STORMWATER MANAGEMENT REPORT

for

83 Myrtle Street Supportive Housing

Block 573, Lots 9, 10 & 12.02
Cranford Township, Union County, New Jersey

March 2022

Prepared for:

Avidd Better Together

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Prepared by:

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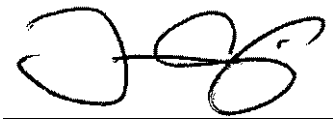

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TABLE OF CONTENTS

STORMWATER MANAGEMENT CALCULATIONS

FIGURES

APPENDICES

1.0 PROJECT DESCRIPTION

Avidd Community Services (Applicant) is seeking land use approvals for the reconfiguration of three (3) existing lots on the north side of Myrtle Street near the intersection with Ludlow Avenue in Cranford Township, Union County, New Jersey (Figure 1) so that two lots can be developed with community supportive housing and the third lot left vacant for future use. The construction project for the two community residences includes two new single family homes, share driveways and parking areas, and amenities such as stormwater management facilities, landscape buffer plantings and lighting.

The subject property is currently vacant and partially wooded land. The site is located within the R-3 Residential zoning district (Figure 2). It will be developed according to the regulations outlined in the Township code.

The surrounding land uses are as follows:

1. To the west, north and east – single family residential; and
2. To the south (across Myrtle Street) – industrial.

Topographic elevations at the site (referenced to the North American Vertical Datum of 1988) range from 87 near the northwestern corner to 77 along Myrtle Street near the intersection with Ludlow Avenue. Runoff generally flows from west to east across the site to a set of inlets on Myrtle Street east of Ludlow Avenue (Figure 3).

The site is located within Flood Zone X (outside the 1%, 100-year flood event) as indicated on the FEMA Flood Insurance Rate Map for Cranford Township, Union County, New Jersey (Figure 4).

According to the USDA Natural Resources Conservation Service (NRCS) New Jersey Soil Survey web data, the soil types on the project site are:

Boonton – Urban land – Haledon complex (BovB), 0 – 8% slopes; and
Haledon – Urban land complex (HatB), 0 – 8% slopes;

As such the entire site consists of soil classified as Hydrologic Soil Group C.

2.0 DESIGN CRITERIA

The stormwater management analysis and design is in accordance with the Stormwater Management Rules at N.J.A.C. 7:8, subchapters 5 and 6, the New Jersey Stormwater Best Management Practices Manual, the New Jersey Residential Site Improvement Standards, the New Jersey Soil Erosion and Sediment Control Standards, and Cranford Township code chapter 365.

In accordance with the New Jersey Department of Environmental Protection (NJDEP) Stormwater Management Rules at N.J.A.C. 7:8 and the Cranford Township code, the development of the project is classified as a "Major Development." A Major Development is defined therein as a development which ultimately disturbs one or more acres of land and/or increases impervious coverage by 1,000 square feet or more. The three technical requirements of the Stormwater Management Rules at N.J.A.C 7:8 that generally need to be addressed are groundwater recharge, runoff quality and runoff quantity using Green Infrastructure measures described in NJAC 7:8-5.3.

- Groundwater Recharge Standard – N.J.A.C. 7:8-5.4(b)1 sets forth the minimum design and performance standards for groundwater recharge where suitable soils exist. The design engineer, using the assumptions and factors for stormwater runoff and groundwater recharge calculations at N.J.A.C. 7:8-5.7, shall either:

  i. Demonstrate through hydrologic and hydraulic analysis that the site and its stormwater management measures maintain 100 percent of the average annual preconstruction groundwater recharge volume for the site; or

  ii. Demonstrate through hydrologic and hydraulic analysis that the increase of stormwater runoff volume from pre-construction to post-construction for the two-year storm is infiltrated.

- Runoff Quality Standard – N.J.A.C. 7:8-5.5 requires the stormwater management measures be designed to reduce the post-developed load of total suspended solids (TSS) in stormwater runoff generated from the water quality design storm by 80 percent of the anticipated load from the developed site, expressed as an annual average. The water quality design storm is 1.25 inches of rainfall in two hours. Water quality calculations shall take into account the distribution of rain from the water quality design storm. The calculation of the volume of runoff may take into account the implementation of non-structural and structural stormwater management measures.

- Runoff Quantity Control Standard - N.J.A.C. 7:8-5.6(b) requires that in order to control stormwater runoff quantity impacts, the design engineer shall, using the assumptions and factors for stormwater runoff calculations at N.J.A.C. 7:8-5.7, complete one of the following:

  (1) Demonstrate through hydrologic and hydraulic analysis that for stormwater leaving the site, post-construction runoff hydrographs for the 2-year, 10-year and 100-year storm events do not exceed, at any point in time, the pre-construction runoff hydrographs for the same storm events; or

  (2) Demonstrate through hydrologic and hydraulic analysis that there is no increase, as compared to the pre-construction condition, in the peak runoff rates of stormwater leaving the site for the 2-year, 10-year and

100-year storm events and that the increased volume or change in timing of stormwater runoff will not increase flood damage at or downstream of the site. This analysis shall include the analysis of impacts of existing land uses and projected land uses assuming full development under existing zoning and land use ordinances in the drainage area; or

(3) Design stormwater management measures so that the post-construction peak runoff rates for the 2-year, 10-year and 100-year storm events are 50, 75 and 80 percent, respectively, of the pre-construction peak runoff rates. The percentages apply only to the post-construction stormwater runoff that is attributable to the portion of the site on which the proposed development or project is to be constructed.

The stormwater runoff quantity standards are required at the site's boundary to each abutting lot, roadway, watercourse, or receiving storm sewer system.

3.0 TECHNIQUES OF ANALYSIS

In accordance with the stormwater runoff calculation methodology at N.J.A.C. 7:8-5.7, the quantity (volume and rate) of stormwater runoff is calculated based on the USDA NRCS methodology using the NRCS Runoff Equation and Dimensionless Unit Hydrograph, as described in Technical Release 55 - Urban Hydrology for Small Watersheds (TR-55), dated June 1986. The NOAA_D storm distribution is used in the calculations and a unit peak discharge factor of 484 is applied to the dimensionless unit hydrograph for runoff estimation.

NRCS 24 hour design storm rainfall depths for New Jersey, as revised August 2012, are used in the calculations. The various Times of Concentration (Tc) were determined for pre and post-developed conditions using the hydraulically longest flow path. The Tc flow path can be found on the Drainage Area Plans located in Appendix H. The pre and post-developed Tc calculations can be found in Appendices C and D. Curve numbers (CN) were generated for the drainage areas for pre and post-developed conditions based on the soil group and existing or proposed land use. The CN calculations can be found in Appendices C and D for the respective routings. Note that impervious areas were calculated as separate subareas to generate hydrographs without weighted CNs as outlined in the BMP manual chapter 5.

Using the drainage areas, the TCs and CNs as input data, version 10.10-6a of *HydroCAD,* a hydrologic/hydraulic software program by HydroCad Software Solutions, LLC, was employed to generate runoff volumes and rates.

4.0 LAND COVER CONDITIONS

The site consists of one drainage area discharging to the eastern end of the project limits. For the purpose of the calculations there are two subareas – one for the

project site to be developed and the other for existing area that drains to and through the site but is not being modified. Pursuant to the rules, improvements to runoff characteristics are only required for the portion of the site being developed. The tables below summarize the pre-developed and post developed cover conditions of the site.

The subject property is currently vacant as shown on the Drainage Area Plans in Appendix H and summarized below:

Table 4.1: Pre-Developed Cover Conditions

Drainage Shed Name	Drainage Shed Area (Ac.)	Paved Surfaces (Ac.)	1/8 Ac Residentail (Ac.)	Open Space (Ac.)	Wooded (Ac.)
Existing Drainage Area 1A (EXDA-1A) (offsite)	1.577	0.259	1.122	0.163	0.033
Existing Drainage Area 1B (EXDA-1B) (onsite)	1.205	0.000	0.000	0.301	0.905
Total	2.783	0.259	1.122	0.464	0.938

Note: Minor differences in totals are due to rounding of acreages.

Table 4.2: Post Developed Cover Conditions

Drainage Shed Name	Drainage Shed Area (Ac.)	Paved Surfaces (Ac.)	1/8 Ac Residentail (Ac.)	Open Space (Ac.)	Wooded (Ac.)
Proposed Drainage Area 1 (PRDA-1)	0.638	0.314	0.083	0.224	0.018
Proposed Drainage Area 2 (PRDA-2)	2.144	0.332	1.039	0.729	0.044
Total	2.783	0.646	1.122	0.953	0.062

Note: Minor differences in totals are due to rounding of acreages.

5.0 STORMWATER MANAGEMENT FACILITIES

The new stormwater management (SWM) facilities proposed for the project are designed to satisfy the Runoff Control Quantity Standard at N.J.A.C. 7:8-5.6, the Runoff Quality Standard at N.J.A.C. 7:8-5.5, and the Groundwater Recharge Standard at N.J.A.C. 7:8-5.4. The system includes one infiltration basin within the Applicant's property, and it will be maintained by the Applicant/Owner. The basin will be constructed in accordance with current NJDEP standards including adequate separation to the estimated seasonal high water table, removal of existing

unsuitable soil material within the basin footprint found to have restrictive infiltration capacity and replacement with material of higher permeability rate, and will include a K5 sand bottom for the purpose of maintaining permeability rates of the subsoil over time allowing ease of replacement for periodic maintenance.

According to Chapter 9.4 of the BMP Manual, the lowest elevation in an infiltration basin must be at least two (2) feet above the seasonal high groundwater table. Soil test pits were advanced at multiple locations at the site, the results for which are included in Appendix H. Depths to the seasonally high groundwater table at each of the test pit locations were measured and are summarized below. Due to restrictive soils found on site the elevation of the seasonal high water table varies substantially and mottling found in the existing soils (which are used to determine seasonal high in this case) are due to perched water over those restrictive soils. It is clear from the investigation that soil on the western side of the site is mostly clay and silt and sand starting a few feet below grade is encountered on the eastern end of the site. The soil profile exhibit in Appendix H graphically depicts the information summarized below. Based on the depth to seasonal high water found on the eastern end of the site, existing grades just east of the site and in the road, and the existence of basements in homes east of the site, we have determined the elevation of the seasonal high water table to be no higher than 75.0 within the area where the basin is proposed. The bottom of the basin is proposed at elevation 77.90. As such, more than two feet of separation to the seasonal high water table is provided in the design.

Table 5.1: Estimated Seasonally High Water Elevation

TP #	Surface Elev. (ft)	Depth to SHW (in)	Depth to SHW (ft)	Elevation SHW (ft)
Stormwater Investigation				
1*	79.04	32	2.67	76.37
2*	81.92	32	2.67	79.25
3*	83.12	30	2.50	80.62
4*	80.59	30	2.50	78.09
Soils and Foundation Investigation				
1s	78.62	36	3.00	75.62
2s	79.10	36	3.00	76.10
3s	80.08	48	4.00	76.08
4s	83.24	36	3.00	80.24
5s	82.44	30	2.50	79.94
6s	85.02	24	2.00	83.02
7s	84.26	24	2.00	82.26

1. Surface elevations are taken from the topographic survey by Vargo Associates included in project plans.

2. Test pit numbers ending in an asterisk (*) denotes that information was taken from a report titled, "Stormwater Investigation", prepared by Mellick-Tully & Associates, dated February 13, 2020 included in Appendix H of this report.
3. Test pit numbers ending in an "s" denotes that the information was taken from a report titled, "Soils and Foundation Investigation", prepared by Mellick-Tully & Associates, dated February 13, 2020 included in Appendix H of this report.

Basin cross-section details showing depth to seasonal high water, outlet control structure features and elevations during the Water Quality, 2-year, 10-year, 100-year and emergency conditions (100-year storm with the basin full at the start of the storm) are included in the overall project plan set and a profile of the basin and existing soil (including that to be replaced) is in Appendix H of this report.

6.0 GROUNDWATER RECHARGE

In accordance with N.J.A.C. 7:8-5.4(b)1.ii, the groundwater recharge requirement is to demonstrate through hydrologic and hydraulic analysis that the increase of stormwater runoff volume from pre-developed to post-developed conditions for the two-year storm is retained and infiltrated on site.

The total increase in runoff volume for the 2-year storm is taken from the pre-developed runoff calculations in Appendix C and post-developed runoff calculations in Appendix D and summarized below in Table 6.1:

Table 6.1: Increase in 2 Year Runoff Volume

Pre Developed 2 Yr Volume		Post Developed 2 Yr Volume	
Drainage Area	Volume (ac-ft)	Drainage Area	Volume (ac-ft)
EXDA-1A	0.306	PRDA-1	0.122
EXDA-1B	0.100	PRDA-2	0.365
Total	0.406	Total	0.487

The net increase in 2-year runoff volume = 0.487 ac-ft – 0.406 ac-ft = 0.081 ac-ft = 3,528 cu ft.

The retained volume in the basin that is stored for recharge is:

Basin 1 = 3,545 cu ft (@78.60)
Total = 3,545 cu ft (> 3,528) OK

The groundwater recharge requirement is met.

7.0 RUNOFF QUANTITY

The stormwater management basins are designed to improve the amount of runoff discharging from the site generated by the required storm events. In accordance with N.J.A.C. 7:8-5.6, the post-development peak runoff rates for the 2-yr, 10-yr, and 100-yr storm events shall not exceed 50%, 75%, and 80%, respectively, of the pre-development peak runoff rates for the area where improvement is proposed.

For the calculation of existing runoff the site was modeled as separate subareas based on proposed disturbance limits and land cover. The Existing Drainage Area Plan (Appendix I) defines the subareas and Appendix C contains the Pre-Developed Runoff Calculations. The calculation of the post-development site runoff was performed in the same manner as the pre-developed with the site broken up into different drainage subareas based on the type of land cover and the proposed disturbance limits. The same existing drainage pattern was maintained with no additional direct discharge offsite. The Proposed Drainage Area Plan (Appendix I) defines the subareas and Appendix D contains the Post-Development Runoff Calculations. Table 7.1 below shows the reduction of pre and post-developed peak runoff rates for the project site:

Table 7.1: Runoff Peak Reduction to Point A

Design Storm (year)	24-hour Rainfall Depth (in.)	Pre-developed Total Peak Runoff (cfs)	Pre-developed Peak runoff from Onsite area (cfs)	Allowable Peak Runoff[1]		Post-Developed Peak Runoff [2]	
				(cfs)	%	(cfs)	%
2	3.39	3.88	0.93	3.42	50	2.96	1
10	5.17	7.19	2.22	6.64	75	6.30	60
100	8.69	14.14	5.15	13.11	80	12.48	68

Notes:

1. The Allowable Peak Runoff was calculated as follows:
   $Q_{Allowable} = Q_{Total\ Existing} - (\%\ Improvement\ Required)(Q_{Onsite\ Area})$
   $Q_{100\text{-}year} = 14.14\ cfs - (1 - 0.80)(5.15\ cfs) = 13.11\ cfs$
2. The Post Developed Peak Runoff percent of existing was calculated as follows:
   $\%\ of\ Existing = 1 - [(Q_{Total\ Existing} - Q_{Total\ Proposed})/Q_{Onsite\ Area}]$
   % of Existing 100-year = 1 – [(14.14 cfs – 12.48 cfs) / 5.15 cfs] = 68%

As shown in the table above and the calculations in Appendix D, the system provides the reduction in flow rates required by the regulations. This project will have a positive impact to downstream areas by reduction to potential flooding conditions.

8.0 RUNOFF QUALITY

In accordance with NJAC 7:8-5.2 and 5.5(a), a land development that creates 0.25

acres or more of new or additional regulated motor vehicle surface must include stormwater management measures that reduce the average annual total suspended solids (TSS) load in the post-construction runoff from the new regulated motor vehicle surface by 80%. Comparing the sum of the coverage conditions from Tables 4.1 and 4.2, the development results in an increase in impervious surface greater than 0.25 acres so the Runoff Quality Standard at NJAC 7:8-5.5 is applicable.

The basin is designed to infiltrate the water quality storm volume produced by the project site. In accordance with Chapter 4 of the BMP Manual, infiltration structures are given a TSS removal rate of 80%. The calculations for the Water Quality Storm in Appendix D show that the entire volume of runoff is retained for infiltration in the basin. Since the volume of runoff retained in the basin is greater than or equal to the runoff generated by the WQ storm, the water quality requirement of the applicable regulations is met.

9.0 GREEN INFRASTRUCTURE AND LOW IMPACT TECHNIQUES

In March of 2021 updated Stormwater Management Rules became effective that include what is termed "Green Infrastructure" or GI. GI is intended to be an objective approach to addressing low impact stormwater management requirements and is generally a methodology to accomplish the quantitative requirements for water quality and groundwater recharge by restricting drainage areas to GI features to no more than 2.5 acres, spreading out the required infiltration volume in smaller stormwater management features around the site rather than one large downstream structure. The GI measures are described in detail in Chapter 9 of the BMP manual.

This project addresses GI requirements since it is a small drainage area of less than 2.5 acres draining to the single shallow infiltration basin. This is considered a small-scale infiltration basin and provides water quality, recharge and quantity control pursuant to the rules. The soil encountered the first few below grade on site is generally not conducive to infiltration and areas of soil that may restrict infiltration of runoff are proposed for replacement.

A Low Impact Development Checklist is also included in Appendix A.

10.0 SOIL EROSION AND SEDIMENT CONTROL

In addition to temporary soil erosion and sediment control measures during construction, the project includes permanent stabilization to outfalls in the basin in the form of rip-rap aprons.

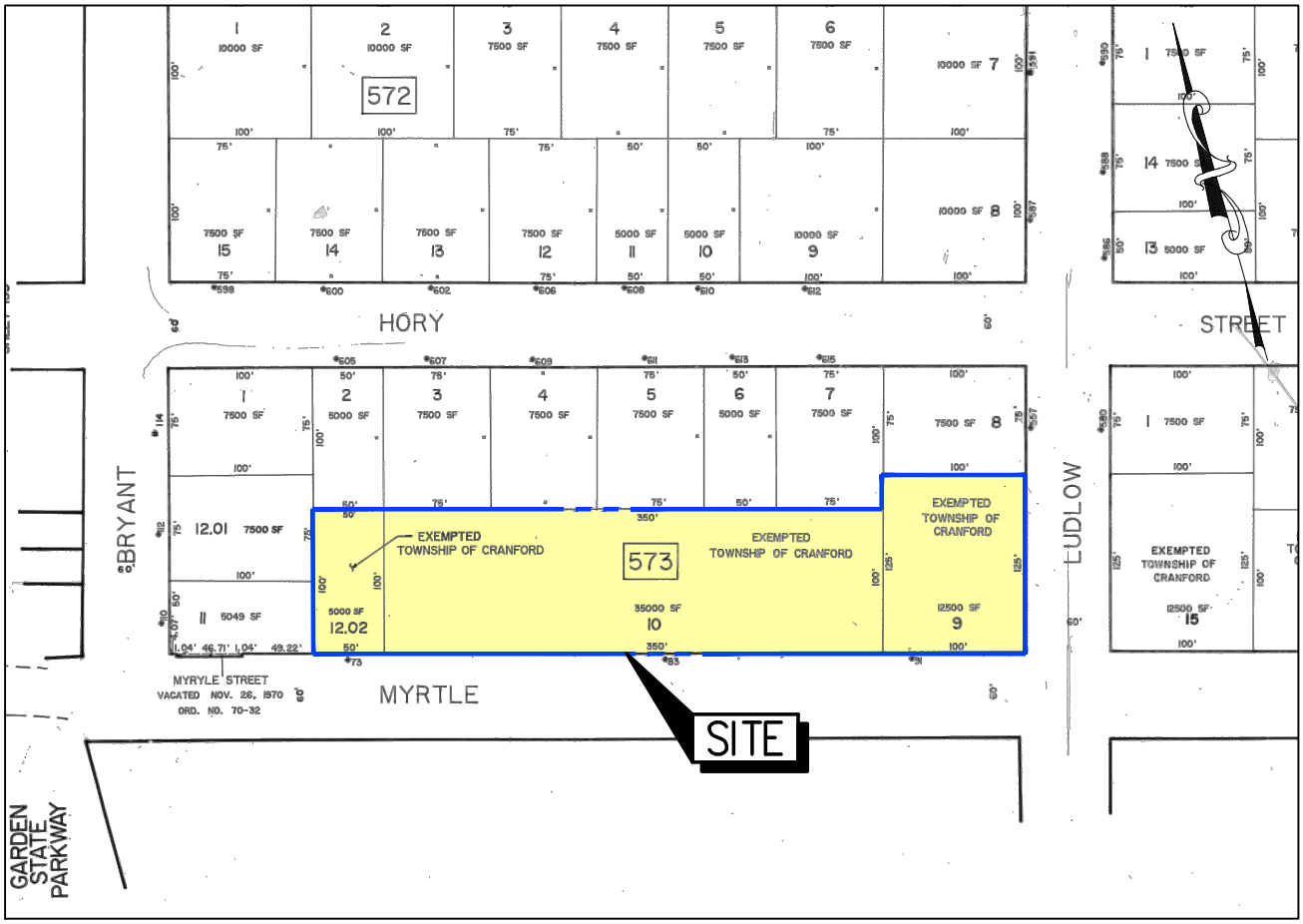
11.0 OFFSITE STABILITY

Offsite stability requirements are met through the reduction in the discharge flow rates from the 2 and 10 year storm events as outlined in the New Jersey Soil Erosion and Sediment Control Standards Chapter 21.

12.0 CONCLUSION

As described above, the entire Stormwater Management System and its components are designed in accordance with applicable state and local municipal regulations and requirements and Green Infrastructure and low impact stormwater management measures are utilized where practical. The infiltration basins are designed to accommodate the required design storms and provide runoff quantity reduction, water quality treatment and groundwater recharge as outlined in the State Stormwater Rules at N.J.A.C. 7:8 and Township ordinance chapter 365 while providing an environmentally responsible and economically feasible system.

FIGURES



SOURCE: TOWNSHIP OF CRANFORD TAX MAP SHEET 141, DATED JUNE 1977, LAST REVISED 9/23/93

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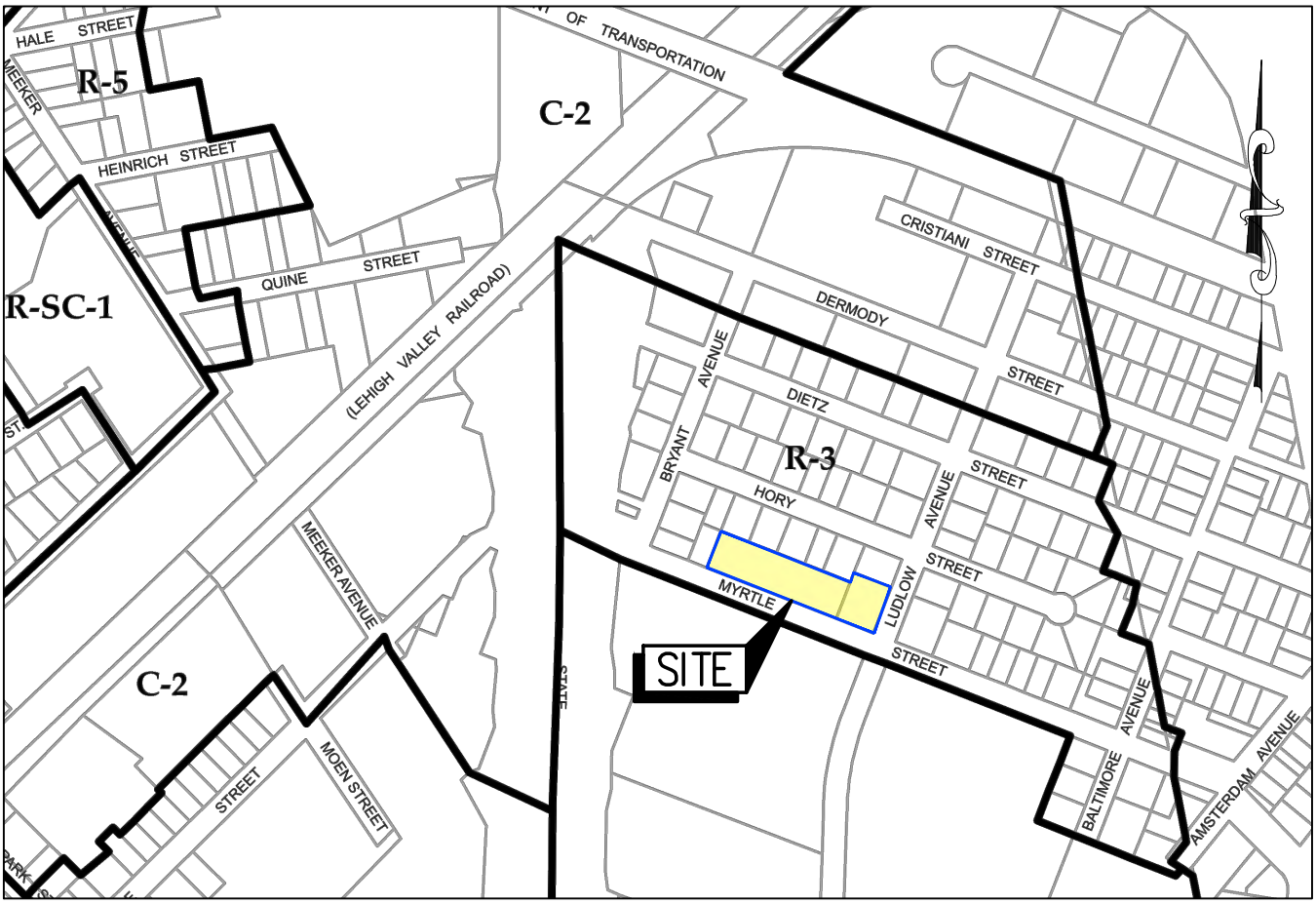
FIGURE 1 TAX MAP

MONARCH HOUSING 83 MYRTLE STREET

CRANFORD TOWNSHIP, UNION COUNTY, NEW JERSEY

DATE:	SCALE:	DRAWN BY:
3/11/2022	NO SCALE	LAT



SOURCE: OFFICIAL ZONING MAP OF CRANFORD TOWNSHIP

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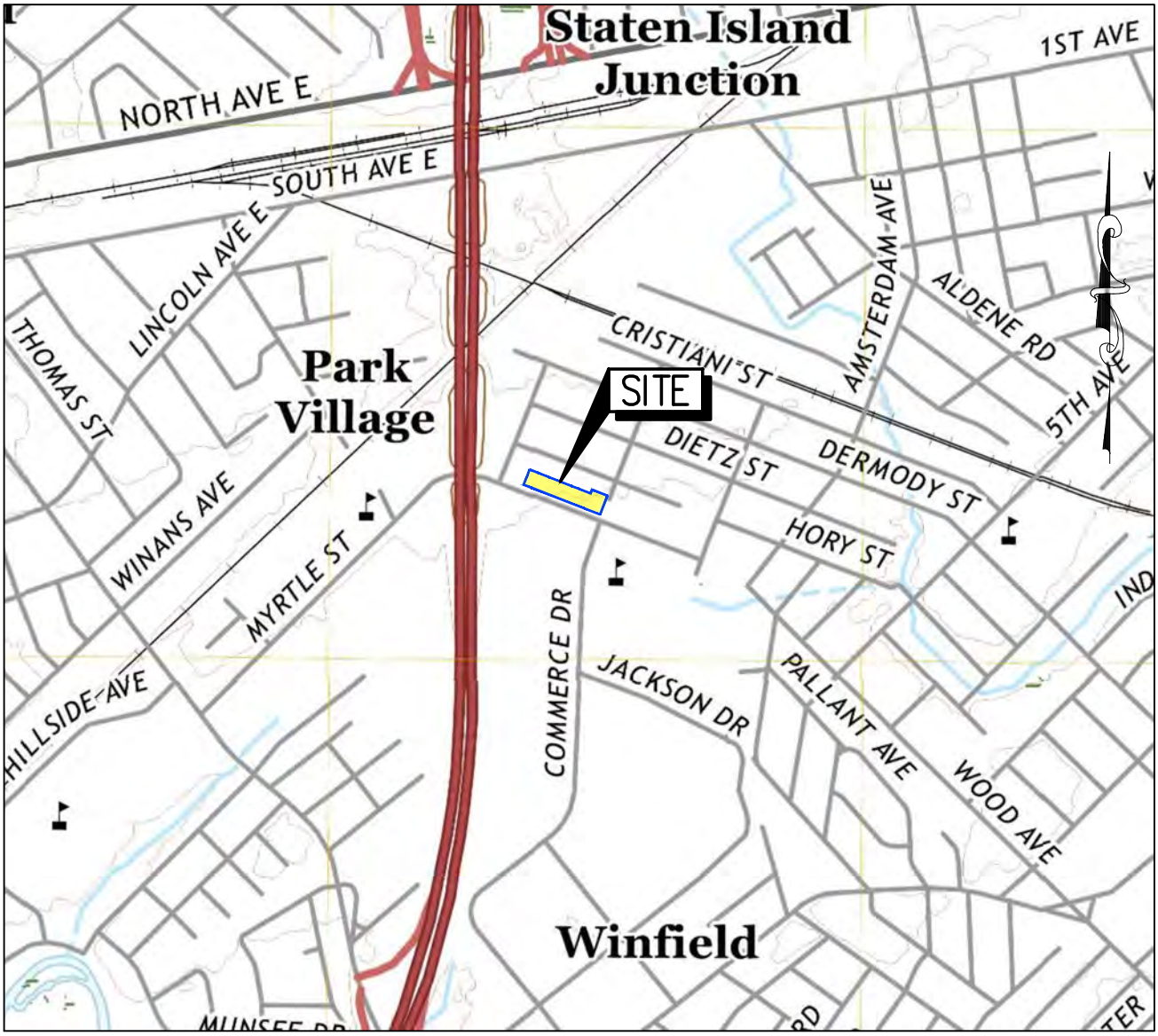
FIGURE 2 ZONING MAP

MONARCH HOUSING 83 MYRTLE STREET

CRANFORD TOWNSHIP, UNION COUNTY, NEW JERSEY

DATE:	SCALE:	DRAWN BY:
3/11/2022	NO SCALE	LAT



U.S.G.S. ROSELLE QUAD SHEET LOCATION MAP

GRAPHIC SCALE

1,000 0 500 1,000

1 INCH = 1,000 FEET

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FIGURE 2 ZONING MAP

MONARCH HOUSING 83 MYRTLE STREET

CRANFORD TOWNSHIP, UNION COUNTY, NEW JERSEY

DATE:	SCALE:	DRAWN BY:
3/11/2022	1" = 1,000'	LAT

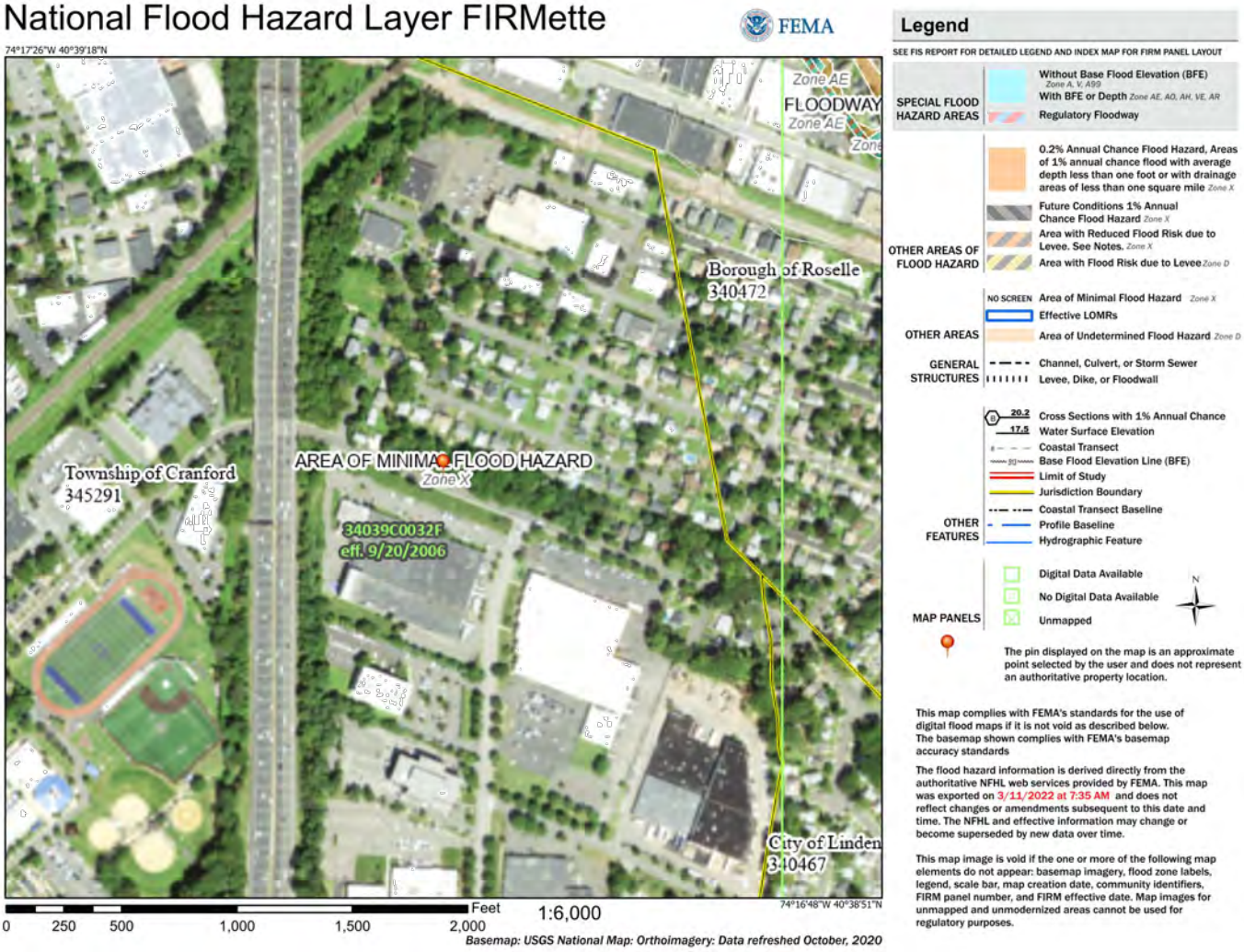

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FIGURE 4 FLOOD ZONE MAP

MONARCH HOUSING 83 MYRTLE STREET

CRANFORD TOWNSHIP, UNION COUNTY, NEW JERSEY

DATE:	SCALE:	DRAWN BY:
3/11/2022	N.T.S.	LAT

SOILS DATA OBTAINED FROM NATURAL RESOURCES CONSERVATION SERVICES (NRCS) U.S. DEPARTMENT OF AGRICULTURE.

GRAPHIC SCALE

500 0 250 500

1 INCH = 500 FEET

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FIGURE 5 SOILS MAP

MONARCH HOUSING 83 MYRTLE STREET

CRANFORD TOWNSHIP, UNION COUNTY, NEW JERSEY

DATE:	SCALE:	DRAWN BY:
3/11/2022	1" = 500'	LAT

APPENDIX A

Low Impact Development Checklist

New Jersey Stormwater Best Management Practices Manual

February 2004

Low Impact Development Checklist

Municipality: Cranford Township

County: Union County Date: March 2022

Review board or agency: Cranford Township Planning Board
Somerset-Union Soil Conservation District

Proposed land development name: 83 Myrtle Street Supportive Housing

Lot(s): Proposed 9,10 & 12.02 Block(s): 573

Project or application number:

Applicant's name: Avidd Community Services

Applicant's address: 92 Broadway, Suite 101
Denville, New Jersey 07834

Telephone: 973-664-1770 Fax:

Email address: tmckeon@aviddnj.org

Designer's name: Jason T. Sciullo, PE, PP; Sciullo Engineering Services, LLC

Designer's address: 17 South Gordons Alley, Suite 3, Atlantic City, NJ 08401

Telephone: 609-300-5171 Fax:

Email address: jsciullo@sciulloengineering.com

Part 1: Description of Nonstructural Approach to Site Design

In narrative form, provide an overall description of the nonstructural stormwater management approach and strategies incorporated into the proposed site's design. Attach additional pages as necessary. Details of each nonstructural strategy are provided in Part 3 below.

The Development Plan that is the subject of this report is a minor subdivision for construction of two community residences for the disabled. The nonstructural stormwater management strategies that are required have been generally employed in the design of this development and include the following:

1. Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss.

(a) The existing site is wooded and the development proposed is the minimum necessary to meet the project needs and address Township stormwater management requirements. The site will be fully stabilized when construction is complete minimizing loss of sediment.

2. Maximize the protection of natural vegetation.

   (a) Any areas of existing woods or trees to remain will be protected during construction.

3. Minimize the decrease in the "time of concentration" from pre-construction to post-construction.

   (a) The development includes use of overland flow where possible.

4. Minimize land disturbance including clearing and grading.

   (a) The development area proposed is the minimum necessary to meet project goals and Township stormwater management requirements.

5. Minimize soil compaction.

   (a) Construction traffic will be limited to only those areas to be developed at the site including parking areas and drives.

6. Provide low-maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers and pesticides.

   (a) All landscaping and vegetative restoration will be through use of native plant material.

7. Provide other source controls to prevent or minimize the use or exposure of pollutants at the site in order to prevent or minimize the release of those pollutants into stormwater runoff.

   (a) Maintenance of the stormwater management facilities will require that any trash or debris must be removed periodically and disposed of according to regulations.

   (b) Revegetation of currently disturbed areas with a permanent vegetative cover will be performed in accordance with the Standards for Soil Erosion and Sediment Control in New Jersey.

Part 2: Review of Local Stormwater Management Regulations

Title and date of stormwater management regulations used in development design:

NJ Stormwater Management Rules (NJAC 7:8-5.1 et. seq.).
NJ Residential Site Improvement Standards (NJAC 5:21)
Cranford Township Stormwater Management Ordinance Chapter 365.

Do regulations include nonstructural requirements? Yes: XX No:

If yes, briefly describe: See NJAC 7:8-5.3(b)1-9.

List LID-BMP's prohibited by local regulations: None

Pre-design meeting held? Yes: XX Date: multiple No:

Meeting held with: Cranford Township Planning Board staff

Pre-design site walk held? Yes: XX Date: 2018 No:

Site walk held with: Client and architect

Other agencies with stormwater review jurisdiction:

Name: Somerset-Union Soil Conservation District

Required approval: Certification of Soil Erosion and Sediment Control Plan

Part 3: Nonstructural Strategies and LID-BMP's in Design

3.1 Vegetation and Landscaping

Effective management of both existing and proposed site vegetation can reduce a development's adverse impacts on groundwater recharges and runoff quality and quantity. This section of the checklist helps identify the vegetation and landscaping strategies and nonstructural LID-BMP's that have been incorporated into the proposed development's design to help maintain existing recharge rates and/or minimize or prevent increases in runoff quantity and pollutant loading.

A. Has an inventory of existing site vegetation been performed? Yes: X No:

   If yes, was this inventory a factor in the site's layout and design? Yes: No: X

B. Does the site design utilize any of the following nonstructural LID-BMP's?

   Preservation of natural areas? Yes: No: X If yes, specify % of site: NA

   Native ground cover? Yes: No: X If yes, specify % of site: NA

   Vegetated buffers? Yes: No: X If yes, specify % of site: NA%

C. Do the land development regulations require these nonstructural LID-BMP's?

   Preservation of natural areas? Yes: No: XX If yes, specify % of site:

   Native ground cover? Yes: No: XX If yes, specify % of site:

   Vegetated buffers? Yes: No: XX If yes, specify % of site:

D. If vegetated filter strips or buffers are utilized, specify their functions:

Reduce runoff volume increases through lower runoff coefficient: Yes: No:

Reduce runoff pollutant loads through runoff treatment: Yes: No:

Maintain groundwater recharge by preserving natural areas: Yes: No:

3.2 Minimize Land Disturbance

Minimizing land disturbance is a nonstructural LID-BMP that can be applied during both the development's construction and post-construction phases. This section of the checklist helps identify those land disturbance strategies and nonstructural LID-BMP's that have been incorporated into the proposed development's design to minimize land disturbance and the resultant change in the site's hydrologic character.

A. Have inventories of existing site soils and slopes been performed? Yes: XX No:

If yes, were these inventories factors in the site's layout and design? Yes:
No: XX

B. Does the development's design utilize any of the following nonstructural LID-BMP's?

Restrict permanent site disturbance by land owners? Yes: No: XX
If yes, how:

Restrict temporary site disturbance during construction? Yes: XX No:

If yes, how: Limit site disturbance to only those areas that are to be developed as part of the project.

Consider soils and slopes in selecting disturbance limits? Yes: XX No:

If yes, how: Site design incorporates natural topographic features and contours into the design of the grading plan and stormwater management system.

C. Specify percentage of site to be cleared: 73% Regraded: 73%

D. Specify percentage of cleared areas done so for buildings: 15%

For driveways and parking: 10% For roadways: NA

E. What design criteria and/or site changes would be required to reduce the percentages in C and D above? Revision to the zoning standards or reduction in project yield.

F. Specify site's (area to be developed) hydrologic soil group (HSG) percentages:

HSG A: 0% HSG B: 0% HSG C: 100% HSG D: 0%

G. Specify percentage of each HSG that will be permanently disturbed:

HSG A: 0% HSG B: 0% HSG C: 100% HSG D: 0%

H. Locating site disturbance within areas with less permeable soils (HSG C and D) and minimizing disturbance within areas with greater permeable soils (HSG A and B) can help maintain groundwater recharge rates and reduce runoff volume increases. In light of the HSG percentages in F and G above, what other practical measures if any can be taken to achieve this?

None. Entire site is Type C.

I. Does the site include Karst topography? Yes: No: XX

If yes, discuss measures taken to limit Karst impacts:

3.3 Impervious Area Management

New impervious surfaces at a development site can have the greatest adverse effect on groundwater recharge and stormwater quality and quantity. This section of the checklist helps identify those nonstructural strategies and LID-BMP's that have been incorporated into a proposed development's design to comprehensively manage the extent and impacts of new impervious surfaces.

A. Specify impervious cover at site (within area to be developed):
Existing: 0.00 acres Proposed: 0.344 acres (34.7%)

B. Specify maximum site impervious coverage allowed by regulations: 38%

C. Compare proposed street cartway widths with those required by regulations:

Type of Street	Proposed Cartway Width (feet)	Required Cartway Width (feet)
Residential access - low intensity	NA	NA
Residential access - medium intensity	NA	NA
Residential access - high intensity with parking	NA	NA
Residential access - high intensity without parking	NA	NA
Neighborhood	NA	NA
Minor collector -low intensity without parking	NA	NA
Minor collector - with one parking lane	NA	NA
Minor collector - with two parking lanes	NA	NA
Minor collector - without parking	NA	NA
Major collector	NA	NA
Private Drive (one way)	18	13

D. Compare proposed parking space dimensions with those required by regulations:

Proposed: onsite 9' x 18' Regulations: 9' x 18'

E. Compare proposed number of parking spaces with those required by regulations (entire site):

Proposed: 8 Regulations: 8

F. Specify percentage of total site (current development) impervious cover created by buildings: 36%

By driveways and parking: 64% By roadways: 0%

G. What design criteria and/or site changes would be required to reduce the percentages in F above? Revise the zoning requirements to allow less coverage.

H. Specify percentage of total impervious area that will be unconnected:

Total site: 0% Buildings: 0% Driveways and parking: 0% Roads: 0%

I. Specify percentage of total impervious area that will be porous:

Total site: 0% Buildings: 0% Driveways and parking: 0% Roads: 0%

J. Specify percentage of total building roof area that will be vegetated: 0%

K. Specify percentage of total parking area located beneath buildings: 0%

L. Specify percentage of total parking located within multi-level parking deck: 0%

3.4 Time of Concentration Modifications

Decreasing a site's time of concentration (Tc) can lead directly to increased site runoff rates which, in turn, can create new and/or aggravate existing erosion and flooding problems downstream. This section of the checklist helps identify those nonstructural strategies and LID-BMP's that have been incorporated into the proposed development's design to effectively minimize such Tc decreases.

When reviewing Tc modification strategies, it is important to remember that a drainage area's Tc should reflect the general conditions throughout the area. As a result, Tc modifications must generally be applied throughout a drainage area, not just along a specific Tc route.

A. Specify percentage of site's total stormwater conveyance system length that will be:

Storm sewer: 40% Vegetated swale: 40% Natural Channel: 0%

Stormwater management facility: 20% Other: NA

Note: the total length of the stormwater conveyance system should be measured from the site's downstream property line to the downstream limit of sheet flow at the system's headwaters.

B. What design criteria and/or site changes would be required to reduce the storm sewer percentages and increase the vegetated swale and natural channel percentages in A above?

Allow runoff to be directed towards public roadway rather than directed to the site's stormwater management feature. This would not allow the project to be compliant with stormwater management standards.

C. In conveyance system sub areas that have overland or sheet flow over impervious surfaces or turf grass, what practical and effective site changes can be made to:

Decrease overland flow slope: none

Increase overland flow roughness: none

3.5 Preventative Source Controls

The most effective way to address water quality concerns is by pollution prevention. This section of the checklist helps identify those nonstructural strategies and LID-BMP's that have been incorporated into the proposed development's design to reduce the exposure of pollutants to prevent their release into the stormwater runoff.

A. Trash Receptacles

Specify the number of trash receptacles provided: 0

Specify the spacing between the trash receptacles: NA

Compare trash receptacles proposed with those required by regulations:

Proposed: 0 Regulations: 0

B. Pet Waste Stations

Specify the number of pet waste stations provided: none

Specify the spacing between the pet waste stations: none

Compare pet waste stations proposed with those required by regulations:

Proposed: NA Regulations: NA

C. Inlets, Trash Racks, and Other Devices that Prevent Discharge of Large Trash and Debris

Specify percentage of total inlets that comply with the NJPDES storm drain inlet criteria: 100%

D. Maintenance

Specify the frequency of the following maintenance activities:

Street sweeping: Proposed: annual Regulations: none

Litter collection: Proposed: weekly Regulations: none

Identify other stormwater management measures on the site that prevent discharge of large trash and debris: All entrances into the stormwater management system are protected with approved inlet grates or trash racks.

E. Prevention and Containment of Spills

Identify locations where pollutants are located on the site, and the features that prevent these pollutants from being exposed to stormwater runoff:

Pollutant: NA Location: NA

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: NA Location: NA

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: NA Location: NA

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: NA Location: NA

Feature utilized to prevent pollutant exposure, harmful accumulation, or contain spills:

Pollutant: NA Location: NA

Part 4: Compliance with Nonstructural Requirements of NJDEP Stormwater Management Rules

1. Based upon the checklist responses above, indicate which nonstructural strategies have been incorporated into the proposed development's design in accordance with N.J.A.C. 7:8-5.3(b):

No.	Nonstructural Strategy	Yes	No
1.	Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss.	X	
2.	Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces.	X	
3.	Maximize the protection of natural drainage features and vegetation.	X	
4.	Minimize the decrease in the pre-construction time of concentration.	X	
5.	Minimize land disturbance including clearing and grading.	X	
6.	Minimize soil compaction.	X	
7.	Provide low maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers, and pesticides.	X	
8.	Provide vegetated open-channel conveyance systems discharge into and through stable vegetated areas.	X	
9.	Provide preventative source controls.	X	

2. For those strategies that have not been incorporated into the proposed development's design, provide engineering, environmental, and/or safety reasons. Attach additional pages as necessary.

   The Low Impact Design measures outlined and recommended within the applicable regulations have been incorporated into the design to the maximum extent practicable.

APPENDIX B

STORMWATER MANAGEMENT FACILITY MAINTENANCE MANUAL

STORMWATER MANAGEMENT FACILITY MAINTENANCE MANUAL

INSPECTION, MAINTENANCE AND CONTROL PLAN

A. PROJECT INFORMATION

I. DRAWINGS OF STORMWATER MANAGEMENT MEASURES:

Site Stormwater Management Plans are included on the Project's Site Plan which is included herein by reference.

II. LOCATION OF STORMWATER MANAGEMENT MEASURES BY MEANS OF LATITIUDE AND LONGITUDE AND BLOCK AND LOT:

The site's BMP's (Stormwater Management Facilities) are located at Block 573 Lots 9, 10 &12.02. The center of the site is approximately LAT: 40.651541, LONG: -74.285334

III. PREVENTATIVE CORRECTIVE MAINTENANCE TASKS AND SCHEDULES:

Refer to SECTION B.III for Summary of Maintenance Procedures.

IV. COST ESTIMATE:

Refer to SECTION B.IV, Cost of SWMF Maintenance Tasks

V. NAME OF PERSON RESPONSIBLE FOR INSPECTIONS AND MAINTENANCE:

Company / Individual:	Avidd Community Services
CONTACT:	Terry McKeon
ADDRESS:	92 Broadway, Suite 101 Denville, New Jersey 07834
PHONE:	973-664-1770

B. PREVENTATIVE MAINTENANCE PROCEDURES

I. OBJECTIVES

The purpose of preventative maintenance is to assure that a Stormwater Management Facility (SWMF) remains operational and safe at all times, while minimizing the need for emergency or corrective procedures.

II. OVERVIEW

A comprehensive SWMP maintenance program is comprised of several related requirements including:

A. Providing adequate funding, staffing, equipment, and materials.

B. Performing routine maintenance procedures on a regular basis.

C. Performing emergency maintenance procedures and repairs in a timely manner.

D. Conducting SWMF inspections to determine the need for and effectiveness of maintenance work.

E. Providing training and instruction to maintenance personnel and inspections.

F. Conducting periodic program reviews and evaluations to determine the overall effectiveness of the maintenance programs and the need for revised or additional maintenance procedures, personnel, and equipment.

G. Instilling pride of workmanship and a commitment to excellence in program personnel.

III. SUMMARY OF MAINTENANCE PROCEDURES

A. PREVENTATIVE MAINTENANCE PROCEDURES

1. Grass Cutting

A regularly scheduled program of mowing and trimming of grass at SWMF's during the growing season will help to maintain a tightly knit turf and will also help to prevent diseases, pests, and the intrusion of weeds. The actual mowing requirements of an area should be tailored to the specific site conditions, grass type, and seasonal variations in the climate. In general, grass should not be allowed to grow more than 1 to 2 inches between cuttings. Allowing the grass to grow more than this amount prior to cutting it may result in damage to the blades growing points and limit its continued healthy growth. Agencies such as the local Soil Conservation District can provide valuable assistance in determining optimum mowing requirements.

2. Grass Maintenance

Grassed areas require periodic fertilizing, de-thatching, and soil conditioning in order to maintain healthy growth. Additionally, provisions should be made to re-seed and re-establish grass cover in areas damaged by sediment accumulation, storm water flow, or other causes. Agencies such as the local Soil Conservation District can provide valuable assistance in establishing a suitable grass maintenance program.

3. Vegetative Cover

Trees, shrubs, and ground cover require periodic maintenance, including fertilizing, pruning, and pest control in order to maintain healthy growth. Agencies such as the local Soil Conservation District can be of assistance in establishing a preventative maintenance program.

4. Removal and Disposal of Trash and Debris

A regularly scheduled program of debris and trash removal from SWMF's will reduce the chance of outlet structures, trash racks, and other components becoming clogged and

inoperable during storm events. Specific attention to the weirs within manholes as well as the oil and grease separators shall be included at each inspection. Additionally, removal of trash and debris will prevent possible damage to vegetated areas and eliminate potential mosquito breeding habitats. Disposal of debris and trash must comply with all local, county, state, and federal waste flow control regulations. Only suitable disposal and recycling sites should be utilized. Agencies such as the Division of Solid Waste Management of the New Jersey Department of Environmental Protection should be contacted for information on disposal regulations.

5. Sediment Removal and Disposal

The roof drainage collection and subterranean storage system are designed as a closed system through the use of gutter guards at the source of the runoff. No other surface runoff is expected to enter this system. Accumulated sediment should be removed before it threatens the operation or storage volume of a SWMF. This includes the sections of the roof drainage collection system, the eccentric manifold at each end of the subterranean basin. Removal of accumulated sediment in these pipes shall be accomplished with the use of Vactor equipment. Disposal of sediment must comply with all local, county, state, and federal regulations. Only suitable disposal sites should be utilized. The sediment removal program in infiltration facilities must also include provisions for monitoring the porosity of the sub-base, and replacement or cleansing of the pervious materials as necessary. Agencies such as the Division of Soil Waste Management of the New Jersey Department of Environmental Protection should be contacted for information on disposal regulations.

6. Mechanical Components

SWMF components, such as valves, sluice gates, pumps, fence gates, locks, and access hatches should remain functional at all times. Regularly scheduled maintenance should be performed in accordance with the manufacturers' recommendations. Additionally, all mechanical components should be operated at least once every three months to assure their continued performance.

7. Elimination of Potential Mosquito Breading Habitats

The most effective mosquito control program is one that eliminates potential breeding habitats. Almost any stagnant pool of water can be attractive to mosquitoes, and the source of a large mosquito population. Ponded water in areas such as open cans and bottles, debris and sediment accumulations and areas of ground settlement provide ideal locations for mosquito breeding. A maintenance program dedicated to eliminating potential breeding areas is certainly preferable to controlling the health and nuisance effects of flying mosquitoes. The local Mosquito Control Commission can provide valuable information on establishing this maintenance program.

8. Inspection

Regularly scheduled inspections of the facility should be performed by qualified inspectors. The primary purpose of the inspections is to ascertain the operational condition of embankments, outlet structures, and other safety-related aspects. Inspections will also provide information on the effectiveness of regularly scheduled preventative and aesthetic maintenance procedures and will help to identify where changes are warranted. Finally, the facility inspections should be used to determine the need for and timing of corrective

maintenance procedures. In addition to regularly scheduled inspections, an informal inspection should be performed during every visit to a SWMF by maintenance or supervisory personnel. An inspection checklist and is included as part of this maintenance plan.

9. Reporting

The recording of all maintenance work and inspections provide valuable data on the facility condition. Along with the written reports, a chain of command for reporting and solving maintenance problems and addressing maintenance needs should be established.

B. CORRECTIVE MAINTENANCE PROCEDURES

1. Removal of Debris and Sediment

Sediment, debris, and trash should be removed immediately and properly disposed of in a timely manner. Equipment and personnel must be available to perform the removal work on short notice. The lack of an available disposal site should not delay the removal of trash, debris, and sediment. Temporary disposal sites may be utilized if necessary.

2. Structural Repairs

Structural damage to gutter guards, outlet and inlet structures, trash racks, and headwalls from vandalism, flood events, or other causes must be repaired promptly. Equipment, material, and personnel must be available to perform these repairs on short notice. The analysis of structural damage and the design and performance of structural repairs shall only be undertaken by qualified personnel.

3. Dam, Embankment, and Slope Repairs

Damage to dams, embankments, and side slopes must be repaired promptly. Typical problems include settlement, scouring, cracking, sloughing, seepage, and rutting. Equipment, materials, and personnel must be available to perform these repairs on short notice. The immediacy or the repairs will depend upon the nature of the damage and its effects on the safety and operation of the facility. The analysis of damage and the design and performance of geotechnical repairs should only be undertaken by qualified personnel.

4. Dewatering

It may be necessary to remove ponded water from within a malfunctioning SWMF. This ponding may be the result of a blocked principal outlet (detention facility), inoperable low level outlet (retention facility), loss of infiltration capacity (infiltration facility), or poor bottom drainage. Portable pumps may be necessary to remove the ponded water temporarily until a permanent solution can be implemented.

5. Extermination of Mosquitoes

If neglected, a SWMF can readily become an ideal mosquito breeding area. Extermination of mosquitoes will usually require the services of an expert, such as the local Mosquito Commission. Proper procedures carried out be trained personnel can control the mosquitoes with a minimum of damage or disturbance to the environment. If mosquito control in a facility becomes necessary, the preventative maintenance program should be re-evaluated, and

more emphasis placed on control of mosquito breeding habitats.

6. Erosion Repair

Vegetative cover or other protective measures are necessary to prevent the loss of soil from the erosive forces of wind and water. Where a re-seeding program has not been effective in maintaining a non-erosive vegetative cover, or other factors have exposed soils, to erosion, corrective steps should be initiated to prevent further loss of soil and any subsequent danger to the stability of the facility. Soil loss can be controlled by a variety of materials and methods, including riprap, gabion lining, sod, seeding, concrete lining, and re-grading. The local Conservation District can provide assistance in recommending materials and methodologies to control erosion.

7. Fence Repair

Fences are damaged by many factors, including vandalism and storm events. Timely repair will maintain the security of the site.

8. Elimination of Trees, Brush, Roots, and Animal Burrows

Large roots can impair the stability of dams, embankments, and side slopes and animal burrows. Burrows can present a safety hazard for maintenance personnel. Trees and brush with extensive, woody root systems should be completely removed from dams and embankments to prevent their destabilization and the creation of seepage routes. Roots should also be completely removed to prevent their decomposition within the dam or embankment. Rood voids and burrows should be plugged by filling with material similar to the existing material, and capped just below grade with stone, concrete, or other material. If plugging of the burrows does not discourage the animals form returning, further measures should be taken to either remove the animal population or to make critical areas of the facility unattractive to them.

9. Snow and Ice Removal

Accumulations of snow and ice can threaten the functioning of a SWMF, particularly at inlets, outlets, and emergency spillways. Providing the equipment, materials, and personnel to monitor and remove snow and ice from these critical areas is necessary to assure the continued functioning of the facility during the winter months.

C. AESTHETIC MAINTENANCE PROCEDURES

1. Graffiti Removal

The timely removal of this eyesore will restore the aesthetic quality of a SWMF. Removal can be accomplished by painting or otherwise covering it, or removing it with scrapers, solvents, or cleansers. Timely removal is important to discourage further graffiti and other acts of vandalism.

2. Grass Trimming

Trimming of grass edges around structures and fences will provide for a neat and attractive appearance of the facility.

3. Control of Weeds

Although a regular grass maintenance program will keep weed intrusion to a minimum, some weeds will appear. Periodic weeding, either chemically or mechanically, will not only help to maintain a healthy turf, but will also keep grassed areas attractive.

4. Details

Careful, meticulous, and frequent attention to the performance of maintenance items such as painting, tree pruning, leaf collection, debris removal, and grass cutting will result in a SWMF that remains both functional and attractive.

D. CHECKLISTS AND LOGS

Included in this report are Tables and Sample Checklists and Logs regarding various aspects of SWMF maintenance and inspection.

IV. MAINTENANCE EQUIPMENT AND MATERIALS

A. GRASS MAINTENANCE EQUIPMENT

1. Tractor-Mounted Mowers
2. Riding Mowers
3. Hand Mowers
4. Gas Powered Trimmers
5. Gas Powered Edgers
6. Seed Spreaders
7. Fertilizer Spreaders
8. De-Thatching Equipment
9. Pesticide and Herbicide Application Equipment
10. Grass Clipping and Leaf Collection Equipment

B. VEGETATIVE COVER MAINTENANCE EQUIPMENT

1. Saws
2. Pruning Shears
3. Hedge Trimmers
4. Wood Chippers

C. TRANSPORTATION EQUIPMENT

1. Trucks for Transportation of Materials
2. Trucks for Transportation of Equipment
3. Vehicles for Transportation of Personnel

D. DEBRIS, TRASH, AND SEDIMENT REMOVAL EQUIPMENT

1. Loader
2. Backhoe
3. Grader
4. Vactor Equipment

E. MISCELLANEOUS EQUIPMENT

1. Shovels
2. Rakes

3. Picks
4. Wheelbarrows
5. Fence Repair Tools
6. Painting Equipment
7. Gloves
8. Standard Mechanics Tools
9. Tools for Maintenance of Equipment
10. Office Space
11. Office Equipment
12. Telephones
13. Safety Equipment
14. Tools for Concrete Work (Mixers, Form Materials, etc.)
15. Welding Equipment (for Repair of Trash Racks, etc.)

F. MATERIALS

1. Topsoil
2. Fill
3. Seed
4. Soil Amenities (Fertilizer, Lime, etc.)
5. Chemicals (Pesticides, Herbicides, etc.)
6. Mulch
7. Paint
8. Paint Removers (for Graffiti)
9. Spare Parts for Equipment
10. Oil and Grease for Equipment and SWMF Components
11. Concrete

V. SWMF MAINTENANCE EQUIPMENT AND MATERIAL COSTS

This estimate is taken from NJDEP Stormwater Management Facilities Manual Table 6-1 and adjusted for 2022 costs

GRASS MAINTENANCE EQUIPMENT

	Purchase (dollars)	Rent (per day) (dollars)
Hand Mower	300 - 500	25 - 40
Riding Mower	3,000 - 5,000	75 - 100
Tractor Mower	15,000 - 20,000	100 - 300
Trimmer / Edger	200 - 500	25 - 35
Spreader	100 - 200	20 - 30
Chemical Sprayer	200 - 500	25 - 40

VEGETATIVE COVER MAINTENANCE EQUIPMENT

	Purchase (dollars)	Rent (per day) (dollars)
Hand Saw	15	5
Chain Saw	300 - 500	15 - 35
Pruning Shears	25	5
Shrub Trimmer	200	25 - 35
Brush Chipper	1,000 - 5,000	50 - 150

TRANSPORTATION EQUIPMENT

	Purchase (dollars)	Lease (per month) (dollars)	Rent (per day) (dollars)
Van	10,000 - 15,000	400	50 - 70
Pickup Truck	10,000 - 15,000	400	50 - 70
Dump Truck	30,000 - 50,000	1,200	75 - 150
Light Duty Trailer	3,000 - 5,000	150	30 - 50
Heavy Duty Trailer	10,000 - 20,000	500	100 - 200

DEBRIS, TRASH, AND SEDIMENT REMOVAL EQUIPMENT

	Purchase (dollars)	Lease (per month) (dollars)	Rent (per day) (dollars)
Front End Loader	50,000 - 100,000	1,500 - 2,000	200 - 400
Backhoe	30,000 - 50,000	1,200	150 - 300
Excavator	100,000+	2,000	400 - 1,000
Grader	100,000+	2,000	400 - 1,000
Vactor Equipment	100,000+	2,000	400 – 1,000

MISCELLANEOUS EQUIPMENT

	Purchase (dollars)	Rent (per day) (dollars)
Shovel	15	5
Leaf Rake	15	5
Soil Rake	15	5
Pick	15	5
Wheelbarrow	100 - 200	10
Gloves	5	N /A
Portable Compressor	500 - 1,000	50 - 100
Portable Generator	500 - 1,000	50 - 100
Concrete Mixer	500 - 1,000	25 - 50
Welding Equipment	500 - 1,500	35 - 70

MATERIALS

	Purchase (dollars)
Topsoil	35 / cubic yard
Fill Soil	15 / cubic yard
Grass Seed	5 / pound
Soil Amenities (Fertilizer, Lime, etc)	0.05 / sq ft
Chemicals (Pesticides, Herbicides, etc)	10 / gallon
Mulch	25 / cubic yard
Paint	20 / gallon
Paint Remover	10 / gallon
Machine / Motor Lubricants	5 / gallon
Dry Mortar Mix	4 / 50 pound bag
Concrete Delivered to Site	60 – 100 / cubic yard

Notes:

1. These estimates are approximation of the probable construction costs in 2021 dollars and are based upon previous construction experience and should be used as an approximate budget figure only.

