DUFFIELD ASSOCIATES
Soil, Water & the Environment

FLOOD MITIGATION FEASIBILITY STUDY

FOR
TOWN OF LITTLE CREEK
KENT COUNTY, DELAWARE

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INTRODUCTION

Little Creek is a small, rural community located in eastern Kent County, Delaware between the City of Dover and the Delaware Bay. Little Creek was settled in the early 1800's and developed a thriving oyster business which led to its growth as a community with homes and businesses. Today its primary features are its location on the Delaware Bayshore Byway, the Little Creek Wildlife Area, the Little River Boat Ramp and Fishing Pier, and the Little Creek Dog Park. The population of Little Creek has reduced but a number of historic buildings still remain in the town. The Town of Little Creek was named to the National Register of Historic Places in 1984.

The Town has experienced recurring flooding events in recent years which threaten both the existing and future use of roads and public, commercial, and residential properties within the Town limits. The area in front of the post office and the intersection of Main Street (DE-9) and Port Mahon Road are frequently flooded during even the smaller storm events experienced. The Town of Little Creek contracted with Duffield Associates, LLC (Duffield) to perform a flood mitigation feasibility study for the northern portion of the Town with the focus on the intersection of Main Street and Port Mahon Road as well as the existing tidal wetlands adjacent to the Little Creek Dog Park. A map showing the Town limits and the area of the study is provided in Figure 1.

Duffield performed a natural resources and existing conditions evaluation of the study area and modeled flooding during various storm events. Publicly available information from the Federal Emergency Management Agency (FEMA), the National Oceanic and Atmospheric Administration (NOAA), Department of Natural Resources and Environmental Control (DNREC), Kent Conservation District (KCD) and Delaware Department of Transportation (DelDOT) was supplemented with field observations to create a model of stormwater runoff in the study area. The model provides limits, depths, and duration of flooding for the individual drainage features.

The results of this model indicate that significant flooding occurs which impacts Main Street and Port Mahon Road on a frequent basis in an area already impacted by tidal conditions from the Little River and the Delaware Bay. The drainage infrastructure in and immediately adjacent to the Town was installed between the 1930s and 1960s and not designed to handle current rainfall events. The existing drainage infrastructure consists of a combination of inlets, storm drain piping, culverts and shallow ditches within the road rights-of-way as well as a tidal channel adjacent to the Little Creek Dog Park connecting to the Little River. Outside of the town is a privately owned pond and a channel which drains to the existing storm drain infrastructure on Main Street. The storm drain piping and culverts have not been adequately maintained with silt filling the inlets and piping. As well, the existing tidal wetlands immediately adjacent to the Little Creek Dog Park and behind the residential properties on Main Street has silted in and no longer functions to provide water quantity or quality management. Action is needed to reduce the frequently occurring flooding impacts to both public and private property within the town as well as within the public roads.

SECTION I

NATURAL RESOURCE EVALUATION

I. NATURAL RESOURCE EVALUATION

Duffield Associates, LLC (Duffield) identified and delineated the approximate boundaries of wetlands and other “waters of the United States” (WOTUS), the 100-year flood plain, and other protected natural resources associated with the Town of Little Creek (the “project site”) and the surrounding watershed. A natural resource evaluation was performed and included a desktop review of available maps for the town limits and a field reconnaissance of the project site, which is limited to the study area in the northern portion of the Town surrounding the intersection of Port Mahon Road and Main Street.

A. DESKTOP REVIEW

The area incorporated in the desktop review is located in a rural area in Little Creek, Delaware and is located within the Little River watershed. This evaluation was primarily limited to the town limits of Little Creek; however, areas located to the north and south were also considered in order to determine the source of flooding in the intersection of Main Street (DE-9) and Port Mahon Road. See Figure 2 for the watershed boundary for the site.

The boundaries of the project site were approximated on the U.S. Geologic Survey (USGS) Topographic On-line map (Figure 2), the U.S. Department of the Interior Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) (Figure 3), and the U.S. Natural Resource Conservation Service On-line Soil Survey (Figure 4), and the NOAA Fisheries Essential Fish Habitat Mapper. Tidal Wetlands regulated by the State of Delaware were identified using the Department of Natural Resources and Environmental Control (DNREC) State Wetlands Online Mapping.

The USGS Map (Figure 2) indicates that the latitude and longitude for the approximate center of the town is N. 39° 10' 01.5" and W. 75° 26' 54.1”. The map additionally indicates that study area is situated approximately 4-feet to 10-feet above mean sea level and slopes downward to the east towards Little River.

The USFWS online NWI Map indicates that several wetland areas are located in Little Creek (Figure 3). The northernmost wetland area is classified as a Palustrine, Forested, Broad-Leaved Deciduous, Emergent, Persistent, Seasonally Flooded, Diked/Impounded (PFO1/EM1Ch) wetland. This wetland appears to drain south through a watercourse which is identified as a Riverine, Intermittent, Streambed, Seasonally Flooded (R4SBC) wetland. The watercourse appears to direct flow to a Palustrine, Emergent, Phragmites australis, Seasonally Flooded (PEM5C) wetland. The PEM5C wetland drains south to Estuarine, Intertidal, Emergent, Phragmites australis, Irregularly Flooded, Partially Drained/Ditched (E2EM5Pd) and Estuarine, Intertidal, Emergent, Persistent, Regularly Flooded (E2EM1N) wetlands. The PEM5C wetlands appear to drain to the estuarine wetlands through a R4SBC watercourse. The NWI Map classified Little River as an Estuarine, Subtidal, Unconsolidated Bottom, Subtidal (E1UBL) wetland.

The Web Soil Survey (Figure 4) indicates that the majority of Little Creek is underlain by soil map units including the Unicorn loam, 0 to 2 percent slopes (UlA), the Unicorn loam, 2 to 5 percent slopes (UlB), the Carmichael loam, 0 to 2 percent slopes (CaA), the Broadkill-Appoquinimink complex, very frequently flooded, tidal (Ba), and the Mattapex silt loam, 0 to 2 percent slopes, Mid-Atlantic Coastal Plain (MtcA) units. The CaA and Ba map units are both classified as hydric soil. The areas underlain by these soils generally correspond with lands identified as wetlands by the NWI Map (Figure 3).

The DNREC State Wetlands Online Mapping indicates that tidal marshes are located in the southern and eastern portions of Little Creek. See Appendix A for the limits of the Delaware Tidal Wetlands.

Essential fish habitats (EFH) for several fish species are mapped near the project site by the NOAA Fisheries EFH Mapper. These species are listed in the table provided in Appendix B.

B. NATURAL RESOURCE EVALUATION RESULTS

The identification and delineation of wetlands was based upon the methods outlined in U.S. Army Corps of Engineers' Wetlands Delineation Manual (1987) as modified by the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (2010). Evidence of the Ordinary High Water Line was used to delineate the boundaries around watercourses when no wetlands were found. The limits of the floodplain were obtained from FEMA floodplain maps. No forest/woodlands were identified on the project site.

The limits of the WOTUS and floodplains are shown on the Natural Resource Map (Figure 5). The limits of the WOTUS shown on the plans were approximated based on the field observations described above and the interpretations of LIDAR topography, aerial photographs, the NWI Map, and the DNREC State Wetlands Online Mapping.

1. WOTUS Resources

The WOTUS resources identified on the project site included a perennial river (Little River), an intermittent stream, and Palustrine Forested, Palustrine Emergent and Estuarine Emergent wetlands. The non-tidal Palustrine Forested wetlands drain to an intermittent stream, which leads to tidal Palustrine Emergent and Estuarine Emergent wetlands. A portion of this stream flows piped, which confirms the desktop review discussed above.

2. Floodplain Resources

According to the FEMA Flood Maps, 100-year floodplain areas are located in the southern portion of the Town of Little Creek. The project area is located within the FEMA Flood Map 10001C0187J, effective July 7, 2014. The limits of the floodplain are shown on Figure 5.

SECTION II

EXISTING CONDITIONS EVALUATION

II. EXISTING CONDITIONS EVALUATION

A. Aerial Imagery

This study utilized medium resolution satellite imagery available from Earthstar Geographics, providing 15-meter resolution. The imagery for Little Creek is provided in Figure 1.

B. Topography

Studies of this nature rely on accurate elevation data for the evaluation area to provide a proper relationship between the various drainage components within the area. The elevation data utilized for this study incorporates LIDAR data obtained from First Map-Delaware open data source. The elevations were obtained from a 2014 LIDAR DEM which was flown for the State of Delaware with the vertical datum of NAVD88 and referenced to the horizontal datum of NAD83 state plane coordinate system. The accuracy of the LIDAR is 6.3 cm vertically although the accuracy is considerably less in heavily vegetated areas or beneath surface water. While the LIDAR is accurate to a degree, field obtained survey data is required to verify the LIDAR topography and supplement it in areas of insufficient detail. The topography for Little Creek is provided in Figure 6.

The elevations range from elevation 4 at the existing dual culvert crossing on the Jarman property to elevation 15 as referenced to the NAVD88 vertical datum near the intersection of Main Street and North Little Creek Road. According to the Federal Emergency Management Agency (FEMA) Firm Rate Map 10001C0187J, effective date July 7, 2014, the project area lies within three separate zones; AE10, X Shaded, and X unshaded. Zone AE10 is an area that lies within the 100-year flood plain with an associated flood elevation of 10. Zone X Shaded is an area that lies within the 500-year flood plain and is subject to flooding only during the most extreme storm events, such as hurricanes. Zone X Unshaded is an area that does not lie within the defined flood plain. The flood plain limits for Little Creek are provided in Figure 7.

C. Tidal Influence

With its location on the Little River and close proximity less than 2 miles to the Delaware Bay, both surface water and groundwater elevations within the town are influenced by the fluctuations of the tides. These tidal impacts, coupled with the low-lying nature of the town, exacerbate flooding during even the more typical storm events.

According to the Delaware Coastal Monitoring System, the mean high water elevation at the intersection of Main Street and Port Mahon Road, is elevation 2.86 while the mean low water elevation is elevation -2.94. Mean sea level lies at elevation 0.22 at this location. All elevations are referenced to NAVD88 datum. While the surface elevations for the roadways and surrounding properties are higher than the mean high water elevation, the inverts of the existing drainage infrastructure at the downstream portion of the system is below this elevation. This allows the tide to frequently flow up the storm drain system as well as block any discharge from the upstream portions of the system.

D. <u>Flood Extents</u>

The intersection of Main Street and Port Mahon Road sees regular flooding which significantly impacts the intersection as well as south along Main Street from the post office and the Little Creek Dog Park to the residences to the north off the Fire Station.

Image 1 – Main Street to Intersection with Port Mahon Road

Image 2 – Existing Tidal Wetlands on property adjacent to the Little Creek Dog Park

The existing drainage infrastructure in the northern end of the town includes inlets and underground storm sewer and man-made ditches, farm ponds and wetlands located within public rights-of-way, on private property or within drainage easements.

The stormwater management modeling of the existing drainage system in Town was performed using the proprietary software HydroCAD. The model utilizes the most current NOAA ATLAS 14 Point Precipitation Frequency Estimates for Kent County, Delaware and incorporates impacts due to high water levels from extreme high tides or storm events such as nor'easters, which can cause wind driven storm surges. The storms evaluated as part of this study were the 1-year, 10-year and 25-year storm events as discussed with the Town since these storm events are the criteria utilized by DelDOT for storm drainage within state rights-of-way of this classification. The existing conditions stormwater management model is provided in Appendix C along with a map depicting the existing drainage system.

The runoff from the contributory drainage area on Main Street from the intersection of North Little Creek Road and Main Street to the intersection of Main Street and Port Mahon Road is collected and conveyed by roadside ditches discharging to inlets. The roadside ditches are v-bottomed ditches with limited depth, lending to minimal capacity to convey runoff. The inlets and storm drains along this portion of Main Street also have limited capacity due to the small pipe sizes, however no flooding is projected for the most of this area for storm events less than the 25-year storm.

The runoff from the northern portion of Main Street and a portion of Port Mahon Road are conveyed through the roadside ditch and inlet system to the intersection of Main Street and Port Mahon Road. It is then routed through a larger storm drain pipe to a manhole, where the runoff from the agricultural area west of town joins these flows into a single discharge pipe to the tidal wetlands adjacent to the Little Creek Dog Park.

The contributory drainage area from the agricultural area west of town is approximately 45 acres in size with its only drainage control being a farm pond and wetlands area prior to discharge into a small v-bottom ditch between two residences and a culvert. The culvert then connects to the storm drain system in Main Street with discharge to the tidal wetlands at the Little Creek Dog Park. Both the culvert and storm drain pipe crossing Main Street do not have the capacity to convey this runoff during the 10-year storm event, let alone larger ones without causing flooding. The v-bottomed ditch is at capacity during the 10-year storm event and floods during the larger storm events.

The majority of the existing storm drain consists of the smaller diameter reinforced concrete (RCP) or corrugated metal pipes (CMP), 15 or 18 inches in diameter. The invert elevations of the storm drain were obtained from information of record or were assumed based on existing conditions as a field survey was not performed as part of this study. We were unable to obtain depths for the inverts or measure down to the inverts of the storm drain pipes due to standing water in the inlets or culverts which are buried partially or fully beneath the existing grade. It is suspected the cause of the standing water is a combination of silted-in outlet pipes not allowing free discharge of runoff, tidal influence from Little Creek on both the waterway and storm pipes, and groundwater backflowing through the outlet pipes and infiltrating into the pipes and inlets through cracks in the structures.

The junction of the storm drain collection systems for this area of Main Street and the agricultural area west of town at the manhole prior to the outlet pipe to the tidal wetlands exceeds the capacity of the downstream storm drain to adequately convey the runoff, especially when subject to the impacts from the tidal influence on the outlet pipe. The outlet pipe is a 30-inch RCP pipe which is completely covered by silt and was therefore unable to by physically located. Despite the silted condition of the pipe, it is assumed that some flow must still occur through the pipe as the runoff collected in the upstream storm drain system drains, albeit slowly. Through review of record drawings, it appears that the original invert elevation for this outlet was 1.70.

The tidal wetlands adjacent to the Little Creek Dog Park and continuing behind the residences on the east side of Main Street was originally created as a tidal ditch to connect the storm drain infrastructure to the existing dual 18-inch culverts under the access drive on the Jarman property. Through reviews of record drawings, it appears that the original invert elevation for these culverts was 0.84. Over time, lack of maintenance of the ditch allowed and the dual 18-inch pipes allowed the pipes to silt in almost completely and no longer allow adequate drainage from the upstream system. This led to the natural development of the wetlands along the length of the tidal ditch with continued expansion as time went on. The tidal ditch or the dual 18-inch pipes were not sized adequately to convey the volume of runoff being directed to them, so the access drive situated at an approximate elevation of 4, acts as a spillway when the water in the tidal ditch/wetlands backs up due to the larger storm events.

During the 10-year storm event, the intersection of Main Street and Port Mahon Road floods to a depth of approximately 7 inches for a duration of 30 minutes. This flooding extends south along Main Street to include the roadway in front of 380 Main Street. The flooding extents and duration worsens with the 25-year storm event, with a flood depth of approximately 22 inches for a duration of 80 minutes and extending south to include the roadway on Main Street in front of the Fire Station. This restricts the ability of emergency personnel to respond safely and quickly to any emergency situations that arise. The extent of typical flooding can be seen in Images 1 and 2.

For extreme weather events such as the 50-year and 100-year storm events, the flooding will be significantly worse and will affect not only the roads but the properties on the eastern side of Main Street. Flood depths associated with these events will be in feet and last for hours, however these storm events were not specifically modeled as part of this study. It can be assumed however, that the possibility of major damage to infrastructure as well as resident safety increases with these extreme weather events.

Based on our existing conditions evaluation of the northern portion of the Town, the extent of flooding during the 10-year and 25-year storm events impacts the safety of the Town’s residents and infrastructure where Main Street becomes impassable. A map has been created showing the extents of flooding during a 10- and 25-year storm event is provided in Figure 8 and specific information on flooding depths and durations for each impacted drainage infrastructure feature is provided in Table 1. A map of the inlet and pipe locations is provided in Appendix C.

Table 1 - Flood Duration and Depths for 10-year and 25-year Storm Events

Storm Event	Flooding Location	Max Flooding Depth (ft)	Flooding Duration (hr)
10-yr	CB-4	0.09	0.3
	CB-5	0.65	0.5
	CB-6	0.61	0.5
	CB-7	1.78	0.6
	CB-8	0.52	0.5
	CB-9	0.07	0.2
	CB-12	0.70	0.5
	CB-13	0.30	0.5
	CB-14	1.03	0.6
	CB-15	0.54	0.4
	CB-16	0.33	0.2
	CB-17	0.85	0.3
25-yr	CB-1	2.11	0.4
	CB-2	1.10	0.3
	CB-3	1.37	0.5
	CB-4	0.39	0.7
	CB-5	2.16	8.0
	CB-6	1.85	3.9
	CB-7	3.43	1.3
	CB-8	1.27	0.9
	CB-9	2.07	0.5
	CB-10	1.01	0.3
	CB-11	1.96	0.4
	CB-12	1.48	2.0
	CB-13	0.73	1.2
	CB-14	2.80	1.2
	CB-15	2.37	0.9
	CB-16	3.75	0.7
	CB-17	4.79	0.8

SECTION III

GREEN INFRASTRUCTURE

III. GREEN INFRASTRUCTURE

A. Introduction

Green Stormwater Infrastructure (GSI) improvements can mitigate flooding through infiltration or extended detention. They can also provide water quality treatment in conjunction with infrastructure maintenance and improvement as well as the proposed wetland restoration.

The Coastal Resilience Design Studio (CRDS) provided the Town of Little Creek with two reports on August 3, 2020. The Community Discovery Process (CDP) report summarizes the projected sea level rise, land use, existing areas of flooding, and existing stormwater infrastructure in the Town of Little Creek. The Conceptual Resilience Plan (CRP) includes conceptual plans for flood mitigation and improvements as a part of the overall project.

Using the existing information provided by CRDS through the CDP and CRP, and supplemented by limited field investigation, a desktop analysis was performed to evaluate the feasibility of conceptual stormwater management features at the intersection of Main Street and Port Mahon Road. These features are proposed to manage stormwater runoff volume, provide traffic calming, and provide high-visibility opportunities for public education and engagement in stormwater management.

GSI interventions were evaluated based on opportunities identified on the Master Plan on page 12 of the CRP and use the same numbering for consistency with that document. Opportunities for interior park improvements were not evaluated at this time; however, additional opportunities for GSI implementation should be considered in conjunction with development of the plans for park renovation. Descriptions of the drainage areas, potential GSI intervention, benefits, additional information or design needs, and conceptual level cost are provided for each area.

- Bioretention – A bioretention facility is a small stormwater management feature which captures runoff and filters the runoff through a special engineered soil media
- Bioswale – A bioswale is a conveyance channel that captures and filters runoff using the vegetation in the channel as well as providing runoff attenuation through the use of stone check dams.

Table 2 below presents the locations evaluated for GSI and the contributing drainage area to each location. The potential interventions are described in detail in the following section and shown in Appendix E Conceptual Green Infrastructure Design.

Table 2 – Runoff Summary of Proposed GSI Implementation Areas

Area	Drainage Area (acres)
1 – Buffered Bike Lane (CB-7)	1.06
2 – Crosswalks (CB-6)	0.06
3 – Green Infrastructure: Bioswale (D-5, P-5, CB-5)	44.84
4 – Green Infrastructure: Bioswale (CB-12)	0.78
4 – Green Infrastructure: Bioswale (CB-13)	3.05
7 – Parkside Trailhead & Bioswale (CB-14)	0.19

Note: All Pipe (P-), Catch Basin (CB-), Manhole (MH-), and Ditch (D-) numbering comes from the existing stormwater infrastructure summary table and exhibit from Sheet 13 of the CDP.

B. GREEN STORMWATER INFRASTRUCTURE INTERVENTIONS

1. Area 1 – Bioretention (Buffered Bike Lane) (CB-7)

A buffered bike lane utilizing a small bioretention facility (BR-1) could be constructed in front of the property at 486 Main Street at the northeastern corner of Main Street and Port Mahon Road to intercept runoff from just over 1 acre that current flows to the existing catch basin (CB-7.) This drainage area includes several residential parcels and is roughly half impervious and half pervious. The proposed facility could be a small rain garden within the front yard of this property or a stormwater bumpout extending into the cartway. The CDP's Master Plan identified the possibility of a buffered bike lane in this area. A bumpout extending into the cartway would provide protection for a multi-use trail located over the existing storm sewer in the right-of-way along the property line. Alternatively, a protected bike lane could be designed with flexible traffic delineators to separate the bike lane from vehicular traffic. If the bike lane is proposed along the roadway shoulder, the rain garden would be located between the edge of the roadway and the property line.

The sizing and placement of any bioretention facility in Area 1 is dependent on the width of the right-of-way along Main Street and how much encroachment into the cartway is allowable for a bike lane or vegetated area to buffer a bike lane. Additionally, the location and depth of storm sewer P-9 will impact the type of stormwater management facility that can be proposed above it.

2. Area 2 – Bioretention (Crosswalks) (CB-6)

A small bioretention facility could be installed in a curb extension/bumpout at the southeast corner of the intersection of Main Street and Port Mahon Road (BR-2) to intercept runoff and provide traffic calming at the intersection. Most of this drainage area is impervious coverage in the roadway but is relatively small compared to the other areas evaluated. A 6-

foot wide bumpout would not manage a large volume of runoff but would serve to enhance the water quality of the runoff received in the facility while also providing traffic calming in the area.

The bumpout would be limited in size by the locations of MH-1, CB-6, and CB-12. Additionally, a new curb ramp may need to be designed and installed depending on the improvements proposed at this location. Additional information including the locations of the proposed crosswalks and the minimum roadway width are needed to further this design.

3. **<u>Area 3 – Green Infrastructure (Vegetated Channel Improvements)</u>**

Improvements to the existing drainage ditch between the properties at 481 and 467 Main Street could help provide water quality improvements for runoff from the large drainages contributing to this ditch and associated infrastructure that crosses Main Street. This ditch is the downslope end of a series of ditches and wetlands that collect runoff from a large agricultural drainage area. The concept report considered a bioswale in this location; however, there is limited space to regrade and create a bioswale adjacent to the existing home and any interventions should avoid additional ponding that may impact that home.

The pipe (P-5) at the downslope end of D-5 was found to be full of sediment during field investigation at this location. Therefore, the top priority should be the removal of this sediment to allow for flow into and through the existing storm sewer. GSI interventions can then be constructed to slow runoff before it reaches the pipe. A small (0.5' high, 3H:1V side slopes) check dam towards the downslope end of the ditch would slow the flow, allow for some settlement of sediment, and provide some water quality treatment prior to entry into the downstream pipe network. Expanding the ditch after it passes the existing home, but upslope of the pipe would allow the check dam to provide enhanced water quality benefits.

The limits of the right-of-way and private property are required to further develop the extent of an expansion and orientation of the proposed check dam upslope of the pipe entry.

4. **<u>Area 4 – Green Infrastructure (Bioswale)</u>**

Two existing ditches (D-6 and D-7) along the north and south sides of Port Mahon Road, east of the intersection with Main Street could be enhanced to attenuate stormwater flows and provide increased water quality treatment. Both ditches were measured to be nine feet wide and are assumed to be two feet deep with a one-foot bottom width and 2:1 side slopes. Almost four acres of primarily agricultural area drain to these ditches. There are several options for interventions that discussed below:

a. *Option 1* – Both ditches could be converted into bioswales with tiered steps leading to slow flow and provide water quality treatment. The tiers could be created with small check dams located approximately every 50 feet along the ditch. This would increase the opportunity for infiltration along Port Mahon Road, while also delaying runoff from these drainage areas reaching the intersection or Port Mahon Road and Main Street. Each step of the bioswale would allow for roughly one foot of ponding before flowing over the check dam into the next step. The attached Conceptual Plan shows two steps in each bioswale with an optional extension father upslope along Port Mahon Road to provide increased benefit.

b. *Option 2* – Construct the bioswales listed in option 1 above and add a bioretention facility (BR-4A) in the front yard of the post office. This bioretention facility could be a rain garden with roughly 2 feet of ponding and 2 feet of amended soil. Dependent upon the depth to the water table, the ponding depth and amended soil depths may be reduced, although a geotechnical evaluation will be necessary to establish this. The bioretention facility would promote infiltration and manage additional volume before it reaches the storm sewer at the intersection.

c. *Option 3* – Construct a large bioretention facility (BR-4B) in the rear yard of the post office between the building and the playground. This would take the place of the proposed community garden identified in the CRP's Master Plan. This facility would require new stormwater piping across Port Mahon Road from D-6 and manage runoff that is currently leading to both CB-12 and CB-13. Trenching would be required within in the root zone of the current row of trees along Port Mahon Road and may require removal of one or two trees. This large bioretention facility could manage more runoff prior to discharge to the constructed wetland. This option would have the largest impact on runoff reduction but would also have greater cost and may conflict with other Town priorities.

Further development of these options depends on a balance of stormwater management with other Town improvements. All of the above options meet the primary goal of reducing the runoff volume entering into the storm sewer system but provide varying levels of benefit. The right-of-way width and/or feasibility of construction on the adjacent properties along Port Mahon Road is needed to determine the locations and sizing of each bioswale tier and check dam. Additional coordination with the community regarding park improvements is needed to determine the feasibility and placement of rain gardens in Options 2 and 3.

5. **<u>Area 7 – Parkside Trailhead & Bioswale</u>**

Porous pavement and a bumpout could provide high visibility stormwater management as well as traffic calming at the park side trailhead. The CRP proposed that the parking lot be replaced with pervious pavement. This could be achieved using either porous asphalt or interlocking concrete pavers (such as grass pavers). Either option would promote infiltration, reduce runoff into the storm sewer system, and offer highly visible example of stormwater management in a public place. The parking lot does not receive much runoff aside from direct rainfall, which is an important consideration for porous paving.

A stormwater bumpout (BR-7) at the trailhead into the park could provide stormwater management in addition or as an alternative to the porous parking lot. This bumpout could include surface ponding and plantings while providing traffic calming and demarcation of the end of the proposed on-street parking lane. The bumpout shown in the Conceptual Plan is six feet wide and extends from the edge of the post office parking lot to the manhole (MH-2) leading into the constructed wetland.

The bumpout placement and sizing would depend on the allowable roadway width in this area, the right-of-way width, and any conflicts with the proposed trailhead improvements.

The green infrastructure options presented are all dependent on their functionality when designed in accordance with the approved Delaware Stormwater Regulations. While infiltration is encouraged in all circumstances, the high groundwater table combined with the tidal influences may not allow for infiltration in areas closer to the Little River. Specific soils testing will be required to determine the groundwater table elevations and definitively determine the feasibility of these options.

C. CONCLUSIONS

Prioritization of Green Infrastructure improvements depends on a combination of stormwater benefit, cost, ancillary benefits, and coordination with other Town priorities. The GSI options describe a variety of potential options for green stormwater infrastructure that could be implemented as a part of this project. The main priority of the project is to improve downstream conditions in storm events to avoid overloading the storm sewer. In this case, the ditch improvements in Area 3, the bioswales and bioretention facilities in Area 4, and the pervious pavement in Area 7 offer the greatest impact to managing runoff volume in the area investigated. The bumpouts proposed in Areas 1, 2, and 7 offer some stormwater management advantages such as runoff filtration and attenuation, but likely do not have enough area to offer a significant runoff reduction. These features offer benefits other than stormwater management, including traffic calming and opportunities for landscaping, which may be preferred to leverage funding opportunities for the project.

Duffield Associates
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SECTION IV

WETLANDS RESTORATION

IV. WETLANDS RESTORATION

The existing tidal wetlands located behind the residential properties and adjacent to the Little Creek Dog Park on Main Street are a key component in the drainage system with Little Creek. The preliminary existing conditions investigation identified key blockages in the current wetland system that are leading to backups of stormwater through the Town's stormwater system, causing flooding in the community. The conceptual design aims to remove those blockages and establish a more resilient and self-maintaining wetland system through the removal of invasive species and reestablishment of high-quality wetland system that also functions as a stormwater and flood management system. Key components of the conceptual wetland restoration design are discussed below and shown on the Wetlands Conceptual Plan in Appendix D.

1. Invasive Species Removal

The first key step in the wetland restoration is the invasive species removal throughout the wetland. The existing stand of phragmites that dominates the wetland area will be removed by mowing down and removing the biomass. Following clearing of the biomass, the top 4 to 6 inches of wetland soils will be stripped to remove the phragmites root systems and seed bank contained in the soil. The cleared biomass and stripped topsoil will be disposed of off-site to ensure as a complete a removal of the invasive species as possible.

2. Low and High Marsh Habitats

The second key step in the wetland restoration involves excavating the existing wetlands to establish the Low and High Marsh habitat areas. The Low Marsh areas within the wetlands are flooded on a daily basis with the tides and act as a key area to trap sediment as well as providing important aquatic habitat. The High Marsh areas within the wetlands see less frequent flooding, generally during the larger tidal and rainfall events and act as a buffer to filter the runoff.

The excavation of the Low and High Marshes will start from the edges of the existing wetland at a gradual slope down towards the center of the wetland and low flow wetland channel (discussed below) to create the high and low marsh habitat areas. Wetland bottom depths shown on the conceptual plan vary from the existing perimeter elevations of the wetland around 5 feet down to 2 feet elevation at the wetland's deepest base elevation. This constant varied slope will provide both high and low marsh habitat, with transitional zone between for maximum habitat diversity. This varied slope also provides long term resiliency as water levels change, versus having one constant bottom elevation for the low and high marsh.

3. Flood Attenuation and Water Quality Improvements

Within the created low and high marsh areas, additional features will be incorporated into the design which focus further on the stormwater treatment and flood storage. These features include a forebay, deep pools, and a low flow wetland channel.

