Project Narrative and Stormwater Management Report

For

Greenwich Bay Townhouses
A Four-Unit Multi-Family Development

5 Williams Street
Warwick, Rhode Island
AP 220, Lot 95

Prepared for:
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Submitted by:

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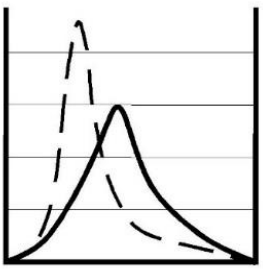

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1 INTRODUCTION

On behalf of our client, Mr. Stephen Miller of JMR Properties, Inc., Joe Casali Engineering, Inc. (JCE) has prepared the following Project Narrative and Stormwater Management Report to identify existing and proposed site conditions related to a proposed multi-family residential development located on Tax Assessor's Plat Map (AP) 220, Lot 95 located at the intersection of 5 Williams Street in Warwick, Rhode Island. The project will require a proposed zone change to add the Planned District Residential-Limited (PDR-L) overlay district to allow a multi-family residential development in the Residence A-10 District.

2 SITE LOCATION AND PHYSICAL DESCRIPTION

Based on a February 2022 Class I Limited Content Boundary Survey and Class III Data Accumulation Survey completed by Ocean State Planners, Inc., the subject parcel has an area of approximately 31,529 square feet (0.72 acres). This parcel is bound by a residential property to the north (AP 220, Lot 211), Amtrak railroad to the east, the dead-end portion of Williams Street and a residential property to the south (AP 220, Lot 137), and a residential property to the west (AP 220, Lot 230). This property is located within the Residence A-10 District (A-10). The parcel is currently occupied by a single-family dwelling with an attached garage.

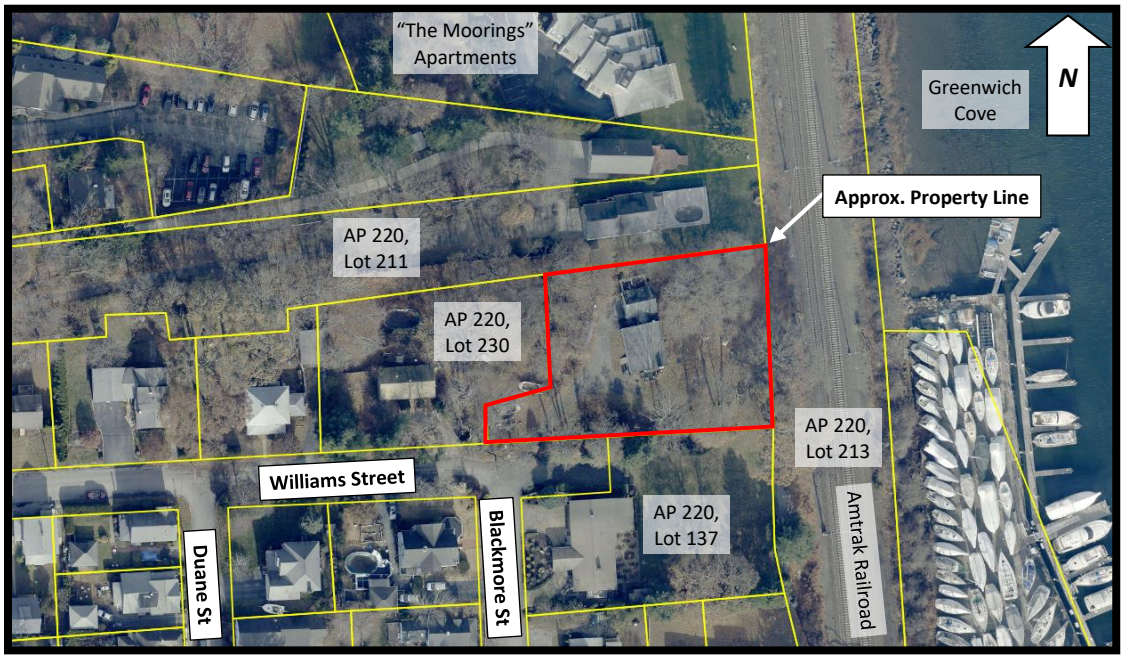

Figure 1 – Locus Map
NOT TO SCALE

2.1 Soil Classification

According to the *Web Soil Survey*, prepared by the US Department of Agriculture, Soil Conservation Service, the soils on the site consist of Hinckley loamy sand, 8 to 15 percent slopes (HkC), as shown on Figure 2 – Soils Map.

HkC soils consist of sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist. These soils are excessively drained, have a very low runoff class and generally have a water table more than 80-inches below grade. HkC soils are classified as Hydrologic Soil Group A.

Figure 2 – Soils Map
NOT TO SCALE

JCE observed and documented the excavation of four (4) soil evaluation test pits for use in stormwater management design (TH-1 through TH-4) in April 2023. The depth of the test pits reached 96-inches below the ground surface. A limiting layer was not encountered for all soil evaluation test pits performed. The depth of the seasonal high groundwater table (SHGWT) was encountered at 84-inches below the ground surface for TH-2 and TH-4. Infiltration rates were determined to be good (Hydrologic Soil Group 'B'). The completed soil evaluation test pit logs and test pit location plan are included in Appendix A.

2.2 Flood Zone Classification

The site is located on the Flood Insurance Rate Map (FIRM) for the City of Warwick, Rhode Island, Map No. 44003C0137H, effective September 18, 2013. According to this FIRM, the site lies within Zone X, which is defined as areas determined to be outside of the 0.2% annual floodplain.

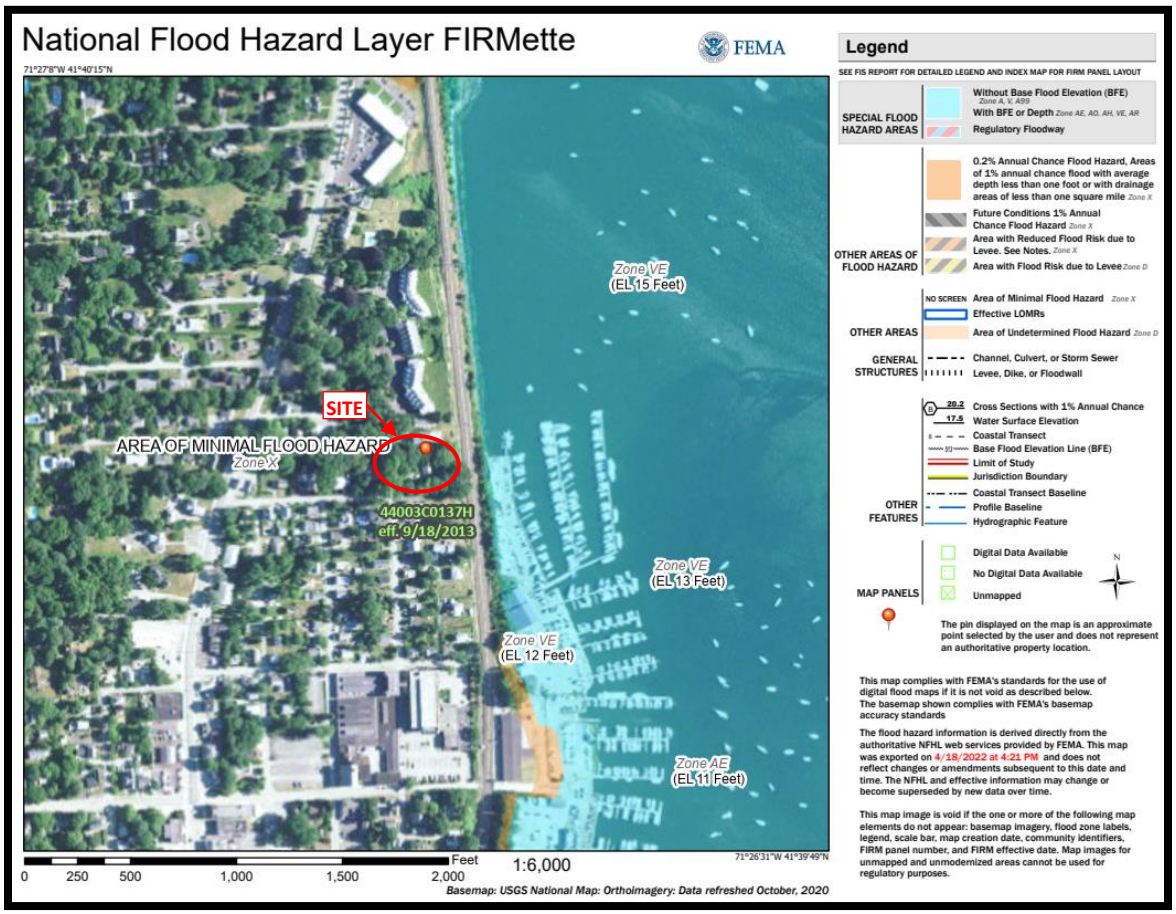

Figure 3 – FEMA Flood Insurance Rate Maps
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2.3 Natural Resource Inventory

The site lies within the Greenwich Bay Watershed (ID No. 01090040903). Stormwater from the site ultimately discharges to Greenwich Cove (ID. No. RI0007025E-05B). Impairments include dissolved oxygen, and total nitrogen. A portion of the property falls within the 200-foot Coastal Resource Management Council (CRMC) jurisdictional buffer associated with Greenwich Cove. Greenwich Cove is classified as Type 5 Waters, Commercial & Recreation Harbor. Per Section 1.1.11.7.a of the Red Book (650-RICR-20-00-1), a 50-foot coastal buffer zone is required from Greenwich Cove for the residential development. It should be noted that the 50-foot coastal buffer zone falls over 62 feet beyond the subject property.

The project site is predominantly within RIDEM's Groundwater Classification Zone GB, which is defined as "groundwater which may not be suitable for drinking water use without treatment due to known or presumed degradation." The parcel is not located in a wellhead protection area.

2.4 Recreational Resource Inventory

There are no known existing public, recreational or cultural resources within the subject site. The parcel is not located in a historic planning district, land conservation area or natural heritage area.

2.5 Zoning

Based on the City of Warwick's Web Geographic Information System (GIS) Maps, AP 320, Lot 95 lies within the City of Warwick Zoning District A-10.

The following are the current dimensional requirements for an A-10 district (permitted uses in all residences districts):

Requirement	A-10 Zone Req'd
Minimum Lot Area	10,000 sq. ft.
Minimum Lot Frontage	100 ft.
Minimum Lot Width	100 ft.
Minimum Front Yard	25 ft.
Minimum Side Yard	15 ft.
Minimum Rear Yard	20 ft.
Maximum Structure Height	35 ft.
Minimum Landscape Open Area	10%

2.6 Easements

Based on the February 2022 Class I Limited Content Boundary Survey completed by Ocean State Planners, Inc., there are no existing easements within or immediately adjacent to the subject property.

2.7 Utilities

Water: An 8-inch DI water main exists within Williams Street. Existing water utility infrastructure is owned and maintained by Kent County Water Authority.

Sewer: A 2-inch low-pressure sewer main exists within Williams Street. Existing sewer utility infrastructure is owned and maintained by the Warwick Sewer Authority.

Electric/Communications/Gas: Electric and communication services are available via overhead lines along the north side of Williams Street. Electrical poles and associated utilities are owned and maintained by National Grid. A gas main is available within Williams Street.

3 PROPOSED MULTI-FAMILY DEVELOPMENT

3.1 Development Design and Zoning

The proposed major land development project has been designed in accordance with the City of Warwick Code of Ordinances and the City of Warwick Land Development Regulations, Appendix D, Subdivision and Development Design Standards, dated January 1996.

The project consists of two (2) residential structures each containing two (2) units. Each structure will have a 1,973 sq. ft. footprint. The proposed townhouse style residential structures will have three stories with a garage located on the lowest level. Each unit has approximately 987 gross sq. ft. on the second and third floors, and 957 sq. ft. dedicated to the garage. A minimum of 2 parking spaces per dwelling unit are required for developments of four (4) units or less; therefore, eight (8) off-street parking spaces are required. Each unit is provided with two (2) garage spaces and two (2) driveway space. Four (4) parking spaces are provided for visitors. A total of 20 parking spaces are provided for the development. The proposed development will be accessed off Williams Street via a 24-foot-wide driveway. Other improvements include landscaping, stormwater management, and utility connections off Williams Street.

The Applicant successfully petitioned the City Council for a Zone Change to develop the subject parcel as Residence A-10 District (A-10) with the Planned District Residential-Limited (PDR-L) overlay at the April 17, 2023 hearing. The Applicant is proposing to develop the subject property as a multi-family development consisting of four (4) units. The following are the current dimensional requirements for a PDR-L multiple-family dwellings with a total of three (3) to nine (9) dwelling units within the A-10 zoning district:

Requirement	PDR-L A-10 Zone Req'd
Minimum Lot Area	30,000 sq. ft.
Maximum Density (dwelling units per acre)	7
Minimum Frontage	155 ft.
Minimum Lot Width	155 ft.
Minimum Front and Corner Side Yard	35 ft.
Minimum Side Yard	25 ft.
Minimum Rear Yard	35 ft.
Maximum Structure Height	35 ft.
Minimum Landscape Open Area	25%

For the multi-family development, the maximum density for this 31,529 square foot lot at 7 dwelling units per acre is 5.06 dwelling units or 5 dwelling units.

3.2 Utilities

Water: An 8-inch DI water main exists within Williams Street. Domestic water will be provided to the proposed residential structure. The water service design will require review and approval by the Kent County Water Authority.

Sewer: A 2-inch low-pressure sewer main exits within Williams Street. New sewer services are proposed to provide sewer service to the new residential structure. The sewer services will require review and approval by the Warwick Sewer Authority.

Electric/Communications: Electric and gas services are proposed to connect to existing RI Energy Services within Williams Street. Coordination with RI Energy Gas and Electric will be required.

3.3 Drainage

There is no existing stormwater management system in place. Generally, stormwater appears to sheet flow across the subject parcel, easterly towards Greenwich Cove. The proposed development will require stormwater infrastructure, as detailed in the *Rhode Island Stormwater Design and Installation Standards Manual* to attenuate peak stormwater runoff rates for the 1-, 2-, 10-, 25-, and 100-year storm events, reduce volume and increase the water quality of the stormwater leaving the site. The stormwater design will be in accordance with all city and state standards and consist of one (1) underground infiltration system (UIC), two (2) sediment forebays, and a bioretention basin. Additional details are provided in Section 4 below.