2. Estimated equipment costs are based upon Industrial / Commercial grade equipment.

VI. COST OF SWMF MAINTENANCE TASKS

Taken from NJDEP Stormwater Management Facilities Manual Table 6-2

PREVENTATIVE MAINTENANCE TASKS

	Small Facility (Man-Hours)	Large Facility (Man-Hours)
Grass Cutting	1	1 - 2
Grass Maintenance	0.5	1
Trash & Debris Removal	0.5	1
Sediment Removal	4	8
Mobilization	1	1
Inspection & Reporting	1	2

CORRECTIVE MAINTENANCE TASKS

	Small Facility (Man-Hours)	Large Facility (Man-Hours)
Trash & Debris Removal	4	8
Structural Repairs	2-4	40
Dewatering	4	8
Mosquito Extermination	1	2-4
Erosion Repair	4	8
Fence Repair	2-4	4-8
Snow & Ice Removal	1	2
Mobilization	2	2

AESTHETIC MAINTENANCE TASKS

	Small Facility (Man-Hours)	Large Facility (Man-Hours)
Grass Trimming	0.5	2
Weed Control	0.5	2
Landscape Maintenance	1 - 2	2 - 4
Graffiti Removal	2 - 4	4 - 8

Notes:

1. This estimate is an approximation of the man-hours as provided in the NJDEP Stormwater Facility Maintenance Manual. It is based upon previous construction experience and should be used as an approximate budget figure only.
2. Cost estimates are presented in terms of man-hours. These values should be used in conjunction with applicable personnel rates to determine labor costs for a specific program or facility.
3. Facility size definitions:
   Small Facility: Total SWMF Site Area ¼ Acre
   Large Facility: Total SWMF Site Area 1 Acre

Appropriate adjustments to the estimates presented should be made as necessary to account for actual SWMF size.

Table 6-3 Taken from NJDEP Stormwater Management Facilities Manual

WORKSHEET FOR DETERMINING DEVELOPER'S 10-YEAR MAINTENANCE BOND FOR PRIVATELY HELD SWMF's OR DEVELOPER'S CONTRIBUTION FOR MUNICIPAL MANAGEMENT OF SWMF's

SURFACE STORMWATER BASINS

Total Area of SWMF's = 0.10 Acres **Total Area of SWMF's Basin Bottom = 0.08** Acres

1. Mowing

A.	Rate per Hour for Labor & Equipment	40	$	
B.	Base number of Hours for Labor and Equipment for Mobilization and Mowing Up to One Acre	2		
C.	Number of Hours for Mowing Additional Area (Based on One Hour Per Acre)	0		
D.	Hours per Mowing = B + C	2		
E.	Cost per Mowing = A x D		$	80
F.	Number of Mowings per Year:	10		
G.	Annual Mowing Cost = E x F		$	800
H.	Materials		$	100
I.	Total Cost = G + H		**$**	**900**

2. Landscape Maintenance

A.	Rate per Hour for Labor & Equipment	40	$	
B.	Number of Hours of Required Landscape Maintenance per Year	10		
C.	Annual Landscape Maintenance Cost = A x B		$	400
D.	Total Cost of Original Landscaping (per Cost Estimate)	$10,000		
E.	Replacement Factor (2% per Year)	x0.02		
F.	Annual Replacement Cost = D x E		$	200
G.	Total Cost = C + F		**$**	**600**

3. General Maintenance

A.	Rate per Hour for Labor & Equipment	40	$	
B.	Number of Required Hours of General Maintenance per Occurrence	2		
C.	Cost per Occurrence = A x B		$	80
D.	Number of Occurrences per Year	20		
E.	Total Cost = C + D		**$**	**1,600**

4. Insurance

A.	Annual Insurance Cost	To be determined	$	To be determined

5. Scarify and De-Silt Basin – Every 5 years

A.	Rate per Hour for Labor & Equipment	50	$	
B.	Number of Required Hours of General	40		

	Maintenance (@ 40 / acre)			
C.	Labor & Equipment Cost = A x B		$	2,000
D.	Cost of Disposal per cubic yard	20	$	
E.	Number of cubic yards (6" Deep Remove & Replace)	85		
F.	Disposal Cost = D x E		$	1,700
G.	Cost per Occurrence = C + F		$	3,700
H	Duration factor = 0.2 (for 5 years)	0.2		
I.	Total Cost = G x H		**$**	**740**

6. Inspection - Annual

A.	Rate per Hour for Labor	100		
B.	Number of Required Hours per Inspection	1		
C.	Total Cost = A x B		**$**	**100**

7. Total First Year Cost

A.	Mowing (1.I)		**$**	**900**
B.	Landscape Maintenance (2.G)		**$**	**600**
C.	General Maintenance (3.E)		**$**	**1,600**
D.	Insurance (4.A)		**$**	To be determined
E.	Scarify and De-Silt (5.I) x 4 / 20 years		**$**	**148**
F.	Inspection (6.C)		**$**	**100**
G.	Total Cost for Year = SUM (A : F)		$	**3,348 + insurance**

Total For 10 yr Maintenance Bond

A.	Total Cost = (7.G) x 10 years		**$**	**33,480+insurance**

OR

Calculation of Developer Contribution

A.	Total Cost = (7.G) x 10 years		$	33,480+insurance
B.	Developer Contribution Percentage	X 0.75		
C.	Total Developer Contribution = A x B		$	25,110+insurance

NOTE: This estimate is an approximation of the probable cost in 2022 dollars. It is based upon previous construction experience and should be used as an approximate budget figure only.

VII. MAINTENANCE REQUIREMENTS FOR DRAINAGE SYSTEMS

SCHEDULE A

MAINTENANCE REQUIREMENTS FOR DRAINAGE SYSTEMS

The following are those minimum activities that shall be the responsibility of the designated entity for maintenance to ensure that the drainage system will operate as designed. The designated party is only responsible for those activities discussed below that apply to the type of drainage structures existing on the project.

Retention and Detention Basins

The following are minimum requirements for maintenance of these systems. Other items recommended by the design engineer are encouraged to ensure the system will function as designed.

In the event of standing water in the drainage system longer than 3 days (72 hours) after all maintenance activities have been conducted, the Municipal or County Engineer's Office shall be notified immediately.

(1) Inspection Schedule

Drainage systems must be inspected on a routine basis to ensure that they are functioning properly. Inspection shall be conducted a minimum of semi-annually and always after major storms.

(2) Inlet and Outlet Structure

All inlet and outlet structures shall be examined at the time of inspection for debris and accumulation of sediment which shall be removed from these structures.

(3) Maintenance of Vegetated Basins

a) A dense turf with extensive root growth is encouraged to reduce erosion of the sides of the basin. Basin bottom shall be constructed of clean sand to enhance infiltration. Well establish turf forming a porous turf will prevent the formation of an impermeable layer.
b) Grasses of the fescue family are recommended for seeding primarily due to their adaptability to dry sandy soils, drought resistance, hardiness, and ability to withstand brief inundations. Fescues will also permit longer intervals between mowings.
c) Mowing of the grass is required twice a year, once around June and again in September. Additional mowing is recommended to ensure the aesthetic quality of the site.
d) Fertilization and liming is left to the discretion of the maintenance entity. A 10-6-4 ratio fertilizer at a rate of 500 lb. per acre (11 lb. per 1,000 sf) is provided for guidance.

(4) Maintenance of Gravel Bottom Retention Basins

a) Sediment shall not be allowed to build up to the point where it reduces the rate of infiltration that the system was designed to accommodate. In the event of standing water greater than 3 days (72) hours because of siltation, the system must be thoroughly cleaned.
b) If the system still remains inoperable after a thorough cleaning; the system must be removed and replaced so that the system will function as designed.

(5) Maintenance of Non-Vegetated Basins (Soil Floors)

a) All sediment accumulated in the basin bottom must be removed. Sediment removal is only to be conducted when the basin is completely dry, after the silt layer has mud cracks and has separated from the basin floor.

b) Tilling is required periodically and at least once annually, form June through September, to restore the natural infiltration capacity the system was designed for by overcoming the effects of surface compaction. All sediment must be removed prior to tilling the basin bottom.

c) Rotary tillers or disc harrows should be used since precise blade control and equipment maneuverability are essential in small areas.

d) After tilling the basin floor should be smooth and free of ridges and furrows to enable easy removal of sediment during future cleaning operations. The basin floor should slope toward a low-flow channel wherever applicable.

VIII. MAINTENANCE AND INSPECTION LOGS AND CHECKLISTS

SWM Maintenance List **Page 1 of 4**

Maintenance Work Order and Checklist
for
Stormwater Management Facilities

Name of Facility: _____
Location: _____ **Date:** _____

Crew:			**Work Started:**		**Time:**	
Equipment:			**Work Completed:**		**Time:**	
Weather:			**Total Man-hours for Work::**			

A. Preventative Maintenance

1. Grass Cutting	Items Required √	Items Done √	Comments and Special Instructions
A. Bottoms			
B. Embankments and Side Slopes			
C. Perimeter Areas			
D. Access Areas and Roads			
E. Other:			

2. Grass Maintenance	Items Required √	Items Done √	Comments and Special Instructions
A. Fertilizing			
B. Re-Seeding			
C. De-Thatching			
D. Pest Control			
E. Other:			

3. Vegetative Cover	Items Required √	Items Done √	Comments and Special Instructions
A. Fertilizing			
B. Pruning			
C. Pest Control			
D. Other:			

4. Trash and Debris Removal	Items Required √	Items Done √	Comments and Special Instructions
A. Bottoms			
B. Embankments and Side Slopes			
C. Perimeter Areas			
D. Access Areas and Roads			
E. Inlets			
F. Outlets and Trash Racks			
G. Other:			

SWM Maintenance List **Page 2 of 4**

5. Sediment Removal	Items Required √	Items Done √	Comments and Special Instructions
A. Inlets			
B. Outlets and Trash Racks			
C. Bottoms			
E. Other			

6. Mechanical Components	Items Required √	Items Done √	Comments and Special Instructions
A. Valves			
B. Sluice Gates			
C. Pumps			
D. Fence Gates			
E. Locks			
F. Access Hatches			
G. Other:			

7. Elimination of Potential Mosquito Breeding Habitats	Items Required √	Items Done √	Comments and Special Instructions
A.			
B.			
C.			
D.			

8. Pond Maintenance	Items Required √	Items Done √	Comments and Special Instructions
A. Aeration Equipment			
B. Debris & Trash Removal			
C. Weed Removal			
D. Other:			

9. Other Preventative Maintenance	Items Required √	Items Done √	Comments and Special Instructions
A.			
B.			
C.			
D.			

SWM Maintenance List **Page 3 of 4**

B. Corrective Maintenance

Work Item	Items Required √	Items Done √	Location, Comments, and Special Instructions
1. Removal of Debris & Sediment			
2. Structural Repairs			
3. Dam, Embankment & Slope Repairs			
4. Dewatering			
5. Control of Mosquitoes			
6. Pond Maintenance			
7. Erosion Repair , Roots &			
8. Fence Repair			
9. Elimination of Trees, Brush and Animal Burrows			
10. Snow & Ice Removal			
11. Other			

C. Aesthetic Maintenance

Work Item	Items Required √	Items Done √	Location, Comments, and Special Instructions
1. Graffiti Removal			
2. Grass Trimming			
3. Weeding			
4. Other			

SWM Maintenance List **Page 4 of 4**

Remarks: (Refer to Item No, If Applicable)

Work Order Prepared By: _____

Work Completed By: _____

SWM Maintenance Log Page 1 of 3

Maintenance Log
Stormwater Management Facilities

Name of Facility:_____

Location:_____ Date: _____

A. Preventative Maintenance

Date:										
Work Item	(√) Completed									
1. Grass Cutting										
A. Bottoms										
B. Embankments and Side Slopes										
C. Perimeter Areas										
D. Access Areas and Roads										
E. Other:										
2. Grass Maintenance										
A. Fertilizing										
B. Re-Seeding										
C. De-Thatching										
D. Pest Control										
E. Other:										
3. Vegetative Cover										
A. Fertilizing										
B. Pruning										
C. Pest Control										
D. Other:										
4. Trash and Debris Removal										
A. Bottoms										
B. Embankments and Side Slopes										
C. Perimeter Areas										
D. Access Areas and Roads										
E. Inlets:										
F. Outlets and Trash Racks										
G. Other:										
5. Sediment Removal										
A. Inlets										
B. Outlets and Trash Racks										
C. Bottoms										
D. Other:										

SWM Maintenance Log Page 2 of 3

Date:										
Work Item	(√) Completed									
6. Mechanical Components										
A. Valves										
B. Sluice Gates										
C. Pumps										
D. Fence Gates										
E. Locks										
F. Access Hatches										
G. Other										
7. Elimination of Potential Mosquito Breeding Habits										
A.										
B.										
C.										
8. Pond Maintenance										
A. Aeration Equipment										
B. Debris & Trash Removal										
C. Weed Removal										
D. Other:										
9. Other Preventative Maintenance										
A.										
B.										
C.										
D.										

B. Corrective Maintenance

Date:										
Work Item	(√) Completed									
1. Removal of Debris & Sediment										
2. Structural Repairs										
3. Dam, Embankment & Slope Repairs										
4. Dewatering										
5. Pond Maintenance										
6. Control of Mosquitoes										
7. Erosion Repair										
8. Fence Repair										
9. Elimination of Trees, Brush, Roots & Animal Burrows										
10. Snow & Ice Removal										
11. Other										

SWM Maintenance Log Page 3 of 3

C. Aesthetic Maintenance

	Date:									
	Work Item	(√) Completed								
1. Graffiti Removal										
2. Grass Trimming										
3. Weeding										
4. Other:										

Remarks: (Refer to Item No, If Applicable)

Work Order Prepared By: _____

Work Completed By: _____

SWM Inspection List Page 1 of 3

Inspection Checklist for Stormwater Management Facilities

Name of Facility:_____

Location:_____ Date: _____

Weather: _____

Facility Item	OK[1]	Routine[2]	Urgent[3]	Comments[4]
1. Embankments and Side Slopes				
A. Vegetation				
B. Linings				
C. Erosion				
D. Settlement				
E. Sloughing				
F. Trash And Debris				
G. Seepage				
H. Aesthetics				
I. Other:				
2. Bottoms (Detention and Infiltration)				
A. Vegetation				
B. Erosion				
C. Standing Water				
D. Settlement				
E. Trash and Debris				
F. Sediment				
G. Aesthetics				
H. Other:				
3. Low Flow Channels (Detention)				
A. Vegetation				
B. Linings				
C. Erosion				
D. Settlement				
E. Standing Water				
F. Trash and Debris				
G. Sediment				
H. Other:				

1. The item checked is in good condition and the maintenance program is adequate.
2. The item checked requires attention but does not present an immediate threat to the facility function or other facility components.
3. The item checked requires immediate attention to keep the facility operational or to prevent damage to other facility components.
4. Provide explanation and details if columns 2 or 3 are checked.

SCIULLO ENGINEERING SERVICES, LLC

SWM Inspection List Page 2 of 3

Facility Item	OK[1]	Routine[2]	Urgent[3]	Comments[4]
4. Ponds (Retention)				
A. Vegetation				
B. Shoreline Erosion				
C. Aeration Equipment				
D. Trash and Debris				
E. Sediment				
F. Water Quality				
G. Other:				
5. Inlet Structure				
A. Condition of Structure				
B. Erosion				
C. Trash & Debris				
D. Sediment				
E. Aesthetics				
F. Other:				
6. Outlet Structure (Detention & Retention)				
A. Condition of Structure				
B. Erosion				
C. Trash & Debris				
D. Sediment				
E. Mechanical Components				
F. Aesthetics				
G. Other:				
7. Emergency Spillway				
A. Vegetation				
B. Lining				
C. Erosion				
D. Trash & Debris				
E. Other:				
8. Perimeter				
A. Vegetation				
B. Erosion				
C. Trash & Debris				
D. Fences & Gates				
E. Aesthetics				
F. Other:				
9. Access Roads				
A. Vegetation				
B. Road Surface				
C. Fences & Gates				
D. Erosion				
E. Aesthetics				
F. Other:				

1. The item checked is in good condition and the maintenance program is adequate.
2. The item checked requires attention but does not present an immediate threat to the facility function or other facility components.
3. The item checked requires immediate attention to keep the facility operational or to prevent damage to other facility components.
4. Provide explanation and details if columns 2 or 3 are checked.

SWM Inspection List Page 3 of 3

Facility Item	OK[1]	Routine[2]	Urgent[3]	Comments[4]
10. Miscellaneous				
A. Effectiveness of Exist. Maint. Program				
B. Dam Inspections				
C. Potential Mosquito Habitats				
D. Mosquitoes				
E.				
F.				
G. :				

1. The item checked is in good condition and the maintenance program is adequate.
2. The item checked requires attention but does not present an immediate threat to the facility function or other facility components.
3. The item checked requires immediate attention to keep the facility operational or to prevent damage to other facility components.
4. Provide explanation and details if columns 2 or 3 are checked.

Remarks: (Refer to Item No, If Applicable)

Inspector: _____

SWM Inspection Page 1 of 3

Maintenance Log
Stormwater Management Facilities

Name of Facility:_____

Location: _____ Date: _____

Date:										
Facility Item	Indicate Condition (i.e. 1, 2, or 3)									
1. Embankments and Side Slopes										
A. Vegetation										
B. Linings										
C. Erosion										
D. Settlement										
E. Sloughing:										
F. Trash and Debris										
G. Seepage										
H. Aesthetics										
I. Other										
2. Bottoms (Detention and Infiltration)										
A. Vegetation										
B. Erosion										
C. Standing Water										
D. Settlement										
E. Trash and Debris										
F. Sediment										
G. Aesthetics										
H. Other										
3. Low Flow Channels (Detention)										
A. Vegetation										
B. Linings										
C. Erosion										
D. Settlement:										
E. Standing Water										
F. Trash and Debris										
G. Sediment										
H. Other										
4. Ponds										
A. Vegetation										
B. Shoreline Erosion										
C. Aeration Equipment										
D. Trash & Debris										
E. Sediment										
F. Water Quality										
G. Other:										

1 The item checked is in good condition and the maintenance program is adequate.

2 The item checked requires attention, but does not present an immediate threat to the facility function or other facility components.

3 The item checked requires immediate attention to keep the facility operational or to prevent damage to other facility components.

SCIULLO ENGINEERING SERVICES, LLC

SWM Maintenance Log Page 2 of 3

	Date:									
Facility Item	Indicate Condition (i.e. 1, 2, or 3)									
5. Inlet Structure										
A. Condition of Structure										
B. Erosion										
C. Trash & Debris										
D. Sediment:										
E. Aesthetics										
F. Other:										
6. Outlet Structure (Detention & Retention)										
A. Condition of Structure										
B. Erosion										
C. Trash & Debris										
D. Sediment										
E. Mechanical Components										
F. Aesthetics										
G. Other										
7. Emergency Spillway										
A. Vegetation										
B. Lining										
C. Trash & Debris										
D. Other:										
8. Perimeter										
A. Vegetation										
B. Erosion										
C. Trash & Debris										
D. Fences & Gates:										
E. Aesthetics										
F. Other:										
9. Access Roads										
A. Vegetation										
B. Road Surface										
C. Trash & Debris										
D. Fences & Gates										
E. Aesthetics										
F. Other:										

1 The item checked is in good condition and the maintenance program is adequate.

2 The item checked requires attention, but does not present an immediate threat to the facility function or other facility components.

3 The item checked requires immediate attention to keep the facility operational or to prevent damage to other facility components.

SWM Maintenance Log Page 3 of 3

10. Miscellaneous

A. Effectiveness of Exist. Maintenance Program										
B. Dam Inspections										
C. Potential Mosquito Habitats										
D. Mosquitoes										
E.										
F.										
G.										

1 The item checked is in good condition and the maintenance program is adequate.

2 The item checked requires attention, but does not present an immediate threat to the facility function or other facility components.

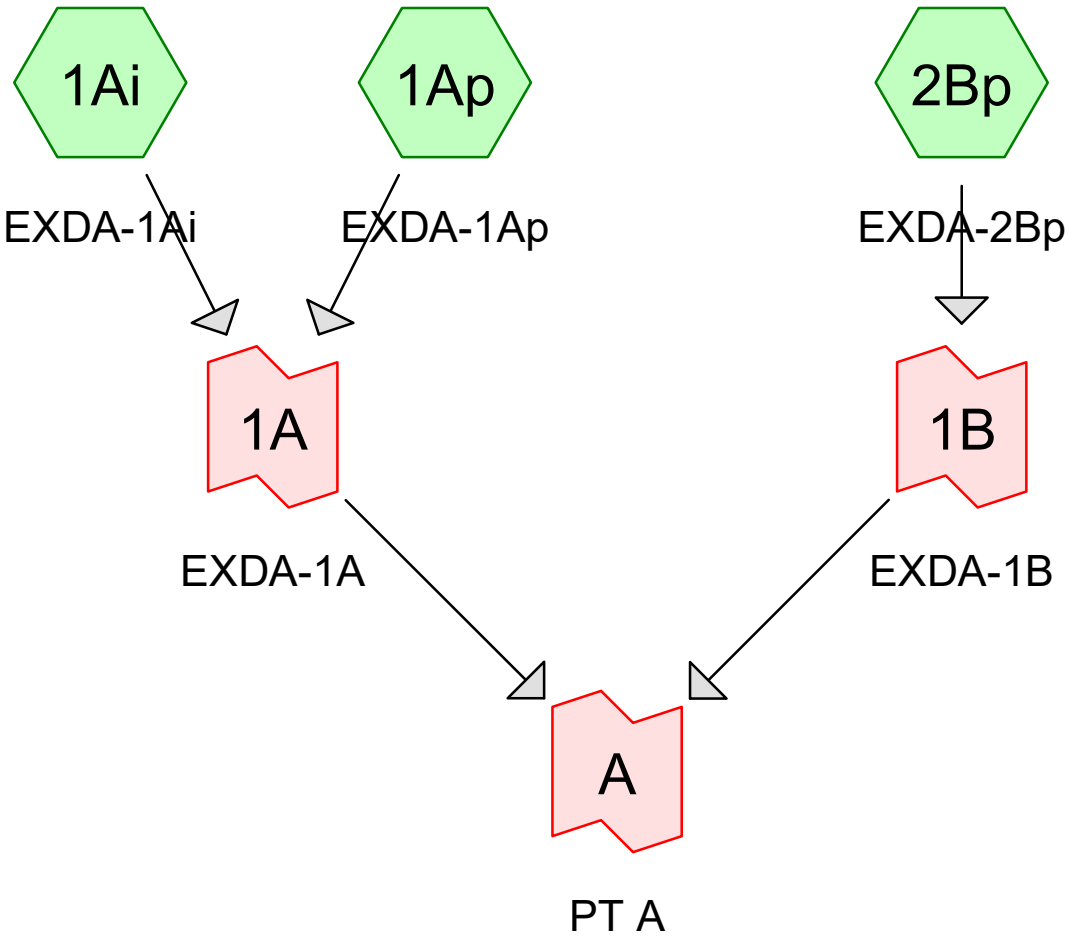
3 The item checked requires immediate attention to keep the facility operational or to prevent damage to other facility components.

Remarks: (Refer to Item No, If Applicable)

Prepared By: _____

APPENDIX C

PRE-DEVELOPED RUNOFF CALCULATIONS



Subcat Reach Pond Link

Routing Diagram for Pre Developed Conditions
Prepared by Sciullo Engineering Services, LLC, Printed 1/5/2022

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	NOAA 24-hr	D	Default	24.00	1	3.39	2
2	10-Year	NOAA 24-hr	D	Default	24.00	1	5.17	2
3	100-Year	NOAA 24-hr	D	Default	24.00	1	8.69	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.122	90	1/8 acre lots, 65% imp, HSG C (1Ap)
0.463	74	>75% Grass cover, Good, HSG C (1Ap, 2Bp)
0.259	98	Paved parking, HSG C (1Ai)
0.938	70	Woods, Good, HSG C (1Ap, 2Bp)
2.783	**81**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
2.783	HSG C	1Ai, 1Ap, 2Bp
0.000	HSG D	
0.000	Other	
2.783		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	1.122	0.000	0.000	1.122	1/8 acre lots, 65% imp	1Ap
0.000	0.000	0.463	0.000	0.000	0.463	>75% Grass cover, Good	1Ap, 2Bp
0.000	0.000	0.259	0.000	0.000	0.259	Paved parking	1Ai
0.000	0.000	0.938	0.000	0.000	0.938	Woods, Good	1Ap, 2Bp
0.000	**0.000**	**2.783**	**0.000**	**0.000**	**2.783**	**TOTAL AREA**	

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1Ai: EXDA-1Ai Runoff Area=11,300 sf 100.00% Impervious Runoff Depth=3.16"
Flow Length=621' Tc=15.7 min CN=98 Runoff=0.61 cfs 0.068 af

Subcatchment 1Ap: EXDA-1Ap Runoff Area=57,410 sf 55.32% Impervious Runoff Depth=2.16"
Flow Length=621' Tc=15.7 min CN=WQ Runoff=2.35 cfs 0.238 af

Subcatchment 2Bp: EXDA-2Bp Runoff Area=52,500 sf 0.00% Impervious Runoff Depth=1.00"
Flow Length=528' Tc=16.4 min CN=WQ Runoff=0.93 cfs 0.100 af

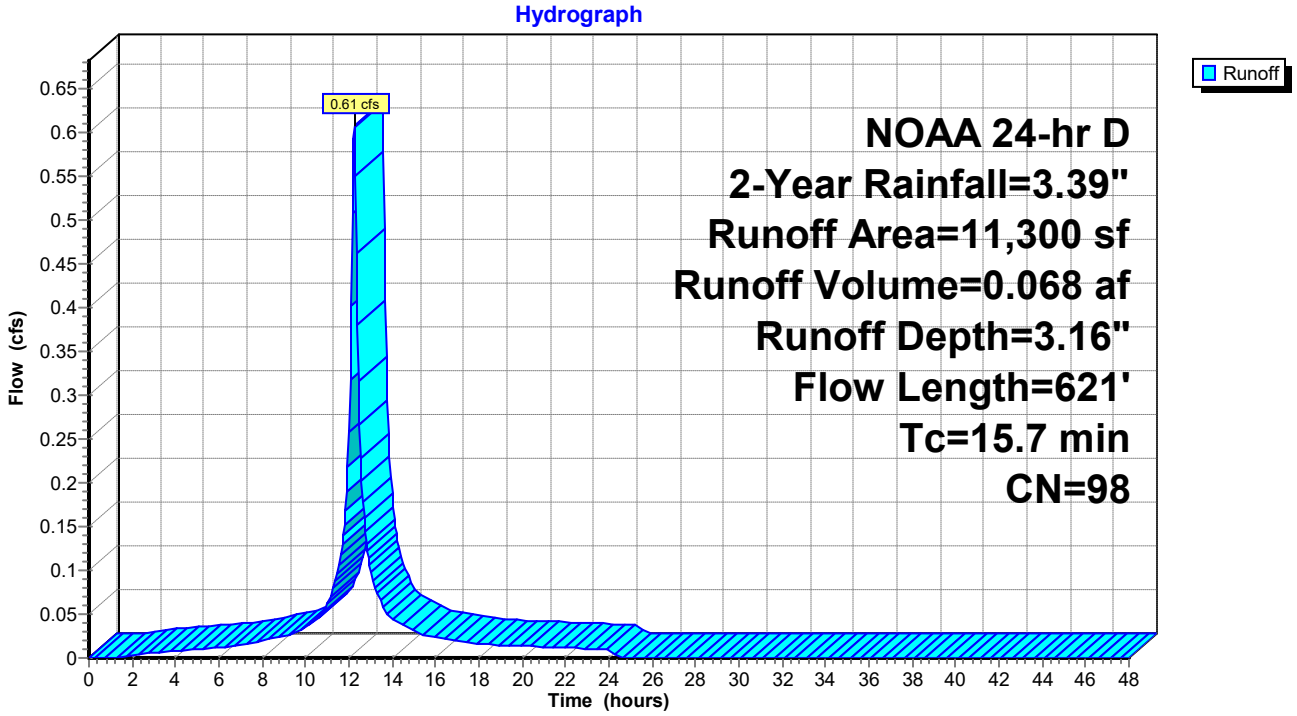
Link 1A: EXDA-1A Inflow=2.96 cfs 0.306 af
Primary=2.96 cfs 0.306 af

Link 1B: EXDA-1B Inflow=0.93 cfs 0.100 af
Primary=0.93 cfs 0.100 af

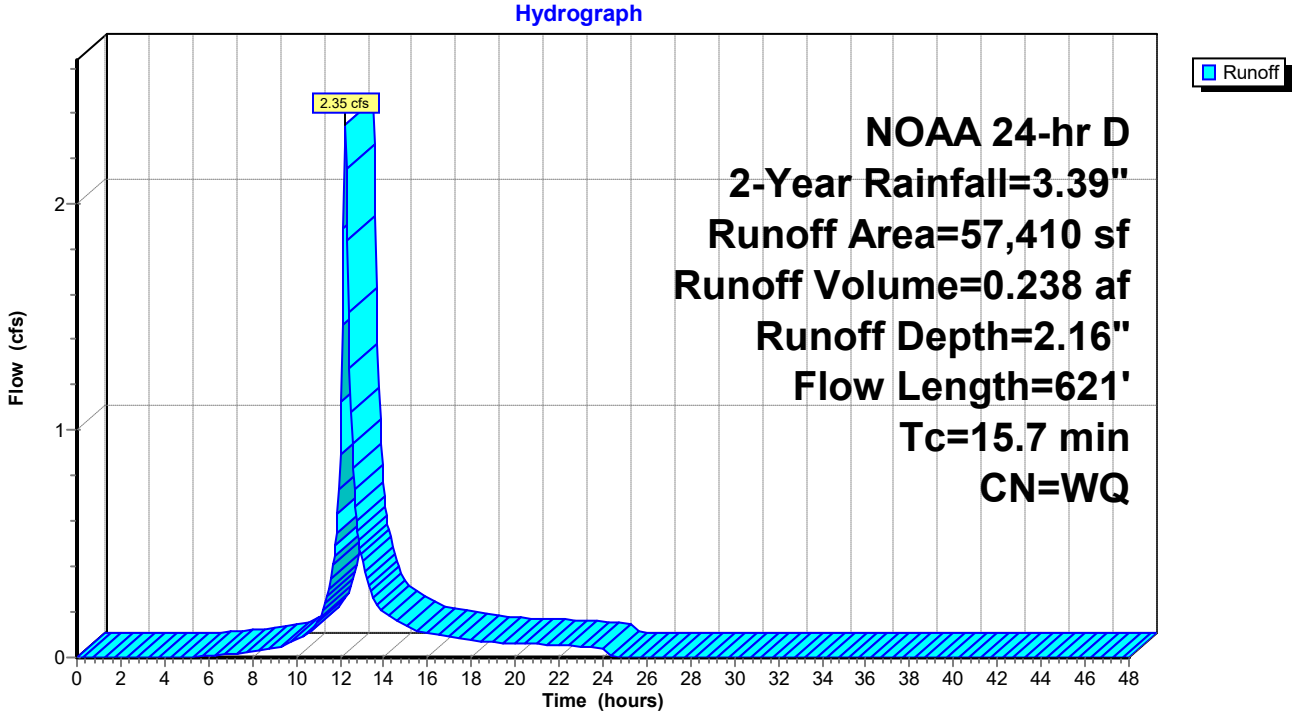
Link A: PT A Inflow=3.88 cfs 0.406 af
Primary=3.88 cfs 0.406 af

Total Runoff Area = 2.783 ac Runoff Volume = 0.406 af Average Runoff Depth = 1.75"
64.48% Pervious = 1.794 ac 35.52% Impervious = 0.988 ac

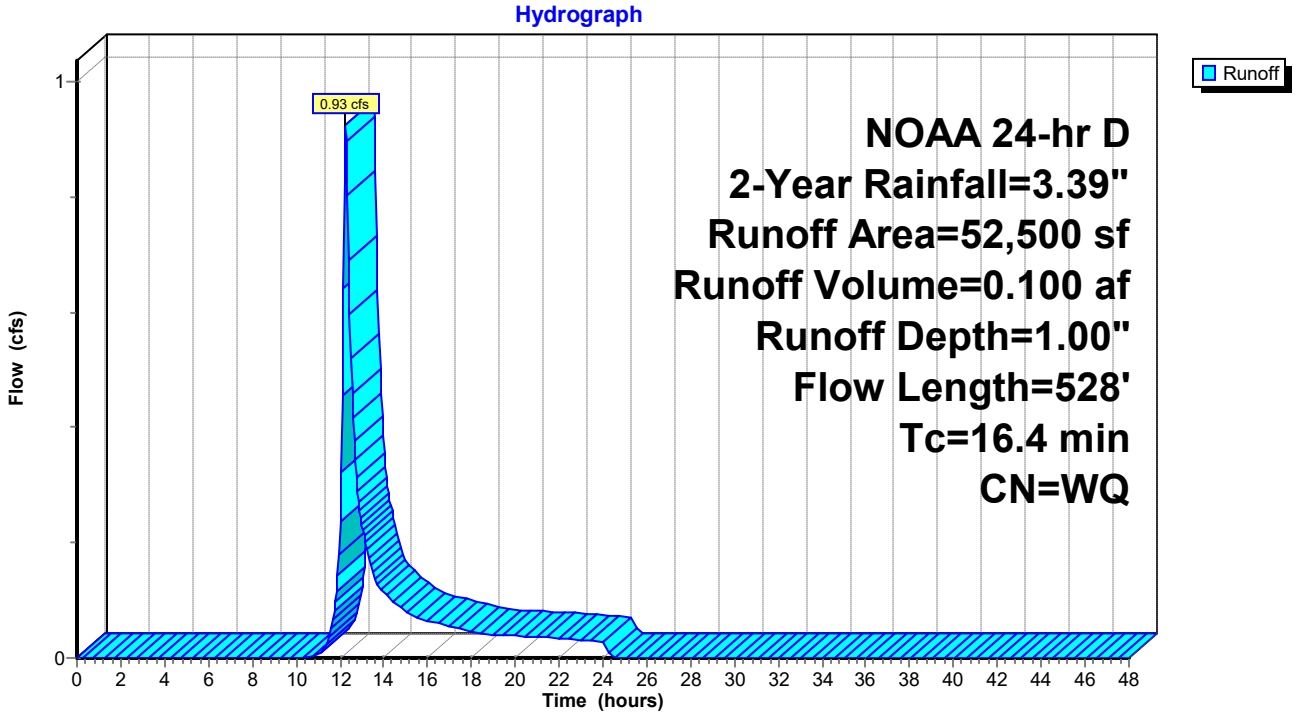
Subcatchment 1Ai: EXDA-1Ai



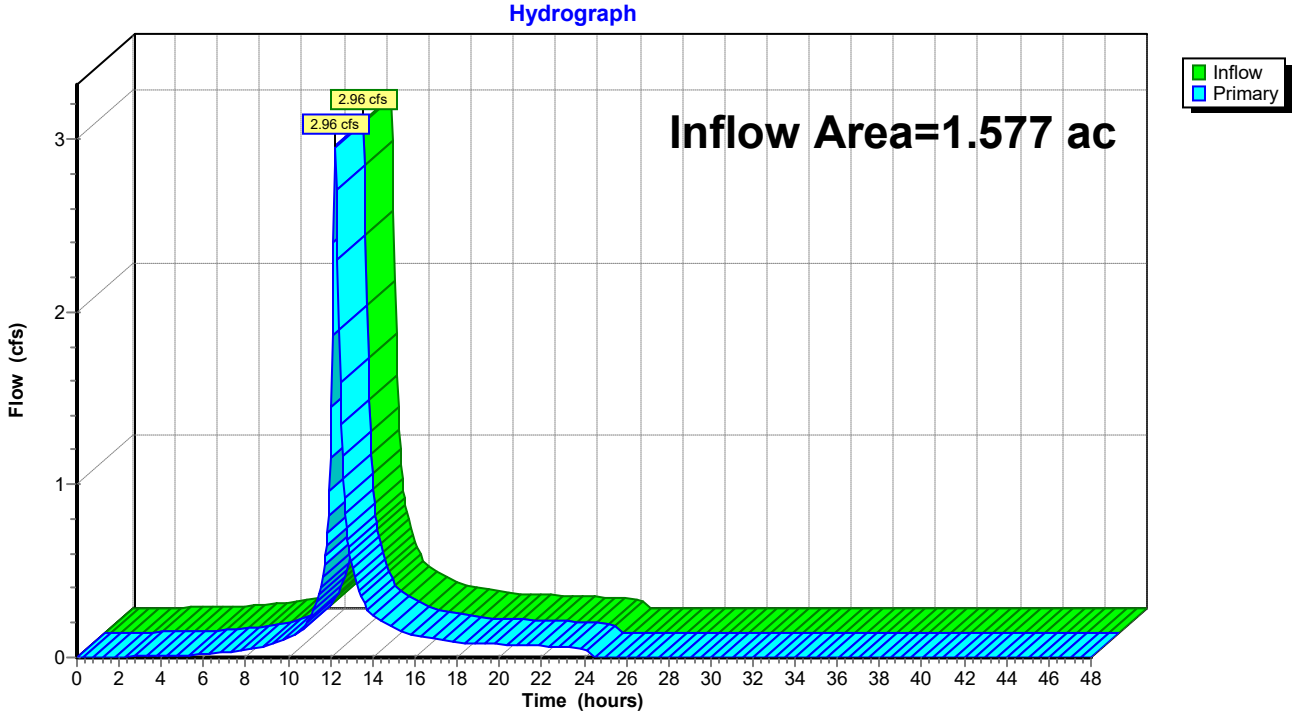
Subcatchment 1Ap: EXDA-1Ap



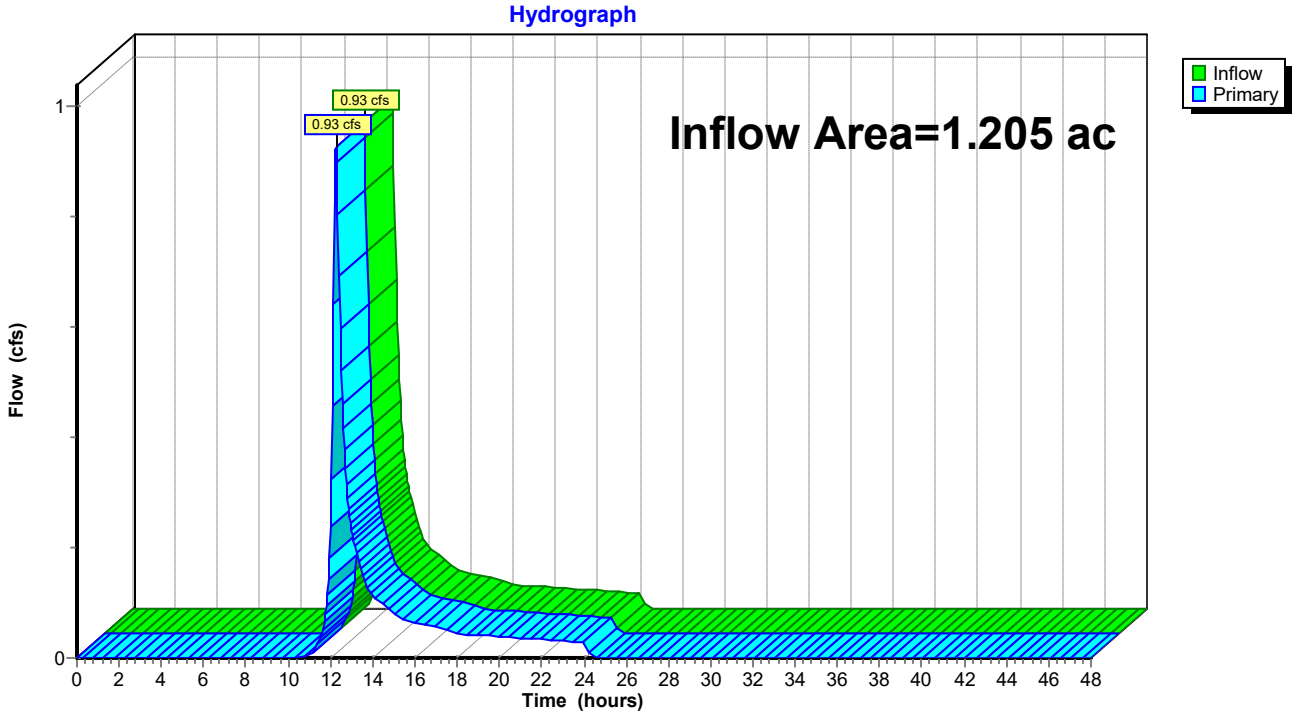
Subcatchment 2Bp: EXDA-2Bp



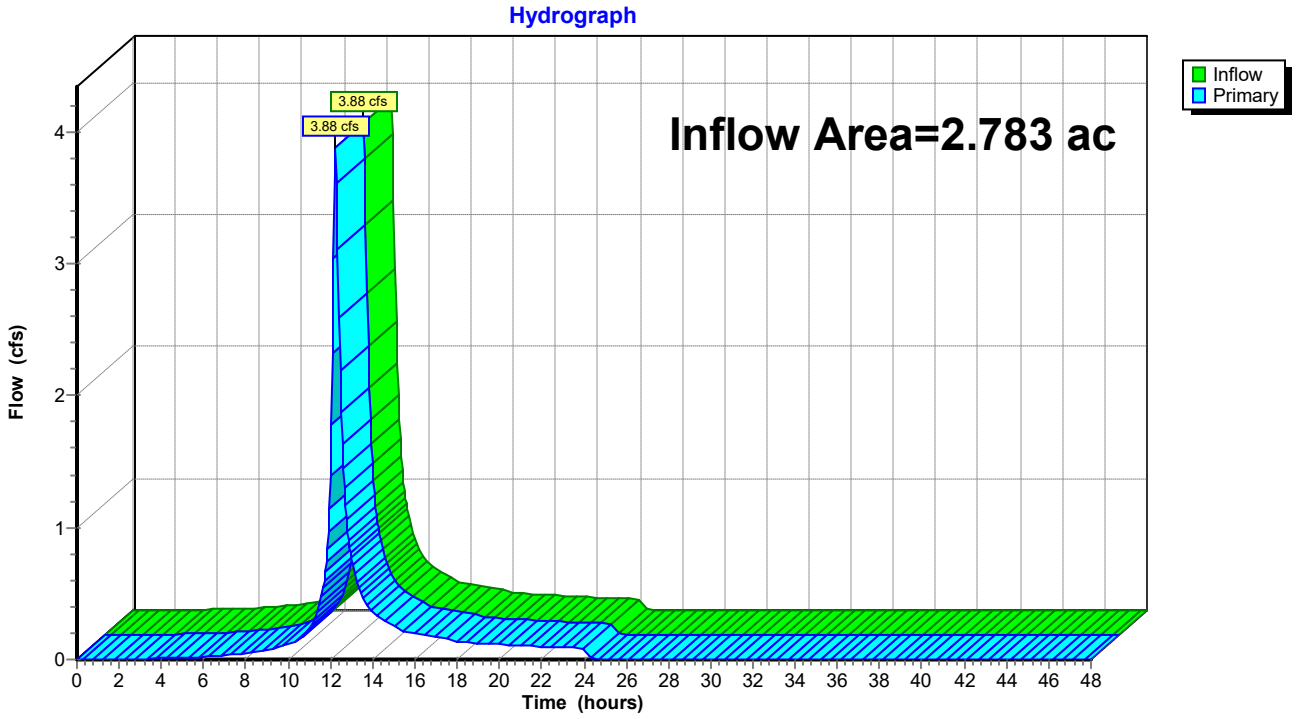
Link 1A: EXDA-1A



Link 1B: EXDA-1B



Link A: PT A



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1Ai: EXDA-1Ai Runoff Area=11,300 sf 100.00% Impervious Runoff Depth=4.93"
Flow Length=621' Tc=15.7 min CN=98 Runoff=0.94 cfs 0.107 af

Subcatchment 1Ap: EXDA-1Ap Runoff Area=57,410 sf 55.32% Impervious Runoff Depth=3.80"
Flow Length=621' Tc=15.7 min CN=WQ Runoff=4.05 cfs 0.418 af

Subcatchment 2Bp: EXDA-2Bp Runoff Area=52,500 sf 0.00% Impervious Runoff Depth=2.25"
Flow Length=528' Tc=16.4 min CN=WQ Runoff=2.22 cfs 0.226 af

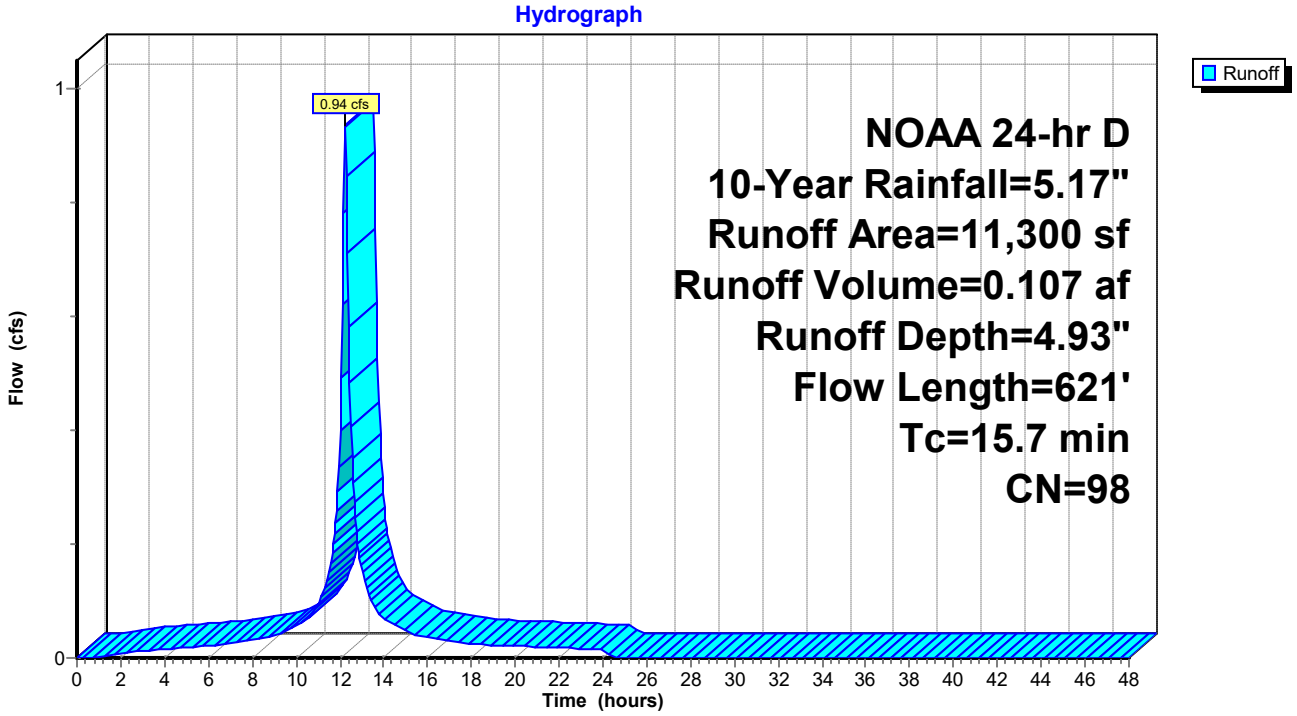
Link 1A: EXDA-1A Inflow=4.99 cfs 0.524 af
Primary=4.99 cfs 0.524 af

Link 1B: EXDA-1B Inflow=2.22 cfs 0.226 af
Primary=2.22 cfs 0.226 af

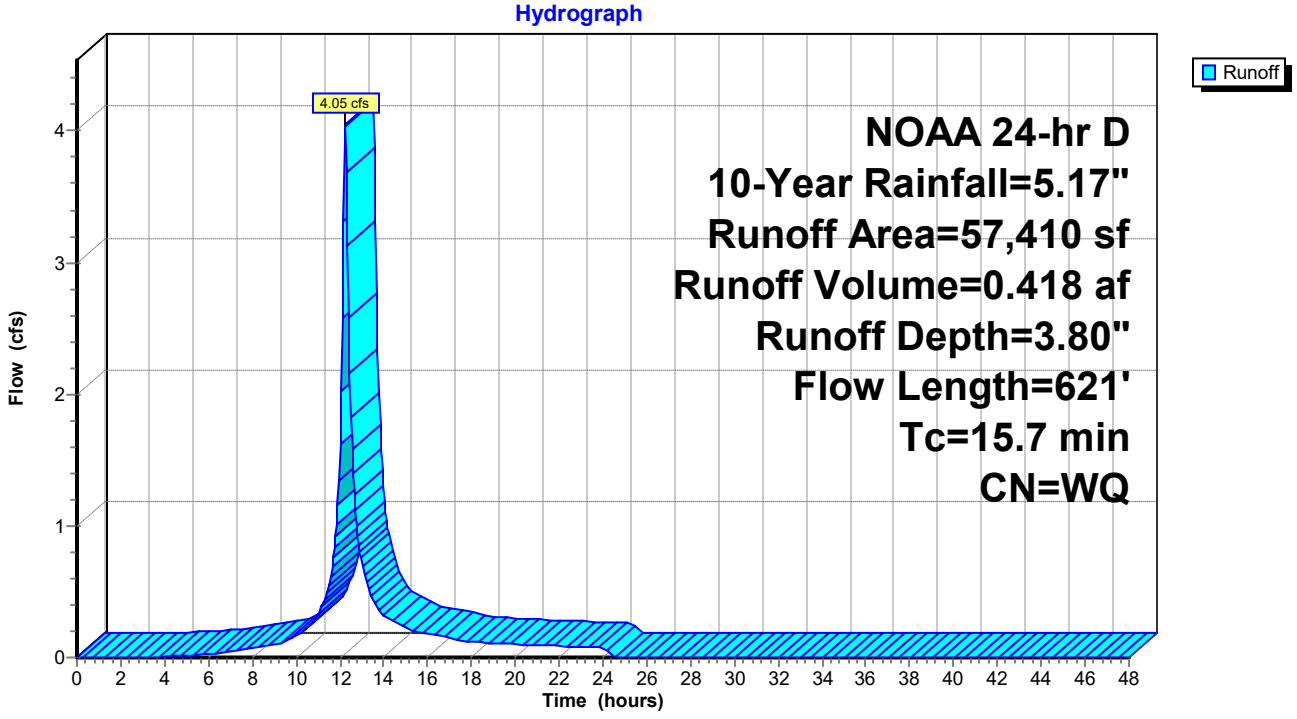
Link A: PT A Inflow=7.19 cfs 0.750 af
Primary=7.19 cfs 0.750 af

Total Runoff Area = 2.783 ac Runoff Volume = 0.750 af Average Runoff Depth = 3.23"
64.48% Pervious = 1.794 ac 35.52% Impervious = 0.988 ac

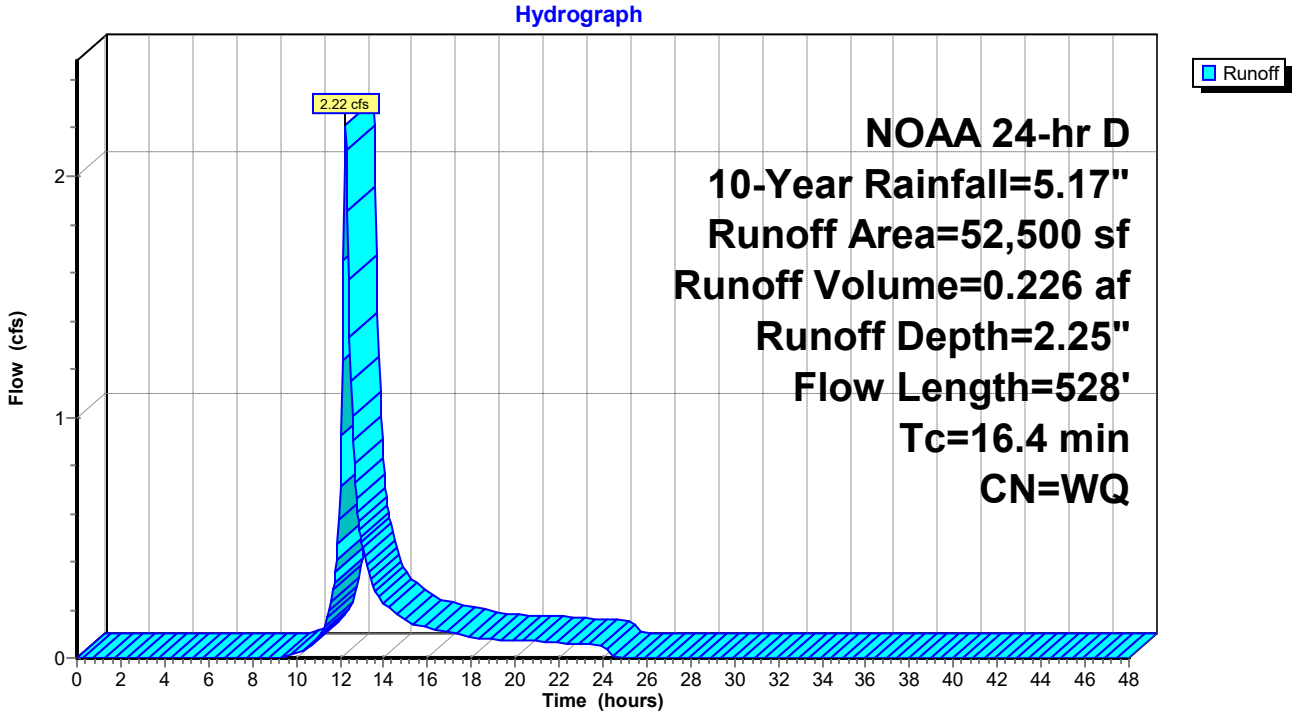
Subcatchment 1Ai: EXDA-1Ai



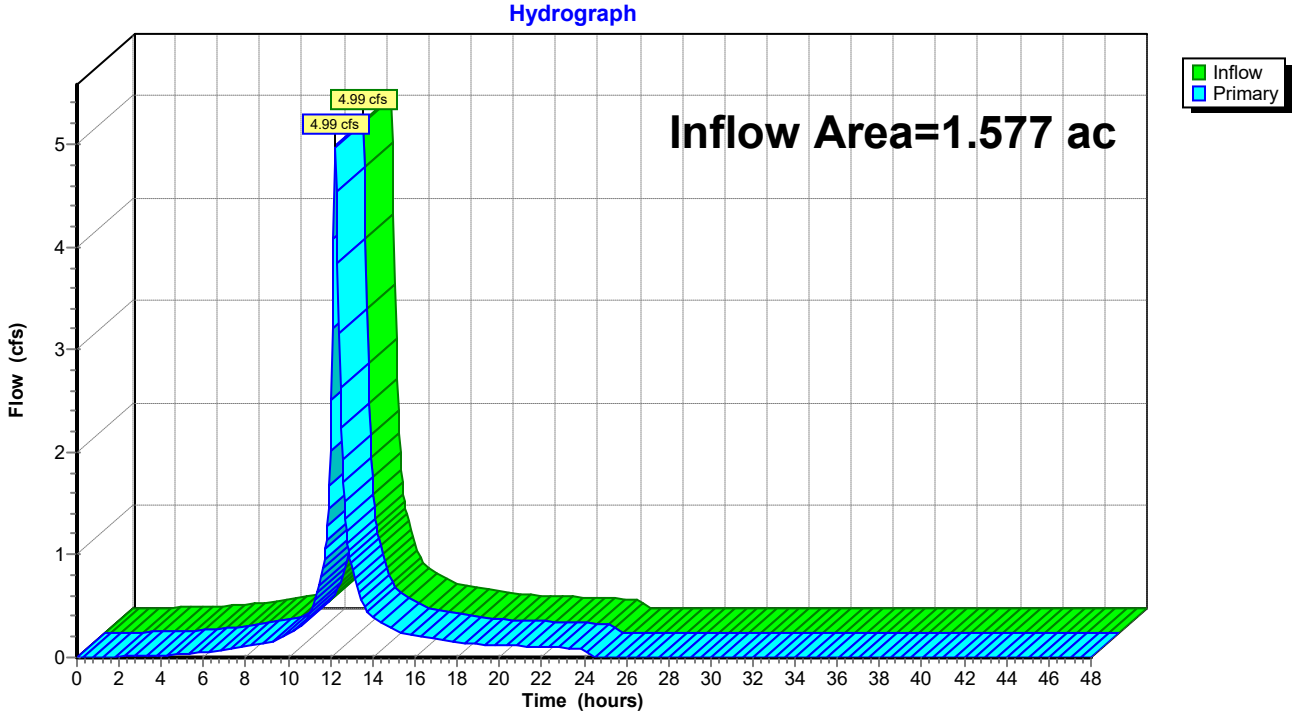
Subcatchment 1Ap: EXDA-1Ap



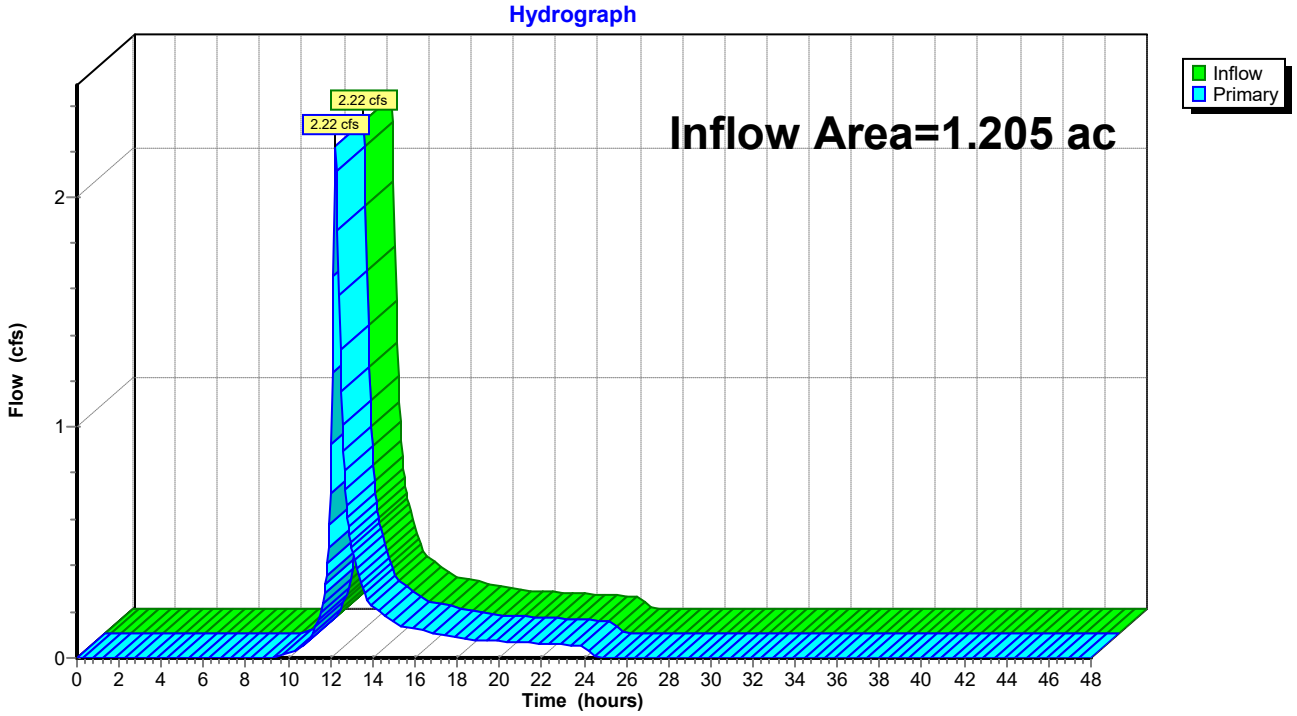
Subcatchment 2Bp: EXDA-2Bp



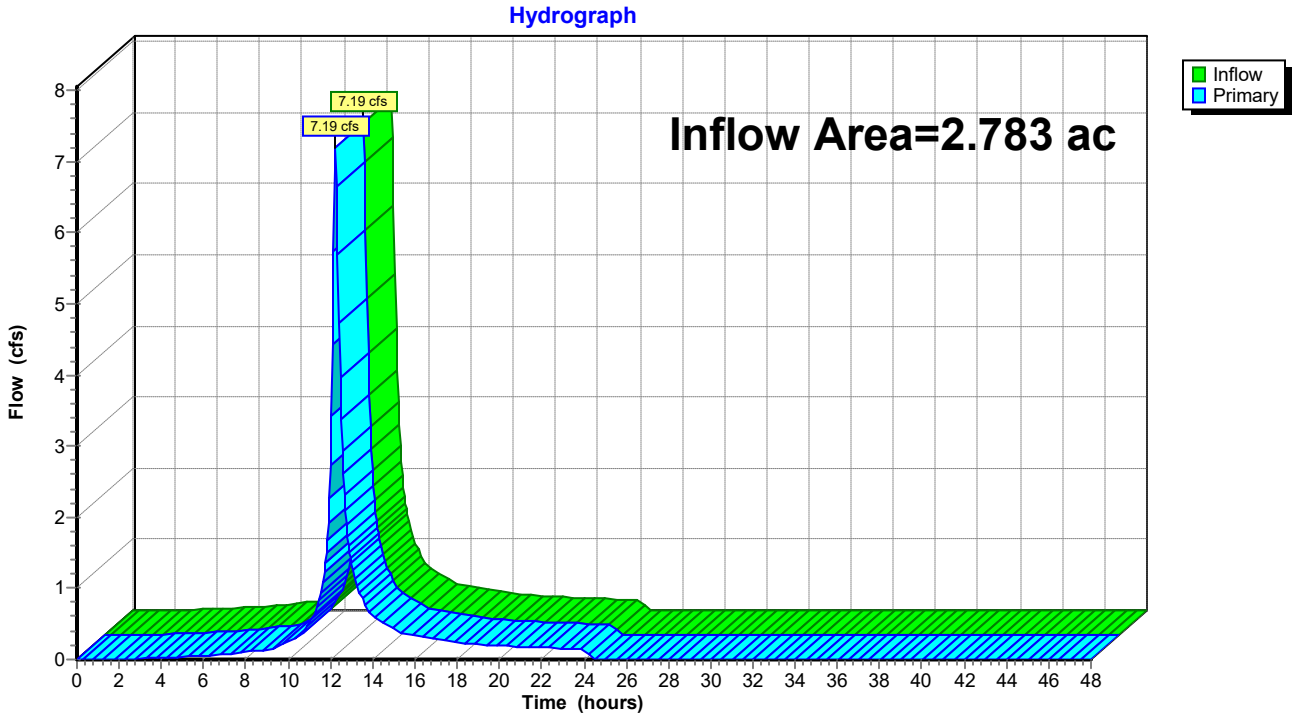
Link 1A: EXDA-1A



Link 1B: EXDA-1B



Link A: PT A



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1Ai: EXDA-1Ai Runoff Area=11,300 sf 100.00% Impervious Runoff Depth=8.45"
Flow Length=621' Tc=15.7 min CN=98 Runoff=1.58 cfs 0.183 af

