TANK
MONT
P S
B P S
305mm
406mm
610mm
762mm
914mm

Hydraulic Capacity and Modeling Analysis Orleans Village

Technical Memorandum

FINAL

Prepared for:
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Prepared by:
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Unit 203, 2502 St. John's Street
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Submission Date: October 15, 2024

Contact: Mr. Werner de Schaetzen, Ph.D., P.Eng.
Project: 2023-075-DSE

Document History and Version Control

Revision No.	Date	Document Description	Revised By	Reviewed By
R0	July 27, 2023	Draft	Ben Loewen	Werner de Schaetzen
R1	October 11, 2024	Updated Draft	Ben Dunkley & Jim Lee	Werner de Schaetzen
R2	October 15, 2024	Final	Jim Lee	Werner de Schaetzen

Statement of Qualifications and Limitations

This document represents GeoAdvice Engineering Inc. best professional judgment based on the information available at the time of its completion and as appropriate for the project scope of work. Services performed in developing the content of this document have been conducted in a manner consistent with that level and skill ordinarily exercised by a member of the engineering profession currently practicing under similar conditions. No warranty, express or implied is made.

1 Introduction

GeoAdvice Engineering Inc. ("GeoAdvice") was retained by David Schaeffer Engineering Ltd. ("DSEL") to size the proposed water main network for the Orleans Village development ("Development") in the City of Ottawa, ON ("City").

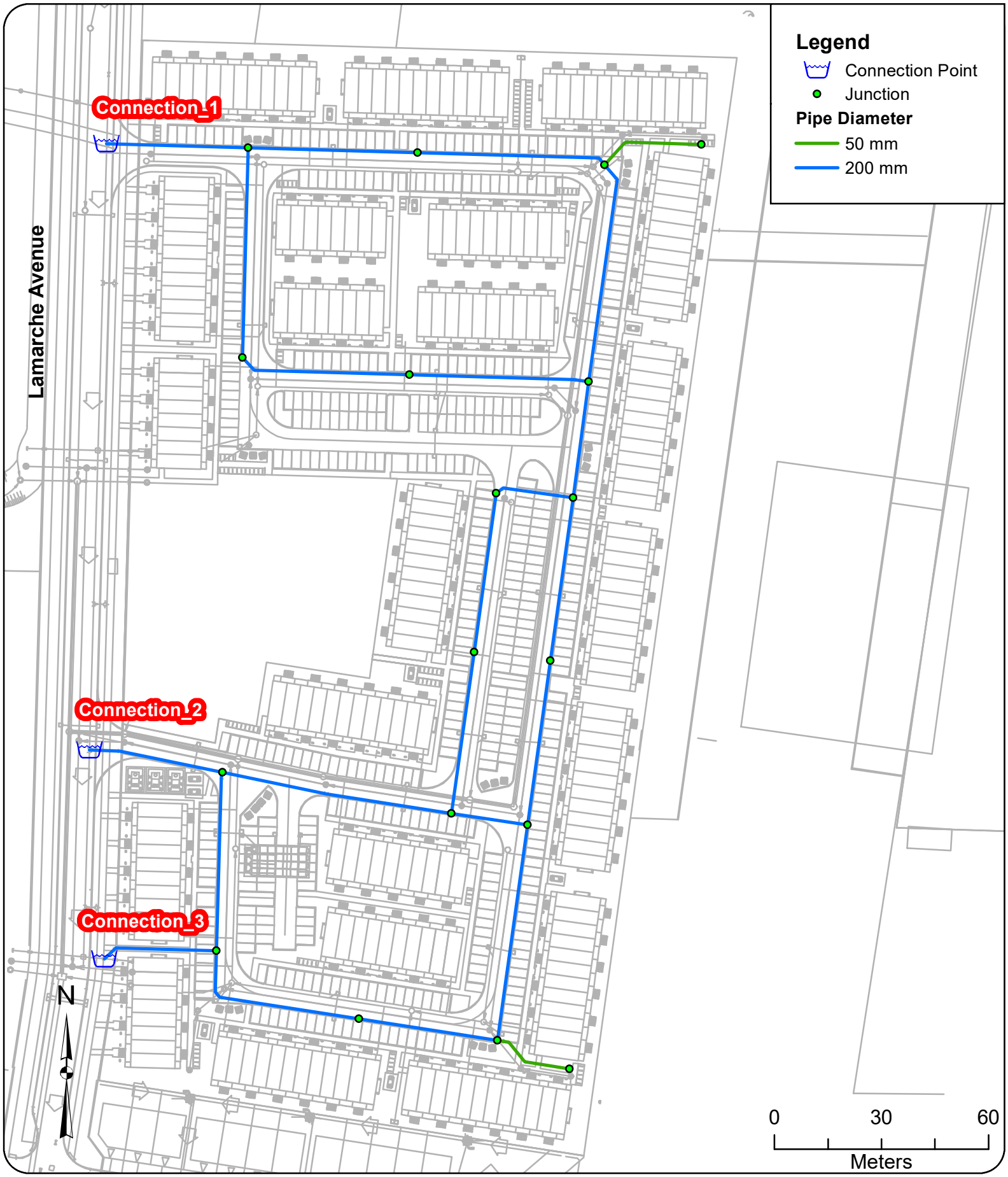
The development will have three (3) connections to the City water distribution system:

- Connection 1: North end of Lamarche Avenue
- Connection 2: 170 m South of Connection 1
- Connection 3: South end of Lamarche Avenue

The development site is shown in **Figure 1.1** on the following page, with the final recommended pipe diameters.

This memo describes the assumptions and results of the hydraulic modeling and capacity analysis using InfoWater (Innovyze), a GIS water distribution system modeling and management software application.

The results presented in this memo are based on the analysis of steady state simulations. The predicted available fire flows, as calculated by the hydraulic model, represent the flow available in the water main while maintaining a residual pressure of 20 psi at the hydrant. No extended period simulations were completed in this analysis to assess the water quality or to assess the hydraulic impact on storage and pumping.



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis**
Orleans Village
2023-075-DSE
Client: **David Schaeffer Engineering Ltd.**
Date: **October 2024**
Created by: **JL**
Reviewed by: **WdS**

Orleans Village Site Layout and Connection Point

Figure 1.1

2 Modeling Considerations

2.1 Water Main Configuration

The water main network was modeled based on drawings prepared by DSEL (1403_gen_coord .dwg) and provided to GeoAdvice on August 22, 2024.

2.2 Elevations

Elevations of the modeled junctions were assigned according to a preliminary site grading plan prepared by DSEL (1403_grad_coord.dwg) and provided to GeoAdvice on August 22, 2024.

2.3 Consumer Demands

The residential demands were based on a demand rate of 280 L/cap/d as per City of Ottawa technical bulletin ISTB 2021-03. Demand factors used for this analysis were taken according to Table 4-2 from the Ottawa design guidelines for developments of 501-3000 people. A summary of these tables highlighting relevant data for this development is shown in **Table 2.1**.

Table 2.1: City of Ottawa Demand Factors

Demand Type	Amount	Units
Average Day Demand		
Residential	280	L/c/d
Maximum Daily Demand		
Residential	2.5 x avg. day	L/c/d
Peak Hour Demand		
Residential	2.2 x max. day	L/c/d

Table 2.2 summarizes the water demand calculations for the Orleans Village development.

Table 2.2: Development Population and Demand Calculations – Orleans Village

Dwelling Type	Number of Units	Persons Per Unit*	Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
Stacked Townhome	476	2.3	1,095	3.55	8.87	19.52

*Provided by David Schaeffer Engineering (August 22, 2024).

Demands were uniformly distributed to the model nodes. Detailed calculations of demands are shown in **Appendix A**.

2.4 Fire Flow Demand

Fire flow calculations were completed in accordance with the Fire Underwriters Survey's (FUS) Water Supply for Public Fire Protection Guideline (2020). The FUS calculations yielded the following required fire flows:

- 16-unit Stacked Townhome: 8,000 L/min (133 L/s)
- 20-unit Stacked Townhome: 9,000 L/min (150 L/s)
- 24-unit Stacked Townhome: 11,000 L/min (183 L/s)

Fire flow simulations were completed at each model node. The locations of nodes do not necessarily represent hydrant locations.

Detailed FUS fire flow calculations as well as the illustrated spatial allocation of the required fire flows are shown in **Appendix B**.

2.5 Boundary Conditions

The boundary conditions were provided by the City of Ottawa in the form of Hydraulic Grade Line (HGL) at the following locations:

- Connection 1: North end of Lamarche Avenue
- Connection 2: 170 m South of Connection 1
- Connection 3: South end of Lamarche Avenue

The above connection points are illustrated in **Figure 1.1**.

Boundary conditions were provided for Peak Hour (PHD), Maximum Day plus Fire (MDD+FF) and Average Day (ADD) demand conditions.

The City boundary conditions were provided to GeoAdvice on October 4, 2024, and can be found in **Appendix C**.

Table 2.3 summarizes the City of Ottawa boundary conditions used to size the water network.

Table 2.3: Boundary Conditions

Condition	Connection 1 HGL (m)	Connection 2 HGL (m)	Connection 3 HGL (m)
Average Day (max. pressure)	130.8	130.8	130.8
Peak Hour (min. pressure)	127.2	127.2	127.2
Max Day + Fire Flow (133 L/s)	127.9	127.1	126.9
Max Day + Fire Flow (150 L/s)	127.5	126.6	126.3
Max Day + Fire Flow (183 L/s)	126.6	125.3	124.9

3 Hydraulic Capacity Design Criteria

3.1 Pipe Characteristics

Pipe characteristics of internal diameter (ID) and Hazen-Williams C factors were assigned in the model according to the City of Ottawa Design Guidelines for PVC water main material. Pipe characteristics used for the development are outlined in **Table 3.1** below.

Table 3.1: Model Pipe Characteristics

Nominal Diameter (mm)	ID PVC (mm)	Hazen Williams C-Factor (/)
150	155	100
200	204	110
250	250	110
300	297	120
400	400	120

3.2 Pressure Requirements

As outlined in the City of Ottawa Design Guidelines, the generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi). Pressure requirements are outlined in **Table 3.2.**

Table 3.2: Pressure Requirements

Demand Condition	Minimum Pressure		Maximum Pressure	
	(kPa)	(psi)	(kPa)	(psi)
Normal Operating Pressure (maximum daily flow)	350	50	480	70
Peak Hour Demand (minimum allowable pressure)	276	40	-	-
Maximum Fixture Pressure (Ontario Building Code)	-	-	552	80
Maximum Distribution Pressure (minimum hour check)	-	-	552	80
Maximum Day Plus Fire	140	20	-	-

4 Hydraulic Capacity Analysis

The proposed water mains within the development were sized to the minimum diameter which would satisfy the greater of maximum day plus fire and peak hour demand. Modeling was carried out for average day, peak hour and maximum day plus fire flow using InfoWater.

4.1 Development Pressure Analysis

The modeling results indicate that the development can be adequately serviced by the proposed water main layout shown in **Figure 1.1**. Modeled service pressures for the development are summarized in **Table 4.1** below.

Table 4.1: Summary of the Orleans Village Available Service Pressures

Average Day Demand Maximum Pressure	Peak Hour Demand Minimum Pressure
59 psi (410 kPa)	51 psi (355 kPa)

As outlined in the City of Ottawa Design Guidelines, the generally accepted best practice is to design new water distribution systems to operate between 350 kPa (50 psi) and 480 kPa (70 psi). The maximum pressure at any point in the distribution system in occupied areas outside of the public right-of-way shall not exceed 552 kPa (80 psi). As such, based on the City boundary conditions for the average day demand scenario, the model does not predict that pressure reducing valves are required throughout the development.

4.2 Development Fire Flow Analysis

Summaries of the minimum available fire flows in the development are shown in **Table 4.2**.

Table 4.2: Summary of the Orleans Village Minimum Available Fire Flows

Required Fire Flow*	Minimum Available Flow	Junction ID
150 L/s	361 L/s	JCT-006
183 L/s	339 L/s	JCT-003

*In the event the contributing area to a model node contained multiple flow requirements (e.g. 133 L/s and 150 L/s), the higher required fire flow was allocated. A flow rate of 133 L/s was not simulated.

As shown in **Table 4.2**, the fire flow requirements can be met at all junctions within the development. High available fire flows (>500 L/s) are theoretical values. Actual available fire flow is limited by the hydraulic losses through the hydrant lateral and hydrant port sizes.

Detailed fire flow results illustrating the fire flow results can be found in **Appendix D.**

Submission

Prepared by:

Jim Lee, E.I.T.
Project Engineer

Approved by:

Werner de Schaetzen, Ph.D., P.Eng.
Senior Modeling Review

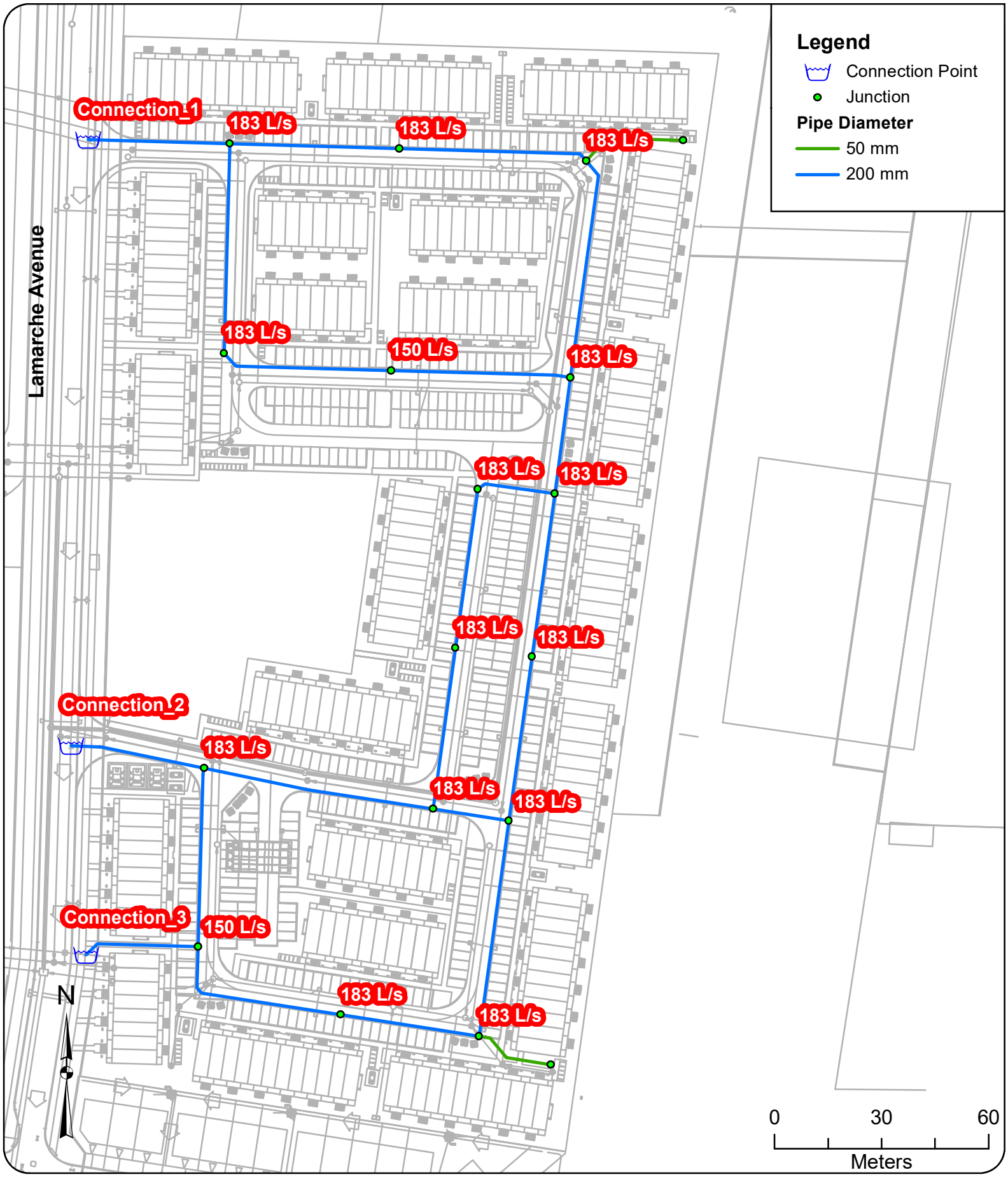
Appendix A Water Demand Calculations

Consumer Water Demands

Orleans Village - Residential Demands

Dwelling Type	Number of Units	Population		Average Day Demand			Max Day 2.5 x Avg. Day (L/s)	Peak Hour 2.2 x Max. Day (L/s)
		Persons per Unit	Population Per Dwelling Type	(L/c/d)	(L/d)	(L/s)		
Stacked Townhome	476	2.3	1,095	280	306,600	3.55	8.87	19.52
Subtotal	**476**		**1,095**		**306,600**	**3.55**	**8.87**	**19.52**

Appendix B FUS Fire Flow Calculations



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis**
Orleans Village
2023-075-DSE
Client: **David Schaeffer Engineering Ltd.**
Date: **October 2024**
Created by: **JL**
Reviewed by: **WdS**

Required Fire Flow

Figure B.1

FUS Required Fire Flow Calculation

Client: David Schaeffer Engineering Ltd.
Project: 2023-075-DSE
Development: Orleans Village — Townhouse Block 10 (24 units)
Zoning: Multi Family Residential — No firewall considered
Date: September 27, 2024

Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 2020.

A. Type of Construction: Ordinary Construction

B. Ground Floor Area: 573 m^2

Note: FUS assumptions based on FUS data provided by DSEL on August 22, 2024 and September 12, 2024.

C. Number of Storeys: 3

D. Required Fire Flow*: $F = 220C\sqrt{A}$

C: Coefficient related to the type of construction — **C =** 1

A: Effective area — **A =** 1719 m^2

The total floor area in m^2 in the building being considered

F = 9,121 L/min — **D =** 9,000 L/min*

E. Occupancy

Occupancy content hazard: Limited Combustible — -15 % of **D** **-1,350 L/min** — **E =** 7,650 L/min

F. Sprinkler Protection

Automatic sprinkler protection: None — 0 % of **E** **0 L/min** — **F =** 7,650 L/min

G. Exposures

Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure	Exposure
North	20.1 to 30 m	61-80 m-storeys	Ordinary or Mass Timber with Unprotected Openings	3%
East	3.1 to 10 m	41-60 m-storeys	Ordinary or Mass Timber with Unprotected Openings	12%
South	3.1 to 10 m	Over 100 m-storeys	Wood Frame	20%
West	3.1 to 10 m	41-60 m-storeys	Ordinary or Mass Timber with Unprotected Openings	12%
			Total	**47%**

% of **E** **+ 3,596 L/min** — **G =** 11,246 L/min

H. Wood Shake Charge — No — **0 L/min** — **H =** 11,246 L/min

For wood shingle or shake roofs

Total Fire Flow Required	**11,000**	**L/min****
	183	**L/s**
Required Duration of Fire Flow	**2.25**	**Hrs**
Required Volume of Fire Flow	**1,485**	**m^3**

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Orleans Village development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change, the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

** Rounded to the nearest 1,000 L/min

FUS Required Fire Flow Calculation

Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 2020.

Client: David Schaeffer Engineering Ltd.
Project: 2023-075-DSE
Development: Orleans Village — Townhouse Block 17 (20-units)
Zoning: Multi Family Residential — No firewall considered
Date: September 27, 2024

A. Type of Construction: Ordinary Construction

B. Ground Floor Area: 478 m^2

Note: FUS assumptions based on FUS data provided by DSEL on August 22, 2024 and September 12, 2024.

C. Number of Storeys: 3

D. Required Fire Flow*: $F = 220C\sqrt{A}$

C: Coefficient related to the type of construction — **C =** 1

A: Effective area — **A =** 1434 m^2

The total floor area in m^2 in the building being considered

F = 8,331 L/min — **D =** 8,000 L/min*

E. Occupancy

Occupancy content hazard	Limited Combustible	-15	% of **D**	**-1,200** L/min	**E =** 6,800 L/min

F. Sprinkler Protection

Automatic sprinkler protection	None	0	% of **E**	**0** L/min	**F =** 6,800 L/min

G. Exposures

Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure	Exposure
North	20.1 to 30 m	81-100 m-storeys	Ordinary or Mass Timber with Unprotected Openings	4%
East	20.1 to 30 m	41-60 m-storeys	Ordinary or Mass Timber with Unprotected Openings	2%
South	3.1 to 10 m	Over 100 m-storeys	Ordinary or Mass Timber with Unprotected Openings	15%
West	10.1 to 20 m	41-60 m-storeys	Ordinary or Mass Timber with Unprotected Openings	7%
			Total	**28%**

% of **E** **+ 1,904** L/min — **G =** 8,704 L/min

H. Wood Shake Charge — No — **0** L/min — **H =** 8,704 L/min

For wood shingle or shake roofs

Total Fire Flow Required	**9,000**	**L/min****
	150	**L/s**
Required Duration of Fire Flow	**2**	**Hrs**
Required Volume of Fire Flow	**1,080**	**m^3**

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Orleans Village development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change, the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

** Rounded to the nearest 1,000 L/min

FUS Required Fire Flow Calculation

Client: David Schaeffer Engineering Ltd.
Project: 2023-075-DSE
Development: Orleans Village — Townhouse Block 18 (16-units)
Zoning: Multi Family Residential — No firewall considered
Date: September 27, 2024

Calculations Based on "Water Supply for Public Fire Protection", Fire Underwriters Survey, 2020.

A. Type of Construction: Ordinary Construction

B. Ground Floor Area: 383 m^2

Note: FUS assumptions based on FUS data provided by DSEL on August 22, 2024 and September 12, 2024.

C. Number of Storeys: 3

D. Required Fire Flow*: $F = 220C\sqrt{A}$

C: Coefficient related to the type of construction — **C =** 1

A: Effective area — **A =** 1149 m^2

The total floor area in m^2 in the building being considered

F = 7,458 L/min — **D =** 7,000 L/min*

E. Occupancy

Occupancy content hazard: Limited Combustible — -15 % of **D** **-1,050 L/min** — **E =** 5,950 L/min

F. Sprinkler Protection

Automatic sprinkler protection: None — 0 % of **E** **0 L/min** — **F =** 5,950 L/min

G. Exposures

Side	Separation Distance	Length-Height Factor - Adjacent Structure	Construction Type - Adjacent Structure	Exposure
North	20.1 to 30 m	61-80 m-storeys	Ordinary or Mass Timber with Unprotected Openings	3%
East	10.1 to 20 m	41-60 m-storeys	Ordinary or Mass Timber with Unprotected Openings	7%
South	3.1 to 10 m	81-100 m-storeys	Ordinary or Mass Timber with Unprotected Openings	14%
West	10.1 to 20 m	41-60 m-storeys	Ordinary or Mass Timber with Unprotected Openings	7%
			Total	**31%**

% of **E** **+ 1,845 L/min** — **G =** 7,795 L/min

H. Wood Shake Charge — No — **0 L/min** — **H =** 7,795 L/min

For wood shingle or shake roofs

Total Fire Flow Required	**8,000**	**L/min****
	133	**L/s**
Required Duration of Fire Flow	**2**	**Hrs**
Required Volume of Fire Flow	**960**	**m^3**

*Rounded to the nearest 1,000 L/min

The Total Required Fire Flow for the Orleans Village development should be reviewed when drawings and site plans have been finalized. The Total Required Fire Flow may be reduced or increased depending on area, construction, occupancy, exposures, and level of sprinkler protection. If any of these items change, the Total Required Fire Flow should be reviewed to determine the impact.

Consideration should be given for fire prevention during construction phases as the required fire flows during construction of buildings is substantially higher than after the buildings are occupied. This is due to exposed framing and inactive sprinkler systems. Fires starting in unprotected portion of buildings quickly become too strong for sprinkler systems in protected portion of buildings. As such, special precautions should be taken any time construction is occurring.

* The amount and rate of water application required in firefighting to confine and control the fires possible in a building or group of buildings which comprise essentially the same fire area by virtue of immediate exposure.

** Rounded to the nearest 1,000 L/min

Appendix C Boundary Conditions

Boundary Conditions
245 – 275 Lamarche

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	213	3.55
Maximum Daily Demand	532	8.87
Peak Hour	1,171	19.52
Fire Flow Demand #1	8,000	133.33
Fire Flow Demand #2	9,000	150.00
Fire Flow Demand #3	11,000	183.33

Location

Results

Connection 1 - Lamarche North

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	130.8	57.0
Peak Hour	127.2	52.0
Max Day plus Fire Flow #1	127.9	52.9
Max Day plus Fire Flow #2	127.5	52.4
Max Day plus Fire Flow #3	126.6	51.1
[1] Ground Elevation =	90.7	m

Connection 2 - Lamarche Middle

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	130.8	58.6
Peak Hour	127.2	53.5
Max Day plus Fire Flow #1	127.1	53.5
Max Day plus Fire Flow #2	126.6	52.7
Max Day plus Fire Flow #3	125.3	50.8
[1] Ground Elevation =	89.5	m

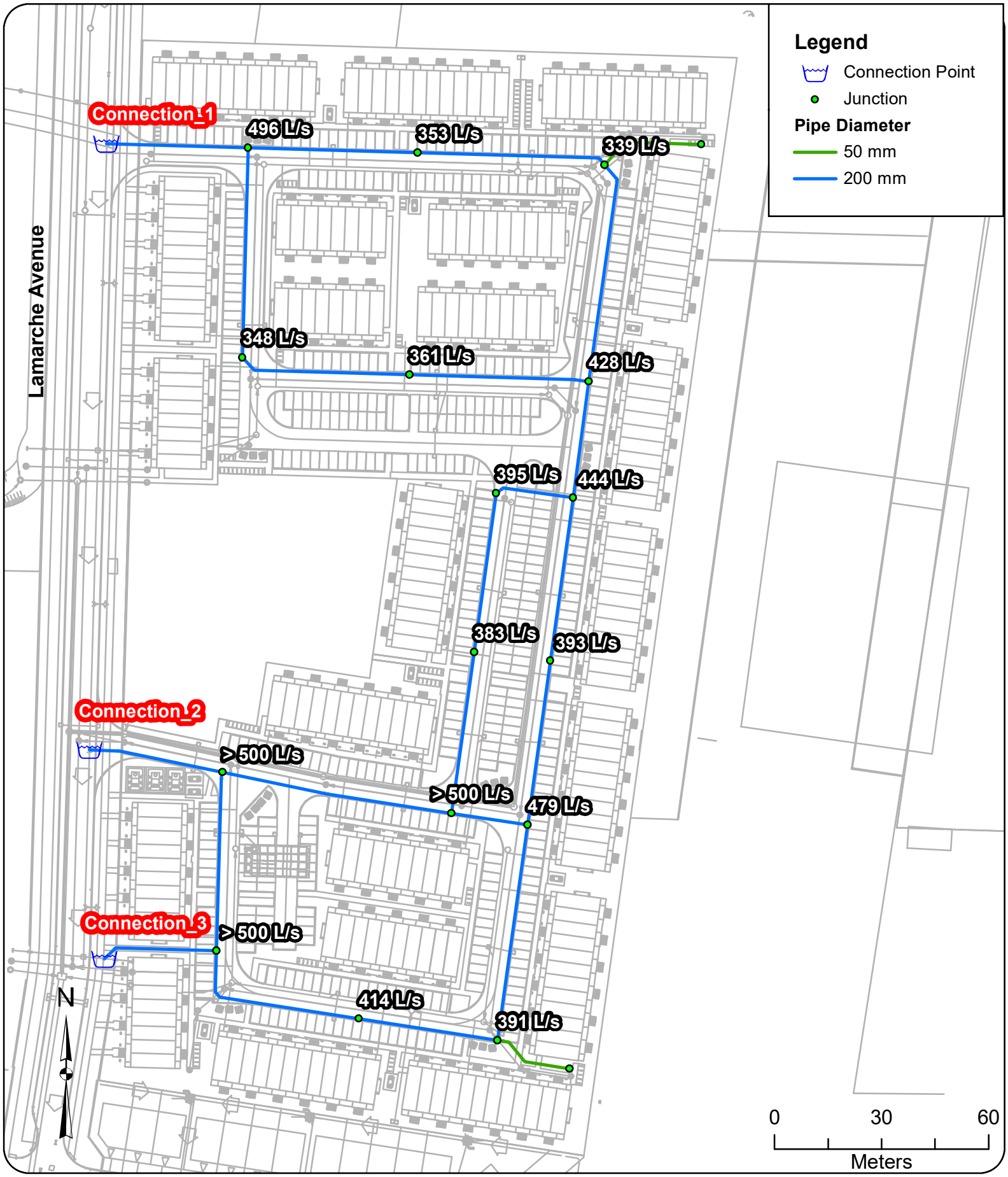
Connection 3 - Lamarche South

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	130.8	59.3
Peak Hour	127.2	54.2
Max Day plus Fire Flow #1	126.9	53.8
Max Day plus Fire Flow #2	126.3	53.0
Max Day plus Fire Flow #3	124.9	50.9
[1] Ground Elevation =	89.0	m

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

Appendix D Fire Flow Results



GeoAdvice Engineering Inc.

Project: **Hydraulic Capacity and Modeling Analysis**
Orleans Village
2023-075-DSE
Client: **David Schaeffer Engineering Ltd.**
Date: **October 2024**
Created by: **JL**
Reviewed by: **WdS**

Available Fire Flow at 20 PSI

Figure D.1

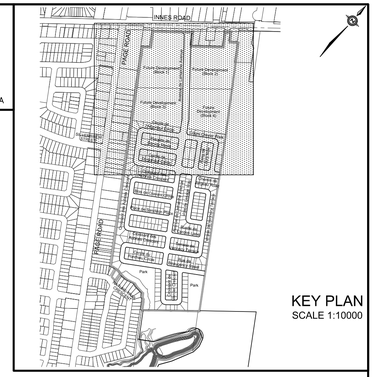
David Schaeffer Engineering Ltd.
120 Iber Road, Suite 103
Stittsville, ON K2S 1E9
613-836-0856
dsel.ca

APPENDIX C

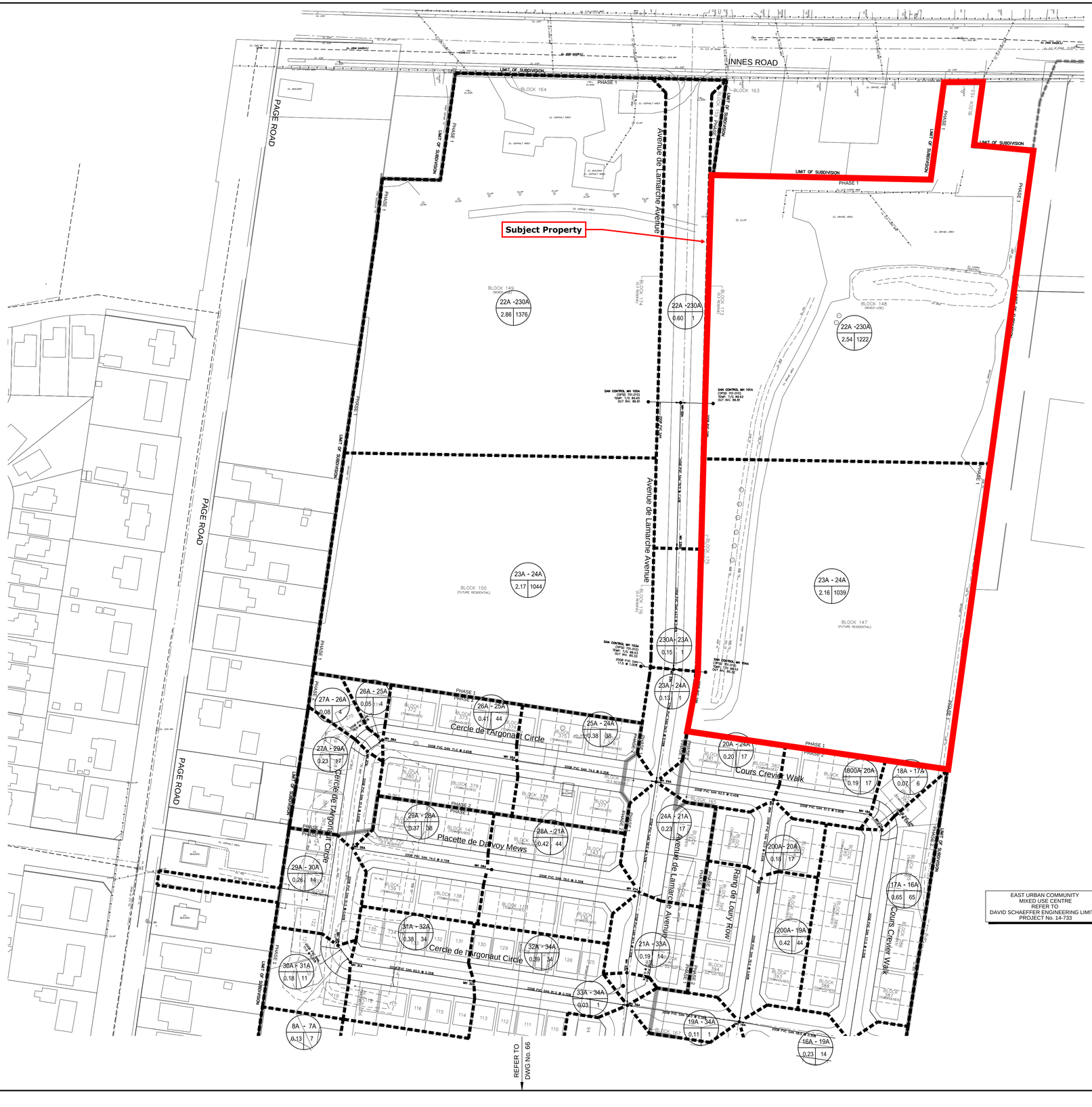
APPROVED ☐ REFUSED ☐

THIS ____ DAY OF _____, 20____

JOSHUA WHITE, P.ENG
PROJECT MANAGER – EAST BRANCH
PLANNING, INFRASTRUCTURE & ECONOMIC
DEVELOPMENT DEPARTMENT, CITY OF OTTAWA



KEY PLAN
SCALE 1:10000



LEGEND

- SANITARY DRAINAGE BOUNDARY
- SANITARY SUB-DRAINAGE BOUNDARY
- SANITARY DRAINAGE BOUNDARY (OTHER PHASES)
- UPSTREAM MH TO DOWNSTREAM MH / AREA IN HECTARES / POPULATION — 43A - 44A | 0.78 | 61
- UPSTREAM MH TO DOWNSTREAM MH / AREA IN OTHER PHASES IN HECTARES / POPULATION — 43A-44A | 0.78 | 61
- EXTERNAL AREA IN HECTARES — A=53.63
- EXTERNAL POPULATION — POP=5739
- DENSITY (PERSONS/HECTARE) — 107
- EXTERNAL LAND USE — RESIDENTIAL
- MAINTENANCE HOLE — 200mm Ø SDS MH202A
- CAP

TOPOGRAPHIC INFORMATION

TOPOGRAPHIC INFORMATION PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16-10-116-00. SURVEYS DATED NOVEMBER 30, 2017.

LEGAL INFORMATION

CALCULATED M-PLAN PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16-10-116-00 (PHASE 1 & 2) DATED SEPTEMBER 14, 2018.

ELEVATION NOTE ELEVATION = 86.12 m

ELEVATIONS ARE GEODETIC AND ARE DERIVED FROM SITE BENCHMARK NCC CONTROL POINT 001196330229 HAVING A PUBLISHED ELEVATION OF 86.12m

EAST URBAN COMMUNITY
MIXED USE CENTRE
REFER TO
DAVID SCHAEFFER ENGINEERING LIMITED
PROJECT No. 14-733

No.	DATE	BY	DESCRIPTION
6.	18-10-30	M.Z.	REVISED M-PLAN
5.	18-07-27	M.Z.	REVISED WEST BOUNDARY STORM SYSTEM
4.	18-07-10	M.Z.	MYLARS FOR PHASE 1 COMMENCE WORK
3.	18-06-28	M.Z.	REVISED AS PER CITY AND UTILITY COMMENTS
2.	18-05-09	M.Z.	ISSUED FOR MOE APPROVAL
1.	18-01-24	M.Z.	1st SUBMISSION

Ottawa CITY OF OTTAWA

PROJECT No. 16-881

LICENSED PROFESSIONAL ENGINEER
M.ZDRAVEVSKI
100130902
18-10-30
PROVINCE OF ONTARIO

SANITARY DRAINAGE PLAN

© DSEL

CAIVAN (ORLEANS VILLAGE) LIMITED

ORLEANS VILLAGE

DSEL david schaeffer engineering ltd
120 Iber Road, Unit 103
Stittsville, ON K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

DRAWN BY: M.Z./J.Y.	CHECKED BY: P.P.	DRAWING NO.	SHEET NO.
DESIGNED BY: P.P.	CHECKED BY: M.Z.		65
SCALE: 1:1000	DATE: JANUARY 2018		

CITY FILE No. D07-16-16-0022 CITY PLAN No. 17675

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION							COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE							
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	**SLOPE AS-BUILT (%)**	CAP (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
Rang de Loury Row - 03																												
	200A	19A	0.42		44	0.42	44	3.66	0.52								0.42	0.42	0.14	0.66	76.00	200	0.90	**0.88**	30.77	0.02	0.98	0.38
To Chemin de Jargeau Road, Pipe 19A - 34A						0.42	44											0.42										
	200A	20A	0.18		17	0.18	17	3.71	0.20								0.18	0.18	0.06	0.26	42.00	200	0.65	**0.60**	25.41	0.01	0.81	0.26
To Cours Crevier Walk, Pipe 20A - 24A						0.18	17											0.18										
Cercle de l'Argonaut Circle - 12																												
	27A	26A	0.08		4	0.08	4	3.76	0.05								0.08	0.08	0.03	0.08	10.00	200	0.65	**0.80**	29.34	0.00	0.93	0.06
			0.05		4	0.13	8										0.05	0.13										
	26A	25A	0.41		44	0.54	52	3.65	0.62								0.41	0.54	0.18	0.80	71.00	200	0.65	**0.63**	26.03	0.03	0.83	0.37
	25A	24A	0.38		38	0.92	90	3.60	1.05								0.38	0.92	0.30	1.35	74.00	200	0.35	**0.36**	19.68	0.07	0.63	0.36
To Avenue de Lamarche Avenue, Pipe 24A - 21A						0.92	90											0.92										
	27A	29A	0.23		17	0.23	17	3.71	0.20								0.23	0.23	0.08	0.28	51.50	200	0.65	**0.67**	26.85	0.01	0.85	0.27
	29A	30A	0.26		14	0.49	31	3.68	0.37								0.26	0.49	0.16	0.53	51.50	200	0.60	**0.47**	22.49	0.02	0.72	0.28
	30A	31A	0.18		11	0.67	42	3.66	0.50								0.18	0.67	0.22	0.72	11.00	200	0.35	**0.62**	25.83	0.03	0.82	0.36
	31A	32A	0.38		34	1.05	76	3.62	0.89								0.38	1.05	0.35	1.24	65.50	200	0.35	**0.35**	19.40	0.06	0.62	0.34
	32A	34A	0.39		34	1.44	110	3.59	1.28								0.39	1.44	0.48	1.76	81.50	200	0.35	**0.38**	20.22	0.09	0.64	0.40
To Avenue de Lamarche Avenue, Pipe 34A - 35A						1.44	110											1.44										
Placette de Darvoy Mews - 13																												
	29A	28A	0.37		38	0.37	38	3.67	0.45								0.37	0.37	0.12	0.57	74.00	200	0.75	**0.73**	28.02	0.02	0.89	0.35
	28A	21A	0.42		44	0.79	82	3.61	0.96								0.42	0.79	0.26	1.22	78.00	200	0.35	**0.33**	18.84	0.06	0.60	0.33
To Avenue de Lamarche Avenue, Pipe 21A - 33A						0.79	82											0.79										
Croissant des Aubrais Crescent - 10																												
	8A	9A	0.55		41	0.55	41	3.67	0.49								0.55	0.55	0.18	0.67	75.00	200	0.65	**0.67**	26.85	0.02	0.85	0.33
	9A	35A	0.30		24	0.85	65	3.63	0.76								0.30	0.85	0.28	1.04	72.50	200	0.35	**0.32**	18.55	0.06	0.59	0.32
To Avenue de Lamarche Avenue, Pipe 35A - 36A						0.85	65											0.85										
	8A	7A	0.13		7	0.13	7	3.74	0.08								0.13	0.13	0.04	0.12	10.00	200	0.65	**0.90**	31.12	0.00	0.99	0.06
	7A	38A	0.23		14	0.36	21	3.70	0.25								0.23	0.36	0.12	0.37	51.50	200	0.35	**0.31**	18.26	0.02	0.58	0.23
To Bois de Cravant Grove, Pipe 38A - 37A						0.36	21											0.36										
	38A	40A	0.25		17	0.25	17	3.71	0.20								0.25	0.25	0.08	0.28	59.00	200	0.65	**0.64**	26.24	0.01	0.84	0.27
	40A	41A	0.22		14	0.47	31	3.68	0.37								0.22	0.47	0.16	0.53	51.50	200	0.35	**0.39**	20.48	0.03	0.65	0.29
	41A	42A	0.14		7	0.61	38	3.67	0.45								0.14	0.61	0.20	0.65	10.00	200	0.35	**0.70**	27.44	0.02	0.87	0.34
	42A	43A	0.40		34	1.01	72	3.62	0.84								0.40	1.01	0.33	1.17	69.00	200	0.35	**0.32**	18.55	0.06	0.59	0.32
	43A	52A	0.36		31	1.37	103	3.59	1.20								0.36	1.37	0.45	1.65	78.00	200	0.35	**0.35**	19.40	0.09	0.62	0.38
To Avenue de Lamarche Avenue, Pipe 52A - 53A						1.37	103											1.37										
Bois de Cravant Grove - 14																												
Contribution From Croissant des Aubrais Crescent, Pipe 7A - 38A						0.36	21										0.36	0.36										
	38A	37A	0.39		34	0.75	55	3.64	0.65								0.39	0.75	0.25	0.90	69.50	200	0.35	**0.35**	19.40	0.05	0.62	0.32
	37A	36A	0.34		28	1.09	83	3.61	0.97								0.34	1.09	0.36	1.33	85.00	200	0.35	**0.39**	20.48	0.06	0.65	0.36
To Avenue de Lamarche Avenue, Pipe 36A - 44A						1.09	83											1.09										

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha			
Average Daily Flow =	280	l/p/day			Industrial Peak Factor = as per MOE Graph		
Comm/Inst Flow =	28000	L/ha/da	0.5787	l/s/Ha	Extraneous Flow =	0.330	L/s/ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha	Minimum Velocity =	0.600	m/s
Max Res. Peak Factor =	4.00				Manning's n = (Conc)	0.013	(Pvc) 0.013
Commercial/Inst./Park Peak Factor =	1.00				Townhouse coeff=	2.7	
Institutional =	0.32	l/s/Ha			Single house coeff=	3.4	

Designed: P.P

Checked: M.Z

Dwg. Reference:
Sanitary Drainage Plan, Dwgs. No.

