Kaitlin Corporation

Block 54 – Fields of Wellington Site Servicing & Stormwater Management Report

Prepared for:

Kaitlin Corporation
315 – 220 Duncan Mill Road
North York, ON M3B 3J5

Prepared by:

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Date: May 2023

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May 8, 2023

Rodrick Sutherland
Land Development Manager
Kaitlin Corporation
315 -220 Duncan Mill Road
North York, ON M3B 3J5

Regarding: **Block 54 – Fields of Wellington**
Site Servicing and Stormwater Management Report

Dear Mr. Sutherland

The enclosed report details the infrastructure upgrades required and recommendations for the proposed development.

Two mid-rise residential buildings are proposed, the North Building and the South Building. The proposed North Building consists of a four-storey residential building with approximately 80 units and the South Building consists of a four-storey residential building with approximately 80 units for a total of 160 units. The development includes one and two-bedroom units, amenity space, swimming pool, club house and surface level parking with access from West Street.

A 150mm water service connection is proposed to West Street.

A 200mm sanitary sewer connection is proposed to the extension of West Street.

An onsite storm sewer system outletting to the proposed Fields of Wellington enhanced swale located along the Millennium Trail is proposed. An onsite StormTech Chamber system is proposed to provide quantity and quality control. Post-development flows are proposed to be attenuated to pre-development levels for all storm events up to the 100 year event.

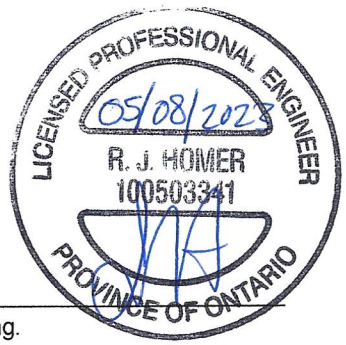
Electrical, communication and natural gas connections are proposed on West Street.

The Report demonstrates that adequate servicing is available for the proposed developments. If you have any enquiries or wish to discuss further, please contact this office.

Sincerely,
FOREFRONT Engineering Inc.

Jeff Homer, P.Eng.

FOREFRONT Signatures



Report Prepared By:

Jeff Homer, P. Eng.

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1. Introduction

Forefront has assembled relevant supporting information for the two mid-rise residential buildings at Block 54, located in the Fields of Wellington Subdivision in the Village of Wellington, Prince Edward County, Ontario. The property is bordered by the extension of West Street to the east, existing residential to the west, land zoned industrial to the east and the Millennium Trail and to the south. Refer to Figure 1: Location Plan for the site location.

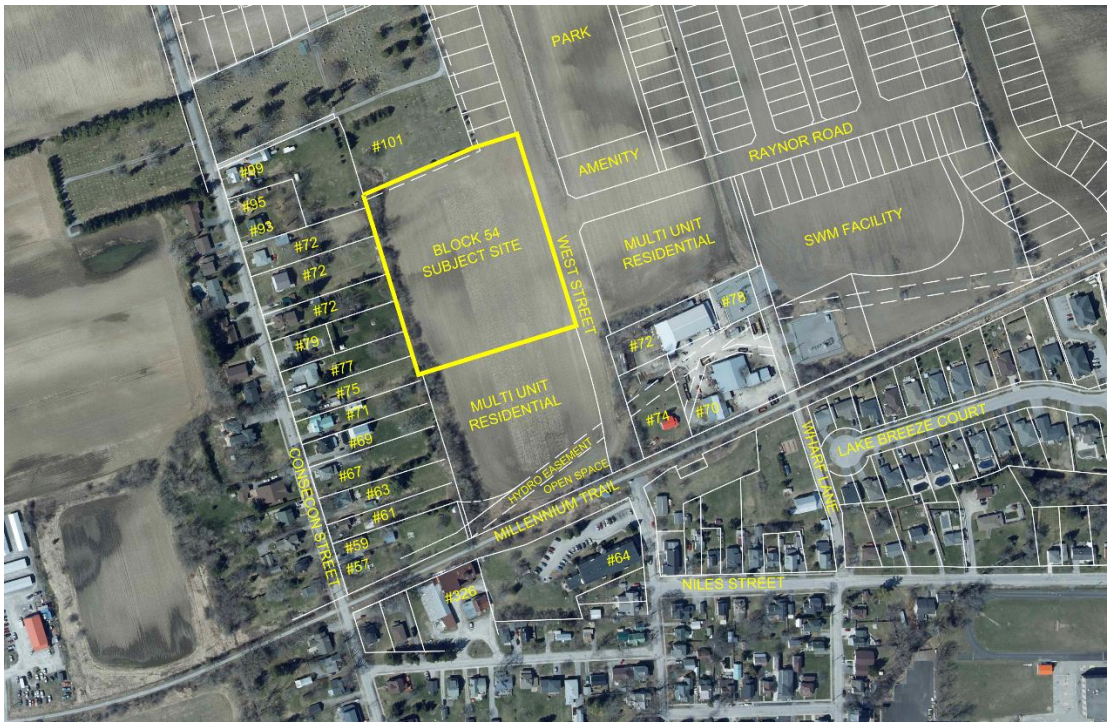


Figure 1: Location Plan

The subject area is currently zoned R3-70 – Urban Residential and is located in the Wellington Urban Centre Secondary Plan. The proposed development is approximately 1.92 hectares in area. Block 54 is proposed as part of Phase 1B of Fields of Wellington Subdivision currently under review for Final Subdivision Approval. The subject site in its current form is vacant and is formerly agricultural lands.

Two mid-rise residential buildings are proposed, the North Building and the South Building. The proposed North Building consists of a four-storey residential building with approximately 80 units and the South Building consists of a four-storey residential building with approximately 80 units for a total of 160 units. The development includes one and two-bedroom units, amenity space, swimming pool, club house and surface level parking with access from West Street.

Development of Block 54 will result in an increase in municipal water consumption, sanitary sewer discharge and stormwater runoff. This report proposes to address water, sanitary and stormwater management requirements for the proposed development.

Refer to Appendix A: **Site Plan** for the proposed development plan.

2. Water Supply

Existing Water Infrastructure

The existing subject site is currently vacant agricultural fields and is not serviced by any water supply infrastructure.

Block 54 is proposed as part of Phase 1B of Fields of Wellington Subdivision. Local infrastructure proposed as part of the Fields of Wellington Subdivision include a 200mm diameter watermain along West Street and a 200mm diameter watermain along the proposed Raynor Road.

A 150mm water service is to be provided from West Street extending to the property limit to serve the subject site.

Forefront Engineering has reviewed the "*Wellington Master Servicing Plan for Water, Wastewater and Stormwater*" (MSP), dated May 6, 2021 prepared by R.V. Anderson Associated Limited in association with the County of Prince Edward (PEC). The subject development is within the MSP study area and the following report has reviewed and considers the findings and recommendations of the MSP.

The MSP notes that the existing water supply distribution system prior to any upgrades currently experiences inadequate pressures in the northern parts of the existing urban area.

With consideration for the findings of the MSP, Prince Edward County (PEC) is undergoing proposed upgrades to the water supply infrastructure. Water supply upgrades to be completed by the County include the construction of a new water treatment plant (WTP) to be constructed in phases, a new elevated storage tank (EST), a 500mm diameter watermain to be constructed in 2023-2024 along the Millennium Trail, and Main Street and 400mm diameter watermain on Bellville Street.

The MSP completed a hydraulic water model of the full buildout of the Wellington Urban Centre including for the proposed Fields of Wellington Subdivision. Refer to Appendix B for further details regarding the **MSP Water Modelling**.

Proposed Development

PEC and MECP require the system to be assessed at the critical locations including peak hour flow, maximum day, and maximum day plus fire flow demand. MECP requires the system to maintain an operating pressure of 280-700 kPa under peak flow conditions and 138 kPa under maximum day plus fire flow conditions.

In accordance with the MSP, MECP guidelines and the Ontario Building Code the following design criteria have been used.

Design Flow Parameters
Average Day Flow Rate – 320 L/cap/day (MSP, 2021)
Average Day Flow Rate – 350 L/cap/day (PEC Request)
Peak Day Factor - 2.75
Peak Hour Factor - 4.25

Population
Multi Unit Population – 1.79 Persons/unit (MSP, 2021)
(Refer to *Wellington Master Servicing Plan – Technical Memorandum 1* for population and demand requirements)

Residential Dwelling Units
North Building – 80 Units
South Building - 80 Units

Currently local hydrant flow data is unavailable for the site.

Both mid-rise residential buildings are proposed to be equipped with a sprinkler system meeting NFPA standards. Wood frame construction is proposed for both buildings.

An onsite fire hydrant is proposed. Fire department connections are proposed approximately 45m from the onsite fire hydrant.

A single 150mm diameter water service is proposed to connect to the 200mm watermain on West Street servicing the proposed development. A single service connection to each building is proposed and is to be 100mm in diameter.

It is assumed water modelling completed as part of the MSP assigned appropriate demands and fire flows to the proposed distribution systems. Refer to the **Water Supply Demand Calculations** and **Fire Flow Calculations** in Appendix B for the site demands and calculated fire flows. Fire flow demands are based on the “Water Supply for Public Fire Protection”, 2020 by Fire Underwriters Survey (FUS). Demand and fire flow calculations for the subject site are below.

The Maximum Daily Flow demand for this development is 3.2 L/s based on a peak day factor of 2.75 and the Peak Hour Flow demand is 4.9 L/s assuming a peak hour factor of 4.25. The calculated minimum recommended fire flow is 300 L/s.

Under Maximum Daily flow plus Fire Flow conditions, 303.2 L/s is the minimum recommended flow. From the MSP hydraulic modelling flow results, available fire flow during max day demand is anticipated to be in the range of 314 to 366 L/s at the minimum operating pressure of 138 kPa. Given that this is greater than the 303.2 L/s required, fire flow available to the site is considered adequate.

The mechanical engineer will be required to undertake a hydrant flow test meeting NFPA requirements to confirm available fire flow for the onsite fire suppression and sprinkler system design prior to construction.

MECP require the systems to maintain an operating pressure of 280-700 kPa (40-100 psi) under peak hour flow conditions. Based on the MSP hydraulic modelling static and residual pressures range from 448–455 kPa (65–66 psi) which are greater than the required 280kPa (40psi).

Based on the infrastructure review and future upgrades to be completed by the County there will be no negative impact on the local water distribution system. There is adequate water pressure and flow available for the proposed development.

Refer to Appendix A, **Drawing C2** –Servicing Plan by Forefront Engineering for details regarding the proposed water servicing.

3. Sanitary Sewer System

Existing Sanitary Infrastructure

The existing subject site is currently vacant agricultural fields and is not serviced by any sanitary sewer infrastructure.

Block 54 is proposed as part of Phase 1B of Fields of Wellington Subdivision. Local infrastructure proposed as part of the Fields of Wellington Subdivision include a 200mm sanitary sewer along the extension of West Street and a 200mm diameter sanitary sewer along the proposed Raynor Road.

A 200mm sanitary service is to be provided within the West Street municipal right-of-way extending to the property limit to serve the subject site.

Wellington Urban Area Sanitary Sewer Upgrades

R.V. Anderson Associates Limited completed a "*Wellington Master Servicing Plan for Water, Wastewater and Stormwater*" (MSP), dated May 6, 2021, in association with the County of Prince Edward for the Wellington Urban Area. The MSP was undertaken as part of a Schedule "B" Class Environmental Assessment (EA). The subject development is within the MSP study area and the following report has reviewed and considers the findings and recommendations of the MSP.

The MSP notes that the existing Wastewater Treatment Plant (WWTP) requires several upgrades as the system capacity is near surpassing the County's threshold of 80% of the rated capacity. Inflow and infiltration from precipitation and groundwater sources have played a major role in pushing wastewater flows above the capacity of the existing WWTP. Immediate upgrades are recommended per the MSP for the WWTP to address the current peak flow.

With consideration for the findings of the MSP, PEC is undergoing proposed upgrades to the sanitary sewer collection system. As noted above the WWTP is proposed to be replaced in the near future. A 450mm sanitary sewer is to be completed in 2023-2024 by the County along Millennium Trail from Belleville Street to the Main Street WWTP to service future developments to the north. A new sewage pumping station on the east end designed for approximately 25 L/s and associated 200mm forcemain is proposed to service future development to the east.

Proposed Development

In accordance with the MSP, MECP guidelines and the Ontario Building Code the following design criteria have been used.

Design Flow Parameters
Average Day Flow Rate – 350 L/cap/day (MSP, 2021)
Average Day Flow Rate – 350 L/cap/day (PEC Request)
Peak Residential Factor - Harmon Formula
Infiltration Allowance - 0.28 L/s/ha (PEC Request)

Population
Unit Population – 1.79 Persons/unit (MSP, 2021)
(Refer to *Wellington Master Servicing Plan – Technical Memorandum 1* for population and demand requirements)

Residential Dwelling Units
North Building – 80 Units
South Building - 80 Units

A 200mm diameter sanitary service is proposed to service the subject site connecting to the 200mm sanitary sewer on West Street.

The proposed development is expected to generate a peak sanitary sewage flow in the order of 5.2 L/s, refer to the **Sanitary Sewer Design Sheet** in Appendix B for further details.

Note that the proposed peak sanitary sewage flow is captured in the Fields of Wellington Subdivision Servicing Report and the MSP. It is understood that with the upgrades to be completed by the County there is adequate downstream sanitary sewer capacity for the proposed development.

Refer to Appendix A, **Drawing C2** –Servicing Plan by Forefront Engineering for further details regarding the proposed sanitary servicing.

4. Drainage and Stormwater Management

Existing Conditions

The existing subject site is currently vacant agricultural fields and is not serviced by any stormwater infrastructure.

Block 54 is proposed as part of Phase 1B of Fields of Wellington Subdivision. Local infrastructure proposed as part of the Fields of Wellington Subdivision include a 375mm diameter to 450mm diameter storm sewer along West Street. The storm sewer outlets to the west property swale to a proposed enhanced swale located north along the Millennium Trail.

General topography of the land drains south towards the Millennium Trail.

Refer to the "*Fields of Wellington Subdivision Stormwater Management Report"* dated May 2023, prepared by Forefront Engineering Inc for further details regarding the existing conditions for the subject site and adjacent land.

As per the findings and recommendations of The Fields of Wellington Subdivision SWM Report (2023), existing drainage from Block 54 is directed southwest to **Outlet 1**, the Wellington area storm sewer system and to Lake Ontario.

Refer to **Figure 2** – Pre-development Catchment Areas in Appendix C for further details regarding the existing site conditions.

Proposed Development

The development includes an approximate building and pool area of 4,700 m^2, an impervious hardscaped surface area of 7,700 m^2 and approximately 6,800 m^2 of pervious landscaping. The total lot area is approximately 1.92ha.

Pitched roofs are proposed for both the North and South buildings with disconnected roof drains directed to the onsite storm sewer and onsite swales.

The proposed Block 54 drainage plan is consistent with the recommendations of the Fields of Wellington Subdivision SWM Report.

Quantity control is proposed onsite as per the recommendations from the Fields of Wellington Subdivision SWM Report. Post-development peak flows outletting from the site are to be equal to pre-development peak flows for the minor storm event up to the major storm event.

Onsite storage is to be provided by the proposed StormTech Chamber system and storm sewer system. Peak flows from the site are to be restricted by an orifice plate fixed to the outlet control structure prior to outletting offsite.

Quality control is proposed onsite. Enhanced protection corresponding to 80% TSS removal is provided for the subject site via the StormTech Isolator Row.

The onsite storm sewer is to be sized to convey the minor event. The major event is to be conveyed by the overland flow path and directed to the StormTech chamber system.

Drainage outletting from the subject site is to be directed to the west property line swale south to the enhanced swale proposed along the Millennium Trail eventually to **Outlet 1,** the Wellington area storm sewer system and to Lake Ontario.

A maximum of 250mm of surface ponding under blocked outlet conditions is proposed.

Refer to **Drawing C2** – Servicing Plan by Forefront Engineering in Appendix A for storm sewer servicing details and **Figure 3**: Post Development Catchment Areas in Appendix C for the post development catchment areas.

4.1 Water Quantity

4.1.1. Storm Sewers

Minor Event

In accordance with general stormwater management practices the onsite storm sewer is to be sized for up to the minor event (5 year event approx.) based on the MTO IDF curve and Manning's equation.

The stormwater collection system shall be designed to accommodate runoff as per the Rational Method formula:

$$Q = 2.78AIR$$

where Q = Design flow in L/s,
A = area in hectares
I = rainfall intensity in mm/hr, and
R = runoff coefficient.

In the absence of local municipal guidelines, a minimum tc (time of concentration) of 15 minutes is to be used in conformance with general stormwater management practices.

The minor and major design storm events are based on IDF rainfall statistics that describe the frequency of rainfall depths over a specified duration. Rainfall intensities with various durations and return periods for the site were obtained from the MTO IDF Curve in Appendix C.

Refer to the **Storm Sewer Design Sheet** in Appendix C for storm sewer design details.

Runoff Coefficients

The runoff coefficient (R) is a dimensionless coefficient relating the amount of runoff to the amount of precipitation received. It is a larger value for areas with low infiltration and high runoff (pavement, steep gradient), and lower for permeable, well vegetated areas (forest, flat land). Coefficients were assigned based on surface cover and soil conditions as follows.

MECP Runoff Coefficients	
Land Use & Topography	**Runoff Coefficients**
Asphalt, concrete, roof area	0.90 - 1.00
Grassed area, parkland	0.15 - 0.35
Brick Roads	0.70 - 0.85
Sandy Soils	0.05 - 0.25
Playgrounds	0.20 - 0.35
Gravel	0.60 – 0.70
Forest and dense wooded areas	0.10 – 0.25
Permeable Pavements	0.15 – 0.25
Note: Values are taken from MECP "Design Criteria for Sanitary, Storm Sewer and Forcemain for Alterations Authorized under Environmental Compliance Approval", 2022	

A runoff coefficient of 0.25 is to be used for grassed and soft landscape surfaces, and 0.9 is proposed for asphalt and rooftops. Refer to **Figure 4** Composite Runoff Coefficient Calculations in Appendix C for further details.

Major Event

Major flows greater than the minor event are to be conveyed via overland flow routes directed to the onsite StormTech Chamber system where they will be controlled to pre-development levels and eventually outlet to the Millennium Trail enhanced swale.

Quality Event

A "Quality Event" design storm was used in this study, defined as a small, frequent storm representing 25mm of rainfall over a short duration. Based on long-term rainfall observations in Southern Ontario, 90-95 percent of all rainfall events have a total rainfall depth of 25mm or less. This rainfall amount over a 4-hour duration has an approximate 6 month return period in this region.

The following formula has been developed for a 25mm – 4hour Chicago Design storm for this area:

$$I_{25mm} = \frac{498}{(t_c + 9.7)^{0.825}}$$

Where I_{25mm} is the 25mm 4 hour event intensity and the Rational Method is used to calculate the peak flow from the 25mm event.

4.1.2. Analysis

Urbanization leads to an increase in impermeable surfaces (rooftops and parking areas). The resultant increased peak flows increase the risk to life, environment, and property damage. Water quantity control is generally required when there may be downstream quantity impacts.

Where the development proposes to outlet to the Wellington Main Street storm sewer system (**Outlet 1**) quantity control is required.

Minor storm drainage systems will be designed for the 5-year design event in accordance with general stormwater management practices. Overland flows paths are to convey the 100 year storm event.

Pre-Development Flows

Analysis of the pre-development conditions and existing peak flows to **Outlet 1** are available in *The Fields of Wellington Subdivision SWM Report*. For the development blocks outletting to **Outlet 1**, the Subdivision SWM Report proposes an allowable 5-year controlled peak outflow of 0.035 m^3/s per hectare for the 5 year event, and a peak flow of 0.058 m^3/s per hectare for the 100 year event.

For the subject site having an area of 1.92 hectares this equates to an allowable controlled peak flow of 0.067 m^3/s for the 5 year event, and 0.111 m^3/s for the 100 year event directed to **Outlet 1**.

Post-Development Flows

The proposed development will increase the imperviousness of the site and hence the runoff. Results shown in Table 4-1 quantify the uncontrolled peak rate of surface runoff that has been routed through the collection system and directed to the onsite storage system.

Table 4-1 Uncontrolled Peak Flows in Post-Development Conditions

Uncontrolled Peak Flows in Post-Development Conditions (m^3/s)					
Outlet	Area (ha)	Composite Coeff.	25mm 4 hour Storm	1:5 Year Storm	1:100 Year Storm
Directed to StormTech Chamber	1.92	0.67	0.118	0.244	0.403

Uncontrolled post-development peak flows result in an increase in peak flows from pre-development levels. The 5 year uncontrolled peak flow is 0.244 m^3/s, requiring a reduction of 0.177 m^3/s to reduce peak outflows to 0.067 m^3/s and the 100 year uncontrolled peak flow is 0.403 m^3/s, requiring a reduction of 0.292 m^3/s to reduce peak outflows to 0.111 m^3/s.

Onsite storage is proposed to restrict post development peak flows to pre-development levels.

Modified Rational Method

When developing the rational method the runoff volume was not considered, and the Rational Method alone was not meant for detention basin design. However, the modified Rational Method, actually an extension of the conventional Rational method, has been used in the past for sizing of detention basins. This method should generally be restricted to drainage areas less than 20 acres, and this method is expected to be appropriate for the subject site. The Modified Rational method uses the peak flow calculations paired with assumptions about the inflow and outflow hydrographs to compute an approximation of storage volumes for simple detention calculations. This approach assumes the stormwater runoff hydrograph (detention basin inflow hydrograph) for the design storm is trapezoidal in shape. The peak runoff rate is calculated using the Rational Formula and it is assumed that the peak of the outflow hydrograph falls on the recession limb of the inflow hydrograph and the rising limb of the outflow hydrograph can be approximated by a straight line. The storage volume is approximated with the following equation;

$$S_d = Q_p t_d - Q_d((t_d + t_c)/2)$$

*Storage Formula (Aron and Kibler, 1990)

Where:

	td = Duration of Storm (min)
Q=Peak runoff rate (m^3/s)	
C=Composite runoff coefficient	Qp = Peak Flow (m^3/s)
I=Rainfall intensity (mm/hr)	Qd = Discharge Rate (m^3/s)
A=Drainage area (ha)	Sd = Required Storage
tc= Time of Concentration (min)	Volume (m^3)

The design storm duration is that duration that maximizes the detention storage volume, Sd, for a given return period. An allowable target outflow is set based on predevelopment conditions. The storm duration is td, and is varied until the storage volume is maximized.

The proposed development has an approximate composite coefficient of 0.67.

StormTech Chamber System

Post development peak flows are to be controlled to pre-development levels to **Outlet 1** for the minor event (5 year) up to the major event (100 year), outletting to the Millennium Trail enhanced swale and Main Street storm sewer system and as summarized in Table 4-2.

Table 4-2 Controlled Peak Flows in Post-Development Conditions

Controlled Peak Flows in Post-Development Conditions						
Outlet	Area (ha)	Composite Coeff.	1:5 Year Peak Flow (m^3/s)	1:5 Year Storage (m^3)	1:100 Year Peak Flow (m^3/s)	1:100 Year Storage (m^3)
Outletting from MH1 to **Outlet 1**	1.92	0.67	0.067	240	0.111	355

Storage is to be provided by the onsite storm sewer system and StormTech MC-3500 Chamber system located at the southwest of the site prior to outletting to the western swale. A combination of two orifice plates fixed to the outlet control structure will restrict flows for the 5 and 100 year storm events to pre-development levels.

Refer to the **Modified Rational Method Calculations** in Appendix C for the 5 year and 100 storage requirement calculations.

A total of 355 m^3 of storage is required to maintain post-development peak flows to pre-development levels. The StormTech MC-3500 Chamber system provides capacity for up to 335 m^3 of storage and the onsite storm sewers provide for an additional 20 m^3 of storage for a total of 355 m^3 of storage. Refer to the **StormTech Cumulative Storage Volumes** and the **Stage-Storage Discharge Calculations** in Appendix C for storage and discharge calculations.

An inlet control structure with an elevated bypass manifold is provided at the inlet to the StormTech Chamber system creating a differential between the Isolator Row chamber and the manifold to the remainder of the system. Stormwater flows from storm events greater than the quality event overtop the bypass manifold into the header pipe and enter the remaining quantity storage portion of the chamber system. After stormwater flows through the Isolator Row and into the remainder of the StormTech chamber system it is passed at a controlled rate through the outlet control maintenance hole. The system is designed for controlled flows to pass through the chamber system to **Outlet 1**, however, it can be expected that some stormwater will infiltrate into the soils below.

The chambers are embedded in a gravel bed filled with 20 to 50mm diameter clear crushed stone having a void ratio of 40% to provide storage and structural support to the chamber system and overlying pavement. The gravel bed is lined with a non-woven geotextile fabric to provide separation between the clear stone material in the gravel bed and underlying soil. The StormTech Chamber system including the gravel bed in which the system is embedded covers an area of 330m^2.

An outlet control structure with combination orifice plates is provided at the outlet to restrict peak flows to pre-development levels. The lower orifice plate controls for the 5-year (minor) event and the elevated orifice plate controls for the 100 year (major) event.

Should the outlet orifice become blocked or an event exceed the 100 year design storm, surface ponding shall occur within the parking area around the catchbasins up to a maximum ponding depth of up to 250mm prior to spilling over the high points towards the west swale. Refer to Appendix A, **Drawing C1** – Grading Plan prepared by Forefront Engineering for further details regarding site grading.

The StormTech Chamber system is to be underlain by clean stone wrapped with a liner. A perforated sub drain is to be provided within the system typical in clay or rock construction to allow water within the underdrain to drain to the outlet maintenance hole.

The west property limit outlet swale has an available capacity of approximately 0.32 m^3/s which is more than adequate to convey up to the controlled major storm event of 0.11 m^3/s and includes capacity for the downstream development. Refer to the **Outlet Swale Capacity Calculations** in Appendix C for calculation details.

4.2 Water Quality

The Stormwater Management Planning and Design Manual by the Ministry of the Environment, Conservation and Parks (MECP) describes various levels of protection of water quality, based on a general relationship between the end-of-pipe stormwater management facilities long-term suspended solids removal and the lethal and chronic effects of suspended solids on aquatic life.

Based on the characteristics of the receiving watercourse and recommendations from the Fields of Wellington Subdivision Stormwater Management Report, Enhanced Protection (corresponding to the end-of-pipe storage volumes required for the long-term removal of 80% of suspended solids) is required.

StormTech Isolator Row

The StormTech Isolator Row system is recognized by the MECP as an effective treatment of stormwater and is an ETV certified technology. Refer to the **ETV Certification** in Appendix C. Water quality treatment is provided by the Isolator Row within the StormTech Chamber system and non-woven geotextile fabric wrapped over the top of the system. The application creates a filter / detention basin that allows water to pass through the surrounding filter fabric while sediment is trapped within.

The treatment rate of the Isolator Row is variable dependant on the incoming particle concentration, chamber contact area and incoming flow rate.

The StormTech Isolator Row is rated for 81% suspend solids (TSS) removal efficiency, an incoming mean particle concentration of 200 mg/L, and a treatment rate of 0.011m^3/s per MC-3500 chamber. The 25mm 4 hour quality event is calculated to have a peak flow rate of 0.118 m^3/s, requiring 11 Isolator Row chambers. 12 Isolator Row chambers are proposed which is greater than the 11 required.

The proposed StormTech MC-3500 Chamber with Isolator Row system will provide a minimum of 80% removal of suspended solids.

The proposed onsite quantity and quality controls will ensure there are no adverse impacts to the downstream natural environment and infrastructure.

4.3 Maintenance

Periodic maintenance inspection of the storm sewer, StormTech Chamber system and swale facilities is the responsibility of the Owner. A summary of observations during inspection of the facility over the course of the year should be provided. These observations should include comments on the:

- Observations resulting from the inspection of the facility over the course of the year. These observations should include comments on the:
    - hydraulic operation of the facilities (detention time, evidence or occurrence of overflows)

- occurrence of obstructions at the inlet and outlet
- evidence of spills and oil/grease contamination
- frequency of trash build-up
- measured sediment depths in the facilities
- maintenance and operational control undertaken during the year
- recommendations for inspection and maintenance program for the coming year

The pipe system will require routine periodic maintenance including hydro vacuuming, flushing and debris removal annually. Removal of accumulated sediment will be required.

A copy of the StormTech Chamber and Isolator Row inspection and maintenance manual shall be provided to the Owner.

At a minimum StormTech recommends annual inspections. The first inspection should take place 6 months after installation and then another 6 months for the second inspection. This will help determine the frequency of maintenance required to keep the storm system free from debris and sediment.

Periodic maintenance of the StormTech system should include inspection of Inlet and Outlet Control Maintenance holes. Inspect the sump of the inlet and outlet control maintenance holes, if sediment buildup is above the inverts of the outlet pipe, cleaning should be scheduled immediately. Inspect the Isolator Row via the inspection port. If measured sediment is between 75mm and 150mm depth in the Isolator Row, cleaning is to be scheduled at the earliest possible date. If sediment buildup is greater than 150mm in depth, cleaning should be scheduled immediately.

4.4 Quality Control (Short Term)

Silt fencing is to be provided at all side slopes and down gradient locations to ensure sediment and erosion control during construction. Other control devices such as straw bale check dams will also be provided where drainage is concentrated. A clear stone mud mat is to be provided at the entrance to the site.

The timeframe for land to remain exposed before it is stabilized with sod, mulch, or hydroseeding is to be minimized.

Inspection of the sediment control works should be undertaken before and after all rainfall (and snowmelt) events. Maintenance is to be undertaken as required to ensure the proper operation of all sediment and erosion controls.

5. Utilities

The proposed development will be serviced by electrical, gas, telephone, and cable television services.

Final gas and electrical service sizes required will be confirmed with the mechanical and electrical engineers prior to Building Permit Approval.

Refer to **Drawing C2** – Servicing Plan by Forefront Engineering detailing the proposed utility servicing.

6. Conclusions

Detailed calculations find that the proposed infrastructure is capable of and will effectively service the proposed demand created by this development.

A 150mm water service connection is proposed to West Street.

A 200mm sanitary sewer connection is proposed to West Street.

An onsite storm sewer system outletting to the storm sewer on West Street discharging to the proposed Fields of Wellington enhanced swale located along the Millennium Trail is proposed. An onsite StormTech Chamber system is proposed to provide quantity and quality control. Post-development flows are proposed to be attenuated to pre-development levels for all storm events up to the 100 year event to Outlet 1.

Electrical, communication and natural gas connections are proposed on West Street.