Subcatchment 1Ap: EXDA-1Ap Runoff Area=57,410 sf 55.32% Impervious Runoff Depth=7.18"
Flow Length=621' Tc=15.7 min CN=WQ Runoff=7.42 cfs 0.789 af

Subcatchment 2Bp: EXDA-2Bp Runoff Area=52,500 sf 0.00% Impervious Runoff Depth=5.18"
Flow Length=528' Tc=16.4 min CN=WQ Runoff=5.15 cfs 0.521 af

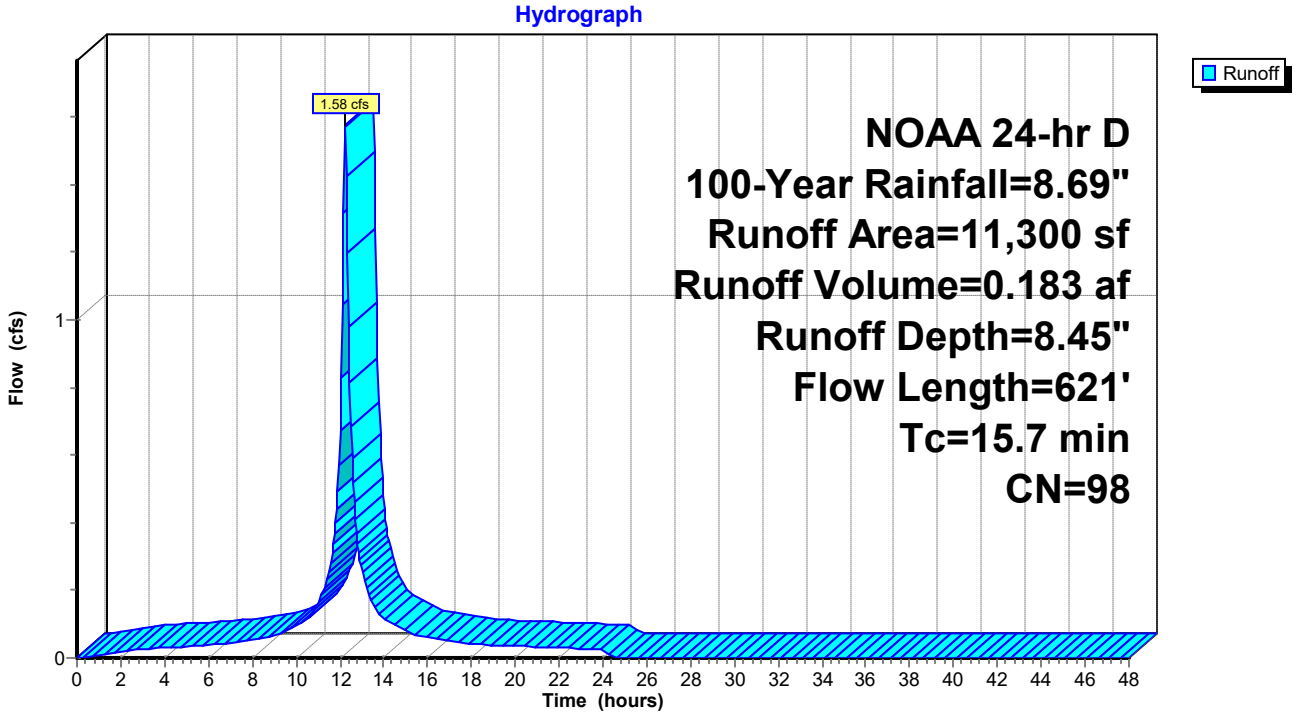
Link 1A: EXDA-1A Inflow=9.00 cfs 0.972 af
Primary=9.00 cfs 0.972 af

Link 1B: EXDA-1B Inflow=5.15 cfs 0.521 af
Primary=5.15 cfs 0.521 af

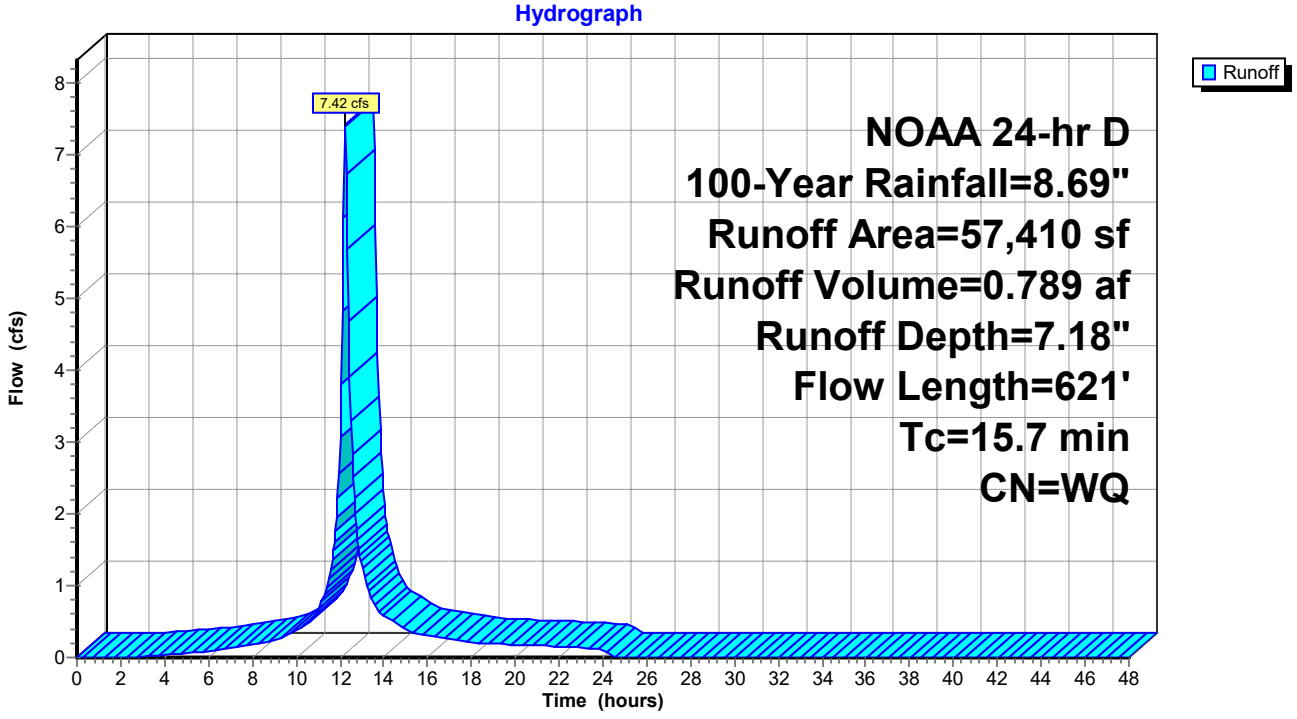
Link A: PT A Inflow=14.14 cfs 1.492 af
Primary=14.14 cfs 1.492 af

Total Runoff Area = 2.783 ac Runoff Volume = 1.492 af Average Runoff Depth = 6.44"
64.48% Pervious = 1.794 ac 35.52% Impervious = 0.988 ac

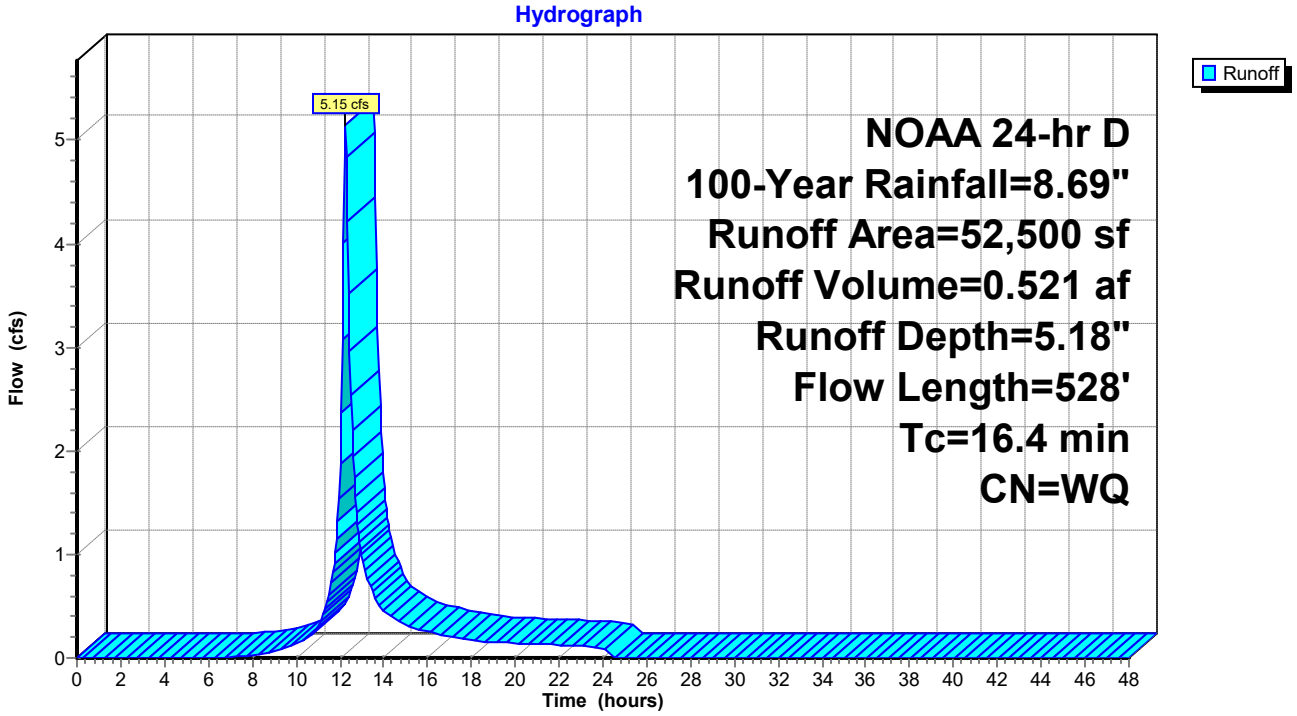
Subcatchment 1Ai: EXDA-1Ai



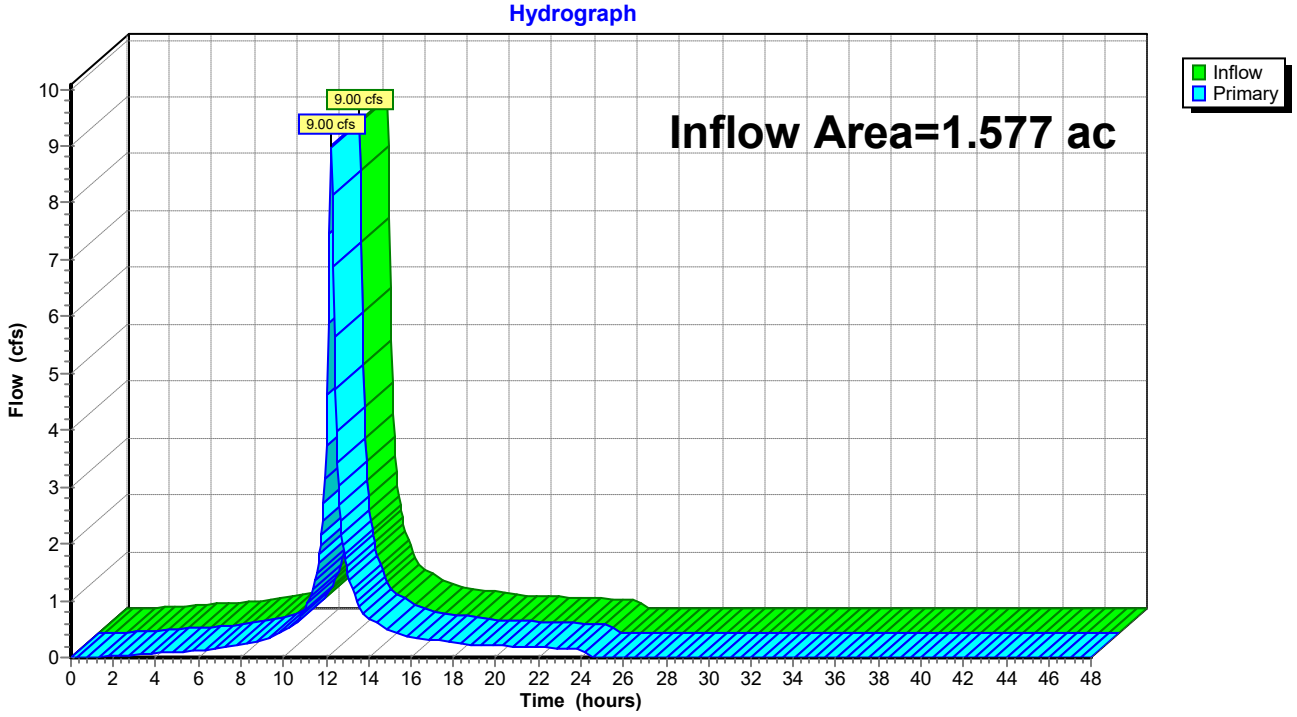
Subcatchment 1Ap: EXDA-1Ap



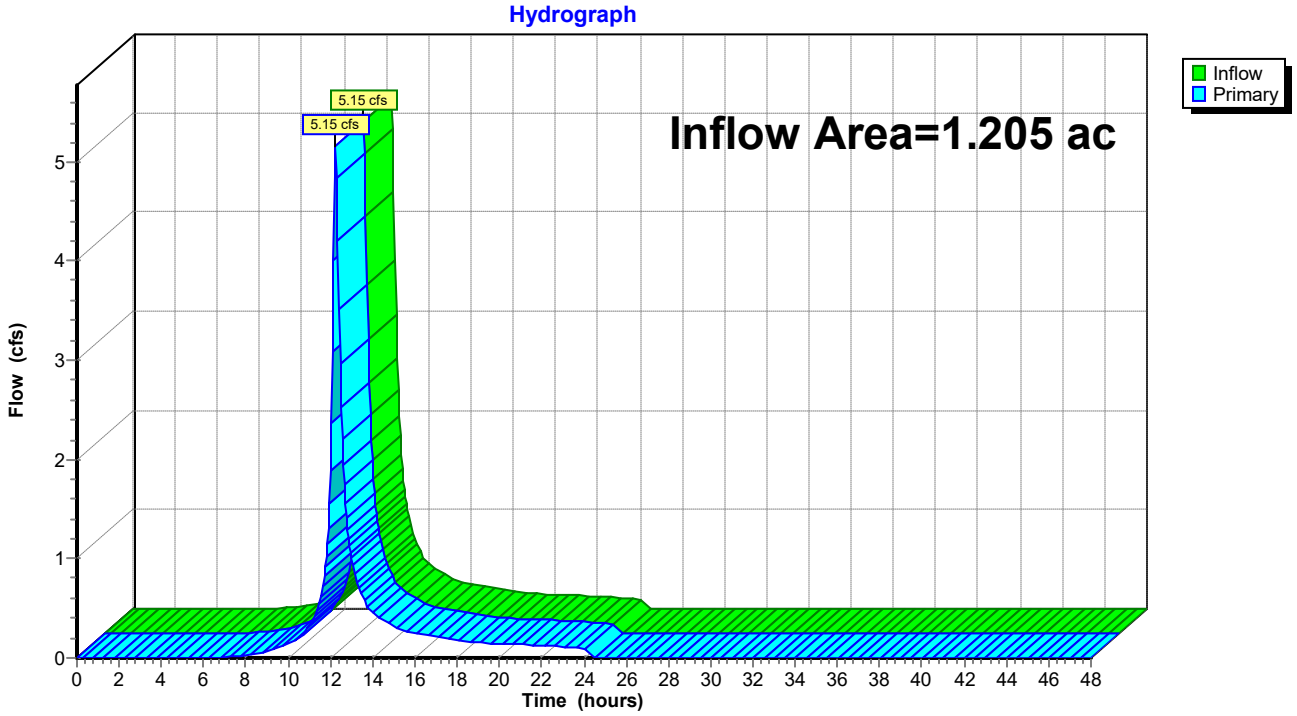
Subcatchment 2Bp: EXDA-2Bp



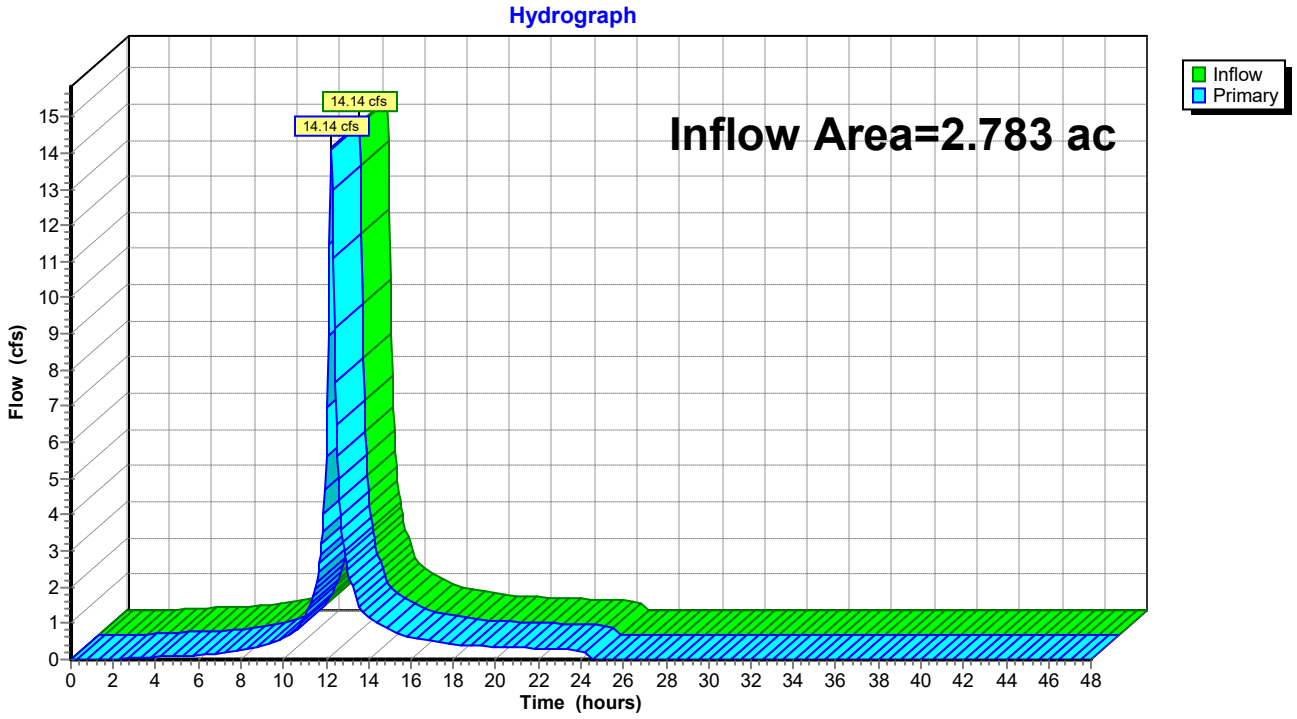
Link 1A: EXDA-1A

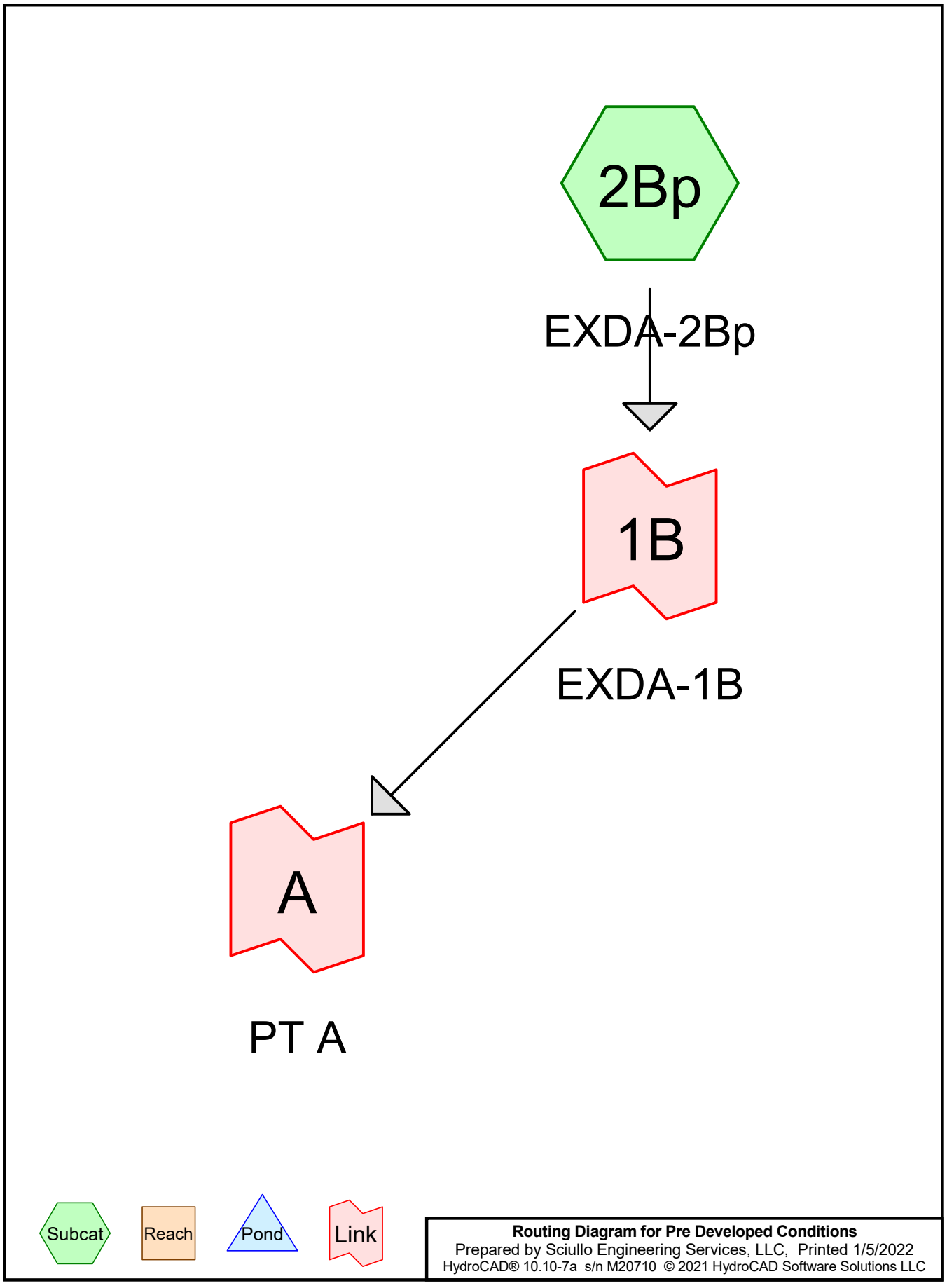


Link 1B: EXDA-1B



Link A: PT A





Routing Diagram for Pre Developed Conditions
Prepared by Sciullo Engineering Services, LLC, Printed 1/5/2022

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	NOAA 24-hr	D	Default	24.00	1	3.39	2
2	10-Year	NOAA 24-hr	D	Default	24.00	1	5.17	2
3	100-Year	NOAA 24-hr	D	Default	24.00	1	8.69	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.301	74	>75% Grass cover, Good, HSG C (2Bp)
0.905	70	Woods, Good, HSG C (2Bp)
1.205	**71**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
1.205	HSG C	2Bp
0.000	HSG D	
0.000	Other	
1.205		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.301	0.000	0.000	0.301	>75% Grass cover, Good	2Bp
0.000	0.000	0.905	0.000	0.000	0.905	Woods, Good	2Bp
0.000	**0.000**	**1.205**	**0.000**	**0.000**	**1.205**	**TOTAL AREA**	

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

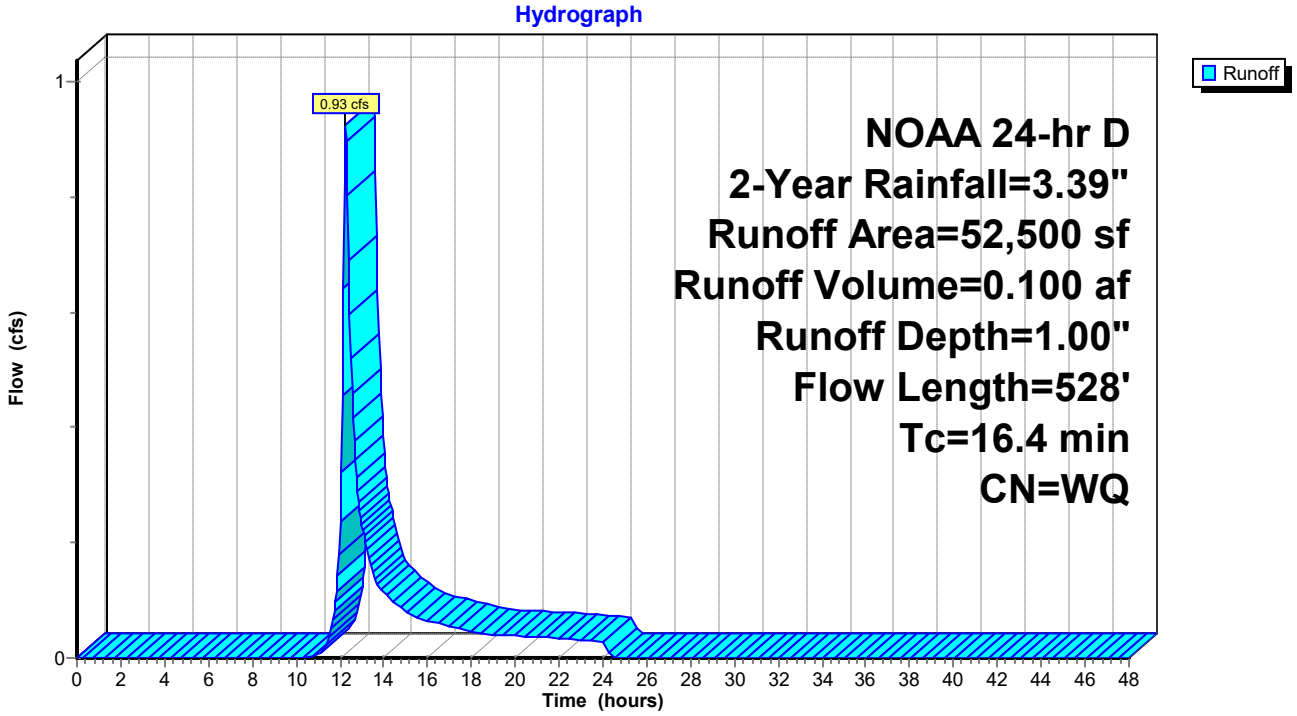
Subcatchment 2Bp: EXDA-2Bp Runoff Area=52,500 sf 0.00% Impervious Runoff Depth=1.00"
Flow Length=528' Tc=16.4 min CN=WQ Runoff=0.93 cfs 0.100 af

Link 1B: EXDA-1B Inflow=0.93 cfs 0.100 af
Primary=0.93 cfs 0.100 af

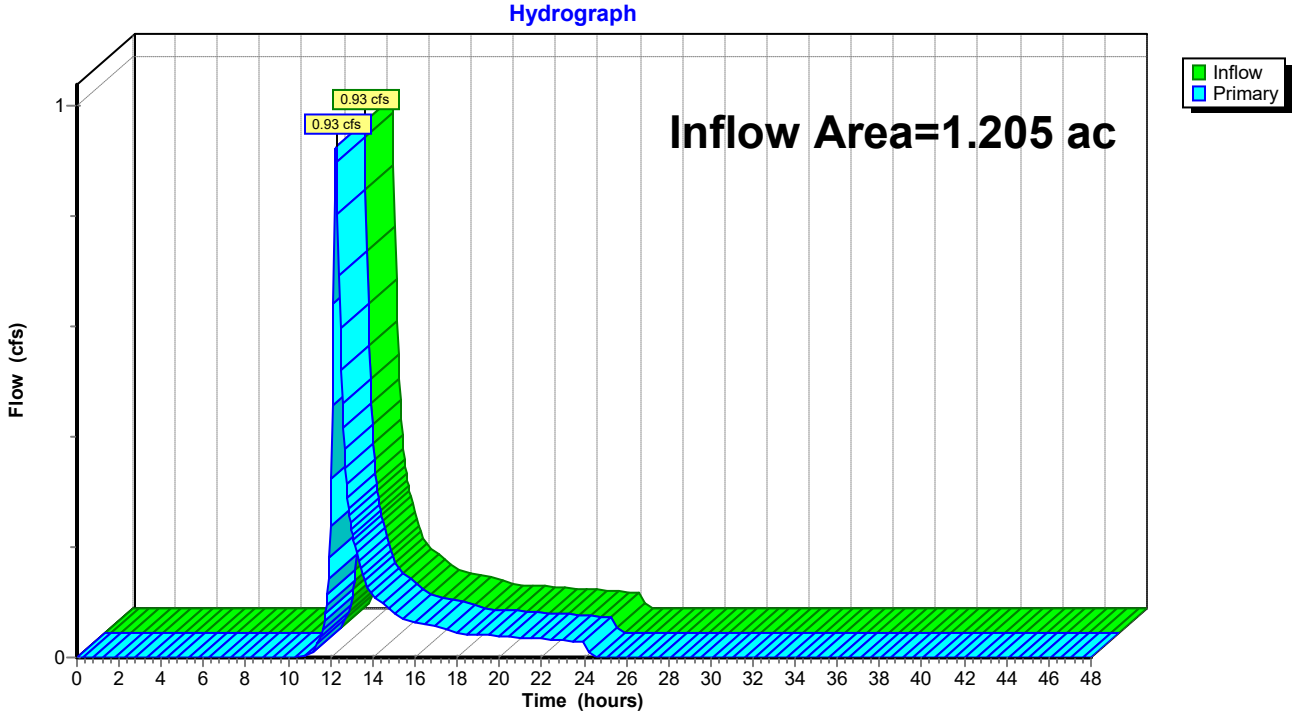
Link A: PT A Inflow=0.93 cfs 0.100 af
Primary=0.93 cfs 0.100 af

Total Runoff Area = 1.205 ac Runoff Volume = 0.100 af Average Runoff Depth = 1.00"
100.00% Pervious = 1.205 ac 0.00% Impervious = 0.000 ac

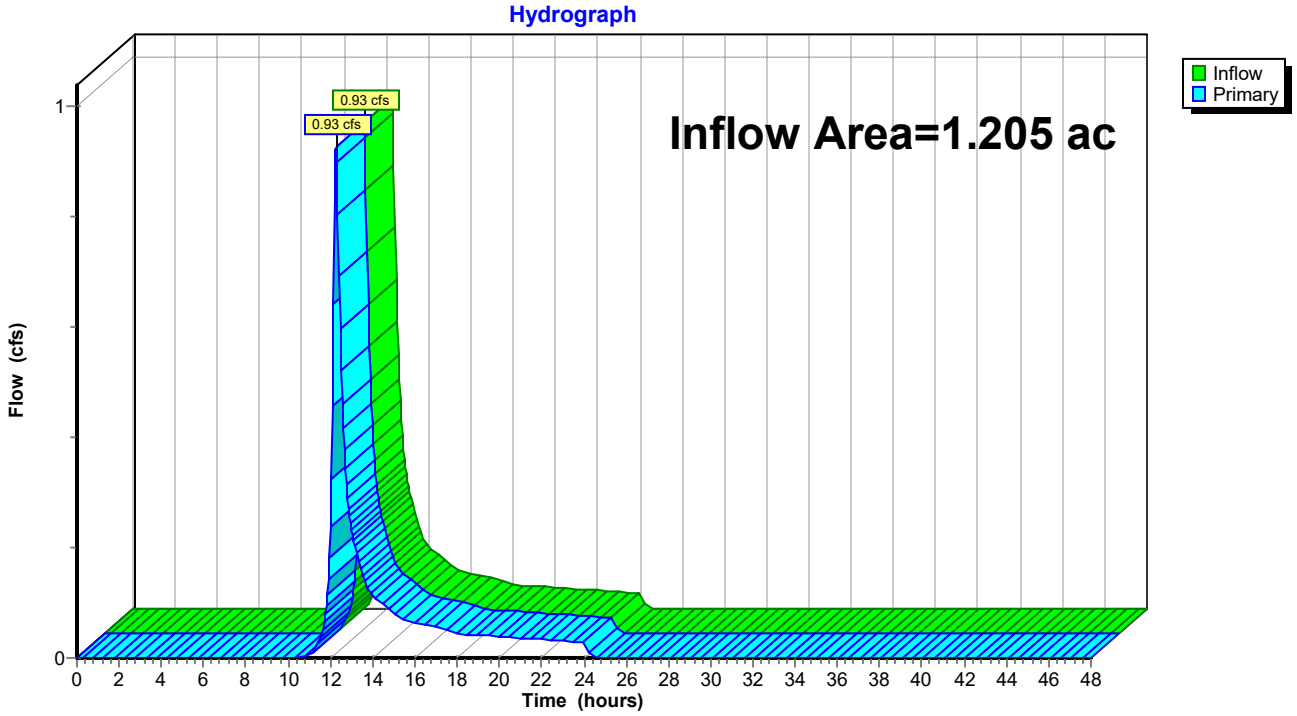
Subcatchment 2Bp: EXDA-2Bp



Link 1B: EXDA-1B



Link A: PT A


Hydrograph
Inflow Area=1.205 ac
0.93 cfs
0.93 cfs
Inflow
Primary
Flow (cfs)
Time (hours)
0
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

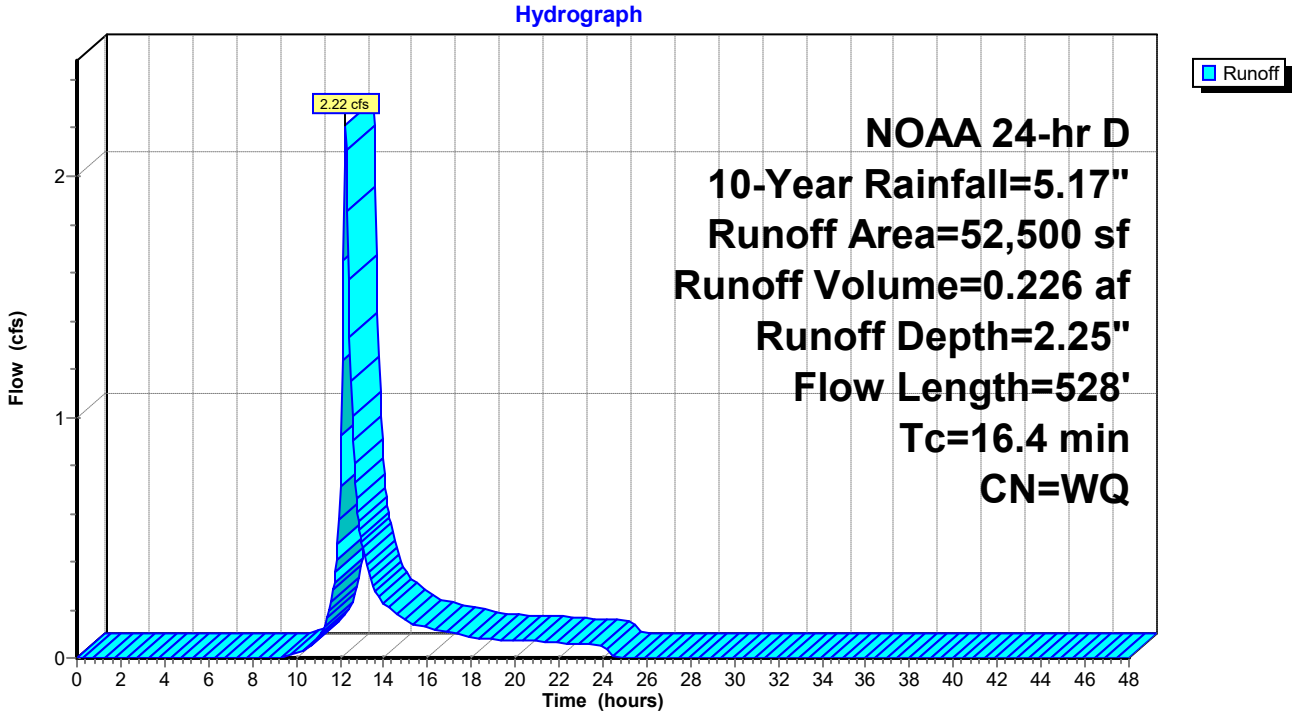
Subcatchment 2Bp: EXDA-2Bp Runoff Area=52,500 sf 0.00% Impervious Runoff Depth=2.25"
Flow Length=528' Tc=16.4 min CN=WQ Runoff=2.22 cfs 0.226 af

Link 1B: EXDA-1B Inflow=2.22 cfs 0.226 af
Primary=2.22 cfs 0.226 af

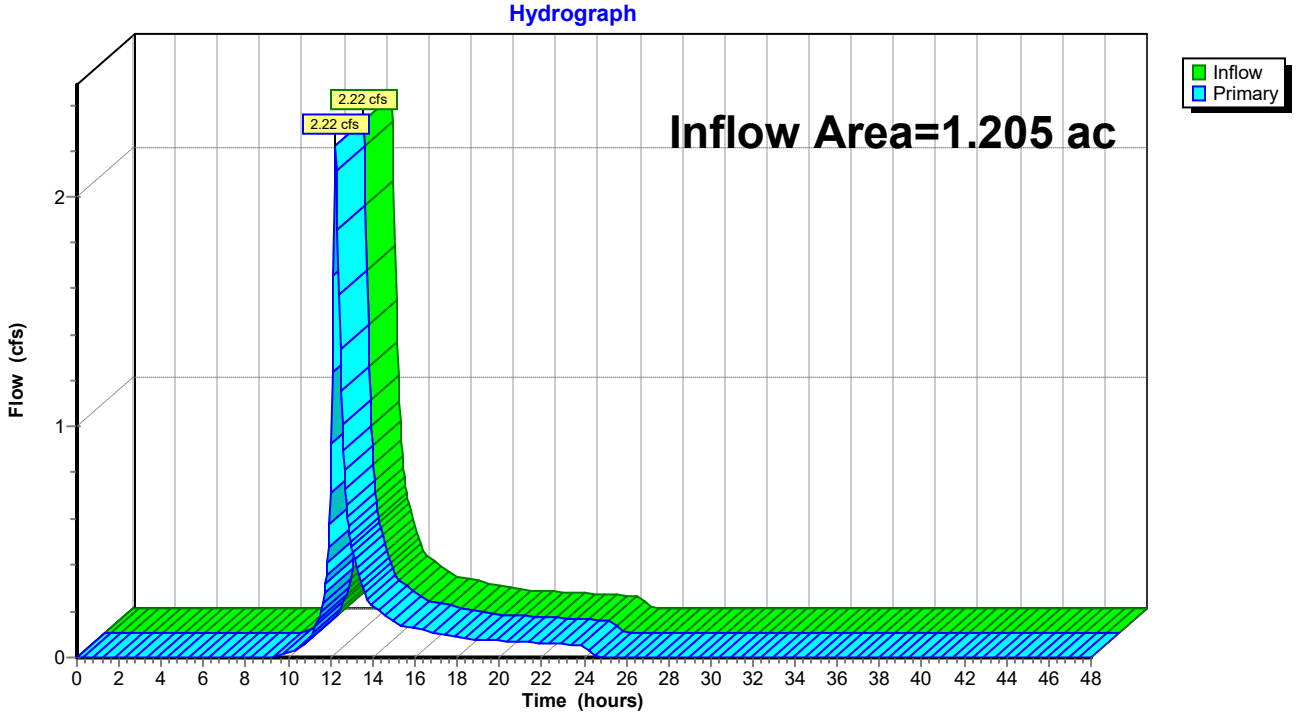
Link A: PT A Inflow=2.22 cfs 0.226 af
Primary=2.22 cfs 0.226 af

Total Runoff Area = 1.205 ac Runoff Volume = 0.226 af Average Runoff Depth = 2.25"
100.00% Pervious = 1.205 ac 0.00% Impervious = 0.000 ac

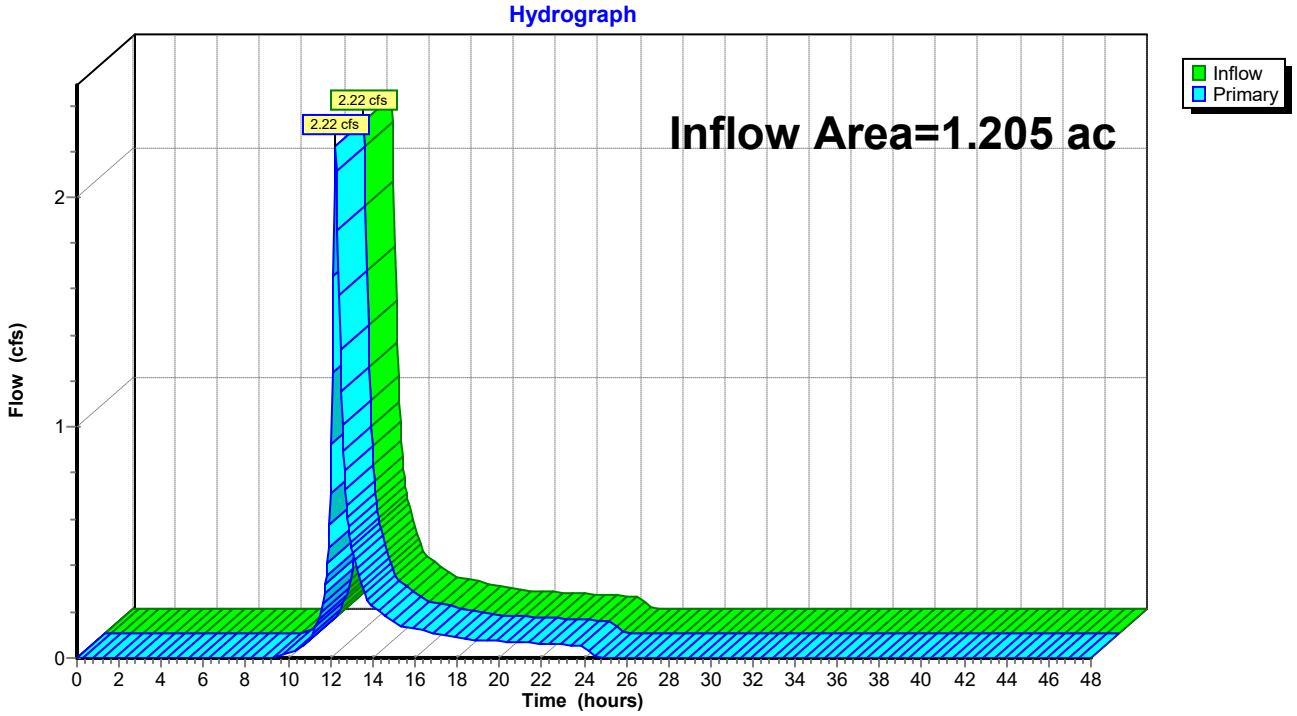
Subcatchment 2Bp: EXDA-2Bp



Link 1B: EXDA-1B



Link A: PT A


Hydrograph
Inflow Area=1.205 ac
Inflow
Primary
2.22 cfs
2.22 cfs
Flow (cfs)
0
1
2
Time (hours)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

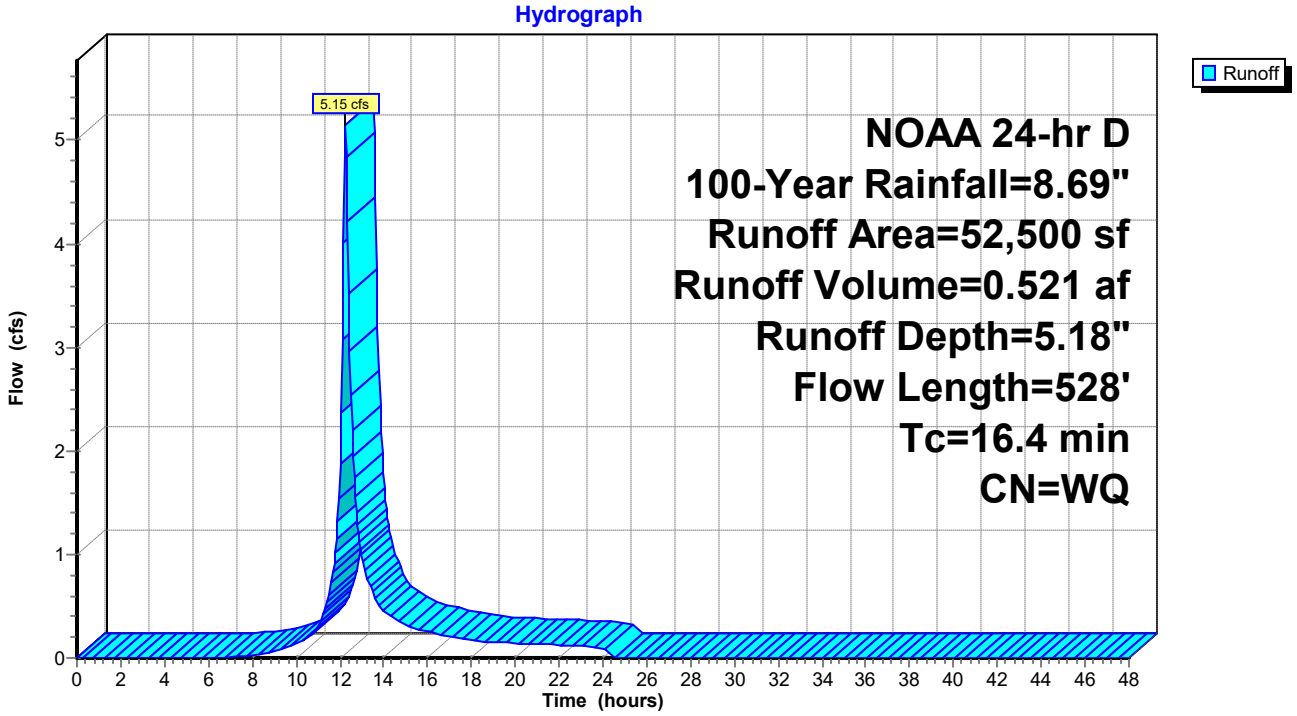
Subcatchment 2Bp: EXDA-2Bp Runoff Area=52,500 sf 0.00% Impervious Runoff Depth=5.18"
Flow Length=528' Tc=16.4 min CN=WQ Runoff=5.15 cfs 0.521 af

Link 1B: EXDA-1B Inflow=5.15 cfs 0.521 af
Primary=5.15 cfs 0.521 af

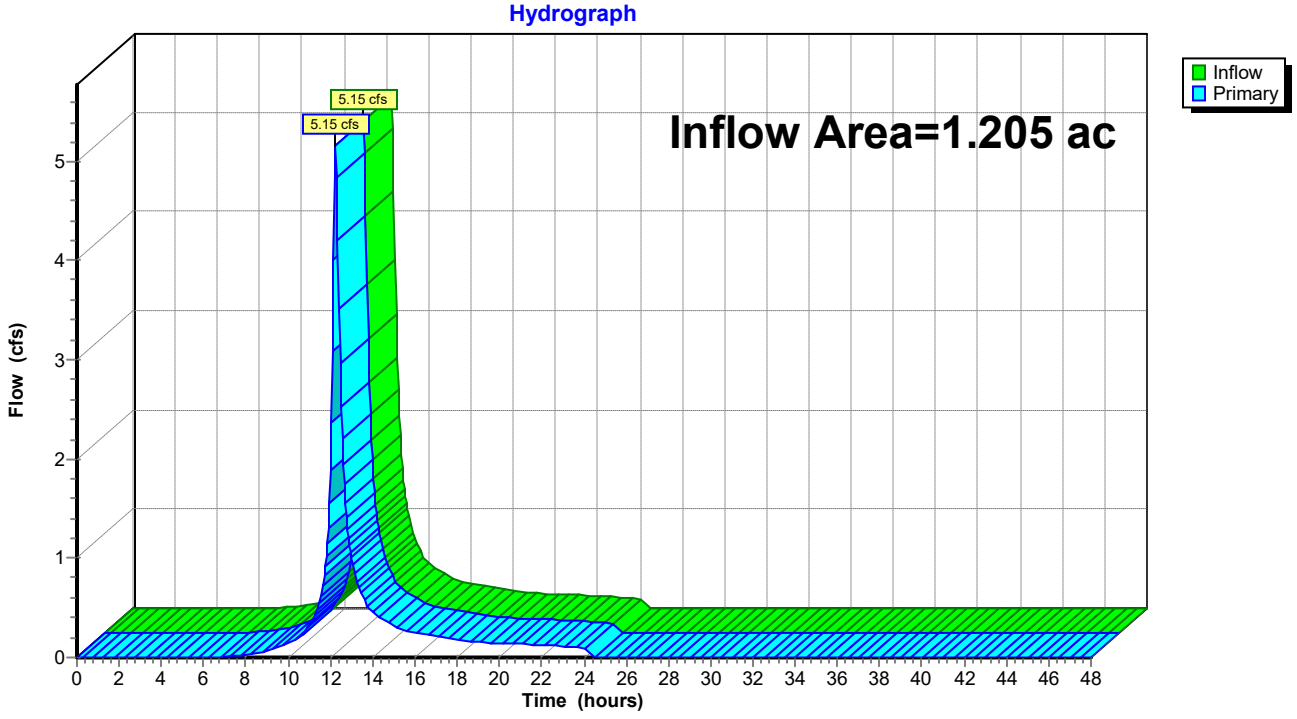
Link A: PT A Inflow=5.15 cfs 0.521 af
Primary=5.15 cfs 0.521 af

Total Runoff Area = 1.205 ac Runoff Volume = 0.521 af Average Runoff Depth = 5.18"
100.00% Pervious = 1.205 ac 0.00% Impervious = 0.000 ac

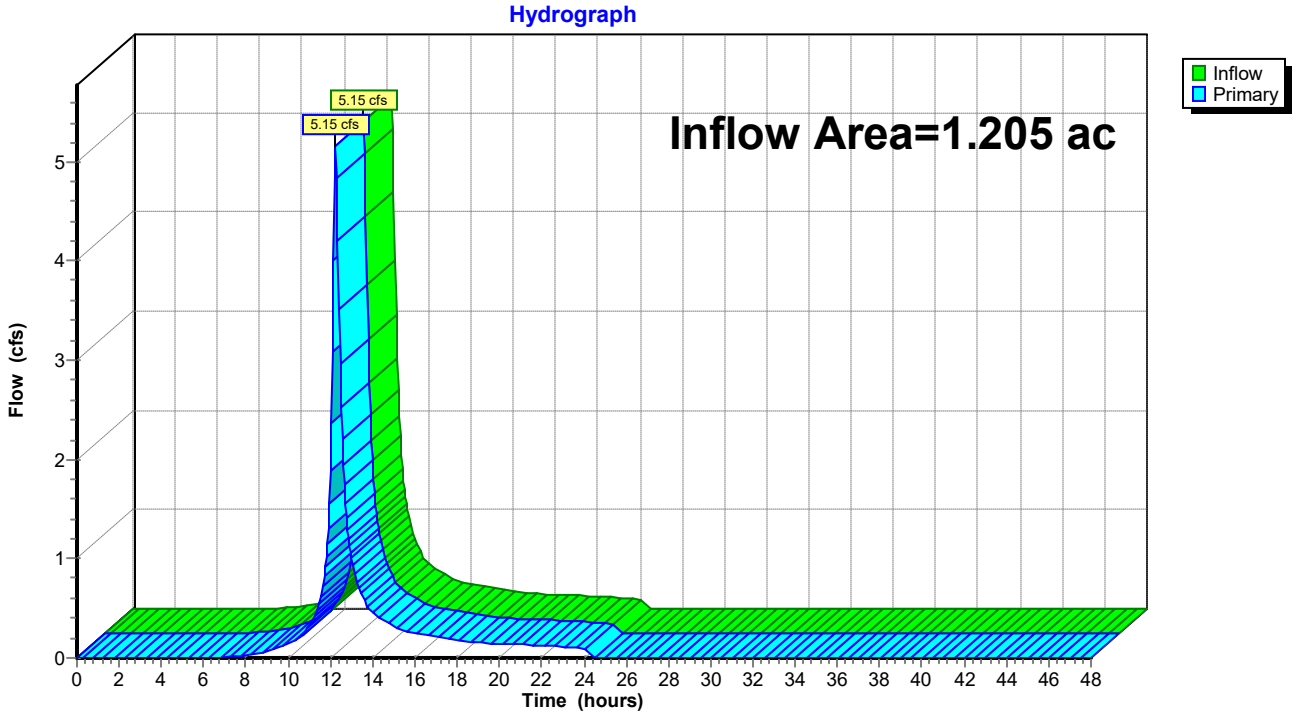
Subcatchment 2Bp: EXDA-2Bp



Link 1B: EXDA-1B

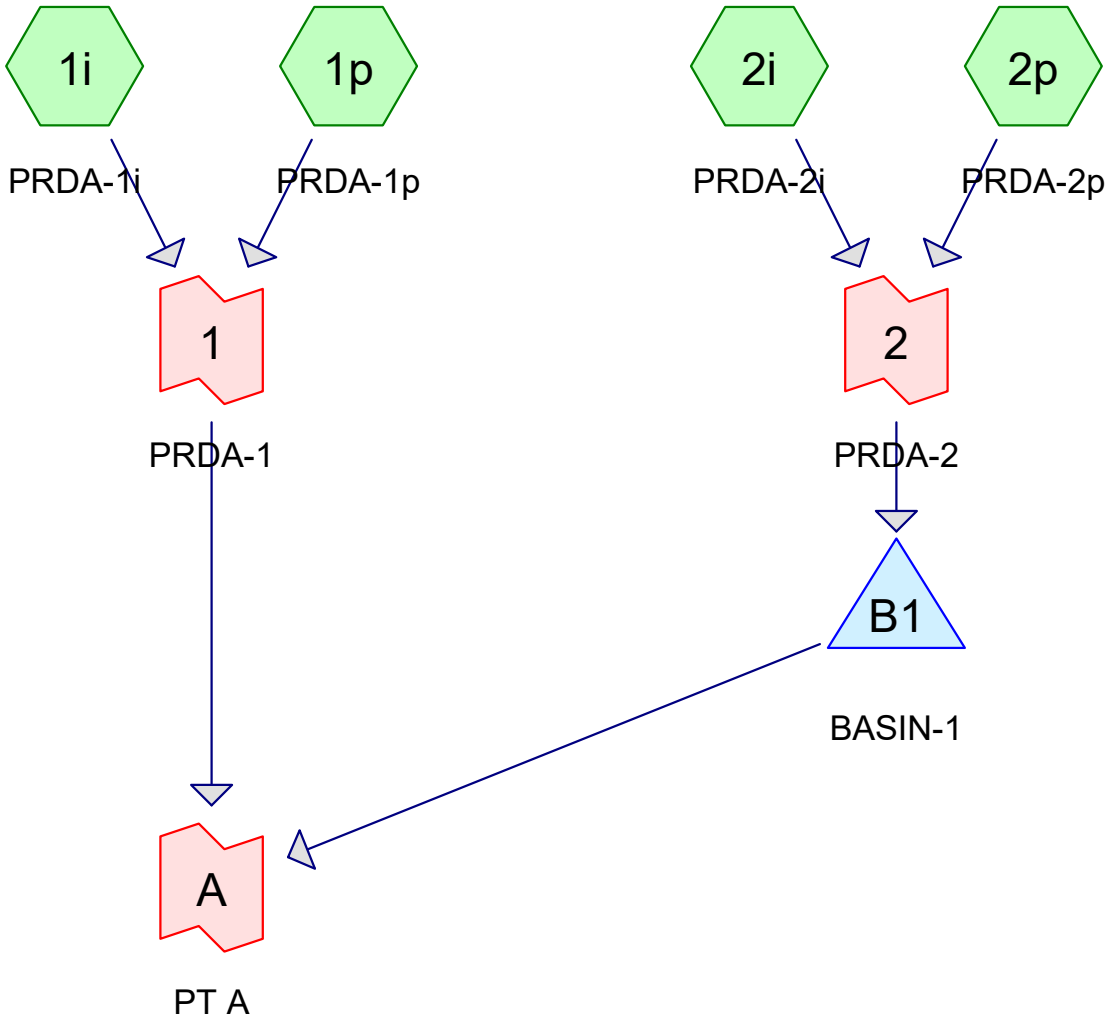


Link A: PT A


Hydrograph
Inflow Area=1.205 ac
5.15 cfs
5.15 cfs
Inflow
Primary
Flow (cfs)
Time (hours)
0
1
2
3
4
5
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48

APPENDIX D

POST-DEVELOPED RUNOFF CALCULATIONS



Subcat Reach Pond Link

Routing Diagram for Post Developed Conditions
Prepared by Sciullo, Printed 3/7/2022

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	NOAA 24-hr	D	Default	24.00	1	3.39	2
2	10-Year	NOAA 24-hr	D	Default	24.00	1	5.17	2
3	100-Year	NOAA 24-hr	D	Default	24.00	1	8.69	2
4	NJDEP WQ	NJ DEP 2-hr		Default	2.00	1	1.25	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.122	90	1/8 acre lots, 65% imp, HSG C (1p, 2p)
0.953	74	>75% Grass cover, Good, HSG C (1p, 2p)
0.646	98	Paved parking, HSG C (1i, 2i)
0.062	70	Woods, Good, HSG C (1p, 2p)
2.783	**86**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
2.783	HSG C	1i, 1p, 2i, 2p
0.000	HSG D	
0.000	Other	
2.783		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	1.122	0.000	0.000	1.122	1/8 acre lots, 65% imp	1p, 2p
0.000	0.000	0.953	0.000	0.000	0.953	>75% Grass cover, Good	1p, 2p
0.000	0.000	0.646	0.000	0.000	0.646	Paved parking	1i, 2i
0.000	0.000	0.062	0.000	0.000	0.062	Woods, Good	1p, 2p
0.000	**0.000**	**2.783**	**0.000**	**0.000**	**2.783**	**TOTAL AREA**	

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1i: PRDA-1i Runoff Area=13,690 sf 100.00% Impervious Runoff Depth=3.16"
Flow Length=666' Tc=4.9 min CN=98 Runoff=1.01 cfs 0.083 af

Subcatchment 1p: PRDA-1p Runoff Area=14,115 sf 16.56% Impervious Runoff Depth=1.45"
Flow Length=666' Tc=4.9 min CN=WQ Runoff=0.54 cfs 0.039 af

Subcatchment 2i: PRDA-2i Runoff Area=14,445 sf 100.00% Impervious Runoff Depth=3.16"
Flow Length=519' Tc=15.0 min CN=98 Runoff=0.80 cfs 0.087 af

Subcatchment 2p: PRDA-2p Runoff Area=78,960 sf 37.26% Impervious Runoff Depth=1.84"
Flow Length=519' Tc=15.0 min CN=WQ Runoff=2.79 cfs 0.277 af

Pond B1: BASIN-1 Peak Elev=78.96' Storage=5,539 cf Inflow=3.58 cfs 0.365 af
Outflow=2.55 cfs 0.283 af

Link 1: PRDA-1 Inflow=1.55 cfs 0.122 af
Primary=1.55 cfs 0.122 af

Link 2: PRDA-2 Inflow=3.58 cfs 0.365 af
Primary=3.58 cfs 0.365 af

Link A: PT A Inflow=2.96 cfs 0.405 af
Primary=2.96 cfs 0.405 af

Total Runoff Area = 2.783 ac Runoff Volume = 0.486 af Average Runoff Depth = 2.10"
50.59% Pervious = 1.408 ac 49.41% Impervious = 1.375 ac

Summary for Subcatchment 1i: PRDA-1i

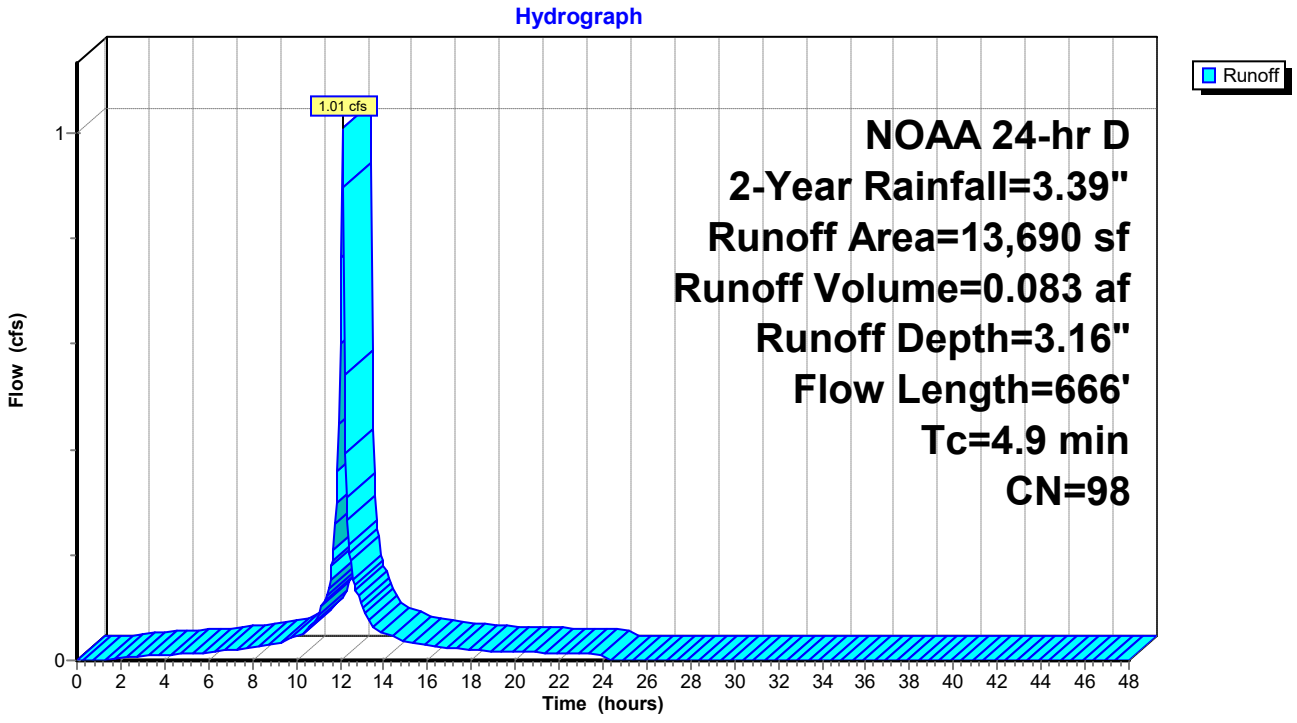
Runoff = 1.01 cfs @ 12.11 hrs, Volume= 0.083 af, Depth= 3.16"
Routed to Link 1 : PRDA-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-Year Rainfall=3.39"

