October 7, 2026

Township of West Lincoln
318 Canborough Street
Smithville, ON LoR 2Ao

Functional Servicing Report (Rev. 1)
6441 Smithville Road, Smithville

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1. Introduction

1.1. Background

LandSmith Engineering & Consulting Ltd. (LandSmith) have been retained by RLD Group (Smithville Road) Inc. for the completion of a Functional Servicing Report in support of the re-zoning applications currently submitted to the Township for approval, for the lands located at 6441 Smithville Road, Smithville.

The purpose of this Functional Servicing Report is to review the existing municipal services currently available for the servicing of the proposed 22 residential townhouse units and ensure their suitability for Site Plan Approval. In addition, this report will address the local Stormwater Management (SWM) context for the site including the required stormwater quantity and quality control measures.

1.2. Site Location & Topography

The site is located at 6441 Smithville Road (Niagara Regional Road 14), Smithville. Approximately 0.643 hectares in size, the site consists mainly of grassed areas and contains an existing 1-storey brick church building with a gravel parking lot that is accessible off of Smithville Road. The site is bound by single detached residential homes to the north and west, a two-storey apartment building to the east, and Smithville Road to the south. As per the Township of West Lincoln's Zoning By-Law No. 2017-70, the site is currently in an Institutional (I) zone. A site location plan is illustrated on Figure 1 on the following page.

A topographic survey of the subject lands was completed in June 2026, by A.T. McLaren Ltd. and is attached in Appendix 'A' for reference purposes. The topography of the site is relatively flat and there is an existing split drainage pattern. The front portion of the site including the church building drains uncontrolled towards the roadside ditch on the north side of Smithville Road. The rear portion of the site drains uncontrolled towards northeast corner where there is an existing catchbasin located in the rear-yard of the adjacent property at 24 Killins Street. This catchbasin conveys flows north towards

the Smithville Country Estates subsivision through a storm easement located between the houses at 24 and 26 Killins Street.



Figure 1: Site Location Plan

1.3. Proposed Development

The current development proposal is described on the Site Plan attached in Appendix 'A' for reference purposes. The existing church building is to be demolished and the existing water and sanitary services removed as per Township standards. The developed site will include the construction of four 2-storey townhouse blocks. There will be a total of 22 townhouse units, with Building's 1 and 2 containing 6 units each, and Building's 3 and 4 containing 5 units each. Vehicular access will be provided by a private laneway off of Smithville Road at the south of the site. Each townhouse unit will have a driveway at the frontage, and there will be 8 additional surface parking spaces provided for the development. The Proposed Site Plan contained in Appendix 'A' was the basis of the following engineering analysis.

2. Servicing Analysis

2.1. Water Servicing

Adjacent to the site, there is an existing 150mm diameter watermain along Smithville Road which is illustrated on the Smithville Country Estates General Plan drawing contained within Appendix 'A' for reference purposes.

As seen on the Servicing Plan attached in Appendix 'A' for reference, the development will be serviced by a proposed 150mm diameter watermain that will connect to the municipal 150mm diameter watermain and run north within the private laneway. Two proposed hydrants will be located north of the private laneway, with one hydrant adjacent to the southwest corner of Building 3, and one hydrant adjacent to the southeast corner of Building 4. The water services for the 22 townhouse units will be 25mm diameter, Type K copper pipe that branches off of the 150mm watermain within the private laneway.

The Ontario Building Code has been utilized to calculate the expected maximum hydraulic load and associated flow rate for the proposed development. These calculations have been based on the Site Plan provided by KNYMH Inc. It was assumed that each townhouse unit will have two bathroom groups, one dishwasher, one clothes washer, one kitchen sink, and one hose bibb.

Based on the fixture unit method the proposed development will have a total of 305.8 fixture units. This is equivalent to a maximum hydraulic load for the development of 6.73 L/s. The supporting calculations describing how this value was determined are attached in Appendix 'B' for reference purposes.

In addition to the hydraulic load calculated as per the OBC, water demands for the proposed development were also calculated in accordance with the 2023 Smithville Master Community Plan, the 2024 Development Charges Background Study for the Township of West Lincoln, and the 2021 Niagara Region Water and Wastewater Master Servicing Plan Update as follows:

As per *Section 2.4.2: Maximum Day Demand Peaking Factor* from the 2021 Niagara MSPU:

Maximum Day Demand Factor (Grimsby WTP) = 1.66

As per *Section 3.1: Waster System Design Criteria* from the 2023 Smithville Water and Wastewater Master Servicing Plan:

Residential Average Day Demand = 240 L/day/person

Peak Hour Demand Factor = 1.5 x Maximum Day Demand

As per *Schedule 3: Current Year Growth Forecast* from Appendix A of the 2024 Development Charges Background Study for the Township of West Lincoln:

Persons per unit (townhouse) = 2.16

Proposed Water Demands:

Site Population = 22 units x 2.16 persons/unit = 48 persons

Residential Average Day Demand = 240 L/day/person x 48 persons = 11,520 L/day = 0.133 L/s

Maximum Day Demand = 1.66 x (11,520) = 19,123.2 L/day = 0.221 L/s

Peak Hour Demand = 1.5 x (Max. Day Demand) = 28,684.8 L/day = **0.332 L/s**

The 2020 Fire Underwriters Survey has also been utilized to calculate the fire-flow demands for the site. Building 1 was analyzed due to its proximity to adjacent existing structures. Details of the fire-flow calculations are contained within Appendix 'B' for reference purposes. Taking into consideration the appropriate water supply and spatial coefficients this building size results in a required flow rate of 153 L/s.

The adjacent 150mm diameter municipal watermain along Smithville Road is expected to be able to meet the domestic and fire demands for the site. However, prior to construction, hydrant flow testing should be undertaken in order to determine the exact and currently available pressures in the nearby system

2.2. Sanitary Servicing

There is an existing 250mm diameter sanitary sewer on Smithville Road that has a slope of approximately 0.50% in the area adjacent to the frontage of the site. A map illustrating the downstream sanitary sewers is attached in Appendix 'B' for reference.

The proposed development will connect to the existing sanitary sewer along Smithville Road through a proposed 200mm diameter sanitary sewer running through the proposed private laneway. Within the site there will be a total of 120m of 200mm diameter sanitary sewers and five sanitary manholes, including a manhole at the front property line. Each of the 22 townhouse units will have a dedicated 150mm diameter sanitary lateral that will connect to the proposed 200mm diameter sanitary sewer within the private laneway. The proposed sanitary sewer layout is illustrated on the Servicing Plan attached in Appendix 'A' for reference.

2.2.1 Wastewater Assessment

Based on the Ontario Building Code, the 2023 Smithville Master Community Plan and the 2024 Development Charges Background Study for the Township of West Lincoln, the calculation of the expected generation of sanitary effluent based on the existing conditions and the proposed development is as follows:

As per OBC 8.2.1.3 Sewage System Design Flows, Table 8.2.1.3.B:

5. a) Churches and Similar Places of Worship (no kitchen) = 8 L/day/seat

As per *Section 3.2: Wastewater System Design Criteria* from the 2023 Smithville Water and Wastewater Master Servicing Plan:

Residential Average Dry Weather Flow = 255 L/day/person
Infiltration Allowance = 0.286 L/s/ha (new developments)
= 0.400 L/s/ha (existing developments)
Peaking Factor (Harmon) = 4.0

As per *Schedule 3: Current Year Growth Forecast* from Appendix A of the 2024 Development Charges Background Study for the Township of West Lincoln:

Persons per unit (townhouse) = 2.16

Existing Sanitary Flows:

Assuming the existing church building has 150 seats, the existing sanitary flows generated from the site (0.643 ha) are as follows:

Church Flows = 150 seats x (8 L/day/seat) = 1200 L/day = 0.014 L/s

Infiltration Flow = 0.400 L/s/ha x 0.643 ha = 0.257 L/s

Estimated Existing Peak Design Flow = (0.014 x 4.0) + 0.257 = **0.313 L/s**

Proposed Sanitary Flows:

The proposed sanitary flows generated from the site (0.621 ha with the road widening) are as follows:

Site Population = 22 units x 2.16 persons/unit = 48 persons

Site Population (per hectare) = 48 persons / 0.621 ha = 78 persons/ha

Population Flow = 255 L/day/person x 48 persons = 12,240 L/day = 0.142 L/s

Infiltration Flow = 0.286 L/s/ha x 0.621 ha = 0.178 L/s

Estimated Proposed Peak Design Flow = (0.142 x 4.0) + 0.178 = **0.746 L/s**

The proposed sanitary service lateral to the site is 200mm in diameter. At a 2.0% slope this lateral has a capacity of 46 L/s which is sufficient for the proposed sanitary flows from the site.

The 2023 Smithville Water and Wastewater Master Servicing Plan indicates that the downstream Smithville Sanitary Pumping Station (SPS) has a rated capacity of 120 L/s and an existing capacity surplus of 5.7 L/s to meet the existing design peak wet weather flow. However, the Region's Master Servicing Plan and DC Background Study have identified an upgrade requirement for Smithville SPS to accommodate future growth. The downstream 450mm diameter trunk sanitary sewer which conveys flows from the site to the SPS along Twenty Mile Creek is reaching the maximum available capacity in the existing peak wet weather flow scenario based on the 5-year design storm, as illustrated in Figure 4-6: Existing Wastewater Modelling Results from the 2023 Smithville MSP which is attached in Appendix 'B' for reference.

2.3 Stormwater Servicing

There are no existing municipal storm sewers adjacent to the site along Smithville Road. There are roadside ditches adjacent to the site which convey flows easterly through CSP culverts running under the driveway entrances. The ditch runoff is conveyed easterly for approximately 180m east of the site, until it enters the 600mm diameter storm sewer along Canborough Street and continues flowing north towards Twenty Mile Creek.

Adjacent to the north of the site is the Smithville Country Estates subdivision. Built in the mid-1970's, this subdivision includes 66 lots of detached single-family dwellings. The Storm Drainage Plan for this subdivision is attached in Appendix 'C' for reference. As can be seen, the northern portion of the site was included as a catchment area for the subdivision – with the downstream receiver being a rear-yard catchbasin (shown in Lot 40 on the Storm Drainage Plan) that conveys flows north through a storm easement towards the Killins Street storm sewer. This easement is in favour of the Township for maintenance of the rear-yard catchbasin and lead (the land transfer documents relating to the easement are attached in Appendix 'C' for reference). LandSmith also attended the site and was able to locate the existing catch-basin box and take photos of the structure. These photos are included in Appendix 'C' of this report for reference. Since the northern portion of the site drains towards the existing catchbasin adjacent to the northeast corner of the site and the downstream sewers were designed to account for these flows, there will be a proposed storm connection to this existing catchbasin. Notwithstanding the fact that the current system accounts for site flows, additional stormwater controls will be placed in the rear yard areas of the site behind Buildings 3 and 4. The proposed storm servicing layout is illustrated on the Servicing Plan attached in Appendix 'A' for reference.

3. Stormwater Management

3.1. Quantity Criteria

As per the Township's SWM quantity criteria from the Smithville Master Community Plan, the development is to incorporate quantity controls to control post-development flows to pre-development levels for all design storm events up to and including the 100-year storm event. The design shall also incorporate on-site extended detention storage for erosion control.

3.2. Quality Criteria

Considering the runoff for the site will ultimately discharge into Twenty Mile Creek, Enhanced stormwater quality treatment control (80% overall total suspended solids removal) will be applied for the proposed development. This will include treatment train design principles in accordance with the Township's and MECP's standards.

3.3. Stormwater Design

3.3.1. Quantity Control

The Pre-Development Storm Drainage Area Plan attached in Appendix 'C' illustrates the existing split drainage pattern for the lot. Pre-development Drainage Area 1 is 0.344 hectares, 7.6% impervious, and includes the front roof portion of the site and the existing church. Drainage Area 1 drains uncontrolled southerly towards the Smithville Road roadside ditch. Pre-development Drainage Area 2 is 0.299 hectares, 0.2% impervious, and includes the rear grassed area of the site. Drainage Area 2 drains uncontrolled towards the northeast corner of the site, towards the low-point and the existing catchbasin located in the rear-yard between the houses at 24 and 26 Killins Street.

The Post-Development Storm Drainage Area Plan attached in Appendix 'C' illustrates the drainage areas for the proposed development. As can be seen the post-development drainage areas will maintain the existing split drainage pattern for the site. Post-development Drainage Area 1 is 0.495 hectares, 66.5% impervious, and consists of the front portion of the site, including the private laneway, Buildings 1 and 2, and the front half of Buildings 3 and 4. Drainage from Post-Dev. Area 1 will be controlled through underground storage tanks and be conveyed southerly towards the roadside ditch adjacent to the frontage of the site. Post-development Drainage Area 2 is 0.126 hectares, 31.7% impervious, and consists of the rear portion of the site, including the back half of Buildings 3 and 4. Drainage from Post-Dev. Area 2 will be controlled through underground storage tanks and be conveyed towards the existing catchbasin adjacent to the northeast corner of the site.

Peak flows for the pre- and post-development areas were found using MIDUSS v2 and the 3-Hour Chicago design storm distribution. Mount Hope's IDF Curve Values were used for the 5, 25, and 100-year storm events. The pre-development peak flows are shown in Table 1 below, and the post-development flows (with no stormwater controls) are shown in Table 2 on the following page. The MIDUSS v2 output files outlining the details of the runoff calculations are attached to this report in Appendix 'C' for reference purposes.

Return Period (Year)	Peak Runoff (m^3/s)			Runoff Volume (m^3)		
	A1	A2	Total	A1	A2	Total
5	0.010	0.008	0.018	49.08	36.18	85.26
25	0.026	0.021	0.047	95.78	75.09	170.87
100	0.045	0.035	0.080	138.64	111.28	249.92

Table 1: Pre-Development Runoff Summary

Return Period (Year)	Peak Runoff (m^3/s)				Runoff Volume (m^3)			
	A1	A2	Total	% Change	A1	A2	Total	% Change
5	0.093	0.013	0.106	+488.9%	155.24	26.82	182.06	+113.5%
25	0.135	0.022	0.157	+234.0%	246.43	46.42	292.85	+71.4%
100	0.174	0.032	0.206	+157.5%	323.35	63.44	386.79	+54.8%

Table 2: Post-Development Runoff Summary (No SWM)

As can be seen in Table 2, the post-development peak runoff increases compared to existing conditions for all return periods. In order to keep stormwater discharge for the site to pre-development levels additional stormwater storage measures will be required for each outlet.

Based on the flow target and the depth of cover constraints of the site, the proposed storage tanks will be Aquabox underground water storage systems. The Aquabox product manual is attached in Appendix 'C' for reference. Each full block is 0.75m long, 0.75m wide, and 0.80m high with a void ratio of 96%. Within landscaped and parking areas, only 0.45m of cover is required over the Aquabox system – which makes it an ideal product for flat sites such as the subject lands. The Aquabox system is considered a Low-Impact Development feature as it includes an open-bottom which promotes groundwater recharge.

Outlet 1: *Southerly towards the roadside ditch (Drainage Area 1)*
Runoff which exits the site southerly towards the roadside ditch occurs in pre- and post-development drainage Area 1. Post-development Area 1 will need to be controlled in order to match the pre-development runoff rates.

As illustrated on the Site Servicing Plan attached in Appendix 'A', there will be five Aquabox tanks within Post-Dev. Area 1 that will convey flows towards the front roadside ditch – one within the private laneway parking area, and two each behind the rear and south sides of Buildings 1 and 2. Proposed catchbasins within the private laneway will convey laneway runoff to the tank underneath the parking spaces. Rear-yard swales behind Buildings 1 and 2 will convey surface runoff to area drains that will connect to the Aquabox tanks adjacent to the east and west property lines. A small portion of the adjacent western property at 6453 Smithville Road drains onto the site – in order for the proposed retaining wall to not block this runoff, a proposed area drain located to the west of the proposed retaining wall behind Building 1 will capture flows from the adjacent lot and connect to the Aquabox tank. To the south of Buildings 1 and 2 adjacent to the front ditch, area drains will convey surface runoff into Aquabox tanks. With a total of 440 full blocks and a combined bed layout covering 247.50m^2, the Aquabox tanks in Post-Dev. Area 1 will provide a total storage volume of 190m^3.

The downstream receiver for all of the Post-Dev. Area 1 Aquabox tanks will be a proposed storm manhole with orifice controls located at the southeast corner of the site. It was determined that a triple control orifice design would be required in order to meet the discharge targets for each of the return period events as follows:

- Orifice 1 – 87mm diameter Inv. Elevation 190.70m (at the bottom of the tank)
- Orifice 2 – 140mm diameter Inv. Elevation 191.14m
- Orifice 3 – 150mm diameter Inv. Elevation 191.35m

The size and elevation of the orifice was utilized in the MIDUSS v2 analysis, as can be seen through review of the output files attached in Appendix 'C' for reference. Based on the routing of the system the discharge from the proposed Aquabox storage tanks for Post-Dev. Area 1 is summarized via Table 3 below. As can be seen the proposed storage and control orifices allow for the post-development flows towards the front ditch to match the pre-development levels.

Return Period (Year)	Max. Storage (m^3)	Peak Outflow (m^3/s)	Allowable Outflow (%)	WSEL (m)
5	103.5	0.010	100%	191.14
25	153.3	0.026	100%	191.35
100	189.6	0.044	98%	191.50

Table 3: Post-Dev. Area 1 – Aquabox Storage and Discharge Summary

Outlet 2: *Northeasterly towards the existing catchbasin (Drainage Area 2)*

Runoff which exits the site northerly towards the existing catchbasin occurs in pre- and post-development drainage Area 2. As seen in Tables 1 and 2, the post-development runoff volumes for all return periods and the 100-year peak flows for this outlet decrease compared to existing conditions (with no stormwater controls). However, since the 5 and 25-year post-development peak flows increase compared to existing conditions, Post-development Area 2 will need to be controlled in order to match the pre-development runoff rates.

As illustrated on the Site Servicing Plan attached in Appendix 'A', there will be one Aquabox tank within Post-Dev. Area 2 that will convey flows towards the existing catchbasin adjacent to the northeast corner of the site. This tank will be located in the rear yard area for Buildings 3 and 4, adjacent to the northern lot line. Proposed swales will convey flows to area drains that will connect to the Aquabox tank. With a total of 85 half blocks and a bed layout covering $47.82m^2$, the Aquabox tank in Post-Dev. Area 2 will provide a total storage volume of $19.7m^3$.

The downstream receiver for all of the Post-Dev. Area 2 Aquabox tank will be a proposed storm catchbasin with orifice controls located at the northeast corner of the site, south of the existing

catchbasin. It was determined that a double control orifice design would be required in order to meet the discharge targets for each of the return period events as follows:

- Orifice 1 – 110mm diameter Inv. Elevation 190.20m (at the bottom of the tank)
- Orifice 2 – 110mm diameter Inv. Elevation 190.37m

The orifices will discharge via one pipe that will be cored into the existing rear-yard catchbasin adjacent to the northeast corner of the site. This existing catchbasin is located within an easement in favour of the Township. The size and elevation of the orifice was utilized in the MIDUSS v2 analysis, as can be seen through review of the output files attached in Appendix 'C' for reference. Based on the routing of the system the discharge from the proposed Aquabox storage tank for Post-Dev. Area 2 is summarized via Table 4 below.

Return Period (Year)	Max. Storage (m^3)	Peak Outflow (m^3/s)	Allowable Outflow (%)	WSEL (m)
5	7.5	0.008	100%	190.36
25	12.6	0.016	76%	190.47
100	16.6	0.023	66%	190.56

Table 4: Post-Dev. Area 2 – Aquabox Storage and Discharge Summary

Based on the foregoing analysis the total site storage of 210m^3 provided by the Aquabox storage systems is sufficient to ensure that the sum of the peak uncontrolled and controlled flows does not exceed the existing runoff for each of the noted return periods. Table 5 below summarizes the total flows from the site under the proposed design and compares them to the existing conditions. As can be seen the post-development discharge from the site is reduced by virtue of the proposed stormwater management design.

Return Period (Year)	Pre-Development Peak Runoff (m^3/s)			Post-Development Peak Runoff (m^3/s) (Controlled with Aquabox)			% Change
	A1	A2	Total	A1	A2	Total	
5	0.010	0.008	0.018	0.010	0.008	0.018	0.0%
25	0.026	0.021	0.047	0.026	0.016	0.042	-10.6%
100	0.045	0.035	0.080	0.044	0.023	0.067	-16.3%

Table 5: Overall Site Stormwater Discharge Summary

3.3.2. Quality Control

Given that runoff from the subject lands eventually discharges into Twenty Mile Creek, MECP Level 1 'Enhanced' stormwater quality control protection is required for this development. This includes providing 80% total suspended solids (TSS) removal. In keeping with Township of West Lincoln criteria, the Environmental Technology Verification (ETV) particle size distribution must be used for sizing of such stormwater quality control measures.

To address quality control requirements for the development a treatment train approach will be utilized. Stormwater quality can be provided by the installation of CB Shield devices in the proposed catchbasins in conjunction with a StormTech Isolator Row Plus that can be incorporated into the Aquabox storage tanks.

Preliminary analysis indicates that the installation of a CB Shield within the site catchbasin will provide approximately 50% TSS removal efficiency based on the ETV particle size distribution. A CB Shield operations manual and design chart, as well as the ETV verification statement is attached within Appendix 'C' for reference.

In addition to the CB Shields, the inclusion of an Isolator Row Plus within the Aquabox tanks will force stormwater entering the chambers to pass through a filter cloth with 0.300mm openings and reduce the amount of TSS exiting the site. The Isolator Row Plus is an ETV verified technology that will provide approximately 80% long term TSS removal as a standalone feature for the Aquabox units on site. The Isolator Row installation guidelines and verification statement are attached in Appendix 'C' for reference purposes. Shop drawings with certification of the ability to provide 80% long term TSS removal will be provided prior to construction.

The proposed treatment train approach of CB Shields and a Separator Row will meet the noted quality control criteria for 'Enhanced' protection for the site, including the long-term removal of 80% TSS.

4. Conclusions

In conclusion, based on the foregoing analysis we recommend that the development can be serviced in accordance with the requirements of the Township of West Lincoln as follows:

1. Water servicing can be provided through a proposed 150mm diameter water service pipe entering the site off of Smithville Road. Fire demands for the site will be 153 L/s, while peak domestic demand is expected to be 0.332 L/s. These water demands can be met through the adjacent 150mm diameter watermain on Smithville Road.

2. It is proposed to provide a 200mm diameter sanitary sewer to service the proposed development which connects to the existing 200mm sanitary sewer on Smithville Road. A peak domestic sanitary flow rate of 0.746 L/s is expected to be generated from the site. The existing 250mm diameter sanitary sewer on Smithville Road will provide adequate capacity for the proposed development.