PROJECT: **ORLEANS VILLAGE**

LOCATION: **City of Ottawa**

File Ref: 16-881

Date: 27/07/2018

Sheet No. 1 of 4

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION							COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE							
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	**SLOPE AS-BUILT (%)**	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
Place de Sandillon Place - 11																												
	40A	39A	0.38		34	0.38	34	3.68	0.41								0.38	0.38	0.13	0.54	69.50	200	0.65	**0.63**	26.03	0.02	0.83	0.32
	39A	44A	0.34		28	0.72	62	3.64	0.73								0.34	0.72	0.24	0.97	85.00	200	0.40	**0.33**	18.84	0.05	0.60	0.31
To Avenue de Lamarche Avenue, Pipe 44A - 52A						0.72	62											0.72										
Cours Crevier Walk- 02																												
	18A	17A	0.07		6	0.07	6	3.75	0.07								0.07	0.07	0.02	0.09	10.00	200	0.65	**0.57**	24.76	0.00	0.79	0.05
	17A	16A	0.65		65	0.72	71	3.63	0.84								0.65	0.72	0.24	1.08	111.50	200	0.35	**0.33**	18.84	0.06	0.60	0.33
To Chemin de Jargeau Road, Pipe 16A - 19A						0.72	71											0.72										
	18A	20A	0.19		17	0.19	17	3.71	0.20								0.19	0.19	0.06	0.26	51.50	200	0.80	**0.80**	29.34	0.01	0.93	0.30
Contribution From Rang de Loury Row, Pipe 200A - 20A						0.18	17										0.18	0.37										
	20A	24A	0.20		17	0.57	51	3.65	0.60								0.20	0.57	0.19	0.79	62.50	200	0.45	**0.37**	19.95	0.04	0.64	0.31
To Avenue de Lamarche Avenue, Pipe 24A - 21A						0.57	51											0.57										
Chemin de Jargeau Road - 04																												
	10A	16A	0.12		7	0.12	7	3.74	0.08								0.12	0.12	0.04	0.12	26.50	200	0.65		26.44	0.00	0.84	0.05
Contribution From Cours Crevier Walk, Pipe 17A - 16A						0.72	71										0.72	0.84										
	16A	19A	0.23		14	1.07	92	3.60	1.07								0.23	1.07	0.35	1.42	58.50	200	0.35	**0.41**	21.00	0.07	0.67	0.38
Contribution From Rang de Loury Row, Pipe 200A - 19A						0.42	44										0.42	1.49										
	19A	34A	0.11		1	1.60	137	3.56	1.58								0.11	1.60	0.53	2.11	59.00	200	0.35	**0.32**	18.55	0.11	0.59	0.38
To Avenue de Lamarche Avenue, Pipe 34A - 35A						1.60	137											1.60										
Voie de Lesage Way - 05																												
	190A	15A	0.21		14	0.21	14	3.72	0.17								0.21	0.21	0.07	0.24	42.50	200	0.65	**0.67**	26.85	0.01	0.85	0.27
	15A	14A	0.60		55	0.81	69	3.63	0.81								0.60	0.81	0.27	1.08	106.50	200	0.35	**0.36**	19.68	0.05	0.63	0.33
	14A	13A	0.13		7	0.94	76	3.62	0.89								0.13	0.94	0.31	1.20	11.50	200	0.35	**0.34**	19.12	0.06	0.61	0.34
	13A	45A	0.16		11	1.10	87	3.61	1.02								0.16	1.10	0.36	1.38	49.00	200	0.35	**0.36**	19.68	0.07	0.63	0.36
To Terrase de Vennecy Terrace, Pipe 45A - 47A						1.10	87											1.10										
Terrase de Vennecy Terrace - 06																												
	15A	11A	0.15		11	0.15	11	3.73	0.13								0.15	0.15	0.05	0.18	49.00	200	0.65	**0.65**	26.44	0.01	0.84	0.27
	11A	12A	0.11		7	0.26	18	3.71	0.22								0.11	0.26	0.09	0.31	11.50	200	0.35	**0.35**	19.40	0.02	0.62	0.24
	12A	45A	0.64		55	0.90	73	3.62	0.86								0.64	0.90	0.30	1.16	106.50	200	0.35	**0.35**	19.40	0.06	0.62	0.34
Contribution From Voie de Lesage Way, Pipe 13A - 45A						1.10	87										1.10	2.00										
	45A	47A	0.43		31	2.43	191	3.52	2.18								0.43	2.43	0.80	2.98	111.00	250	0.30	**0.33**	34.16	0.09	0.70	0.43
	47A	48A	0.12		7	2.55	198	3.52	2.26								0.12	2.55	0.84	3.10	10.50	250	0.30	**0.38**	36.66	0.08	0.75	0.45
	48A	53A	0.59		55	3.14	253	3.49	2.86								0.59	3.14	1.04	3.90	108.50	250	0.30	**0.30**	32.57	0.12	0.66	0.44
To Avenue de Lamarche Avenue, Pipe 53A - 55A						3.14	253											3.14										
Ruelle de Carden Lane - 07																												
	46A	52A	0.56		48	0.56	48	3.65	0.57								0.56	0.56	0.18	0.75	105.50	200	0.65	**0.64**	26.24	0.03	0.84	0.37
To Avenue de Lamarche Avenue, Pipe 52A - 53A						0.56	48											0.56										

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha			
Average Daily Flow =	280	l/p/day			Industrial Peak Factor = as per MOE Graph		
Comm/Inst Flow =	28000	L/ha/da	0.5787	l/s/Ha	Extraneous Flow =	0.330	L/s/ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha	Minimum Velocity =	0.600	m/s
Max Res. Peak Factor =	4.00				Manning's n = (Conc)	0.013 (Pvc)	0.013
Commercial/Inst./Park Peak Factor =	1.00				Townhouse coeff=	2.7	
Institutional =	0.32	l/s/Ha			Single house coeff=	3.4	

Designed: P.P

Checked: M.Z

Dwg. Reference:
Sanitary Drainage Plan, Dwgs. No.

PROJECT: **ORLEANS VILLAGE**

LOCATION: **City of Ottawa**

File Ref: 16-881 | Date: 27/07/2018 | Sheet No. 2 of 4

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION				RESIDENTIAL AREA AND POPULATION							COMM		INSTIT		PARK		C+I+I	INFILTRATION					PIPE							
STREET		FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	**SLOPE AS-BUILT (%)**	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
Croissant de Mercier Crescent- 09																													
		4A	5A	0.13		7	0.13	7	3.74	0.08								0.13	0.13	0.04	0.12	7.00	200	0.95	**0.71**	27.64	0.00	0.88	0.05
		5A	6A	0.61		48	0.74	55	3.64	0.65								0.61	0.74	0.24	0.89	107.50	200	0.50	**0.53**	23.88	0.04	0.76	0.36
To Cercle du Ponthieu Circle, Pipe 6A - 55A							0.74	55											0.74										
		4A	3A	0.21		11	0.21	11	3.73	0.13								0.21	0.21	0.07	0.20	46.50	200	0.65	**0.62**	25.83	0.01	0.82	0.26
		3A	2A	0.08		4	0.29	15	3.72	0.18								0.08	0.29	0.10	0.28	10.50	200	0.35	**0.45**	22.00	0.01	0.70	0.22
		2A	54A	0.60		51	0.89	66	3.63	0.78								0.60	0.89	0.29	1.07	100.50	200	0.35	**0.41**	21.00	0.05	0.67	0.35
		54A	55A	0.05		4	0.94	70	3.63	0.82								0.05	0.94	0.31	1.13	13.50	200	0.35	**0.67**	26.85	0.04	0.85	0.41
To Cercle du Ponthieu Circle, Pipe 55A - 58A							0.94	70											0.94										
Avenue de Lamarche Avenue - 01																													
				0.60		1	0.60	1			2.54	2.54						3.14	3.14										
				2.54		1222	3.14	1223			2.86	5.40						5.40	8.54										
		22A	230A	2.86		1376	6.00	2599	3.00	25.27		5.40					1.75	2.86	11.40	3.76	30.78	76.50	250	1.20	**1.22**	65.68	0.47	1.34	1.31
		230A	23A	0.15		1	6.15	2600	3.00	25.28		5.40					1.75	0.15	11.55	3.81	30.84	63.50	250	0.85	**0.85**	54.83	0.56	1.12	1.15
				0.13		1	6.28	2601				5.40						0.13	11.68										
				2.16		1039	8.44	3640				5.40						2.16	13.84										
		23A	24A	2.17		1044	10.61	4684	2.82	42.81		5.40					1.75	2.17	16.01	5.28	49.84	59.50	375	0.29	**0.29**	94.42	0.53	0.85	0.86
Contribution From Cours Crevier Walk, Pipe 20A - 24A							0.57	51										0.57	16.58										
Contribution From Cercle de l'Argonaut Circle, Pipe 25A - 24A							0.92	90										0.92	17.50										
		24A	21A	0.23		17	12.33	4842	2.81	44.09		5.40					1.75	0.23	17.73	5.85	51.69	58.50	375	0.30	**0.29**	94.42	0.55	0.85	0.87
Contribution From Placette de Darvoy Mews, Pipe 28A - 21A							0.79	82										0.79	18.52										
		21A	33A	0.19		14	13.31	4938	2.80	44.81		5.40					1.75	0.19	18.71	6.17	52.73	42.50	375	0.20	**0.21**	80.35	0.66	0.73	0.78
		33A	34A	0.03		1	13.34	4939	2.80	44.82		5.40					1.75	0.03	18.74	6.18	52.75	17.00	375	0.42	**0.28**	92.78	0.57	0.84	0.87
Contribution From Chemin de Jargeau Road, Pipe 19A - 34A							1.60	137										1.60	20.34										
Contribution From Cercle de l'Argonaut Circle, Pipe 32A - 34A							1.44	110										1.44	21.78										
		34A	35A	0.29		24	16.67	5210	2.78	46.94		5.40					1.75	0.29	22.07	7.28	57.27	58.50	375	0.20	**0.24**	85.89	0.65	0.78	0.83
Contribution From Croissant des Aubrais Crescent, Pipe 9A - 35A							0.85	65										0.85	22.92										
		35A	36A	0.31		28	17.83	5303	2.78	47.78		5.40					1.75	0.31	23.23	7.67	57.20	58.50	375	0.20	**0.23**	84.09	0.68	0.76	0.81
Contribution From Bois de Cravant Grove, Pipe 37A - 36A							1.09	83										1.09	24.32										
		36A	44A	0.32		28	19.24	5414	2.77	48.60		5.40					1.75	0.32	24.64	8.13	58.48	58.50	375	0.20	**0.22**	82.24	0.71	0.74	0.80
Contribution From Place de Sandillon Place, Pipe 39A - 44A							0.72	62										0.72	25.36										
		44A	52A	0.29		24	20.25	5500	2.77	49.37		5.40					1.75	0.29	25.65	8.46	59.58	58.50	450	0.15	**0.12**	98.76	0.60	0.62	0.64
Contribution From Croissant des Aubrais Crescent, Pipe 43A - 52A							1.37	103										1.37	27.02										
Contribution From Ruelle de Carden Lane, Pipe 46A - 52A							0.56	48										0.56	27.58										
		52A	53A	0.09		1	22.27	5652	2.76	50.55		5.40					1.75	0.09	27.67	9.13	61.43	58.50	450	0.15	**0.19**	124.27	0.49	0.78	0.77
Contribution From Terrase de Vennecy Terrace, Pipe 48A - 53A							3.14	253										3.14	30.81										
Contribution From Cercle du Ponthieu Circle, Pipe 51A - 53A							0.80	69										0.80	31.61										
		53A	55A	0.09		1	26.30	5975	2.74	53.06		5.40					1.75	0.09	31.70	10.46	65.27	61.50	450	0.15	**0.16**	114.04	0.57	0.72	0.74
To Cercle du Ponthieu Circle, Pipe 55A - 58A							26.30	5975				5.40							31.70										

Most Restrictive leg

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha	
Average Daily Flow =	280	l/p/day			Industrial Peak Factor = as per MOE Graph
Comm/Inst Flow =	28000	L/ha/da	0.5787	l/s/Ha	Extraneous Flow = 0.330 L/s/ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha	Minimum Velocity = 0.600 m/s
Max Res. Peak Factor =	4.00				Manning's n = (Conc) 0.013 (Pvc) 0.013
Commercial/Inst./Park Peak Factor =	1.00				Townhouse coeff= 2.7
Institutional =	0.32	l/s/Ha			Single house coeff= 3.4

Designed: P.P

Checked: M.Z

Dwg. Reference: Sanitary Drainage Plan, Dwgs. No.

PROJECT: **ORLEANS VILLAGE**

LOCATION: **City of Ottawa**

File Ref: 16-881 | Date: 27/07/2018 | Sheet No. 3 of 4

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION							COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE							
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	**SLOPE AS-BUILT (%)**	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
Cercle du Ponthieu Circle - 08																												
	50A	51A	0.25		21	0.25	21	3.70	0.25								0.25	0.25	0.08	0.33	41.50	200	0.70	**0.67**	26.85	0.01	0.85	0.27
	51A	53A	0.55		48	0.80	69	3.63	0.81								0.55	0.80	0.26	1.07	98.50	200	0.55	**0.62**	25.83	0.04	0.82	0.39
To Avenue de Lamarche Avenue, Pipe 53A - 55A						0.80	69											0.80										
	490A	49A	0.14		7	0.14	7	3.74	0.08								0.14	0.14	0.05	0.13	11.00	200	0.65	**0.64**	26.44	0.00	0.84	0.05
	49A	57A	0.24		14	0.38	21	3.70	0.25								0.24	0.38	0.13	0.38	50.50	200	0.35	**0.34**	19.12	0.02	0.61	0.24
	57A	58A	0.09		4	0.47	25	3.69	0.30								0.09	0.47	0.16	0.46	14.00	200	0.35	**0.39**	20.48	0.02	0.65	0.25
To Nature Trail Crescent, Pipe 58A - 59A						0.47	25											0.47										
Rue de Beaugency Street - 08																												
	500A	501A	0.33		24	0.33	24	3.70	0.29					0.65	0.65	0.07	0.98	0.98	0.32	0.68	62.50	200	0.65	**0.59**	26.44	0.03	0.84	0.37
	501A	502A	0.19		14	0.52	38	3.67	0.45						0.65	0.07	0.19	1.17	0.39	0.91	78.50	200	0.35	**0.55**	19.40	0.05	0.62	0.32
	502A	55A				0.52	38	3.67	0.45						0.65	0.07	0.00	1.17	0.39	0.91	2.50	200	1.65	**0.80**	29.34	0.03	0.93	0.41
Cercle du Ponthieu Circle - 08																												
	503A	504A	0.25		17	0.25	17	3.71	0.20								0.25	0.25	0.08	0.28	57.50	200.00	0.65	**0.65**	26.44	0.01	0.84	0.27
	504A	505A	0.26		17	0.51	34	3.68	0.41					0.77	0.77	0.08	1.03	1.28	0.42	0.91	69.50	200.00	0.50	**0.45**	22.00	0.04	0.70	0.34
	505A	58A				0.51	34	3.68	0.41						0.77	0.08	0.00	1.28	0.42	0.91	3.00	200.00	1.00	**0.67**	26.85	0.03	0.85	0.37
To Nature Trail Crescent, Pipe 58A - 59A						0.51	34								0.77			1.28										
	1A	6A	63.57		6462	63.57	6462	2.71	56.75	53.65	53.65			10.45	10.45	18.51	127.67	127.67	42.13	117.39	88.50	675	0.11		278.79	0.42	0.78	0.74
Contribution From Croissant de Mercier Crescent, Pipe 5A - 6A						0.74	55										0.74	128.41										
	6A	55A				64.31	6517	2.71	57.23		53.65				10.45	18.51	0.00	128.41	42.38	118.12	57.00	675	0.11	**0.09**	278.79	0.42	0.78	0.74
Contribution From Avenue de Lamarche Avenue, Pipe 53A - 55A						26.30	5975				5.40						31.70	160.11										
Contribution From Croissant de Mercier Crescent, Pipe 54A - 55A						0.94	70										0.94	161.05										
	55A	58A				92.07	12600	2.48	101.27		59.05				11.10	20.33	0.00	161.05	53.15	174.75	143.00	675	0.11	**0.10**	265.82	0.66	0.74	0.79
To Sanitary Easement, Pipe 58A - 59A						92.07	12600				59.05				11.10			161.05										
Sanitary Easement - 20																												
Contribution From Cercle du Ponthieu Circle, Pipe 505A - 58A						0.51	34								0.77		1.28	1.28		0.00								
Contribution From Cercle du Ponthieu Circle, Pipe 55A - 58A						92.07	12600				59.05				11.10		161.05	162.33		0.00								
Contribution From Cercle du Ponthieu Circle, Pipe 57A - 58A						0.47	25										0.47	162.80										
	58A	59A	0.07		1	93.12	12660	2.48	101.75		59.05				11.87	20.41	0.07	162.87	53.75	175.91	48.00	675	0.11	**0.30**	460.41	0.38	1.29	1.20
			0.01		1	93.13	12661				59.05				11.87		0.01	162.88										
	59A	60A	0.05		1	93.18	12662	2.48	101.76		59.05				11.87	20.41	0.05	162.93	53.77	175.94	33.00	675	0.11	**0.11**	278.79	0.63	0.78	0.83
To Nature Trail Crescent, Pipe 60A - 61A						93.18	12662				59.05				11.87			162.93		0.00								
Nature Trail Crescent - 21																												
Contribution From Sanitary Easement, Pipe 59A - 60A						93.18	12662				59.05				11.87		162.93	162.93		0.00								
			0.06		4	93.24	12666				59.05				11.87		0.06	162.99										
	60A	61A	1.47		82	94.71	12748	2.48	102.46		59.05				11.87	20.41	1.47	164.46	54.27	177.14	11.00	675	0.11	**0.09**	252.18	0.70	0.70	0.76
	61A	62A	0.59		47	95.30	12795	2.48	102.83		59.05				11.87	20.41	0.59	165.05	54.47	177.71	73.50	675	0.11	**0.08**	237.75	0.75	0.66	0.73

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha
Average Daily Flow =	280	l/p/day		
Comm/Inst Flow =	28000	L/ha/da	0.5787	l/s/Ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha
Max Res. Peak Factor =	4.00			
Commercial/Inst./Park Peak Factor =	1.00			
Institutional =	0.32	l/s/Ha		

Industrial Peak Factor = as per MOE Graph

Extraneous Flow =		0.330	L/s/ha	
Minimum Velocity =		0.600	m/s	
Manning's n =	(Conc)	0.013	(Pvc)	0.013
Townhouse coeff=		2.7		
Single house coeff=		3.4		

Designed: P.P

Checked: M.Z

Dwg. Reference: Sanitary Drainage Plan, Dwgs. No.

PROJECT: **ORLEANS VILLAGE**

LOCATION: **City of Ottawa**

File Ref: 16-881 Date: 27/07/2018 Sheet No. 4 of 4

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION								COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE						
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	UNITS Singles	UNITS Townhouse	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
SERVICING 2																													
	82A	83A	0.05	8		8	19	0.05	19	3.71	0.23		0.00		0.00		0.00	0.00	0.05	0.05	0.02	0.24	14.0	200	0.65	26.44	0.01	0.84	0.26
	83A	84A	0.04	6		6	14	0.09	33	3.68	0.39		0.00		0.00		0.00	0.00	0.04	0.09	0.03	0.42	14.0	200	0.35	19.40	0.02	0.62	0.25
To Private Street 1, Pipe 84A - 87A								0.09	33				0.00		0.00		0.00			0.09									
Private Street 3																													
	78A	79A	0.60	36		36	83	0.60	83	3.61	0.97		0.00		0.00		0.00	0.00	0.60	0.60	0.20	1.17	85.0	200	0.65	26.44	0.04	0.84	0.42
	79A	80A						0.60	83	3.61	0.97		0.00		0.00		0.00	0.00	0.00	0.60	0.20	1.17	8.5	200	0.35	19.40	0.06	0.62	0.34
To Private Street 1, Pipe 80A - 81A								0.60	83				0.00		0.00		0.00			0.60									
SERVICING 1																													
	72A	73A	0.07	12		12	28	0.07	28	3.69	0.33		0.00		0.00		0.00	0.00	0.07	0.07	0.02	0.36	23.0	200	0.65	26.44	0.01	0.84	0.29
	73A	74A	0.06	8		8	19	0.13	47	3.66	0.56		0.00		0.00		0.00	0.00	0.06	0.13	0.04	0.60	12.0	200	0.35	19.40	0.03	0.62	0.28
To Private Street 1, Pipe 74A - 75A								0.13	47				0.00		0.00		0.00			0.13									
Private Street 1																													
	70A	71A	0.12	16		16	37	0.12	37	3.67	0.44		0.00		0.00		0.00	0.00	0.12	0.12	0.04	0.48	30.0	200	1.30	37.40	0.01	1.19	0.40
	71A	74A	0.57	76		76	175	0.69	212	3.51	2.41		0.00		0.00		0.00	0.00	0.57	0.69	0.23	2.64	94.5	200	0.85	30.24	0.09	0.96	0.58
Contribution From SERVICING 1, Pipe 73A - 74A								0.13	47				0.00		0.00		0.00		0.13	0.82									
	74A	75A						0.82	259	3.48	2.92		0.00		0.00		0.00	0.00	0.00	0.82	0.27	3.19	6.0	200	0.35	19.40	0.16	0.62	0.45
	75A	80A	0.25	32		32	74	1.07	333	3.45	3.72		0.00		0.00		0.00	0.00	0.25	1.07	0.35	4.07	64.5	200	0.35	19.40	0.21	0.62	0.49
Contribution From Private Street 3, Pipe 79A - 80A								0.60	83				0.00		0.00		0.00		0.60	1.67									
	80A	81A	0.44	54		54	125	2.11	541	3.37	5.90		0.00		0.00		0.00	0.00	0.44	2.11	0.70	6.60	114.5	200	0.35	19.40	0.34	0.62	0.56
	81A	84A	0.24	28		28	65	2.35	606	3.34	6.57		0.00		0.00		0.00	0.00	0.24	2.35	0.78	7.34	61.0	250	0.30	32.57	0.23	0.66	0.53
Contribution From SERVICING 2, Pipe 83A - 84A								0.09	33				0.00		0.00		0.00		0.09	2.44									
	84A	87A	0.39	56		56	129	2.83	768	3.30	8.21		0.00		0.00		0.00	0.00	0.39	2.83	0.93	9.14	75.5	250	0.30	32.57	0.28	0.66	0.57
	87A	91A	0.23				0	3.06	768	3.30	8.21		0.00		0.00		0.00	0.00	0.23	3.06	1.01	9.22	63.0	250	0.30	32.57	0.28	0.66	0.57
To Private Street 5, Pipe 91A - 92A								3.06	768				0.00		0.00		0.00			3.06									
Private Street 4																													
	88A	89A	0.30	24		24	56	0.30	56	3.64	0.66		0.00		0.00		0.00	0.00	0.30	0.30	0.10	0.76	87.0	200	0.65	26.44	0.03	0.84	0.37
To Private Street 5, Pipe 89A - 90A								0.30	56				0.00		0.00		0.00			0.30									
Private Street 5																													
Contribution From Private Street 4, Pipe 88A - 89A								0.30	56				0.00		0.00		0.00		0.30	0.30									
	89A	90A	0.23	34		34	79	0.53	135	3.56	1.56		0.00		0.00		0.00	0.00	0.23	0.53	0.17	1.73	38.5	200	0.35	19.40	0.09	0.62	0.38
	90A	91A	0.10	10		10	23	0.63	158	3.55	1.82		0.00		0.00		0.00	0.00	0.10	0.63	0.21	2.02	27.0	200	0.35	19.40	0.10	0.62	0.40
Contribution From Private Street 1, Pipe 87A - 91A								3.06	768				0.00		0.00		0.00		3.06	3.69									
	91A	92A						3.69	926	3.26	9.77		0.00		0.00		0.00	0.00	0.00	3.69	1.22	10.99	30.5	250	0.30	32.57	0.34	0.66	0.60
	92A	EX 230						3.69	926	3.26	9.77		0.00		0.00	0.45	0.45	0.05	0.45	4.14	1.37	11.19	12.5	250	0.30	32.57	0.34	0.66	0.60
Avenue de Lamarche Avenue																													
	222A	EX 22A	0.18	40		40	92	0.18	92	3.60	1.07		0.00		0.00		0.00	0.00	0.18	0.18	0.06	1.13	81.0	200	1.50	40.17	0.03	1.28	0.56
Block 149								2.86	1376																				
	EX 22A	EX 230A	0.60					3.64	1468	3.15	14.98		0.00		0.00		0.00	0.00	0.60	0.60	0.20	15.18	76.5	250	1.20	65.14	0.23	1.33	1.08
Contribution From Private Street 5, Pipe 92A - 230A			0.15	36		36	83	3.84	1009				0.00		0.00		0.45		0.53	1.13									
	EX 230A	EX 23A	0.15					7.63	2477	3.01	24.16		0.00		0.00		0.45	0.05	0.15	0.15	0.05	24.26	63.5	250	0.85	54.83	0.44	1.12	1.08
Block 150								2.17	1044																				
	EX 23A	EX 24A	0.13					9.93	3521	2.91	33.16		0.00		0.00		0.45	0.05	0.13	0.13	0.04	33.25	59.5	375	0.29	94.42	0.35	0.85	0.78

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha		
Average Daily Flow =	280	l/p/day			Industrial Peak Factor = as per MOE Graph	
Comm/Inst Flow =	28000	L/ha/da	0.3241	l/s/Ha	Extraneous Flow =	0.330 L/s/ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha	Minimum Velocity =	0.600 m/s
Max Res. Peak Factor =	4.00				Manning's n = (Conc)	0.013 (Pvc) 0.013
Commercial/Inst./Park Peak Factor =	1.00				Townhouse coeff=	2.3
Institutional =	0.32	l/s/Ha			Single house coeff=	3.4

Designed: CPB

Checked: SLM

Dwg. Reference: Sanitary Drainage Plan, Dwgs. No. 22

PROJECT: **Orleans Village Phase 4**

LOCATION: **City of Ottawa**

File Ref:

Date: **29 Aug 2024**

Sheet No. 1 of 1

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION							COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE							
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	SLOPE AS-BUILT (%)	CAP (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
Rang de Loury Row - 03																												
	200A	19A	0.42		44	0.42	44	3.66	0.52								0.42	0.42	0.14	0.66	76.00	200	0.90	**0.88**	30.77	0.02	0.98	0.38
To Chemin de Jargeau Road, Pipe 19A - 34A						0.42	44											0.42										
	200A	20A	0.18		17	0.18	17	3.71	0.20								0.18	0.18	0.06	0.26	42.00	200	0.65	**0.60**	25.41	0.01	0.81	0.26
To Cours Crevier Walk, Pipe 20A - 24A						0.18	17											0.18										
Cercle de l'Argonaut Circle - 12																												
	27A	26A	0.08		4	0.08	4	3.76	0.05								0.08	0.08	0.03	0.08	10.00	200	0.65	**0.80**	29.34	0.00	0.93	0.06
			0.05		4	0.13	8										0.05	0.13										
	26A	25A	0.41		44	0.54	52	3.65	0.62								0.41	0.54	0.18	0.80	71.00	200	0.65	**0.63**	26.03	0.03	0.83	0.37
	25A	24A	0.38		38	0.92	90	3.60	1.05								0.38	0.92	0.30	1.35	74.00	200	0.35	**0.36**	19.68	0.07	0.63	0.36
To Avenue de Lamarche Avenue, Pipe 24A - 21A						0.92	90											0.92										
	27A	29A	0.23		17	0.23	17	3.71	0.20								0.23	0.23	0.08	0.28	51.50	200	0.65	**0.67**	26.85	0.01	0.85	0.27
	29A	30A	0.26		14	0.49	31	3.68	0.37								0.26	0.49	0.16	0.53	51.50	200	0.60	**0.47**	22.49	0.02	0.72	0.28
	30A	31A	0.18		11	0.67	42	3.66	0.50								0.18	0.67	0.22	0.72	11.00	200	0.35	**0.62**	25.83	0.03	0.82	0.36
	31A	32A	0.38		34	1.05	76	3.62	0.89								0.38	1.05	0.35	1.24	65.50	200	0.35	**0.35**	19.40	0.06	0.62	0.34
	32A	34A	0.39		34	1.44	110	3.59	1.28								0.39	1.44	0.48	1.76	81.50	200	0.35	**0.38**	20.22	0.09	0.64	0.40
To Avenue de Lamarche Avenue, Pipe 34A - 35A						1.44	110											1.44										
Placette de Darvoy Mews - 13																												
	29A	28A	0.37		38	0.37	38	3.67	0.45								0.37	0.37	0.12	0.57	74.00	200	0.75	**0.73**	28.02	0.02	0.89	0.35
	28A	21A	0.42		44	0.79	82	3.61	0.96								0.42	0.79	0.26	1.22	78.00	200	0.35	**0.33**	18.84	0.06	0.60	0.33
To Avenue de Lamarche Avenue, Pipe 21A - 33A						0.79	82											0.79										
Croissant des Aubrais Crescent - 10																												
	8A	9A	0.55		41	0.55	41	3.67	0.49								0.55	0.55	0.18	0.67	75.00	200	0.65	**0.67**	26.85	0.02	0.85	0.33
	9A	35A	0.30		24	0.85	65	3.63	0.76								0.30	0.85	0.28	1.04	72.50	200	0.35	**0.32**	18.55	0.06	0.59	0.32
To Avenue de Lamarche Avenue, Pipe 35A - 36A						0.85	65											0.85										
	8A	7A	0.13		7	0.13	7	3.74	0.08								0.13	0.13	0.04	0.12	10.00	200	0.65	**0.90**	31.12	0.00	0.99	0.06
	7A	38A	0.23		14	0.36	21	3.70	0.25								0.23	0.36	0.12	0.37	51.50	200	0.35	**0.31**	18.26	0.02	0.58	0.23
To Bois de Cravant Grove, Pipe 38A - 37A						0.36	21											0.36										
	38A	40A	0.25		17	0.25	17	3.71	0.20								0.25	0.25	0.08	0.28	59.00	200	0.65	**0.64**	26.24	0.01	0.84	0.27
	40A	41A	0.22		14	0.47	31	3.68	0.37								0.22	0.47	0.16	0.53	51.50	200	0.35	**0.39**	20.48	0.03	0.65	0.29
	41A	42A	0.14		7	0.61	38	3.67	0.45								0.14	0.61	0.20	0.65	10.00	200	0.35	**0.70**	27.44	0.02	0.87	0.34
	42A	43A	0.40		34	1.01	72	3.62	0.84								0.40	1.01	0.33	1.17	69.00	200	0.35	**0.32**	18.55	0.06	0.59	0.32
	43A	52A	0.36		31	1.37	103	3.59	1.20								0.36	1.37	0.45	1.65	78.00	200	0.35	**0.35**	19.40	0.09	0.62	0.38
To Avenue de Lamarche Avenue, Pipe 52A - 53A						1.37	103											1.37										
Bois de Cravant Grove - 14																												
Contribution From Croissant des Aubrais Crescent, Pipe 7A - 38A						0.36	21										0.36	0.36										
	38A	37A	0.39		34	0.75	55	3.64	0.65								0.39	0.75	0.25	0.90	69.50	200	0.35	**0.35**	19.40	0.05	0.62	0.32
	37A	36A	0.34		28	1.09	83	3.61	0.97								0.34	1.09	0.36	1.33	85.00	200	0.35	**0.39**	20.48	0.06	0.65	0.36
To Avenue de Lamarche Avenue, Pipe 36A - 44A						1.09	83											1.09										

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha			
Average Daily Flow =	280	l/p/day			Industrial Peak Factor = as per MOE Graph		
Comm/Inst Flow =	28000	L/ha/da	0.5787	l/s/Ha	Extraneous Flow =	0.330	L/s/ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha	Minimum Velocity =	0.600	m/s
Max Res. Peak Factor =	4.00				Manning's n = (Conc)	0.013 (Pvc)	0.013
Commercial/Inst./Park Peak Factor =	1.00				Townhouse coeff=	2.7	
Institutional =	0.32	l/s/Ha			Single house coeff=	3.4	

Designed: P.P

Checked: M.Z

Dwg. Reference:
Sanitary Drainage Plan, Dwgs. No.

PROJECT: **ORLEANS VILLAGE**

LOCATION: **City of Ottawa**

File Ref: 16-881

Date: 2018-07-27

Sheet No. 1 of 4

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION							COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE							
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	**SLOPE AS-BUILT (%)**	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
Place de Sandillon Place - 11																												
	40A	39A	0.38		34	0.38	34	3.68	0.41								0.38	0.38	0.13	0.54	69.50	200	0.65	**0.63**	26.03	0.02	0.83	0.32
	39A	44A	0.34		28	0.72	62	3.64	0.73								0.34	0.72	0.24	0.97	85.00	200	0.40	**0.33**	18.84	0.05	0.60	0.31
To Avenue de Lamarche Avenue, Pipe 44A - 52A						0.72	62											0.72										
Cours Crevier Walk- 02																												
	18A	17A	0.07		6	0.07	6	3.75	0.07								0.07	0.07	0.02	0.09	10.00	200	0.65	**0.57**	24.76	0.00	0.79	0.05
	17A	16A	0.65		65	0.72	71	3.63	0.84								0.65	0.72	0.24	1.08	111.50	200	0.35	**0.33**	18.84	0.06	0.60	0.33
To Chemin de Jargeau Road, Pipe 16A - 19A						0.72	71											0.72										
	18A	20A	0.19		17	0.19	17	3.71	0.20								0.19	0.19	0.06	0.26	51.50	200	0.80	**0.80**	29.34	0.01	0.93	0.30
Contribution From Rang de Loury Row, Pipe 200A - 20A						0.18	17										0.18	0.37										
	20A	24A	0.20		17	0.57	51	3.65	0.60								0.20	0.57	0.19	0.79	62.50	200	0.45	**0.37**	19.95	0.04	0.64	0.31
To Avenue de Lamarche Avenue, Pipe 24A - 21A						0.57	51											0.57										
Chemin de Jargeau Road - 04																												
	10A	16A	0.12		7	0.12	7	3.74	0.08								0.12	0.12	0.04	0.12	26.50	200	0.65		26.44	0.00	0.84	0.05
Contribution From Cours Crevier Walk, Pipe 17A - 16A						0.72	71										0.72	0.84										
	16A	19A	0.23		14	1.07	92	3.60	1.07								0.23	1.07	0.35	1.42	58.50	200	0.35	**0.41**	21.00	0.07	0.67	0.38
Contribution From Rang de Loury Row, Pipe 200A - 19A						0.42	44										0.42	1.49										
	19A	34A	0.11		1	1.60	137	3.56	1.58								0.11	1.60	0.53	2.11	59.00	200	0.35	**0.32**	18.55	0.11	0.59	0.38
To Avenue de Lamarche Avenue, Pipe 34A - 35A						1.60	137											1.60										
Voie de Lesage Way - 05																												
	190A	15A	0.21		14	0.21	14	3.72	0.17								0.21	0.21	0.07	0.24	42.50	200	0.65	**0.67**	26.85	0.01	0.85	0.27
	15A	14A	0.60		55	0.81	69	3.63	0.81								0.60	0.81	0.27	1.08	106.50	200	0.35	**0.36**	19.68	0.05	0.63	0.33
	14A	13A	0.13		7	0.94	76	3.62	0.89								0.13	0.94	0.31	1.20	11.50	200	0.35	**0.34**	19.12	0.06	0.61	0.34
	13A	45A	0.16		11	1.10	87	3.61	1.02								0.16	1.10	0.36	1.38	49.00	200	0.35	**0.36**	19.68	0.07	0.63	0.36
To Terrase de Vennecy Terrace, Pipe 45A - 47A						1.10	87											1.10										
Terrase de Vennecy Terrace - 06																												
	15A	11A	0.15		11	0.15	11	3.73	0.13								0.15	0.15	0.05	0.18	49.00	200	0.65	**0.65**	26.44	0.01	0.84	0.27
	11A	12A	0.11		7	0.26	18	3.71	0.22								0.11	0.26	0.09	0.31	11.50	200	0.35	**0.35**	19.40	0.02	0.62	0.24
	12A	45A	0.64		55	0.90	73	3.62	0.86								0.64	0.90	0.30	1.16	106.50	200	0.35	**0.35**	19.40	0.06	0.62	0.34
Contribution From Voie de Lesage Way, Pipe 13A - 45A						1.10	87										1.10	2.00										
	45A	47A	0.43		31	2.43	191	3.52	2.18								0.43	2.43	0.80	2.98	111.00	250	0.30	**0.33**	34.16	0.09	0.70	0.43
	47A	48A	0.12		7	2.55	198	3.52	2.26								0.12	2.55	0.84	3.10	10.50	250	0.30	**0.38**	36.66	0.08	0.75	0.45
	48A	53A	0.59		55	3.14	253	3.49	2.86								0.59	3.14	1.04	3.90	108.50	250	0.30	**0.30**	32.57	0.12	0.66	0.44
To Avenue de Lamarche Avenue, Pipe 53A - 55A						3.14	253											3.14										
Ruelle de Carden Lane - 07																												
	46A	52A	0.56		48	0.56	48	3.65	0.57								0.56	0.56	0.18	0.75	105.50	200	0.65	**0.64**	26.24	0.03	0.84	0.37
To Avenue de Lamarche Avenue, Pipe 52A - 53A						0.56	48											0.56										

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha			
Average Daily Flow =	280	l/p/day			Industrial Peak Factor = as per MOE Graph		
Comm/Inst Flow =	28000	L/ha/da	0.5787	l/s/Ha	Extraneous Flow =	0.330	L/s/ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha	Minimum Velocity =	0.600	m/s
Max Res. Peak Factor =	4.00				Manning's n = (Conc)	0.013 (Pvc)	0.013
Commercial/Inst./Park Peak Factor =	1.00				Townhouse coeff=	2.7	
Institutional =	0.32	l/s/Ha			Single house coeff=	3.4	

Designed: P.P

Checked: M.Z

Dwg. Reference:
Sanitary Drainage Plan, Dwgs. No.