Appendix A

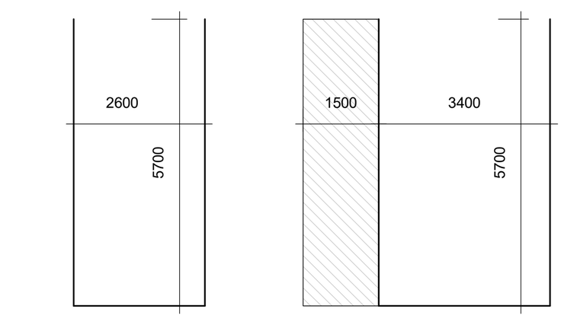
Architect Site Plan

C1 – Grading Plan

C2 – Servicing Plan

C3 – Details

C4 – Details



RESIDENTIAL ENTRANCE (BF)

FOR INFORMATION EXCHANGE
4/25/2023 2:28:15 PM

RZA
RICHARD ZIEGLER ARCHITECT INC.
39 POLSON STREET TORONTO, ONTARIO M5A 1A4
T: 416 461 1494 or 1 800 413 7992 F: 866 893 1488
www.rzarchitect.com E: mail@rzarchitect.com

NO.	ISSUANCE	DATE
1	ISSUED FOR COORDINATION	2023.04.25

THE GENERAL CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE ARCHITECT. DO NOT SCALE THE DRAWINGS. DO NOT USE THIS DRAWING FOR CONSTRUCTION UNLESS SIGNED AND SEALED BY THE ARCHITECT.

NORTH

STAMP

KAITLIN CORPORATION

FIELDS OF WELLINGTON

Block 54
Wellington, ON

SITE PLAN

SCALE	As indicated	PROJECT NUMBER
DATE	4/25/2023 2:28:15 PM	202220
DRAWN	SO	
CHECKED	REZ	

SHEET: A.100

REVISION

SITE WORKS

1. Refer to Geotechnical Report by Malroz Engineering Inc. dated November 5, 2018 .
2. Road cuts to be reinstated as per The County of Prince Edward requirements.
3. Provide construction fencing and signage as per The County Prince Edward requirements.
4. Hot mix, hot laid asphalt concrete as per OPSS 1150.
5. Mix designs shall contain a minimum of 5.4% asphalt cement with a performance grade of PH58-28 and 3.5% air voids.
   Parking lot cross sections shall be:
   Heavy Duty
   40mm HL3
   50mm HL8
   150mm Granular 'A'
   300mm Granular 'B' Type II
6. Concrete curb shall be barrier type OPSD 600.110 unless indicated otherwise.
7. Concrete shall be 32Mpa 28 day strength, 19mm coarse aggregate nominal maximum size, 6.0% to 8.0% air content. Normal portland cement type as per OPSS 1301. Concrete materials and production as per OPSS 350, 351, 352, 353, 1301, 1302, and 1350.
8. Boulevards and grass areas to be finished with 100mm of topsoil and seed.
9. Paint lines for standard parking spaces to be CAN/CGSB-1.74-2001, ALKYD Traffic Paint. Pavement surface to be free from ponded water, frost, ice, dust, oil, grease, and other foreign materials prior to painting. Paint lines to be uniform colour and density with sharp edges. Protect pavement markings until dry.
10. All construction dewatering during building construction up to occupancy is the Contractor's responsibility.

GRADING

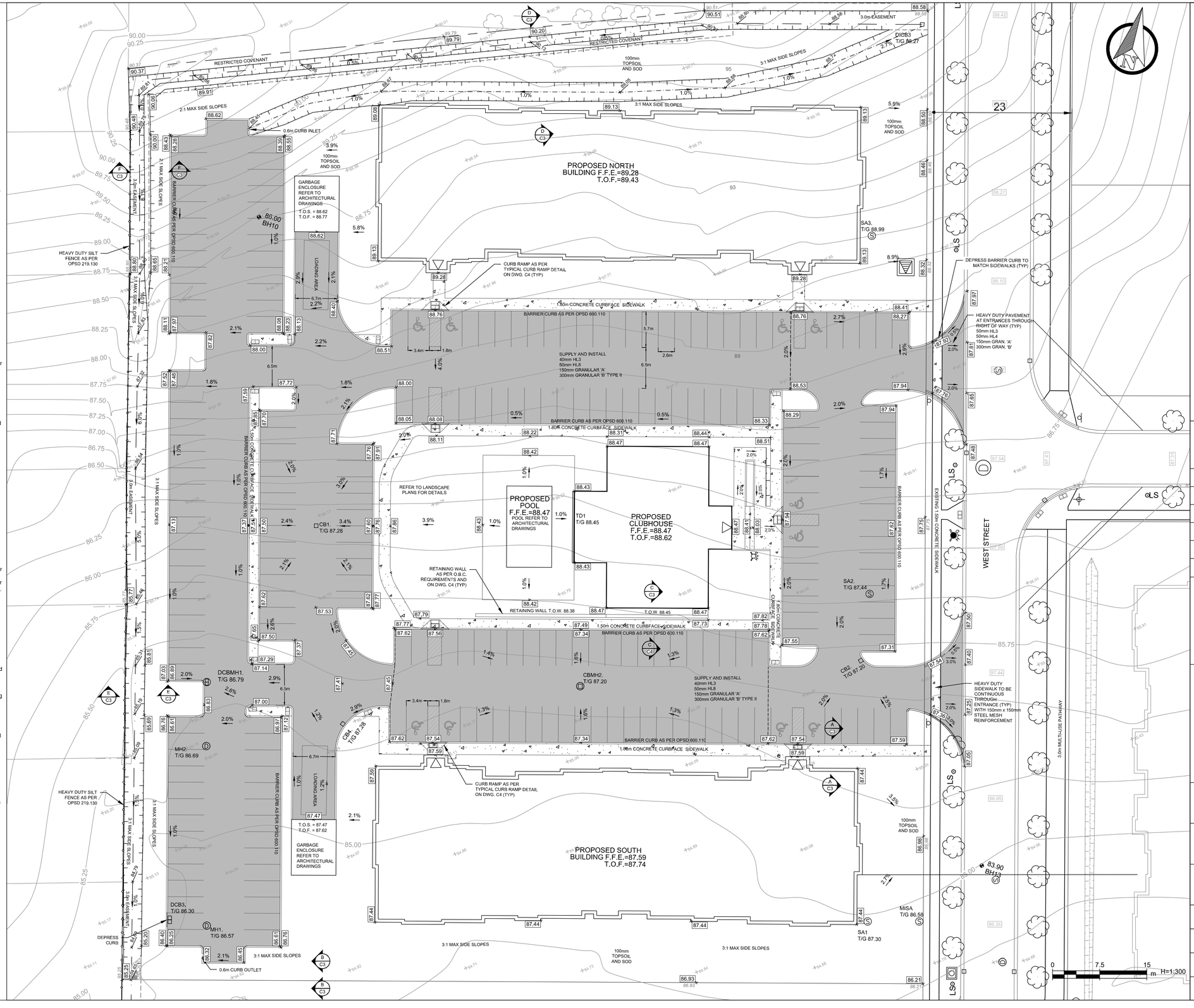
1. Existing elevations as per Forefront Survey 2022.
2. Positive drainage away from the building shall be achieved. Finished surfaces shall be at a minimum grade of 2% unless otherwise noted.
3. 150mm of granular 'A' shall be supplied and installed under all steps, decks, and porches unless otherwise specified.
4. Side slopes shall be a maximum slope of 3:1 unless otherwise noted.
5. All existing elevations and grades are to be verified by the contractor prior to grading.
6. Utilities are to be located prior to construction.
7. All ground surfaces shall be graded to prevent ponding and without low areas except where approved swale or catchbasin outlets are provided.
8. Maximum hard surface grades are to be 8.0%.
9. Staked straw bale filters and flow checks to be installed as per OPSD 219.100 and OPSD 219.180 around catchbasins and sewer inlets.
10. Conflicts between the architectural drawings and grading shall be brought to the attention of the contract administrator.
11. The contractor is responsible for reviewing proposed grades with conflicts regarding the proposed structures.
12. Sub-drain and outlet elevations are to be confirmed prior to the construction of any structures.
13. Sub-grade shall be graded at a minimum of 2%, until a lower ditch is encountered or the existing surface drains away from the sloped sub-grade.
14. Grades are to match the adjacent properties unless otherwise noted.
15. All driveway curbing within 0.6m of a county sidewalk is to be depressed to the elevation of the sidewalk.
16. F.F.E. shall mean First Floor Elevation
    T.O.F. shall mean Top Of Foundation
    T.O.S. shall mean Top Of Slab

SEDIMENT AND EROSION CONTROL NOTES

1. All erosion and sediment controls shall be installed prior to construction and monitored and maintained by the Contractor throughout the construction process, until all disturbed areas have been revegetated, then the temporary sediment and erosion control measures must be removed once the site has been stabilized and or the site works are complete.
2. Staked straw bale filters and flow checks to be installed as per OPSD 219.100 and OPSD 219.180 around catchbasins and sewer inlets.
3. All erosion and sediment control measures shall be inspected after each rainfall to the satisfaction of Prince Edward County and QCA.
4. Any disturbed area not scheduled for further construction within forty-five (45) days will be provided with a suitable temporary mulch and seed cover within seven (7) days of completion of that particular phase of construction.
5. Regardless of site specific items detailed on the plans, the Contractor shall install erosion control measures to suit the proposed work methods controlling sediment runoff from discharging offsite prior to any disturbance.
6. Following construction, disturbed areas, as well as proposed grassed and vegetated surfaces, shall be reinstated as soon as practical.
7. The placement of surplus fill to be placed and/or temporarily stored in accordance with Prince Edward County requirements or O.Reg.148/06 where applicable. Temporary fill sites will require the approval of the County. Fill locations, side slopes, elevations as per the Approved Drawings. Restoration to be completed during the final phase of construction.
8. All roads used to access the site shall be kept clean to the satisfaction of the Director of Engineering Services.

CLOSEOUT

1. Request Final Inspection and SPA securities release from the Civil Engineering Consultant.
2. Maintain as-built drawings throughout the durations of the project. Submit as-built drawings for the project record.
3. Complete and submit a final site survey certificate (completed by OLS or Engineer), certifying that elevations and locations of completed Works are in conformance, or non-conformance with Contract Documents.
4. Prior to final review remove surplus products, tools, construction machinery and equipment. Remove waste products and debris including that caused by Owner or other Contractors. Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds. Remove dirt and other disfiguration from exterior surfaces. Sweep and wash clean paved areas.



LEGEND

- HEAVY DUTY ASPHALT
- CONCRETE
- PROPOSED STORMWATER
- PROPOSED SANITARY
- PROPOSED WATERMAIN
- PROPOSED SWALE
- EXISTING SANITARY
- EXISTING STORM
- EXISTING WATER
- EXISTING GAS
- EXISTING BELL CABLE
- EXISTING UNDG. HYDRO
- EXISTING FENCE
- EXISTING CB, DCB
- EXISTING STORM MH, CBMH
- EXISTING SANITARY MH
- EXISTING HYDRANT, VALVE
- EXISTING DECIDUOUS, CONIFEROUS TREE
- EXISTING LIGHT STANDARD
- BENCHMARK
- BOREHOLE
- WELL
- 101.45 EXISTING GRADE
- 102.56 PROPOSED GRADE
- 2.0% SLOPE ARROW
- 99.99 PROPOSED SWALE GRADE

Benchmark

1. BENCH MARK BEING THE SPIKE IN CONCRETE SIDEWALK, NORTHING: 4869368.064 EASTING:311081.400, HAVING AN ELEVATION OF 84.38m.
2. BM2 BEING NAIL IN HYDRO POLE, NORTHING:4869536.270 EASTING:311425.870, HAVING AN ELEVATION OF 85.15

No.	Revision/Issue	Date
1		

DRAFT

Forefront Engineering Inc

1329 Gardiners Road. Suite 210
Kingston, ON, Canada K7P 0L8
613.634.9009 tel.
1.888.884.9392 fax.

Client
KAITLIN CORPORATION

Project
FIELDS OF WELLINGTON SUBDIVISION BLOCK 54

Drawing
GRADING PLAN

Drawn by:	Checked by:	Project No.
CDD	JH	
Designed by:	Approved by:	Drawing No.
KMN	KMN	C1
Date: APRIL 2023		
Scale: 1:300		

0 7.5 15 m H=1:300

GENERAL

1. All works to be installed in accordance with current Prince Edward County Development Guidelines, Ontario Building Code and, Ontario Provincial Standard Specifications and Drawings unless specified otherwise.
2. The Contractor shall acquire all permits as required for all works within the Municipal Right of Way. Cut permits are required for all offsite works.
3. Refer to the Architectural and Landscape Architectural Drawings and coordinate.
4. Prior to construction, Contractor to verify all dimensions, sewer inverts and utility locates and identify possible conflicts.
5. Refer to Geotechnical Report by Malroz Engineering dated Nov. 5, 2018
6. In the event that human remains are encountered during construction, the Contractor shall immediately contact the Ministry of Tourism Culture and Sport (416-314-7132), the Registrar of the Cemeteries Regulation Unit from the Ministry of Consumer Services, at (416-326-8393), Ontario Provincial Police (613-476-2151).
7. In the event that deeply buried or previously undiscovered archaeological deposits are discovered in the course of development or site alteration, the Contractor shall immediately contact the Ministry of Tourism Culture and Sport (416-314-7132).

WATERMAINS

1. Watermains shall be AWWA C900-Poly (Vinyl Chloride) (PVC) Specification, SDR18, Pressure Class (PC) of 235 or (b) AWWA C909-Molecularly Oriented Polyvinyl Chloride (PVCO) Specification,Pressure Class(PC) of 235. Other pipe materials may be accepted by the County at the sole discretion of the Director of Engineering Services based on the acceptance of technical specification for that material.
2. Pipe bedding and cover shall conform to OPSD 802 series. Bedding and cover shall be Granular "A".
3. The minimum depth of cover measured from the top of a main or a service connection gooseneck shall not be less than 1.8m.
4. Watermain to have a minimum separation of 2.5m from parallel ditches and sewers, crossing sewers shall have a minimum vertical separation.
5. Watermain vertical seperation of 0.5m and insulated as directed by the Engineer.
6. Service connections to PVC mains shall be by stainless steel saddle within municipal right of ways and molded tee fitting within the buildings property, or approved equivalent.
7. Valve boxes shall be adjusted to finish grade. Valve boxes shall be of cast iron as manufactured by Bibby Ste Croix or Star Pipe Products, 112mm and shall be of sliding type, complete with grommeted hole for tracer wire,which cannot carry any surface load down to the pipe. The covers shall be of a design which prevents unauthorized entry and marked "Water", length to be 140mm to 240mm.
8. Gate valves for pipe shall be Clow or equal, cast iron body, resilient seated mechanical joint pattern conforming to ANSI/AWWA C509, designed for a working pressure of not less than 150 PSI. Valves shall open when turned in a clockwise direction, shall be fitted with a compound operating nut.
9. Water services a minimum of 5.5m in length shall be tested and disinfected to County Standards, AWWA and Building Code Standards.
10. Water services 100mm in diameter or larger shall be hydrostatically tested and disinfected to County, AWWA and Building Code Standards. Fire supply lines shall be tested to NFPA 24.
11. Hydrant shall be the colour for private hydrants. Chrome yellow or red, Contractor to confirm with building department prior to ordering.
12. Prior to testing and disinfection of the watermain and large services, Prince Edward County requires the contractor submit for review a testing, Disinfection and Final Connection Plan.

SEWERS

1. Existing pipe inverts are approximate and must be confirmed by The Contractor in the field.
2. Pipe bedding and cover shall conform to OPSD 802 series. Bedding and cover shall be Granular "A".
3. Storm sewer materials as per:
   a) Reinforced concrete pipe per OPSS 1820 according to CSA A257.2 Class 65-D with rubber gaskets or
   b) Type PSM polyvinyl chloride (PVC) pipe with elastomeric gasketed bell and spigot type joints as per OPSS 1841 and CSA B182.2.
   (i) Mains - DR 35 pipe
   (ii) Storm Laterals - DR 35 pipe
   c) Profile Polyvinyl Chloride (PVC) pipe with elastomeric gasketed bell and spigot type joints meeting OPSS 1841 and CSA B182.4 and having a minimum stiffness of 320 kPa may be used for storm sewer applications.
   d) ADS N-12 ST/WT sizes 100mm to 900mm corrugated dual-wall High Density Polyethylene (HDPE) pipe with elastomeric gasketed bell and spigot type joints meeting CSA 182.8 and OPSS 1840, and having a minimum stiffness of 320 kPa.
4. All manhole and catchbasin grate elevations are approximate and are subject to adjustment in the field.
5. Catchbasin leads to be 200mm unless noted otherwise.
6. Water and sewer services and foundation drains may be laid in the same trench subject to the provisions of the Ontario Building Code and MOECC.
7. Sanitary laterals shall be PVC, CSA certified and conform to OPSS.
8. Laterals are to be sized to meet the Ontario Building Code as amended and shall be minimum 125mm. The colour shall be green.
9. Saddles and fittings for services are to be approved by Prince Edward County.
10. Backwater Valve to be installed on all storm services to the satisfaction of Prince Edward County.
11. Sanitary sewers shall be tested for deflection as per OPSS 410.
12. Where a clearance between pipe or conduit crossings of 300mm or less cannot be avoided, there shall be concrete encasement or non-shrink backfill of the crossing extending one metre in each direction of each pipe.
13. Sanitary maintenance hole cover to OPSD 401.01 Type A. Storm maintenance hole cover to OPSD 401.01 Type B. unless noted otherwise. Catch basin cover to be 400.010.
14. All maintenance holes and catch basins located in the pavement are to have the frame set at base course elevation. These frames are to be subjected to final adjustment at such time as the surface course is applied.
15. Geotextiles must be placed under the lids of all existing manholes and catch basins in the working area for the duration of construction. Upon completion of construction, geotextile is to be removed along with any accumulated sediment.
16. Basement sanitary sewers and foundation subdrains are to be pumped to the proposed service connections, foundation drain shall include backwater valve. Refer to Mechanical Engineering Drawings.

CLOSEOUT

1. Request Final Inspection and SPA securities release from the Civil Engineering Consultant.
2. Contractor to maintain as-built drawings throughout the durations of the project. Submit as-built drawings for the project record.
3. Complete and submit a final site survey certificate (completed by OLS or Engineer), certifying that elevations and locations of completed Works are in conformance, or non-conformance with Contract Documents.
4. Prior to final review remove surplus products, tools, construction machinery and equipment. Remove waste products and debris including that caused by Owner or other Contractors. Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds. Remove dirt and other disfiguration from exterior surfaces. Sweep and wash clean paved areas.
5. Clean, flush and CCTV all sanitary and storm sewer's prior to expiration of the Contractor's warranty for Contract Administrators approval.
6. Contractor to Mandrel all sewers under Contract Administrators supervision.
7. Contractor to Leak test sanitary sewer system under Contract Administrators supervision.

SANITARY MAINTENANCE HOLE SCHEDULE

STRUCTURE	STRUCTURE OPSD	GRATE OPSD	T/G	INLET	OUTLET
MISA	701.010	401.010 'A'	86.58	84.01 (W)	
SA1	701.010	401.010 'A'	87.30	85.24 (N) 84.19 (W)	84.17 (E)
SA2.	701.010	401.010 'A'	87.44	85.52 (N) 85.76 (W)	84.48 (S) 85.50 (S)
SA3.	701.010	401.010 'A'	88.99	85.86 (W)	85.80 (S)

CATCH BASIN SCHEDULE

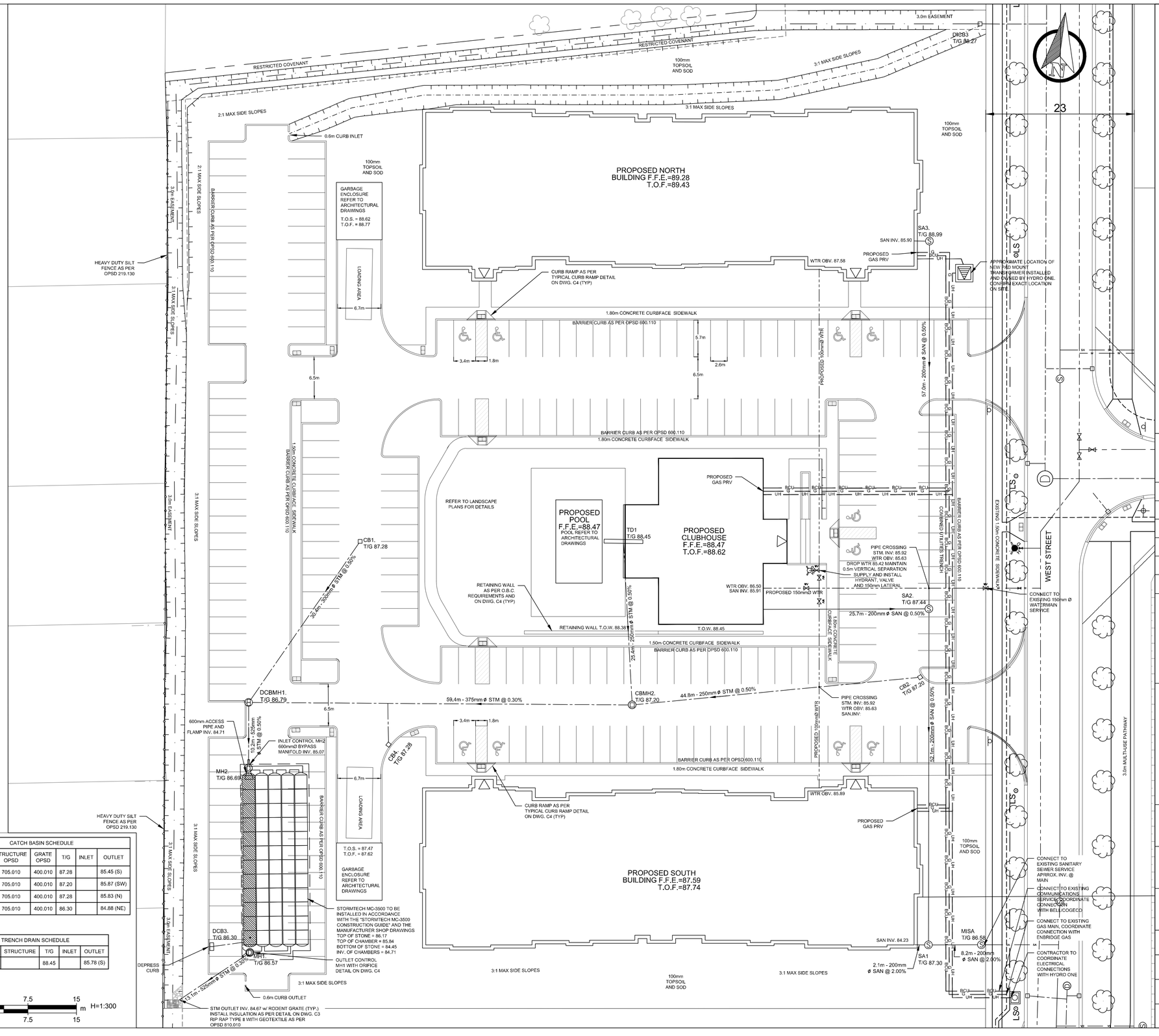
STRUCTURE	STRUCTURE OPSD	GRATE OPSD	T/G	INLET	OUTLET
CB1.	705.010	400.010	87.28		85.45 (S)
CB2.	705.010	400.010	87.20		85.87 (SW)
CB4.	705.010	400.010	87.28		85.83 (N)
DCB3.	705.010	400.010	86.30		84.88 (NE)

STORM MAINTENANCE HOLE SCHEDULE

STRUCTURE	STRUCTURE OPSD	GRATE OPSD	T/G	INLET	OUTLET
CBMH2.	701.010	400.010	87.20	85.64 (NE) 85.65 (N)	85.50 (W)
DCBMH1.	701.010	400.010	86.79	85.32 (S) 85.50 (N)	85.10 (S)
MH1.	701.010	401.010 'B'	86.41	84.71 (E)	84.71 (SW)
MH2.	701.010	401.010 'B'	86.69	85.05 (N)	

TRENCH DRAIN SCHEDULE

STRUCTURE	STRUCTURE	T/G	INLET	OUTLET
TD1		88.45		85.78 (S)



LEGEND

- PROPOSED STORMWATER
- PROPOSED SANITARY
- PROPOSED WATERMAIN
- PROPOSED SWALE
- EXISTING SANITARY
- EXISTING STORM
- EXISTING WATER
- EXISTING GAS
- EXISTING BELL CABLE
- EXISTING UNDG. HYDRO
- EXISTING FENCE
- EXISTING CB, DCB
- EXISTING STORM MH, CBMH
- EXISTING SANITARY MH
- EXISTING HYDRANT, VALVE
- EXISTING DECIDUOUS, CONIFEROUS TREE
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- EXISTING GRADE
- PROPOSED GRADE

Benchmark

1. BENCH MARK BEING THE SPIKE IN CONCRETE SIDEWALK, NORTHING: 4869368.064 EASTING:311081.400, HAVING AN ELEVATION OF 84.38m.

2. BM2 BEING NAIL IN HYDRO POLE, NORTHING:4869536.270 EASTING:311425.870, HAVING AN ELEVATION OF 85.15

No.	Revision/Issue	Date
01		

DRAFT

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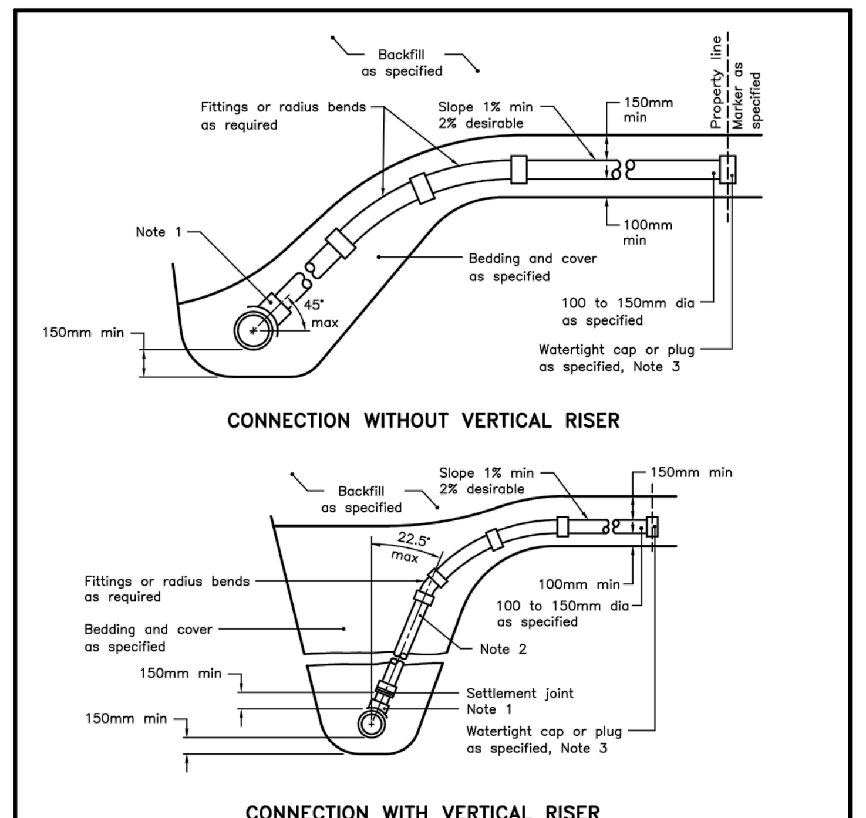
613.634.9009 tel.
1.888.884.9392 fax.

Client
KAITLIN CORPORATION

Project
FIELDS OF WELLINGTON SUBDIVISION
BLOCK 54

Drawing
SERVICING PLAN

Drawn by:	Checked by:	Project No.
CGD	JH	
Designed by:	Approved by:	Drawing No.
KMN	KMN	C2
Date: APRIL 2023		
Scale: 1:300		



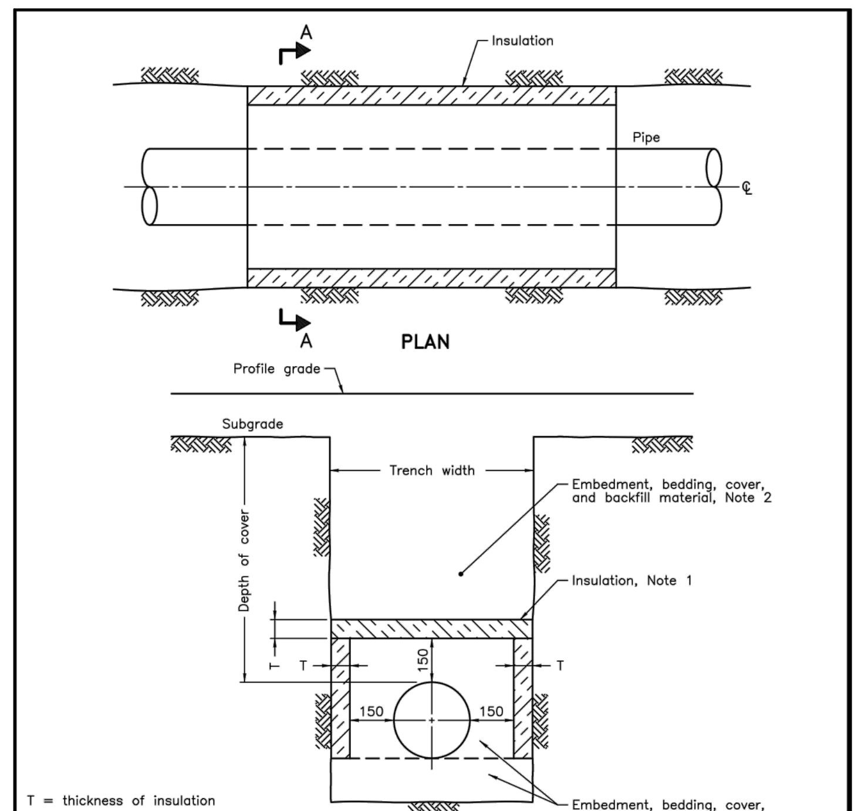
NOTES:
1 Sewer service connections to the main pipe sewer shall be made using factory made tees, strap-on-saddles, or other approved saddles.
2 Vertical risers shall be as specified.
3 Cap or plug at property line shall be adequately braced.