Area (sf)	CN	Description
13,690	98	Paved parking, HSG C
13,690	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0190	1.38		**Sheet Flow, Segment 1.1** Smooth surfaces n= 0.011 P2= 3.36"
1.1	258	0.0345	3.77		**Shallow Concentrated Flow, Segment 1.2** Paved Kv= 20.3 fps
2.6	308	0.0094	1.97		**Shallow Concentrated Flow, Segment 1.3** Paved Kv= 20.3 fps
4.9	666	Total			

Subcatchment 1i: PRDA-1i



Summary for Subcatchment 1p: PRDA-1p

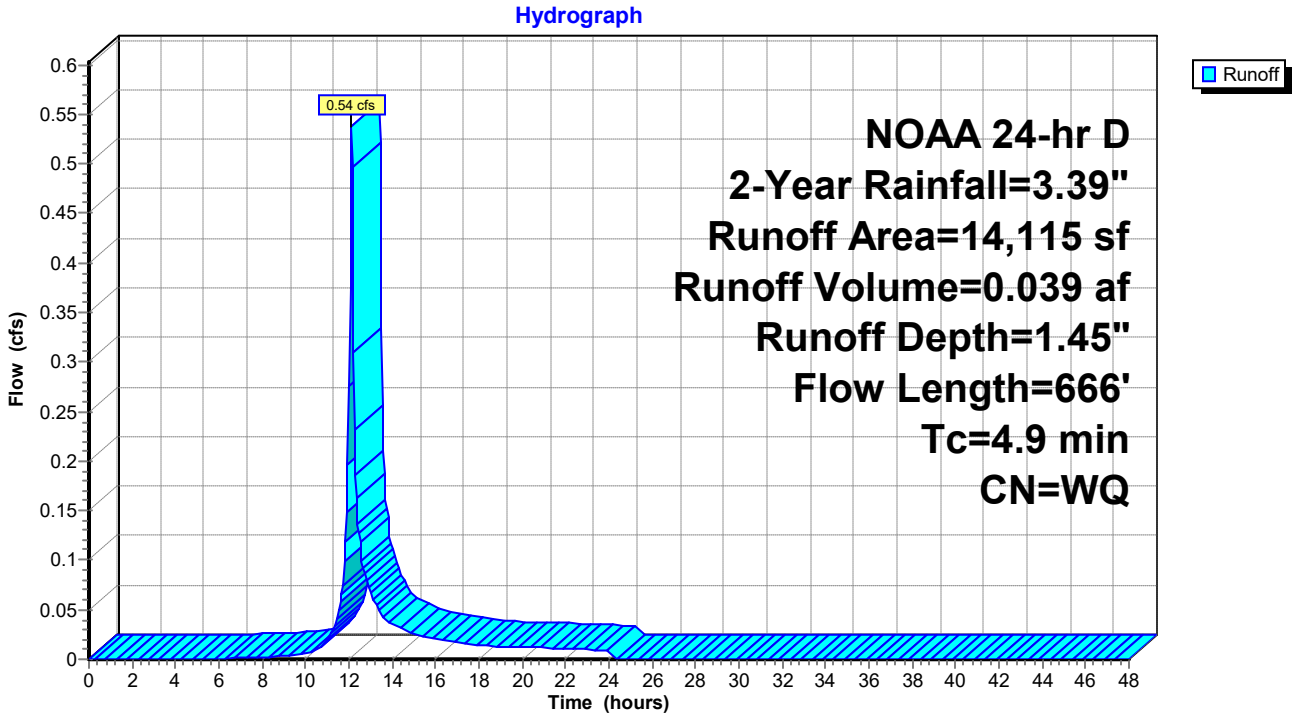
Runoff = 0.54 cfs @ 12.12 hrs, Volume= 0.039 af, Depth= 1.45"
Routed to Link 1 : PRDA-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-Year Rainfall=3.39"

Area (sf)	CN	Description
3,595	90	1/8 acre lots, 65% imp, HSG C
9,745	74	>75% Grass cover, Good, HSG C
775	70	Woods, Good, HSG C
14,115		Weighted Average
11,778	74	83.44% Pervious Area
2,337	98	16.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0190	1.38		**Sheet Flow, Segment 1.1** Smooth surfaces n= 0.011 P2= 3.36"
1.1	258	0.0345	3.77		**Shallow Concentrated Flow, Segment 1.2** Paved Kv= 20.3 fps
2.6	308	0.0094	1.97		**Shallow Concentrated Flow, Segment 1.3** Paved Kv= 20.3 fps
4.9	666	Total			

Subcatchment 1p: PRDA-1p



Summary for Subcatchment 2i: PRDA-2i

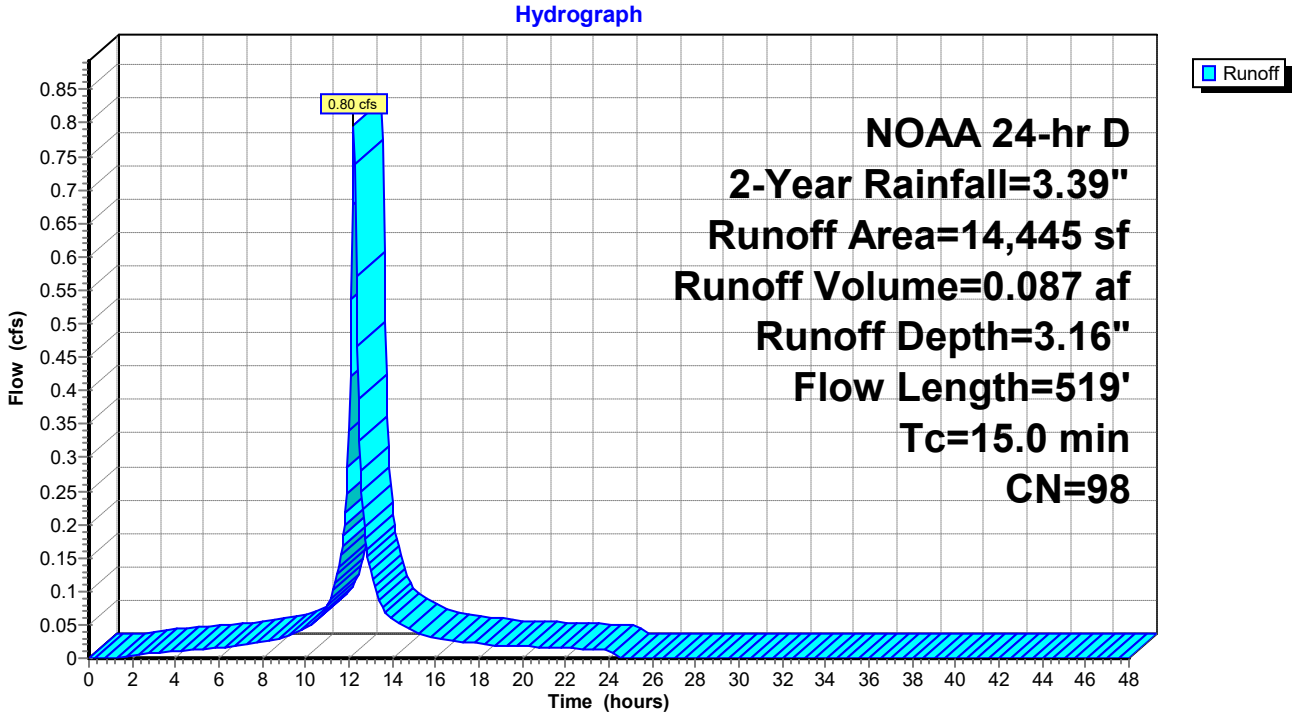
Runoff = 0.80 cfs @ 12.22 hrs, Volume= 0.087 af, Depth= 3.16"
Routed to Link 2 : PRDA-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-Year Rainfall=3.39"

Area (sf)	CN	Description
14,445	98	Paved parking, HSG C
14,445	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	100	0.0300	0.14		**Sheet Flow, Segment 2.1** Grass: Dense n= 0.240 P2= 3.36"
0.6	87	0.0230	2.44		**Shallow Concentrated Flow, Segment 2.2** Unpaved Kv= 16.1 fps
1.0	100	0.0100	1.61		**Shallow Concentrated Flow, Segment 2.3** Unpaved Kv= 16.1 fps
1.6	232	0.0237	2.48		**Shallow Concentrated Flow, Segment 2.4** Unpaved Kv= 16.1 fps
15.0	519	Total			

Subcatchment 2i: PRDA-2i



Summary for Subcatchment 2p: PRDA-2p

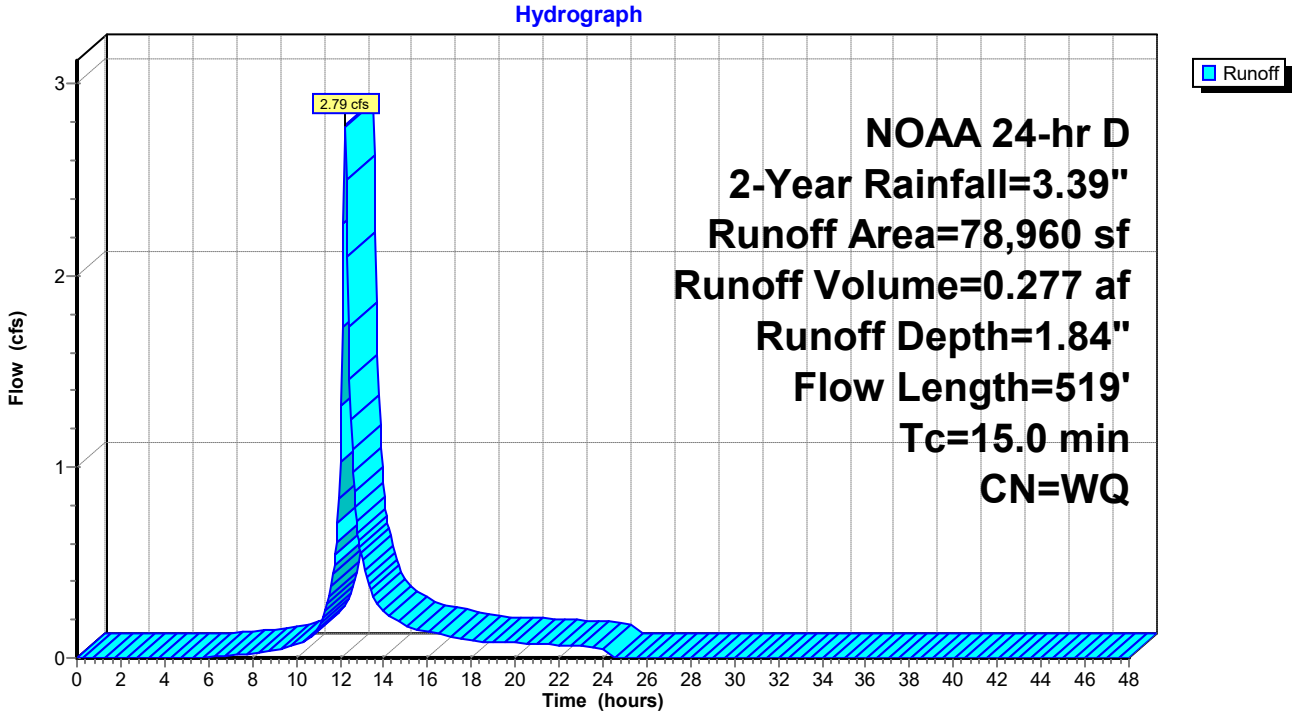
Runoff = 2.79 cfs @ 12.23 hrs, Volume= 0.277 af, Depth= 1.84"
Routed to Link 2 : PRDA-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-Year Rainfall=3.39"

Area (sf)	CN	Description
45,265	90	1/8 acre lots, 65% imp, HSG C
31,770	74	>75% Grass cover, Good, HSG C
1,925	70	Woods, Good, HSG C
78,960		Weighted Average
49,538	74	62.74% Pervious Area
29,422	98	37.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	100	0.0300	0.14		**Sheet Flow, Segment 2.1** Grass: Dense n= 0.240 P2= 3.36"
0.6	87	0.0230	2.44		**Shallow Concentrated Flow, Segment 2.2** Unpaved Kv= 16.1 fps
1.0	100	0.0100	1.61		**Shallow Concentrated Flow, Segment 2.3** Unpaved Kv= 16.1 fps
1.6	232	0.0237	2.48		**Shallow Concentrated Flow, Segment 2.4** Unpaved Kv= 16.1 fps
15.0	519	Total			

Subcatchment 2p: PRDA-2p



Summary for Pond B1: BASIN-1

Inflow Area = 2.144 ac, 46.96% Impervious, Inflow Depth = 2.04" for 2-Year event
Inflow = 3.58 cfs @ 12.23 hrs, Volume= 0.365 af
Outflow = 2.55 cfs @ 12.37 hrs, Volume= 0.283 af, Atten= 29%, Lag= 8.2 min
Primary = 2.55 cfs @ 12.37 hrs, Volume= 0.283 af
Routed to Link A : PT A

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 78.96' @ 12.37 hrs Surf.Area= 5,713 sf Storage= 5,539 cf

Plug-Flow detention time= 174.2 min calculated for 0.283 af (78% of inflow)
Center-of-Mass det. time= 84.4 min (903.7 - 819.3)

Volume	Invert	Avail.Storage	Storage Description
#1	77.90'	16,652 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

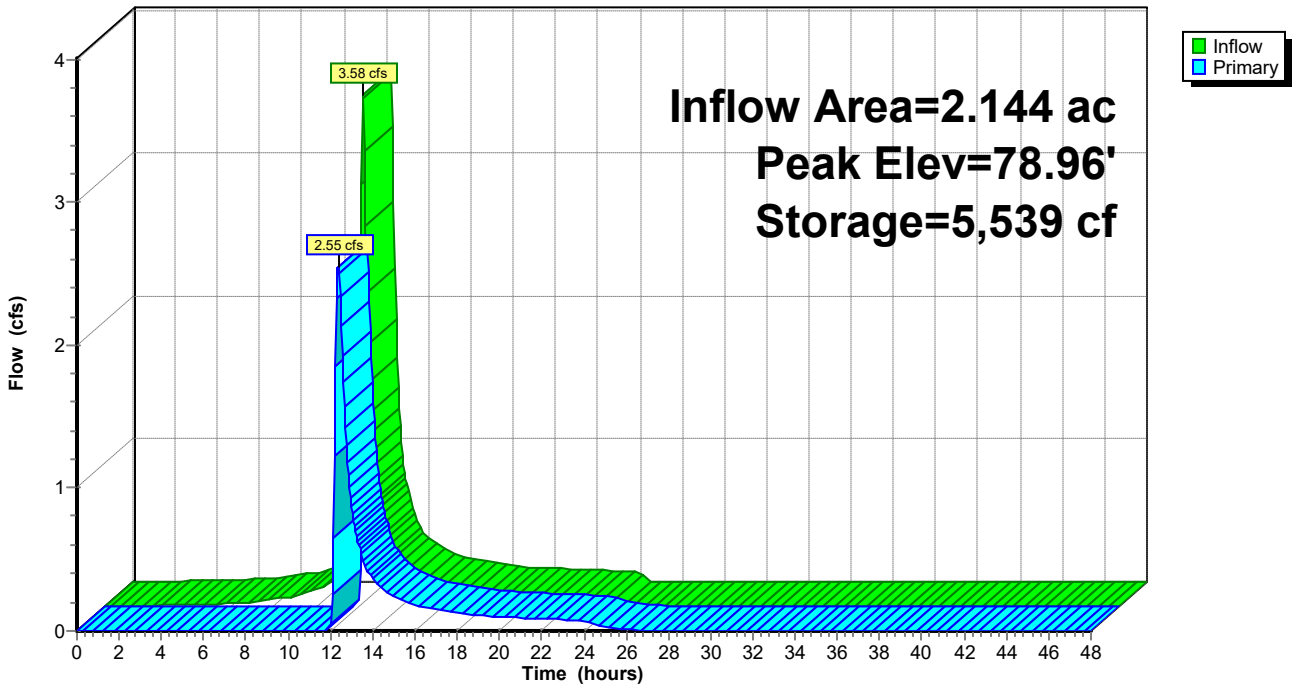
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
77.90	4,750	0	0
78.00	4,835	479	479
79.00	5,750	5,293	5,772
80.00	7,805	6,778	12,549
80.50	8,605	4,103	16,652

Device	Routing	Invert	Outlet Devices
#1	Primary	78.60'	**2' Wide Broadcrested Weir, Cv= 3.10 (C= 3.88)**
			Head (feet) 0.00 1.15
			Width (feet) 2.00 10.40

Primary OutFlow Max=2.52 cfs @ 12.37 hrs HW=78.96' TW=0.00' (Dynamic Tailwater)
↑—**1=2' Wide Broadcrested Weir** (Weir Controls 2.52 cfs @ 2.13 fps)

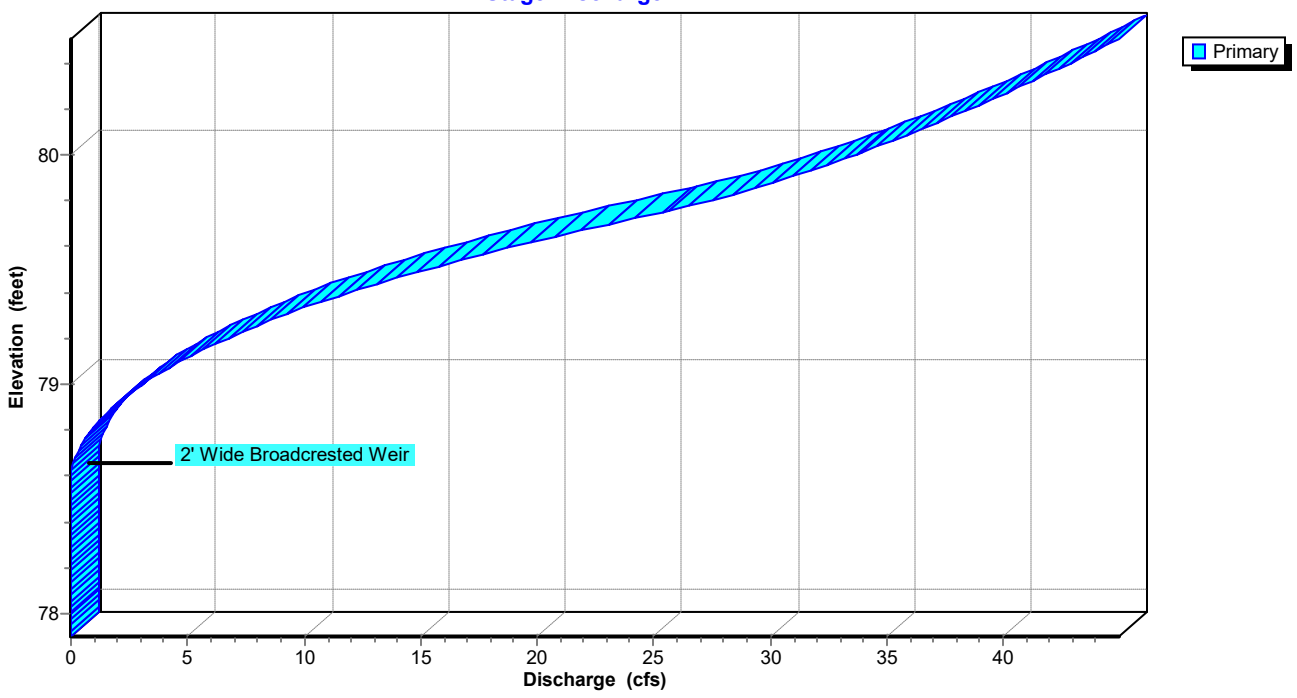
Pond B1: BASIN-1

Hydrograph

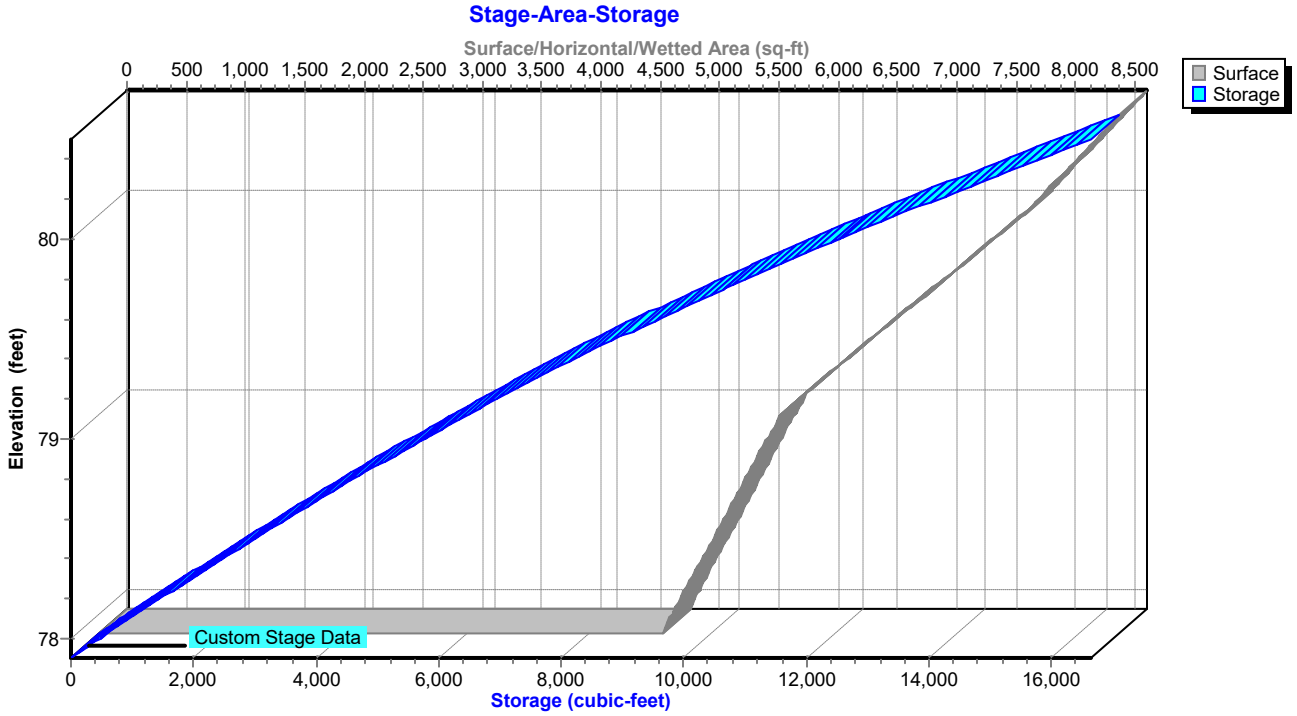


Pond B1: BASIN-1

Stage-Discharge



Pond B1: BASIN-1

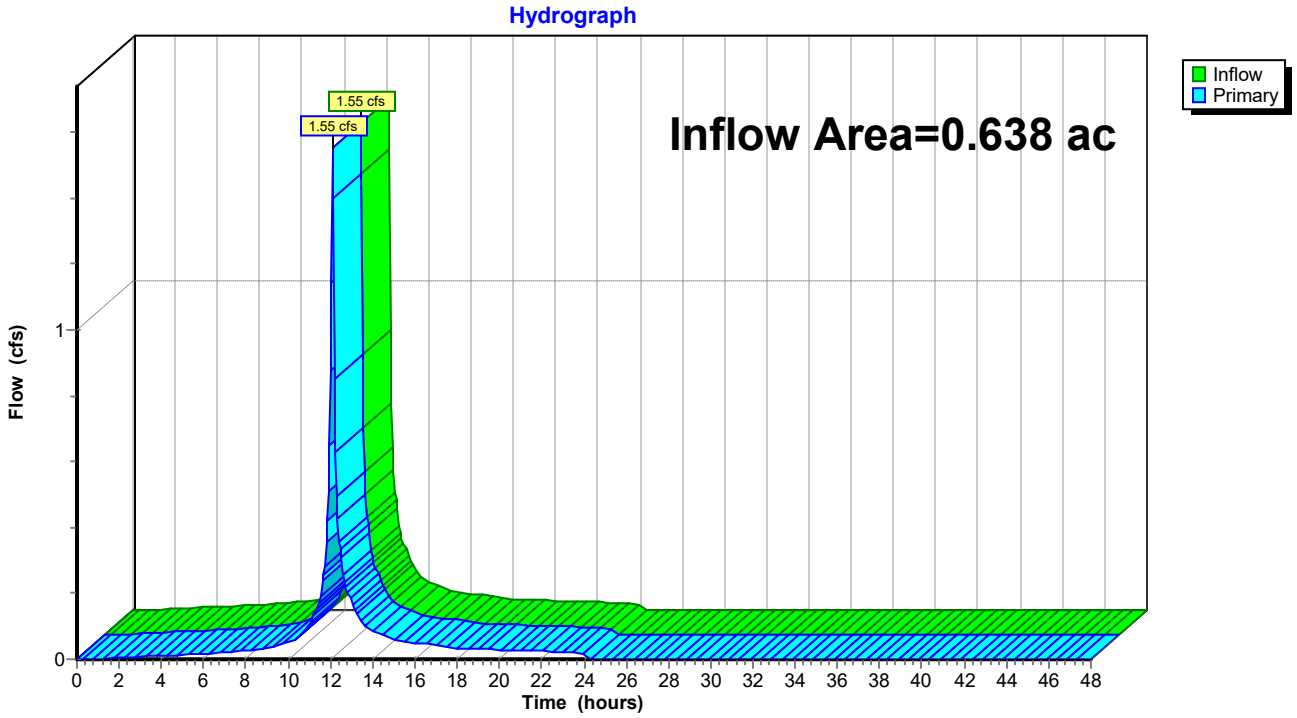


Summary for Link 1: PRDA-1

Inflow Area = 0.638 ac, 57.64% Impervious, Inflow Depth = 2.29" for 2-Year event
Inflow = 1.55 cfs @ 12.11 hrs, Volume= 0.122 af
Primary = 1.55 cfs @ 12.11 hrs, Volume= 0.122 af, Atten= 0%, Lag= 0.0 min
Routed to Link A : PT A

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 1: PRDA-1

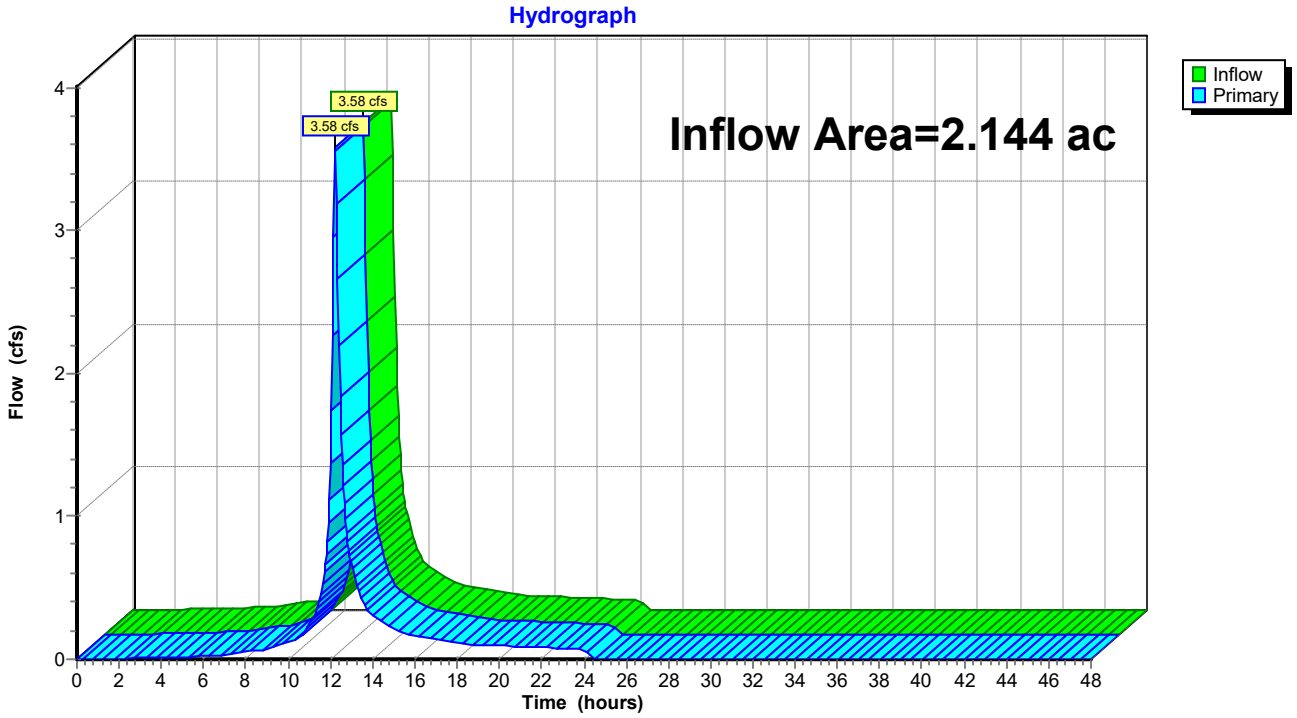


Summary for Link 2: PRDA-2

Inflow Area = 2.144 ac, 46.96% Impervious, Inflow Depth = 2.04" for 2-Year event
Inflow = 3.58 cfs @ 12.23 hrs, Volume= 0.365 af
Primary = 3.58 cfs @ 12.23 hrs, Volume= 0.365 af, Atten= 0%, Lag= 0.0 min
Routed to Pond B1 : BASIN-1

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 2: PRDA-2

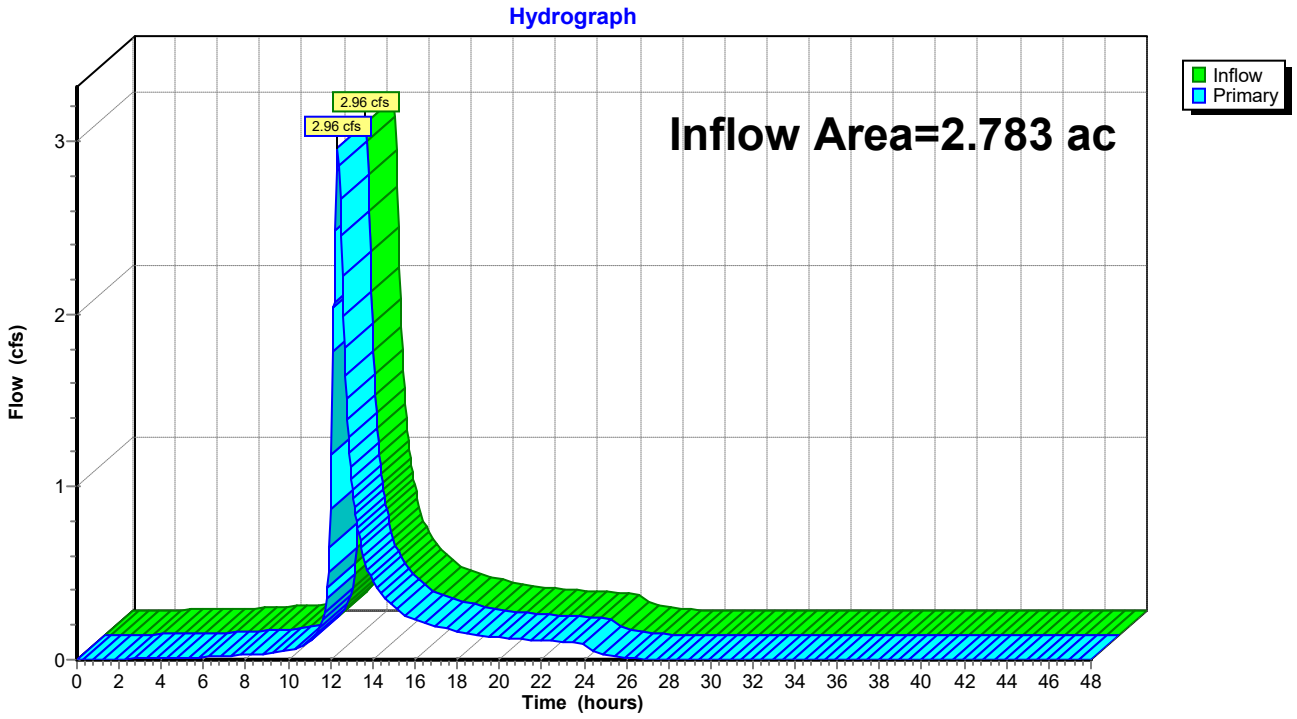


Summary for Link A: PT A

Inflow Area = 2.783 ac, 49.41% Impervious, Inflow Depth = 1.75" for 2-Year event
Inflow = 2.96 cfs @ 12.35 hrs, Volume= 0.405 af
Primary = 2.96 cfs @ 12.35 hrs, Volume= 0.405 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link A: PT A



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1i: PRDA-1i Runoff Area=13,690 sf 100.00% Impervious Runoff Depth=4.93"
Flow Length=666' Tc=4.9 min CN=98 Runoff=1.55 cfs 0.129 af

Subcatchment 1p: PRDA-1p Runoff Area=14,115 sf 16.56% Impervious Runoff Depth=2.87"
Flow Length=666' Tc=4.9 min CN=WQ Runoff=1.07 cfs 0.078 af

Subcatchment 2i: PRDA-2i Runoff Area=14,445 sf 100.00% Impervious Runoff Depth=4.93"
Flow Length=519' Tc=15.0 min CN=98 Runoff=1.22 cfs 0.136 af

Subcatchment 2p: PRDA-2p Runoff Area=78,960 sf 37.26% Impervious Runoff Depth=3.38"
Flow Length=519' Tc=15.0 min CN=WQ Runoff=5.09 cfs 0.510 af

Pond B1: BASIN-1 Peak Elev=79.14' Storage=6,589 cf Inflow=6.31 cfs 0.646 af
Outflow=5.47 cfs 0.565 af

Link 1: PRDA-1 Inflow=2.62 cfs 0.207 af
Primary=2.62 cfs 0.207 af

Link 2: PRDA-2 Inflow=6.31 cfs 0.646 af
Primary=6.31 cfs 0.646 af

Link A: PT A Inflow=6.30 cfs 0.772 af
Primary=6.30 cfs 0.772 af

Total Runoff Area = 2.783 ac Runoff Volume = 0.853 af Average Runoff Depth = 3.68"
50.59% Pervious = 1.408 ac 49.41% Impervious = 1.375 ac

Summary for Subcatchment 1i: PRDA-1i

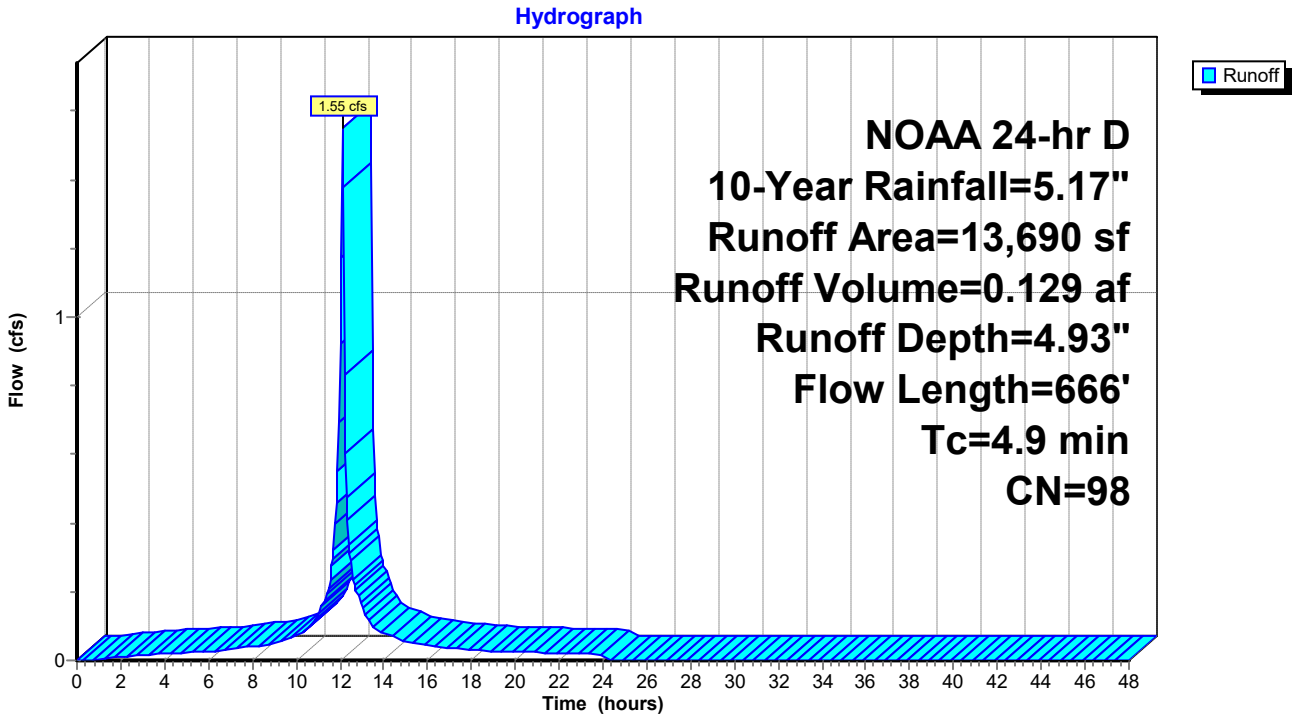
Runoff = 1.55 cfs @ 12.11 hrs, Volume= 0.129 af, Depth= 4.93"
Routed to Link 1 : PRDA-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-Year Rainfall=5.17"

Area (sf)	CN	Description
13,690	98	Paved parking, HSG C
13,690	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0190	1.38		**Sheet Flow, Segment 1.1** Smooth surfaces n= 0.011 P2= 3.36"
1.1	258	0.0345	3.77		**Shallow Concentrated Flow, Segment 1.2** Paved Kv= 20.3 fps
2.6	308	0.0094	1.97		**Shallow Concentrated Flow, Segment 1.3** Paved Kv= 20.3 fps
4.9	666	Total			

Subcatchment 1i: PRDA-1i



Summary for Subcatchment 1p: PRDA-1p

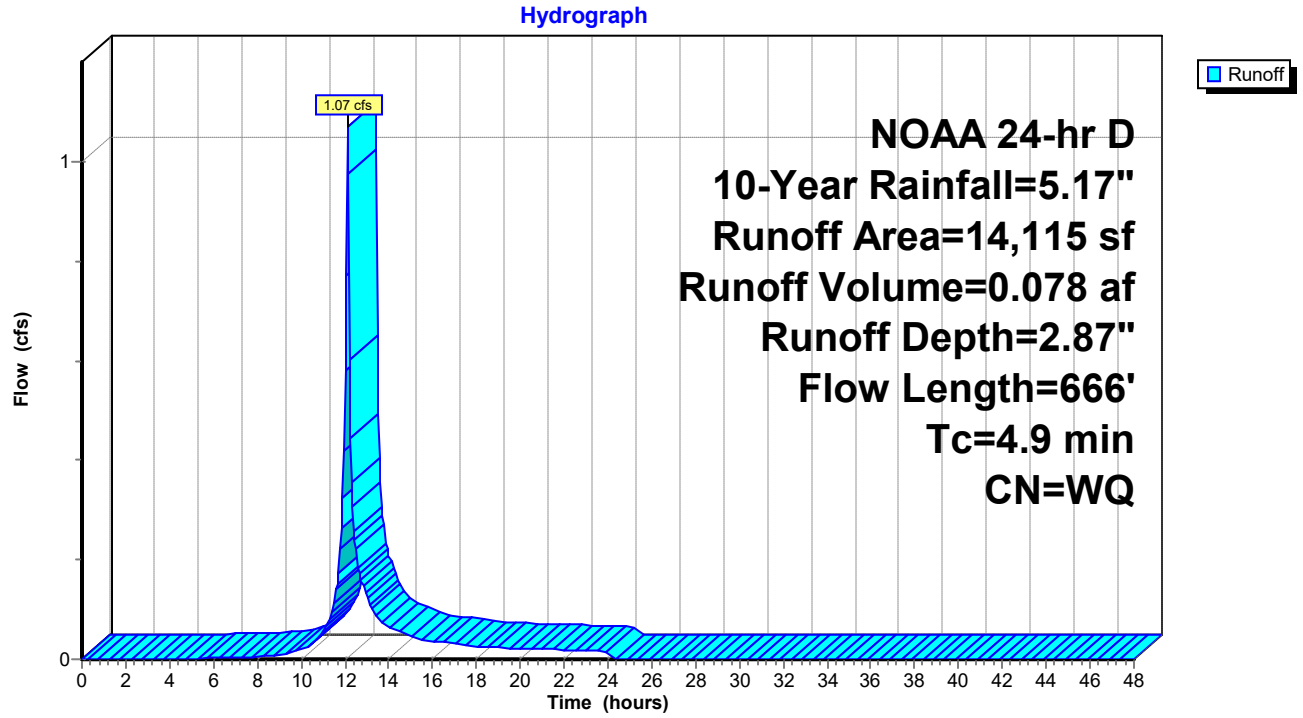
Runoff = 1.07 cfs @ 12.11 hrs, Volume= 0.078 af, Depth= 2.87"
Routed to Link 1 : PRDA-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-Year Rainfall=5.17"

Area (sf)	CN	Description
3,595	90	1/8 acre lots, 65% imp, HSG C
9,745	74	>75% Grass cover, Good, HSG C
775	70	Woods, Good, HSG C
14,115		Weighted Average
11,778	74	83.44% Pervious Area
2,337	98	16.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0190	1.38		**Sheet Flow, Segment 1.1** Smooth surfaces n= 0.011 P2= 3.36"
1.1	258	0.0345	3.77		**Shallow Concentrated Flow, Segment 1.2** Paved Kv= 20.3 fps
2.6	308	0.0094	1.97		**Shallow Concentrated Flow, Segment 1.3** Paved Kv= 20.3 fps
4.9	666	Total			

Subcatchment 1p: PRDA-1p



Summary for Subcatchment 2i: PRDA-2i

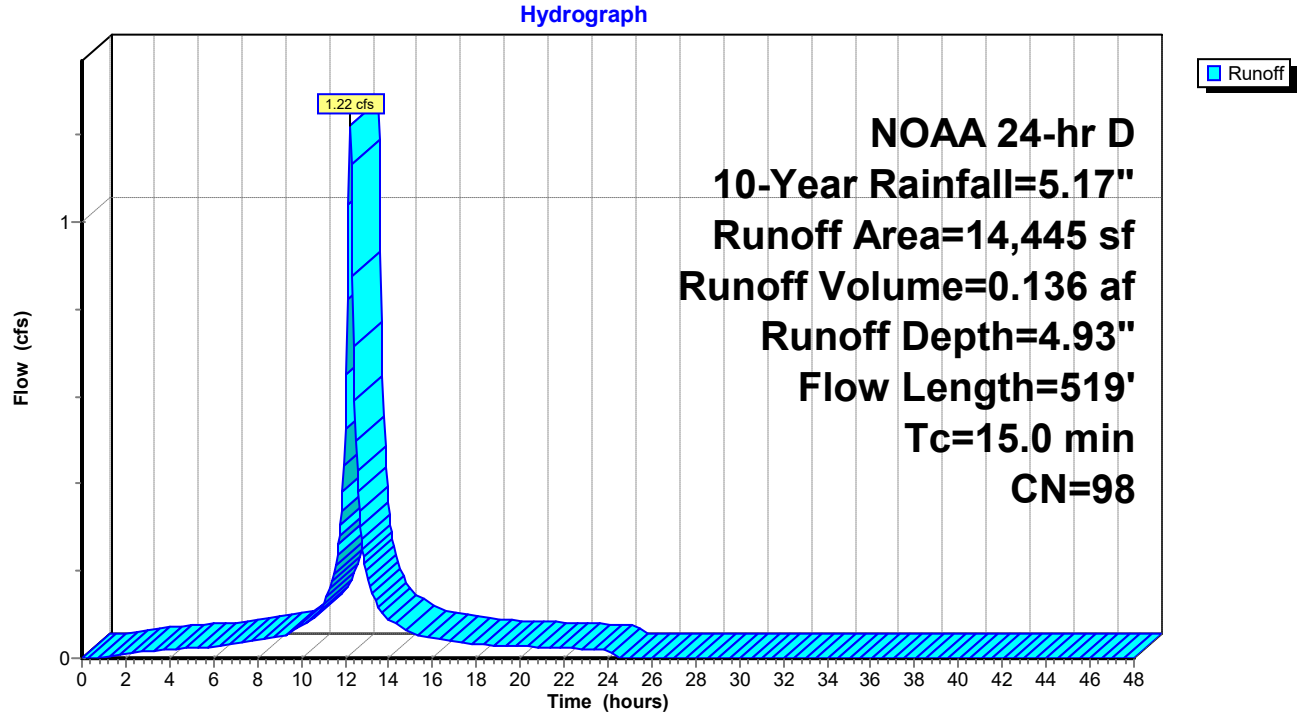
Runoff = 1.22 cfs @ 12.22 hrs, Volume= 0.136 af, Depth= 4.93"
Routed to Link 2 : PRDA-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-Year Rainfall=5.17"

Area (sf)	CN	Description
14,445	98	Paved parking, HSG C
14,445	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	100	0.0300	0.14		**Sheet Flow, Segment 2.1** Grass: Dense n= 0.240 P2= 3.36"
0.6	87	0.0230	2.44		**Shallow Concentrated Flow, Segment 2.2** Unpaved Kv= 16.1 fps
1.0	100	0.0100	1.61		**Shallow Concentrated Flow, Segment 2.3** Unpaved Kv= 16.1 fps
1.6	232	0.0237	2.48		**Shallow Concentrated Flow, Segment 2.4** Unpaved Kv= 16.1 fps
15.0	519	Total			

Subcatchment 2i: PRDA-2i



Summary for Subcatchment 2p: PRDA-2p

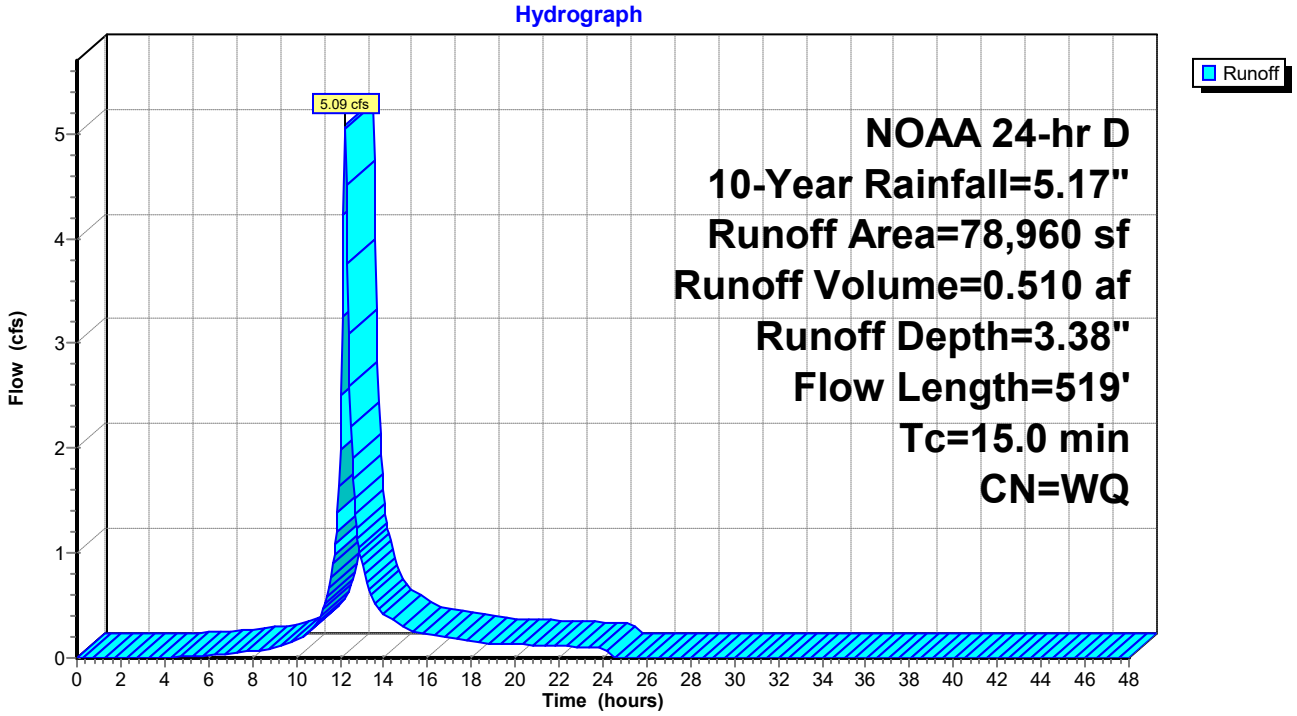
Runoff = 5.09 cfs @ 12.23 hrs, Volume= 0.510 af, Depth= 3.38"
Routed to Link 2 : PRDA-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-Year Rainfall=5.17"

Area (sf)	CN	Description
45,265	90	1/8 acre lots, 65% imp, HSG C
31,770	74	>75% Grass cover, Good, HSG C
1,925	70	Woods, Good, HSG C
78,960		Weighted Average
49,538	74	62.74% Pervious Area
29,422	98	37.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	100	0.0300	0.14		**Sheet Flow, Segment 2.1** Grass: Dense n= 0.240 P2= 3.36"
0.6	87	0.0230	2.44		**Shallow Concentrated Flow, Segment 2.2** Unpaved Kv= 16.1 fps
1.0	100	0.0100	1.61		**Shallow Concentrated Flow, Segment 2.3** Unpaved Kv= 16.1 fps
1.6	232	0.0237	2.48		**Shallow Concentrated Flow, Segment 2.4** Unpaved Kv= 16.1 fps
15.0	519	Total			

Subcatchment 2p: PRDA-2p



Summary for Pond B1: BASIN-1

Inflow Area = 2.144 ac, 46.96% Impervious, Inflow Depth = 3.62" for 10-Year event
Inflow = 6.31 cfs @ 12.23 hrs, Volume= 0.646 af
Outflow = 5.47 cfs @ 12.31 hrs, Volume= 0.565 af, Atten= 13%, Lag= 4.8 min
Primary = 5.47 cfs @ 12.31 hrs, Volume= 0.565 af
Routed to Link A : PT A

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 79.14' @ 12.31 hrs Surf.Area= 6,035 sf Storage= 6,589 cf

Plug-Flow detention time= 122.5 min calculated for 0.564 af (87% of inflow)
Center-of-Mass det. time= 61.3 min (867.8 - 806.4)

Volume	Invert	Avail.Storage	Storage Description
#1	77.90'	16,652 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

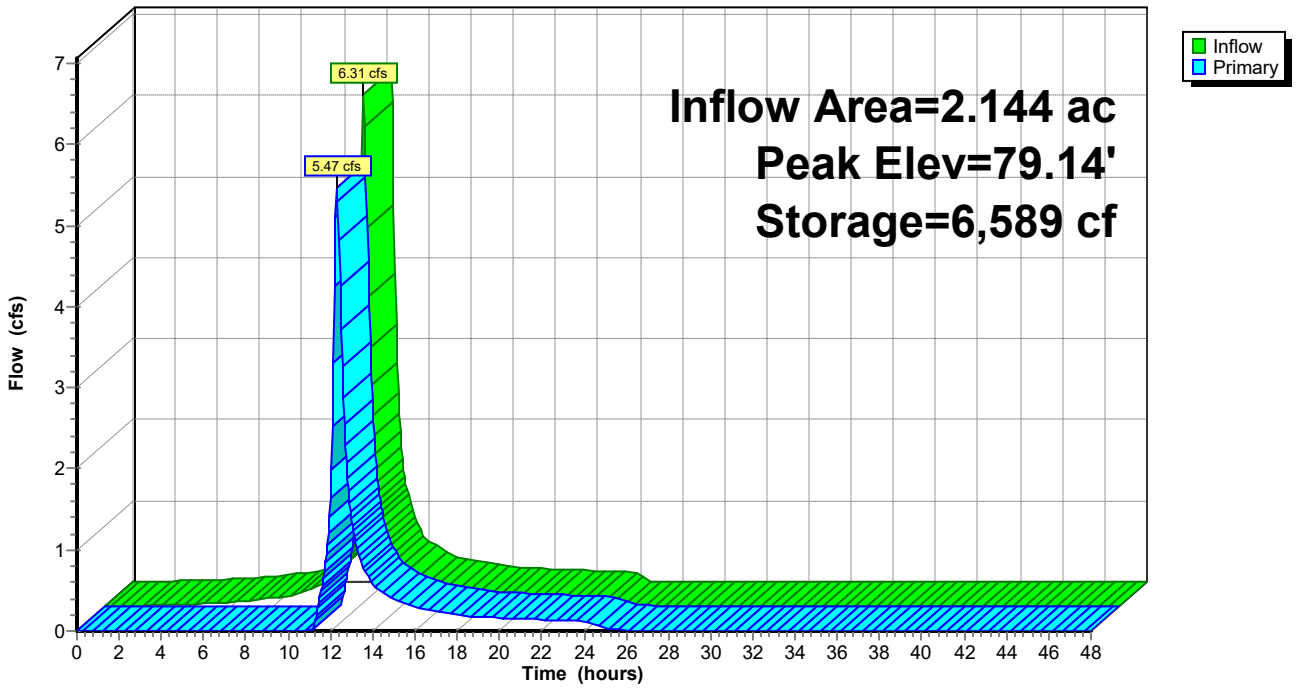
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
77.90	4,750	0	0
78.00	4,835	479	479
79.00	5,750	5,293	5,772
80.00	7,805	6,778	12,549
80.50	8,605	4,103	16,652

Device	Routing	Invert	Outlet Devices
#1	Primary	78.60'	**2' Wide Broadcrested Weir, Cv= 3.10 (C= 3.88)**
			Head (feet) 0.00 1.15
			Width (feet) 2.00 10.40

Primary OutFlow Max=5.43 cfs @ 12.31 hrs HW=79.14' TW=0.00' (Dynamic Tailwater)
↑—**1=2' Wide Broadcrested Weir** (Weir Controls 5.43 cfs @ 2.56 fps)

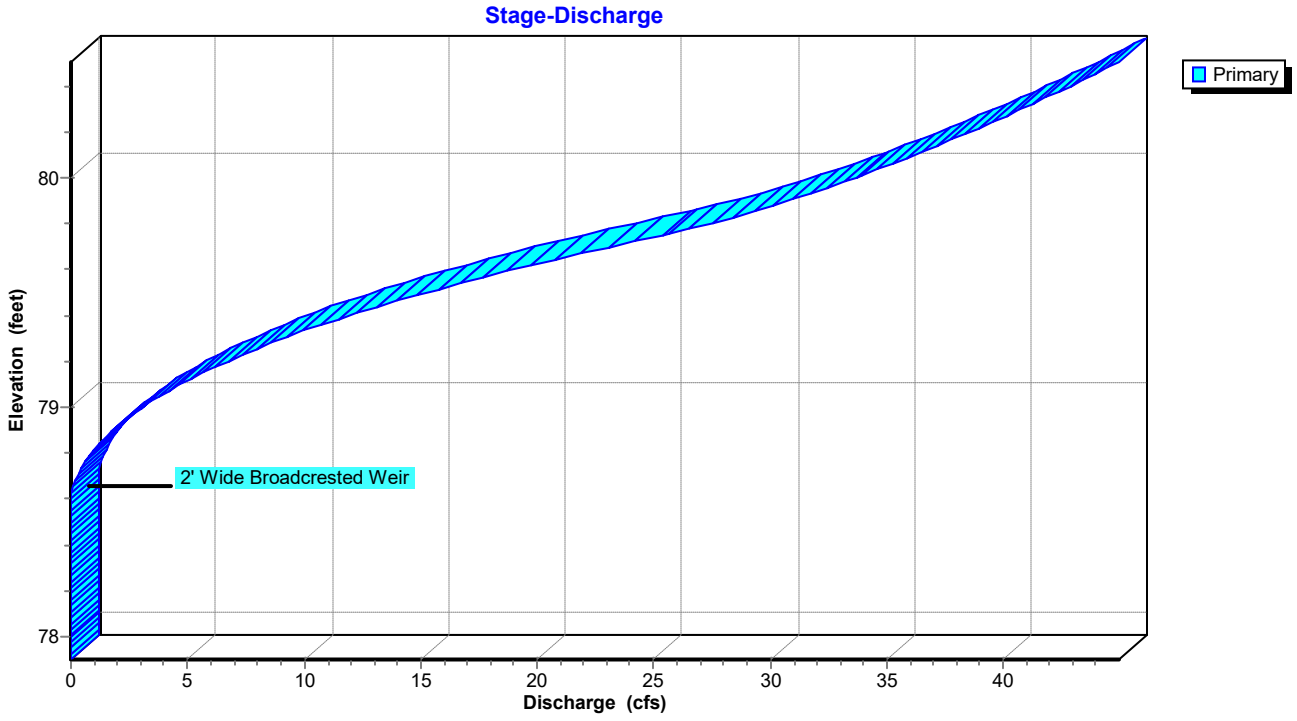
Pond B1: BASIN-1

Hydrograph

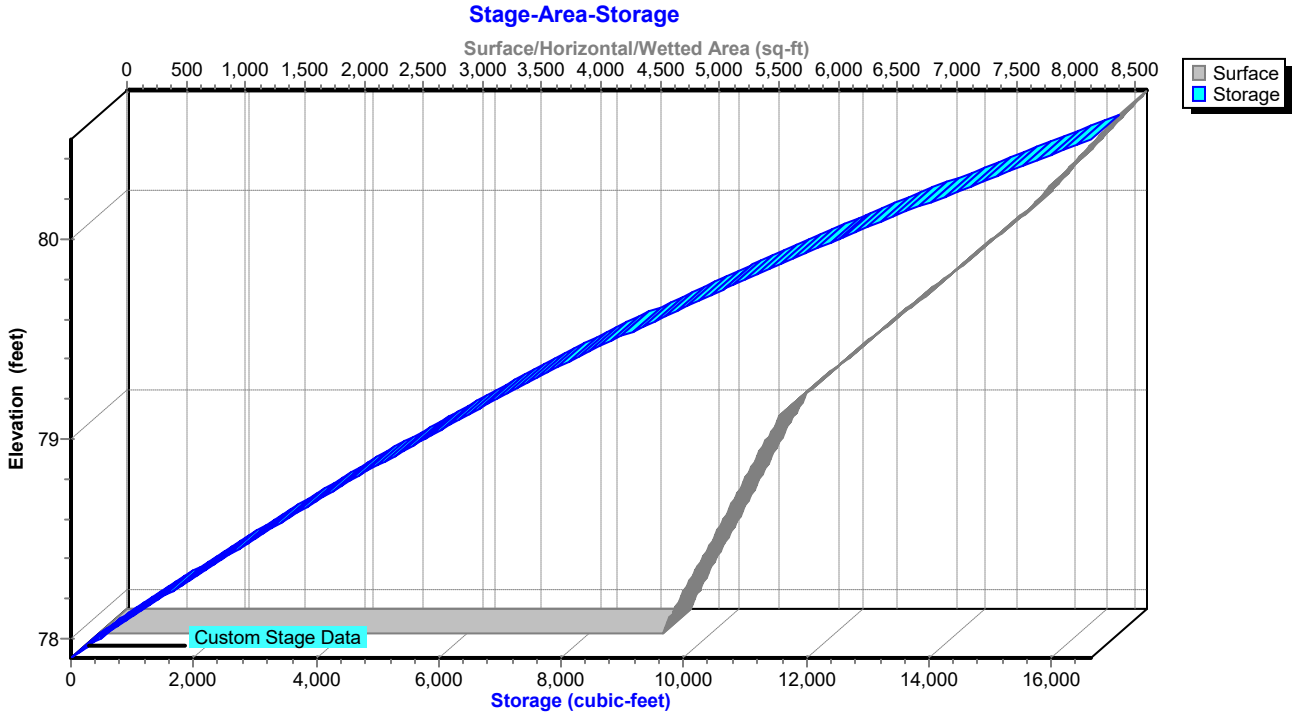


Pond B1: BASIN-1

Stage-Discharge



Pond B1: BASIN-1

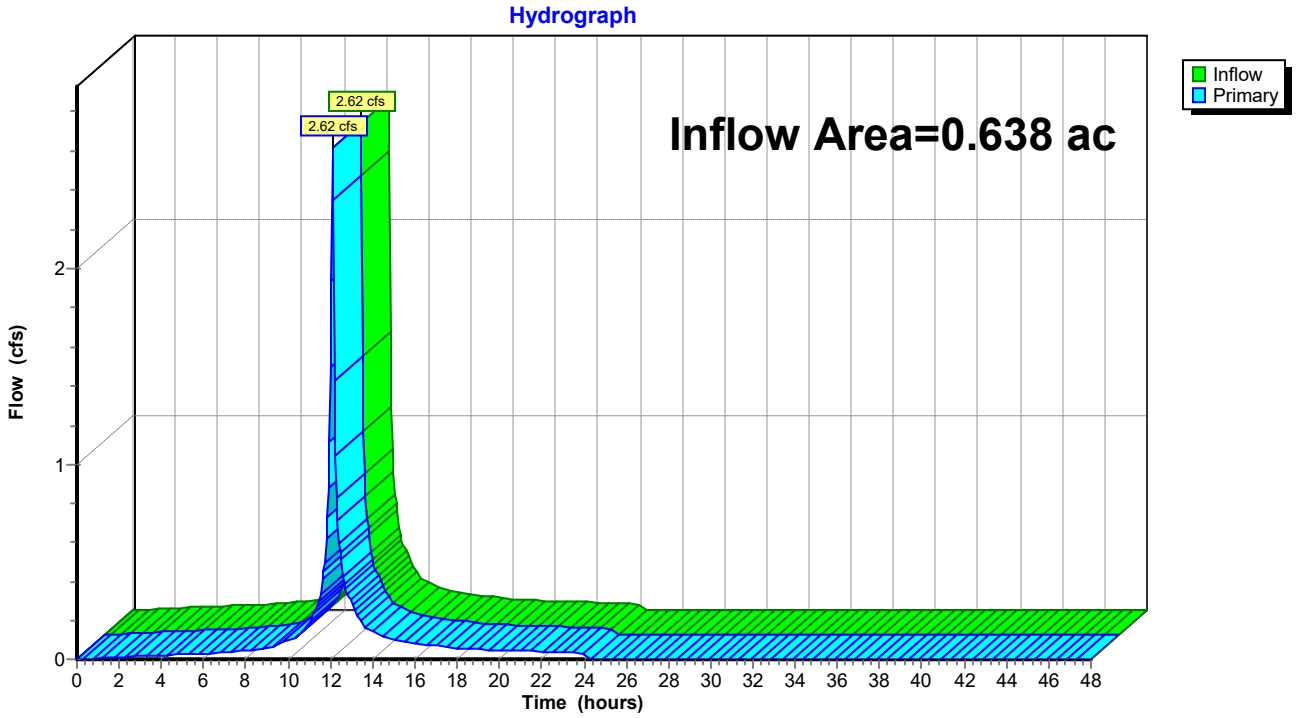


Summary for Link 1: PRDA-1

Inflow Area = 0.638 ac, 57.64% Impervious, Inflow Depth = 3.89" for 10-Year event
Inflow = 2.62 cfs @ 12.11 hrs, Volume= 0.207 af
Primary = 2.62 cfs @ 12.11 hrs, Volume= 0.207 af, Atten= 0%, Lag= 0.0 min
Routed to Link A : PT A