To create the forebay, the existing 30-inch storm sewer discharging the runoff from the northern storm drain into the existing wetlands adjacent to the Little Creek Dog Park will be removed and daylighted into a deep water forebay at the existing MH-2 location at an invert of elevation 1.7. This forebay will be excavated to an approximate elevation of -1.0 to provide sediment settlement storage. A check valve is proposed to be installed on the daylighted 30-inch sewer to prevent backflow into the storm sewer network from the wetlands. This forebay is anticipated to have an approximate capacity of 180 CY for stormwater and sediment storage. This storage is the volume calculated below mean high water level (MHHW) of elevation 2.9. It is anticipated that this forebay will require regular maintenance dredging to remove accumulated sediments. The forebay is located near Main Street and the Little Creek Dog Park, making it easily accessible.

The deep pool feature will be excavated downstream from the forebay. This pool will provide stormwater storage and help to dissipate storm and tidal flow energies, as well as act as open water marsh habitat. This deep pool is anticipated to have an approximate capacity of 400 CY for stormwater storage below MHHW.

The low flow channel will be excavated through the entire wetland to maintain a flow path for stormwater and tidal flows to drain from the wetlands and flush sediments through the system. A critical issue identified during the site investigation was that the current wetland inlet and outlet inverts are at elevations which cause backwatering and still water areas within the wetlands. This has led to sedimentation of the wetlands and existing storm drain pipes. Establishing the low flow wetland channel will alleviate this problem. The channel has a maximum elevation of 1.7, which matches with the 30-inch storm sewer invert at the inlet of the channel. The channel will be 6 feet wide with 1.5:1 side slope that will pass through the entire wetland to the outlet with a constant slope of 0.1% to tie into the outlet invert of 0.84. This configuration will provide for constant inflow and outflow driven by tidal events, allowing sediments to be flushed through the channel. High points in the base wetland are established between the forebays and deep pool areas, but the channel bottom elevation will be maintained through these areas. These high points help to create a head gradient from the upstream to downstream portions of the wetland as tide waters recede, which will help to maintain velocities in the channel.

Like the forebay at the wetland inlet, a deep pool will be excavated to an approximate elevation of -1.5 to provide energy dissipation from incoming tidal flows and sediment settlement storage. This pool is anticipated to have an approximate capacity of 350 CY for stormwater and sediment storage. This storage is the volume calculated below mean high water level (MHHW) of elevation 2.9. It is anticipated that this forebay will need to be dredged less frequently than the forebay at the wetland inlet, but it is located along near the edge of the wetlands and can be accessed more readily as needed for maintenance.

4. Culvert Improvements

Another key drainage blockage of flow is the existing dual 18-inch culverts underneath the field drive located at the downstream end of the wetlands. These culverts were observed to be silted over and shown to be undersized through the existing conditions stormwater modeling. To improve this condition, these culverts will be removed and an open channel connection to the downstream wetland area is proposed. This open channel is conceptually shown to have 6-foot-wide bottom with 3:1 side slope. Further hydraulic analysis is needed to determine final sizing of this channel. The bottom elevation of this channel is shown at an elevation of 0.84 which matches the historic culvert invert (from record drawings). This channel would be excavated through the existing crossing and daylighted into the downstream wetlands. Note: this assumes that the downstream wetland does not have blockages above the channel invert elevation of 0.84. Additional analysis of the downstream wetlands is needed to determine this. It should also be noted that wetland improvements made in the upstream wetland area may not be as effective or function as intended if the downstream wetlands are blocked, causing a backwater affect.

5. Flood Protection Berm

An additional element of the conceptual design is a flood protection berm. To provide further flood protection to the residences that border the wetland, an earthen berm is proposed along the western edge of the wetlands. It is anticipated that this berm will be created utilizing materials excavated from the wetlands and is shown with a 4-foot wide top, 2:1 exterior slope, and 3:1 interior slope on the residence side. The berm top is set to a constant elevation of 8 which is approximately 0.5 feet above the 10-year floodplain limits for the area. Drainage culverts are shown at low points along the berm with one-way check valves to allow for drainage of the properties after larger storm events.

6. Wetlands Revegetation

The final key step in the wetlands restoration is the revegetation of the wetlands. Following the earthwork activities associated with the regrading of the wetlands and installation of the flood protection berm, the site will be re-vegetated for final and permanent stabilization. Plantings within the wetland area will be native emergent/tidal wetland plant species. Species will be selected and placed based on anticipated hydraulic conditions and suitability to the low and high marsh areas. Areas outside of the wetlands disturbed by construction, including the flood protection berm, will be seeded with native upland grasses or turf grass as appropriate to the location.

The completed wetland restoration will serve a dual function of providing a stormwater and flood management system and a healthy and diverse marsh wetland ecosystem. The conceptual design incorporates features that address current blockage issues with the Town of Little Creek's stormwater system and is expected to improve the current flooding situation. Conceptual design elements such as the forebay and deep pools will help to capture sediment and provide stormwater storage, and the proposed wetland channel will allow for the main drainage of the wetlands to flush sediments, maintaining the wetland bottom elevation to eliminate the current blockages. Other elements of the design including the removal of the downstream culverts and the flood protection berm will serve to mitigate flooding in the town and provide additional protection to properties which abut the wetlands. The design of the low and high marsh areas will create maximum habitat diversity and their varied slope also provides long term resiliency as water levels change. Native wetland plant species selected for the marsh will create a diverse and healthy habitat which can be enjoyed as an amenity to the Little Creek Park. These components of the overall conceptual design accomplish the goals of the project by removing blockages in the stormwater system and establishing a more resilient and self-maintaining wetland system.

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SECTION V

SCOPE OF DESIGN

V. SCOPE OF DESIGN

While the feasibility study was the first step in mitigating the frequent flooding occurring at the intersection of Port Mahon Road and Main Street, additional steps are necessary to bring the potential flood mitigation options to actual construction. This next key step is providing preliminary and final designs for these options, including the additional field investigations needed to obtain the required information for the design. The design scope for the various potential flood mitigation options is discussed in the section below.

A. Natural Resources Evaluation

A formal wetlands delineation will be required to proceed with the wetlands restoration adjacent to the Little Creek Dog Park and behind the residences on Main Street. This entails a one-day field reconnaissance to identify and delineate the wetland/waters boundary on the project site. Wetlands will be identified using the procedures defined in the 1987 Corps of Engineers Wetlands Delineation Manual and the 2010 Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region Version 2.0. When no wetlands are found beyond the edge of watercourse or ponds, the jurisdictional boundaries will be determined using the Ordinary High Water Mark (OHWM). The preparation of a wetland delineation report that is suitable for submission to the regulatory agencies will be provided.

A surface water delineation will also be required to move forward with design and for permitting. The surface water delineation will be performed where restoration activities are proposed. Understanding the location and quality of surface water features is necessary for future permitting activities and construction impacts to those features. The goal of this delineation is to identify the boundaries of surface water features so the necessary permits can be obtained prior to construction. The surface water delineation will be performed in accordance with the 1987 U.S. Army Corps of Engineers (USACE) Wetland Delineation Manual, the 2012 Regional Supplement to USACE's Wetland Delineation Manual - Northcentral and Northeast (v. 2.0); subsequent guidance issued by the USACE; DNREC guidance on evaluation of wetlands and streams; and established principles and practices of plant community ecology, botany, and wildlife biology.

Additional site assessments and investigations required to be performed for permitting include threatened and endangered species review and cultural resources investigations. The project team will need to coordinate with the appropriate regulatory agencies such as DNREC and USFWS to identify the potential for the presence of rare, threatened and endangered (T&E) species or their habitat onsite. This coordination will include the identification of known protected populations, occurrences within the vicinity of the project, and the potential presence of suitable habitat within and adjacent to the proposed restoration projects. When appropriate and where possible, we will coordinate requests to obtain waivers from USFWS and/or DNREC for time of year and location-sensitive restrictions. A cultural resources review is also needed to be conducted to evaluate the potential for impacts to cultural resources by consulting available online databases, National Register of

Historic Places listings, and any available local landmarks information. These data will be compiled in summary documents or letter reports with brief narrative descriptions of the results, data tables of nearby historic sites or resources, and topographic and aerial photograph maps of the project locations and historic resources. Both of these tasks will produce summary reports of the studies which will be utilized for permitting for the project.

B. Green Infrastructure Improvements

The next steps of the project would involve a detailed topographic survey, discussion of priorities with the Town of Little Creek, and hydrologic modeling including the proposed. Topographic survey of the project area provides information to move the designs beyond a conceptual level. This information would also confirm the limits of the right-of-way and property lines, to determine placement and sizing of the proposed green infrastructure features. A discussion on the priorities of the project would help to determine which of the above listed green infrastructure features is most preferred or most feasible based on the overarching goals of the Town for this project. Assumptions were made in the placement and sizing of the conceptual designs that may need to change based on further discussion. Once the survey occurs, decisions can be made based on the priorities for the project, including necessary geotechnical evaluation and testing to determine seasonal high water table depths and infiltration capacity of the soils. Then a hydrologic model will be created to provide quantitative results regarding the benefits of each of the above options.

Once the decision has been made as to which green infrastructure features the Town wishes to implement has been made, detailed design of the various features can be performed with construction documents prepare for submission to the review agencies for permitting.

C. Wetlands Restoration

To develop the conceptual plan into a final design for construction, additional site assessments, design, and permitting tasks must be performed. These tasks include topographic survey, surface water delineation, geotechnical exploration, preliminary and final design, and construction documents, and permitting.

¬To begin the next phase of project, moving from conceptual to preliminary design, a topographic survey of the site will be required. Topographic survey will include surveying the location and elevation of visible site features, such wetland boundary, wetland topography, existing wetland drainage features, existing infrastructure, signs, fences, culverts, visible utilities, and freestanding significant trees (8" DBH and larger) and all pertinent property, right-of-way, and existing easement lines. The topographic survey extents will be within the approximate limits of the proposed project area and will include detailed topographic and bathymetric data within the wetland to provide the necessary data needed to complete the restoration design and details. Sediment in the wetlands at critical infrastructure will also be measured by probing or hand excavating to determine invert elevations. Additional topographic information adjacent to the proposed project limits will be collected as needed to complete a storm and Hydrologic and Hydraulic (H&H) analysis to ensure no flooding will occur as a result of the project (e.g., adjacent roadway, storm sewers, culvert structures, and field drainage ditch elevations, downstream wetland elevations).

It is recommended that soil profile information be gathered at several locations throughout the project area in order to determine the properties of excavated materials for construction. These profiles should be performed to planned excavation depths to characterize the soil profile of the site. The goal will be to verify existing soil survey mapping and identify soils which could be suitable for the wetland berm fill and determine depths of sediment in the wetlands to further inform the design.

Following site assessments, the conceptual design will be updated to utilizing the information gathered by these initial tasks to produce a preliminary and final design. The preliminary design plans will focus on further developing the conceptual plan and preparing drawings and reports provided project stakeholders for review and feedback prior to advancing to the preparation of the final design. During this period, a preliminary estimate of construction costs, as well as a life cycle cost analysis, will be performed on the project. After preliminary design is approved, final design will commence with the completion of the construction plans, specifications, and documents needed for construction. Design plans and final engineered drawings will include, but are not limited to:

- Summary of existing conditions and details of relevant information gathered during the surveying and site characterization;
- Site grading and earthwork activities (e.g., site preparation, excavation, grading, etc.);
- Proposed site improvements and final end-use plan depicting contours, dimensions, locations, and materials for each improvement feature;
- Sediment and erosion control plan; and
- Native planting plan and planting schedule.

Final design plans and engineering drawings will be used for obtaining necessary permits and implementation of the proposed site improvements.

The construction plan set will include relative elevations and grades that could be field adjusted by the contractor during construction, as approved by the design engineer.

Throughout the preliminary and final design phase, H&H modeling will be used to aid and validate design and ensure functionality of the system. Proposed wetland restoration will be evaluated using the most suitable H&H approach based on the final design. H&H data will be integral with the development of the design through the preliminary and each milestone phase of the final design. A summary of the

H&H studies will be included in a preliminary design report and the final design report for the project and used as a basis to support a floodplain development application.

Following design and permitting approval, and project implantation can occur. Construction activities will commence with site mobilization and installation of erosion & sediment controls. Next, site clearing, and grubbing activities will occur, primarily consisting of clearing of invasive species. The existing stand of phragmites will mowed down and the biomass removed. Following clearing of the biomass, the top 4 to 6 inches of wetland soils will be stripped to remove the phragmites root systems and seed bank contained in the soil. Earthwork activities will next be performed including mass excavation of the wetland area to achieve proposed wetland elevations, including excavation of the forebay and deep pools. During excavation of the forebay, the demolition and daylighting of the 30-inch storm sewer and check valve installation will occur. The majority of the excavated materials will be hauled and loaded for off-site disposal. A smaller portion of the excavated materials will be used to construct the flood protection berm using excavated soils which are suitable for its construction. Upon achieving rough final grade of the wetland area, the low flow wetland channel will be excavated and wetland final grading will be performed, except for the wetland outlet channel which will be performed last. With the completion of earthwork activities, the site permanent stabilization such as erosion control blanket and rock channel protection will be installed up the wetlands outlet. Site planting will then occur with wetland plantings installed through the wetland as well as disturbed upland areas the floodplain berm. Lastly, the wetland outlet channel will be excavated and the dual 18” culverts removed. The channel will be permanently stabilized and planted for project substantial completion. Throughout the entire construction period, water at the site will be managed by the contractor to keep the site sufficiently dewatered to perform construction activities. Erosion and sediment controls and other stormwater BMP’s will also be maintained and adjusted as needed to prevent stormwater pollution from the site. Erosion and sediment controls will remain in place until the site has established proper vegetated cover and reached target final stabilization.

SECTION VI

PERMITTING

VI. PERMITTING

A. Existing Storm Drainage Infrastructure Maintenance

Maintenance of the existing storm drainage infrastructure within the state maintained right-of-way will require coordination with DelDOT since they own the inlets and pipes. Upgrades to the existing storm drainage infrastructure within the state owned right-of-way will require a DelDOT utility permit. The remaining storm drainage infrastructure, which includes the existing dual culvert crossing underneath the access drive, will require coordination with the individual property owners although they lie within drainage easements. This work is maintenance in nature and as such is not anticipated to require permits.

B. Green Infrastructure Design

Permits will be required from the following agencies for the green stormwater infrastructure improvements:

1. Kent Conservation District (KCD) – The State of Delaware Sediment and Stormwater Regulations require that a person shall not disturb land without an approved Sediment and Stormwater Management Plan. A Sediment and Stormwater Management Plan Approval is required from the Kent Conservation District.

2. Delaware Department of Transportation (DelDOT) – Since a portion of the proposed green infrastructure lies within the rights-of-way of state owned and maintained roads, an approval from DelDOT's Stormwater Engineer will be required. A Record plan approval will also be needed to establish easements and maintenance responsibilities for the green infrastructure.

3. Department of Natural Resources and Environmental Control (DNREC) – All construction projects with land disturbance over 1 acre are required to submit a Notice of Intent (NOI) as part of the NPDES General Permit for Storm Water Discharges associated with Construction Activity.

C. Wetlands Restoration

Permits will be required from the following agencies for the wetlands restoration:

1. U.S. Army Corps of Engineers (USACE) - The USACE Permitting requires the completion of a ENG Form 4345 (latest edition), and notifications of the following agencies: U.S. Fish and Wildlife Service; U.S. Environmental Protection Agency; National Marine Fisheries Service; the Delaware Department of Natural Resource and Environmental Control, Division of Water and Division of Watershed Stewardship; National Park Service, and the Delaware State Historic Preservation Office.

2. Department of Natural Resources and Environmental Control (DNREC) – The DNREC permitting process requires the preparation and submission of an application for a Subaqueous Permit to DNREC. The permit application will require the completion of the Basic Application Form and the appropriate Appendices. This application will include a description of the proposed activity, a written statement that describes measures used to avoid impacts to protect resources, and plans of the project site, including cross-sections, showing existing and proposed conditions.
3. Department of Natural Resources and Environmental Control (DNREC) – All construction projects with land disturbance over 1 acre are required to submit a Notice of Intent (NOI) as part of the NPDES General Permit for Storm Water Discharges associated with Construction Activity.

SECTION VII

ENGINEER’S OPINION OF PROBABLE COST

VII. ENGINEER'S OPINION OF PROBABLE COST

A preliminary opinion of probable cost has been prepared for both the design and construction of the provided flood mitigation options based on our knowledge of similar projects. The estimates of probable cost are provided in Appendix F.

Engineering Costs

Engineering costs associated with design of the conceptual improvements and construction related services have been estimated based on a percentage of the estimated construction costs for the conceptual level designs provided in this study. The associated scope is provided in Section V of this report with an estimated Total Engineering Cost of **$ 213,300.00**, which is 20% of the EOPCC as indicated below.

Construction Cost

The Engineer's Opinion of Probable Construction Cost (EOPCC) is a Class 4 estimate based on criteria of the Association for the Advancement of Cost Engineering (AACE). A Class 4 estimate is typically used for project screening, determination of feasibility, concept evaluation and preliminary budget approval.

The EOPCC is based on the conceptual level designs prepared with this study. The EOPCC, provided in Appendix F, is $1,123,900 and is summarized below.

Existing Storm Drain Infrastructure Improvements	**$ 251,100.00**
Green Infrastructure	**$ 313,500.00**
Wetlands Restoration	**$ 502,000.00**
EOPCC Total	**$ 1,066,600.00**

The EOPCC is made by an engineer and not by a professional construction cost estimator or construction contractor. Consistent with AACE criteria, the Class 4 estimate herein includes a 20% contingency and was prepared for determination of feasibility and preliminary budget consideration.

SECTION VIII

RECOMMENDATIONS

VIII. RECOMMENDATIONS

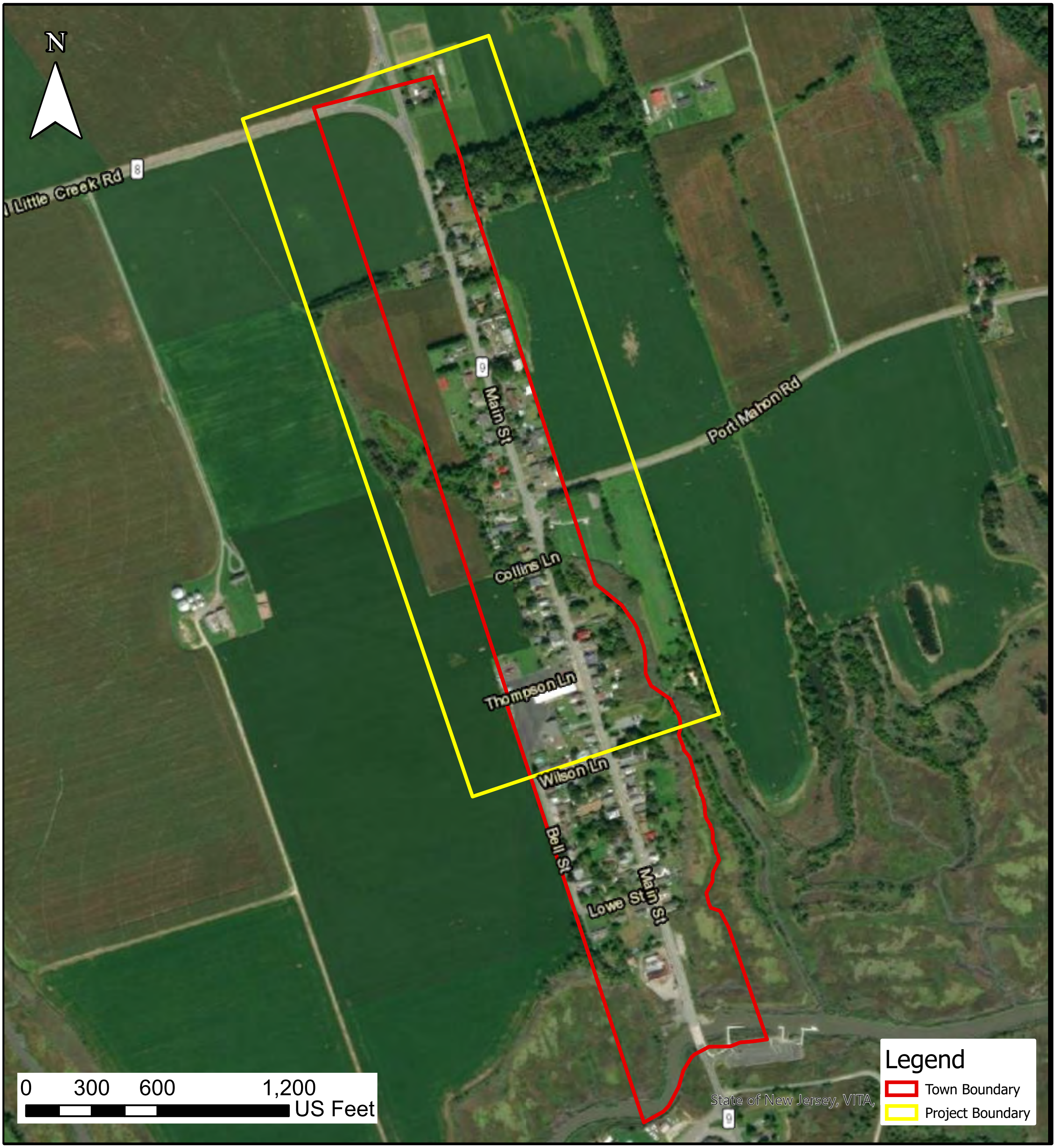
The current drainage conditions within the Town of Little Creek requires changes to ensure the safety of the Town residents and their homes as well as people visiting the Delaware Bayshore Byway, the Little Creek Wildlife Area, the Little River Boat Ramp and Fishing Pier, and the Little Creek Dog Park. In order to help mitigate the flooding during typical storm events and tidal conditions, we recommend the implementation of the following items:

- Maintenance of the existing storm drainage infrastructure - A large part of the flooding issue at the intersection of Main Street and Port Mahon Road is due to the lack of maintenance of existing infrastructure. Immediate maintenance to clean the existing culverts and identify existing cracks, leaks, or breaks is recommended. This will restore the intended purpose of these culverts and allow the runoff to be conveyed toward the tidal channel of Little River.
- Upgrade of existing storm drainage infrastructure – Since the existing infrastructure was designed and installed decades ago, it does not have the necessary capacity to handle current runoff directed to it. Upgrades to the existing stormwater piping and drainage inlets will allow additional runoff to be conveyed through the pipes and be removed more quickly from the streets, thereby reducing flooding by increasing capacity.
- Implementation of Green Infrastructure – While a large part of the flooding at the intersection of Main Street and Port Mahon Road is caused by a lack of adequate maintenance to the storm drainage infrastructure, it is also affected by its undersized nature. The implementation of green infrastructure features such as bioswales, pervious pavement, or buffered bike lanes would promote infiltration of stormwater and reduce demand on existing infrastructure to convey peak flows.
- Restoration of the existing tidal wetlands – The silted in nature of the existing wetlands does not allow for adequate storage or conveyance of the runoff from the study area to the tidal channel of the Little River. Restoration of the wetlands will not only provide additional storage to help mitigate the flooding, but it will also provide suitable habitat for the native plant and animal species in this area. With the addition of backflow prevention valves to existing storm drains connected to the tidal wetlands, the impacts from storm surge and tides will be significantly reduced.

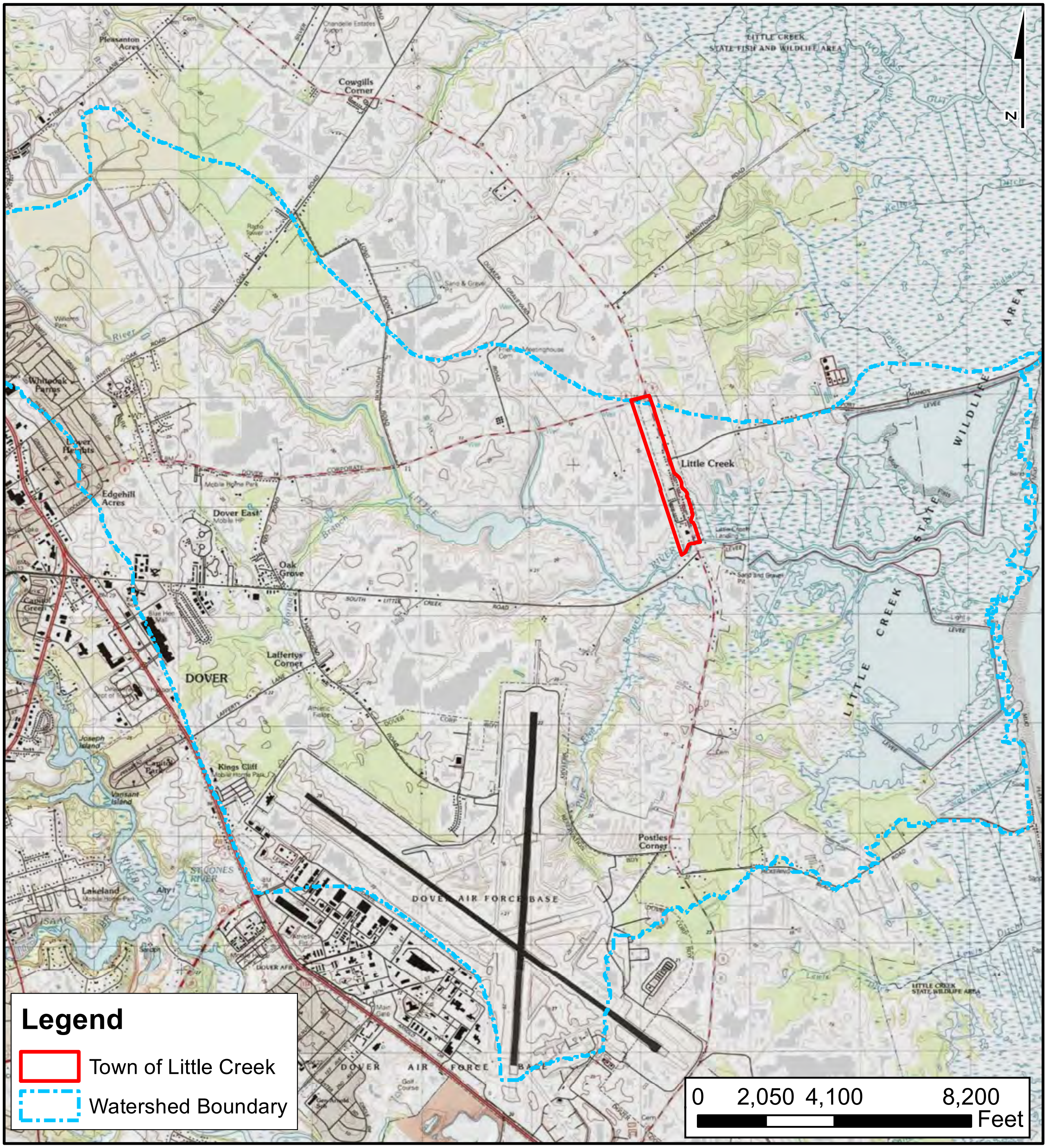
The above improvements will mitigate flooding, although the exact extent cannot be projected until definitive sizing of the improvements is developed in the engineering design phase. However, there are 2 key priorities in the implementation of the improvements, the maintenance of the existing storm drainage infrastructure and the restoration of the tidal wetlands. By implementing these priorities, it will improve the functionality of the existing storm drainage infrastructure until such time as other mitigation options can be implemented.