A Maintenance holes shall be used at the main sewer to connect service connections greater than 200mm.
B For new construction, saddles shall be installed on the main pipe before that pipe is laid.
C Approved cut-in tool shall be used for field made connections.
D All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING — Nov 2021 — Rev 4

SEWER SERVICE CONNECTIONS FOR MAIN PIPE SEWER

OPSD 1006.010



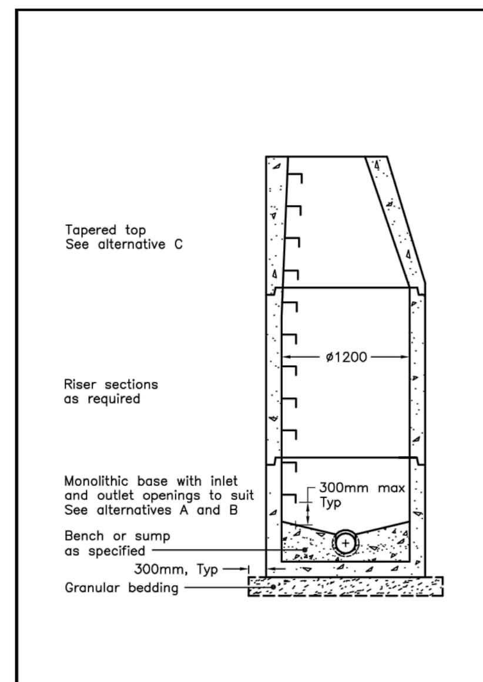
SECTION A-A
TYPICAL PIPE INSULATION DETAIL

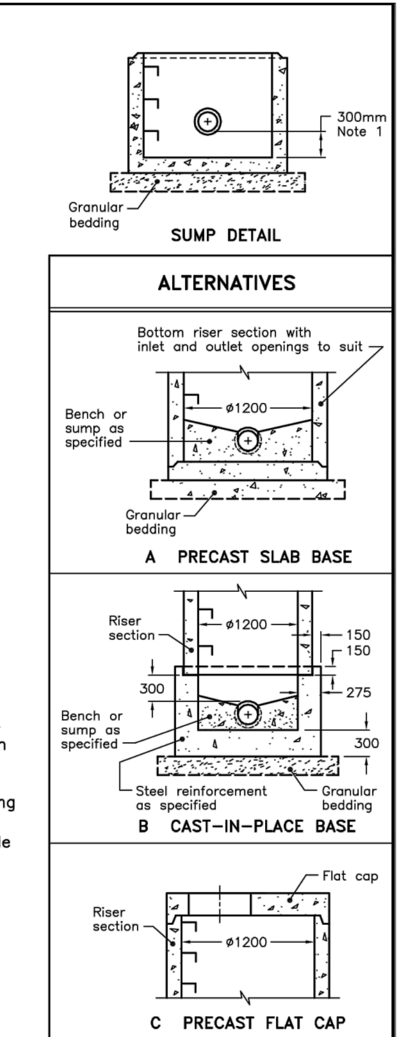
NOTES:
1 The insulation material shall be extruded polystyrene according to OPSS 1605 with a minimum compressive strength of 275 kPa.
2 Pipe embedment or bedding, cover, and backfill shall be according to:
a) Flexible OPSD 802.010, 802.013, 802.020, and 802.023.
b) Rigid – OPSD 802.030, 802.031, 802.032, 802.033, 802.050, 802.051, 802.052, and 802.053.
A Minimum insulation thickness shall be 50mm.
B Joints shall be staggered for multiple insulation sheets.
C This OPSD is to be read in conjunction with OPSD 3090.100 and 3090.101.
D All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING — Nov 2020 — Rev 1

INSULATION FOR SEWERS AND WATERMAINS IN SHALLOW TRENCHES

OPSD 1109.030



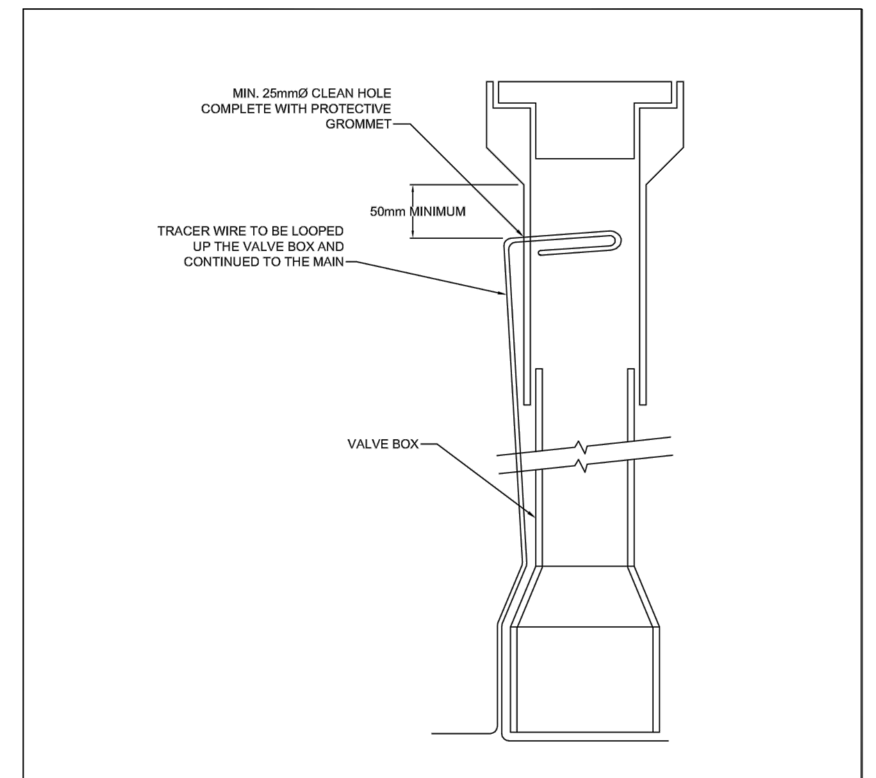


NOTES:
1 The sump is measured from the lowest invert.
A Granular backfill shall be placed to a minimum thickness of 300mm all around the maintenance hole.
B Precast concrete components shall be according to OPSD 701.030, 701.031, or 701.032.
C Structure exceeding 5.0m in depth shall include safety platform according to OPSD 404.020.
D Pipe support according to OPSD 708.020.
E For benching and pipe opening details, see OPSD 701.021.
F For adjustment unit and frame installation, see OPSD 704.010.
G All dimensions are nominal.
H All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING — Nov 2014 — Rev 5

PRECAST CONCRETE MAINTENANCE HOLE 1200mm DIAMETER

OPSD 701.010



NOTES:

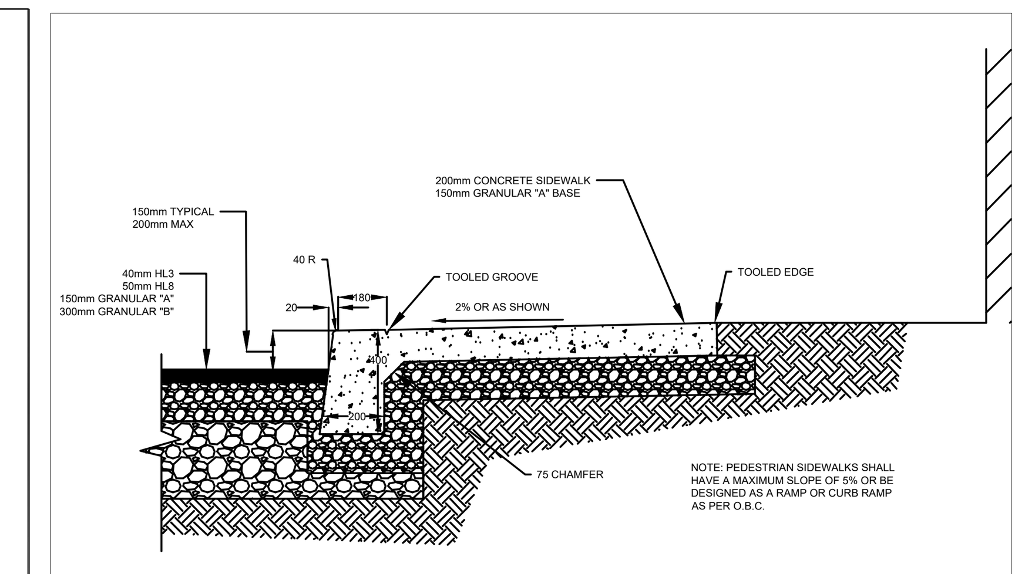
1. TRACER WIRE - #12 GUAGE SOLID C.S.A. TYPE T.W.M.

2. TRACER WIRE SHOULD BE LOOPED UP THE OUTSIDE OF ALL MAIN VALVE BOXES AND EXTENDED INTO THE VALVE BOX BY AT LEAST 150mm THROUGH HOLE 50mm BELOW THE BOTTOM OF THE COVER BELL.

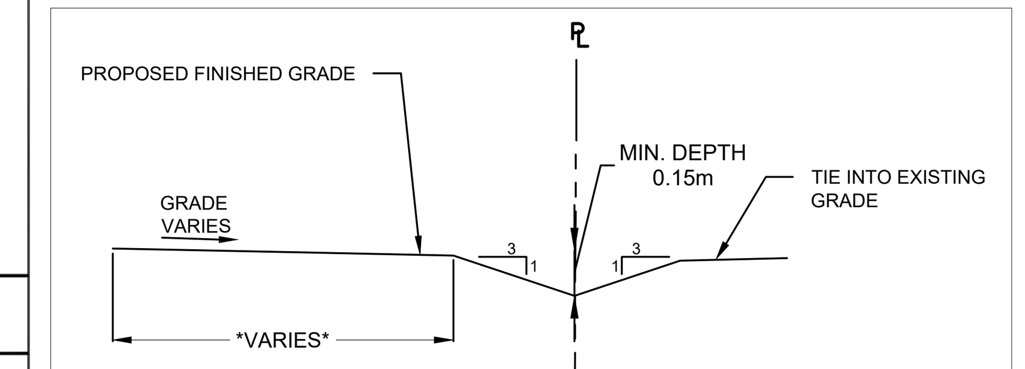
3. CONNECTIONS USED FOR SPLICING TRACER WIRE SHALL BE WING NUT TYPE WITH NYLON SHELL AND NON-CORROSIVE STEEL WIRE SPRING.

TRACER WIRE ARRANGEMENT AT VALVE BOX FOR PVC OR CPP WATERMAIN

Revision: Feb 26,2007
Scale: NTS
Drawing No.: W03-03-105

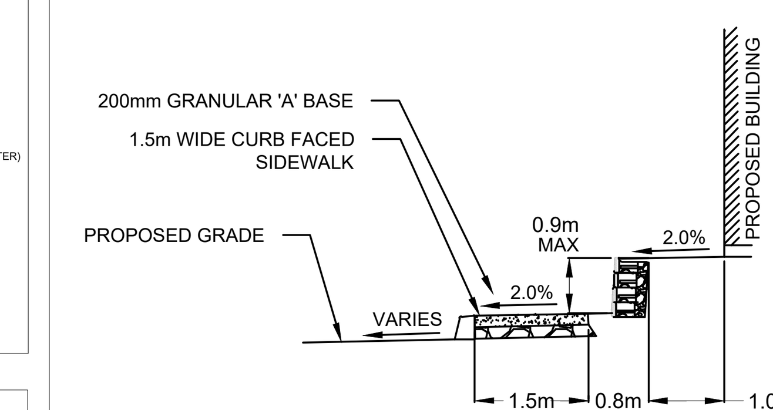


A / C3 **TYPICAL CURB FACE CONCRETE SIDEWALK DETAIL**
NTS



NOTES:
1. ALL DIMENSIONS ARE IN METRES OR MILLIMETRES UNLESS OTHERWISE SHOWN.
2. ALL DISTURBED AREAS TO BE REINSTATED WITH 100mm OF TOPSOIL AND SOD UNLESS SPECIFIED OTHERWISE.
3. SUBGRADE CONSTRUCTION TO BE COMPACTED TO 98% S.P.M.D.D. GRANULAR COURSES TO BE 95% S.P.M.D.D.
4. CONCRETE WALKWAY SHALL BE CONSTRUCTED IN ACCORDANCE WITH OPSD 310.010.

B / C3 **SECTION B: SHARED SWALE**
NTS



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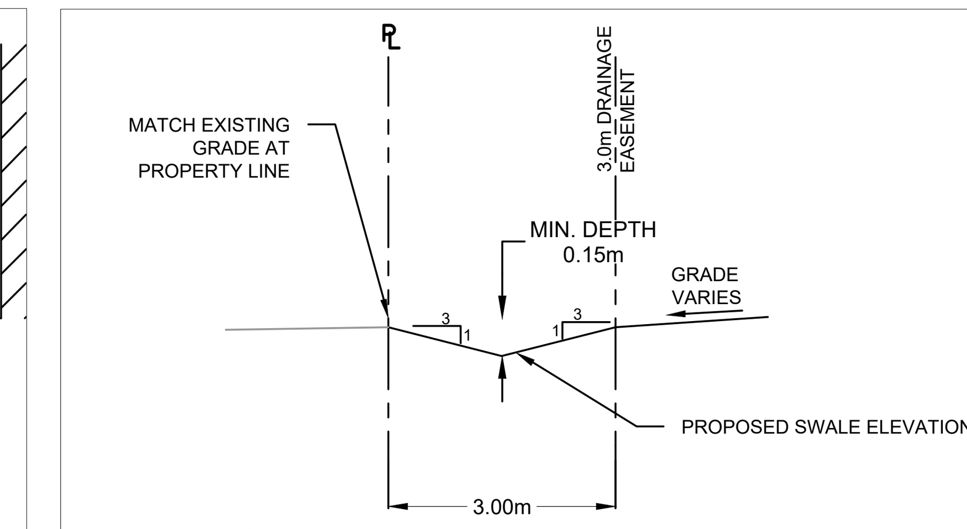
4. CONCRETE WALKWAY SHALL BE CONSTRUCTED IN ACCORDANCE WITH OPSD 310.010.

C / C3 **SECTION C: RETAINING WALL**
NTS



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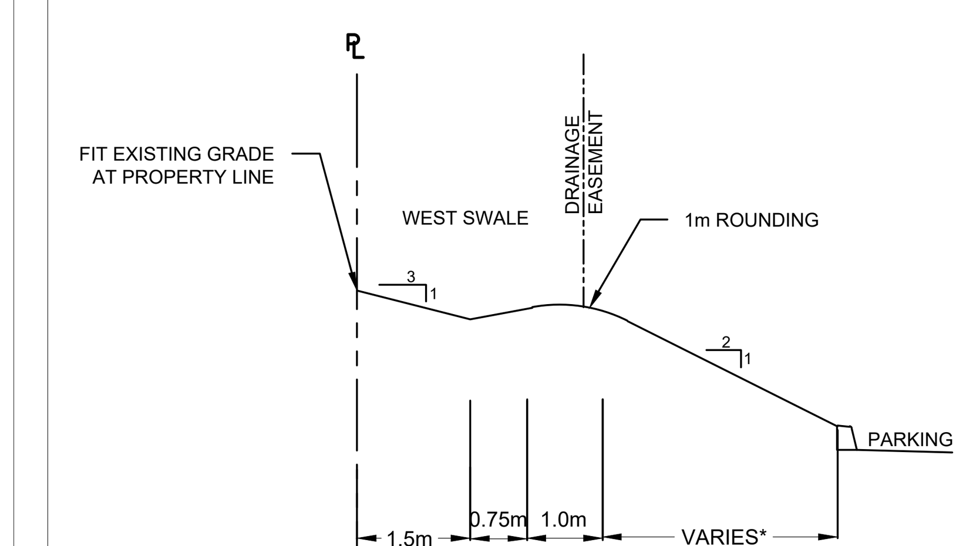
3. SUBGRADE CONSTRUCTION TO BE COMPACTED TO 98% S.P.M.D.D. GRANULAR COURSES TO BE 95% S.P.M.D.D.

E / C3 **SECTION D: SIDE YARD SWALE**
NTS



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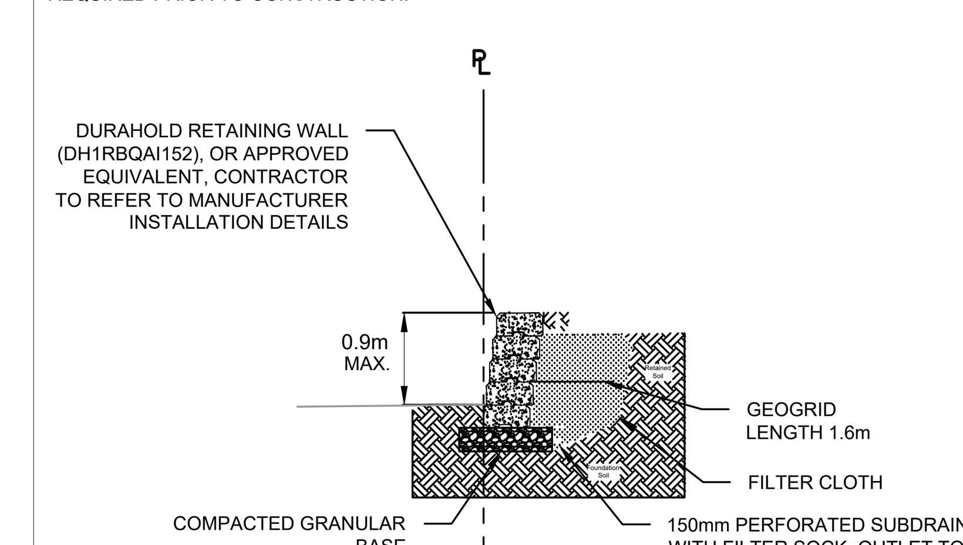
2. ALL DISTURBED AREAS TO BE REINSTATED WITH 100mm OF TOPSOIL AND SOD UNLESS SPECIFIED OTHERWISE.
3. SUBGRADE CONSTRUCTION TO BE COMPACTED TO 100% S.P.M.D.D. GRANULAR COURSES TO BE 100% S.P.M.D.D.

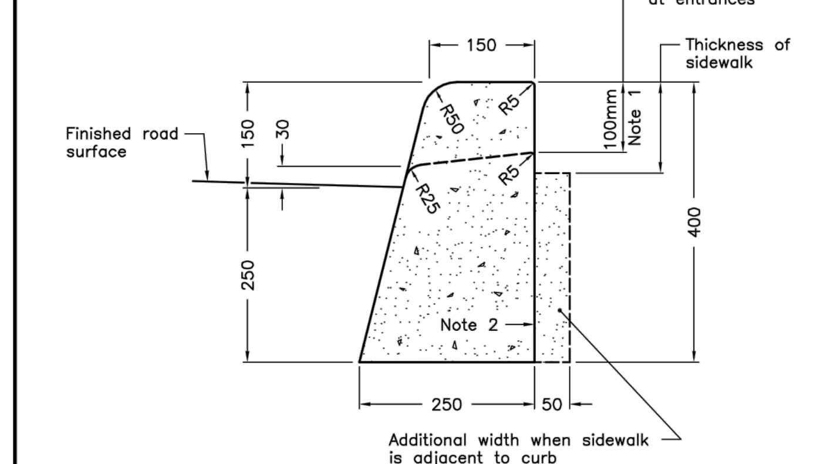
F / C3 **SECTION E: WEST SWALE**
NTS

RETAINING WALL SHALL BE DESIGNED BY CONTRACTORS DESIGN ENGINEER AND PER THE MANUFACTURER REQUIREMENTS. APPROVED ENGINEERED SHOP DRAWING REQUIRED PRIOR TO CONSTRUCTION.



NOTES:
1. ALL DIMENSIONS ARE IN METRES OR MILLIMETRES UNLESS OTHERWISE SHOWN.
2. ALL DISTURBED AREAS TO BE REINSTATED WITH 100mm OF TOPSOIL AND SOD UNLESS SPECIFIED OTHERWISE.
3. SUBGRADE CONSTRUCTION TO BE COMPACTED TO 100% S.P.M.D.D. GRANULAR COURSES TO BE 100% S.P.M.D.D.
4. STRUCTURES SUCH AS HANDRAILS, GUARDRAILS, FENCES, TERRACES, AND SITE CONDITIONS SUCH AS WATER APPLICATIONS, DRAINAGE AND SOIL CONDITIONS, ADDITIONAL LIVE AND DEAD LOADS, ETC., HAVE SIGNIFICANT EFFECTS ON THE WALL DESIGN AND HAVE NOT BEEN TAKEN INTO ACCOUNT IN THIS TYPICAL SECTION. WHEN ACCOUNTED FOR IN THE FINAL DESIGN, OTHER CONDITIONS AND ELEMENTS MAY RESULT IN ADDITIONAL DESIGN MEASURES (GEOGRID, DRAINAGE, ETC) AND COST. CONTRACTORS DESIGN ENGINEER CERTIFICATION REQUIRED.

RETAINING WALL DETAIL
N.T.S.



NOTES:
1 When sidewalk is continuously adjacent, the dropped curb at entrances shall be reduced to 75mm.
2 For slipforming procedure a 5% batter is acceptable.
A Treatment at entrances shall be according to OPSD 351.010.
B Outlet treatment shall be according to the OPSD 610 Series.
C The transition from one curb type to another shall be a minimum length of 3.0m, except in conjunction with guide rail where it shall be according to the OPSD 900 Series.
D All dimensions are in millimetres unless otherwise shown.

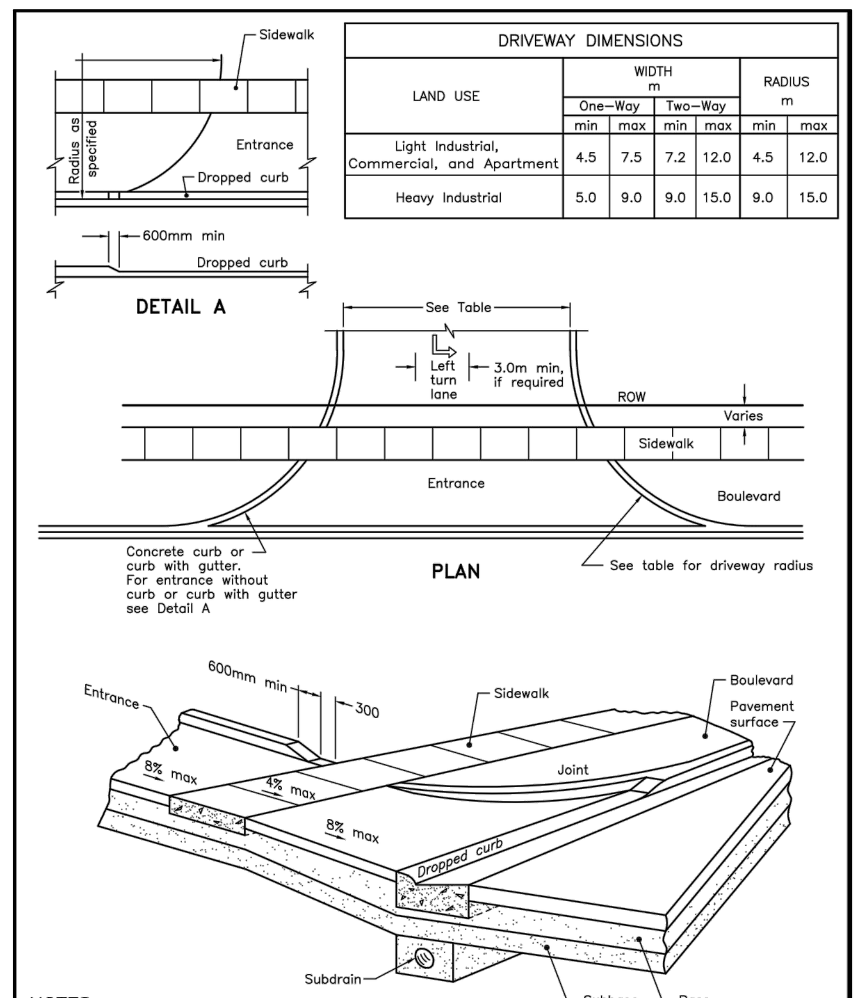
ONTARIO PROVINCIAL STANDARD DRAWING — Nov 2012 — Rev 2

CONCRETE BARRIER CURB

OPSD 600.110

LAND USE	WIDTH m One-Way min	One-Way max	Two-Way min	Two-Way max	RADIUS m min	RADIUS m max
Light Industrial, Commercial, and Apartment	4.5	7.5	7.2	12.0	4.5	12.0
Heavy Industrial	5.0	9.0	9.0	15.0	9.0	15.0

DRIVEWAY DIMENSIONS

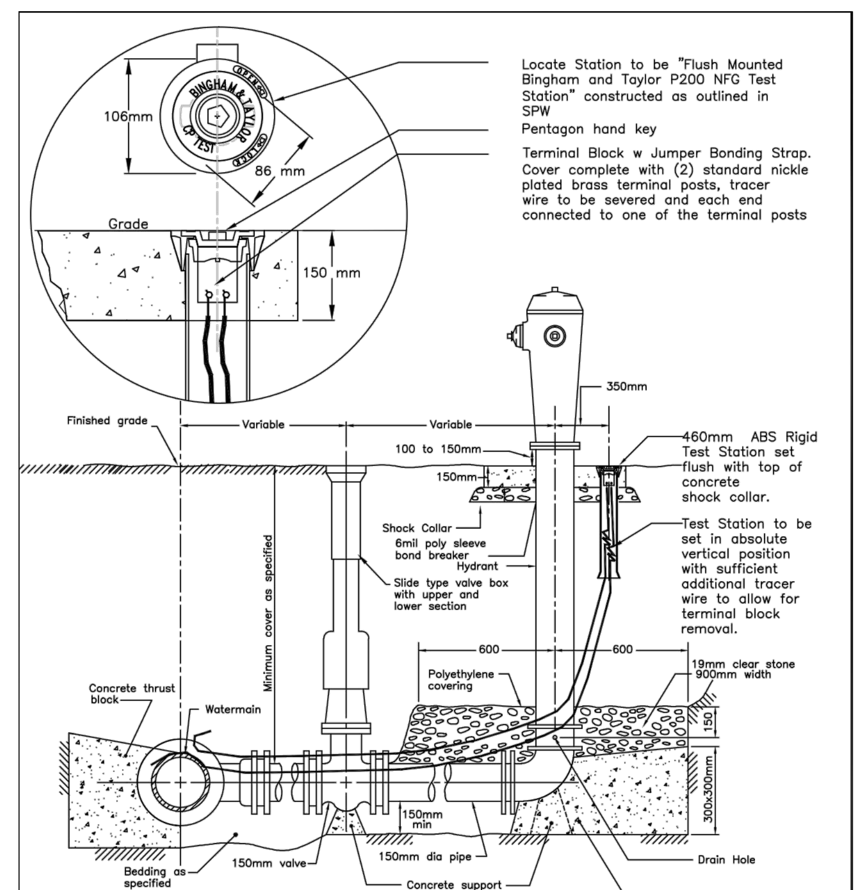


NOTES:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING — Nov 2018 — Rev 2

URBAN INDUSTRIAL, COMMERCIAL, AND APARTMENT ENTRANCES

OPSD 350.010



NOTES:
A All concrete thrust blocks to be poured against undisturbed ground.
B Bond breaker to be used between the concrete and the fittings and appurtenances.
C Bolts and nuts for buried flange to flange connections are to be stainless steel.
D Flange of standpipe extensions not to be in frost zone.
E Concrete Shock Collar to be 1.0m x 1.0m x 150mm , broom finished with trowelled edge.
F Derived from OPSS 1105.010

Typical Fire Hydrant with Flush Mounted Two Terminal Test Station

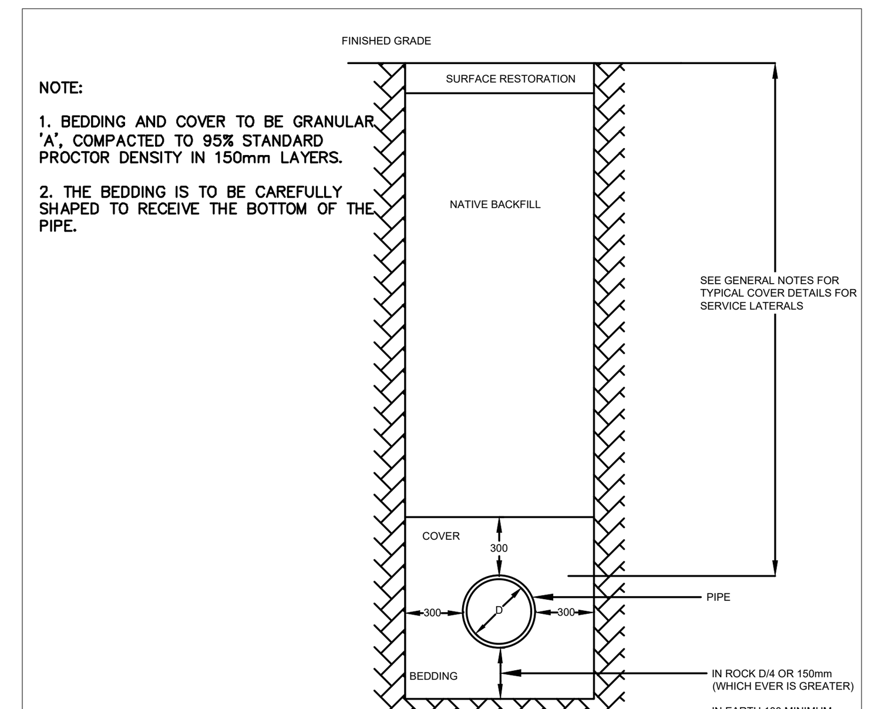
R.H. — Oct 2013 — SCALE NTS

W03-03-116

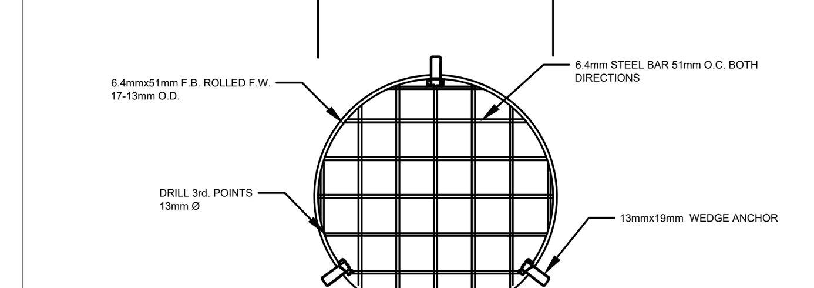
NOTE:

1. BEDDING AND COVER TO BE GRANULAR 'A', COMPACTED TO 95% STANDARD PROCTOR DENSITY IN 150mm LAYERS.

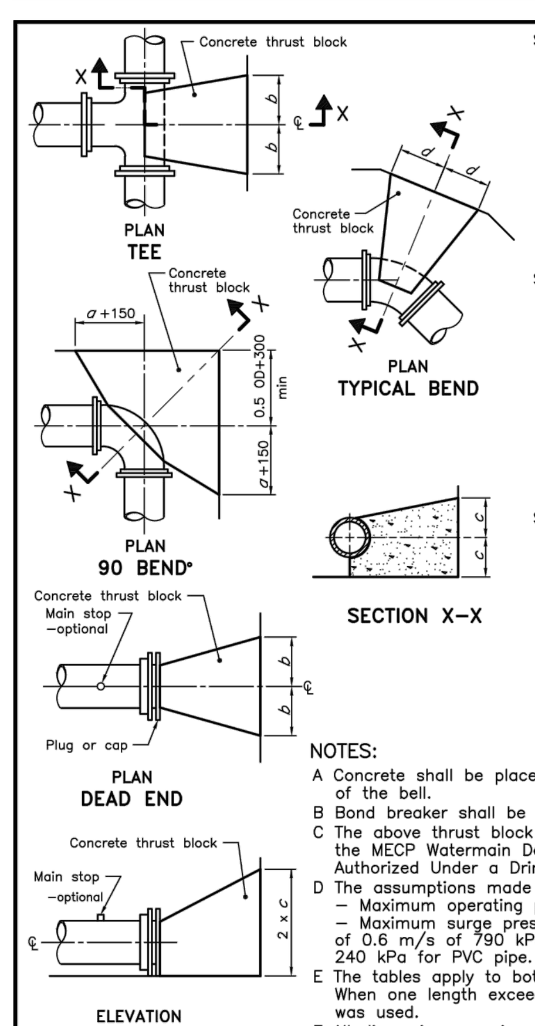
2. THE BEDDING IS TO BE CAREFULLY SHAPED TO RECEIVE THE BOTTOM OF THE PIPE.