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 1: PRDA-1

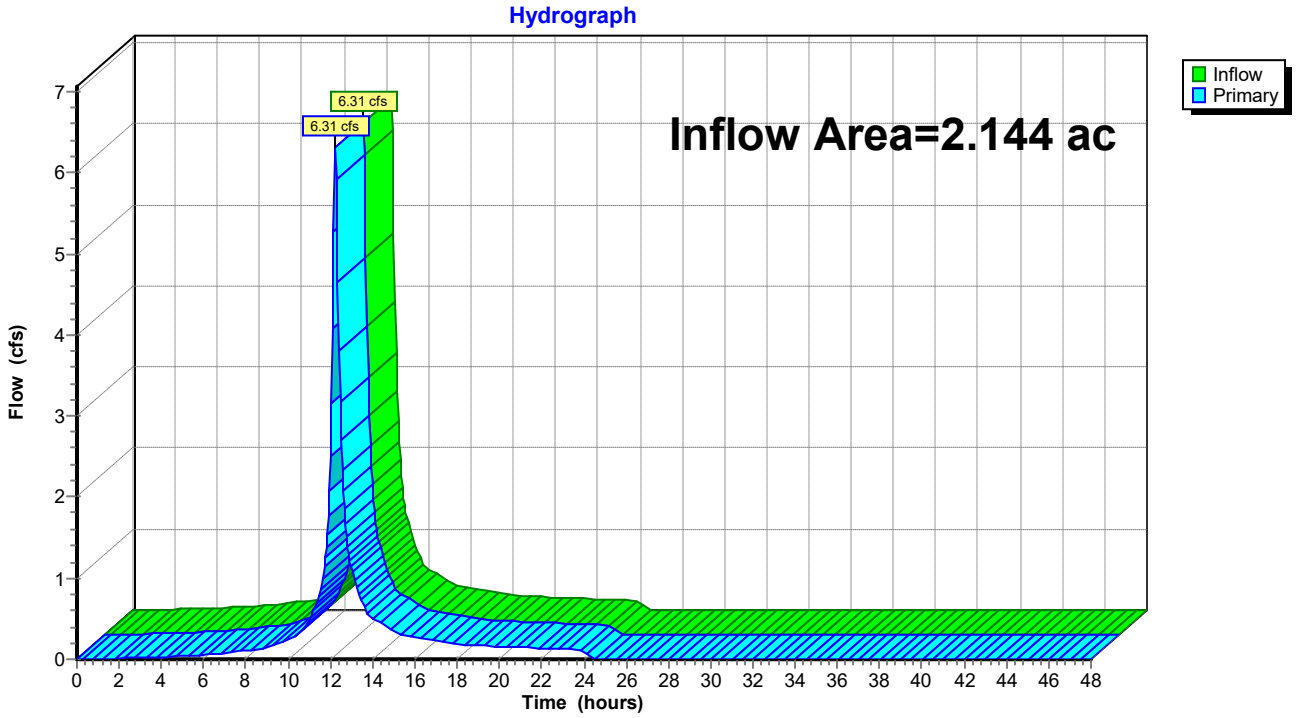


Summary for Link 2: PRDA-2

Inflow Area = 2.144 ac, 46.96% Impervious, Inflow Depth = 3.62" for 10-Year event
Inflow = 6.31 cfs @ 12.23 hrs, Volume= 0.646 af
Primary = 6.31 cfs @ 12.23 hrs, Volume= 0.646 af, Atten= 0%, Lag= 0.0 min
Routed to Pond B1 : BASIN-1

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 2: PRDA-2

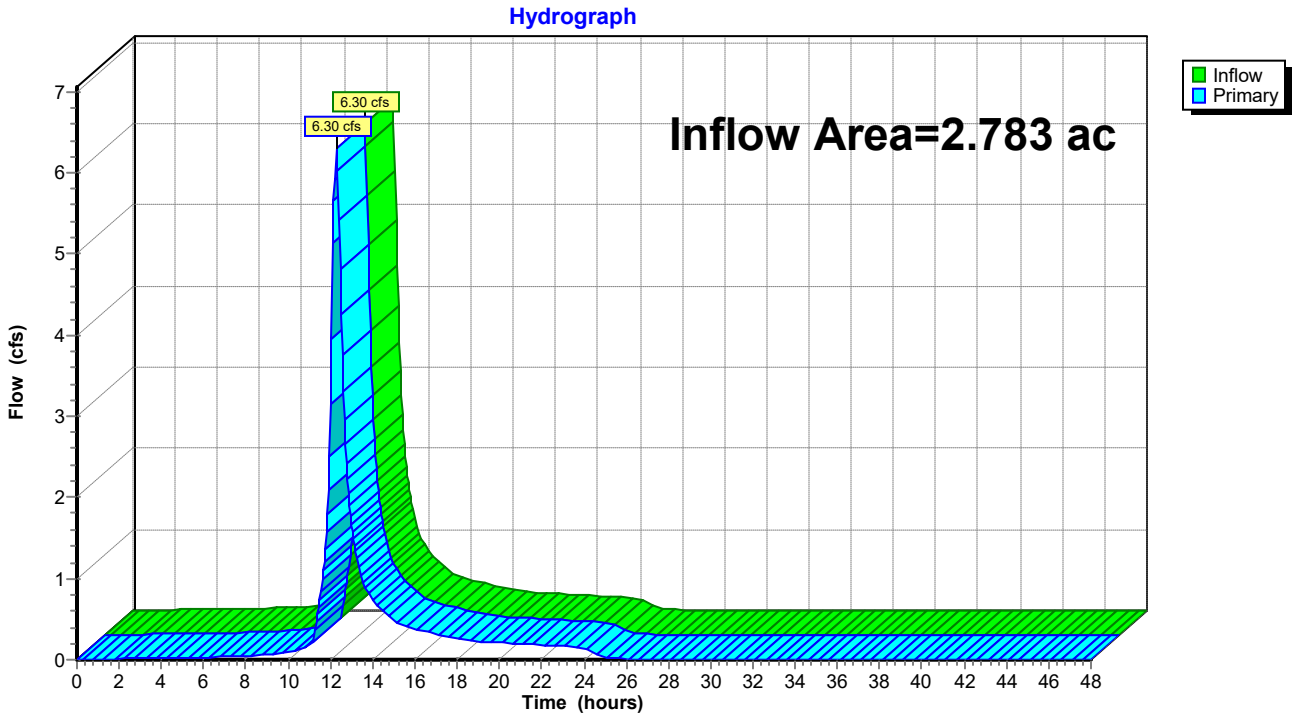


Summary for Link A: PT A

Inflow Area = 2.783 ac, 49.41% Impervious, Inflow Depth = 3.33" for 10-Year event
Inflow = 6.30 cfs @ 12.29 hrs, Volume= 0.772 af
Primary = 6.30 cfs @ 12.29 hrs, Volume= 0.772 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link A: PT A



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1i: PRDA-1i Runoff Area=13,690 sf 100.00% Impervious Runoff Depth=8.45"
Flow Length=666' Tc=4.9 min CN=98 Runoff=2.62 cfs 0.221 af

Subcatchment 1p: PRDA-1p Runoff Area=14,115 sf 16.56% Impervious Runoff Depth=6.01"
Flow Length=666' Tc=4.9 min CN=WQ Runoff=2.20 cfs 0.162 af

Subcatchment 2i: PRDA-2i Runoff Area=14,445 sf 100.00% Impervious Runoff Depth=8.45"
Flow Length=519' Tc=15.0 min CN=98 Runoff=2.06 cfs 0.234 af

Subcatchment 2p: PRDA-2p Runoff Area=78,960 sf 37.26% Impervious Runoff Depth=6.65"
Flow Length=519' Tc=15.0 min CN=WQ Runoff=9.80 cfs 1.004 af

Pond B1: BASIN-1 Peak Elev=79.36' Storage=7,978 cf Inflow=11.86 cfs 1.238 af
Outflow=10.85 cfs 1.156 af

Link 1: PRDA-1 Inflow=4.82 cfs 0.384 af
Primary=4.82 cfs 0.384 af

Link 2: PRDA-2 Inflow=11.86 cfs 1.238 af
Primary=11.86 cfs 1.238 af

Link A: PT A Inflow=12.48 cfs 1.540 af
Primary=12.48 cfs 1.540 af

Total Runoff Area = 2.783 ac Runoff Volume = 1.621 af Average Runoff Depth = 6.99"
50.59% Pervious = 1.408 ac 49.41% Impervious = 1.375 ac

Summary for Subcatchment 1i: PRDA-1i

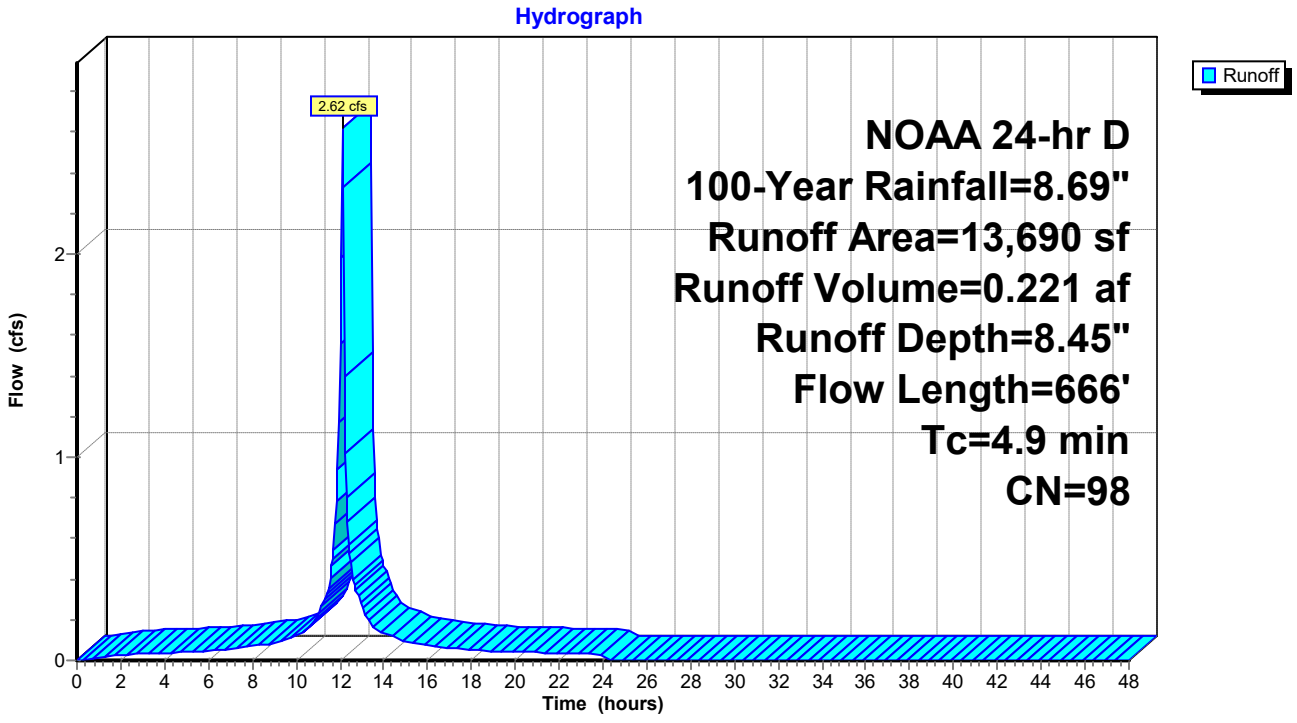
Runoff = 2.62 cfs @ 12.11 hrs, Volume= 0.221 af, Depth= 8.45"
Routed to Link 1 : PRDA-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-Year Rainfall=8.69"

Area (sf)	CN	Description
13,690	98	Paved parking, HSG C
13,690	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0190	1.38		**Sheet Flow, Segment 1.1** Smooth surfaces n= 0.011 P2= 3.36"
1.1	258	0.0345	3.77		**Shallow Concentrated Flow, Segment 1.2** Paved Kv= 20.3 fps
2.6	308	0.0094	1.97		**Shallow Concentrated Flow, Segment 1.3** Paved Kv= 20.3 fps
4.9	666	Total			

Subcatchment 1i: PRDA-1i



Summary for Subcatchment 1p: PRDA-1p

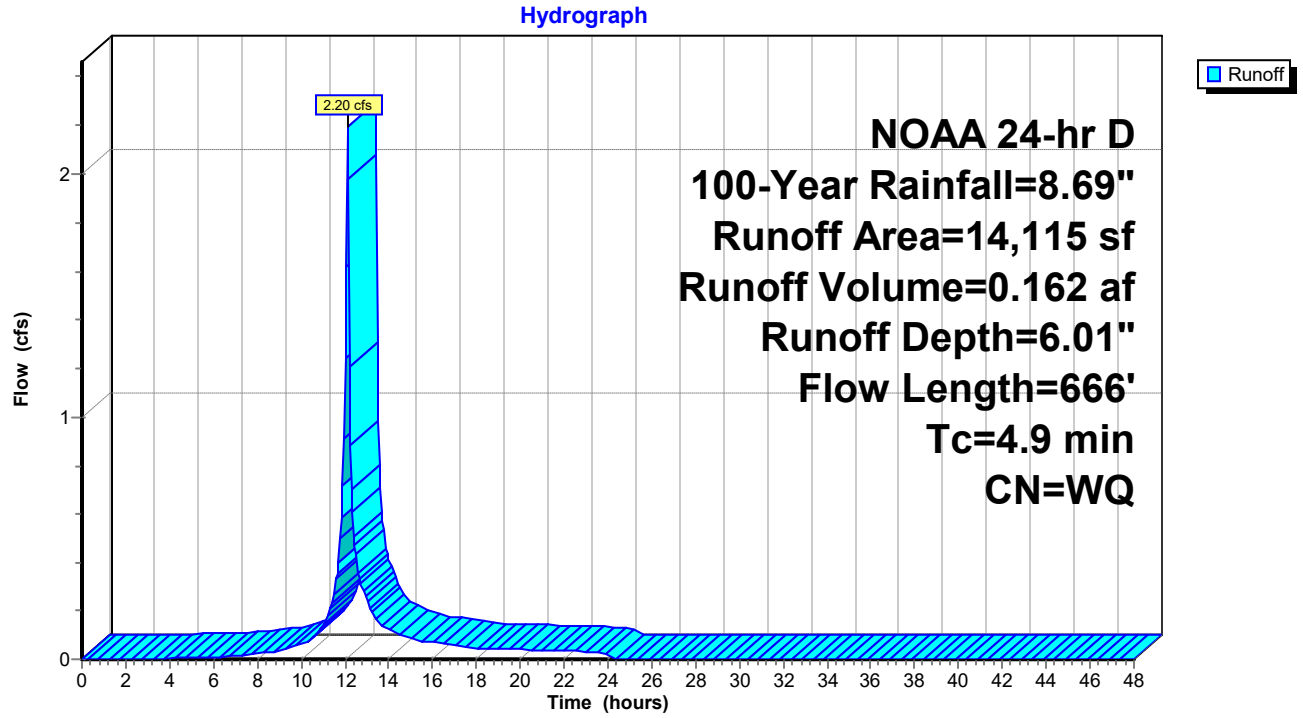
Runoff = 2.20 cfs @ 12.11 hrs, Volume= 0.162 af, Depth= 6.01"
Routed to Link 1 : PRDA-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-Year Rainfall=8.69"

Area (sf)	CN	Description
3,595	90	1/8 acre lots, 65% imp, HSG C
9,745	74	>75% Grass cover, Good, HSG C
775	70	Woods, Good, HSG C
14,115		Weighted Average
11,778	74	83.44% Pervious Area
2,337	98	16.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0190	1.38		**Sheet Flow, Segment 1.1** Smooth surfaces n= 0.011 P2= 3.36"
1.1	258	0.0345	3.77		**Shallow Concentrated Flow, Segment 1.2** Paved Kv= 20.3 fps
2.6	308	0.0094	1.97		**Shallow Concentrated Flow, Segment 1.3** Paved Kv= 20.3 fps
4.9	666	Total			

Subcatchment 1p: PRDA-1p



Summary for Subcatchment 2i: PRDA-2i

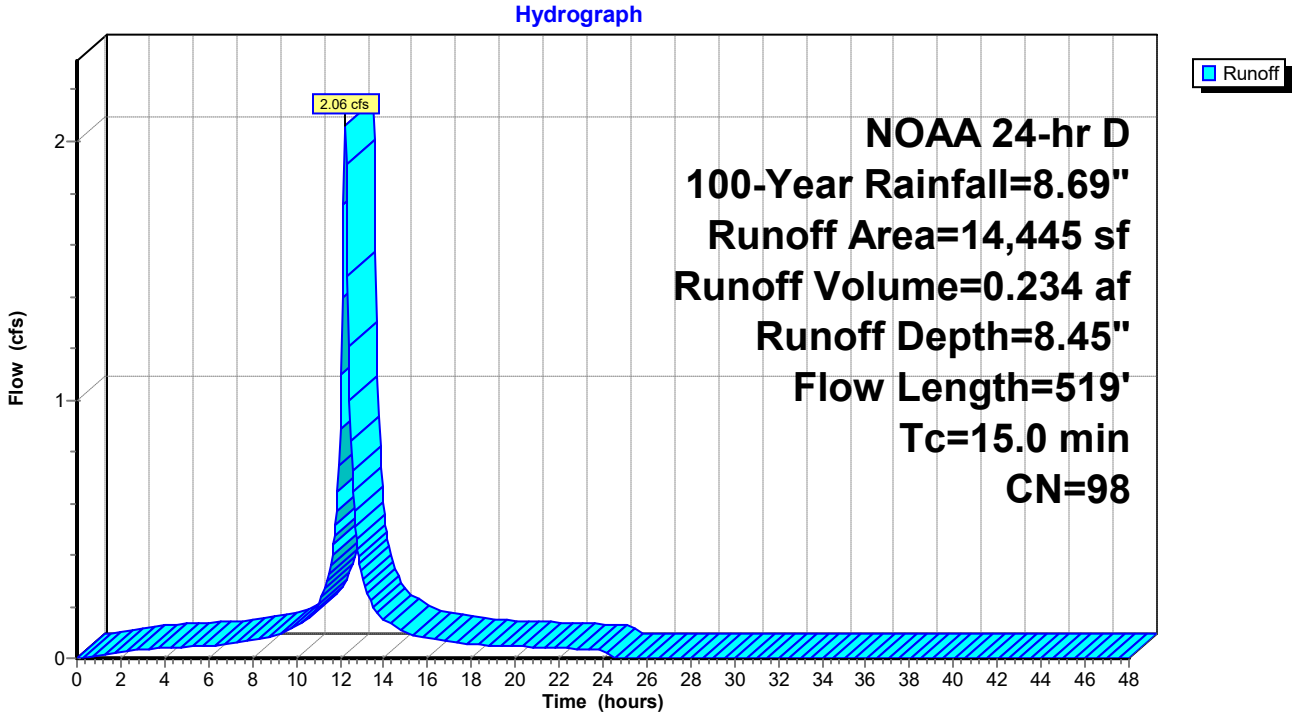
Runoff = 2.06 cfs @ 12.22 hrs, Volume= 0.234 af, Depth= 8.45"
Routed to Link 2 : PRDA-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-Year Rainfall=8.69"

Area (sf)	CN	Description
14,445	98	Paved parking, HSG C
14,445	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	100	0.0300	0.14		**Sheet Flow, Segment 2.1** Grass: Dense n= 0.240 P2= 3.36"
0.6	87	0.0230	2.44		**Shallow Concentrated Flow, Segment 2.2** Unpaved Kv= 16.1 fps
1.0	100	0.0100	1.61		**Shallow Concentrated Flow, Segment 2.3** Unpaved Kv= 16.1 fps
1.6	232	0.0237	2.48		**Shallow Concentrated Flow, Segment 2.4** Unpaved Kv= 16.1 fps
15.0	519	Total			

Subcatchment 2i: PRDA-2i



Summary for Subcatchment 2p: PRDA-2p

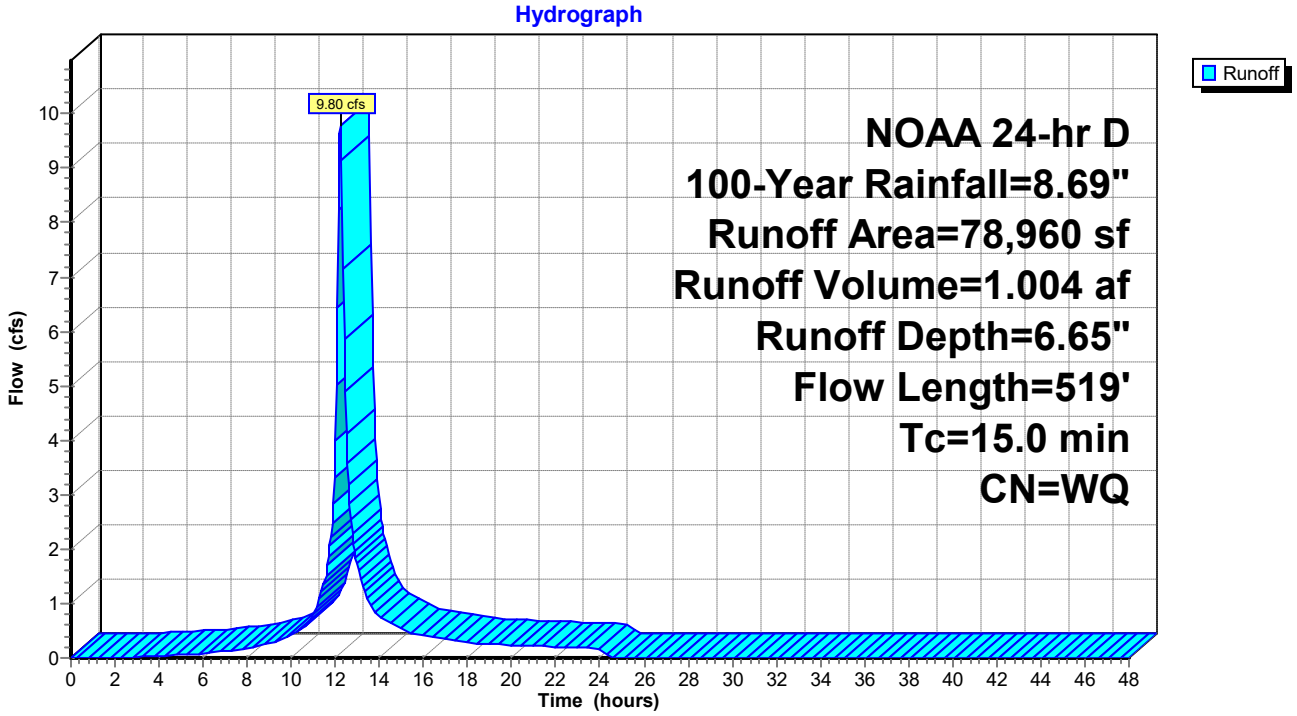
Runoff = 9.80 cfs @ 12.23 hrs, Volume= 1.004 af, Depth= 6.65"
Routed to Link 2 : PRDA-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-Year Rainfall=8.69"

Area (sf)	CN	Description
45,265	90	1/8 acre lots, 65% imp, HSG C
31,770	74	>75% Grass cover, Good, HSG C
1,925	70	Woods, Good, HSG C
78,960		Weighted Average
49,538	74	62.74% Pervious Area
29,422	98	37.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	100	0.0300	0.14		**Sheet Flow, Segment 2.1** Grass: Dense n= 0.240 P2= 3.36"
0.6	87	0.0230	2.44		**Shallow Concentrated Flow, Segment 2.2** Unpaved Kv= 16.1 fps
1.0	100	0.0100	1.61		**Shallow Concentrated Flow, Segment 2.3** Unpaved Kv= 16.1 fps
1.6	232	0.0237	2.48		**Shallow Concentrated Flow, Segment 2.4** Unpaved Kv= 16.1 fps
15.0	519	Total			

Subcatchment 2p: PRDA-2p



Summary for Pond B1: BASIN-1

Inflow Area = 2.144 ac, 46.96% Impervious, Inflow Depth = 6.93" for 100-Year event
Inflow = 11.86 cfs @ 12.23 hrs, Volume= 1.238 af
Outflow = 10.85 cfs @ 12.29 hrs, Volume= 1.156 af, Atten= 9%, Lag= 3.8 min
Primary = 10.85 cfs @ 12.29 hrs, Volume= 1.156 af
Routed to Link A : PT A

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 79.36' @ 12.29 hrs Surf.Area= 6,491 sf Storage= 7,978 cf

Plug-Flow detention time= 81.9 min calculated for 1.155 af (93% of inflow)
Center-of-Mass det. time= 45.2 min (836.7 - 791.4)

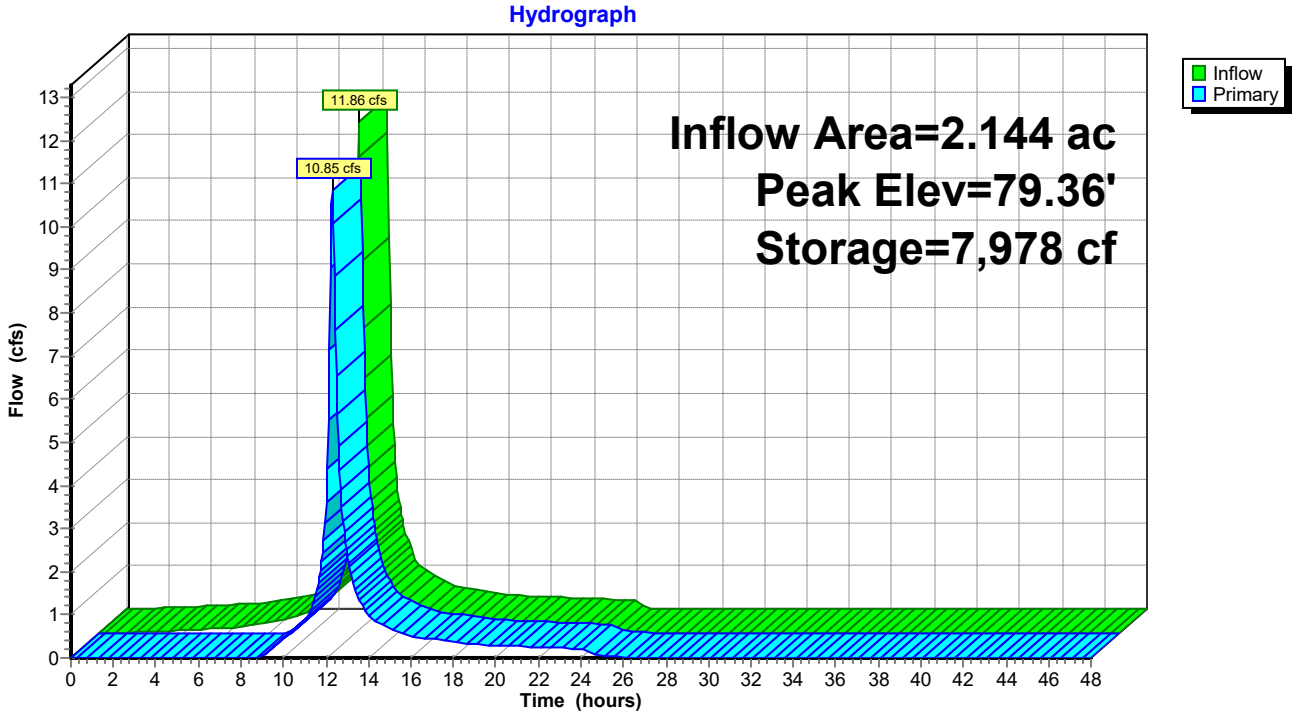
Volume	Invert	Avail.Storage	Storage Description
#1	77.90'	16,652 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
77.90	4,750	0	0
78.00	4,835	479	479
79.00	5,750	5,293	5,772
80.00	7,805	6,778	12,549
80.50	8,605	4,103	16,652

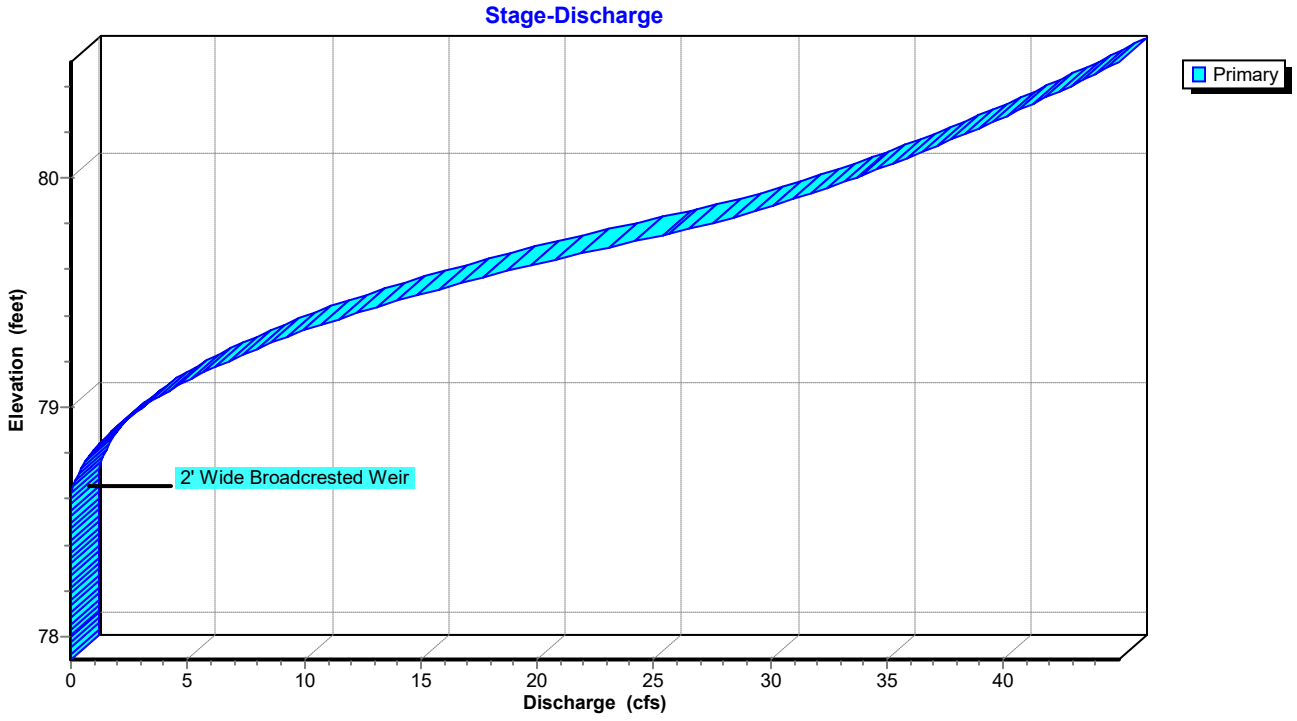
Device	Routing	Invert	Outlet Devices
#1	Primary	78.60'	**2' Wide Broadcrested Weir, Cv= 3.10 (C= 3.88)**
			Head (feet) 0.00 1.15
			Width (feet) 2.00 10.40

Primary OutFlow Max=10.77 cfs @ 12.29 hrs HW=79.36' TW=0.00' (Dynamic Tailwater)
↑—**1=2' Wide Broadcrested Weir** (Weir Controls 10.77 cfs @ 2.98 fps)

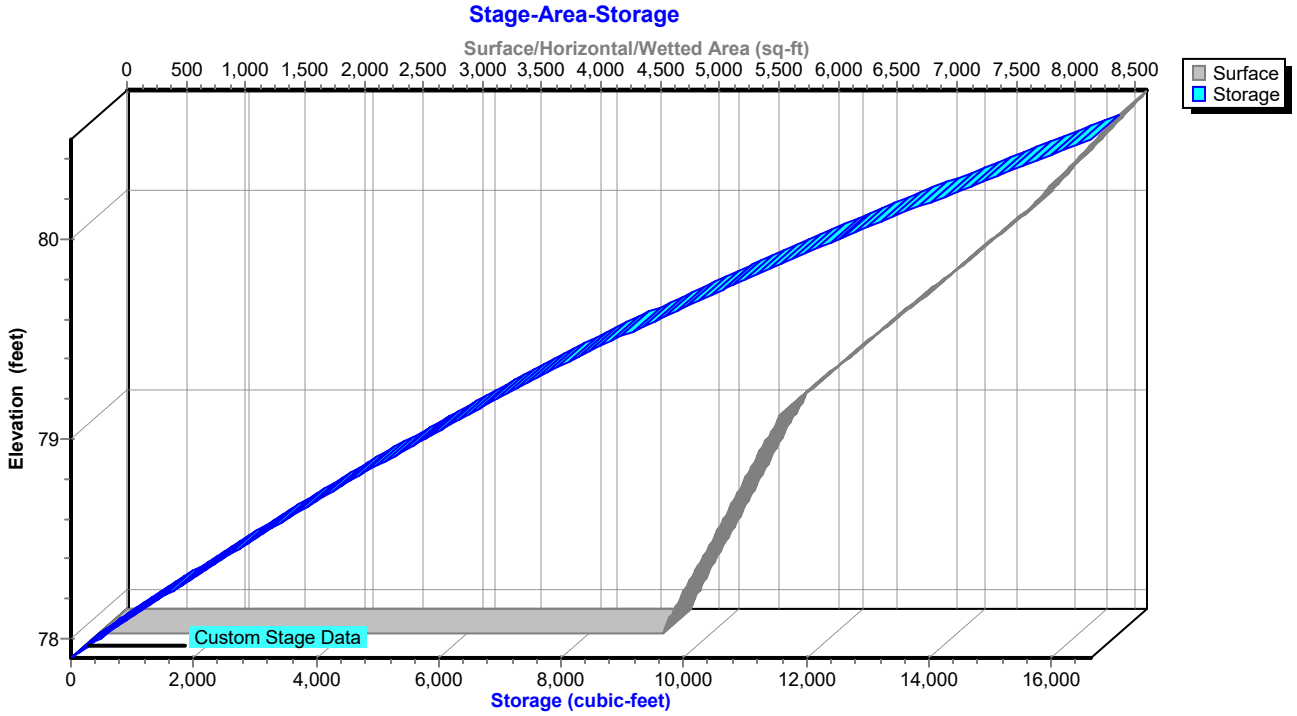
Pond B1: BASIN-1



Pond B1: BASIN-1



Pond B1: BASIN-1

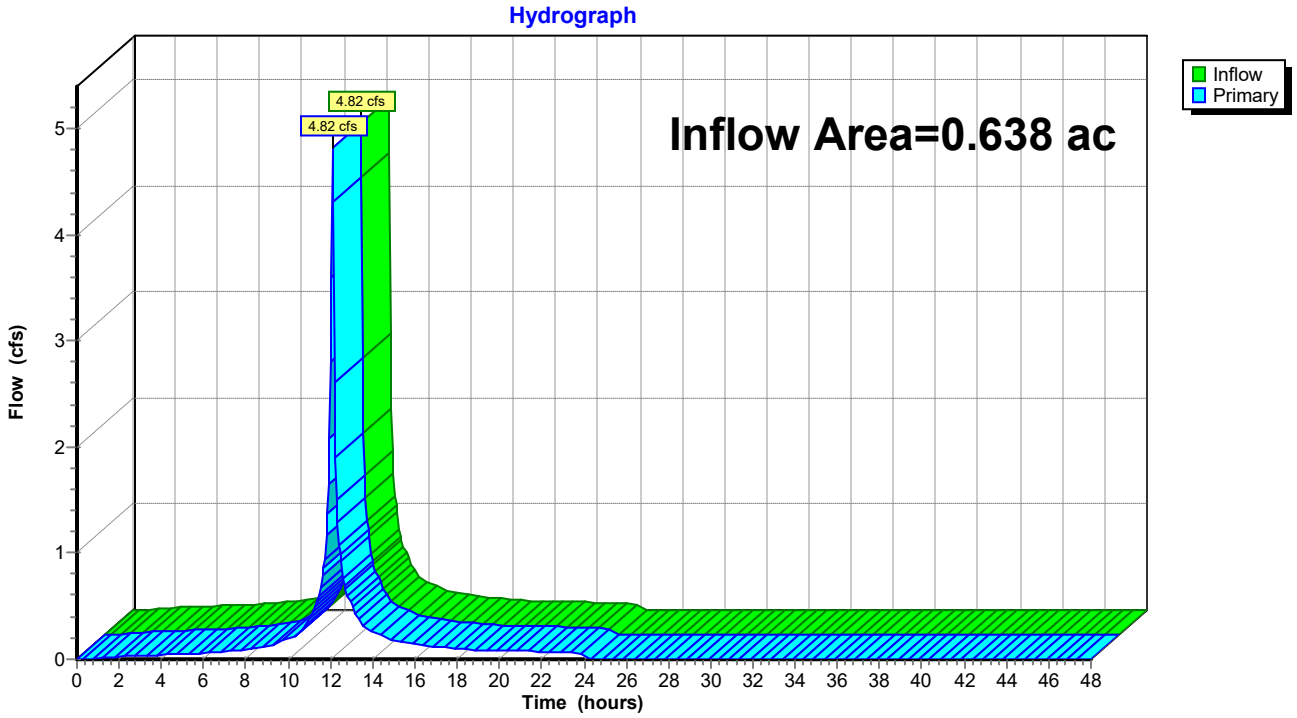


Summary for Link 1: PRDA-1

Inflow Area = 0.638 ac, 57.64% Impervious, Inflow Depth = 7.21" for 100-Year event
Inflow = 4.82 cfs @ 12.11 hrs, Volume= 0.384 af
Primary = 4.82 cfs @ 12.11 hrs, Volume= 0.384 af, Atten= 0%, Lag= 0.0 min
Routed to Link A : PT A

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 1: PRDA-1

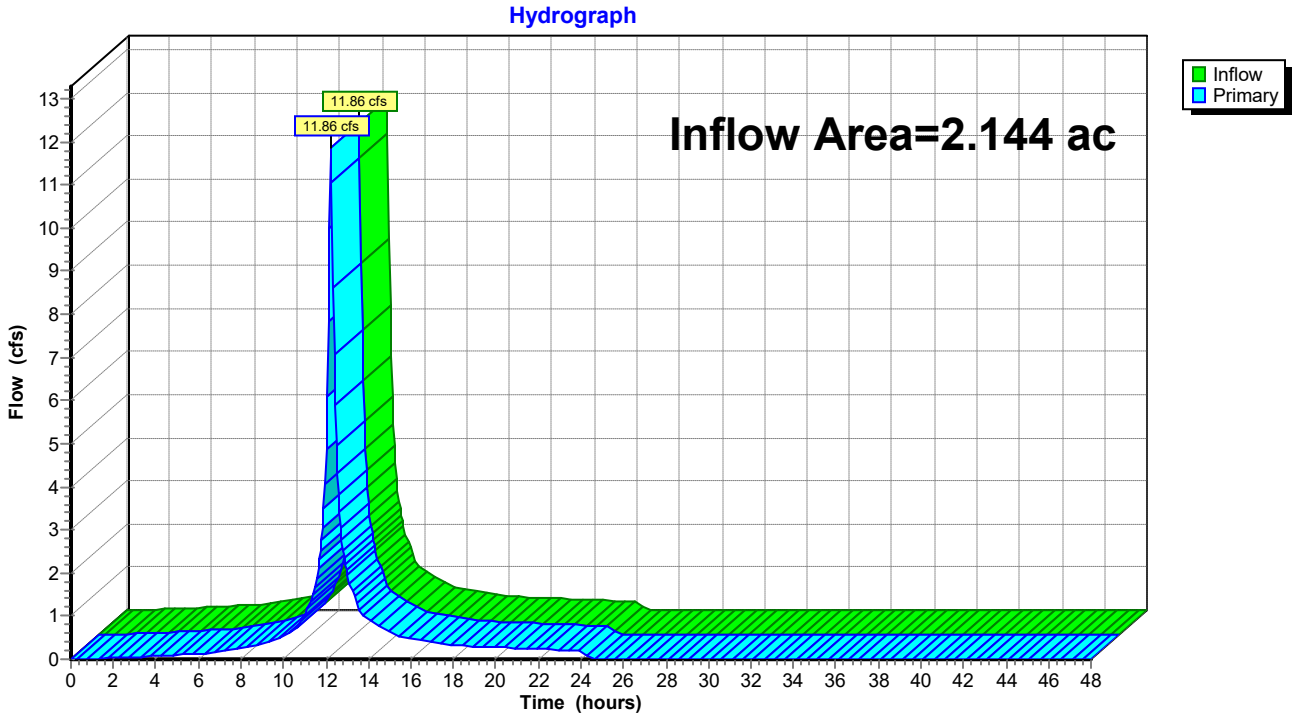


Summary for Link 2: PRDA-2

Inflow Area = 2.144 ac, 46.96% Impervious, Inflow Depth = 6.93" for 100-Year event
Inflow = 11.86 cfs @ 12.23 hrs, Volume= 1.238 af
Primary = 11.86 cfs @ 12.23 hrs, Volume= 1.238 af, Atten= 0%, Lag= 0.0 min
Routed to Pond B1 : BASIN-1

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 2: PRDA-2

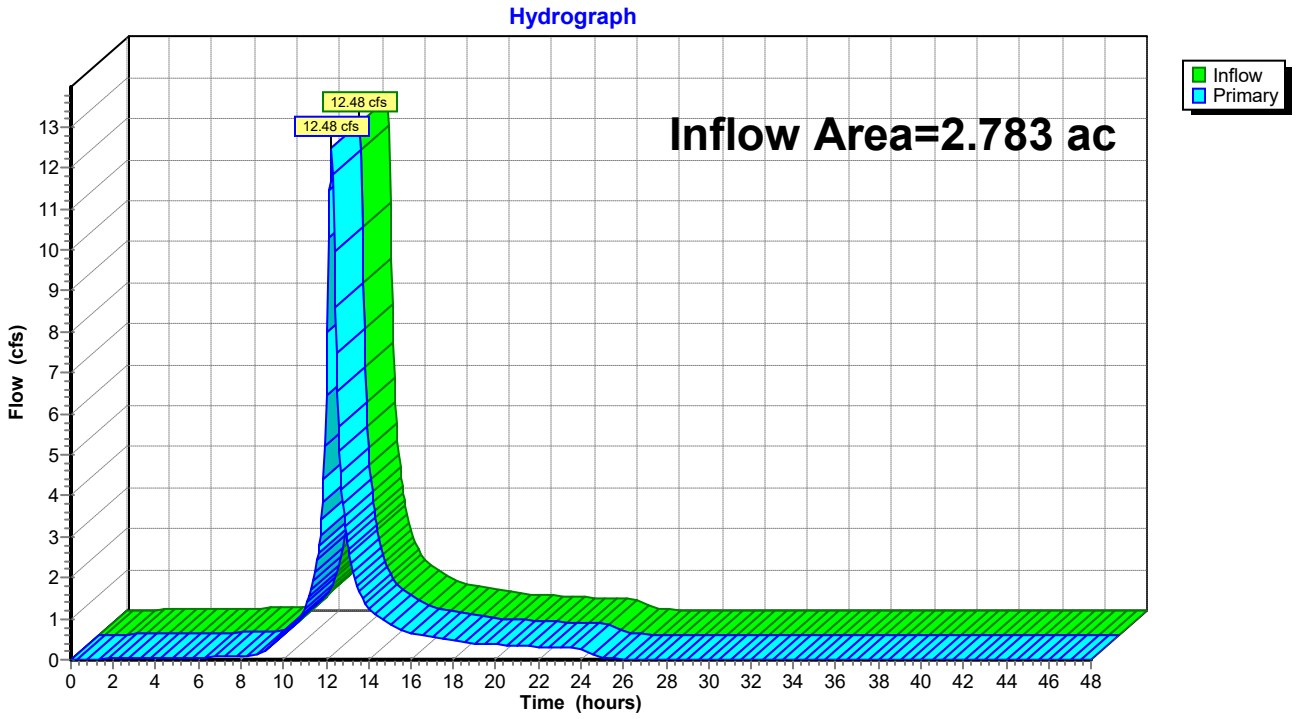


Summary for Link A: PT A

Inflow Area = 2.783 ac, 49.41% Impervious, Inflow Depth = 6.64" for 100-Year event
Inflow = 12.48 cfs @ 12.27 hrs, Volume= 1.540 af
Primary = 12.48 cfs @ 12.27 hrs, Volume= 1.540 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link A: PT A



Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1i: PRDA-1i Runoff Area=13,690 sf 100.00% Impervious Runoff Depth=1.03"
Flow Length=666' Tc=4.9 min CN=98 Runoff=0.94 cfs 0.027 af

Subcatchment 1p: PRDA-1p Runoff Area=14,115 sf 16.56% Impervious Runoff Depth=0.18"
Flow Length=666' Tc=4.9 min CN=WQ Runoff=0.15 cfs 0.005 af

Subcatchment 2i: PRDA-2i Runoff Area=14,445 sf 100.00% Impervious Runoff Depth=1.03"
Flow Length=519' Tc=15.0 min CN=98 Runoff=0.73 cfs 0.029 af

Subcatchment 2p: PRDA-2p Runoff Area=78,960 sf 37.26% Impervious Runoff Depth=0.31"
Flow Length=519' Tc=15.0 min CN=WQ Runoff=1.18 cfs 0.047 af

Pond B1: BASIN-1 Peak Elev=78.56' Storage=3,309 cf Inflow=1.88 cfs 0.076 af
Outflow=0.00 cfs 0.000 af

Link 1: PRDA-1 Inflow=1.08 cfs 0.032 af
Primary=1.08 cfs 0.032 af

Link 2: PRDA-2 Inflow=1.88 cfs 0.076 af
Primary=1.88 cfs 0.076 af

Link A: PT A Inflow=1.08 cfs 0.032 af
Primary=1.08 cfs 0.032 af

Total Runoff Area = 2.783 ac Runoff Volume = 0.108 af Average Runoff Depth = 0.47"
50.59% Pervious = 1.408 ac 49.41% Impervious = 1.375 ac

Summary for Subcatchment 1i: PRDA-1i

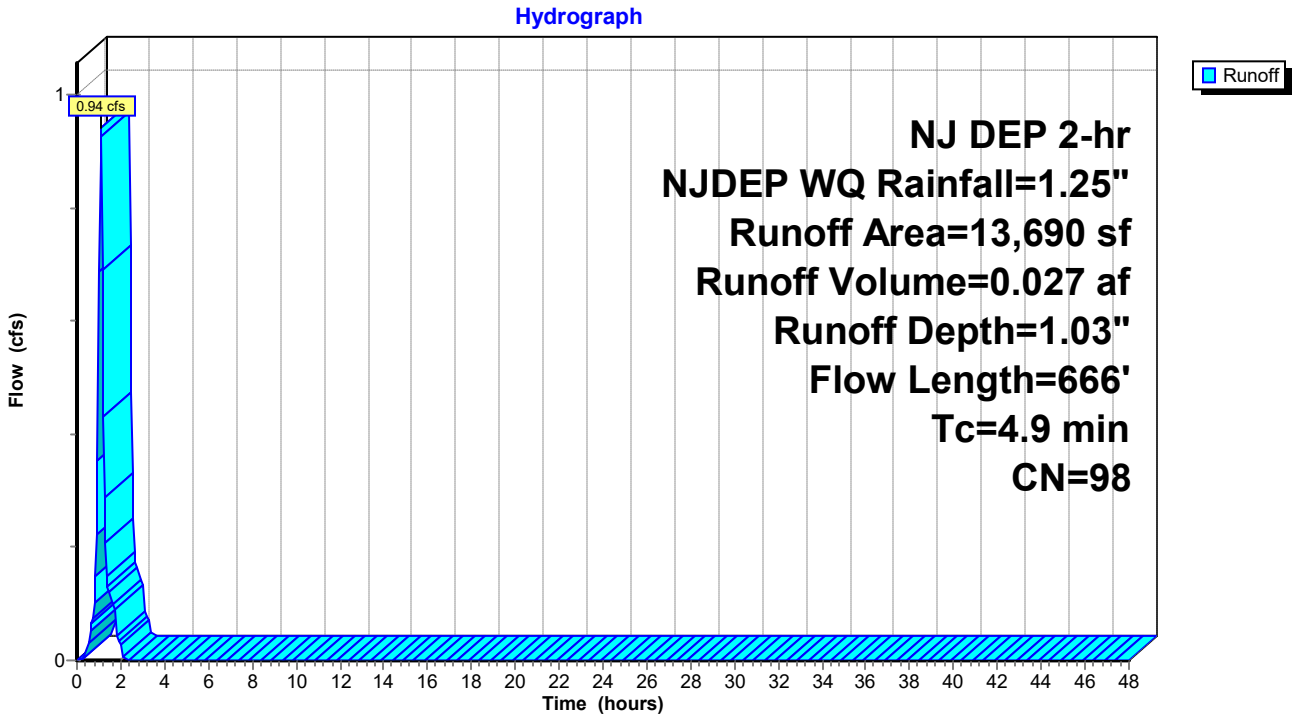
Runoff = 0.94 cfs @ 1.08 hrs, Volume= 0.027 af, Depth= 1.03"
Routed to Link 1 : PRDA-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

Area (sf)	CN	Description
13,690	98	Paved parking, HSG C
13,690	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0190	1.38		**Sheet Flow, Segment 1.1** Smooth surfaces n= 0.011 P2= 3.36"
1.1	258	0.0345	3.77		**Shallow Concentrated Flow, Segment 1.2** Paved Kv= 20.3 fps
2.6	308	0.0094	1.97		**Shallow Concentrated Flow, Segment 1.3** Paved Kv= 20.3 fps
4.9	666	Total			

Subcatchment 1i: PRDA-1i



Summary for Subcatchment 1p: PRDA-1p

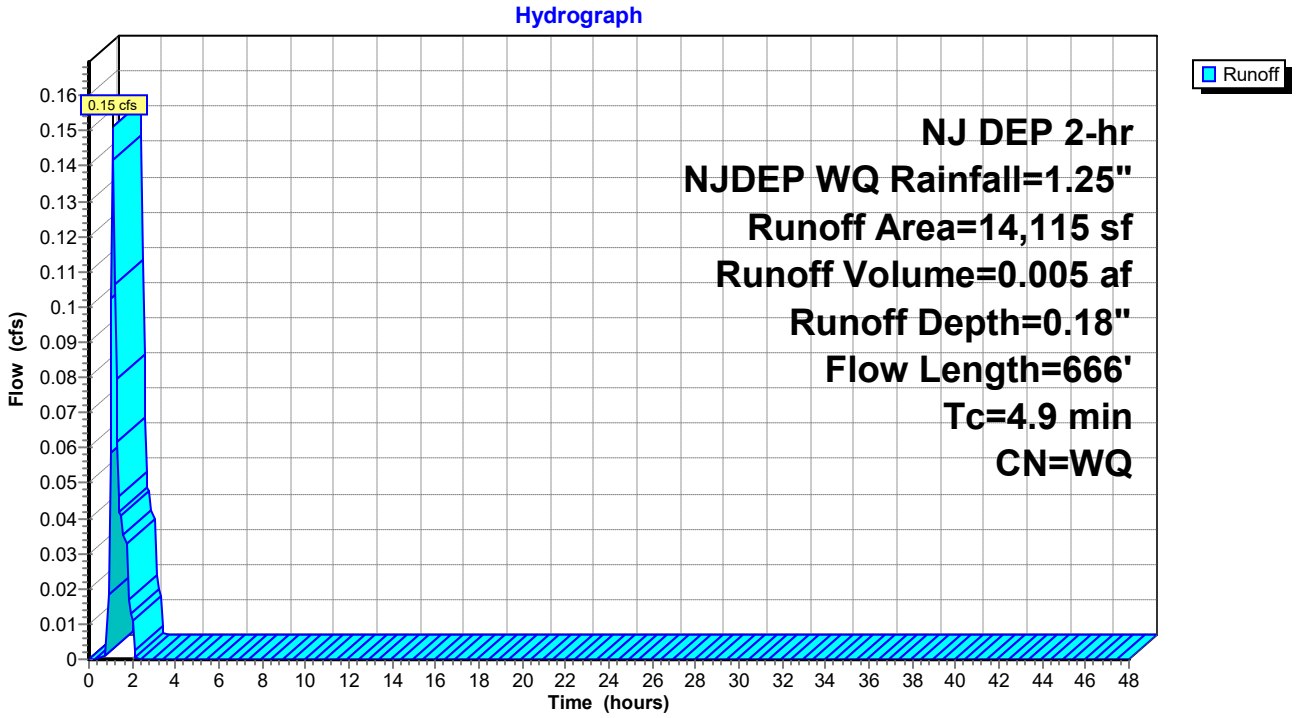
Runoff = 0.15 cfs @ 1.12 hrs, Volume= 0.005 af, Depth= 0.18"
Routed to Link 1 : PRDA-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

Area (sf)	CN	Description
3,595	90	1/8 acre lots, 65% imp, HSG C
9,745	74	>75% Grass cover, Good, HSG C
775	70	Woods, Good, HSG C
14,115		Weighted Average
11,778	74	83.44% Pervious Area
2,337	98	16.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0190	1.38		**Sheet Flow, Segment 1.1** Smooth surfaces n= 0.011 P2= 3.36"
1.1	258	0.0345	3.77		**Shallow Concentrated Flow, Segment 1.2** Paved Kv= 20.3 fps
2.6	308	0.0094	1.97		**Shallow Concentrated Flow, Segment 1.3** Paved Kv= 20.3 fps
4.9	666	Total			

Subcatchment 1p: PRDA-1p



Summary for Subcatchment 2i: PRDA-2i

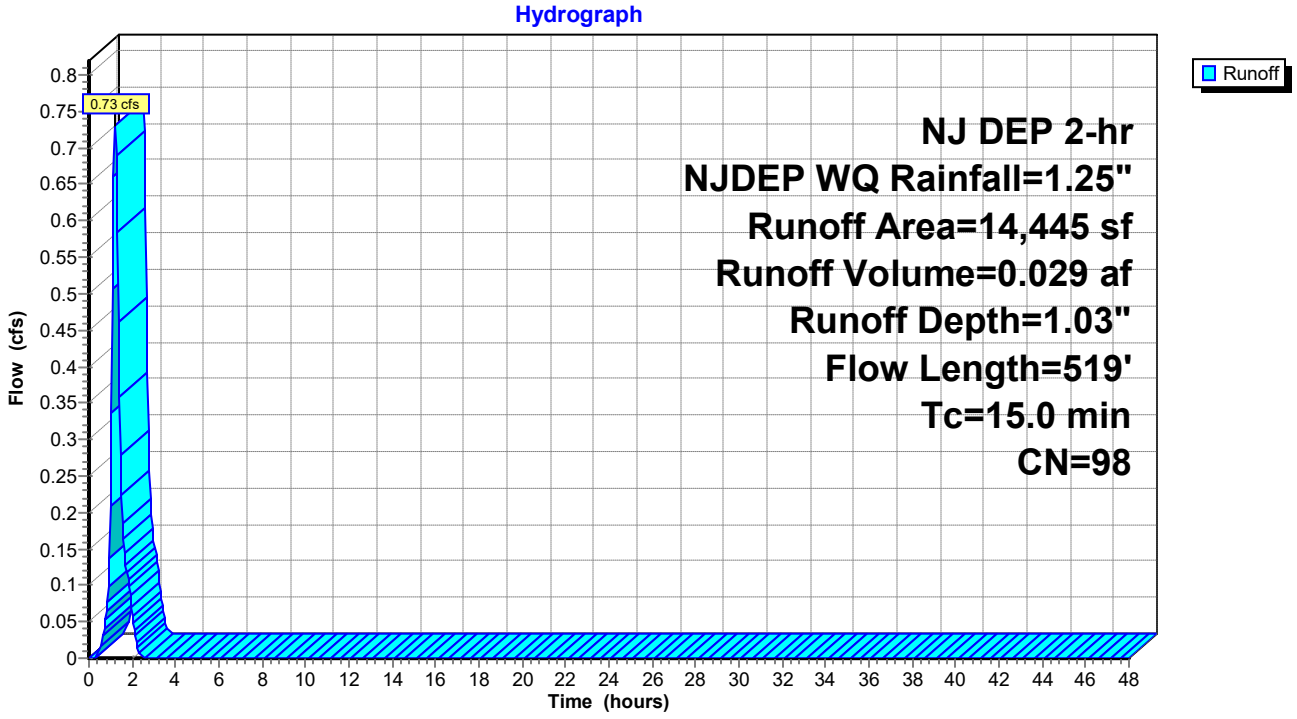
Runoff = 0.73 cfs @ 1.21 hrs, Volume= 0.029 af, Depth= 1.03"
Routed to Link 2 : PRDA-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

Area (sf)	CN	Description
14,445	98	Paved parking, HSG C
14,445	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	100	0.0300	0.14		**Sheet Flow, Segment 2.1** Grass: Dense n= 0.240 P2= 3.36"
0.6	87	0.0230	2.44		**Shallow Concentrated Flow, Segment 2.2** Unpaved Kv= 16.1 fps
1.0	100	0.0100	1.61		**Shallow Concentrated Flow, Segment 2.3** Unpaved Kv= 16.1 fps
1.6	232	0.0237	2.48		**Shallow Concentrated Flow, Segment 2.4** Unpaved Kv= 16.1 fps
15.0	519	Total			

Subcatchment 2i: PRDA-2i



Summary for Subcatchment 2p: PRDA-2p

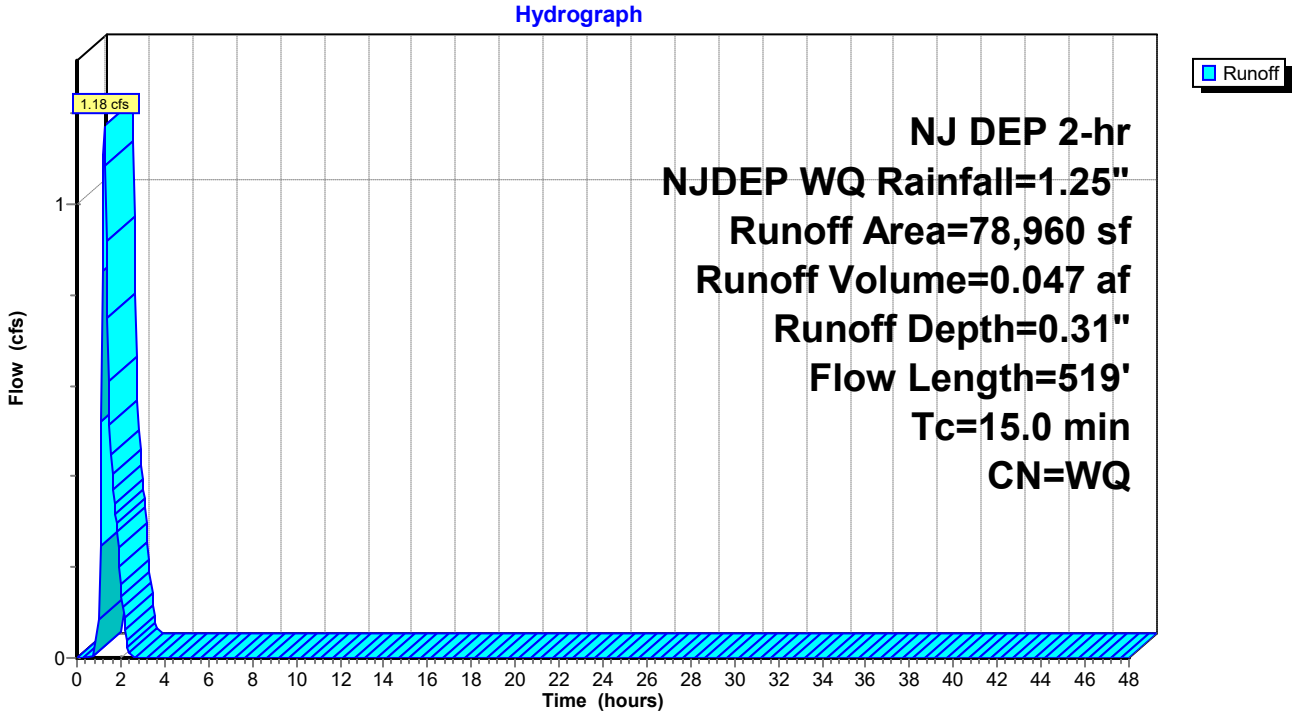
Runoff = 1.18 cfs @ 1.25 hrs, Volume= 0.047 af, Depth= 0.31"
Routed to Link 2 : PRDA-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NJ DEP 2-hr NJDEP WQ Rainfall=1.25"

Area (sf)	CN	Description
45,265	90	1/8 acre lots, 65% imp, HSG C
31,770	74	>75% Grass cover, Good, HSG C
1,925	70	Woods, Good, HSG C
78,960		Weighted Average
49,538	74	62.74% Pervious Area
29,422	98	37.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	100	0.0300	0.14		**Sheet Flow, Segment 2.1** Grass: Dense n= 0.240 P2= 3.36"
0.6	87	0.0230	2.44		**Shallow Concentrated Flow, Segment 2.2** Unpaved Kv= 16.1 fps
1.0	100	0.0100	1.61		**Shallow Concentrated Flow, Segment 2.3** Unpaved Kv= 16.1 fps
1.6	232	0.0237	2.48		**Shallow Concentrated Flow, Segment 2.4** Unpaved Kv= 16.1 fps
15.0	519	Total			

Subcatchment 2p: PRDA-2p



Summary for Pond B1: BASIN-1

Inflow Area = 2.144 ac, 46.96% Impervious, Inflow Depth = 0.43" for NJDEP WQ event
Inflow = 1.88 cfs @ 1.23 hrs, Volume= 0.076 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link A : PT A

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 78.56' @ 2.90 hrs Surf.Area= 5,344 sf Storage= 3,309 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	77.90'	16,652 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