DUFFIELD ASSOCIATES
Soil, Water & the Environment

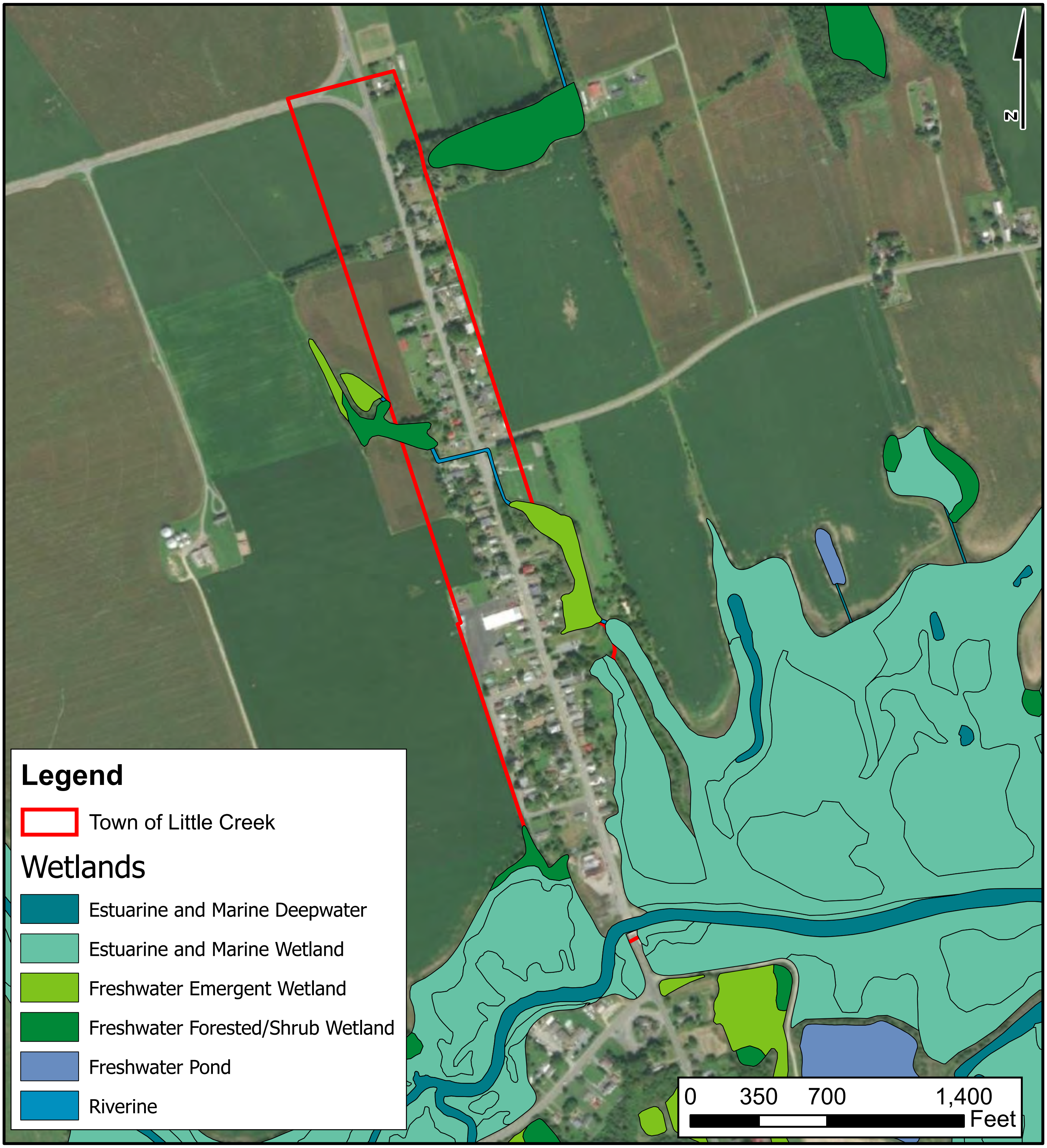
FIGURES



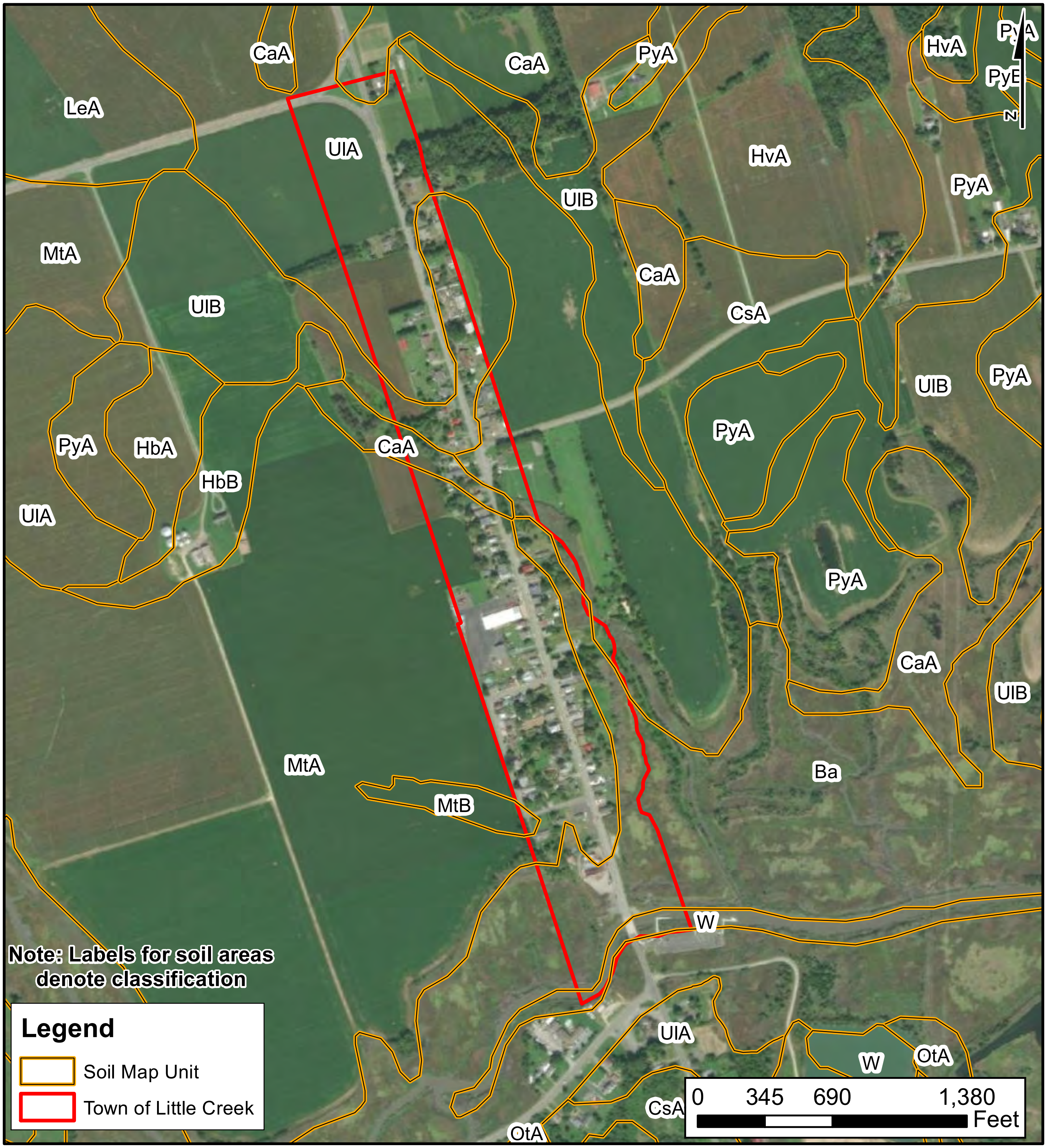
Date: 09/2021	TOWN LOCATION MAP	DESIGNED BY: MVH	DUFFIELD ASSOCIATES Soil, Water & the Environment
SCALE: AS SHOWN	**LITTLE CREEK FLOOD MITIGATION STUDY**	DRAWN BY: MVH	1060 S. GOVERNORS AVENUE, SUITE 101, DOVER, DE 19904-1232 TEL. (302) 674-9280 FAX (302) 674-1099
PROJECT NO. 13027BA		CHECKED BY: SKC	OFFICES IN PENNSYLVANIA, SOUTHERN DELAWARE, MARYLAND AND NEW JERSEY
FIGURE: 1	LITTLE CREEK ~ KENT COUNTY ~ DELAWARE	FILE: TOWN LOCATION MAP	EMAIL: DUFFIELD@DUFFNET.COM



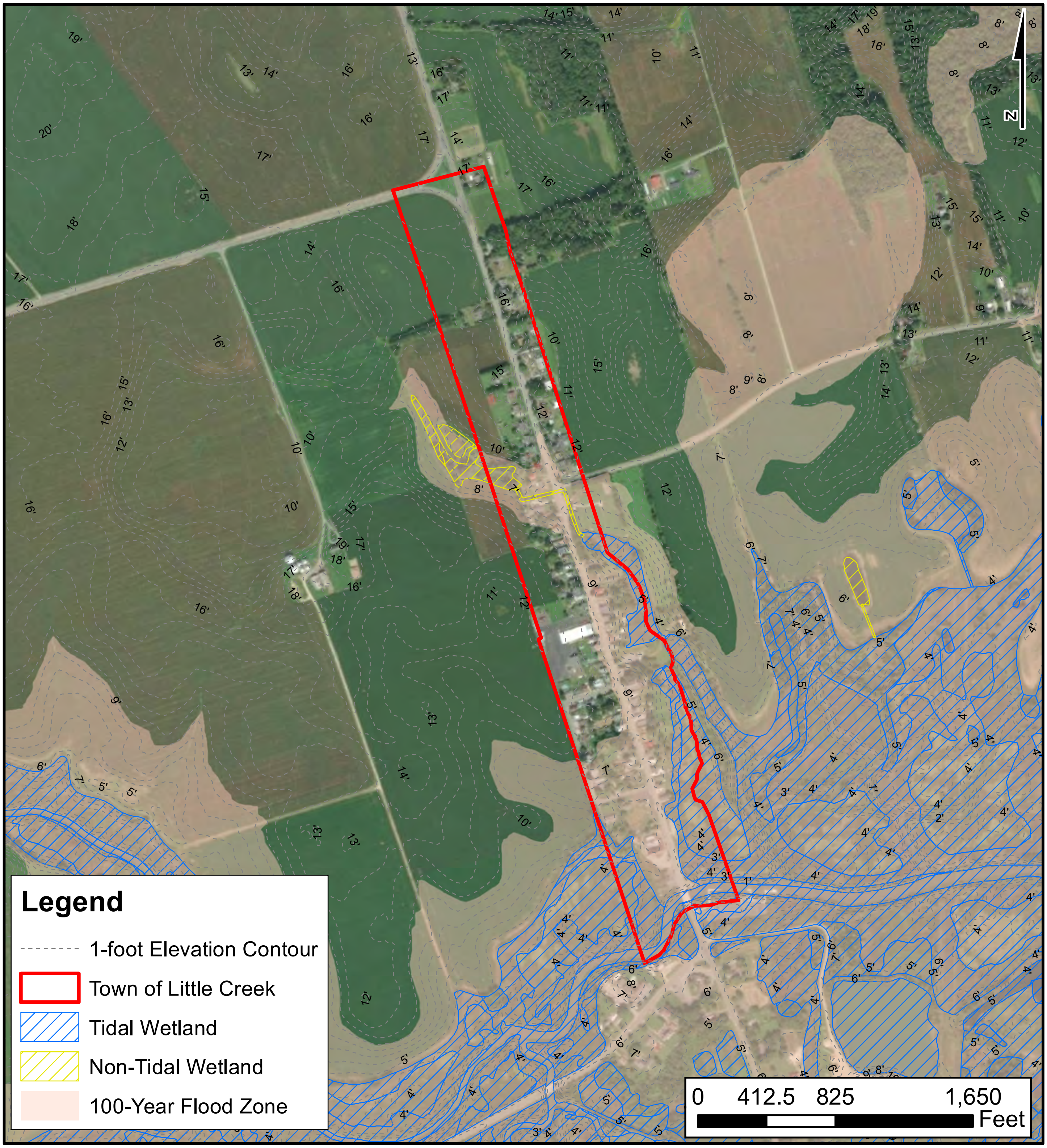
Date: 08/2021	**NATURAL RESOURCE MAPS**	DESIGNED BY: KEB	DUFFIELD ASSOCIATES Soil, Water & the Environment
SCALE: AS SHOWN	**Site Location Map**	DRAWN BY: KEB	5400 LIMESTONE ROAD WILMINGTON, DE 19808-1232 TEL. (302)239-6634 FAX (302)239-8485
PROJECT NO. 13027.BA	TOWN OF LITTLE CREEK	CHECKED BY: RBD	OFFICES IN PENNSYLVANIA, SOUTHERN DELAWARE, MARYLAND AND NEW JERSEY
FIGURE 2	KENT COUNTY~DELAWARE	FILE: 13101.EA.LittleCreek_ WetlandSketch.mxd	EMAIL: DUFFIELD@DUFFNET.COM



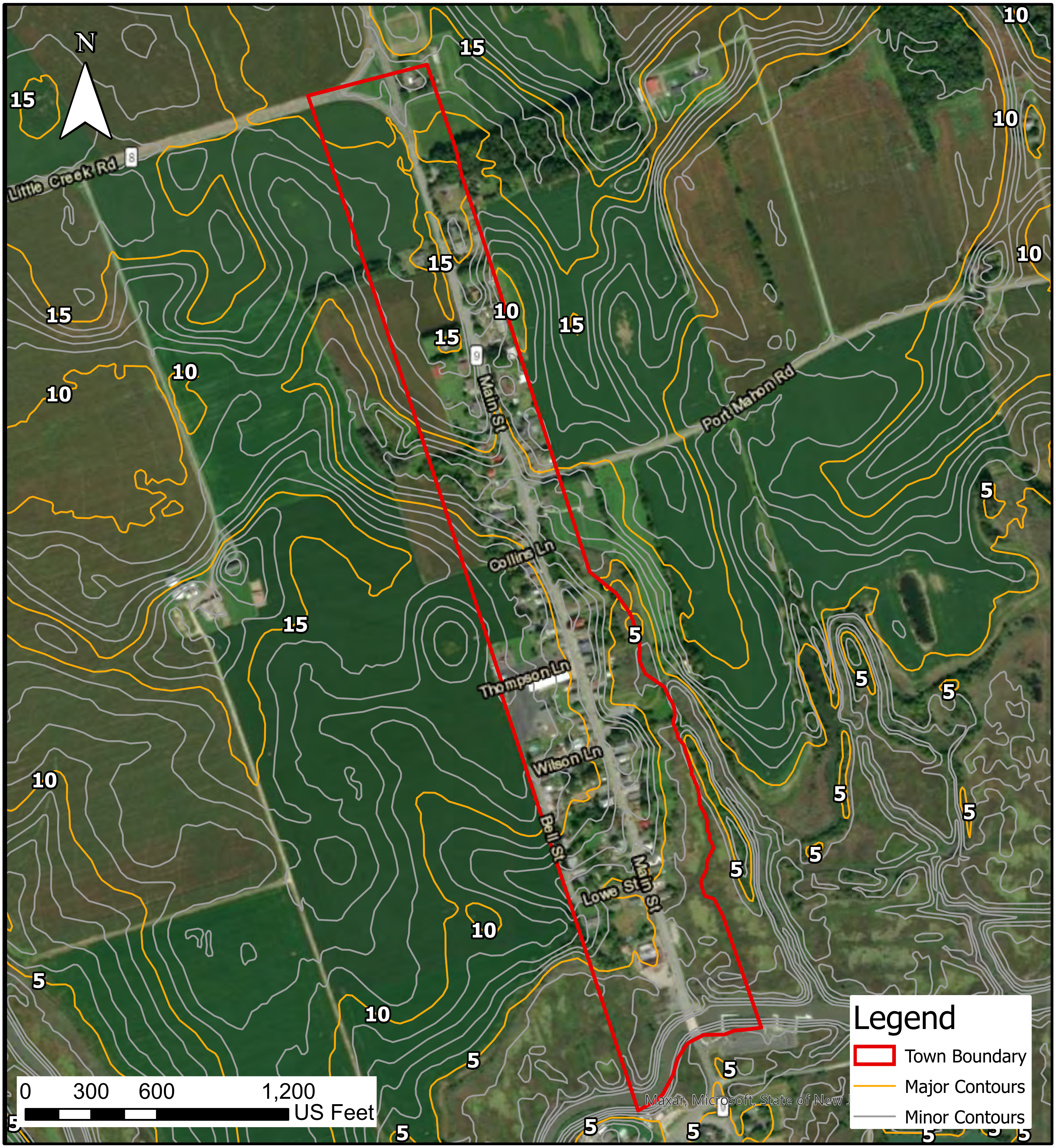
Date: 12/2021	**NATURAL RESOURCE MAPS**	DESIGNED BY: KLS	DUFFIELD ASSOCIATES Soil, Water & the Environment
SCALE: AS SHOWN	**NATIONAL WETLANDS INVENTORY MAP**	DRAWN BY: KLS	**5400 LIMESTONE ROAD WILMINGTON, DE 19808-1232 TEL. (302)239-6634 FAX (302)239-8485**
PROJECT NO. 13027.BA	TOWN OF LITTLE CREEK	CHECKED BY: RBD	**OFFICES IN PENNSYLVANIA, SOUTHERN DELAWARE, MARYLAND AND NEW JERSEY**
FIGURE 3	KENT COUNTY~DELAWARE	FILE: 13101.EA.LittleCreek_NWI.mxd	EMAIL: DUFFIELD@DUFFNET.COM



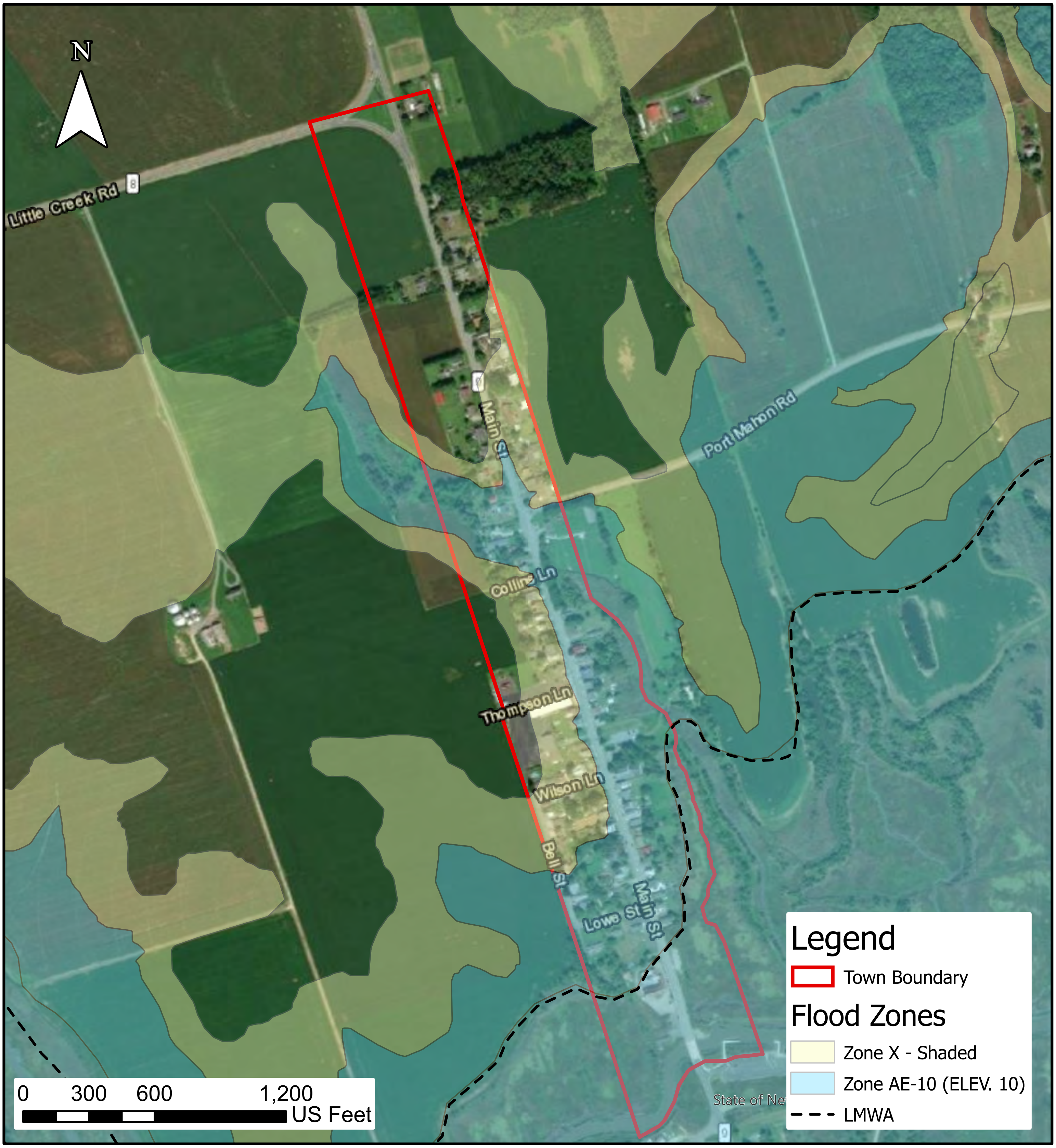
Date: 12/2021	**NATURAL RESOURCE MAPS**	DESIGNED BY: KLS	DUFFIELD ASSOCIATES Soil, Water & the Environment
SCALE: AS SHOWN	**SOILS MAP**	DRAWN BY: KLS	5400 LIMESTONE ROAD WILMINGTON, DE 19808-1232 TEL. (302)239-6634 FAX (302)239-8485
PROJECT NO. 13027.BA	TOWN OF LITTLE CREEK	CHECKED BY: RBD	OFFICES IN PENNSYLVANIA, SOUTHERN DELAWARE, MARYLAND AND NEW JERSEY
FIGURE 4	KENT COUNTY~DELAWARE	FILE: 13101.EA.LittleCreek_SoilsSketch.mxd	EMAIL: DUFFIELD@DUFFNET.COM



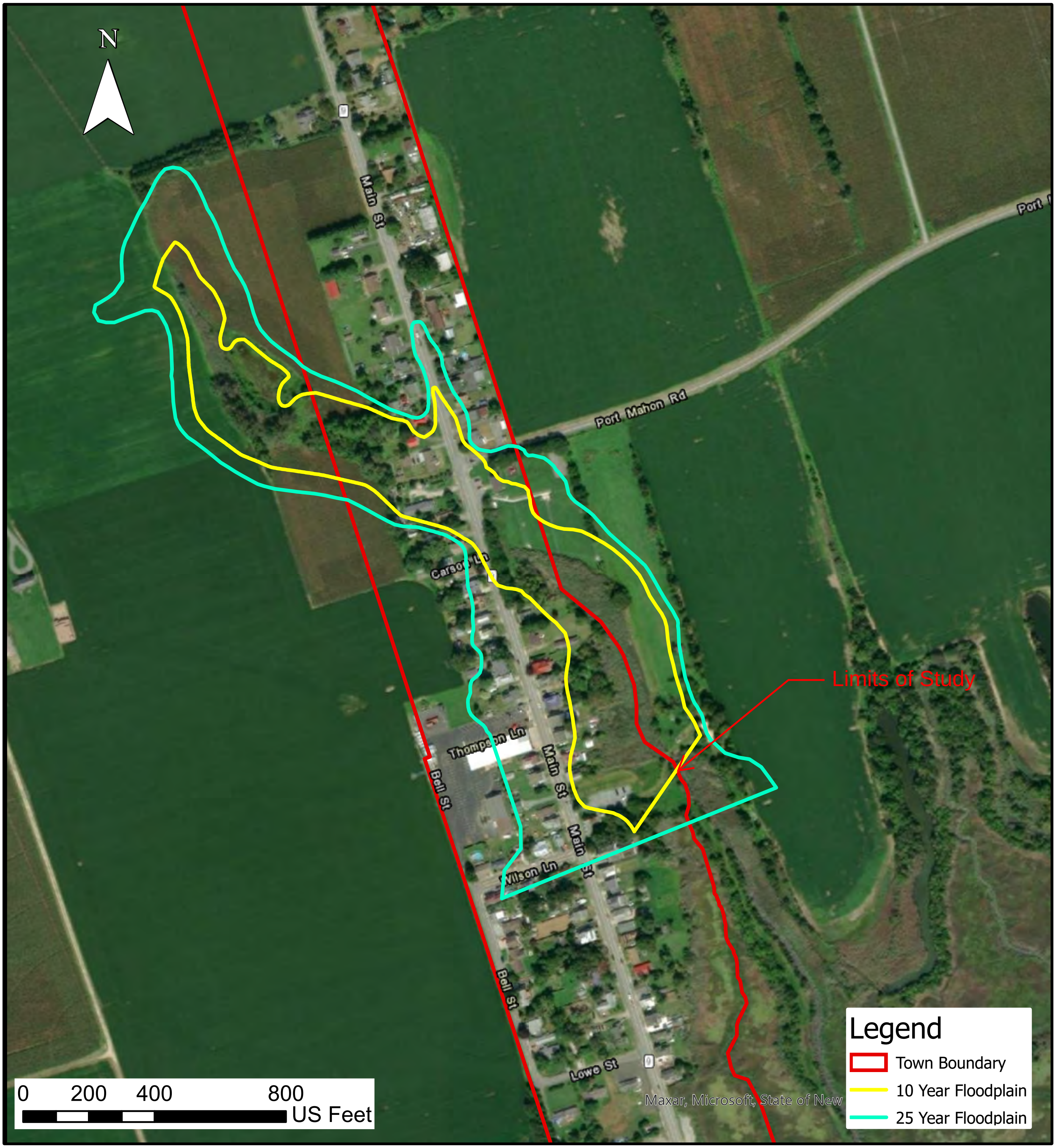
Date: 08/2021	**NATURAL RESOURCE MAPS**	DESIGNED BY: KEB	DUFFIELD ASSOCIATES Soil, Water & the Environment
SCALE: AS SHOWN	**Wetlands and Floodplain Map**	DRAWN BY: KEB	5400 LIMESTONE ROAD WILMINGTON, DE 19808-1232 TEL. (302)239-6634 FAX (302)239-8485
PROJECT NO. 13027.BA	TOWN OF LITTLE CREEK	CHECKED BY: RBD	OFFICES IN PENNSYLVANIA, SOUTHERN DELAWARE, MARYLAND AND NEW JERSEY
FIGURE 5	KENT COUNTY~DELAWARE	FILE: 13101.EA.LittleCreek_ WetlandSketch.mxd	EMAIL: DUFFIELD@DUFFNET.COM



Date: 09/2021	TOPOGRAPHY MAP	DESIGNED BY: MVH	DUFFIELD ASSOCIATES Soil, Water & the Environment
SCALE: AS SHOWN	**LITTLE CREEK FLOOD MITIGATION STUDY**	DRAWN BY: MVH	1060 S. GOVERNORS AVENUE, SUITE 101, DOVER, DE 19904-1232 TEL. (302) 674-9280 FAX (302) 674-1099
PROJECT NO. 13027BA		CHECKED BY: SKC	OFFICES IN PENNSYLVANIA, SOUTHERN DELAWARE, MARYLAND AND NEW JERSEY
FIGURE: 6	LITTLE CREEK ~ KENT COUNTY ~ DELAWARE	FILE: TOPOGRAPHY MAP	EMAIL: DUFFIELD@DUFFNET.COM



Date: 09/2021	EXISTING FLOODPLAIN MAP PER FEMA MAP NO. 10001C0187J **LITTLE CREEK FLOOD MITIGATION STUDY** LITTLE CREEK ~ KENT COUNTY ~ DELAWARE	DESIGNED BY: MVH	DUFFIELD ASSOCIATES Soil, Water & the Environment
SCALE: AS SHOWN		DRAWN BY: MVH	1060 S. GOVERNORS AVENUE, SUITE 101, DOVER, DE 19904-1232 TEL. (302) 674-9280 FAX (302) 674-1099
PROJECT NO. 13027BA		CHECKED BY: SKC	OFFICES IN PENNSYLVANIA, SOUTHERN DELAWARE, MARYLAND AND NEW JERSEY
FIGURE: 7		FILE: EXISTING FLOODPLAIN MAP	EMAIL: DUFFIELD@DUFFNET.COM



Date: 09/2021	EXISTING CONDITIONS EVALUATION FLOOD EXTENTS MAP **LITTLE CREEK FLOOD MITIGATION STUDY**	DESIGNED BY: MVH	DUFFIELD ASSOCIATES Soil, Water & the Environment
SCALE: AS SHOWN		DRAWN BY: MVH	1060 S. GOVERNORS AVENUE, SUITE 101, DOVER, DE 19904-1232 TEL. (302) 674-9280 FAX (302) 674-1099
PROJECT NO. 13027BA		CHECKED BY: SKC	OFFICES IN PENNSYLVANIA, SOUTHERN DELAWARE, MARYLAND AND NEW JERSEY
FIGURE: 8	LITTLE CREEK ~ KENT COUNTY ~ DELAWARE	FILE: FLOOD EXTENTS MAP	EMAIL: DUFFIELD@DUFFNET.COM

APPENDIX A

DELAWARE TIDAL WETLANDS

PHOTO # 18-019

FILENAME - DNR220

SCALE 1:3600

State of Delaware Wetlands
KENT COUNTY, DELAWARE
(In Accordance with the Delaware Wetlands Act # 6607)
Approximate Scale (1:3600)

Prepared for: DEPARTMENT OF NATURAL RESOURCES and ENVIRONMENTAL CONTROL

Produced by: SALISBURY STATE UNIVERSITY
IMAGE PROCESSING & REMOTE SENSING CENTER
SALISBURY, MARYLAND

Legend for Delaware Tidal Wetland Delineations:

B - Beach
DF - Disturbed Forested Swamp
DM - Disturbed Marsh (vegetation removed for agricultural activities)
F - Tidal Forested Swamp
IF - Impounded Forested Wetland
ILM - Impounded Low Marsh
IM - Impounded Marsh
IS - Impounded Scrub-Shrub Wetland
IW - Impounded Water
LM - Low Marsh
M - Marsh
MS - Marsh in spoil areas
N - Non-tidal wetlands (400 acres+, including tidal forested swamps)
O - Other (Upland or Non-tidal wetlands less than 400 acres)
S - Tidal Scrub-Shrub Swamps
SS - Areas flooded by tidal storm surges
SS* - Areas flooded by storm surges at a higher flood plain elevation
T - Tidal Mudflats (in some cases vegetated)/ sand bars
W - Water
WS - Water in a spoil area
/ - complexes among different commmunity types (ex. M/S)

Map Change See Box File + Violation File

APPENDIX B

ESSENTIAL FISH HABITAT LIST

EFH Data Notice: Essential Fish Habitat (EFH) is defined by textual descriptions contained in the fishery management plans developed by the regional Fishery Management Councils. In most cases mapping data can not fully represent the complexity of the habitats that make up EFH. This report should be used for general interest queries only and should not be interpreted as a definitive evaluation of EFH at this location. A location-specific evaluation of EFH for any official purposes must be performed by a regional expert. Please refer to the following links for the appropriate regional resources.

Greater Atlantic Regional Office
Atlantic Highly Migratory Species Management Division

Query Results

Degrees, Minutes, Seconds: Latitude = 39º9'34" N, Longitude = 76º33'49" W
Decimal Degrees: Latitude = 39.16, Longitude = -75.44

The query location intersects with spatial data representing EFH and/or HAPCs for the following species/management units.

*** W A R N I N G ***

Please note under "Life Stage(s) Found at Location" the category "ALL" indicates that all life stages of that species share the same map and are designated at the queried location.

EFH

Show	Link	Data Caveats	Species/Management Unit	Lifestage(s) Found at Location	Management Council	FMP
			Little Skate	Juvenile Adult	New England	Amendment 2 to the Northeast Skate Complex FMP
			Atlantic Herring	Juvenile Adult	New England	Amendment 3 to the Atlantic Herring FMP
			Red Hake	Adult	New England	Amendment 14 to the Northeast Multispecies FMP
			Windowpane Flounder	Adult Juvenile	New England	Amendment 14 to the Northeast Multispecies FMP
			Winter Skate	Adult Juvenile	New England	Amendment 2 to the Northeast Skate Complex FMP
			Clearnose Skate	Adult Juvenile	New England	Amendment 2 to the Northeast Skate Complex FMP
			Longfin Inshore Squid	Eggs	Mid-Atlantic	Atlantic Mackerel, Squid,& Butterfish Amendment 11
			Bluefish	Adult Juvenile	Mid-Atlantic	Bluefish
			Atlantic Butterfish	Larvae Adult	Mid-Atlantic	Atlantic Mackerel, Squid,& Butterfish Amendment 11
			Scup	Juvenile Adult	Mid-Atlantic	Summer Flounder, Scup, Black Sea Bass
			Summer Flounder	Juvenile Adult	Mid-Atlantic	Summer Flounder, Scup, Black Sea Bass
			Black Sea Bass	Juvenile Adult	Mid-Atlantic	Summer Flounder, Scup, Black Sea Bass

HAPCs

No Habitat Areas of Particular Concern (HAPC) were identified at the report location.