3.4 City of Warwick Permit Requirements

3.4.1 Warwick Planning Board

According to the City of Warwick's Land Development Regulations, the proposed development is considered a Major Subdivision and Major Land Development Project. The project received Master Plan Approval at the February 8, 2023 Warwick Planning Board hearing and a positive recommendation to the Warwick City Council for a roadway abandonment and zone change. The permitting schedule forward is as follows, and consists of abutter notification, public meetings, and Planning Board Approval:

1. Pre-Application (August 10, 2022)
2. Master Plan (February 8, 2023)
3. Preliminary Plan, and

4. Final Plan (administrative or before Warwick Board).

3.4.2 Warwick City Council

The project received approval for its petition to the City Council for a Zone Change to develop the subject parcel as Residence A-10 District (A-10) with the Planned District Residential-Limited (PDR-L) overlay to allow a multi-family development.

3.4.3 Fire Department

The proposed project's layout will require review and approval from the City of Warwick Fire Department.

3.4.4 Kent County Water Authority

The project will require a filing with Kent County Water Authority for review and approval.

3.4.5 Warwick Sewer

The project will require a filing with the Warwick Sewer Authority for review and approval.

3.4.6 Warwick Department of Public Works

The project will require a soil erosion permit from the Warwick Department of Public Works, Engineering Division, for the proposed site improvements.

3.5 State of Rhode Island Permitting Requirements

3.5.1 Rhode Island Coastal Resource Management Council (RICRMC)

The project area falls under the Rhode Island Coastal Resources Management Council (CRMC) jurisdiction and will require a Category 'A' Council Assent for the proposed residential development within 200 feet of a coastal feature.

4 STORMWATER MANAGEMENT PLAN

The proposed development is subject to the requirements of the Rhode Island Stormwater Design and Installation Standards Manual (RISDISM), implemented in December 2010, amended March 2015, by both the Rhode Island Department of Environmental Management (RIDEM) and the Rhode Island Coastal Resources Management Council (CRMC). Generally, stormwater appears to sheet flow across the subject parcel, easterly towards Greenwich Cove.

Stormwater practices for the proposed site have been designed in accordance with the *Rhode Island Stormwater Design and Installation Standards Manual, amended March 2015*. The stormwater management techniques being implemented include two (2) sediment forebays for pre-treatment, one (1) bioretention basin for water quality, and one (1) underground infiltration systems (UIC) for water quality.

4.1 Standard 1: LID Planning and Design Strategies

Low Impact Development (LID) site planning and design strategies must be used to the maximum extent practicable.

Standard Met
LID practices of an underground infiltration chamber system, bioretention basins and maintenance planning have been included in the site stormwater management design. Proposed drainage patterns will closely mimic those of existing conditions, including reduction of pre-development peak runoff rates and volumes. Infiltration of stormwater generated by proposed improvements will be accomplished using an underground infiltration chamber system and an infiltration basin.

4.2 Standard 2: Groundwater Recharge

Stormwater must be recharged within the same sub-watershed to maintain base flow at pre-development recharge levels to the maximum extent practicable.

Standard Met
Groundwater recharge will be provided on site through an underground infiltration chamber system and a bioretention basin. All calculations were completed in accordance with Section 3.3.2 of the RISDISM using the following formula:

$Re_v = (1") (F) (I) / 12$

Based on the results of the soil evaluation test pits, a recharge factor of 0.35 was used, associated with Hydrologic Soil Group B.

Table 1: Recharge Requirements		
Subwatershed	**1B & 1C**	**2B**
Treatment System	Bioretention Basin #1	UIC #1
Impervious Area (SF)	8,906	4,000
Recharge factor (in)	0.35	0.35
Required Recharge Volume (CF)	260	117
Provided Recharge Volume (CF)	299	412
Recharge Requirement Met?	Yes	Yes

Notes: 1. Refer to Proposed Watershed Map located in Appendix D for BMP locations.
2. Based on Routing Analysis of WQ_V, the entire volume is infiltrated.
3. Recharge Volumes are calculated as the Static Storage Volume.

4.3 Standard 3: Water Quality

The stormwater runoff from the site must be treated prior to discharge.

Standard Met

Water quality treatment is provided for the Water Quality Volume generated by all proposed impervious surfaces on site. Calculations are provided in Appendix F. Stormwater runoff from the site is treated prior to discharge via the proposed underground infiltration chamber system (UIC) and the bioretention basin. This system has been sized to capture and treat the required water quality volume prior to discharge. Pre-treatment is provided via the two (2) sediment forebays. Calculations were completed in accordance with Section 3.3.3 of the RISDISM using the following formula:

$WQ_v = (1") (I) /12$ in/ft

Tables 2 and 3 below provide sizing calculations for the Water Quality Volume (WQ_V) of the pretreatment area and the treatment area, respectively.

Table 2: Pretreatment Requirements		
Subwatershed	**1C**	**1B**
Treatment System	Sediment Forebay #1	Sediment Forebay #2
Impervious Area (SF)	1,560	7,346
Water Quality Factor (in)	1.00	1.00
Required Water Quality Volume (CF)	130	612
Required Static Storage Volume for Pretreatment (CF) (25% of WQv)	33	153
Provided Static Storage Volume for Pretreatment (CF) (25% of WQv)	635	398
Pretreatment Requirement Met?	Yes	Yes

Table 3: Treatment Requirements		
Subwatershed	**1B & 1C**	**2B**
Treatment Type	Bioretention Basin #1 & Sediment Forebays #1 & 2	UIC #1
Impervious Area (sf)	8,906	4,000
Water Quality Factor (in)	1.00	1.00
Required Water Quality Volume (CF)	742	333
Required Static Volume for Treatment (CF)	557	333
Provided Static Storage Volume for Treatment (CF)	1,590	412
Treatment Requirement Met	Yes	Yes

Notes:

1. Static Storage Volume (UIC) = Volume of chambers & volume of voids in stone below outlet; 100% static storage volume required for UIC.
2. Static Storage Volume (basin) = Storage volume of system below spillway; 75% static storage required for the entire filtering treatment system (bioretention basin, including pre-treatment sediment forebays)
3. As shown in the water quality calculations, Appendix F, the proposed BMPs fully contain and infiltrate the water quality design storm event and the 1-year design storm event.

As shown in Tables 1 through 3 above, the site's proposed stormwater management system exceeds the requirements for groundwater recharge volume, water quality pre-treatment volume and water quality treatment volume. This is in accordance with all RISDISM and City of Warwick's Standards, and ultimately eliminates or reduces any instances of untreated stormwater entering Greenwich Cove.

4.4 Standard 4: Conveyance and Natural Channel Protection

This standard is designed to prevent erosive flow within natural channels and drainage ways.

Standard Met

The proposed improvements have been designed to accommodate stormwater conveyance up to and including the 100-year design storm event while maintaining peak stormwater flow rates at or below existing conditions. The infiltration basins have each been designed with an outlet control structure to convey excess stormwater off-site at rates and volumes lower than those of which exist under exiting conditions.

4.5 Standard 5: Overbank Flood Protection

Downstream overbank flood protection must be provided by attenuating the post-development peak discharge rate to the pre-development levels for the 1–, 10-, and 100-year, Type III design storm events.

Standard Met

HydroCAD calculations for the proposed site, included in Appendix C & E, show that post-development peak stormwater discharge rates are less than the pre-development peak stormwater discharge rates for the 1-, 2-, 10-, 25- and 100-year storm events. In addition, the total stormwater volume discharged to the Design Points is less than the pre-development conditions. See Section 5.4 and Appendices C & E for supporting calculations.

4.6 Standard 6: Redevelopment and Infill Projects

For redevelopment sites with 40% or more existing impervious surface coverage and infill sites, only Standards 2, 3, and 7-11 must be addressed.

Standard Met

As shown below, the proposed site development is not considered a redevelopment:

Existing Site Area	Existing Impervious Area	Percent Impervious	Redevelopment?
31,529 sf	4,381 sf	13.9%	No

4.7 Standard 7: Pollution Prevention

All development sites require the use of source control and pollution prevention measures to minimize the impact that the land use may have on stormwater runoff quality.

Standard Met

Soil erosion and pollution control measures including a crushed stone construction access and a compost filter sock are proposed during construction. A long-term Operation and Maintenance Plan (O&M) has been prepared in accordance with the Manual and will be provided under separate cover.

4.8 Standard 8: Land Uses with Higher Potential Pollutant Loads

Stormwater discharges from land uses with higher potential pollutant loads (LUHPPLs) require the use of specific source control and pollution prevention measures and the specific stormwater BMPs approved for such use.

A stormwater LUHPPL is defined by the following land uses and activities:

1. Areas within an industrial site (as defined in RIPDES Rule 31(b)(15)) that are the location of activities subject to the RIPDES Multi-Sector General Permit (except where a No Exposure Certification for Exclusion from RIPDES Stormwater Permitting has been executed);
2. Auto fueling facilities (i.e., gas stations);

3. Exterior vehicle service, maintenance and equipment cleaning areas;
4. Road salt storage and loading areas (if exposed to rainfall); and
5. Outdoor storage and loading/unloading of hazardous substances.

Standard Not Applicable
The subject site does not meet the definition of a LUHPPL, as it does not maintain or require a RIPDES Multi-Sector General Permit.

4.9 Standard 9: Illicit Discharges

All illicit discharges to stormwater management systems are prohibited, including discharges from OWTS, and sub-drains and French drains near OWTSs that do not meet the State's OWTS Rules.

Standard Met
There are no known existing illicit discharges at the site nor are any proposed as part of this project.

4.10 Standard 10: Construction and Erosion Sedimentation Control

Erosion and sedimentation control (ESC) practices must be utilized during the construction phase as well as during any land disturbing activities.

Standard Met
Soil Erosion and Sediment Control Practices have been employed to avoid and minimize impacts to abutting properties. Detailed notes have been included in the plans to ensure effective implementation of erosion and sedimentation controls, which include a compost sock around the perimeter of the site and a crushed stone construction access at the entrance to the site. The soil erosion and sedimentation control measures will be installed prior to the initiation of construction activities and maintained throughout construction. Once established, these measures will be monitored daily until construction activities are complete. The compost sock line will serve as the strict limits of disturbance for the project. No alterations, including vegetative clearing or surface disturbance, will occur beyond this line. The limits of clearing, grading, and disturbance will be kept to a minimum within the proposed area of construction. All areas outside of these limits, as depicted on the project site plans, will remain undisturbed, in a completely natural condition.

4.11 Standard 11: Stormwater Management System Operation and Maintenance

The stormwater management system, including all structural stormwater controls and conveyances, must have an Operation and Maintenance Plan to ensure that it continues to function as designed.

Standard Met
A long-term Stormwater Operation and Maintenance Plan has been prepared for the development in accordance with the Manual and is provided under separate cover.

5 DRAINAGE ANALYSIS

5.1 Methodology

The comparative pre- versus post-development hydrologic analysis was performed using the Soil Conservation Service, Technical Release 20 and 55 (TR-20 and TR-55) methodology. The 1-, 2-, 10-, 25-, and 100-year storm events were modeled for a 24-hour, Type III storm utilizing HydroCAD version 10.00. As shown in the following sections, the proposed stormwater management system has been designed to attenuate peak stormwater runoff rates and reduce stormwater volumes leaving the site for the 1-, 2-, 10-, 25- and 100-year design storm events. HydroCAD modeling reports for the existing and proposed conditions can be found in Appendices C and E, respectively.

5.2 Existing Conditions

The existing site consists of two (2) watersheds discharging to two (2) design points, which can be seen on the Existing Condition Watershed Map, included in Appendix B.

Design Point 1 – Southeastern Lower Gradient
Watershed 1 consists of 35,214 sq. ft. of area, consisting primarily of grassed areas with the former single-family dwelling and associated driveway. This watershed has been assigned a Time of Concentration (T_c) of 15.2 minutes and a Composite Runoff Number (CN) of 68. Ultimately, stormwater from this subwatershed area is conveyed via overland flow to the southeastern lower gradient (Design Point 1).

Design Point 2 – Northeastern Lower Gradient
Watershed 2 consists of 11,192 sq. ft. of area, consisting primarily of grassed areas. This watershed has been assigned a Time of Concentration (T_c) of 8.8 minutes and a Composite Runoff Number (CN) of 63. Ultimately, stormwater from this subwatershed area is conveyed via overland flow to the northeastern lower gradient (Design Point 2).

5.3 Proposed Conditions

The applicant is proposing to construct a four (4) unit residential development with parking areas, utility improvements and stormwater management. In general, the proposed drainage patterns mimic existing conditions, discharging to the same design point as under

existing conditions. Water quality and volume control are achieved by means of infiltration practices and detention practices. The Proposed Watershed Map is included in Appendix D.

Design Point 1 – Southeastern Lower Gradient

Subwatershed 1A consists of 13,649 sq. ft. of area, consisting mostly of grassed areas associated with the abutter to the west. This subwatershed has been assigned a Time of Concentration (T_c) of 6.3 minutes and a Composite Runoff Number (CN) of 66. Stormwater runoff from this subwatershed area sheet flows to the proposed Bioretention Basin #1. The bioretention basin has been designed with an outlet control structure to convey excess treated stormwater to the southeastern lower gradient (Design Point 1), mimicking existing conditions.

Subwatershed 1B consists of 3,749 sq. ft. of mostly grassed areas with the northern portion of the proposed driveway and parking area. This subwatershed has been assigned a Tc of 8.9 minutes and a CN of 76. Stormwater runoff from this subwatershed area sheet flows to the proposed Sediment Forebay #1 for pre-treatment prior to being conveyed to Bioretention Basin #1. The basin has been designed with an outlet control structure to convey excess treated stormwater to the southeastern lower gradient (Design Point 1).

Subwatershed 1C consists of 11,828 sq. ft. that contains the remaining portion of the proposed driveway and parking areas. This subwatershed has been assigned a minimum Tc of 6.0 minutes and a CN of 84. Stormwater runoff from this subwatershed area sheet flows to the proposed Sediment Forebay #2 for pre-treatment prior to being conveyed to Bioretention Basin #1. The basin has been designed with an outlet control structure to convey excess treated stormwater to the southeastern lower gradient (Design Point 1).

Subwatershed 1D consists of 10,104 sq. ft. of area, consisting of grassed areas mostly to the east of the proposed residential structures. Accordingly, this subwatershed has been assigned a Tc of 7.7 minutes and a CN of 61. Stormwater from this subwatershed area sheet flows in an easterly direction to the southeastern lower gradient (Design Point 1).

Design Point 2 – Northeastern Lower Gradient

Watershed 2A consists of 3,076 sq. ft. of area, consisting primarily of grassed areas. This watershed has been assigned a Time of Concentration (T_c) of 9.7 minutes and a Composite Runoff Number (CN) of 63. Ultimately, stormwater from this subwatershed area is conveyed via overland flow to the northeastern lower gradient (Design Point 2).