PROJECT: **ORLEANS VILLAGE**

LOCATION: **City of Ottawa**

File Ref: 16-881 | Date: 2018-07-27 | Sheet No. 2 of 4

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION				RESIDENTIAL AREA AND POPULATION							COMM		INSTIT		PARK		C+I+I	INFILTRATION					PIPE							
STREET		FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	**SLOPE AS-BUILT (%)**	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
Croissant de Mercier Crescent- 09																													
		4A	5A	0.13		7	0.13	7	3.74	0.08								0.13	0.13	0.04	0.12	7.00	200	0.95	**0.71**	27.64	0.00	0.88	0.05
		5A	6A	0.61		48	0.74	55	3.64	0.65								0.61	0.74	0.24	0.89	107.50	200	0.50	**0.53**	23.88	0.04	0.76	0.36
To Cercle du Ponthieu Circle, Pipe 6A - 55A							0.74	55											0.74										
		4A	3A	0.21		11	0.21	11	3.73	0.13								0.21	0.21	0.07	0.20	46.50	200	0.65	**0.62**	25.83	0.01	0.82	0.26
		3A	2A	0.08		4	0.29	15	3.72	0.18								0.08	0.29	0.10	0.28	10.50	200	0.35	**0.45**	22.00	0.01	0.70	0.22
		2A	54A	0.60		51	0.89	66	3.63	0.78								0.60	0.89	0.29	1.07	100.50	200	0.35	**0.41**	21.00	0.05	0.67	0.35
		54A	55A	0.05		4	0.94	70	3.63	0.82								0.05	0.94	0.31	1.13	13.50	200	0.35	**0.67**	26.85	0.04	0.85	0.41
To Cercle du Ponthieu Circle, Pipe 55A - 58A							0.94	70											0.94										
Avenue de Lamarche Avenue - 01																													
				0.60		1	0.60	1			2.54	2.54						3.14	3.14										
				2.54		92	3.14	93			2.86	5.40						5.40	8.54										
		22A	230A	2.86		1376	6.00	1469	3.15	15.00		5.40					1.75	2.86	11.40	3.76	20.51	76.50	250	1.20	**1.22**	65.68	0.31	1.34	1.18
		230A	23A	0.15		1	6.15	1470	3.15	15.01		5.40					1.75	0.15	11.55	3.81	20.57	63.50	250	0.85	**0.85**	54.83	0.38	1.12	1.04
				0.13		1	6.28	1471				5.40						0.13	11.68										
				2.16		1003	8.44	2474				5.40						2.16	13.84										
		23A	24A	2.17		1044	10.61	3518	2.91	33.18		5.40					1.75	2.17	16.01	5.28	40.21	59.50	375	0.29	**0.29**	94.42	0.43	0.85	0.82
Contribution From Cours Crevier Walk, Pipe 20A - 24A							0.57	51										0.57	16.58										
Contribution From Cercle de l'Argonaut Circle, Pipe 25A - 24A							0.92	90										0.92	17.50										
		24A	21A	0.23		17	12.33	3676	2.89	34.43		5.40					1.75	0.23	17.73	5.85	42.03	58.50	375	0.30	**0.29**	94.42	0.45	0.85	0.82
Contribution From Placette de Darvoy Mews, Pipe 28A - 21A							0.79	82										0.79	18.52										
		21A	33A	0.19		14	13.31	3772	2.88	35.21		5.40					1.75	0.19	18.71	6.17	43.13	42.50	375	0.20	**0.21**	80.35	0.54	0.73	0.74
		33A	34A	0.03		1	13.34	3773	2.88	35.21		5.40					1.75	0.03	18.74	6.18	43.14	17.00	375	0.42	**0.28**	92.78	0.46	0.84	0.82
Contribution From Chemin de Jargeau Road, Pipe 19A - 34A							1.60	137										1.60	20.34										
Contribution From Cercle de l'Argonaut Circle, Pipe 32A - 34A							1.44	110										1.44	21.78										
		34A	35A	0.29		24	16.67	4044	2.86	37.48		5.40					1.75	0.29	22.07	7.28	46.51	59.00	375	0.20	**0.24**	85.89	0.54	0.78	0.80
Contribution From Croissant des Aubrais Crescent, Pipe 9A - 35A							0.85	65										0.85	22.92										
		35A	36A	0.31		28	17.83	4137	2.86	38.34		5.40					1.75	0.31	23.23	7.67	47.76	58.50	375	0.20	**0.23**	84.09	0.57	0.76	0.78
Contribution From Bois de Cravant Grove, Pipe 37A - 36A							1.09	83										1.09	24.32										
		36A	44A	0.32		28	19.24	4248	2.85	39.24		5.40					1.75	0.32	24.64	8.13	49.12	58.50	375	0.20	**0.22**	82.24	0.60	0.74	0.77
Contribution From Place de Sandillon Place, Pipe 39A - 44A							0.72	62										0.72	25.36										
		44A	52A	0.29		24	20.25	4334	2.84	39.89		5.40					1.75	0.29	25.65	8.46	50.10	58.50	450	0.15	**0.12**	98.76	0.51	0.62	0.62
Contribution From Croissant des Aubrais Crescent, Pipe 43A - 52A							1.37	103										1.37	27.02										
Contribution From Ruelle de Carden Lane, Pipe 46A - 52A							0.56	48										0.56	27.58										
		52A	53A	0.09		1	22.27	4486	2.83	41.14		5.40					1.75	0.09	27.67	9.13	52.02	58.50	450	0.15	**0.19**	124.27	0.42	0.78	0.74
Contribution From Terrase de Vennecy Terrace, Pipe 48A - 53A							3.14	253										3.14	30.81										
Contribution From Cercle du Ponthieu Circle, Pipe 51A - 53A							0.80	69										0.80	31.61										
		53A	55A	0.09		1	26.30	4809	2.81	43.79		5.40					1.75	0.09	31.70	10.46	56.00	61.50	450	0.15	**0.16**	114.04	0.49	0.72	0.71
To Cercle du Ponthieu Circle, Pipe 55A - 58A							26.30	4809				5.40							31.70										

Revised Population

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha			
Average Daily Flow =	280	l/p/day			Industrial Peak Factor = as per MOE Graph		
Comm/Inst Flow =	28000	L/ha/da	0.5787	l/s/Ha	Extraneous Flow =	0.330	L/s/ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha	Minimum Velocity =	0.600	m/s
Max Res. Peak Factor =	4.00				Manning's n = (Conc)	0.013	(Pvc) 0.013
Commercial/Inst./Park Peak Factor =	1.00				Townhouse coeff=	2.7	
Institutional =	0.32	l/s/Ha			Single house coeff=	3.4	

Designed: P.P

Checked: M.Z

Dwg. Reference: Sanitary Drainage Plan, Dwgs. No.

PROJECT: **ORLEANS VILLAGE**

LOCATION: **City of Ottawa**

File Ref: 16-881 | Date: 2018-07-27 | Sheet No. 3 of 4

SANITARY SEWER CALCULATION SHEET

Manning's n=0.013

LOCATION			RESIDENTIAL AREA AND POPULATION							COMM		INSTIT		PARK		C+I+I	INFILTRATION				PIPE							
STREET	FROM M.H.	TO M.H.	AREA (ha)	UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)	DIST (m)	DIA (mm)	SLOPE (%)	**SLOPE AS-BUILT (%)**	CAP. (FULL) (l/s)	RATIO Q act/Q cap	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
Cercle du Ponthieu Circle - 08																												
	50A	51A	0.25		21	0.25	21	3.70	0.25								0.25	0.25	0.08	0.33	41.50	200	0.70	**0.67**	26.85	0.01	0.85	0.27
	51A	53A	0.55		48	0.80	69	3.63	0.81								0.55	0.80	0.26	1.07	98.50	200	0.55	**0.62**	25.83	0.04	0.82	0.39
To Avenue de Lamarche Avenue, Pipe 53A - 55A						0.80	69											0.80										
	490A	49A	0.14		7	0.14	7	3.74	0.08								0.14	0.14	0.05	0.13	11.00	200	0.65	**0.64**	26.44	0.00	0.84	0.05
	49A	57A	0.24		14	0.38	21	3.70	0.25								0.24	0.38	0.13	0.38	50.50	200	0.35	**0.34**	19.12	0.02	0.61	0.24
	57A	58A	0.09		4	0.47	25	3.69	0.30								0.09	0.47	0.16	0.46	14.00	200	0.35	**0.39**	20.48	0.02	0.65	0.25
To Nature Trail Crescent, Pipe 58A - 59A						0.47	25											0.47										
Rue de Beaugency Street - 08																												
	500A	501A	0.33		24	0.33	24	3.70	0.29					0.65	0.65	0.07	0.98	0.98	0.32	0.68	62.50	200	0.65	**0.59**	26.44	0.03	0.84	0.37
	501A	502A	0.19		14	0.52	38	3.67	0.45						0.65	0.07	0.19	1.17	0.39	0.91	78.50	200	0.35	**0.55**	19.40	0.05	0.62	0.32
	502A	55A				0.52	38	3.67	0.45						0.65	0.07	0.00	1.17	0.39	0.91	2.50	200	1.65	**0.80**	29.34	0.03	0.93	0.41
Cercle du Ponthieu Circle - 08																												
	503A	504A	0.25		17	0.25	17	3.71	0.20								0.25	0.25	0.08	0.28	57.50	200.00	0.65	**0.65**	26.44	0.01	0.84	0.27
	504A	505A	0.26		17	0.51	34	3.68	0.41					0.77	0.77	0.08	1.03	1.28	0.42	0.91	69.50	200.00	0.50	**0.45**	22.00	0.04	0.70	0.34
	505A	58A				0.51	34	3.68	0.41						0.77	0.08	0.00	1.28	0.42	0.91	3.00	200.00	1.00	**0.67**	26.85	0.03	0.85	0.37
To Nature Trail Crescent, Pipe 58A - 59A						0.51	34								0.77			1.28										
	1A	6A	63.57		6462	63.57	6462	2.71	56.75	53.65	53.65			10.45	10.45	18.51	127.67	127.67	42.13	117.39	88.50	675	0.11		278.79	0.42	0.78	0.74
Contribution From Croissant de Mercier Crescent, Pipe 5A - 6A						0.74	55										0.74	128.41										
	6A	55A				64.31	6517	2.71	57.23		53.65				10.45	18.51	0.00	128.41	42.38	118.12	57.00	675	0.11	**0.09**	278.79	0.42	0.78	0.74
Contribution From Avenue de Lamarche Avenue, Pipe 53A - 55A						26.30	4809				5.40						31.70	160.11										
Contribution From Croissant de Mercier Crescent, Pipe 54A - 55A						0.94	70										0.94	161.05										
	55A	58A				92.07	11434	2.52	93.38		59.05				11.10	20.33	0.00	161.05	53.15	166.86	143.00	675	0.11	**0.10**	265.82	0.63	0.74	0.78
To Sanitary Easement, Pipe 58A - 59A						92.07	11434				59.05				11.10			161.05										
Sanitary Easement - 20																												
Contribution From Cercle du Ponthieu Circle, Pipe 505A - 58A						0.51	34								0.77		1.28	1.28		0.00								
Contribution From Cercle du Ponthieu Circle, Pipe 55A - 58A						92.07	11434				59.05				11.10		161.05	162.33		0.00								
Contribution From Cercle du Ponthieu Circle, Pipe 57A - 58A						0.47	25										0.47	162.80										
	58A	59A	0.07		1	93.12	11494	2.52	93.87		59.05				11.87	20.41	0.07	162.87	53.75	168.03	48.00	675	0.11	**0.30**	460.41	0.36	1.29	1.17
			0.01		1	93.13	11495				59.05				11.87		0.01	162.88										
	59A	60A	0.05		1	93.18	11496	2.52	93.88		59.05				11.87	20.41	0.05	162.93	53.77	168.06	33.00	675	0.11	**0.11**	278.79	0.60	0.78	0.81
To Nature Trail Crescent, Pipe 60A - 61A						93.18	11496				59.05				11.87			162.93		0.00								
Nature Trail Crescent - 21																												
Contribution From Sanitary Easement, Pipe 59A - 60A						93.18	11496				59.05				11.87		162.93	162.93		0.00								
			0.06		4	93.24	11500				59.05				11.87		0.06	162.99										
	60A	61A	1.47		82	94.71	11582	2.51	94.21		59.05				11.87	20.41	1.47	164.46	54.27	168.89	11.00	675	0.11	**0.09**	252.18	0.67	0.70	0.75
	61A	62A	0.59		47	95.30	11629	2.51	94.59		59.05				11.87	20.41	0.59	165.05	54.47	169.47	73.50	675	0.11	**0.08**	237.75	0.71	0.66	0.71

DESIGN PARAMETERS

Park Flow =	9300	L/ha/da	0.10764	l/s/Ha
Average Daily Flow =	280	l/p/day		
Comm/Inst Flow =	28000	L/ha/da	0.5787	l/s/Ha
Industrial Flow =	35000	L/ha/da	0.40509	l/s/Ha
Max Res. Peak Factor =	4.00			
Commercial/Inst./Park Peak Factor =	1.00			
Institutional =	0.32	l/s/Ha		

Industrial Peak Factor = as per MOE Graph

Extraneous Flow =		0.330	L/s/ha	
Minimum Velocity =		0.600	m/s	
Manning's n =	(Conc)	0.013	(Pvc)	0.013
Townhouse coeff=		2.7		
Single house coeff=		3.4		

Designed: P.P

Checked: M.Z

Dwg. Reference: Sanitary Drainage Plan, Dwgs. No.

PROJECT: **ORLEANS VILLAGE**

LOCATION: **City of Ottawa**

File Ref: 16-881 Date: 2018-07-27 Sheet No. 4 of 4

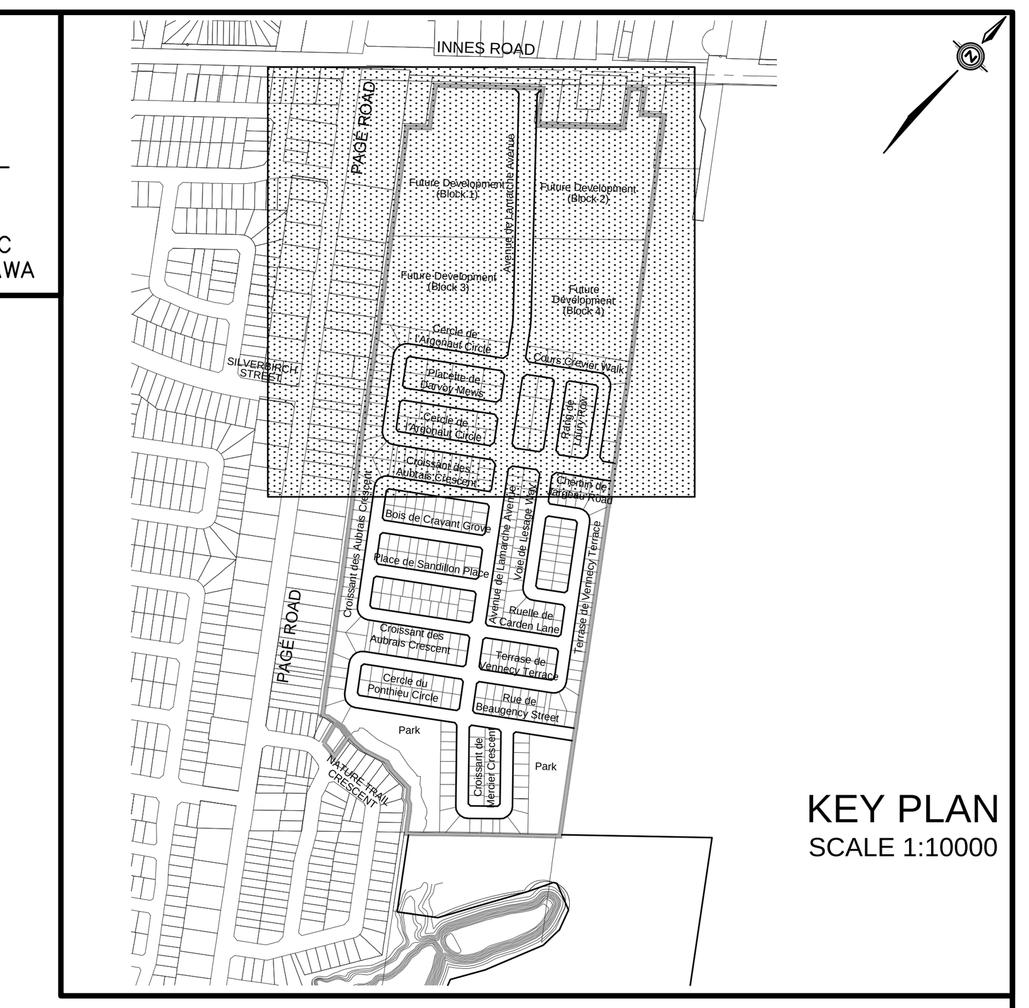
David Schaeffer Engineering Ltd.
120 Iber Road, Suite 103
Stittsville, ON K2S 1E9
613-836-0856
dsel.ca

APPENDIX D

APPROVED ☐ REFUSED ☐

THIS ____ DAY OF__________, 20____

JOSHUA WHITE, P.ENG
PROJECT MANAGER – EAST BRANCH
PLANNING, INFRASTRUCTURE & ECONOMIC
DEVELOPMENT DEPARTMENT, CITY OF OTTAWA



LEGEND

STORM DRAINAGE BOUNDARY
STORM DRAINAGE BOUNDARY (OTHER PHASES)
UPSTREAM MH TO DOWNSTREAM MH — 43 - 44
AREA IN HECTARES — 0.37
RUNOFF COEFFICIENT — 0.51
EXTERNAL 2.78AC = — 2.78AC=14.40
EXTERNAL TIME OF CONCENTRATION — TC=14.5 MIN
EXTERNAL BLENDED RUNOFF COEFFICIENT — C= 0.70
STREET CATCHBASIN & LEAD
STREET CATCHBASIN WITH CLOSED LID & LEAD
MAINTENANCE HOLE — MH202
CURB INLET CATCHBASIN & LEAD
CATCHBASIN/ MAINTENANCE HOLE — CBMH201
INTERCONNECTED CATCH BASIN & LEADS
CAP
OVERLAND FLOW DIRECTION
EXTERNAL OVERLAND FLOW DIRECTION
EMERGENCY OVERLAND FLOW DIRECTION

TOPOGRAPHIC INFORMATION

TOPOGRAPHIC INFORMATION PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16–10–116–00. SURVEYS DATED NOVEMBER 30, 2017.

LEGAL INFORMATION

CALCULATED M–PLAN PROVIDED BY J.D. BARNES LIMITED, PROJECT No. 16–10–116–00 (PHASE 1 & 2) DATED SEPTEMBER 14, 2018.

ELEVATION NOTE

ELEVATION = 86.12 m

ELEVATIONS ARE GEODETIC AND ARE DERIVED FROM SITE BENCHMARK NCC CONTROL POINT 001196530229 HAVING A PUBLISHED ELEVATION OF 86.12m

No.	DATE	BY	DESCRIPTION
6.	18–10–30	M.Z.	REVISED M–PLAN
5.	18–07–27	M.Z.	REVISED WEST BOUNDARY STORM SYSTEM
4.	18–07–10	M.Z.	MYLARS FOR PHASE 1 COMMENCE WORK
3.	18–06–28	M.Z.	REVISED AS PER CITY AND UTILITY COMMENTS
2.	18–05–09	M.Z.	ISSUED FOR MOE APPROVAL
1.	18–01–24	M.Z.	1st SUBMISSION

Ottawa CITY OF OTTAWA

PROJECT No. 16–881

LICENSED PROFESSIONAL ENGINEER
M.ZDRAVEVSKI
100130902
18-10-30
PROVINCE OF ONTARIO

STORM DRAINAGE PLAN

CAIVAN (ORLEANS VILLAGE) LIMITED

ORLEANS VILLAGE

DSEL
david schaeffer engineering ltd
120 Iber Road, Unit 103
Stittsville, ON K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

DRAWN BY:	M.Z.	CHECKED BY:	P.P.	DRAWING NO.	SHEET NO.
DESIGNED BY:	P.P.	CHECKED BY:	M.Z.		67
SCALE:	1:1000	DATE:	JANUARY 2018		

CITY PLAN No. 17675

CITY FILE No. D07-16-16-0022

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Arterial Roads Return Frequency = 10 years

Manning 0.013

	LOCATION		AREA (Ha)														FLOW						SEWER DATA								
			2 YEAR				5 YEAR				10 YEAR				100 YEAR				Time of	Intensity	Intensity	Intensity	Intensity	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATIO
			AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	Conc.	2 Year	5 Year	10 Year	100 Year										
Location	From Node	To Node	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	FLOW (min.	Q/Q full
West Boundary STM System																																	
					0.00	0.00			0.00	0.00			0.00	0.00	1.74	0.55	2.66	2.66															
					0.00	0.00			0.00	0.00			0.00	0.00	0.02	0.70	0.04	2.70															
					0.00	0.00			0.00	0.00			0.00	0.00	0.14	0.50	0.19	2.89															
					0.00	0.00			0.00	0.00			0.00	0.00	0.05	0.50	0.07	2.96	Tc=340/(2*60)+10min. (For 340.0m and 2.0m/s)					-59	FLOW TO MH C8 TO 5								
	MH C12 (100yr. Intake	HW C13			0.00	0.00			0.00	0.00			0.00	0.00	0.44	0.50	0.61	3.58	12.80	67.50	91.41	0.00	156.46	500	600	600	CONC	0.90	22.0	583	2.06	0.18	0.86
	.																																

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

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: P.P./C.M.	PROJECT: **Caivan Communities** **Orleans Village**		
Checked: M.Z.	LOCATION: **City of Ottawa**		
Dwg. Reference:	File Ref:	Date: 30 Oct 2018	Sheet No. SHEET 1 OF 5

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Arterial Roads Return Frequency = 10 years

Manning 0.013

	LOCATION		AREA (Ha)																FLOW						SEWER DATA							
			2 YEAR				5 YEAR				10 YEAR				100 YEAR				Time of	Intensity	Intensity	Intensity	Intensity	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATIO
			AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	Conc.	2 Year	5 Year	10 Year	100 Year										
Location	From Node	To Node	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	FLOW (min.	Q/Q full
Block 155 - 2003																																
Contribution From Block 155, Pipe C8 - 5																								59	SUBDRAIN FLOW							
	C8	5			0.00	0.00			0.00	0.00			0.00	0.00	0.06	0.50	0.08	0.08	10.00	76.81	104.19	0.00	178.56	74	300	300	PVC	1.00	26.0	97	1.37	0.32	0.76
To Cercle du Ponthieu Circle, Pipe 5 - 56						0.00				0.00				0.00				0.08	10.32					59									
Rue de Beaugency Street-08																																
	CTRL MH 106	4	0.66	0.40	0.73	0.73			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	56	300	300	CONC	0.50	10.5	68	0.97	0.18	0.82
			0.13	0.50	0.18	0.18			0.00	0.00			0.00	0.00			0.00	0.00														
	4	58	0.25	0.70	0.49	1.40			0.00	0.00			0.00	0.00			0.00	0.00	10.18	76.12	103.25	0.00	176.92	107	375	375	PVC	0.70	81.5	147	1.33	1.02	0.73
			0.14	0.70	0.27	1.01			0.00	0.00			0.00	0.00			0.00	0.00														
	58	57	0.22	0.50	0.31	3.45			0.00	0.00			0.00	0.00			0.00	0.00	11.20	72.47	98.24	0.00	168.26	250	450	450	PVC	1.25	61.5	319	2.00	0.51	0.78
To Avenue de Lamarche Avenue, Pipe 57 - 1TEE						3.45				0.00				0.00				0.00	11.72														
Contribution Block 155, Pipe C8 - 5						0.00				0.00				0.00				0.08	10.32					59									
			0.30	0.50	0.42	0.42			0.00	0.00			0.00	0.00			0.00	0.08														
	5	56	0.63	0.70	1.23	1.64			0.00	0.00			0.00	0.00			0.00	0.08	10.32	75.61	102.55	0.00	175.71	198	675	675	CONC	0.95	138.0	819	2.29	1.00	0.24
To Avenue de Lamarche Avenue, Pipe 56 - 57						1.64				0.00				0.00				0.08	11.32					59									
	5	6			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	0	300	300	PVC	1.00	14.5	97	1.37	0.18	0.00
	6	7			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.18	76.13	103.27	0.00	176.96	0	300	300	PVC	0.65	47.0	78	1.10	0.71	0.00
	7	8			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.89	73.56	99.73	0.00	170.84	0	300	300	PVC	0.55	12.0	72	1.01	0.20	0.00
			0.13	0.50	0.18	0.18			0.00	0.00			0.00	0.00			0.00	0.00														
	8	9	0.27	0.70	0.53	0.71			0.00	0.00			0.00	0.00			0.00	0.00	11.08	72.88	98.80	0.00	169.22	51	300	300	PVC	0.55	68.0	72	1.01	1.12	0.72
	CTRL MH 105	9	0.71	0.40	0.79	0.79			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	61	375	375	PVC	0.40	10.5	111	1.00	0.17	0.55
			0.18	0.50	0.25				0.00	0.00			0.00	0.00			0.00	0.00														
	9	57	0.20	0.70	0.39	2.14			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	164	375	375	CONC	1.30	71.5	200	1.81	0.66	0.82
To Avenue de Lamarche Avenue, Pipe 57 - 1TEE						2.14				0.00				0.00				0.00	10.17														
Voie de Lesage Way - 05																																
	410	42	0.07	0.70	0.14	0.14			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	10	300	300	PVC	0.69	51.0	80	1.14	0.75	0.13
			0.17	0.50	0.24	0.37			0.00	0.00			0.00	0.00			0.00	0.00														
	42	45	0.35	0.70	0.68	1.05			0.00	0.00			0.00	0.00			0.00	0.00	10.75	74.05	100.40	0.00	172.00	78	375	375	PVC	0.35	103.0	104	0.94	1.83	0.75
	45	46			0.00	1.05			0.00	0.00			0.00	0.00			0.00	0.00	12.58	68.15	92.31	0.00	158.00	72	375	375	PVC	0.72	10.5	149	1.35	0.13	0.48
			0.05	0.50	0.07	1.12			0.00	0.00			0.00	0.00			0.00	0.00														
	46	47	0.25	0.70	0.49	1.61			0.00	0.00			0.00	0.00			0.00	0.00	12.71	67.77	91.79	0.00	157.10	109	450	450	CONC	0.47	45.5	195	1.23	0.62	0.56
To Terrase de Vennecy Terrace, Pipe 47 - 54						1.61				0.00				0.00				0.00	13.32														
Terrase de Vennecy Terrace - 06																																
			0.22	0.50	0.31	0.31			0.00	0.00			0.00	0.00			0.00	0.00														
	42	43	0.26	0.70	0.51	0.81			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	62	375	375	PVC	0.66	45.5	142	1.29	0.59	0.44
	43	44			0.00	0.81			0.00	0.00			0.00	0.00			0.00	0.00	10.59	74.62	101.19	0.00	173.36	61	375	375	PVC	1.04	10.5	179	1.62	0.11	0.34
			0.13	0.50	0.18	0.99			0.00	0.00			0.00	0.00			0.00	0.00														
	44	47	0.34	0.70	0.66	1.65			0.00	0.00			0.00	0.00			0.00	0.00	10.70	74.23	100.65	0.00	172.44	123	450	450	CONC	0.38	103.0	176	1.11	1.55	0.70
Contribution From Voie de Lesage Way, Pipe 46 - 47						1.61				0.00				0.00				0.00	13.32														
			0.05	0.50	0.07	3.33			0.00	0.00			0.00	0.00			0.00	0.00														
			0.12	0.50	0.17	3.50			0.00	0.00			0.00	0.00			0.00	0.00														
			0.13	0.50	0.18	3.68			0.00	0.00			0.00	0.00			0.00	0.00														
	47	54	0.33	0.70	0.64	4.32			0.00	0.00			0.00	0.00			0.00	0.00	13.32	66.03	89.40	0.00	152.98	285	600	600	CONC	0.39	111.5	383	1.36	1.37	0.74
	54	55			0.00	4.32			0.00	0.00			0.00	0.00			0.00	0.00	14.69	62.50	84.56	0.00	144.63	270	600	600	CONC	0.35	10.0	363	1.28	0.13	0.74
			0.18	0.50	0.25	4.57			0.00	0.00			0.00	0.00			0.00	0.00														
	55	56	0.31	0.70	0.60	5.18			0.00	0.00			0.00	0.00			0.00	0.00	14.82	62.19	84.13	0.00	143.89	322	675	675	CONC	0.52	110.0	606	1.69	1.08	0.53
To Avenue de Lamarche Avenue, Pipe 56 - 57						5.18				0.00				0.00				0.00	15.91														
Ruelle de Carden Lane - 07																																
			0.28	0.50	0.39	0.39			0.00	0.00			0.00	0.00			0.00	0.00														
	48	52	0.37	0.70	0.72	1.11			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	85	375	375	PVC	1.10	110.0	184	1.66	1.10	0.46
To Avenue de Lamarche Avenue, Pipe 52 - 56						1.11				0.00				0.00				0.00	11.10														

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

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: P.P./C.M.
Checked: M.Z.
Dwg. Reference:

PROJECT: **Caivan Communities**
Orleans Village
LOCATION: **City of Ottawa**
File Ref:
Date: 30 Oct 2018
Sheet No. SHEET 2 OF 5

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Arterial Roads Return Frequency = 10 years

Manning 0.013

	LOCATION		AREA (Ha)																FLOW						SEWER DATA							
			2 YEAR				5 YEAR				10 YEAR				100 YEAR				Time of	Intensity	Intensity	Intensity	Intensity	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATIO
			AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	Conc.	2 Year	5 Year	10 Year	100 Year										
Location	From Node	To Node	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	FLOW (min.	Q/Q full
Place de Sandillon Place - 11																																
			0.13	0.50	0.18	0.18			0.00	0.00			0.00	0.00			0.00	0.00														
	36	37	0.26	0.70	0.51	0.69			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	53	300	300	PVC	0.68	59.0	80	1.13	0.87	0.66
			0.17	0.50	0.24	0.92			0.00	0.00			0.00	0.00			0.00	0.00														
	37	38	0.26	0.70	0.51	1.43			0.00	0.00			0.00	0.00			0.00	0.00	10.87	73.61	99.80	0.00	170.96	105	375	375	PVC	0.75	80.5	152	1.37	0.98	0.69
To Avenue de Lamarche Avenue, Pipe 38 - 52						1.43				0.00				0.00				0.00	11.85														
Bois de Cravant Grove - 14																																
Contribution From Croissant des Aubrais Crescent, Pipe 35 - 10						0.00				0.00				0.00				0.00	11.18														
			0.12	0.50	0.17	0.17			0.00	0.00			0.00	0.00			0.00	0.00														
	10	11	0.26	0.70	0.51	0.67			0.00	0.00			0.00	0.00			0.00	0.00	11.18	72.54	98.33	0.00	168.42	49	375	375	PVC	0.38	69.0	108	0.98	1.18	0.45
			0.19	0.50	0.26	0.94			0.00	0.00			0.00	0.00			0.00	0.00														
	11	34	0.29	0.70	0.56	1.50			0.00	0.00			0.00	0.00			0.00	0.00	12.36	68.80	93.19	0.00	159.53	103	375	375	PVC	0.76	80.5	153	1.38	0.97	0.68
To Avenue de Lamarche Avenue, Pipe 34 - 38						1.50				0.00				0.00				0.00	13.33														
Croissant des Aubrais Crescent - 10																																
			0.05	0.50	0.07	0.07			0.00	0.00			0.00	0.00			0.00	0.00														
			0.29	0.50	0.40	0.47			0.00	0.00			0.00	0.00			0.00	0.00														
	31	33	0.68	0.70	1.32	1.80			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	138	450	450	CONC	0.85	143.0	263	1.65	1.44	0.52
To Avenue de Lamarche Avenue, Pipe 33 - 34						1.80				0.00				0.00				0.00	11.44														
	31	35			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	0	300	300	PVC	1.05	9.5	99	1.40	0.11	0.00
	35	10			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.11	76.37	103.60	0.00	177.53	0	300	300	PVC	0.35	52.0	57	0.81	1.07	0.00
To Bois de Cravant Grove, Pipe 10 - 11						0.00				0.00				0.00				0.00	11.18														
	10	49	0.19	0.70	0.37	0.37			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	28	300	300	PVC	0.69	106.5	80	1.14	1.56	0.35
	49	50			0.00	0.37			0.00	0.00			0.00	0.00			0.00	0.00	11.56	71.29	96.61	0.00	165.44	26	300	300	PVC	0.35	9.5	57	0.81	0.20	0.46
			0.13	0.50	0.18	0.55			0.00	0.00			0.00	0.00			0.00	0.00														
			0.17	0.50	0.24	0.79			0.00	0.00			0.00	0.00			0.00	0.00														
	50	52	0.62	0.70	1.21	1.99			0.00	0.00			0.00	0.00			0.00	0.00	11.76	70.66	95.74	0.00	163.94	141	450	450	CONC	0.50	142.5	202	1.27	1.87	0.70
To Avenue de Lamarche Avenue, Pipe 52 - 56						1.99				0.00				0.00				0.00	13.63														
Chemin de Jargeau Road - 04																																
	39	40	0.04	0.54	0.06	0.06			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	5	300	300	PVC	1.60	27.0	122	1.73	0.26	0.04
Contribution From Cours Crevier Walk, Pipe 16 - 40						1.09				0.00				0.00				0.00	11.79														
			0.03	0.54	0.05	1.19			0.00	0.00			0.00	0.00			0.00	0.00														
	40	41	0.24	0.70	0.47	1.66			0.00	0.00			0.00	0.00			0.00	0.00	11.79	70.55	95.60	0.00	163.69	117	525	525	CONC	0.30	54.5	236	1.09	0.83	0.50
Contribution From Rang de Loury Row, Pipe 180 - 41						0.75				0.00				0.00				0.00	10.99														
			0.01	0.70	0.02	2.42			0.00	0.00			0.00	0.00			0.00	0.00														
			0.03	0.54	0.05	2.47			0.00	0.00			0.00	0.00			0.00	0.00														
	41	30	0.13	0.70	0.25	2.72			0.00	0.00			0.00	0.00			0.00	0.00	12.63	68.00	92.10	0.00	157.65	185	525	525	CONC	0.80	64.0	385	1.78	0.60	0.48
To Avenue de Lamarche Avenue, Pipe 30 - 33						2.72				0.00				0.00				0.00	13.23														
Block 158 - 2002																																
															0.06	0.25	0.04	0.04														
															0.95	0.55	1.45	1.49						-29	SUBDRAIN FLOW							
	C100	C4													0.19	0.50	0.26	1.76	10.00	76.81	104.19	0.00	178.56	285	375	375	PVC	3.40	6.0	323	2.93	0.03	0.88
																			10.03														
															0.25	0.55	0.38	0.38														
	C101	C4													0.11	0.50	0.15	0.54	10.00	76.81	104.19	0.00	178.56	67	300	300	PVC	2.00	4.5	137	1.93	0.04	0.49
																			10.04														
	C4	2200															0.00	2.29	10.00	76.81	104.19	0.00	178.56	381	450	450	CONC	2.40	31.0	442	2.78	0.19	0.86
To Cercle de l'Argonaut Circle, Pipe 2200 - 27						0.00				0.00				0.00				2.29	10.19					-29									
Placette de Darvoy Mews - 13																																
	22	24	0.50	0.72	1.00	1.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	77	450	450	CONC	0.75	147.5	247	1.55	1.58	0.31
To Avenue de Lamarche Avenue, Pipe 24 - 25						1.00				0.00				0.00				0.00	11.58														
Cercle de l'Argonaut Circle - 12																																
			0.02	0.72	0.04	0.04			0.00	0.00			0.00	0.00			0.00	0.00														
			0.05	0.50	0.07	0.11			0.00	0.00			0.00	0.00			0.00	0.00														
			0.12	0.70	0.23	0.34			0.00	0.00			0.00	0.00			0.00	0.00														
			0.15	0.54	0.23	0.57			0.00	0.00			0.00	0.00			0.00	0.00														
	19	21	0.46	0.72	0.92	1.49			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	114	450	450	CONC	0.75	141.0	247	1.55	1.51	0.46
To Avenue de Lamarche Avenue, Pipe 21 - 24						1.49				0.00				0.00				0.00	11.51														

Definitions:
Q = 2.78 AIR, where
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A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: P.P./C.M.
Checked: M.Z.
Dwg. Reference:

PROJECT: **Caivan Communities**
Orleans Village
LOCATION: **City of Ottawa**
File Ref:
Date: 30 Oct 2018
Sheet No. SHEET 3 OF 5

881_STM5_Rev.xlsx

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Arterial Roads Return Frequency = 10 years