SINGLE SEWER OR WATER SERVICE PIPE TRENCH
NTS



TYPICAL RODENT GRATE DETAIL
NTS



SOILS WITH TYPICAL BEARING STRENGTH OF 100 TO 199 kPa

PIPE DIA	Dimensions a	b	c	d
100	150	250	200	200
150	250	400	250	300
200	400	550	300	450
250	500	650	400	500
300	650	800	450	650
350	700	900	550	700
400	900	1050	600	850

SOILS WITH TYPICAL BEARING STRENGTH OF 200 TO 299 kPa

PIPE DIA	Dimensions a	b	c	d
100	150	200	150	150
150	250	250	200	200
200	400	350	250	300
250	500	450	300	350
300	650	500	350	400
350	700	600	400	500
400	900	750	400	600

SOILS WITH TYPICAL BEARING STRENGTH OF 300 kPa AND OVER

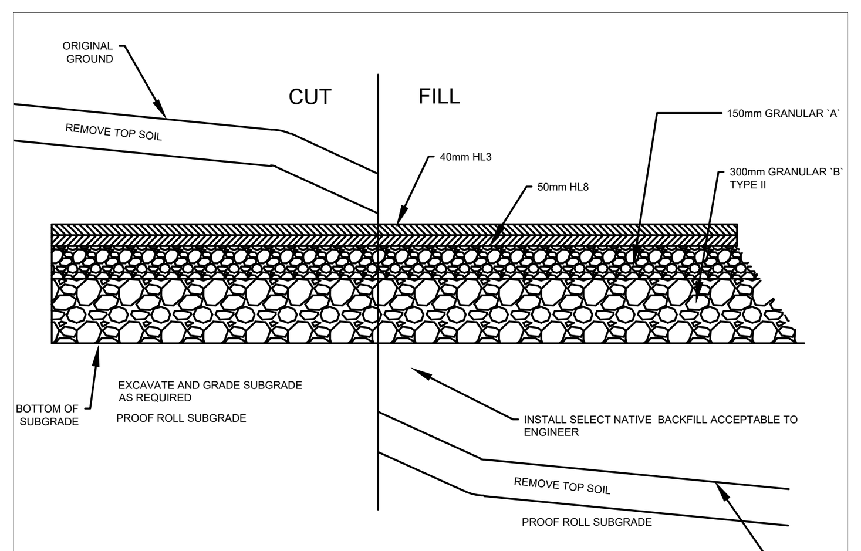
PIPE DIA	Dimensions a	b	c	d
100	150	150	150	150
150	250	200	200	200
200	400	300	200	250
250	500	400	250	300
300	650	450	300	300
350	700	550	350	350
400	900	650	350	450

NOTES:
A Concrete shall be placed to within 50mm of the face of the bell.
B Bond breaker shall be used between concrete and fittings.
C The above thrust block dimensions meet or exceed the MECP Watermain Design Criteria for Future Alterations Authorized Under a Drinking Water Works Permit.
D The assumptions made for the above calculations are:
– Maximum operating pressure of 690 kPa,
– Maximum surge pressure with a flow velocity change of 0.6 m/s of 790 kPa for Class 52 DI pipe and 240 kPa for PVC pipe.
E The tables apply to both ductile iron and PVC pipe. When one length exceeded the other, the longer length was used.
F All dimensions are in millimetres unless otherwise shown.

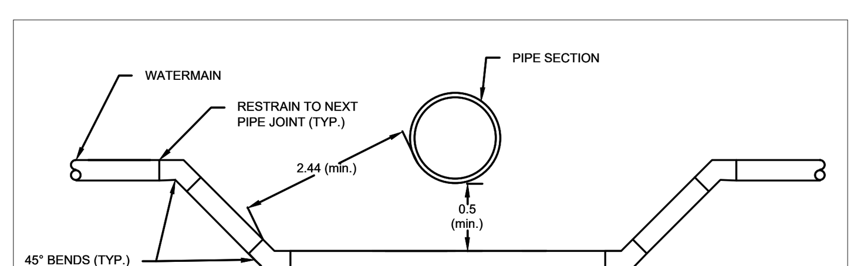
ONTARIO PROVINCIAL STANDARD DRAWING — Nov 2018 — Rev 3

CONCRETE THRUST BLOCKS FOR TEES, PLUGS, AND HORIZONTAL BENDS

OPSD 1103.010

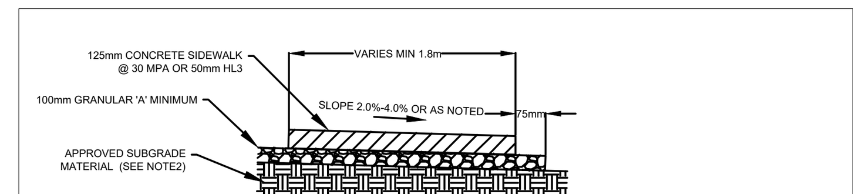


PAVEMENT COMPOSITION - HEAVY DUTY
NTS



NOTE:
1. ALL JOINTS SHALL BE RESTRAINED WITH 4 RODS
2. DIAMETER OF LOWERED WATERMAIN PIPE TO MATCH CONNECTED WATERMAIN PIPE DIAMETER.

WATERMAIN LOWERING



TYPICAL CONCRETE OR ASPHALT SIDEWALK
NTS

NOTE:

1. ALL DIMENSIONS ARE AFTER CONSOLIDATION TO 100% STD. PROCTOR DENSITY.

2. SUBGRADE MATERIAL TO BE COMPACTED TO 95% STD. PROCTOR DENSITY.

3.JOINT SPACING
A) JOINTS EVERY 1.5m
B) EXPANSION JOINTS AS FOLLOWS
- AT 6.0m ON STRAIGHT SECTIONS
- AT 3.0m ON CURVED SECTIONS
- AT THE BEGINNING AND END OF CURVES BETWEEN ADJACENT STRUCTURES

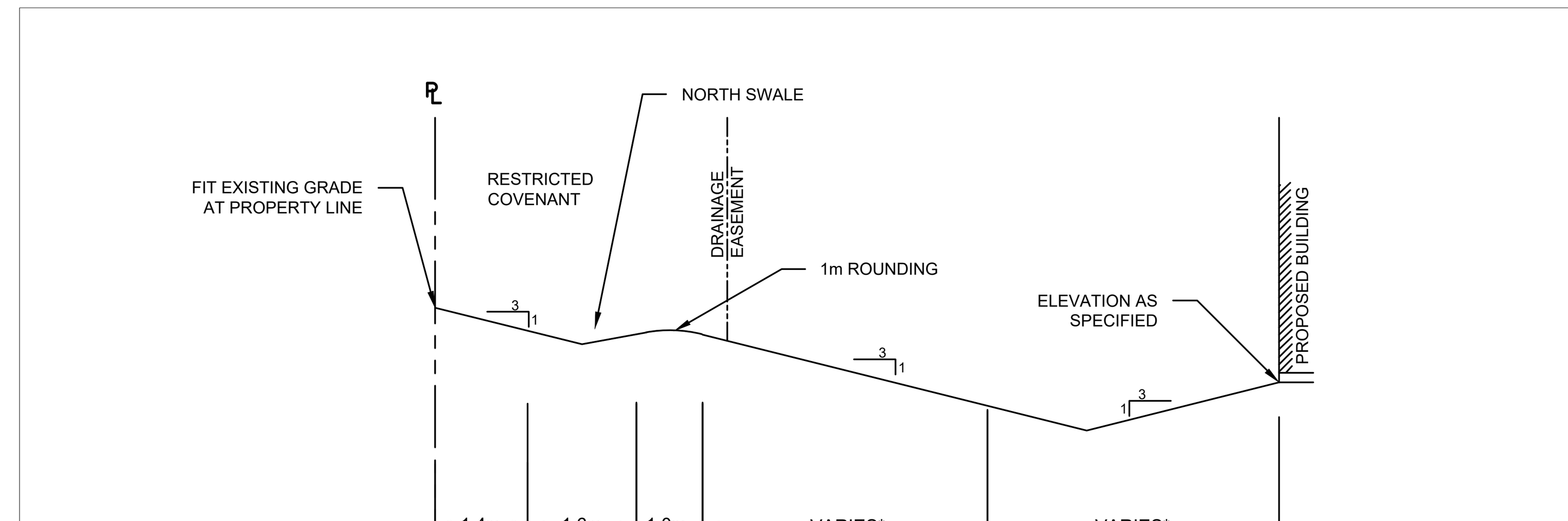
4. ALL OTHER JOINTS TO BE CONTRACTION JOINTS WITH A MINIMUM DEPTH OF 30mm

5. CONCRETE SHALL CONFORM TO THE FOLLOWING:

CLASS OF CONCRETE	MAX STRENGTH - 30MPA AT 28 DAYS
COARSE AGGREGATE	19mm NOMINAL MAXIMUM SIZE
AIR CONTENT	6.0% TO 8.0%
WATER	O.P.S.S 1302
AGGREGATE CEMENT - NORMAL PORTLAND TYPE	O.P.S.S. 1301 (SLAG CEMENT NOT ACCEPTED)
MAXIMUM WATER / CEMENT RATIO	0.45
MAXIMUM SLUMP	75mm
CURING COMPOUND - WHITE PIGMENTED	O.P.S.S1315

6. HEAVY DUTY SIDEWALK TO BE CONTINUOUS THROUGH ENTRANCES, INCLUDES 150mm X 150mm STEEL MESH REINFORCEMENT PLACED 1/3 FROM TOP OF SIDEWALK, 200mm CONCRETE THICKNESS AND HANDICAPPED ACCESSIBLE.

7. INSPECTION OF SIDEWALK ON MUNICIPAL ROAD ALLOWANCE TO BE DONE BY COUNTY STAFF.



NOTES:
1. ALL DIMENSIONS ARE IN METRES OR MILLIMETRES UNLESS OTHERWISE SHOWN.
2. ALL DISTURBED AREAS TO BE REINSTATED WITH 100mm OF TOPSOIL AND SOD UNLESS SPECIFIED OTHERWISE.
3. SUBGRADE CONSTRUCTION TO BE COMPACTED TO 100% S.P.M.D.D. GRANULAR COURSES TO BE 100% S.P.M.D.D.

D / C3 **SECTION B: NORTH SWALE**
NTS

Benchmark

1. BENCH MARK BEING THE SPIKE IN CONCRETE SIDEWALK, NORTHING: 4869368.064 EASTING:311081.400, HAVING AN ELEVATION OF 84.38m.

2. BM2 BEING NAIL IN HYDRO POLE, NORTHING:4869536.270 EASTING:311425.870, HAVING AN ELEVATION OF 85.15

No.	Revision/Issue	Date
R1		

DRAFT

Forefront Engineering Inc
1329 Gardiners Road, Suite 210
Kingston, ON, Canada K7P 0L8
613.634.9009 tel.
1.888.884.9392 fax.

Client
KAITLIN CORPORATION

Project
FIELDS OF WELLINGTON BLOCK 54

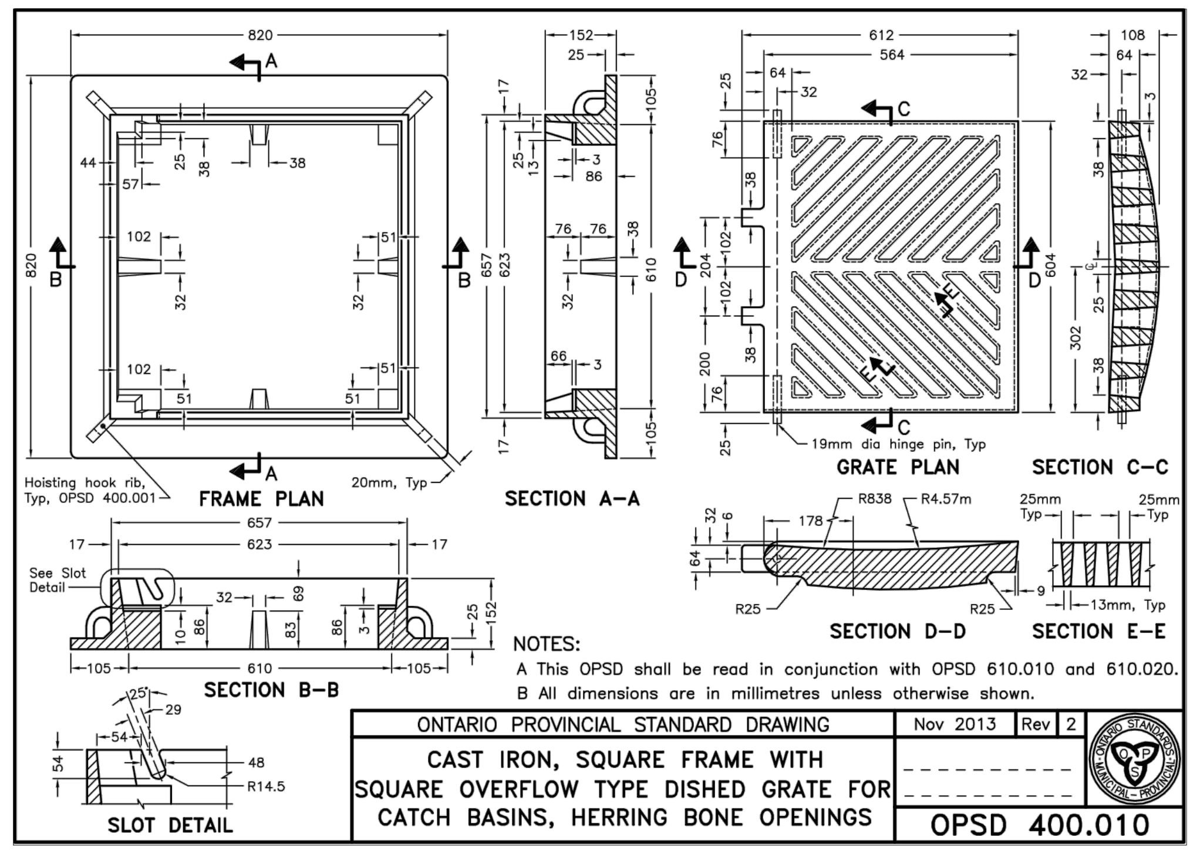
Drawing
DETAILS

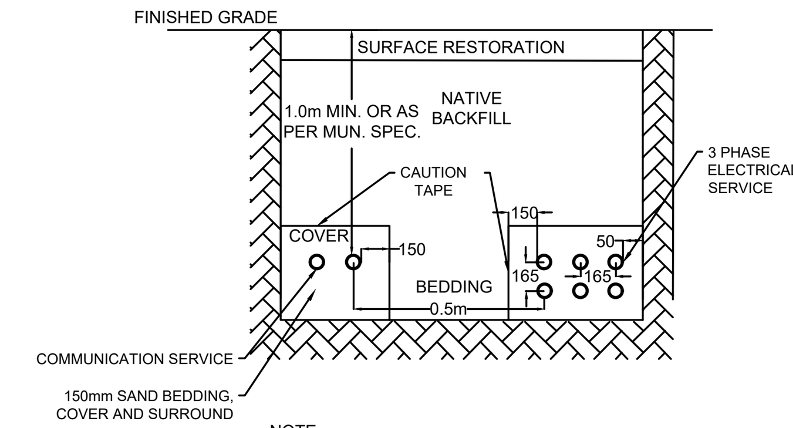
Drawn by: CGO	Checked by: JH	Project No.
Designed by: KMN	Approved by: KMN	Drawing No.

Date: APRIL 2023

Scale: AS SHOWN

C3





NOTE:

1. BEDDING AND COVER TO BE CLEAN MASON SAND, CONFORMING TO LOCAL MUNICIPAL OR GAS AUTHORITY SPECIFICATION, COMPACTED TO 95% STANDARD PROCTOR DENSITY IN 150mm LAYERS.

2. THE BEDDING IS TO BE CAREFULLY SHAPED TO RECEIVE THE BOTTOM OF THE PIPE.

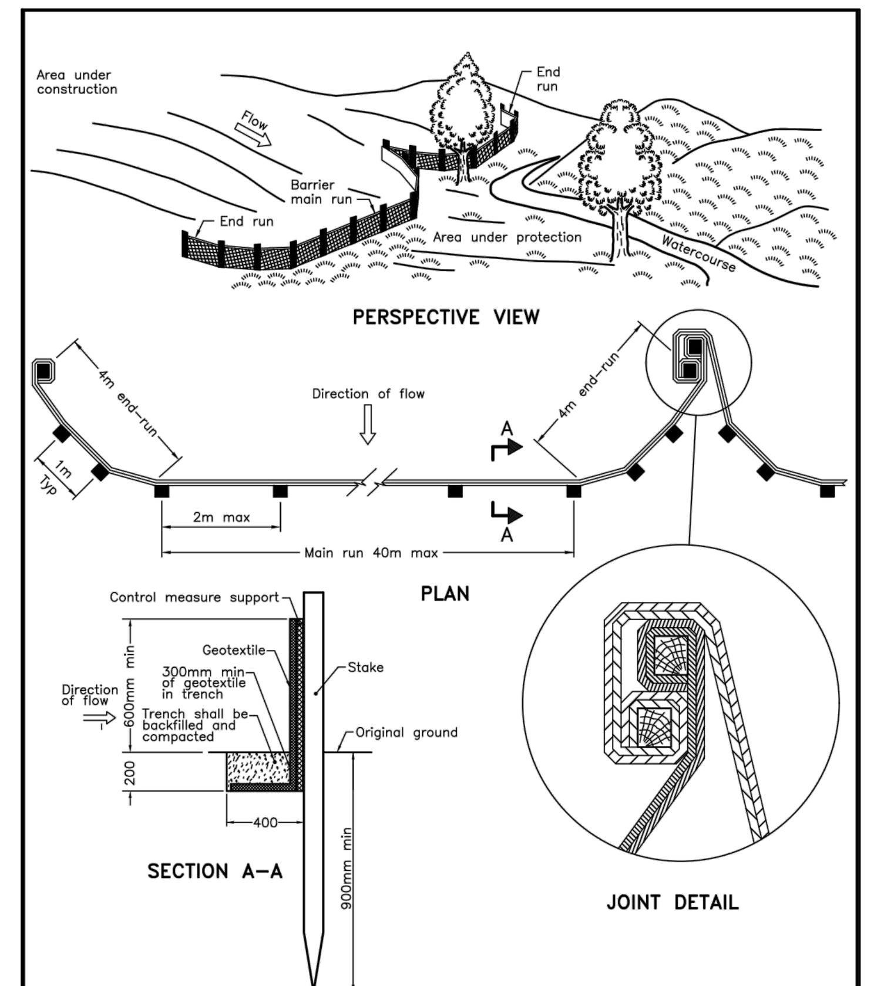
3. COMMUNICATION AND ELECTRICAL SERVICE MUST MAINTAIN 300mm MINIMUM, HORIZONTAL AND VERTICAL, FROM ALL EXPOSED SUPPLY CABLES TO GAS MAIN. ALL SUPPLY CABLES MUST BE INSTALLED BELOW GAS MAIN.

4. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE NOTED.

5. UTILITY SERVICES SHALL MAINTAIN A MINIMUM CLEARANCE OF 0.50m FROM STREET FURNITURE AND 1.5m TO FIREHYDRANTS.

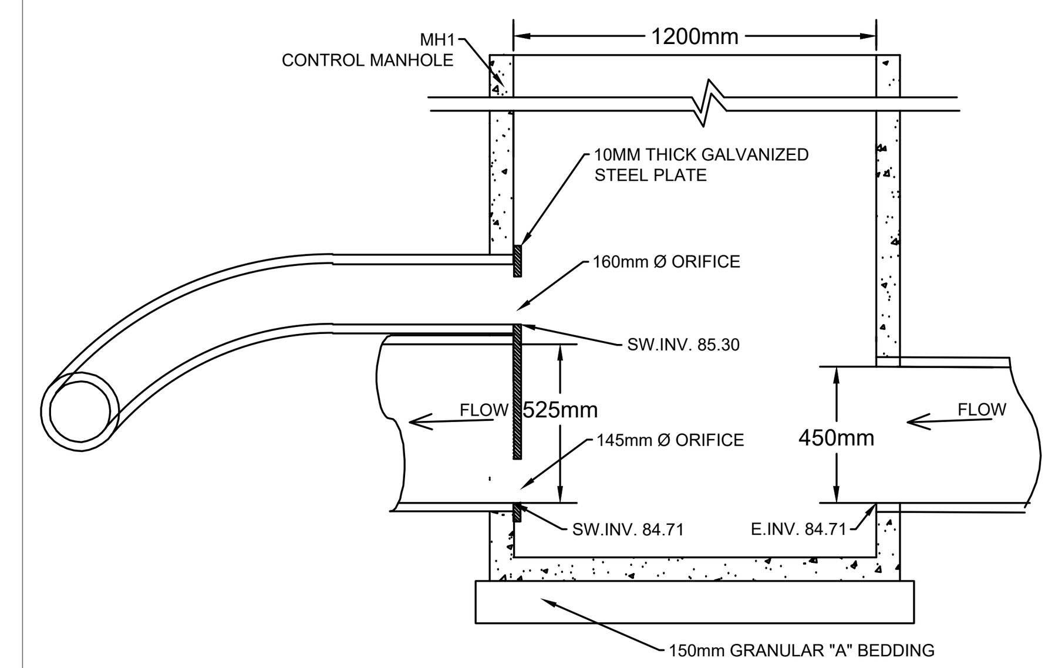
6. DUCTS SHALL BE TRENCH TO TRENCH WHEN CROSSING ROADWAY. ALL DUCTS TO BE CAPPED. LONG RADIUS BENDS TO BE USED TO CHANGE DIRECTION AT TRENCH INTERSECTIONS.

COMMUNICATION AND ELECTRICAL SERVICE IN COMMON TRENCH
N.T.S

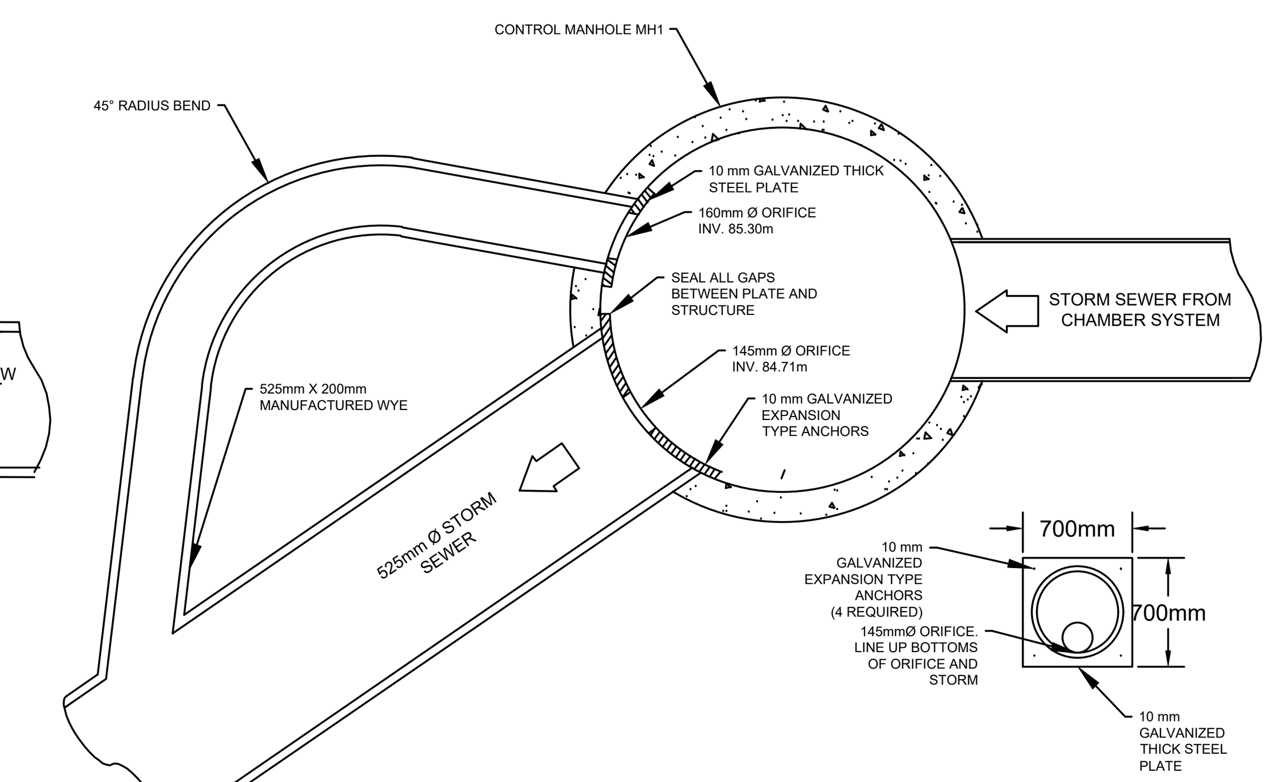


NOTE:
A All dimensions are in millimetres unless otherwise shown.

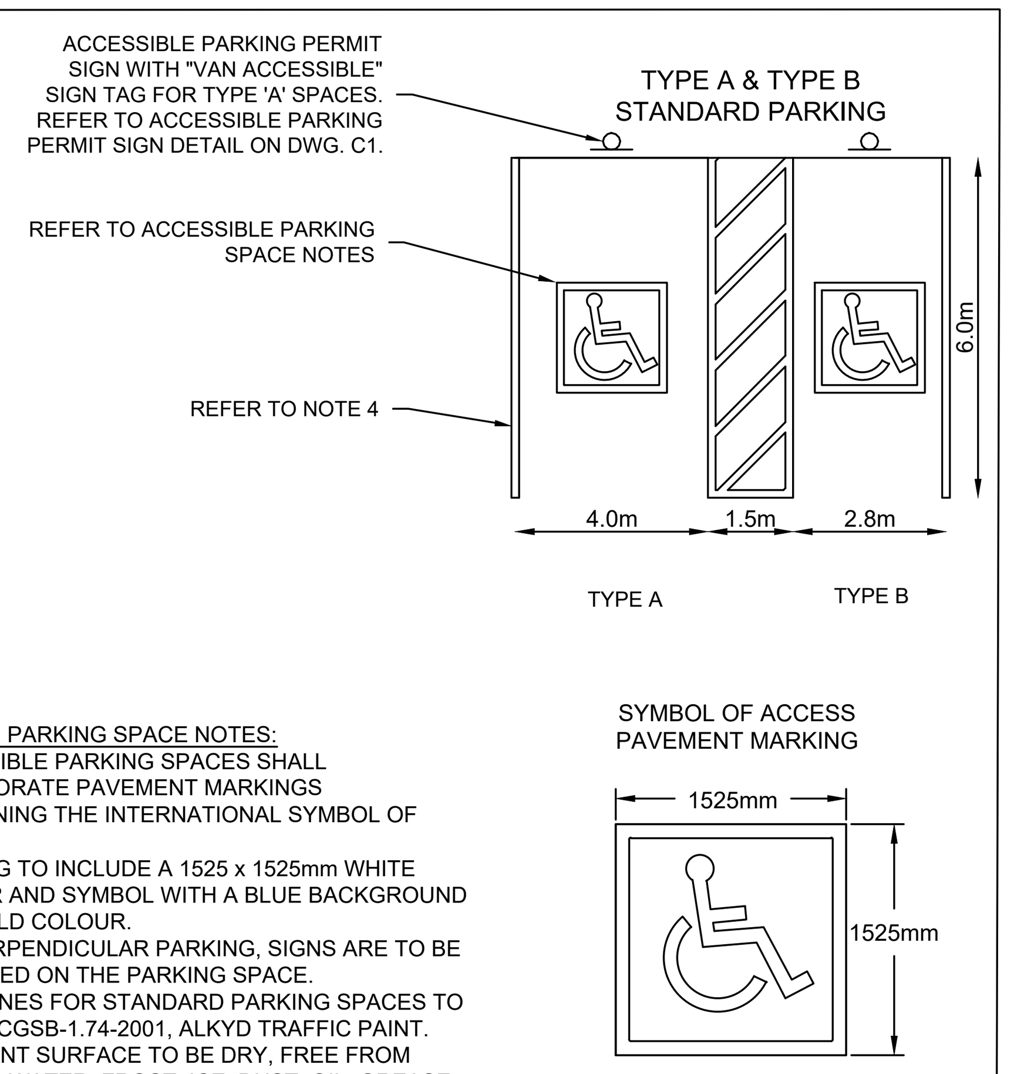
ONTARIO PROVINCIAL STANDARD DRAWING — Nov 2021 Rev 3
HEAVY–DUTY SILT FENCE BARRIER
OPSD 219.130



ORIFICE PLATE DETAIL PROFILE
NTS



ORIFICE PLATE DETAIL PLAN
NTS



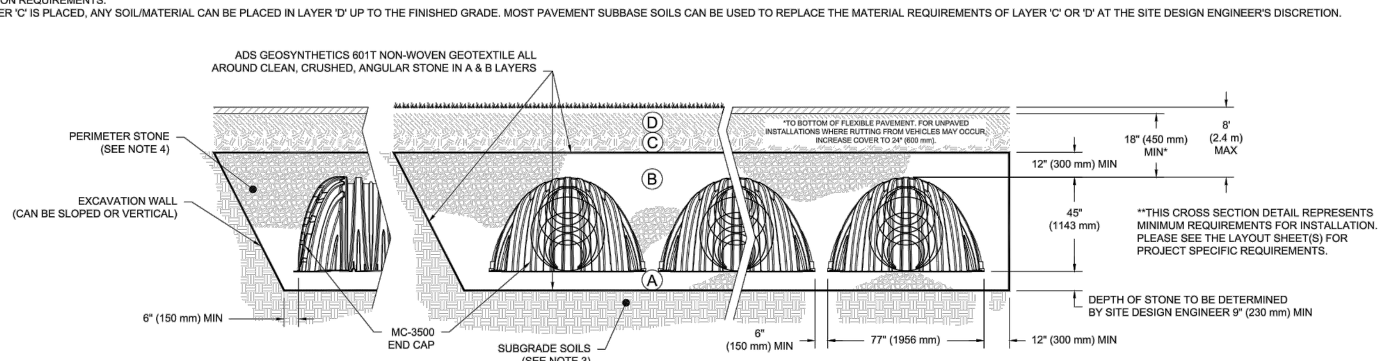
ACCESSIBLE PARKING SPACE NOTES:
1. ACCESSIBLE PARKING SPACES SHALL INCORPORATE PAVEMENT MARKINGS CONTAINING THE INTERNATIONAL SYMBOL OF ACCESS
2. MARKING TO INCLUDE A 1525 x 1525mm WHITE BORDER AND SYMBOL WITH A BLUE BACKGROUND AND FIELD COLOUR.
3. FOR PERPENDICULAR PARKING, SIGNS ARE TO BE CENTERED ON THE PARKING SPACE.
4. PAINT LINES FOR STANDARD PARKING SPACES TO BE CAN/CGSB-1.74-2001, ALKYD TRAFFIC PAINT. PAVEMENT SURFACE TO BE DRY, FREE FROM PONDED WATER, FROST, ICE, DUST, OIL, GREASE AND OTHER FOREIGN MATERIALS PRIOR TO PAINTING. PAINT LINES TO BE UNIFORM COLOUR AND DENSITY WITH SHARP EDGES. PROTECT PAVEMENT MARKINGS UNTIL DRY.