Subwatershed 2B consists of 4,000 sq. ft. of area, consisting of the proposed residential rooftops. This subwatershed has been assigned a minimum Tc of 6.0 minutes and a CN of

98. Stormwater from this subwatershed area is conveyed through a closed drainage system, discharged to the proposed underground infiltration chamber system. For larger design storm events, excess stormwater discharges via the proposed pop-up emitter, ultimately being discharged to the northeastern lower gradient (Design Point 2).

5.4 Results

A runoff analysis of the pre- and post-construction conditions was completed using the TR-20 methodology and is summarized in Table 4 below. Supporting calculations for the pre- and post-construction conditions are included in Appendices C and E respectively.

Table 5.1: Watershed Data

	Area (SF)	**CN**	**Tc (min.)**
Existing Conditions			
Watershed 1	35,214	68	15.2
Watershed 2	11,192	63	8.8
Existing Site Total	***46,406***	***67***	**--**
Proposed Conditions			
Subwatershed 1A	13,649	66	6.3
Subwatershed 1B	3,749	76	8.9
Subwatershed 1C	11,828	84	6.0
Subwatershed 1D	10,104	61	7.7
Watershed 2A	3,076	63	9.7
Watershed 2B	4,000	98	6.0
Proposed Site Total	***46,406***	***73***	**--**
Δ	***0***	***+6***	**--**

As shown in Table 5.1 above, the overall watershed area remains unchanged when comparing existing to proposed conditions. However, under proposed conditions, the CN value has increased when comparing existing to proposed conditions due to the increase in impervious areas associated with the proposed development.

Table 5.2: Stormwater Runoff Discharge

	Peak Discharge (cfs) to Design Point				
	1-Year	2-Year	10-Year	25-Year	100-Year
Existing DP #1	0.25	0.48	1.19	1.89	3.43
Proposed DP #1	0.03	0.18	0.90	1.55	2.54
ΔQ	-0.22	-0.30	-0.29	-0.34	-0.89
Existing DP #2	0.04	0.11	0.34	0.58	1.13
Proposed DP #2	0.01	0.03	0.25	0.47	0.80
ΔQ	-0.03	-0.08	-0.09	-0.411	-0.33

As shown in Table 5.2, through the use of various infiltration practices, the peak stormwater runoff rates realized at the design point have been decreased for all design storm events when comparing the existing condition to the proposed condition.

Table 5.3: Stormwater Total Runoff Volume

	Total Runoff Volume (cf) to Design Point				
	1-Year	2-Year	10-Year	25-Year	100-Year
Existing DP #1	1,404	2,311	5,102	7,917	14,172
Proposed DP #1	218	809	3,463	6,342	12,950
ΔV	-1,186	-1,502	-1,639	-1,575	-1,222
Existing DP #2	293	527	1,291	2,095	3,942
Proposed DP #2	81	145	594	1,089	2,227
ΔV	-212	-382	-697	-1,006	-1,715

As shown in Table 5.3, through the use of various infiltration practices, the total runoff volumes realized at the design point have been decreased for all design storm events when comparing the existing condition to the proposed condition.

6 CONCLUSIONS

As shown in Sections 4 and 5 above, the proposed improvements have been designed in order to minimize impacts of the proposed site development by reducing peak stormwater runoff rates for the 1, 2, 10, 25, and 100-year design storm events and increasing the quality of the stormwater leaving the site by the installation of BMP's including an underground infiltration chamber system and a bioretention basin in accordance with the Rhode Island Stormwater and Installation Manual. In addition, stormwater runoff volumes have been reduced for the 1, 2, 10, 25, and 100-year design storm events.

Due to the implementation of the proposed stormwater management appurtenances, which infiltrate and detain stormwater, all proposed design points experience reduction in peak stormwater runoff rates and total stormwater volumes. The proposed stormwater management system has been designed to be in compliance with the rules and regulations stipulated in the RISDISM. The stormwater management system as designed will not have any negative impacts to neighboring properties or to Greenwich Cove. In addition, as shown within this report, the WQv design storm is completely infiltrated on-site thereby improving current water quality conditions.

Appendix A

Soil Evaluation Test Pit Location Plan
Soil Evaluation Test Pit Logs

ZONING DIMENSIONAL REQUIREMENTS:
PROPOSED MULTI-FAMILY DEVELOPMENT

ZONING CRITERIA	REQUIRED	PROPOSED
ZONING DISTRICT	A-10 (PDR-L)	A-10 (PDR-L)
MULTI-FAMILY (3-9 DWELLING UNITS)		
MINIMUM LOT AREA	30,000 SF	31,529 SF
MAX. DENSITY (D.U. PER AC.)	7	(SEE TABLE)
MINIMUM FRONTAGE	155 FT	100.00 FT[1]
MINIMUM LOT WIDTH	155 FT	237.67 FT
MINIMUM FRONT AND CORNER SIDE YARD	35 FT	>35 FT
MINIMUM SIDE YARD	25 FT	23.2 FT
MINIMUM REAR YARD	35 FT	23.2 FT
MAXIMUM STRUCTURE HEIGHT	35 FT	<35 FT
MINIMUM LANDSCAPED OPEN SPACE	25%	>25%

NOTE:
1. PRE-EXISTING, NON-CONFORMING CONDITION

DENSITY CALCULATION:
DENSITY OF 7 DWELLING UNITS/ACRE

TOTAL AREA: 31,529 SF
31,529 SF * (7 D.U / 43,560 SF) = 5.06 D.U.

5 DWELLING UNITS ALLOWED
4 DWELLING UNITS PROPOSED

ANTICIPATED RELIEF FOR THE PROPOSED DEVELOPMENT INCLUDES THE FOLLOWING:

1. PER SECTION 308.3(B) OF THE ZONING ORDINANCE: MINIMUM FRONTAGE IN THE A-10 WITH PDR-L OVERLAY IS 155 FEET
   REQUIRED: 155 FEET
   PROPOSED: 100 FEET (PRE-EXISTING NON-CONFORMING CONDITION)
   RELIEF REQUESTED: 55 FEET

2. PER SECTION 308.3(B) OF THE ZONING ORDINANCE: MINIMUM SIDE YARD SETBACK IN THE A-10 WITH PDR-L OVERLAY IS 25 FEET
   REQUIRED: 25 FEET
   PROPOSED: 23.2 FEET
   RELIEF REQUESTED: 1.8 FEET

3. PER SECTION 308.3(B) OF THE ZONING ORDINANCE: MINIMUM REAR YARD SETBACK IN THE A-10 WITH PDR-L OVERLAY IS 35 FEET
   REQUIRED: 35 FEET
   PROPOSED: 23.2 FEET
   RELIEF REQUESTED: 11.8 FEET

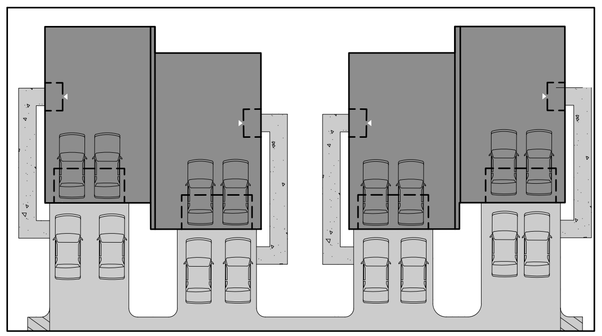
4. PER SECTION 308.2(A) OF THE ZONING ORDINANCE: ANY SIDE WALL OF A BUILDING MAY NOT BE LESS THAN 30 FEET FROM ANY SIDE WALL OF ANOTHER BUILDING
   REQUIRED: 30 FEET
   PROPOSED: 20 FEET
   RELIEF REQUESTED: 10 FEET

5. PER SECTION 308.2(E) OF THE ZONING ORDINANCE: ...NO OUTDOOR PARKING SPACE OR DRIVEWAY IS PERMITTED WITHIN 15 FEET OF ANY RESIDENTIAL BUILDING.
   REQUIRED: 15 FEET
   PROPOSED: 0 FEET
   (PROPOSED INDIVIDUAL DRIVEWAYS ABUT PROPOSED RESIDENTIAL BUILDINGS)
   RELIEF REQUESTED: 15 FEET

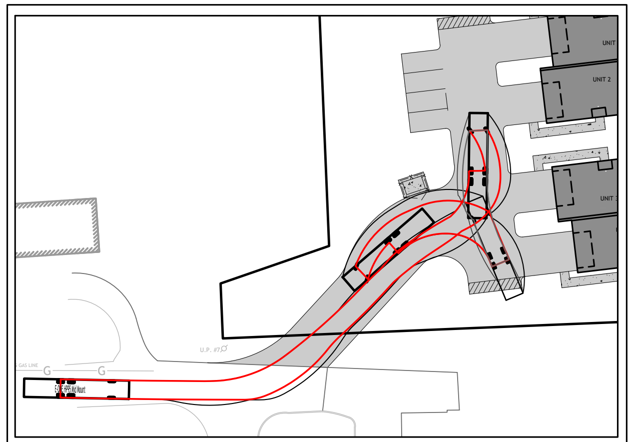
OFF-STREET PARKING CALCULATION:
PER SEC. 308.2(E) A MIN. OF 2 PARKING SPACES PER DWELLING UNIT SHALL BE REQUIRED FOR DEVELOPMENTS OF 4 UNITS OR LESS

4-UNIT DEVELOPMENT:
2 SPACES * 4 D.U. = 8 SPACES

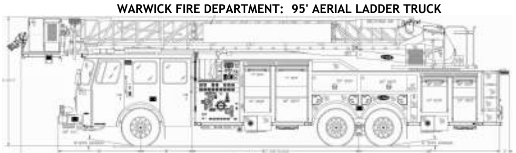
REQUIRED: 8 PARKING SPACES
PROPOSED: 20 PARKING SPACES



RESIDENTIAL UNIT PARKING DETAIL
SCALE 1"=20'



WARWICK FIRE DEPARTMENT: 95' AERIAL LADDER TRUCK



45'-8" OVERALL LENGTH

FIRE TRUCK TURNAROUND DETAIL
SCALE 1"=40'

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JOSEPH A. CASALI
No. 7250
REGISTERED PROFESSIONAL ENGINEER
CIVIL
1.9.2023

GREENWICH BAY TOWNHOUSES
5 WILLIAMS STREET
WAWICK, RHODE ISLAND
AP 220, LOT 95

REVISIONS:

NO.	DATE.	DESCRIPTION
R1	1/9/22	REV. SETBACKS

DESIGNED BY:	WMLJR
DRAWN BY:	SEP
CHECKED BY:	JAC
DATE:	20-10b
PROJECT NO:	NOV. 2022

PRELIMINARY, NOT FOR CONSTRUCTION

SITE PLAN

Test Pit Location: See Plan
Ground Surface El. / Datum: 42.0 - NAVD88
Excavator Type: Bobcat E60 Mini-Excavator
Operator: Wilco Excavation and Site Services

Date Start / Finish: April 12, 2023
Conditions: Partly Sunny, 60 deg. F
Excavator Reach: Approx. 10-feet
JCE Rep.: Daniel R. Decesaris, P.E. (RI #10162)

TH-1

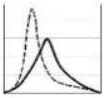
Depth (ft)	Sample Type/No.	Layer	Remarks	Soil and Rock Description	Estimated Hydraulic Conductivity
0		FILL	Occassional bricks within top 12-inches.	(0-48") SILTY SAND WITH GRAVEL (SM); Brown and gray, dry, 65% fine to coarse sand, 20% nonplastic fines, 15% fine to coarse gravel, FILL.	NA
4		GLACIAL DEPOSITS		(48-56") SILTY SAND (SM); Dark gray and brown, moist, 60% fine to medium sand, 35% nonplastic fines, 5% fine gravel. *Sandy Loam.* (56-72") SILTY SAND (SM); Brown, dry, 70% fine to coarse sand, 15% nonplastic fines, 15% fine to coarse gravel. *Loamy Sand.* (72-96") POORLY GRADED SAND (SP); Light brown, dry, 95% fine to medium sand, 5% nonplastic fines. *Sand.*	HSG B 1.02 in/hr HSG B 2.41 in/hr
8				Bottom of test hole at 96-inches; open excavation backfilled with previously excavated material upon completion.	

Notes: Test pit located within possible footprint of former structure (based on aerial imagery).

SHWT: Not encountered; > 96-inches
Impervious/Limiting Layer Depth: Not encountered; > 96-inches

Project Name: Greenwich Bay Townhouses
Project Number: 20-10b

JOE CASALI ENGINEERING, INC.



Test Pit Location: See Plan
Date Start / Finish: April 12, 2023
Ground Surface El. / Datum: 42.5 - NAVD88
Conditions: Partly Sunny, 60 deg. F
Excavator Type: Bobcat E60 Mini-Excavator
Excavator Reach: Approx. 10-feet
Operator: Wilco Excavation and Site Services
JCE Rep.: Daniel R. Decesaris, P.E. (RI #10162)

TH-2

Depth (ft)	Sample Type/No.	Layer	Remarks	Soil and Rock Description	Estimated Hydraulic Conductivity
0		FILL	Occassional cobbles throughout fill layer.	(0-24") SILTY SAND WITH GRAVEL (SM); Brown and gray, dry, 70% fine to coarse sand, 15% nonplastic fines, 15% fine to coarse gravel, FILL.	
2		FILL		(24-60") POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); Light brown, dry, 75% fine to medium sand, 20% nonplastic fines, 15% fine to coarse gravel, FILL.	NA
5		GLACIAL DEP.		(60-72") SILTY SAND (SM); Dark gray and brown, moist, 60% fine to medium sand, 35% nonplastic fines, 5% fine gravel. *Sandy Loam.*	HSG B 1.02 in/hr
6		GLACIAL DEP.	Heavy oxidation observed at 84-inches.	(72-96") SILTY SAND WITH GRAVEL (SM); Brown, moist, 70% fine to coarse sand, 15% nonplastic fines, 15% fine to coarse gravel. *Loamy Sand.*	HSG B 2.41 in/hr
8				Bottom of test hole at 96-inches; open excavation backfilled with previously excavated material upon completion.	

Notes: Test pit located within possible footprint of former structure (based on aerial imagery).

SHWT: 84-inches
Impervious/Limiting Layer Depth: Not encountered; > 96-inches

Project Name: Greenwich Bay Townhouses
Project Number: 20-10b

JOE CASALI ENGINEERING, INC.