Manning 0.013

	LOCATION		AREA (Ha) 2 YEAR				AREA (Ha) 5 YEAR				AREA (Ha) 10 YEAR				AREA (Ha) 100 YEAR				FLOW						SEWER DATA								
			AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	Time of Conc.	Intensity 2 Year	Intensity 5 Year	Intensity 10 Year	Intensity 100 Year	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATIO
Location	From Node	To Node	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	FLOW (min.	Q/Q full
	19	26			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	0	300	300	PVC	0.35	9.5	57	0.81	0.20	0.000
			0.07	0.70	0.14	0.14			0.00	0.00			0.00	0.00			0.00	0.00															
	26	22	0.12	0.54	0.18	0.32			0.00	0.00			0.00	0.00			0.00	0.00	10.20	76.06	103.17	0.00	176.79	24	300	300	PVC	0.40	52.0	61	0.87	1.00	0.393
	22	2200			0.00	0.32			0.00	0.00			0.00	0.00			0.00	0.00	11.20	72.49	98.27	0.00	168.31	23	300	300	PVC	0.41	29.0	62	0.88	0.55	0.370
Contribution From Block 158 Pipe C4 - 2200						0.00				0.00				0.00				2.29	10.19					-29.00									
	2200	27			0.00	0.32			0.00	0.00			0.00	0.00			0.00	2.29	11.75	70.68	95.78	0.00	164.01	399	675	675	CONC	0.50	19.0	594	1.66	0.19	0.670
	27	28			0.00	0.32			0.00	0.00			0.00	0.00			0.00	2.29	11.94	70.08	94.95	0.00	162.58	395	675	675	CONC	1.00	10.5	841	2.35	0.07	0.470
			0.05	0.50	0.07	0.39			0.00	0.00			0.00	0.00			0.00	2.29															
			0.05	0.54	0.08	0.46			0.00	0.00			0.00	0.00			0.00	2.29															
			0.10	0.50	0.14	0.60			0.00	0.00			0.00	0.00			0.00	2.29															
			0.10	0.54	0.15	0.75			0.00	0.00			0.00	0.00			0.00	2.29															
	28	30	0.67	0.70	1.30	2.05			0.00	0.00			0.00	0.00			0.00	2.29	12.01	69.85	94.64	0.00	162.03	515	750	750	CONC	0.50	142.5	787	1.78	1.33	0.654
To Avenue de Lamarche Avenue, Pipe 30 - 33						2.05				0.00				0.00				2.29	13.35					-29									
Rang de Loury Row - 03																																	
	180	18	0.16	0.72	0.32	0.32			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	25	300	300	PVC	1.06	38.0	100	1.41	0.45	0.247
To Cours Crevier Walk, Pipe 18 - 21						0.32				0.00				0.00				0.00	10.45														
			0.19	0.54	0.29	0.29			0.00	0.00			0.00	0.00			0.00	0.00															
	180	41	0.23	0.72	0.46	0.75			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	57	300	300	PVC	0.88	76.0	91	1.28	0.99	0.631
To Chemin de Jargeau Road, Pipe 41 - 30						0.75				0.00				0.00				0.00	10.99														
Cours Crevier Walk - 02																																	
	17	16			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	0	300	300	PVC	2.00	9.5	137	1.93	0.08	0.000
			0.15	0.54	0.23	0.23			0.00	0.00			0.00	0.00			0.00	0.00															
	16	40	0.43	0.72	0.86	1.09			0.00	0.00			0.00	0.00			0.00	0.00	10.08	76.49	103.76	0.00	177.81	83	375	375	PVC	0.44	108.0	116	1.05	1.71	0.714
To Chemin de Jargeau Road, Pipe 40 - 41						1.09				0.00				0.00				0.00	11.79														
	17	18	0.00	0.00	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	0	300	300	PVC	1.09	48.0	101	1.43	0.56	0.000
Contribution From Rang de Loury Row, Pipe 180 - 18						0.32				0.00				0.00				0.00	10.45														
			0.02	0.72	0.04	0.36			0.00	0.00			0.00	0.00			0.00	0.00															
			0.15	0.54	0.23	0.59			0.00	0.00			0.00	0.00			0.00	0.00															
	18	21	0.21	0.72	0.42	1.01			0.00	0.00			0.00	0.00			0.00	0.00	10.56	74.72	101.32	0.00	173.60	75	375	375	PVC	0.54	67.0	129	1.17	0.96	0.583
To Avenue de Lamarche Avenue, Pipe 21 - 24						1.01				0.00				0.00				0.00	11.52														
Avenue de Lamarche Avenue - 01																																	
			0.05	0.40	0.06	0.06			0.00	0.00			0.00	0.00			0.00	0.00															
	CTRL MH 1200	120	0.52	0.47	0.68	0.74			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	56	300	300	PVC	0.50	16.0	68	0.97	0.28	0.826
			0.04	0.85	0.09	0.83																											
	120	12	0.06	0.85	0.14	0.97			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	75	300	300	PVC	1.51	51.0	119	1.68	0.51	0.628
	12	13	0.35	0.85	0.83	1.80			0.00	0.00			0.00	0.00			0.00	0.00	10.51	74.92	101.60	0.00	174.06	135	375	375	PVC	2.00	76.0	248	2.25	0.56	0.543
			2.86	0.85	6.76				0.00	0.00			0.00	0.00			0.00	0.00															
	CTRL MH 100	13	0.11	0.40	0.12	6.88			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	528	750	750	CONC	0.35	14.5	659	1.49	0.16	0.802
			0.07	0.56	0.11				0.00	0.00			0.00	0.00			0.00	0.00															
	CTRL MH 101	13	2.54	0.85	6.00	6.11			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	469	750	750	CONC	0.30	19.5	610	1.38	0.24	0.770
	13	15	0.18	0.85	0.43	15.22			0.00	0.00			0.00	0.00			0.00	0.00	10.24	75.91	102.97	0.00	176.43	1155	825	825	CONC	1	139	1505	2.82	0.82	0.767
	CTRL MH 103	15	2.17	0.75	4.52	4.52			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	348	675	675	CONC	0.30	15.0	460	1.29	0.19	0.755
	CTRL MH 104	15	2.16	0.75	4.50	4.50			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	346	675	675	CONC	0.30	19.5	460	1.29	0.25	0.751
	15	21	0.30	0.85	0.71	24.95			0.00	0.00			0.00	0.00			0.00	0.00	10.25	75.85	102.88	0.00	176.28	1893	1350	1350	CONC	0.37	59	3247	2.27	0.43	0.583
Contribution From Cours Crevier Walk, Pipe 18 - 21						1.01				0.00				0.00				0.00	11.52														
Contribution From Cercle de l'Argonaut Circle, Pipe 19 - 21						1.49				0.00				0.00				0.00	11.51														
			0.05	0.72	0.10	27.55			0.00	0.00			0.00	0.00			0.00	0.00															
	21	24	0.18	0.54	0.27	27.82			0.00	0.00			0.00	0.00			0.00	0.00	11.52	71.43	96.81	0.00	165.78	1987	1350	1350	CONC	0.43	58.5	3500	2.45	0.40	0.568
Contribution From Placette de Darvoy Mews, Pipe 220 - 24						1.00				0.00				0.00				0.00	11.58														
			0.19	0.54	0.29	29.10			0.00	0.00			0.00	0.00			0.00	0.00															
	24	25	0.26	0.72	0.52	29.62			0.00	0.00			0.00	0.00			0.00	0.00	11.92	70.16	95.06	0.00	162.75	2078	1350	1350	CONC	0.50	41.5	3774	2.64	0.26	0.551
	25	30			0.00	29.62			0.00	0.00			0.00	0.00			0.00	0.00	12.18	69.34	93.94	0.00	160.83	2054	1350	1350	CONC	0.49	14.0	3736	2.61	0.09	0.550

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

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: P.P./C.M.
Checked: M.Z.
Dwg. Reference:

PROJECT: **Caivan Communities**
Orleans Village
LOCATION: **City of Ottawa**
File Ref:
Date: 30 Oct 2018
Sheet No. SHEET 4 OF 5

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Arterial Roads Return Frequency = 10 years

Manning 0.013

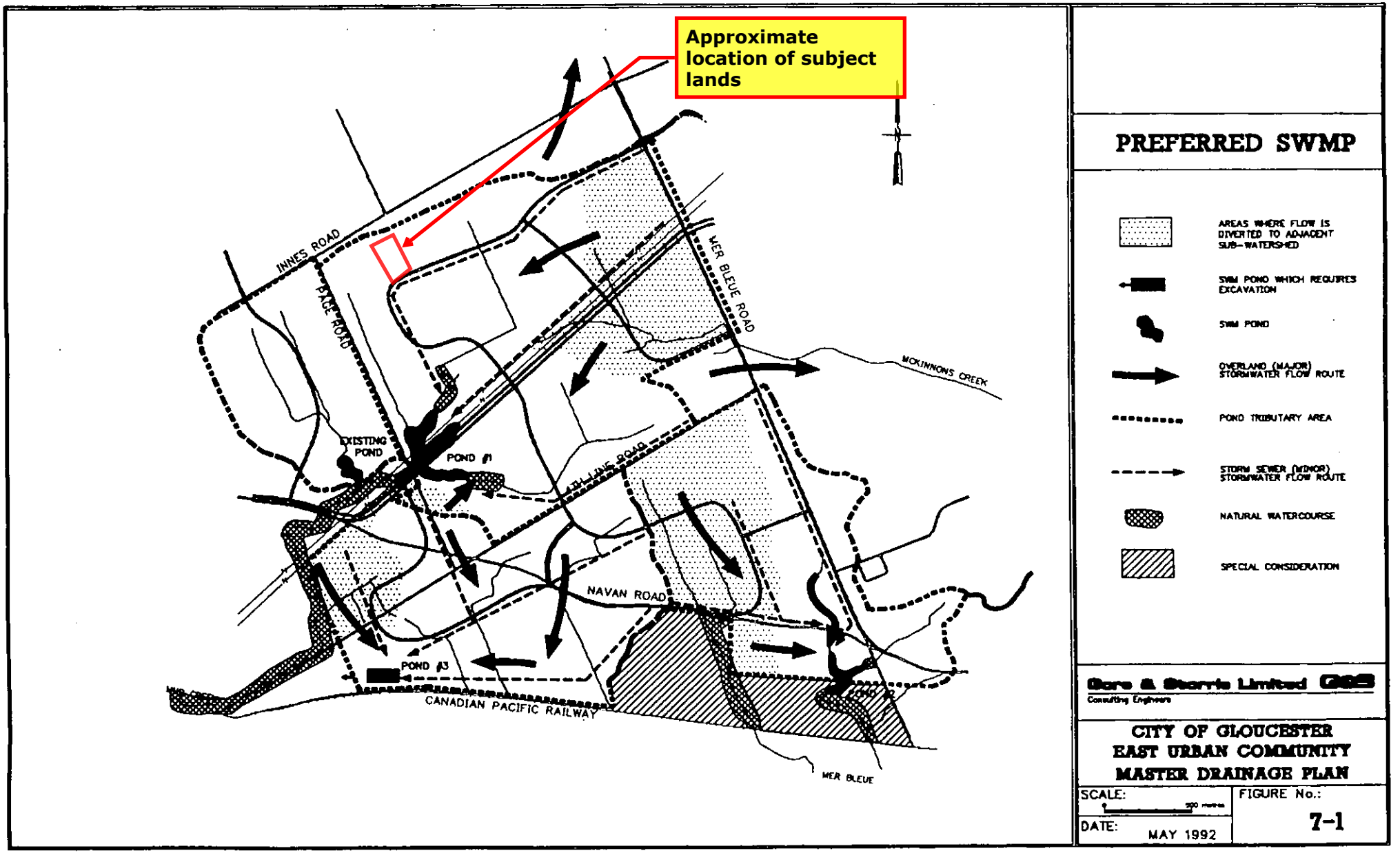
	LOCATION		AREA (Ha)														FLOW						SEWER DATA								
			2 YEAR				5 YEAR				10 YEAR				100 YEAR				Time of	Intensity	Intensity	Intensity	Intensity	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATIO
			AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	Conc.	2 Year	5 Year	10 Year	100 Year										
Location	From Node	To Node	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	FLOW (min.	Q/Q full
Contribution From Cercle de l'Argonaut Circle, Pipe 28 - 30						2.05				0.00				0.00				2.29	13.35					-29									
Contribution From Chemin de Jargeau Road, Pipe 41 - 30						2.72				0.00				0.00				0.00	13.23														
	30	33			0.00	34.40			0.00	0.00			0.00	0.00			0.00	2.29	13.35	65.97	89.31	0.00	152.82	2620	1500	1500	CONC	0.20	63.5	3161	1.79	0.59	0.829
Contribution From Croissant des Aubrais Crescent, Pipe 31 - 33						1.80				0.00				0.00				0.00	11.44														
			0.25	0.50	0.35	36.54			0.00	0.00			0.00	0.00			0.00	2.29															
	33	34	0.31	0.70	0.60	37.15			0.00	0.00			0.00	0.00			0.00	2.29	13.94	64.39	87.15	0.00	149.10	2734	1500	1500	CONC	0.23	58.5	3390	1.92	0.51	0.806
Contribution From Bois de Cravant Grove, Pipe 11 - 34						1.50				0.00				0.00				0.00	13.33														
	34	38			0.00	38.65			0.00	0.00			0.00	0.00			0.00	2.29	14.45	63.10	85.39	0.00	146.05	2774	1500	1500	CONC	0.24	58.5	3463	1.96	0.50	0.801
Contribution From Place de Sandillon Place, Pipe 37 - 38						1.43				0.00				0.00				0.00	11.85														
	38	52	0.28	0.70	0.54	40.62			0.00	0.00			0.00	0.00			0.00	2.29	14.94	61.90	83.74	0.00	143.20	2843	1650	1650	CONC	0.16	54.5	3646	1.71	0.53	0.780
Contribution From Ruelle de Carden Lane, Pipe 48 - 52						1.11				0.00				0.00				0.00	11.10														
Contribution From Croissant des Aubrais Crescent, Pipe 50 - 52						1.99				0.00				0.00				0.00	13.63														
	52	56			0.00	43.72			0.00	0.00			0.00	0.00			0.00	2.29	15.48	60.66	82.05	0.00	140.29	2974	1650	1650	CONC	0.18	58.5	3867	1.81	0.54	0.769
Contribution From Cercle du Ponthieu Circle, Pipe 5 - 56						1.64				0.00				0.00				0.08	11.32					59									
Contribution From Terrase de Vennecy Terrace, Pipe 55 - 56						5.18				0.00				0.00				0.00	15.91														
	56	57	0.11	0.70	0.21	50.76			0.00	0.00			0.00	0.00			0.00	2.38	16.02	59.47	80.41	0.00	137.47	3404	1650	1650	CONC	0.23	60.5	4371	2.04	0.49	0.779
Contribution From Cercle du Ponthieu Circle, Pipe 58 - 57						3.45				0.00				0.00				0.00	11.72														
Contribution From Cercle du Ponthieu Circle, Pipe 9 - 57						2.14				0.00				0.00				0.00	10.17														
	57	1TEE			0.00	56.34			0.00	0.00			0.00	0.00			0.00	2.38	16.51	58.42	78.98	0.00	134.99	3671	1800	1800	CONC	0.15	10.5	4452	1.75	0.10	0.825
To Croissant de Mercier Crescent, Pipe 1TEE - 2TEE						56.34				0.00				0.00				2.38	16.61					30									
Croissant de Mercier Crescent - 09																																	
			0.20	0.50	0.28	0.28			0.00	0.00			0.00	0.00			0.00	0.00															
			0.24	0.50	0.33	0.61			0.00	0.00			0.00	0.00			0.00	0.00															
	590	59	0.39	0.70	0.76	1.37			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	0.00	178.56	105	375	375	PVC	0.85	102.0	162	1.46	1.16	0.651
	59	63			0.00	1.37			0.00	0.00			0.00	0.00			0.00	0.00	11.16	72.62	98.43	0.00	168.60	100	375	375	PVC	0.45	8.5	118	1.06	0.13	0.846
	63	60			0.00	1.37			0.00	0.00			0.00	0.00			0.00	0.00	11.29	72.17	97.82	0.00	167.53	99	375	375	PVC	0.60	9.0	136	1.23	0.12	0.728
To Unknown Road5, Pipe 60 - 61TEE						1.37				0.00				0.00				0.00	11.42														
Contribution From Avenue de Lamarche Avenue, Pipe 57 - 1TEE						56.34				0.00				0.00				2.38	16.61					30									
			0.19	0.70	0.37	56.71			0.00	0.00			0.00	0.00			0.00	2.38															
	1TEE	2TEE	0.39	0.70	0.76	57.47			0.00	0.00			0.00	0.00			0.00	2.38	16.61	58.21	78.69	0.00	134.50	3695	1800	1800	CONC	0.15	105.0	4452	1.75	1.00	0.830
	2TEE	3TEE	0.25	0.50	0.35	57.81			0.00	0.00			0.00	0.00			0.00	2.38	17.61	56.22	75.97	0.00	129.81	3589	1800	1800	CONC	0.15	13.5	4452	1.75	0.13	0.806
	3TEE	60			0.00	57.81			0.00	0.00			0.00	0.00			0.00	2.38	17.74	55.98	75.64	0.00	129.24	3574	1800	1800	CONC	0.15	41.5	4452	1.75	0.40	0.803
To Block 382, Pipe 60 - 61TEE						57.81				0.00				0.00				2.38	18.13					30									
Block 382 - 51																																	
Contribution From Croissant de Mercier Crescent, Pipe 3TEE - 60						57.81				0.00				0.00				2.38	18.13					30									
Contribution From Croissant de Mercier Crescent, Pipe 63 - 60						1.37				0.00				0.00				0.00	11.42														
	60	61TEE			0.00	59.19			0.00	0.00			0.00	0.00			0.00	2.38	18.13	55.24	74.63	0.00	127.50	3602	1800	1800	CONC	0.15	30.5	4452	1.75	0.29	0.809
	61TEE	62TEE			0.00	59.19			0.00	0.00			0.00	0.00			0.00	2.38	18.42	54.71	73.91	0.00	126.26	3568	1800	1800	CONC	0.15	73.5	4452	1.75	0.70	0.802
	62TEE	600TEE			0.00	59.19			0.00	0.00			0.00	0.00			0.00	2.38	19.12	53.48	72.23	0.00	123.36	3489	1800	1800	CONC	0.15	48.0	4452	1.75	0.46	0.784
	600TEE	64TEE			0.00	59.19			0.00	0.00			0.00	0.00			0.00	2.38	19.58	52.71	71.18	0.00	121.55	3439	1800	1800	CONC	0.15	23.5	4452	1.75	0.22	0.772
	64TEE	65			0.00	59.19			0.00	0.00			0.00	0.00			0.00	2.38	19.81	52.35	70.68	0.00	120.69	3415	1800	1800	CONC	0.15	3.0	4452	1.75	0.03	0.767

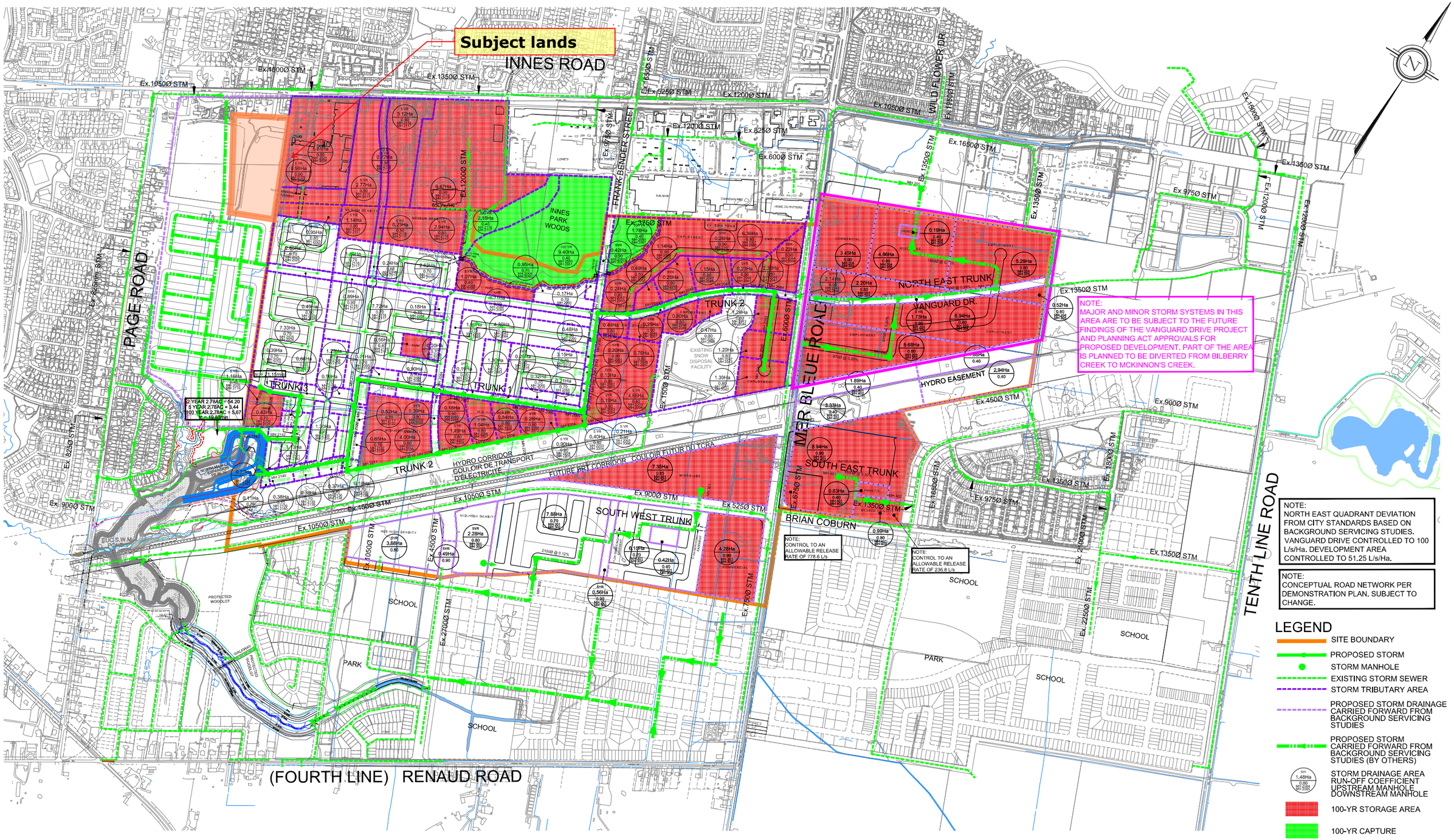
Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed: P.P./C.M.
Checked: M.Z.
Dwg. Reference:

PROJECT: **Caivan Communities**
Orleans Village
LOCATION: **City of Ottawa**
File Ref:
Date: 30 Oct 2018
Sheet No. SHEET 5 OF 5


Approximate location of subject lands
INNES ROAD
PAGE ROAD
MER BLEUE ROAD
MCKINNONS CREEK
EXISTING POND
POND #1
ELLIS ROAD
NAVAN ROAD
POND #3
POND #2
CANADIAN PACIFIC RAILWAY
MER BLEUE
PREFERRED SWMP
AREAS WHERE FLOW IS DIVERTED TO ADJACENT SUB-WATERSHED
SWM POND WHICH REQUIRES EXCAVATION
SWM POND
OVERLAND (MAJOR) STORMWATER FLOW ROUTE
POND TRIBUTARY AREA
STORM SEWER (MINOR) STORMWATER FLOW ROUTE
NATURAL WATERCOURSE
SPECIAL CONSIDERATION
Clare & Storrie Limited
Consulting Engineers
CITY OF GLOUCESTER
EAST URBAN COMMUNITY
MASTER DRAINAGE PLAN
SCALE:
DATE: MAY 1992
FIGURE No.: 7-1



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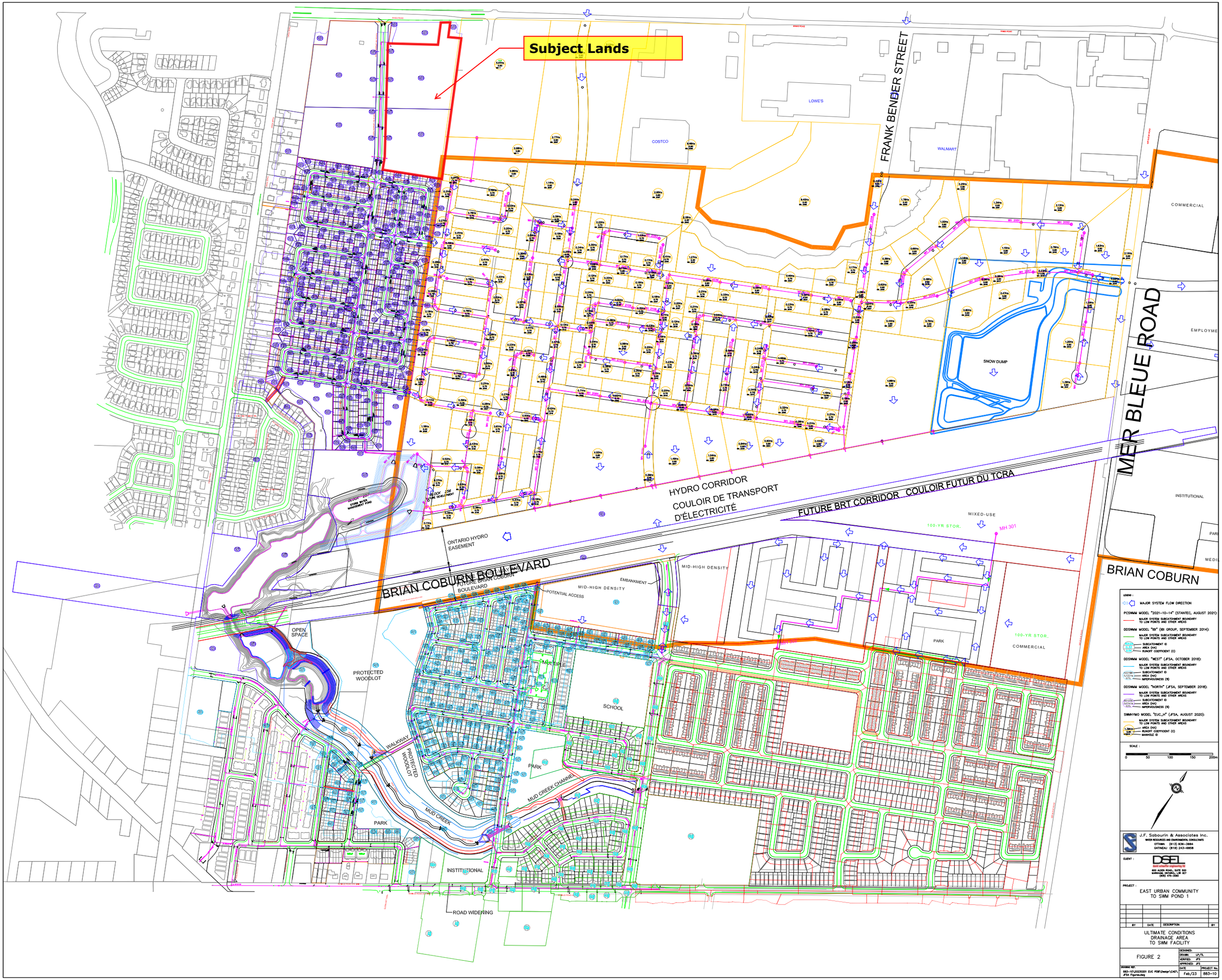
EAST URBAN COMMUNITY PHASE 3 AREA COMMUNITY DESIGN PLAN
CONCEPTUAL STORM SERVICING

PROJECT No. :	14-733
SCALE	1:5000
DATE:	OCTOBER 2019
DRAWING No.	4


Subject Lands
FRANK BENDER STREET
LOWE'S
COSTCO
WALMART
COMMERCIAL
MER BLEUE ROAD
EMPLOYME
SNOW DUMP
HYDRO CORRIDOR
COULOIR DE TRANSPORT
D'ÉLECTRICITÉ
FUTURE BRT CORRIDOR COULOIR FUTUR DU TCRA
MIXED-USE
100-YR STOR.
MH 301
INSTITUTIONAL
BRIAN COBURN
ONTARIO HYDRO EASEMENT
BRIAN COBURN BOULEVARD
FUTURE BRIAN COBURN BOULEVARD
POTENTIAL ACCESS
MID-HIGH DENSITY
EMBANKMENT
MID-HIGH DENSITY
PARK
100-YR STOR.
COMMERCIAL
OPEN SPACE
PROTECTED WOODLOT
Machine
SCHOOL
WALKWAY
PROTECTED WOODLOT
PARK
MUD CREEK CHANNEL
MUD CREEK
PARK
INSTITUTIONAL
ROAD WIDENING
LEGEND :
MAJOR SYSTEM FLOW DIRECTION
PCSWMM MODEL "2021-10-14" (STANTEC, AUGUST 2021):
MAJOR SYSTEM SUBCATCHMENT BOUNDARY TO LOW POINTS AND OTHER AREAS
DDSWMM MODEL "SE" (BI GROUP, SEPTEMBER 2014):
MAJOR SYSTEM SUBCATCHMENT BOUNDARY TO LOW POINTS AND OTHER AREAS
SUBCATCHMENT ID
AREA (HA)
RUNOFF COEFFICIENT (C)
DDSWMM MODEL "WEST" (JFSA, OCTOBER 2018):
MAJOR SYSTEM SUBCATCHMENT BOUNDARY TO LOW POINTS AND OTHER AREAS
SUBCATCHMENT ID
AREA (HA)
IMPERVIOUSNESS (%)
DDSWMM MODEL "NORTH" (JFSA, SEPTEMBER 2018):
MAJOR SYSTEM SUBCATCHMENT BOUNDARY TO LOW POINTS AND OTHER AREAS
SUBCATCHMENT ID
AREA (HA)
IMPERVIOUSNESS (%)
SWMHYMO MODEL "EUC_H" (JFSA, AUGUST 2020):
MAJOR SYSTEM SUBCATCHMENT BOUNDARY TO LOW POINTS AND OTHER AREAS
AREA (HA)
RUNOFF COEFFICIENT (C)
MANHOLE ID
SCALE :
0 50 100 150 200m
J.F. Sabourin & Associates Inc.
WATER RESOURCES AND ENVIRONMENTAL CONSULTANTS
OTTAWA (613) 836-3884
GATINEAU (819) 243-6858
CLIENT :
DSEL
600 ALDEN ROAD, SUITE 500
MARKHAM, ONTARIO, L3R 0E7
(905) 475-3262
PROJECT :
EAST URBAN COMMUNITY
TO SWM POND 1
BY DATE DESCRIPTION BY
ULTIMATE CONDITIONS
DRAINAGE AREA
TO SWM FACILITY
FIGURE 2
DESIGNED:
DRAWN: LP/TL
VERIFIED: JFS
APPROVED: JFS
DATE Feb/23
PROJECT No. 883-10
DRAWING REF: 883-10\2023\01 EUC PDR\Design\CAD\JFSA Figures.dwg

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

	LOCATION		AREA (Ha) 2 YEAR				AREA (Ha) 5 YEAR				AREA (Ha) 10 YEAR				AREA (Ha) 100 YEAR				FLOW						SEWER DATA							
			AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	Time of	Intensity	Intensity	Intensity	Intensity	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATIO
Location	From Node	To Node	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	Conc. (min)	2 Year (mm/h)	5 Year (mm/h)	10 Year (mm/h)	100 Year (mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	LOW (min	Q/Q full
Park Block																																	
	88	89	0.45	0.40	0.50	0.50			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	38	300	300	PVC	0.40	4.5	61.1589	0.8652	0.0867	0.628
To Private Street 5, Pipe 89 - 90						0.50				0.00				0.00				0.00	10.09														
RYCB 2																																	
	842	841			0.00	0.00			0.00	0.00			0.00	0.00	0.28	0.64	0.50	0.50	10.00	76.81	104.19	122.14	178.56	89	375	375	PVC	0.40	32.0	110.8885	1.0040	0.5312	0.802
To Private Street 1, Pipe 841 - 85						0.00				0.00				0.00				0.50	10.53														
Private Street 4																																	
			0.10	0.84	0.23	0.23			0.00	0.00			0.00	0.00			0.00	0.00															
	80	81	0.15	0.84	0.35	0.58			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	45	300	300	PVC	0.70	84.0	80.9057	1.1446	1.2232	0.554
To Private Street 5, Pipe 81 - 82						0.58				0.00				0.00				0.00	11.22														
Private Street 2																																	
	74	76	0.13	0.84	0.30	0.30			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	23	300	300	PVC	0.75	62.0	83.7453	1.1848	0.8722	0.278
To Private Street 3, Pipe 76 - 77						0.30				0.00				0.00				0.00	10.87														
	75	76	0.09	0.83	0.21	0.21			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	16	300	300	PVC	0.75	13.5	83.7453	1.1848	0.1899	0.190
To Private Street 3, Pipe 76 - 77						0.21				0.00				0.00				0.00	10.19														
Private Street 3																																	
Contribution From Private Street 2, Pipe 74 - 76						0.30				0.00				0.00				0.00	10.87														
Contribution From Private Street 2, Pipe 75 - 76						0.21				0.00				0.00				0.00	10.19														
			0.04	0.82	0.09	0.60			0.00	0.00			0.00	0.00			0.00	0.00															
			0.10	0.82	0.23	0.83			0.00	0.00			0.00	0.00			0.00	0.00															
			0.11	0.81	0.25	1.08			0.00	0.00			0.00	0.00			0.00	0.00															
	76	77	0.13	0.83	0.30	1.38			0.00	0.00			0.00	0.00			0.00	0.00	10.87	73.61	99.80	116.97	170.96	101	525	525	CONC	0.25	81.5	215.0311	0.9933	1.3675	0.472
	77	78			0.00	1.38			0.00	0.00			0.00	0.00			0.00	0.00	12.24	69.16	93.68	109.77	160.39	95	525	525	CONC	0.25	8.0	215.0311	0.9933	0.1342	0.443
To Private Street 1, Pipe 78 - 79						1.38				0.00				0.00				0.00	12.37														
DICB 1																																	
					0.00	0.00			0.00	0.00			0.00	0.00	0.19	0.63	0.33	0.33															
	712	711			0.00	0.00			0.00	0.00			0.00	0.00	0.83	0.59	1.36	1.69	10.00	76.81	104.19	122.14	178.56	303	600	600	CONC	0.35	32.0	363.2541	1.2847	0.4151	0.833
To Private Street 1, Pipe 711 - 72						0.00				0.00				0.00				1.69	10.42														
Private Street 1																																	
	83	84	0.17	0.81	0.38	0.38			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	29	375	375	PVC	0.45	48.5	117.6150	1.0649	0.7591	0.250
	84	841	0.06	0.80	0.13	0.52			0.00	0.00			0.00	0.00			0.00	0.00	10.76	74.01	100.35	117.61	171.91	38	375	375	PVC	0.40	20.5	110.8885	1.0040	0.3403	0.345
Contribution From RYCB 2, Pipe 842 - 841						0.00				0.00				0.00				0.50	10.53														
			0.08	0.79	0.18	0.69			0.00	0.00			0.00	0.00			0.00	0.50															
	841	85	0.15	0.82	0.34	1.03			0.00	0.00			0.00	0.00			0.00	0.50	11.10	72.83	98.72	115.70	169.10	160	525	525	CONC	0.20	51.0	192.3297	0.8885	0.9567	0.829
			0.04	0.78	0.09	1.12			0.00	0.00			0.00	0.00			0.00	0.50															
	85	86	0.09	0.73	0.18	1.30			0.00	0.00			0.00	0.00			0.00	0.50	12.06	69.72	94.46	110.68	161.72	171	525	525	CONC	0.25	37.5	215.0311	0.9933	0.6292	0.797
	86	87	0.24	0.80	0.53	1.84			0.00	0.00			0.00	0.00			0.00	0.50	12.69	67.83	91.87	107.63	157.24	203	525	525	CONC	0.55	25.0	318.9427	1.4733	0.2828	0.636
To Private Street 5, Pipe 87 - 89						1.84				0.00				0.00				0.50	12.97														
	70	71			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00	10.00	76.81	104.19	122.14	178.56	0	300	300	PVC	2.35	33.0	148.2395	2.0972	0.2623	0.000
	71	711	0.11	0.80	0.24	0.24			0.00	0.00			0.00	0.00			0.00	0.00	10.26	75.81	102.83	120.53	176.20	19	375	375	PVC	0.45	71.0	117.6150	1.0649	1.1112	0.158
Contribution From DICB 1, Pipe 712 - 711						0.00				0.00				0.00				1.69	10.42														
	711	72	0.32	0.84	0.75	0.99			0.00	0.00			0.00	0.00			0.00	1.69	11.37	71.91	97.46	114.21	166.91	354	675	675	CONC	0.55	19.5	623.3969	1.7421	0.1866	0.568
	72	73	0.07	0.82	0.16	1.15			0.00	0.00			0.00	0.00			0.00	1.69	11.56	71.29	96.62	113.22	165.45	362	675	675	CONC	1.35	5.0	976.6752	2.7293	0.0305	0.371
			0.14	0.82	0.32	1.47			0.00	0.00			0.00	0.00			0.00	1.69															
	73	78	0.19	0.65	0.34	1.81			0.00	0.00			0.00	0.00			0.00	1.69	11.59	71.19	96.48	113.06	165.22	409	750	750	CONC	0.40	64.5	704.0982	1.5938	0.6745	0.581

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

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed:
Checked:
Dwg. Reference:

PROJECT:
LOCATION:
City of Ottawa
File Ref:
Date: 29 Aug 2024
Sheet No. SHEET 1 OF 2

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Local Roads Return Frequency = 2 years
Collector Roads Return Frequency = 5 years
Manning 0.013 Arterial Roads Return Frequency = 10 years

	LOCATION		AREA (Ha)														FLOW						SEWER DATA								
			2 YEAR				5 YEAR				10 YEAR				100 YEAR				Time of	Intensity	Intensity	Intensity	Intensity	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATIO
			AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	AREA	R	Indiv.	Accum.	Conc.	2 Year	5 Year	10 Year	100 Year										
Location	From Node	To Node	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(Ha)		2.78 AC	2.78 AC	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	LOW (min	Q/Q full
Contribution From Private Street 3, Pipe 77 - 78						1.38				0.00				0.00				0.00	12.37														
					0.00	3.19			0.00	0.00			0.00	0.00	0.06	0.67	0.11	1.81															
					0.00	3.19			0.00	0.00			0.00	0.00	0.14	0.60	0.23	2.04															
			0.15	0.84	0.35	3.54			0.00	0.00			0.00	0.00			0.00	2.04															
	78	79	0.16	0.84	0.37	3.92			0.00	0.00			0.00	0.00			0.00	2.04	12.37	68.75	93.13	109.11	159.42	594	825	825	CONC	0.40	110.5	907.8492	1.6983	1.0844	0.655
To Private Street 5, Pipe 79 - 81						3.92				0.00				0.00				2.04	13.46														
Private Street 5																																	
Contribution From Private Street 1, Pipe 78 - 79						3.92				0.00				0.00				2.04	13.46														
	79	81			0.00	3.92			0.00	0.00			0.00	0.00			0.00	2.04	13.46	65.66	88.89	104.13	152.11	567	825	825	CONC	0.35	12.5	849.2152	1.5886	0.1311	0.668
Contribution From Private Street 4, Pipe 80 - 81						0.58				0.00				0.00				0.00	11.22														
	81	82	0.15	0.84	0.35	4.85			0.00	0.00			0.00	0.00			0.00	2.04	13.59	65.31	88.41	103.56	151.27	625	825	825	CONC	0.25	41.5	717.7178	1.3426	0.5152	0.871
	82	87			0.00	4.85			0.00	0.00			0.00	0.00	0.11	0.68	0.21	2.25	14.10	63.96	86.57	101.39	148.09	643	825	825	CONC	0.30	24.5	786.2205	1.4708	0.2776	0.818
Contribution From Private Street 1, Pipe 86 - 87						1.84				0.00				0.00				0.50	12.97														
	87	89	0.11	0.83	0.25	6.94			0.00	0.00			0.00	0.00			0.00	2.75	14.38	63.26	85.61	100.26	146.43	841	825	825	CONC	0.50	32.5	1015.0063	1.8988	0.2853	0.829
Contribution From Park Block, Pipe 88 - 89						0.50				0.00				0.00				0.00	10.09														
	89	90			0.00	7.44			0.00	0.00			0.00	0.00			0.00	2.75	14.67	62.56	84.65	99.13	144.78	863	825	825	CONC	0.50	15.5	1015.0063	1.8988	0.1361	0.850
To Avenue de Lamarche Avenue, Pipe 90 - 151						7.44				0.00				0.00				2.75	14.80														
Avenue de Lamarche Avenue																																	
Contribution From Private Street 5, Pipe 89 - 90						7.44				0.00				0.00				2.75	14.80														
			0.63	0.85	1.49	8.93			0.00	0.00			0.00	0.00			0.00	2.75	11.00														
			2.86	0.85	6.76	15.69			0.00	0.00			0.00	0.00			0.00	2.75	11.00														
			0.10	0.67	0.19	15.87			0.00	0.00			0.00	0.00			0.00	2.75															
	90	151	0.12	0.66	0.22	16.09			0.00	0.00			0.00	0.00			0.00	2.75	14.80	62.23	84.20	98.60	144.00	1397	825	825	CONC	1.12	68.5	1519.1223	2.8418	0.4017	0.920