ACCESSIBLE PARKING SPACE DETAIL
NTS

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	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

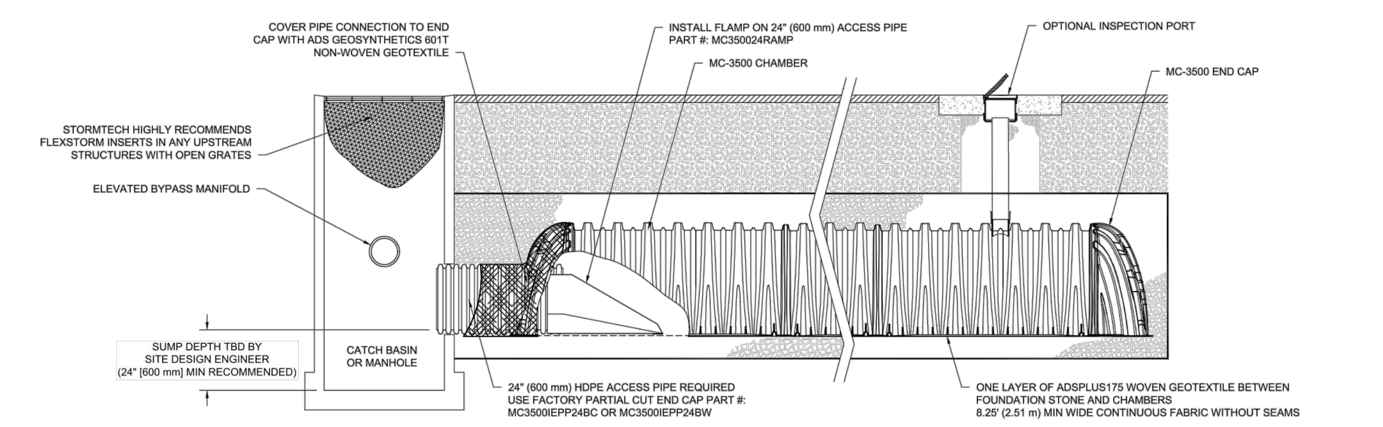
PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN 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.



*FOR COVER DEPTHS GREATER THAN 8.0' (2.4 m) PLEASE CONTACT ADS

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.
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 AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/FT/%. 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.

MC-3500 STANDARD CROSS SECTION — DATE: 8/03/22 DRAWN: KLJ CHECKED: KLJ PROJECT #:
StormTech® Chamber System — 888-892-2694 | WWW.STORMTECH.COM
ADS — 4640 TRUEMAN BLVD HILLIARD, OH 43026
SHEET 1 OF 1



MC-3500 ISOLATOR ROW PLUS DETAIL
NTS

INSPECTION & MAINTENANCE

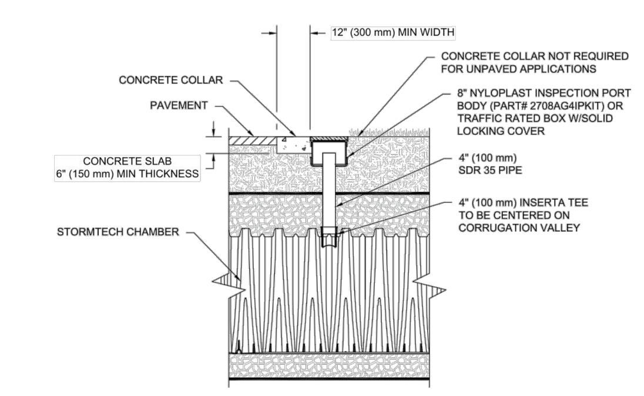
STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER 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.

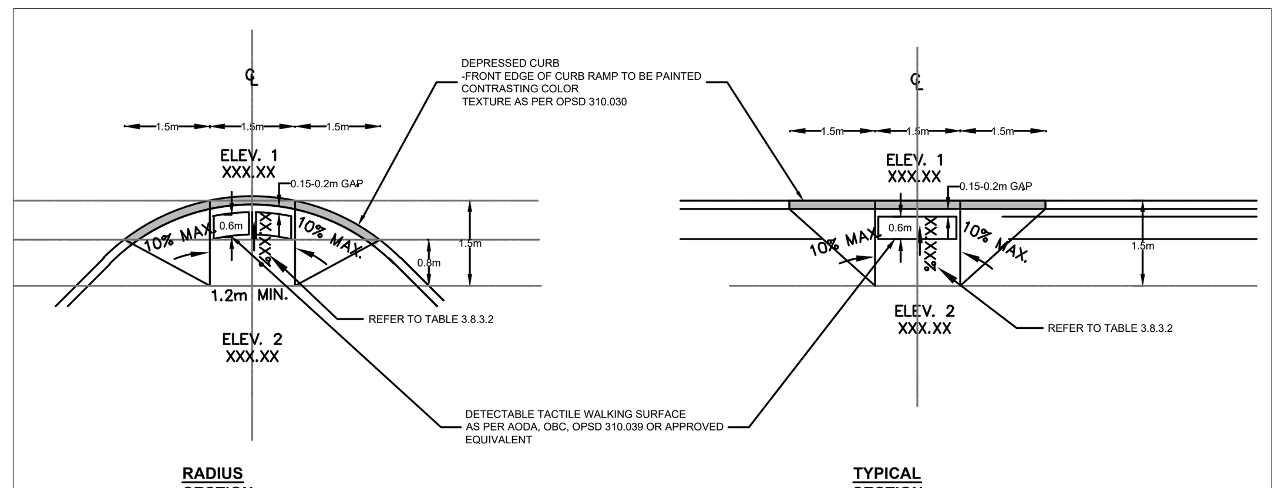
NOTES
1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.



NOTE:
INSPECTION PORTS MAY BE CONNECTED THROUGH ANY CHAMBER CORRUGATION VALLEY.

4" PVC INSPECTION PORT DETAIL
(MC SERIES CHAMBER)
NTS

MC-3500 ISOLATOR ROW PLUS DETAILS — DATE: 8/03/22 DRAWN: KLJ CHECKED: KLJ PROJECT #:
StormTech® Chamber System — 888-892-2694 | WWW.STORMTECH.COM
ADS — 4640 TRUEMAN BLVD HILLIARD, OH 43026
SHEET 1 OF 1



TYPICAL CURB RAMP DETAILS
NTS

NOTE: WHERE A DIFFERENCE IN ELEVATION IS LESS THAN 200mm, THE ABOVE DETAILS MAY BE USED WHERE THE SLOPE EXCEEDS 5% AND A RAMP AS PER O.B.C. IS NOT SPECIFIED.

O.B.C. TABLE 3.8.3.2 RAMP RISE AND SLOPE	
VERTICAL RISE BETWEEN SURFACES	SLOPE
75 TO 200mm	1:10 TO 1:12
LESS THAN 75	1:8 TO 1:10


KINESIK ENGINEERED PRODUCTS

Advantage® Cast Iron

Designed for Durability

Engineered for Ultimate Strength™

Advantage® Cast Iron Tactile Walking Surface Indicator (TWSI) plates are manufactured in strict accordance with ASTM A-48, Class 35B Grey Cast Iron. The Advantage® Cast in Place System is lightweight with exceptional high strength, and utilizes the most advanced metallurgical Engineering Science and Technology to meet and exceed the most stringent municipal standards. Advantage® Cast Iron is aesthetically pleasing, has exceptional longevity and incorporates integral texture for a permanent slip resistant surface.

Tactile Walking Surface Indicators (TWSI) products for the following and many more applications:
- Curb Ramps
- Pedestrian Crossings
- Transit Platforms
- Vehicular Passage Ways
- Parking Areas
- Top of Stair Landings

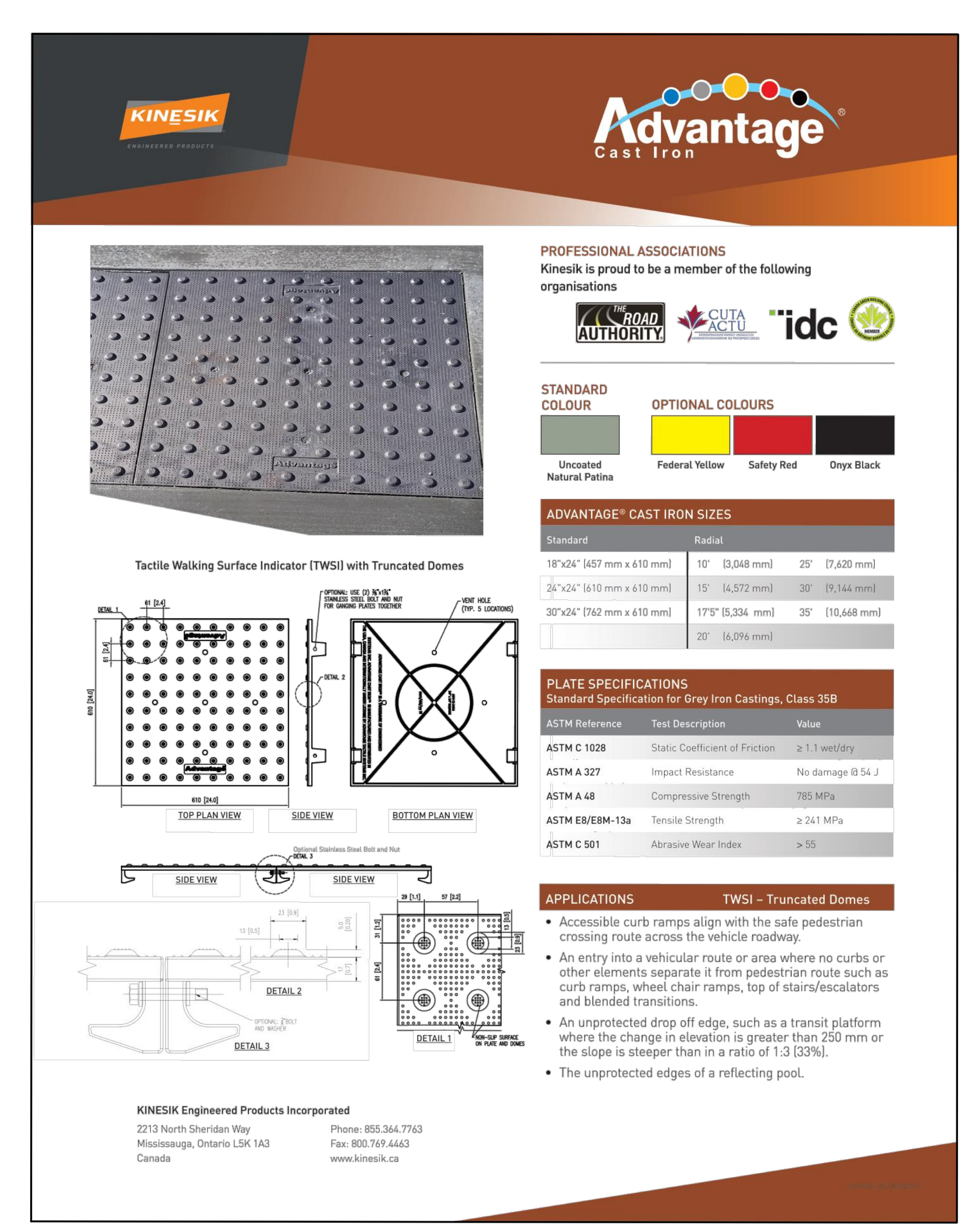
COMPLIANCE

Kinesik Engineered Products Incorporated is in full compliance with Canadian Accessibility Codes. The full product range of Kinesik tactile walking surface indicators meet the most recent AODA, CSA, ISO, provincial and national building codes. Kinesik Engineered Products Incorporated is your one stop source for all tactile systems for internal and external applications. Only Kinesik provides a complete range of products designed for safety, convenience and code compliance.

See back for details.

PRODUCT FEATURES
- Lightweight and easy to install
- Bolted connection allows for easy connectability between two or more plates
- Available in various sizes and radii
- Engineered to endure the toughest conditions such as snow plows, overweight vehicular loads and heavy pedestrian traffic
- Maintenance-free natural patina
- ASTM A48, Class 35B Grey Cast Iron
- Can be recycled after its lifecycle
- Largest selection of standard and radii sizes
- 10 year manufacturer's warranty

Phone: 855.364.7763


KINESIK ENGINEERED PRODUCTS

Advantage® Cast Iron

Tactile Walking Surface Indicator (TWSI) with Truncated Domes

TOP PLAN VIEW — SIDE VIEW — BOTTOM PLAN VIEW — SIDE VIEW — DETAIL 1 — DETAIL 2 — DETAIL 3

PROFESSIONAL ASSOCIATIONS
Kinesik is proud to be a member of the following organisations

STANDARD COLOUR: Uncoated Natural Patina
OPTIONAL COLOURS: Federal Yellow, Safety Red, Onyx Black

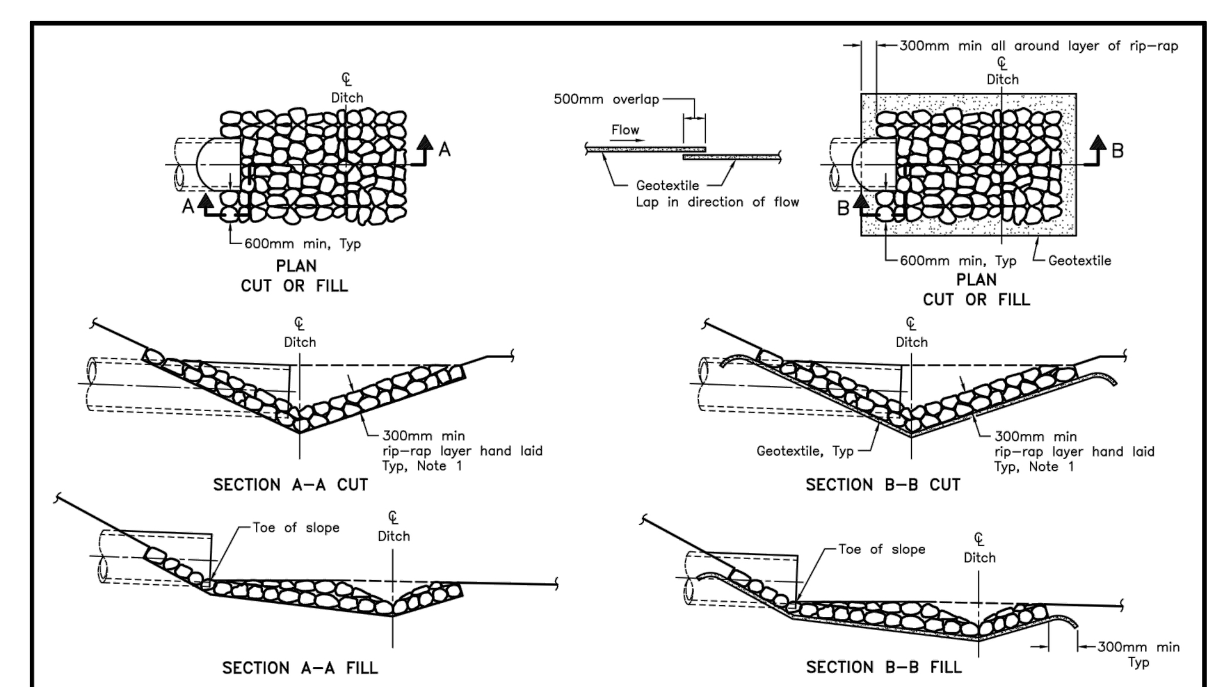
ADVANTAGE® CAST IRON SIZES		
Standard	Radial	
18"x24" (457 mm x 610 mm)	10' (3,048 mm)	25' (7,620 mm)
24"x24" (610 mm x 610 mm)	15' (4,572 mm)	30' (9,144 mm)
30"x24" (762 mm x 610 mm)	17'5" (5,334 mm)	35' (10,668 mm)
	20' (6,096 mm)	

PLATE SPECIFICATIONS
Standard Specification for Grey Iron Castings, Class 35B

ASTM Reference	Test Description	Value
ASTM C 1028	Static Coefficient of Friction	≥ 1.1 wet/dry
ASTM A 327	Impact Resistance	No damage @ 54 J
ASTM A 48	Compressive Strength	785 MPa
ASTM E8/E8M-13a	Tensile Strength	≥ 241 MPa
ASTM C 501	Abrasive Wear Index	> 55

APPLICATIONS — TWSI – Truncated Domes
- Accessible curb ramps align with the safe pedestrian crossing route across the vehicle roadway.
- An entry into a vehicular route or area where no curbs or other elements separate it from pedestrian route such as curb ramps, wheel chair ramps, top of stairs/escalators and blended transitions.
- An unprotected drop off edge, such as a transit platform where the change in elevation is greater than 250 mm or the slope is steeper than in a ratio of 1:3 (33%).
- The unprotected edges of a reflecting pool.

KINESIK Engineered Products Incorporated
2213 North Sheridan Way, Mississauga, Ontario L5K 1A3, Canada
Phone: 855.364.7763 Fax: 800.769.4463 www.kinesik.ca



NOTES:
1 The thickness of the rip–rap layer shall be at least 1.5 times the rip–rap mean diameter.
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING — Nov 2018 Rev 3
GENERAL RIP–RAP LAYOUT FOR SEWER AND CULVERT OUTLETS
OPSD 810.010

Benchmark
1. BENCH MARK BEING THE SPIKE IN CONCRETE SIDEWALK, NORTHING: 4869368.064 EASTING:311081.400, HAVING AN ELEVATION OF 84.38m.
2. BM2 BEING NAIL IN HYDRO POLE, NORTHING:4869536.270 EASTING:311425.870, HAVING AN ELEVATION OF 85.15

No.	Revision/Issue	Date
R1		

DRAFT

Forefront Engineering Inc
1329 Gardiners Road, Suite 210
Kingston, ON, Canada K7P 0L8
613.634.9009 tel.
1.888.884.9392 fax.

Client: KAITLIN CORPORATION

Project: FIELDS OF WELLINGTON BLOCK 54

Drawing: DETAILS

Drawn by: CGD	Checked by: JH	Project No.
Designed by: KMN	Approved by: KMN	Drawing No. C4
Date: APRIL 2023		
Scale: AS SHOWN		

Appendix B

Water Demand Calculations

Fire Flow Calculations

MSP Water Model Figures

Sanitary Sewer Design Sheet

Water Supply Demand Calculations

Block 54 - Fields of Wellington Subdivision

DESIGN NOTES:

q=average daily per capita flow (L/cap. d)	**350**	L/cap. D	(PEC Request, MSP = 320 L/cap.D)
-Multi- unit residential	**1.79**	ppl/unit	(MSP, 2021)

Category	# of Residential Units	Population	Demand		L/day	L/s	Peak Flow Demands		Fire Flow Required
							Peak Hour L/s	Maximum Day L/s	L/s
Residential	160	286	350	L/cap. D	100240	1.16	4.93	3.19	
	Total	286			100240	1.2	4.9	3.2	300

TOTAL AVERAGE DAY FLOW	1.2	L/s		
PEAK DAY FACTOR - 2.75				
MAXIMIUM DAY FLOW	191	L/min	3.19	L/s
PEAK HOUR FACTOR - 4.25				
PEAK HOUR FLOW	296	L/min	4.93	L/s
MD+Fire Flow	18191	L/min	303.2	L/s

FUS Fire Flow Calculation

Project Name: Block 54 Fields of Wellington
Date: April 2023
Data Input by: Erik Persson
Review by: Jeff Homer

Calculations based on "Water Supply for Public Fire Proectection" by Fire Underwriters' Survey, 2020

Fire Flow Calculation #: 1
Building Description: 4 Storey Wood Frame Apartment Complex
North Building

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Units	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame used for Construction of Unit	Coefficient related to type of construction (C)	Type V Wood Frame Construction	1.5	Wood Frame	1.5	Units	
			Type IV-A Mass Timber Construction	0.8				
			Typie IV-B Mass Timber Construction	0.9				
			Type IV-C Mass Timber Construction	1.0				
			Type IV-D Mass Timber Construction	1.5				
			Type III Ordinary Construction	1.0				
			Type II Non-Combustible Construction	0.8				
			Type I Fire resistive construction (>2 hrs)	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH Enter Number of Units Per TH Block)	Type of Housing	Single Family		Mid Rise Residential		80	
			Townhouse - Indicate # of units					
			Other (Comm, Ind, Apt, etc.)					
2.1	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement)				4	Storeys	
3	Enter Ground Floor Area of One Unit	Building Area Calculation (Total Effective Area)				6532	m^2	
		For Wood Frame and Ordinary Construction 100% of all floor areas are considered in determining the Total Effective Area.						
		Total Floor Area (√A)				81	$\sqrt{m^2}$	
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increses per FUS) (F=220*C*√A)						26671
5	Apply Factors Affecting Burning	Reductions/Increases Due to Factors Affecting Burning						
5.1	Choose Combustability of Building Contents	Occupancy content hazard reduction or surcharge	Non-Combustible	-0.25	Limited Combustible	-0.15	N/A	-4001
			Limited Combustible	-0.15				
			Combustible	0				
			Free Burning	0.15				
			Rapid Burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler Reduction	Adequate Sprinkler Conforms to NFPA13	-0.3	Sprinkler System Confoming to NFPA 13	-0.3	N/A	-6801.07
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water Supply is standard	-0.1	N/A	-2267.02
			Water supply is not standard or N/A	0				
		Sprinkler Supervision	Sprinkler system is fully supervised	-0.1	N/A	0	N/A	0
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Separation Distance Between Units	Exposure Distance Between Units	N. Side	20m to 30m	0.1	0.2	m	4534
			E. Side	Greater than 45m	0			
			S. Side	20m to 30m	0.1			
			W. Side	Greater than 45m	0			
6	Obtain Required Fire Flow, Duration & Volume	**Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:**						**18000**
		Total Required Fire Flow (above) in L/s						**300**
		Required Duration of Fire Flow (hrs)						**4.0**
		Required Volume of Fire Flow (m^3)						**4320**

Notes:
(1) 4 storey building

Building Area Calculation (Approximate Floor Areas)

Story	Area (m^2)	Adjustment Factor	Adjusted Areas (m^2)
Ground	1633	100%	1633
2	1633	100%	1633
3	1633	100%	1633
4	1633	100%	1633

(2) Separation Charge

The Total percentage shall be the sum of the percentages for all sides, but shall not exceed 75%

Dinstance to exposure	Exposure Charge
0 to 3 m	25%
3.1 to 10 m	20%
10.1 to 20 m	15%
20.1 to 30 m	10%
30.1 to 45 m	0%

Firewall- Using a 10% exposure charge for fire wall (FUS, Note E)

FUS Fire Flow Calculation

Project Name: Block 54 Fields of Wellington
Date: April 2023
Data Input by: Erik Persson
Review by: Jeff Homer

Calculations based on "Water Supply for Public Fire Proectection" by Fire Underwriters' Survey, 2020

Fire Flow Calculation #: 1
Building Description: 4 Storey Wood Frame Apartment Complex
South Building

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Units	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame used for Construction of Unit	Coefficient related to type of construction (C)	Type V Wood Frame Construction	1.5	Wood Frame	1.5	Units	
			Type IV-A Mass Timber Construction	0.8				
			Typie IV-B Mass Timber Construction	0.9				
			Type IV-C Mass Timber Construction	1.0				
			Type IV-D Mass Timber Construction	1.5				
			Type III Ordinary Construction	1.0				
			Type II Non-Combustible Construction	0.8				
			Type I Fire resistive construction (>2 hrs)	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH Enter Number of Units Per TH Block)	Type of Housing	Single Family		Mid Rise Residential		80	
			Townhouse - Indicate # of units					
			Other (Comm, Ind, Apt, etc.)					
2.1	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement)				4	Storeys	
3	Enter Ground Floor Area of One Unit	Building Area Calculation (Total Effective Area)				6532	m^2	
		For Wood Frame and Ordinary Construction 100% of all floor areas are considered in determining the Total Effective Area.						
		Total Floor Area (√A)				81	$\sqrt{m^2}$	
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increses per FUS) (F=220*C*√A)						26671
5	Apply Factors Affecting Burning	Reductions/Increases Due to Factors Affecting Burning						
5.1	Choose Combustability of Building Contents	Occupancy content hazard reduction or surcharge	Non-Combustible	-0.25	Limited Combustible	-0.15	N/A	-4001
			Limited Combustible	-0.15				
			Combustible	0				
			Free Burning	0.15				
			Rapid Burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler Reduction	Adequate Sprinkler Conforms to NFPA13	-0.3	Sprinkler System Confoming to NFPA 13	-0.3	N/A	-6801.07
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water Supply is standard	-0.1	N/A	-2267.02
			Water supply is not standard or N/A	0				
		Sprinkler Supervision	Sprinkler system is fully supervised	-0.1	N/A	0	N/A	0
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Separation Distance Between Units	Exposure Distance Between Units	N. Side	20m to 30m	0.1	0.2	m	4534
			E. Side	Greater than 45m	0			
			S. Side	20m to 30m	0.1			
			W. Side	Greater than 45m	0			
6	Obtain Required Fire Flow, Duration & Volume	**Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:**						**18000**
		Total Required Fire Flow (above) in L/s						**300**
		Required Duration of Fire Flow (hrs)						**4.0**
		Required Volume of Fire Flow (m^3)						**4320**

Notes:
(1) 4 storey building

Building Area Calculation (Approximate Floor Areas)

Story	Area (m^2)	Adjustment Factor	Adjusted Areas (m^2)
Ground	1633	100%	1633
2	1633	100%	1633
3	1633	100%	1633
4	1633	100%	1633

(2) Separation Charge

The Total percentage shall be the sum of the percentages for all sides, but shall not exceed 75%

Dinstance to exposure	Exposure Charge
0 to 3 m	25%
3.1 to 10 m	20%
10.1 to 20 m	15%
20.1 to 30 m	10%
30.1 to 45 m	0%

Firewall- Using a 10% exposure charge for fire wall (FUS, Note E)

APPENDIX 5

Wellington Water Model Figures

Figure 1 - Wellington Water Model
Existing Scenario - HLPs off
Pressure during Peak Hour Demand

Pressure (psi)	Diameter (mm)
Less than 40	50
40.00 ~ 60.00	100
60.00 ~ 80.00	150
Greater than 80	200
	250
	400

N

0 90 180 360
Meters

17 psi
30 psi
42 psi
39 psi
43 psi
valve open
36 psi
valve open
38 psi
valve open
36 psi
45 psi
all pumps shut off
Water Level 116.3m
53 psi
50 psi
50 psi

Private System
Private System

Wellington on the Lake Golf Cours
Consecon St
Cleminson St
Main St
Loyalist Pkwy
Niles St
2nd Ave
Wharf St
Maple St
Beach St
Bellevillle
1st Ave
Prince Edward Dr
Hillcrest Rd
Ewisville Dr

Figure 2 - Wellington Water Model
Existing Scenario - HLPs On
Pressure during Peak Hour Demand

Pressure (psi)	Diameter (mm)
Less than 40	50
40.00 ~ 60.00	100
60.00 ~ 80.00	150
Greater than 80	200
	250
	400

0 95 190 380
Meters

N

Kaitlan Phase 2
Kaitlan Phase 1
Berkhout phase 2
Berkhout phase 1
Hirshfield Phase 2
Hirshfield Phase 1
42 psi
45 psi
38 psi
46 psi
55 psi
53 psi
53 psi
57 psi
Water Level 116.3m
Schickedanz
valve open
56 psi
valve open
59 psi
valve open
56 psi
66 psi
three pumps on
Private System
Private System
Consecon St
Main St
Loyalist Pkwy
Wharf St
Male St
Emmerson St
Prince Edward Dr
Skiff Cres
Wellington on the Lake Golf Course