Test Pit Location: See Plan
Date Start / Finish: April 12, 2023
Ground Surface El. / Datum: 42.2 - NAVD88
Conditions: Partly Sunny, 60 deg. F
Excavator Type: Bobcat E60 Mini-Excavator
Excavator Reach: Approx. 10-feet
Operator: Wilco Excavation and Site Services
JCE Rep.: Daniel R. Decesaris, P.E. (RI #10162)

TH-3

Depth (ft)	Sample Type/No.	Layer	Remarks	Soil and Rock Description	Estimated Hydraulic Conductivity
0		TS		(0-8") SILTY SAND (SM); Dark brown, dry, 70% fine to medium sand, 20% nonplastic fines, 5% fine to coarse gravel. TOPSOIL.	
1		FILL		(8-40") POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); Light brown, dry, 75% fine to medium sand, 15% fine to coarse gravel, 10% nonplastic fines.	NA
4		GLACIAL DEPOSITS		(40-98") SILTY SAND WITH GRAVEL (SM); Brown, dry, 70% fine to coarse sand, 15% nonplastic fines, 15% fine to coarse gravel. *Loamy Sand.*	HSG B 2.41 in/hr
8				Bottom of test hole at 98-inches; open excavation backfilled with previously excavated material upon completion.	

Notes:

SHWT: Not encountered; > 98-inches
Impervious/Limiting Layer Depth: Not encountered; > 98-inches

Project Name: Greenwich Bay Townhouses
Project Number: 20-10b

JOE CASALI ENGINEERING, INC.

Test Pit Location: See Plan
Date Start / Finish: April 12, 2023
Ground Surface El. / Datum: 41.5 - NAVD88
Conditions: Partly Sunny, 60 deg. F
Excavator Type: Bobcat E60 Mini-Excavator
Excavator Reach: Approx. 10-feet
Operator: Wilco Excavation and Site Services
JCE Rep.: Daniel R. Decesaris, P.E. (RI #10162)

TH-4

Depth (ft)	Sample Type/No.	Layer	Remarks	Soil and Rock Description	Estimated Hydraulic Conductivity
0 - 2		FILL	Roots observed from 0 to 24-inches.	(0-24") SILTY SAND (SM); Dark brown, dry, 70% fine to medium sand, 20% nonplastic fines, 5% fine to coarse gravel. FILL.	NA
2 - 4		GLACIAL DEPOSITS		(24-48") POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); Light brown, dry, 75% fine to medium sand, 15% fine to coarse gravel, 10% nonplastic fines. *Loamy Sand.*	HSG B 2.41 in/hr
4 - 6				(48-76") SILTY SAND (SM); Gray and brown, moist, 60% fine to medium sand, 35% nonplastic fines, 5% fine gravel. *Sandy Loam.*	HSG B 1.02 in/hr
6 - 8			Heavy iron oxide staining observed at 84-inches	(76-98") SILTY SAND WITH GRAVEL (SM); Brown, moist, 70% fine to coarse sand, 15% nonplastic fines, 15% fine to coarse gravel. *Loamy Sand.*	HSG B 2.41 in/hr
8 - 12				Bottom of test hole at 98-inches; open excavation backfilled with previously excavated material upon completion.	

Notes:

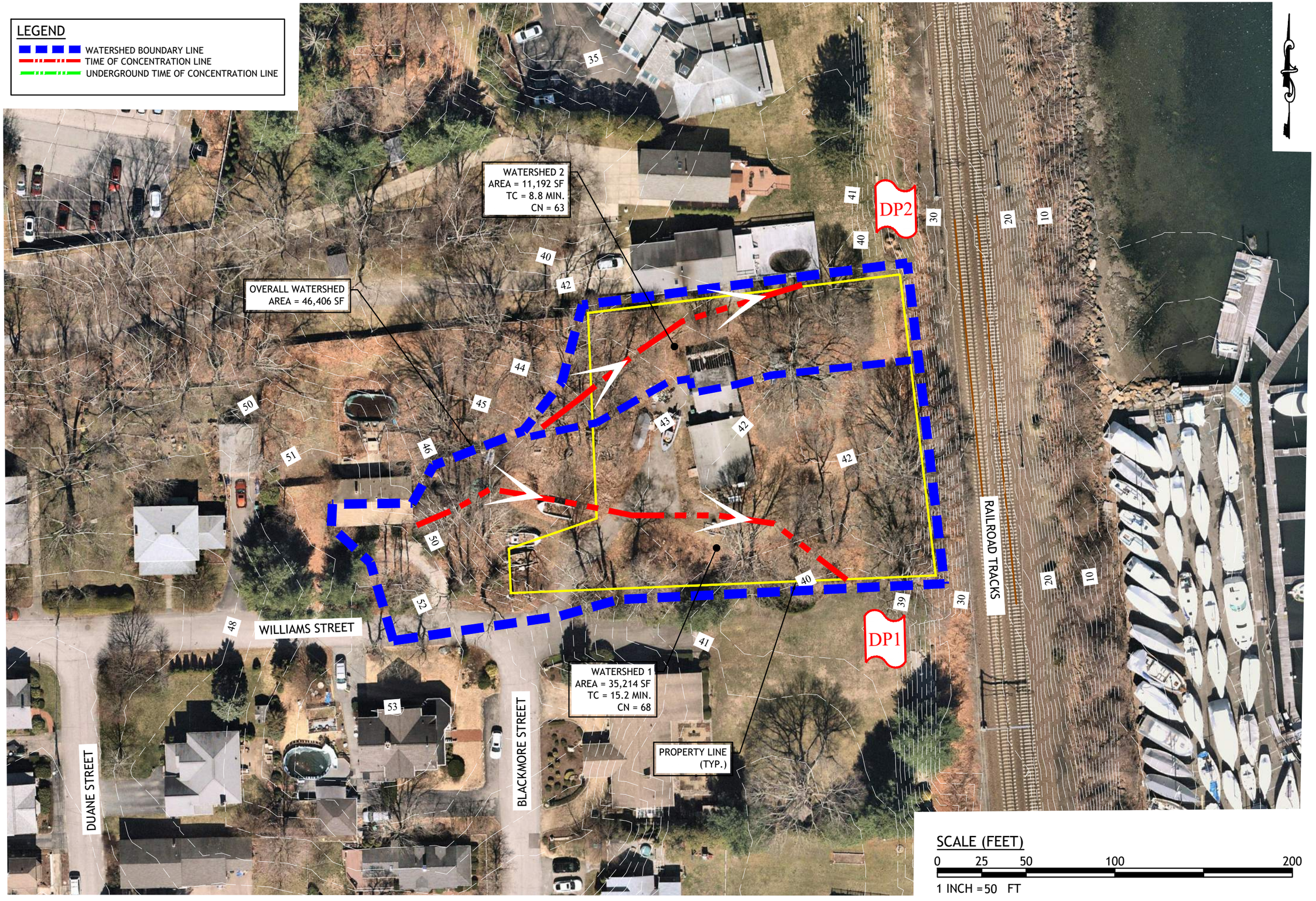
SHWT: 84-inches
Impervious/Limiting Layer Depth: Not encountered; > 98-inches

Project Name: Greenwich Bay Townhouses
Project Number: 20-10b

JOE CASALI ENGINEERING, INC.

Appendix B

Existing Condition Watershed Map



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GREENWICH BAY TOWNHOUSES
5 WILLIAMS STREET
WARWICK, RHODE ISLAND
AP 220, LOT 95

REVISIONS:

NO.	DATE.	DESCRIPTION

DESIGNED BY:	SD
DRAWN BY:	SD
CHECKED BY:	JAC
DATE:	JUNE 2023
PROJECT NO:	20-10b

STORMWATER REPORT

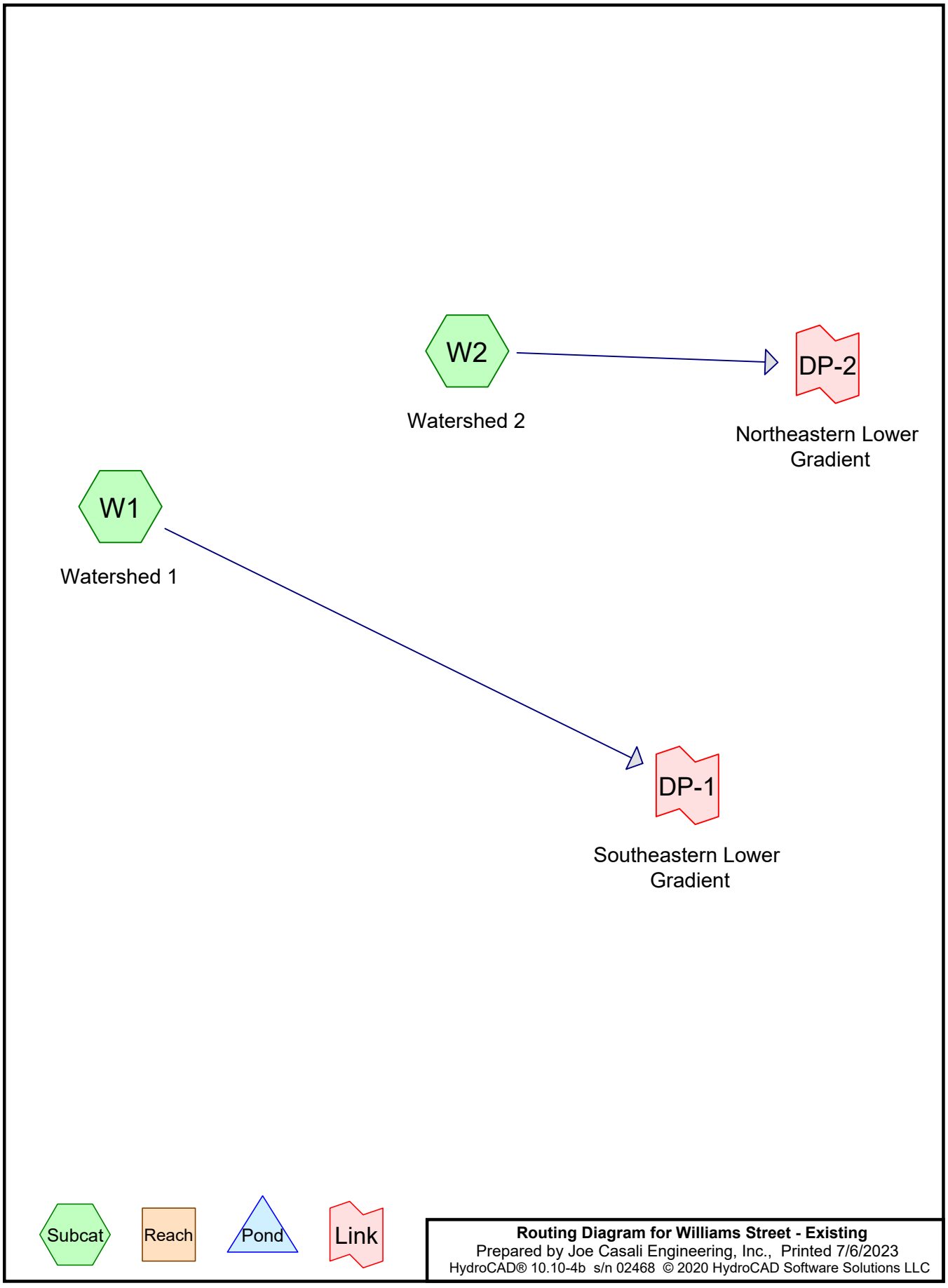
EXISTING CONDITIONS WATERSHED MAP

SHEET 1 OF 1

Q:\20-10 Steve Miller\20-10b Williams Street\Drainage\Watershed Maps\Williams St, Warwick [Watershed Map]-R1.dwg Jul. 05, 2023 5:08pm

Appendix C

Existing Condition HydroCAD Calculations



Routing Diagram for Williams Street - Existing
Prepared by Joe Casali Engineering, Inc., Printed 7/6/2023

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
39,363	61	>75% Grass cover, Good, HSG B (W1, W2)
7,043	98	Impervious Surfaces, HSG B (W1, W2)
46,406	**67**	**TOTAL AREA**

Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment W1: Watershed 1 Runoff Area=35,214 sf 18.52% Impervious Runoff Depth=0.48"
Flow Length=659' Tc=15.2 min CN=68 Runoff=0.25 cfs 1,404 cf

Subcatchment W2: Watershed 2 Runoff Area=11,192 sf 4.66% Impervious Runoff Depth=0.31"
Flow Length=169' Tc=8.8 min CN=63 Runoff=0.04 cfs 293 cf

Link DP-1: Southeastern Lower Gradient Inflow=0.25 cfs 1,404 cf
Primary=0.25 cfs 1,404 cf

Link DP-2: Northeastern Lower Gradient Inflow=0.04 cfs 293 cf
Primary=0.04 cfs 293 cf

Total Runoff Area = 46,406 sf Runoff Volume = 1,698 cf Average Runoff Depth = 0.44"
84.82% Pervious = 39,363 sf 15.18% Impervious = 7,043 sf

Summary for Subcatchment W1: Watershed 1

Runoff = 0.25 cfs @ 12.27 hrs, Volume= 1,404 cf, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.70"

	Area (sf)	CN	Description
*	6,521	98	Impervious Surfaces, HSG B
	28,693	61	>75% Grass cover, Good, HSG B
	35,214	68	Weighted Average
	28,693	61	81.48% Pervious Area
	6,521	98	18.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	100	0.0600	0.27		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
0.2	20	0.0100	2.03		**Shallow Concentrated Flow, SEG B** Paved Kv= 20.3 fps
1.1	139	0.0216	2.20		**Shallow Concentrated Flow, SEG C** Grassed Waterway Kv= 15.0 fps
7.7	400	0.0300	0.87		**Shallow Concentrated Flow, SEG D** Woodland Kv= 5.0 fps
15.2	659	Total			

Summary for Subcatchment W2: Watershed 2

Runoff = 0.04 cfs @ 12.21 hrs, Volume= 293 cf, Depth= 0.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.70"

	Area (sf)	CN	Description
*	522	98	Impervious Surfaces, HSG B
	10,670	61	>75% Grass cover, Good, HSG B
	11,192	63	Weighted Average
	10,670	61	95.34% Pervious Area
	522	98	4.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0300	0.20		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
0.6	69	0.0150	1.84		**Shallow Concentrated Flow, SEG B** Grassed Waterway Kv= 15.0 fps
8.8	169	Total			

Summary for Link DP-1: Southeastern Lower Gradient

Inflow Area = 35,214 sf, 18.52% Impervious, Inflow Depth = 0.48" for 1-Year event
Inflow = 0.25 cfs @ 12.27 hrs, Volume= 1,404 cf
Primary = 0.25 cfs @ 12.27 hrs, Volume= 1,404 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: Northeastern Lower Gradient