3. On-site stormwater quantity controls will be provided by Aquabox underground storage tanks. In order to match pre-development runoff levels, approximately 210m^3 of storage volume shall be provided along with orifice controls.

4. On-site stormwater quality controls will be provided through the use of CB Shields within all site catchbasins as well as an isolator row within the proposed storage tanks, which will filter stormwater runoff and trap sediment prior to the release of stormwater from the site. This treatment train approach will provide an Enhanced level protection for the proposed development with 80% long-term TSS removal.

Thank you for your consideration of the above Functional Servicing Report. Should you have any questions or require clarification with respect to any part of the above please do not hesitate to contact the undersigned.

Respectfully submitted,





Andrew Smith, P. Eng.
Principal & Director
LandSmith Engineering & Consulting Ltd.
289-309-3632
andrew@landsmithec.com

Attachments:

Appendix 'A' – Background Information

Topographic Survey by A.T. McLaren Ltd.
Site Plan by KNYMH Inc.
Servicing Plan by LandSmith
Grading Plan by LandSmith

Appendix 'B' – Water and Wastewater Servicing Analysis

Smithville: Existing Sanitary Sewers Map by Amec
Domestic Water Demand Calculations
Fire Flow Requirement Calculations
Figure 4-6: Existing Wastewater Modelling Results (Smithville, 2023 MSP)

Appendix 'C' – SWM Analysis

Smithville Country Estates Storm Drainage Plan by Douglas G. Ure & Sons
Land Transfer Documents for Storm Sewer Easement between 24 and 26 Killins Street
Site Photos re Existing Catch-Basin
Pre-Development Storm Drainage Area Plan
Post-Development Storm Drainage Area Plan
MIDUSS v2 Output Files
Aquabox Design Manual
Installation Guidelines: Aquabox with StormTech Isolator Row Plus
StormTech Isolator Row Plus ETV Verification Statement
CB Shield Operations Manual and Design Chart
CB Shield ETV Verification Statement

Appendix 'A' – Background Information

Topographic Survey by A.T. McLaren Ltd.

Site Plan by KNYMH Inc.

Servicing Plan by LandSmith

Grading Plan by LandSmith

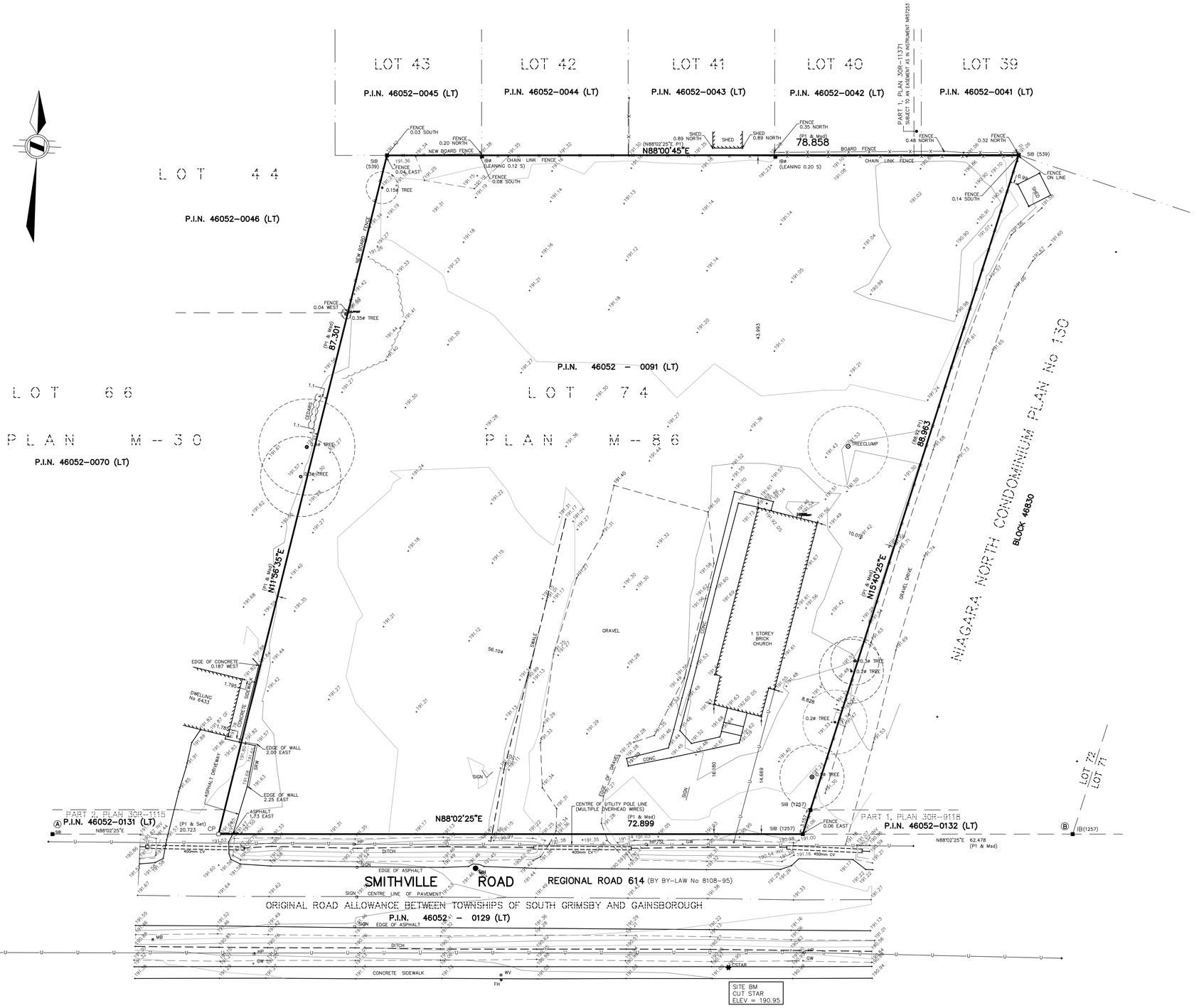
LandSmith
ENGINEERING & CONSULTING LTD.

PLAN OF SURVEY
OF
LOT 74
PLAN M-86
IN THE
TOWNSHIP OF WEST LINCOLN
REGIONAL MUNICIPALITY OF NIAGARA

SCALE 1:250 METRIC

5 3 0 5 10 15 metres

R.A. McLAREN, O.L.S. – 2026



BEARING COMPARISON
FOR BEARING COMPARISONS A ROTATION OF 1°01'05" COUNTER CLOCKWISE WAS APPLIED TO BEARINGS ON PLAN P1 TO CONVERT TO GRID BEARINGS

BEARING NOTE:
BEARINGS ARE UTM GRID, DERIVED FROM OBSERVED REFERENCE POINTS A AND B, BY REAL TIME NETWORK OBSERVATIONS, UTM ZONE 17, NAD83 (CSRS) (2010.0)

NOTE:
DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.9997463

INTEGRATION DATA

OBSERVED REFERENCE POINTS (ORP's): UTM ZONE 17, NAD83 (CSRS) (2010.0). COORDINATES TO URBAN ACCURACY PER SEC. 14(2) OF O.REG. 216/10

POINT ID	NORTHING	EASTING
ORP A	4771975.891	617736.652
ORP B	4771981.230	617892.642

COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN.

NOTE:
UNDERGROUND SERVICE AND UTILITY LOCATIONS MUST BE VERIFIED PRIOR TO CONSTRUCTION.

INVERTS MUST BE VERIFIED PRIOR TO CONSTRUCTION.

BENCHMARK NOTE:
0011989U029

BISMARK CONCRETE CULVERT ALONG REGIONAL ROAD NO. 65, 3.1 KM WEST OF CHURCH, 0.9 KM EAST OF INTERSECTION WITH C.P.R., OPPOSITE POINT ON ROAD 22 M NORTHWEST OF WOODEN POLE (NO. 481), 7.3 M SOUTHWEST OF CENTRE OF ROAD, TABLET IN TOP OF CULVERT, 30 CM NORTHEAST OF SOUTHWEST END, 30 CM SOUTHEAST OF NORTHWEST FACE, AT ROAD LEVEL.

ELEV = 182.679 CGVD28:78

LEGEND:

□	DENOTES	MONUMENT SET
■	"	MONUMENT FOUND
IB	"	IRON BAR
SIB	"	STANDARD IRON BAR
SSIB	"	SHORT STANDARD IRON BAR
B24	"	A.T. McLAREN, O.L.S.
539	"	D.G. URE, O.L.S.
1257	"	R. LAROCQUE, O.L.S.
Msd	"	MEASURED
P1	"	PLAN M-86
DS	"	DOOR SILL
FH	"	FIRE HYDRANT
GW	"	GUY WIRE
HP	"	HYDRO POLE
MB	"	MAIL BOX
MH	"	MANHOLE
LP	"	LIGHT POLE
WV	"	WATER VALVE

METRIC NOTE:
DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

SURVEYOR'S CERTIFICATE:
I CERTIFY THAT:
1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE REGULATIONS MADE UNDER THEM.
2. THE SURVEY WAS COMPLETED ON THE DAY OF

DATE R.A. McLAREN, O.L.S.

THIS PLAN OF SURVEY RELATES TO AOLS PLAN SUBMISSION FORM NUMBER

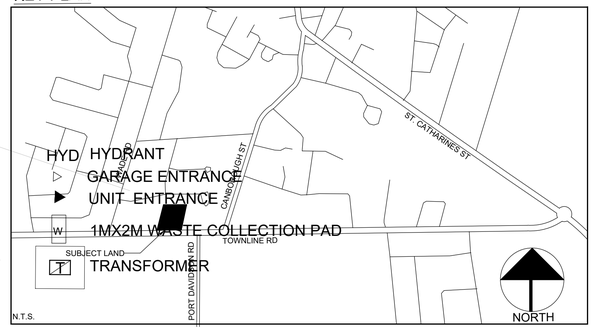
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A.T. McLaren Limited
LEGAL AND ENGINEERING SURVEYS
69 JOHN STREET SOUTH, SUITE 230
HAMILTON, ONTARIO, L8N 2B9
PHONE (905) 527-8559

Drawn	Checked	Crew Chief	Scale	Dwg.No.
DG	RBM	JS	1:250	38458



KEY PLAN



		LOT AREA	BLDG/ PORCH AREA	LOT COVERAGE	HARD/ SOFT LANDSCAPE (AMENITY) AREA	HARD/ SOFT LANDSCAPE (AMENITY) PERCENTAGE	REAR AMENITY AREA
BUILDING 1	LOT 1	389.2 SM	116.0 SM	29.8%	252.1 SM	64.8%	126.4 SM
	LOT 2	181.3 SM	100.0 SM	55.2%	60.1 SM	33.1%	48.6 SM
	LOT 3	180.2 SM	100.0 SM	55.5%	59.5 SM	33.0%	48.0 SM
	LOT 4	180.2 SM	100.0 SM	55.5%	59.0 SM	32.7%	47.5 SM
	LOT 5	179.6 SM	100.0 SM	55.6%	58.4 SM	32.5%	46.9 SM
	LOT 6	211.2 SM	102.4 SM	48.5%	87.5 SM	41.4%	54.9 SM
BUILDING 3	total		618.4 SM				
	LOT 7	290.5 SM	85.1 SM	29.2%	182.5 SM	62.8%	79.3 SM
	LOT 8	170.3 SM	83.4 SM	49.0%	62.4 SM	36.6%	50.1 SM
	LOT 9	170.3 SM	83.4 SM	49.0%	62.4 SM	36.6%	50.1 SM
	LOT 10	170.3 SM	83.4 SM	49.0%	62.4 SM	36.6%	50.1 SM
	LOT 11	216.4 SM	85.1 SM	39.3%	106.8 SM	49.4%	65.5 SM
BUILDING 4	total		420.4 SM				
	LOT 12	216.5 SM	85.1 SM	39.3%	108.7 SM	43.3%	62.2 SM
	LOT 13	170.4 SM	83.4 SM	48.9%	62.4 SM	36.6%	50.1 SM
	LOT 14	170.4 SM	83.4 SM	48.9%	62.4 SM	36.6%	50.1 SM
	LOT 15	170.4 SM	83.4 SM	48.9%	62.4 SM	36.6%	50.1 SM
	LOT 16	373.4 SM	85.1 SM	40.4%	263.6 SM	70.6%	129.0 SM
BUILDING 2	total		420.4 SM				
	LOT 17	393.1 SM	102.4 SM	26.0%	169.6 SM	43.1%	145.7 SM
	LOT 18	216.5 SM	100.0 SM	46.2%	95.3 SM	44.0%	83.8 SM
	LOT 19	213.6 SM	100.0 SM	46.8%	92.3 SM	43.2%	80.8 SM
	LOT 20	210.6 SM	100.0 SM	47.5%	89.3 SM	42.4%	77.8 SM
	LOT 21	207.6 SM	100.0 SM	48.1%	86.4 SM	41.6%	74.9 SM
	LOT 22	333.0 SM	88.4 SM	26.5%	223.4 SM	67.1%	88.6 SM
	total		590.8 SM				
			2050.0 SM				

22 UNIT 2 STOREY TOWNHOUSE PROJECT

1800 SF UNIT SIZE TYP APPROX- units 1-6, units 17-21
1500 SF UNIT SIZE TYP APPROX- units 7-16

COMMON ELEMENT CONDOMINIUM WITH 22 POTLS
CURBSIDE WASTE PICKUP

LOT AREA	6207 SM
BUILDING AREA	2050 SM 33.0%
ASPHALT / CURB AREA	1481 SM
UTILITIES	100 SM
HARD/ SOFT LANDSCAPE AREA	2576 SM 41.5%
DENSITY	36 UNITS/ HA
AMENITY	SMALLEST REAR YARD IS 46.9 SM
	FRONT YARD GREATER THAN 40% LOS

2 OWNER PARKING SPACES PER UNIT
0.25 VISITOR SPACES PER UNIT PLUS 2 BARRIER FREE

1 / SP1 SITE PLAN
1:200

CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS AND JOB CONDITIONS BEFORE PROCEEDING WITH WORK.
ALL DRAWINGS MAY BE SUBJECT TO CHANGE DUE TO COMMENTS FROM MUNICIPAL DEPARTMENTS AND OTHER AGENCIES WITH AUTHORITY.
ALL DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF THE ARCHITECTS AND MUST BE RETURNED AT THE COMPLETION OF THE WORK. THE CONTRACTOR WORKING FROM DRAWINGS NOT SPECIFICALLY MARKED "FOR CONSTRUCTION" MUST ASSUME FULL RESPONSIBILITY AND BEAR COSTS FOR ANY CORRECTIONS OR DAMAGES RESULTING FROM HIS OR HER WORK.

DRAWING SETS ISSUED	No.	DATE (YY.MM.DD)
CONCEPT 1	-1	2026.04.27
CONCEPT 2	2	2026.04.30
CONCEPT 3- 2 STOREY TOWNS	3	2026.06.05
AS PER CURRENT SURVEY	4	2026.06.29
PER DRAFT GRADING	5	2026.08.04
TOWN COMMENTS	6	2026.09.23

ALL PREVIOUS ISSUES OF THIS DRAWING ARE SUPERSEDED

REVISIONS TO DRAWING	No.	DATE (YY.MM.DD)

KNYMH
ARCHITECTURE + SOLUTIONS
KNYMH INC.
BURLINGTON HEAD OFFICE
1006 SKYVIEW DRIVE • SUITE 101
BURLINGTON, ONTARIO • L7P 0V1
T 905.639.6595
CAMBRIDGE OFFICE
34 WATER STREET N. • SUITE 101
CAMBRIDGE, ONTARIO • N1R 3B1
T 519.621.8200
www.knymh.com
info@knymh.com
ONTARIO ASSOCIATION OF ARCHITECTS
PRZEMYSLAW MYSZKOWSKI
LICENCE 7984

BUILDING PERMIT NUMBER:
NOT FOR CONSTRUCTION WITHOUT PERMIT
APPLICATION FILE NUMBER:
-

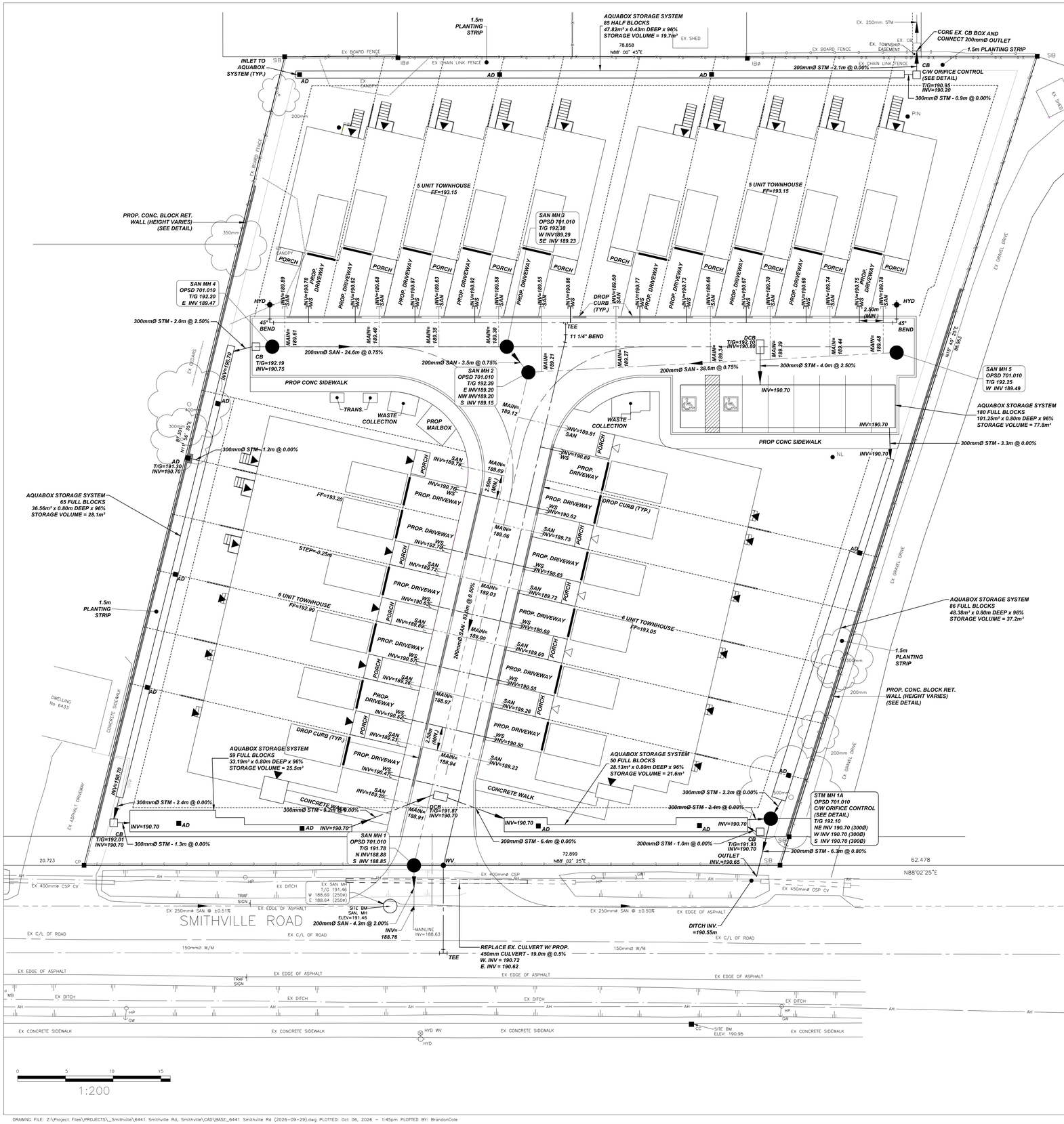
TOWNHOUSE PROJECT
6441 SMITHVILLE RD
SMITHVILLE, ONTARIO

DRAWING SHEET TITLE
SITE PLAN

AS NOTED

PROJECT NUMBER	PLOT DATE
26902	2026-09-24

DRAWING SHEET NUMBER
SP1



LEGEND

SAN	EXISTING SANITARY MAINTENANCE HOLE		EXISTING SANITARY SEWER
SAN	PROPOSED SANITARY MAINTENANCE HOLE		PROPOSED SANITARY SERVICE
PLUG	PROPOSED PLUG		EXISTING WATERMAIN
STM MH	EXISTING STORM MAINTENANCE HOLE		PROPOSED WATER SERVICE
STM MH	PROPOSED STORM MAINTENANCE HOLE		EXISTING STORM SEWER
CB	EXISTING CATCH BASIN		PROPOSED STORM SERVICE
CB	PROPOSED CATCH BASIN		PROPOSED SILT FENCE
CB	PROPOSED CATCH BASIN W/ SILT SACK		ROADWAY RESTORATION
WV	EXISTING WATER VALVE		BOULEVARD RESTORATION
CS	PROPOSED CURB STOP	C1	PIPE CROSSING LOCATION
HP	EXISTING HYDRO POLE		
GM	EXISTING GAS METER		
BF	PROPOSED BACK-FLOW PREVENTION DEVICE		
WM	PROPOSED WATER METER		
SP	PROPOSED SUMP PUMP		



KEY PLAN N.T.S.

BENCHMARK NOTE:

ELEVATION = 182.679 (CGVD28:78)
MONUMENT: 0011989U029

BISMARK CONCRETE CULVERT ALONG REGIONAL ROAD NO. 65, 3.1 KM WEST OF CHURCH, 0.9 KM EAST OF INTERSECTION WITH C.P.R., OPPOSITE POINT ON ROAD 22 M NORTHWEST OF WOODEN POLE (NO. 481), 7.3 M SOUTHWEST OF CENTRE OF ROAD , TABLET IN TOP OF CULVERT, 30 CM NORTHEAST OF SOUTHWEST END, 30 CM SOUTHEAST OF NORTHWEST FACE, AT ROAD LEVEL.

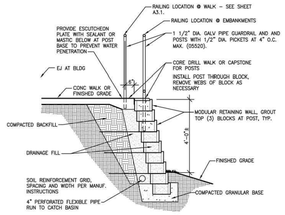
SITE BENCHMARK:

ELEVATION = 191.46m

MANHOLE ALONG THE FRONTAGE OF THE SITE, ON SMITHVILLE ROAD, AS INDICATED ON THE PLAN.

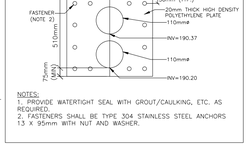
GENERAL NOTES:

1. TENDERER SHALL SATISFY THEMSELVES AS TO THE NATURE OF THE GROUND AND BID ACCORDINGLY.
2. ALL ROCK LINE INDICATIONS SHOWN ON THE PLAN MUST BE VERIFIED BY THE CONTRACTOR.
3. CONTRACTOR SHALL VERIFY LOCATIONS AND INVERTS OF ALL EXISTING SANITARY AND STORM SEWERS AND WATERMAINS, PRIVATE DRAINS AND WATER SERVICES, GAS MAINS, CABLE TV, HYDRO AND TELEPHONE DUCTS ETC AT START OF CONSTRUCTION.