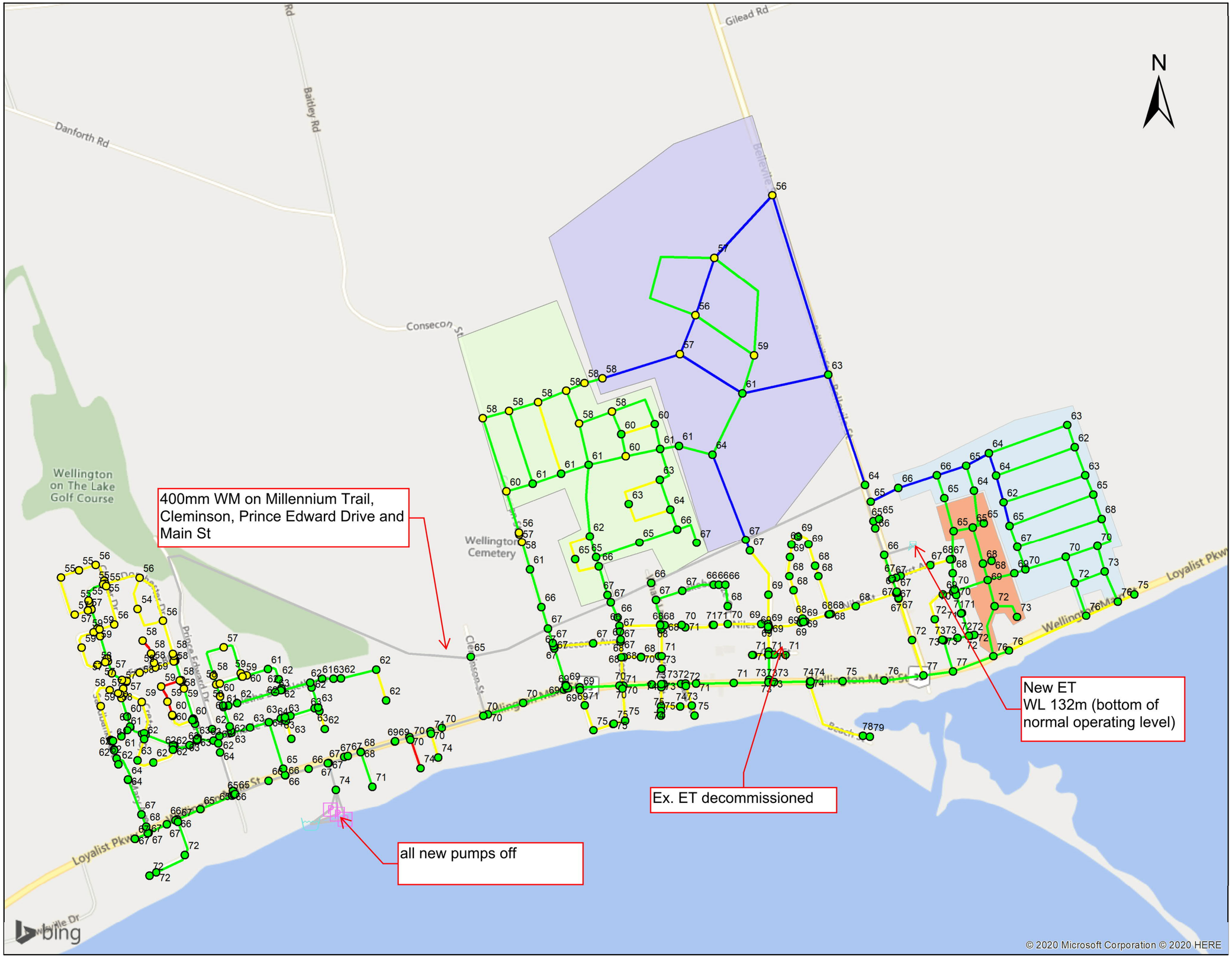
Figure 3 - Wellington Water Model
Existing Scenario - HLPs On
Available Flow during Max Day Demand

Available Flow (L/s)	Diameter (mm)
Less than 50	50
50.00 ~ 75.00	100
75.00 ~ 100.00	150
100.00 ~ 150.00	200
Greater than 150	250
	400

0 95 190 380
Meters

N

Kaitlan Phase 2
Kaitlan Phase 1
Berkhout phase 2
49 L/s
Berkhout phase 1
Hirshfield Phase 2
Hirshfield Phase 1
38 L/s
49 L/s
46 L/s
Private System
valve open
102 L/s
105 L/s
28 L/s
86 L/s
Schickedanz
Water Level 116.3m
37 L/s
valve open
83 L/s
177 L/s
three pumps on
valve open
93 L/s
Private System
Consecon St
Loyalist Pkwy
Main St
Wellington on the Lake Golf Course



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PRINCE EDWARD COUNTY ♦ ONTARIO

Figure A-1: Wellington Water Model

New ET, New Millennium Trail Watermain; HLPs Off

Pressure during Peak Hour Demand

Legend

Node Pressure (psi)		Pipe Diameter (mm)	
	< 40		< =100
	40 ~ 60		150
	60 ~ 80		200
	> 80		250
			300
			400

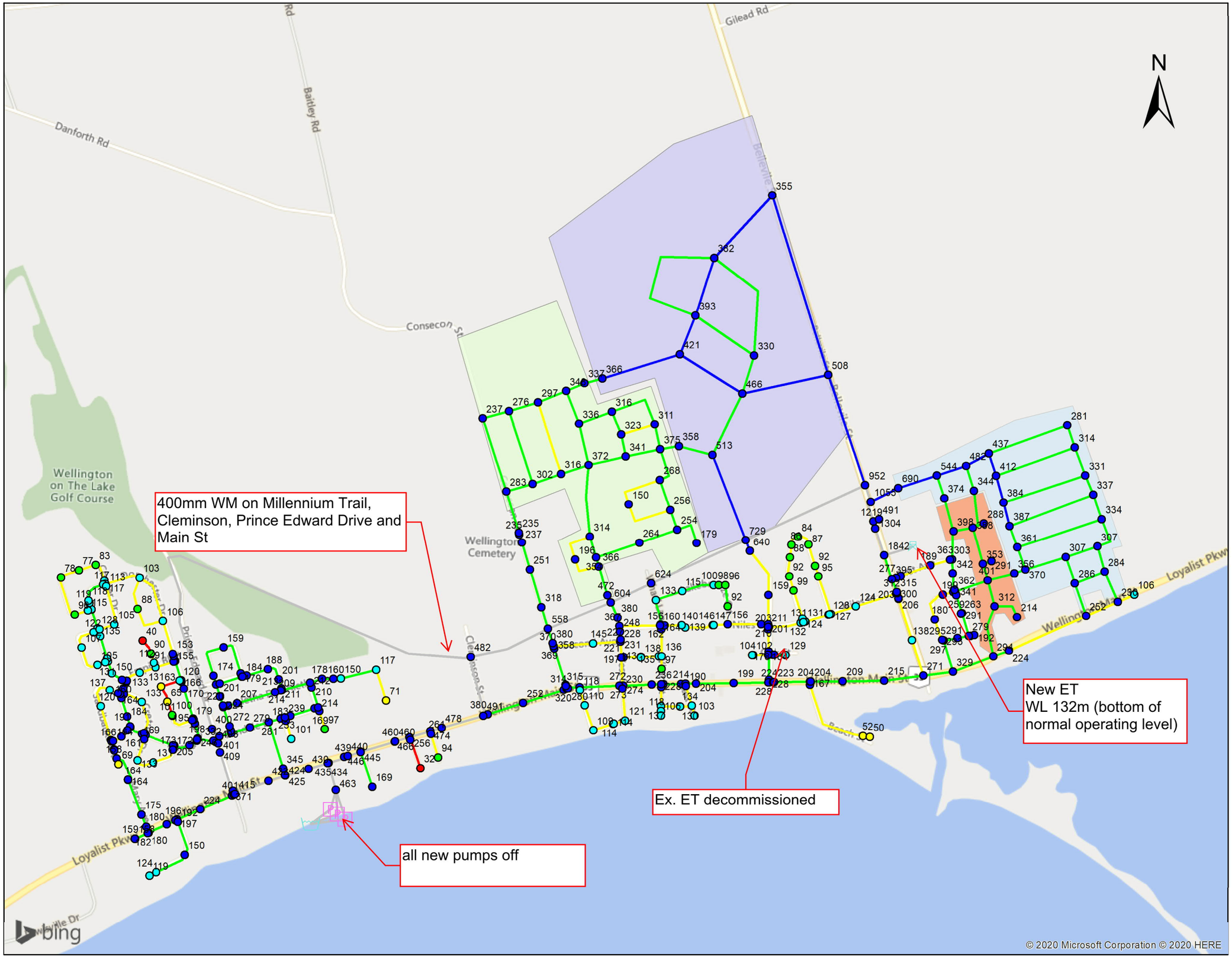
Developments

- Fields of Wellington
- Country Club Estates
- Lakeside Estates
- Wellington Bay Estates

RVA

RVA Project Number: 183934
Date: June 2020

0 200 400 800
Meters



TheCounty
PRINCE EDWARD COUNTY ♦ ONTARIO

Figure A-2: Wellington Water Model

New ET, New Millennium Trail Watermain; HLPs Off

Available Fire Flows during Max Day Demand

Legend

Node FF (L/s)		Pipe Diameter (mm)	
	< 50		< =100
	50 ~ 75		150
	75 ~ 100		200
	100 ~ 150		250
	> 150		300
			400

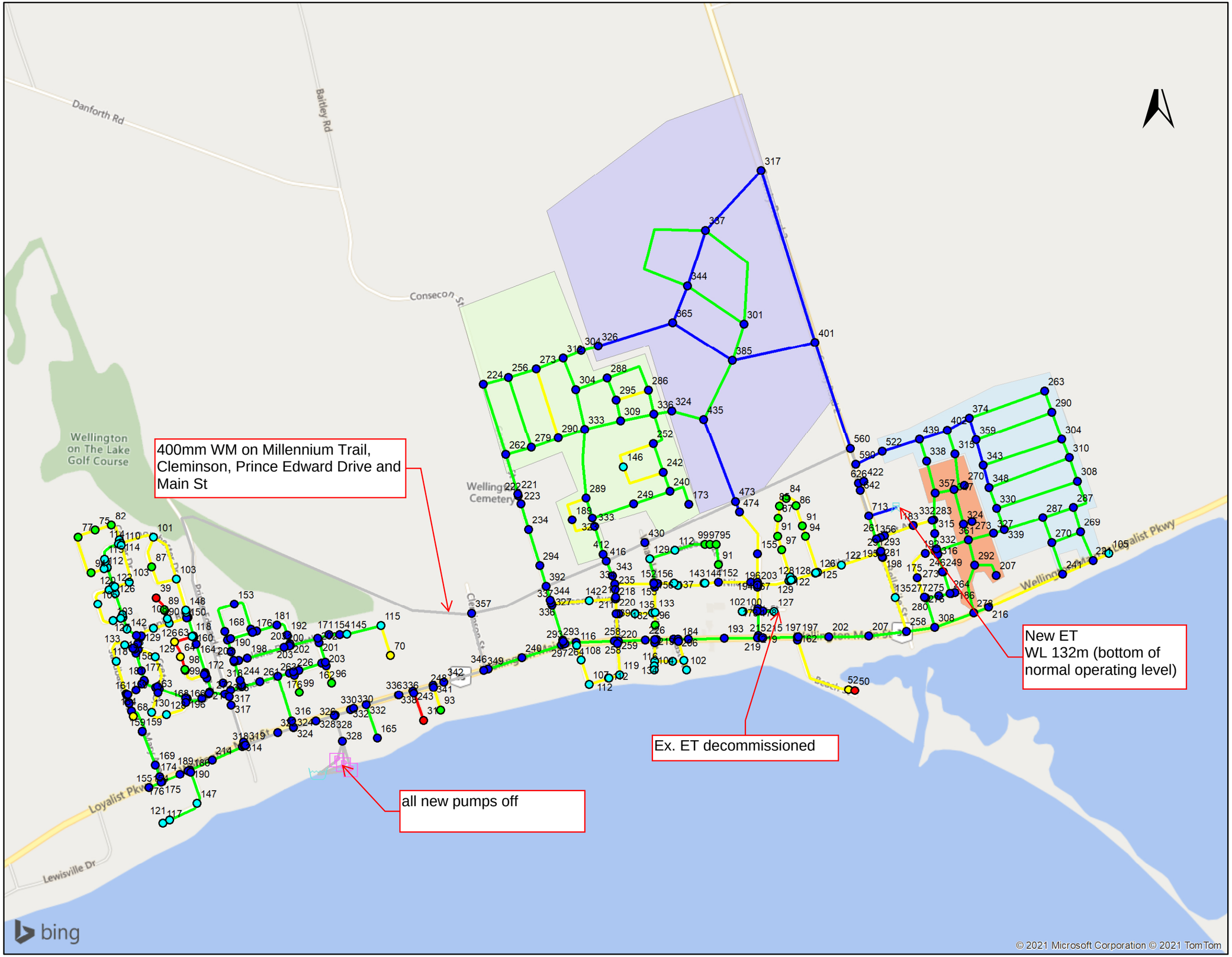
Developments

- Fields of Wellington
- Country Club Estates
- Lakeside Estates
- Wellington Bay Estates

RVA

RVA Project Number: 183934
Date: June 2020

0 200 400 800
Meters



TheCounty
PRINCE EDWARD COUNTY ✦ ONTARIO

Figure A-2: Wellington Water Model

New ET, New Millennium Trail Watermain; HLPs Off

Available Fire Flows during Max Day Demand

Legend

Node FF (L/s)		Pipe Diameter (mm)	
	< 50		< =100
	50 ~ 75		150
	75 ~ 100		200
	100 ~ 150		250
	> 150		300
			400

Developments

- Fieldis of Wellington
- Country Club Estates
- Lakeside Estates
- Wellington Bay Estates

rva

RVA Project Number: 183934
Date: June 2020

0 210 420 840
Meters

SANITARY SEWER DESIGN SHEET
BLOCK 54 - FIELDS OF WELLINGTON
PROPOSED SEWERAGE

Date: April 2023

Client: Kaitlin Corporation

Municipality: Prince Edward County

Drainage Area: 1.92 ha

Guidelines : Prince Edward County

Single Family Res.

q=average daily per capita flow (L/cap. d) **350** (PEC)

I=unit of peak extraneous flow (L/ha. s) **0.28** (PEC)

M=peaking factor 1+14/(4+(P/1000)^0.5) 4.0 MAX

Q(p)=peak population flow (L/s)

Q(i)=peak extraneous flow (L/s)

Q(d)=peak design flow

Minimum Velocity (m/s) 0.6

capita per dwelling unit

-Multi- unit residential **1.79** ppl/dwelling (MSP)

# of Bedrooms: **78**

# of Units **60**

LOCATION	INDIVIDUAL			CUMULATIVE		Peaking factor M	Pop. flow Q(p) (L/s)	Peak Extraneous flow Q(i) (L/s)	Peak design flow Q(d) (L/s)	PROPOSED SEWER							
	Dwelling Units Multi Unit Res.	Pop.	Area A (hectares)	Pop.	Area A (hectares)					Length (m)	Pipe size (mm)	Type of Pipe	Grade %	Pipe Capacity (L/s) n=0.013	Full flow velocity (m/s)	Actual velocity (m/s)	Utilized Capacity (%)
SA3 to SA2	80	143	1.92	143	1.92	4.00	2.32	0.54	2.9	57.0	200	PVC	0.50	23.2	0.74	0.45	12%
SA2 to SA1			1.92	143	1.92	4.00	2.32	0.54	2.9	52.1	200	PVC	0.50	23.2	0.74	0.45	12%
SA1 to MISA	80	143	1.92	286	1.92	4.00	4.64	0.54	5.2	8.2	200	PVC	2.00	46.4	1.48	0.91	11%
MISA to EX			1.92	286	1.92	4.00	4.64	0.54	5.2	12.1	200	PVC	2.00	46.4	1.48	0.91	11%

Appendix C

MTO IDF Curve

Figure 2: Pre-Development Catchment Areas

Figure 3: Post-Development Catchment Areas (Storm Sewers)

Figure 4: Post-Development Runoff Coefficient Calculations

Storm Sewer Design Sheet

Modified Rational Method Calculations

StormTech MC-3500 Cumulative Storage Volumes

Outlet Stage-Storage Discharge Calculations

Outlet Swale Capacity Calculations

Isolator Row Details and Verification

Ontario IDF CURVE LOOKUP

Active coordinate

43° 56' 44" N, 77° 23' 15" W (43.945833,-77.387500)

Retrieved: Mon, 06 Jun 2022 20:39:30 GMT

Location summary

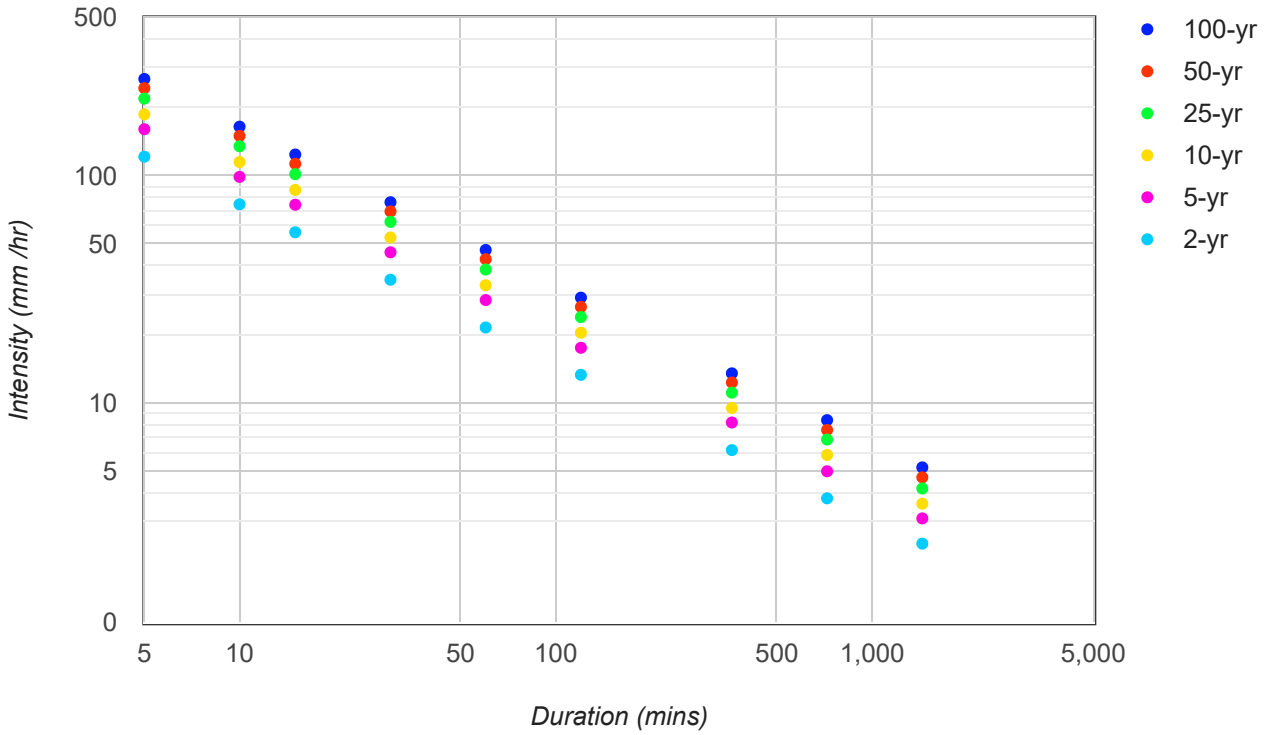
These are the locations in the selection.

IDF Curve: 43° 56' 44" N, 77° 23' 15" W (43.945833,-77.387500)

Results

An IDF curve was found.

Coordinate: 43.945833, -77.387500
IDF curve year: 2022



Coefficient summary

IDF Curve: 43° 56' 44" N, 77° 23' 15" W (43.945833,-77.387500)

Retrieved: Mon, 06 Jun 2022 20:39:30 GMT

Data year: 2010
IDF curve year: 2022

Statistics

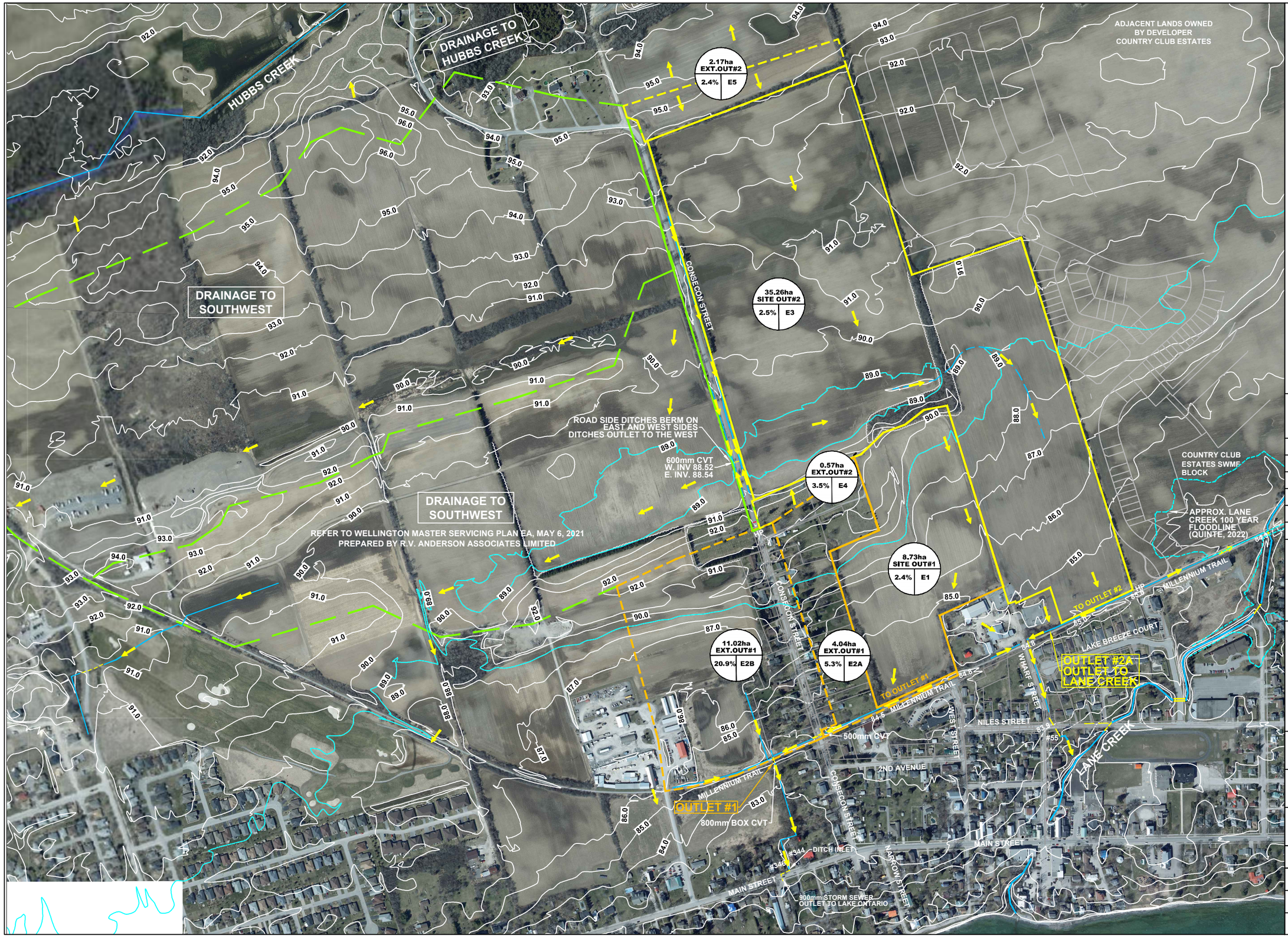
Rainfall intensity (mm hr^{-1})

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	121.6	75.0	56.5	34.9	21.5	13.3	6.2	3.8	2.4
5-yr	160.7	99.1	74.7	46.1	28.4	17.5	8.2	5.0	3.1
10-yr	186.9	115.2	86.8	53.6	33.0	20.4	9.5	5.9	3.6
25-yr	219.3	135.2	101.9	62.8	38.7	23.9	11.1	6.9	4.2
50-yr	243.7	150.2	113.2	69.8	43.0	26.5	12.3	7.6	4.7
100-yr	267.5	164.9	124.3	76.6	47.2	29.1	13.5	8.4	5.2

Rainfall depth (mm)

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	10.1	12.5	14.1	17.4	21.5	26.6	37.2	45.6	57.6
5-yr	13.4	16.5	18.7	23.1	28.4	35.0	49.2	60.0	74.4
10-yr	15.6	19.2	21.7	26.8	33.0	40.8	57.0	70.8	86.4
25-yr	18.3	22.5	25.5	31.4	38.7	47.8	66.6	82.8	100.8
50-yr	20.3	25.0	28.3	34.9	43.0	53.0	73.8	91.2	112.8
100-yr	22.3	27.5	31.1	38.3	47.2	58.2	81.0	100.8	124.8

Terms of Use



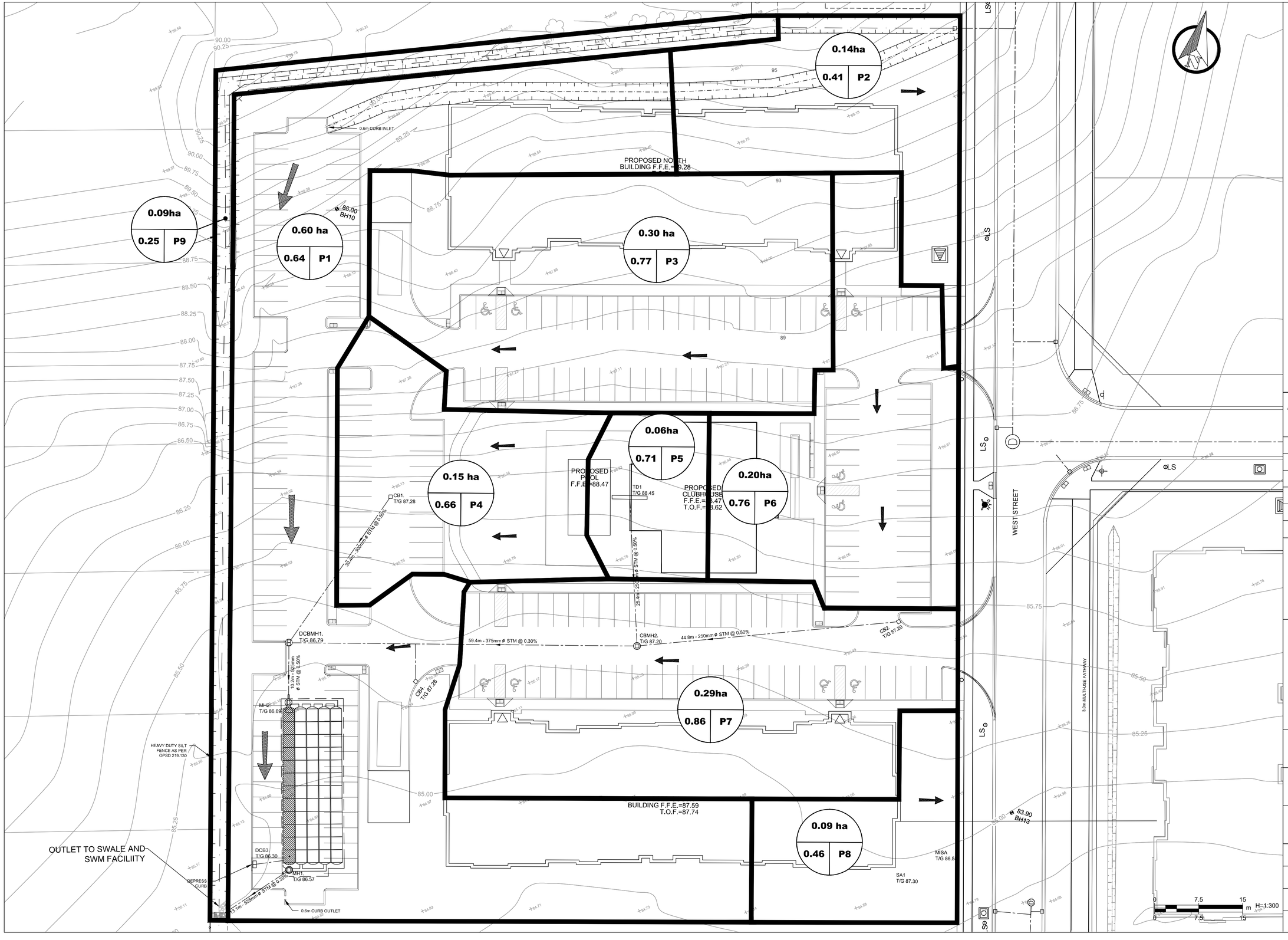
Forefront Engineering Inc
1329 Gardiners Road, Suite 210
Kingston, ON, Canada K7P 0L8
613.634.9009 tel.
1.866.884.9392 fax.

Client
KAITLIN CORPORATION

Project
THE FIELDS OF WELLINGTON

Drawing
PRE-DEVELOPMENT CATCHMENT AREAS

Drawn by:	Checked by:	Project No.
JH	JH	
Designed by:	Approved by:	Drawing No.
KMN	KMN	FIG.2
Date: JUNE 2022		
Scale: 1:6000		



Benchmark

1. BENCH MARK BEING THE SPIKE IN CONCRETE SIDEWALK, NORTHING: 4869368.064 EASTING:311081.400, HAVING AN ELEVATION OF 84.38m.

2. BM2 BEING NAIL IN HYDRO POLE, NORTHING:4869536.270 EASTING:311425.870, HAVING AN ELEVATION OF 85.15

No.	Revision/Issue	Date

Forefront Engineering Inc

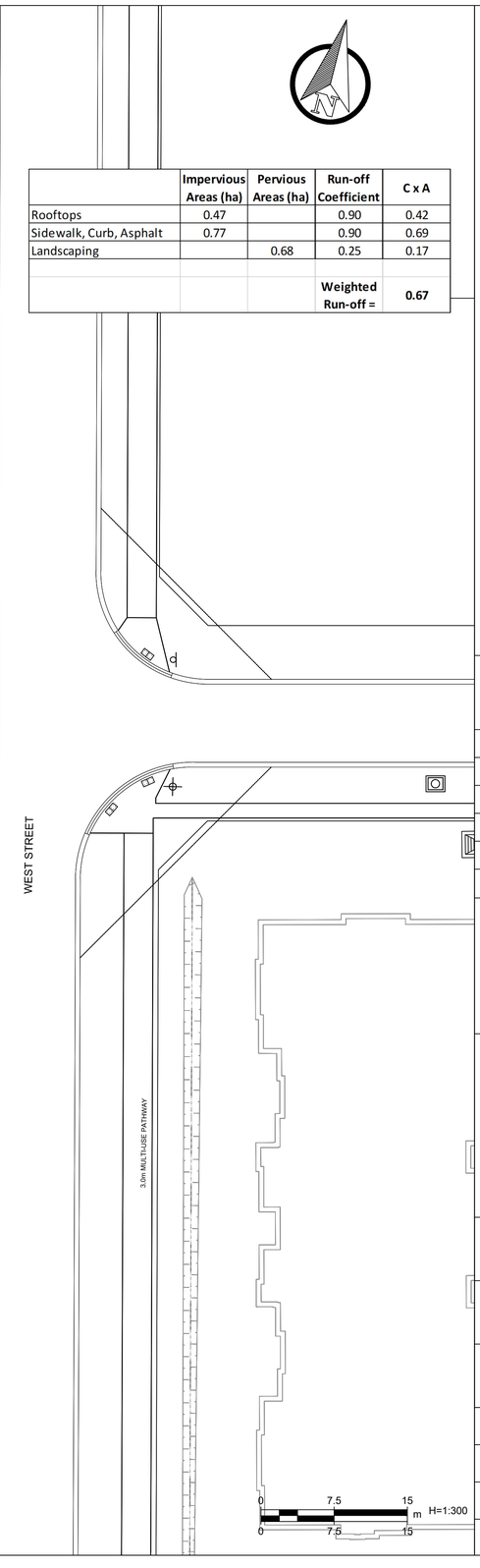
1329 Gardiners Road, Suite 210
Kingston, ON, Canada K7P 0L8
613.634.9009 tel.
1.888.884.9392 fax.