Inflow Area = 11,192 sf, 4.66% Impervious, Inflow Depth = 0.31" for 1-Year event
Inflow = 0.04 cfs @ 12.21 hrs, Volume= 293 cf
Primary = 0.04 cfs @ 12.21 hrs, Volume= 293 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment W1: Watershed 1 Runoff Area=35,214 sf 18.52% Impervious Runoff Depth=1.74"
Flow Length=659' Tc=15.2 min CN=68 Runoff=1.19 cfs 5,102 cf

Subcatchment W2: Watershed 2 Runoff Area=11,192 sf 4.66% Impervious Runoff Depth=1.38"
Flow Length=169' Tc=8.8 min CN=63 Runoff=0.34 cfs 1,291 cf

Link DP-1: Southeastern Lower Gradient Inflow=1.19 cfs 5,102 cf
Primary=1.19 cfs 5,102 cf

Link DP-2: Northeastern Lower Gradient Inflow=0.34 cfs 1,291 cf
Primary=0.34 cfs 1,291 cf

Total Runoff Area = 46,406 sf Runoff Volume = 6,392 cf Average Runoff Depth = 1.65"
84.82% Pervious = 39,363 sf 15.18% Impervious = 7,043 sf

Summary for Subcatchment W1: Watershed 1

Runoff = 1.19 cfs @ 12.22 hrs, Volume= 5,102 cf, Depth= 1.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

	Area (sf)	CN	Description
*	6,521	98	Impervious Surfaces, HSG B
	28,693	61	>75% Grass cover, Good, HSG B
	35,214	68	Weighted Average
	28,693	61	81.48% Pervious Area
	6,521	98	18.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	100	0.0600	0.27		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
0.2	20	0.0100	2.03		**Shallow Concentrated Flow, SEG B** Paved Kv= 20.3 fps
1.1	139	0.0216	2.20		**Shallow Concentrated Flow, SEG C** Grassed Waterway Kv= 15.0 fps
7.7	400	0.0300	0.87		**Shallow Concentrated Flow, SEG D** Woodland Kv= 5.0 fps
15.2	659	Total			

Summary for Subcatchment W2: Watershed 2

Runoff = 0.34 cfs @ 12.14 hrs, Volume= 1,291 cf, Depth= 1.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

	Area (sf)	CN	Description
*	522	98	Impervious Surfaces, HSG B
	10,670	61	>75% Grass cover, Good, HSG B
	11,192	63	Weighted Average
	10,670	61	95.34% Pervious Area
	522	98	4.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0300	0.20		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
0.6	69	0.0150	1.84		**Shallow Concentrated Flow, SEG B** Grassed Waterway Kv= 15.0 fps
8.8	169	Total			

Summary for Link DP-1: Southeastern Lower Gradient

Inflow Area = 35,214 sf, 18.52% Impervious, Inflow Depth = 1.74" for 10-Year event
Inflow = 1.19 cfs @ 12.22 hrs, Volume= 5,102 cf
Primary = 1.19 cfs @ 12.22 hrs, Volume= 5,102 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: Northeastern Lower Gradient

Inflow Area = 11,192 sf, 4.66% Impervious, Inflow Depth = 1.38" for 10-Year event
Inflow = 0.34 cfs @ 12.14 hrs, Volume= 1,291 cf
Primary = 0.34 cfs @ 12.14 hrs, Volume= 1,291 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment W1: Watershed 1 Runoff Area=35,214 sf 18.52% Impervious Runoff Depth=4.83"
Flow Length=659' Tc=15.2 min CN=68 Runoff=3.43 cfs 14,172 cf

Subcatchment W2: Watershed 2 Runoff Area=11,192 sf 4.66% Impervious Runoff Depth=4.23"
Flow Length=169' Tc=8.8 min CN=63 Runoff=1.13 cfs 3,942 cf

Link DP-1: Southeastern Lower Gradient Inflow=3.43 cfs 14,172 cf
Primary=3.43 cfs 14,172 cf

Link DP-2: Northeastern Lower Gradient Inflow=1.13 cfs 3,942 cf
Primary=1.13 cfs 3,942 cf

Total Runoff Area = 46,406 sf Runoff Volume = 18,115 cf Average Runoff Depth = 4.68"
84.82% Pervious = 39,363 sf 15.18% Impervious = 7,043 sf

Summary for Subcatchment W1: Watershed 1

Runoff = 3.43 cfs @ 12.21 hrs, Volume= 14,172 cf, Depth= 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

	Area (sf)	CN	Description
*	6,521	98	Impervious Surfaces, HSG B
	28,693	61	>75% Grass cover, Good, HSG B
	35,214	68	Weighted Average
	28,693	61	81.48% Pervious Area
	6,521	98	18.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	100	0.0600	0.27		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
0.2	20	0.0100	2.03		**Shallow Concentrated Flow, SEG B** Paved Kv= 20.3 fps
1.1	139	0.0216	2.20		**Shallow Concentrated Flow, SEG C** Grassed Waterway Kv= 15.0 fps
7.7	400	0.0300	0.87		**Shallow Concentrated Flow, SEG D** Woodland Kv= 5.0 fps
15.2	659	Total			

Summary for Subcatchment W2: Watershed 2

Runoff = 1.13 cfs @ 12.13 hrs, Volume= 3,942 cf, Depth= 4.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

	Area (sf)	CN	Description
*	522	98	Impervious Surfaces, HSG B
	10,670	61	>75% Grass cover, Good, HSG B
	11,192	63	Weighted Average
	10,670	61	95.34% Pervious Area
	522	98	4.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0300	0.20		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
0.6	69	0.0150	1.84		**Shallow Concentrated Flow, SEG B** Grassed Waterway Kv= 15.0 fps
8.8	169	Total			

Summary for Link DP-1: Southeastern Lower Gradient

Inflow Area = 35,214 sf, 18.52% Impervious, Inflow Depth = 4.83" for 100-Year event
Inflow = 3.43 cfs @ 12.21 hrs, Volume= 14,172 cf
Primary = 3.43 cfs @ 12.21 hrs, Volume= 14,172 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: Northeastern Lower Gradient

Inflow Area = 11,192 sf, 4.66% Impervious, Inflow Depth = 4.23" for 100-Year event
Inflow = 1.13 cfs @ 12.13 hrs, Volume= 3,942 cf
Primary = 1.13 cfs @ 12.13 hrs, Volume= 3,942 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Appendix D

Proposed Condition Watershed Map

LEGEND

WATERSHED BOUNDARY LINE
TIME OF CONCENTRATION LINE
UNDERGROUND TIME OF CONCENTRATION LINE

WATERSHED 1B
AREA = 3,749 SF
TC = 8.9MIN.
CN = 76

WATERSHED 2A
AREA = 3,076 SF
TC = 9.7 MIN.
CN = 63

PROPOSED
SEDIMENT FOREBAY #2

PROPOSED
BIORETENTION BASIN

PROPOSED
OUTLET STRUCTURE #1

OVERALL WATERSHED
AREA = 46,406 SF

DP2

WATERSHED 2B - ROOF
AREA = 4,000 SF
TC = 6.0 MIN.
CN = 98

PROPOSED UNDERGROUND
CHAMBER SYSTEM SC-310
(12 CHAMBERS)

WATERSHED 1A
AREA =13,649 SF
TC = 6.3 MIN.
CN = 66

WILLIAMS STREET

RAILROAD TRACKS

PROPOSED
SEDIMENT FOREBAY #1

WATERSHED 1C
AREA =11,828 SF
TC = 6.0 MIN.
CN = 84

DP1

PROPERTY LINE
(TYP.)

DUANE STREET

BLACKMORE STREET

WATERSHED 1D
AREA = 10,104 SF
TC = 7.7 MIN.
CN = 61

SCALE (FEET)
0 25 50 100 200
1 INCH =50 FT

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GREENWICH BAY TOWNHOUSES
5 WILLIAMS STREET
WARWICK, RHODE ISLAND
AP 220, LOT 95

REVISIONS:
NO. DATE. DESCRIPTION

DESIGNED BY: SD
DRAWN BY: SD
CHECKED BY: JAC
DATE: JUNE 2023
PROJECT NO: 20-10b

STORMWATER REPORT

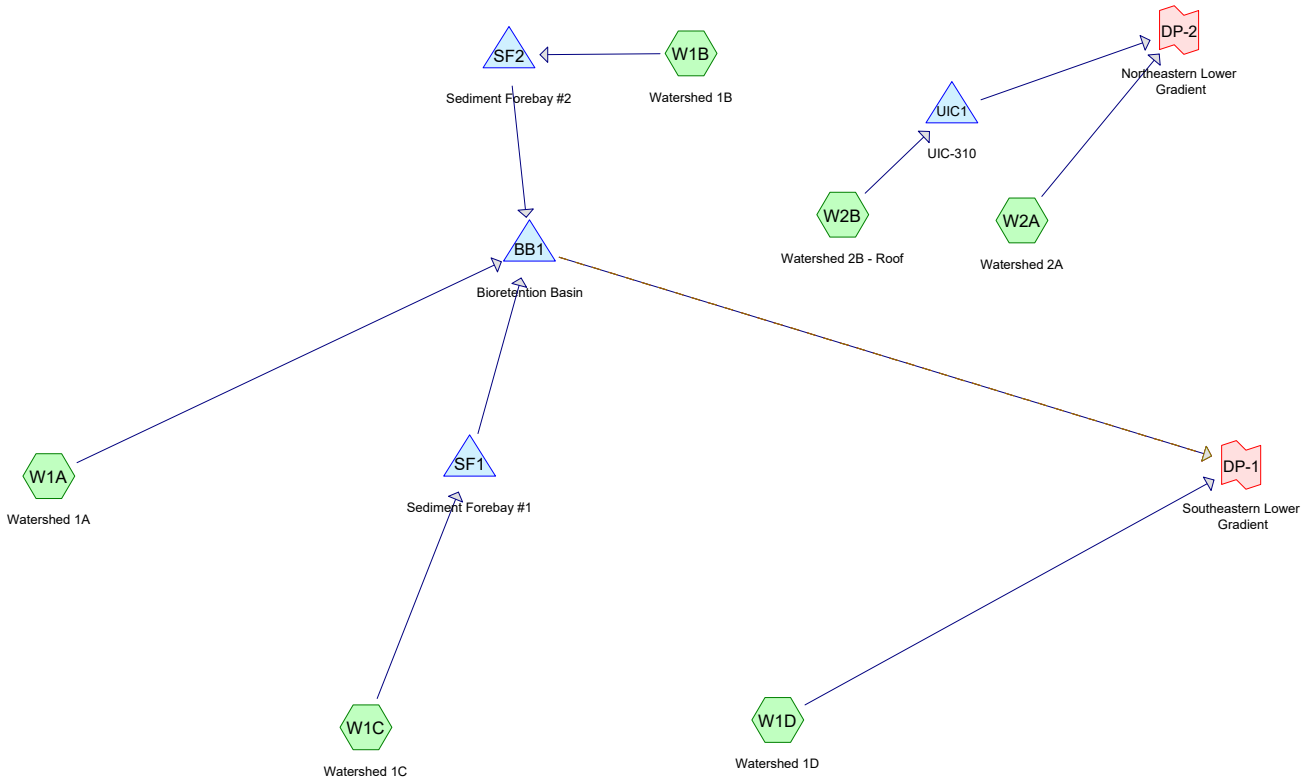
PROPOSED CONDITIONS WATERSHED MAP

SHEET 1 OF 1

Q:\20-10 Steve Miller\20-10b Williams Street\Drainage\Watershed Maps\Williams St. Warwick [Watershed Map]-R1.dwg Jul. 11, 2023 4:56pm

Appendix E

Proposed Condition HydroCAD Calculations



Subcat Reach Pond Link

Routing Diagram for Williams Street - Proposed R2
Prepared by Joe Casali Engineering, Inc., Printed 7/11/2023

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
31,345	61	>75% Grass cover, Good, HSG B (W1A, W1B, W1C, W1D, W2A)
157	98	Impervious Surface, HSG B (W2A)
10,904	98	Impervious Surfaces, HSG B (W1A, W1B, W1C)
4,000	98	Roofs, HSG B (W2B)
46,406	**73**	**TOTAL AREA**

Time span=0.00-28.00 hrs, dt=0.05 hrs, 561 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentW1A: Watershed 1A Runoff Area=13,649 sf 14.64% Impervious Runoff Depth=0.41"
Flow Length=115' Tc=6.3 min CN=66 Runoff=0.10 cfs 465 cf

SubcatchmentW1B: Watershed 1B Runoff Area=3,749 sf 41.61% Impervious Runoff Depth=0.82"
Flow Length=45' Slope=0.0050 '/' Tc=8.9 min CN=76 Runoff=0.07 cfs 256 cf

SubcatchmentW1C: Watershed 1C Runoff Area=11,828 sf 62.11% Impervious Runoff Depth=1.27"
Flow Length=95' Slope=0.0600 '/' Tc=6.0 min CN=84 Runoff=0.40 cfs 1,255 cf

SubcatchmentW1D: Watershed 1D Runoff Area=10,104 sf 0.00% Impervious Runoff Depth=0.26"
Flow Length=136' Tc=7.7 min CN=61 Runoff=0.03 cfs 218 cf

SubcatchmentW2A: Watershed 2A Runoff Area=3,076 sf 5.10% Impervious Runoff Depth=0.31"
Flow Length=71' Slope=0.0100 '/' Tc=9.7 min CN=63 Runoff=0.01 cfs 81 cf

SubcatchmentW2B: Watershed 2B - Roof Runoff Area=4,000 sf 100.00% Impervious Runoff Depth=2.47"
Tc=6.0 min CN=98 Runoff=0.23 cfs 823 cf

Pond BB1: Bioretention Basin Peak Elev=39.99' Storage=280 cf Inflow=0.10 cfs 1,085 cf
arded=0.04 cfs 1,085 cf Primary=0.00 cfs 0 cf Secondary=0.00 cfs 0 cf Tertiary=0.00 cfs 0 cf Outflow=0.04 cfs 1,085 cf

Pond SF1: Sediment Forebay #1 Peak Elev=42.51' Storage=644 cf Inflow=0.40 cfs 1,255 cf
Outflow=0.07 cfs 620 cf

Pond SF2: Sediment Forebay #2 Peak Elev=42.13' Storage=256 cf Inflow=0.07 cfs 256 cf
Outflow=0.00 cfs 0 cf

Pond UIC1: UIC-310 Peak Elev=40.67' Storage=279 cf Inflow=0.23 cfs 823 cf
Discarded=0.02 cfs 823 cf Primary=0.00 cfs 0 cf Outflow=0.02 cfs 823 cf

Link DP-1: Southeastern Lower Gradient Inflow=0.03 cfs 218 cf
Primary=0.03 cfs 218 cf