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

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.80 m/s

Designed:	PROJECT:		
Checked:	LOCATION: **City of Ottawa**		
Dwg. Reference:	File Ref:	Date: 29 Aug 2024	Sheet No. SHEET 2 OF 2

Table 1A- 100 Year Chicago 3Hr -HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-70	MH-71	1-8	89.41	3.4	33	88.16	87.36	87.44	1.97
MH-70	MH-71	1-7	89.41	6.7	33	88.16	87.36	87.52	1.89
MH-70	MH-71	1-6	89.41	11.4	33	88.16	87.36	87.64	1.77
MH-70	MH-71	1-5	89.41	14.8	33	88.16	87.36	87.72	1.69
MH-70	MH-71	1-4	89.41	18.6	33	88.16	87.36	87.81	1.60
MH-70	MH-71	1-3	89.41	22.4	33	88.16	87.36	87.90	1.51
MH-70	MH-71	1-2	89.41	26.2	33	88.16	87.36	87.99	1.42
MH-70	MH-71	1-1	89.41	30.1	33	88.16	87.36	88.09	1.32
MH-71	MH-711	2-12	88.87	3.2	71	87.36	87.21	87.22	1.65
MH-71	MH-711	17-6	88.55	3.4	71	87.36	87.21	87.22	1.33
MH-71	MH-711	17-5	88.55	7.6	71	87.36	87.21	87.23	1.32
MH-71	MH-711	2-11	88.87	9.1	71	87.36	87.21	87.23	1.64
MH-71	MH-711	17-4	88.55	11	71	87.36	87.21	87.24	1.31
MH-71	MH-711	2-10	88.87	12.7	71	87.36	87.21	87.24	1.63
MH-71	MH-711	17-3	88.55	14.9	71	87.36	87.21	87.25	1.30
MH-71	MH-711	2-9	88.87	16.7	71	87.36	87.21	87.25	1.62
MH-71	MH-711	17-2	88.55	18.6	71	87.36	87.21	87.25	1.30
MH-71	MH-711	2-8	88.87	20.5	71	87.36	87.21	87.26	1.61
MH-71	MH-711	17-1	88.55	22.7	71	87.36	87.21	87.26	1.29
MH-71	MH-711	2-7	88.87	23.9	71	87.36	87.21	87.26	1.61
MH-71	MH-711	2-6	88.87	27.1	71	87.36	87.21	87.27	1.60
MH-71	MH-711	2-5	88.87	31.9	71	87.36	87.21	87.28	1.59
MH-71	MH-711	2-4	88.87	35.7	71	87.36	87.21	87.29	1.58
MH-71	MH-711	18-8	88.76	38.6	71	87.36	87.21	87.29	1.47
MH-71	MH-711	2-3	88.87	39.6	71	87.36	87.21	87.30	1.57
MH-71	MH-711	18-7	88.76	42.4	71	87.36	87.21	87.30	1.46
MH-71	MH-711	2-2	88.87	43.4	71	87.36	87.21	87.30	1.57
MH-71	MH-711	18-6	88.76	46.2	71	87.36	87.21	87.31	1.45
MH-71	MH-711	2-1	88.87	48.3	71	87.36	87.21	87.31	1.56
MH-71	MH-711	18-5	88.76	50	71	87.36	87.21	87.32	1.44
MH-71	MH-711	18-4	88.76	54.5	71	87.36	87.21	87.33	1.43
MH-71	MH-711	18-3	88.76	57.6	71	87.36	87.21	87.33	1.43
MH-71	MH-711	1-12	89.41	58	71	87.36	87.21	87.33	2.08
MH-71	MH-711	18-2	88.76	61.4	71	87.36	87.21	87.34	1.42
MH-71	MH-711	1-11	89.41	63.1	71	87.36	87.21	87.35	2.06
MH-71	MH-711	18-1	88.76	65.8	71	87.36	87.21	87.35	1.41
MH-71	MH-711	1-10	89.41	66.9	71	87.36	87.21	87.35	2.06
MH-71	MH-711	1-9	89.41	70.7	71	87.36	87.21	87.36	2.05
MH-71	MH-76	20-2	88.61	1.1	62	87.36	87.14	87.14	1.47
MH-71	MH-76	20-1	88.61	6.4	62	87.36	87.14	87.16	1.45
MH-71	MH-76	19-12	89.29	13.3	62	87.36	87.14	87.19	2.10
MH-71	MH-76	19-11	89.29	17.3	62	87.36	87.14	87.20	2.09
MH-71	MH-76	19-10	89.29	21.8	62	87.36	87.14	87.22	2.07
MH-71	MH-76	19-9	89.29	25.6	62	87.36	87.14	87.23	2.06
MH-71	MH-76	19-8	89.29	29.4	62	87.36	87.14	87.24	2.05
MH-71	MH-76	19-7	89.29	32.7	62	87.36	87.14	87.26	2.03
MH-71	MH-76	19-6	89.29	37.4	62	87.36	87.14	87.27	2.02
MH-71	MH-76	19-5	89.29	40.8	62	87.36	87.14	87.29	2.00
MH-71	MH-76	19-4	89.29	44.6	62	87.36	87.14	87.30	1.99

Table 1A- 100 Year Chicago 3Hr -HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-71	MH-76	19-3	89.29	48.4	62	87.36	87.14	87.31	1.98
MH-71	MH-76	19-2	89.29	52.1	62	87.36	87.14	87.33	1.96
MH-71	MH-76	19-1	89.29	56.4	62	87.36	87.14	87.34	1.95
MH-711	MH-72	3-4	88.41	1.6	19.5	87.21	87.18	87.18	1.23
MH-711	MH-72	3-3	88.41	3.6	19.5	87.21	87.18	87.18	1.23
MH-711	MH-72	3-2	88.41	7.4	19.5	87.21	87.18	87.19	1.22
MH-711	MH-72	17-10	88.55	8.4	19.5	87.21	87.18	87.19	1.36
MH-711	MH-72	3-1	88.41	11.2	19.5	87.21	87.18	87.20	1.21
MH-711	MH-72	17-9	88.55	11.5	19.5	87.21	87.18	87.20	1.35
MH-711	MH-72	17-8	88.55	15.4	19.5	87.21	87.18	87.21	1.34
MH-711	MH-72	17-7	88.55	19.5	19.5	87.21	87.18	87.21	1.34
MH-72	MH-73	4-2	88.4	1.3	5	87.18	87.15	87.16	1.24
MH-72	MH-73	4-3	88.4	1.3	5	87.18	87.15	87.16	1.24
MH-72	MH-73	3-8	88.41	3	5	87.18	87.15	87.17	1.24
MH-72	MH-73	3-10	88.41	3.1	5	87.18	87.15	87.17	1.24
MH-72	MH-73	3-12	88.41	3.1	5	87.18	87.15	87.17	1.24
MH-72	MH-73	3-5	88.41	3.1	5	87.18	87.15	87.17	1.24
MH-72	MH-73	3-6	88.41	3.1	5	87.18	87.15	87.17	1.24
MH-72	MH-73	3-7	88.41	3.1	5	87.18	87.15	87.17	1.24
MH-72	MH-73	3-9	88.41	3.1	5	87.18	87.15	87.17	1.24
MH-72	MH-73	4-1	88.4	3.1	5	87.18	87.15	87.17	1.23
MH-73	MH-78	5-6	88.4	2.4	64.5	87.15	87.04	87.05	1.35
MH-73	MH-78	5-5	88.4	5.8	64.5	87.15	87.04	87.05	1.35
MH-73	MH-78	5-4	88.4	9.6	64.5	87.15	87.04	87.06	1.34
MH-73	MH-78	5-3	88.4	13.4	64.5	87.15	87.04	87.06	1.34
MH-73	MH-78	5-2	88.4	17.2	64.5	87.15	87.04	87.07	1.33
MH-73	MH-78	5-1	88.4	22	64.5	87.15	87.04	87.08	1.32
MH-73	MH-78	4-12	88.4	31.6	64.5	87.15	87.04	87.10	1.30
MH-73	MH-78	4-11	88.4	36.5	64.5	87.15	87.04	87.10	1.30
MH-73	MH-78	4-10	88.4	40.3	64.5	87.15	87.04	87.11	1.29
MH-73	MH-78	4-9	88.4	44.1	64.5	87.15	87.04	87.12	1.28
MH-73	MH-78	4-8	88.4	47.9	64.5	87.15	87.04	87.12	1.28
MH-73	MH-78	4-7	88.4	51.1	64.5	87.15	87.04	87.13	1.27
MH-73	MH-78	4-6	88.4	56	64.5	87.15	87.04	87.14	1.26
MH-73	MH-78	4-5	88.4	59.4	64.5	87.15	87.04	87.15	1.25
MH-73	MH-78	4-4	88.4	63.2	64.5	87.15	87.04	87.15	1.25
MH-75	MH-76	20-3	88.61	2.6	13.5	87.15	87.14	87.14	1.47
MH-75	MH-76	20-4	88.61	6.4	13.5	87.15	87.14	87.14	1.47
MH-75	MH-76	20-5	88.61	10.2	13.5	87.15	87.14	87.14	1.47
MH-75	MH-76	20-6	88.61	12.3	13.5	87.15	87.14	87.14	1.47
MH-75	MH-76	20-7	88.61	12.3	13.5	87.15	87.14	87.14	1.47
MH-75	MH-76	20-8	88.61	12.3	13.5	87.15	87.14	87.14	1.47
MH-76	MH-77	16-10	88.36	0.6	81.5	87.14	87.05	87.05	1.31
MH-76	MH-77	16-9	88.36	4.9	81.5	87.14	87.05	87.06	1.30
MH-76	MH-77	16-8	88.36	8.7	81.5	87.14	87.05	87.06	1.30
MH-76	MH-77	16-7	88.36	11.8	81.5	87.14	87.05	87.07	1.29
MH-76	MH-77	16-6	88.36	16.3	81.5	87.14	87.05	87.07	1.29
MH-76	MH-77	16-5	88.36	20.1	81.5	87.14	87.05	87.07	1.29
MH-76	MH-77	16-4	88.36	23.9	81.5	87.14	87.05	87.08	1.28

Table 1A- 100 Year Chicago 3Hr -HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-76	MH-77	16-3	88.36	27.7	81.5	87.14	87.05	87.08	1.28
MH-76	MH-77	16-2	88.36	32.2	81.5	87.14	87.05	87.09	1.27
MH-76	MH-77	16-1	88.36	35.4	81.5	87.14	87.05	87.09	1.27
MH-76	MH-77	15-8	88.51	49	81.5	87.14	87.05	87.10	1.41
MH-76	MH-77	15-7	88.51	52.8	81.5	87.14	87.05	87.11	1.40
MH-76	MH-77	15-6	88.51	56.6	81.5	87.14	87.05	87.11	1.40
MH-76	MH-77	15-5	88.51	60.4	81.5	87.14	87.05	87.12	1.39
MH-76	MH-77	15-4	88.51	64.2	81.5	87.14	87.05	87.12	1.39
MH-76	MH-77	15-3	88.51	68	81.5	87.14	87.05	87.12	1.39
MH-76	MH-77	15-2	88.51	71.8	81.5	87.14	87.05	87.13	1.38
MH-76	MH-77	15-1	88.51	76.2	81.5	87.14	87.05	87.13	1.38
MH-78	MH-79	7-9	87.49	2	110.5	87.04	86.82	86.82	0.67
MH-78	MH-79	7-8	87.49	3.6	110.5	87.04	86.82	86.83	0.66
MH-78	MH-79	7-7	87.49	6.2	110.5	87.04	86.82	86.83	0.66
MH-78	MH-79	7-6	87.49	10.9	110.5	87.04	86.82	86.84	0.65
MH-78	MH-79	7-5	87.49	14.3	110.5	87.04	86.82	86.85	0.64
MH-78	MH-79	7-4	87.49	18.1	110.5	87.04	86.82	86.86	0.63
MH-78	MH-79	7-3	87.49	21.9	110.5	87.04	86.82	86.86	0.63
MH-78	MH-79	7-2	87.49	25.7	110.5	87.04	86.82	86.87	0.62
MH-78	MH-79	7-1	87.49	30	110.5	87.04	86.82	86.88	0.61
MH-78	MH-79	6-12	88	38.2	110.5	87.04	86.82	86.90	1.10
MH-78	MH-79	6-11	88	42.5	110.5	87.04	86.82	86.90	1.10
MH-78	MH-79	6-10	88	46.3	110.5	87.04	86.82	86.91	1.09
MH-78	MH-79	6-9	88	50.1	110.5	87.04	86.82	86.92	1.08
MH-78	MH-79	6-8	88	53.9	110.5	87.04	86.82	86.93	1.07
MH-78	MH-79	6-7	88	57.3	110.5	87.04	86.82	86.93	1.07
MH-78	MH-79	6-6	88	62	110.5	87.04	86.82	86.94	1.06
MH-78	MH-79	6-5	88	65.3	110.5	87.04	86.82	86.95	1.05
MH-78	MH-79	6-4	88	69.2	110.5	87.04	86.82	86.96	1.04
MH-78	MH-79	6-3	88	73	110.5	87.04	86.82	86.97	1.03
MH-78	MH-79	6-2	88	76.8	110.5	87.04	86.82	86.97	1.03
MH-78	MH-79	6-1	88	81	110.5	87.04	86.82	86.98	1.02
MH-78	MH-79	5-12	88.4	89.3	110.5	87.04	86.82	87.00	1.40
MH-78	MH-79	5-11	88.4	93.5	110.5	87.04	86.82	87.01	1.39
MH-78	MH-79	5-10	88.4	97.3	110.5	87.04	86.82	87.01	1.39
MH-78	MH-79	5-9	88.4	101.1	110.5	87.04	86.82	87.02	1.38
MH-78	MH-79	5-8	88.4	105	110.5	87.04	86.82	87.03	1.37
MH-78	MH-79	5-7	88.4	108.3	110.5	87.04	86.82	87.04	1.36
MH-79	MH-81	12-10	87.32	1.5	12.5	86.82	86.80	86.80	0.52
MH-80	MH-81	14-12	87.92	39.4	84	87.21	86.80	86.99	0.93
MH-80	MH-81	14-11	87.92	45.3	84	87.21	86.80	87.02	0.90
MH-80	MH-81	14-10	87.92	49.1	84	87.21	86.80	87.04	0.88
MH-80	MH-81	14-9	87.92	52.9	84	87.21	86.80	87.06	0.86
MH-80	MH-81	14-8	87.92	56.7	84	87.21	86.80	87.08	0.84
MH-80	MH-81	14-7	87.92	60.1	84	87.21	86.80	87.09	0.83
MH-80	MH-81	14-6	87.92	64.8	84	87.21	86.80	87.12	0.80
MH-80	MH-81	14-5	87.92	68.1	84	87.21	86.80	87.13	0.79
MH-80	MH-81	14-4	87.92	72	84	87.21	86.80	87.15	0.77
MH-80	MH-81	14-3	87.92	76	84	87.21	86.80	87.17	0.75

Table 1A- 100 Year Chicago 3Hr -HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-80	MH-81	14-2	87.92	79.6	84	87.21	86.80	87.19	0.73
MH-80	MH-81	14-1	87.92	84.2	84	87.21	86.80	87.21	0.71
MH-81	MH-82	13-6	87.36	3.3	41.5	86.80	86.70	86.71	0.65
MH-81	MH-82	12-1	87.32	4.8	41.5	86.80	86.70	86.71	0.61
MH-81	MH-82	13-7	87.36	5.9	41.5	86.80	86.70	86.72	0.64
MH-81	MH-82	13-8	87.36	10.9	41.5	86.80	86.70	86.73	0.63
MH-81	MH-82	12-2	87.32	11.1	41.5	86.80	86.70	86.73	0.59
MH-81	MH-82	13-9	87.36	13.5	41.5	86.80	86.70	86.73	0.63
MH-81	MH-82	12-3	87.32	14.9	41.5	86.80	86.70	86.74	0.58
MH-81	MH-82	13-10	87.36	18.5	41.5	86.80	86.70	86.74	0.62
MH-81	MH-82	12-4	87.32	18.8	41.5	86.80	86.70	86.75	0.57
MH-81	MH-82	13-11	87.36	21.1	41.5	86.80	86.70	86.75	0.61
MH-81	MH-82	12-5	87.32	22.5	41.5	86.80	86.70	86.75	0.57
MH-81	MH-82	12-6	87.32	25.7	41.5	86.80	86.70	86.76	0.56
MH-81	MH-82	13-12	87.36	26.9	41.5	86.80	86.70	86.76	0.60
MH-81	MH-82	12-7	87.32	30.6	41.5	86.80	86.70	86.77	0.55
MH-81	MH-82	12-8	87.32	34	41.5	86.80	86.70	86.78	0.54
MH-81	MH-82	12-9	87.32	37.7	41.5	86.80	86.70	86.79	0.53
MH-82	MH-87	13-1	87.36	7.3	24.5	86.70	86.66	86.67	0.69
MH-82	MH-87	13-2	87.36	12.5	24.5	86.70	86.66	86.68	0.68
MH-82	MH-87	13-3	87.36	15.1	24.5	86.70	86.66	86.69	0.67
MH-82	MH-87	13-4	87.36	20.1	24.5	86.70	86.66	86.70	0.66
MH-82	MH-87	13-5	87.36	22.7	24.5	86.70	86.66	86.70	0.66
MH-83	MH-84	8-11	87.45	0.8	48.5	86.89	86.85	86.85	0.60
MH-83	MH-84	8-10	87.45	2.6	48.5	86.89	86.85	86.86	0.59
MH-83	MH-84	8-9	87.45	6.4	48.5	86.89	86.85	86.86	0.59
MH-83	MH-84	8-8	87.45	10.2	48.5	86.89	86.85	86.86	0.59
MH-83	MH-84	8-7	87.45	13.5	48.5	86.89	86.85	86.86	0.59
MH-83	MH-84	8-6	87.45	18.3	48.5	86.89	86.85	86.87	0.58
MH-83	MH-84	8-5	87.45	21.6	48.5	86.89	86.85	86.87	0.58
MH-83	MH-84	8-4	87.45	25.4	48.5	86.89	86.85	86.87	0.58
MH-83	MH-84	8-3	87.45	29.2	48.5	86.89	86.85	86.88	0.57
MH-83	MH-84	8-2	87.45	33	48.5	86.89	86.85	86.88	0.57
MH-83	MH-84	8-1	87.45	37.9	48.5	86.89	86.85	86.88	0.57
MH-83	MH-84	7-10	87.49	46.9	48.5	86.89	86.85	86.89	0.60
MH-83	MH-84	7-11	87.49	46.9	48.5	86.89	86.85	86.89	0.60
MH-83	MH-84	7-12	87.49	46.9	48.5	86.89	86.85	86.89	0.60
MH-84	MH-841	11-8	87.38	1.2	20.5	86.85	86.85	86.85	0.53
MH-84	MH-841	9-1	87.38	3.5	20.5	86.85	86.85	86.85	0.53
MH-84	MH-841	11-9	87.38	5.1	20.5	86.85	86.85	86.85	0.53
MH-84	MH-841	9-2	87.38	7.4	20.5	86.85	86.85	86.85	0.53
MH-84	MH-841	11-10	87.38	9.7	20.5	86.85	86.85	86.85	0.53
MH-84	MH-841	9-3	87.38	11.2	20.5	86.85	86.85	86.85	0.53
MH-84	MH-841	9-4	87.38	15	20.5	86.85	86.85	86.85	0.53
MH-84	MH-841	9-10	87.38	17.8	20.5	86.85	86.85	86.85	0.53
MH-84	MH-841	9-11	87.38	17.8	20.5	86.85	86.85	86.85	0.53
MH-84	MH-841	9-5	87.38	17.8	20.5	86.85	86.85	86.85	0.53
MH-84	MH-841	9-6	87.38	17.8	20.5	86.85	86.85	86.85	0.53
MH-84	MH-841	9-7	87.38	17.8	20.5	86.85	86.85	86.85	0.53

Table 1A- 100 Year Chicago 3Hr -HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-84	MH-841	9-8	87.38	17.8	20.5	86.85	86.85	86.85	0.53
MH-84	MH-841	9-9	87.38	17.8	20.5	86.85	86.85	86.85	0.53
MH-84	MH-841	8-12	87.45	18.4	20.5	86.85	86.85	86.85	0.60
MH-84	MH-841	9-12	87.38	18.4	20.5	86.85	86.85	86.85	0.53
MH-841	MH-85	10-1	87.37	1.3	51	86.85	86.77	86.77	0.60
MH-841	MH-85	10-2	87.37	5	51	86.85	86.77	86.78	0.59
MH-841	MH-85	10-3	87.37	8.2	51	86.85	86.77	86.78	0.59
MH-841	MH-85	10-4	87.37	12	51	86.85	86.77	86.79	0.58
MH-841	MH-85	10-5	87.37	15.8	51	86.85	86.77	86.80	0.57
MH-841	MH-85	10-6	87.37	19.2	51	86.85	86.77	86.80	0.57
MH-841	MH-85	10-7	87.37	23.9	51	86.85	86.77	86.81	0.56
MH-841	MH-85	11-1	87.32	24.8	51	86.85	86.77	86.81	0.51
MH-841	MH-85	10-8	87.37	27.8	51	86.85	86.77	86.81	0.56
MH-841	MH-85	11-2	87.32	29.5	51	86.85	86.77	86.81	0.51
MH-841	MH-85	10-9	87.37	31.1	51	86.85	86.77	86.82	0.55
MH-841	MH-85	11-3	87.38	33.3	51	86.85	86.77	86.82	0.56
MH-841	MH-85	10-10	87.37	34.9	51	86.85	86.77	86.82	0.55
MH-841	MH-85	11-4	87.38	36.6	51	86.85	86.77	86.82	0.56
MH-841	MH-85	10-11	87.37	38.7	51	86.85	86.77	86.83	0.54
MH-841	MH-85	11-5	87.38	40.8	51	86.85	86.77	86.83	0.55
MH-841	MH-85	10-12	87.37	43	51	86.85	86.77	86.83	0.54
MH-841	MH-85	11-6	87.38	44.7	51	86.85	86.77	86.84	0.54
MH-841	MH-85	11-7	87.38	48.5	51	86.85	86.77	86.84	0.54
MH-85	MH-86	21-4	87.23	1	37.5	86.77	86.72	86.72	0.51
MH-85	MH-86	21-5	87.23	5.6	37.5	86.77	86.72	86.73	0.50
MH-85	MH-86	21-6	87.23	9	37.5	86.77	86.72	86.73	0.50
MH-85	MH-86	21-7	87.28	12.8	37.5	86.77	86.72	86.74	0.54
MH-85	MH-86	21-8	87.28	16.6	37.5	86.77	86.72	86.74	0.54
MH-85	MH-86	21-9	87.28	20.4	37.5	86.77	86.72	86.75	0.53
MH-85	MH-86	21-10	87.28	25.6	37.5	86.77	86.72	86.76	0.52
MH-85	MH-86	22-1	87.29	33.2	37.5	86.77	86.72	86.77	0.52
MH-85	MH-86	22-2	87.29	35.4	37.5	86.77	86.72	86.77	0.52
MH-85	MH-86	22-3	87.29	35.4	37.5	86.77	86.72	86.77	0.52
MH-85	MH-86	22-4	87.29	35.4	37.5	86.77	86.72	86.77	0.52
MH-85	MH-86	22-5	87.29	35.4	37.5	86.77	86.72	86.77	0.52
MH-85	MH-86	22-6	87.29	35.4	37.5	86.77	86.72	86.77	0.52
MH-85	MH-86	22-7	87.29	35.4	37.5	86.77	86.72	86.77	0.52
MH-85	MH-86	22-8	87.29	35.4	37.5	86.77	86.72	86.77	0.52
MH-86	MH-87	21-1	87.23	14.4	25	86.72	86.66	86.69	0.54
MH-86	MH-87	21-2	87.23	19.7	25	86.72	86.66	86.71	0.52
MH-86	MH-87	21-3	87.23	22.7	25	86.72	86.66	86.71	0.52

Table 1B- 100 Year SCS 24Hr -HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-70	MH-71	1-8	89.41	3.4	33	88.14	87.35	87.43	1.98
MH-70	MH-71	1-7	89.41	6.7	33	88.14	87.35	87.51	1.90
MH-70	MH-71	1-6	89.41	11.4	33	88.14	87.35	87.62	1.79
MH-70	MH-71	1-5	89.41	14.8	33	88.14	87.35	87.70	1.71
MH-70	MH-71	1-4	89.41	18.6	33	88.14	87.35	87.80	1.61
MH-70	MH-71	1-3	89.41	22.4	33	88.14	87.35	87.89	1.52
MH-70	MH-71	1-2	89.41	26.2	33	88.14	87.35	87.98	1.43
MH-70	MH-71	1-1	89.41	30.1	33	88.14	87.35	88.07	1.34
MH-71	MH-711	2-12	88.87	3.2	71	87.35	87.09	87.11	1.76
MH-71	MH-711	17-6	88.55	3.4	71	87.35	87.09	87.11	1.44
MH-71	MH-711	17-5	88.55	7.6	71	87.35	87.09	87.12	1.43
MH-71	MH-711	2-11	88.87	9.1	71	87.35	87.09	87.13	1.74
MH-71	MH-711	17-4	88.55	11	71	87.35	87.09	87.13	1.42
MH-71	MH-711	2-10	88.87	12.7	71	87.35	87.09	87.14	1.73
MH-71	MH-711	17-3	88.55	14.9	71	87.35	87.09	87.15	1.40
MH-71	MH-711	2-9	88.87	16.7	71	87.35	87.09	87.15	1.72
MH-71	MH-711	17-2	88.55	18.6	71	87.35	87.09	87.16	1.39
MH-71	MH-711	2-8	88.87	20.5	71	87.35	87.09	87.17	1.70
MH-71	MH-711	17-1	88.55	22.7	71	87.35	87.09	87.18	1.37
MH-71	MH-711	2-7	88.87	23.9	71	87.35	87.09	87.18	1.69
MH-71	MH-711	2-6	88.87	27.1	71	87.35	87.09	87.19	1.68
MH-71	MH-711	2-5	88.87	31.9	71	87.35	87.09	87.21	1.66
MH-71	MH-711	2-4	88.87	35.7	71	87.35	87.09	87.22	1.65
MH-71	MH-711	18-8	88.76	38.6	71	87.35	87.09	87.23	1.53
MH-71	MH-711	2-3	88.87	39.6	71	87.35	87.09	87.24	1.63
MH-71	MH-711	18-7	88.76	42.4	71	87.35	87.09	87.25	1.51
MH-71	MH-711	2-2	88.87	43.4	71	87.35	87.09	87.25	1.62
MH-71	MH-711	18-6	88.76	46.2	71	87.35	87.09	87.26	1.50
MH-71	MH-711	2-1	88.87	48.3	71	87.35	87.09	87.27	1.60
MH-71	MH-711	18-5	88.76	50	71	87.35	87.09	87.28	1.48
MH-71	MH-711	18-4	88.76	54.5	71	87.35	87.09	87.29	1.47
MH-71	MH-711	18-3	88.76	57.6	71	87.35	87.09	87.30	1.46
MH-71	MH-711	1-12	89.41	58	71	87.35	87.09	87.30	2.11
MH-71	MH-711	18-2	88.76	61.4	71	87.35	87.09	87.32	1.44
MH-71	MH-711	1-11	89.41	63.1	71	87.35	87.09	87.32	2.09
MH-71	MH-711	18-1	88.76	65.8	71	87.35	87.09	87.33	1.43
MH-71	MH-711	1-10	89.41	66.9	71	87.35	87.09	87.34	2.07
MH-71	MH-711	1-9	89.41	70.7	71	87.35	87.09	87.35	2.06
MH-71	MH-76	20-2	88.61	1.1	62	87.35	87.07	87.07	1.54
MH-71	MH-76	20-1	88.61	6.4	62	87.35	87.07	87.10	1.51
MH-71	MH-76	19-12	89.29	13.3	62	87.35	87.07	87.13	2.16
MH-71	MH-76	19-11	89.29	17.3	62	87.35	87.07	87.15	2.14
MH-71	MH-76	19-10	89.29	21.8	62	87.35	87.07	87.17	2.12
MH-71	MH-76	19-9	89.29	25.6	62	87.35	87.07	87.19	2.10
MH-71	MH-76	19-8	89.29	29.4	62	87.35	87.07	87.20	2.09
MH-71	MH-76	19-7	89.29	32.7	62	87.35	87.07	87.22	2.07
MH-71	MH-76	19-6	89.29	37.4	62	87.35	87.07	87.24	2.05
MH-71	MH-76	19-5	89.29	40.8	62	87.35	87.07	87.25	2.04
MH-71	MH-76	19-4	89.29	44.6	62	87.35	87.07	87.27	2.02

Table 1B- 100 Year SCS 24Hr -HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-71	MH-76	19-3	89.29	48.4	62	87.35	87.07	87.29	2.00
MH-71	MH-76	19-2	89.29	52.1	62	87.35	87.07	87.31	1.98
MH-71	MH-76	19-1	89.29	56.4	62	87.35	87.07	87.33	1.96
MH-711	MH-72	3-4	88.41	1.6	19.5	87.09	87.08	87.08	1.33
MH-711	MH-72	3-3	88.41	3.6	19.5	87.09	87.08	87.08	1.33
MH-711	MH-72	3-2	88.41	7.4	19.5	87.09	87.08	87.08	1.33
MH-711	MH-72	17-10	88.55	8.4	19.5	87.09	87.08	87.08	1.47
MH-711	MH-72	3-1	88.41	11.2	19.5	87.09	87.08	87.09	1.32
MH-711	MH-72	17-9	88.55	11.5	19.5	87.09	87.08	87.09	1.46
MH-711	MH-72	17-8	88.55	15.4	19.5	87.09	87.08	87.09	1.46
MH-711	MH-72	17-7	88.55	19.5	19.5	87.09	87.08	87.09	1.46
MH-72	MH-73	4-2	88.4	1.3	5	87.08	87.06	87.07	1.33
MH-72	MH-73	4-3	88.4	1.3	5	87.08	87.06	87.07	1.33
MH-72	MH-73	3-8	88.41	3	5	87.08	87.06	87.07	1.34
MH-72	MH-73	3-10	88.41	3.1	5	87.08	87.06	87.07	1.34
MH-72	MH-73	3-12	88.41	3.1	5	87.08	87.06	87.07	1.34
MH-72	MH-73	3-5	88.41	3.1	5	87.08	87.06	87.07	1.34
MH-72	MH-73	3-6	88.41	3.1	5	87.08	87.06	87.07	1.34
MH-72	MH-73	3-7	88.41	3.1	5	87.08	87.06	87.07	1.34
MH-72	MH-73	3-9	88.41	3.1	5	87.08	87.06	87.07	1.34
MH-72	MH-73	4-1	88.4	3.1	5	87.08	87.06	87.07	1.33
MH-73	MH-78	5-6	88.4	2.4	64.5	87.06	86.99	86.99	1.41
MH-73	MH-78	5-5	88.4	5.8	64.5	87.06	86.99	87.00	1.40
MH-73	MH-78	5-4	88.4	9.6	64.5	87.06	86.99	87.00	1.40
MH-73	MH-78	5-3	88.4	13.4	64.5	87.06	86.99	87.01	1.39
MH-73	MH-78	5-2	88.4	17.2	64.5	87.06	86.99	87.01	1.39
MH-73	MH-78	5-1	88.4	22	64.5	87.06	86.99	87.02	1.38
MH-73	MH-78	4-12	88.4	31.6	64.5	87.06	86.99	87.03	1.37
MH-73	MH-78	4-11	88.4	36.5	64.5	87.06	86.99	87.03	1.37
MH-73	MH-78	4-10	88.4	40.3	64.5	87.06	86.99	87.04	1.36
MH-73	MH-78	4-9	88.4	44.1	64.5	87.06	86.99	87.04	1.36
MH-73	MH-78	4-8	88.4	47.9	64.5	87.06	86.99	87.05	1.35
MH-73	MH-78	4-7	88.4	51.1	64.5	87.06	86.99	87.05	1.35
MH-73	MH-78	4-6	88.4	56	64.5	87.06	86.99	87.05	1.35
MH-73	MH-78	4-5	88.4	59.4	64.5	87.06	86.99	87.06	1.34
MH-73	MH-78	4-4	88.4	63.2	64.5	87.06	86.99	87.06	1.34
MH-75	MH-76	20-3	88.61	2.6	13.5	87.10	87.07	87.07	1.54
MH-75	MH-76	20-4	88.61	6.4	13.5	87.10	87.07	87.08	1.53
MH-75	MH-76	20-5	88.61	10.2	13.5	87.10	87.07	87.09	1.52
MH-75	MH-76	20-6	88.61	12.3	13.5	87.10	87.07	87.09	1.52
MH-75	MH-76	20-7	88.61	12.3	13.5	87.10	87.07	87.09	1.52
MH-75	MH-76	20-8	88.61	12.3	13.5	87.10	87.07	87.09	1.52
MH-76	MH-77	16-10	88.36	0.6	81.5	87.07	87.00	87.00	1.36
MH-76	MH-77	16-9	88.36	4.9	81.5	87.07	87.00	87.01	1.35
MH-76	MH-77	16-8	88.36	8.7	81.5	87.07	87.00	87.01	1.35
MH-76	MH-77	16-7	88.36	11.8	81.5	87.07	87.00	87.01	1.35
MH-76	MH-77	16-6	88.36	16.3	81.5	87.07	87.00	87.02	1.34
MH-76	MH-77	16-5	88.36	20.1	81.5	87.07	87.00	87.02	1.34
MH-76	MH-77	16-4	88.36	23.9	81.5	87.07	87.00	87.02	1.34

Table 1B- 100 Year SCS 24Hr -HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-76	MH-77	16-3	88.36	27.7	81.5	87.07	87.00	87.03	1.33
MH-76	MH-77	16-2	88.36	32.2	81.5	87.07	87.00	87.03	1.33
MH-76	MH-77	16-1	88.36	35.4	81.5	87.07	87.00	87.03	1.33
MH-76	MH-77	15-8	88.51	49	81.5	87.07	87.00	87.04	1.47
MH-76	MH-77	15-7	88.51	52.8	81.5	87.07	87.00	87.05	1.46
MH-76	MH-77	15-6	88.51	56.6	81.5	87.07	87.00	87.05	1.46
MH-76	MH-77	15-5	88.51	60.4	81.5	87.07	87.00	87.05	1.46
MH-76	MH-77	15-4	88.51	64.2	81.5	87.07	87.00	87.05	1.46
MH-76	MH-77	15-3	88.51	68	81.5	87.07	87.00	87.06	1.45
MH-76	MH-77	15-2	88.51	71.8	81.5	87.07	87.00	87.06	1.45
MH-76	MH-77	15-1	88.51	76.2	81.5	87.07	87.00	87.06	1.45
MH-78	MH-79	7-9	87.49	2	110.5	86.99	86.73	86.73	0.76
MH-78	MH-79	7-8	87.49	3.6	110.5	86.99	86.73	86.74	0.75
MH-78	MH-79	7-7	87.49	6.2	110.5	86.99	86.73	86.74	0.75
MH-78	MH-79	7-6	87.49	10.9	110.5	86.99	86.73	86.75	0.74
MH-78	MH-79	7-5	87.49	14.3	110.5	86.99	86.73	86.76	0.73
MH-78	MH-79	7-4	87.49	18.1	110.5	86.99	86.73	86.77	0.72
MH-78	MH-79	7-3	87.49	21.9	110.5	86.99	86.73	86.78	0.71
MH-78	MH-79	7-2	87.49	25.7	110.5	86.99	86.73	86.79	0.70
MH-78	MH-79	7-1	87.49	30	110.5	86.99	86.73	86.80	0.69
MH-78	MH-79	6-12	88	38.2	110.5	86.99	86.73	86.82	1.18
MH-78	MH-79	6-11	88	42.5	110.5	86.99	86.73	86.83	1.17
MH-78	MH-79	6-10	88	46.3	110.5	86.99	86.73	86.84	1.16
MH-78	MH-79	6-9	88	50.1	110.5	86.99	86.73	86.85	1.15
MH-78	MH-79	6-8	88	53.9	110.5	86.99	86.73	86.86	1.14
MH-78	MH-79	6-7	88	57.3	110.5	86.99	86.73	86.86	1.14
MH-78	MH-79	6-6	88	62	110.5	86.99	86.73	86.88	1.12
MH-78	MH-79	6-5	88	65.3	110.5	86.99	86.73	86.88	1.12
MH-78	MH-79	6-4	88	69.2	110.5	86.99	86.73	86.89	1.11
MH-78	MH-79	6-3	88	73	110.5	86.99	86.73	86.90	1.10
MH-78	MH-79	6-2	88	76.8	110.5	86.99	86.73	86.91	1.09
MH-78	MH-79	6-1	88	81	110.5	86.99	86.73	86.92	1.08
MH-78	MH-79	5-12	88.4	89.3	110.5	86.99	86.73	86.94	1.46
MH-78	MH-79	5-11	88.4	93.5	110.5	86.99	86.73	86.95	1.45
MH-78	MH-79	5-10	88.4	97.3	110.5	86.99	86.73	86.96	1.44
MH-78	MH-79	5-9	88.4	101.1	110.5	86.99	86.73	86.97	1.43
MH-78	MH-79	5-8	88.4	105	110.5	86.99	86.73	86.98	1.42
MH-78	MH-79	5-7	88.4	108.3	110.5	86.99	86.73	86.99	1.41
MH-79	MH-81	12-10	87.32	1.5	12.5	86.73	86.70	86.70	0.62
MH-80	MH-81	14-12	87.92	39.4	84	87.11	86.70	86.89	1.03
MH-80	MH-81	14-11	87.92	45.3	84	87.11	86.70	86.92	1.00
MH-80	MH-81	14-10	87.92	49.1	84	87.11	86.70	86.94	0.98
MH-80	MH-81	14-9	87.92	52.9	84	87.11	86.70	86.96	0.96
MH-80	MH-81	14-8	87.92	56.7	84	87.11	86.70	86.98	0.94
MH-80	MH-81	14-7	87.92	60.1	84	87.11	86.70	86.99	0.93
MH-80	MH-81	14-6	87.92	64.8	84	87.11	86.70	87.02	0.90
MH-80	MH-81	14-5	87.92	68.1	84	87.11	86.70	87.03	0.89
MH-80	MH-81	14-4	87.92	72	84	87.11	86.70	87.05	0.87
MH-80	MH-81	14-3	87.92	76	84	87.11	86.70	87.07	0.85