Client
KAITLIN CORPORATION

Project
FIELDS OF WELLINGTON SUBDIVISION
BLOCK 54

Drawing
POST-DEVELOPMENT CATCHMENT AREAS (STORM SEWERS)

Drawn by:	Checked by:	Project No.
CGD	KMN	
Designed by:	Approved by:	Drawing No.
KMN	KMN	FIG. 3
Date: APRIL 2023		
Scale: 1:300		



	Impervious Areas (ha)	Pervious Areas (ha)	Run-off Coefficient	C x A
Rooftops	0.47		0.90	0.42
Sidewalk, Curb, Asphalt	0.77		0.90	0.69
Landscaping		0.68	0.25	0.17
			Weighted Run-off =	**0.67**

AREA IN HECTARES

X.XXha

X.XX

RUNOFF COEFFICIENT

ROOFTOP = 0.47 ha

SIDEWALK, CURB, PARKING LOT = 0.77 ha

LANDSCAPING = 0.68 ha

Benchmark

1. BENCH MARK BEING THE SPIKE IN CONCRETE SIDEWALK, NORTHING: 4869368.064 EASTING:311081.400, HAVING AN ELEVATION OF 84.38m.

2. BM2 BEING NAIL IN HYDRO POLE, NORTHING:4869536.270 EASTING:311425.870, HAVING AN ELEVATION OF 85.15

No.	Revision/Issue	Date

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Project
FIELDS OF WELLINGTON SUBDIVISION
BLOCK 54

Drawing
POST-DEVELOPMENT
RUNOFF COEFFICIENT

Drawn by:	Checked by:	Project No.
CGD	KMN	
Designed by:	**Approved by:**	**Drawing No.**
KMN	KMN	FIG. 4
Date: APRIL 2023		
Scale: 1:300		

STORM SEWER DESIGN SHEET - BLOCK 54 - MINOR EVENT

CLIENT KAITLIN CORPORATION
PROJECT NAME Wellington Block 54
DATE April 2023

Min. V = 0.75 m/s
Max. V = 6 m/s

DESIGN FREQUENCY MTO Look up
RAINFALL STATIONS
DESIGNED 'n' 0.013

LOCATION: | STORM SEWER CATCHMENT AREA = 1.92 ha | RUNOFF 3 | PIPE SELECTION

Area (ha)	Inlet Description	FROM	TO	R = 0.25 ha	R = 0.45 ha	R = 0.50 ha	R = 0.65 ha	R = 0.75 ha	R = 0.85 ha	High Density R = 0.90 ha	Minor Event Indiv. 2.78AC ha	Minor Event Accum. 2.78AC ha	Time of Conc. (min)	Minor Event Intensity I (mm/hr)	Peak Flow Q (L/S)	Type of Pipe	Required Pipe Diameter D (m)	Nominal Diameter D (mm)	Pipe Length (m)	Grade S	Full Capacity (L/S)	Full Flow Velocity V (m/s)	Time of Flow (min)	Capacity Used Q/Q(f)	Actual Velocity (m/s)	Normal Depth (mm)	Free Outfall D/S HGL (m)	Fall in Sewer (m)
0.06	TD1 (P5)	TD1	CBMH2					0.060			0.125	0.125	15.0	75	9	HDPE	0.142	250	25	0.50%	42.0	0.86	0.49	0.22	0.68	79	0.08	0.127
0.20	CB2 (P6)	CB2	CBMH2					0.200			0.417	0.417	15.0	75	31	HDPE	0.223	250	45	0.50%	42.0	0.86	0.87	0.74	0.94	159	0.16	0.224
0.29	CBMH2 (P7)	CBMH2	CBMH1						0.290		0.685	1.226	15.9	72	89	HDPE	0.364	375	59	0.30%	96.0	0.87	1.14	0.92	0.99	283	0.28	0.178
0.45	CB1 (P3 & P4)	CB1	CBMH1				0.150	0.300			0.896	0.896	17.0	69	61	HDPE	0.288	300	30	0.50%	68.4	0.97	0.52	0.90	1.09	222	0.22	0.152
0.60	DCBMH1 (P1)	DCBMH1 & CB3	MH2/STM TECH				0.600				1.083	3.206	17.5	67	216	HDPE	0.461	525	10	0.50%	304.1	1.40	0.12	0.71	1.52	326	0.33	0.051
	MH1/STM TECH	MH1	Swale Outlet									3.206	17.5	67	216	HDPE	0.508	525	13	0.30%	235.6	1.09	0.20	0.91	1.23	394	0.39	0.039
0.09	West Swale (P9)	West Swale	South Swale	0.090							0.063	0.063	15.0	75	**5**													
0.09	South Swale (P8)	South Swale	SWMF		0.090						0.113	0.113	15.0	75	**8**													
0.14	North Swale (P2)	North Swale	SWMF		0.140						0.175	0.350	15.0	75	**26**													

Notes:

1. StormTech Outlet Pipe is sized for the uncontrolled flow. Control MH1 is proposed to Control flow to pre-development levels

2. Intensity Calculation from MTO Look up Curve provided below

$$i = \frac{A}{(t_d + B)^c}$$

Example
15min 74.8 mm/hr
20min 61.3 mm/hr
25min 52.5 mm/hr
30min 46.2 mm/hr

I = rainfall intensity, mm/h
t_d = duration, min
A, B, C are constants

A = 499.354
B = 0.10
c = 0.69917

MODIFIED RATIONAL METHOD CACULATIONS &
STORAGE VOLUMES FOR SMALL SITES

Project: Fields of Wellington Block 54

Date: April 2023

5 Year Return Period

Pre-development Runoff	
Q (m^3/s)	0.057

Post-development Characteristics			
Description	C	Area (ha)	CxA
Total	0.67	1.92	1.28

Post-development Peak Flow	
C	0.67
t_c (min)	17.50
Area (ha)	1.92
Intensity (mm/hr)	67.23
Q (m^3/s)	0.241

Duration (td- min)	Intensity (mm/hr)	CxA	Q_p- Uncontrolled Runoff Rate (m^3/s)	Q_d- Allowable Outflow (m^3/s)	Peak Storage Rate (m^3/s)	Storage Volume (m^3)	Comments
5	159.84	1.28	0.573	0.057	0.516	133.30	
10	99.13	1.28	0.355	0.057	0.298	166.03	
15	74.83	1.28	0.268	0.057	0.211	185.68	
20	61.48	1.28	0.220	0.057	0.163	200.16	
25	52.60	1.28	0.188	0.057	0.131	209.96	
30	46.31	1.28	0.166	0.057	0.109	217.35	
35	41.58	1.28	0.149	0.057	0.092	222.97	
40	37.87	1.28	0.136	0.057	0.079	227.24	
45	34.88	1.28	0.125	0.057	0.068	230.43	
50	32.40	1.28	0.116	0.057	0.059	232.75	
55	30.31	1.28	0.109	0.057	0.052	234.32	
60	28.52	1.28	0.102	0.057	0.045	235.27	
65	27.23	1.28	0.098	0.057	0.041	239.38	Maximum Storage Volume
70	25.84	1.28	0.093	0.057	0.036	239.13	
75	24.61	1.28	0.088	0.057	0.031	238.50	
80	23.51	1.28	0.084	0.057	0.027	237.51	
85	22.52	1.28	0.081	0.057	0.024	236.21	
90	21.63	1.28	0.077	0.057	0.020	234.62	

Outlet	Orifice / Pipe Diameter (m)	Water Surface Elevation (m)	Invert of Orifice (m)	Centreline of Orifice Elevation (m)	Head (m)	Release Rate (m^3/s)	Required Release (m^3/s)	Velocity m/s	Comments
Orifice 1	0.145	85.47	84.710	84.783	0.688	0.039	0.057	2.39	5 Year Orifice
Orifice 2	0.160	85.47	85.300	85.380	0.090	0.017	0.057	0.86	
Combined Orifice 1 & 2						0.057	0.057		

Note: Refer to Stage - Storage Discharge Calculations in Appendix C for further details

Formulas:

I= MTO IDF Curve

$Q = 0.0028 * C * I * A$

$S_d = Q_p t_d - Q_d((t_d+t_c)/2)$

*Storage Formula (Aron and Kibler, 1990)

Where:

Q=Peak runoff rate (m^3/s)

C=Composite runoff coefficient

I=Rainfall intensity (mm/hr)

A=Drainage area (ha)

tc= Time of Concentration (min)

td = Duration of Storm (min)

Qp = Peak Flow (m^3/s)

Q_d = Discharge Rate (m^3/s)

Sd = Required Storage Volume (m^3)

Orifice Equation

$Q = 0.65\ A\ (2gH)^{1/2}$

where A = orifice area; g = gravity; and H=head above centre of orifice (m)

MODIFIED RATIONAL METHOD CACULATIONS &
STORAGE VOLUMES FOR SMALL SITES

Project: Fields of Wellington Block 54
Date: April 2023

100 Year Return Period

Pre-development Runoff	
Q (m^3/s)	0.111

Post-development Characteristics			
Description	C	Area (ha)	CxA
Total	0.67	1.92	1.28

Post-development Peak Flow	
C	0.67
t_c (min)	17.50
Area (ha)	1.92
Intensity (mm/hr)	111.14
Q (m^3/s)	0.397

Duration (td- min)	Intensity (mm/hr)	CxA	Q_p- Uncontrolled Runoff Rate (m^3/s)	Q_d- Allowable Outflow (m^3/s)	Peak Storage Rate (m^3/s)	Storage Volume (m^3)	Comments
5	263.92	1.28	0.944	0.111	0.833	208.14	
10	163.79	1.28	0.586	0.111	0.475	259.75	
15	123.69	1.28	0.442	0.111	0.331	289.74	
20	101.65	1.28	0.363	0.111	0.252	311.20	
25	86.98	1.28	0.311	0.111	0.200	324.93	
30	76.59	1.28	0.274	0.111	0.163	334.66	
35	68.77	1.28	0.246	0.111	0.135	341.47	
40	62.65	1.28	0.224	0.111	0.113	346.05	
45	57.70	1.28	0.206	0.111	0.095	348.85	
50	53.61	1.28	0.192	0.111	0.081	350.19	
55	50.16	1.28	0.179	0.111	0.068	350.32	
60	47.20	1.28	0.169	0.111	0.058	349.41	
65	45.07	1.28	0.161	0.111	0.050	353.70	Maximum Storage Volume
70	42.77	1.28	0.153	0.111	0.042	350.82	
75	40.73	1.28	0.146	0.111	0.035	347.28	
80	38.92	1.28	0.139	0.111	0.028	343.16	
85	37.29	1.28	0.133	0.111	0.022	338.53	
90	35.81	1.28	0.128	0.111	0.017	333.42	

Outlet	Orifice / Pipe Diameter (m)	Water Surface Elevation (m)	Invert of Orifice (m)	Centreline of Orifice Elevation (m)	Head (m)	Release Rate (m^3/s)	Required Release (m^3/s)	Velocity m/s	Comments
Orifice 1	0.145	86.15	84.710	84.783	1.368	0.056	0.111	3.37	5 Year Orifice
Orifice 2	0.160	86.15	85.300	85.380	0.770	0.051	0.111	2.53	100 Year Orfice
Combined Orifice 1 & 2						0.106	0.111		

Note: Refer to Stage - Storage Discharge Calculations in Appendix C for further details

Formulas:

I= MTO IDF Curve

$Q = 0.0028 * C * I * A$

$S_d = Q_p t_d - Q_d((t_d+t_c)/2)$

*Storage Formula (Aron and Kibler, 1990)

Where:

Q=Peak runoff rate (m^3/s)
C=Composite runoff coefficient
I=Rainfall intensity (mm/hr)
A=Drainage area (ha)
tc= Time of Concentration (min)
td = Duration of Storm (min)
Qp = Peak Flow (m^3/s)
Q_d = Discharge Rate (m^3/s)
Sd = Required Storage Volume (m^3)

Orifice Equation

$Q = 0.65\ A\ (2gH)^{1/2}$

where A = orifice area; g = gravity; and H=head above centre of orifice (m)

Project: **Block 54 - Fields of Wellington**

Chamber Model -	MC-3500		
Units -	**Metric**	Click Here for Imperial	
Number of Chambers -	60		
Number of End Caps -	10		
Voids in the stone (porosity) -	40	%	
Base of Stone Elevation -	84.45	m	☑ Include Perimeter Stone in Calculations
Amount of Stone Above Chambers -	305	mm	
Amount of Stone Below Chambers -	230	mm	
Area of system -	330	sq.meters	Min. Area - 303.912 sq.meters

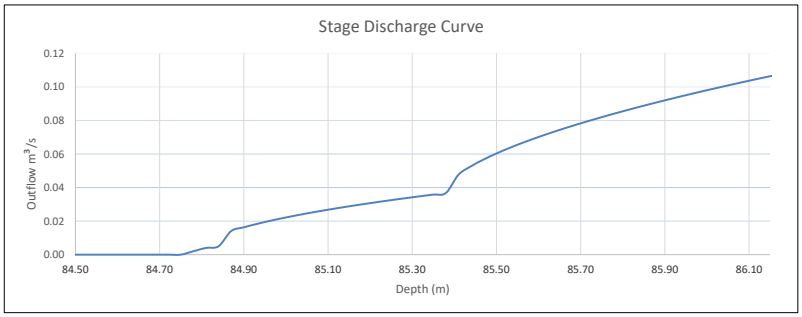
StormTech MC-3500 Cumulative Storage Volumes

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Single End Cap *(cubic meters)*	Incremental Chambers *(cubic meters)*	Incremental End Cap *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Chamber, End Cap and Stone *(cubic meters)*	Cumulative System *(cubic meters)*	Elevation *(meters)*
1676	0.00	0.00	0.00	0.00	3.351	3.35	335.80	86.13
1651	0.00	0.00	0.00	0.00	3.351	3.35	332.45	86.10
1626	0.00	0.00	0.00	0.00	3.351	3.35	329.09	86.08
1600	0.00	0.00	0.00	0.00	3.351	3.35	325.74	86.05
1575	0.00	0.00	0.00	0.00	3.351	3.35	322.39	86.02
1549	0.00	0.00	0.00	0.00	3.351	3.35	319.04	86.00
1524	0.00	0.00	0.00	0.00	3.351	3.35	315.69	85.97
1499	0.00	0.00	0.00	0.00	3.351	3.35	312.34	85.95
1473	0.00	0.00	0.00	0.00	3.351	3.35	308.99	85.92
1448	0.00	0.00	0.00	0.00	3.351	3.35	305.64	85.90
1422	0.00	0.00	0.00	0.00	3.351	3.35	302.29	85.87
1397	0.00	0.00	0.00	0.00	3.351	3.35	298.93	85.85
1372	0.00	0.00	0.10	0.00	3.312	3.41	295.58	85.82
1346	0.01	0.00	0.33	0.01	3.216	3.55	292.17	85.80
1321	0.01	0.00	0.50	0.01	3.147	3.66	288.62	85.77
1295	0.01	0.00	0.69	0.01	3.071	3.77	284.96	85.75
1270	0.02	0.00	1.17	0.02	2.876	4.06	281.19	85.72
1245	0.03	0.00	1.75	0.02	2.642	4.41	277.13	85.69
1219	0.04	0.00	2.12	0.03	2.490	4.64	272.71	85.67
1194	0.04	0.00	2.42	0.04	2.370	4.82	268.07	85.64
1168	0.04	0.00	2.67	0.04	2.266	4.98	263.25	85.62
1143	0.05	0.00	2.90	0.05	2.172	5.12	258.27	85.59
1118	0.05	0.01	3.11	0.05	2.088	5.25	253.15	85.57
1092	0.05	0.01	3.29	0.06	2.011	5.36	247.90	85.54
1067	0.06	0.01	3.47	0.06	1.939	5.47	242.54	85.52
1041	0.06	0.01	3.63	0.07	1.874	5.57	237.07	85.49
1016	0.06	0.01	3.78	0.07	1.811	5.66	231.51	85.47
991	0.07	0.01	3.92	0.08	1.753	5.75	225.85	85.44
965	0.07	0.01	4.05	0.08	1.699	5.83	220.10	85.42
940	0.07	0.01	4.18	0.08	1.647	5.91	214.27	85.39
914	0.07	0.01	4.30	0.09	1.598	5.98	208.36	85.36
889	0.07	0.01	4.41	0.09	1.552	6.05	202.38	85.34
864	0.08	0.01	4.51	0.09	1.508	6.12	196.33	85.31
838	0.08	0.01	4.61	0.10	1.467	6.18	190.21	85.29
813	0.08	0.01	4.71	0.10	1.427	6.24	184.04	85.26
787	0.08	0.01	4.80	0.11	1.389	6.29	177.80	85.24
762	0.08	0.01	4.89	0.11	1.353	6.35	171.51	85.21
737	0.08	0.01	4.97	0.11	1.319	6.40	165.16	85.19
711	0.08	0.01	5.05	0.12	1.287	6.45	158.76	85.16
686	0.09	0.01	5.12	0.12	1.256	6.49	152.31	85.14
660	0.09	0.01	5.19	0.12	1.227	6.54	145.82	85.11
635	0.09	0.01	5.26	0.12	1.198	6.58	139.28	85.09
610	0.09	0.01	5.32	0.13	1.172	6.62	132.70	85.06
584	0.09	0.01	5.38	0.13	1.147	6.66	126.08	85.03
559	0.09	0.01	5.44	0.13	1.123	6.69	119.43	85.01
533	0.09	0.01	5.49	0.14	1.101	6.73	112.73	84.98
508	0.09	0.01	5.54	0.14	1.079	6.76	106.01	84.96
483	0.09	0.01	5.59	0.14	1.059	6.79	99.25	84.93
457	0.09	0.01	5.64	0.14	1.039	6.82	92.46	84.91
432	0.09	0.01	5.68	0.15	1.020	6.85	85.64	84.88
406	0.10	0.01	5.72	0.15	1.003	6.87	78.79	84.86
381	0.10	0.01	5.76	0.15	0.986	6.90	71.92	84.83
356	0.10	0.02	5.80	0.15	0.970	6.92	65.02	84.81
330	0.10	0.02	5.84	0.15	0.954	6.95	58.09	84.78
305	0.10	0.02	5.87	0.16	0.939	6.97	51.15	84.75
279	0.10	0.02	5.91	0.16	0.924	6.99	44.18	84.73
254	0.10	0.02	5.96	0.17	0.902	7.03	37.19	84.70
229	0.00	0.00	0.00	0.00	3.351	3.35	30.16	84.68
203	0.00	0.00	0.00	0.00	3.351	3.35	26.81	84.65
178	0.00	0.00	0.00	0.00	3.351	3.35	23.46	84.63
152	0.00	0.00	0.00	0.00	3.351	3.35	20.11	84.60
127	0.00	0.00	0.00	0.00	3.351	3.35	16.76	84.58
102	0.00	0.00	0.00	0.00	3.351	3.35	13.40	84.55
76	0.00	0.00	0.00	0.00	3.351	3.35	10.05	84.53
51	0.00	0.00	0.00	0.00	3.351	3.35	6.70	84.50
25	0.00	0.00	0.00	0.00	3.351	3.35	3.35	84.48

Block 54 - Outlet Stage - Storage Discharge Calculations

Orifice 1 Equation	$0.65*A*(2gh)^{1/2}$
Orifice Invert	84.71 m
Orifice Size	0.145 m
Centreline	84.78 m
Orifice 2 Equation	$0.65*A*(2gh)^{1/2}$
Orifice Invert	85.30 m
Orifice Size	0.160 m
Centreline	85.38 m

Height (m)	Water Surface Elevation (m)	Inc. Depth (m)	StormTech Volume (m^3)	Pipe Volume (m^3)	Total Volume (m^3)	Orifice 1 Release Rate (m^3/s)	Orifice 2 Release Rate (m^3/s)	Total Release Rate (m^3/s)	Notes
0.000	84.45	0.000	0		0	0.000		0.000	
0.030	84.48	0.030	3		3	0.000		0.000	
0.060	84.51	0.030	7		7	0.000		0.000	
0.090	84.54	0.030	10		10	0.000		0.000	
0.120	84.57	0.030	13		13	0.000		0.000	
0.150	84.60	0.030	17		17	0.000		0.000	
0.180	84.63	0.030	23		23	0.000		0.000	
0.210	84.66	0.030	27		27	0.000		0.000	
0.240	84.69	0.030	30		30	0.000		0.000	
0.270	84.72	0.030	37		37	0.000		0.000	
0.300	84.75	0.030	44		44	0.000		0.000	
0.330	84.78	0.030	51		51	0.002		0.002	
0.360	84.81	0.030	65		65	0.004		0.004	
0.390	84.84	0.030	72		72	0.005		0.005	
0.420	84.87	0.030	79	0	79	0.014		0.014	
0.450	84.90	0.030	86	1	86	0.016		0.016	
0.480	84.93	0.030	92	1	94	0.018		0.018	
0.510	84.96	0.030	106	2	108	0.020		0.020	
0.540	84.99	0.030	113	2	115	0.022		0.022	
0.570	85.02	0.030	119	3	122	0.023		0.023	
0.600	85.05	0.030	126	4	130	0.025		0.025	
0.630	85.08	0.030	133	4	137	0.026		0.026	
0.660	85.11	0.030	139	5	144	0.027		0.027	
0.690	85.14	0.030	152	5	158	0.028		0.028	
0.720	85.17	0.030	159	6	165	0.030		0.030	
0.750	85.20	0.030	165	7	172	0.031		0.031	
0.780	85.23	0.030	172	7	179	0.032		0.032	
0.810	85.26	0.030	178	8	186	0.033		0.033	
0.840	85.29	0.030	190	8	199	0.034		0.034	
0.870	85.32	0.030	196	9	205	0.035		0.035	
0.900	85.35	0.030	202	10	212	0.036		0.036	
0.930	85.38	0.030	208	10	219	0.037	0.000	0.037	
0.960	85.41	0.030	214	11	225	0.038	0.010	0.048	
0.990	85.44	0.030	220	11	231	0.039	0.014	0.053	
1.020	85.47	0.010	232	12	244	0.039	0.017	0.057	5 Year Event
1.050	85.50	0.030	237	13	250	0.040	0.020	0.060	
1.080	85.53	0.030	243	13	256	0.041	0.022	0.064	
1.110	85.56	0.030	248	14	262	0.042	0.025	0.066	
1.140	85.59	0.030	253	14	268	0.043	0.027	0.069	
1.170	85.62	0.030	263	15	278	0.044	0.028	0.072	
1.200	85.65	0.030	268	16	284	0.044	0.030	0.074	
1.230	85.68	0.030	273	16	289	0.045	0.032	0.077	
1.260	85.71	0.030	277	17	294	0.046	0.033	0.079	
1.290	85.74	0.030	281	17	299	0.047	0.035	0.081	
1.320	85.77	0.030	285	18	303	0.047	0.036	0.083	
1.350	85.80	0.030	292	19	311	0.048	0.038	0.085	
1.380	85.83	0.030	296	19	315	0.049	0.039	0.087	
1.410	85.86	0.030	299	20	319	0.049	0.040	0.089	
1.440	85.89	0.030	302	20	322	0.050	0.041	0.091	
1.470	85.92	0.030	306	20	325	0.051	0.043	0.093	
1.500	85.95	0.030	312	20	332	0.051	0.044	0.095	
1.530	85.98	0.030	316	20	335	0.052	0.045	0.097	
1.560	86.01	0.030	319	20	339	0.053	0.046	0.099	
1.590	86.04	0.030	322	20	342	0.053	0.047	0.100	
1.620	86.07	0.030	326	20	346	0.054	0.048	0.102	
1.650	86.10	0.030	329	20	349	0.055	0.049	0.104	
1.680	86.13	0.030	336	20	356	0.055	0.050	0.105	
1.710	86.16	0.030	336	20	356	0.056	0.051	0.107	100 Year Event



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, May 5 2023

Outlet Swale Calculations

Triangular

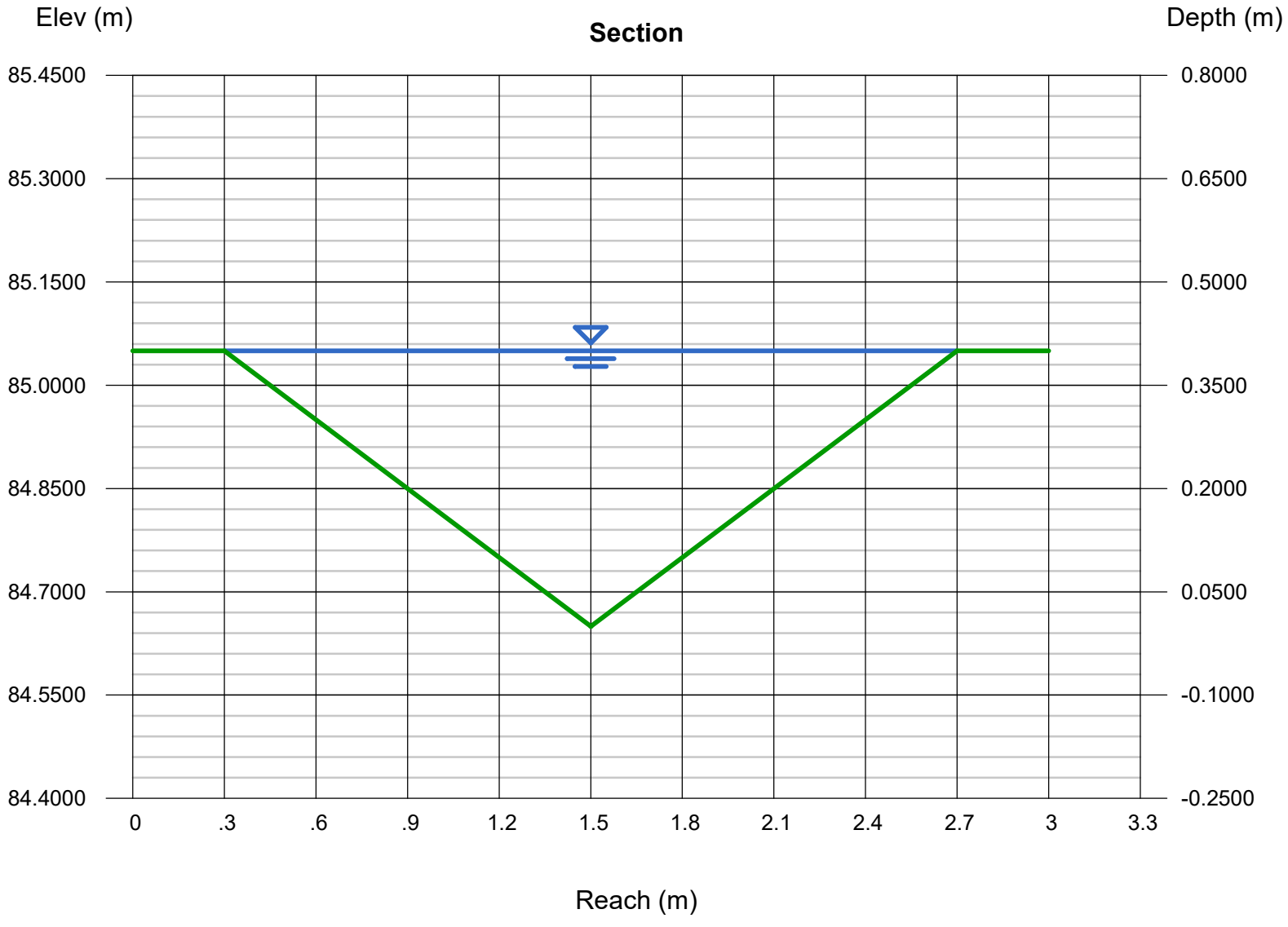
Side Slopes (z:1)	= 3.0000, 3.0000
Total Depth (m)	= 0.4000
Invert Elev (m)	= 84.6500
Slope (%)	= 0.5000
N-Value	= 0.035

Calculations

Compute by:	Q vs Depth
No. Increments	= 10

Highlighted

Depth (m)	= 0.4000
Q (cms)	= 0.3202
Area (sqm)	= 0.4800
Velocity (m/s)	= 0.6670
Wetted Perim (m)	= 2.5298
Crit Depth, Yc (m)	= 0.2987
Top Width (m)	= 2.4000
EGL (m)	= 0.4227



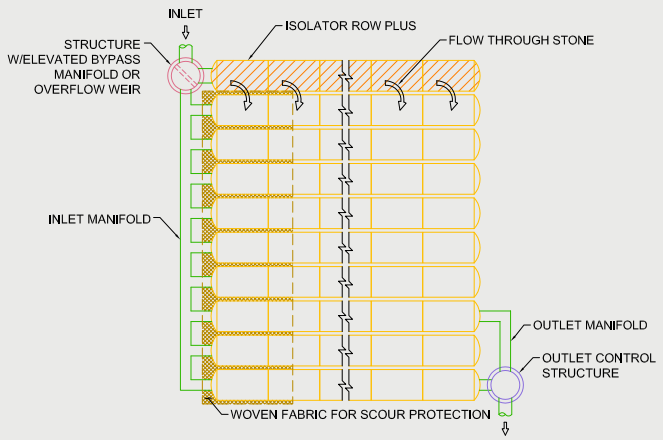
Isolator® Row Plus

The StormTech Isolator Row Plus is an enhancement to our proven water quality treatment system. This updated system is an NJCAT verified water quality treatment device that can be incorporated into any system layout.