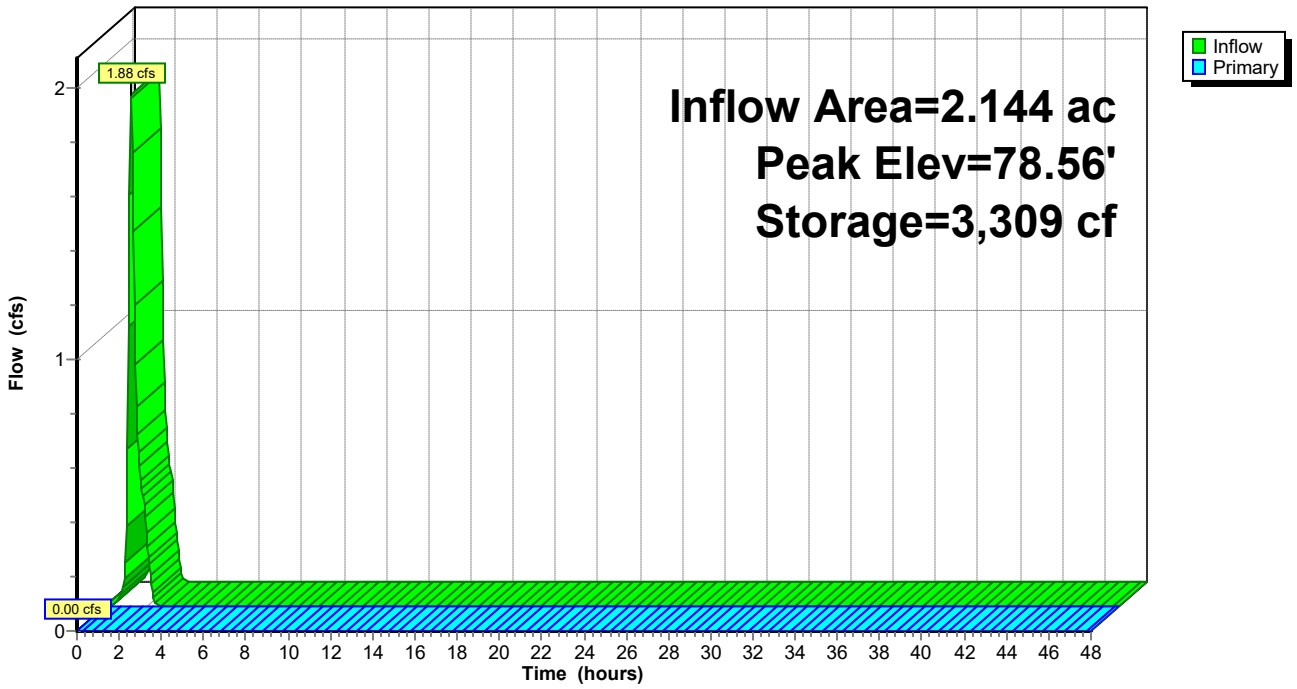
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
77.90	4,750	0	0
78.00	4,835	479	479
79.00	5,750	5,293	5,772
80.00	7,805	6,778	12,549
80.50	8,605	4,103	16,652

Device	Routing	Invert	Outlet Devices
#1	Primary	78.60'	**2' Wide Broadcrested Weir, Cv= 3.10 (C= 3.88)** Head (feet) 0.00 1.15 Width (feet) 2.00 10.40

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=77.90' TW=0.00' (Dynamic Tailwater)
↑—**1=2' Wide Broadcrested Weir** (Controls 0.00 cfs)

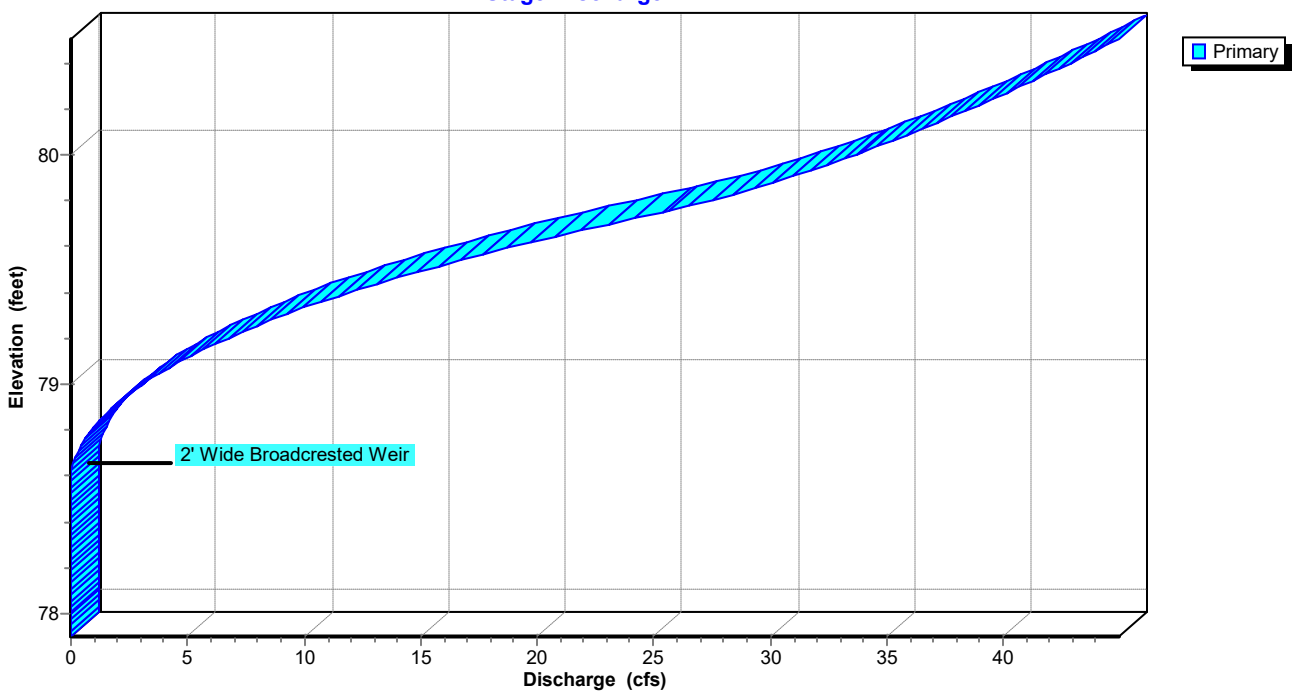
Pond B1: BASIN-1

Hydrograph

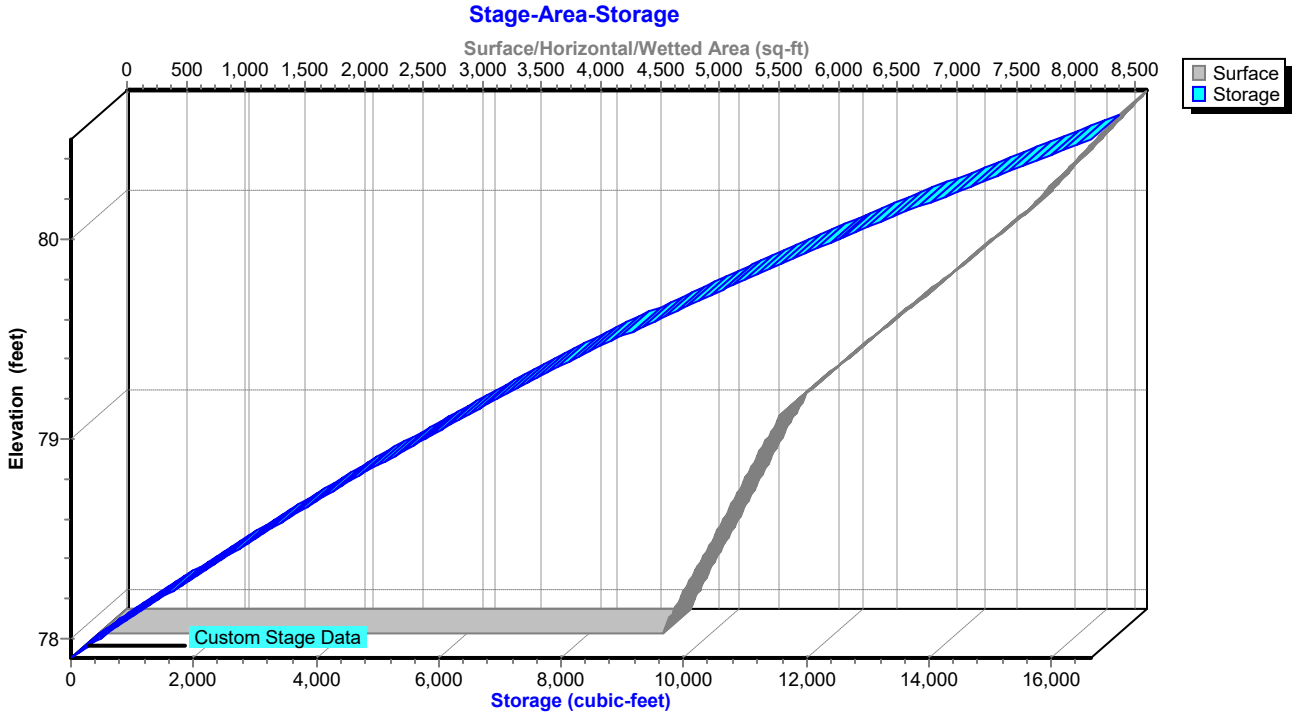


Pond B1: BASIN-1

Stage-Discharge



Pond B1: BASIN-1

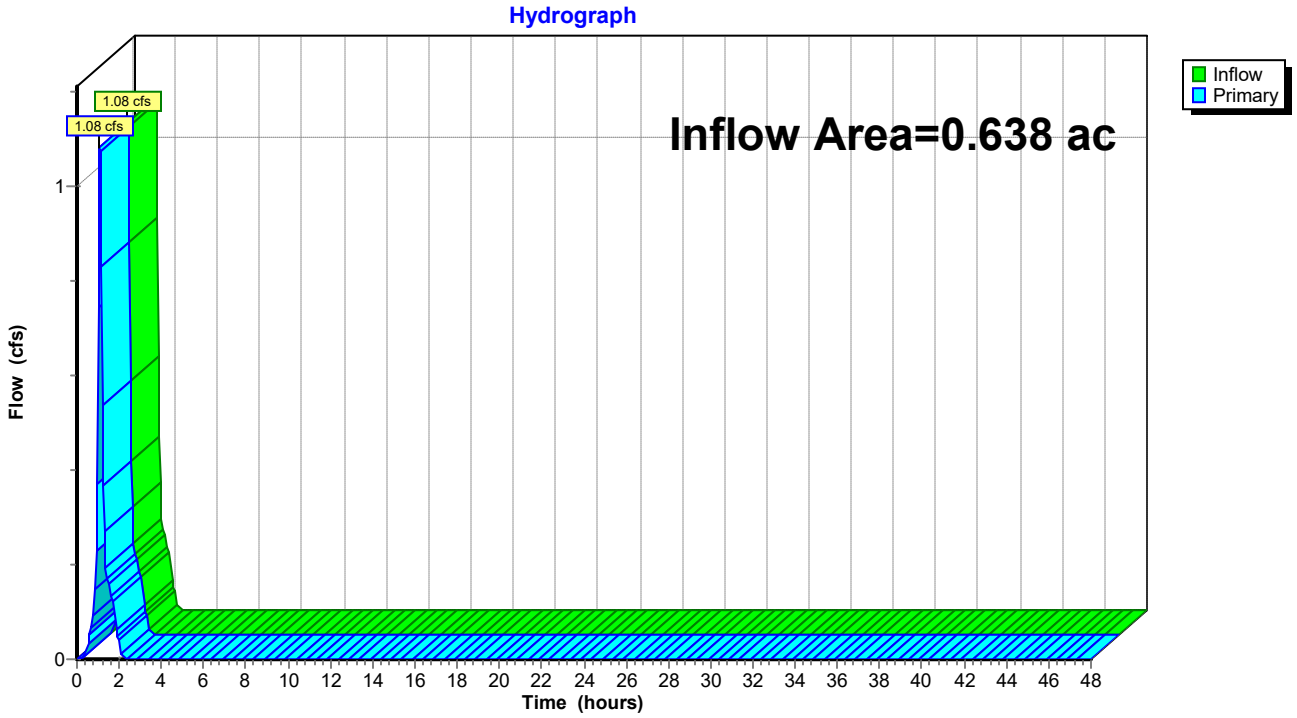


Summary for Link 1: PRDA-1

Inflow Area = 0.638 ac, 57.64% Impervious, Inflow Depth = 0.60" for NJDEP WQ event
Inflow = 1.08 cfs @ 1.09 hrs, Volume= 0.032 af
Primary = 1.08 cfs @ 1.09 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.0 min
Routed to Link A : PT A

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 1: PRDA-1

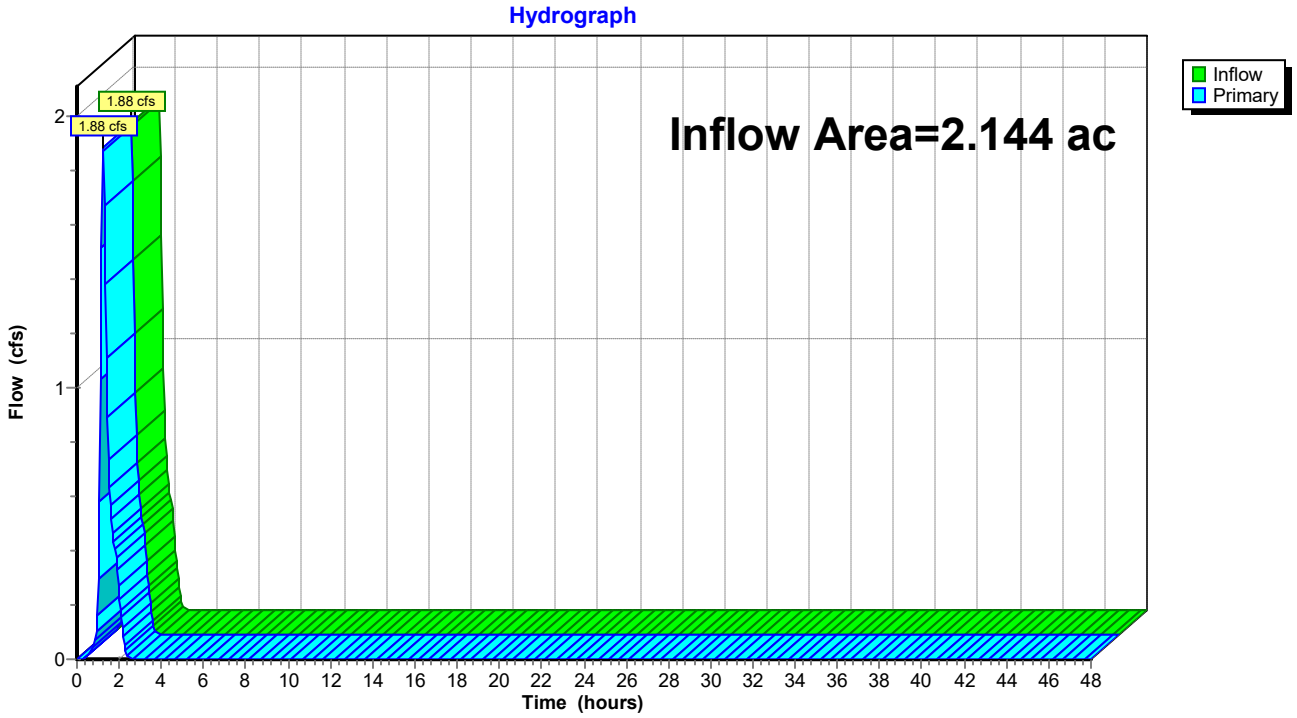


Summary for Link 2: PRDA-2

Inflow Area = 2.144 ac, 46.96% Impervious, Inflow Depth = 0.43" for NJDEP WQ event
Inflow = 1.88 cfs @ 1.23 hrs, Volume= 0.076 af
Primary = 1.88 cfs @ 1.23 hrs, Volume= 0.076 af, Atten= 0%, Lag= 0.0 min
Routed to Pond B1 : BASIN-1

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 2: PRDA-2

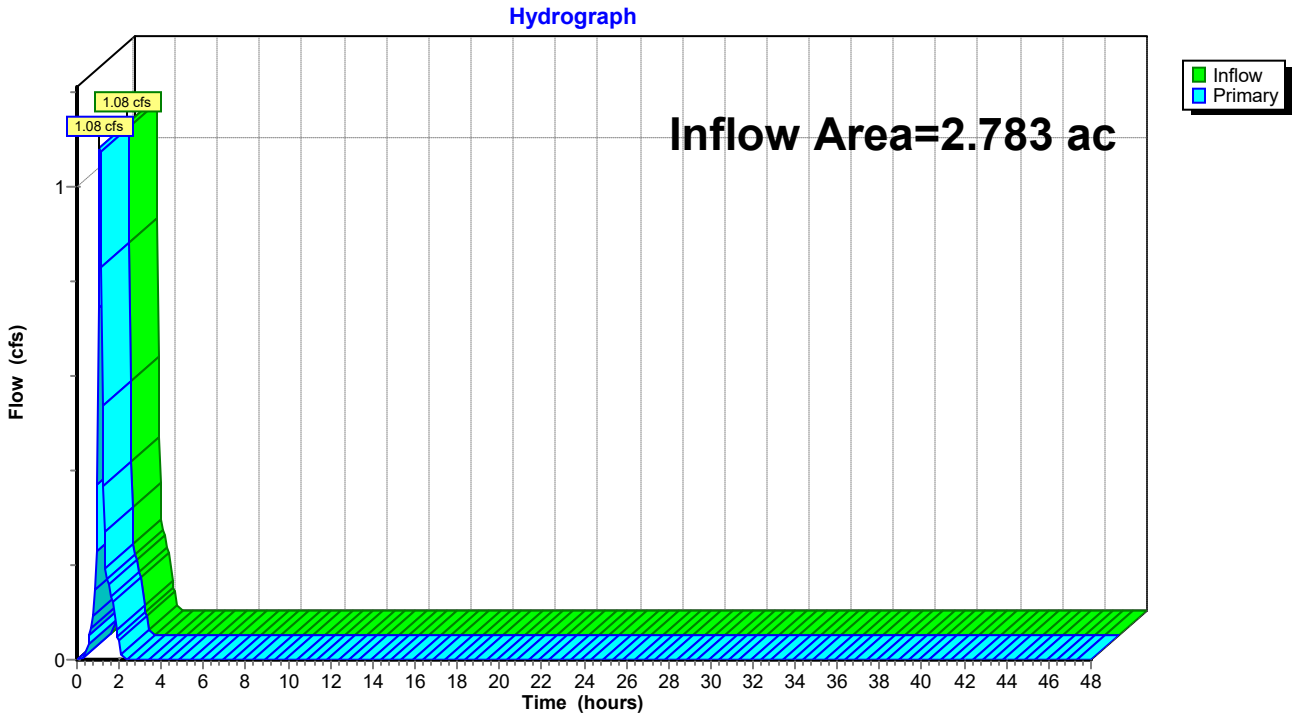


Summary for Link A: PT A

Inflow Area = 2.783 ac, 49.41% Impervious, Inflow Depth = 0.14" for NJDEP WQ event
Inflow = 1.08 cfs @ 1.09 hrs, Volume= 0.032 af
Primary = 1.08 cfs @ 1.09 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link A: PT A



APPENDIX E

INFILTRATION AND MOUNDING CALCULATIONS

INFILTRATION CALCULATIONS

Equations and Terms

Q = K i A
Q = infiltration flow rate
K = hydraulic conductivity of soil (ft/hr)
i = hydraulic gradient = D_{AVG} / d
A = infiltration area
D = depth from ESHWT to bottom of infiltration area (ft)
d_{STORM} = depth from infiltration area bottom to storm event elevation
D_{AVG} = average distance from water surface to ESHWT
V = basin volume during storm event
T = time to infiltrate basin (hr) = V / Q
ESHWT = Estimated Seasonal High Water Table

Basin 1 4,750 sf equals basin bottom area at elevation 77.90
Spillway is at elevation 78.60

Profile Pit TP-4
Permeability of Underlying Soils = 0.10 in/hr
Design permeability rate = 0.5 x K_{TEST} = 0.05 in/hr = 0.00 ft/hr

Storm frequency	D (ft)	d_{STORM} (ft)	D_{AVG} (ft)	i (unitless)	A (sf)	Q (cf/hr)	V (cf)	T (hr)
2 - year	2.90	0.70	3.25	1.12	4,750	22	3,545	159.8
10 - year	2.90	0.70	3.25	1.12	4,750	22	3,545	159.8
100 - year	2.90	0.70	3.25	1.12	4,750	22	3,545	159.8
WQ	2.90	0.66	3.23	1.11	4,750	22	3,309	150.1

All times are greater than 72 hours
Excavate poor soils and backfill with K4 sand and recalculate

Basin 1 4,750 sf equals basin bottom area at elevation 77.90
Spillway is at elevation 78.60

Profile Pit TP-4
Permeability of Underlying Soils (K4) = 6.00 in/hr
Design permeability rate = 0.5 x K_{TEST} = 3 in/hr = 0.25 ft/hr

Storm frequency	D (ft)	d_{STORM} (ft)	D_{AVG} (ft)	i (unitless)	A (sf)	Q (cf/hr)	V (cf)	T (hr)
2 - year	2.90	0.90	3.35	1.16	4,750	1372	3,545	2.6
10 - year	2.90	0.90	3.35	1.16	4,750	1372	3,545	2.6
100 - year	2.90	0.90	3.35	1.16	4,750	1372	3,545	2.6
WQ	2.90	0.85	3.33	1.15	4,750	1362	3,309	2.4

All times are less than 72 hours

GROUNDWATER MOUNDING ANALYSIS

Sciullo Engineering Services, LLC (SE) completed a groundwater mounding analysis at the proposed stormwater management infiltration basin at 83 Myrtle Street Supportive Housing, Cranford Township, NJ using the computer model developed by the United States Geological Survey (USGS) in their Scientific Investigation Report (SIR) 2010-5102 and the NJDEP BMP Manual Chapter 13 for Groundwater Table Hydraulic Impact Assessment Guide for Infiltration BMPs**.** Both the report and the guidelines utilize the Hantush equation for simulation of ground water mounding.

There is a single individual basin proposed at this site.

1st Trial - BASIN 1

This facility is roughly rectangular in shape with a bottom area of 4,750 square feet at elevation 77.90. Existing grades in the area of this facility range from 80.5 to 78.5. Since the computer model requires the input of the dimensions of a rectangular shape, the idealized basin will be assumed to be 50.0' by 95.0' (4,750 sf). Further, the retained volume of stormwater stored is 3,545 cubic feet (@ elev. 78.60).

As described in section 5 of the report and shown on the Soil Profile Exhibit in Appendix H of this report, it is apparent that the seasonally high groundwater table is sloping downward in a west to east direction across the site (and beyond). At the location of the proposed basin, it is estimated to be at elevation 75.0.

The soil profile pits excavated at the site nearest to the proposed basin are TP-2s and TP-3s. They were excavated to a depth of 14 feet below the ground surface. The soils logs show the presence of hydraulically restrictive soils to a depth of 5.5 and 9.0 feet, respectively. It will be assumed in this calculation and as part of the overall drainage system that these restrictive soils will be excavated to the bottom of the restrictive layer and replaced with K4 (6.0 – 20 in/hr) soils beneath the proposed basin.

The computer model requires the input of the following parameters to calculate elevation of the groundwater mound that will develop beneath this facility as recharge of the stored stormwater occurs. They are:

Recharge rate (R) is the vertical hydraulic conductivity rate in feet per day that water enters the soil. According to the Guidelines the initial input should be the permeability of the soil divided by a factor of safety of 2. The initial rate used in this analysis will be:

R = 6.0 in/hr / 2 = 3.0 in/hr (assumed rate of K4 soil replacement)

GROUNDWATER MOUNDING ANALYSIS

Specific yield (Sy) is the volume of water that will drain from a soil specimen by gravity divided by the total volume of the specimen. The guidelines require a specific yield within the range of 0.15 to 0.20. The specific yield used in this analysis will be:

Sy = 0.15

The horizontal hydraulic conductivity (K) is the rate at which water moves horizontally through the soil. Since this site is outside of the Coastal Plain of New Jersey the guidelines require that the horizontal hydraulic conductivity be equal to the initial vertical rate. The horizontal hydraulic conductivity used in this analysis will be:

K = 1 x 3.0 in/hr = 3.0 in/hr

Basin dimensions will be 95.0 ft / 2 = 47.5 ft and 50.0 ft / 2 = 25.0 ft.

The duration of recharge (t) is equal to the time required for the basin to drain at the specified recharge rate. The initial duration will be:

t = (3,545 cf x 12 in/ft) / (4,750 sf x 3.0 in/hr) = 2.99 hours

The initial thickness of the saturated zone (hi(0)) is the distance from the seasonally high groundwater table to first hydraulically restrictive layer. The guidelines require that a value of 10 feet be used unless onsite testing demonstrates that a larger value can be justified up to a maximum of 75 feet. The on-site soil testing shows sandy material to a depth of 12.8 feet below the basin bottom. As such, the thickness of the saturated zone used in this analysis will be:

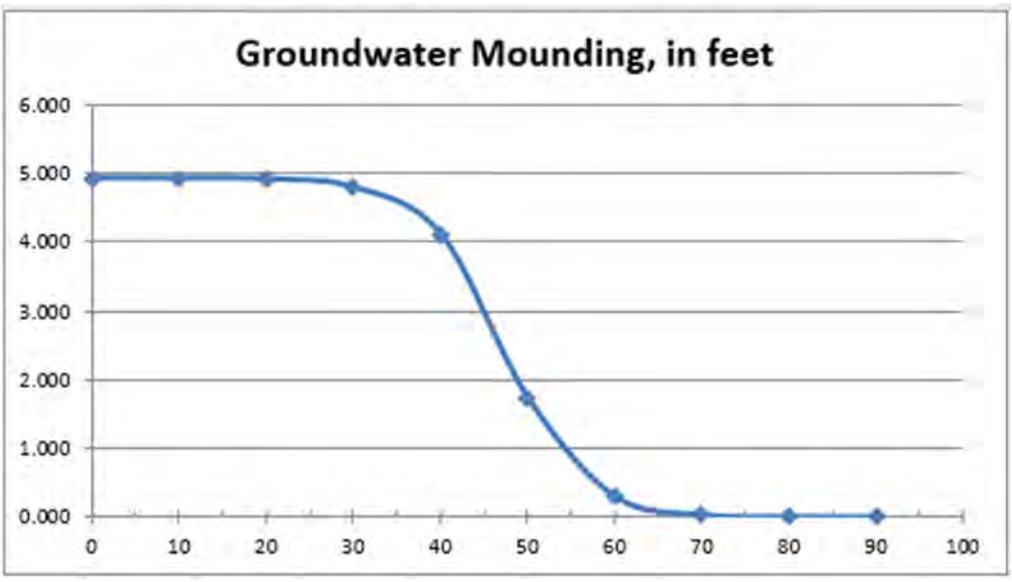
hi(0) = 12.8 feet

The printout below shows the results of calculations of the model as suggested in the Guidelines.

GROUNDWATER MOUNDING ANALYSIS

1st Trial - Basin 1 parameters:

Recharge Rate (R) = 6.0 in/hr / 2 = 3.0 in/hr
Specific Yield (Sy) = 0.15
Hydraulic Conductivity (Kh) = 1 x R = 3.0 in/hr
Basin Bottom Area = 4,750 sf @ 77.90
Basin Width (y) = 50.0 ft: y/2 = 25.0 ft
Basin Length (x) = 95.0 ft; x/2 = 47.5 ft
Volume to be Infiltrated (V) = 3,545 cf
Duration of Infiltration (t) = 2.99 hr
Initial thickness of Saturated Zone (hi(0)) = 12.8 ft



A mound of 4.93' develops above the seasonal high water table. The elevation of this mound is then 75.00 + 4.93 = 79.93. This is well above the bottom elevation of the K5 sand layer in the basin bottom (77.90 – 0.50 = 77.40 < 79.96). NG

As discussed in Chapter 13 of the BMP Manual, when the mound rises above the bottom of the infiltration layer an iterative process of adjusting the Recharge Rate (R) and the Duration of Infiltration (t) should be employed to reduce the height of the mound. The adjusted Duration of Infiltration must be less than 72 hours. The results of that process are shown below:

GROUNDWATER MOUNDING ANALYSIS

Final Trial - BASIN 1

The reduced rate used in this analysis will be:

R = 0.124 in/hr

The specific yield used in this analysis will be:

Sy = 0.15

The horizontal hydraulic conductivity (K) is the rate at which water moves horizontally through the soil. Since this site is outside of the Coastal Plain of New Jersey the guidelines require that the horizontal hydraulic conductivity be equal to the initial vertical rate. The horizontal hydraulic conductivity used in this analysis will be:

K = 1 x 3.0 in/hr = 3.0 in/hr

Basin dimensions will be 95.0 ft / 2 = 47.5 ft and 50.0 ft / 2 = 25.0 ft.

The duration of recharge (t) is equal to the time required for the basin to drain at the specified recharge rate. The initial duration will be:

t = (3,545 cf x 12 in/ft) / (4,750 sf x 0.124 in/hr) = 72.00 hours

The initial thickness of the saturated zone (hi(0)) is the distance from the seasonally high groundwater table to first hydraulically restrictive layer. The guidelines require that a value of 10 feet be used unless onsite testing demonstrates that a larger value can be justified up to a maximum of 75 feet. The on-site soil testing shows sandy material to a depth of 12.8 feet below the basin bottom. As such, the thickness of the saturated zone used in this analysis will be:

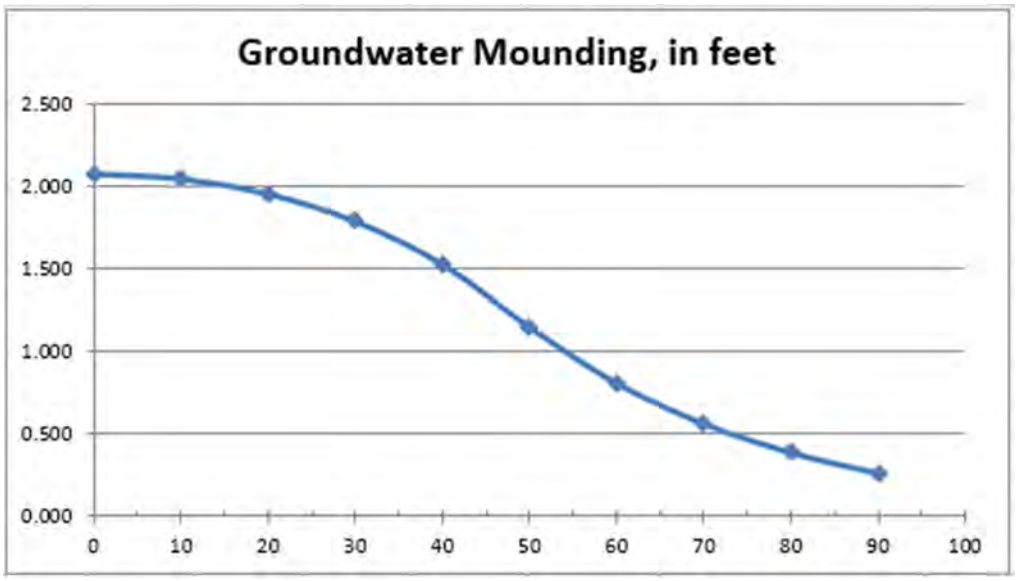
hi(0) = 12.8 feet

The printout below shows the results of calculations of the model as suggested in the Draft Guidelines.

GROUNDWATER MOUNDING ANALYSIS

Final Trial - Basin 1 parameters:

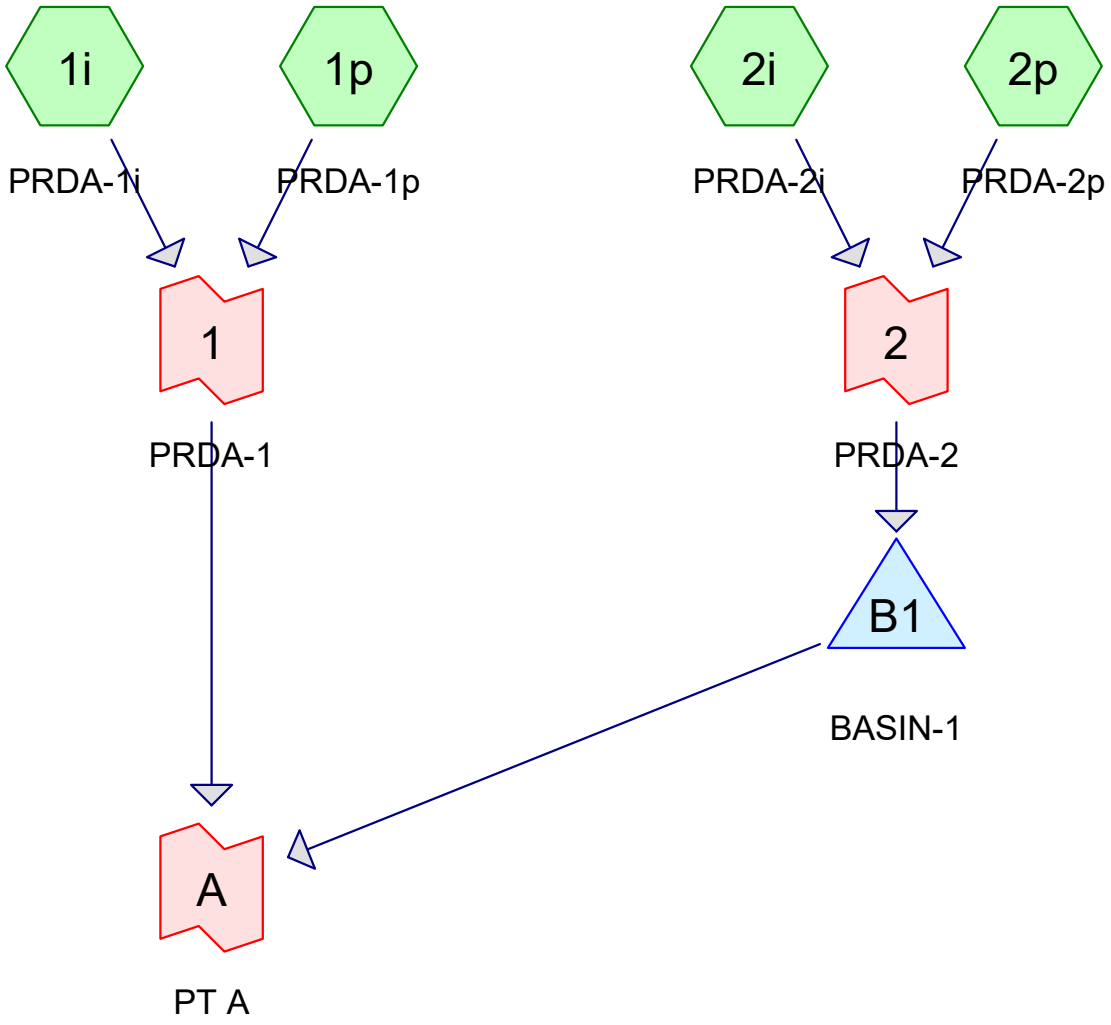
Recharge Rate (R) = 0.124 in/hr
Specific Yield (Sy) = 0.15
Hydraulic Conductivity (Kh) = 1 x R = 3.0 in/hr
Basin Bottom Area = 4,750 sf @ 77.90
Basin Width (y) = 50.0 ft: y/2 = 25.0 ft
Basin Length (x) = 95 ft; x/2 = 47.5 ft
Volume to be Infiltrated (V) = 3,545 cf
Duration of Infiltration (t) = 72.00 hr
Initial thickness of Saturated Zone (hi(0)) = 12.8 ft



A mound of 2.08' develops above the seasonal high water table. The elevation of this mound is then 75.00 + 2.08 = 77.08. This is less than the bottom elevation of the K5 sand layer in the basin bottom (77.90 – 0.50 = 77.40 > 77.08). OK

APPENDIX F

EMERGENCY CONDITIONS CALCULATIONS



Subcat Reach Pond Link

Routing Diagram for Emergency Conditions
Prepared by Sciullo, Printed 3/7/2022

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.122	90	1/8 acre lots, 65% imp, HSG C (1p, 2p)
0.953	74	>75% Grass cover, Good, HSG C (1p, 2p)
0.646	98	Paved parking, HSG C (1i, 2i)
0.062	70	Woods, Good, HSG C (1p, 2p)
2.783	**86**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
2.783	HSG C	1i, 1p, 2i, 2p
0.000	HSG D	
0.000	Other	
2.783		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	1.122	0.000	0.000	1.122	1/8 acre lots, 65% imp	1p, 2p
0.000	0.000	0.953	0.000	0.000	0.953	>75% Grass cover, Good	1p, 2p
0.000	0.000	0.646	0.000	0.000	0.646	Paved parking	1i, 2i
0.000	0.000	0.062	0.000	0.000	0.062	Woods, Good	1p, 2p
0.000	**0.000**	**2.783**	**0.000**	**0.000**	**2.783**	**TOTAL AREA**	

Time span=0.00-48.00 hrs, dt=0.05 hrs, 961 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1i: PRDA-1i Runoff Area=13,690 sf 100.00% Impervious Runoff Depth=8.45"
Flow Length=666' Tc=4.9 min CN=98 Runoff=2.62 cfs 0.221 af

Subcatchment 1p: PRDA-1p Runoff Area=14,115 sf 16.56% Impervious Runoff Depth=6.01"
Flow Length=666' Tc=4.9 min CN=WQ Runoff=2.20 cfs 0.162 af

Subcatchment 2i: PRDA-2i Runoff Area=14,445 sf 100.00% Impervious Runoff Depth=8.45"
Flow Length=519' Tc=15.0 min CN=98 Runoff=2.06 cfs 0.234 af

Subcatchment 2p: PRDA-2p Runoff Area=78,960 sf 37.26% Impervious Runoff Depth=6.65"
Flow Length=519' Tc=15.0 min CN=WQ Runoff=9.80 cfs 1.004 af

Pond B1: BASIN-1 Peak Elev=79.36' Storage=7,978 cf Inflow=11.86 cfs 1.238 af
Outflow=10.85 cfs 1.237 af

Link 1: PRDA-1 Inflow=4.82 cfs 0.384 af
Primary=4.82 cfs 0.384 af

Link 2: PRDA-2 Inflow=11.86 cfs 1.238 af
Primary=11.86 cfs 1.238 af

Link A: PT A Inflow=12.48 cfs 1.621 af
Primary=12.48 cfs 1.621 af

Total Runoff Area = 2.783 ac Runoff Volume = 1.621 af Average Runoff Depth = 6.99"
50.59% Pervious = 1.408 ac 49.41% Impervious = 1.375 ac

Summary for Subcatchment 1i: PRDA-1i

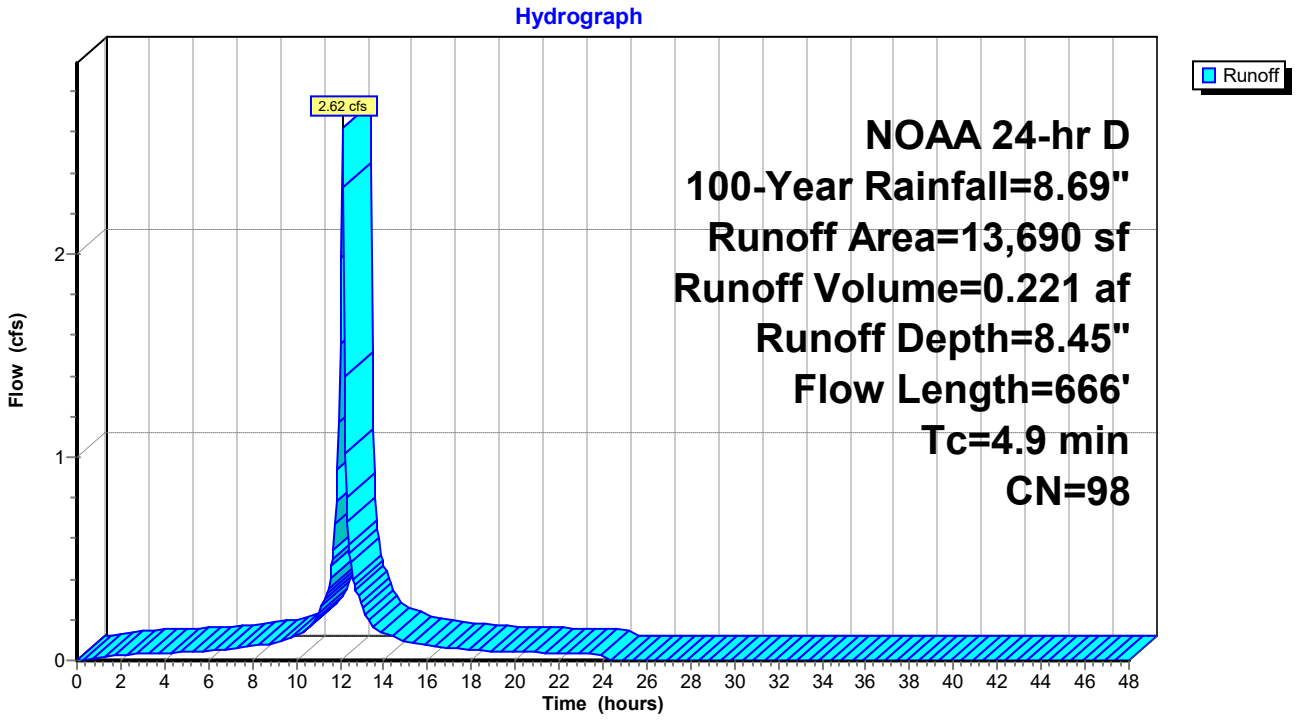
Runoff = 2.62 cfs @ 12.11 hrs, Volume= 0.221 af, Depth= 8.45"
Routed to Link 1 : PRDA-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-Year Rainfall=8.69"

Area (sf)	CN	Description
13,690	98	Paved parking, HSG C
13,690	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0190	1.38		**Sheet Flow, Segment 1.1** Smooth surfaces n= 0.011 P2= 3.36"
1.1	258	0.0345	3.77		**Shallow Concentrated Flow, Segment 1.2** Paved Kv= 20.3 fps
2.6	308	0.0094	1.97		**Shallow Concentrated Flow, Segment 1.3** Paved Kv= 20.3 fps
4.9	666	Total			

Subcatchment 1i: PRDA-1i



Summary for Subcatchment 1p: PRDA-1p

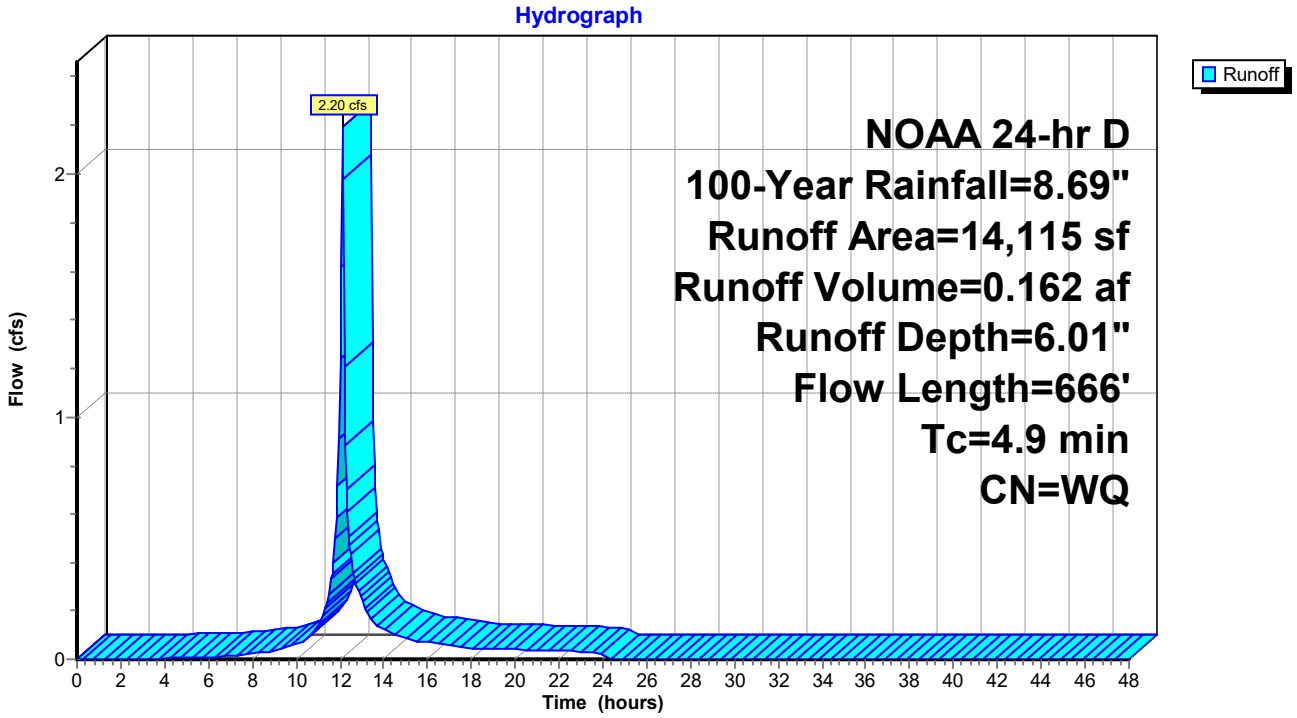
Runoff = 2.20 cfs @ 12.11 hrs, Volume= 0.162 af, Depth= 6.01"
Routed to Link 1 : PRDA-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-Year Rainfall=8.69"

Area (sf)	CN	Description
3,595	90	1/8 acre lots, 65% imp, HSG C
9,745	74	>75% Grass cover, Good, HSG C
775	70	Woods, Good, HSG C
14,115		Weighted Average
11,778	74	83.44% Pervious Area
2,337	98	16.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0190	1.38		**Sheet Flow, Segment 1.1** Smooth surfaces n= 0.011 P2= 3.36"
1.1	258	0.0345	3.77		**Shallow Concentrated Flow, Segment 1.2** Paved Kv= 20.3 fps
2.6	308	0.0094	1.97		**Shallow Concentrated Flow, Segment 1.3** Paved Kv= 20.3 fps
4.9	666	Total			

Subcatchment 1p: PRDA-1p



Summary for Subcatchment 2i: PRDA-2i

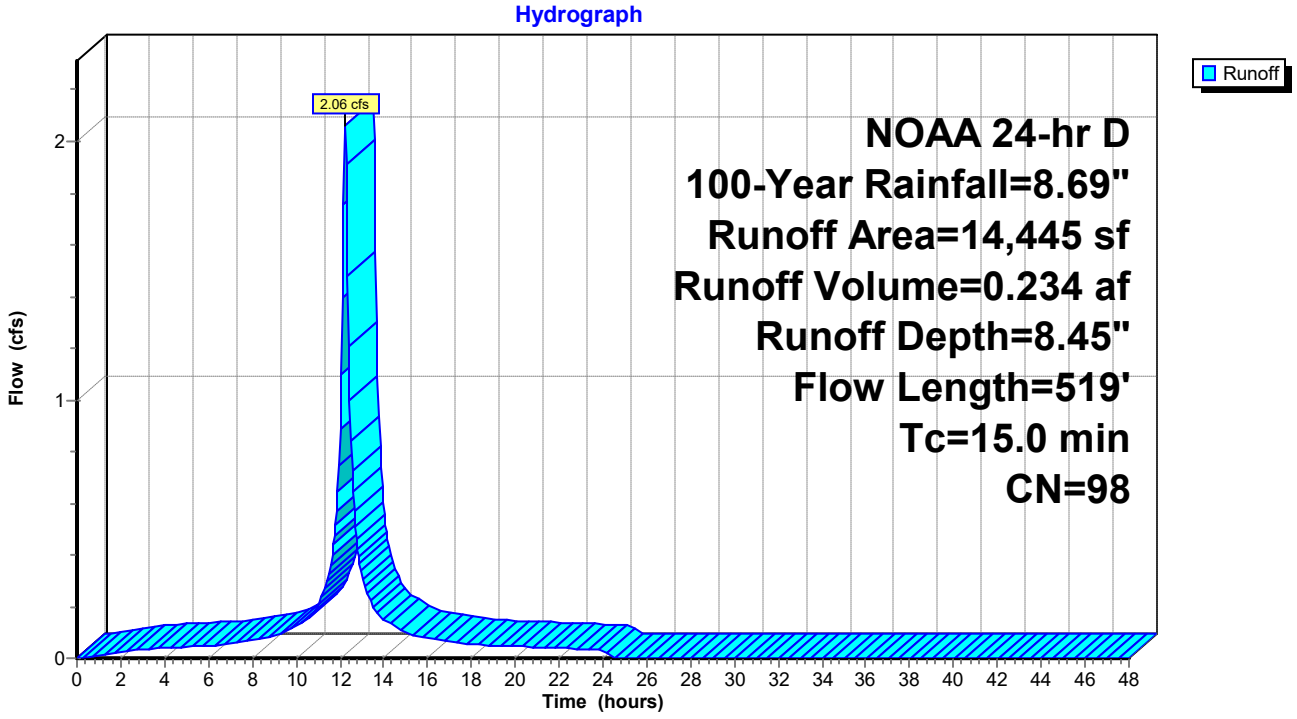
Runoff = 2.06 cfs @ 12.22 hrs, Volume= 0.234 af, Depth= 8.45"
Routed to Link 2 : PRDA-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-Year Rainfall=8.69"

Area (sf)	CN	Description
14,445	98	Paved parking, HSG C
14,445	98	100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	100	0.0300	0.14		**Sheet Flow, Segment 2.1** Grass: Dense n= 0.240 P2= 3.36"
0.6	87	0.0230	2.44		**Shallow Concentrated Flow, Segment 2.2** Unpaved Kv= 16.1 fps
1.0	100	0.0100	1.61		**Shallow Concentrated Flow, Segment 2.3** Unpaved Kv= 16.1 fps
1.6	232	0.0237	2.48		**Shallow Concentrated Flow, Segment 2.4** Unpaved Kv= 16.1 fps
15.0	519	Total			

Subcatchment 2i: PRDA-2i



Summary for Subcatchment 2p: PRDA-2p

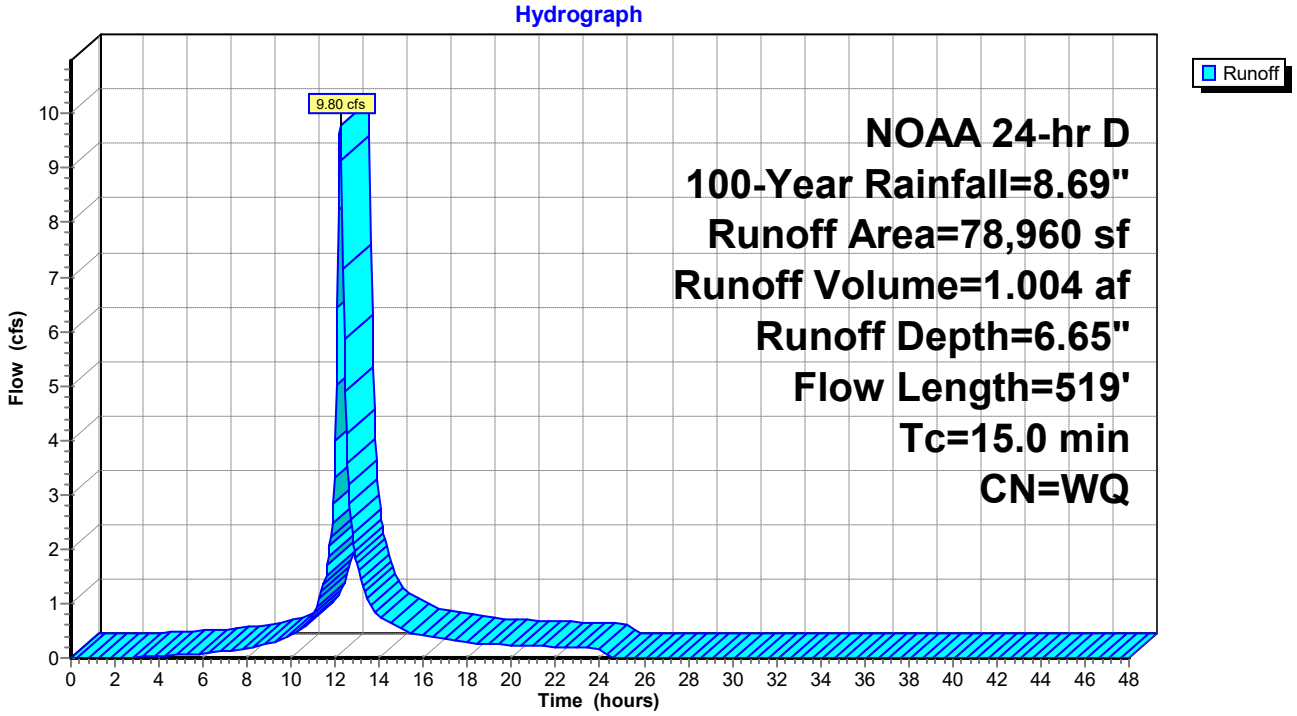
Runoff = 9.80 cfs @ 12.23 hrs, Volume= 1.004 af, Depth= 6.65"
Routed to Link 2 : PRDA-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-Year Rainfall=8.69"

Area (sf)	CN	Description
45,265	90	1/8 acre lots, 65% imp, HSG C
31,770	74	>75% Grass cover, Good, HSG C
1,925	70	Woods, Good, HSG C
78,960		Weighted Average
49,538	74	62.74% Pervious Area
29,422	98	37.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	100	0.0300	0.14		**Sheet Flow, Segment 2.1** Grass: Dense n= 0.240 P2= 3.36"
0.6	87	0.0230	2.44		**Shallow Concentrated Flow, Segment 2.2** Unpaved Kv= 16.1 fps
1.0	100	0.0100	1.61		**Shallow Concentrated Flow, Segment 2.3** Unpaved Kv= 16.1 fps
1.6	232	0.0237	2.48		**Shallow Concentrated Flow, Segment 2.4** Unpaved Kv= 16.1 fps
15.0	519	Total			

Subcatchment 2p: PRDA-2p



Summary for Pond B1: BASIN-1

Inflow Area = 2.144 ac, 46.96% Impervious, Inflow Depth = 6.93" for 100-Year event
Inflow = 11.86 cfs @ 12.23 hrs, Volume= 1.238 af
Outflow = 10.85 cfs @ 12.29 hrs, Volume= 1.237 af, Atten= 9%, Lag= 3.8 min
Primary = 10.85 cfs @ 12.29 hrs, Volume= 1.237 af
Routed to Link A : PT A

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
Starting Elev= 78.60' Surf.Area= 5,384 sf Storage= 3,545 cf
Peak Elev= 79.36' @ 12.29 hrs Surf.Area= 6,491 sf Storage= 7,978 cf (4,433 cf above start)

Plug-Flow detention time= 82.3 min calculated for 1.155 af (93% of inflow)
Center-of-Mass det. time= 18.7 min (810.1 - 791.4)

Volume	Invert	Avail.Storage	Storage Description
#1	77.90'	16,652 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

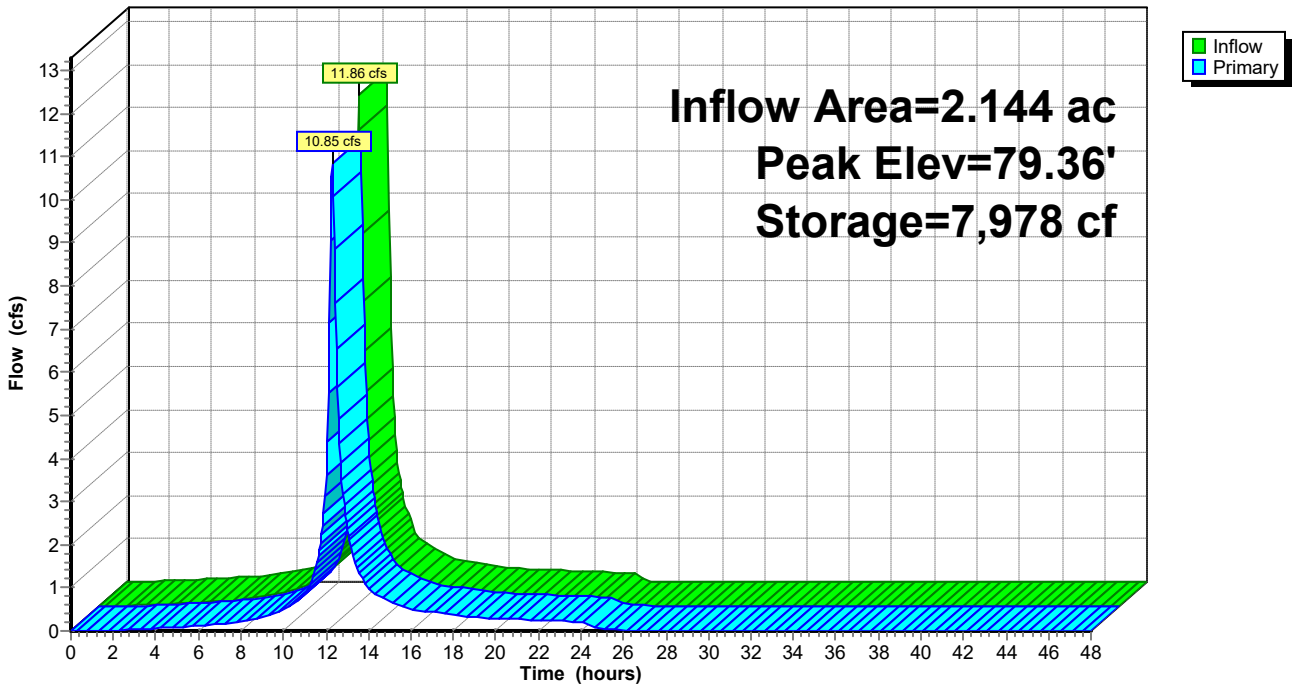
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
77.90	4,750	0	0
78.00	4,835	479	479
79.00	5,750	5,293	5,772
80.00	7,805	6,778	12,549
80.50	8,605	4,103	16,652

Device	Routing	Invert	Outlet Devices
#1	Primary	78.60'	**2' Wide Broadcrested Weir, Cv= 3.10 (C= 3.88)** Head (feet) 0.00 1.15 Width (feet) 2.00 10.40

Primary OutFlow Max=10.77 cfs @ 12.29 hrs HW=79.36' TW=0.00' (Dynamic Tailwater)
↑—**1=2' Wide Broadcrested Weir** (Weir Controls 10.77 cfs @ 2.98 fps)

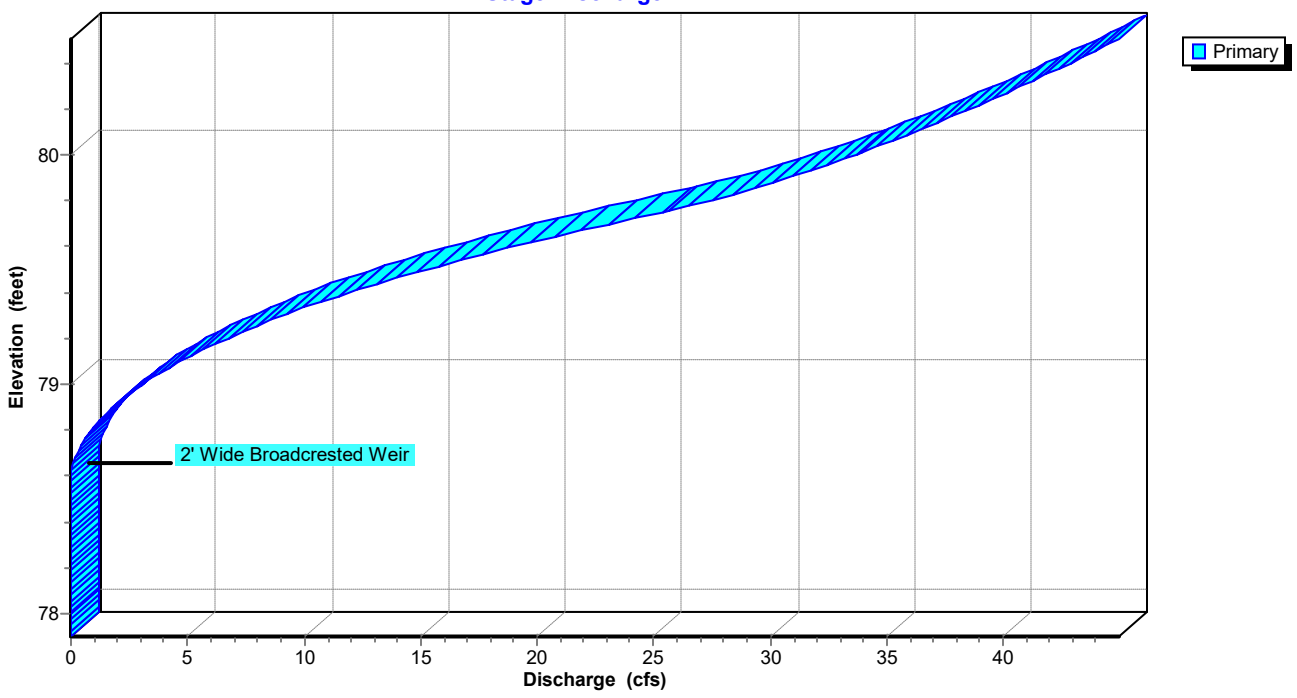
Pond B1: BASIN-1

Hydrograph

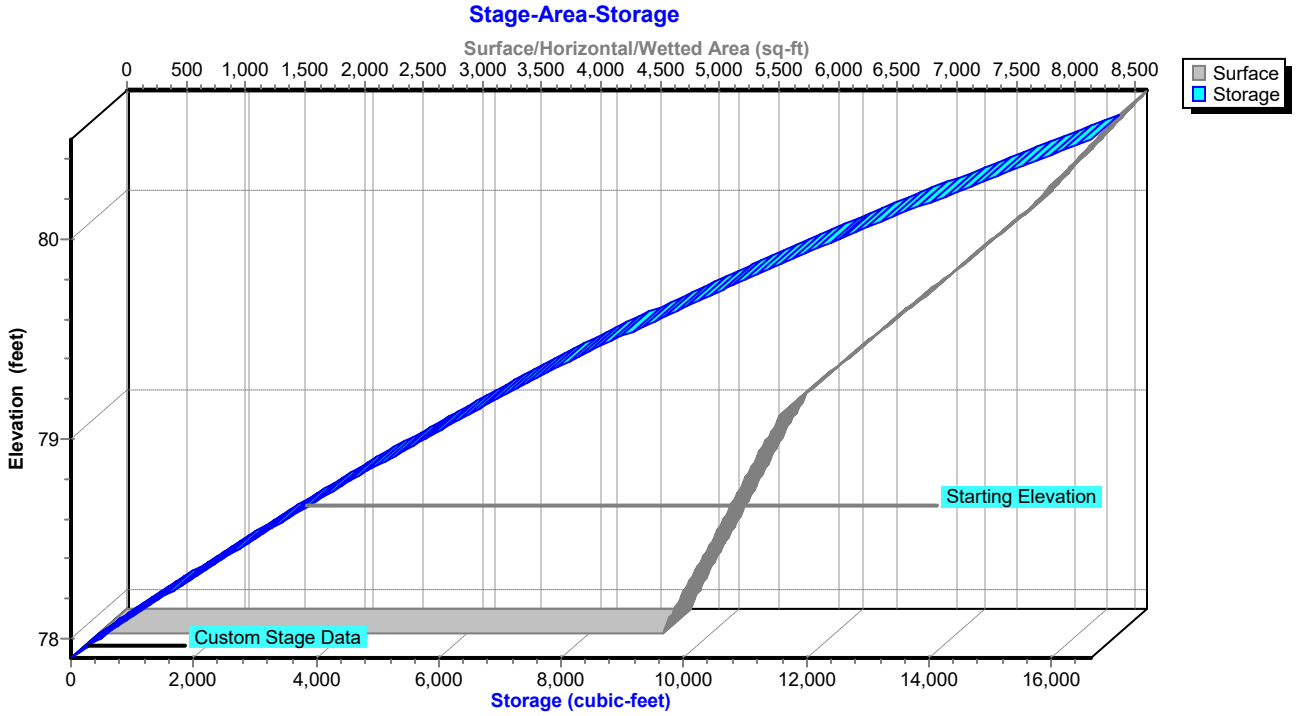


Pond B1: BASIN-1

Stage-Discharge



Pond B1: BASIN-1

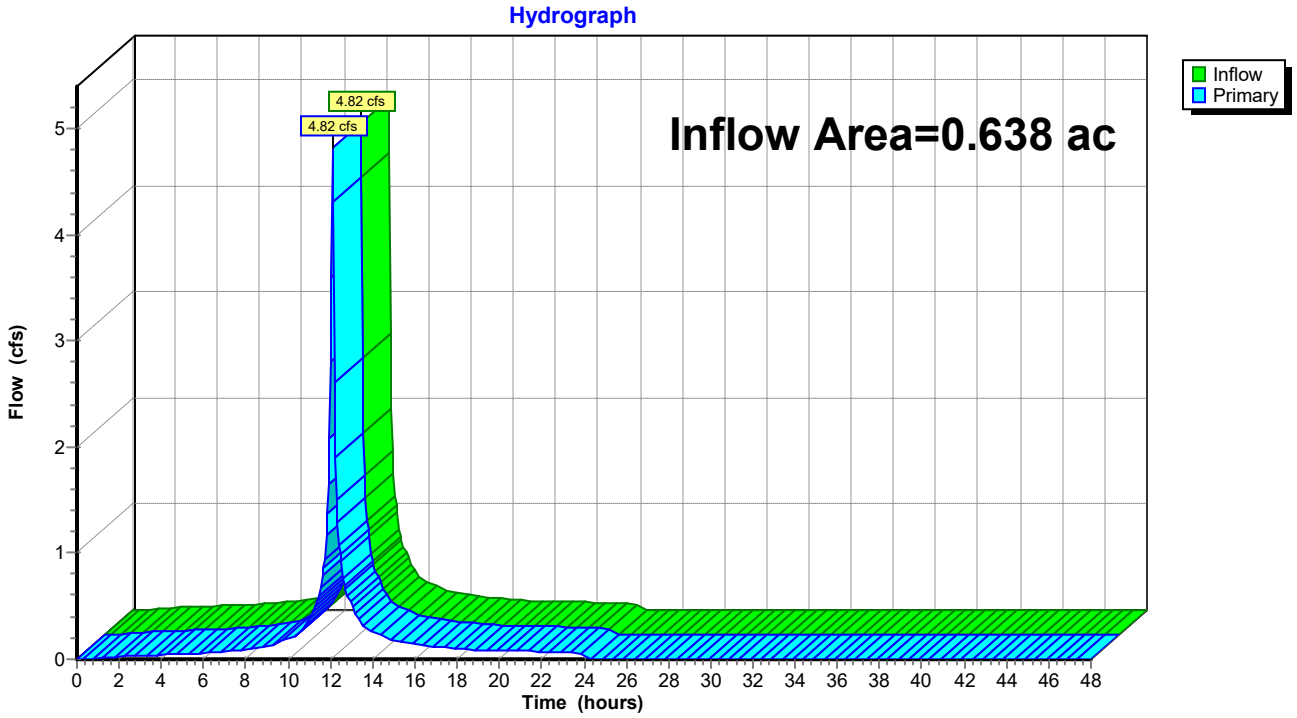


Summary for Link 1: PRDA-1

Inflow Area = 0.638 ac, 57.64% Impervious, Inflow Depth = 7.21" for 100-Year event
Inflow = 4.82 cfs @ 12.11 hrs, Volume= 0.384 af
Primary = 4.82 cfs @ 12.11 hrs, Volume= 0.384 af, Atten= 0%, Lag= 0.0 min
Routed to Link A : PT A