EFH Areas Protected from Fishing

No EFH Areas Protected from Fishing (EFHA) were identified at the report location.

Spatial data does not currently exist for all the managed species in this area. The following is a list of species or management units for which there is no spatial data. **For links to all EFH text descriptions see the complete data inventory: open data inventory -->
All spatial data is currently mapped for this region

APPENDIX C

EXISTING CONDITIONS RUNOFF MODELING

LEGEND:

DRAINAGE AREA LINES	
STORMWATER PIPES	SD
CENTERLINE OF DITCH	
PROPERTY LINES	
CATCH BASIN	
MANHOLE	ST
OVERHEAD ELECTRIC	OE
UTILITY POLE	
BUILDING FOOTPRINT	

150' 0 150' 300'

DRAWING SCALE 1" = 150'

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FILE NAME: Ebase

SHARON K. CRUZ

STATE: DELAWARE P.E. #####

No.	REVISION	CHK'D BY DATE
	PRELIMINARY NOT FOR CONSTRUCTION	
-		
-		

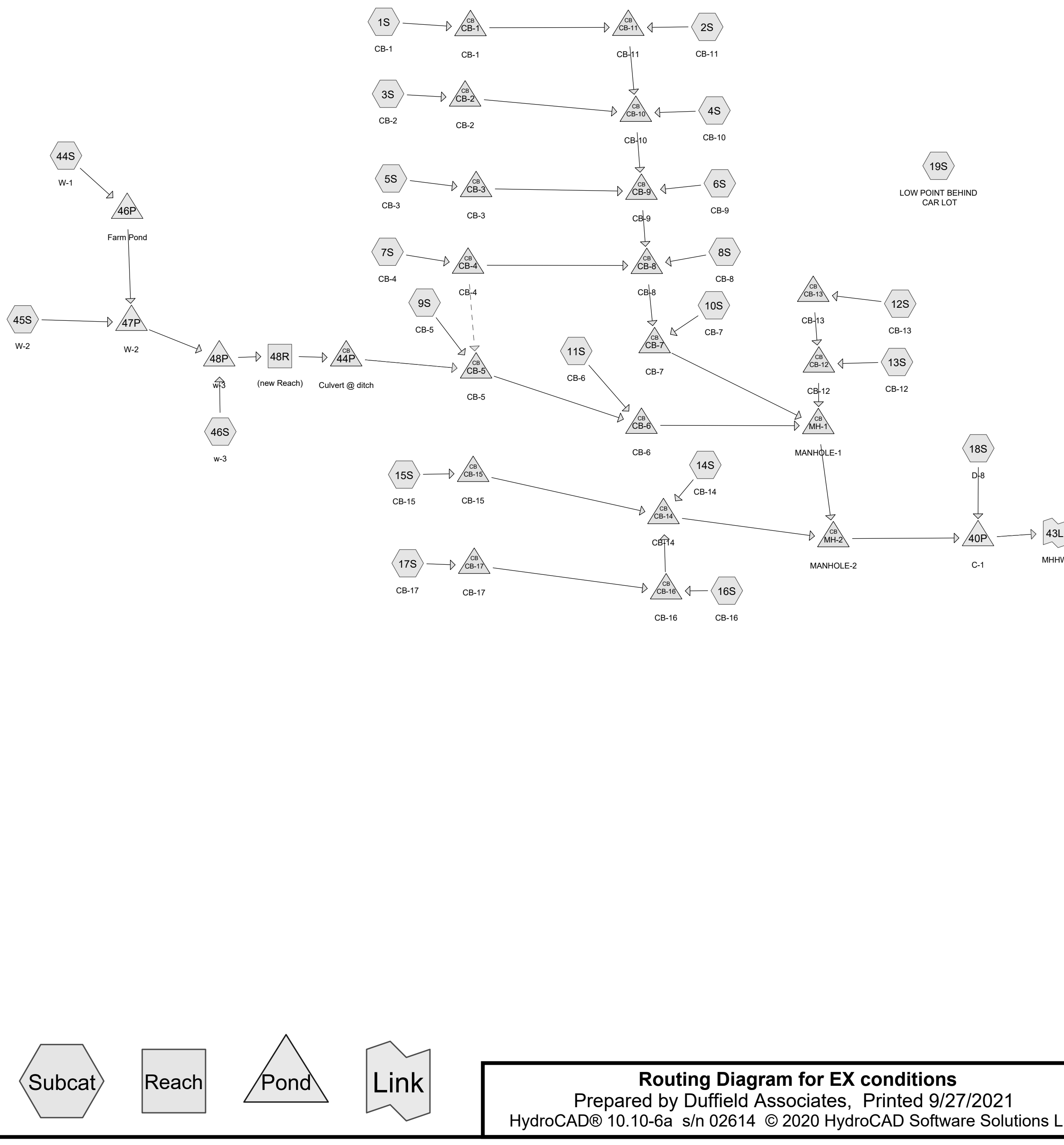
OWNER:

DRAINAGE AREA MAP

TOWN OF LITTLE CREEK FLOOD MITIGATION STUDY

LITTLE CREEK ~ KENT COUNTY ~ DELAWARE

DATE: DECEMBER 29, 2021
SCALE: 1" = 150'
PROJECT NO. 13027.BA
SHEET: 1 OF 1



Routing Diagram for EX conditions
Prepared by Duffield Associates, Printed 9/27/2021
HydroCAD® 10.10-6a s/n 02614 © 2020 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1-YEAR	NOAA 24-hr	C	Default	24.00	1	2.71	2
2	10-YEAR	NOAA 24-hr	C	Default	24.00	1	5.20	2
3	25-YEAR	NOAA 24-hr	C	Default	24.00	1	6.50	2

Time span=0.00-120.00 hrs, dt=0.05 hrs, 2401 points x 2
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: CB-1 Runoff Area=60,375 sf 76.98% Impervious Runoff Depth=1.89"
Flow Length=714' Tc=30.6 min CN=92 Runoff=1.20 cfs 0.218 af

Subcatchment2S: CB-11 Runoff Area=32,762 sf 66.90% Impervious Runoff Depth=1.72"
Flow Length=374' Tc=40.3 min CN=90 Runoff=0.50 cfs 0.108 af

Subcatchment3S: CB-2 Runoff Area=18,624 sf 62.33% Impervious Runoff Depth=1.56"
Flow Length=82' Tc=8.9 min CN=88 Runoff=0.58 cfs 0.056 af

Subcatchment4S: CB-10 Runoff Area=11,778 sf 68.53% Impervious Runoff Depth=1.72"
Flow Length=200' Tc=34.9 min CN=90 Runoff=0.20 cfs 0.039 af

Subcatchment5S: CB-3 Runoff Area=28,691 sf 55.35% Impervious Runoff Depth=1.64"
Flow Length=339' Tc=9.0 min CN=89 Runoff=0.93 cfs 0.090 af

Subcatchment6S: CB-9 Runoff Area=16,934 sf 80.61% Impervious Runoff Depth=1.98"
Flow Length=347' Tc=22.0 min CN=93 Runoff=0.42 cfs 0.064 af

Subcatchment7S: CB-4 Runoff Area=38,400 sf 56.67% Impervious Runoff Depth=1.56"
Flow Length=125' Tc=11.2 min CN=88 Runoff=1.09 cfs 0.115 af

Subcatchment8S: CB-8 Runoff Area=25,733 sf 59.19% Impervious Runoff Depth=1.56"
Flow Length=273' Tc=21.5 min CN=88 Runoff=0.52 cfs 0.077 af

Subcatchment9S: CB-5 Runoff Area=39,037 sf 49.18% Impervious Runoff Depth=1.42"
Flow Length=429' Tc=19.5 min CN=86 Runoff=0.75 cfs 0.106 af

Subcatchment10S: CB-7 Runoff Area=46,251 sf 51.01% Impervious Runoff Depth=1.42"
Flow Length=465' Tc=27.4 min CN=86 Runoff=0.73 cfs 0.125 af

Subcatchment11S: CB-6 Runoff Area=2,434 sf 88.34% Impervious Runoff Depth=2.17"
Flow Length=10' Slope=0.0020 '/' Tc=5.6 min CN=95 Runoff=0.12 cfs 0.010 af

Subcatchment12S: CB-13 Runoff Area=132,969 sf 18.61% Impervious Runoff Depth=1.35"
Flow Length=709' Tc=29.7 min CN=85 Runoff=1.88 cfs 0.343 af

Subcatchment13S: CB-12 Runoff Area=5,191 sf 33.31% Impervious Runoff Depth=1.15"
Flow Length=71' Slope=0.0127 '/' Tc=12.8 min CN=82 Runoff=0.10 cfs 0.011 af

Subcatchment14S: CB-14 Runoff Area=8,326 sf 77.79% Impervious Runoff Depth=1.98"
Flow Length=120' Slope=0.0034 '/' Tc=33.0 min CN=93 Runoff=0.16 cfs 0.032 af

Subcatchment15S: CB-15 Runoff Area=44,745 sf 26.93% Impervious Runoff Depth=1.28"
Flow Length=478' Tc=24.3 min CN=84 Runoff=0.67 cfs 0.110 af

Subcatchment16S: CB-16 Runoff Area=21,986 sf 53.58% Impervious Runoff Depth=1.56"
Flow Length=139' Tc=42.6 min CN=88 Runoff=0.29 cfs 0.066 af

Subcatchment17S: CB-17 Runoff Area=175,968 sf 30.74% Impervious Runoff Depth=1.35"
Flow Length=574' Tc=29.7 min CN=85 Runoff=2.49 cfs 0.454 af

Subcatchment18S: D-8 Runoff Area=510,532 sf 9.48% Impervious Runoff Depth=0.73"
Flow Length=624' Tc=66.3 min CN=74 Runoff=2.05 cfs 0.713 af

Subcatchment19S: LOW POINT BEHIND Runoff Area=726,316 sf 8.66% Impervious Runoff Depth=1.15"
Flow Length=992' Tc=44.2 min CN=82 Runoff=6.74 cfs 1.605 af

Subcatchment44S: W-1 Runoff Area=80,729 sf 0.00% Impervious Runoff Depth=0.88"
Flow Length=473' Tc=35.1 min CN=77 Runoff=0.62 cfs 0.135 af

Subcatchment45S: W-2 Runoff Area=1,571,690 sf 0.83% Impervious Runoff Depth=1.09"
Flow Length=1,444' Tc=71.4 min CN=81 Runoff=9.93 cfs 3.292 af

Subcatchment46S: w-3 Runoff Area=301,007 sf 7.39% Impervious Runoff Depth=1.09"
Flow Length=607' Tc=44.8 min CN=81 Runoff=2.60 cfs 0.630 af

Reach 48R: (new Reach) Avg. Flow Depth=1.34' Max Vel=1.41 fps Inflow=2.74 cfs 3.399 af
n=0.050 L=304.0' S=0.0058 '/' Capacity=13.73 cfs Outflow=2.74 cfs 3.399 af

Pond 40P: C-1 Peak Elev=3.63' Storage=18,079 cf Inflow=12.14 cfs 6.134 af
Outflow=8.79 cfs 6.100 af

Pond 44P: Culvert @ ditch Peak Elev=5.61' Inflow=2.74 cfs 3.399 af
Primary=2.74 cfs 3.399 af Secondary=0.00 cfs 0.000 af Outflow=2.74 cfs 3.399 af

Pond 46P: Farm Pond Peak Elev=6.98' Storage=5,888 cf Inflow=0.62 cfs 0.135 af
Outflow=0.00 cfs 0.000 af

Pond 47P: W-2 Peak Elev=8.10' Storage=36,893 cf Inflow=9.93 cfs 3.292 af
Outflow=7.81 cfs 3.292 af

Pond 48P: w-3 Peak Elev=8.09' Storage=70,576 cf Inflow=9.85 cfs 3.922 af
Outflow=2.74 cfs 3.399 af

Pond CB-1: CB-1 Peak Elev=13.00' Inflow=1.20 cfs 0.218 af
18.0" Round Culvert n=0.012 L=34.0' S=0.0100 '/' Outflow=1.20 cfs 0.218 af

Pond CB-10: CB-10 Peak Elev=11.38' Inflow=2.17 cfs 0.420 af
18.0" Round Culvert n=0.012 L=403.0' S=0.0011 '/' Outflow=2.17 cfs 0.420 af

Pond CB-11: CB-11 Peak Elev=11.83' Inflow=1.67 cfs 0.326 af
18.0" Round Culvert n=0.012 L=400.0' S=0.0013 '/' Outflow=1.67 cfs 0.326 af

Pond CB-12: CB-12 Peak Elev=4.53' Inflow=1.96 cfs 0.354 af
Primary=1.96 cfs 0.354 af Secondary=0.00 cfs 0.000 af Outflow=1.96 cfs 0.354 af

Pond CB-13: CB-13 Peak Elev=5.41' Inflow=1.88 cfs 0.343 af
Outflow=1.88 cfs 0.343 af

Pond CB-14: CB-14 Peak Elev=4.18' Inflow=3.58 cfs 0.661 af
18.0" Round Culvert n=0.012 L=12.0' S=0.0083 '/' Outflow=3.58 cfs 0.661 af

Pond CB-15: CB-15 Peak Elev=4.20' Inflow=0.67 cfs 0.110 af
18.0" Round Culvert n=0.012 L=30.0' S=0.0033 '/' Outflow=0.67 cfs 0.110 af

Pond CB-16: CB-16 Peak Elev=4.96' Inflow=2.76 cfs 0.519 af
22.0" x 13.5", R=13.8"/27.5" Pipe Arch Culvert n=0.012 L=307.0' S=0.0039 '/' Outflow=2.76 cfs 0.519 af

Pond CB-17: CB-17 Peak Elev=5.22' Inflow=2.49 cfs 0.454 af
18.0" Round Culvert n=0.012 L=30.0' S=0.0033 '/' Outflow=2.49 cfs 0.454 af

Pond CB-2: CB-2 Peak Elev=12.82' Inflow=0.58 cfs 0.056 af
18.0" Round Culvert n=0.012 L=30.0' S=0.0100 '/' Outflow=0.58 cfs 0.056 af

Pond CB-3: CB-3 Peak Elev=11.14' Inflow=0.93 cfs 0.090 af
18.0" Round Culvert n=0.012 L=30.0' S=0.0100 '/' Outflow=0.93 cfs 0.090 af

Pond CB-4: CB-4 Peak Elev=6.14' Inflow=1.09 cfs 0.115 af
Primary=1.09 cfs 0.115 af Secondary=0.00 cfs 0.000 af Outflow=1.09 cfs 0.115 af

Pond CB-5: CB-5 Peak Elev=4.47' Inflow=2.78 cfs 3.505 af
24.0" Round Culvert n=0.012 L=32.0' S=0.0116 '/' Outflow=2.78 cfs 3.505 af

Pond CB-6: CB-6 Peak Elev=4.47' Inflow=2.78 cfs 3.515 af
24.0" Round Culvert n=0.012 L=5.0' S=0.0040 '/' Outflow=2.78 cfs 3.515 af

Pond CB-7: CB-7 Peak Elev=4.82' Inflow=5.27 cfs 0.892 af
18.0" Round Culvert n=0.012 L=75.0' S=0.0015 '/' Outflow=5.27 cfs 0.892 af

Pond CB-8: CB-8 Peak Elev=6.12' Inflow=4.61 cfs 0.766 af
Outflow=4.61 cfs 0.766 af

Pond CB-9: CB-9 Peak Elev=10.74' Inflow=3.17 cfs 0.574 af
18.0" Round Culvert n=0.012 L=396.0' S=0.0061 '/' Outflow=3.17 cfs 0.574 af

Pond MH-1: MANHOLE-1 Peak Elev=4.46' Inflow=7.90 cfs 4.761 af
30.0" Round Culvert n=0.025 L=170.0' S=0.0038 '/' Outflow=7.90 cfs 4.761 af

Pond MH-2: MANHOLE-2 Peak Elev=3.96' Inflow=11.37 cfs 5.421 af
30.0" Round Culvert w/ 6.0" inside fill n=0.012 L=150.0' S=0.0043 '/' Outflow=11.37 cfs 5.421 af

Link 43L: MHHW Inflow=8.79 cfs 6.100 af
Primary=8.79 cfs 6.100 af

Total Runoff Area = 89.543 ac Runoff Volume = 8.397 af Average Runoff Depth = 1.13"
88.29% Pervious = 79.053 ac 11.71% Impervious = 10.490 ac

Summary for Subcatchment 1S: CB-1

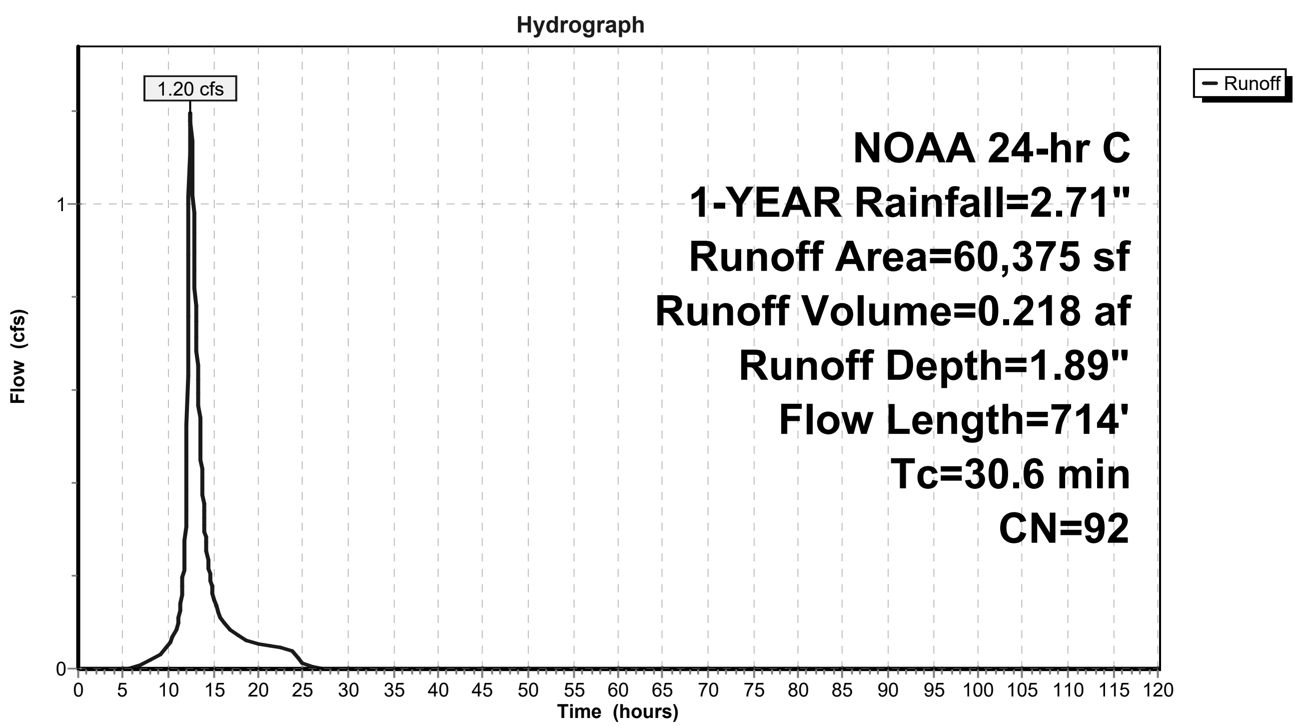
Runoff = 1.20 cfs @ 12.46 hrs, Volume= 0.218 af, Depth= 1.89"
Routed to Pond CB-1 : CB-1

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-YEAR Rainfall=2.71"

Area (sf)	CN	Description
46,198	98	Paved roads w/curbs & sewers, HSG C
13,058	74	>75% Grass cover, Good, HSG C
1,119	80	1/2 acre lots, 25% imp, HSG C
60,375	92	Weighted Average
13,897		23.02% Pervious Area
46,478		76.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.4	70	0.0050	0.06		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
12.2	644	0.0015	0.88	0.88	**Parabolic Channel, D-1** W=3.00' D=0.50' Area=1.0 sf Perim=3.2' n= 0.030 Earth, dense weeds
30.6	714	Total			

Subcatchment 1S: CB-1



Summary for Subcatchment 2S: CB-11

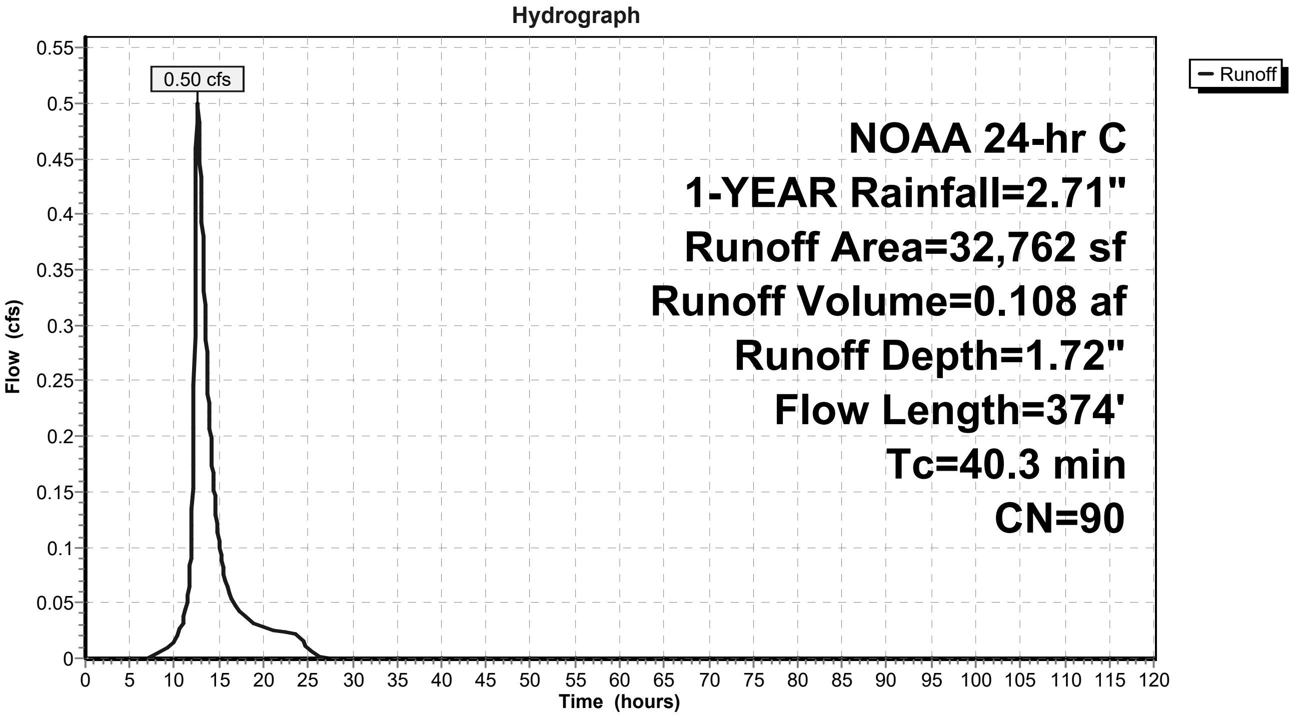
Runoff = 0.50 cfs @ 12.60 hrs, Volume= 0.108 af, Depth= 1.72"
Routed to Pond CB-11 : CB-11

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-YEAR Rainfall=2.71"

Area (sf)	CN	Description
18,046	98	Paved roads w/curbs & sewers, HSG C
3,852	81	1/3 acre lots, 30% imp, HSG C
10,864	80	1/2 acre lots, 25% imp, HSG C
32,762	90	Weighted Average
10,844		33.10% Pervious Area
21,918		66.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.8	150	0.0050	0.07		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.30"
0.6	40	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
5.9	184	0.0051	0.52	0.21	**Parabolic Channel, D-2** W=1.20' D=0.50' Area=0.4 sf Perim=1.6' n= 0.080 Earth, long dense weeds
40.3	374	Total			

Subcatchment 2S: CB-11



Summary for Subcatchment 3S: CB-2

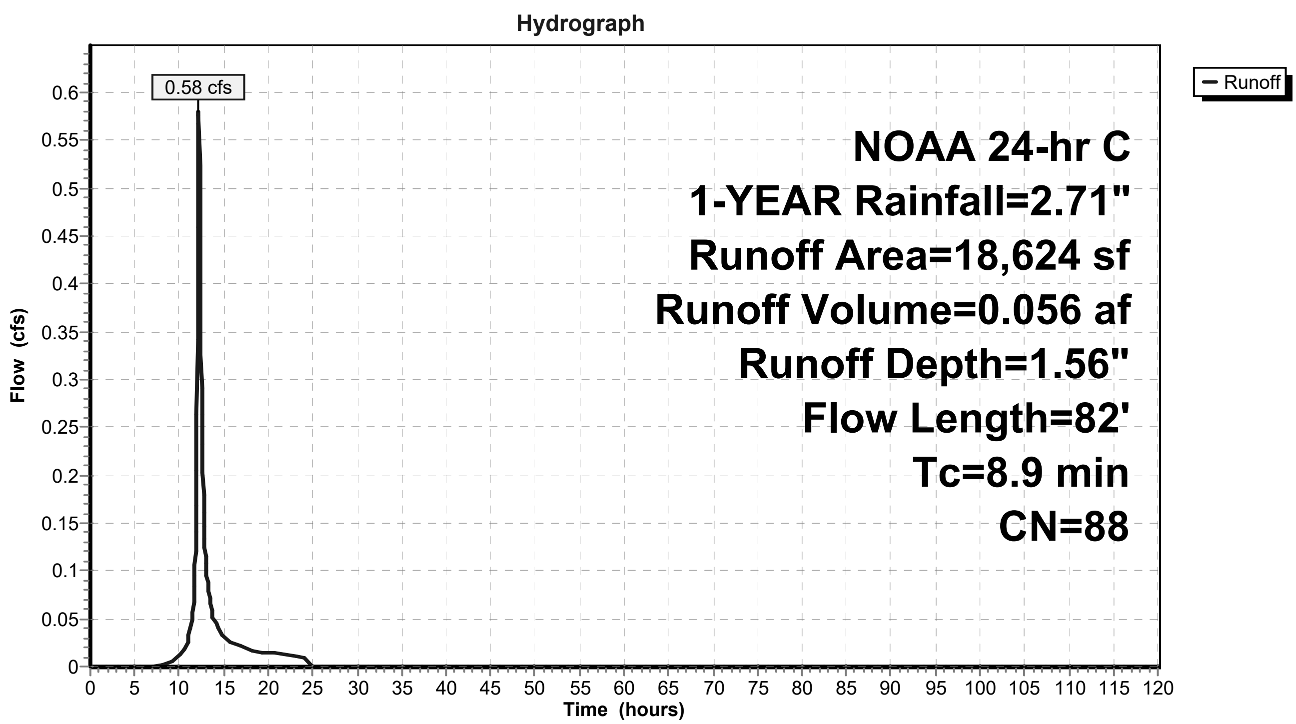
Runoff = 0.58 cfs @ 12.18 hrs, Volume= 0.056 af, Depth= 1.56"
Routed to Pond CB-2 : CB-2

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-YEAR Rainfall=2.71"

Area (sf)	CN	Description
11,190	98	Paved roads w/curbs & sewers, HSG C
5,757	72	Woods/grass comb., Good, HSG C
1,677	80	1/2 acre lots, 25% imp, HSG C
18,624	88	Weighted Average
7,015		37.67% Pervious Area
11,609		62.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0200	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
0.8	32	0.0010	0.64		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
8.9	82	Total			

Subcatchment 3S: CB-2



Summary for Subcatchment 4S: CB-10

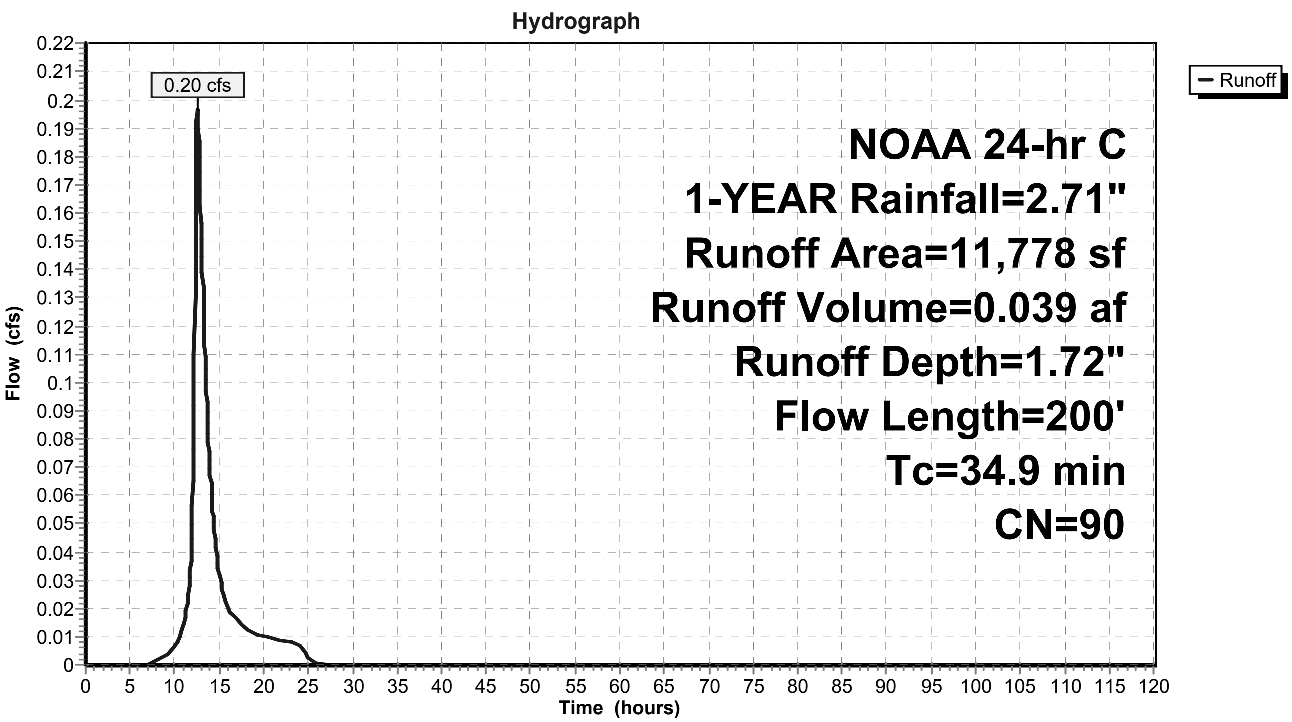
Runoff = 0.20 cfs @ 12.52 hrs, Volume= 0.039 af, Depth= 1.72"
Routed to Pond CB-10 : CB-10