Link DP-2: Northeastern Lower Gradient Inflow=0.01 cfs 81 cf
Primary=0.01 cfs 81 cf

Total Runoff Area = 46,406 sf Runoff Volume = 3,097 cf Average Runoff Depth = 0.80"
67.55% Pervious = 31,345 sf 32.45% Impervious = 15,061 sf

Summary for Subcatchment W1A: Watershed 1A

Runoff = 0.10 cfs @ 12.13 hrs, Volume= 465 cf, Depth= 0.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.70"

	Area (sf)	CN	Description
*	1,998	98	Impervious Surfaces, HSG B
	11,651	61	>75% Grass cover, Good, HSG B
	13,649	66	Weighted Average
	11,651	61	85.36% Pervious Area
	1,998	98	14.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	100	0.0600	0.27		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
0.1	15	0.0100	2.03		**Shallow Concentrated Flow, SEG B** Paved Kv= 20.3 fps
6.3	115	Total			

Summary for Subcatchment W1B: Watershed 1B

Runoff = 0.07 cfs @ 12.14 hrs, Volume= 256 cf, Depth= 0.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.70"

	Area (sf)	CN	Description
*	1,560	98	Impervious Surfaces, HSG B
	2,189	61	>75% Grass cover, Good, HSG B
	3,749	76	Weighted Average
	2,189	61	58.39% Pervious Area
	1,560	98	41.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	45	0.0050	0.08		**Sheet Flow, Seg A** Grass: Short n= 0.150 P2= 3.30"

Summary for Subcatchment W1C: Watershed 1C

Runoff = 0.40 cfs @ 12.09 hrs, Volume= 1,255 cf, Depth= 1.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.70"

	Area (sf)	CN	Description
*	7,346	98	Impervious Surfaces, HSG B
	4,482	61	>75% Grass cover, Good, HSG B
	11,828	84	Weighted Average
	4,482	61	37.89% Pervious Area
	7,346	98	62.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	95	0.0600	0.27		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"

Summary for Subcatchment W1D: Watershed 1D

Runoff = 0.03 cfs @ 12.31 hrs, Volume= 218 cf, Depth= 0.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.70"

Area (sf)	CN	Description
10,104	61	>75% Grass cover, Good, HSG B
10,104	61	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.0400	0.23		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
0.4	36	0.0100	1.50		**Shallow Concentrated Flow, SEG B** Grassed Waterway Kv= 15.0 fps
7.7	136	Total			

Summary for Subcatchment W2A: Watershed 2A

Runoff = 0.01 cfs @ 12.20 hrs, Volume= 81 cf, Depth= 0.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.70"

	Area (sf)	CN	Description
	2,919	61	>75% Grass cover, Good, HSG B
*	157	98	Impervious Surface, HSG B
	3,076	63	Weighted Average
	2,919	61	94.90% Pervious Area
	157	98	5.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	71	0.0100	0.12		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"

Summary for Subcatchment W2B: Watershed 2B - Roof

Runoff = 0.23 cfs @ 12.09 hrs, Volume= 823 cf, Depth= 2.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.70"

Area (sf)	CN	Description
4,000	98	Roofs, HSG B
4,000	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Pond BB1: Bioretention Basin

Inflow Area = 29,226 sf, 37.31% Impervious, Inflow Depth = 0.45" for 1-Year event
Inflow = 0.10 cfs @ 12.58 hrs, Volume= 1,085 cf
Outflow = 0.04 cfs @ 14.09 hrs, Volume= 1,085 cf, Atten= 59%, Lag= 90.5 min
Discarded = 0.04 cfs @ 14.09 hrs, Volume= 1,085 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Peak Elev= 39.99' @ 14.09 hrs Surf.Area= 427 sf Storage= 280 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 118.8 min (1,058.8 - 940.0)

Volume	Invert	Avail.Storage	Storage Description
#1	40.00'	3,323 cf	**100% Voids (Prismatic)** Listed below (Recalc)
#2	38.00'	282 cf	**Amended Soils (Prismatic)** Listed below (Recalc) 854 cf Overall x 33.0% Voids
		3,605 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
40.00	427	0	0
41.00	835	631	631
42.00	1,333	1,084	1,715
43.00	1,883	1,608	3,323

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
38.00	427	0	0
40.00	427	854	854

Device	Routing	Invert	Outlet Devices
#1	Discarded	38.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Tertiary	42.65'	**2.5" x 2.5" Horiz. Orifice/Grate X 6.00 columns** X 6 rows C= 0.600 Limited to weir flow at low heads
#3	Primary	40.00'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	40.65'	**4.0" Vert. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 14.09 hrs HW=39.99' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=38.00' (Free Discharge)
↑—**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=38.00' (Free Discharge)
↑—**4=Orifice/Grate** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=38.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond SF1: Sediment Forebay #1

Inflow Area = 11,828 sf, 62.11% Impervious, Inflow Depth = 1.27" for 1-Year event
Inflow = 0.40 cfs @ 12.09 hrs, Volume= 1,255 cf
Outflow = 0.07 cfs @ 12.60 hrs, Volume= 620 cf, Atten= 82%, Lag= 30.3 min
Primary = 0.07 cfs @ 12.60 hrs, Volume= 620 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 42.51' @ 12.60 hrs Surf.Area= 867 sf Storage= 644 cf

Plug-Flow detention time= 245.5 min calculated for 620 cf (49% of inflow)
Center-of-Mass det. time= 125.4 min (963.1 - 837.6)

Volume	Invert	Avail.Storage	Storage Description
#1	41.50'	1,124 cf	**Sediment Forebay (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
41.50	419	0	0
42.00	630	262	262
43.00	1,094	862	1,124

Device	Routing	Invert	Outlet Devices
#1	Primary	42.50'	**23.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.06 cfs @ 12.60 hrs HW=42.51' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 0.06 cfs @ 0.25 fps)

Summary for Pond SF2: Sediment Forebay #2

Inflow Area = 3,749 sf, 41.61% Impervious, Inflow Depth = 0.82" for 1-Year event
Inflow = 0.07 cfs @ 12.14 hrs, Volume= 256 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 42.13' @ 24.55 hrs Surf.Area= 336 sf Storage= 256 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	41.00'	639 cf	**Sediment Forebay (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
41.00	124	0	0
42.00	307	216	216
43.00	540	424	639

Device	Routing	Invert	Outlet Devices
#1	Primary	42.50'	**11.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=41.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond UIC1: UIC-310

Inflow Area = 4,000 sf,100.00% Impervious, Inflow Depth = 2.47" for 1-Year event
Inflow = 0.23 cfs @ 12.09 hrs, Volume= 823 cf
Outflow = 0.02 cfs @ 11.50 hrs, Volume= 823 cf, Atten= 90%, Lag= 0.0 min
Discarded = 0.02 cfs @ 11.50 hrs, Volume= 823 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 40.67' @ 12.84 hrs Surf.Area= 428 sf Storage= 279 cf

Plug-Flow detention time= 80.0 min calculated for 822 cf (100% of inflow)
Center-of-Mass det. time= 79.9 min (840.0 - 760.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	39.16'	448 cf	**4.83'W x 88.64'L x 3.58'H Field A** 1,535 cf Overall - 177 cf Embedded = 1,358 cf x 33.0% Voids
#2A	40.16'	177 cf	**ADS_StormTech SC-310 +Cap** x 12 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap
		625 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	39.16'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	41.25'	**4.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 11.50 hrs HW=39.20' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=39.16' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond UIC1: UIC-310 - Chamber Wizard Field A

Chamber Model = ADS_StormTechSC-310 +Cap (ADS StormTech®SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

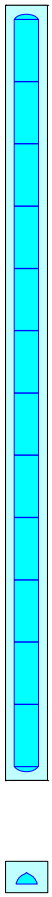
12 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 86.64' Row Length +12.0" End Stone x 2 = 88.64' Base Length
1 Rows x 34.0" Wide + 12.0" Side Stone x 2 = 4.83' Base Width
12.0" Stone Base + 16.0" Chamber Height + 15.0" Stone Cover = 3.58' Field Height

12 Chambers x 14.7 cf = 176.9 cf Chamber Storage

1,535.2 cf Field - 176.9 cf Chambers = 1,358.3 cf Stone x 33.0% Voids = 448.2 cf Stone Storage

Chamber Storage + Stone Storage = 625.1 cf = 0.014 af
Overall Storage Efficiency = 40.7%
Overall System Size = 88.64' x 4.83' x 3.58'

12 Chambers
56.9 cy Field
50.3 cy Stone



Summary for Link DP-1: Southeastern Lower Gradient

Inflow Area = 39,330 sf, 27.72% Impervious, Inflow Depth = 0.07" for 1-Year event
Inflow = 0.03 cfs @ 12.31 hrs, Volume= 218 cf
Primary = 0.03 cfs @ 12.31 hrs, Volume= 218 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: Northeastern Lower Gradient

Inflow Area = 7,076 sf, 58.75% Impervious, Inflow Depth = 0.14" for 1-Year event
Inflow = 0.01 cfs @ 12.20 hrs, Volume= 81 cf
Primary = 0.01 cfs @ 12.20 hrs, Volume= 81 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Summary for Subcatchment W1A: Watershed 1A

Runoff = 0.54 cfs @ 12.10 hrs, Volume= 1,812 cf, Depth= 1.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

	Area (sf)	CN	Description
*	1,998	98	Impervious Surfaces, HSG B
	11,651	61	>75% Grass cover, Good, HSG B
	13,649	66	Weighted Average
	11,651	61	85.36% Pervious Area
	1,998	98	14.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	100	0.0600	0.27		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
0.1	15	0.0100	2.03		**Shallow Concentrated Flow, SEG B** Paved Kv= 20.3 fps
6.3	115	Total			

Summary for Subcatchment W1B: Watershed 1B

Runoff = 0.21 cfs @ 12.13 hrs, Volume= 741 cf, Depth= 2.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

	Area (sf)	CN	Description
*	1,560	98	Impervious Surfaces, HSG B
	2,189	61	>75% Grass cover, Good, HSG B
	3,749	76	Weighted Average
	2,189	61	58.39% Pervious Area
	1,560	98	41.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	45	0.0050	0.08		**Sheet Flow, Seg A** Grass: Short n= 0.150 P2= 3.30"

Summary for Subcatchment W1C: Watershed 1C

Runoff = 0.96 cfs @ 12.09 hrs, Volume= 3,044 cf, Depth= 3.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

	Area (sf)	CN	Description
*	7,346	98	Impervious Surfaces, HSG B
	4,482	61	>75% Grass cover, Good, HSG B
	11,828	84	Weighted Average
	4,482	61	37.89% Pervious Area
	7,346	98	62.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	95	0.0600	0.27		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"

Summary for Subcatchment W1D: Watershed 1D

Runoff = 0.28 cfs @ 12.13 hrs, Volume= 1,053 cf, Depth= 1.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

	Area (sf)	CN	Description
	10,104	61	>75% Grass cover, Good, HSG B
	10,104	61	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.0400	0.23		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
0.4	36	0.0100	1.50		**Shallow Concentrated Flow, SEG B** Grassed Waterway Kv= 15.0 fps
7.7	136	Total			

Summary for Subcatchment W2A: Watershed 2A

Runoff = 0.09 cfs @ 12.15 hrs, Volume= 355 cf, Depth= 1.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

	Area (sf)	CN	Description
	2,919	61	>75% Grass cover, Good, HSG B
*	157	98	Impervious Surface, HSG B
	3,076	63	Weighted Average
	2,919	61	94.90% Pervious Area
	157	98	5.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	71	0.0100	0.12		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"

Summary for Subcatchment W2B: Watershed 2B - Roof

Runoff = 0.42 cfs @ 12.09 hrs, Volume= 1,521 cf, Depth= 4.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.80"

Area (sf)	CN	Description
4,000	98	Roofs, HSG B
4,000	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Pond BB1: Bioretention Basin

Inflow Area = 29,226 sf, 37.31% Impervious, Inflow Depth = 1.88" for 10-Year event
Inflow = 1.47 cfs @ 12.10 hrs, Volume= 4,570 cf
Outflow = 0.78 cfs @ 12.27 hrs, Volume= 4,570 cf, Atten= 47%, Lag= 10.3 min
Discarded = 0.07 cfs @ 12.27 hrs, Volume= 2,160 cf
Primary = 0.38 cfs @ 12.27 hrs, Volume= 2,016 cf
Secondary = 0.33 cfs @ 12.27 hrs, Volume= 394 cf
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Peak Elev= 40.97' @ 12.27 hrs Surf.Area= 1,250 sf Storage= 889 cf

Plug-Flow detention time= 60.2 min calculated for 4,570 cf (100% of inflow)
Center-of-Mass det. time= 60.2 min (925.8 - 865.7)

Volume	Invert	Avail.Storage	Storage Description
#1	40.00'	3,323 cf	**100% Voids (Prismatic)** Listed below (Recalc)
#2	38.00'	282 cf	**Amended Soils (Prismatic)** Listed below (Recalc) 854 cf Overall x 33.0% Voids
		3,605 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
40.00	427	0	0
41.00	835	631	631
42.00	1,333	1,084	1,715
43.00	1,883	1,608	3,323

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
38.00	427	0	0
40.00	427	854	854

Device	Routing	Invert	Outlet Devices
#1	Discarded	38.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Tertiary	42.65'	**2.5" x 2.5" Horiz. Orifice/Grate X 6.00 columns** X 6 rows C= 0.600 Limited to weir flow at low heads
#3	Primary	40.00'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	40.65'	**4.0" Vert. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.07 cfs @ 12.27 hrs HW=40.97' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.38 cfs @ 12.27 hrs HW=40.97' (Free Discharge)
↑—**3=Orifice/Grate** (Orifice Controls 0.38 cfs @ 4.31 fps)

Secondary OutFlow Max=0.33 cfs @ 12.27 hrs HW=40.97' (Free Discharge)
↑—**4=Orifice/Grate** (Orifice Controls 0.33 cfs @ 1.92 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=38.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond SF1: Sediment Forebay #1

Inflow Area = 11,828 sf, 62.11% Impervious, Inflow Depth = 3.09" for 10-Year event
Inflow = 0.96 cfs @ 12.09 hrs, Volume= 3,044 cf
Outflow = 0.93 cfs @ 12.10 hrs, Volume= 2,416 cf, Atten= 3%, Lag= 0.6 min
Primary = 0.93 cfs @ 12.10 hrs, Volume= 2,416 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 42.57' @ 12.10 hrs Surf.Area= 892 sf Storage= 692 cf

Plug-Flow detention time= 118.6 min calculated for 2,411 cf (79% of inflow)
Center-of-Mass det. time= 41.7 min (853.9 - 812.2)