Table 1B- 100 Year SCS 24Hr -HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-80	MH-81	14-2	87.92	79.6	84	87.11	86.70	87.09	0.83
MH-80	MH-81	14-1	87.92	84.2	84	87.11	86.70	87.11	0.81
MH-81	MH-82	13-6	87.36	3.3	41.5	86.70	86.61	86.62	0.74
MH-81	MH-82	12-1	87.32	4.8	41.5	86.70	86.61	86.62	0.70
MH-81	MH-82	13-7	87.36	5.9	41.5	86.70	86.61	86.62	0.74
MH-81	MH-82	13-8	87.36	10.9	41.5	86.70	86.61	86.64	0.72
MH-81	MH-82	12-2	87.32	11.1	41.5	86.70	86.61	86.64	0.68
MH-81	MH-82	13-9	87.36	13.5	41.5	86.70	86.61	86.64	0.72
MH-81	MH-82	12-3	87.32	14.9	41.5	86.70	86.61	86.64	0.68
MH-81	MH-82	13-10	87.36	18.5	41.5	86.70	86.61	86.65	0.71
MH-81	MH-82	12-4	87.32	18.8	41.5	86.70	86.61	86.65	0.67
MH-81	MH-82	13-11	87.36	21.1	41.5	86.70	86.61	86.66	0.70
MH-81	MH-82	12-5	87.32	22.5	41.5	86.70	86.61	86.66	0.66
MH-81	MH-82	12-6	87.32	25.7	41.5	86.70	86.61	86.67	0.65
MH-81	MH-82	13-12	87.36	26.9	41.5	86.70	86.61	86.67	0.69
MH-81	MH-82	12-7	87.32	30.6	41.5	86.70	86.61	86.67	0.65
MH-81	MH-82	12-8	87.32	34	41.5	86.70	86.61	86.68	0.64
MH-81	MH-82	12-9	87.32	37.7	41.5	86.70	86.61	86.69	0.63
MH-82	MH-87	13-1	87.36	7.3	24.5	86.61	86.57	86.58	0.78
MH-82	MH-87	13-2	87.36	12.5	24.5	86.61	86.57	86.59	0.77
MH-82	MH-87	13-3	87.36	15.1	24.5	86.61	86.57	86.60	0.76
MH-82	MH-87	13-4	87.36	20.1	24.5	86.61	86.57	86.61	0.75
MH-82	MH-87	13-5	87.36	22.7	24.5	86.61	86.57	86.61	0.75
MH-83	MH-84	8-11	87.45	0.8	48.5	86.81	86.77	86.77	0.68
MH-83	MH-84	8-10	87.45	2.6	48.5	86.81	86.77	86.78	0.67
MH-83	MH-84	8-9	87.45	6.4	48.5	86.81	86.77	86.78	0.67
MH-83	MH-84	8-8	87.45	10.2	48.5	86.81	86.77	86.78	0.67
MH-83	MH-84	8-7	87.45	13.5	48.5	86.81	86.77	86.78	0.67
MH-83	MH-84	8-6	87.45	18.3	48.5	86.81	86.77	86.79	0.66
MH-83	MH-84	8-5	87.45	21.6	48.5	86.81	86.77	86.79	0.66
MH-83	MH-84	8-4	87.45	25.4	48.5	86.81	86.77	86.79	0.66
MH-83	MH-84	8-3	87.45	29.2	48.5	86.81	86.77	86.80	0.65
MH-83	MH-84	8-2	87.45	33	48.5	86.81	86.77	86.80	0.65
MH-83	MH-84	8-1	87.45	37.9	48.5	86.81	86.77	86.80	0.65
MH-83	MH-84	7-10	87.49	46.9	48.5	86.81	86.77	86.81	0.68
MH-83	MH-84	7-11	87.49	46.9	48.5	86.81	86.77	86.81	0.68
MH-83	MH-84	7-12	87.49	46.9	48.5	86.81	86.77	86.81	0.68
MH-84	MH-841	11-8	87.38	1.2	20.5	86.77	86.77	86.77	0.61
MH-84	MH-841	9-1	87.38	3.5	20.5	86.77	86.77	86.77	0.61
MH-84	MH-841	11-9	87.38	5.1	20.5	86.77	86.77	86.77	0.61
MH-84	MH-841	9-2	87.38	7.4	20.5	86.77	86.77	86.77	0.61
MH-84	MH-841	11-10	87.38	9.7	20.5	86.77	86.77	86.77	0.61
MH-84	MH-841	9-3	87.38	11.2	20.5	86.77	86.77	86.77	0.61
MH-84	MH-841	9-4	87.38	15	20.5	86.77	86.77	86.77	0.61
MH-84	MH-841	9-10	87.38	17.8	20.5	86.77	86.77	86.77	0.61
MH-84	MH-841	9-11	87.38	17.8	20.5	86.77	86.77	86.77	0.61
MH-84	MH-841	9-5	87.38	17.8	20.5	86.77	86.77	86.77	0.61
MH-84	MH-841	9-6	87.38	17.8	20.5	86.77	86.77	86.77	0.61
MH-84	MH-841	9-7	87.38	17.8	20.5	86.77	86.77	86.77	0.61

Table 1B- 100 Year SCS 24Hr -HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-84	MH-841	9-8	87.38	17.8	20.5	86.77	86.77	86.77	0.61
MH-84	MH-841	9-9	87.38	17.8	20.5	86.77	86.77	86.77	0.61
MH-84	MH-841	8-12	87.45	18.4	20.5	86.77	86.77	86.77	0.68
MH-84	MH-841	9-12	87.38	18.4	20.5	86.77	86.77	86.77	0.61
MH-841	MH-85	10-1	87.37	1.3	51	86.77	86.67	86.68	0.69
MH-841	MH-85	10-2	87.37	5	51	86.77	86.67	86.68	0.69
MH-841	MH-85	10-3	87.37	8.2	51	86.77	86.67	86.69	0.68
MH-841	MH-85	10-4	87.37	12	51	86.77	86.67	86.69	0.68
MH-841	MH-85	10-5	87.37	15.8	51	86.77	86.67	86.70	0.67
MH-841	MH-85	10-6	87.37	19.2	51	86.77	86.67	86.71	0.66
MH-841	MH-85	10-7	87.37	23.9	51	86.77	86.67	86.72	0.65
MH-841	MH-85	11-1	87.32	24.8	51	86.77	86.67	86.72	0.60
MH-841	MH-85	10-8	87.37	27.8	51	86.77	86.67	86.72	0.65
MH-841	MH-85	11-2	87.32	29.5	51	86.77	86.67	86.73	0.59
MH-841	MH-85	10-9	87.37	31.1	51	86.77	86.67	86.73	0.64
MH-841	MH-85	11-3	87.38	33.3	51	86.77	86.67	86.73	0.65
MH-841	MH-85	10-10	87.37	34.9	51	86.77	86.67	86.74	0.63
MH-841	MH-85	11-4	87.38	36.6	51	86.77	86.67	86.74	0.64
MH-841	MH-85	10-11	87.37	38.7	51	86.77	86.67	86.74	0.63
MH-841	MH-85	11-5	87.38	40.8	51	86.77	86.67	86.75	0.63
MH-841	MH-85	10-12	87.37	43	51	86.77	86.67	86.75	0.62
MH-841	MH-85	11-6	87.38	44.7	51	86.77	86.67	86.75	0.63
MH-841	MH-85	11-7	87.38	48.5	51	86.77	86.67	86.76	0.62
MH-85	MH-86	21-4	87.23	1	37.5	86.67	86.63	86.63	0.60
MH-85	MH-86	21-5	87.23	5.6	37.5	86.67	86.63	86.64	0.59
MH-85	MH-86	21-6	87.23	9	37.5	86.67	86.63	86.64	0.59
MH-85	MH-86	21-7	87.28	12.8	37.5	86.67	86.63	86.64	0.64
MH-85	MH-86	21-8	87.28	16.6	37.5	86.67	86.63	86.65	0.63
MH-85	MH-86	21-9	87.28	20.4	37.5	86.67	86.63	86.65	0.63
MH-85	MH-86	21-10	87.28	25.6	37.5	86.67	86.63	86.66	0.62
MH-85	MH-86	22-1	87.29	33.2	37.5	86.67	86.63	86.67	0.62
MH-85	MH-86	22-2	87.29	35.4	37.5	86.67	86.63	86.67	0.62
MH-85	MH-86	22-3	87.29	35.4	37.5	86.67	86.63	86.67	0.62
MH-85	MH-86	22-4	87.29	35.4	37.5	86.67	86.63	86.67	0.62
MH-85	MH-86	22-5	87.29	35.4	37.5	86.67	86.63	86.67	0.62
MH-85	MH-86	22-6	87.29	35.4	37.5	86.67	86.63	86.67	0.62
MH-85	MH-86	22-7	87.29	35.4	37.5	86.67	86.63	86.67	0.62
MH-85	MH-86	22-8	87.29	35.4	37.5	86.67	86.63	86.67	0.62
MH-86	MH-87	21-1	87.23	14.4	25	86.63	86.57	86.60	0.63
MH-86	MH-87	21-2	87.23	19.7	25	86.63	86.57	86.62	0.61
MH-86	MH-87	21-3	87.23	22.7	25	86.63	86.57	86.62	0.61

Table 1C- 100 Year Chicago 3Hr + 20% -HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-70	MH-71	1-8	89.41	3.4	33	88.45	88.27	88.29	1.12
MH-70	MH-71	1-7	89.41	6.7	33	88.45	88.27	88.31	1.10
MH-70	MH-71	1-6	89.41	11.4	33	88.45	88.27	88.33	1.08
MH-70	MH-71	1-5	89.41	14.8	33	88.45	88.27	88.35	1.06
MH-70	MH-71	1-4	89.41	18.6	33	88.45	88.27	88.37	1.04
MH-70	MH-71	1-3	89.41	22.4	33	88.45	88.27	88.39	1.02
MH-70	MH-71	1-2	89.41	26.2	33	88.45	88.27	88.41	1.00
MH-70	MH-71	1-1	89.41	30.1	33	88.45	88.27	88.43	0.98
MH-71	MH-711	2-12	88.87	3.2	71	88.27	88.21	88.22	0.65
MH-71	MH-711	17-6	88.55	3.4	71	88.27	88.21	88.22	0.33
MH-71	MH-711	17-5	88.55	7.6	71	88.27	88.21	88.22	0.33
MH-71	MH-711	2-11	88.87	9.1	71	88.27	88.21	88.22	0.65
MH-71	MH-711	17-4	88.55	11	71	88.27	88.21	88.22	0.33
MH-71	MH-711	2-10	88.87	12.7	71	88.27	88.21	88.22	0.65
MH-71	MH-711	17-3	88.55	14.9	71	88.27	88.21	88.23	0.32
MH-71	MH-711	2-9	88.87	16.7	71	88.27	88.21	88.23	0.64
MH-71	MH-711	17-2	88.55	18.6	71	88.27	88.21	88.23	0.32
MH-71	MH-711	2-8	88.87	20.5	71	88.27	88.21	88.23	0.64
MH-71	MH-711	17-1	88.55	22.7	71	88.27	88.21	88.23	0.32
MH-71	MH-711	2-7	88.87	23.9	71	88.27	88.21	88.23	0.64
MH-71	MH-711	2-6	88.87	27.1	71	88.27	88.21	88.24	0.63
MH-71	MH-711	2-5	88.87	31.9	71	88.27	88.21	88.24	0.63
MH-71	MH-711	2-4	88.87	35.7	71	88.27	88.21	88.24	0.63
MH-71	MH-711	18-8	88.76	38.6	71	88.27	88.21	88.25	0.51
MH-71	MH-711	2-3	88.87	39.6	71	88.27	88.21	88.25	0.62
MH-71	MH-711	18-7	88.76	42.4	71	88.27	88.21	88.25	0.51
MH-71	MH-711	2-2	88.87	43.4	71	88.27	88.21	88.25	0.62
MH-71	MH-711	18-6	88.76	46.2	71	88.27	88.21	88.25	0.51
MH-71	MH-711	2-1	88.87	48.3	71	88.27	88.21	88.25	0.62
MH-71	MH-711	18-5	88.76	50	71	88.27	88.21	88.25	0.51
MH-71	MH-711	18-4	88.76	54.5	71	88.27	88.21	88.26	0.50
MH-71	MH-711	18-3	88.76	57.6	71	88.27	88.21	88.26	0.50
MH-71	MH-711	1-12	89.41	58	71	88.27	88.21	88.26	1.15
MH-71	MH-711	18-2	88.76	61.4	71	88.27	88.21	88.26	0.50
MH-71	MH-711	1-11	89.41	63.1	71	88.27	88.21	88.27	1.14
MH-71	MH-711	18-1	88.76	65.8	71	88.27	88.21	88.27	0.49
MH-71	MH-711	1-10	89.41	66.9	71	88.27	88.21	88.27	1.14
MH-71	MH-711	1-9	89.41	70.7	71	88.27	88.21	88.27	1.14
MH-71	MH-76	20-2	88.61	1.1	62	88.27	88.08	88.08	0.53
MH-71	MH-76	20-1	88.61	6.4	62	88.27	88.08	88.10	0.51
MH-71	MH-76	19-12	89.29	13.3	62	88.27	88.08	88.12	1.17
MH-71	MH-76	19-11	89.29	17.3	62	88.27	88.08	88.13	1.16
MH-71	MH-76	19-10	89.29	21.8	62	88.27	88.08	88.15	1.14
MH-71	MH-76	19-9	89.29	25.6	62	88.27	88.08	88.16	1.13
MH-71	MH-76	19-8	89.29	29.4	62	88.27	88.08	88.17	1.12
MH-71	MH-76	19-7	89.29	32.7	62	88.27	88.08	88.18	1.11
MH-71	MH-76	19-6	89.29	37.4	62	88.27	88.08	88.20	1.09
MH-71	MH-76	19-5	89.29	40.8	62	88.27	88.08	88.21	1.08
MH-71	MH-76	19-4	89.29	44.6	62	88.27	88.08	88.22	1.07

Table 1C- 100 Year Chicago 3Hr + 20% -HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-71	MH-76	19-3	89.29	48.4	62	88.27	88.08	88.23	1.06
MH-71	MH-76	19-2	89.29	52.1	62	88.27	88.08	88.24	1.05
MH-71	MH-76	19-1	89.29	56.4	62	88.27	88.08	88.25	1.04
MH-711	MH-72	3-4	88.41	1.6	19.5	88.21	88.15	88.15	0.26
MH-711	MH-72	3-3	88.41	3.6	19.5	88.21	88.15	88.16	0.25
MH-711	MH-72	3-2	88.41	7.4	19.5	88.21	88.15	88.17	0.24
MH-711	MH-72	17-10	88.55	8.4	19.5	88.21	88.15	88.18	0.37
MH-711	MH-72	3-1	88.41	11.2	19.5	88.21	88.15	88.19	0.22
MH-711	MH-72	17-9	88.55	11.5	19.5	88.21	88.15	88.19	0.36
MH-711	MH-72	17-8	88.55	15.4	19.5	88.21	88.15	88.20	0.35
MH-711	MH-72	17-7	88.55	19.5	19.5	88.21	88.15	88.21	0.34
MH-72	MH-73	4-2	88.4	1.3	5	88.15	88.11	88.12	0.28
MH-72	MH-73	4-3	88.4	1.3	5	88.15	88.11	88.12	0.28
MH-72	MH-73	3-8	88.41	3	5	88.15	88.11	88.13	0.28
MH-72	MH-73	3-10	88.41	3.1	5	88.15	88.11	88.13	0.28
MH-72	MH-73	3-12	88.41	3.1	5	88.15	88.11	88.13	0.28
MH-72	MH-73	3-5	88.41	3.1	5	88.15	88.11	88.13	0.28
MH-72	MH-73	3-6	88.41	3.1	5	88.15	88.11	88.13	0.28
MH-72	MH-73	3-7	88.41	3.1	5	88.15	88.11	88.13	0.28
MH-72	MH-73	3-9	88.41	3.1	5	88.15	88.11	88.13	0.28
MH-72	MH-73	4-1	88.4	3.1	5	88.15	88.11	88.13	0.27
MH-73	MH-78	5-6	88.4	2.4	64.5	88.11	87.89	87.90	0.50
MH-73	MH-78	5-5	88.4	5.8	64.5	88.11	87.89	87.91	0.49
MH-73	MH-78	5-4	88.4	9.6	64.5	88.11	87.89	87.92	0.48
MH-73	MH-78	5-3	88.4	13.4	64.5	88.11	87.89	87.94	0.46
MH-73	MH-78	5-2	88.4	17.2	64.5	88.11	87.89	87.95	0.45
MH-73	MH-78	5-1	88.4	22	64.5	88.11	87.89	87.97	0.43
MH-73	MH-78	4-12	88.4	31.6	64.5	88.11	87.89	88.00	0.40
MH-73	MH-78	4-11	88.4	36.5	64.5	88.11	87.89	88.02	0.38
MH-73	MH-78	4-10	88.4	40.3	64.5	88.11	87.89	88.03	0.37
MH-73	MH-78	4-9	88.4	44.1	64.5	88.11	87.89	88.04	0.36
MH-73	MH-78	4-8	88.4	47.9	64.5	88.11	87.89	88.06	0.34
MH-73	MH-78	4-7	88.4	51.1	64.5	88.11	87.89	88.07	0.33
MH-73	MH-78	4-6	88.4	56	64.5	88.11	87.89	88.08	0.32
MH-73	MH-78	4-5	88.4	59.4	64.5	88.11	87.89	88.10	0.30
MH-73	MH-78	4-4	88.4	63.2	64.5	88.11	87.89	88.11	0.29
MH-75	MH-76	20-3	88.61	2.6	13.5	88.08	88.08	88.08	0.53
MH-75	MH-76	20-4	88.61	6.4	13.5	88.08	88.08	88.08	0.53
MH-75	MH-76	20-5	88.61	10.2	13.5	88.08	88.08	88.08	0.53
MH-75	MH-76	20-6	88.61	12.3	13.5	88.08	88.08	88.08	0.53
MH-75	MH-76	20-7	88.61	12.3	13.5	88.08	88.08	88.08	0.53
MH-75	MH-76	20-8	88.61	12.3	13.5	88.08	88.08	88.08	0.53
MH-76	MH-77	16-10	88.36	0.6	81.5	88.08	87.91	87.92	0.44
MH-76	MH-77	16-9	88.36	4.9	81.5	88.08	87.91	87.92	0.44
MH-76	MH-77	16-8	88.36	8.7	81.5	88.08	87.91	87.93	0.43
MH-76	MH-77	16-7	88.36	11.8	81.5	88.08	87.91	87.94	0.42
MH-76	MH-77	16-6	88.36	16.3	81.5	88.08	87.91	87.95	0.41
MH-76	MH-77	16-5	88.36	20.1	81.5	88.08	87.91	87.95	0.41
MH-76	MH-77	16-4	88.36	23.9	81.5	88.08	87.91	87.96	0.40

Table 1C- 100 Year Chicago 3Hr + 20% -HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-76	MH-77	16-3	88.36	27.7	81.5	88.08	87.91	87.97	0.39
MH-76	MH-77	16-2	88.36	32.2	81.5	88.08	87.91	87.98	0.38
MH-76	MH-77	16-1	88.36	35.4	81.5	88.08	87.91	87.99	0.37
MH-76	MH-77	15-8	88.51	49	81.5	88.08	87.91	88.01	0.50
MH-76	MH-77	15-7	88.51	52.8	81.5	88.08	87.91	88.02	0.49
MH-76	MH-77	15-6	88.51	56.6	81.5	88.08	87.91	88.03	0.48
MH-76	MH-77	15-5	88.51	60.4	81.5	88.08	87.91	88.04	0.47
MH-76	MH-77	15-4	88.51	64.2	81.5	88.08	87.91	88.04	0.47
MH-76	MH-77	15-3	88.51	68	81.5	88.08	87.91	88.05	0.46
MH-76	MH-77	15-2	88.51	71.8	81.5	88.08	87.91	88.06	0.45
MH-76	MH-77	15-1	88.51	76.2	81.5	88.08	87.91	88.07	0.44
MH-78	MH-79	7-9	87.49	2	110.5	87.89	87.13	87.14	0.35
MH-78	MH-79	7-8	87.49	3.6	110.5	87.89	87.13	87.15	0.34
MH-78	MH-79	7-7	87.49	6.2	110.5	87.89	87.13	87.17	0.32
MH-78	MH-79	7-6	87.49	10.9	110.5	87.89	87.13	87.20	0.29
MH-78	MH-79	7-5	87.49	14.3	110.5	87.89	87.13	87.23	0.26
MH-78	MH-79	7-4	87.49	18.1	110.5	87.89	87.13	87.25	0.24
MH-78	MH-79	7-3	87.49	21.9	110.5	87.89	87.13	87.28	0.21
MH-78	MH-79	7-2	87.49	25.7	110.5	87.89	87.13	87.31	0.18
MH-78	MH-79	7-1	87.49	30	110.5	87.89	87.13	87.34	0.15
MH-78	MH-79	6-12	88	38.2	110.5	87.89	87.13	87.39	0.61
MH-78	MH-79	6-11	88	42.5	110.5	87.89	87.13	87.42	0.58
MH-78	MH-79	6-10	88	46.3	110.5	87.89	87.13	87.45	0.55
MH-78	MH-79	6-9	88	50.1	110.5	87.89	87.13	87.47	0.53
MH-78	MH-79	6-8	88	53.9	110.5	87.89	87.13	87.50	0.50
MH-78	MH-79	6-7	88	57.3	110.5	87.89	87.13	87.52	0.48
MH-78	MH-79	6-6	88	62	110.5	87.89	87.13	87.56	0.44
MH-78	MH-79	6-5	88	65.3	110.5	87.89	87.13	87.58	0.42
MH-78	MH-79	6-4	88	69.2	110.5	87.89	87.13	87.61	0.39
MH-78	MH-79	6-3	88	73	110.5	87.89	87.13	87.63	0.37
MH-78	MH-79	6-2	88	76.8	110.5	87.89	87.13	87.66	0.34
MH-78	MH-79	6-1	88	81	110.5	87.89	87.13	87.69	0.31
MH-78	MH-79	5-12	88.4	89.3	110.5	87.89	87.13	87.74	0.66
MH-78	MH-79	5-11	88.4	93.5	110.5	87.89	87.13	87.77	0.63
MH-78	MH-79	5-10	88.4	97.3	110.5	87.89	87.13	87.80	0.60
MH-78	MH-79	5-9	88.4	101.1	110.5	87.89	87.13	87.83	0.57
MH-78	MH-79	5-8	88.4	105	110.5	87.89	87.13	87.85	0.55
MH-78	MH-79	5-7	88.4	108.3	110.5	87.89	87.13	87.88	0.52
MH-79	MH-81	12-10	87.32	1.5	12.5	87.13	87.09	87.09	0.23
MH-80	MH-81	14-12	87.92	39.4	84	87.60	87.09	87.33	0.59
MH-80	MH-81	14-11	87.92	45.3	84	87.60	87.09	87.36	0.56
MH-80	MH-81	14-10	87.92	49.1	84	87.60	87.09	87.39	0.53
MH-80	MH-81	14-9	87.92	52.9	84	87.60	87.09	87.41	0.51
MH-80	MH-81	14-8	87.92	56.7	84	87.60	87.09	87.43	0.49
MH-80	MH-81	14-7	87.92	60.1	84	87.60	87.09	87.45	0.47
MH-80	MH-81	14-6	87.92	64.8	84	87.60	87.09	87.48	0.44
MH-80	MH-81	14-5	87.92	68.1	84	87.60	87.09	87.50	0.42
MH-80	MH-81	14-4	87.92	72	84	87.60	87.09	87.53	0.39
MH-80	MH-81	14-3	87.92	76	84	87.60	87.09	87.55	0.37

Table 1C- 100 Year Chicago 3Hr + 20% -HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-80	MH-81	14-2	87.92	79.6	84	87.60	87.09	87.57	0.35
MH-80	MH-81	14-1	87.92	84.2	84	87.60	87.09	87.60	0.32
MH-81	MH-82	13-6	87.36	3.3	41.5	87.09	86.95	86.96	0.40
MH-81	MH-82	12-1	87.32	4.8	41.5	87.09	86.95	86.97	0.35
MH-81	MH-82	13-7	87.36	5.9	41.5	87.09	86.95	86.97	0.39
MH-81	MH-82	13-8	87.36	10.9	41.5	87.09	86.95	86.99	0.37
MH-81	MH-82	12-2	87.32	11.1	41.5	87.09	86.95	86.99	0.33
MH-81	MH-82	13-9	87.36	13.5	41.5	87.09	86.95	87.00	0.36
MH-81	MH-82	12-3	87.32	14.9	41.5	87.09	86.95	87.00	0.32
MH-81	MH-82	13-10	87.36	18.5	41.5	87.09	86.95	87.01	0.35
MH-81	MH-82	12-4	87.32	18.8	41.5	87.09	86.95	87.01	0.31
MH-81	MH-82	13-11	87.36	21.1	41.5	87.09	86.95	87.02	0.34
MH-81	MH-82	12-5	87.32	22.5	41.5	87.09	86.95	87.03	0.29
MH-81	MH-82	12-6	87.32	25.7	41.5	87.09	86.95	87.04	0.28
MH-81	MH-82	13-12	87.36	26.9	41.5	87.09	86.95	87.04	0.32
MH-81	MH-82	12-7	87.32	30.6	41.5	87.09	86.95	87.05	0.27
MH-81	MH-82	12-8	87.32	34	41.5	87.09	86.95	87.06	0.26
MH-81	MH-82	12-9	87.32	37.7	41.5	87.09	86.95	87.07	0.25
MH-82	MH-87	13-1	87.36	7.3	24.5	86.95	86.87	86.89	0.47
MH-82	MH-87	13-2	87.36	12.5	24.5	86.95	86.87	86.91	0.45
MH-82	MH-87	13-3	87.36	15.1	24.5	86.95	86.87	86.92	0.44
MH-82	MH-87	13-4	87.36	20.1	24.5	86.95	86.87	86.94	0.42
MH-82	MH-87	13-5	87.36	22.7	24.5	86.95	86.87	86.95	0.41
MH-83	MH-84	8-11	87.45	0.8	48.5	87.22	87.19	87.19	0.26
MH-83	MH-84	8-10	87.45	2.6	48.5	87.22	87.19	87.20	0.25
MH-83	MH-84	8-9	87.45	6.4	48.5	87.22	87.19	87.20	0.25
MH-83	MH-84	8-8	87.45	10.2	48.5	87.22	87.19	87.20	0.25
MH-83	MH-84	8-7	87.45	13.5	48.5	87.22	87.19	87.20	0.25
MH-83	MH-84	8-6	87.45	18.3	48.5	87.22	87.19	87.20	0.25
MH-83	MH-84	8-5	87.45	21.6	48.5	87.22	87.19	87.21	0.24
MH-83	MH-84	8-4	87.45	25.4	48.5	87.22	87.19	87.21	0.24
MH-83	MH-84	8-3	87.45	29.2	48.5	87.22	87.19	87.21	0.24
MH-83	MH-84	8-2	87.45	33	48.5	87.22	87.19	87.21	0.24
MH-83	MH-84	8-1	87.45	37.9	48.5	87.22	87.19	87.22	0.23
MH-83	MH-84	7-10	87.49	46.9	48.5	87.22	87.19	87.22	0.27
MH-83	MH-84	7-11	87.49	46.9	48.5	87.22	87.19	87.22	0.27
MH-83	MH-84	7-12	87.49	46.9	48.5	87.22	87.19	87.22	0.27
MH-84	MH-841	11-8	87.38	1.2	20.5	87.19	87.17	87.17	0.21
MH-84	MH-841	9-1	87.38	3.5	20.5	87.19	87.17	87.17	0.21
MH-84	MH-841	11-9	87.38	5.1	20.5	87.19	87.17	87.17	0.21
MH-84	MH-841	9-2	87.38	7.4	20.5	87.19	87.17	87.18	0.20
MH-84	MH-841	11-10	87.38	9.7	20.5	87.19	87.17	87.18	0.20
MH-84	MH-841	9-3	87.38	11.2	20.5	87.19	87.17	87.18	0.20
MH-84	MH-841	9-4	87.38	15	20.5	87.19	87.17	87.19	0.19
MH-84	MH-841	9-10	87.38	17.8	20.5	87.19	87.17	87.19	0.19
MH-84	MH-841	9-11	87.38	17.8	20.5	87.19	87.17	87.19	0.19
MH-84	MH-841	9-5	87.38	17.8	20.5	87.19	87.17	87.19	0.19
MH-84	MH-841	9-6	87.38	17.8	20.5	87.19	87.17	87.19	0.19
MH-84	MH-841	9-7	87.38	17.8	20.5	87.19	87.17	87.19	0.19

Table 1C- 100 Year Chicago 3Hr + 20% -HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-84	MH-841	9-8	87.38	17.8	20.5	87.19	87.17	87.19	0.19
MH-84	MH-841	9-9	87.38	17.8	20.5	87.19	87.17	87.19	0.19
MH-84	MH-841	8-12	87.45	18.4	20.5	87.19	87.17	87.19	0.26
MH-84	MH-841	9-12	87.38	18.4	20.5	87.19	87.17	87.19	0.19
MH-841	MH-85	10-1	87.37	1.3	51	87.17	87.05	87.06	0.31
MH-841	MH-85	10-2	87.37	5	51	87.17	87.05	87.06	0.31
MH-841	MH-85	10-3	87.37	8.2	51	87.17	87.05	87.07	0.30
MH-841	MH-85	10-4	87.37	12	51	87.17	87.05	87.08	0.29
MH-841	MH-85	10-5	87.37	15.8	51	87.17	87.05	87.09	0.28
MH-841	MH-85	10-6	87.37	19.2	51	87.17	87.05	87.10	0.27
MH-841	MH-85	10-7	87.37	23.9	51	87.17	87.05	87.11	0.26
MH-841	MH-85	11-1	87.32	24.8	51	87.17	87.05	87.11	0.21
MH-841	MH-85	10-8	87.37	27.8	51	87.17	87.05	87.11	0.26
MH-841	MH-85	11-2	87.32	29.5	51	87.17	87.05	87.12	0.20
MH-841	MH-85	10-9	87.37	31.1	51	87.17	87.05	87.12	0.25
MH-841	MH-85	11-3	87.38	33.3	51	87.17	87.05	87.13	0.25
MH-841	MH-85	10-10	87.37	34.9	51	87.17	87.05	87.13	0.24
MH-841	MH-85	11-4	87.38	36.6	51	87.17	87.05	87.13	0.25
MH-841	MH-85	10-11	87.37	38.7	51	87.17	87.05	87.14	0.23
MH-841	MH-85	11-5	87.38	40.8	51	87.17	87.05	87.14	0.24
MH-841	MH-85	10-12	87.37	43	51	87.17	87.05	87.15	0.22
MH-841	MH-85	11-6	87.38	44.7	51	87.17	87.05	87.15	0.23
MH-841	MH-85	11-7	87.38	48.5	51	87.17	87.05	87.16	0.22
MH-85	MH-86	21-4	87.23	1	37.5	87.05	86.98	86.98	0.25
MH-85	MH-86	21-5	87.23	5.6	37.5	87.05	86.98	86.99	0.24
MH-85	MH-86	21-6	87.23	9	37.5	87.05	86.98	87.00	0.23
MH-85	MH-86	21-7	87.28	12.8	37.5	87.05	86.98	87.00	0.28
MH-85	MH-86	21-8	87.28	16.6	37.5	87.05	86.98	87.01	0.27
MH-85	MH-86	21-9	87.28	20.4	37.5	87.05	86.98	87.02	0.26
MH-85	MH-86	21-10	87.28	25.6	37.5	87.05	86.98	87.03	0.25
MH-85	MH-86	22-1	87.29	33.2	37.5	87.05	86.98	87.04	0.25
MH-85	MH-86	22-2	87.29	35.4	37.5	87.05	86.98	87.05	0.24
MH-85	MH-86	22-3	87.29	35.4	37.5	87.05	86.98	87.05	0.24
MH-85	MH-86	22-4	87.29	35.4	37.5	87.05	86.98	87.05	0.24
MH-85	MH-86	22-5	87.29	35.4	37.5	87.05	86.98	87.05	0.24
MH-85	MH-86	22-6	87.29	35.4	37.5	87.05	86.98	87.05	0.24
MH-85	MH-86	22-7	87.29	35.4	37.5	87.05	86.98	87.05	0.24
MH-85	MH-86	22-8	87.29	35.4	37.5	87.05	86.98	87.05	0.24
MH-86	MH-87	21-1	87.23	14.4	25	86.98	86.87	86.93	0.30
MH-86	MH-87	21-2	87.23	19.7	25	86.98	86.87	86.96	0.27
MH-86	MH-87	21-3	87.23	22.7	25	86.98	86.87	86.97	0.26

Table 1D- 1979 Event-HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-70	MH-71	1-8	89.41	3.4	33	88.13	87.34	87.42	1.99
MH-70	MH-71	1-7	89.41	6.7	33	88.13	87.34	87.50	1.91
MH-70	MH-71	1-6	89.41	11.4	33	88.13	87.34	87.61	1.80
MH-70	MH-71	1-5	89.41	14.8	33	88.13	87.34	87.69	1.72
MH-70	MH-71	1-4	89.41	18.6	33	88.13	87.34	87.79	1.62
MH-70	MH-71	1-3	89.41	22.4	33	88.13	87.34	87.88	1.53
MH-70	MH-71	1-2	89.41	26.2	33	88.13	87.34	87.97	1.44
MH-70	MH-71	1-1	89.41	30.1	33	88.13	87.34	88.06	1.35
MH-71	MH-711	2-12	88.87	3.2	71	87.34	87.17	87.18	1.69
MH-71	MH-711	17-6	88.55	3.4	71	87.34	87.17	87.18	1.37
MH-71	MH-711	17-5	88.55	7.6	71	87.34	87.17	87.19	1.36
MH-71	MH-711	2-11	88.87	9.1	71	87.34	87.17	87.20	1.67
MH-71	MH-711	17-4	88.55	11	71	87.34	87.17	87.20	1.35
MH-71	MH-711	2-10	88.87	12.7	71	87.34	87.17	87.20	1.67
MH-71	MH-711	17-3	88.55	14.9	71	87.34	87.17	87.21	1.34
MH-71	MH-711	2-9	88.87	16.7	71	87.34	87.17	87.21	1.66
MH-71	MH-711	17-2	88.55	18.6	71	87.34	87.17	87.22	1.33
MH-71	MH-711	2-8	88.87	20.5	71	87.34	87.17	87.22	1.65
MH-71	MH-711	17-1	88.55	22.7	71	87.34	87.17	87.23	1.32
MH-71	MH-711	2-7	88.87	23.9	71	87.34	87.17	87.23	1.64
MH-71	MH-711	2-6	88.87	27.1	71	87.34	87.17	87.24	1.63
MH-71	MH-711	2-5	88.87	31.9	71	87.34	87.17	87.25	1.62
MH-71	MH-711	2-4	88.87	35.7	71	87.34	87.17	87.26	1.61
MH-71	MH-711	18-8	88.76	38.6	71	87.34	87.17	87.27	1.49
MH-71	MH-711	2-3	88.87	39.6	71	87.34	87.17	87.27	1.60
MH-71	MH-711	18-7	88.76	42.4	71	87.34	87.17	87.27	1.49
MH-71	MH-711	2-2	88.87	43.4	71	87.34	87.17	87.28	1.59
MH-71	MH-711	18-6	88.76	46.2	71	87.34	87.17	87.28	1.48
MH-71	MH-711	2-1	88.87	48.3	71	87.34	87.17	87.29	1.58
MH-71	MH-711	18-5	88.76	50	71	87.34	87.17	87.29	1.47
MH-71	MH-711	18-4	88.76	54.5	71	87.34	87.17	87.30	1.46
MH-71	MH-711	18-3	88.76	57.6	71	87.34	87.17	87.31	1.45
MH-71	MH-711	1-12	89.41	58	71	87.34	87.17	87.31	2.10
MH-71	MH-711	18-2	88.76	61.4	71	87.34	87.17	87.32	1.44
MH-71	MH-711	1-11	89.41	63.1	71	87.34	87.17	87.32	2.09
MH-71	MH-711	18-1	88.76	65.8	71	87.34	87.17	87.33	1.43
MH-71	MH-711	1-10	89.41	66.9	71	87.34	87.17	87.33	2.08
MH-71	MH-711	1-9	89.41	70.7	71	87.34	87.17	87.34	2.07
MH-71	MH-76	20-2	88.61	1.1	62	87.34	87.15	87.15	1.46
MH-71	MH-76	20-1	88.61	6.4	62	87.34	87.15	87.17	1.44
MH-71	MH-76	19-12	89.29	13.3	62	87.34	87.15	87.19	2.10
MH-71	MH-76	19-11	89.29	17.3	62	87.34	87.15	87.20	2.09
MH-71	MH-76	19-10	89.29	21.8	62	87.34	87.15	87.22	2.07
MH-71	MH-76	19-9	89.29	25.6	62	87.34	87.15	87.23	2.06
MH-71	MH-76	19-8	89.29	29.4	62	87.34	87.15	87.24	2.05
MH-71	MH-76	19-7	89.29	32.7	62	87.34	87.15	87.25	2.04
MH-71	MH-76	19-6	89.29	37.4	62	87.34	87.15	87.27	2.02
MH-71	MH-76	19-5	89.29	40.8	62	87.34	87.15	87.28	2.01
MH-71	MH-76	19-4	89.29	44.6	62	87.34	87.15	87.29	2.00

Table 1D- 1979 Event-HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-71	MH-76	19-3	89.29	48.4	62	87.34	87.15	87.30	1.99
MH-71	MH-76	19-2	89.29	52.1	62	87.34	87.15	87.31	1.98
MH-71	MH-76	19-1	89.29	56.4	62	87.34	87.15	87.32	1.97
MH-711	MH-72	3-4	88.41	1.6	19.5	87.17	87.16	87.16	1.25
MH-711	MH-72	3-3	88.41	3.6	19.5	87.17	87.16	87.16	1.25
MH-711	MH-72	3-2	88.41	7.4	19.5	87.17	87.16	87.16	1.25
MH-711	MH-72	17-10	88.55	8.4	19.5	87.17	87.16	87.16	1.39
MH-711	MH-72	3-1	88.41	11.2	19.5	87.17	87.16	87.17	1.24
MH-711	MH-72	17-9	88.55	11.5	19.5	87.17	87.16	87.17	1.38
MH-711	MH-72	17-8	88.55	15.4	19.5	87.17	87.16	87.17	1.38
MH-711	MH-72	17-7	88.55	19.5	19.5	87.17	87.16	87.17	1.38
MH-72	MH-73	4-2	88.4	1.3	5	87.16	87.14	87.15	1.25
MH-72	MH-73	4-3	88.4	1.3	5	87.16	87.14	87.15	1.25
MH-72	MH-73	3-8	88.41	3	5	87.16	87.14	87.15	1.26
MH-72	MH-73	3-10	88.41	3.1	5	87.16	87.14	87.15	1.26
MH-72	MH-73	3-12	88.41	3.1	5	87.16	87.14	87.15	1.26
MH-72	MH-73	3-5	88.41	3.1	5	87.16	87.14	87.15	1.26
MH-72	MH-73	3-6	88.41	3.1	5	87.16	87.14	87.15	1.26
MH-72	MH-73	3-7	88.41	3.1	5	87.16	87.14	87.15	1.26
MH-72	MH-73	3-9	88.41	3.1	5	87.16	87.14	87.15	1.26
MH-72	MH-73	4-1	88.4	3.1	5	87.16	87.14	87.15	1.25
MH-73	MH-78	5-6	88.4	2.4	64.5	87.14	87.07	87.07	1.33
MH-73	MH-78	5-5	88.4	5.8	64.5	87.14	87.07	87.08	1.32
MH-73	MH-78	5-4	88.4	9.6	64.5	87.14	87.07	87.08	1.32
MH-73	MH-78	5-3	88.4	13.4	64.5	87.14	87.07	87.09	1.31
MH-73	MH-78	5-2	88.4	17.2	64.5	87.14	87.07	87.09	1.31
MH-73	MH-78	5-1	88.4	22	64.5	87.14	87.07	87.10	1.30
MH-73	MH-78	4-12	88.4	31.6	64.5	87.14	87.07	87.11	1.29
MH-73	MH-78	4-11	88.4	36.5	64.5	87.14	87.07	87.11	1.29
MH-73	MH-78	4-10	88.4	40.3	64.5	87.14	87.07	87.12	1.28
MH-73	MH-78	4-9	88.4	44.1	64.5	87.14	87.07	87.12	1.28
MH-73	MH-78	4-8	88.4	47.9	64.5	87.14	87.07	87.13	1.27
MH-73	MH-78	4-7	88.4	51.1	64.5	87.14	87.07	87.13	1.27
MH-73	MH-78	4-6	88.4	56	64.5	87.14	87.07	87.13	1.27
MH-73	MH-78	4-5	88.4	59.4	64.5	87.14	87.07	87.14	1.26
MH-73	MH-78	4-4	88.4	63.2	64.5	87.14	87.07	87.14	1.26
MH-75	MH-76	20-3	88.61	2.6	13.5	87.15	87.15	87.15	1.46
MH-75	MH-76	20-4	88.61	6.4	13.5	87.15	87.15	87.15	1.46
MH-75	MH-76	20-5	88.61	10.2	13.5	87.15	87.15	87.15	1.46
MH-75	MH-76	20-6	88.61	12.3	13.5	87.15	87.15	87.15	1.46
MH-75	MH-76	20-7	88.61	12.3	13.5	87.15	87.15	87.15	1.46
MH-75	MH-76	20-8	88.61	12.3	13.5	87.15	87.15	87.15	1.46
MH-76	MH-77	16-10	88.36	0.6	81.5	87.15	87.08	87.08	1.28
MH-76	MH-77	16-9	88.36	4.9	81.5	87.15	87.08	87.09	1.27
MH-76	MH-77	16-8	88.36	8.7	81.5	87.15	87.08	87.09	1.27
MH-76	MH-77	16-7	88.36	11.8	81.5	87.15	87.08	87.09	1.27
MH-76	MH-77	16-6	88.36	16.3	81.5	87.15	87.08	87.10	1.26
MH-76	MH-77	16-5	88.36	20.1	81.5	87.15	87.08	87.10	1.26
MH-76	MH-77	16-4	88.36	23.9	81.5	87.15	87.08	87.10	1.26