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-YEAR Rainfall=2.71"

Area (sf)	CN	Description
5,998	98	Paved roads w/curbs & sewers, HSG C
4,835	83	1/4 acre lots, 38% imp, HSG C
945	80	1/2 acre lots, 25% imp, HSG C
11,778	90	Weighted Average
3,706		31.47% Pervious Area
8,072		68.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.0	43	0.0012	0.03		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
12.9	157	0.0001	0.20		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
34.9	200	Total			

Subcatchment 4S: CB-10



Summary for Subcatchment 5S: CB-3

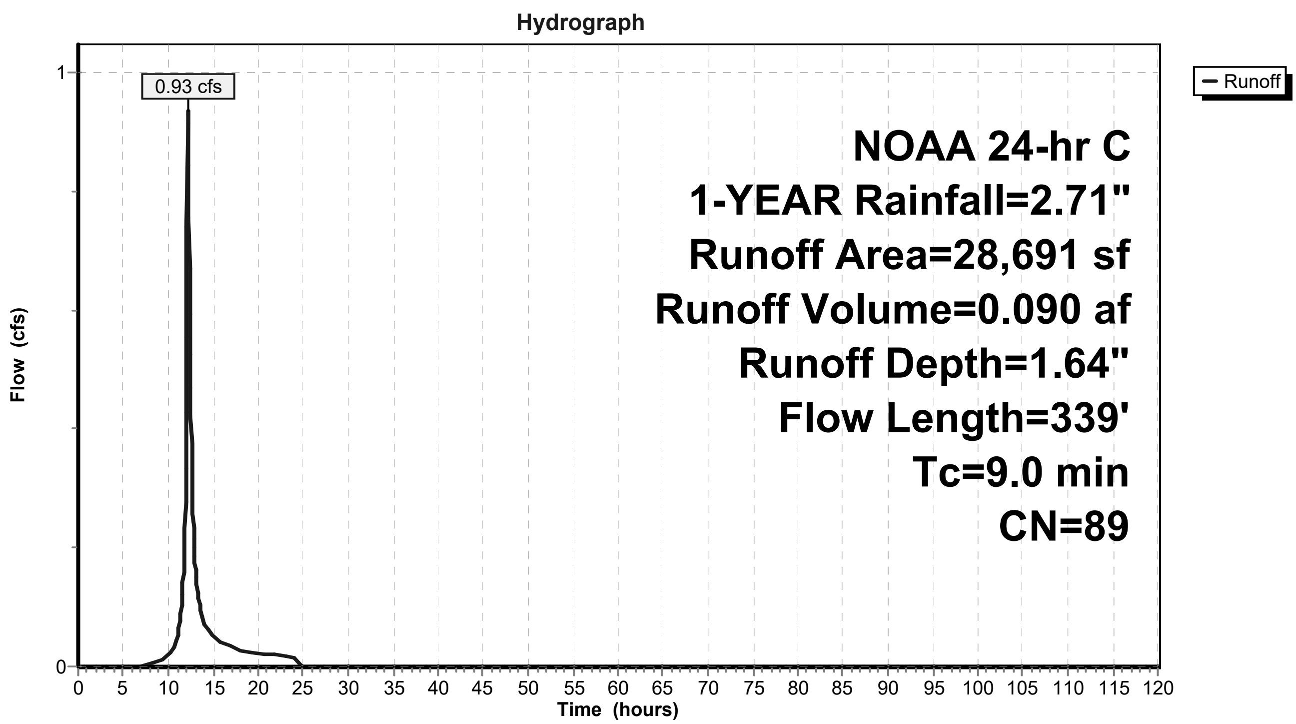
Runoff = 0.93 cfs @ 12.18 hrs, Volume= 0.090 af, Depth= 1.64"
Routed to Pond CB-3 : CB-3

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-YEAR Rainfall=2.71"

Area (sf)	CN	Description
12,824	98	Paved roads w/curbs & sewers, HSG C
6,927	82	Row crops, SR + CR, Good, HSG C
6,318	83	1/4 acre lots, 38% imp, HSG C
2,622	80	1/2 acre lots, 25% imp, HSG C
28,691	89	Weighted Average
12,811		44.65% Pervious Area
15,880		55.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	26	0.0200	0.12		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
5.4	313	0.0050	0.96	0.16	**Parabolic Channel,** W=0.50' D=0.50' Area=0.2 sf Perim=1.2' n= 0.030 Earth, grassed & winding
9.0	339	Total			

Subcatchment 5S: CB-3



Summary for Subcatchment 6S: CB-9

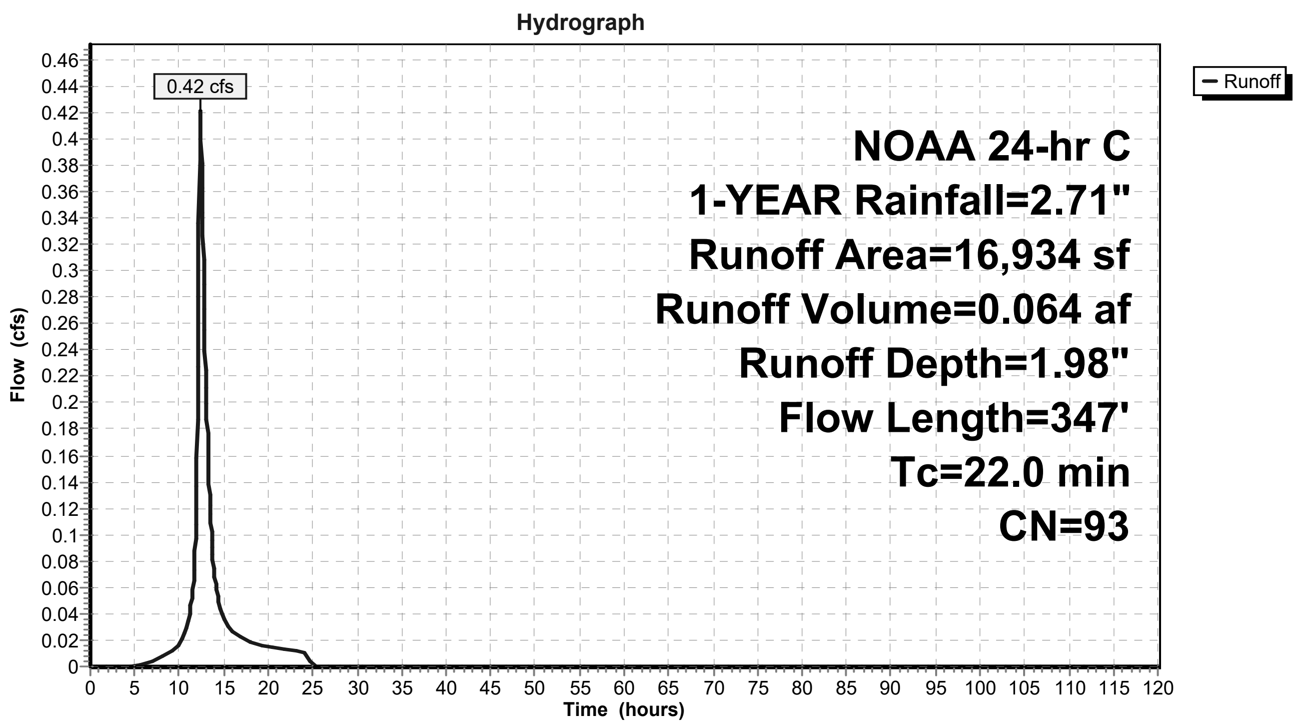
Runoff = 0.42 cfs @ 12.35 hrs, Volume= 0.064 af, Depth= 1.98"
Routed to Pond CB-9 : CB-9

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-YEAR Rainfall=2.71"

Area (sf)	CN	Description
11,659	98	Paved roads w/curbs & sewers, HSG C
1,125	72	Woods/grass comb., Good, HSG C
1,923	83	1/4 acre lots, 38% imp, HSG C
1,148	81	1/3 acre lots, 30% imp, HSG C
1,079	94	Urban commercial, 85% imp, HSG C
16,934	93	Weighted Average
3,283		19.39% Pervious Area
13,651		80.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.6	110	0.0106	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
2.4	237	0.0066	1.65		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
22.0	347	Total			

Subcatchment 6S: CB-9



Summary for Subcatchment 7S: CB-4

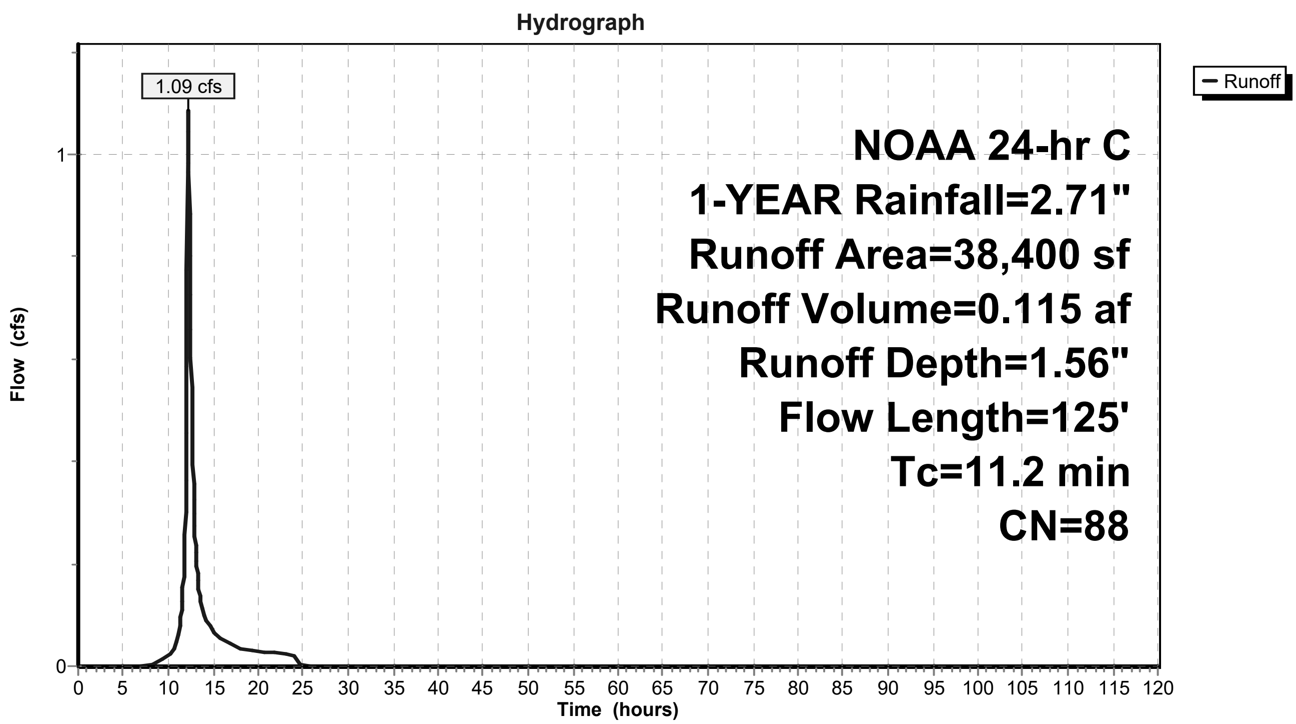
Runoff = 1.09 cfs @ 12.21 hrs, Volume= 0.115 af, Depth= 1.56"
Routed to Pond CB-4 : CB-4

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-YEAR Rainfall=2.71"

Area (sf)	CN	Description
11,566	98	Paved roads w/curbs & sewers, HSG C
26,834	83	1/4 acre lots, 38% imp, HSG C
38,400	88	Weighted Average
16,637		43.33% Pervious Area
21,763		56.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	88	0.0300	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
0.4	37	0.0059	1.56		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
11.2	125	Total			

Subcatchment 7S: CB-4



Summary for Subcatchment 8S: CB-8

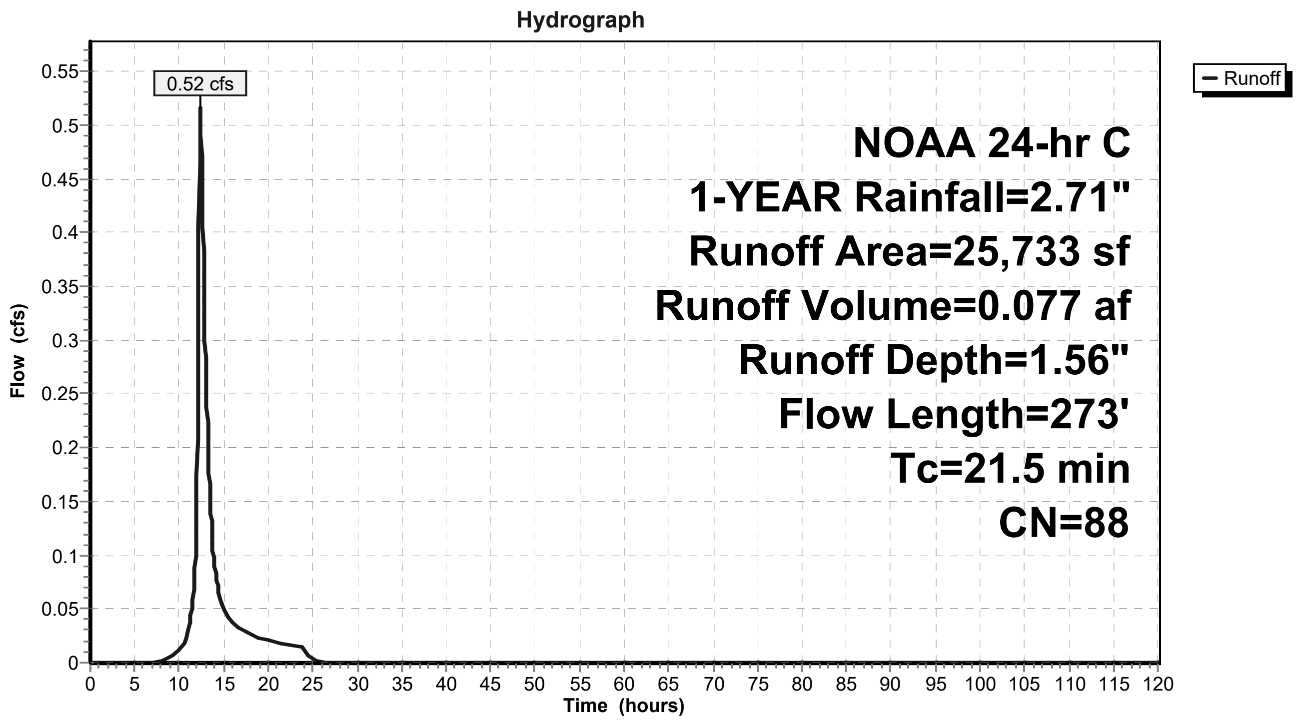
Runoff = 0.52 cfs @ 12.35 hrs, Volume= 0.077 af, Depth= 1.56"
Routed to Pond CB-8 : CB-8

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-YEAR Rainfall=2.71"

Area (sf)	CN	Description
10,976	98	Paved parking, HSG C
1,828	81	1/3 acre lots, 30% imp, HSG C
12,139	80	1/2 acre lots, 25% imp, HSG C
790	94	Urban commercial, 85% imp, HSG C
25,733	88	Weighted Average
10,502		40.81% Pervious Area
15,231		59.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.0	108	0.0096	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
1.5	165	0.0078	1.79		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
21.5	273	Total			

Subcatchment 8S: CB-8



Summary for Subcatchment 9S: CB-5

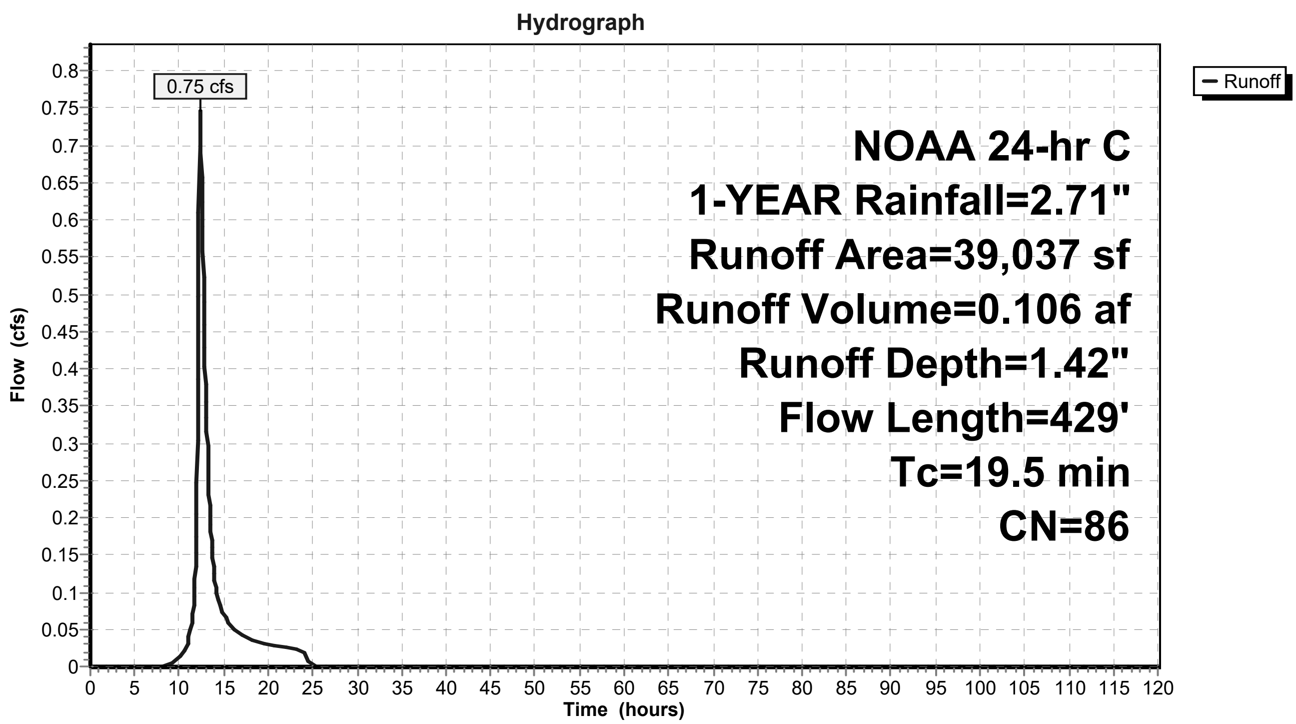
Runoff = 0.75 cfs @ 12.32 hrs, Volume= 0.106 af, Depth= 1.42"
Routed to Pond CB-5 : CB-5

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-YEAR Rainfall=2.71"

Area (sf)	CN	Description
10,204	98	Paved roads w/curbs & sewers, HSG C
9,715	83	1/4 acre lots, 38% imp, HSG C
10,479	81	1/3 acre lots, 30% imp, HSG C
5,019	80	1/2 acre lots, 25% imp, HSG C
3,620	85	1/2 acre lots, 25% imp, HSG D
39,037	86	Weighted Average
19,838		50.82% Pervious Area
19,199		49.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	137	0.0233	0.13		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
2.5	292	0.0090	1.93		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
19.5	429	Total			

Subcatchment 9S: CB-5



Summary for Subcatchment 10S: CB-7

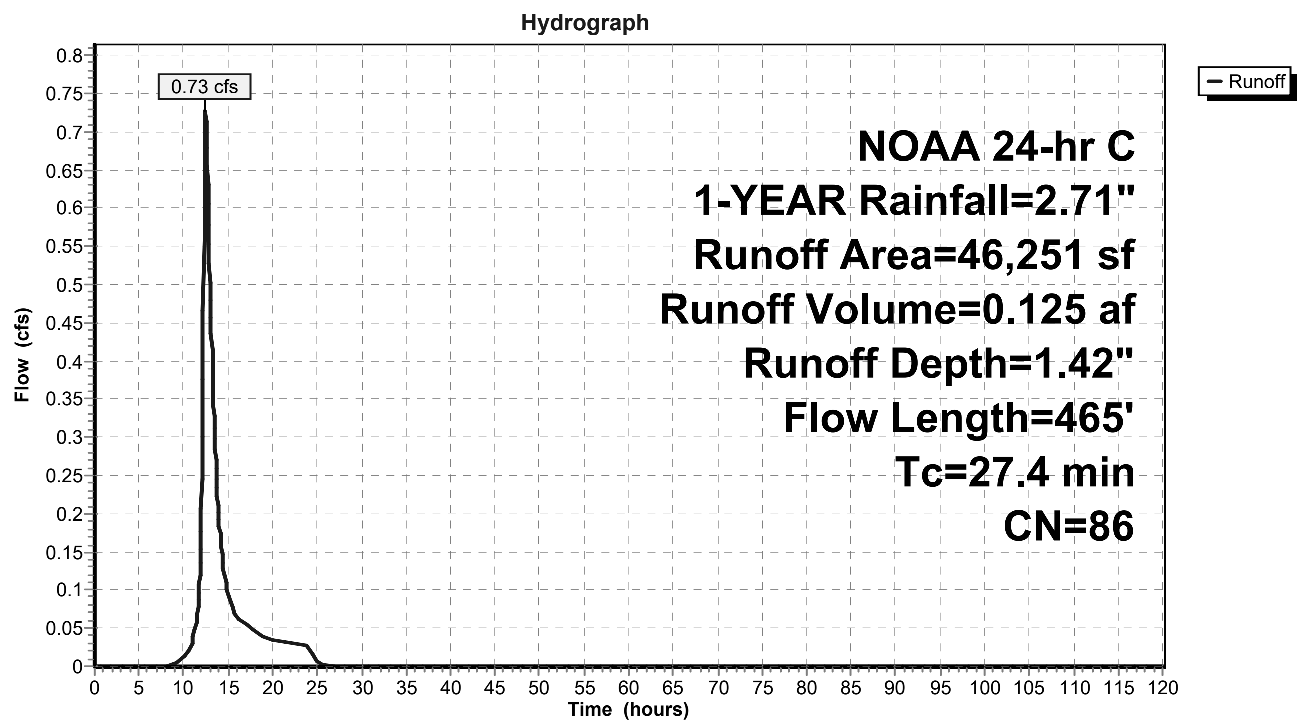
Runoff = 0.73 cfs @ 12.44 hrs, Volume= 0.125 af, Depth= 1.42"
Routed to Pond CB-7 : CB-7

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-YEAR Rainfall=2.71"

Area (sf)	CN	Description
10,245	98	Paved roads w/curbs & sewers, HSG C
33,447	83	1/4 acre lots, 38% imp, HSG C
2,559	80	1/2 acre lots, 25% imp, HSG C
46,251	86	Weighted Average
22,656		48.99% Pervious Area
23,595		51.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.5	150	0.0112	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
0.3	32	0.0112	1.70		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.6	283	0.0078	1.79		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
27.4	465	Total			

Subcatchment 10S: CB-7



Summary for Subcatchment 11S: CB-6

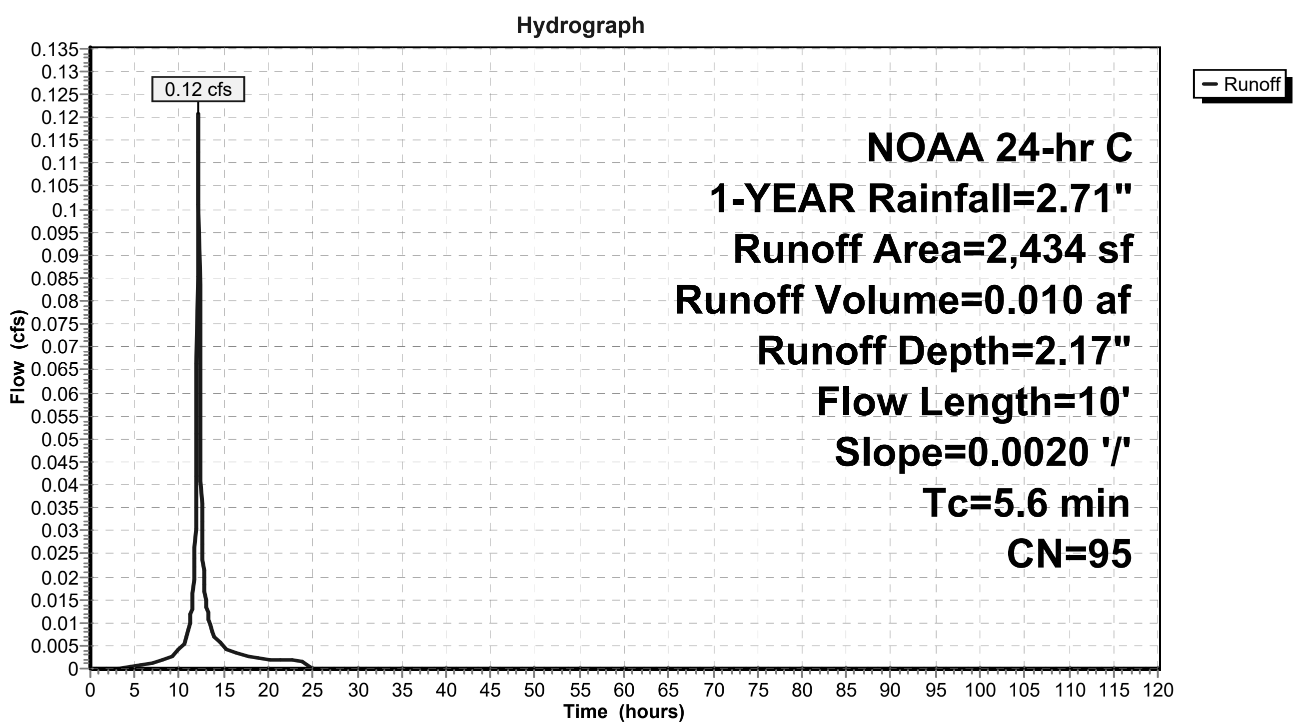
Runoff = 0.12 cfs @ 12.14 hrs, Volume= 0.010 af, Depth= 2.17"
Routed to Pond CB-6 : CB-6

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-YEAR Rainfall=2.71"

Area (sf)	CN	Description
2,137	98	Paved roads w/curbs & sewers, HSG C
35	83	1/4 acre lots, 38% imp, HSG C
262	74	>75% Grass cover, Good, HSG C
2,434	95	Weighted Average
284		11.66% Pervious Area
2,150		88.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	10	0.0020	0.03		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"

Subcatchment 11S: CB-6



Summary for Subcatchment 12S: CB-13

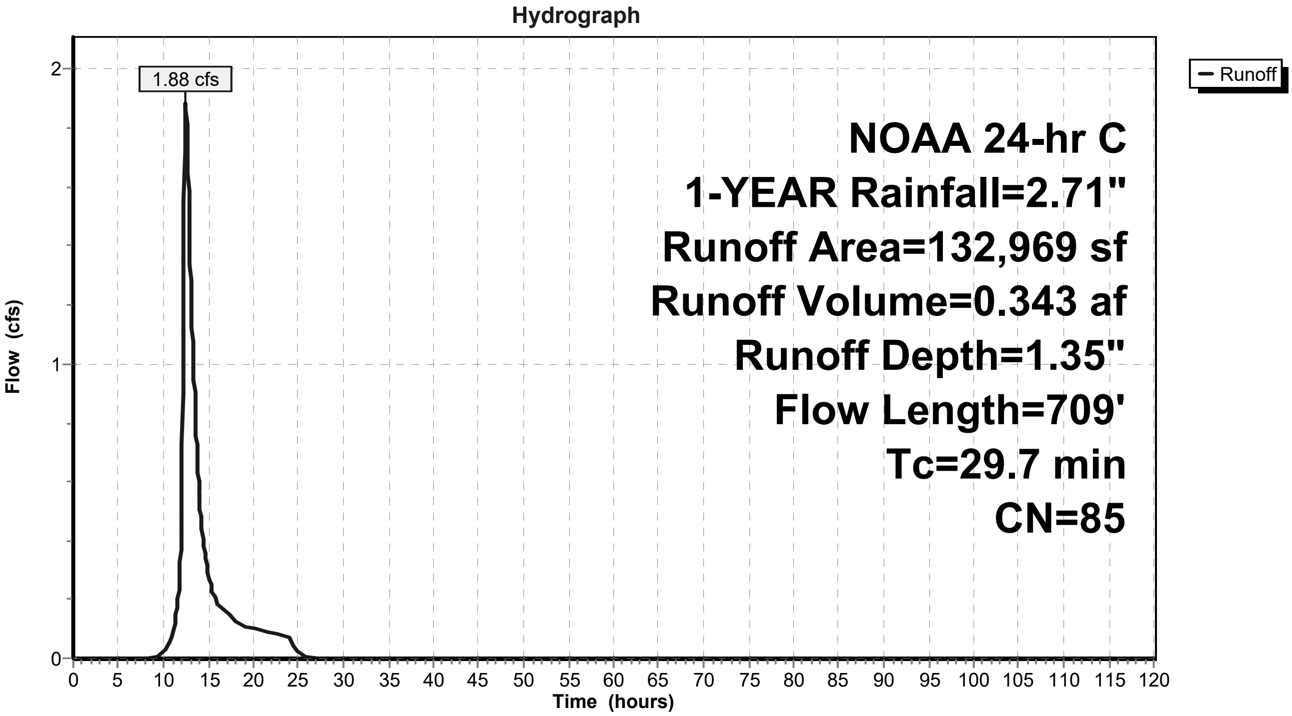
Runoff = 1.88 cfs @ 12.48 hrs, Volume= 0.343 af, Depth= 1.35"
Routed to Pond CB-13 : CB-13