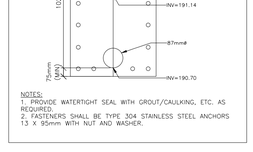
E2 SECTION DETAIL
A1.2 MODULAR RETAINING WALL
1/2"=1'-0"

ORIFICE PLATE DETAIL REAR (N.T.S.)



NOTES:
1. PROVIDE WATERTIGHT SEAL WITH GROUT/CAULKING, ETC. AS REQUIRED.
2. FASTENERS SHALL BE TYPE 304 STAINLESS STEEL ANCHORS 13 x 95mm WITH NUT AND WASHER.

ORIFICE PLATE DETAIL FRONT (N.T.S.)



NOTES:
1. PROVIDE WATERTIGHT SEAL WITH GROUT/CAULKING, ETC. AS REQUIRED.
2. FASTENERS SHALL BE TYPE 304 STAINLESS STEEL ANCHORS 13 x 95mm WITH NUT AND WASHER.

ROOFWATER LEADERS / SUMP PUMPS

ALL ROOFWATER LEADERS SHALL DISCHARGE ONTO SPLASH PADS AND THEN TO GRASSED OR LANDSCAPED AREAS A MIN. OF 0.6M FROM THE BUILDING FACE.
SUMP PUMPS WITH CHECK VALVES ARE TO BE INSTALLED IN EACH DWELLING TO PUMP THE WEEPING TILES TO THE STORM PRIVATE DRAIN. THE SUMP OUTLET SHALL EXTEND A MINIMUM OF 150mm ABOVE THE PROPOSED GRADE AT THE DWELLING (BASEMENT CEILING) PRIOR TO DISCHARGING TO THE STORM PRIVATE DRAIN.

FOUNDATION DRAINS

WEEPING TILES SHALL DRAIN TO SUMP PIT AND BE PUMPED TO STORM SEWER VIA PUMP SUMP WITH BACK-FLOW PREVENTOR (SEE DETAL). MIN ½ HP PUMP WITH BACK-UP POWER REQUIRED.

NOTES:
1. LOCATIONS OF UNDERGROUND SERVICES ARE APPROXIMATE AND MUST BE FIELD VERIFIED PRIOR TO CONSTRUCTION.
2. ANY DISCREPANCIES BETWEEN SERVICE LOCATIONS AND THESE ENGINEERING DRAWINGS MUST BE BROUGHT TO THE ATTENTION OF THE PROJECT ENGINEER.

NO:	DATE:	DESCRIPTION:
1	2026-10-06	REVISED PER UPDATED SITE PLAN
0	2026-08-07	ISSUED WITH FSR

REVISIONS

NORTH

LICENSED PROFESSIONAL ENGINEER
A. P. SMITH
100193971
2026-10-06
PROVINCE OF ONTARIO

SEAL

LandSmith ENGINEERING & CONSULTING LTD.
LANDSMITH ENGINEERING & CONSULTING LTD.
1059 UPPER JAMES STREET, SUITE 207
HAMILTON, ON L9C 3A6
ANDREW@LANDSMITHEC.COM
289-309-3632

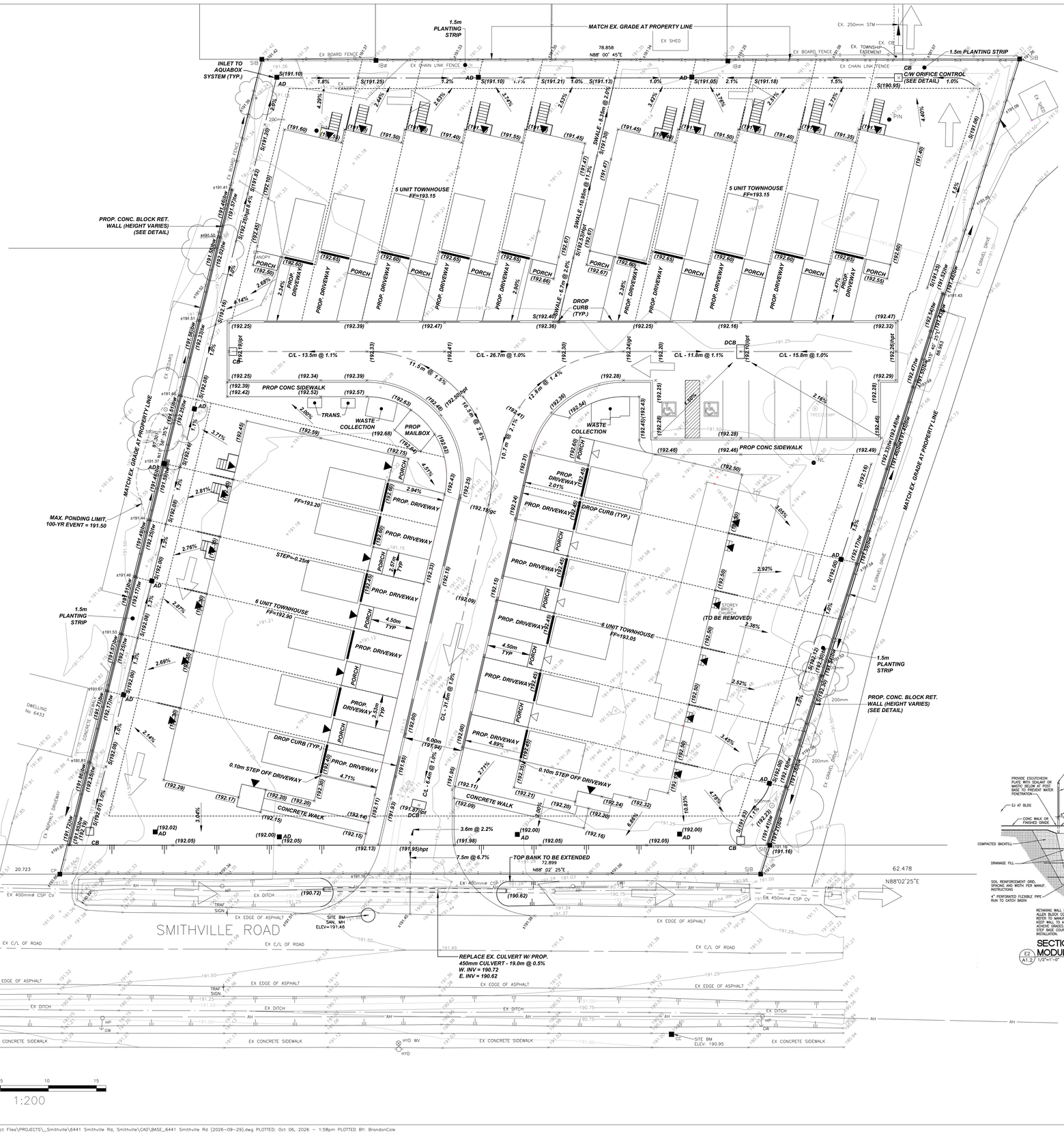
CLIENT:
RLD GROUP (SMITHVILLE ROAD) INC.

MUNICIPALITY:
TOWN OF WEST LINCOLN

PROJECT NAME:
6441 SMITHVILLE RD, SMITHVILLE

TITLE:
SITE SERVICING PLAN

SCALE: 1:200	DATE: 2026-06-25
CHECKED BY: AS	DESIGNED BY: OJ/BC
DWG No: 26037ROY	SHEET No: S1



LEGEND

- ×100.50 EXISTING ELEVATION
- ×±100.50 EXISTING ELEVATION (CALCULATED)
- 0.00% EXISTING SLOPE
- EXISTING DOWNSPOUT
- ×(100.00) PROPOSED ELEVATION
- ×(100.00) PROPOSED APRON ELEVATION
- ×S(100.00) PROPOSED SWALE ELEVATION
- 0.00% PROPOSED SLOPE
- PROPOSED DOWNSPOUT
- PROPOSED SWALE
- PROPOSED SWALE W/ SUBDRAIN
- PROPOSED SILT FENCE
- PROPOSED ENTRANCE LOCATION
- EXISTING ENTRANCE LOCATION
- (SP) PROPOSED SUMP PUMP
- OVERLAND FLOW ROUTE
- AD PROPOSED AREA DRAIN

GENERAL GRADING NOTES:

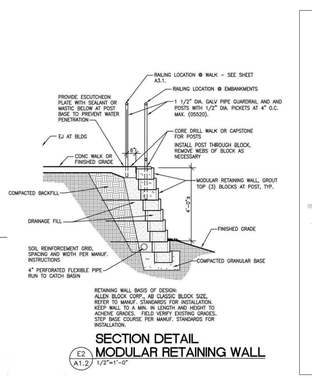
1. MATCH EXISTING GRADE AT PROPERTY / DEVELOPMENT LIMITS WITH SODDED SLOPES OF MAXIMUM 3:1 AND/OR RETAINING WALLS AS SPECIFIED.
2. SLOPES OF SWALES FOR BOTH "BACK-TO-FRONT" AND "SPLIT" DRAINAGE SHALL BE NO LESS THAN 2.0% AND NO GREATER THAN 33% (3:1).
3. MINIMUM GRADE FOR APRON "WRAP-AROUND" SWALE AT THE REAR OF THE UNIT SHALL BE 1.0%.
4. WHEN MATCHING TO EXISTING GRADE AT THE LIMITS OF THE DEVELOPMENT / PROPERTY WHERE 2.0% SLOPE CANNOT BE REASONABLY ACHIEVED A 1.5% GRADE IS PERMITTED PROVIDED A 150MM SUB-DRAIN IS INSTALLED WITH THE SWALE AS PER RD-121 AND CONNECTED TO A SUITABLE OUTLET.
5. DRIVEWAY SLOPES SHALL NOT BE LESS THAN 2.0% AND SHALL NOT BE MORE THAN 7.0%. REVERSED SLOPED DRIVEWAYS ARE NOT ALLOWED FOR ANY NEW CONSTRUCTION.
6. GARAGE FLOOR ELEVATION SHALL BE SET A MINIMUM OF 0.30M HIGHER THAN THE BACK OF WALK, UNLESS OTHERWISE SPECIFIED.
7. THE TOP OF FOUNDATION WALL FOR THE DWELLING UNIT SHALL BE A MINIMUM 150MM (6") ABOVE FINISHED GRADE.
8. UNLESS OTHERWISE NOTED, THE GROUND BETWEEN PROPOSED ELEVATIONS SHALL BE GRADED AS A STRAIGHT LINE.
9. IF GRADING IS REQUIRED ON LANDS ADJACENT TO THE PROPERTY / DEVELOPMENT WHICH ARE NOT OWNED BY THE DEVELOPER, THEN THE DEVELOPER MUST OBTAIN WRITTEN PERMISSION FROM THE ADJACENT PROPERTY OWNER, OTHERWISE RETAINING WALLS MUST BE USED.
10. ALL RETAINING WALLS SHALL BE PLACED A MINIMUM 0.45M FROM PROPERTY LINES.
11. ANY WALL OF GREATER HEIGHT THAN 1.0M MUST BE DESIGNED BY A PROFESSIONAL ENGINEER.
12. TOP OF RETAINING WALL ELEVATIONS SHALL BE SET A MINIMUM OF 150MM ABOVE THE PROPOSED SIDE-YARD SWALES.
13. RETAINING WALLS 0.60M AND HIGHER REQUIRE CONSTRUCTION OF A FENCE OR GUARD RAIL AT THE TOP OF THE WALL. SUCH FENCES OR GUARD RAILS SHALL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH THE REQUIREMENTS OF THE ONTARIO BUILDING CODE.
14. ALL FILL COMPACTED ON THE LOT(S) SHALL BE COMPACTED TO A MINIMUM 95% SPD (UNLESS OTHERWISE RECOMMENDED BY A GEOTECHNICAL ENGINEER). MATERIALS SHALL BE PLACED IN LIFTS NOT EXCEEDING 300MM DEPTH.
15. FOR DELINEATION OF TREE PROTECTION ZONES, BUFFERS, REMOVALS, AND PROTECTION SCHEMATICS REFER TO THE TREE PROTECTION PLAN (IF APPLICABLE).

BACKYARD GRADING NOTES:

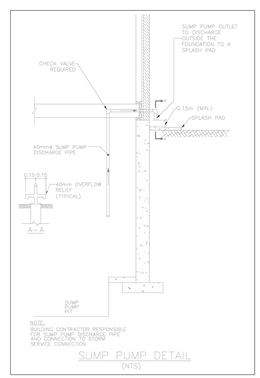
1. "REQUIRED BACKYARD" SHALL BE A MINIMUM OF 6.0 METRES UNLESS OTHERWISE DEFINED IN THE APPLICABLE ZONING BY-LAW.
2. THE MAXIMUM SLOPE IN THE BACKYARD ADJACENT TO THE BUILDING FOR A DISTANCE EQUAL TO THE REQUIRED BACKYARD SHALL BE 5% EXCEPT FOR SIDE OR REAR YARD SWALES AND RETAINING WALLS.
3. WHERE THE 5% RESTRICTION ON THE BACKYARD'S GRADES RESULTS IN ELEVATION DIFFERENCES BETWEEN ADJACENT PROPERTIES, RETAINING WALL SHALL BE CONSTRUCTED ALONG THE SIDES AND BACK OF THE LOT.
4. GENERALLY, SLOPES SHALL BE PLACED ON THE LOWER LOT, WHEREAS RETAINING WALLS SHALL BE PLACED ON THE HIGHER LANDS.
5. THE 5% RESTRICTION DOES NOT PRECLUDE RETAINING WALLS IN THE REQUIRED BACKYARDS PROVIDING THE TERRACES ARE MAINTAINED TO THE 5% GRADE AS SET OUT ABOVE, THE INTENTION OF THIS PROVISION IS TO PROVIDE FOR FLEXIBILITY OF HOUSE CONSTRUCTION.
6. BACK TO FRONT DRAINAGE SHALL ONLY BE PERMITTED WHERE THE COMBINED SIDE YARD SETBACK IS 2.0m OR MORE, PROVIDING A MINIMUM OF 2.0m BETWEEN FOUNDATION WALLS FOR DRAINAGE SWALES. A 1.2m SETBACK IS REQUIRED ON THE GARAGE SIDE OF THE LOT

SILTATION AND EROSION CONTROL NOTES:

1. SILTATION CONTROL BARRIERS SHALL BE PLACED AS DETAILED ON THE PLAN ACCORDING TO OPSD 219.110.
2. ALL SILTATION CONTROL MEASURES SHALL BE CLEANED AND MAINTAINED AFTER EACH RAINFALL EVENT TO THE SATISFACTION OF THE CITY OF ST. CATHARINES.
3. CATCH BASIN SEDIMENT CONTROL DEVICES SHALL BE SILTSACK BY ACF ENVIRONMENTAL OR APPROVED EQUIVALENT, TO BE PLACED AS PER THE MANUFACTURER'S RECOMMENDATIONS (IF APPLICABLE).
4. ADDITIONAL SILTATION CONTROL MEASURES MAY BE REQUIRED AS PER FIELD CONDITIONS AS DETERMINED BY THE CITY.



SECTION DETAIL
E2 / A1.2 MODULAR RETAINING WALL
1/2"=1'-0"



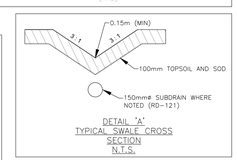
SUMP PUMP DETAIL
(NTS)

ROOFWATER LEADERS/SUMP PUMPS

ALL ROOFWATER LEADERS SHALL DISCHARGE ONTO SPLASH PADS AND THEN TO GRASSED OR LANDSCAPED AREAS A MIN. OF 0.6M FROM THE BUILDING FACE.
SUMP PUMPS WITH CHECK VALVES ARE TO BE INSTALLED IN EACH DWELLING TO PUMP THE WEEPING TILES TO THE STORM PRIVATE DRAIN. THE SUMP OUTLET SHALL EXTEND A MINIMUM OF 150mm ABOVE THE PROPOSED GRADE AT THE DWELLING (BASEMENT CEILING) PRIOR TO DISCHARGING TO THE STORM PRIVATE DRAIN

FOUNDATION DRAINS

WEEPING TILES SHALL DRAIN TO SUMP PIT AND BE PUMPED TO STORM SEWER VIA PUMP SUMP WITH BACK-FLOW PREVENTOR (SEE DETAIL). MIN. ½ HP PUMP WITH BACK-UP POWER REQUIRED.



DETAIL 'A'
TYPICAL SWALE CROSS SECTION
N.T.S.

NOTES:

1. LOCATIONS OF UNDERGROUND SERVICES ARE APPROXIMATE AND MUST BE FIELD VERIFIED PRIOR TO CONSTRUCTION.
2. ANY DISCREPANCIES BETWEEN SERVICE LOCATIONS AND THESE ENGINEERING DRAWINGS MUST BE BROUGHT TO THE ATTENTION OF THE PROJECT ENGINEER.



KEY PLAN N.T.S.

BENCHMARK NOTE:

ELEVATION = 182.679 (CGVD28:78)
MONUMENT: 0011989U029

BISMARK CONCRETE CULVERT ALONG REGIONAL ROAD NO. 65, 3.1 KM WEST OF CHURCH, 0.9 KM EAST OF INTERSECTION WITH C.P.R., OPPOSITE POINT ON ROAD 22 M NORTHWEST OF WOODEN POLE (NO. 481), 7.3 M SOUTHWEST OF CENTRE OF ROAD , TABLET IN TOP OF CULVERT, 30 CM NORTHEAST OF SOUTHWEST END, 30 CM SOUTHEAST OF NORTHWEST FACE, AT ROAD LEVEL.

SITE BENCHMARK:

ELEVATION = 191.46m

MANHOLE ALONG THE FRONTAGE OF THE SITE, ON SMITHVILLE ROAD, AS INDICATED ON THE PLAN.

GENERAL NOTES:

1. TENDERER SHALL SATISFY THEMSELVES AS TO THE NATURE OF THE GROUND AND BID ACCORDINGLY.
2. ALL ROCK LINE INDICATIONS SHOWN ON THE PLAN MUST BE VERIFIED BY THE CONTRACTOR.
3. CONTRACTOR SHALL VERIFY LOCATIONS AND INVERTS OF ALL EXISTING SANITARY AND STORM SEWERS AND WATERMAINS, PRIVATE DRAINS AND WATER SERVICES, GAS MAINS, CABLE TV, HYDRO AND TELEPHONE DUCTS ETC AT START OF CONSTRUCTION.

NO:	DATE:	DESCRIPTION:
1	2026-10-06	REVISED PER UPDATED SITE PLAN
0	2026-08-07	ISSUED WITH FSR

REVISIONS

NORTH

LICENSED PROFESSIONAL ENGINEER
A. P. SMITH
100193971
2026-10-06
PROVINCE OF ONTARIO

SEAL

LandSmith ENGINEERING & CONSULTING LTD.
LANDSMITH ENGINEERING & CONSULTING LTD.
1059 UPPER JAMES STREET, SUITE 207
HAMILTON, ON L9C 3A6
ANDREW@LANDSMITHEC.COM
289-309-3632

CLIENT:
RLD GROUP (SMITHVILLE ROAD) INC.

MUNICIPALITY:
TOWN OF WEST LINCOLN

PROJECT NAME:
6441 SMITHVILLE RD, SMITHVILLE

TITLE:
SITE GRADING PLAN

SCALE: 1:200	DATE: 2026-06-25
CHECKED BY: AS	DESIGNED BY: OJ/BC
DWG No: 26037ROY	SHEET No: G1

Appendix 'B' – Water and Wastewater Servicing Analysis

Smithville: Existing Sanitary Sewers Map

Domestic Water Demand Calculations

Fire Flow Requirement Calculations

Figure 4-6: Existing Wastewater Modelling Results (Smithville, 2023 MSP)

LandSmith
ENGINEERING & CONSULTING LTD.

Parcel B
(16 ha & 1 ha)

Parcel C
(15.7 ha)

Parcel A
(16.3 ha)

Parcel D
(11 ha)

LEGEND

- SANITARY MANHOLE AND NUMBER
- EXISTING SANITARY SEWER
- EXISTING SANITARY FORCEMAIN
- SANITARY PLUG
- URBAN AREA BOUNDARY

LAND USE

- URBAN RESIDENTIAL
- GENERAL COMMERCIAL
- INSTITUTIONAL
- INDUSTRIAL
- HAZARD
- PUBLIC PARKS
- NEW DEVELOPMENT–RESIDENTIAL
- NEW DEVELOPMENT–COMMERCIAL
- NEW DEVELOPMENT–INDUSTRIAL

0 100 200 300 400 500
metres

LAST MH # 482

TOWNSHIP OF WEST LINCOLN SANITARY SYSTEM

SMITHVILLE

WASTEWATER CONVEYANCE SYSTEM

amec

Scale 1:4000

Consultant File No. TP112128

Drawing No. SHEET B1 OF 2

P:\Work\TP112128\hwy\Sanitary dwg\Sanitary FINAL.dwg

Jun 07/13 – dina.kuvandykova

LandSmith
ENGINEERING & CONSULTING LTD.

Date: ***2026-07-22***

DOMESTIC WATER USEAGE REQUIREMENTS

Project: 6441 Smithville Road, Smithville
Method: Fixture Unit Method, Per OBC Table 7.6.3.2.A

Fixtures: The number of fixtures was estimated based on the Site Plan provided by KNYMH Inc. dated June 29, 2026.

Amount	***Fixture Type***	***Fixture Units Per***	***Total***
44	Private Bathroom Group	3.6	158.4
22	Dishwasher	1.4	30.8
22	Kitchen Sink	1.4	30.8
22	Clothes Washer	1.4	30.8
22	Hose Bibb	2.5	55.0
	Total:		***305.8***

1 - Reference Table 7.6.3.2.A, Ontario Building Code

Hydraulic Load: Fixture units are then transferred to Hydaulic Load based on Ontario Building Code Table 7.4.10.5.

Column 1	Column 2	Column 3	Column 4
Fixture Units in service	*Max Drainage Rate (Gal/m)*		
	Col. 1	Col. 1 × 10	Col. 1 × 100
100	53	174	900
90	51	164	835
80	49	153	750
70	47	140	680
60	44	128	600
50	41	115	520
40	38	102	435
30	33	88	350
20	27	72	262
10	21	53	174

Maximum hydraulic load is estimated to be 88.8 Imperial Gallons / Minute

305.8 Fixture Units = 88.8 Imp Gal/min = 6.73 L/s

The estimated maximum hydraulic load for the proposed development is 6.73 L/s.

LandSmith
ENGINEERING & CONSULTING LTD.