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 1: PRDA-1

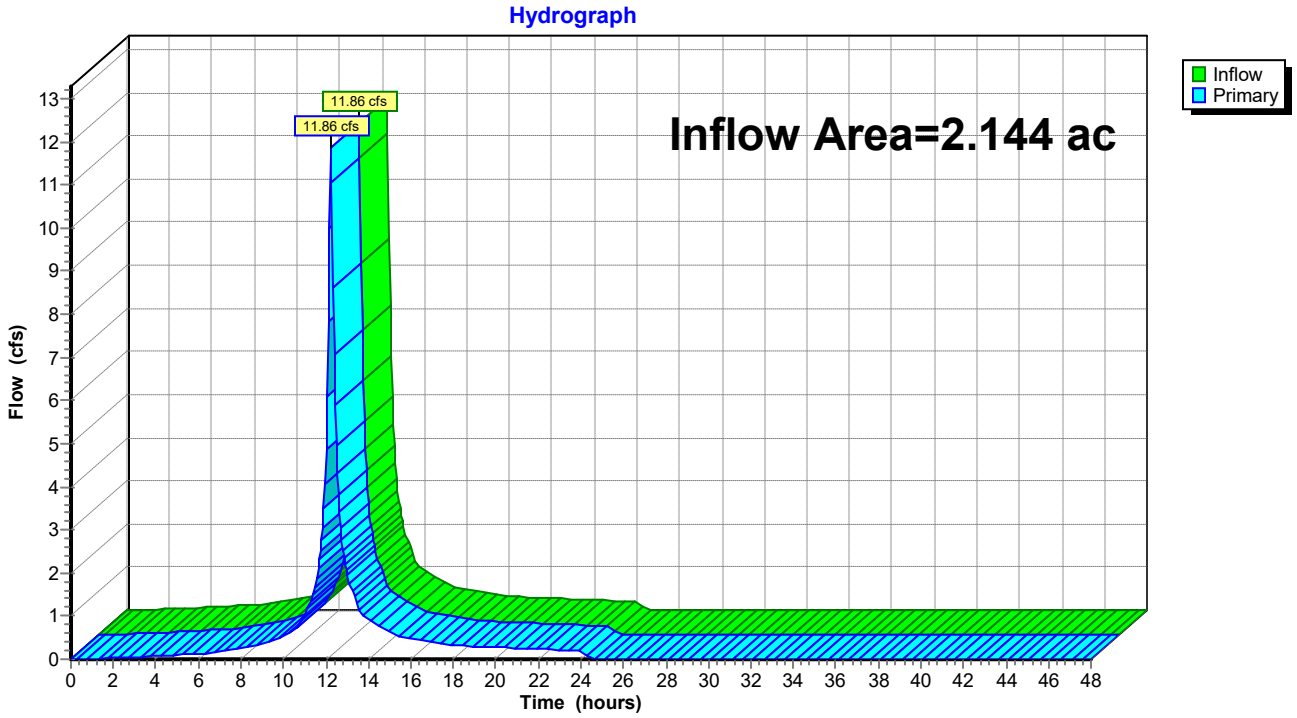


Summary for Link 2: PRDA-2

Inflow Area = 2.144 ac, 46.96% Impervious, Inflow Depth = 6.93" for 100-Year event
Inflow = 11.86 cfs @ 12.23 hrs, Volume= 1.238 af
Primary = 11.86 cfs @ 12.23 hrs, Volume= 1.238 af, Atten= 0%, Lag= 0.0 min
Routed to Pond B1 : BASIN-1

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link 2: PRDA-2

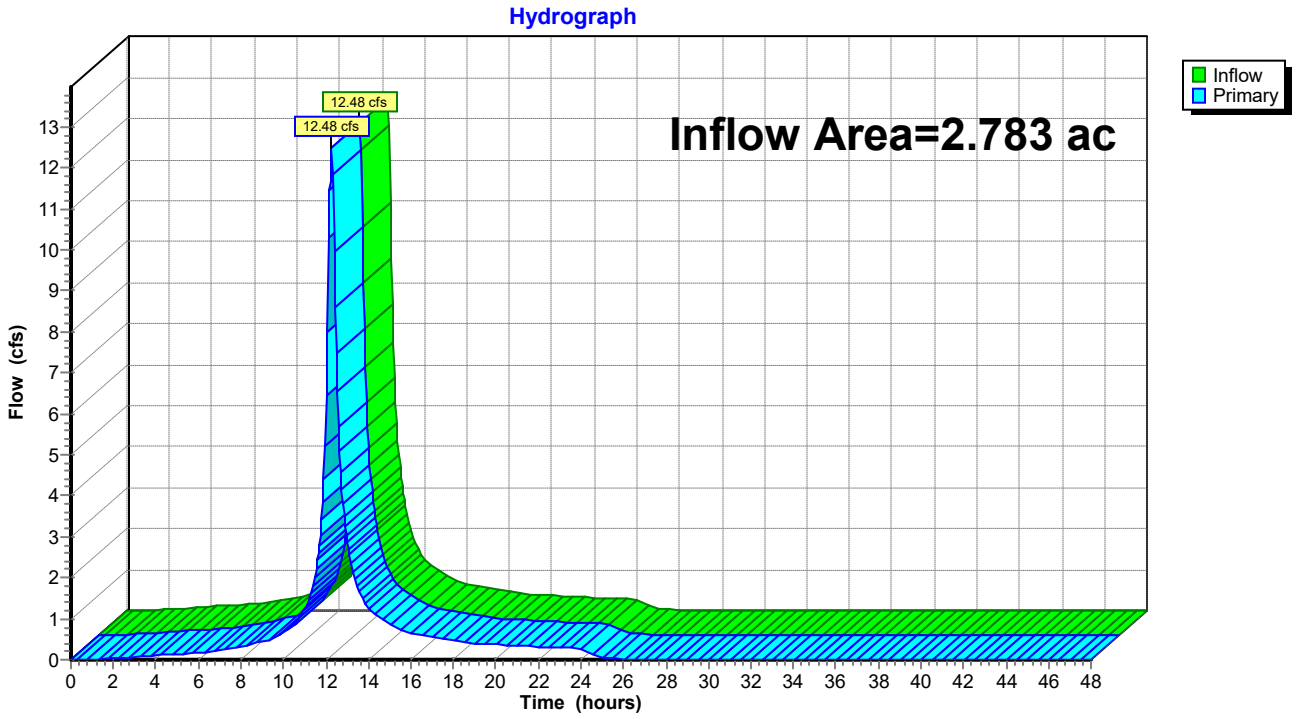


Summary for Link A: PT A

Inflow Area = 2.783 ac, 49.41% Impervious, Inflow Depth = 6.99" for 100-Year event
Inflow = 12.48 cfs @ 12.27 hrs, Volume= 1.621 af
Primary = 12.48 cfs @ 12.27 hrs, Volume= 1.621 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs

Link A: PT A



APPENDIX G

STORM SEWER CALCULATIONS

SCIULLO ENGINEERING SERVICES, LLC

STORM SEWER CALCULATIONS

Project: K&A 001.01
Computed By: DFW Date: 1/4/2022
Revised By: DFW Date: 3/6/2022

Sheet 1 Of 1
Pipe Material: HDPEP RCP
"n" Factor: 0.010 0.013

10 Year Storm

Location	From	To	Inc. Area Ac	C	Equiv. Area C * A	Total Area C * A	Tc min	I in/hr	Q CFS	Slope ft/ft	Pipe Dia. in	V FPS	Pipe Length ft	Flow Time min.	Pipe Cap. CFS	Ground Elev. Upper End	Ground Elev. Lower End	Invert Elev. Upper End	Invert Elev. Lower End
P-1	RD-2	CO-2	0.03	0.99	0.03	0.03	10.00	5.80	0.17	0.0100	6	3.72	83	0.37	0.73	83.25	83.00	81.25	80.42
P-2	CO-2	CO-4	---	---	---	0.03	10.37	5.71	0.17	0.0100	6	3.72	45	0.20	0.73	83.00	83.00	80.42	79.97
P-3	RD-1	CO-4	0.03	0.99	0.03	0.03	10.00	5.80	0.18	0.0184	6	5.04	83	0.27	0.99	83.25	83.50	81.50	79.97
P-4	CO-4	CO-5	---	---	---	0.06	10.57	5.67	0.35	0.0088	6	3.49	135	0.65	0.68	83.50	81.50	79.97	78.78
P-5	RD-4	CO-8	0.03	0.99	0.03	0.09	11.22	5.52	0.51	0.0088	6	3.49	83	0.40	0.68	81.50	81.50	78.78	78.05
P-6	RD-3	CO-7	0.03	0.99	0.03	0.03	10.00	5.80	0.17	0.0094	6	3.60	83	0.38	0.71	81.25	81.00	79.25	78.47
P-7	CO-7	CO-8	---	---	---	0.03	10.38	5.71	0.17	0.0094	6	3.60	45	0.21	0.71	81.00	81.50	78.47	78.05
P-8	CO-8	FES-1	---	---	---	0.12	11.62	5.45	0.67	0.0088	6	3.49	17	0.08	0.68	81.50	78.50	78.05	77.90
P-9	INLT-1	SLT DR-1	0.40	0.63	0.26	0.26	10.00	5.80	1.48	0.0017	12	2.43	10	0.07	1.91	80.00	80.00	78.50	78.48
SD	SLT DR-1	SLT DR-1	0.02	0.90	0.02	0.27	10.59	5.66	1.55	0.0017	12	2.43	15	0.10	1.91	80.00	80.00	78.48	78.46
P-10	SLT DR-1	INLT-3	---	---	---	0.27	10.70	5.63	1.55	0.0017	12	2.43	78	0.53	1.91	80.00	79.00	78.46	78.32
P-11	INLT-2	INLT-3	0.16	0.87	0.14	0.14	10.00	5.80	0.80	0.0125	12	6.59	42	0.11	5.18	80.85	79.00	78.85	78.32
P-12	INLT-3	SLT DR-2	0.06	0.63	0.04	0.45	11.23	5.52	2.48	0.0029	12	3.16	15	0.08	2.48	79.00	79.50	78.32	78.28
SD	SLT DR-2	SLT DR-2	0.01	0.99	0.01	0.46	11.31	5.51	2.53	0.0030	12	3.22	15	0.08	2.53	79.50	79.50	78.28	78.24
P-13	SLT DR-2	INLT-4	---	---	---	0.46	11.39	5.49	2.52	0.0030	12	3.22	90	0.47	2.53	79.50	79.25	78.24	77.97
P-14	INLT-4	HDWL-1	0.06	0.65	0.04	0.50	11.85	5.40	2.68	0.0034	12	3.41	21	0.10	2.68	79.25	79.50	77.97	77.90

CONDUIT OUTLET PROTECTION CALCULATIONS

Project: 83 Myrtle St Supportive Housing
Computed By: DFW Date: 3/6/2022
Revised By: Date:
Project Number K&A 001.01

Structure No. FES-1

25 Yr. Discharge (Q25)	0.77 cfs	q=unit discharge=Q25/Wo =	1.54
Do =	0.50 feet	HW Inv. = 77.90	
Wo =	0.50 feet	2Yr. Basin elevation	78.96
Tailwater (TW) =	1.06 feet		

Apron Length (La) = ((q x 3) / Do^0.5)
La = 6.53 feet

Apron Width (W) = 3 x Wo + 0.4(La)
W = 4.11 feet

Median Stone Dia.(D50) = (0.016/TW)x(q)^1.33
(D50) 0.03 feet Use 6" min.

Structure No. HDWL-1

25 Yr. Discharge (Q25)	3.11 cfs	q=unit discharge=Q25/Wo =	3.11
Do =	1.00 feet	HW Inv. = 77.90	
Wo =	1.00 feet	2Yr. Basin elevation	78.96
Tailwater (TW) =	1.06 feet		

Apron Length (La) = ((q x 3) / Do^0.5)
La = 9.33 feet

Apron Width (W) = 3 x Wo + 0.4(La)
W = 6.73 feet

Median Stone Dia.(D50) = (0.016/TW)x(q)^1.33
(D50) 0.07 feet Use 6" min.

APPENDIX H

SOIL PROFILE PITS AND PERMEABILITY TEST DATA

Map Scale: 1:4,500 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Union County, New Jersey
Survey Area Data: Version 14, Jun 1, 2020

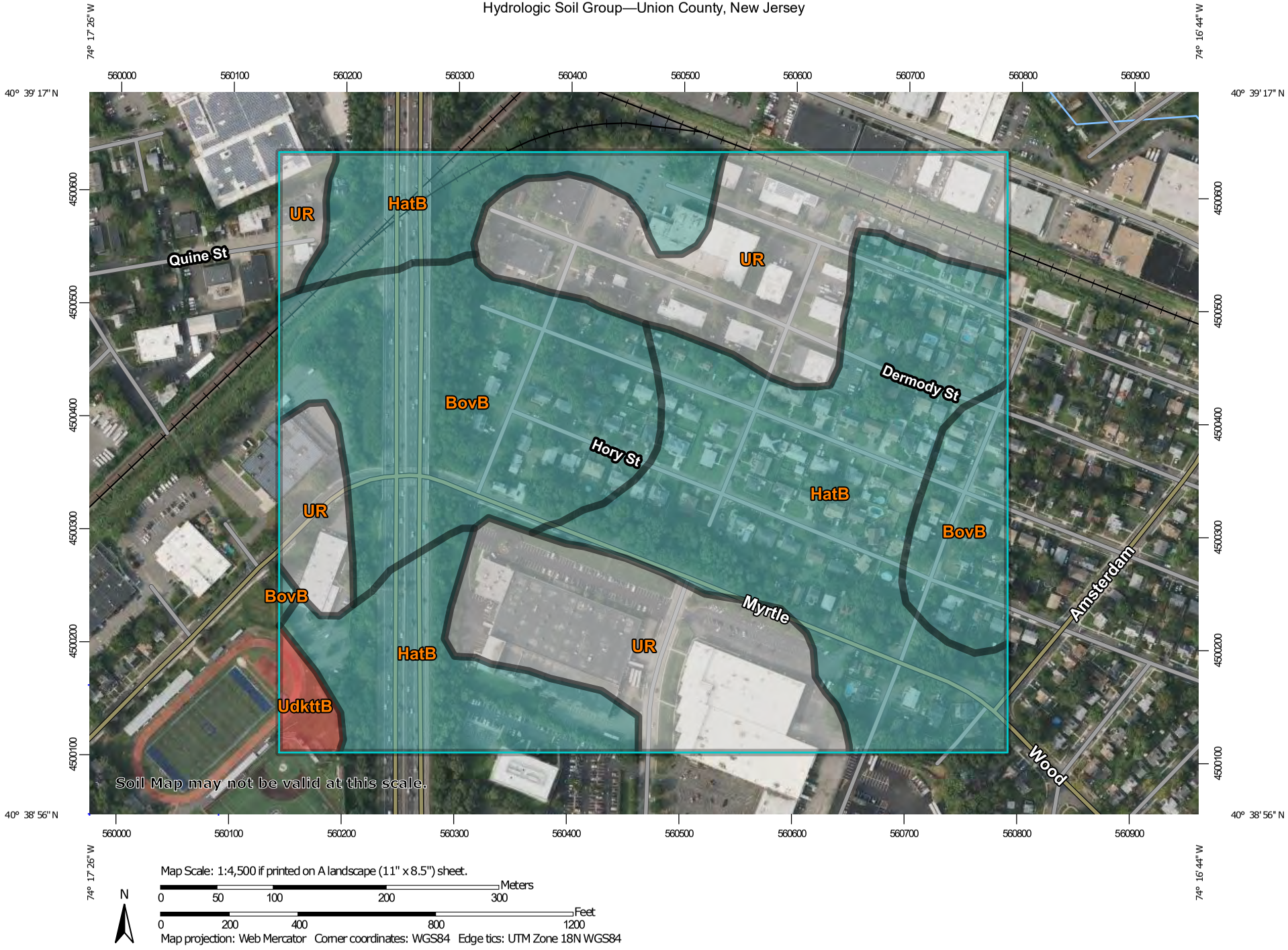
Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 14, 2020—Oct 3, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BovB	Boonton-Urban land-Haledon complex, 0 to 8 percent slopes	20.7	24.3%
HatB	Haledon-Urban land-Hasbrouck complex, 0 to 8 percent slopes	35.6	41.7%
UdkttB	Udorthents, loamy substratum, 0 to 8 percent slopes	1.0	1.2%
UR	Urban land	27.9	32.7%
Totals for Area of Interest		**85.3**	**100.0%**



Map Scale: 1:4,500 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Union County, New Jersey
Survey Area Data: Version 14, Jun 1, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 14, 2020—Oct 3, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BovB	Boonton-Urban land-Haledon complex, 0 to 8 percent slopes	C	20.7	24.3%
HatB	Haledon-Urban land-Hasbrouck complex, 0 to 8 percent slopes	C	35.6	41.7%
UdkttB	Udorthents, loamy substratum, 0 to 8 percent slopes	D	1.0	1.2%
UR	Urban land		27.9	32.7%
Totals for Area of Interest			**85.3**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Melick-Tully
& Associates

A Division of GZA

STORMWATER INVESTIGATION

PROPOSED GROUP HOME DEVELOPMENT
SCIULLO ENGINEERING SERVICES, LLC
83 Myrtle Street
Cranford, Union County, New Jersey

February 13, 2020
File No. 26.0092024.01

PREPARED FOR:
Sciullo Engineering Services, LLC
9615 Ventnor Avenue, Suite 3
Margate, New Jersey

Melick-Tully & Associates, a Division of GZA
117 Canal Road | South Bound Brook, NJ 08880
732-356-3400

GZA has 32 Offices Nationwide
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Eugene M. Gallagher, Jr., P.E., *Principal*
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GEOTECHNICAL
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February 13, 2020
File No. 26.0092024.01

Sciullo Engineering Services, LLC
9615 Ventnor Avenue, Suite 3
Margate, New Jersey 08402

Attention: Mr. Jason T. Sciullo, P.E., PP

Report
Stormwater Investigation
Proposed Group Home Development
Cranford, Union County, New Jersey
Sciullo Engineering Services, LLC

Introduction

This report presents the results of a stormwater investigation completed by Melick-Tully & Associates, a Division of GZA GeoEnvironmental, Inc. (MTA) for proposed stormwater management facilities for a proposed group home residential development which may be constructed in Cranford, Union County, New Jersey. The subject site is located at 83 Myrtle Street, as shown on the Site Location Map, Plate 1. Our work was performed in general conformance with our proposal dated August 21, 2018.

Proposed Construction

A draft plan provided to us which was prepared by Sciullo Engineering Services, LLC dated September 18, 2018 indicates that the proposed development will consist of two, four-unit special needs housing buildings each about 3,200 square feet in plan area. The buildings will be one story in height and of slab-on-grade construction.

Stormwater management facilities will be constructed to service the proposed development between the two proposed structures in the center of the property, one to the south near Myrtle Street and one to the north along the property line. No details of the system types or depths have been provided to us at the time of this report.

Purpose and Scope of Work

The purpose of our services was to:

1) explore the subsurface soil and groundwater conditions via test pits as close as possible to the proposed stormwater management facility locations;

2) collect tube samples of the upper soil layers for laboratory tube permeameter permeability testing; and

3) prepare a summary report of our findings for use by Sciullo Engineering in their evaluation and design of the stormwater improvements.

To accomplish these purposes, a subsurface exploration program of four supervised test pits was performed at the site near the proposed stormwater management facilities. The test pits were excavated using a Link Belt 135 excavator and extended to depths of 12 to 13.5 feet below grade. Test Pits 2 and 3 were relocated slightly to the south outside of the proposed management facility as the adjacent property owners to the north have encroached on the subject site with improvements and used the space for their backyards. In order to mitigate any potential conflicts with the adjacent property owners and our stormwater investigation, MTA voluntarily moved those two test pits as close as practical to the proposed location which was to the edge of the tree line. The locations of the test pits are shown in relation to existing and proposed site features on the Plot Plan, Plate 2.

All field work was performed under the direct technical supervision of a geologist from MTA. Our representative located the explorations in the field, maintained continuous logs of the test pits as the work proceeded, obtained bulk samples of the materials encountered in the test pits suitable for identification purposes and obtained relatively undisturbed tube samples from the test pits for laboratory tube permeameter permeability testing.

Detailed descriptions of the encountered subsurface conditions are indicated on the Logs of Test Pits, Plates 3A through 3D. The soils were visually classified in general accordance with the procedures of the United States Department of Agriculture Soil Classification System (USDA) described on Plate 4.

All soil samples were brought to our office, and selected samples were subjected to laboratory gradation, moisture content and tube permeameter permeability testing. The results of the laboratory moisture content testing are reported on the corresponding test pit logs. The results of the gradation testing are provided on the Gradation Curves, Plate 5. The permeability test results are presented in a subsequent section of this report.

The following discussions of our findings are subject to the Limitations attached as an Appendix to this report.

Site Conditions

Surface Features: The property is a moderately wooded and/or brushed-covered site with landscaped grass areas on the northern half near the adjacent properties. Much of the northern half of the property is currently being used by the adjacent property owners, and their backyards encroach on the subject

site. A playset belonging to one of the adjacent property owners is present within the northern proposed stormwater management facility. Additional area is covered by lawn area.

Topographic information provided to us indicates the ground surface elevations at the property slope downward from the northwest at about Elevation +87 feet to about Elevation +79 feet in the southeast.

Subsurface Conditions: Test Pits 1, 3, and 4 encountered 6 to 15 inches of topsoil at the ground surface while Test Pit 2 encountered about 1.5 feet of silt loam fill at the surface. The topsoil and fill materials were underlain by clay loam and sandy clay loam soils which extended to the bottom of the test pits at depths of 12 to 13.5 feet.

Groundwater was observed in the test pits at depths of about 2.5 to 4 feet below the existing ground surface. Mottling, which can be indicative of seasonally saturated conditions, was observed at 2.5 feet below the ground surface in all of the test pits.

Findings

Tube permeameter permeability tests were performed on the clayey subsoils collected from the Test Pits. The table below provides a summary of the laboratory tube permeameter permeability test results.

Test Pit No.	Depth (ft)	Permeability Replicate A (in/hr)	Permeability Replicate B (in/hr)	USDA Visual Soil Description
1	1.5	0.21	0.05	Clay Loam
1	9	0.10	0.08	Sandy Clay Loam
2	2	0.05	0.01	Clay Loam
2	4	0.01	0.01	Sandy Clay Loam
3	1.5	0.19	0.13	Clay Loam
4	1	0.01	0.01	Clay Loam

Please contact us if you have any questions regarding this information.

The following Plates and Appendix are attached and complete this report:

Plate 1 – Site Location Map
Plate 2 – Plot Plan
Plates 3A through 3D – Logs of Test Pits
Plate 4 – USDA Soil Textural Chart
Plate 5 – Gradation Curves
Appendix – Limitations

Respectfully submitted,

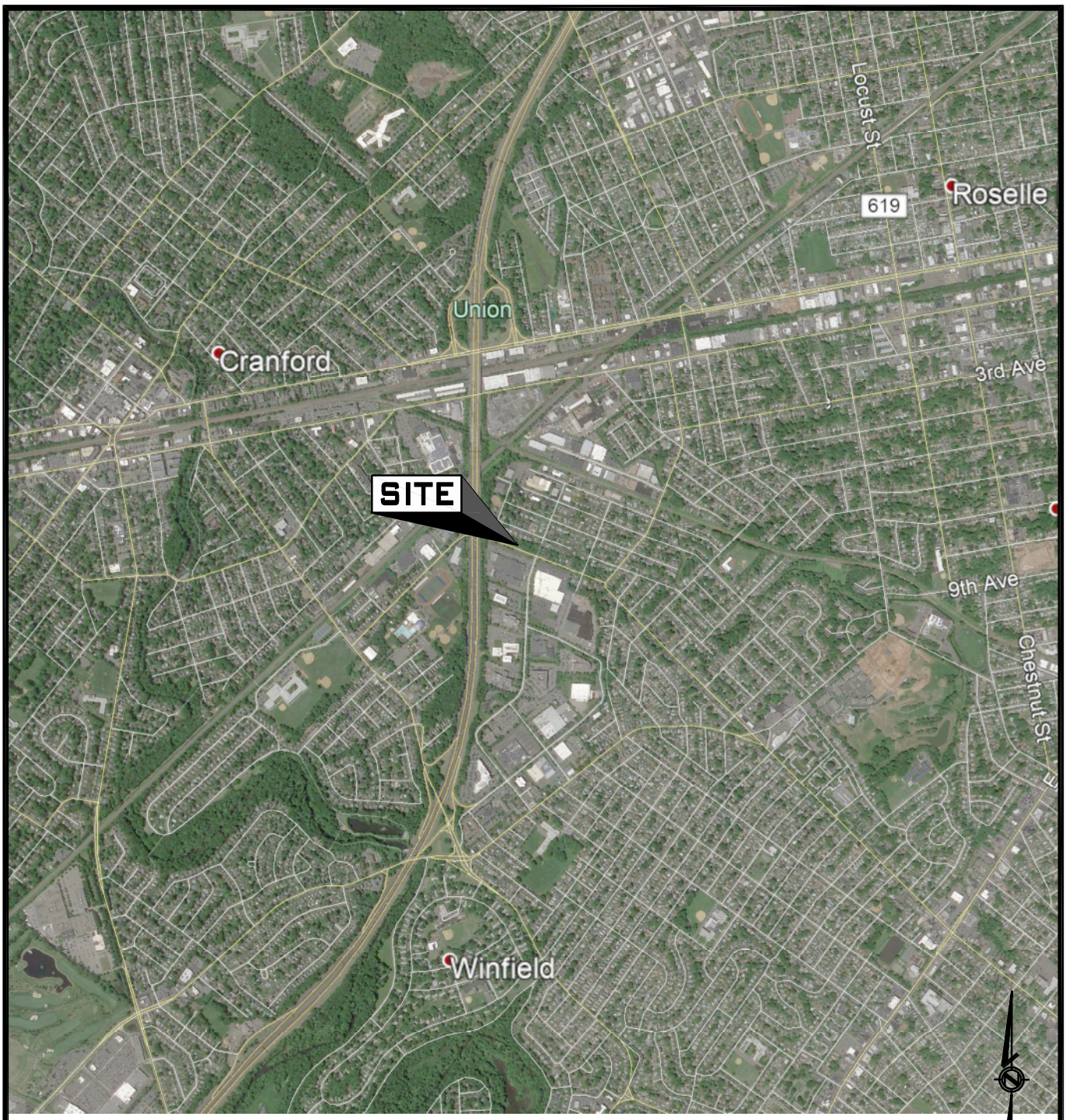
MELICK-TULLY and ASSOCIATES,
a Division of GZA GeoEnvironmental, Inc.

Cory S. Karinja, P.E.
Associate Project Manager

Eugene M. Gallagher, P.E.
Principal

Mark R. Denno, P.E.
Consultant/Reviewer

CSK:EMG/pm



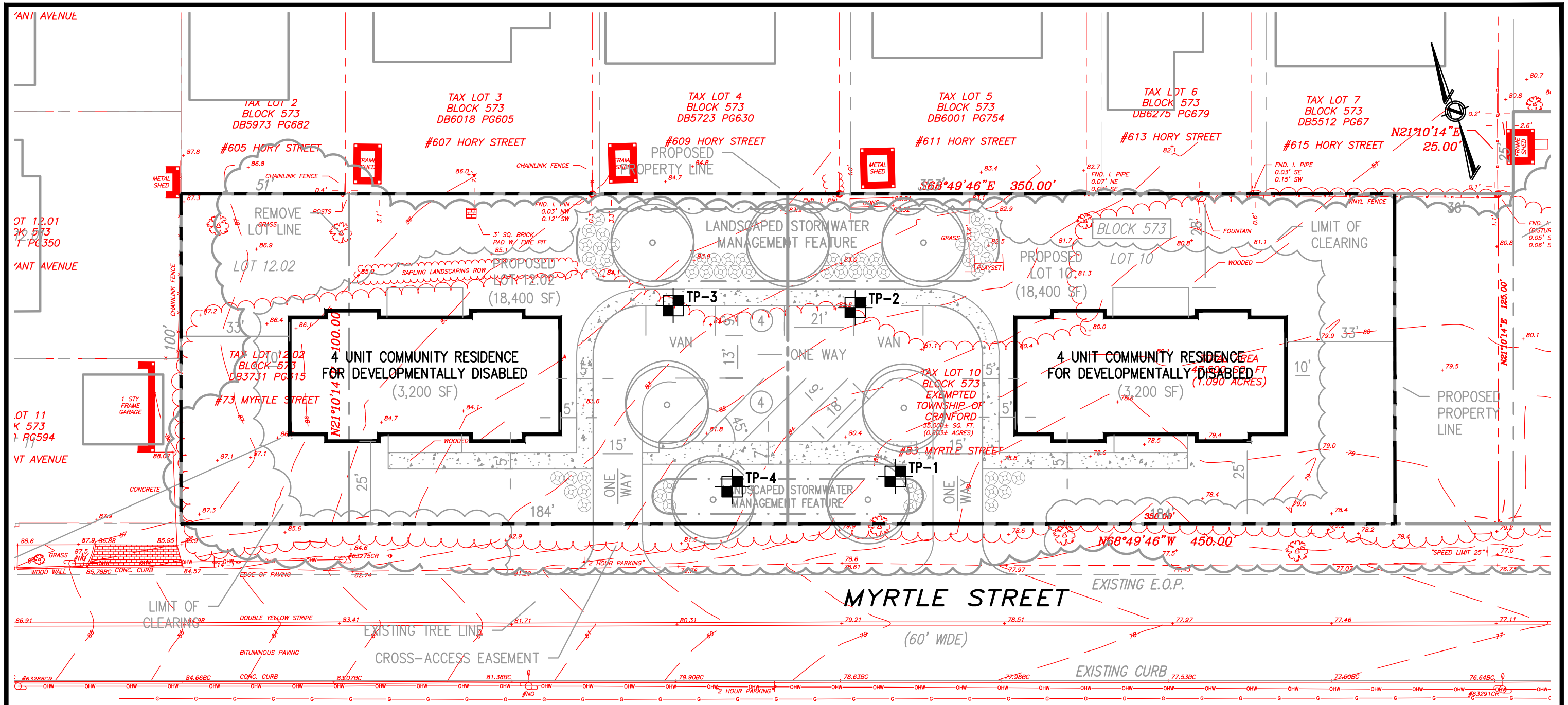
Aerial Photo courtesy of Google Earth Pro

MELICK–TULLY AND ASSOCIATES
A Division of GZA
Geotechnical Engineers & Environmental Consultants
117 Canal Road
South Bound Brook, New Jersey 08880
(732) 356–3400

SITE LOCATION MAP

PROPOSED GROUP HOME DEVELOPMENT–STORMWATER
CRANFORD, UNION COUNTY, NEW JERSEY
SCIULLO ENGINEERING SERVICES, LLC

JOB NO.	FILE NO.	DR. BY	CHK. BY	DATE	SCALE	PLATE
26.0092024.01	–	VJD	CSK	2/4/20	1"=2,000'	1



KEY:

TP-1 NUMBER AND APPROXIMATE LOCATION OF TEST PITS PERFORMED FOR THIS STUDY

NOTES:

1. This drawing is part of Melick–Tully and Associates, a Division of GZA, Report No. 26.0092024.01 and should be read together with the report for complete evaluation.

2. General layout was obtained from two drawings, the first prepared by Sciullo Eng., entitled "Concept Plan" not dated, scale 1"= 40'and another prepared by Vargo Eng., entitled "Boundary & Topographic Survey Tax Lots 9 & 10, Block 573, Cranford Township" dated 1/24/20, scale 1"= 20'.

PLOT PLAN

PROPOSED GROUP HOME DEVELOPMENT–STORMWATER
CRANFORD, UNION COUNTY, NEW JERSEY
SCIULLO ENGINEERING SERVICES, LLC

MELICK–TULLY AND ASSOCIATES
A Division of GZA
Geotechnical Engineers & Environmental Consultants
117 Canal Road
South Bound Brook, New Jersey 08880
(732) 356–3400

JOB NO.	FILE NO.
26.0092024.01	–

DR. BY	CHK. BY	DATE	SCALE	PLATE
VJD	CSK	2/4/20	1"= 30'	2

TEST PIT LOG

MTA, a Division of GZA GeoEnvironmental, Inc *Engineers and Scientists*	**Sciullo Engineering Services, LLC** **Cranford, NJ**	**EXPLORATION NO.: TP-1** **SHEET: 1 of 1** **PROJECT NO: 26.0092024.01** **REVIEWED BY: Cory Karinja**

Logged By: Glenn Zmigrodski
Contractor:
Operator:

Test Pit Location: See Plan
Ground Surface Elev. (ft.): 79.5

Final Test Pit Depth (ft.): 12
Date Start - Finish: 1/27/2020 - 1/27/2020

Type of Excavator:

Excavator Model:

Groundwater Depth (ft.)			
Date	**Time**	**Water Depth**	**Stab.Time**
1/27/20		3'	

Depth (ft)	Sample No.	Sample Depth (ft.)	Stratum Depth (ft.)	Symbol	Sample Description and Identification	Water Content (%)	Remark
1			0-1.25		0-15" Topsoil - Dark brown (7.5YR, 3/3) silt loam, weak fine angular blocky, moist, friable, abrupt smooth boundary, common medium roots		
2	S1, T1	1.5	1.25-2.7		15"-32" Strong brown (7.5YR, 4/6) clay loam, moderate medium angular blocky, moist, friable, clear wavy boundary		
3			2.7-6		32"-72" Dusky red (10R, 3/4) clay loam, 10% gravel, 2% cobbles, moderate medium angular blocky, wet, friable, gradual irregular boundary, few fine faint gray (10YR, 6/1) mottles encountered @ 32 inches to 72 inches		
4	S2, T2	4					
5							
6			6-12		72"-144" Weak red (10YR, 4/4) sandy clay loam, 10% gravel, 5% cobbles, 5% stone/boulders, moderate medium angular blocky, wet, friable, few fine faint gray (10YR, 6/1) mottles encountered @ 72 inches to 144 inches.		
7							
8							
9	S3, T3	9				12.6	
10							
11							
12							
13					End of exploration at 12 feet.		
14					Moderate groundwater seepage encountered @ 3' Mottling @ 32"		
15							
16							
17							
18							
19							
20							

REMARKS

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Plate No.:3A

3 - MTA TEST PIT STRATUM LINES; 2/13/2020; 2:40:08 PM

TEST PIT LOG

MTA, a Division of GZA GeoEnvironmental, Inc
Engineers and Scientists

Sciullo Engineering Services, LLC
Cranford, NJ

EXPLORATION NO.: TP-2
SHEET: 1 of 1
PROJECT NO: 26.0092024.01
REVIEWED BY: Cory Karinja

Logged By: Glenn Zmigrodski
Contractor:
Operator:

Test Pit Location: See Plan
Ground Surface Elev. (ft.): 82.5

Final Test Pit Depth (ft.): 12.5
Date Start - Finish: 1/27/2020 - 1/27/2020

Type of Excavator:

Excavator Model:

Groundwater Depth (ft.)			
Date	**Time**	**Water Depth**	**Stab.Time**
1/27/20		4'	

Depth (ft)	Sample No.	Sample Depth (ft.)	Stratum Depth (ft.)	Symbol	Sample Description and Identification	Water Content (%)	Remark
1			0-1.5		0-18" FILL - Weak red (10R, 4/3) silt loam, weak fine angular blocky, moist, friable, clear wavy boundary, few medium roots		
2	S1, T1	2	1.5-2.7		18"-32" Strong brown (7.5YR, 4/6) clay loam, moderate medium angular blocky, moist, friable, clear wavy boundary, common medium roots		
3			2.7-8		32"-96" Weak red (10R, 5/4) sandy clay loam, 2% gravel, moderate medium angular blocky, wet, firm, clear wavy boundary, few fine faint gray (10YR, 5/1) mottles encountered @ 32 inches to 96 inches		
4	S2, T2	4				17.7	
5							
6							
7							
8							
9	S3, T3	9	8-12.5		96"-150" Weak red (10R, 4/4) sandy clay loam, 10% gravel, 10% cobbles, moderate medium angular blocky, wet, friable, few fine faint gray (10YR, 6/1) mottles encountered @ 96 inches to 150 inches		
10							
11							
12							
13					End of exploration at 12.5 feet.		
14					Moderate groundwater seepage encountered @ 4'		
15					Mottling @ 32"		
16							
17							
18							
19							
20							

REMARKS

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Plate No.:3B

3 - MTA TEST PIT STRATUM LINES; 2/13/2020; 2:40:09 PM

TEST PIT LOG

MTA, a Division of GZA GeoEnvironmental, Inc
Engineers and Scientists

Sciullo Engineering Services, LLC
Cranford, NJ

EXPLORATION NO.: TP-3
SHEET: 1 of 1
PROJECT NO: 26.0092024.01
REVIEWED BY: Cory Karinja

Logged By: Glenn Zmigrodski
Contractor:
Operator:

Test Pit Location: See Plan
Ground Surface Elev. (ft.): 83.5

Final Test Pit Depth (ft.): 13.5
Date Start - Finish: 1/27/2020 - 1/27/2020

Type of Excavator:

Excavator Model:

Groundwater Depth (ft.)			
Date	**Time**	**Water Depth**	**Stab.Time**
1/27/20		3'	

Depth (ft)	Sample No.	Sample Depth (ft.)	Stratum Depth (ft.)	Symbol	Sample Description and Identification	Water Content (%)	Remark
1			0-1		0-12" Topsoil - Dark brown (7.5YR, 3/3) silt loam, weak fine angular blocky, moist, friable, abrupt smooth boundary, few medium roots		
2	S1, T1	1.5	1-2.5		12"-30" Strong brown (7.5YR, 4/6) clay loam, moderate medium angular blocky, moist, friable, clear wavy boundary	27.6	
3			2.5-6		30"-72" Weak red (10R, 4/4) clay loam, 10% gravel, 5% cobbles, moderate medium angular blocky, wet, friable, clear wavy boundary, few fine faint gray (10YR, 6/1) mottles encountered @ 30 inches to 72 inches		
4	S2, T2	4					
5							
6			6-13.5		72"-162" Weak red (10R, 4/4) sandy clay loam to clay loam, 10% gravel, 10% cobbles, moderate medium angular blocky, wet, friable, few fine faint gray (10YR, 6/1) mottles encountered @ 72 inches to 162 inches		
7							
8							
9							
10	S3, T3	10					
11							
12							
13							
14					End of exploration at 13.5 feet.		
15					Slight groundwater seepage encountered @ 3'		
16					Moderate to rapid groundwater seepage encountered @ 6'		
17					Mottling @ 30"		
18							
19							
20							

REMARKS

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Plate No.:3C

3 - MTA TEST PIT STRATUM LINES; 2/13/2020; 2:40:09 PM

TEST PIT LOG

MTA, a Division of GZA GeoEnvironmental, Inc
Engineers and Scientists

Sciullo Engineering Services, LLC
Cranford, NJ

EXPLORATION NO.: TP-4
SHEET: 1 of 1
PROJECT NO: 26.0092024.01
REVIEWED BY: Cory Karinja

Logged By: Glenn Zmigrodski
Contractor:
Operator:

Test Pit Location: See Plan
Ground Surface Elev. (ft.): 81.5

Final Test Pit Depth (ft.): 12.5
Date Start - Finish: 1/27/2020 - 1/27/2020

Type of Excavator:

Excavator Model:

Groundwater Depth (ft.)			
Date	**Time**	**Water Depth**	**Stab.Time**
1/27/20		2.5	

Depth (ft)	Sample No.	Sample Depth (ft.)	Stratum Depth (ft.)	Symbol	Sample Description and Identification	Water Content (%)	Remark
1	S1, T1	1	0-0.5		0-6" Topsoil - Dark brown (7.5YR, 3/2) silt loam, weak fine angular blocky, moist, friable, abrupt smooth boundary, common medium roots		
2			0.5-2.5		6"-30" Strong brown (7.5YR, 4/6) clay loam, moderate medium angular blocky, moist, friable, clear wavy boundary		
3			2.5-6		30"-72" Weak red (10R, 4/4) clay loam, moderate medium angular blocky, wet, friable, gradual irregular boundary, common medium distinct gray (10YR, 6/1) mottles encountered @ 30 inches to 72 inches		
4	S2, T2	4					
5							
6			6-12.5		72"-150" Weak red (10R, 4/4) clay loam, 10% gravel, 10% cobbles, moderate medium angular blocky, wet, friable, few fine faint gray (10YR, 6/1) mottles encountered @ 72 inches to 150 inches		
7							
8							
9							
10	S3, T3	10					
11							
12							
13					End of exploration at 12.5 feet.		
14					Moderate groundwater seepage encountered @ 2.5'		
15					Rapid groundwater seepage encountered @ 6'		
16					Mottling @ 30"		
17							
18							
19							
20							

REMARKS

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Plate No.:3D

3 - MTA TEST PIT STRATUM LINES; 2/13/2020; 2:40:09 PM

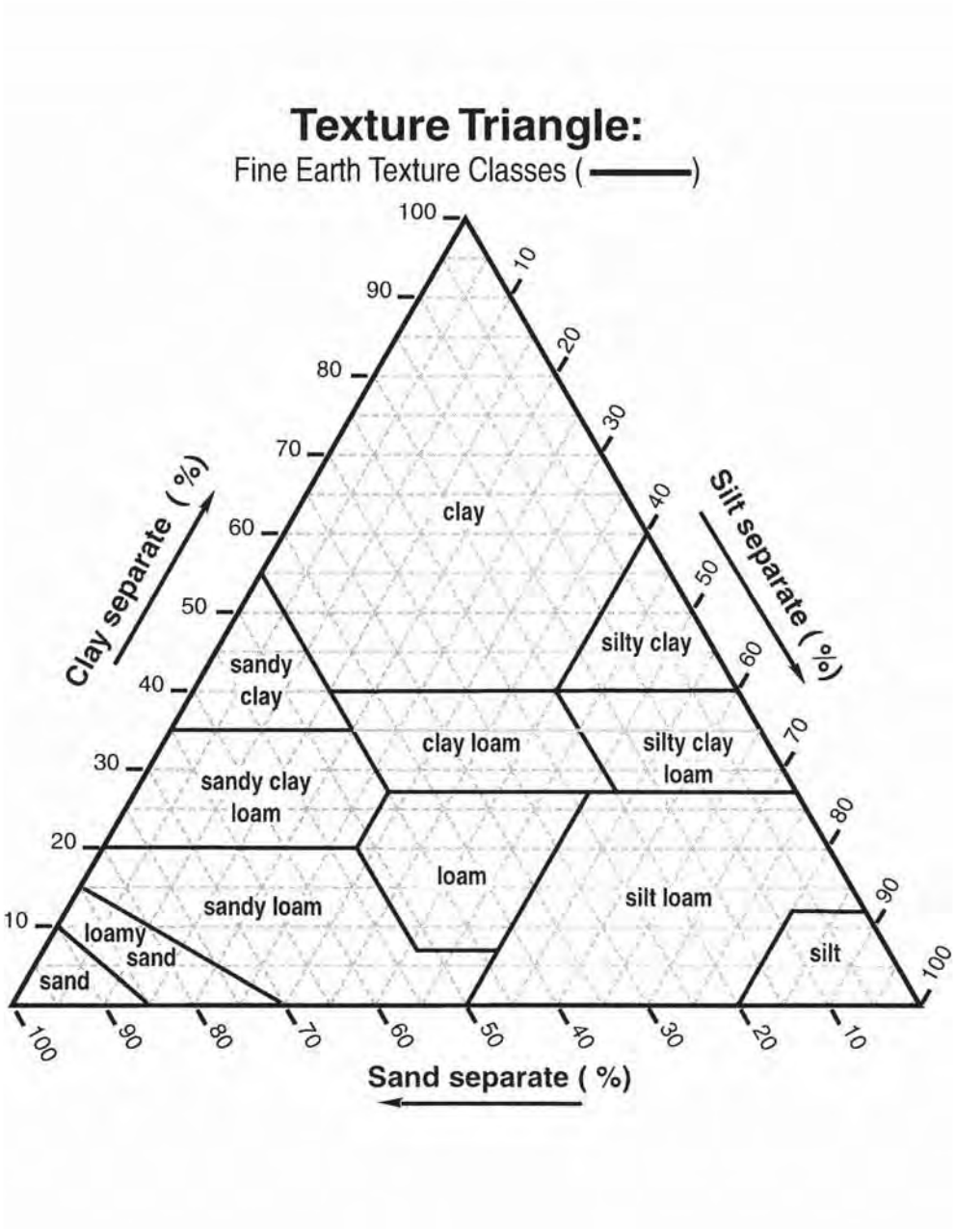
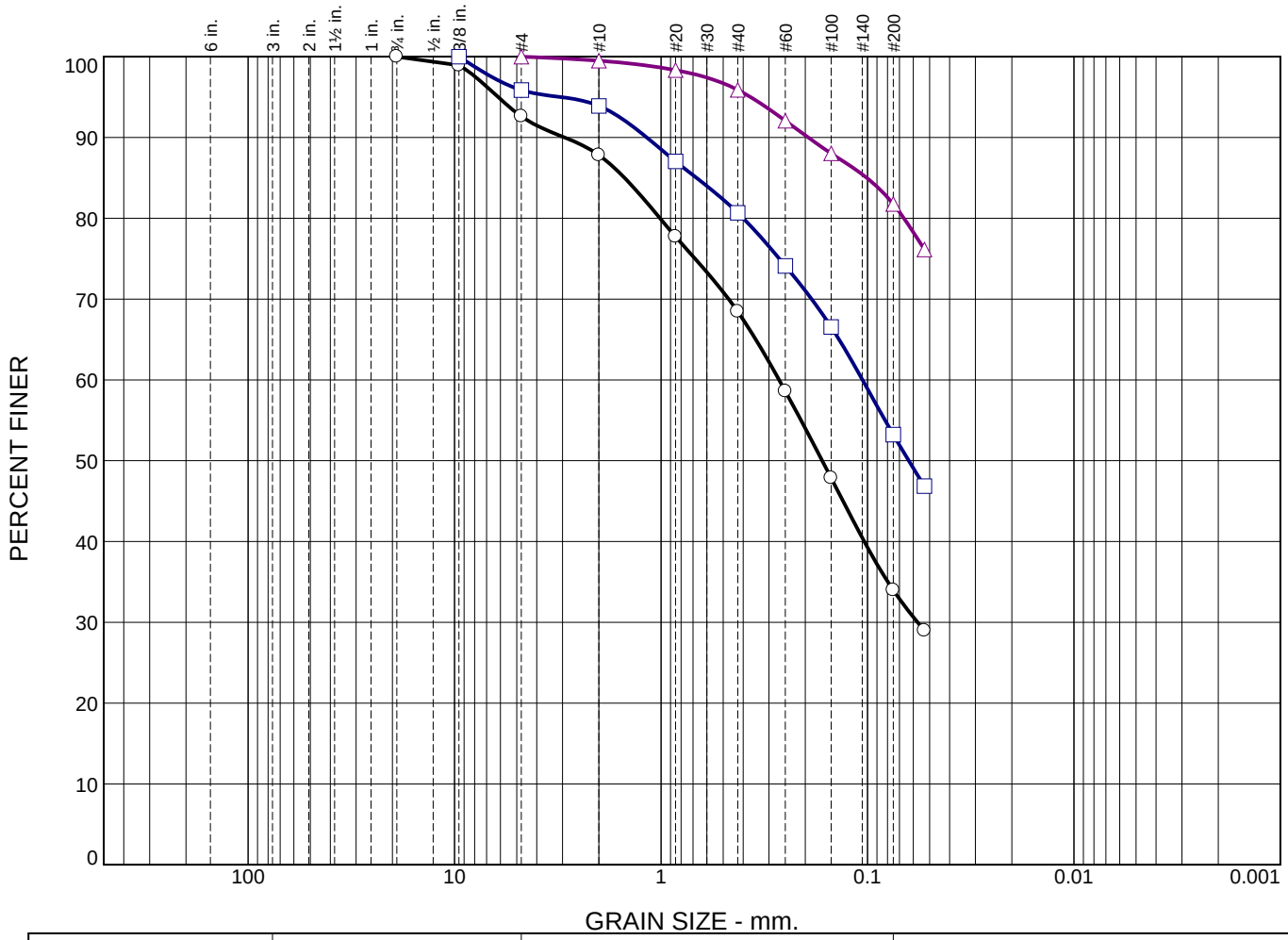

Texture Triangle:
Fine Earth Texture Classes (———)
Clay separate (%)
Silt separate (%)
Sand separate (%)
clay
silty clay
sandy clay
clay loam
silty clay loam
sandy clay loam
loam
silt loam
sandy loam
loamy sand
sand
silt
100
90
80
70
60
50
40
30
20
10

PLATE 4

Gradation Curve(s)



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	7.4	4.8	19.4	34.4	34.0	
□	0.0	0.0	4.1	2.0	13.2	27.5	53.2	
△	0.0	0.0	0.0	0.5	3.6	14.1	81.8	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	TP-1	S-3	9	Sandy clay loam.	
□	TP-2	S-2	4	Sandy clay loam	
△	TP-3	S-1	1.5	Clay loam.	

Melick-Tully & Associates
a Division of GZA GeoEnvironmental, Inc.
South Bound Brook, NJ

Client: Sciullo Engineering Services, LLC
Project: Group Home Development, Cranford, NJ
Project No.: 26.0092024.00 **Plate** 5

APPENDIX - Limitations

APPENDIX

Limitations

A. Subsurface Information

Locations: The locations of the explorations were approximately determined by tape measurement from existing site features. Elevations of the explorations were approximately determined by interpolation between contours shown on topographic plans provided to us. The locations and elevations of the explorations should be considered accurate only to the degree implied by the method used.

Interface of Strata: The stratification lines shown on the individual logs of the subsurface explorations represent the approximate boundaries between soil types, and the transitions may be gradual.

Field Logs/Final Logs: A field log was prepared for each exploration by a member of our staff. The field log contains factual information and interpretation of the soil conditions between samples. Our recommendations are based on the final logs as shown in this report and the information contained therein, and not on the field logs. The final logs represent our interpretation of the contents of the field logs, and the results of the laboratory observations and/or tests of the field samples.

Water Levels: Water level readings have been made in the explorations at times and under conditions stated on the individual logs. These data have been reviewed and interpretations made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater will occur due to variations in rainfall, temperature, and other factors.

Pollution/Contamination: Unless specifically indicated to the contrary in this report, the scope of our services was limited only to investigation and evaluation of the geotechnical engineering aspects of the site conditions, and did not include any consideration of potential site pollution or contamination resulting from the presence of chemicals, metals, radioactive elements, etc. This report offers no facts or opinions related to potential pollution/contamination of the site.

Environmental Considerations: Unless specifically indicated to the contrary in this report, this report does not address environmental considerations which may affect the site development, e.g., wetlands determinations, flora and fauna, wildlife, etc. The conclusions and recommendations of this report are not intended to supersede any environmental conditions which should be reflected in the site planning.

B. Applicability of Report

This report has been prepared in accordance with generally accepted soils and foundation engineering practices for the exclusive use of Sciullo Engineering Services, LLC for specific application to the design of the proposed stormwater management facilities. No other warranty, expressed or implied, is made.

This report may be referred to in the project specifications for general information purposes only, but should not be used as the technical specifications for the work, as it was prepared for design purposes exclusively.

C. Reinterpretation of Recommendations

Change in Location or Nature of Facilities: In the event that any changes in the nature, design or location of the facilities are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing.

Changed Conditions During Construction: The analyses and recommendations submitted in this report are based in part upon the data obtained from four widely-spaced test pit excavations performed for this study. The nature and extent of variations between the explorations may not become evident until construction. If variations then appear evident, it will be necessary to reevaluate the recommendations of this report.

Changes in State-of-the-Art: The conclusions and recommendations contained in this report are based upon the applicable standards of our profession at the time this report was prepared.

D. Use of Report by Prospective Bidders

This soil and foundation engineering report was prepared for the project by Melick-Tully and Associates, a Division of GZA GeoEnvironmental Inc. (MTA) for design purposes and may not be sufficient to prepare an accurate bid. Contractors utilizing the information in the report should do so with the express understanding that its scope was developed to address design considerations. Prospective bidders should obtain the owner's permission to perform whatever additional explorations or data gathering they deem necessary to prepare their bid accurately.

E. Construction Observation

We recommend that MTA be retained to provide on-site soils engineering services during the earthwork construction and foundation phases of the work. This is to observe compliance with the design concepts and to allow changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

Melick-Tully
& Associates

A Division of GZA

SOILS AND FOUNDATION INVESTIGATION

PROPOSED GROUP HOME DEVELOPMENT
SCIULLO ENGINEERING SERVICES, LLC
83 Myrtle Street
Cranford, Union County, New Jersey

February 13, 2020
File No. 26.0092024.00

PREPARED FOR:
Sciullo Engineering Services, LLC
9615 Ventnor Avenue, Suite 3
Margate, New Jersey

Melick-Tully & Associates, a Division of GZA
117 Canal Road | South Bound Brook, NJ 08880
732-356-3400

GZA has 32 Offices Nationwide
www.melick-tully.com www.gza.com

Melick-Tully
& Associates
A Division of GZA

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Robert E. Schwankert, P.E., *Principal*
Mark R. Denno, P.E., *Principal*
Christopher P. Tansey P.E., *Associate Principal*
Todd E. Horowitz, P.E., *Associate Principal*

February 13, 2020
File No. 26.0092024.00

Sciullo Engineering Services, LLC
9615 Ventnor Avenue, Suite 3
Margate, New Jersey 08402

Attention: Mr. Jason T. Sciullo, P.E., PP

Report
Soils and Foundation Investigation
Proposed Group Home Development
Cranford, Union County, New Jersey
Sciullo Engineering Services, LLC

Introduction

This report presents the results of a subsurface investigation performed by Melick-Tully and Associates, a Division of GZA GeoEnvironmental, Inc. (MTA) for a proposed group home residential development which may be constructed in Cranford, Union County, New Jersey. The subject site is located at 83 Myrtle Street. The approximate location of the site is shown on the Site Location Map, Plate 1. This report was prepared in general accordance with our proposal dated July 13, 2018.

Proposed Construction

A draft plan provided to us prepared by Sciullo Engineering Services, LLC dated September 18, 2018 indicates that the proposed development will consist of two, four-unit special needs housing buildings each about 3,200 square feet in plan area. The buildings will be one story in height and of slab-on-grade construction.

Structural loading information has not been provided to us, but structures of the type planned typically impose relatively light foundation and floor slab loads. No proposed grading plan was provided.

Purpose and Scope of Work

The purpose of our services was to:

1) explore the subsurface soil and groundwater conditions within accessible locations around the proposed building areas;

2) estimate the relevant geotechnical engineering properties of the encountered materials;

3) evaluate the site foundation requirements considering the anticipated structural loads and encountered subsurface conditions;

4) recommend an appropriate type of foundation for support of the proposed structures, and provide geotechnical-related foundation design and installation criteria, including an estimate of the Site Class as defined by the International Building Code 2018, New Jersey Edition, for seismic design purposes;

5) provide recommendations for the support and the need for subdrainage of the ground level floor slabs;

6) estimate the post-construction settlements of the recommended floor and foundation systems;

7) provide geotechnical-related parameters for use in pavement design; and

8) discuss appropriate earthwork operations or considerations consistent with the proposed construction and encountered subsurface conditions.

To accomplish these purposes, a subsurface exploration program consisting of seven supervised test pit excavations was performed. The test pits were advanced using a Link Belt 135 excavator and extended to depths ranging from approximately 4.5 feet to 14 feet beneath the existing surface levels. We could not perform all of the explorations as planned as the adjacent property owners to the north have encroached on the subject site with improvements and used the space for their backyards. In order to mitigate any potential conflicts with the adjacent property owners and our geotechnical investigation, MTA relocated some of the

test pits to along the tree line so as not to disturb the grass landscape areas. In addition, the western edge of the site could not be accessed due to numerous trees larger than 5 inches in diameter which could not be cleared per the Town ordinance, so two shallow test pits (Test Pits 6 and 7) were excavated within the building footprint.

All field work was performed under direct technical observation of a geologist from MTA. Our representative located the explorations in the field, maintained continuous logs of the explorations as the work proceeded and obtained bulk samples of the encountered materials to develop the desired subsurface information.

The approximate locations of the explorations are shown on the Plot Plan, Plate 2. Detailed descriptions of the encountered subsurface conditions are presented on the individual Logs of Test Pits, Plates 3A through 3G. The soils from the explorations were visually described in general accordance with the Unified Soil Classification System shown on Plate 4.

All soil samples were brought to our office where they were further examined in our soil mechanics laboratory. A geotechnical laboratory testing program consisting of mechanical grain-size analyses (ASTM D-422) and moisture content determinations (ASTM D-2216) was performed on selected samples to assist in their classification and evaluation. The results of the mechanical grain size tests are presented on the Gradation Curves, Plate 5, while the results of the natural moisture content determinations are shown on the appropriate test pit logs.

The results of our subsurface explorations and laboratory testing have provided the basis for our engineering analyses and geotechnical design recommendations. The following discussions of our findings and recommendations are subject to the Limitations attached as an Appendix to this report.

Site Conditions

Surface Features: The property is a moderately wooded and/or brush-covered site with landscaped grass areas on the northern half near the adjacent properties. Much of the northern half of the property is currently being used by the adjacent property owners for their backyard with some improvements and those backyards encroach on the subject site. A playset belonging to one of the adjacent property owners was near the northwest corner of the eastern proposed structure as well as a sapling landscaping row and lawn areas along the northern edge of the western proposed structure.

Topographic information provided to us indicates the ground surface elevations at the property slope downward from the northwest at about Elevation +87 feet to about Elevation +79 feet in the southeast.

Subsurface Conditions: The subsurface conditions encountered in the test pits generally consisted of topsoil on the order of 6 to 9 inches in thickness with the exception of Test Pit 3 which encountered about 15 inches of fill materials consisting of commingled topsoil and clayey silt soil.

The surficial topsoil and fill, where encountered, were typically underlain by clayey silt, silty clay and silty sand soils which extended to the termination depths of the explorations. The silty sands were encountered below the silty and clayey soils at depths of 4 to 9 feet in Test Pits 1 through 3.

Groundwater seepage was observed in the test pits at depths of about 2 to 5.5 feet below the existing ground surface. Mottling, which can be indicative of seasonally saturated conditions, was observed at 2 to 4 feet below the ground surface in the test pits.

Findings and Recommendations

General: Based on the results of the explorations performed for this study, it is our opinion that:

1) The proposed structures may derive their support from conventional shallow foundations established on the undisturbed natural soils or controlled compacted fill placed after removal of any soft native soils or existing fill materials, where present. The building floor slabs may also derive their support from the natural materials or properly placed controlled compacted fill.

2) Groundwater seepage was encountered at depths ranging from 2 to 5.5 feet below the existing ground surface; therefore, dewatering should be anticipated during construction. Grading plans are not currently available for the proposed structures, but dewatering should be expected for any utility or foundation trenches that extend below the groundwater levels.