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-YEAR Rainfall=2.71"

Area (sf)	CN	Description
21,153	98	Paved roads w/curbs & sewers, HSG C
102,369	82	Row crops, SR + CR, Good, HSG C
9,447	83	1/4 acre lots, 38% imp, HSG C
132,969	85	Weighted Average
108,226		81.39% Pervious Area
24,743		18.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.1	150	0.0073	0.11		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
5.0	269	0.0101	0.90		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
1.9	187	0.0069	1.68	3.35	**Parabolic Channel, D-6** W=6.00' D=0.50' Area=2.0 sf Perim=6.1' n= 0.035 Earth, dense weeds
0.4	34	0.0030	1.47	0.40	**Pipe Channel,** 10.0" Round w/ 5.0" inside fill Area= 0.3 sf Perim= 2.1' r= 0.13' n= 0.014 Concrete pipe, finished
0.3	69	0.0199	4.37	17.48	**Parabolic Channel,** W=6.00' D=1.00' Area=4.0 sf Perim=6.4' n= 0.035 Earth, dense weeds
29.7	709	Total			

Subcatchment 12S: CB-13



Summary for Subcatchment 13S: CB-12

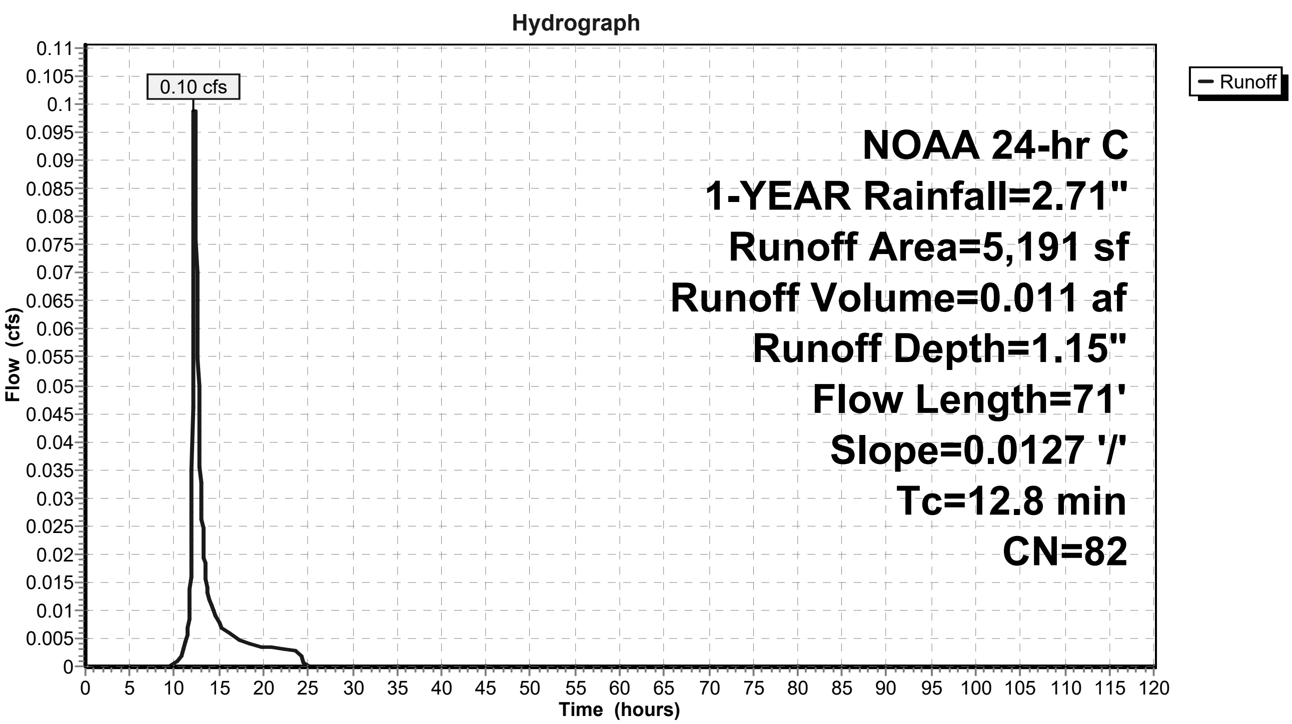
Runoff = 0.10 cfs @ 12.24 hrs, Volume= 0.011 af, Depth= 1.15"
Routed to Pond CB-12 : CB-12

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-YEAR Rainfall=2.71"

Area (sf)	CN	Description
1,729	98	Paved roads w/curbs & sewers, HSG C
3,462	74	>75% Grass cover, Good, HSG C
5,191	82	Weighted Average
3,462		66.69% Pervious Area
1,729		33.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	71	0.0127	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"

Subcatchment 13S: CB-12



Summary for Subcatchment 14S: CB-14

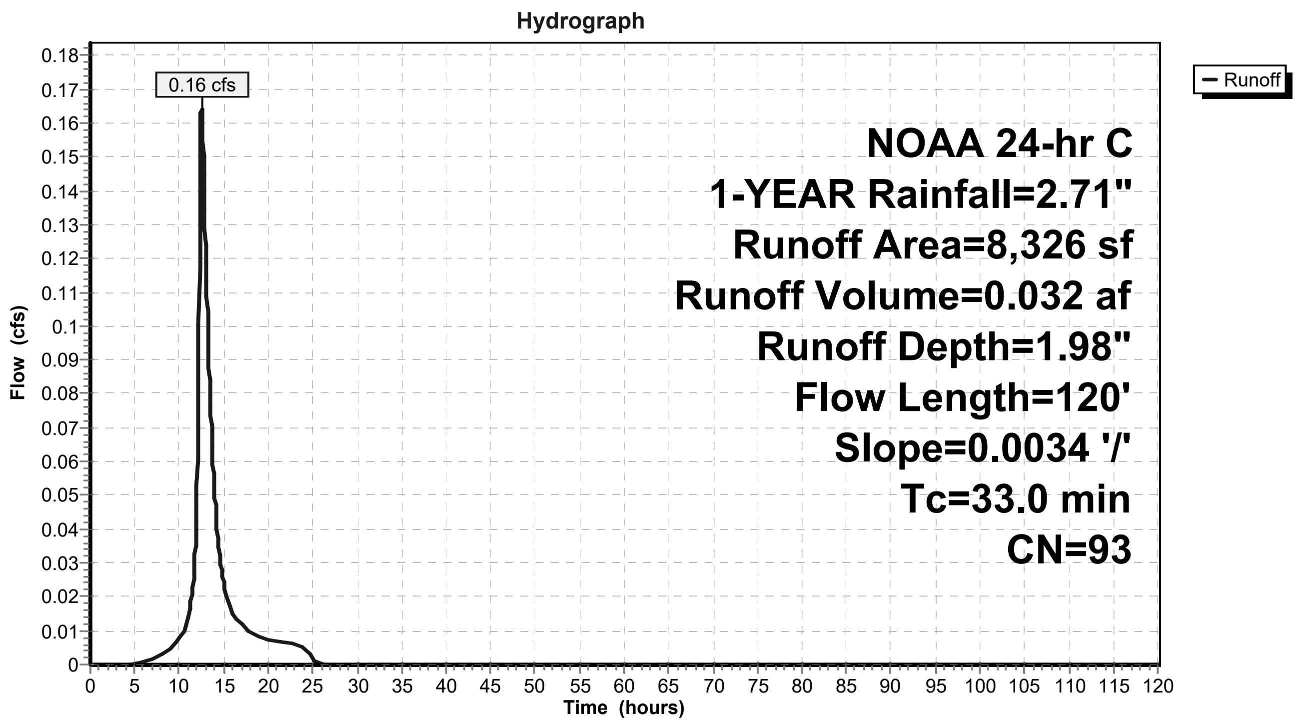
Runoff = 0.16 cfs @ 12.49 hrs, Volume= 0.032 af, Depth= 1.98"
Routed to Pond CB-14 : CB-14

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-YEAR Rainfall=2.71"

Area (sf)	CN	Description
6,418	98	Paved roads w/curbs & sewers, HSG C
1,849	74	>75% Grass cover, Good, HSG C
59	98	Paved roads w/curbs & sewers, HSG D
8,326	93	Weighted Average
1,849		22.21% Pervious Area
6,477		77.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.0	120	0.0034	0.06		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"

Subcatchment 14S: CB-14



Summary for Subcatchment 15S: CB-15

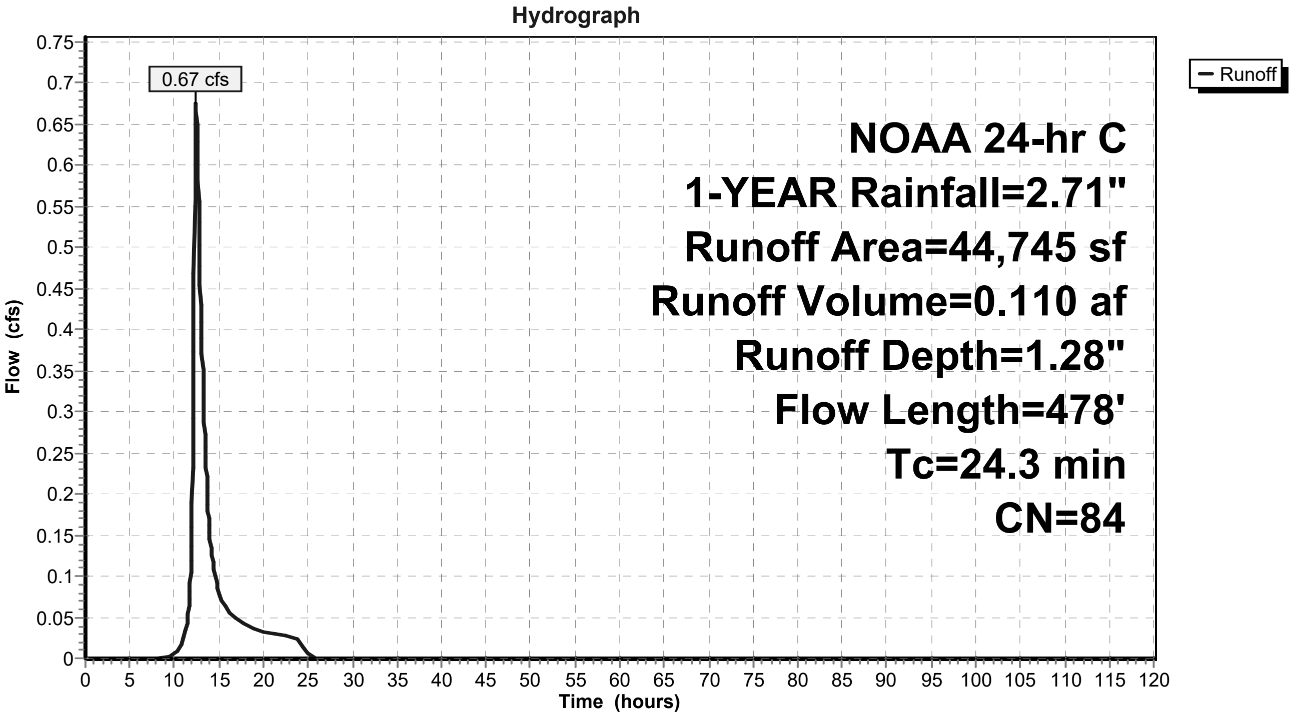
Runoff = 0.67 cfs @ 12.40 hrs, Volume= 0.110 af, Depth= 1.28"
Routed to Pond CB-15 : CB-15

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-YEAR Rainfall=2.71"

Area (sf)	CN	Description
3,608	98	Paved roads w/curbs & sewers, HSG C
14,612	82	Row crops, SR + CR, Good, HSG C
4,652	83	1/4 acre lots, 38% imp, HSG C
10,561	80	1/2 acre lots, 25% imp, HSG C
684	98	Paved roads w/curbs & sewers, HSG C
5,318	87	1/4 acre lots, 38% imp, HSG D
5,310	85	1/2 acre lots, 25% imp, HSG D
44,745	84	Weighted Average
32,697		73.07% Pervious Area
12,048		26.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.6	150	0.0129	0.14		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
0.1	4	0.0129	1.02		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
2.2	270	0.0167	2.08		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
4.4	54	0.0001	0.20		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
24.3	478	Total			

Subcatchment 15S: CB-15



Summary for Subcatchment 16S: CB-16

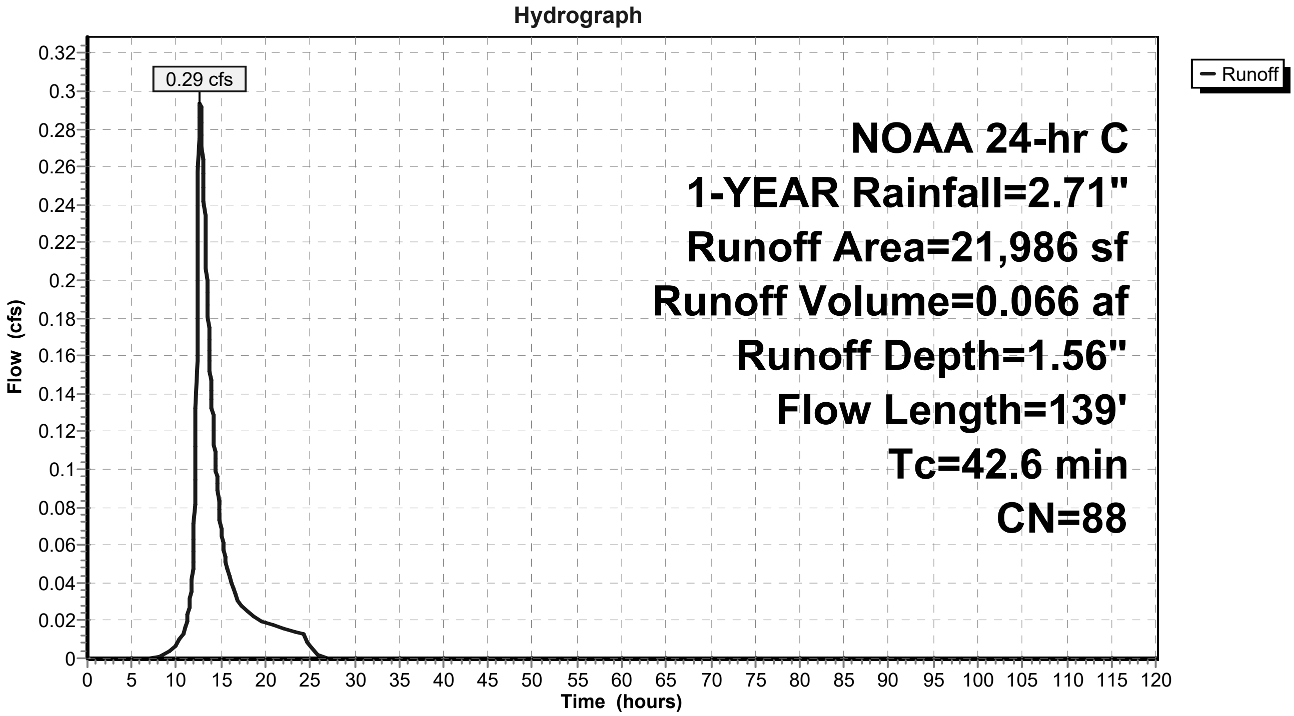
Runoff = 0.29 cfs @ 12.64 hrs, Volume= 0.066 af, Depth= 1.56"
Routed to Pond CB-16 : CB-16

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-YEAR Rainfall=2.71"

Area (sf)	CN	Description
7,490	98	Paved roads w/curbs & sewers, HSG C
2,534	74	>75% Grass cover, Good, HSG C
728	83	1/4 acre lots, 38% imp, HSG C
1,489	81	1/3 acre lots, 30% imp, HSG C
2,781	80	1/2 acre lots, 25% imp, HSG C
2,781	98	Paved roads w/curbs & sewers, HSG D
3,870	80	>75% Grass cover, Good, HSG D
82	70	1/2 acre lots, 25% imp, HSG B
231	72	1/3 acre lots, 30% imp, HSG B
21,986	88	Weighted Average
10,207		46.42% Pervious Area
11,779		53.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.8	44	0.0004	0.02		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
7.8	95	0.0001	0.20		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
42.6	139	Total			

Subcatchment 16S: CB-16



Summary for Subcatchment 17S: CB-17

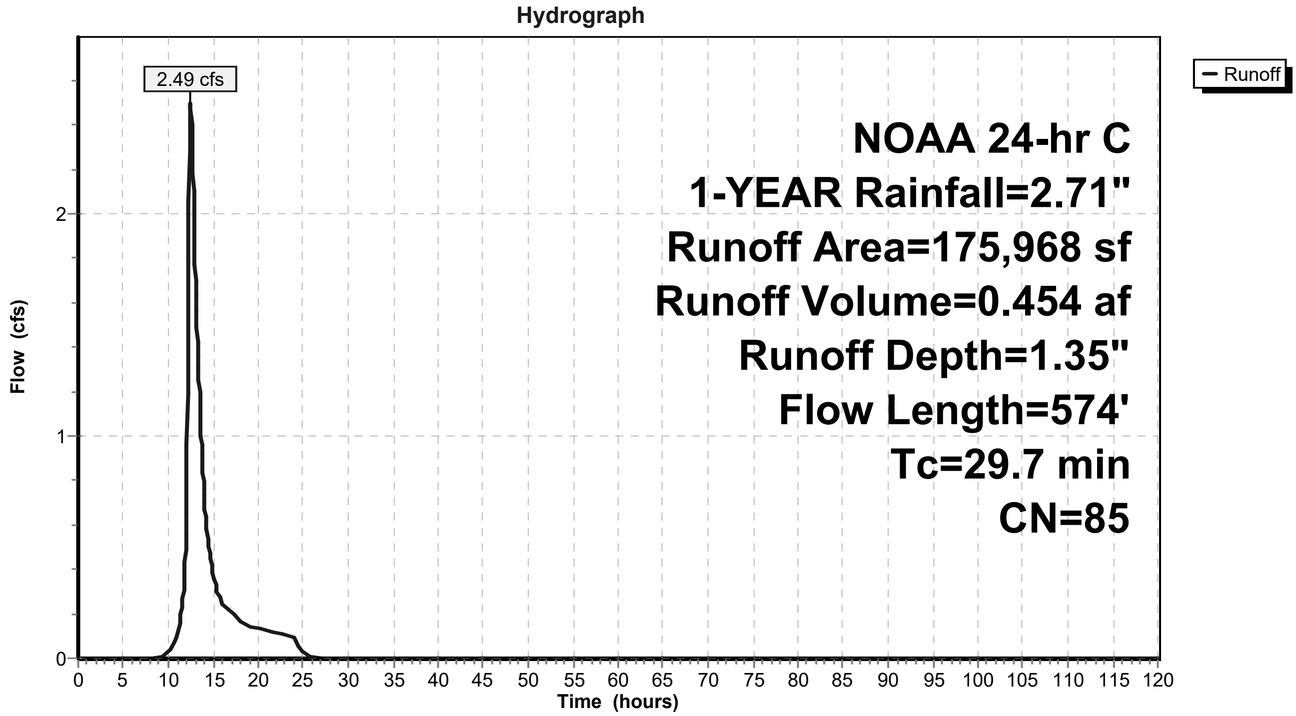
Runoff = 2.49 cfs @ 12.48 hrs, Volume= 0.454 af, Depth= 1.35"
Routed to Pond CB-17 : CB-17

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-YEAR Rainfall=2.71"

Area (sf)	CN	Description
24,112	98	Paved roads w/curbs & sewers, HSG C
77,330	82	Row crops, SR + CR, Good, HSG C
68,554	83	1/4 acre lots, 38% imp, HSG C
3,251	98	Paved roads w/curbs & sewers, HSG D
11	87	1/4 acre lots, 38% imp, HSG D
2,710	85	1/2 acre lots, 25% imp, HSG D
175,968	85	Weighted Average
121,873		69.26% Pervious Area
54,095		30.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.6	150	0.0087	0.12		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
0.6	32	0.0087	0.84		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
1.5	201	0.0198	2.27		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
7.0	191	0.0005	0.45		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
29.7	574	Total			

Subcatchment 17S: CB-17



Summary for Subcatchment 18S: D-8

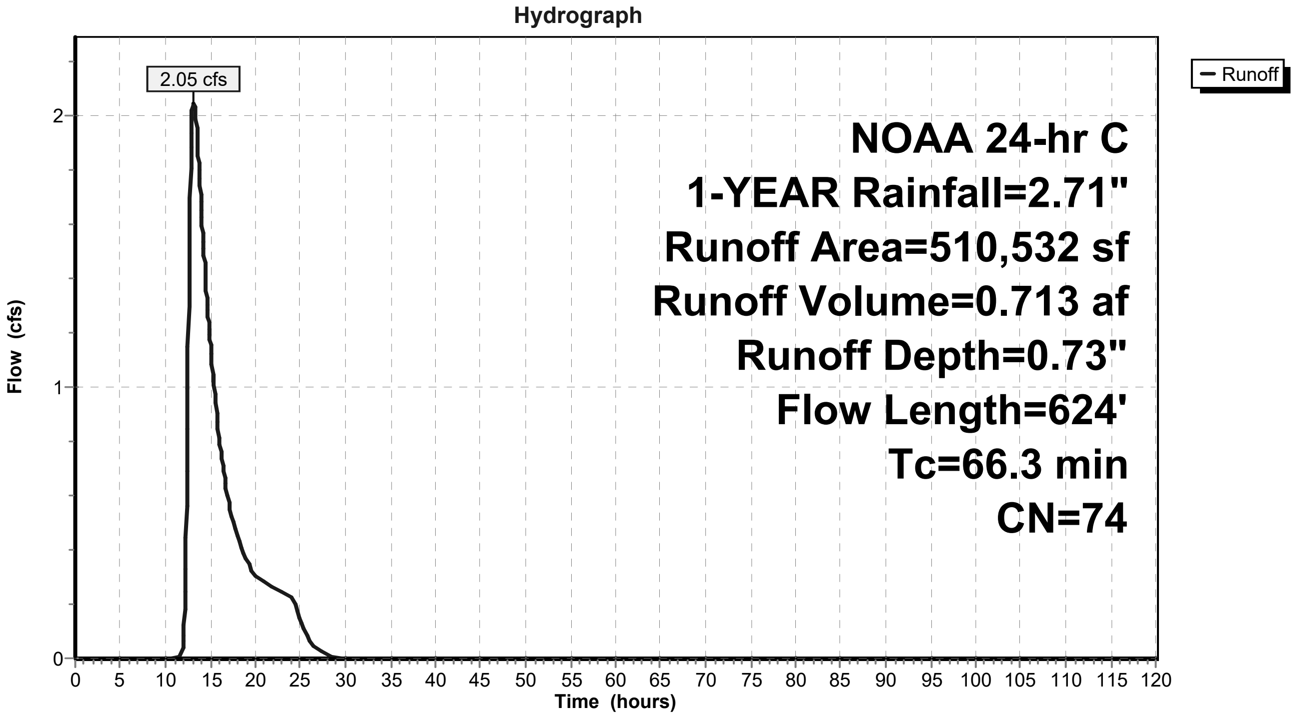
Runoff = 2.05 cfs @ 13.12 hrs, Volume= 0.713 af, Depth= 0.73"
Routed to Pond 40P : C-1

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-YEAR Rainfall=2.71"

Area (sf)	CN	Description
20,906	61	>75% Grass cover, Good, HSG B
34,255	75	1/4 acre lots, 38% imp, HSG B
19,157	72	1/3 acre lots, 30% imp, HSG B
15,536	70	1/2 acre lots, 25% imp, HSG B
8,099	68	1 acre lots, 20% imp, HSG B
2,079	98	Paved roads w/curbs & sewers, HSG C
338,487	74	>75% Grass cover, Good, HSG C
39,648	83	1/4 acre lots, 38% imp, HSG C
8,414	81	1/3 acre lots, 30% imp, HSG C
5,839	80	1/2 acre lots, 25% imp, HSG C
14,980	79	1 acre lots, 20% imp, HSG C
3,132	80	>75% Grass cover, Good, HSG D
510,532	74	Weighted Average
462,139		90.52% Pervious Area
48,393		9.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.9	150	0.0133	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
3.1	353	0.0142	1.92		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
40.3	121	0.0001	0.05		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
66.3	624	Total			

Subcatchment 18S: D-8



Summary for Subcatchment 19S: LOW POINT BEHIND CAR LOT

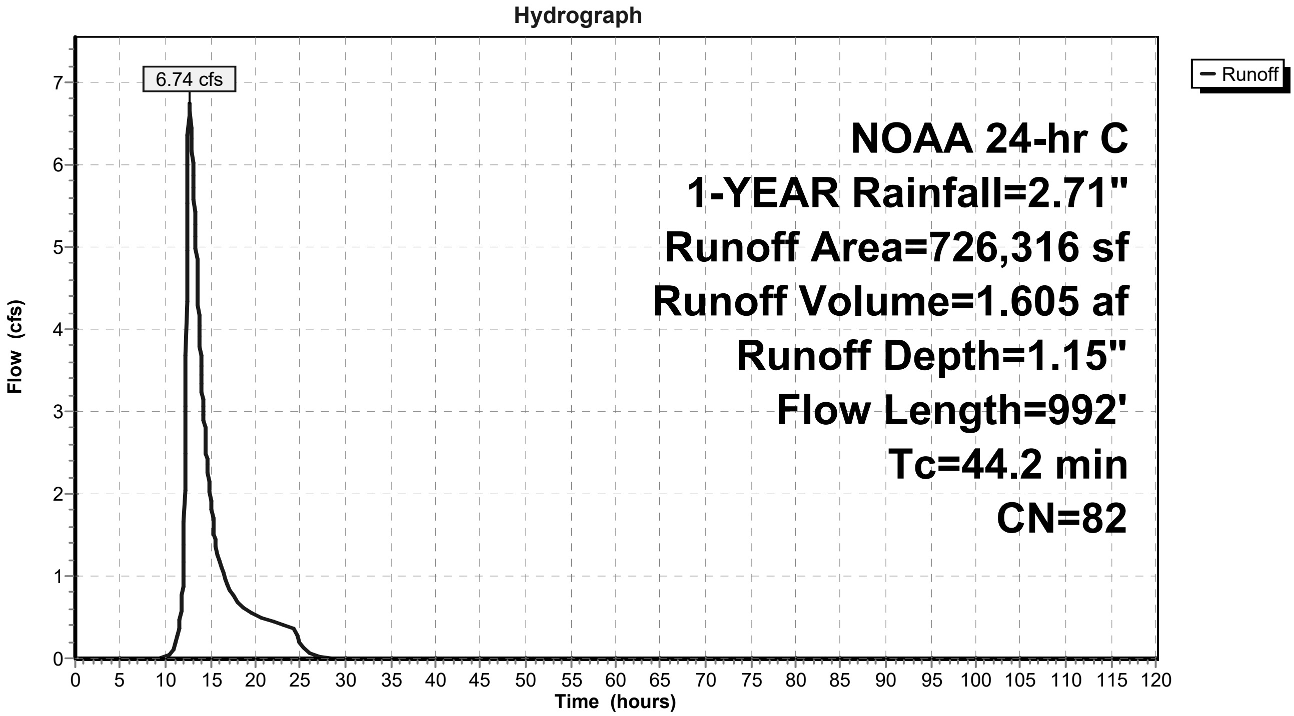
Runoff = 6.74 cfs @ 12.70 hrs, Volume= 1.605 af, Depth= 1.15"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-YEAR Rainfall=2.71"

Area (sf)	CN	Description
574,884	82	Row crops, SR + CR, Good, HSG C
42,712	83	1/4 acre lots, 38% imp, HSG C
42,050	81	1/3 acre lots, 30% imp, HSG C
37,738	80	1/2 acre lots, 25% imp, HSG C
28,932	94	Urban commercial, 85% imp, HSG C
726,316	82	Weighted Average
663,444		91.34% Pervious Area
62,872		8.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	150	0.0067	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
3.4	160	0.0125	0.78		**Shallow Concentrated Flow, Grass flow** Short Grass Pasture Kv= 7.0 fps
15.5	368	0.0063	0.40		**Shallow Concentrated Flow, Forested area** Woodland Kv= 5.0 fps
4.6	314	0.0159	1.13		**Shallow Concentrated Flow, farm field** Cultivated Straight Rows Kv= 9.0 fps
44.2	992	Total			

Subcatchment 19S: LOW POINT BEHIND CAR LOT



Summary for Subcatchment 44S: W-1

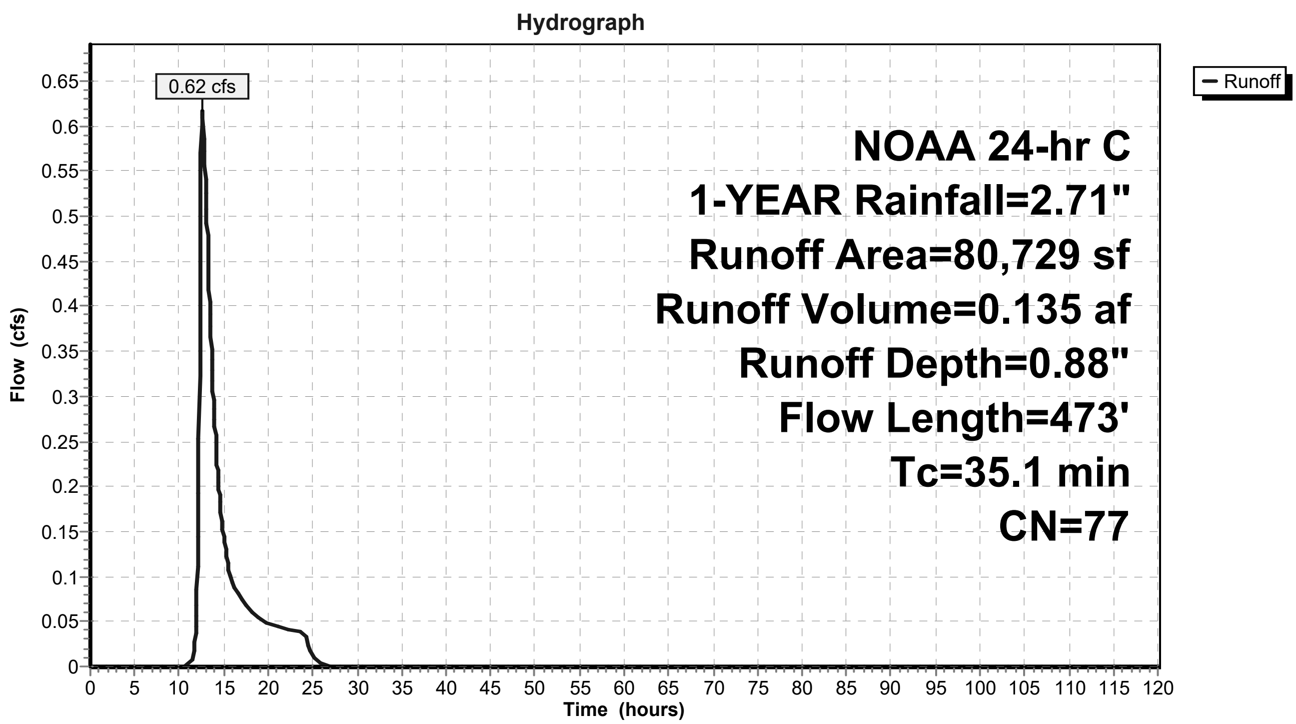
Runoff = 0.62 cfs @ 12.61 hrs, Volume= 0.135 af, Depth= 0.88"
Routed to Pond 46P : Farm Pond