Volume	Invert	Avail.Storage	Storage Description
#1	41.50'	1,124 cf	**Sediment Forebay (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
41.50	419	0	0
42.00	630	262	262
43.00	1,094	862	1,124

Device	Routing	Invert	Outlet Devices
#1	Primary	42.50'	**23.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.93 cfs @ 12.10 hrs HW=42.56' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.93 cfs @ 0.62 fps)

Summary for Pond SF2: Sediment Forebay #2

Inflow Area = 3,749 sf, 41.61% Impervious, Inflow Depth = 2.37" for 10-Year event
Inflow = 0.21 cfs @ 12.13 hrs, Volume= 741 cf
Outflow = 0.03 cfs @ 12.77 hrs, Volume= 342 cf, Atten= 84%, Lag= 38.1 min
Primary = 0.03 cfs @ 12.77 hrs, Volume= 342 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 42.51' @ 12.77 hrs Surf.Area= 426 sf Storage= 402 cf

Plug-Flow detention time= 257.0 min calculated for 342 cf (46% of inflow)
Center-of-Mass det. time= 137.0 min (974.0 - 836.9)

Volume	Invert	Avail.Storage	Storage Description
#1	41.00'	639 cf	**Sediment Forebay (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
41.00	124	0	0
42.00	307	216	216
43.00	540	424	639

Device	Routing	Invert	Outlet Devices
#1	Primary	42.50'	**11.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.02 cfs @ 12.77 hrs HW=42.51' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 0.02 cfs @ 0.23 fps)

Summary for Pond UIC1: UIC-310

Inflow Area = 4,000 sf,100.00% Impervious, Inflow Depth = 4.56" for 10-Year event
Inflow = 0.42 cfs @ 12.09 hrs, Volume= 1,521 cf
Outflow = 0.20 cfs @ 12.26 hrs, Volume= 1,522 cf, Atten= 53%, Lag= 10.4 min
Discarded = 0.02 cfs @ 10.45 hrs, Volume= 1,283 cf
Primary = 0.17 cfs @ 12.26 hrs, Volume= 239 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 41.42' @ 12.26 hrs Surf.Area= 428 sf Storage= 438 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 111.6 min (860.3 - 748.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	39.16'	448 cf	**4.83'W x 88.64'L x 3.58'H Field A** 1,535 cf Overall - 177 cf Embedded = 1,358 cf x 33.0% Voids
#2A	40.16'	177 cf	**ADS_StormTech SC-310 +Cap** x 12 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap
		625 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	39.16'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	41.25'	**4.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 10.45 hrs HW=39.20' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.17 cfs @ 12.26 hrs HW=41.42' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 0.17 cfs @ 1.98 fps)

Summary for Link DP-1: Southeastern Lower Gradient

Inflow Area = 39,330 sf, 27.72% Impervious, Inflow Depth = 1.06" for 10-Year event
Inflow = 0.90 cfs @ 12.25 hrs, Volume= 3,463 cf
Primary = 0.90 cfs @ 12.25 hrs, Volume= 3,463 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: Northeastern Lower Gradient

Inflow Area = 7,076 sf, 58.75% Impervious, Inflow Depth = 1.01" for 10-Year event
Inflow = 0.25 cfs @ 12.24 hrs, Volume= 594 cf
Primary = 0.25 cfs @ 12.24 hrs, Volume= 594 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Summary for Subcatchment W1A: Watershed 1A

Runoff = 1.64 cfs @ 12.10 hrs, Volume= 5,219 cf, Depth= 4.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

	Area (sf)	CN	Description
*	1,998	98	Impervious Surfaces, HSG B
	11,651	61	>75% Grass cover, Good, HSG B
	13,649	66	Weighted Average
	11,651	61	85.36% Pervious Area
	1,998	98	14.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	100	0.0600	0.27		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
0.1	15	0.0100	2.03		**Shallow Concentrated Flow, SEG B** Paved Kv= 20.3 fps
6.3	115	Total			

Summary for Subcatchment W1B: Watershed 1B

Runoff = 0.52 cfs @ 12.12 hrs, Volume= 1,812 cf, Depth= 5.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

	Area (sf)	CN	Description
*	1,560	98	Impervious Surfaces, HSG B
	2,189	61	>75% Grass cover, Good, HSG B
	3,749	76	Weighted Average
	2,189	61	58.39% Pervious Area
	1,560	98	41.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	45	0.0050	0.08		**Sheet Flow, Seg A** Grass: Short n= 0.150 P2= 3.30"

Summary for Subcatchment W1C: Watershed 1C

Runoff = 2.03 cfs @ 12.09 hrs, Volume= 6,672 cf, Depth= 6.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

	Area (sf)	CN	Description
*	7,346	98	Impervious Surfaces, HSG B
	4,482	61	>75% Grass cover, Good, HSG B
	11,828	84	Weighted Average
	4,482	61	37.89% Pervious Area
	7,346	98	62.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	95	0.0600	0.27		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"

Summary for Subcatchment W1D: Watershed 1D

Runoff = 1.00 cfs @ 12.11 hrs, Volume= 3,357 cf, Depth= 3.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

	Area (sf)	CN	Description
	10,104	61	>75% Grass cover, Good, HSG B
	10,104	61	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.0400	0.23		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
0.4	36	0.0100	1.50		**Shallow Concentrated Flow, SEG B** Grassed Waterway Kv= 15.0 fps
7.7	136	Total			

Summary for Subcatchment W2A: Watershed 2A

Runoff = 0.30 cfs @ 12.14 hrs, Volume= 1,083 cf, Depth= 4.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

	Area (sf)	CN	Description
	2,919	61	>75% Grass cover, Good, HSG B
*	157	98	Impervious Surface, HSG B
	3,076	63	Weighted Average
	2,919	61	94.90% Pervious Area
	157	98	5.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	71	0.0100	0.12		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"

Summary for Subcatchment W2B: Watershed 2B - Roof

Runoff = 0.77 cfs @ 12.09 hrs, Volume= 2,820 cf, Depth= 8.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.70"

Area (sf)	CN	Description
4,000	98	Roofs, HSG B
4,000	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Pond BB1: Bioretention Basin

Inflow Area = 29,226 sf, 37.31% Impervious, Inflow Depth = 5.20" for 100-Year event
Inflow = 4.10 cfs @ 12.10 hrs, Volume= 12,670 cf
Outflow = 1.85 cfs @ 12.32 hrs, Volume= 12,670 cf, Atten= 55%, Lag= 13.1 min
Discarded = 0.11 cfs @ 12.32 hrs, Volume= 3,077 cf
Primary = 0.64 cfs @ 12.32 hrs, Volume= 5,890 cf
Secondary = 1.09 cfs @ 12.32 hrs, Volume= 3,703 cf
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Peak Elev= 42.50' @ 12.32 hrs Surf.Area= 2,036 sf Storage= 2,735 cf

Plug-Flow detention time= 34.6 min calculated for 12,648 cf (100% of inflow)
Center-of-Mass det. time= 34.8 min (862.0 - 827.2)

Volume	Invert	Avail.Storage	Storage Description
#1	40.00'	3,323 cf	**100% Voids (Prismatic)** Listed below (Recalc)
#2	38.00'	282 cf	**Amended Soils (Prismatic)** Listed below (Recalc) 854 cf Overall x 33.0% Voids
		3,605 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
40.00	427	0	0
41.00	835	631	631
42.00	1,333	1,084	1,715
43.00	1,883	1,608	3,323

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
38.00	427	0	0
40.00	427	854	854

Device	Routing	Invert	Outlet Devices
#1	Discarded	38.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Tertiary	42.65'	**2.5" x 2.5" Horiz. Orifice/Grate X 6.00 columns** X 6 rows C= 0.600 Limited to weir flow at low heads
#3	Primary	40.00'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	40.65'	**4.0" Vert. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.11 cfs @ 12.32 hrs HW=42.50' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.11 cfs)

Primary OutFlow Max=0.64 cfs @ 12.32 hrs HW=42.50' (Free Discharge)
↑—**3=Orifice/Grate** (Orifice Controls 0.64 cfs @ 7.35 fps)

Secondary OutFlow Max=1.09 cfs @ 12.32 hrs HW=42.50' (Free Discharge)
↑—**4=Orifice/Grate** (Orifice Controls 1.09 cfs @ 6.24 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=38.00' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond SF1: Sediment Forebay #1

Inflow Area = 11,828 sf, 62.11% Impervious, Inflow Depth = 6.77" for 100-Year event
Inflow = 2.03 cfs @ 12.09 hrs, Volume= 6,672 cf
Outflow = 1.99 cfs @ 12.10 hrs, Volume= 6,035 cf, Atten= 2%, Lag= 0.5 min
Primary = 1.99 cfs @ 12.10 hrs, Volume= 6,035 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 42.61' @ 12.10 hrs Surf.Area= 912 sf Storage= 731 cf

Plug-Flow detention time= 74.4 min calculated for 6,025 cf (90% of inflow)
Center-of-Mass det. time= 28.2 min (818.4 - 790.2)

Volume	Invert	Avail.Storage	Storage Description
#1	41.50'	1,124 cf	**Sediment Forebay (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
41.50	419	0	0
42.00	630	262	262
43.00	1,094	862	1,124

Device	Routing	Invert	Outlet Devices
#1	Primary	42.50'	**23.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=1.97 cfs @ 12.10 hrs HW=42.61' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 1.97 cfs @ 0.80 fps)

Summary for Pond SF2: Sediment Forebay #2

Inflow Area = 3,749 sf, 41.61% Impervious, Inflow Depth = 5.80" for 100-Year event
Inflow = 0.52 cfs @ 12.12 hrs, Volume= 1,812 cf
Outflow = 0.51 cfs @ 12.14 hrs, Volume= 1,416 cf, Atten= 2%, Lag= 0.8 min
Primary = 0.51 cfs @ 12.14 hrs, Volume= 1,416 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 42.57' @ 12.14 hrs Surf.Area= 440 sf Storage= 429 cf

Plug-Flow detention time= 123.9 min calculated for 1,416 cf (78% of inflow)
Center-of-Mass det. time= 44.1 min (855.4 - 811.3)

Volume	Invert	Avail.Storage	Storage Description
#1	41.00'	639 cf	**Sediment Forebay (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
41.00	124	0	0
42.00	307	216	216
43.00	540	424	639

Device	Routing	Invert	Outlet Devices
#1	Primary	42.50'	**11.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.49 cfs @ 12.14 hrs HW=42.57' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.49 cfs @ 0.64 fps)

Summary for Pond UIC1: UIC-310

Inflow Area = 4,000 sf,100.00% Impervious, Inflow Depth = 8.46" for 100-Year event
Inflow = 0.77 cfs @ 12.09 hrs, Volume= 2,820 cf
Outflow = 0.52 cfs @ 12.17 hrs, Volume= 2,824 cf, Atten= 32%, Lag= 5.3 min
Discarded = 0.02 cfs @ 8.55 hrs, Volume= 1,681 cf
Primary = 0.50 cfs @ 12.17 hrs, Volume= 1,144 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 42.67' @ 12.17 hrs Surf.Area= 428 sf Storage= 614 cf

Plug-Flow detention time= 88.5 min calculated for 2,819 cf (100% of inflow)
Center-of-Mass det. time= 89.5 min (829.7 - 740.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	39.16'	448 cf	**4.83'W x 88.64'L x 3.58'H Field A** 1,535 cf Overall - 177 cf Embedded = 1,358 cf x 33.0% Voids
#2A	40.16'	177 cf	**ADS_StormTech SC-310 +Cap** x 12 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap
		625 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	39.16'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	41.25'	**4.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 8.55 hrs HW=39.20' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.49 cfs @ 12.17 hrs HW=42.64' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 0.49 cfs @ 5.67 fps)

Summary for Link DP-1: Southeastern Lower Gradient

Inflow Area = 39,330 sf, 27.72% Impervious, Inflow Depth = 3.95" for 100-Year event
Inflow = 2.54 cfs @ 12.15 hrs, Volume= 12,950 cf
Primary = 2.54 cfs @ 12.15 hrs, Volume= 12,950 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: Northeastern Lower Gradient

Inflow Area = 7,076 sf, 58.75% Impervious, Inflow Depth = 3.78" for 100-Year event
Inflow = 0.80 cfs @ 12.16 hrs, Volume= 2,227 cf
Primary = 0.80 cfs @ 12.16 hrs, Volume= 2,227 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Appendix F

Water Quality Calculations

Version: 4/2015

Project Name: Greenwich Bay Townhouses
Date: July 2023

Water Quality Volume Calculation WorkSheet

This worksheet is designed to assist the project engineer with a determination of the required water quality treatment area. The worksheet leads the designer through redevelopment applicability first and then receiving water requirements. This tool is intended to compliment to the Redevelopment Criteria Guidance and the Water Quality Guidance and assist both the designer and the permit application reviewer towards consistent results. Enter information into only the YELLOW Boxes.

Redevelopment Criteria Guidance
Water Quality Goals "Stormwater Compensation Method"

Step 1 - Determine which office in OWR you are applying to: Application Guidance

Step 2 - Site Information		value/calculation	units
Total Site Area (total area of project parcels)	TS	0.72	acres
Total Jurisdictional Wetlands and/or floodplain within the above TSA	JW1	0.00	acres
Existing impervious also within the Jurisdictonal Wetlands	-JW2	0.00	acres
Conservation Land within the TSA		0.00	acres
Site Size = (TSA)-(JW1-JW2)-CL	**SS=**	**0.72**	acres

Step 3 - Redevelopment Applicability			
Total Impervious Area (pre-construction)	TIA=	0.10	acres
% Impervious (if ≥40% - redevelopment standard 3.2.6 applies)		**0.14**	

REPEAT IF NECESSARY Steps 4, 5 and 6 for EACH Waterbody ID (RIVER-ID as found in the GIS Map Server)

Step 4 - Receiving waterbody information

Waterbody ID or RIVER ID from GIS Map Server	RI0007025E-05B
Waterbody Name from GIS Map Server	Greenwich Cove
Name the sub-watersheds (design-points) contributing to this Waterbody ID	DP1
Is this Waterbody Impaired/TMDL for any Phosphorus, Metals or Bacteria?	NO
Is this Waterbody Impaired for Nitrogen?	YES

Step 5 - Pre-Post Construction Conditions to the Waterbody

Total Pre-Construction Impervious Surface to this Waterbody ID	0.09	acres
Total Disturbed Existing Impervious (DI)	0.09	acres
Total Post-Construction Impervious to this Waterbody ID	0.20	acres
Net Increased Impervious (NII)	0.12	acres

Step 6 - Infiltration and BMP information - Note: Increasing infiltration will likely decrease stormwater treatment area for Metals, Bacteria and Phosporus

I am proposing to infiltrate this percentage WQv to this WBID	100%	%
I am proposing this number of BMP's	1	#

RESULTS - Select the Larger Number of the 2 numbers provided

Applicable Condition	**Min Water Quality Treatment Area**	**Min Treatment w/o WQ consideration**
No Impairement or TMDL - New Development		
No Impairment or TMDL - Redevelopment		
Only Phosphorus, Metals or Bacteria Impairment - New Development		
Only Phosphorus, Metals or Bacteria Impairment - Redevelopment		
Nitrogen Impairment - New Development	0.29	0.20
Nitrogen Impairment - Redevelopment		
REQUIRED STORMWATER TREATMENT AREA	**0.3** acres	

* Enter the name of the STP (both type and label) which has been designed to treat this particular Rev or Rea.