Date: 2026-10-07

FIRE FLOW DEMAND REQUIREMENTS

Project: 6441 Smithville Road, Smithville (BUILDING 1)
Method: Fire Underwriter's Survey:"Water Supply for Public Protection" (1999)

Formula:

$$F = 220C\sqrt{A}$$

Where:
C= construction coefficient related to the type of construction
A= total floor area in square meters for the building being considered
F = Fire-flow in liters per minute
Together with various reductions and adjustments noted on FUS pages 17-20 as per the below

Step A:

Construction Coefficient (C)

C: 1

1.5 For wood frame construction (structure essentially all combustible)
1 For ordinary construction (brick or masonry walls, combustible floor / interior)
0.8 For non-combustible construction (unprotected metal structural components, masonry or metal walls)
0.6 For fire-resistive construction (fully protected frame, floors, roof)

Step B:

AREA (A)

Ground Floor Area:	619	sq.m
Stories:	2	
Total Area:	1238	sq.m

Step C:

Fire Flow (F)

L/min	7740.75	
L/min	8000	(Rounded)
L/s	133.33	

Step D:

Occupancy Adjustment

Percentage (+/-)	-0.25	
Adjusted Fire-Flow	-2000	L/Min
	6000	L/Min

Non-Combustible	-25%
Limited Combustible	-15%
Combustible	No change
Free Burning	15%
Rapid Burning	25%

Step E:

Sprinker Adjustment

Percentage (+/-)	10%	
Adjusted Fire-flow	-800	L/min

Fully Supervised	-50%
NFPA13 System	-30%
Municipal standard water supply	-10%

Step F:

Exposure Adjustment

Percentage (+/-)	50%	
Adjusted Fire-Flow	4000	L/min

0-3m	25%
3.1 - 10m	20%
10.1 - 20m	15%
20.1 - 30m	10%
30.1 - 45m	5%
45+m	0%

	Distance (m)	% Change
North	17.5	15%
South	45+	0%
East	16.9	15%
West	9.8	20%
Total:		50%

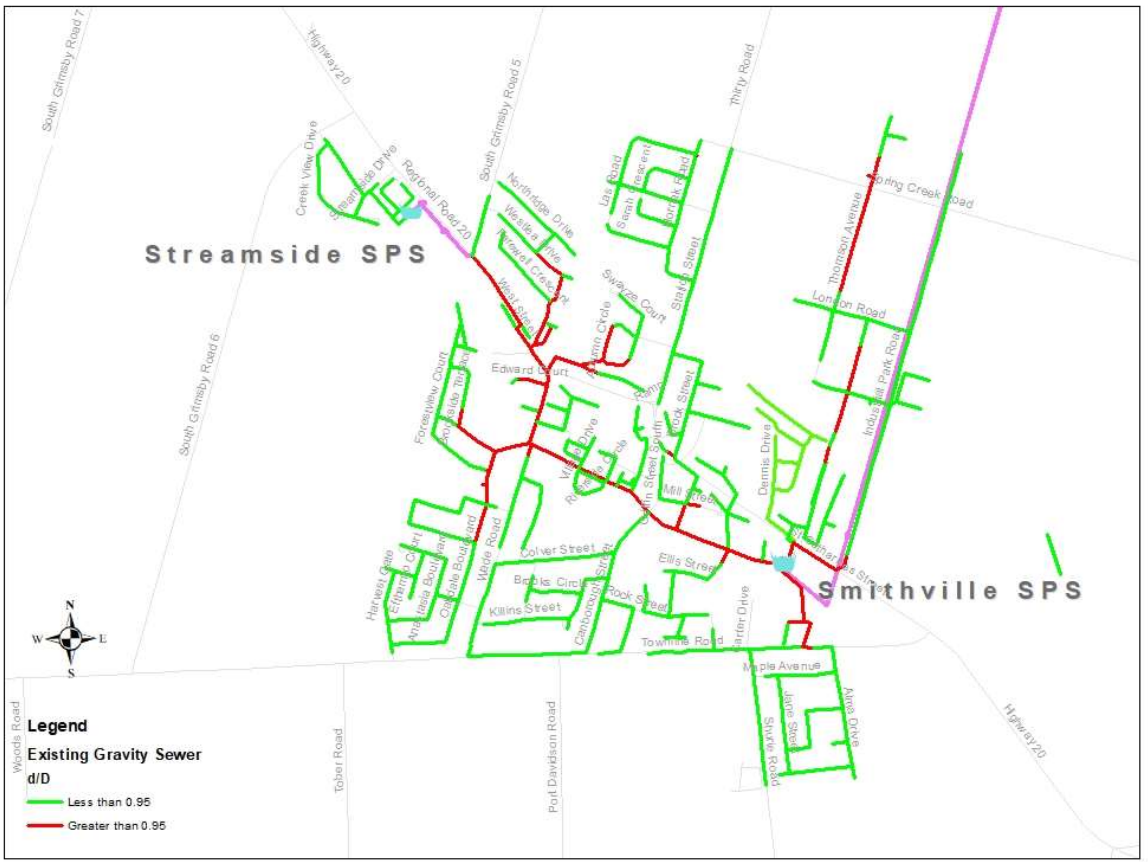
Step G:

= D + E + F

9200 L/Min

FINAL REQUIRED FIRE-FLOW: 153 L/s

Figure 4-6: Existing Wastewater Modelling Results



Appendix 'C' – SWM Analysis

Smithville Country Estates Storm Drainage Plan

Land Transfer Documents for Storm Sewer Easement between 24 and 26 Killins Street

Site Photos re Existing Catch-Basin

Pre-Development Storm Drainage Area Plan

Post-Development Storm Drainage Area Plan

MIDUSS v2 Output Files


Aquabox Design Manual

Installation Guidelines: Aquabox with StormTech Isolator Row Plus

StormTech Isolator Row Plus ETV Verification Statement

CB Shield Operations Manual and Design Chart

CB Shield ETV Verification Statement


SEE DWG. NO. 10 FOR STORM SEWER OUTLET
COLVER STREET
THOMPSON STREET
BROOKS CIRCLE
KILLINS STREET
WADE ROAD
CANBOROUGH ROAD
ROCK STREET
TOWNLINE ROAD
REGIONAL ROAD NO. 614
N
NOT FINAL
DOUGLAS G. URE & SONS
CONSULTING ENGINEERS & ONTARIO LAND SURVEYORS
66 QUEEN STREET ST. CATHARINES
SMITHVILLE COUNTRY ESTATES
TOWNSHIP OF WEST LINCOLN
TOWNSHIP OF WEST LINCOLN
APPROVED BY
DATE
STORM DRAINAGE PLAN
DATE: JULY 1974
FILE: L-93
DWG. Nº4 OF 10

Province of Ontario

Transfer/Deed of Land

Form 1 — Land Registration Reform Act, 1984

DYE & DURHAM CO. LIMITED Form No. 970

A

NR. 57253 CERTIFICATE OF RECEIPT MAR 9 - 2005 14:03 NIAGARA N. (30) ST.CATHARINES LAND REGISTRAR

ONTARIO - USE ONLY

(1) Registry ☐ **Land Titles** ☒ **(2) Page 1 of** 3 **Pages**

(3) Property Identifiers(s) **Block** **Property** **Additional: See Schedule** ☐

Part of 46052-0042 (LT)

(4) Consideration

One ---------- (00/100) ---------- **Dollars** $1.00

New Property Identifiers **Additional: See Schedule** ☐

Executions **Additional: See Schedule** ☐

Clear

(5) Description **This is a:** **Property Division** ☐ **Property Consolidation** ☐

Part of Lot 40
Registered Plan M-30
Township of West Lincoln
Regional Municipality of Niagara
Being Part 1 on Reference Plan 30R- 11371

(6) This Document Contains **(a) Redescription New Easement Plan/Sketch** ☐ **(b) Schedule for:** **Description** ☐ **Additional Parties** ☐ **Other** ☐ **(7) Interest/Estate Transferred**

Easement

(8) Transferor(s) The Transferor hereby transfers the easement to the transferee and certifies that the transferor is at least eighteen years old and that we are spouses of one another.

Name(s)		Date of Signature Y M D
Gawley, Lyle Paul	Paul Gawley	2004 07 02
Gawley, Ruthann Catherine	Ruthann Gawley	2004 07 02

(9) Spouse(s) of Transferor(s) I hereby consent to this transaction

Name (s)	Date of Signature Y M D

(10) Transferor(s) Address for Service

24 Killins St. Smithville Ontario L0R 2A0

(11) Transferee(s) **Date of Birth Y M D**

The Corporation of the Township of West Lincoln

(12) Transferee(s) Address for Service

318 Canborough Street Smithville Ontario L0R 2A0

Planning Act - OPTIONAL

(13) Transferor(s) The transferor verifies that to the best of the transferor's knowledge and belief, this transfer does not contravene section 50 of the Planning Act.

Signature **Date of Signature Y M D**

Signature **Date of Signature Y M D**

Solicitor for Transferor(s) I have explained the effect of section 50 of the Planning Act to the transferor and I have made inquiries of the transferor to determine that this transfer does not contravene that section and based on the information supplied by the transferor, to the best of my knowledge and belief, this transfer does not contravene that section. I am an Ontario solicitor in good standing.

Name and Address of Solicitor

Signature **Date of Signature Y M D**

Affix Statement by Solicitor for Transferee(s) here if necessary

(14) Solicitor for Transferee(s) I have investigated the title to this land and to abutting land where relevant and I am satisfied that the title records reveal no contravention as set out in subclause 50 (22) (c) (ii) of the Planning Act and that to the best of my knowledge and belief this transfer does not contravene section 50 of the Planning Act. I act independently of the solicitor of the transferor(s) and I am an Ontario solicitor in good standing.

Name and Address of Solicitor

Signature **Date of Signature Y M D**

(15) Assessment Roll Number of Property	Cty.	Mun.	Map	Sub.	Par.	

(16) Municipal Address of Property
24 Killins St.
Smithville, Ontario
L0R 2A0

(17) Document Prepared by:
The Larocque Group
12 Lyman Street, St. Catharines, ON L2R 5M7

OFFICE USE ONLY

Fees and Tax	
Registration Fee	70
Land Transfer Tax	
Total	

Additional Property Identifier(s) and/or Other Information

SCHEDULE

Form 5 – Land Registration Reform Act, 1984

1. The Transferor grants and transfers to the Transferee the free, uninterrupted and unobstructed right and easement in perpetuity for the Transferee and its servants, employees, agents, contractors and workers to enter, construct, install, operate, maintain, inspect, alter and repair its storm sewer line or catch basin along with all necessary appurtenances and accessories thereto, in, on, over, along, upon and under the lands described in Box (5) herein (hereinafter called "the servient lands"), and for the said purposes, the right to be enjoyed and exercised by the Transferee and its servants, agents, workmen and contractors at all times to have access to the servient lands and to bring upon the servient lands all necessary machinery, material, vehicles and equipment.

2. The Transferee shall fully indemnify and save harmless the Transferor in respect to any and all claims for damages, injury or loss of any nature, caused to any person or property resulting in any way either directly or indirectly from the granting of this easement or related works.

3. The Transferor covenants and agrees not to erect or permit the erection on the servient lands of any buildings, structures, or other obstructions of any nature whatsoever or to place or permit to be placed fill, earth or other covering or any object on the servient lands so as to obstruct or hinder the Transferee in the exercise of the rights hereby created, provided that the Transferor may erect a fence upon the boundary of the Transferor's lands. Should any such obstruction or hindrance be placed upon the servient lands, the Transferee, in addition to its other rights, may enter and remove same and shall not thereby render itself liable in damages to the Transferor.

4. The Transferor covenants with the Transferee, its successors and assigns, that they have the right to convey the easement over the said lands to the Transferee and that the Transferee shall quietly possess and enjoy the said easement. The Transferor further covenants that they will execute such further and other assurances of the said easement as may be required.

5. The burden and benefit of this transfer of easements shall run with the lands and shall extend to, be binding upon, and enure to the benefit of the parties hereto and their respective successors and assigns and is appurtenant to the storm sewer line, catch basin and other equipment owned, controlled and managed by the Transferee.

WHEREAS Instrument Number LT0205897 registered Dec. 28, 2001 is a Mortgage/Charge to ROYAL BANK OF CANADA

AND WHEREAS the Mortgagee, ROYAL BANK OF CANADA, in consideration of the sum of One ($1.00) Dollar, the receipt whereof is hereby acknowledged, joins herein for the purpose of consenting hereto and agrees to the easement hereby granted and covenants that the Transferee shall have quiet possession of the right privileges and easements hereby granted.

ROYAL BANK OF CANADA

PER: _____ ~~2004~~/ Jan 25/05
(Date of Signature)

PER: _____ 200~~4~~/ JAN 25
GAIL BERBERICK (Date of Signature

Land Transfer Tax Affidavit

Land Transfer Tax Act

Property Identifier(s) No.

46052-0042 (LT)

Refer to all instructions on reverse side.

IN THE MATTER OF THE CONVEYANCE OF (insert brief description of land) Part of Lot 40, Registered Plan M-30 , Township of West Lincoln, Regional Municipality of Niagara, Being Part 1 on Reference Plan 30R-

BY *(print names of all transferors in full)* Gawley, Lyle Paul and Gawley, Ruthann Catherine

TO *(print names of all transferees in full)* The Corporation of the Township of West Lincoln

I/We have personal knowledge of the facts herein deposed to and MAKE OATH AND SAY THAT:

1. I am/We are *(place a clear mark within the square opposite the following paragraph(s) that describe(s) the capacity of the deponents)*:
   - ☒ (a) the transferee(s) named in the above-described conveyance; Authorized on behalf of
   - ☐ (b) the authorized agent or solicitor acting in this transaction for the transferee(s);
   - ☐ (c) the President, Vice-President, Secretary, Treasurer, Director or Manager authorized to act for _____ (the transferee(s));
   - ☐ (d) a transferee and am making the affidavit on my own behalf and on behalf of *(insert name of spouse or same-sex partner)* _____ who is my spouse or same-sex partner.
   - ☐ (e) the transferor and ☐ I am tendering this document for registration and ☐ no tax is payable on registration of this document.

2. **THE TOTAL CONSIDERATION FOR THIS TRANSACTION IS ALLOCATED AS FOLLOWS:**

(a) Monies paid or to be paid in cash	$ 1.00	
(b) Mortgages (i) Assumed *(principal and interest)*	$ NIL	
(ii) Given back to vendor	$ NIL	
(c) Property transferred in exchange *(detail below in para. 5)*	$ NIL	
(d) Other consideration subject to tax *(detail below)*	$ NIL	
(e) Fair market value of the lands (see Instruction 2)	$ NIL	
(f) Value of land, building, fixtures and goodwill subject to Land Transfer Tax (Total of (a) to (e))	$ 1.00	$ 1.00
(g) Value of all chattels – items of tangible personal property which are taxable under the provisions of the *Retail Sales Tax Act*		$ NIL
(h) Other consideration for transaction not included in (f) or (g) above		$ NIL
(i) Total Consideration		$ 1.00

All blanks must be filled in. Insert "Nil" where applicable.

3. To be completed where the value of the consideration for the conveyance exceeds $400,000.00
   I have read and considered the definition of "single family residence" set out in subsection 1(1) of the Act. The land conveyed in the above-described conveyance:
   - ☐ does not contain a single family residence or contains more than two single family residences.
   - ☐ contains at least one and not more than two single family residences.
   - ☐ contains at least one and not more than two single family residences and the lands are used for other than just residential purposes. The transferee has accordingly apportioned the value of consideration on the basis that the consideration for the single family residence is $_____ and the remainder of the lands are used for _____ purposes.

> ***Note:*** *Subsection 2(1)(b) imposes an additional tax at the rate of one-half of one percent upon the value of the consideration in excess of $400,000.00 where the conveyance contains at least one and not more than two single family residences and 2(2) allows an apportionment of the consideration where the lands are used for other than just residential purposes.*

4. If consideration is nominal, is the land subject to any encumbrance? ☒ Yes ☐ No

5. Other remarks and explanations, if necessary. Charge LT205897

Sworn before me at the Township of West Lincoln
in the Regional Municipality of Niagara
this 1 day of March, 20 05
A Commissioner for taking Affidavits, etc. Joanne Sume

Signature(s)

Property Information Record

A. Describe nature of instrument: Easement

B. (i) Address of property being conveyed: *(if available)* 24 Killins St. , Smithville, ON L0R 2A0

(ii) Assessment Roll No.: *(if available)* _____

C. Mailing address(es) for future Notices of Assessment under the Assessment Act for property being conveyed: _____

D. (i) Registration number for last conveyance of property being conveyed: *(if available)* LT69694
(ii) Legal Description of property conveyed: same as in D. (i) above. ☐ Yes ☐ No ☐ Not Known

E. Name(s) and address(es) of each transferee's solicitor:

For Land Registry Office Use Only

Registration No. _____

Registration Date (Year/Month/Day) _____

Land Registry Office No. _____

School Support (Voluntary Election) **(see reverse for explanation)**

		Yes	No
(a)	Are all individual transferees Roman Catholic?	☐	☐
(b)	If Yes, do all individual transferees wish to be Roman Catholic Separate School Supporters?	☐	☐
(c)	Do all individual transferees have French Language Education Rights?	☐	☐
(d)	If Yes, do all individual transferees wish to support the French Language School Board (where established)?	☐	☐

Note: As to (c) and (d) the land being transferred will receive French Public School Board Election unless otherwise directed in (a) and (b).



Photo 1: Existing Low Area Near CB Inlet



Photo 2: Existing Concrete CB Box Visible Through Existing Fence



LEGEND

- 0.035 / 1 / 100% — DRAINAGE AREA (HECTARES); IMPERVIOUSNESS (%); DRAINAGE AREA NUMBER
- DRAINAGE AREA BOUNDARY
- OVERLAND FLOW ROUTE
- IMPERVIOUS SURFACE
- SHEET FLOW DIRECTION



KEY PLAN N.T.S.

6441 SMITHVILLE RD, SMITHVILLE

BENCHMARK NOTE:

ELEVATION = 182.679 (CGVD28:78)
MONUMENT: 0011989U029

BISMARK CONCRETE CULVERT ALONG REGIONAL ROAD NO. 65, 3.1 KM WEST OF CHURCH, 0.9 KM EAST OF INTERSECTION WITH C.P.R., OPPOSITE POINT ON ROAD 22 M NORTHWEST OF WOODEN POLE (NO. 481), 7.3 M SOUTHWEST OF CENTRE OF ROAD , TABLET IN TOP OF CULVERT, 30 CM NORTHEAST OF SOUTHWEST END, 30 CM SOUTHEAST OF NORTHWEST FACE, AT ROAD LEVEL.

SITE BENCHMARK:

ELEVATION = 191.46m

MANHOLE ALONG THE FRONTAGE OF THE SITE, ON SMITHVILLE ROAD, AS INDICATED ON THE PLAN.

GENERAL NOTES:

1. TENDERER SHALL SATISFY THEMSELVES AS TO THE NATURE OF THE GROUND AND BID ACCORDINGLY.
2. ALL ROCK LINE INDICATIONS SHOWN ON THE PLAN MUST BE VERIFIED BY THE CONTRACTOR.
3. CONTRACTOR SHALL VERIFY LOCATIONS AND INVERTS OF ALL EXISTING SANITARY AND STORM SEWERS AND WATERMAINS, PRIVATE DRAINS AND WATER SERVICES, GAS MAINS, CABLE TV, HYDRO AND TELEPHONE DUCTS ETC AT START OF CONSTRUCTION.

ROOFWATER LEADERS / SUMP PUMPS

ALL ROOFWATER LEADERS SHALL DISCHARGE ONTO SPLASH PADS AND THEN TO GRASSED OR LANDSCAPED AREAS A MIN. OF 0.6M FROM THE BUILDING FACE.
SUMP PUMPS WITH CHECK VALVES ARE TO BE INSTALLED IN EACH DWELLING TO PUMP THE WEEPING TILES TO THE STORM PRIVATE DRAIN. THE SUMP OUTLET SHALL EXTEND A MINIMUM OF 150mm ABOVE THE PROPOSED GRADE AT THE DWELLING (BASEMENT CEILING) PRIOR TO DISCHARGING TO THE STORM PRIVATE DRAIN.

FOUNDATION DRAINS

WEEPING TILES SHALL DRAIN TO SUMP PIT AND BE PUMPED TO STORM SEWER VIA PUMP SUMP WITH BACK-FLOW PREVENTOR (SEE DETAIL). MIN ½ HP PUMP WITH BACK-UP POWER REQUIRED.

NOTES:

1. LOCATIONS OF UNDERGROUND SERVICES ARE APPROXIMATE AND MUST BE FIELD VERIFIED PRIOR TO CONSTRUCTION.
2. ANY DISCREPANCIES BETWEEN SERVICE LOCATIONS AND THESE ENGINEERING DRAWINGS MUST BE BROUGHT TO THE ATTENTION OF THE PROJECT ENGINEER.

NO:	DATE:	DESCRIPTION:
0	2026-07-28	ISSUED WITH FSR

REVISIONS

NORTH

SEAL

LandSmith ENGINEERING & CONSULTING LTD.
LANDSMITH ENGINEERING & CONSULTING LTD.
1059 UPPER JAMES STREET, SUITE 207
HAMILTON, ON L9C 3A6
ANDREW@LANDSMITHEC.COM
289-309-3632

CLIENT:
RLD GROUP (SMITHVILLE ROAD) INC.

MUNICIPALITY:
TOWN OF WEST LINCOLN

PROJECT NAME:
6441 SMITHVILLE RD, SMITHVILLE

TITLE:
SITE PRE-DEVELOPMENT DRAINAGE AREA PLAN

SCALE: 1:200	DATE: 2026-06-25
CHECKED BY: AS	DESIGNED BY: OJ/BC
DWG No: 26037ROY	SHEET No: PD1

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LEGEND

- 0.035 / 1 / 100% — DRAINAGE AREA (HECTARES) / IMPERVIOUSNESS (%) / DRAINAGE AREA NUMBER
- DRAINAGE AREA BOUNDARY
- OVERLAND FLOW ROUTE
- IMPERVIOUS SURFACE
- SHEET FLOW DIRECTION



KEY PLAN N.T.S.

BENCHMARK NOTE:

ELEVATION = 182.679 (CGVD28:78)
MONUMENT: 0011989U029

BISMARK CONCRETE CULVERT ALONG REGIONAL ROAD NO. 65, 3.1 KM WEST OF CHURCH, 0.9 KM EAST OF INTERSECTION WITH C.P.R., OPPOSITE POINT ON ROAD 22 M NORTHWEST OF WOODEN POLE (NO. 481), 7.3 M SOUTHWEST OF CENTRE OF ROAD , TABLET IN TOP OF CULVERT, 30 CM NORTHEAST OF SOUTHWEST END, 30 CM SOUTHEAST OF NORTHWEST FACE, AT ROAD LEVEL.

SITE BENCHMARK:

ELEVATION = 191.46m

MANHOLE ALONG THE FRONTAGE OF THE SITE, ON SMITHVILLE ROAD, AS INDICATED ON THE PLAN.