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-YEAR Rainfall=2.71"

Area (sf)	CN	Description
978	48	Brush, Good, HSG B
56,376	82	Row crops, SR + CR, Good, HSG C
17,219	65	Brush, Good, HSG C
6,156	73	Brush, Good, HSG D
80,729	77	Weighted Average
80,729		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.1	150	0.0067	0.08		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
4.3	279	0.0143	1.08		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
0.7	44	0.0450	1.06		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
35.1	473	Total			

Subcatchment 44S: W-1



Summary for Subcatchment 45S: W-2

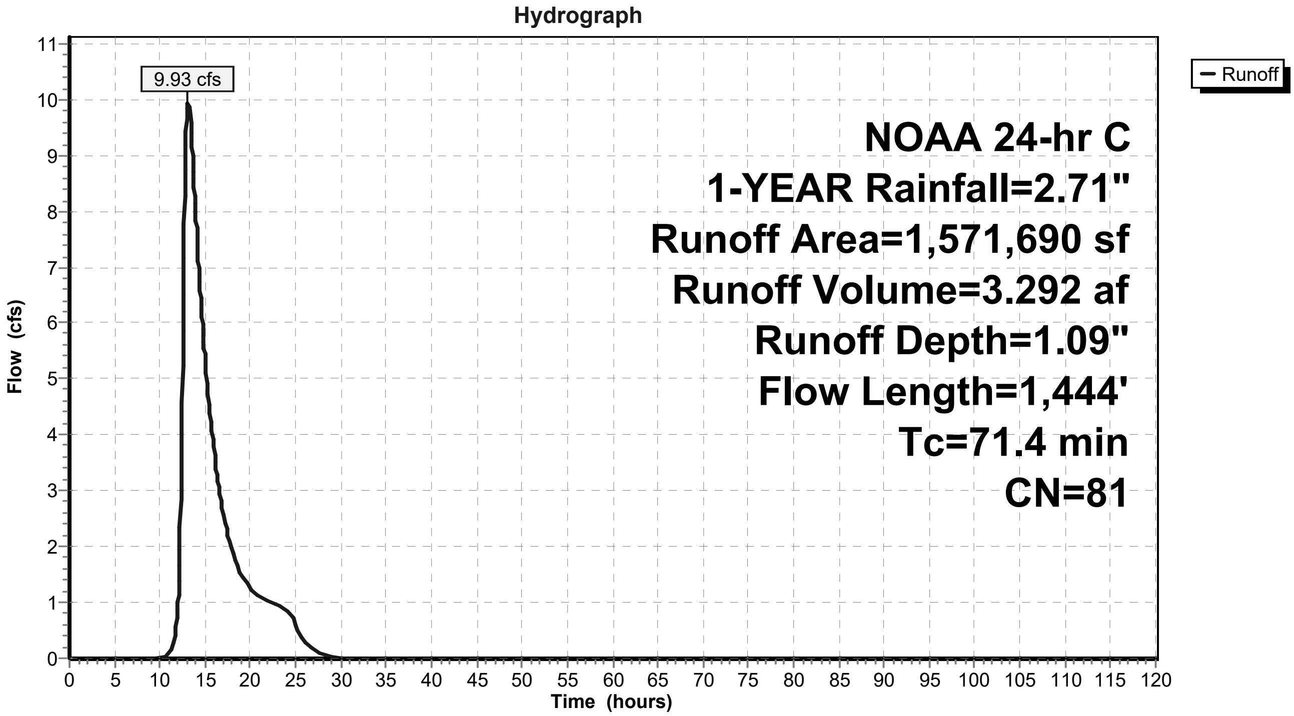
Runoff = 9.93 cfs @ 13.13 hrs, Volume= 3.292 af, Depth= 1.09"
Routed to Pond 47P : W-2

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-YEAR Rainfall=2.71"

Area (sf)	CN	Description
1,251,599	82	Row crops, SR + CR, Good, HSG C
41,690	72	Woods/grass comb., Good, HSG C
177,558	75	Row crops, SR + CR, Good, HSG B
24,058	83	1/4 acre lots, 38% imp, HSG C
15,439	80	1/2 acre lots, 25% imp, HSG C
61,346	73	Brush, Good, HSG D
1,571,690	81	Weighted Average
1,558,688		99.17% Pervious Area
13,002		0.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.1	150	0.0020	0.07		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
18.2	730	0.0055	0.67		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
3.9	94	0.0063	0.40		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.2	470	0.0051	0.64		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
71.4	1,444	Total			

Subcatchment 45S: W-2



Summary for Subcatchment 46S: w-3

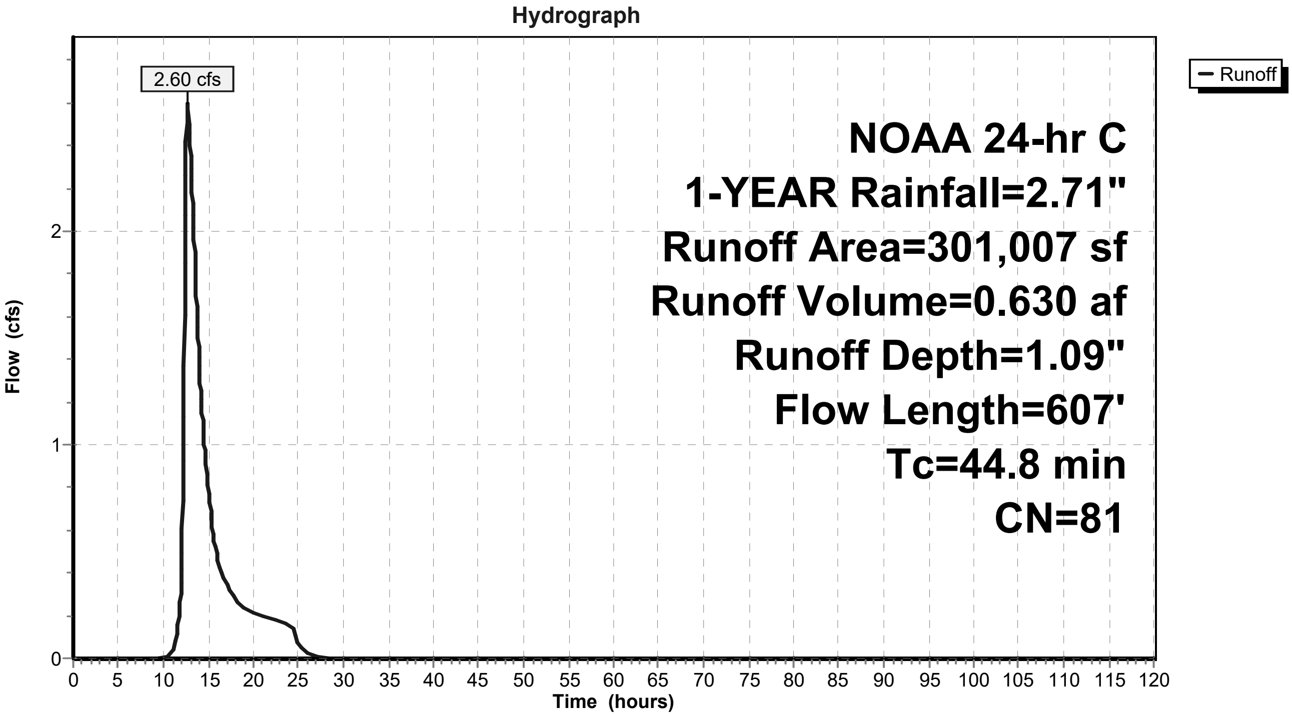
Runoff = 2.60 cfs @ 12.73 hrs, Volume= 0.630 af, Depth= 1.09"
Routed to Pond 48P : w-3

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 1-YEAR Rainfall=2.71"

Area (sf)	CN	Description
178,174	82	Row crops, SR + CR, Good, HSG C
32,241	83	1/4 acre lots, 38% imp, HSG C
15,039	81	1/3 acre lots, 30% imp, HSG C
4,043	80	1/2 acre lots, 25% imp, HSG C
55,172	73	Brush, Good, HSG D
434	87	1/4 acre lots, 38% imp, HSG D
6,581	86	1/3 acre lots, 30% imp, HSG D
9,323	85	1/2 acre lots, 25% imp, HSG D
301,007	81	Weighted Average
278,763		92.61% Pervious Area
22,244		7.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.1	150	0.0020	0.07		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
6.2	400	0.0141	1.07		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
1.5	57	0.0158	0.63		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
44.8	607	Total			

Subcatchment 46S: w-3



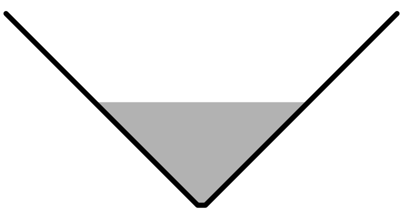
Summary for Reach 48R: (new Reach)

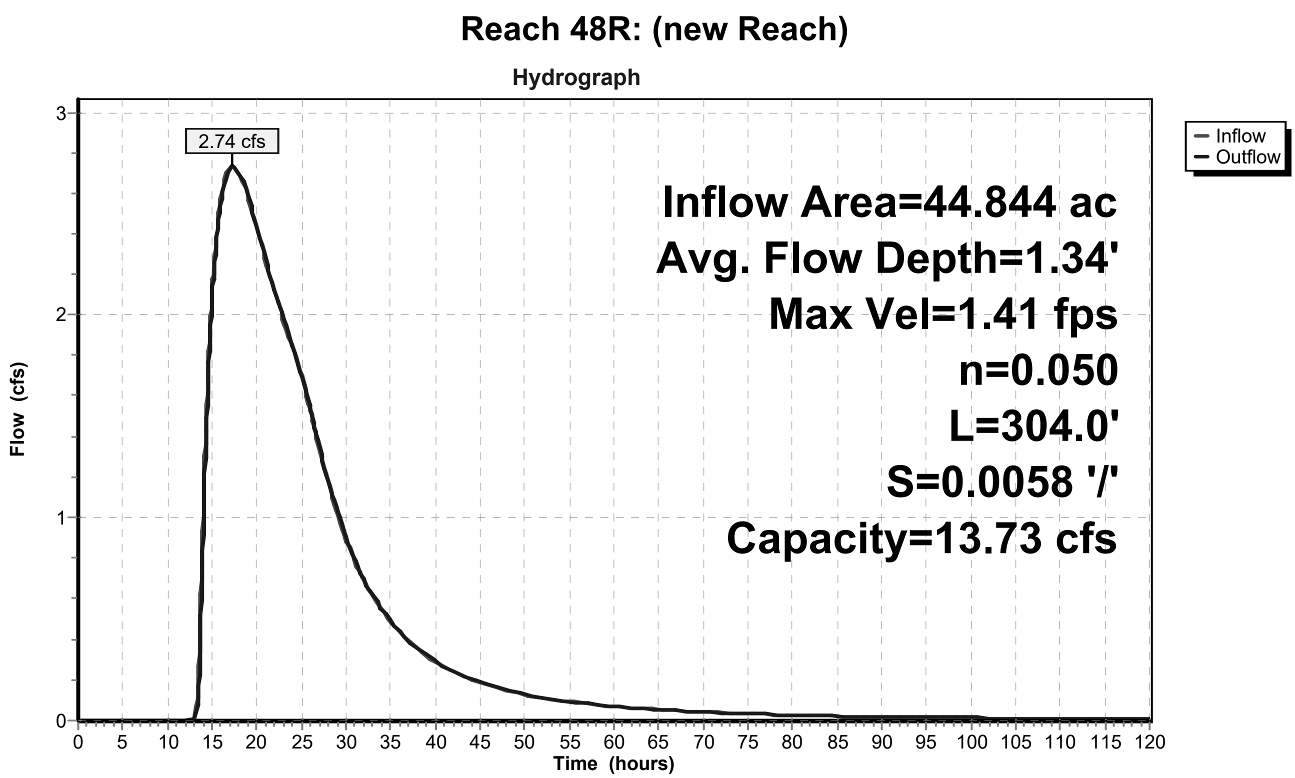
Inflow Area = 44.844 ac, 1.80% Impervious, Inflow Depth > 0.91" for 1-YEAR event
Inflow = 2.74 cfs @ 17.27 hrs, Volume= 3.399 af
Outflow = 2.74 cfs @ 17.31 hrs, Volume= 3.399 af, Atten= 0%, Lag= 2.7 min
Routed to Pond 44P : Culvert @ ditch

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Max. Velocity= 1.41 fps, Min. Travel Time= 3.6 min
Avg. Velocity = 0.65 fps, Avg. Travel Time= 7.8 min

Peak Storage= 588 cf @ 17.31 hrs
Average Depth at Peak Storage= 1.34' , Surface Width= 2.78'
Bank-Full Depth= 2.50' Flow Area= 6.5 sf, Capacity= 13.73 cfs

0.10' x 2.50' deep channel, n= 0.050
Side Slope Z-value= 1.00 '/' Top Width= 5.10'
Length= 304.0' Slope= 0.0058 '/'
Inlet Invert= 6.75', Outlet Invert= 5.00'





Summary for Pond 40P: C-1

Inflow Area = 72.869 ac, 12.41% Impervious, Inflow Depth > 1.01" for 1-YEAR event
Inflow = 12.14 cfs @ 12.45 hrs, Volume= 6.134 af
Outflow = 8.79 cfs @ 13.07 hrs, Volume= 6.100 af, Atten= 28%, Lag= 36.8 min
Primary = 8.79 cfs @ 13.07 hrs, Volume= 6.100 af
Routed to Link 43L : MHHW

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Starting Elev= 2.70' Surf.Area= 6,440 sf Storage= 4,293 cf
Peak Elev= 3.63' @ 13.07 hrs Surf.Area= 25,343 sf Storage= 18,079 cf (13,786 cf above start)
Flood Elev= 5.50' Surf.Area= 101,376 sf Storage= 128,769 cf (124,476 cf above start)

Plug-Flow detention time= 97.2 min calculated for 6.001 af (98% of inflow)
Center-of-Mass det. time= 12.2 min (1,293.6 - 1,281.4)

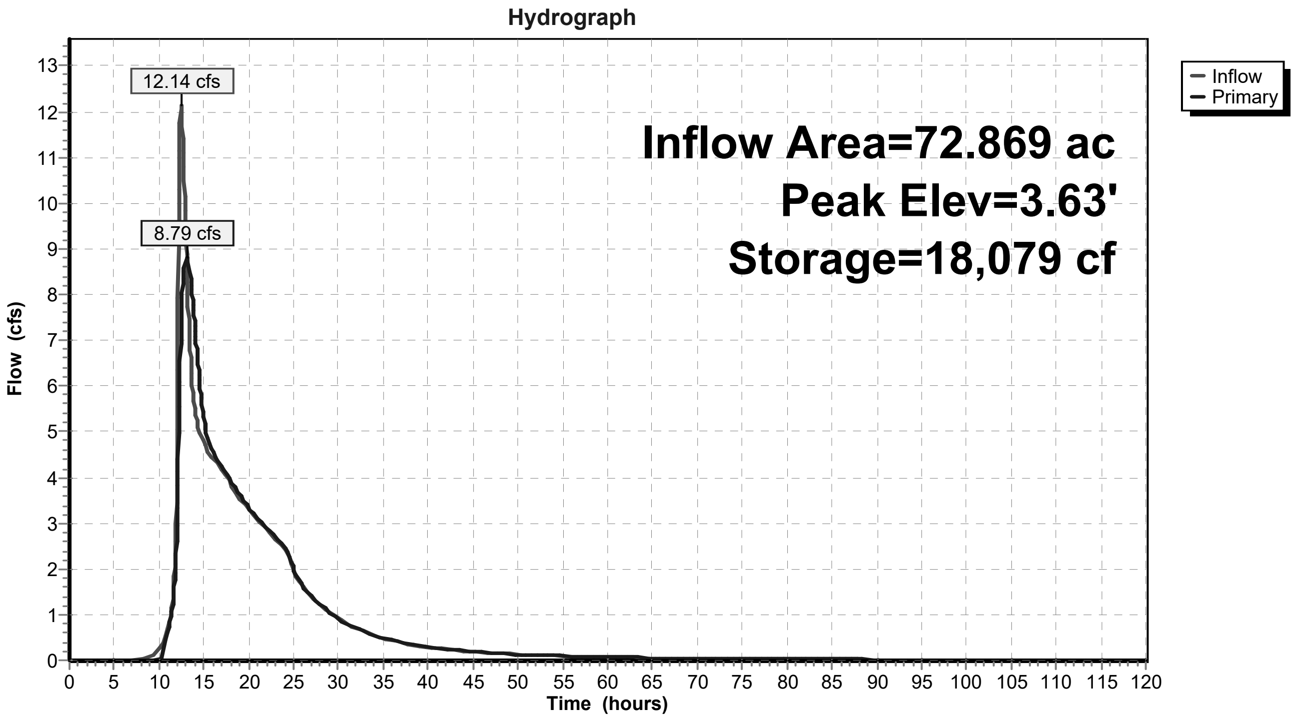
Volume	Invert	Avail.Storage	Storage Description
#1	0.70'	128,769 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
0.70	0	0.0	0	0	0
2.70	6,440	1,626.0	4,293	4,293	210,399
5.50	101,376	2,163.2	124,476	128,769	372,471

Device	Routing	Invert	Outlet Devices
#1	Primary	0.84'	**18.0" Round Culvert X 2.00 w/ 6.0" inside fill** L= 25.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 0.34' / 0.09' S= 0.0100 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.25 sf
#2	Primary	4.04'	**50.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=8.79 cfs @ 13.07 hrs HW=3.63' TW=2.89' (Dynamic Tailwater)
1=Culvert (Outlet Controls 8.79 cfs @ 3.51 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 40P: C-1


Hydrograph
12.14 cfs
8.79 cfs
Inflow
Primary
Inflow Area=72.869 ac
Peak Elev=3.63'
Storage=18,079 cf
Flow (cfs)
Time (hours)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120

Summary for Pond 44P: Culvert @ ditch

Inflow Area = 44.844 ac, 1.80% Impervious, Inflow Depth > 0.91" for 1-YEAR event
Inflow = 2.74 cfs @ 17.31 hrs, Volume= 3.399 af
Outflow = 2.74 cfs @ 17.31 hrs, Volume= 3.399 af, Atten= 0%, Lag= 0.0 min
Primary = 2.74 cfs @ 17.31 hrs, Volume= 3.399 af
Routed to Pond CB-5 : CB-5
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond CB-5 : CB-5

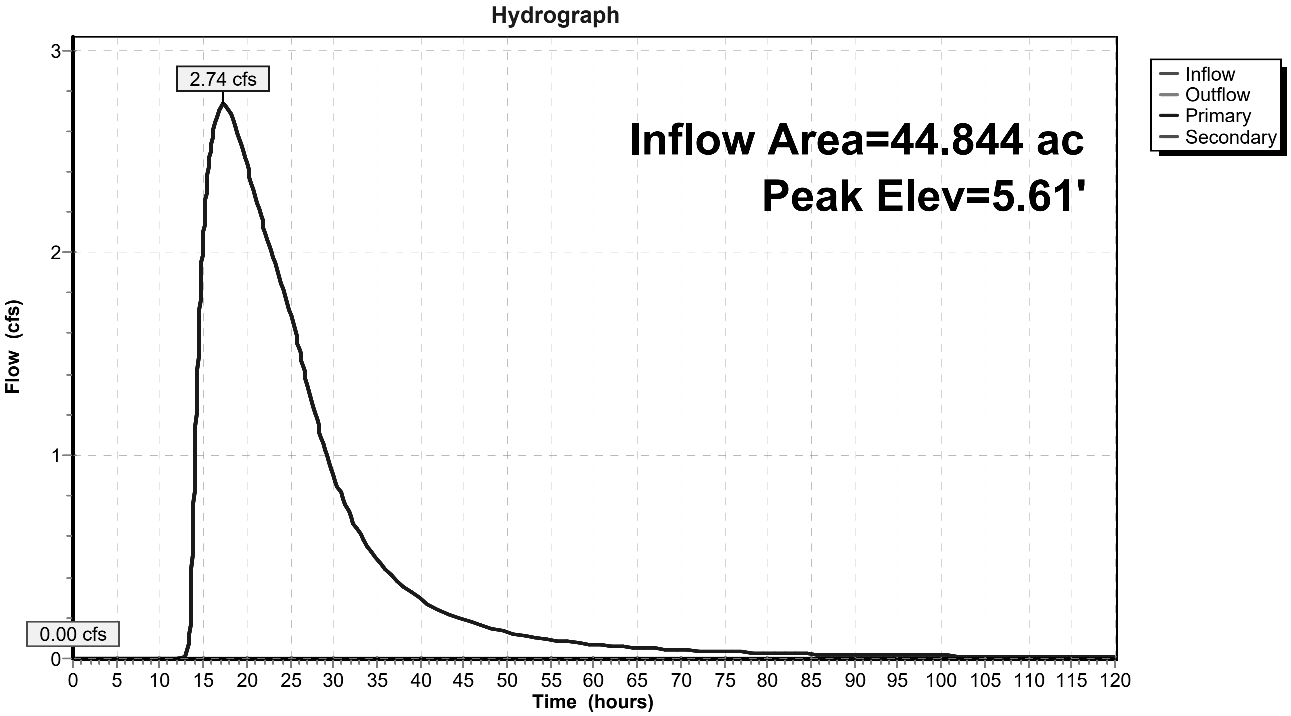
Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 5.61' @ 17.31 hrs
Flood Elev= 7.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	5.00'	**24.0" Round Culvert** L= 20.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 5.00' / 4.34' S= 0.0330 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Secondary	7.00'	**6.0' long x 12.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Primary OutFlow Max=2.74 cfs @ 17.31 hrs HW=5.61' TW=3.88' (Dynamic Tailwater)
1=Culvert (Inlet Controls 2.74 cfs @ 3.34 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=5.00' TW=2.74' (Dynamic Tailwater)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 44P: Culvert @ ditch



Summary for Pond 46P: Farm Pond

Inflow Area = 1.853 ac, 0.00% Impervious, Inflow Depth = 0.88" for 1-YEAR event
Inflow = 0.62 cfs @ 12.61 hrs, Volume= 0.135 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 Pond 47P : W-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 6.98' @ 27.90 hrs Surf.Area= 5,935 sf Storage= 5,888 cf

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

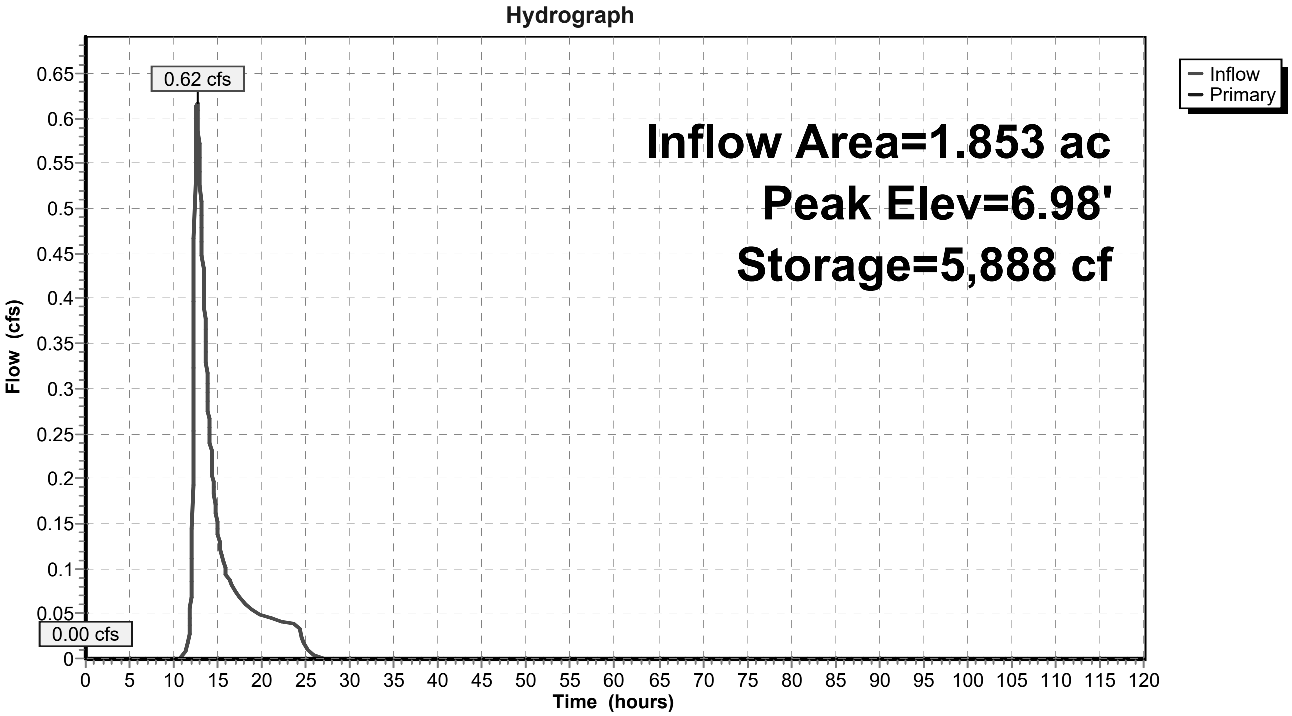
Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	37,392 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
4.00	0	0.0	0	0	0
8.00	10,722	446.1	14,296	14,296	15,861
9.00	21,600	638.0	15,847	30,143	32,426
10.00	1	1.0	7,249	37,392	64,819

Device	Routing	Invert	Outlet Devices
#1	Primary	7.90'	**25.0' long x 35.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=4.00' TW=7.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 46P: Farm Pond



Summary for Pond 47P: W-2

Inflow Area = 37.934 ac, 0.79% Impervious, Inflow Depth = 1.04" for 1-YEAR event
Inflow = 9.93 cfs @ 13.13 hrs, Volume= 3.292 af
Outflow = 7.81 cfs @ 13.35 hrs, Volume= 3.292 af, Atten= 21%, Lag= 13.1 min
Primary = 7.81 cfs @ 13.35 hrs, Volume= 3.292 af
Routed to Pond 48P : w-3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Starting Elev= 7.00' Surf.Area= 7,186 sf Storage= 7,186 cf
Peak Elev= 8.10' @ 17.17 hrs Surf.Area= 53,690 sf Storage= 36,893 cf (29,707 cf above start)
Flood Elev= 9.00' Surf.Area= 116,660 sf Storage= 111,889 cf (104,703 cf above start)

Plug-Flow detention time= 238.8 min calculated for 3.126 af (95% of inflow)
Center-of-Mass det. time= 190.4 min (1,146.2 - 955.8)

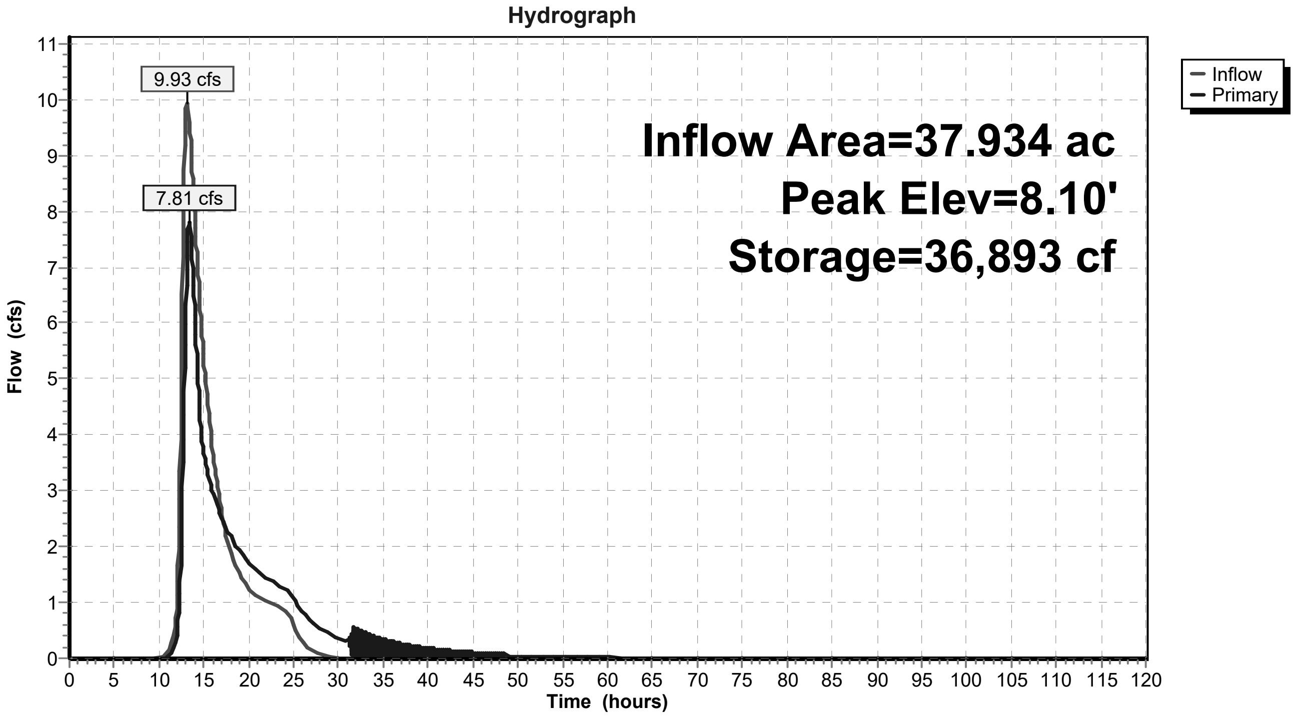
Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	150,890 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
4.00	0	0.0	0	0	0
7.00	7,186	362.8	7,186	7,186	10,488
8.00	48,289	1,234.1	24,701	31,887	121,214
9.00	116,660	1,809.4	80,002	111,889	260,556
10.00	1	1.0	39,001	150,890	521,089