Table 1D- 1979 Event-HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-76	MH-77	16-3	88.36	27.7	81.5	87.15	87.08	87.11	1.25
MH-76	MH-77	16-2	88.36	32.2	81.5	87.15	87.08	87.11	1.25
MH-76	MH-77	16-1	88.36	35.4	81.5	87.15	87.08	87.11	1.25
MH-76	MH-77	15-8	88.51	49	81.5	87.15	87.08	87.12	1.39
MH-76	MH-77	15-7	88.51	52.8	81.5	87.15	87.08	87.13	1.38
MH-76	MH-77	15-6	88.51	56.6	81.5	87.15	87.08	87.13	1.38
MH-76	MH-77	15-5	88.51	60.4	81.5	87.15	87.08	87.13	1.38
MH-76	MH-77	15-4	88.51	64.2	81.5	87.15	87.08	87.13	1.38
MH-76	MH-77	15-3	88.51	68	81.5	87.15	87.08	87.14	1.37
MH-76	MH-77	15-2	88.51	71.8	81.5	87.15	87.08	87.14	1.37
MH-76	MH-77	15-1	88.51	76.2	81.5	87.15	87.08	87.14	1.37
MH-78	MH-79	7-9	87.49	2	110.5	87.07	86.84	86.84	0.65
MH-78	MH-79	7-8	87.49	3.6	110.5	87.07	86.84	86.85	0.64
MH-78	MH-79	7-7	87.49	6.2	110.5	87.07	86.84	86.85	0.64
MH-78	MH-79	7-6	87.49	10.9	110.5	87.07	86.84	86.86	0.63
MH-78	MH-79	7-5	87.49	14.3	110.5	87.07	86.84	86.87	0.62
MH-78	MH-79	7-4	87.49	18.1	110.5	87.07	86.84	86.88	0.61
MH-78	MH-79	7-3	87.49	21.9	110.5	87.07	86.84	86.88	0.61
MH-78	MH-79	7-2	87.49	25.7	110.5	87.07	86.84	86.89	0.60
MH-78	MH-79	7-1	87.49	30	110.5	87.07	86.84	86.90	0.59
MH-78	MH-79	6-12	88	38.2	110.5	87.07	86.84	86.92	1.08
MH-78	MH-79	6-11	88	42.5	110.5	87.07	86.84	86.93	1.07
MH-78	MH-79	6-10	88	46.3	110.5	87.07	86.84	86.94	1.06
MH-78	MH-79	6-9	88	50.1	110.5	87.07	86.84	86.94	1.06
MH-78	MH-79	6-8	88	53.9	110.5	87.07	86.84	86.95	1.05
MH-78	MH-79	6-7	88	57.3	110.5	87.07	86.84	86.96	1.04
MH-78	MH-79	6-6	88	62	110.5	87.07	86.84	86.97	1.03
MH-78	MH-79	6-5	88	65.3	110.5	87.07	86.84	86.98	1.02
MH-78	MH-79	6-4	88	69.2	110.5	87.07	86.84	86.98	1.02
MH-78	MH-79	6-3	88	73	110.5	87.07	86.84	86.99	1.01
MH-78	MH-79	6-2	88	76.8	110.5	87.07	86.84	87.00	1.00
MH-78	MH-79	6-1	88	81	110.5	87.07	86.84	87.01	0.99
MH-78	MH-79	5-12	88.4	89.3	110.5	87.07	86.84	87.03	1.37
MH-78	MH-79	5-11	88.4	93.5	110.5	87.07	86.84	87.04	1.36
MH-78	MH-79	5-10	88.4	97.3	110.5	87.07	86.84	87.04	1.36
MH-78	MH-79	5-9	88.4	101.1	110.5	87.07	86.84	87.05	1.35
MH-78	MH-79	5-8	88.4	105	110.5	87.07	86.84	87.06	1.34
MH-78	MH-79	5-7	88.4	108.3	110.5	87.07	86.84	87.07	1.33
MH-79	MH-81	12-10	87.32	1.5	12.5	86.84	86.82	86.82	0.50
MH-80	MH-81	14-12	87.92	39.4	84	87.03	86.82	86.92	1.00
MH-80	MH-81	14-11	87.92	45.3	84	87.03	86.82	86.93	0.99
MH-80	MH-81	14-10	87.92	49.1	84	87.03	86.82	86.94	0.98
MH-80	MH-81	14-9	87.92	52.9	84	87.03	86.82	86.95	0.97
MH-80	MH-81	14-8	87.92	56.7	84	87.03	86.82	86.96	0.96
MH-80	MH-81	14-7	87.92	60.1	84	87.03	86.82	86.97	0.95
MH-80	MH-81	14-6	87.92	64.8	84	87.03	86.82	86.98	0.94
MH-80	MH-81	14-5	87.92	68.1	84	87.03	86.82	86.99	0.93
MH-80	MH-81	14-4	87.92	72	84	87.03	86.82	87.00	0.92
MH-80	MH-81	14-3	87.92	76	84	87.03	86.82	87.01	0.91

Table 1D- 1979 Event-HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-80	MH-81	14-2	87.92	79.6	84	87.03	86.82	87.02	0.90
MH-80	MH-81	14-1	87.92	84.2	84	87.03	86.82	87.03	0.89
MH-81	MH-82	13-6	87.36	3.3	41.5	86.82	86.73	86.74	0.62
MH-81	MH-82	12-1	87.32	4.8	41.5	86.82	86.73	86.74	0.58
MH-81	MH-82	13-7	87.36	5.9	41.5	86.82	86.73	86.74	0.62
MH-81	MH-82	13-8	87.36	10.9	41.5	86.82	86.73	86.76	0.60
MH-81	MH-82	12-2	87.32	11.1	41.5	86.82	86.73	86.76	0.56
MH-81	MH-82	13-9	87.36	13.5	41.5	86.82	86.73	86.76	0.60
MH-81	MH-82	12-3	87.32	14.9	41.5	86.82	86.73	86.76	0.56
MH-81	MH-82	13-10	87.36	18.5	41.5	86.82	86.73	86.77	0.59
MH-81	MH-82	12-4	87.32	18.8	41.5	86.82	86.73	86.77	0.55
MH-81	MH-82	13-11	87.36	21.1	41.5	86.82	86.73	86.78	0.58
MH-81	MH-82	12-5	87.32	22.5	41.5	86.82	86.73	86.78	0.54
MH-81	MH-82	12-6	87.32	25.7	41.5	86.82	86.73	86.79	0.53
MH-81	MH-82	13-12	87.36	26.9	41.5	86.82	86.73	86.79	0.57
MH-81	MH-82	12-7	87.32	30.6	41.5	86.82	86.73	86.79	0.53
MH-81	MH-82	12-8	87.32	34	41.5	86.82	86.73	86.80	0.52
MH-81	MH-82	12-9	87.32	37.7	41.5	86.82	86.73	86.81	0.51
MH-82	MH-87	13-1	87.36	7.3	24.5	86.73	86.68	86.70	0.66
MH-82	MH-87	13-2	87.36	12.5	24.5	86.73	86.68	86.71	0.65
MH-82	MH-87	13-3	87.36	15.1	24.5	86.73	86.68	86.71	0.65
MH-82	MH-87	13-4	87.36	20.1	24.5	86.73	86.68	86.72	0.64
MH-82	MH-87	13-5	87.36	22.7	24.5	86.73	86.68	86.73	0.63
MH-83	MH-84	8-11	87.45	0.8	48.5	86.86	86.83	86.83	0.62
MH-83	MH-84	8-10	87.45	2.6	48.5	86.86	86.83	86.84	0.61
MH-83	MH-84	8-9	87.45	6.4	48.5	86.86	86.83	86.84	0.61
MH-83	MH-84	8-8	87.45	10.2	48.5	86.86	86.83	86.84	0.61
MH-83	MH-84	8-7	87.45	13.5	48.5	86.86	86.83	86.84	0.61
MH-83	MH-84	8-6	87.45	18.3	48.5	86.86	86.83	86.84	0.61
MH-83	MH-84	8-5	87.45	21.6	48.5	86.86	86.83	86.85	0.60
MH-83	MH-84	8-4	87.45	25.4	48.5	86.86	86.83	86.85	0.60
MH-83	MH-84	8-3	87.45	29.2	48.5	86.86	86.83	86.85	0.60
MH-83	MH-84	8-2	87.45	33	48.5	86.86	86.83	86.85	0.60
MH-83	MH-84	8-1	87.45	37.9	48.5	86.86	86.83	86.86	0.59
MH-83	MH-84	7-10	87.49	46.9	48.5	86.86	86.83	86.86	0.63
MH-83	MH-84	7-11	87.49	46.9	48.5	86.86	86.83	86.86	0.63
MH-83	MH-84	7-12	87.49	46.9	48.5	86.86	86.83	86.86	0.63
MH-84	MH-841	11-8	87.38	1.2	20.5	86.83	86.84	86.83	0.55
MH-84	MH-841	9-1	87.38	3.5	20.5	86.83	86.84	86.83	0.55
MH-84	MH-841	11-9	87.38	5.1	20.5	86.83	86.84	86.83	0.55
MH-84	MH-841	9-2	87.38	7.4	20.5	86.83	86.84	86.83	0.55
MH-84	MH-841	11-10	87.38	9.7	20.5	86.83	86.84	86.83	0.55
MH-84	MH-841	9-3	87.38	11.2	20.5	86.83	86.84	86.83	0.55
MH-84	MH-841	9-4	87.38	15	20.5	86.83	86.84	86.83	0.55
MH-84	MH-841	9-10	87.38	17.8	20.5	86.83	86.84	86.83	0.55
MH-84	MH-841	9-11	87.38	17.8	20.5	86.83	86.84	86.83	0.55
MH-84	MH-841	9-5	87.38	17.8	20.5	86.83	86.84	86.83	0.55
MH-84	MH-841	9-6	87.38	17.8	20.5	86.83	86.84	86.83	0.55
MH-84	MH-841	9-7	87.38	17.8	20.5	86.83	86.84	86.83	0.55

Table 1D- 1979 Event-HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-84	MH-841	9-8	87.38	17.8	20.5	86.83	86.84	86.83	0.55
MH-84	MH-841	9-9	87.38	17.8	20.5	86.83	86.84	86.83	0.55
MH-84	MH-841	8-12	87.45	18.4	20.5	86.83	86.84	86.83	0.62
MH-84	MH-841	9-12	87.38	18.4	20.5	86.83	86.84	86.83	0.55
MH-841	MH-85	10-1	87.37	1.3	51	86.84	86.78	86.78	0.59
MH-841	MH-85	10-2	87.37	5	51	86.84	86.78	86.79	0.58
MH-841	MH-85	10-3	87.37	8.2	51	86.84	86.78	86.79	0.58
MH-841	MH-85	10-4	87.37	12	51	86.84	86.78	86.80	0.57
MH-841	MH-85	10-5	87.37	15.8	51	86.84	86.78	86.80	0.57
MH-841	MH-85	10-6	87.37	19.2	51	86.84	86.78	86.80	0.57
MH-841	MH-85	10-7	87.37	23.9	51	86.84	86.78	86.81	0.56
MH-841	MH-85	11-1	87.32	24.8	51	86.84	86.78	86.81	0.51
MH-841	MH-85	10-8	87.37	27.8	51	86.84	86.78	86.81	0.56
MH-841	MH-85	11-2	87.32	29.5	51	86.84	86.78	86.81	0.51
MH-841	MH-85	10-9	87.37	31.1	51	86.84	86.78	86.81	0.56
MH-841	MH-85	11-3	87.38	33.3	51	86.84	86.78	86.82	0.56
MH-841	MH-85	10-10	87.37	34.9	51	86.84	86.78	86.82	0.55
MH-841	MH-85	11-4	87.38	36.6	51	86.84	86.78	86.82	0.56
MH-841	MH-85	10-11	87.37	38.7	51	86.84	86.78	86.82	0.55
MH-841	MH-85	11-5	87.38	40.8	51	86.84	86.78	86.82	0.56
MH-841	MH-85	10-12	87.37	43	51	86.84	86.78	86.83	0.54
MH-841	MH-85	11-6	87.38	44.7	51	86.84	86.78	86.83	0.55
MH-841	MH-85	11-7	87.38	48.5	51	86.84	86.78	86.83	0.55
MH-85	MH-86	21-4	87.23	1	37.5	86.78	86.75	86.75	0.48
MH-85	MH-86	21-5	87.23	5.6	37.5	86.78	86.75	86.75	0.48
MH-85	MH-86	21-6	87.23	9	37.5	86.78	86.75	86.76	0.47
MH-85	MH-86	21-7	87.28	12.8	37.5	86.78	86.75	86.76	0.52
MH-85	MH-86	21-8	87.28	16.6	37.5	86.78	86.75	86.76	0.52
MH-85	MH-86	21-9	87.28	20.4	37.5	86.78	86.75	86.77	0.51
MH-85	MH-86	21-10	87.28	25.6	37.5	86.78	86.75	86.77	0.51
MH-85	MH-86	22-1	87.29	33.2	37.5	86.78	86.75	86.78	0.51
MH-85	MH-86	22-2	87.29	35.4	37.5	86.78	86.75	86.78	0.51
MH-85	MH-86	22-3	87.29	35.4	37.5	86.78	86.75	86.78	0.51
MH-85	MH-86	22-4	87.29	35.4	37.5	86.78	86.75	86.78	0.51
MH-85	MH-86	22-5	87.29	35.4	37.5	86.78	86.75	86.78	0.51
MH-85	MH-86	22-6	87.29	35.4	37.5	86.78	86.75	86.78	0.51
MH-85	MH-86	22-7	87.29	35.4	37.5	86.78	86.75	86.78	0.51
MH-85	MH-86	22-8	87.29	35.4	37.5	86.78	86.75	86.78	0.51
MH-86	MH-87	21-1	87.23	14.4	25	86.75	86.68	86.72	0.51
MH-86	MH-87	21-2	87.23	19.7	25	86.75	86.68	86.73	0.50
MH-86	MH-87	21-3	87.23	22.7	25	86.75	86.68	86.74	0.49

Table 1E- 1988 Event-HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-70	MH-71	1-8	89.41	3.4	33	88.13	87.34	87.42	1.99
MH-70	MH-71	1-7	89.41	6.7	33	88.13	87.34	87.50	1.91
MH-70	MH-71	1-6	89.41	11.4	33	88.13	87.34	87.61	1.80
MH-70	MH-71	1-5	89.41	14.8	33	88.13	87.34	87.69	1.72
MH-70	MH-71	1-4	89.41	18.6	33	88.13	87.34	87.79	1.62
MH-70	MH-71	1-3	89.41	22.4	33	88.13	87.34	87.88	1.53
MH-70	MH-71	1-2	89.41	26.2	33	88.13	87.34	87.97	1.44
MH-70	MH-71	1-1	89.41	30.1	33	88.13	87.34	88.06	1.35
MH-71	MH-711	2-12	88.87	3.2	71	87.34	86.98	87.00	1.87
MH-71	MH-711	17-6	88.55	3.4	71	87.34	86.98	87.00	1.55
MH-71	MH-711	17-5	88.55	7.6	71	87.34	86.98	87.02	1.53
MH-71	MH-711	2-11	88.87	9.1	71	87.34	86.98	87.03	1.84
MH-71	MH-711	17-4	88.55	11	71	87.34	86.98	87.04	1.51
MH-71	MH-711	2-10	88.87	12.7	71	87.34	86.98	87.05	1.82
MH-71	MH-711	17-3	88.55	14.9	71	87.34	86.98	87.06	1.49
MH-71	MH-711	2-9	88.87	16.7	71	87.34	86.98	87.07	1.80
MH-71	MH-711	17-2	88.55	18.6	71	87.34	86.98	87.08	1.47
MH-71	MH-711	2-8	88.87	20.5	71	87.34	86.98	87.09	1.78
MH-71	MH-711	17-1	88.55	22.7	71	87.34	86.98	87.10	1.45
MH-71	MH-711	2-7	88.87	23.9	71	87.34	86.98	87.10	1.77
MH-71	MH-711	2-6	88.87	27.1	71	87.34	86.98	87.12	1.75
MH-71	MH-711	2-5	88.87	31.9	71	87.34	86.98	87.14	1.73
MH-71	MH-711	2-4	88.87	35.7	71	87.34	86.98	87.16	1.71
MH-71	MH-711	18-8	88.76	38.6	71	87.34	86.98	87.18	1.58
MH-71	MH-711	2-3	88.87	39.6	71	87.34	86.98	87.18	1.69
MH-71	MH-711	18-7	88.76	42.4	71	87.34	86.98	87.20	1.56
MH-71	MH-711	2-2	88.87	43.4	71	87.34	86.98	87.20	1.67
MH-71	MH-711	18-6	88.76	46.2	71	87.34	86.98	87.22	1.54
MH-71	MH-711	2-1	88.87	48.3	71	87.34	86.98	87.23	1.64
MH-71	MH-711	18-5	88.76	50	71	87.34	86.98	87.24	1.52
MH-71	MH-711	18-4	88.76	54.5	71	87.34	86.98	87.26	1.50
MH-71	MH-711	18-3	88.76	57.6	71	87.34	86.98	87.27	1.49
MH-71	MH-711	1-12	89.41	58	71	87.34	86.98	87.28	2.13
MH-71	MH-711	18-2	88.76	61.4	71	87.34	86.98	87.29	1.47
MH-71	MH-711	1-11	89.41	63.1	71	87.34	86.98	87.30	2.11
MH-71	MH-711	18-1	88.76	65.8	71	87.34	86.98	87.32	1.44
MH-71	MH-711	1-10	89.41	66.9	71	87.34	86.98	87.32	2.09
MH-71	MH-711	1-9	89.41	70.7	71	87.34	86.98	87.34	2.07
MH-71	MH-76	20-2	88.61	1.1	62	87.34	86.98	86.98	1.63
MH-71	MH-76	20-1	88.61	6.4	62	87.34	86.98	87.02	1.59
MH-71	MH-76	19-12	89.29	13.3	62	87.34	86.98	87.06	2.23
MH-71	MH-76	19-11	89.29	17.3	62	87.34	86.98	87.08	2.21
MH-71	MH-76	19-10	89.29	21.8	62	87.34	86.98	87.11	2.18
MH-71	MH-76	19-9	89.29	25.6	62	87.34	86.98	87.13	2.16
MH-71	MH-76	19-8	89.29	29.4	62	87.34	86.98	87.15	2.14
MH-71	MH-76	19-7	89.29	32.7	62	87.34	86.98	87.17	2.12
MH-71	MH-76	19-6	89.29	37.4	62	87.34	86.98	87.20	2.09
MH-71	MH-76	19-5	89.29	40.8	62	87.34	86.98	87.22	2.07
MH-71	MH-76	19-4	89.29	44.6	62	87.34	86.98	87.24	2.05

Table 1E- 1988 Event-HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-71	MH-76	19-3	89.29	48.4	62	87.34	86.98	87.26	2.03
MH-71	MH-76	19-2	89.29	52.1	62	87.34	86.98	87.28	2.01
MH-71	MH-76	19-1	89.29	56.4	62	87.34	86.98	87.31	1.98
MH-711	MH-72	3-4	88.41	1.6	19.5	86.98	86.98	86.98	1.43
MH-711	MH-72	3-3	88.41	3.6	19.5	86.98	86.98	86.98	1.43
MH-711	MH-72	3-2	88.41	7.4	19.5	86.98	86.98	86.98	1.43
MH-711	MH-72	17-10	88.55	8.4	19.5	86.98	86.98	86.98	1.57
MH-711	MH-72	3-1	88.41	11.2	19.5	86.98	86.98	86.98	1.43
MH-711	MH-72	17-9	88.55	11.5	19.5	86.98	86.98	86.98	1.57
MH-711	MH-72	17-8	88.55	15.4	19.5	86.98	86.98	86.98	1.57
MH-711	MH-72	17-7	88.55	19.5	19.5	86.98	86.98	86.98	1.57
MH-72	MH-73	4-2	88.4	1.3	5	86.98	86.97	86.97	1.43
MH-72	MH-73	4-3	88.4	1.3	5	86.98	86.97	86.97	1.43
MH-72	MH-73	3-8	88.41	3	5	86.98	86.97	86.98	1.43
MH-72	MH-73	3-10	88.41	3.1	5	86.98	86.97	86.98	1.43
MH-72	MH-73	3-12	88.41	3.1	5	86.98	86.97	86.98	1.43
MH-72	MH-73	3-5	88.41	3.1	5	86.98	86.97	86.98	1.43
MH-72	MH-73	3-6	88.41	3.1	5	86.98	86.97	86.98	1.43
MH-72	MH-73	3-7	88.41	3.1	5	86.98	86.97	86.98	1.43
MH-72	MH-73	3-9	88.41	3.1	5	86.98	86.97	86.98	1.43
MH-72	MH-73	4-1	88.4	3.1	5	86.98	86.97	86.98	1.42
MH-73	MH-78	5-6	88.4	2.4	64.5	86.97	86.90	86.90	1.50
MH-73	MH-78	5-5	88.4	5.8	64.5	86.97	86.90	86.91	1.49
MH-73	MH-78	5-4	88.4	9.6	64.5	86.97	86.90	86.91	1.49
MH-73	MH-78	5-3	88.4	13.4	64.5	86.97	86.90	86.92	1.48
MH-73	MH-78	5-2	88.4	17.2	64.5	86.97	86.90	86.92	1.48
MH-73	MH-78	5-1	88.4	22	64.5	86.97	86.90	86.93	1.47
MH-73	MH-78	4-12	88.4	31.6	64.5	86.97	86.90	86.94	1.46
MH-73	MH-78	4-11	88.4	36.5	64.5	86.97	86.90	86.94	1.46
MH-73	MH-78	4-10	88.4	40.3	64.5	86.97	86.90	86.95	1.45
MH-73	MH-78	4-9	88.4	44.1	64.5	86.97	86.90	86.95	1.45
MH-73	MH-78	4-8	88.4	47.9	64.5	86.97	86.90	86.96	1.44
MH-73	MH-78	4-7	88.4	51.1	64.5	86.97	86.90	86.96	1.44
MH-73	MH-78	4-6	88.4	56	64.5	86.97	86.90	86.96	1.44
MH-73	MH-78	4-5	88.4	59.4	64.5	86.97	86.90	86.97	1.43
MH-73	MH-78	4-4	88.4	63.2	64.5	86.97	86.90	86.97	1.43
MH-75	MH-76	20-3	88.61	2.6	13.5	87.10	86.98	87.00	1.61
MH-75	MH-76	20-4	88.61	6.4	13.5	87.10	86.98	87.03	1.58
MH-75	MH-76	20-5	88.61	10.2	13.5	87.10	86.98	87.07	1.54
MH-75	MH-76	20-6	88.61	12.3	13.5	87.10	86.98	87.08	1.53
MH-75	MH-76	20-7	88.61	12.3	13.5	87.10	86.98	87.08	1.53
MH-75	MH-76	20-8	88.61	12.3	13.5	87.10	86.98	87.08	1.53
MH-76	MH-77	16-10	88.36	0.6	81.5	86.98	86.92	86.92	1.44
MH-76	MH-77	16-9	88.36	4.9	81.5	86.98	86.92	86.93	1.43
MH-76	MH-77	16-8	88.36	8.7	81.5	86.98	86.92	86.93	1.43
MH-76	MH-77	16-7	88.36	11.8	81.5	86.98	86.92	86.93	1.43
MH-76	MH-77	16-6	88.36	16.3	81.5	86.98	86.92	86.93	1.43
MH-76	MH-77	16-5	88.36	20.1	81.5	86.98	86.92	86.94	1.42
MH-76	MH-77	16-4	88.36	23.9	81.5	86.98	86.92	86.94	1.42

Table 1E- 1988 Event-HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-76	MH-77	16-3	88.36	27.7	81.5	86.98	86.92	86.94	1.42
MH-76	MH-77	16-2	88.36	32.2	81.5	86.98	86.92	86.95	1.41
MH-76	MH-77	16-1	88.36	35.4	81.5	86.98	86.92	86.95	1.41
MH-76	MH-77	15-8	88.51	49	81.5	86.98	86.92	86.96	1.55
MH-76	MH-77	15-7	88.51	52.8	81.5	86.98	86.92	86.96	1.55
MH-76	MH-77	15-6	88.51	56.6	81.5	86.98	86.92	86.96	1.55
MH-76	MH-77	15-5	88.51	60.4	81.5	86.98	86.92	86.96	1.55
MH-76	MH-77	15-4	88.51	64.2	81.5	86.98	86.92	86.97	1.54
MH-76	MH-77	15-3	88.51	68	81.5	86.98	86.92	86.97	1.54
MH-76	MH-77	15-2	88.51	71.8	81.5	86.98	86.92	86.97	1.54
MH-76	MH-77	15-1	88.51	76.2	81.5	86.98	86.92	86.97	1.54
MH-78	MH-79	7-9	87.49	2	110.5	86.90	86.65	86.65	0.84
MH-78	MH-79	7-8	87.49	3.6	110.5	86.90	86.65	86.66	0.83
MH-78	MH-79	7-7	87.49	6.2	110.5	86.90	86.65	86.66	0.83
MH-78	MH-79	7-6	87.49	10.9	110.5	86.90	86.65	86.67	0.82
MH-78	MH-79	7-5	87.49	14.3	110.5	86.90	86.65	86.68	0.81
MH-78	MH-79	7-4	87.49	18.1	110.5	86.90	86.65	86.69	0.80
MH-78	MH-79	7-3	87.49	21.9	110.5	86.90	86.65	86.70	0.79
MH-78	MH-79	7-2	87.49	25.7	110.5	86.90	86.65	86.71	0.78
MH-78	MH-79	7-1	87.49	30	110.5	86.90	86.65	86.72	0.77
MH-78	MH-79	6-12	88	38.2	110.5	86.90	86.65	86.74	1.26
MH-78	MH-79	6-11	88	42.5	110.5	86.90	86.65	86.75	1.25
MH-78	MH-79	6-10	88	46.3	110.5	86.90	86.65	86.75	1.25
MH-78	MH-79	6-9	88	50.1	110.5	86.90	86.65	86.76	1.24
MH-78	MH-79	6-8	88	53.9	110.5	86.90	86.65	86.77	1.23
MH-78	MH-79	6-7	88	57.3	110.5	86.90	86.65	86.78	1.22
MH-78	MH-79	6-6	88	62	110.5	86.90	86.65	86.79	1.21
MH-78	MH-79	6-5	88	65.3	110.5	86.90	86.65	86.80	1.20
MH-78	MH-79	6-4	88	69.2	110.5	86.90	86.65	86.81	1.19
MH-78	MH-79	6-3	88	73	110.5	86.90	86.65	86.82	1.18
MH-78	MH-79	6-2	88	76.8	110.5	86.90	86.65	86.82	1.18
MH-78	MH-79	6-1	88	81	110.5	86.90	86.65	86.83	1.17
MH-78	MH-79	5-12	88.4	89.3	110.5	86.90	86.65	86.85	1.55
MH-78	MH-79	5-11	88.4	93.5	110.5	86.90	86.65	86.86	1.54
MH-78	MH-79	5-10	88.4	97.3	110.5	86.90	86.65	86.87	1.53
MH-78	MH-79	5-9	88.4	101.1	110.5	86.90	86.65	86.88	1.52
MH-78	MH-79	5-8	88.4	105	110.5	86.90	86.65	86.89	1.51
MH-78	MH-79	5-7	88.4	108.3	110.5	86.90	86.65	86.90	1.50
MH-79	MH-81	12-10	87.32	1.5	12.5	86.65	86.63	86.63	0.69
MH-80	MH-81	14-12	87.92	39.4	84	87.04	86.63	86.82	1.10
MH-80	MH-81	14-11	87.92	45.3	84	87.04	86.63	86.85	1.07
MH-80	MH-81	14-10	87.92	49.1	84	87.04	86.63	86.87	1.05
MH-80	MH-81	14-9	87.92	52.9	84	87.04	86.63	86.89	1.03
MH-80	MH-81	14-8	87.92	56.7	84	87.04	86.63	86.91	1.01
MH-80	MH-81	14-7	87.92	60.1	84	87.04	86.63	86.92	1.00
MH-80	MH-81	14-6	87.92	64.8	84	87.04	86.63	86.95	0.97
MH-80	MH-81	14-5	87.92	68.1	84	87.04	86.63	86.96	0.96
MH-80	MH-81	14-4	87.92	72	84	87.04	86.63	86.98	0.94
MH-80	MH-81	14-3	87.92	76	84	87.04	86.63	87.00	0.92

Table 1E- 1988 Event-HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-80	MH-81	14-2	87.92	79.6	84	87.04	86.63	87.02	0.90
MH-80	MH-81	14-1	87.92	84.2	84	87.04	86.63	87.04	0.88
MH-81	MH-82	13-6	87.36	3.3	41.5	86.63	86.55	86.56	0.80
MH-81	MH-82	12-1	87.32	4.8	41.5	86.63	86.55	86.56	0.76
MH-81	MH-82	13-7	87.36	5.9	41.5	86.63	86.55	86.56	0.80
MH-81	MH-82	13-8	87.36	10.9	41.5	86.63	86.55	86.57	0.79
MH-81	MH-82	12-2	87.32	11.1	41.5	86.63	86.55	86.57	0.75
MH-81	MH-82	13-9	87.36	13.5	41.5	86.63	86.55	86.58	0.78
MH-81	MH-82	12-3	87.32	14.9	41.5	86.63	86.55	86.58	0.74
MH-81	MH-82	13-10	87.36	18.5	41.5	86.63	86.55	86.59	0.77
MH-81	MH-82	12-4	87.32	18.8	41.5	86.63	86.55	86.59	0.73
MH-81	MH-82	13-11	87.36	21.1	41.5	86.63	86.55	86.59	0.77
MH-81	MH-82	12-5	87.32	22.5	41.5	86.63	86.55	86.59	0.73
MH-81	MH-82	12-6	87.32	25.7	41.5	86.63	86.55	86.60	0.72
MH-81	MH-82	13-12	87.36	26.9	41.5	86.63	86.55	86.60	0.76
MH-81	MH-82	12-7	87.32	30.6	41.5	86.63	86.55	86.61	0.71
MH-81	MH-82	12-8	87.32	34	41.5	86.63	86.55	86.61	0.71
MH-81	MH-82	12-9	87.32	37.7	41.5	86.63	86.55	86.62	0.70
MH-82	MH-87	13-1	87.36	7.3	24.5	86.55	86.50	86.52	0.84
MH-82	MH-87	13-2	87.36	12.5	24.5	86.55	86.50	86.53	0.83
MH-82	MH-87	13-3	87.36	15.1	24.5	86.55	86.50	86.53	0.83
MH-82	MH-87	13-4	87.36	20.1	24.5	86.55	86.50	86.54	0.82
MH-82	MH-87	13-5	87.36	22.7	24.5	86.55	86.50	86.55	0.81
MH-83	MH-84	8-11	87.45	0.8	48.5	86.75	86.70	86.70	0.75
MH-83	MH-84	8-10	87.45	2.6	48.5	86.75	86.70	86.71	0.74
MH-83	MH-84	8-9	87.45	6.4	48.5	86.75	86.70	86.71	0.74
MH-83	MH-84	8-8	87.45	10.2	48.5	86.75	86.70	86.71	0.74
MH-83	MH-84	8-7	87.45	13.5	48.5	86.75	86.70	86.72	0.73
MH-83	MH-84	8-6	87.45	18.3	48.5	86.75	86.70	86.72	0.73
MH-83	MH-84	8-5	87.45	21.6	48.5	86.75	86.70	86.73	0.72
MH-83	MH-84	8-4	87.45	25.4	48.5	86.75	86.70	86.73	0.72
MH-83	MH-84	8-3	87.45	29.2	48.5	86.75	86.70	86.73	0.72
MH-83	MH-84	8-2	87.45	33	48.5	86.75	86.70	86.74	0.71
MH-83	MH-84	8-1	87.45	37.9	48.5	86.75	86.70	86.74	0.71
MH-83	MH-84	7-10	87.49	46.9	48.5	86.75	86.70	86.75	0.74
MH-83	MH-84	7-11	87.49	46.9	48.5	86.75	86.70	86.75	0.74
MH-83	MH-84	7-12	87.49	46.9	48.5	86.75	86.70	86.75	0.74
MH-84	MH-841	11-8	87.38	1.2	20.5	86.70	86.70	86.70	0.68
MH-84	MH-841	9-1	87.38	3.5	20.5	86.70	86.70	86.70	0.68
MH-84	MH-841	11-9	87.38	5.1	20.5	86.70	86.70	86.70	0.68
MH-84	MH-841	9-2	87.38	7.4	20.5	86.70	86.70	86.70	0.68
MH-84	MH-841	11-10	87.38	9.7	20.5	86.70	86.70	86.70	0.68
MH-84	MH-841	9-3	87.38	11.2	20.5	86.70	86.70	86.70	0.68
MH-84	MH-841	9-4	87.38	15	20.5	86.70	86.70	86.70	0.68
MH-84	MH-841	9-10	87.38	17.8	20.5	86.70	86.70	86.70	0.68
MH-84	MH-841	9-11	87.38	17.8	20.5	86.70	86.70	86.70	0.68
MH-84	MH-841	9-5	87.38	17.8	20.5	86.70	86.70	86.70	0.68
MH-84	MH-841	9-6	87.38	17.8	20.5	86.70	86.70	86.70	0.68
MH-84	MH-841	9-7	87.38	17.8	20.5	86.70	86.70	86.70	0.68

Table 1E- 1988 Event-HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-84	MH-841	9-8	87.38	17.8	20.5	86.70	86.70	86.70	0.68
MH-84	MH-841	9-9	87.38	17.8	20.5	86.70	86.70	86.70	0.68
MH-84	MH-841	8-12	87.45	18.4	20.5	86.70	86.70	86.70	0.75
MH-84	MH-841	9-12	87.38	18.4	20.5	86.70	86.70	86.70	0.68
MH-841	MH-85	10-1	87.37	1.3	51	86.70	86.58	86.59	0.78
MH-841	MH-85	10-2	87.37	5	51	86.70	86.58	86.59	0.78
MH-841	MH-85	10-3	87.37	8.2	51	86.70	86.58	86.60	0.77
MH-841	MH-85	10-4	87.37	12	51	86.70	86.58	86.61	0.76
MH-841	MH-85	10-5	87.37	15.8	51	86.70	86.58	86.62	0.75
MH-841	MH-85	10-6	87.37	19.2	51	86.70	86.58	86.63	0.74
MH-841	MH-85	10-7	87.37	23.9	51	86.70	86.58	86.64	0.73
MH-841	MH-85	11-1	87.32	24.8	51	86.70	86.58	86.64	0.68
MH-841	MH-85	10-8	87.37	27.8	51	86.70	86.58	86.64	0.73
MH-841	MH-85	11-2	87.32	29.5	51	86.70	86.58	86.65	0.67
MH-841	MH-85	10-9	87.37	31.1	51	86.70	86.58	86.65	0.72
MH-841	MH-85	11-3	87.38	33.3	51	86.70	86.58	86.66	0.72
MH-841	MH-85	10-10	87.37	34.9	51	86.70	86.58	86.66	0.71
MH-841	MH-85	11-4	87.38	36.6	51	86.70	86.58	86.66	0.72
MH-841	MH-85	10-11	87.37	38.7	51	86.70	86.58	86.67	0.70
MH-841	MH-85	11-5	87.38	40.8	51	86.70	86.58	86.67	0.71
MH-841	MH-85	10-12	87.37	43	51	86.70	86.58	86.68	0.69
MH-841	MH-85	11-6	87.38	44.7	51	86.70	86.58	86.68	0.70
MH-841	MH-85	11-7	87.38	48.5	51	86.70	86.58	86.69	0.69
MH-85	MH-86	21-4	87.23	1	37.5	86.58	86.54	86.54	0.69
MH-85	MH-86	21-5	87.23	5.6	37.5	86.58	86.54	86.55	0.68
MH-85	MH-86	21-6	87.23	9	37.5	86.58	86.54	86.55	0.68
MH-85	MH-86	21-7	87.28	12.8	37.5	86.58	86.54	86.55	0.73
MH-85	MH-86	21-8	87.28	16.6	37.5	86.58	86.54	86.56	0.72
MH-85	MH-86	21-9	87.28	20.4	37.5	86.58	86.54	86.56	0.72
MH-85	MH-86	21-10	87.28	25.6	37.5	86.58	86.54	86.57	0.71
MH-85	MH-86	22-1	87.29	33.2	37.5	86.58	86.54	86.58	0.71
MH-85	MH-86	22-2	87.29	35.4	37.5	86.58	86.54	86.58	0.71
MH-85	MH-86	22-3	87.29	35.4	37.5	86.58	86.54	86.58	0.71
MH-85	MH-86	22-4	87.29	35.4	37.5	86.58	86.54	86.58	0.71
MH-85	MH-86	22-5	87.29	35.4	37.5	86.58	86.54	86.58	0.71
MH-85	MH-86	22-6	87.29	35.4	37.5	86.58	86.54	86.58	0.71
MH-85	MH-86	22-7	87.29	35.4	37.5	86.58	86.54	86.58	0.71
MH-85	MH-86	22-8	87.29	35.4	37.5	86.58	86.54	86.58	0.71
MH-86	MH-87	21-1	87.23	14.4	25	86.54	86.50	86.52	0.71
MH-86	MH-87	21-2	87.23	19.7	25	86.54	86.50	86.53	0.70
MH-86	MH-87	21-3	87.23	22.7	25	86.54	86.50	86.54	0.69