GENERAL NOTES:

1. TENDERER SHALL SATISFY THEMSELVES AS TO THE NATURE OF THE GROUND AND BID ACCORDINGLY.
2. ALL ROCK LINE INDICATIONS SHOWN ON THE PLAN MUST BE VERIFIED BY THE CONTRACTOR.
3. CONTRACTOR SHALL VERIFY LOCATIONS AND INVERTS OF ALL EXISTING SANITARY AND STORM SEWERS AND WATERMAINS, PRIVATE DRAINS AND WATER SERVICES, GAS MAINS, CABLE TV, HYDRO AND TELEPHONE DUCTS ETC AT START OF CONSTRUCTION.

ROOFWATER LEADERS / SUMP PUMPS

ALL ROOFWATER LEADERS SHALL DISCHARGE ONTO SPLASH PADS AND THEN TO GRASSED OR LANDSCAPED AREAS A MIN. OF 0.6M FROM THE BUILDING FACE.
SUMP PUMPS WITH CHECK VALVES ARE TO BE INSTALLED IN EACH DWELLING TO PUMP THE WEEPING TILES TO THE STORM PRIVATE DRAIN. THE SUMP OUTLET SHALL EXTEND A MINIMUM OF 150mm ABOVE THE PROPOSED GRADE AT THE DWELLING (BASEMENT CEILING) PRIOR TO DISCHARGING TO THE STORM PRIVATE DRAIN.

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WEEPING TILES SHALL DRAIN TO SUMP PIT AND BE PUMPED TO STORM SEWER VIA PUMP SUMP WITH BACK-FLOW PREVENTOR (SEE DETAIL). MIN ½ HP PUMP WITH BACK-UP POWER REQUIRED.

NOTES:

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2. ANY DISCREPANCIES BETWEEN SERVICE LOCATIONS AND THESE ENGINEERING DRAWINGS MUST BE BROUGHT TO THE ATTENTION OF THE PROJECT ENGINEER.

NO:	DATE:	DESCRIPTION:
0	2026-07-28	ISSUED WITH FSR

REVISIONS

NORTH

SEAL

LandSmith ENGINEERING & CONSULTING LTD.
LANDSMITH ENGINEERING & CONSULTING LTD.
1059 UPPER JAMES STREET, SUITE 207
HAMILTON, ON L9C 3A6
ANDREW@LANDSMITHEC.COM
289-309-3632

CLIENT:
RLD GROUP (SMITHVILLE ROAD) INC.

MUNICIPALITY:
TOWN OF WEST LINCOLN

PROJECT NAME:
6441 SMITHVILLE RD, SMITHVILLE

TITLE:
SITE POST-DEVELOPMENT DRAINAGE AREA PLAN

SCALE: 1:200	DATE: 2026-06-25
CHECKED BY: AS	DESIGNED BY: OJ/BC
DWG No: 26037ROY	SHEET No: PSD2

DRAWING FILE: Z:\Project Files\PROJECTS_Smithville\6441 Smithville Rd, Smithville\CAD\BASE_6441 SMITHVILLE RD.dwg PLOTTED: Jul 28, 2026 - 4:58pm PLOTTED BY: LandS

PRE-DEVELOPMENT – AREA 1 - 5-YEAR STORM:

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"                           6441 Smithville Rd, Smithville\SWM\Pre-Dev_Hamilton"
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"     1500.000   Max. Hydrograph"
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"           1   Chicago storm"
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"        8.000   Constant B"
"        0.803   Exponent C"
"        0.500   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
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"             Total depth                 46.985    mm"
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"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         101   No description"
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"        0.344   Total Area"
"       55.000   Flow length"
"        0.700   Overland Slope"
"        0.318   Pervious Area"
"       55.000   Pervious length"
"        0.700   Pervious slope"
"        0.026   Impervious Area"
"       55.000   Impervious length"
"        0.700   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.256   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.880   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.010     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.318      0.026      0.344      hectare"
"             Time of concentration  36.155     4.366      29.155     minutes"
"             Time to Centroid       156.592    103.887    144.985    minutes"
"             Rainfall depth         46.985     46.985     46.985     mm"
"             Rainfall volume        149.34     12.28      161.63     c.m"
"             Rainfall losses        34.943     5.640      32.716     mm"
"             Runoff depth           12.041     41.344     14.268     mm"
"             Runoff volume          38.27      10.81      49.08      c.m"
"             Runoff coefficient     0.256      0.880      0.304      "
"             Maximum flow           0.009      0.007      0.010      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                     0.010     0.010     0.000     0.000"
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PRE-DEVELOPMENT – AREA 1 - 25-YEAR STORM:

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"                Company                                                 LandSmith"
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"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1719.500   Coefficient A"
"       10.000   Constant B"
"        0.823   Exponent C"
"        0.500   Fraction R"
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"        1.000   Time step multiplier"
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"        7.600   % Impervious"
"        0.344   Total Area"
"       55.000   Flow length"
"        0.700   Overland Slope"
"        0.318   Pervious Area"
"       55.000   Pervious length"
"        0.700   Pervious slope"
"        0.026   Impervious Area"
"       55.000   Impervious length"
"        0.700   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.364   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.901   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.026     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.318      0.026      0.344      hectare"
"             Time of concentration  27.449     3.778      23.450     minutes"
"             Time to Centroid       143.108    101.908    136.148    minutes"
"             Rainfall depth         68.724     68.724     68.724     mm"
"             Rainfall volume        218.44     17.97      236.41     c.m"
"             Rainfall losses        43.680     6.833      40.880     mm"
"             Runoff depth           25.044     61.891     27.844     mm"
"             Runoff volume          79.60      16.18      95.78      c.m"
"             Runoff coefficient     0.364      0.901      0.405      "
"             Maximum flow           0.024      0.010      0.026      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.026     0.026     0.000     0.000"
```

PRE-DEVELOPMENT – AREA 1 - 100-YEAR STORM:

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                    February 7, 2010"
"           10   Units used:                                              ie METRIC"
"                Job folder:            Z:\Project Files\PROJECTS\_Smithville\"
"                           6441 Smithville Rd, Smithville\SWM\Pre-Dev_Hamilton"
"                Output filename:                                  PRE_A1_100.out"
"                Licensee name:                                 Atticus Francisci"
"                Company                                                 LandSmith"
"                Date & Time last used:               2026-07-20 at 10:24:22 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     2317.400   Coefficient A"
"       11.000   Constant B"
"        0.836   Exponent C"
"        0.500   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          181.813    mm/hr"
"             Total depth                 86.135    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   No description"
"        7.600   % Impervious"
"        0.344   Total Area"
"       55.000   Flow length"
"        0.700   Overland Slope"
"        0.318   Pervious Area"
"       55.000   Pervious length"
"        0.700   Pervious slope"
"        0.026   Impervious Area"
"       55.000   Impervious length"
"        0.700   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.431   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.914   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.045     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.318      0.026      0.344      hectare"
"             Time of concentration  23.603     3.455      20.611     minutes"
"             Time to Centroid       136.913    100.847    131.556    minutes"
"             Rainfall depth         86.135     86.135     86.135     mm"
"             Rainfall volume        273.78     22.52      296.30     c.m"
"             Rainfall losses        48.995     7.366      45.831     mm"
"             Runoff depth           37.140     78.769     40.304     mm"
"             Runoff volume          118.05     20.59      138.64     c.m"
"             Runoff coefficient     0.431      0.914      0.468      "
"             Maximum flow           0.041      0.013      0.045      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.045     0.045     0.000     0.000"
```

PRE-DEVELOPMENT – AREA 2 - 5-YEAR STORM:

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                    February 7, 2010"
"           10   Units used:                                              ie METRIC"
"                Job folder:            Z:\Project Files\PROJECTS\_Smithville\"
"                           6441 Smithville Rd, Smithville\SWM\Pre-Dev_Hamilton"
"                Output filename:                                    PRE_A2_5.out"
"                Licensee name:                                 Atticus Francisci"
"                Company                                                 LandSmith"
"                Date & Time last used:               2026-07-20 at 10:26:41 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"           1   Chicago storm"
"     1049.500   Coefficient A"
"        8.000   Constant B"
"        0.803   Exponent C"
"        0.500   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          103.038    mm/hr"
"             Total depth                 46.985    mm"
"           6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         101   No description"
"        0.200   % Impervious"
"        0.299   Total Area"
"       73.000   Flow length"
"        0.840   Overland Slope"
"        0.298   Pervious Area"
"       73.000   Pervious length"
"        0.840   Pervious slope"
"        0.001   Impervious Area"
"       73.000   Impervious length"
"        0.840   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.256   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.885   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.008     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.298      0.001      0.299      hectare"
"             Time of concentration  40.569     4.899      40.324     minutes"
"             Time to Centroid       162.139    104.588    161.743    minutes"
"             Rainfall depth         46.985     46.985     46.985     mm"
"             Rainfall volume        140.20     0.28       140.48     c.m"
"             Rainfall losses        34.945     5.414      34.886     mm"
"             Runoff depth           12.040     41.570     12.099     mm"
"             Runoff volume          35.93      0.25       36.18      c.m"
"             Runoff coefficient     0.256      0.885      0.258      "
"             Maximum flow           0.008      0.000      0.008      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                     0.008     0.008     0.000     0.000"
```

PRE-DEVELOPMENT – AREA 2 - 25-YEAR STORM:

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                    February 7, 2010"
"           10   Units used:                                              ie METRIC"
"                Job folder:            Z:\Project Files\PROJECTS\_Smithville\"
"                           6441 Smithville Rd, Smithville\SWM\Pre-Dev_Hamilton"
"                Output filename:                                    PRE_A2_25.out"
"                Licensee name:                                 Atticus Francisci"
"                Company                                                 LandSmith"
"                Date & Time last used:               2026-07-20 at 10:27:23 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1719.500   Coefficient A"
"       10.000   Constant B"
"        0.823   Exponent C"
"        0.500   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          146.101    mm/hr"
"             Total depth                 68.724    mm"
"            6   025hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   No description"
"        0.200   % Impervious"
"        0.299   Total Area"
"       73.000   Flow length"
"        0.840   Overland Slope"
"        0.298   Pervious Area"
"       73.000   Pervious length"
"        0.840   Pervious slope"
"        0.001   Impervious Area"
"       73.000   Impervious length"
"        0.840   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.364   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.911   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.021     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.298      0.001      0.299      hectare"
"             Time of concentration  30.800     4.239      30.667     minutes"
"             Time to Centroid       147.324    102.538    147.101    minutes"
"             Rainfall depth         68.724     68.724     68.724     mm"
"             Rainfall volume        205.07     0.41       205.49     c.m"
"             Rainfall losses        43.685     6.112      43.610     mm"
"             Runoff depth           25.039     62.612     25.114     mm"
"             Runoff volume          74.72      0.37       75.09      c.m"
"             Runoff coefficient     0.364      0.911      0.365      "
"             Maximum flow           0.021      0.000      0.021      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.021     0.021     0.000     0.000"
```

PRE-DEVELOPMENT – AREA 2 - 100-YEAR STORM:

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                    February 7, 2010"
"           10   Units used:                                              ie METRIC"
"                Job folder:            Z:\Project Files\PROJECTS\_Smithville\"
"                           6441 Smithville Rd, Smithville\SWM\Pre-Dev_Hamilton"
"                Output filename:                                  PRE_A2_100.out"
"                Licensee name:                                 Atticus Francisci"
"                Company                                                 LandSmith"
"                Date & Time last used:               2026-07-20 at 10:28:06 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     2317.400   Coefficient A"
"       11.000   Constant B"
"        0.836   Exponent C"
"        0.500   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          181.813    mm/hr"
"             Total depth                 86.135    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   No description"
"        0.200   % Impervious"
"        0.299   Total Area"
"       73.000   Flow length"
"        0.840   Overland Slope"
"        0.298   Pervious Area"
"       73.000   Pervious length"
"        0.840   Pervious slope"
"        0.001   Impervious Area"
"       73.000   Impervious length"
"        0.840   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.431   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.918   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.035     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.298      0.001      0.299      hectare"
"             Time of concentration  26.485     3.877      26.389     minutes"
"             Time to Centroid       140.530    101.433    140.363    minutes"
"             Rainfall depth         86.135     86.135     86.135     mm"
"             Rainfall volume        257.03     0.52       257.54     c.m"
"             Rainfall losses        49.002     7.076      48.919     mm"
"             Runoff depth           37.132     79.059     37.216     mm"
"             Runoff volume          110.80     0.47       111.28     c.m"
"             Runoff coefficient     0.431      0.918      0.432      "
"             Maximum flow           0.035      0.000      0.035      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.035     0.035     0.000     0.000"
```

POST-DEVELOPMENT – AREA 1 – CONTROLLED AQUABOX ROUTING - 5-YEAR STORM:

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                    February 7, 2010"
"           10   Units used:                                              ie METRIC"
"                Job folder:            Z:\Project Files\PROJECTS\_Smithville\"
"                                     6441 Smithville Rd, Smithville\SWM\Post-Dev"
"                Output filename:                          POST_A1_5 storage.out"
"                Licensee name:                                Atticus Francisci"
"                Company                                               LandSmith"
"                Date & Time last used:                2026-07-22 at 8:03:12 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1049.500   Coefficient A"
"        8.000   Constant B"
"        0.803   Exponent C"
"        0.500   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          103.038    mm/hr"
"             Total depth                 46.985    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   No description"
"       66.500   % Impervious"
"        0.495   Total Area"
"       50.000   Flow length"
"        2.000   Overland Slope"
"        0.166   Pervious Area"
"       50.000   Pervious length"
"        2.000   Pervious slope"
"        0.329   Impervious Area"
"       50.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.256   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.875   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.093     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.166      0.329      0.495      hectare"
"             Time of concentration  24.921     3.010      5.827      minutes"
"             Time to Centroid       142.493    102.020    107.224    minutes"
"             Rainfall depth         46.985     46.985     46.985     mm"
"             Rainfall volume        77.91      154.66     232.57     c.m"
"             Rainfall losses        34.947     5.889      15.623     mm"
"             Runoff depth           12.037     41.096     31.361     mm"
"             Runoff volume          19.96      135.28     155.24     c.m"
"             Runoff coefficient     0.256      0.875      0.667      "
"             Maximum flow           0.006      0.092      0.093      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.093     0.093     0.000     0.000"
" 54          POND DESIGN"
"        0.093   Current peak flow    c.m/sec"
"        0.045   Target outflow    c.m/sec"
"        155.2   Hydrograph volume    c.m"
"          17.   Number of stages"
"      190.700   Minimum water level    metre"
```

```
"      191.500   Maximum water level    metre"
"      190.700   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                190.700     0.000     0.000"
"                190.750   0.00078    11.880"
"                190.800   0.00340    23.760"
"                190.850   0.00503    35.640"
"                190.900   0.00625    47.520"
"                190.950   0.00727    59.400"
"                191.000   0.00816    71.280"
"                191.050   0.00896    83.160"
"                191.100   0.00970    95.040"
"                191.150   0.01041   106.920"
"                191.200   0.01278   118.800"
"                191.250   0.01636   130.680"
"                191.300   0.02371   142.560"
"                191.350   0.02775   154.440"
"                191.400   0.03221   166.320"
"                191.450   0.03796   178.200"
"                191.500   0.04449   190.080"
"           3.   ORIFICES"
"                Orifice   Orifice   Orifice Number of"
"                 invert coefficie  diameter  orifices"
"                190.700     0.630    0.0870     1.000"
"                191.135     0.630    0.1400     1.000"
"                191.350     0.630    0.1500     1.000"
"             Peak outflow                 0.010    c.m/sec"
"             Maximum level              191.136    metre"
"             Maximum storage            103.500    c.m"
"             Centroidal lag               4.374   hours"
"                  0.093     0.093     0.010     0.000 c.m/sec"
```

POST-DEVELOPMENT – AREA 1 – CONTROLLED AQUABOX ROUTING - 25-YEAR STORM:

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                                    February 7, 2010"
"           10   Units used:                                            ie METRIC"
"                Job folder:            Z:\Project Files\PROJECTS\_Smithville\"
"                                    6441 Smithville Rd, Smithville\SWM\Post-Dev"
"                Output filename:                          POST_A1_25 storage.out"
"                Licensee name:                                 Atticus Francisci"
"                Company                                               LandSmith"
"                Date & Time last used:                2026-07-22 at 7:54:29 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"           1   Chicago storm"
"     1719.500   Coefficient A"
"       10.000   Constant B"
"        0.823   Exponent C"
"        0.500   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          146.101    mm/hr"
"             Total depth                 68.724    mm"
"           6   025hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         101   No description"
"       66.500   % Impervious"
"        0.495   Total Area"
"       50.000   Flow length"
"        2.000   Overland Slope"
"        0.166   Pervious Area"
"       50.000   Pervious length"
"        2.000   Pervious slope"
"        0.329   Impervious Area"
"       50.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.364   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.906   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.135     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.166      0.329      0.495      hectare"
"             Time of concentration  18.919     2.604      5.350      minutes"
"             Time to Centroid       132.391    100.290    105.693    minutes"
"             Rainfall depth         68.724     68.724     68.724     mm"
"             Rainfall volume        113.96     226.22     340.18     c.m"
"             Rainfall losses        43.710     6.461      18.940     mm"
"             Runoff depth           25.014     62.263     49.785     mm"
"             Runoff volume          41.48      204.95     246.43     c.m"
"             Runoff coefficient     0.364      0.906      0.724      "
"             Maximum flow           0.016      0.130      0.135      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                     0.135     0.135     0.000     0.000"
" 54          POND DESIGN"
"        0.135   Current peak flow    c.m/sec"
"        0.026   Target outflow    c.m/sec"
"        246.4   Hydrograph volume    c.m"
"          17.   Number of stages"
"      190.700   Minimum water level    metre"
```

```
"      191.500   Maximum water level    metre"
"      190.700   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                190.700     0.000     0.000"
"                190.750   0.00078    11.880"
"                190.800   0.00340    23.760"
"                190.850   0.00503    35.640"
"                190.900   0.00625    47.520"
"                190.950   0.00727    59.400"
"                191.000   0.00816    71.280"
"                191.050   0.00896    83.160"
"                191.100   0.00970    95.040"
"                191.150   0.01039   106.920"
"                191.200   0.01210   118.800"
"                191.250   0.01536   130.680"
"                191.300   0.02244   142.560"
"                191.350   0.02679   154.440"
"                191.400   0.03141   166.320"
"                191.450   0.03726   178.200"
"                191.500   0.04386   190.080"
"           3.   ORIFICES"
"                Orifice   Orifice   Orifice Number of"
"                 invert coefficie  diameter  orifices"
"                190.700     0.630    0.0870     1.000"
"                191.135     0.630    0.1400     1.000"
"                191.350     0.630    0.1500     1.000"
"             Peak outflow                  0.026    c.m/sec"
"             Maximum level               191.345    metre"
"             Maximum storage             153.321    c.m"
"             Centroidal lag                4.033   hours"
"                  0.135     0.135     0.026     0.000 c.m/sec"
```

POST-DEVELOPMENT – AREA 1 – CONTROLLED AQUABOX ROUTING - 100-YEAR STORM:

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                                February 7, 2010"
"           10   Units used:                                          ie METRIC"
"                Job folder:            Z:\Project Files\PROJECTS\_Smithville\"
"                                    6441 Smithville Rd, Smithville\SWM\Post-Dev"
"                Output filename:                      POST_A1_100 storage.out"
"                Licensee name:                              Atticus Francisci"
"                Company                                             LandSmith"
"                Date & Time last used:             2026-07-21 at 11:53:13 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     2317.400   Coefficient A"
"       11.000   Constant B"
"        0.836   Exponent C"
"        0.500   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          181.813    mm/hr"
"             Total depth                 86.135    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   No description"
"       66.500   % Impervious"
"        0.495   Total Area"
"       50.000   Flow length"
"        2.000   Overland Slope"
"        0.166   Pervious Area"
"       50.000   Pervious length"
"        2.000   Pervious slope"
"        0.329   Impervious Area"
"       50.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.430   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.924   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.174     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.166      0.329      0.495      hectare"
"             Time of concentration  16.269     2.382      5.021      minutes"
"             Time to Centroid       127.681    99.418     104.790    minutes"
"             Rainfall depth         86.135     86.135     86.135     mm"
"             Rainfall volume        142.83     283.53     426.37     c.m"
"             Rainfall losses        49.073     6.576      20.812     mm"
"             Runoff depth           37.062     79.559     65.323     mm"
"             Runoff volume          61.46      261.89     323.35     c.m"
"             Runoff coefficient     0.430      0.924      0.758      "
"             Maximum flow           0.028      0.164      0.174      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.174     0.174     0.000     0.000"
" 54          POND DESIGN"
"        0.174   Current peak flow    c.m/sec"
"        0.045   Target outflow    c.m/sec"
"        323.3   Hydrograph volume    c.m"
"          17.   Number of stages"
"      190.700   Minimum water level    metre"
```

```
"      191.500   Maximum water level    metre"
"      190.700   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                190.700     0.000     0.000"
"                190.750   0.00078    11.880"
"                190.800   0.00340    23.760"
"                190.850   0.00503    35.640"
"                190.900   0.00625    47.520"
"                190.950   0.00727    59.400"
"                191.000   0.00816    71.280"
"                191.050   0.00896    83.160"
"                191.100   0.00970    95.040"
"                191.150   0.01041   106.920"
"                191.200   0.01278   118.800"
"                191.250   0.01636   130.680"
"                191.300   0.02371   142.560"
"                191.350   0.02775   154.440"
"                191.400   0.03221   166.320"
"                191.450   0.03796   178.200"
"                191.500   0.04449   190.080"
"           3.   ORIFICES"
"                Orifice   Orifice   Orifice Number of"
"                 invert coefficie  diameter  orifices"
"                190.700     0.630    0.0870     1.000"
"                191.135     0.630    0.1400     1.000"
"                191.350     0.630    0.1500     1.000"
"             Peak outflow                  0.044    c.m/sec"
"             Maximum level               191.498    metre"
"             Maximum storage             189.600    c.m"
"             Centroidal lag                3.677   hours"
"                  0.174     0.174     0.044     0.000 c.m/sec"
```

POST-DEVELOPMENT – AREA 2 – CONTROLLED AQUABOX ROUTING - 5-YEAR STORM:

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"                MIDUSS created                                    February 7, 2010"
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"                                     6441 Smithville Rd, Smithville\SWM\Post-Dev"
"                Output filename:                          POST_A2_5 storage.out"
"                Licensee name:                                Atticus Francisci"
"                Company                                               LandSmith"
"                Date & Time last used:                2026-07-22 at 9:01:37 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"           1   Chicago storm"
"     1049.500   Coefficient A"
"        8.000   Constant B"
"        0.803   Exponent C"
"        0.500   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          103.038    mm/hr"
"             Total depth                 46.985    mm"
"           6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         101   No description"
"       31.700   % Impervious"
"        0.126   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.086   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.040   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.256   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.877   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.013     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.086      0.040      0.126      hectare"
"             Time of concentration  14.381     1.737      6.616      minutes"
"             Time to Centroid       129.223    100.270    111.444    minutes"
"             Rainfall depth         46.985     46.985     46.985     mm"
"             Rainfall volume        40.43      18.77      59.20      c.m"
"             Rainfall losses        34.959     5.757      25.702     mm"
"             Runoff depth           12.025     41.228     21.283     mm"
"             Runoff volume          10.35      16.47      26.82      c.m"
"             Runoff coefficient     0.256      0.877      0.453      "
"             Maximum flow           0.005      0.011      0.013      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                     0.013     0.013     0.000     0.000"
" 54          POND DESIGN"
"        0.013   Current peak flow    c.m/sec"
"        0.008   Target outflow    c.m/sec"
"         26.8   Hydrograph volume    c.m"
"          10.   Number of stages"
"      190.200   Minimum water level    metre"
```

```
"      190.630   Maximum water level    metre"
"      190.200   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                190.200     0.000     0.000"
"                190.250   0.00092     2.300"
"                190.300   0.00307     4.590"
"                190.350   0.00734     6.890"
"                190.400   0.00978     9.180"
"                190.450   0.01325    11.480"
"                190.500   0.01894    13.770"
"                190.550   0.02261    16.070"
"                190.600   0.02565    18.360"
"                190.630   0.02730    19.740"
"           2.   ORIFICES"
"                Orifice   Orifice   Orifice Number of"
"                 invert coefficie  diameter  orifices"
"                190.200     0.630    0.1100     1.000"
"                190.370     0.630    0.1100     1.000"
"             Peak outflow                  0.008    c.m/sec"
"             Maximum level               190.364    metre"
"             Maximum storage               7.522    c.m"
"             Centroidal lag                2.260   hours"
"                  0.013     0.013     0.008     0.000 c.m/sec"
```

POST-DEVELOPMENT – AREA 2 – CONTROLLED AQUABOX ROUTING - 25-YEAR STORM:

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"                MIDUSS created                                    February 7, 2010"
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"                                    6441 Smithville Rd, Smithville\SWM\Post-Dev"
"                Output filename:                          POST_A2_25 storage.out"
"                Licensee name:                                 Atticus Francisci"
"                Company                                               LandSmith"
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"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1719.500   Coefficient A"
"       10.000   Constant B"
"        0.823   Exponent C"
"        0.500   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          146.101    mm/hr"
"             Total depth                 68.724    mm"
"            6   025hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   No description"
"       31.700   % Impervious"
"        0.126   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.086   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.040   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.364   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.907   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.022     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.086      0.040      0.126      hectare"
"             Time of concentration  10.918     1.503      5.867      minutes"
"             Time to Centroid       122.329    98.833     109.723    minutes"
"             Rainfall depth         68.724     68.724     68.724     mm"
"             Rainfall volume        59.14      27.45      86.59      c.m"
"             Rainfall losses        43.721     6.371      31.881     mm"
"             Runoff depth           25.003     62.353     36.843     mm"
"             Runoff volume          21.52      24.91      46.42      c.m"
"             Runoff coefficient     0.364      0.907      0.536      "
"             Maximum flow           0.011      0.016      0.022      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.022     0.022     0.000     0.000"
" 54          POND DESIGN"
"        0.022   Current peak flow    c.m/sec"
"        0.008   Target outflow    c.m/sec"
"         46.4   Hydrograph volume    c.m"
"          10.   Number of stages"
"      190.200   Minimum water level    metre"
```

```
"      190.630   Maximum water level    metre"
"      190.200   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                190.200     0.000     0.000"
"                190.250   0.00092     2.300"
"                190.300   0.00307     4.590"
"                190.350   0.00734     6.890"
"                190.400   0.00978     9.180"
"                190.450   0.01325    11.480"
"                190.500   0.01894    13.770"
"                190.550   0.02261    16.070"
"                190.600   0.02565    18.360"
"                190.630   0.02730    19.740"
"           2.   ORIFICES"
"                Orifice   Orifice   Orifice Number of"
"                 invert coefficie  diameter  orifices"
"                190.200     0.630    0.1100     1.000"
"                190.370     0.630    0.1100     1.000"
"             Peak outflow                 0.016    c.m/sec"
"             Maximum level              190.474    metre"
"             Maximum storage             12.569    c.m"
"             Centroidal lag               2.159   hours"
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```

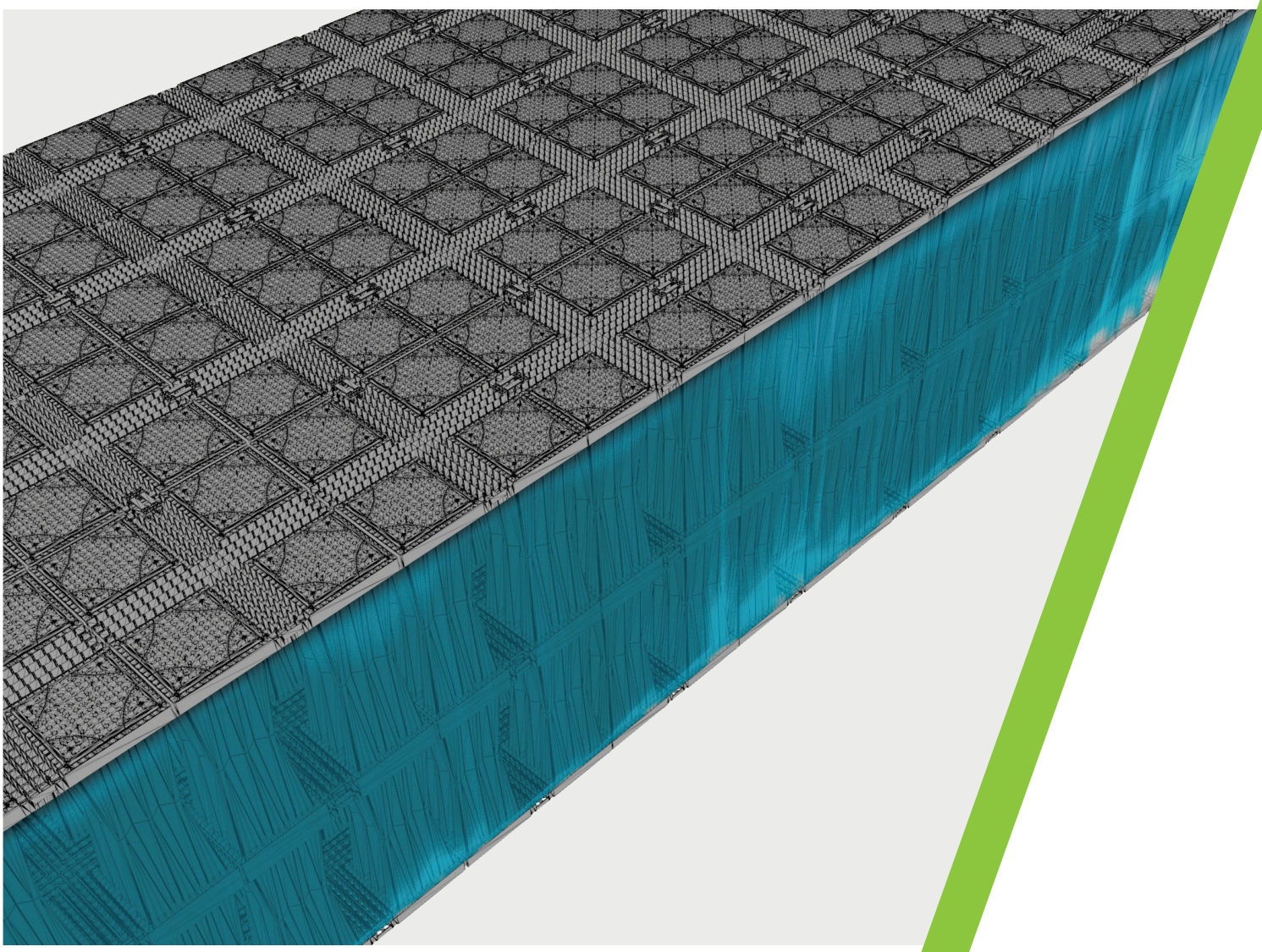
POST-DEVELOPMENT – AREA 2 – CONTROLLED AQUABOX ROUTING - 100-YEAR STORM:

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"     2317.400   Coefficient A"
"       11.000   Constant B"
"        0.836   Exponent C"
"        0.500   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          181.813    mm/hr"
"             Total depth                 86.135    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   No description"
"       31.700   % Impervious"
"        0.126   Total Area"
"       20.000   Flow length"
"        2.000   Overland Slope"
"        0.086   Pervious Area"
"       20.000   Pervious length"
"        2.000   Pervious slope"
"        0.040   Impervious Area"
"       20.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.429   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.919   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.032     0.000     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           0.086      0.040      0.126      hectare"
"             Time of concentration  9.388      1.374      5.394      minutes"
"             Time to Centroid       118.999    98.054     108.560    minutes"
"             Rainfall depth         86.135     86.135     86.135     mm"
"             Rainfall volume        74.13      34.40      108.53     c.m"
"             Rainfall losses        49.155     6.968      35.782     mm"
"             Runoff depth           36.980     79.167     50.353     mm"
"             Runoff volume          31.82      31.62      63.44      c.m"
"             Runoff coefficient     0.429      0.919      0.585      "
"             Maximum flow           0.018      0.019      0.032      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.032     0.032     0.000     0.000"
" 54          POND DESIGN"
"        0.032   Current peak flow    c.m/sec"
"        0.035   Target outflow    c.m/sec"
"         63.4   Hydrograph volume    c.m"
"          10.   Number of stages"
"      190.200   Minimum water level    metre"
```

```
"      190.630   Maximum water level    metre"
"      190.200   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                190.200     0.000     0.000"
"                190.250   0.00092     2.300"
"                190.300   0.00307     4.590"
"                190.350   0.00734     6.890"
"                190.400   0.00978     9.180"
"                190.450   0.01325    11.480"
"                190.500   0.01894    13.770"
"                190.550   0.02261    16.070"
"                190.600   0.02565    18.360"
"                190.630   0.02730    19.740"
"           2.   ORIFICES"
"                Orifice   Orifice   Orifice Number of"
"                 invert coefficie  diameter  orifices"
"                190.200     0.630    0.1100     1.000"
"                190.370     0.630    0.1100     1.000"
"             Peak outflow                 0.023    c.m/sec"
"             Maximum level              190.561    metre"
"             Maximum storage             16.583    c.m"
"             Centroidal lag               2.102   hours"
"                  0.032     0.032     0.023     0.000 c.m/sec"
```

Aquabox Design Manual

Modular System For Stormwater Management

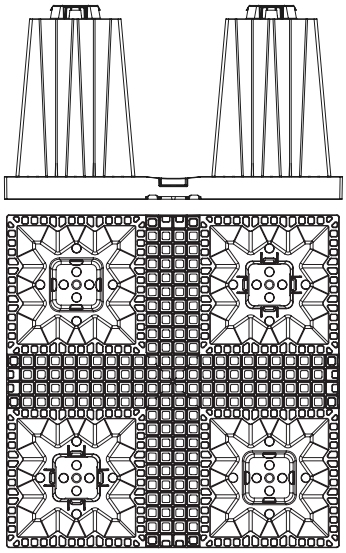


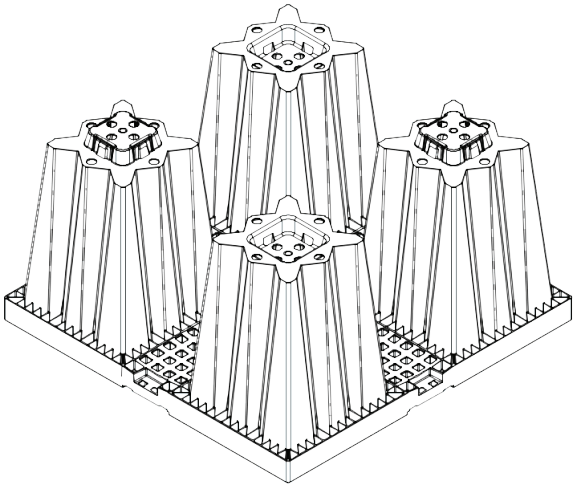
1.0 Aquabox System

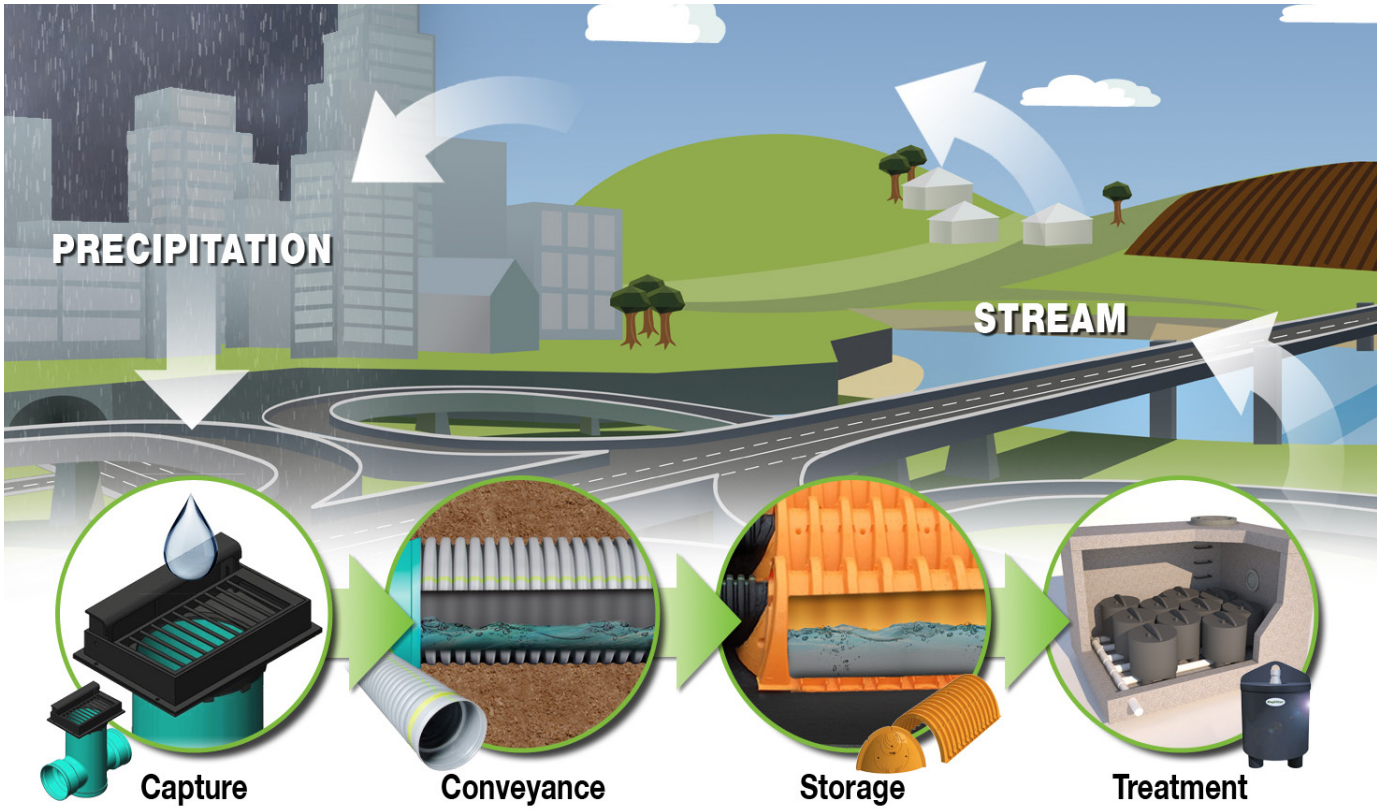
1.1 Purposes and Functions

Heavy rainfalls combined with the expansion of urban impervious surfaces are showing the need for efficient and sustainable stormwater management solutions.

The Aquabox storage system offers several solutions, suitable for varying stormwater management requirements using both detention and retention techniques. Stormwater detention with a controlled release to the watershed and/or receiving waters helps to mitigate the potential negative impacts by helping to reduce flooding and degraded water quality during heavy rainfall events. In short, the Aquabox system offers a wide range of solutions capable to addressing the specific needs of a development project.







1.2 Brief Description

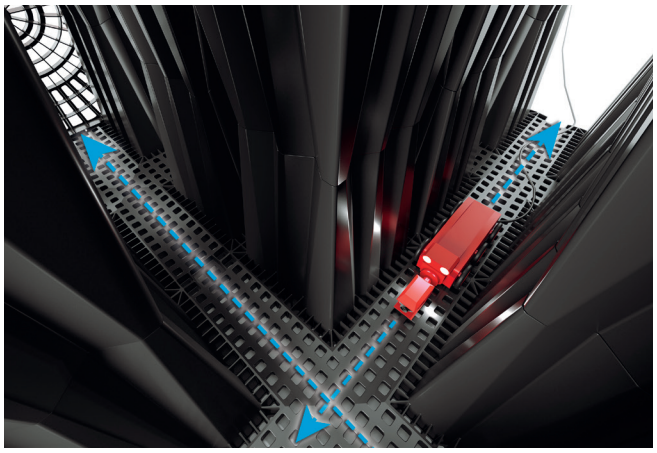
Aquabox is a modular system with a truncated pyramid structure made of recycled polypropylene with glass additive. It is designed to create an underground storage system for stormwater management.

Aquabox is used for the control of rainwater and to reduce possible flooding created by the increase of urban areas. It creates infiltration, detention or harvesting, which enhances water by reusing it.

The modules are assembled on site and installed. The modules are interlocked by means of special connectors that guarantee the stability of the tank. Aquabox has high mechanical resistance, so it can be installed both in urban areas and in industrial / commercial areas where there is an intense transit of heavy vehicles.

Aquabox modules are designed and produced to the requirements of ASTM F3754. Below is the technical data for the single Aquabox module (1 Aquabox = 2 pieces).

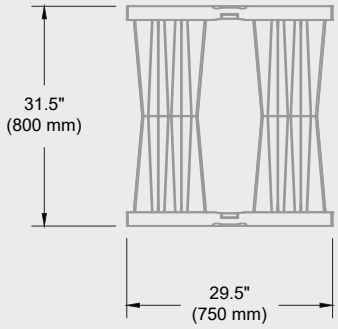
Aquabox allows one to store up to 15.24 ft^3 (0.4 m^3) of rainwater per module, thanks to its very high porosity of 96%. The Aquabox maintenance row traps suspended sediments near the inlet for easy inspection and maintenance.

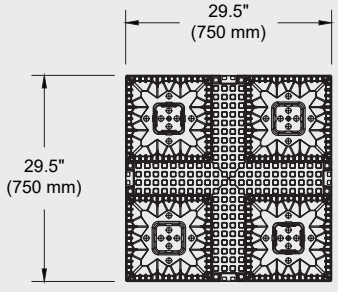


Module dimensions of Aquabox

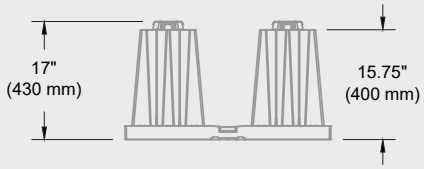
Aquabox is designed for the passage of heavy vehicles, load class HS20. The basin is equipped with access points for inspection and cleaning of the basin.

Dimensions	29.5” x 29.5” x 31.5” (750 x 750 x 800 mm)
Weight	45 lbs (20.4 kg)
Material	Recycled polypropylene with glass additive
Net volume	15.24 ft^3 (0.43 m^3)
Porosity	96%
Pallet Size	31.5” x 60.0” x 101.6” (800 x 1520 x 2580 mm)
Number of pieces per pallet	80

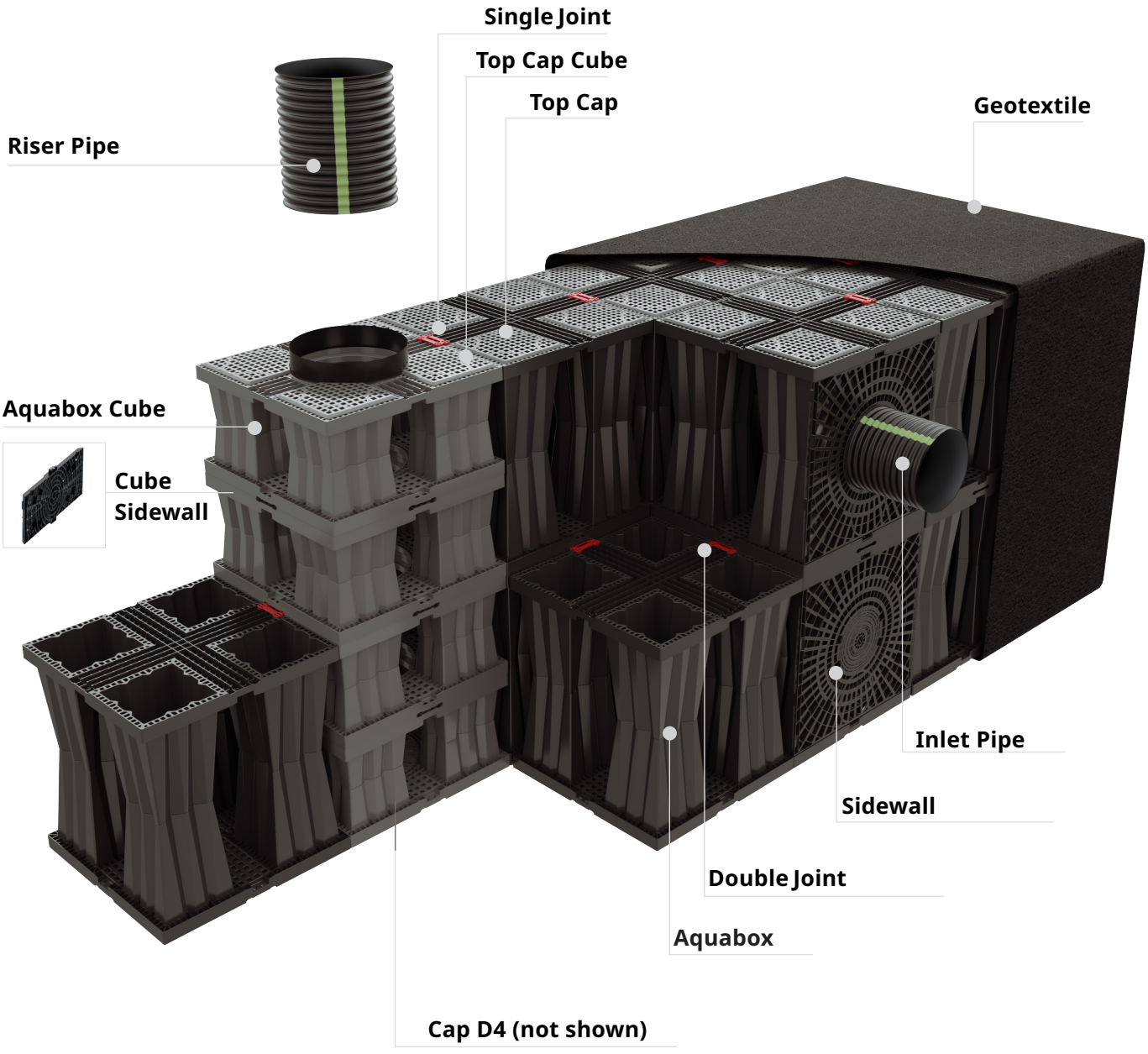




Half Module



1.3 Overview


Single Joint
Top Cap Cube
Top Cap
Geotextile
Riser Pipe
Aquabox Cube
Cube
Sidewall
Inlet Pipe
Sidewall
Double Joint
Aquabox
Cap D4 (not shown)

Installation Guidelines:
Aquabox with StormTech® Isolator Row Plus

Overview

Aquabox modules & StormTech chambers are both high-end stormwater retention products with dynamic installation configurations. This document outlines the necessary procedures to safely & effectively install a StormTech Isolator Row Plus within the envelope of an Aquabox stormwater management system.