Features

- Isolator Row Plus is now NJCAT verified. As a Manufactured Treatment Device it achieves over 81% TSS removal by filtration NJDEP Laboratory Protocol Assessment NJCAT Technology Verification.
- A patented Flamp™ (Flared End Ramp) provides a smooth transition from pipe invert to fabric bottom. The Flamp is attached to the inlet pipe inside the chamber end cap and improves chamber function over time by distributing sediment and debris that would otherwise collect at the inlet. It also serves to improve the fluid and solid flow back into the inlet pipe during maintenance and cleaning.
- Proprietary ADS Plus fabric maintains durability and sediment removal while allowing for higher water quality flow rates. A single layer of ADS Plus fabric is placed between the angular base stone and the Isolator Row Plus chambers.

Schematic of the StormTech Isolator Row Plus System



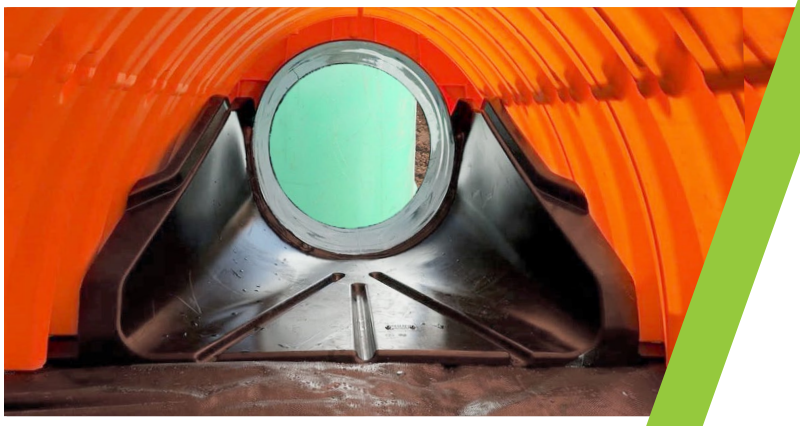
Technology Descriptions

The Isolator Row Plus is designed to capture the “first flush” runoff and offers the versatility to be sized on a volume or a flow basis. An upstream manhole not only provides access to the Isolator Row Plus but includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row Plus bypass through a manifold to the other chambers. This is achieved with either an elevated bypass manifold or a high-flow weir. This creates a differential between the Isolator Row Plus row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row Plus. After Stormwater flows through the Isolator Row Plus and into the rest of the StormTech chamber system it is either infiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

Summary of Verified Claims[1]

Treatment Rate (gpm/ft²)	4.1
Underlying Geotextile Layers	1
NJDEP Test Sediment	1-1000µ
Mean Particle Concentration (mg/L)	200
TSS Removal Efficiency	81%

[1] Verification testing of the StormTech SC-740 Isolator Row PLUS in accordance with NJDEP Laboratory protocol to access total suspended solids removal by filtration manufactured treatment device, 2013

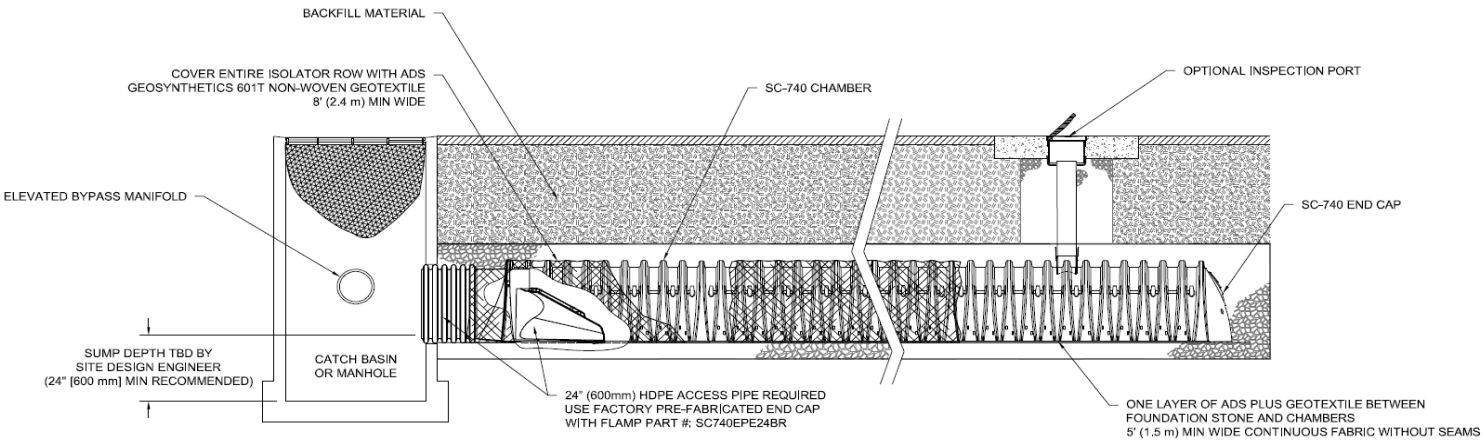


ADS StormTech™

adspipe.com
800-821-6710

StormTech Isolator Row Plus (not to scale)

Note: Non-woven fabric is only required over the chambers for the SC-310 and SC-740 chamber models.



Maintenance

The Isolator Row Plus was designed to reduce the cost of periodic maintenance. By "isolating" sediment to just one row of the StormTech system, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout.

Maintenance is accomplished with the JetVac® process. The JetVac process utilizes a high-pressure water nozzle to propel itself down the Isolator Row Plus while scouring and suspending sediment. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency.

StormTech Isolator Row Plus

Chamber Model	Chamber Storage	Chamber Footprint	Treatment Rate
SC-160LP	15.0 cf (0.42 m^3)	11.45 sf (1.06 m^2)	0.11 cfs (3.11 L/s)
SC-310	31.0 cf (0.88 m^3)	17.7 sf (1.64 m^2)	0.16 cfs (4.53 L/s)
SC-740	74.9 cf (2.12 m^3)	27.8 sf (2.58 m^2)	0.26 cfs (7.36 L/s)
DC-780	78.4 cf (2.22 m^3)	27.8 sf (2.58 m^2)	0.26 cfs (7.36 L/s)
MC-3500	175.0 cf (4.96 m^3)	42.9 sf (3.99 m^2)	0.40 cfs (11.32 L/s)
MC-4500	162.6 cf (4.60 m^3)	30.1 sf (2.80 m^2)	0.28 cfs (7.93 L/s)
MC-7200	267.3 cf (7.57 m^3)	50.0 sf (4.65 m^2)	0.45 cfs (12.74 L/s)

Installation

Installation of the stormwater treatment unit(s) shall be preformed per manufacture's installation instructions. Such instructions can be obtained by calling Advanced Drainage Systems Inc. at (800) 821-6710 or by logging on to www.ads-pipe.com or www.stormtech.com

Verification Statement

StormTech Isolator® Row PLUS
Registration number: (V-2020-10-01)
Date of issue: (2020-October-27)

Technology type	Stormwater Filtration Device
Application	Stormwater filtration technology to remove sediments, nutrients, heavy metals, and organic contaminants from stormwater runoff
Company	StormTech, LLC.
Address	520 Cromwell Avenue, Rocky Hill, CT 06067 USA **Phone** +1-888-892-2694
Website	www.stormtech.com
E-mail	info@stormtech.com

Verified Performance Claims

The StormTech Isolator® Row PLUS technology was tested at the Mid-Atlantic Storm Water Research Center (MASWRC), under the supervision of Boggs Environmental Consultants, Inc. The performance test results for two overlapping StormTech Isolator® Row PLUS chambers (commercial unit model SC-740) were verified by Good Harbour Laboratories Inc. (GHL), following the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. Based on the laboratory testing conducted, the verified performance claims are as follows:

Total Suspended Solids (TSS) Removal Efficiency - The StormTech Isolator® Row PLUS achieved 82% ± 1% removal efficiency of suspended sediment concentration (SCC) at a 95% confidence level.

Average Loading Rate - Based on the reported flow rate data and the effective sedimentation and filtration treatment area of the test unit, the average loading rate of the test unit was 4.15 ± 0.03 GPM/ft^2 at a 95% confidence level.

Maximum Treatment Flow Rate (MTFR) - Although the MTFR varies among the StormTech Isolator® Row PLUS model sizes and the number of chambers, the design surface loading rate remains the same (4.13 gpm/ ft^2 of treatment surface area). The test unit consisted of two overlapping StormTech SC-740 chambers with a nominal MTFR of 225 GPM (0.501 CFS) and an effective filtration treatment area (EFTA) of approximately 54.5 ft^2.

Detention Time and Volume - The StormTech Isolator Row PLUS detention time and wet volume varies with model size. The unit tested had a wet volume of approximately 65.1 ft^3 and a detention time of 2.2 minutes.

Maximum Sediment Storage Depth and Volume - The sediment storage volume and depth vary according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the maximum sediment storage volume is 2.3 ft^3 at a sediment depth of 0.5 inches.

Effective Sedimentation/Filtration Treatment Areas - The Effective Sedimentation Area (ESA) and the Effective Filtration Treatment Area (EFTA) increase as the size of the system increases. For the two overlapping StormTech SC-740 chambers tested, the ESA and the ratio of ESA/EFTA were 54.5 ft^2 and 1.0, respectively.

Sediment Mass Load Capacity - The sediment mass load capacity varies according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the mass loading capture was 158.4 lbs ± 0.8 lbs (2.91 ±0.01 lbs/ ft^2) following a total sediment loading of 195.2 lbs.

Technology Application

The StormTech "Isolator® Row PLUS" is a stormwater treatment technology designed for use under parking lots, roadways and heavy earth loads while providing a superior and durable structural system. The technology comprises a row of chambers covered in a non-woven geotextile fabric with a single layer of proprietary woven fabric at the bottom that serves as a filter strip, providing surface area for infiltration and runoff reduction with enhanced suspended solids and pollutant removal. The following features make the Isolator® Row PLUS effective as a water quality solution:

- Enhanced infiltration Surface Area
- Runoff Volume Reduction
- Peak Flow Reduction
- Sediment/Pollutant Removal
- Internal Water Storage (IWS)
- Water Temperature Cooling (Thermal Buffer).

Technology Description

The Isolator® Row PLUS (shown in Figures 1 and 2) is the first row of StormTech chambers that is surrounded with filter fabric and connected to a closely located manhole for easy access. The Isolator® Row PLUS provides for settling and filtration of sediment as stormwater rises in the chamber and ultimately passes through the filter fabric. The open-bottom chambers allow stormwater to flow out of the chambers, while sediment is captured in the Isolator® Row PLUS.

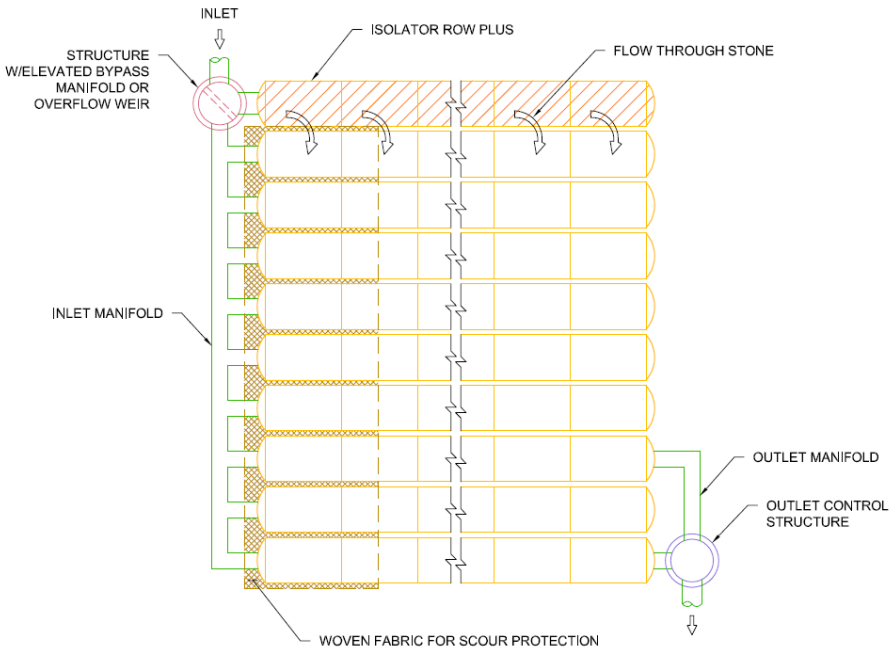


Figure 1: Schematic of the StormTech Isolator® Row PLUS System

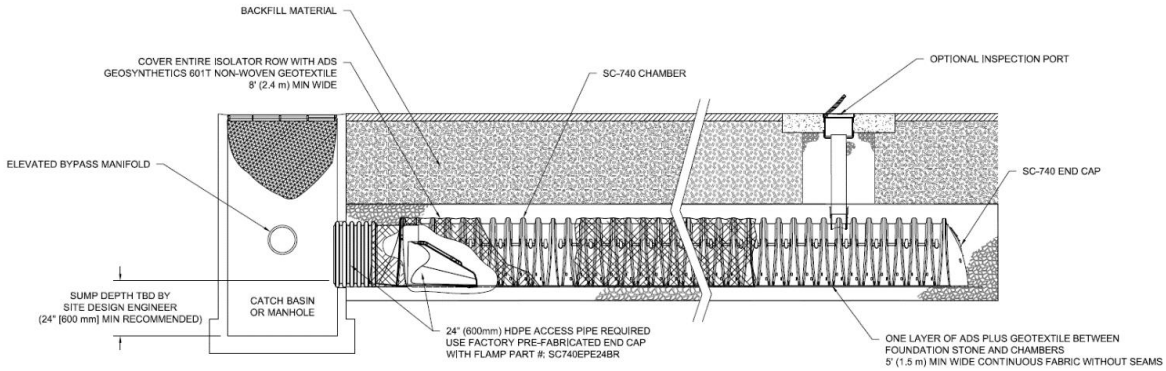


Figure 2: Isolator® Row PLUS Detail

A single layer of proprietary Advanced Drainage Systems (ADS) PLUS fabric is placed between the angular base stone and the Isolator Row PLUS chamber. The geotextile provides the means for stormwater filtration and provides a durable surface for maintenance operations. A 6 oz. non-woven fabric is placed over the chambers.

The Isolator® Row PLUS is designed to capture the “first flush” and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole not only provides access to the Isolator® Row PLUS but includes a high low/concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator® Row PLUS bypass through a manifold to the other chambers. This is achieved with either a high-flow weir or an elevated manifold. This creates a differential between the Isolator® Row PLUS and the manifold, thus allowing for settlement time in the Isolator® Row PLUS. After Stormwater flows through the Isolator® Row PLUS and into the rest of the StormTech chamber system it is either infiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

StormTech developed and owns the Isolator® Row PLUS technology and has filed a number of patent applications relating to the Isolator® Row PLUS system.[1]

Description of Test Procedure for the StormTech Isolator® Row PLUS

In January 2020, two overlapping StormTech SC-740 Isolator® Row PLUS commercial size chambers were installed at the Mid-Atlantic Storm Water Research Center (MASWRC, a subsidiary of BaySaver), in Mount Airy, Maryland, to evaluate the performance of the Isolator® Row PLUS system for Total Suspended Solid (TSS) removal (Figure 3) All testing and data collection procedures were supervised by Boggs Environmental Consultants, Inc. (BEC), who was hired by ADS for third party oversight, and were in accordance with the *New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device (January 2013)*.

Prior to the start of testing, a Quality Assurance Project Plan (QAPP), revision dated January 09, 2020, was submitted and approved by the New Jersey Corporation for Advanced Technology (NJCAT), c/o Center for Environmental Systems, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ 07030.

[1] (U.S. Provisional Application No. 62/753,050, filed October 30, 2018; U.S. Non-Provisional Application No. 16/670,628, filed October 31, 2019; International Application No. PCT/US2019/059283, filed October 31, 2019; U.S. Application No. 16/938,482, filed July 24, 2020; U.S. Application No. 16/938,657, filed July 24, 2020; PCT International Application No. PCT/US2020/043543, filed July 24, 2020; PCT International Application No. PCT/US2020/043557, filed July 24, 2020.

Figure 3: StormTech "Isolator® Row PLUS" Test Set-up at MASWRC

Verification Results

The verification process for the StormTech Isolator® Row PLUS technology was conducted by GHL in accordance with the VerifiGlobal Verification Plan for the StormTech "Isolator® Row PLUS" Technology – 2020-09-09. The technology performance claims verified by GHL are summarized at the front of this Verification Statement and in Table 6 on Page 8 under the heading "Verification Summary".

Particle size distribution analysis was performed by ECS Mid-Atlantic, LLC of Frederick, MD in accordance with ASTM D422-63(2007). ECS is accredited by the American Association of State Highways and Transportation Officials (AASHTO).

ASTM D422-63(2007) is a sieve and hydrometer method where the larger particles, > 75 microns, are measured using a standard sieve stack while the smaller particles are measured based on their settling time using a hydrometer.

The PSD meets the requirements of NJDEP, which is generally accepted as representative of the type of particle sizes an OGS would be designed to treat. Actual PSD is site and rainfall event specific, so it was necessary to choose a standard PSD to make testing and comparison manageable.

Table 1 shows the NJDEP PSD specification. Table 2 and Figure 4 show the incoming material PSD as determined by ECS Mid-Atlantic and confirmed by the verifier.

Table 1: NJDEP PSD Specification

Particle Size (µm)	NJDEP Minimum Specification
1000	98
500	93
250	88
150	73
100	58
75	48
50	43
20	33
8	18
5	8
2	3
d_{50}	< 75 µm

Table 2 – Particle Size Distribution (PSD) of Test Sediment

Mesh (mm)	US Sieve Size	Sample ID		
		PSD A	PSD B	PSD C
		Percent Finer		
9.525	0.375	100.0	100.0	100.0
4.750	#4	100.0	100.0	100.0
4.000	#5	100.0	100.0	100.0
2.360	#8	100.0	100.0	100.0
2.000	#10	100.0	100.0	100.0
1.180	#16	100.0	100.0	100.0
1.000	#18	100.0	100.0	100.0
0.500	#35	100.0	100.0	100.0
0.425	#40	93.3	93.0	93.6
0.250	#60	90.3	89.8	90.2
0.150	#100	79.3	78.1	78.1
0.125	#120	73.6	71.7	71.7
0.106	#140	68.4	65.2	64.8
0.090	#170	60.2	58.3	57.5
0.075	#200	52.0	50.9	50.3
0.053	#270	48.0	48.3	47.8
0.045	Hydrometer	46.6	46.7	46.7
0.032		42.8	42.9	41.0
0.021		37.1	37.2	35.3
0.0125		25.7	25.7	25.8
0.0090		20.1	20.1	19.2
0.0064		16.3	16.4	14.5
0.0032		8.8	8.7	7.8
0.0014		3.8	3.7	3.8

The suspended sediment concentration analysis was completed by Fredericktowne Labs Inc., Meyersville, MD. Fredericktown Labs is accredited by the Maryland Department of Environment as Maryland Certified Water Quality Laboratory. The analysis procedure was ASTM D3977-97, Suspended Sediment Concentration. The sampling procedure and submission of samples to the test lab were overseen by the independent observer, Boggs Environmental Consultants, Inc.

All test data and calculations were detailed in the report “NJCAT TECHNOLOGY VERIFICATION Isolator® Row PLUS StormTech, LLC”, July 2020, which was submitted to and verified by the New Jersey Corporation for Advanced Technology (NJCAT).

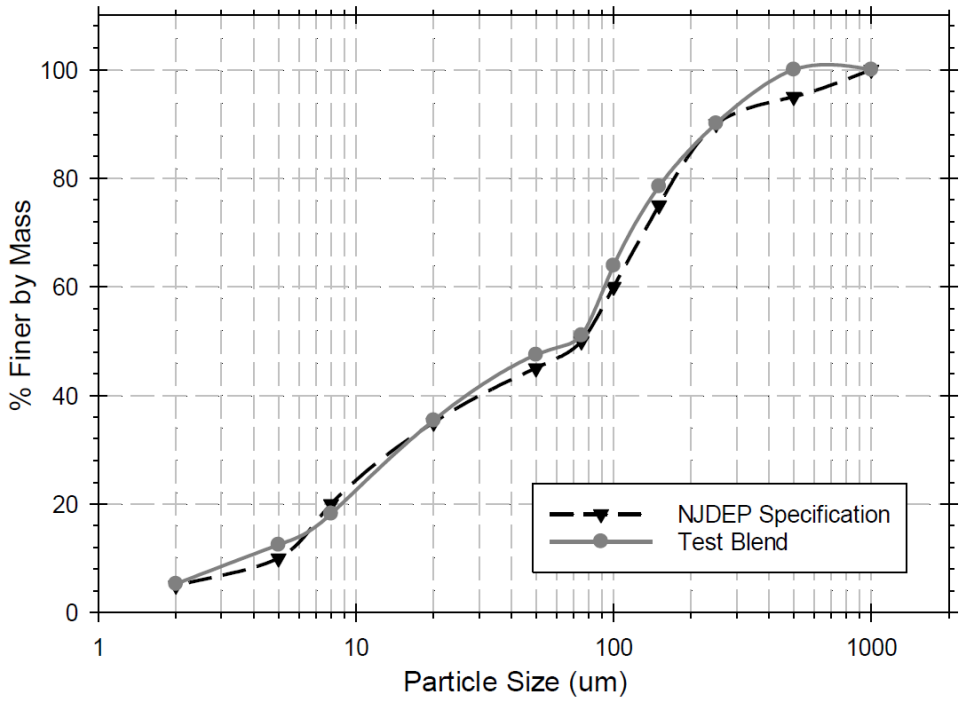


Figure 4– Particle Size Distribution (PSD)

The data in Table 3 (Flow Rate and Temperature) and Table 4 (Removal Efficiency) form the basis for the verified technology performance claim, specifically, flow rate, sediment captured and removal efficiency.

Table 3: Flow Rate and Temperature Summary

Run	Max Flow (gpm)	Min Flow (gpm)	Average Flow (gpm)	Flow COV	Flow Compliance (COV< 0.1)	Maximum Temperature (Fahrenheit)	NJDEP Temperature Compliance (< 80 F)
1	232.8	223.9	226.3	0.0078	Y	48.2	Y
2	228.9	218.6	220.8	0.0104	Y	51.5	Y
3	229.4	220.0	227.2	0.0094	Y	44.7	Y
4	230.2	218.7	223.2	0.0138	Y	40.5	Y
5	228.7	216.9	222.2	0.0103	Y	44.7	Y
6	227.6	217.0	224.2	0.0115	Y	46.7	Y
7	229.7	221.9	226.4	0.0092	Y	44.6	Y
8	230.3	222.2	226.8	0.0089	Y	43.5	Y
9	233.2	218.4	225.6	0.0136	Y	45.5	Y
10	232.2	219.7	228.4	0.0126	Y	44.7	Y
11	226.9	219.2	224.1	0.0088	Y	52.4	Y
12	232.2	222.1	226.9	0.0107	Y	48.5	Y
13	234.7	221.2	226.1	0.0109	Y	48.5	Y
14	231.9	223.4	228.7	0.0103	Y	45.6	Y
15	236.8	224.1	231.4	0.0131	Y	52.2	Y
16	232.5	221.3	229.0	0.0137	Y	47.8	Y

Table 4: Removal Efficiency Results

Run	Average Influent TSS (mg/L)	Influent Water Volume (gal)	Adjusted Average Effluent TSS (mg/L)	Effluent Water Volume (gal)	Adjusted Average Drain Down TSS (mg/L)	Drain Down Water Volume (gal)	Single Run Removal Efficiency (%)	Mass of Captured Sediment (g)	Cumulative Removal Efficiency (%)
1	203	7166	46	6881	34	285	77.8	4282	77.8
2	199	6993	32	6639	27	354	84.0	4415	80.8
3	207	7197	37	6793	27	403	82.6	4654	81.4
4	217	7068	33	6635	29	433	84.9	4923	82.3
5	215	7037	39	6593	29	444	82.2	4705	82.3
6	207	7097	40	6643	31	454	81.2	4504	82.1
7	198	7169	37	6693	30	476	81.6	4386	82.0
8	201	7184	37	6716	32	468	81.6	4473	82.0
9	205	7147	38	6675	30	472	81.8	4539	82.0
10	203	7235	38	6759	31	476	81.4	4523	81.9
11	208	7096	38	6624	30	472	81.8	4567	81.9
12	209	7185	41	6709	30	476	80.7	4584	81.8
13	198	7162	41	6680	32	482	79.7	4277	81.6
14	200	7242	43	6757	34	485	78.8	4318	81.4
15	196	7329	41	6842	32	487	79.5	4320	81.3
16	202	7254	44	6769	31	485	78.9	4384	81.2
Avg.	**204.2**	**7160**	**39**	**6713**	**31**	**447**	**81.2**	**4491**	**N/A**
Cumulative Mass Removed (g)							**71854**		
Cumulative Mass Removed (lb)							**158.4**		
Total Mass Loaded (lb)							**195.2**		
Cumulative Removal Efficiency (%)							**81.2**		

Quality Assurance

Performance verification of the StormTech Isolator® Row PLUS technology was performed in accordance with the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. This included reviewing all data sheets and calculated values, as well as overall management of the test system, quality control and data integrity.

Additional information on quality control measures taken can be found in section 5 of the QAPP for StormTech Isolator Row New Jersey Department of Environmental Protection Testing, Rev. 1/9/2020.

Specific QA/QC measures reviewed by the verifier are summarized in Table 5 below.

Table 5. Validation of QA/QC Procedures

QC Parameter	Acceptance Criteria
Independence of observer	Confirmed in letter from Boggs Environmental Consultants, Inc. to NJCAT
Consistency of procedure	Daily logs confirm proper procedure
Existence of QAPP	Confirmed. “QAPP For StormTech Isolator Row New Jersey Department of Environmental Protection Testing”, Rev. 1/9/2020*)*
Use of appropriate sample analysis method – ASTM D3799	Confirmed by method reference on lab reports from Fredericktowne Labs Inc.
Test method appropriate for the technology	Used industry stakeholder approved protocol: *New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids*

	Removal by a Filtration Manufactured Treatment Device (January 2013)
Test parameters stayed within required limits	Confirmed in report "NJCAT TECHNOLOGY VERIFICATION Isolator® Row PLUS StormTech, LLC", July 2020
Third party verified data	All testing was observed and reviewed by Boggs Environmental Consultants, Inc.

Variance

Performance claims regarding structural load limitations were not verified as they are outside the scope of the performance testing that was conducted in accordance with the 'Quality Assurance Project Plan (QAPP) for StormTech Isolator Row, New Jersey Department of Environmental Protection Testing', revision dated January 09, 2020.

Verification Summary

The StormTech "Isolator® Row PLUS" is a stormwater treatment technology designed for use under parking lots, roadways and heavy earth loads while providing a superior and durable structural system. The technology comprises a row of chambers wrapped in woven geotextile fabric with two layers at the bottom that serve as a filter strip, providing surface area for infiltration and runoff reduction with enhanced suspended solids and pollutant removal.

The StormTech Isolator® Row PLUS technology was tested at the Mid-Atlantic Storm Water Research Center (MASWRC), under the supervision of Boggs Environmental Consultants, Inc. The performance test results for two overlapping StormTech Isolator® Row PLUS chambers (commercial unit model SC-740) were verified by Good Harbour Laboratories Inc. (GHL), following the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. Table 6 summarizes the verification results in relation to the technology performance parameters that were identified in the Verification Plan to determine the efficacy of the StormTech Isolator® Row PLUS technology.

Table 6 - Summary of Verification Results Against Performance Parameters

Parameters	Verified Claims	Accuracy
Total Suspended Solids (TSS) Removal Efficiency	Based on the laboratory testing conducted, the StormTech Isolator® Row PLUS achieved an average 82% removal efficiency of SSC	± 1% (95% confidence level)
Average Loading Rate	Based on the laboratory testing parameters, the StormTech Isolator® Row PLUS maintained a loading rate of 4.15 GPM/sf	±0.03 GPM/sf (95% confidence level)
Maximum Treatment Flow Rate (MTFR)	Although the MTFR varies among the StormTech Isolator® Row PLUS model sizes and the number of chambers, the design surface loading rate remains the same (4.13 GPM/ft^2 of treatment surface area). The test unit consisted of two overlapping StormTech SC-740 chambers with a nominal MTFR of 225 GPM (0.501 CFS) and an effective filtration treatment area (EFTA) of approximately 54.5 ft^2.	± 1.4 GPM (95% confidence level)
Detention Time and Volume	Detention time and wet volume varies with model size. The unit tested had a wet volume of approximately 65.1 ft^3 (based on	N/A

	physical measurement) and a detention time of 2.2 minutes.	
Maximum Sediment Storage Depth and Volume	The sediment storage volume and depth vary according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the maximum sediment storage volume is 2.3 ft^3 at a sediment depth of 0.5 inches.	N/A
Effective Sedimentation/ Filtration Treatment Area	The effective sedimentation and filtration treatment area increases as the size of the chamber increases. Under the tested conditions using 2 overlapping chambers, the treatment area was 54.5 ft^2	The sedimentation /filtration area was determined from the actual physical dimensions of the test unit*
Sediment Mass Load Capacity	The sediment mass load capacity varies according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the mass loading capture was 158.4 lbs (2.91 lbs/ ft^2) following a total sediment loading of 195.2 lbs	± 0.8 lbs (±0.01 lbs/ft^2) (95% confidence level)

*Note: These numbers are determined based on physical measurement or a dimensional drawing, which is standard practice. Highly accurate measurements are not practical.

In conclusion, the StormTech Isolator® Row PLUS is a viable technology that can be used to remove contaminants from stormwater runoff via filtration. This technology has proven effective at removing suspended sediment from stormwater through in-lab testing using an industry recognized laboratory protocol.

By extension of sediment removal, this technology should also remove particle bound nutrients, heavy metals, and a wide variety of organic contaminants. Performance is a function of pollutant properties, hydraulic retention time, filter media, pre-treatment, and flow rate, such that proper design of the system is critical to achieving the desired results.

What is ISO 14034?

The purpose of environmental technology verification is to provide a credible and impartial account of the performance of environmental technologies. Environmental technology verification is based on a number of principles to ensure that verifications are performed and reported accurately, clearly, unambiguously and objectively. The International Organization for Standardization (ISO) standard for environmental technology verification (ETV) is ISO 14034, which was published in November 2016.

Benefits of ETV

ETV contributes to protection and conservation of the environment by promoting and facilitating market uptake of innovative environmental technologies, especially those that perform better than relevant alternatives. ETV is particularly applicable to those environmental technologies whose innovative features or performance cannot be fully assessed using existing standards. Through the provision of objective evidence, ETV provides an independent and impartial confirmation of the performance of an environmental technology based on reliable test data. ETV aims to strengthen the credibility of new, innovative technologies by supporting informed decision-making among interested parties.

For more information on the StormTech "Isolator® Row PLUS" technology, contact:	For more information on VerifiGlobal, contact:
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