Version: 4/2015

Project Name: Greenwich Bay Townhouses
Date: July 2023

Water Quality Volume Calculation WorkSheet

This worksheet is designed to assist the project engineer with a determination of the required water quality treatment area. The worksheet leads the designer through redevelopment applicability first and then receiving water requirements. This tool is intended to compliment to the Redevelopment Criteria Guidance and the Water Quality Guidance and assist both the designer and the permit application reviewer towards consistent results. Enter information into only the YELLOW Boxes.

Redevelopment Criteria Guidance
Water Quality Goals "Stormwater Compensation Method"

Step 1 - Determine which office in OWR you are applying to: Application Guidance

Step 2 - Site Information

		value/calculation	units
Total Site Area (total area of project parcels)	TS	0.72	acres
Total Jurisdictional Wetlands and/or floodplain within the above TSA	JW1	0.00	acres
Existing impervious also within the Jurisdictonal Wetlands	-JW2	0.00	acres
Conservation Land within the TSA		0.00	acres
Site Size = (TSA)-(JW1-JW2)-CL	**SS=**	**0.72**	acres

Step 3 - Redevelopment Applicability

Total Impervious Area (pre-construction)	TIA=	0.10	acres
% Impervious (if ≥40% - redevelopment standard 3.2.6 applies)		**0.14**	

REPEAT IF NECESSARY Steps 4, 5 and 6 for EACH Waterbody ID (RIVER-ID as found in the GIS Map Server)

Step 4 - Receiving waterbody information

Waterbody ID or RIVER ID from GIS Map Server	RI0007025E-05B
Waterbody Name from GIS Map Server	Greenwich Cove
Name the sub-watersheds (design-points) contributing to this Waterbody ID	DP2
Is this Waterbody Impaired/TMDL for any Phosphorus, Metals or Bacteria?	NO
Is this Waterbody Impaired for Nitrogen?	YES

Step 5 - Pre-Post Construction Conditions to the Waterbody

Total Pre-Construction Impervious Surface to this Waterbody ID	0.01	acres
Total Disturbed Existing Impervious (DI)	0.01	acres
Total Post-Construction Impervious to this Waterbody ID	0.10	acres
Net Increased Impervious (NII)	0.08	acres

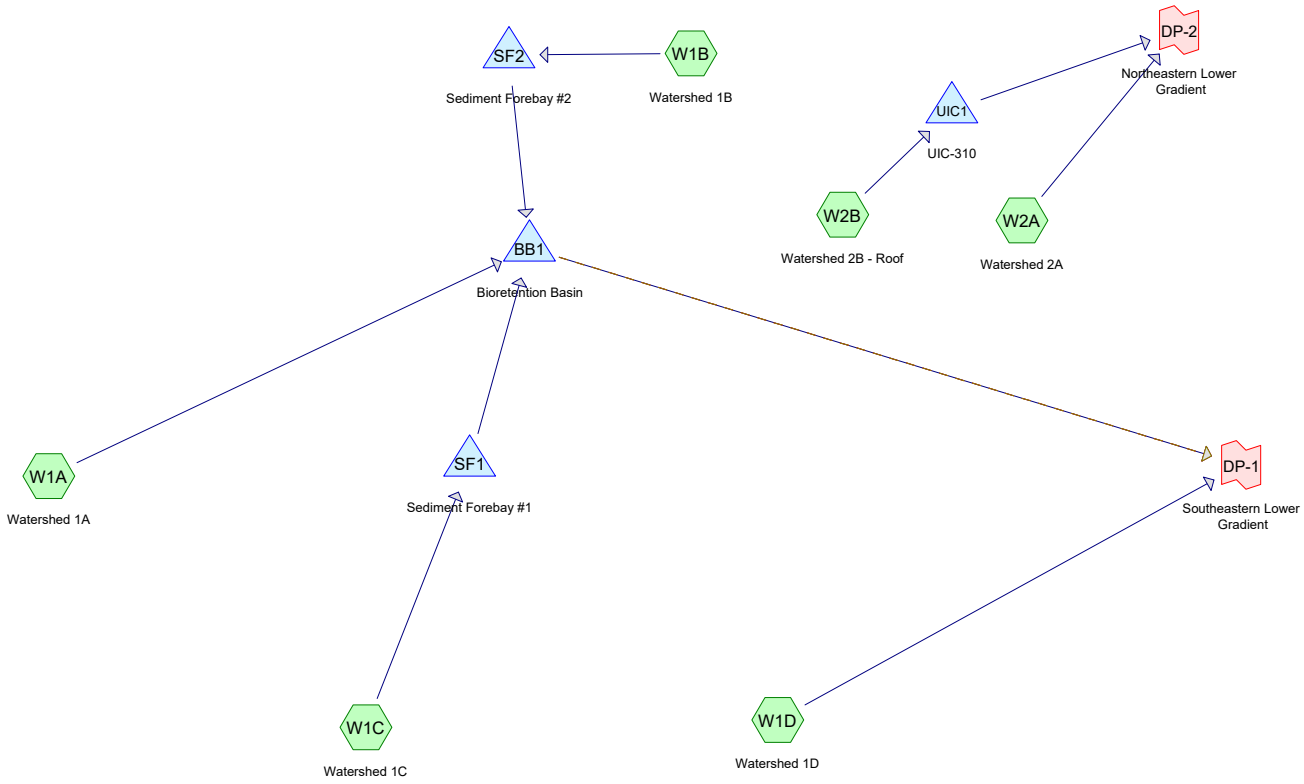
Step 6 - Infiltration and BMP information - Note: Increasing infiltration will likely decrease stormwater treatment area for Metals, Bacteria and Phosporus

I am proposing to infiltrate this percentage WQv to this WBID	100%	%
I am proposing this number of BMP's	1	#

RESULTS - Select the Larger Number of the 2 numbers provided

Applicable Condition	Min Water Quality Treatment Area	Min Treatment w/o WQ consideration
No Impairement or TMDL - New Development		
No Impairment or TMDL - Redevelopment		
Only Phosphorus, Metals or Bacteria Impairment - New Development		
Only Phosphorus, Metals or Bacteria Impairment - Redevelopment		
Nitrogen Impairment - New Development	0.21	0.10
Nitrogen Impairment - Redevelopment		
REQUIRED STORMWATER TREATMENT AREA	**0.2** acres	

* Enter the name of the STP (both type and label) which has been designed to treat this particular Rev or Rea.



Subcat Reach Pond Link

Routing Diagram for Williams Street - WQv R2
Prepared by Joe Casali Engineering, Inc., Printed 7/11/2023

Summary for Subcatchment W1A: Watershed 1A

Runoff = 0.05 cfs @ 12.09 hrs, Volume= 164 cf, Depth= 0.14"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr WQV Rainfall=1.20"

	Area (sf)	CN	Description
*	1,998	98	Impervious Surfaces, HSG B
	11,651	61	>75% Grass cover, Good, HSG B
	13,649	66	Weighted Average
	11,651	61	85.36% Pervious Area
	1,998	98	14.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	100	0.0600	0.27		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
0.1	15	0.0100	2.03		**Shallow Concentrated Flow, SEG B** Paved Kv= 20.3 fps
6.3	115	Total			

Summary for Subcatchment W1B: Watershed 1B

Runoff = 0.04 cfs @ 12.12 hrs, Volume= 128 cf, Depth= 0.41"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr WQV Rainfall=1.20"

	Area (sf)	CN	Description
*	1,560	98	Impervious Surfaces, HSG B
	2,189	61	>75% Grass cover, Good, HSG B
	3,749	76	Weighted Average
	2,189	61	58.39% Pervious Area
	1,560	98	41.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	45	0.0050	0.08		**Sheet Flow, Seg A** Grass: Short n= 0.150 P2= 3.30"

Summary for Subcatchment W1C: Watershed 1C

Runoff = 0.18 cfs @ 12.09 hrs, Volume= 603 cf, Depth= 0.61"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr WQV Rainfall=1.20"

	Area (sf)	CN	Description
*	7,346	98	Impervious Surfaces, HSG B
	4,482	61	>75% Grass cover, Good, HSG B
	11,828	84	Weighted Average
	4,482	61	37.89% Pervious Area
	7,346	98	62.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	95	0.0600	0.27		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"

Summary for Subcatchment W1D: Watershed 1D

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr WQV Rainfall=1.20"

Area (sf)	CN	Description
10,104	61	>75% Grass cover, Good, HSG B
10,104	61	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.3	100	0.0400	0.23		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"
0.4	36	0.0100	1.50		**Shallow Concentrated Flow, SEG B** Grassed Waterway Kv= 15.0 fps
7.7	136	Total			

Summary for Subcatchment W2A: Watershed 2A

Runoff = 0.00 cfs @ 12.13 hrs, Volume= 13 cf, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr WQV Rainfall=1.20"

	Area (sf)	CN	Description
	2,919	61	>75% Grass cover, Good, HSG B
*	157	98	Impervious Surface, HSG B
	3,076	63	Weighted Average
	2,919	61	94.90% Pervious Area
	157	98	5.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	71	0.0100	0.12		**Sheet Flow, SEG A** Grass: Short n= 0.150 P2= 3.30"

Summary for Subcatchment W2B: Watershed 2B - Roof

Runoff = 0.10 cfs @ 12.09 hrs, Volume= 329 cf, Depth= 0.99"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Type III 24-hr WQV Rainfall=1.20"

Area (sf)	CN	Description
4,000	98	Roofs, HSG B
4,000	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Pond BB1: Bioretention Basin

Inflow Area = 29,226 sf, 37.31% Impervious, Inflow Depth = 0.07" for WQV event
Inflow = 0.05 cfs @ 12.09 hrs, Volume= 164 cf
Outflow = 0.02 cfs @ 12.05 hrs, Volume= 164 cf, Atten= 51%, Lag= 0.0 min
Discarded = 0.02 cfs @ 12.05 hrs, Volume= 164 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs
Peak Elev= 38.14' @ 12.26 hrs Surf.Area= 427 sf Storage= 19 cf

Plug-Flow detention time= 6.6 min calculated for 164 cf (100% of inflow)
Center-of-Mass det. time= 6.6 min (788.9 - 782.3)

Volume	Invert	Avail.Storage	Storage Description
#1	40.00'	3,323 cf	**100% Voids (Prismatic)** Listed below (Recalc)
#2	38.00'	282 cf	**Amended Soils (Prismatic)** Listed below (Recalc) 854 cf Overall x 33.0% Voids
		3,605 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
40.00	427	0	0
41.00	835	631	631
42.00	1,333	1,084	1,715
43.00	1,883	1,608	3,323

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
38.00	427	0	0
40.00	427	854	854

Device	Routing	Invert	Outlet Devices
#1	Discarded	38.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Tertiary	42.65'	**2.5" x 2.5" Horiz. Orifice/Grate X 6.00 columns** X 6 rows C= 0.600 Limited to weir flow at low heads
#3	Primary	40.00'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	40.65'	**4.0" Vert. Orifice/Grate X 2.00** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 12.05 hrs HW=38.06' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=38.00' (Free Discharge)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=38.00' (Free Discharge)
└**4=Orifice/Grate** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=38.00' (Free Discharge)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond SF1: Sediment Forebay #1

Inflow Area = 11,828 sf, 62.11% Impervious, Inflow Depth = 0.61" for WQV event
Inflow = 0.18 cfs @ 12.09 hrs, Volume= 603 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 42.46' @ 24.40 hrs Surf.Area= 845 sf Storage= 603 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	41.50'	1,124 cf	**Sediment Forebay (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
41.50	419	0	0
42.00	630	262	262
43.00	1,094	862	1,124

Device	Routing	Invert	Outlet Devices
#1	Primary	42.50'	**23.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=41.50' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond SF2: Sediment Forebay #2

Inflow Area = 3,749 sf, 41.61% Impervious, Inflow Depth = 0.41" for WQV event
Inflow = 0.04 cfs @ 12.12 hrs, Volume= 128 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 41.69' @ 24.55 hrs Surf.Area= 250 sf Storage= 128 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	41.00'	639 cf	**Sediment Forebay (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
41.00	124	0	0
42.00	307	216	216
43.00	540	424	639

Device	Routing	Invert	Outlet Devices
#1	Primary	42.50'	**11.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=41.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond UIC1: UIC-310

Inflow Area = 4,000 sf,100.00% Impervious, Inflow Depth = 0.99" for WQV event
Inflow = 0.10 cfs @ 12.09 hrs, Volume= 329 cf
Outflow = 0.02 cfs @ 11.80 hrs, Volume= 329 cf, Atten= 76%, Lag= 0.0 min
Discarded = 0.02 cfs @ 11.80 hrs, Volume= 329 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 39.67' @ 12.47 hrs Surf.Area= 428 sf Storage= 72 cf

Plug-Flow detention time= 16.8 min calculated for 328 cf (100% of inflow)
Center-of-Mass det. time= 16.9 min (798.9 - 782.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	39.16'	448 cf	**4.83'W x 88.64'L x 3.58'H Field A** 1,535 cf Overall - 177 cf Embedded = 1,358 cf x 33.0% Voids
#2A	40.16'	177 cf	**ADS_StormTech SC-310 +Cap** x 12 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap
		625 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	39.16'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	41.25'	**4.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.02 cfs @ 11.80 hrs HW=39.20' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=39.16' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Link DP-1: Southeastern Lower Gradient

Inflow Area = 39,330 sf, 27.72% Impervious, Inflow Depth = 0.00" for WQV event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs

Summary for Link DP-2: Northeastern Lower Gradient

Inflow Area = 7,076 sf, 58.75% Impervious, Inflow Depth = 0.02" for WQV event
Inflow = 0.00 cfs @ 12.13 hrs, Volume= 13 cf
Primary = 0.00 cfs @ 12.13 hrs, Volume= 13 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.05 hrs