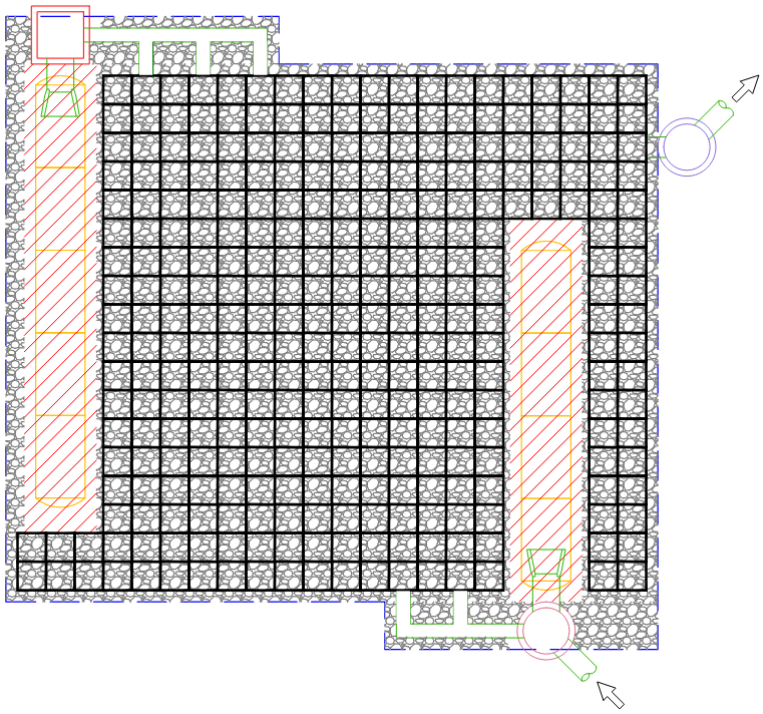
Installation Guidelines

Installation procedures vary based on site-specific constraints, however methods described below are recommended for safety & adequacy of installation.

Prior to installation of the Aquabox modules & StormTech chambers, establishing a stable base for the system is paramount. Begin by preparing the subgrade and base stone as detailed in the *Aquabox Installation Guide* and further within this document.

This document first covers standard base stone preparation before identifying two methods for product installation. These two installation methods are specific to the example system shown below.

Figure 1: Example Aquabox system with StormTech Isolator Row Plus.



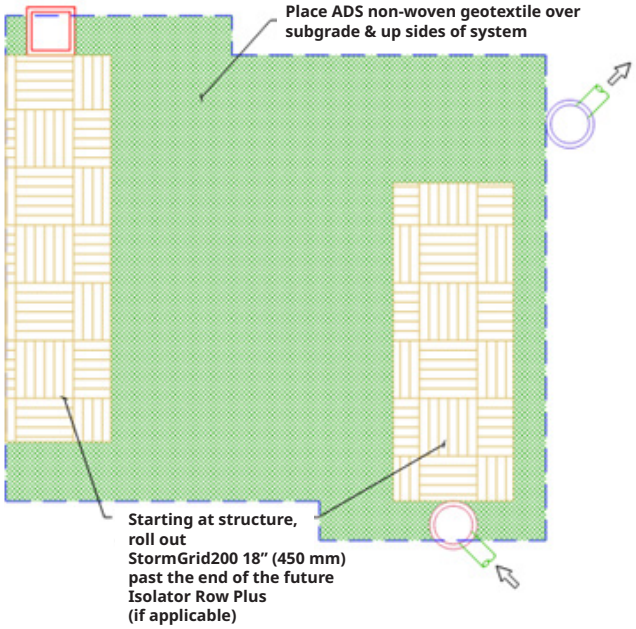
Preliminary Installation Steps

Proper preparation of the subgrade & base stone layer is an integral component of a functional system installation.

1. After preparing the subgrade, install the nonwoven geotextile (and liner, if applicable) around the excavation limits.

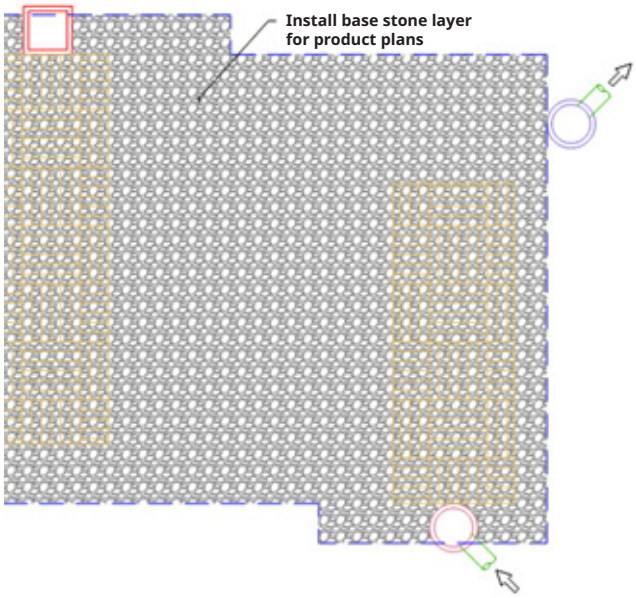
    a. **DC-780 only**: Before installation of the base stone layer, identify locations where an Isolator Row Plus will be placed. Starting at the structure, roll out StormGrid200 to the end of the row, plus an additional 18" (450 mm). *This step is not required of systems using SC-310 chambers.*

Figure 2.1: Placement of non-woven and StormGrid geotextile.



2. Install the base stone layer in accordance with the project plans & Aquabox Installation Guide.

Figure 2.2: Installation of base stone layer.



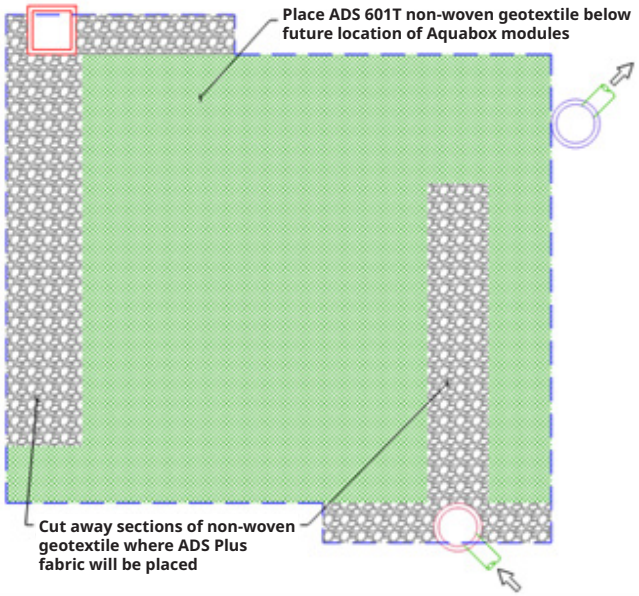
3A: Optional

Following installation of base stone, place ADS 601T non-woven geotextile over the base stone layer, in locations where Aquabox modules will be placed

a. Identify locations where an Isolator Row Plus will be placed, and cut & remove the non-woven geotextile from these areas.

b. Non-woven geotextile directly below the Isolator Row will hinder hydraulic performance.

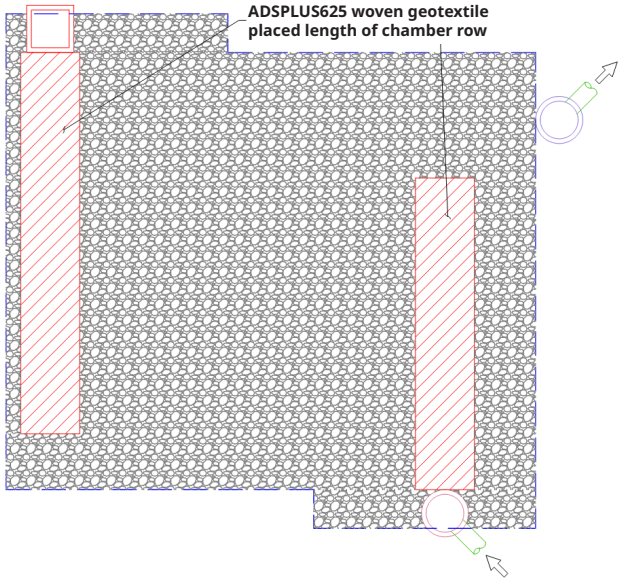
Figure 2.3: Placement of non-woven below modules if specified by engineer of record. Non-woven is removed where ADS Plus will be installed.



Note: ADS standards do not require non-woven geotextile to be place between modules and base stone but may be included if specified by the engineer of record

3B: In future Isolator Row Plus locations, roll out ADS Plus geotextile the length of the chamber row.

Figure 2.4: Placement of ADS Plus geotextile where StormTech Isolator Row Plus will be installed.

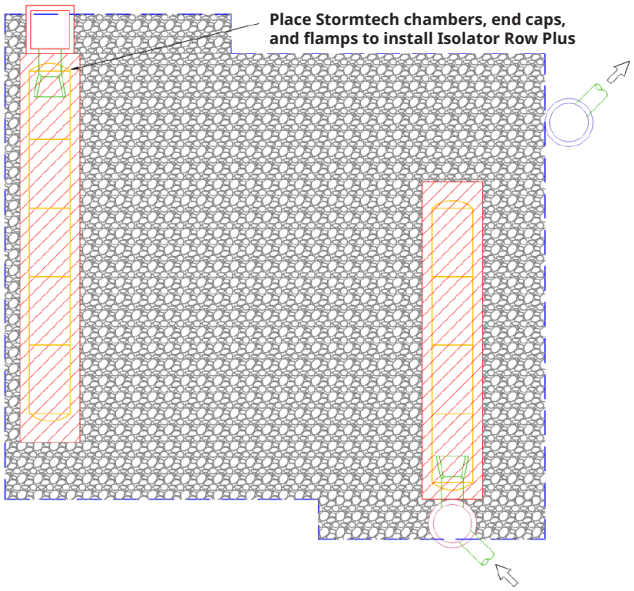


Option 1: Starting with Isolator Row Plus (Recommended)

Assembly of subsurface retention systems often begins with placement of inlet & outlet structures, establishing landmarks to be used during construction. For this reason, installation starting at a structure can be desirable. For installations starting at inlet structures, StormTech chambers are installed first.

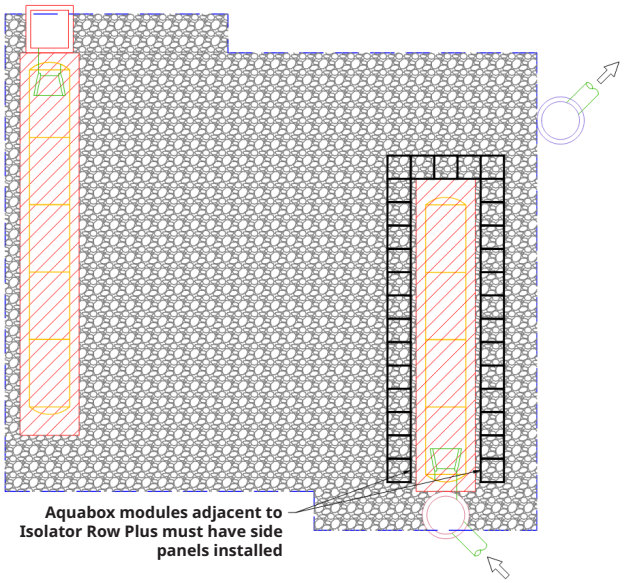
1. Place entire row of chambers, terminating with end caps once completed. Ensure the geotextile is extending beyond the feet of the chamber on both sides, and past both end caps at either end of the row.

Figure 3.1: Installation of Isolator Row Plus.



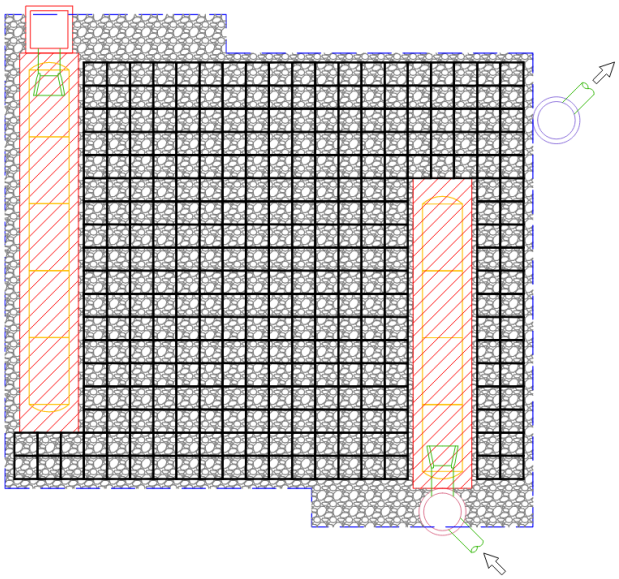
2. Once Isolator Row Plus components are installed, begin placement of Aquabox modules. Adequate spacing is required between the Aquabox modules & StormTech chambers.
   a. Spacing must be ≥300 mm (12”) between the StormTech chamber/end cap and Aquabox module.
   b. Remember that modules adjacent to the Isolator Row Plus must have side panels installed. It is recommended to assemble each module with its side panel and then shift into place next to the Isolator Row Plus.

Figure 3.2: Installation of adjacent Aquabox modules with side panels.



3. Complete installation by assembling remaining Aquabox modules & system components in accordance with the Aquabox Installation Guide.

Figure 3.3: Installation of remaining Aquabox modules.

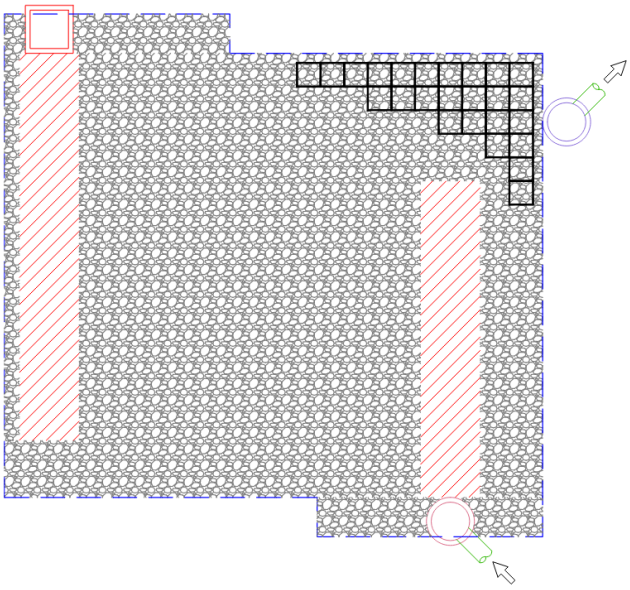


Option 2: Starting with Aquabox

An alternate installation method can be starting in one section of a system & building toward the inlet structures. This method includes near-complete installation of all Aquabox modules, followed by installation of the StormTech chambers in the spaces left behind.

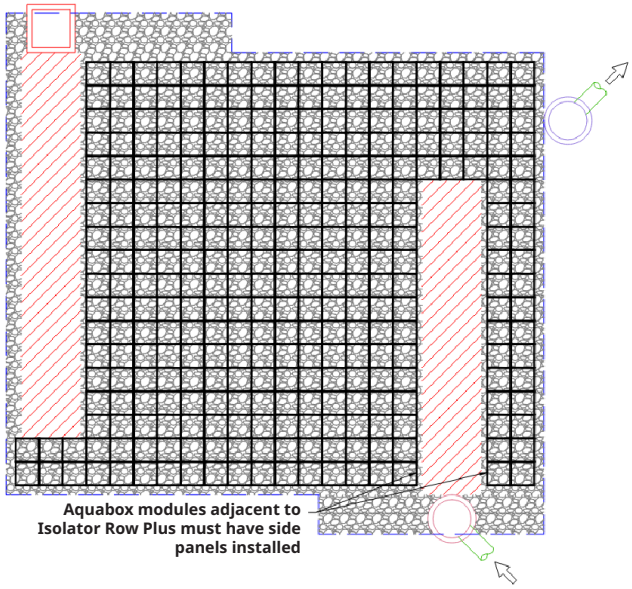
1. Begin installation of Aquabox modules at the perimeter of the system, filling in per the project drawings until all modules are installed.
    a. Note: This installation method requires precision to ensure adequate space is left for the StormTech chambers.

Figure 4.1: Installation of Aquabox modules starting at perimeter.



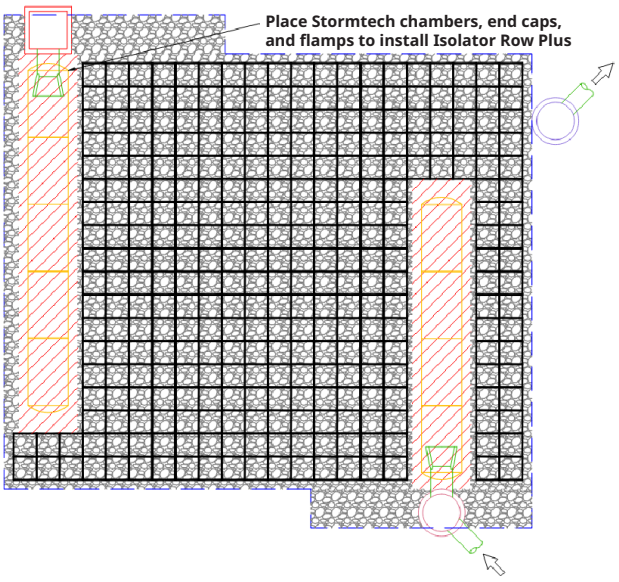
2. Complete Aquabox installation, ensuring ample space remains for StormTech Isolator Row Plus.
    a. Ensure that Aquabox modules adjacent to the Isolator Row Plus have side panels installed.

Figure 4.2: Completed Aquabox module installation, leaving room for Isolator Row Plus chambers.



3. Install Isolator Row Plus chambers on ADSPLUS geotextile.
    a. Install chambers starting with farthest from structure. Also install farthest end cap at this time.
    b. Spacing must be ≥ 300 mm (12”) between the StormTech chamber/end cap and Aquabox module.
    c. Continue installing toward inlet structure until Isolator Row Plus is installed.

Figure 4.3: Installation of the Isolator Row Plus.



4. Complete installation of system components in accordance with the *Aquabox Installation Guide.*

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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.

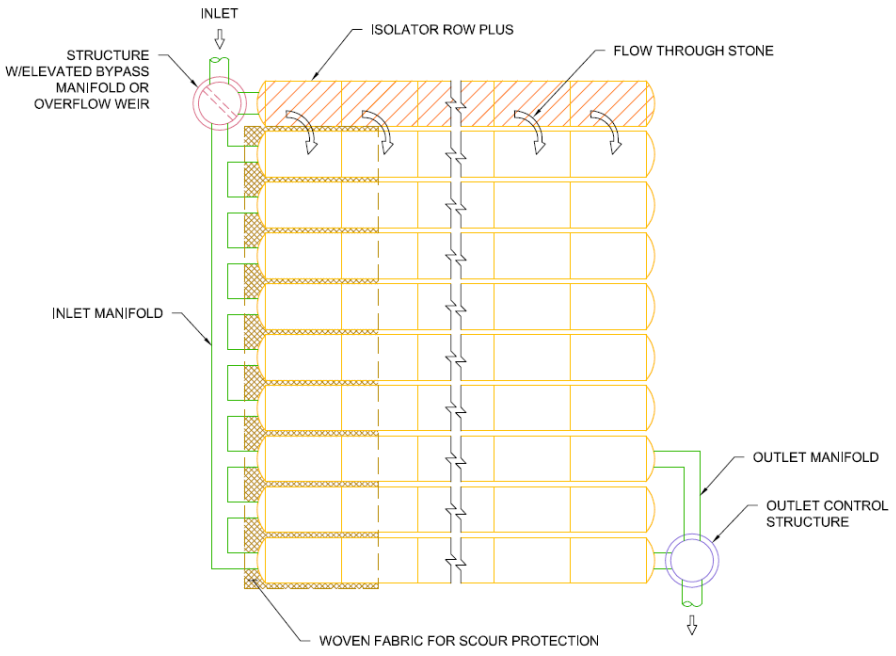


Figure 1: Schematic of the StormTech Isolator® Row PLUS System

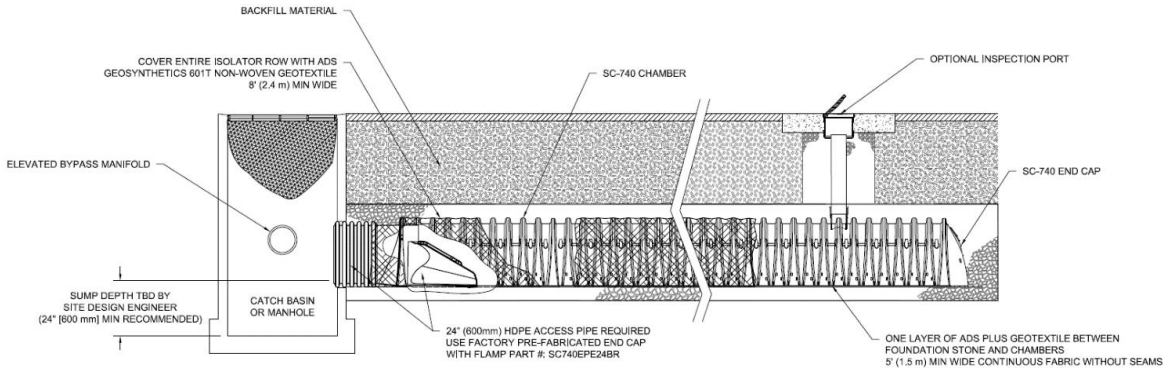


Figure 2: Isolator® Row PLUS Detail

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).