3) Excavated residual silty and clayey natural soils which are prevalent throughout the site would typically be poorly suited for reuse as fill as they are highly susceptible to moisture-related stability and compaction problems. The silty and clayey soils would best be used in deeper fill areas, if any, where they can be capped with higher-quality granular fill materials, or in non-structural areas beyond the building and pavement limits.

4) Proposed new pavements established on the in-place clayey and silty soils or similar materials used as controlled compacted fill should be designed for a poor subgrade support condition.

Further discussion of these items is presented in subsequent sections of this report.

Site Preparation and Earthwork: The site should be cleared and grubbed of all vegetation and roots. Trees within the proposed improvement areas should be removed and the topsoil stripped for its full depth from within and at least 5 feet beyond the proposed building and pavement areas. The topsoil will not be suitable for reuse as controlled compacted fill in building, pavement or other structural areas. All existing fill materials, where encountered, should also be completely removed from the proposed building and pavement areas. Grading plans were not provided to us, but it is expected that the structures and paved areas would be established within several feet of the current existing grades.

After clearing, stripping and removal of any unsuitable materials from below the proposed improved areas, and prior to placement of controlled compacted fill in areas to be raised, the exposed subgrade materials should be proofrolled and compacted to a dense and stable consistency with numerous passes of a heavy, self-propelled vibrating drum compactor under the observation of a geotechnical engineer from MTA. Any

subgrade materials which are observed to be soft or unstable should be excavated to the surface of competent soils and replaced with controlled compacted fill. The majority of the site soils exposed after stripping the topsoil and removal of fill will consist of clayey silts or silty clays. Our laboratory testing indicates that these materials were at or above estimated moisture contents to permit compaction at the time of the test pits. In addition, these materials are highly susceptible to softening and disturbance from construction equipment traffic if they become wet, and aeration of the in-place materials may be required in order to compact them to a stable condition and to the required densities.

Fill and/or backfill required to achieve the subgrade levels within building and paved areas should consist of controlled compacted fill. Clayey and silty soils which will be encountered below the topsoil could be reused as controlled compacted fill at depth but are currently very moist and would require drying to allow their reuse, which would be limited to drier/warmer times of year. These materials are better used in non-structural areas or in deep structural fill areas, if any, after drying where they can be covered by at least 24 inches of granular compacted fill materials. Any materials placed as fill should be moisture conditioned, as needed, to permit compaction to the required densities.

Any imported fill if required to complete the site grading in the building and paved areas should consist of uncontaminated relatively well-graded granular soils containing less than 15 percent by weight of material passing a U.S. Standard No. 200 sieve and a maximum particle size of 4 inches. The fill supplier should provide documentation of the environmental quality of all imported fill.

All materials placed in building and paved areas should be spread in layers on the order of 12 inches or less in loose thickness and be uniformly compacted to at least 95 percent of its maximum dry density as determined by the ASTM D-1557 test procedure. Backfill placed in confined areas such as foundation and

utility trench excavations should be spread in thinner layers and uniformly compacted to similar densities using manually operated compaction equipment.

Construction excavations should be performed in accordance with all applicable safety codes including the latest excavation regulations. Based on the soils encountered in the test pits, it is our opinion that the near surface clayey silt and silty clay materials or deeper silty sands would typically be considered Type "C" soils as defined by the OSHA excavation guidelines.

Groundwater seepage was encountered in all of the test pits at depths of approximately 2 to 5.5 feet below grade. Groundwater seepage conditions should be expected to vary seasonally and could be encountered at higher levels, particularly during and following wet periods. The contractor should be required to provide all dewatering as necessary to maintain relatively dry excavations during construction. It is anticipated that pumping from sumps or trenches located adjacent to the site excavations could be used for dewatering most shallow excavations. We also recommend that the site be graded and cutoff trenches or berms be provided as necessary to divert surface runoff away from the work areas. Exposure of the subgrade soils to runoff could result in softening and disturbance of the subgrade soils and possibly require overexcavation of unstable soils.

Foundation Design Criteria: Following the previously described site preparation procedures, the proposed structures could be supported by conventional shallow foundations which derive their support from the undisturbed natural clayey and silty soils or controlled compacted fill installed to reach the proposed foundation and floor slab subgrade levels. Foundations established on the stiff residual soils or properly placed controlled compacted fill may be designed for allowable net bearing pressures of up to 3,000 pounds per square foot.

Exterior foundations should be established at depths of at least 3 feet below the lowest adjacent exterior grades to provide protection from frost penetration. Interior foundations in permanently heated portions of the structures may be established at convenient depths below the ground level floor slabs. Where clayey soils are present at the foundation subgrade levels, it may be prudent to overexcavate 6 to 12 inches and place 3/4-inch clean crushed stone below the foundations to avoid disturbance of the subgrades during foundation construction.

We estimate that post-construction settlements of the anticipated lightly loaded foundations designed and constructed in accordance with our recommendations would be approximately 3/4 of 1 inch, or less.

Seismic Design: Based on the results of our investigation and our knowledge of the regional geology, the materials beneath the site would generally be classified as a Site Class "D" as defined by the International Building Code 2018, New Jersey Edition.

Floor Slab Design Criteria: Following the previously described site preparation procedures, the ground floor slabs of the proposed structures may be supported on the recompacted soils or properly placed controlled compacted fill. Floor slabs should be established at least 2 feet above observed groundwater and mottling levels. Assuming the new slabs are established at or above current grades, a porous subslab layer consisting of a minimum of 6 inches of crushed stone or washed gravel should be provided below the ground level floor slabs to provide a capillary break between the slabs and the underlying subgrade soils. Immediately prior to floor slab construction, the exposed subgrade materials should be recompacted to a dense and unyielding condition under the observation of a geotechnical engineer from MTA. Any soft or disturbed subgrade soils should be dried and recompacted to a dense condition or excavated and replaced with controlled compacted fill or clean crushed stone.

We estimate that post-construction settlements of lightly loaded floor slabs supported by materials prepared in accordance with our recommendations would be less than 1/2 of 1 inch.

Pavement Design Criteria

We recommend that the site paved areas be prepared in general accordance with our prior discussions including stripping of topsoil and the existing fill materials which consisted of clayey silt soils mixed with topsoil. Immediately prior to pavement construction, the surface of the exposed subgrades should be compacted to a firm and unyielding consistency and to at least 95 percent of their maximum dry density as determined by the ASTM D-1557 test procedure. If pavements are established on the natural residual silty and clayey soils or similar materials used as controlled compacted fill, the pavement should be designed assuming a poor subgrade support condition with an estimated California Bearing Ratio (CBR) value of 3 percent. If the pavements are established atop a minimum of 18 inches of granular free-draining materials, we believe the pavements could be designed for a good pavement support condition with a CBR value of 10 percent. The actual value should be confirmed by laboratory testing. Subgrade conditions consistent with the pavement design should be confirmed at the time of construction.

Future Work

Additional test pit excavations should be performed at the time of construction to verify the soil conditions and confirm our recommendations in the areas not explored due to limited access as a result of the large trees or space occupied by the adjacent property owners.

Please feel free to contact us if there are any questions regarding this report.

The following Plates and Appendix are attached and complete this report:

Plate 1 – Site Location Map
Plate 2 – Plot Plan
Plates 3A through 3G – Logs of Test Pits
Plate 4 – Unified Soil Classification System
Plate 5 – Gradation Curves
Appendix – Limitations

Respectfully submitted,

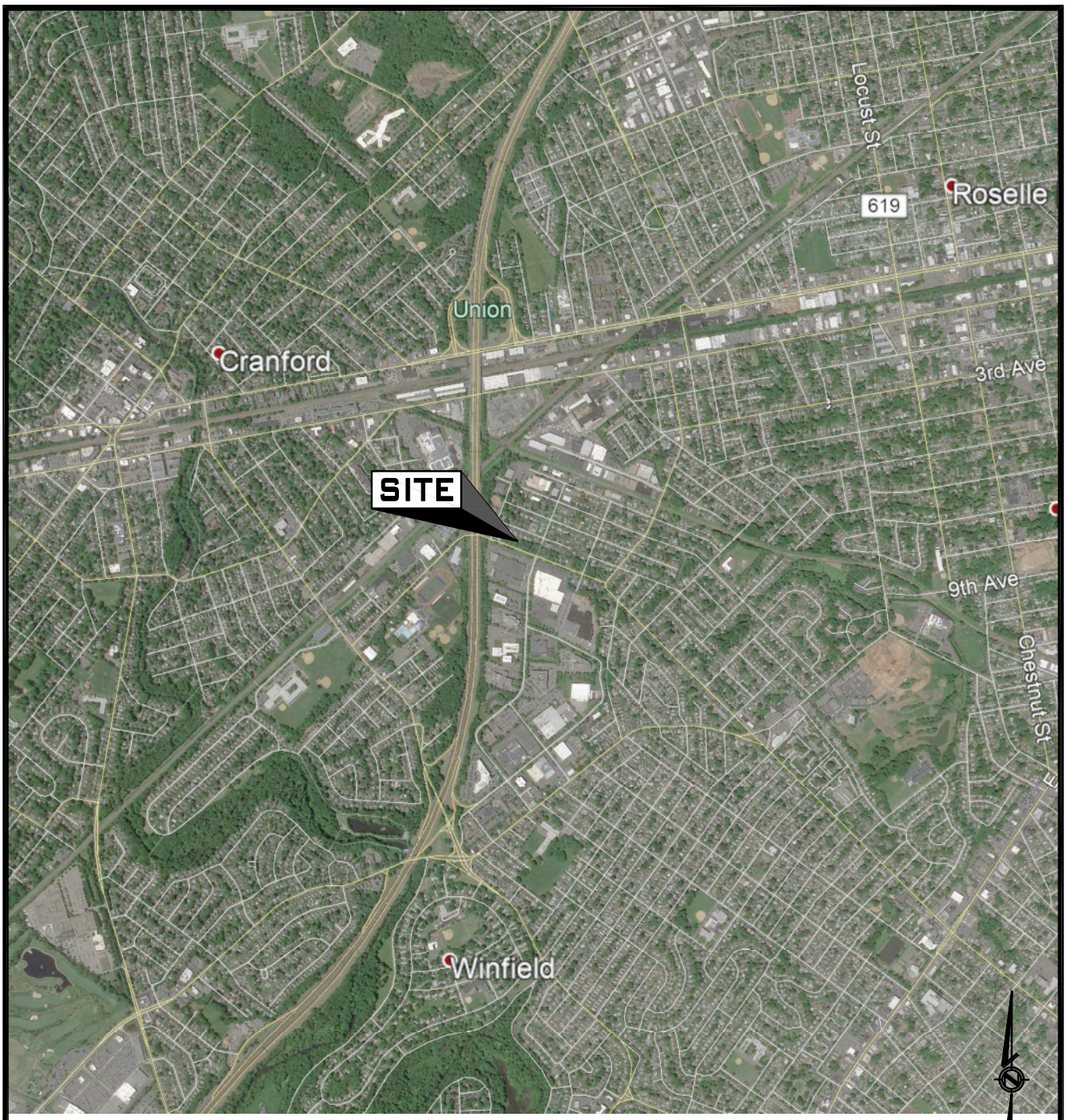
MELICK-TULLY and ASSOCIATES,
a Division of GZA GeoEnvironmental, Inc.

Cory S. Karinja, P.E.
Assistant Project Manager

Eugene M. Gallagher, Jr., P.E.
Principal

Mark R. Denno, P.E.
Consultant/Reviewer

CSK:EMG/csk
(1 copy submitted via e-mail)



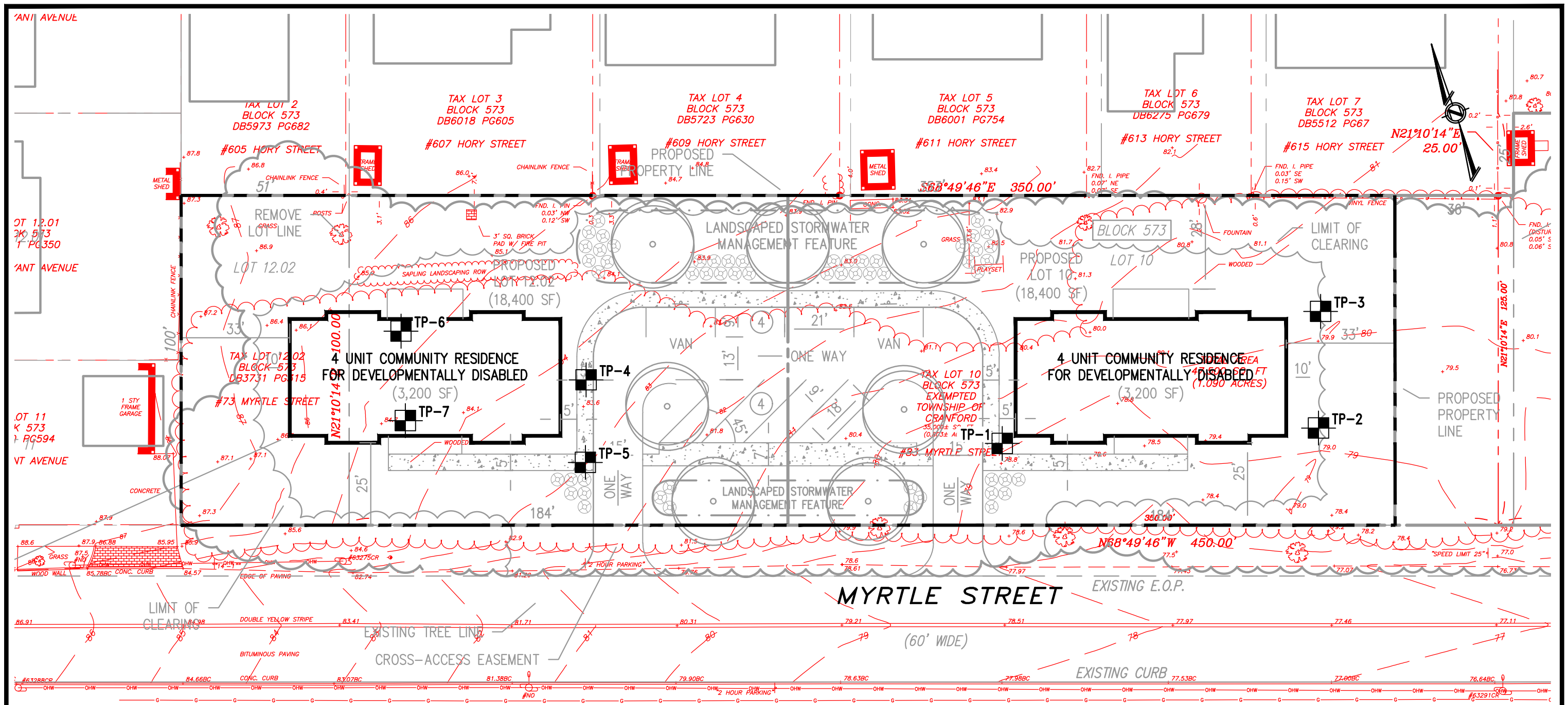
Aerial Photo courtesy of Google Earth Pro

MELICK–TULLY AND ASSOCIATES
A Division of GZA
Geotechnical Engineers & Environmental Consultants
117 Canal Road
South Bound Brook, New Jersey 08880
(732) 356–3400

SITE LOCATION MAP

PROPOSED GROUP HOME DEVELOPMENT– GEOTECHNICAL
CRANFORD, UNION COUNTY, NEW JERSEY
SCIULLO ENGINEERING SERVICES, LLC

JOB NO.	FILE NO.	DR. BY	CHK. BY	DATE	SCALE	PLATE
26.0092024.00	–	VJD	CSK	2/3/20	1"=2,000'	1



KEY:

TP-1 — NUMBER AND APPROXIMATE LOCATION OF TEST PITS PERFORMED FOR THIS STUDY

NOTES:

1. This drawing is part of Melick–Tully and Associates, a Division of GZA, Report No. 26.0092024.00 and should be read together with the report for complete evaluation.
2. General layout was obtained from two drawings, the first prepared by Sciullo Eng., entitled "Concept Plan" not dated, scale 1"= 40'and another prepared by Vargo Eng., entitled "Boundary & Topographic Survey Tax Lots 9 & 10, Block 573, Cranford Township" dated 1/24/20, scale 1"= 20'.

PLOT PLAN

PROPOSED GROUP HOME DEVELOPMENT– GEOTECHNICAL
CRANFORD, UNION COUNTY, NEW JERSEY
SCIULLO ENGINEERING SERVICES, LLC

MELICK–TULLY AND ASSOCIATES
A Division of GZA
Geotechnical Engineers & Environmental Consultants
117 Canal Road
South Bound Brook, New Jersey 08880
(732) 356–3400

JOB NO.	FILE NO.
26.0092024.00	–

DR. BY	CHK. BY	DATE	SCALE	PLATE
VJD	CSK	2/3/20	1"= 30'	2

TEST PIT LOG

MTA, a Division of GZA GeoEnvironmental, Inc
Engineers and Scientists

Sciullo Engineering

Cranford, NJ

EXPLORATION NO.: TP-1
SHEET: 1 of 1
PROJECT NO: 26.0092024.00
REVIEWED BY: Cory Karinja

Logged By: G. Zmigrodski
Contractor: Neary
Operator: Matt

Test Pit Location: See Plan
Ground Surface Elev. (ft.): 79

Final Test Pit Depth (ft.): 14
Date Start - Finish: 1/27/2020 - 1/27/2020

Type of Excavator: Trackhoe

Excavator Model: Link Belt 135

Groundwater Depth (ft.)

Date	Time	Water Depth	Stab.Time
1/27/20		4	

Depth (ft)	Sample No.	Sample Depth (ft.)	Stratum Depth (ft.)	Symbol	Sample Description and Identification	Water Content (%)	Remark
1			0-0.75		9" Topsoil		
2	S1	2	0.75-2.5	ML	Brown clayey silt, little fine sand (moist)(medium)	25.1	
3			2.5-4	CL	Red-brown silty clay, little fine sand, little fine to coarse gravel (moist)(stiff)		
4							
5			4-14	SM	Red-brown fine to coarse sand, some clayey silt, little fine gravel, with cobbles (wet)(medium dense)		
6	S2	6				17.0	
7							
8							
9							
10							
11							
12							
13	S3	13					
14					End of exploration at 14 feet.		
15					Moderate groundwater seepage encountered @ 4'		
16					Mottling from 3' to 14'		
17							
18							
19							
20							

REMARKS

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Plate No.:3A

3 - MTA TEST PIT STRATUM LINES; 2/13/2020; 2:33:06 PM

TEST PIT LOG

MTA, a Division of GZA GeoEnvironmental, Inc
Engineers and Scientists

Sciullo Engineering

Cranford, NJ

EXPLORATION NO.: TP-2
SHEET: 1 of 1
PROJECT NO: 26.0092024.00
REVIEWED BY: Cory Karinja

Logged By: G. Zmigrodski
Contractor: Neary
Operator: Matt

Test Pit Location: See Plan
Ground Surface Elev. (ft.): 79.5

Final Test Pit Depth (ft.): 14
Date Start - Finish: 1/27/2020 - 1/27/2020

Type of Excavator: Trackhoe
Excavator Model: Link Belt 135

Groundwater Depth (ft.)

Date	Time	Water Depth	Stab.Time
1/27/20		4	

Depth (ft)	Sample No.	Sample Depth (ft.)	Stratum Depth (ft.)	Symbol	Sample Description and Identification	Water Content (%)	Remark
			0-0.5		6" Topsoil		
1			0.5-2.5	ML	Brown clayey silt, little fine to medium sand (moist)(medium)		
2	S1	2				22.2	
3			2.5-9		Red-brown clayey silt, little fine to medium sand, little fine to coarse gravel, with cobbles (wet)(stiff)		
4							
5							
6				ML			
7	S2	6				17.2	
8							
9							
10			9-14		Red-brown fine to coarse sand, some clayey silt, some fine to coarse gravel, with cobbles (wet)(medium dense)		
11							
12				SM			
13	S3	13					
14							
15					End of exploration at 14 feet.		
16					Moderate groundwater seepage encountered @ 4'		
17					Mottling from 3' to 14'		
18							
19							
20							

REMARKS

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Plate No.:3B

3 - MTA TEST PIT STRATUM LINES; 2/13/2020; 2:33:07 PM

TEST PIT LOG

MTA, a Division of GZA GeoEnvironmental, Inc
Engineers and Scientists

Sciullo Engineering

Cranford, NJ

EXPLORATION NO.: TP-3
SHEET: 1 of 1
PROJECT NO: 26.0092024.00
REVIEWED BY: Cory Karinja

Logged By: G. Zmigrodski
Contractor: Neary
Operator: Matt

Test Pit Location: See Plan
Ground Surface Elev. (ft.): 80.5

Final Test Pit Depth (ft.): 14
Date Start - Finish: 1/28/2020 - 1/28/2020

Type of Excavator: Trackhoe

Excavator Model: Link Belt 135

Groundwater Depth (ft.)			
Date	**Time**	**Water Depth**	**Stab.Time**
1/28/20		5.5	

Depth (ft)	Sample No.	Sample Depth (ft.)	Stratum Depth (ft.)	Symbol	Sample Description and Identification	Water Content (%)	Remark
1	S1	1	0-1.5		15" Fill - Comingled topsoil with brown clayey silt	23.3	
2	S2	2	1.5-2.5	ML	Brown clayey silt (moist)(medium)	22,5	
3			2.5-5.5		Red-brown clayey silt, some fine to medium sand (moist)(medium to stiff)		
4	S3	4		ML		18.5	
5							
6			5.5-14		Red-brown fine to medium sand, some clayey silt, some fine to coarse gravel, with cobbles (wet)(medium dense)		
7							
8	S4	8					
9							
10				SM			
11							
12							
13							
14							
15					End of exploration at 14 feet. Moderate groundwater seepage encountered @ 5.5' Mottling from 4' to 14'		
16							
17							
18							
19							
20							

REMARKS

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Plate No.:3C

3 - MTA TEST PIT STRATUM LINES; 2/13/2020; 2:33:07 PM

TEST PIT LOG

MTA, a Division of GZA GeoEnvironmental, Inc
Engineers and Scientists

Sciullo Engineering
Cranford, NJ

EXPLORATION NO.: TP-4
SHEET: 1 of 1
PROJECT NO: 26.0092024.00
REVIEWED BY: Cory Karinja

Logged By: G. Zmigrodski
Contractor: Neary
Operator: Matt

Test Pit Location: See Plan
Ground Surface Elev. (ft.): 83.5

Final Test Pit Depth (ft.): 13
Date Start - Finish: 1/28/2020 - 1/28/2020

Type of Excavator: Trackhoe
Excavator Model: Link Belt 135

Groundwater Depth (ft.)			
Date	**Time**	**Water Depth**	**Stab.Time**
1/28/20		4	

Depth (ft)	Sample No.	Sample Depth (ft.)	Stratum Depth (ft.)	Symbol	Sample Description and Identification	Water Content (%)	Remark
1	S1	4	0-0.75		9" Topsoil	13.1	
			0.75-1.5	ML	Brown clayey silt (moist)(medium)		
2			1.5-5	ML	Red-brown clayey silt, little fine to coarse sand, little fine to coarse gravel (moist)(stiff)		
3							
4							
5							
6			5-13	ML	Red-brown clayey silt, little fine to coarse sand, some fine to coarse gravel, with cobbles and occasional boulders (wet)(very stiff)		
7							
8							
9							
10							
11							
12							
13					- refusal on boulder @ 13'		
14					End of exploration at 13 feet.		
15					Moderate groundwater seepage encountered @ 4' Mottlling from 3' to 13'		
16							
17							
18							
19							
20							

REMARKS

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Plate No.:3D

3 - MTA TEST PIT STRATUM LINES; 2/13/2020; 2:33:07 PM

TEST PIT LOG

MTA, a Division of GZA GeoEnvironmental, Inc
Engineers and Scientists

Sciullo Engineering
Cranford, NJ

EXPLORATION NO.: TP-5
SHEET: 1 of 1
PROJECT NO: 26.0092024.00
REVIEWED BY: Cory Karinja

Logged By: G. Zmigrodski
Contractor: Neary
Operator: Matt

Test Pit Location: See Plan
Ground Surface Elev. (ft.): 83

Final Test Pit Depth (ft.): 12
Date Start - Finish: 1/28/2020 - 1/28/2020

Type of Excavator: Trackhoe
Excavator Model: Link Belt 135

Groundwater Depth (ft.)

Date	Time	Water Depth	Stab.Time
1/28/20		2.5	

Depth (ft)	Sample No.	Sample Depth (ft.)	Stratum Depth (ft.)	Symbol	Sample Description and Identification	Water Content (%)	Remark
1			0-0.75		9" Topsoil		
2	S1	1.5	0.75-2.5	ML	Brown clayey silt, trace to little fine to medium sand (moist)(medium)	22.1	
3			2.5-8.5		Red-brown clayey silt, little fine to medium sand, little fine to coarse gravel, with cobbles (moist to wet)(stiff)		
4	S2	4				26.1	
5							
6				ML			
7							
8							
9			8.5-12		Red-brown clayey silt, little fine to coarse sand, some fine to coarse gravel, with cobbles (wet)(stiff)		
10							
11				ML			
12							
13					End of exploration at 12 feet.		
14					Slight groundwater seepage encountered @ 2.5'		
15					Moderate groundwater seepage @ 6'		
16					Mottling @ 2.5'		
17							
18							
19							
20							

REMARKS

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Plate No.:3E

TEST PIT LOG

MTA, a Division of GZA GeoEnvironmental, Inc
Engineers and Scientists

Sciullo Engineering

Cranford, NJ

EXPLORATION NO.: TP-6
SHEET: 1 of 1
PROJECT NO: 26.0092024.00
REVIEWED BY: Cory Karinja

Logged By: G. Zmigrodski
Contractor: Neary
Operator: Matt

Test Pit Location: See Plan
Ground Surface Elev. (ft.): 85.5

Final Test Pit Depth (ft.): 4.5
Date Start - Finish: 1/28/2020 - 1/28/2020

Type of Excavator: Trackhoe

Excavator Model: Link Belt 135

Groundwater Depth (ft.)

Date	Time	Water Depth	Stab.Time
1/28/20		2	

Depth (ft)	Sample No.	Sample Depth (ft.)	Stratum Depth (ft.)	Symbol	Sample Description and Identification	Water Content (%)	Remark
1			0-0.75		9" Topsoil		
2	S1	1.5	0.75-2	ML	Yellow-brown clayey silt, and fine to medium sand (moist)(medium)	16.2	
3			2-4.5	ML	Red-brown clayey silt, little fine to coarse sand, little fine to coarse gravel (wet)(stiff)		
4	S2	4				14.9	
5					End of exploration at 4.5 feet.		
6					Moderate groundwater seepage encountered @ 2'		
7					Mottling from 2' to 4'		
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

REMARKS

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Plate No.:3F

3 - MTA TEST PIT STRATUM LINES; 2/13/2020; 2:33:08 PM

TEST PIT LOG

MTA, a Division of GZA GeoEnvironmental, Inc
Engineers and Scientists

Sciullo Engineering

Cranford, NJ

EXPLORATION NO.: TP-7
SHEET: 1 of 1
PROJECT NO: 26.0092024.00
REVIEWED BY: Cory Karinja

Logged By: G. Zmigrodski
Contractor: Neary
Operator: Matt

Test Pit Location: See Plan
Ground Surface Elev. (ft.): 84.5

Final Test Pit Depth (ft.): 4.5
Date Start - Finish: 1/28/2020 - 1/28/2020

Type of Excavator: Trackhoe

Excavator Model: Link Belt 135

Groundwater Depth (ft.)			
Date	**Time**	**Water Depth**	**Stab.Time**
1/28/20		2	

Depth (ft)	Sample No.	Sample Depth (ft.)	Stratum Depth (ft.)	Symbol	Sample Description and Identification	Water Content (%)	Remark
1			0-0.75		9" Topsoil		
2			0.75-2	ML	Brown clayey silt, little fine to medium sand (moist)(medium)		
3			2-4.5	ML	Red-brown clayey silt, little fine to medium sand, little fine to coarse gravel (moist)(stiff)		
4							
5					End of exploration at 4.5 feet.		
6					Moderate groundwater seepage @ 2'		
7					Mottling from 2' to 4.5'		
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

REMARKS

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Plate No.:3G

3 - MTA TEST PIT STRATUM LINES; 2/13/2020; 2:33:08 PM

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS More than 50% of material is LARGER than No. 200 Sieve	GRAVEL & GRAVELLY SOILS More than 50% of coarse fraction RETAINED on No. 4 Sieve	CLEAN GRAVELS (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS More than 50% of coarse fraction PASSING a No. 4 Sieve	CLEAN SAND (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines.
			SP	Poorly-graded sands, gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS More than 50% of material is SMALLER than No. 200 Sieve	SILTS AND CLAYS	Liquid limit LESS than 50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS	Liquid limit GREATER than 50	MH	Inorganic silts, micaceous or diatomaceous fine sand or silty soils.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			PT	Peat, humus, swamp soils with high organic contents.

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS.

GRADATION*	COMPACTNESS* sand and/or gravel	CONSISTENCY* clay and/or silt
% Finer by Weight	Relative Density	Range of Shearing Strength in Pounds per Square Foot

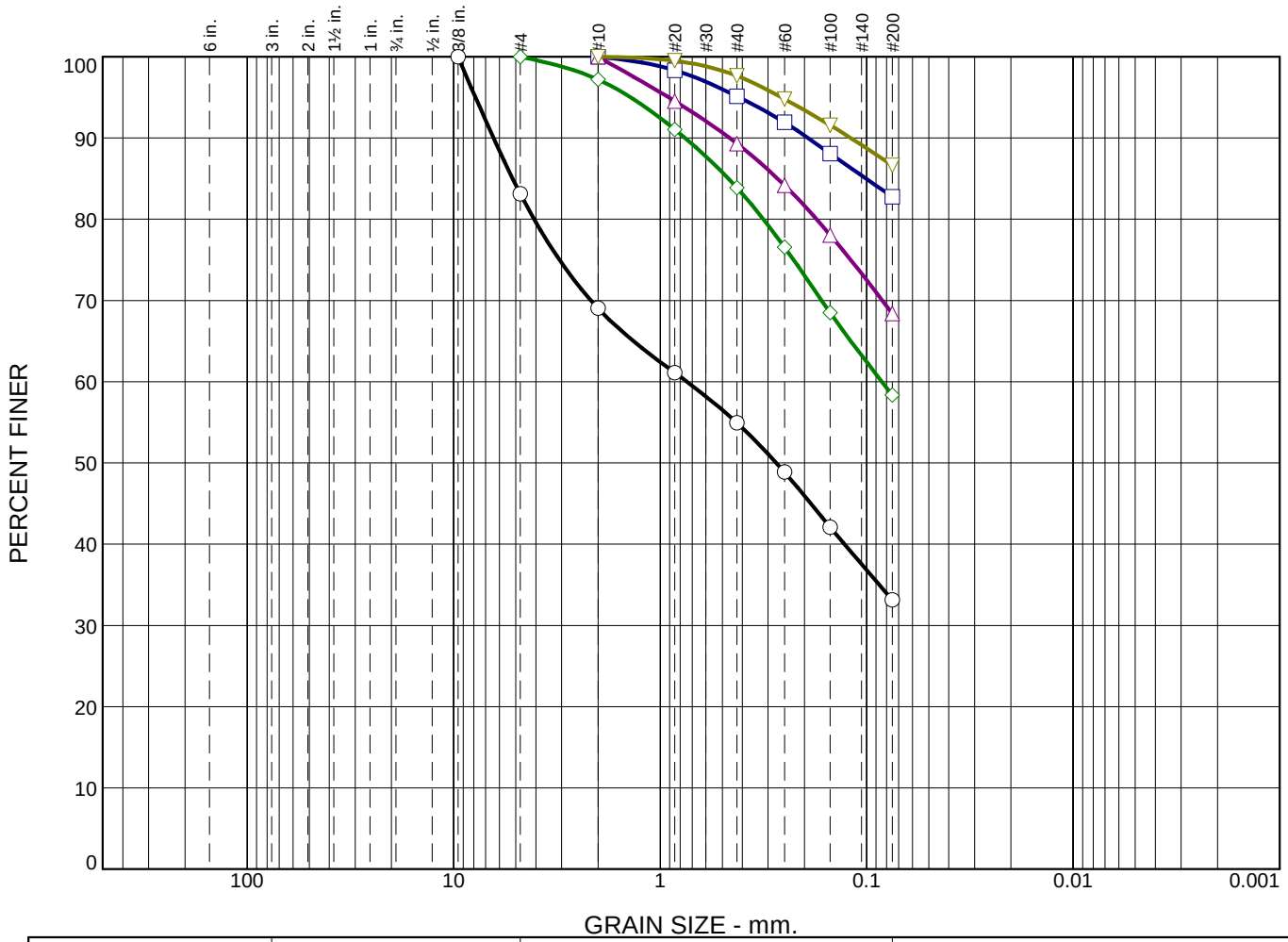
Trace	0% to 10%	Loose	0% to 40%	Very Soft	less than 250
Little	10% to 20%	Medium Dense	40% to 70%	Soft	250 to 500
Some	20% to 35%	Dense	70% to 90%	Medium	500 to 1000
And	35% to 50%	Very Dense	90% to 100%	Stiff	1000 to 2000
				Very Stiff	2000 to 4000
				Hard	Greater than 4000

**Values are from laboratory or field test data, where applicable. When no testing was performed, values are estimated.*

UNIFIED SOIL CLASSIFICATION SYSTEM

SOIL CLASSIFICATION CHART

Gradation Curve(s)



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	16.9	14.1	14.1	21.8	33.1	
□	0.0	0.0	0.0	0.0	4.9	12.3	82.8	
△	0.0	0.0	0.0	0.0	10.7	20.9	68.4	
◇	0.0	0.0	0.0	2.8	13.3	25.6	58.3	
▽	0.0	0.0	0.0	0.0	2.4	11.0	86.6	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	TP-1	S-2	6	F-c Sand, some Clayey Silt, little fine Gravel. (MC=17.0%)	SM
□	TP-2	S-1	2	Clayey Silt, little fine to medium Sand. (MC=22.2%)	ML
△	TP-3	S-3	4	Clayey Silt, some fine to medium Sand. (MC=18.5%)	ML
◇	TP-5	S-2	4	Clayey Silt, and fine to medium Sand. (MC=16.2%)	ML
▽	TP-6	S-1	1.5	Clayey Silt, little fine to medium Sand. (MC=26.1%)	ML

Melick-Tully & Associates
a Division of GZA GeoEnvironmental, Inc.
South Bound Brook, NJ

Client: Sciullo Engineering Services, LLC
Project: Group Home Development, Cranford, NJ

Project No.: 26.0092024.00 **Plate** 5

APPENDIX - Limitations

APPENDIX

Limitations

A. Subsurface Information

Locations: The locations of the explorations were approximately determined by tape measurement from existing site features. Elevations of the explorations were approximately determined by interpolation between contours shown on topographic plans provided to us. The locations and elevations of the explorations should be considered accurate only to the degree implied by the method used.

Interface of Strata: The stratification lines shown on the individual logs of the subsurface explorations represent the approximate boundaries between soil types, and the transitions may be gradual.

Field Logs/Final Logs: A field log was prepared for each exploration by a member of our staff. The field log contains factual information and interpretation of the soil conditions between samples. Our recommendations are based on the final logs as shown in this report and the information contained therein, and not on the field logs. The final logs represent our interpretation of the contents of the field logs, and the results of the laboratory observations and/or tests of the field samples.

Water Levels: Water level readings have been made in the explorations at times and under conditions stated on the individual logs. These data have been reviewed and interpretations made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater will occur due to variations in rainfall, temperature, and other factors.

Pollution/Contamination: Unless specifically indicated to the contrary in this report, the scope of our services was limited only to investigation and evaluation of the geotechnical engineering aspects of the site conditions, and did not include any consideration of potential site pollution or contamination resulting from the presence of chemicals, metals, radioactive elements, etc. This report offers no facts or opinions related to potential pollution/contamination of the site.

Environmental Considerations: Unless specifically indicated to the contrary in this report, this report does not address environmental considerations which may affect the site development, e.g., wetlands determinations, flora and fauna, wildlife, etc. The conclusions and recommendations of this report are not intended to supersede any environmental conditions which should be reflected in the site planning.

B. Applicability of Report

This report has been prepared in accordance with generally accepted soils and foundation engineering practices for the exclusive use of Sciullo Engineering Services, LLC for specific application to the design of the proposed group home residential development. No other warranty, expressed or implied, is made.

This report may be referred to in the project specifications for general information purposes only, but should not be used as the technical specifications for the work, as it was prepared for design purposes exclusively.

C. Reinterpretation of Recommendations

Change in Location or Nature of Facilities: In the event that any changes in the nature, design or location of the facilities are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing.

Changed Conditions During Construction: The analyses and recommendations submitted in this report are based in part upon the data obtained from seven widely spaced test pit excavations performed for this study. The nature and extent of variations between the explorations may not become evident until construction. If variations then appear evident, it will be necessary to reevaluate the recommendations of this report.

Changes in State-of-the-Art: The conclusions and recommendations contained in this report are based upon the applicable standards of our profession at the time this report was prepared.

D. Use of Report by Prospective Bidders

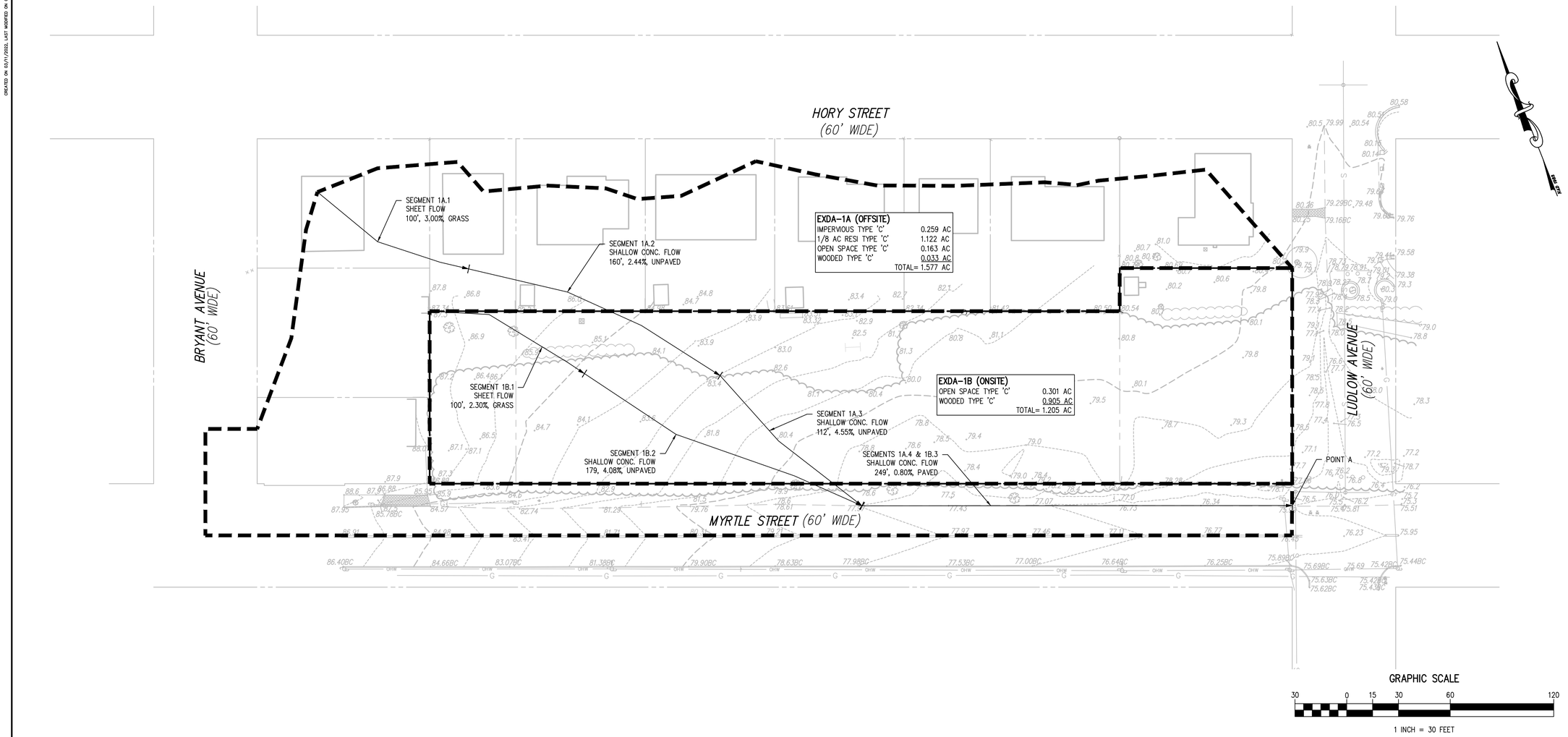
This soil and foundation engineering report was prepared for the project by Melick-Tully and Associates, a Division of GZA GeoEnvironmental Inc. (MTA) for design purposes and may not be sufficient to prepare an accurate bid. Contractors utilizing the information in the report should do so with the express understanding that its scope was developed to address design considerations. Prospective bidders should obtain the owner's permission to perform whatever additional explorations or data gathering they deem necessary to prepare their bid accurately.

E. Construction Observation

We recommend that MTA be retained to provide on-site soils engineering services during the earthwork construction and foundation phases of the work. This is to observe compliance with the design concepts and to allow changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

APPENDIX I

DRAINAGE AREA PLANS



GRAPHIC SCALE

30 0 15 30 60 120

1 INCH = 30 FEET

1. EXISTING UTILITY INFORMATION SHOWN ON THESE PLANS IS FURNISHED BY THE UTILITY COMPANIES AND/OR THE SURVEYOR AND THE ACCURACY THEREOF IS NOT THE RESPONSIBILITY OF SCIULLO ENGINEERING SERVICES, LLC. IT IS THE RESPONSIBILITY OF THE OWNERS REPRESENTATIVE TO CONTACT ALL UTILITIES AND MAKE ARRANGEMENTS FOR FIELD LOCATION OF UNDERGROUND UTILITIES PRIOR TO CONSTRUCTION.
2. THESE PLANS ARE NOT FOR CONSTRUCTION UNTIL "ISSUED FOR CONSTRUCTION" APPEARS IN THE TITLEBLOCK.

811 Know what's below. Call before you dig.

JASON T. SCIULLO, P.E., P.P.
PROFESSIONAL ENGINEER, NEW JERSEY LICENSE NO. 24GE04586000
PROFESSIONAL PLANNER, NEW JERSEY LICENSE NO. 33LI00628400
jsciullo@sciulloengineering.com

SCIULLO ENGINEERING SERVICES, LLC
17 SOUTH GORDON'S ALLEY, SUITE 3
ATLANTIC CITY, NEW JERSEY 08401
PHONE: (609) 300-5177
www.sciulloengineering.com
NJ CERTIFICATE OF AUTHORIZATION NO. 24GA28290700

83 MYRTLE STREET SUPPORTIVE HOUSING

BLOCK 573, LOTS 9, 10 & 12.02
CRANFORD TOWNSHIP, UNION COUNTY, NEW JERSEY

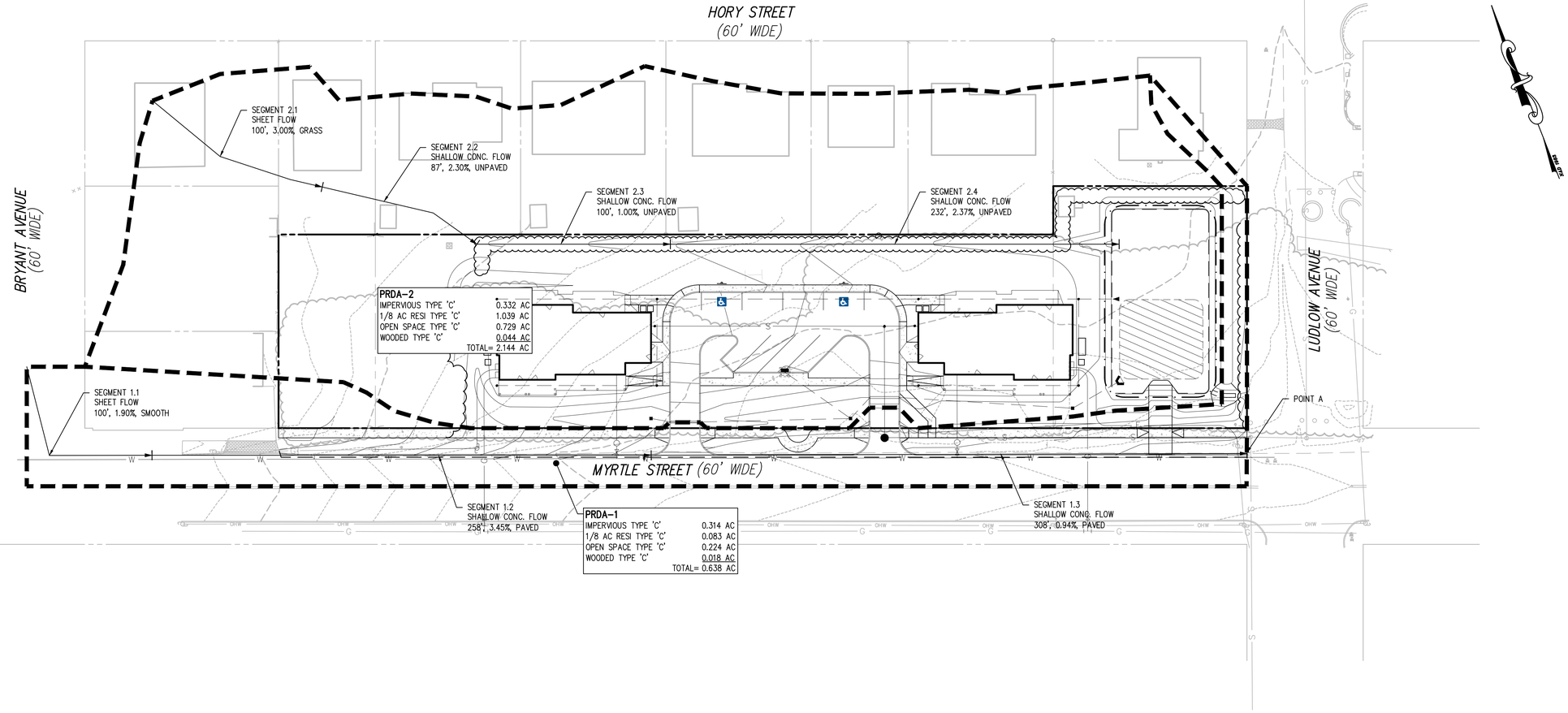
EXISTING DRAINAGE AREA PLAN

756 HADDON AVENUE
COLLINGSWOOD, NEW JERSEY 08108

Kitchen & Associates

DATE	ISSUE NO.	SUBMISSION/REVISION	BY	APPR.
3/17/2022	1	INITIAL SUBMISSION	LAT	JTS

PROJECT NO. K&A 001.01
SCALE 1" = 30'
SHEET 1 OF 4
DRAWING NO. C1401



GRAPHIC SCALE

30 0 15 30 60 120

1 INCH = 30 FEET

1. EXISTING UTILITY INFORMATION SHOWN ON THESE PLANS IS FURNISHED BY THE UTILITY COMPANIES AND/OR THE SURVEYOR AND THE ACCURACY THEREOF IS NOT THE RESPONSIBILITY OF SCIULLO ENGINEERING SERVICES, LLC. IT IS THE RESPONSIBILITY OF THE OWNERS REPRESENTATIVES TO CONTACT ALL UTILITIES PRIOR TO FIELD LOCATION OF UNDERGROUND UTILITIES PRIOR TO CONSTRUCTION.
2. THESE PLANS ARE NOT FOR CONSTRUCTION UNTIL SIGNED BY ALL CONSTRUCTION APPEARS IN THE TITLEBLOCK.

811 Know what's below. Call before you dig.

JASON T. SCIULLO, P.E., P.P.
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www.sciulloengineering.com
NJ CERTIFICATE OF AUTHORIZATION NO. 24GA28290700

83 MYRTLE STREET SUPPORTIVE HOUSING

BLOCK 573, LOTS 9, 10 & 12.02
CRANFORD TOWNSHIP, UNION COUNTY, NEW JERSEY

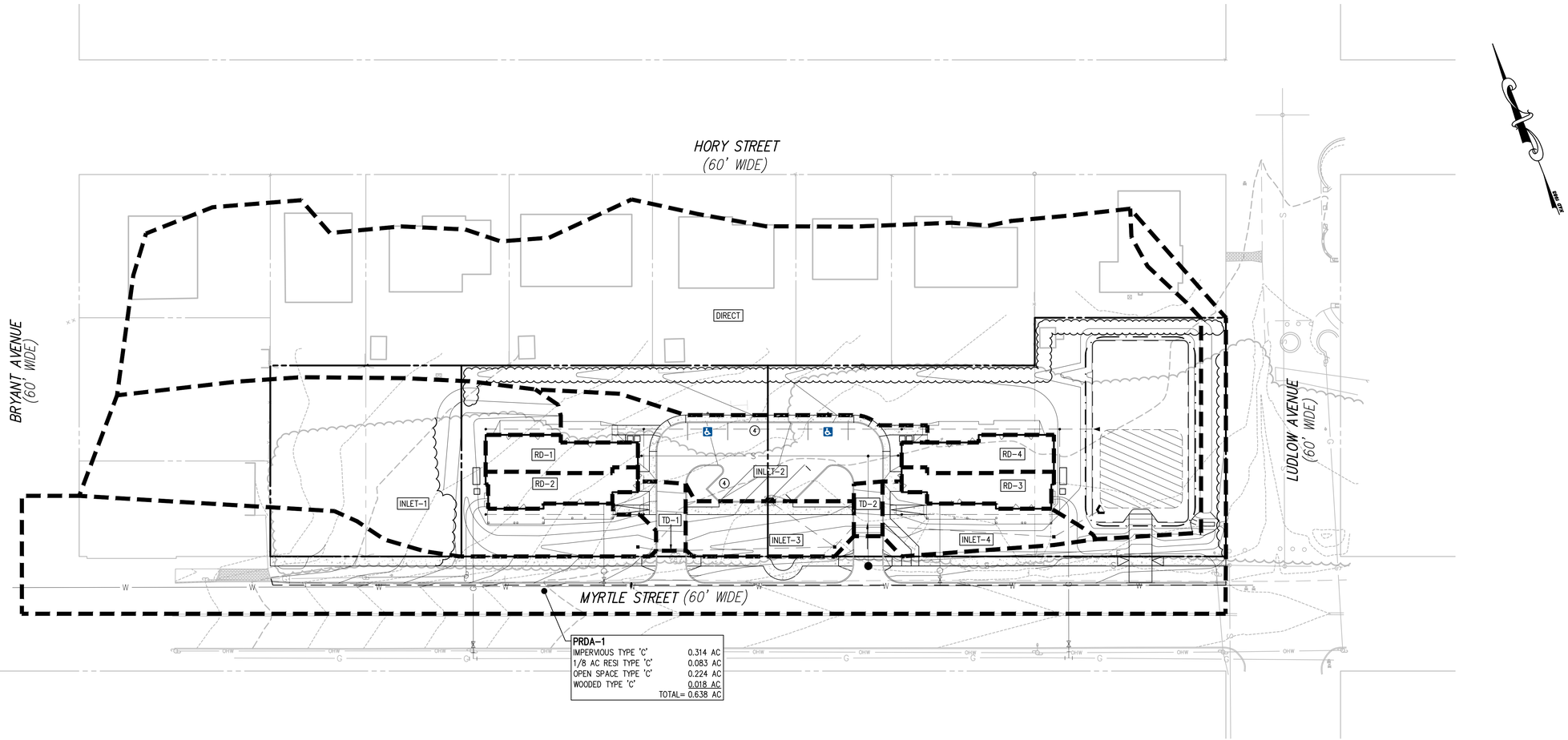
PROPOSED DRAINAGE AREA PLAN

756 HADDON AVENUE
COLLINGSWOOD, NEW JERSEY 08108

Kitchens & Associates

DATE	ISSUE NO.	SUBMISSION/REVISION	BY	APPR.
3/17/2022	1	INITIAL SUBMISSION	LAT	JTS

PROJECT NO. K&A 001.01
SCALE 1" = 30'
SHEET 2 OF 4
DRAWING NO. C1402



INLET-1

	Area SF	AC	HSG C Area SF	AC	C	CA	ΣcA	c(ave)
Impervio	795	0.018	795	0.018	0.99	0.018		
0.125 Ac	5400	0.124	5400	0.124	0.86	0.107		
Open Sp	9490	0.218	9490	0.218	0.51	0.111		
Wodded	1930	0.044	1930	0.044	0.45	0.020		
	17615	0.404	17615	0.404		0.256	0.256	0.632

INLET-2

	Area SF	AC	HSG C Area SF	AC	C	CA	ΣcA	c(ave)
Impervio	5220	0.120	5220	0.120	0.99	0.119		
Open Sp	1715	0.039	1715	0.039	0.51	0.020		
	6935	0.159	6935	0.159		0.139	0.139	0.871

INLET-3

	Area SF	AC	HSG C Area SF	AC	C	CA	ΣcA	c(ave)
Impervio	605	0.014	605	0.014	0.99	0.014		
Open Sp	1905	0.044	1905	0.044	0.51	0.022		
	2510	0.058	2510	0.058		0.036	0.036	0.626

INLET-4

	Area SF	AC	HSG C Area SF	AC	C	CA	ΣcA	c(ave)
Impervio	735	0.017	735	0.017	0.99	0.017		
Open Sp	1785	0.041	1785	0.041	0.51	0.021		
	2520	0.058	2520	0.058		0.038	0.038	0.650

RD-1

	Area SF	AC	HSG C Area SF	AC	C	CA	ΣcA	c(ave)
Impervio	1370	0.031	1370	0.031	0.99	0.031		
Open Sp	0	0.000	0	0.000	0.51	0.000		
	1370	0.031	1370	0.031		0.031	0.031	0.990

RD-2

	Area SF	AC	HSG C Area SF	AC	C	CA	ΣcA	c(ave)
Impervio	1320	0.030	1320	0.030	0.99	0.030		
Open Sp	0	0.000	0	0.000	0.51	0.000		
	1320	0.030	1320	0.030		0.030	0.030	0.990

RD-3

	Area SF	AC	HSG C Area SF	AC	C	CA	ΣcA	c(ave)
Impervio	1320	0.030	1320	0.030	0.99	0.030		
Open Sp	0	0.000	0	0.000	0.51	0.000		
	1320	0.030	1320	0.030		0.030	0.030	0.990

RD-4

	Area SF	AC	HSG C Area SF	AC	C	CA	ΣcA	c(ave)
Impervio	1370	0.031	1370	0.031	0.99	0.031		
Open Sp	0	0.000	0	0.000	0.51	0.000		
	1370	0.031	1370	0.031		0.031	0.031	0.990

TD-1

	Area SF	AC	HSG C Area SF	AC	C	CA	ΣcA	c(ave)
Impervio	740	0.017	740	0.017	0.99	0.017		
Open Sp	165	0.004	165	0.004	0.51	0.002		
	905	0.021	905	0.021		0.019	0.019	0.902

TD-2

	Area SF	AC	HSG C Area SF	AC	C	CA	ΣcA	c(ave)
Impervio	420	0.010	420	0.010	0.99	0.010		
Open Sp	0	0.000	0	0.000	0.51	0.000		
	420	0.010	420	0.010		0.010	0.010	0.990

DIRECT

	Area SF	AC	HSG C Area SF	AC	C	CA	ΣcA	c(ave)
Impervio	550	0.013	550	0.013	0.99	0.013		
0.125 Ac	39865	0.915	39865	0.915	0.86	0.787		
Open Sp	16700	0.383	16700	0.383	0.51	0.196		
Wodded	0	0.000	0	0.000	0.45	0.000		
	57115	1.311	57115	1.311		0.995	0.995	0.759

GRAPHIC SCALE

30 0 15 30 60 120

1 INCH = 30 FEET

1. EXISTING UTILITY INFORMATION SHOWN ON THESE PLANS IS FURNISHED BY THE UTILITY COMPANIES AND/OR THE SURVEYOR AND THE ACCURACY THEREOF IS NOT THE RESPONSIBILITY OF SCIULLO ENGINEERING SERVICES, LLC. IT IS THE RESPONSIBILITY OF THE OWNERS REPRESENTATIVES TO VERIFY THE LOCATIONS AND TO ARRANGE FOR FIELD LOCATION OF UNDERGROUND UTILITIES PRIOR TO CONSTRUCTION.
2. THESE PLANS ARE NOT FOR CONSTRUCTION UNTIL "ISSUED FOR CONSTRUCTION" APPEARS IN THE TITLEBLOCK.

811 Know what's below. Call before you dig.

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NJ CERTIFICATE OF AUTHORIZATION NO. 24GA28290700

83 MYRTLE STREET SUPPORTIVE HOUSING

BLOCK 573, LOTS 9, 10 & 12.02
CRANFORD TOWNSHIP, UNION COUNTY, NEW JERSEY

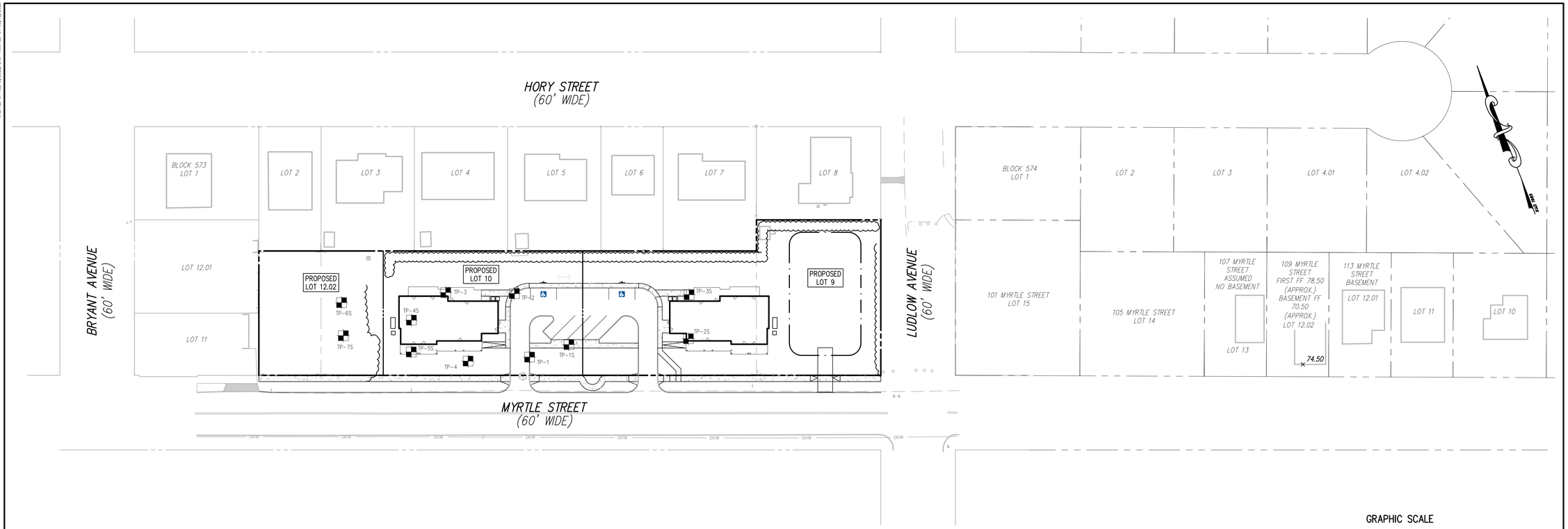
INLET AREA PLAN

756 HADDON AVENUE
COLLINGSWOOD, NEW JERSEY 08108

Kitchen & Associates

DATE	ISSUE NO.	SUBMISSION/REVISION	BY	APPR.
3/17/2022	1	INITIAL SUBMISSION	LAT	JTS

PROJECT NO. K&A 001.01
SCALE 1" = 30'
SHEET 3 OF 4
DRAWING NO. C1403



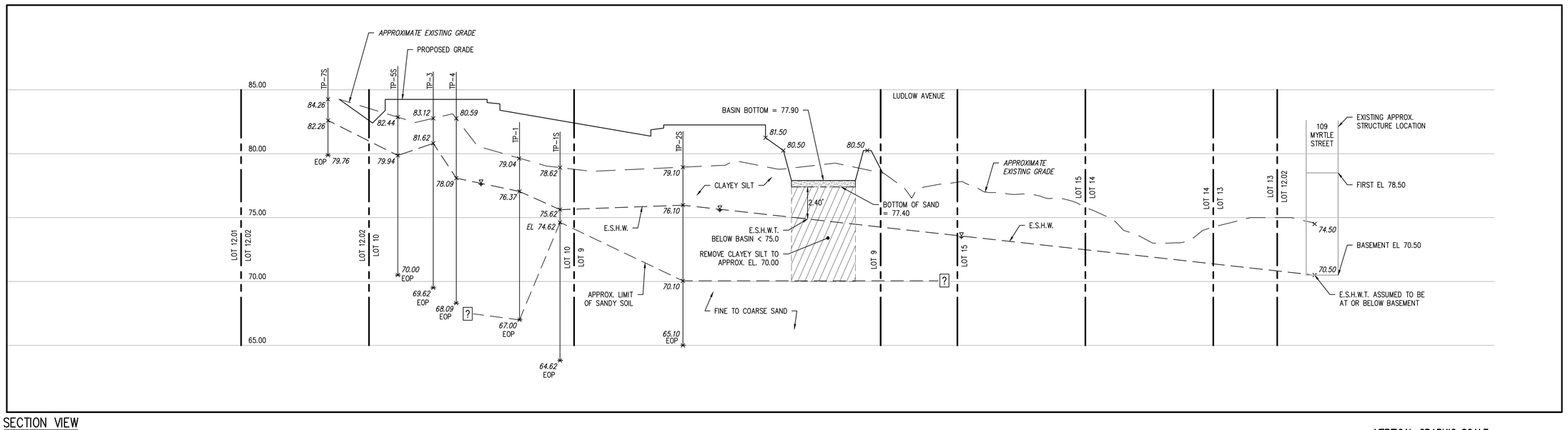
PLAN VIEW

SCALE: 1" = 40'

GRAPHIC SCALE

40 0 20 40 80 160

1 INCH = 40 FEET



SECTION VIEW

SCALE: 1" = 40'

VERTICAL GRAPHIC SCALE

4 0 2 4 8 16

1 INCH = 4 FEET

GRAPHIC SCALE

40 0 20 40 80 160

1 INCH = 40 FEET

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BLOCK 573, LOTS 9, 10 & 12.02
CRANFORD TOWNSHIP, UNION COUNTY, NEW JERSEY

SOIL PROFILE EXHIBIT

756 HADDON AVENUE
COLLINGSWOOD, NEW JERSEY 08108

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DATE	ISSUE NO.	SUBMISSION/REVISION	BY	APPR.
3/17/2022	1	INITIAL SUBMISSION	LAT	JTS

PROJECT NO. K&A 001.01
SCALE AS SHOWN
SHEET 4 OF 4
DRAWING NO. C1404