Table 1F- 1996 Event-HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-70	MH-71	1-8	89.41	3.4	33	88.13	87.34	87.42	1.99
MH-70	MH-71	1-7	89.41	6.7	33	88.13	87.34	87.50	1.91
MH-70	MH-71	1-6	89.41	11.4	33	88.13	87.34	87.61	1.80
MH-70	MH-71	1-5	89.41	14.8	33	88.13	87.34	87.69	1.72
MH-70	MH-71	1-4	89.41	18.6	33	88.13	87.34	87.79	1.62
MH-70	MH-71	1-3	89.41	22.4	33	88.13	87.34	87.88	1.53
MH-70	MH-71	1-2	89.41	26.2	33	88.13	87.34	87.97	1.44
MH-70	MH-71	1-1	89.41	30.1	33	88.13	87.34	88.06	1.35
MH-71	MH-711	2-12	88.87	3.2	71	87.34	86.81	86.84	2.03
MH-71	MH-711	17-6	88.55	3.4	71	87.34	86.81	86.84	1.71
MH-71	MH-711	17-5	88.55	7.6	71	87.34	86.81	86.87	1.68
MH-71	MH-711	2-11	88.87	9.1	71	87.34	86.81	86.88	1.99
MH-71	MH-711	17-4	88.55	11	71	87.34	86.81	86.90	1.65
MH-71	MH-711	2-10	88.87	12.7	71	87.34	86.81	86.91	1.96
MH-71	MH-711	17-3	88.55	14.9	71	87.34	86.81	86.92	1.63
MH-71	MH-711	2-9	88.87	16.7	71	87.34	86.81	86.94	1.93
MH-71	MH-711	17-2	88.55	18.6	71	87.34	86.81	86.95	1.60
MH-71	MH-711	2-8	88.87	20.5	71	87.34	86.81	86.97	1.90
MH-71	MH-711	17-1	88.55	22.7	71	87.34	86.81	86.98	1.57
MH-71	MH-711	2-7	88.87	23.9	71	87.34	86.81	86.99	1.88
MH-71	MH-711	2-6	88.87	27.1	71	87.34	86.81	87.02	1.85
MH-71	MH-711	2-5	88.87	31.9	71	87.34	86.81	87.05	1.82
MH-71	MH-711	2-4	88.87	35.7	71	87.34	86.81	87.08	1.79
MH-71	MH-711	18-8	88.76	38.6	71	87.34	86.81	87.10	1.66
MH-71	MH-711	2-3	88.87	39.6	71	87.34	86.81	87.11	1.76
MH-71	MH-711	18-7	88.76	42.4	71	87.34	86.81	87.13	1.63
MH-71	MH-711	2-2	88.87	43.4	71	87.34	86.81	87.14	1.73
MH-71	MH-711	18-6	88.76	46.2	71	87.34	86.81	87.16	1.60
MH-71	MH-711	2-1	88.87	48.3	71	87.34	86.81	87.17	1.70
MH-71	MH-711	18-5	88.76	50	71	87.34	86.81	87.19	1.57
MH-71	MH-711	18-4	88.76	54.5	71	87.34	86.81	87.22	1.54
MH-71	MH-711	18-3	88.76	57.6	71	87.34	86.81	87.24	1.52
MH-71	MH-711	1-12	89.41	58	71	87.34	86.81	87.25	2.16
MH-71	MH-711	18-2	88.76	61.4	71	87.34	86.81	87.27	1.49
MH-71	MH-711	1-11	89.41	63.1	71	87.34	86.81	87.28	2.13
MH-71	MH-711	18-1	88.76	65.8	71	87.34	86.81	87.30	1.46
MH-71	MH-711	1-10	89.41	66.9	71	87.34	86.81	87.31	2.10
MH-71	MH-711	1-9	89.41	70.7	71	87.34	86.81	87.34	2.07
MH-71	MH-76	20-2	88.61	1.1	62	87.34	86.91	86.92	1.69
MH-71	MH-76	20-1	88.61	6.4	62	87.34	86.91	86.95	1.66
MH-71	MH-76	19-12	89.29	13.3	62	87.34	86.91	87.00	2.29
MH-71	MH-76	19-11	89.29	17.3	62	87.34	86.91	87.03	2.26
MH-71	MH-76	19-10	89.29	21.8	62	87.34	86.91	87.06	2.23
MH-71	MH-76	19-9	89.29	25.6	62	87.34	86.91	87.09	2.20
MH-71	MH-76	19-8	89.29	29.4	62	87.34	86.91	87.11	2.18
MH-71	MH-76	19-7	89.29	32.7	62	87.34	86.91	87.14	2.15
MH-71	MH-76	19-6	89.29	37.4	62	87.34	86.91	87.17	2.12
MH-71	MH-76	19-5	89.29	40.8	62	87.34	86.91	87.19	2.10
MH-71	MH-76	19-4	89.29	44.6	62	87.34	86.91	87.22	2.07

Table 1F- 1996 Event-HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-71	MH-76	19-3	89.29	48.4	62	87.34	86.91	87.25	2.04
MH-71	MH-76	19-2	89.29	52.1	62	87.34	86.91	87.27	2.02
MH-71	MH-76	19-1	89.29	56.4	62	87.34	86.91	87.30	1.99
MH-711	MH-72	3-4	88.41	1.6	19.5	86.81	86.69	86.70	1.71
MH-711	MH-72	3-3	88.41	3.6	19.5	86.81	86.69	86.71	1.70
MH-711	MH-72	3-2	88.41	7.4	19.5	86.81	86.69	86.74	1.67
MH-711	MH-72	17-10	88.55	8.4	19.5	86.81	86.69	86.74	1.81
MH-711	MH-72	3-1	88.41	11.2	19.5	86.81	86.69	86.76	1.65
MH-711	MH-72	17-9	88.55	11.5	19.5	86.81	86.69	86.76	1.79
MH-711	MH-72	17-8	88.55	15.4	19.5	86.81	86.69	86.79	1.76
MH-711	MH-72	17-7	88.55	19.5	19.5	86.81	86.69	86.81	1.74
MH-72	MH-73	4-2	88.4	1.3	5	86.69	86.61	86.63	1.77
MH-72	MH-73	4-3	88.4	1.3	5	86.69	86.61	86.63	1.77
MH-72	MH-73	3-8	88.41	3	5	86.69	86.61	86.66	1.75
MH-72	MH-73	3-10	88.41	3.1	5	86.69	86.61	86.66	1.75
MH-72	MH-73	3-12	88.41	3.1	5	86.69	86.61	86.66	1.75
MH-72	MH-73	3-5	88.41	3.1	5	86.69	86.61	86.66	1.75
MH-72	MH-73	3-6	88.41	3.1	5	86.69	86.61	86.66	1.75
MH-72	MH-73	3-7	88.41	3.1	5	86.69	86.61	86.66	1.75
MH-72	MH-73	3-9	88.41	3.1	5	86.69	86.61	86.66	1.75
MH-72	MH-73	4-1	88.4	3.1	5	86.69	86.61	86.66	1.74
MH-73	MH-78	5-6	88.4	2.4	64.5	86.61	86.46	86.47	1.93
MH-73	MH-78	5-5	88.4	5.8	64.5	86.61	86.46	86.47	1.93
MH-73	MH-78	5-4	88.4	9.6	64.5	86.61	86.46	86.48	1.92
MH-73	MH-78	5-3	88.4	13.4	64.5	86.61	86.46	86.49	1.91
MH-73	MH-78	5-2	88.4	17.2	64.5	86.61	86.46	86.50	1.90
MH-73	MH-78	5-1	88.4	22	64.5	86.61	86.46	86.51	1.89
MH-73	MH-78	4-12	88.4	31.6	64.5	86.61	86.46	86.54	1.86
MH-73	MH-78	4-11	88.4	36.5	64.5	86.61	86.46	86.55	1.85
MH-73	MH-78	4-10	88.4	40.3	64.5	86.61	86.46	86.56	1.84
MH-73	MH-78	4-9	88.4	44.1	64.5	86.61	86.46	86.57	1.83
MH-73	MH-78	4-8	88.4	47.9	64.5	86.61	86.46	86.57	1.83
MH-73	MH-78	4-7	88.4	51.1	64.5	86.61	86.46	86.58	1.82
MH-73	MH-78	4-6	88.4	56	64.5	86.61	86.46	86.59	1.81
MH-73	MH-78	4-5	88.4	59.4	64.5	86.61	86.46	86.60	1.80
MH-73	MH-78	4-4	88.4	63.2	64.5	86.61	86.46	86.61	1.79
MH-75	MH-76	20-3	88.61	2.6	13.5	87.10	86.91	86.94	1.67
MH-75	MH-76	20-4	88.61	6.4	13.5	87.10	86.91	87.00	1.61
MH-75	MH-76	20-5	88.61	10.2	13.5	87.10	86.91	87.05	1.56
MH-75	MH-76	20-6	88.61	12.3	13.5	87.10	86.91	87.08	1.53
MH-75	MH-76	20-7	88.61	12.3	13.5	87.10	86.91	87.08	1.53
MH-75	MH-76	20-8	88.61	12.3	13.5	87.10	86.91	87.08	1.53
MH-76	MH-77	16-10	88.36	0.6	81.5	86.91	86.62	86.63	1.73
MH-76	MH-77	16-9	88.36	4.9	81.5	86.91	86.62	86.64	1.72
MH-76	MH-77	16-8	88.36	8.7	81.5	86.91	86.62	86.65	1.71
MH-76	MH-77	16-7	88.36	11.8	81.5	86.91	86.62	86.67	1.69
MH-76	MH-77	16-6	88.36	16.3	81.5	86.91	86.62	86.68	1.68
MH-76	MH-77	16-5	88.36	20.1	81.5	86.91	86.62	86.69	1.67
MH-76	MH-77	16-4	88.36	23.9	81.5	86.91	86.62	86.71	1.65

Table 1F- 1996 Event-HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-76	MH-77	16-3	88.36	27.7	81.5	86.91	86.62	86.72	1.64
MH-76	MH-77	16-2	88.36	32.2	81.5	86.91	86.62	86.74	1.62
MH-76	MH-77	16-1	88.36	35.4	81.5	86.91	86.62	86.75	1.61
MH-76	MH-77	15-8	88.51	49	81.5	86.91	86.62	86.79	1.72
MH-76	MH-77	15-7	88.51	52.8	81.5	86.91	86.62	86.81	1.70
MH-76	MH-77	15-6	88.51	56.6	81.5	86.91	86.62	86.82	1.69
MH-76	MH-77	15-5	88.51	60.4	81.5	86.91	86.62	86.83	1.68
MH-76	MH-77	15-4	88.51	64.2	81.5	86.91	86.62	86.85	1.66
MH-76	MH-77	15-3	88.51	68	81.5	86.91	86.62	86.86	1.65
MH-76	MH-77	15-2	88.51	71.8	81.5	86.91	86.62	86.87	1.64
MH-76	MH-77	15-1	88.51	76.2	81.5	86.91	86.62	86.89	1.62
MH-78	MH-79	7-9	87.49	2	110.5	86.46	86.17	86.17	1.32
MH-78	MH-79	7-8	87.49	3.6	110.5	86.46	86.17	86.18	1.31
MH-78	MH-79	7-7	87.49	6.2	110.5	86.46	86.17	86.19	1.30
MH-78	MH-79	7-6	87.49	10.9	110.5	86.46	86.17	86.20	1.29
MH-78	MH-79	7-5	87.49	14.3	110.5	86.46	86.17	86.21	1.28
MH-78	MH-79	7-4	87.49	18.1	110.5	86.46	86.17	86.22	1.27
MH-78	MH-79	7-3	87.49	21.9	110.5	86.46	86.17	86.23	1.26
MH-78	MH-79	7-2	87.49	25.7	110.5	86.46	86.17	86.24	1.25
MH-78	MH-79	7-1	87.49	30	110.5	86.46	86.17	86.25	1.24
MH-78	MH-79	6-12	88	38.2	110.5	86.46	86.17	86.27	1.73
MH-78	MH-79	6-11	88	42.5	110.5	86.46	86.17	86.28	1.72
MH-78	MH-79	6-10	88	46.3	110.5	86.46	86.17	86.29	1.71
MH-78	MH-79	6-9	88	50.1	110.5	86.46	86.17	86.30	1.70
MH-78	MH-79	6-8	88	53.9	110.5	86.46	86.17	86.31	1.69
MH-78	MH-79	6-7	88	57.3	110.5	86.46	86.17	86.32	1.68
MH-78	MH-79	6-6	88	62	110.5	86.46	86.17	86.33	1.67
MH-78	MH-79	6-5	88	65.3	110.5	86.46	86.17	86.34	1.66
MH-78	MH-79	6-4	88	69.2	110.5	86.46	86.17	86.35	1.65
MH-78	MH-79	6-3	88	73	110.5	86.46	86.17	86.36	1.64
MH-78	MH-79	6-2	88	76.8	110.5	86.46	86.17	86.37	1.63
MH-78	MH-79	6-1	88	81	110.5	86.46	86.17	86.38	1.62
MH-78	MH-79	5-12	88.4	89.3	110.5	86.46	86.17	86.40	2.00
MH-78	MH-79	5-11	88.4	93.5	110.5	86.46	86.17	86.42	1.98
MH-78	MH-79	5-10	88.4	97.3	110.5	86.46	86.17	86.43	1.97
MH-78	MH-79	5-9	88.4	101.1	110.5	86.46	86.17	86.44	1.96
MH-78	MH-79	5-8	88.4	105	110.5	86.46	86.17	86.45	1.95
MH-78	MH-79	5-7	88.4	108.3	110.5	86.46	86.17	86.46	1.94
MH-79	MH-81	12-10	87.32	1.5	12.5	86.17	86.15	86.15	1.17
MH-80	MH-81	14-12	87.92	39.4	84	86.48	86.15	86.30	1.62
MH-80	MH-81	14-11	87.92	45.3	84	86.48	86.15	86.33	1.59
MH-80	MH-81	14-10	87.92	49.1	84	86.48	86.15	86.34	1.58
MH-80	MH-81	14-9	87.92	52.9	84	86.48	86.15	86.36	1.56
MH-80	MH-81	14-8	87.92	56.7	84	86.48	86.15	86.37	1.55
MH-80	MH-81	14-7	87.92	60.1	84	86.48	86.15	86.39	1.53
MH-80	MH-81	14-6	87.92	64.8	84	86.48	86.15	86.40	1.52
MH-80	MH-81	14-5	87.92	68.1	84	86.48	86.15	86.42	1.50
MH-80	MH-81	14-4	87.92	72	84	86.48	86.15	86.43	1.49
MH-80	MH-81	14-3	87.92	76	84	86.48	86.15	86.45	1.47

Table 1F- 1996 Event-HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-80	MH-81	14-2	87.92	79.6	84	86.48	86.15	86.46	1.46
MH-80	MH-81	14-1	87.92	84.2	84	86.48	86.15	86.48	1.44
MH-81	MH-82	13-6	87.36	3.3	41.5	86.15	86.05	86.06	1.30
MH-81	MH-82	12-1	87.32	4.8	41.5	86.15	86.05	86.06	1.26
MH-81	MH-82	13-7	87.36	5.9	41.5	86.15	86.05	86.07	1.29
MH-81	MH-82	13-8	87.36	10.9	41.5	86.15	86.05	86.08	1.28
MH-81	MH-82	12-2	87.32	11.1	41.5	86.15	86.05	86.08	1.24
MH-81	MH-82	13-9	87.36	13.5	41.5	86.15	86.05	86.08	1.28
MH-81	MH-82	12-3	87.32	14.9	41.5	86.15	86.05	86.09	1.23
MH-81	MH-82	13-10	87.36	18.5	41.5	86.15	86.05	86.09	1.27
MH-81	MH-82	12-4	87.32	18.8	41.5	86.15	86.05	86.10	1.22
MH-81	MH-82	13-11	87.36	21.1	41.5	86.15	86.05	86.10	1.26
MH-81	MH-82	12-5	87.32	22.5	41.5	86.15	86.05	86.10	1.22
MH-81	MH-82	12-6	87.32	25.7	41.5	86.15	86.05	86.11	1.21
MH-81	MH-82	13-12	87.36	26.9	41.5	86.15	86.05	86.11	1.25
MH-81	MH-82	12-7	87.32	30.6	41.5	86.15	86.05	86.12	1.20
MH-81	MH-82	12-8	87.32	34	41.5	86.15	86.05	86.13	1.19
MH-81	MH-82	12-9	87.32	37.7	41.5	86.15	86.05	86.14	1.18
MH-82	MH-87	13-1	87.36	7.3	24.5	86.05	86.01	86.02	1.34
MH-82	MH-87	13-2	87.36	12.5	24.5	86.05	86.01	86.03	1.33
MH-82	MH-87	13-3	87.36	15.1	24.5	86.05	86.01	86.04	1.32
MH-82	MH-87	13-4	87.36	20.1	24.5	86.05	86.01	86.05	1.31
MH-82	MH-87	13-5	87.36	22.7	24.5	86.05	86.01	86.05	1.31
MH-83	MH-84	8-11	87.45	0.8	48.5	86.20	86.13	86.14	1.31
MH-83	MH-84	8-10	87.45	2.6	48.5	86.20	86.13	86.14	1.31
MH-83	MH-84	8-9	87.45	6.4	48.5	86.20	86.13	86.14	1.31
MH-83	MH-84	8-8	87.45	10.2	48.5	86.20	86.13	86.15	1.30
MH-83	MH-84	8-7	87.45	13.5	48.5	86.20	86.13	86.15	1.30
MH-83	MH-84	8-6	87.45	18.3	48.5	86.20	86.13	86.16	1.29
MH-83	MH-84	8-5	87.45	21.6	48.5	86.20	86.13	86.16	1.29
MH-83	MH-84	8-4	87.45	25.4	48.5	86.20	86.13	86.17	1.28
MH-83	MH-84	8-3	87.45	29.2	48.5	86.20	86.13	86.17	1.28
MH-83	MH-84	8-2	87.45	33	48.5	86.20	86.13	86.18	1.27
MH-83	MH-84	8-1	87.45	37.9	48.5	86.20	86.13	86.19	1.26
MH-83	MH-84	7-10	87.49	46.9	48.5	86.20	86.13	86.20	1.29
MH-83	MH-84	7-11	87.49	46.9	48.5	86.20	86.13	86.20	1.29
MH-83	MH-84	7-12	87.49	46.9	48.5	86.20	86.13	86.20	1.29
MH-84	MH-841	11-8	87.38	1.2	20.5	86.13	86.11	86.11	1.27
MH-84	MH-841	9-1	87.38	3.5	20.5	86.13	86.11	86.11	1.27
MH-84	MH-841	11-9	87.38	5.1	20.5	86.13	86.11	86.11	1.27
MH-84	MH-841	9-2	87.38	7.4	20.5	86.13	86.11	86.12	1.26
MH-84	MH-841	11-10	87.38	9.7	20.5	86.13	86.11	86.12	1.26
MH-84	MH-841	9-3	87.38	11.2	20.5	86.13	86.11	86.12	1.26
MH-84	MH-841	9-4	87.38	15	20.5	86.13	86.11	86.13	1.25
MH-84	MH-841	9-10	87.38	17.8	20.5	86.13	86.11	86.13	1.25
MH-84	MH-841	9-11	87.38	17.8	20.5	86.13	86.11	86.13	1.25
MH-84	MH-841	9-5	87.38	17.8	20.5	86.13	86.11	86.13	1.25
MH-84	MH-841	9-6	87.38	17.8	20.5	86.13	86.11	86.13	1.25
MH-84	MH-841	9-7	87.38	17.8	20.5	86.13	86.11	86.13	1.25

Table 1F- 1996 Event-HGL Summary

US MH	DS MH	Lot #	USF (m)	Dist from DS MH (m)	Pipe Length (m)	US MH HGL (m)	DS MH HGL (m)	Interpolated HGL (m)	Freeboard (m)
MH-84	MH-841	9-8	87.38	17.8	20.5	86.13	86.11	86.13	1.25
MH-84	MH-841	9-9	87.38	17.8	20.5	86.13	86.11	86.13	1.25
MH-84	MH-841	8-12	87.45	18.4	20.5	86.13	86.11	86.13	1.32
MH-84	MH-841	9-12	87.38	18.4	20.5	86.13	86.11	86.13	1.25
MH-841	MH-85	10-1	87.37	1.3	51	86.11	86.05	86.05	1.32
MH-841	MH-85	10-2	87.37	5	51	86.11	86.05	86.06	1.31
MH-841	MH-85	10-3	87.37	8.2	51	86.11	86.05	86.06	1.31
MH-841	MH-85	10-4	87.37	12	51	86.11	86.05	86.07	1.30
MH-841	MH-85	10-5	87.37	15.8	51	86.11	86.05	86.07	1.30
MH-841	MH-85	10-6	87.37	19.2	51	86.11	86.05	86.07	1.30
MH-841	MH-85	10-7	87.37	23.9	51	86.11	86.05	86.08	1.29
MH-841	MH-85	11-1	87.32	24.8	51	86.11	86.05	86.08	1.24
MH-841	MH-85	10-8	87.37	27.8	51	86.11	86.05	86.08	1.29
MH-841	MH-85	11-2	87.32	29.5	51	86.11	86.05	86.08	1.24
MH-841	MH-85	10-9	87.37	31.1	51	86.11	86.05	86.08	1.29
MH-841	MH-85	11-3	87.38	33.3	51	86.11	86.05	86.09	1.29
MH-841	MH-85	10-10	87.37	34.9	51	86.11	86.05	86.09	1.28
MH-841	MH-85	11-4	87.38	36.6	51	86.11	86.05	86.09	1.29
MH-841	MH-85	10-11	87.37	38.7	51	86.11	86.05	86.09	1.28
MH-841	MH-85	11-5	87.38	40.8	51	86.11	86.05	86.09	1.29
MH-841	MH-85	10-12	87.37	43	51	86.11	86.05	86.10	1.27
MH-841	MH-85	11-6	87.38	44.7	51	86.11	86.05	86.10	1.28
MH-841	MH-85	11-7	87.38	48.5	51	86.11	86.05	86.10	1.28
MH-85	MH-86	21-4	87.23	1	37.5	86.05	86.04	86.04	1.19
MH-85	MH-86	21-5	87.23	5.6	37.5	86.05	86.04	86.04	1.19
MH-85	MH-86	21-6	87.23	9	37.5	86.05	86.04	86.04	1.19
MH-85	MH-86	21-7	87.28	12.8	37.5	86.05	86.04	86.04	1.24
MH-85	MH-86	21-8	87.28	16.6	37.5	86.05	86.04	86.05	1.23
MH-85	MH-86	21-9	87.28	20.4	37.5	86.05	86.04	86.05	1.23
MH-85	MH-86	21-10	87.28	25.6	37.5	86.05	86.04	86.05	1.23
MH-85	MH-86	22-1	87.29	33.2	37.5	86.05	86.04	86.05	1.24
MH-85	MH-86	22-2	87.29	35.4	37.5	86.05	86.04	86.05	1.24
MH-85	MH-86	22-3	87.29	35.4	37.5	86.05	86.04	86.05	1.24
MH-85	MH-86	22-4	87.29	35.4	37.5	86.05	86.04	86.05	1.24
MH-85	MH-86	22-5	87.29	35.4	37.5	86.05	86.04	86.05	1.24
MH-85	MH-86	22-6	87.29	35.4	37.5	86.05	86.04	86.05	1.24
MH-85	MH-86	22-7	87.29	35.4	37.5	86.05	86.04	86.05	1.24
MH-85	MH-86	22-8	87.29	35.4	37.5	86.05	86.04	86.05	1.24
MH-86	MH-87	21-1	87.23	14.4	25	86.04	86.01	86.03	1.20
MH-86	MH-87	21-2	87.23	19.7	25	86.04	86.01	86.03	1.20
MH-86	MH-87	21-3	87.23	22.7	25	86.04	86.01	86.04	1.19

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

Advanced Drainage Systems, Inc.

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OTTAWA, ON, CANADA

MC-3500 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-3500.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL BE CERTIFIED TO CSA B184, "POLYMERIC SUB-SURFACE STORMWATER MANAGEMENT STRUCTURES", AND MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE CSA S6 CL-625 TRUCK AND THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 75 mm (3").
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 23° C / 73° F), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.
10. MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE. DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
11. ADS DOES NOT DESIGN OR PROVIDE MEMBRANE LINER SYSTEMS. TO MINIMIZE THE LEAKAGE POTENTIAL OF LINER SYSTEMS, THE MEMBRANE LINER SYSTEM SHOULD BE DESIGNED BY A KNOWLEDGEABLE GEOTEXTILE PROFESSIONAL AND INSTALLED BY A QUALIFIED CONTRACTOR.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-3500 CHAMBER SYSTEM

1. STORMTECH MC-3500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 150 mm (6") SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 300 mm (12") INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE WELL GRADED BETWEEN ¾" AND 2" (20-50 mm)..
9. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
10. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
11. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-3500 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. FULL 900 mm (36") OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

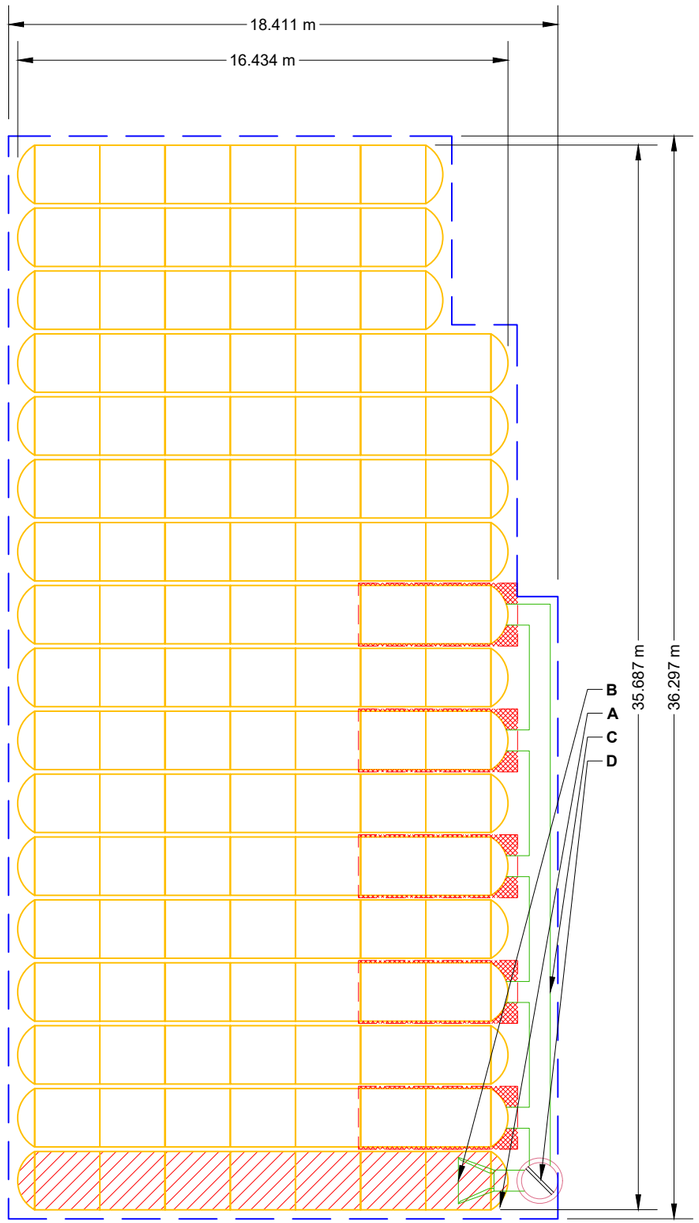
USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-800-821-6710 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

PROPOSED LAYOUT		CONCEPTUAL ELEVATIONS:	
116	STORMTECH MC-3500 CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	3.810
34	STORMTECH MC-3500 END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	1.981
305	STONE ABOVE (mm)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	1.829
229	STONE BELOW (mm)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	1.829
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	1.829
650.0	INSTALLED SYSTEM VOLUME (m^3) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	1.676
		TOP OF MC-3500 CHAMBER:	1.372
		600 mm x 600 mm BOTTOM MANIFOLD INVERT:	0.281
		600 mm ISOLATOR ROW PLUS INVERT:	0.281
633.3	SYSTEM AREA (m^2)	BOTTOM OF MC-3500 CHAMBER:	0.229
109.4	SYSTEM PERIMETER (m)	BOTTOM OF STONE:	0.000

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	600 mm BOTTOM CORED END CAP, PART#: MC3500IEPP24BC / TYP OF ALL 600 mm BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	52 mm	
FLAMP	B	INSTALL FLAMP ON 600 mm ACCESS PIPE / PART#: MCFLAMP		
MANIFOLD	C	600 mm x 600 mm BOTTOM MANIFOLD, ADS N-12	52 mm	
CONCRETE STRUCTURE W/WEIR	D	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		1013 L/s IN



ISOLATOR ROW PLUS
(SEE DETAIL)

PLACE MINIMUM 5.334 m OF ADSPLUS125 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES

- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- **NOT FOR CONSTRUCTION**: THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

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OTTAWA, ON, CANADA

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ADS
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HILLIARD, OH 43026
1-800-733-7473

SCALE = 1 : 200

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Chamber System
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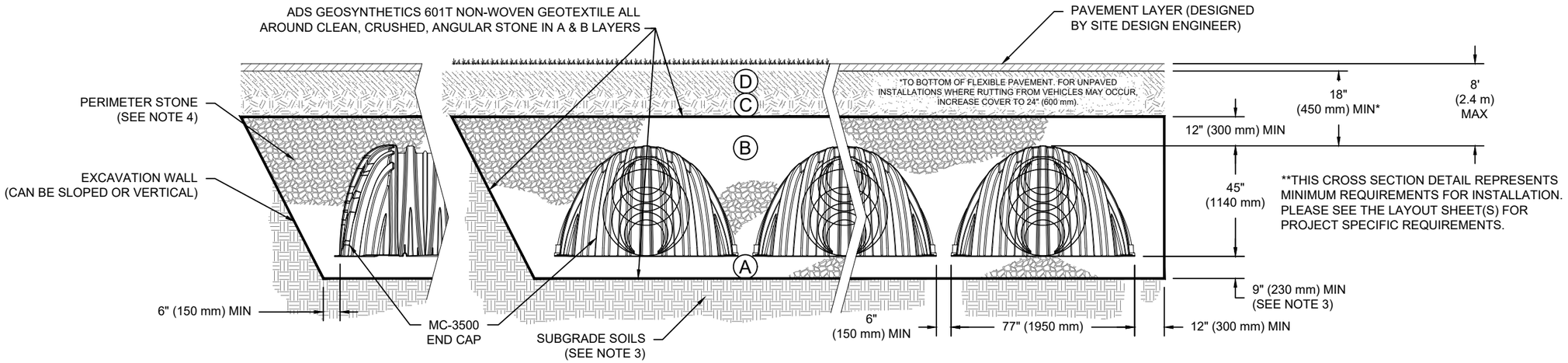
ACCEPTABLE FILL MATERIALS: STORMTECH MC-3500 CHAMBER SYSTEMS

	MATERIAL LOCATION	DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE[5]	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE[5]	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.
5. WHERE RECYCLED CONCRETE AGGREGATE IS USED IN LAYERS 'A' OR 'B' THE MATERIAL SHOULD ALSO MEET THE ACCEPTABILITY CRITERIA OUTLINED IN TECHNICAL NOTE 6.20 "RECYCLED CONCRETE STRUCTURAL BACKFILL".



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
2. MC-3500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS. REFERENCE STORMTECH DESIGN MANUAL FOR BEARING CAPACITY GUIDANCE.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

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DATE: 08/30/2024 | DRAWN: BC | CHECKED: N/A | PROJECT #:

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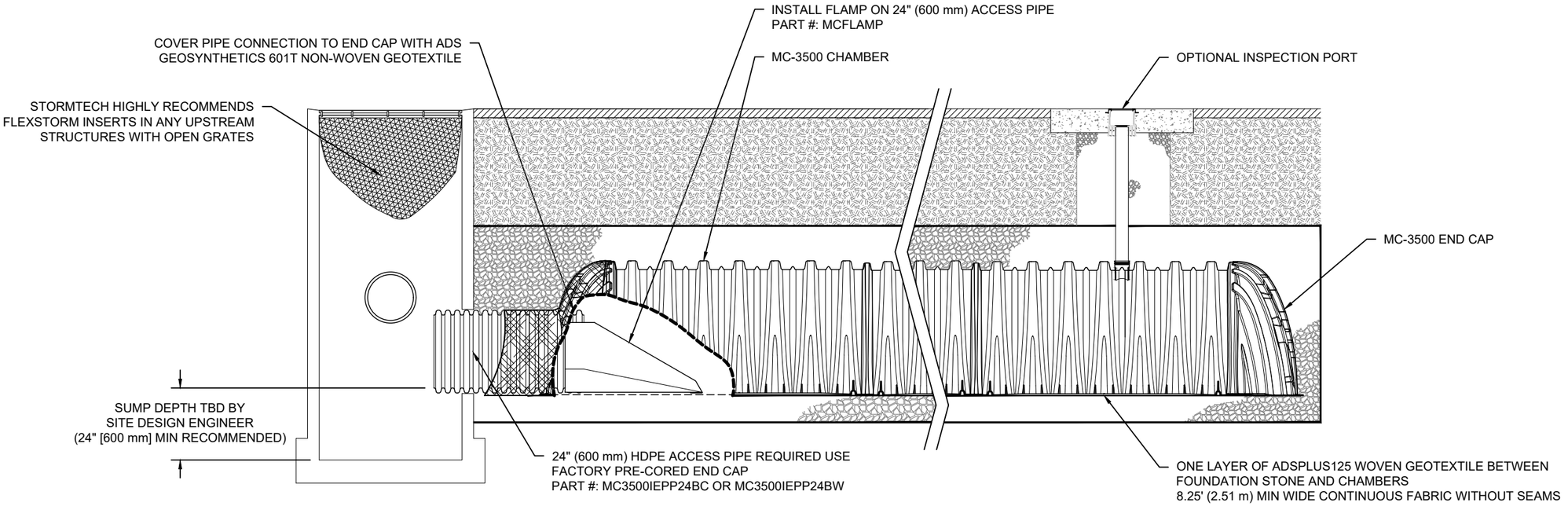
Chamber System
1-800-821-6710 | WWW.STORMTECH.COM

4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473



MC-3500 ISOLATOR ROW PLUS DETAIL
NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.

2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

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MC-3500 TECHNICAL SPECIFICATION

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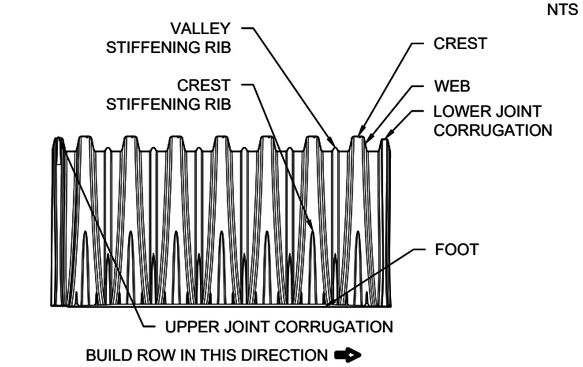
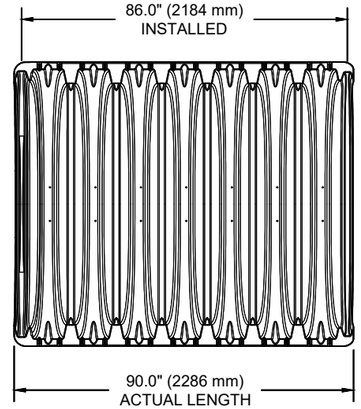
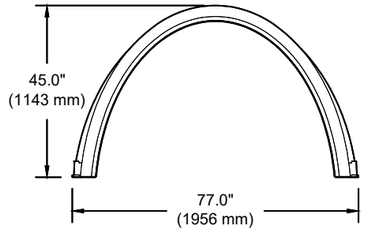
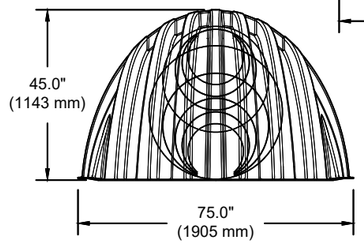
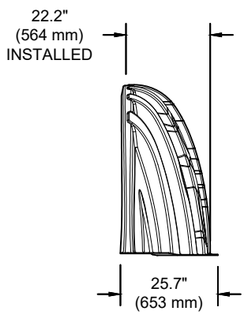










NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X 86.0"	(1956 mm X 1143 mm X 2184 mm)
CHAMBER STORAGE	109.9 CUBIC FEET	(3.11 m³)
MINIMUM INSTALLED STORAGE*	175.0 CUBIC FEET	(4.96 m³)
WEIGHT	134 lbs.	(60.8 kg)

NOMINAL END CAP SPECIFICATIONS

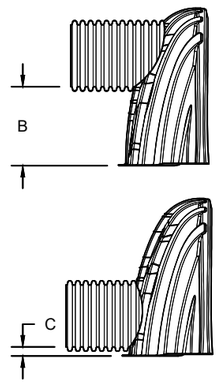
SIZE (W X H X INSTALLED LENGTH)	75.0" X 45.0" X 22.2"	(1905 mm X 1143 mm X 564 mm)
END CAP STORAGE	14.9 CUBIC FEET	(0.42 m³)
MINIMUM INSTALLED STORAGE*	45.1 CUBIC FEET	(1.28 m³)
WEIGHT	49 lbs.	(22.2 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION, 6" SPACING BETWEEN CHAMBERS, 6" (152 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY

STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A WELDED CROWN PLATE END WITH "C"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

PART #	STUB	B	C
MC3500IEPP06T	6" (150 mm)	33.21" (844 mm)	---
MC3500IEPP06B		---	0.66" (17 mm)
MC3500IEPP08T	8" (200 mm)	31.16" (791 mm)	---
MC3500IEPP08B		---	0.81" (21 mm)
MC3500IEPP10T	10" (250 mm)	29.04" (738 mm)	---
MC3500IEPP10B		---	0.93" (24 mm)
MC3500IEPP12T	12" (300 mm)	26.36" (670 mm)	---
MC3500IEPP12B		---	1.35" (34 mm)
MC3500IEPP15T	15" (375 mm)	23.39" (594 mm)	---
MC3500IEPP15B		---	1.50" (38 mm)
MC3500IEPP18TC	18" (450 mm)	20.03" (509 mm)	---
MC3500IEPP18TW			
MC3500IEPP18BC		---	1.77" (45 mm)
MC3500IEPP18BW			
MC3500IEPP24TC	24" (600 mm)	14.48" (368 mm)	---
MC3500IEPP24TW			
MC3500IEPP24BC		---	2.06" (52 mm)
MC3500IEPP24BW			
MC3500IEPP30BC	30" (750 mm)	---	2.75" (70 mm)

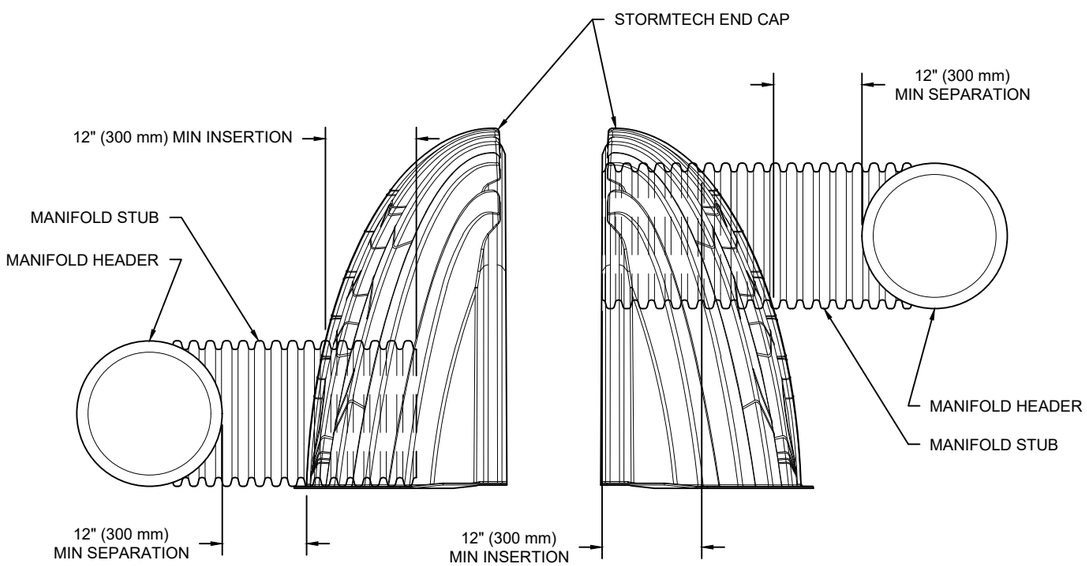
NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PRECORED INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-3500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

MC-SERIES END CAP INSERTION DETAIL

NTS



NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

OVPH4
OTTAWA, ON, CANADA
DATE: 08/30/2024 | DRAWN: BC | CHECKED: N/A
PROJECT #:

DESCRIPTION	CHK	DRW	DATE

StormTech® Chamber System
1-800-821-6710 | WWW.STORMTECH.COM
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HILLIARD, OH 43026
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