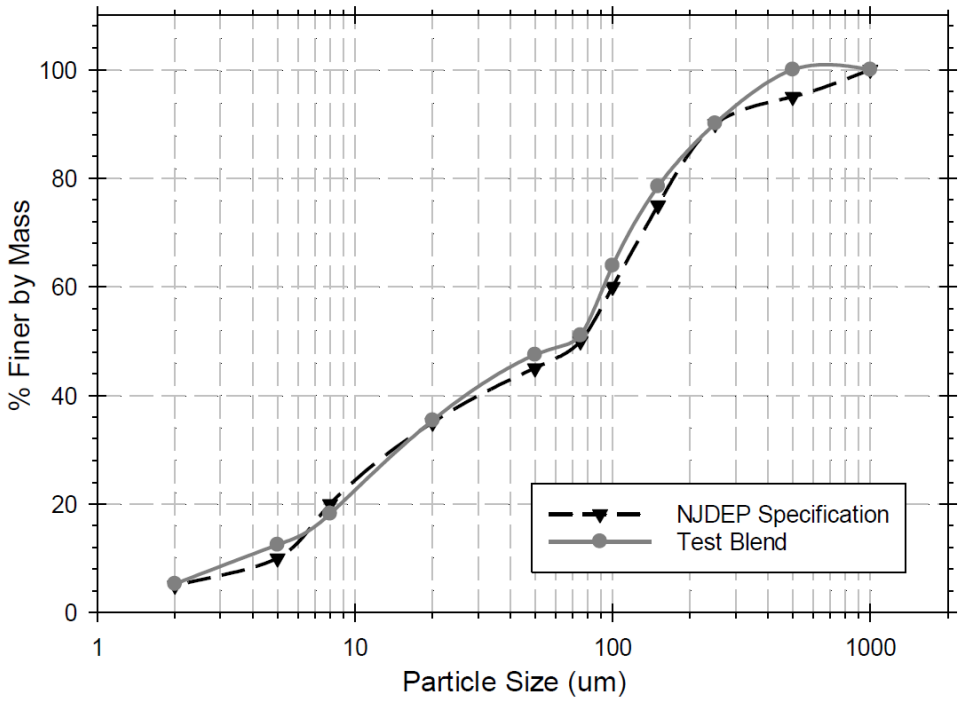


Figure 4– Particle Size Distribution (PSD)

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.

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Signed for StormTech: *Original signed by:* *Greg Spires* Greg Spires, P.E. General Manager	Signed for VerifiGlobal: *Original signed by:* *Thomas Bruun* Thomas Bruun, Managing Director *Original signed by:* *John Neate* John Neate, Managing Director

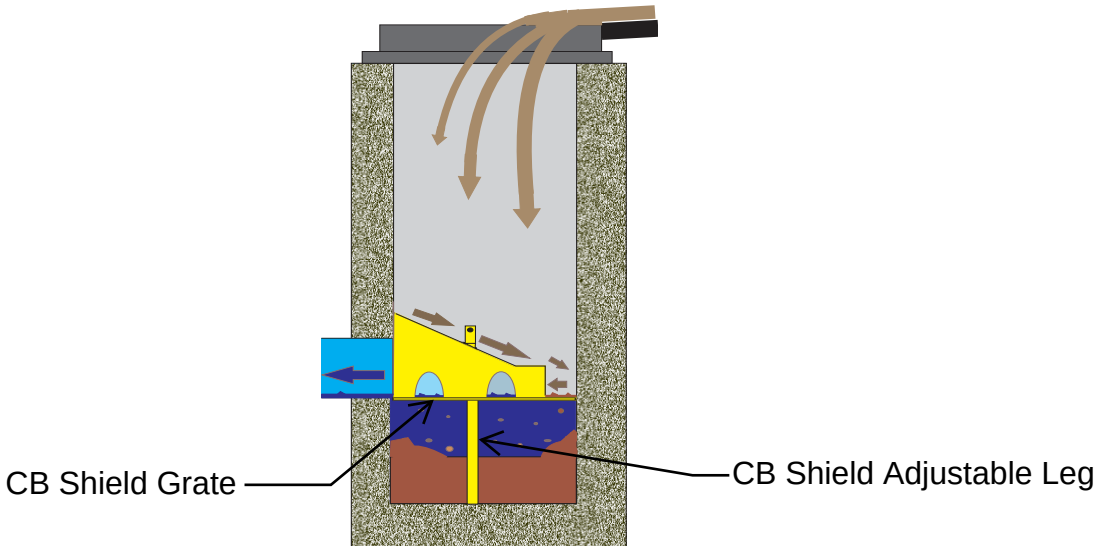
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CB Shield Operations Manual

Installing CB Shield

It is important the catch basin frame and cover is aligned properly with the catch basin below
If it is misaligned it may be difficult to install the CB Shield insert
Determine the depth of the sump (i.e. the distance from the invert of the outlet pipe to the bottom of the catch basin). If the catch basin is in service the sump depth will be the depth of the water. The grate section of the CB Shield insert should be the same elevation as the water depth in the sump.



Adjust the leg of the CB Shield to achieve the appropriate elevation
The CB Shield is lowered into place with the rope attached to the top of the leg. The high side of the sloped plate should face the wall with the outlet pipe. (The incoming water should be directed to the wall furthest from the outlet)
The flexible plastic skirt around the outer edges of the CB Shield insert may interfere with some misaligned frame and grates. If so a slice can be cut into the skirt with a utility knife at the point of interference.
Make sure the grate is at the desired level or remove CB Shield and re-adjust the leg length.

Inspecting a CB Shield Enhanced Catch Basin

Open grate
A lifting rope is attached to the top of the centered leg of the CB Shield insert. Lift and remove the insert.
Inspect CB Shield for any possible damage. Quite often leaves will accumulate on the grate. This can actually improve the Shield's ability to capture sediment and assist in preventing leave litter from being washed down stream.
Use a Sludge Judge to measure the sediment depth in 4 - 6 locations of the sump.
If the sediment depth is 300mm – 600mm deep it is recommended that the unit be cleaned.

Cleaning a CB Shield Enhanced Catch Basin

Open grate and remove CB Shield with lift rope.
Clean catch basin as usual with a Vacuum truck.
Clean CB Shield (if needed) and re-install into catch basin.
If there is any significant damage to a CB Shield please send a picture and its location to CB Shield Inc. (info@cbshield.com).

Average Annual Sediment Removal Rates (%) using a CB Shield (based on ETV Sediment - 1 to 1000 micron Particle Size Distribution)

Area to CB (ha)	Imperviousness[1] (%)					
	20%	35%	50%	65%	80%	100%
0.02	57%	57%	57%	57%	56%	56%
0.05	56%	56%	56%	55%	55%	54%
0.10	56%	55%	54%	53%	52%	51%
0.20	54%	53%	51%	49%	48%	46%
0.30	53%	50%	48%	46%	45%	43%
0.40	51%	48%	46%	44%	42%	40%
0.50	50%	47%	44%	42%	40%	38%
0.60	49%	45%	43%	40%	39%	36%

Notes:

1. Runoff Coefficient 'C' is approximately equal to 0.05 + 0.9*Impervious Fraction.
2. Above chart is based on long term continuous hydrologic analysis of Toronto, Ontario (Bloor St) rainfall data.
3. Assumes 0.6 m sump in CB and that maintenance is performed (i.e. CB cleaning) when required by sediment/pollutant build-up or otherwise.
4. See accompanying chart for suggested maintenance scheduling - AND - get CB Shield Inc. to monitor it for you in field.
5. Sediment/Pollutant removal rates based on third party certified laboratory testing using ETV sediment (PSD analysis available on request).
6. See additional discussion regarding scour protection from CB Shield during more infrequent runoff events.

◆ Verification Statement ◆ Verification Statement ◆ Verification Statement ◆

VERIFICATION STATEMENT

GLOBE Performance Solutions

Verifies the performance of

CB Shield® Stormwater Quality Device

Developed by CB Shield Inc.
Oakville, Ontario, Canada

Registration: GPS-ETV_VR2022-10-31

In accordance with

ISO 14034:2016

Environmental Management —
Environmental Technology Verification (ETV)

John D. Wiebe, PhD
Executive Chairman
GLOBE Performance Solutions

October 31, 2022
Vancouver, BC, Canada

Verification Body
GLOBE Performance Solutions
404 – 999 Canada Place | Vancouver, B.C | Canada |V6C 3E2

Technology description and application

The CB Shield® technology provides an environmental benefit of controlling sediment wash off at upstream locations. A standard catch basin has a 1.2 m waterfall inflow that churns up sediment in the sump below causing a very poor rate of sediment retention. The CB Shield is a flow deflection device that is inserted into a standard catch basin. It contains a sloped plate to direct runoff to the back wall of the catch basin, thereby dissipating the energy of stormwater inflows. The dissipation of inflow energy allows time for settling of sediment in stormwater runoff, increasing capture and reducing scour/ re-suspension of previously deposited sediment. Installation involves lowering the unit into a standard sized catch basin, and adjusting the height of the unit to the height of the permanent pool in the sump. The unit is manufactured with durable fiberglass requiring little maintenance and is estimated to be operated on the same cleanout schedule set for the catch basin. Due to high rates of scour in a standard catch basin, they are seldom filled beyond 40% of sump capacity. Clean out routines and expenses are optimized when the CB Shield captures and retains more sediment within the sump.

In an urban setting, there are typically approximately 5 catch basins installed per hectare. Assuming an equal distribution of overland flow, the tested flow rates for the scour and capture tests are meaningful in the context of 78 L/s per hectare and 42 L/s per hectare, respectively. The CB Shield's scour prevention performance has been evaluated in a laboratory setting relative to a standard unshielded catch basin for flows of 1.2 to15.6 L/s. The device's sediment capture performance was evaluated for flows of 0.24 to 8.4 L/s. Hydraulically, the CB Shield has been tested to pass flows up to 60 L/s without any negative impacts (i.e., surcharging).

Performance conditions

Claim 1: Capture test

The capture test is carried out in a laboratory with a constructed simulated street scape (1 % slope along its 2.4 m (96 inch) length, 2 % slope along its 1.2 m (48 inch) width). The catch basin was clean of any litter or debris. Capture performance was tested by comparing the mass of retained sediment with the influent sediment mass for each of six inflow rates: 0.24, 0.48, 1.20, 2.40, 6.00, and 8.40 L/s. The test sediment consisted of ground silica (1 – 1000 micron) with a specific gravity of 2.65, uniformly mixed to meet the particle size distribution specified in the *Procedure for Laboratory Testing of Oil Grit Separators (TRCA, 2014)*. Sediment was injected onto the street scape at a point just upstream of the catch basin to allow mixing prior to discharge while avoiding excessive buildup of sediment on the street scape. The sediment feed rate was adjusted for each flow rate to keep the influent concentrations consistent at 200 mg/L. The tests were conducted with a false floor set at 300 mm below the outlet invert simulating a catch basin that is filled to 50% of the manufacturer's recommended maximum sediment storage.

Claim 2: Scour test

The scour test was carried out in a laboratory on catch basins with and without the CB Shield® insert with a constructed simulated street scape (1 % slope along its 2.4 m (96 inch) length, 2 % slope along its 1.2 m (48 inch) width) and the catch basins clean of any litter or debris. A false floor was set in the catch basins at 254 mm below the outlet invert and preloaded with the test sediment (1- 1000 micron silica blend) test up to 150 mm below the outlet invert simulating a catch basin that is ¾ full of sediment. Water was filled to the effluent pipe and sediments were allowed to settle for 12-24 hours. Flows of 1.2, 4.8, 8.4, 12, and 15.6 L/s were tested on a continuous run with flow rates maintained at 5 minutes and a one minute transition time between flow rates. A minimum effluent grab sample of 500 mL was collected in 1000 mL jars by holding it under the entire effluent stream. A sample was taken at 30 seconds during the flow transitions to account for scour during the transition. Background samples were also taken at least once

every flow rate and effluent concentrations were corrected accordingly. Effluent flow was filtered using a 10µm filter and was recycled during the continuous 30 min test.

Performance claim(s)

Claim 1: Capture test

During the sediment capture test, for a catch basin with a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and a constant influent sediment concentration of 200 mg/L, the catch basin with a CB Shield® insert removed 64, 59.9, 52.4, 42.6, 25.2, and 26.7 percent of influent test sediment by mass at inflow rates of 0.24, 0.48, 1.20, 2.40, 6.00, and 8.40 L/s, respectively.

Claim 2: Scour test

For a catch basin filled to three quarters of the manufacturer's recommended maximum sediment storage depth, with the CB Shield® insert, scouring of test sediment is at most 8% of the control catch basin during a continuous 30 minute scour test run with 5 minute duration inflows of 1.2, 4.8, 8.4, 12.0, and 15.6 L/s.

Performance results

The test sediment used to evaluate the CB Shield® technology was the same as that required by CETV for the evaluation of Oil Grit Separators. The comparison of the average test sediment PSD to the CETV specified PSD in Figure 1 indicates that the test sediment was finer than the specified PSD, with a median particle size of approximately 50 microns.

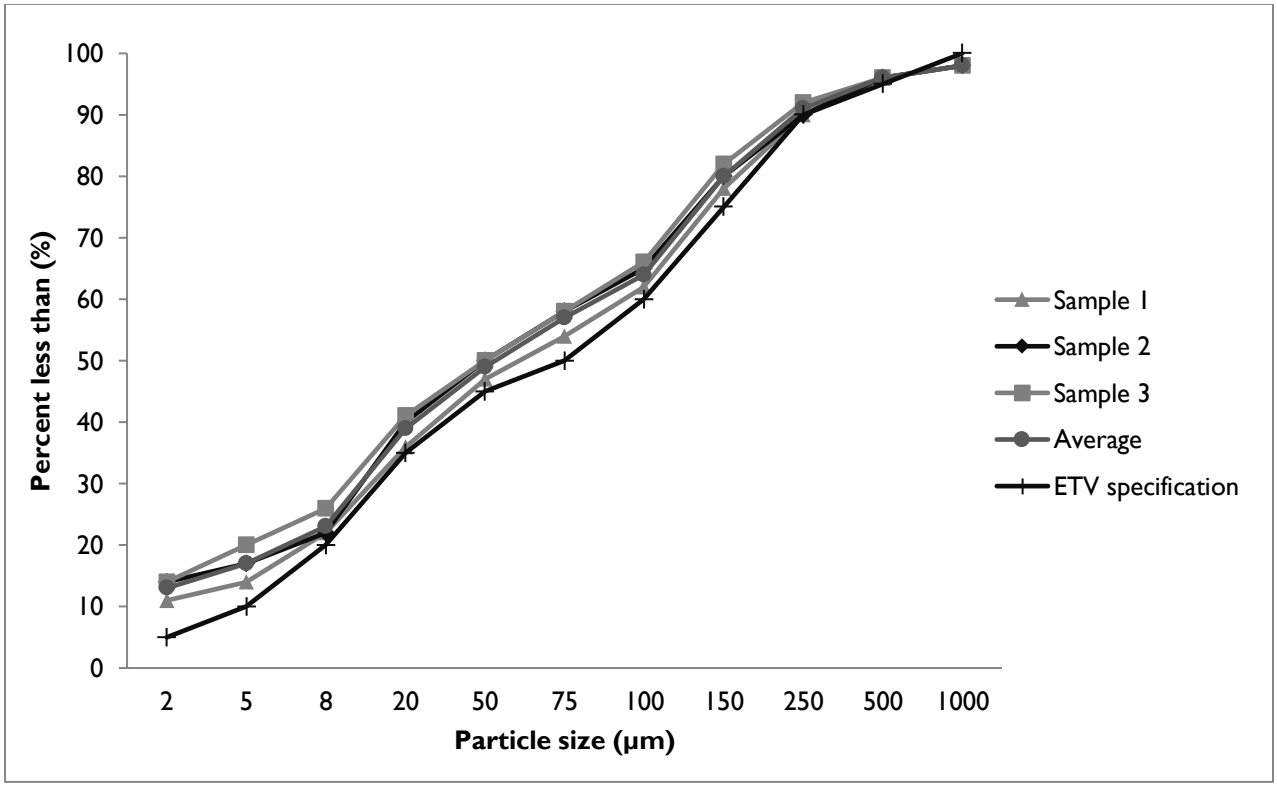


Figure 1. Test sediment particle size distribution (PSD) in relation to specified PSD.

The capacity of the device to retain sediment was determined at six surface loading rates using the modified mass balance method (see TRCA, 2014). During each of the tested flow rates, a known quantity

of sediment was injected at a constant rate onto a simulated street scape just upstream of the catch basin containing the CB Shield® technology. Based on these results, removal efficiencies were determined for each of the tested surface loading rates (Table 1).

Table 1. Removal efficiencies (%) based on modified mass balance results at specified surface loading rates.

Flow rate	**(L/s)**	0.24	0.48	1.20	2.40	6.00	8.40
Surface loading rate	**(L/min/m²)**	40	80	200	400	1000	1400
Total mass added	**(kg)**	1.217	2.302	5.072	5.150	4.921	4.812
Total mass captured	**(kg)**	0.778	1.378	2.659	2.196	1.238	1.287
Removal efficiency	**(%)**	64.0	59.9	52.4	42.6	25.2	26.7

Table 2 shows the results of the sediment scour and re-suspension test. This test involved preloading fresh test sediment into the sedimentation area of two catch basins with and without the CB Shield technology, as described in Performance Conditions section above. Effluent samples were collected at one-minute sampling intervals and analyzed for Suspended Sediment Concentration (SSC). The mean sediment scour load of the catch basin with the CB shield insert was shown to be only 5% that of the control catch basin.

Table 2. Scour test effluent sediment concentration and loads.

Run	Flow rates (L/sec)	Surface loading rate (L/min/m²)	CB Shield®			Control		
			Run time (min)	Effluent suspended sediment concentration (mg/L)	Sediment load (g)	Run time (min)	Effluent suspended sediment concentration (mg/L)	Sediment load (g)
			1:00	17.7	1.3	1:00	129.2	9.7
			2:00	6.5	0.47	2:00	185.3	13.9
			3:00	2.7	0.19	3:00	206.0	15.5
			4:00	3.1	0.22	4:00	176.0	13.2
			5:00	4.6	0.33	5:00	523.6	39.4
			6:00	0.6	0.04	6:00	495.7	41.8
1	1.2	200	**Sum**		**2.6**	**Sum**		**133.5**
			7:00	8.2	2.4	7:00	7164.0	2069.0
			8:00	4	1.2	8:00	8094.0	2338.0
			9:00	0.6	0.2	9:00	6762.0	1950.0
			10:00	0.6	0.2	10:00	4842.0	1393.0
			11:00	1.7	0.5	11:00	5266.0	1517.0
			12:00	0.6	0.2	12:00	4768.0	1457.0
2	4.8	800	**Sum**		**4.7**	**Sum**		**10724.0**
			13:00	5.4	2.7	13:00	5429.0	2725.0
			14:00	10.0	5.0	14:00	6648.0	3332.0
			15:00	9.5	4.8	15:00	5025.0	2528.0
			16:00	10.0	5.0	16:00	5859.0	2939.0
			17:00	8.4	4.2	17:00	5019.0	2515.0
			18:00	8.2	4.1	18:00	3249.0	1628.0
3	8.4	1400	**Sum**		**25.8**	**Sum**		**15667.0**
			19:00	38.4	27.6	25:30	1886.0	1347.0
			20:00	79.4	57.2	26:30	1432.0	1027.0
			21:00	113.0	81.3	27:30	1167.0	844.0
			22:00	103.0	74.2	28:30	1508.0	1089.0
			23:00	114.0	82.1	29:30	1100.0	795.0
			24:00	92.3	66.5	30:30	708.0	512.0
4	12	2000	**Sum**		**388.9**	**Sum**		**5614.0**
			25:00	117.4	166.0	52:30	386.9	364.8
			26:00	211.6	198.1	53:30	252.7	237.8
			27:00	220.3	206.2	54:30	372.5	349.6
			28:00	187.8	175.8	55:30	332.4	311.7
			29:00	224.4	210.0	56:30	279.8	262.6
			30:00	199.2	186.5	57:30	310.2	290.9
5	15.6	2600	**Sum**		**1142.6**	**Sum**		**1817.4**
Total load					**1564.6**			**33956.0**

Potential sources of error

1. Background concentrations during the scour test were measured to be generally under 5 mg/L for both CB Shield® and Control treatments. However, background concentrations for the Control treatment at flow rates of 12.0 L/s and 15.6 L/s were substantially higher than the expected threshold of 20 mg/L as a result of inefficient recycling of water in the laboratory. Effluent samples were corrected based on the measured background concentrations since it was assumed that background sediments consisted of fine particles that were not captured in the device and flowed through as effluent concentration. If instead, some of the background sediments settled, the correction for all background sediments would bias against the relative performance of the CB Shield and therefore result in a more conservative evaluation of the CB Shield technology performance.

2. The reduction in scour at higher flow rates for the Control treatment suggested that the amount of preloaded sediment (10.2 cm depth) may have been insufficient to provide a continuous supply of fine particles for scour throughout the test. A similar decrease in scour at high flow rates was not observed for the CB Shield® treatment. This interpretation of the data implies that preloading both catch basins with additional sediment would likely have shown increased relative scour for the Control treatment, particularly at high flow rates. Although further testing would be required to verify this interpretation, it is reasonable to suggest that the test as conducted may have produced a smaller relative difference, resulting in a more conservative claim for the CB Shield technology.

Verification

This verification was first completed in October, 2016 and is considered valid for subsequent renewal periods every three (3) years thereafter. Data and information provided by CB Shield Inc. to support the performance claim included the following: Performance test report prepared by Good Harbour Laboratories of Mississauga, Ontario, dated 24 August 2016; the report was based on testing completed in accordance with the Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014).

The original verification was completed by the Toronto and Region Conservation Authority, contracted by GLOBE Performance Solutions, using the Canadian ETV Program's General Verification Protocol (June 2012) and taking into account ISO/FDIS 14034:2015(E). This ETV renewal is considered to meet the equivalency of an ETV verification completed using the International Standard ***ISO 14034:2016 Environmental management -- Environmental technology verification (ETV)***.

What is ISO14034:2016 Environmental management – Environmental technology verification (ETV)?

ISO 14034:2016 specifies principles, procedures and requirements for environmental technology verification (ETV) and was developed and published by the *International Organization for Standardization (ISO)*. The objective of ETV is to provide credible, reliable and independent verification of the performance of environmental technologies. An environmental technology is a technology that either results in an environmental added value or measures parameters that indicate an environmental impact. Such technologies have an increasingly important role in addressing environmental challenges and achieving sustainable development.

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