Device	Routing	Invert	Outlet Devices
#1	Primary	7.00'	**5.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=7.81 cfs @ 13.35 hrs HW=7.72' TW=7.12' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 7.81 cfs @ 2.16 fps)

Pond 47P: W-2


Hydrograph
Inflow
Primary
9.93 cfs
7.81 cfs
Inflow Area=37.934 ac
Peak Elev=8.10'
Storage=36,893 cf
Flow (cfs)
Time (hours)
0
1
2
3
4
5
6
7
8
9
10
11
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120

Summary for Pond 48P: w-3

Inflow Area = 44.844 ac, 1.80% Impervious, Inflow Depth = 1.05" for 1-YEAR event
Inflow = 9.85 cfs @ 13.31 hrs, Volume= 3.922 af
Outflow = 2.74 cfs @ 17.27 hrs, Volume= 3.399 af, Atten= 72%, Lag= 237.5 min
Primary = 2.74 cfs @ 17.27 hrs, Volume= 3.399 af
Routed to Reach 48R : (new Reach)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 8.09' @ 17.27 hrs Surf.Area= 55,467 sf Storage= 70,576 cf

Plug-Flow detention time= 608.9 min calculated for 3.399 af (87% of inflow)
Center-of-Mass det. time= 481.6 min (1,590.7 - 1,109.0)

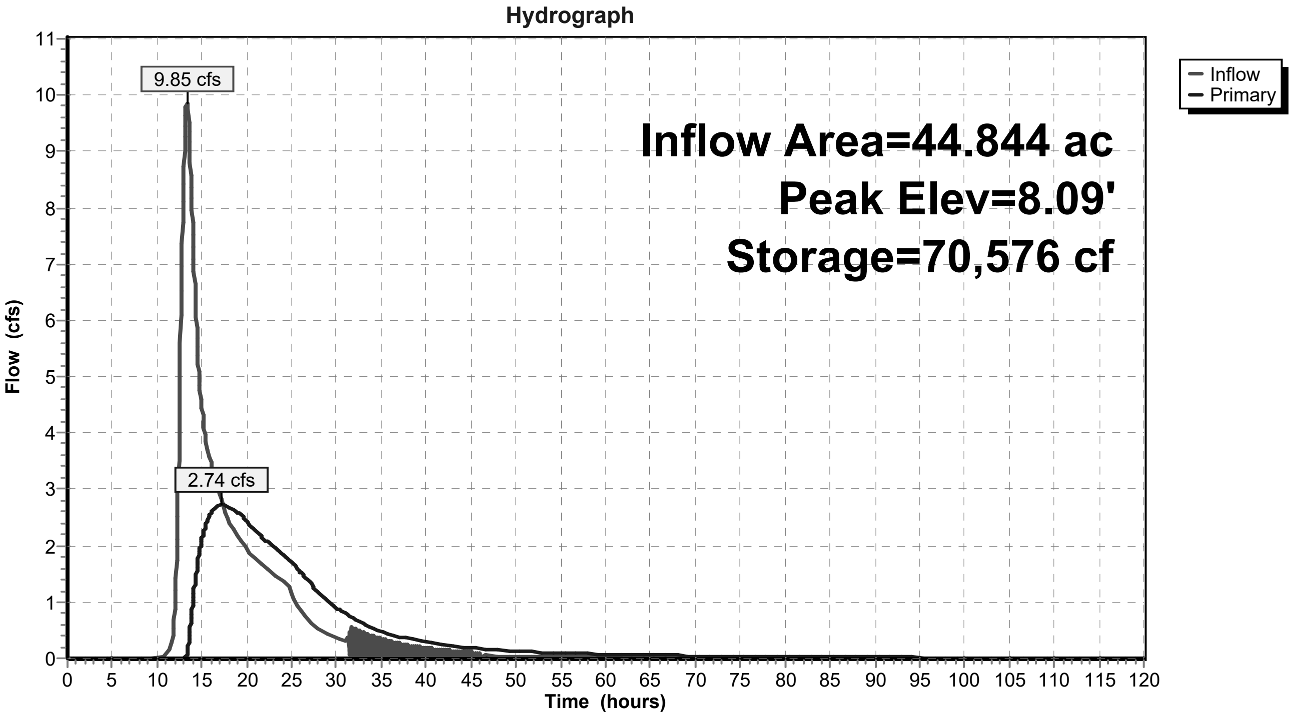
Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	210,516 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
4.00	0	0.0	0	0	0
7.00	26,232	838.7	26,232	26,232	55,990
8.00	54,023	958.7	39,300	65,532	73,178
9.00	70,709	1,081.7	62,179	127,711	93,175
12.50	1	1.0	82,805	210,516	186,306

Device	Routing	Invert	Outlet Devices
#1	Primary	6.75'	**Channel/Reach** using Reach 48R: (new Reach)

Primary OutFlow Max=2.74 cfs @ 17.27 hrs HW=8.09' TW=8.09' (Dynamic Tailwater)
└─**1=Channel/Reach** (Channel Controls 2.74 cfs @ 1.41 fps)

Pond 48P: w-3


Hydrograph
9.85 cfs
2.74 cfs
Inflow
Primary
Inflow Area=44.844 ac
Peak Elev=8.09'
Storage=70,576 cf
Flow (cfs)
Time (hours)
0
1
2
3
4
5
6
7
8
9
10
11
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120

Summary for Pond CB-1: CB-1

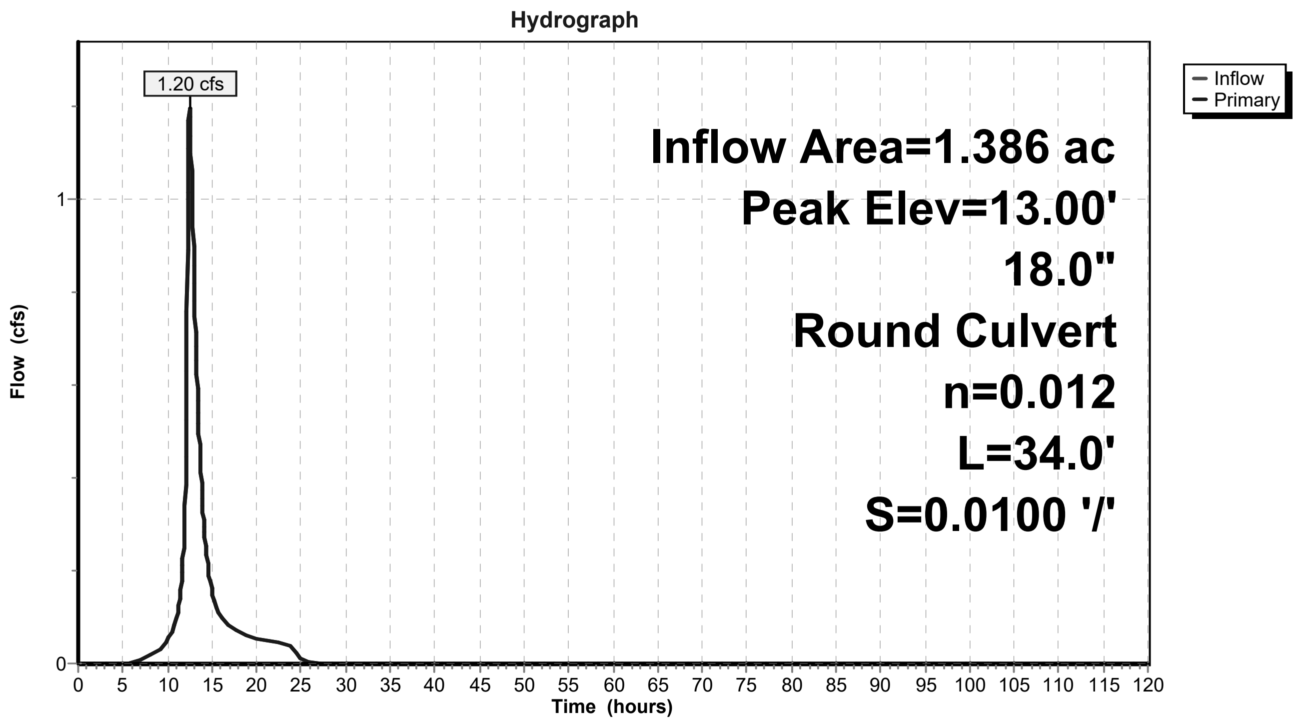
Inflow Area = 1.386 ac, 76.98% Impervious, Inflow Depth = 1.89" for 1-YEAR event
Inflow = 1.20 cfs @ 12.46 hrs, Volume= 0.218 af
Outflow = 1.20 cfs @ 12.46 hrs, Volume= 0.218 af, Atten= 0%, Lag= 0.0 min
Primary = 1.20 cfs @ 12.46 hrs, Volume= 0.218 af
Routed to Pond CB-11 : CB-11

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 13.00' @ 12.46 hrs
Flood Elev= 15.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	12.50'	**18.0" Round RCP_Round 18"** L= 34.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 12.50' / 12.16' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=1.19 cfs @ 12.46 hrs HW=13.00' TW=11.82' (Dynamic Tailwater)
1=RCP_Round 18" (Barrel Controls 1.19 cfs @ 3.42 fps)

Pond CB-1: CB-1



Summary for Pond CB-10: CB-10

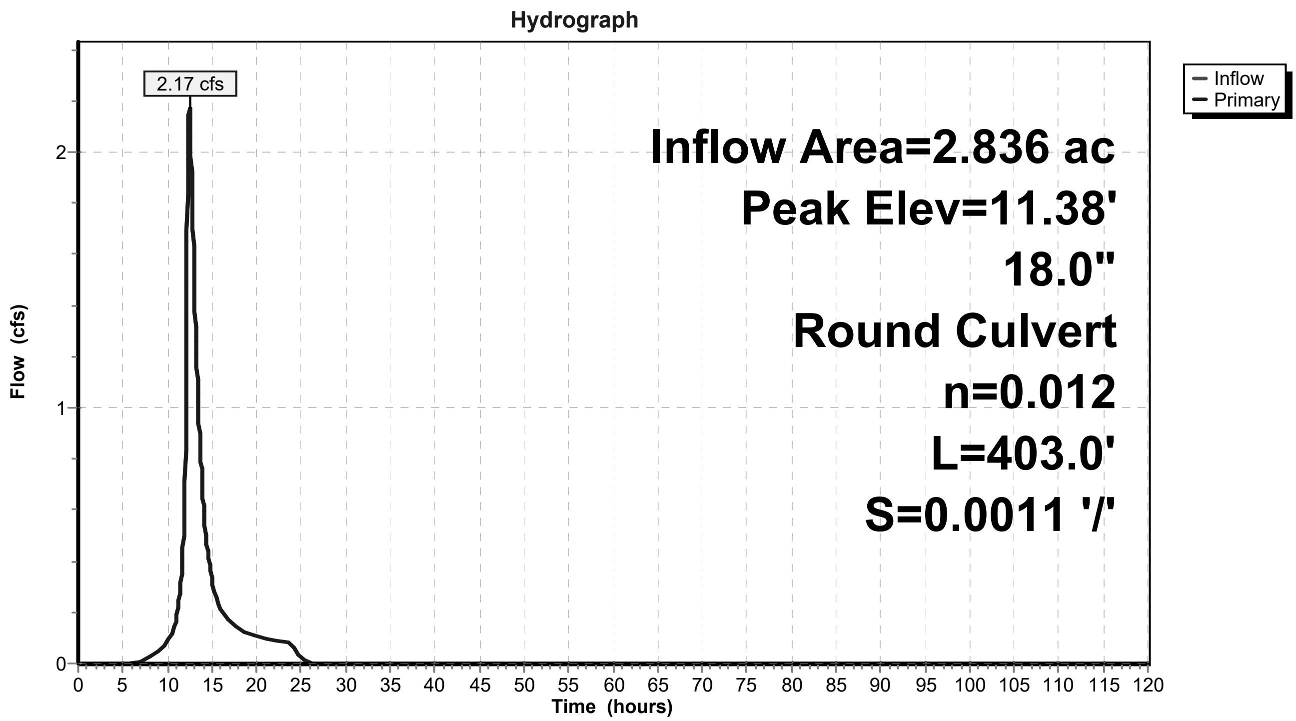
Inflow Area = 2.836 ac, 71.29% Impervious, Inflow Depth = 1.78" for 1-YEAR event
Inflow = 2.17 cfs @ 12.46 hrs, Volume= 0.420 af
Outflow = 2.17 cfs @ 12.46 hrs, Volume= 0.420 af, Atten= 0%, Lag= 0.0 min
Primary = 2.17 cfs @ 12.46 hrs, Volume= 0.420 af
Routed to Pond CB-9 : CB-9

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 11.38' @ 12.44 hrs
Flood Elev= 15.05'

Device	Routing	Invert	Outlet Devices
#1	Primary	10.34'	**18.0" Round RCP_Round 18"** L= 403.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 10.34' / 9.89' S= 0.0011 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=2.17 cfs @ 12.46 hrs HW=11.38' TW=10.73' (Dynamic Tailwater)
1=RCP_Round 18" (Outlet Controls 2.17 cfs @ 2.35 fps)

Pond CB-10: CB-10



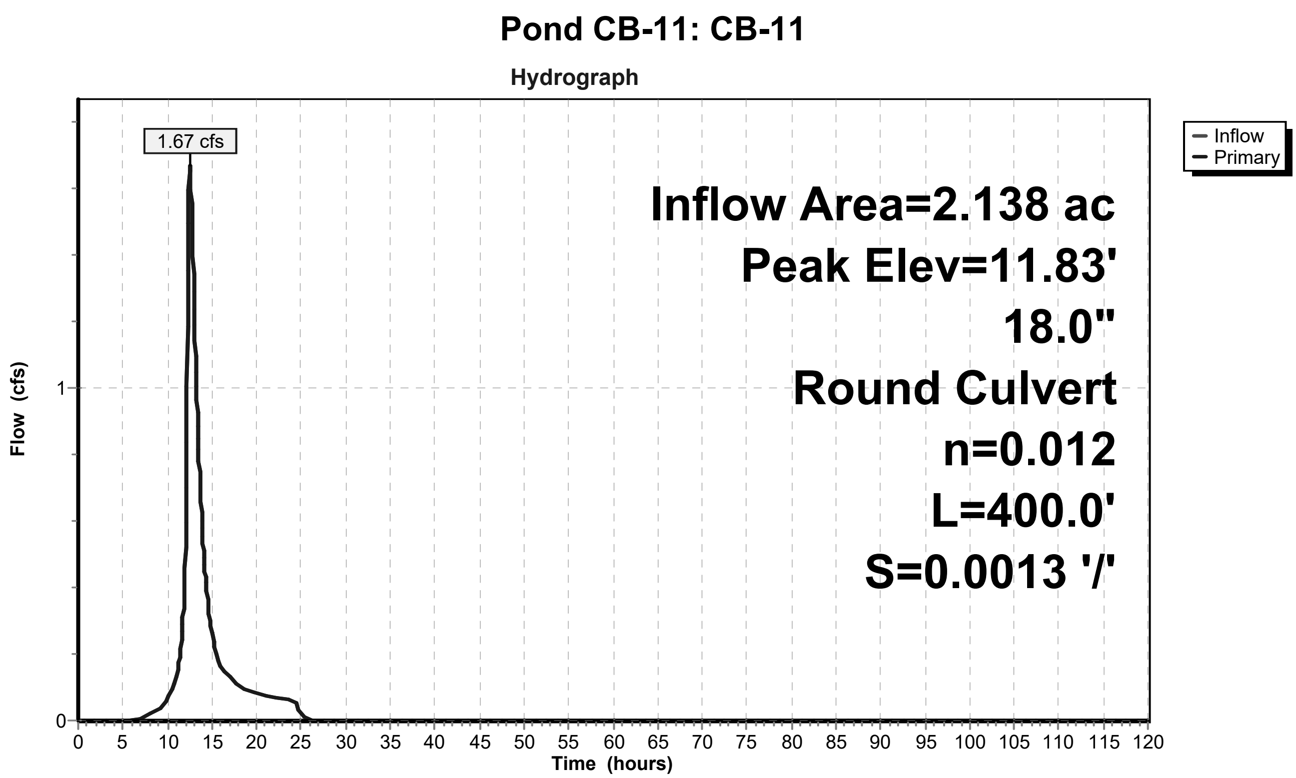
Summary for Pond CB-11: CB-11

Inflow Area = 2.138 ac, 73.44% Impervious, Inflow Depth = 1.83" for 1-YEAR event
Inflow = 1.67 cfs @ 12.51 hrs, Volume= 0.326 af
Outflow = 1.67 cfs @ 12.51 hrs, Volume= 0.326 af, Atten= 0%, Lag= 0.0 min
Primary = 1.67 cfs @ 12.51 hrs, Volume= 0.326 af
Routed to Pond CB-10 : CB-10

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 11.83' @ 12.48 hrs
Flood Elev= 15.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	10.84'	**18.0" Round Culvert** L= 400.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 10.84' / 10.34' S= 0.0013 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=1.68 cfs @ 12.51 hrs HW=11.82' TW=11.37' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 1.68 cfs @ 1.94 fps)



Summary for Pond CB-12: CB-12

Inflow Area = 3.172 ac, 19.16% Impervious, Inflow Depth = 1.34" for 1-YEAR event
Inflow = 1.96 cfs @ 12.47 hrs, Volume= 0.354 af
Outflow = 1.96 cfs @ 12.47 hrs, Volume= 0.354 af, Atten= 0%, Lag= 0.0 min
Primary = 1.96 cfs @ 12.47 hrs, Volume= 0.354 af
Routed to Pond MH-1 : MANHOLE-1
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

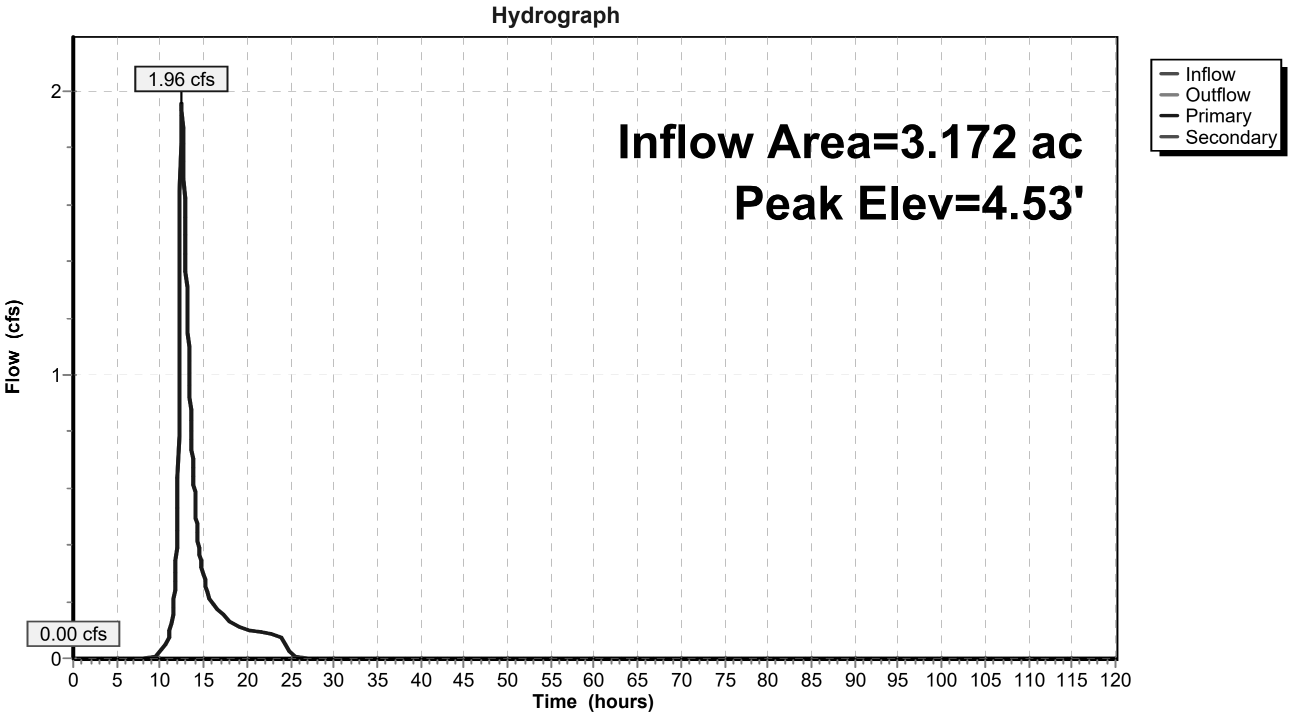
Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 4.53' @ 12.46 hrs
Flood Elev= 6.97'

Device	Routing	Invert	Outlet Devices
#1	Primary	3.13'	**18.0" Round Culvert** L= 32.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 3.13' / 2.35' S= 0.0244 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf
#2	Secondary	7.25'	**2.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=2.02 cfs @ 12.47 hrs HW=4.53' TW=4.46' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 2.02 cfs @ 1.53 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=3.13' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond CB-12: CB-12



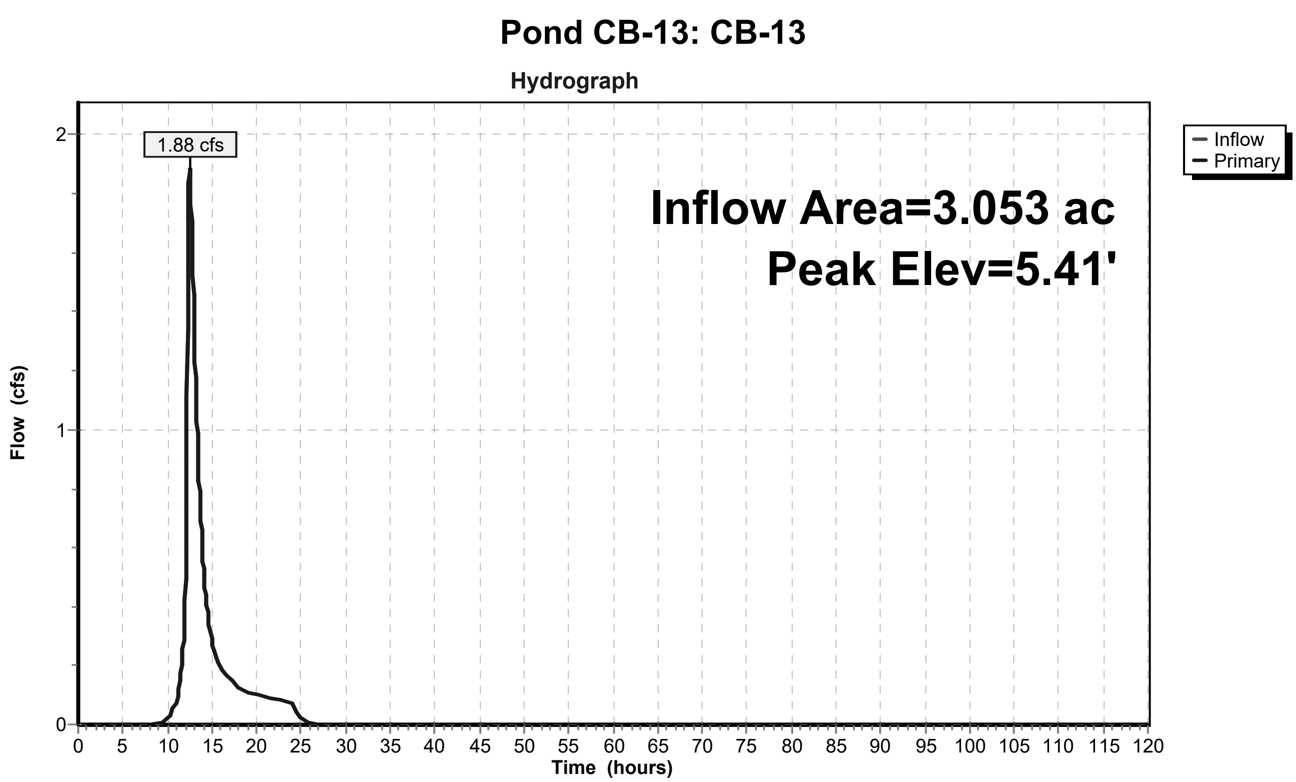
Summary for Pond CB-13: CB-13

Inflow Area = 3.053 ac, 18.61% Impervious, Inflow Depth = 1.35" for 1-YEAR event
Inflow = 1.88 cfs @ 12.48 hrs, Volume= 0.343 af
Outflow = 1.88 cfs @ 12.48 hrs, Volume= 0.343 af, Atten= 0%, Lag= 0.0 min
Primary = 1.88 cfs @ 12.48 hrs, Volume= 0.343 af
Routed to Pond CB-12 : CB-12

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 5.41' @ 12.48 hrs
Flood Elev= 7.93'

Device	Routing	Invert	Outlet Devices
#1	Primary	4.85'	**18.0" Round RCP_Round 18" w/ 9.0" inside fill** L= 40.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 4.10' / 3.13' S= 0.0242 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.88 sf
#2	Primary	7.93'	**4.0' long x 40.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=1.88 cfs @ 12.48 hrs HW=5.41' TW=4.53' (Dynamic Tailwater)
1=RCP_Round 18" (Inlet Controls 1.88 cfs @ 2.49 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)



Summary for Pond CB-14: CB-14

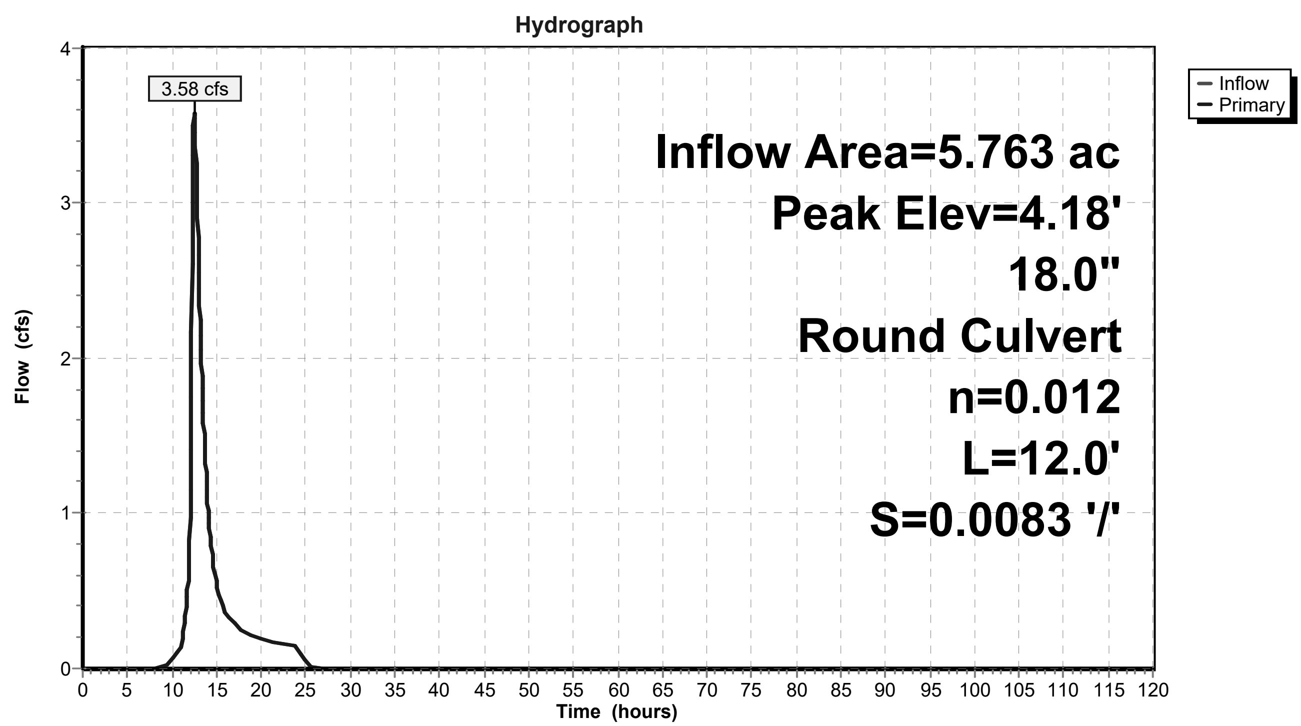
Inflow Area = 5.763 ac, 33.62% Impervious, Inflow Depth = 1.38" for 1-YEAR event
Inflow = 3.58 cfs @ 12.48 hrs, Volume= 0.661 af
Outflow = 3.58 cfs @ 12.48 hrs, Volume= 0.661 af, Atten= 0%, Lag= 0.0 min
Primary = 3.58 cfs @ 12.48 hrs, Volume= 0.661 af
Routed to Pond MH-2 : MANHOLE-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 4.18' @ 12.53 hrs
Flood Elev= 6.16'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.94'	**18.0" Round RCP_Round 18"** L= 12.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2.94' / 2.84' S= 0.0083 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=3.38 cfs @ 12.48 hrs HW=4.17' TW=3.95' (Dynamic Tailwater)
1=RCP_Round 18" (Outlet Controls 3.38 cfs @ 2.96 fps)

Pond CB-14: CB-14



Summary for Pond CB-15: CB-15

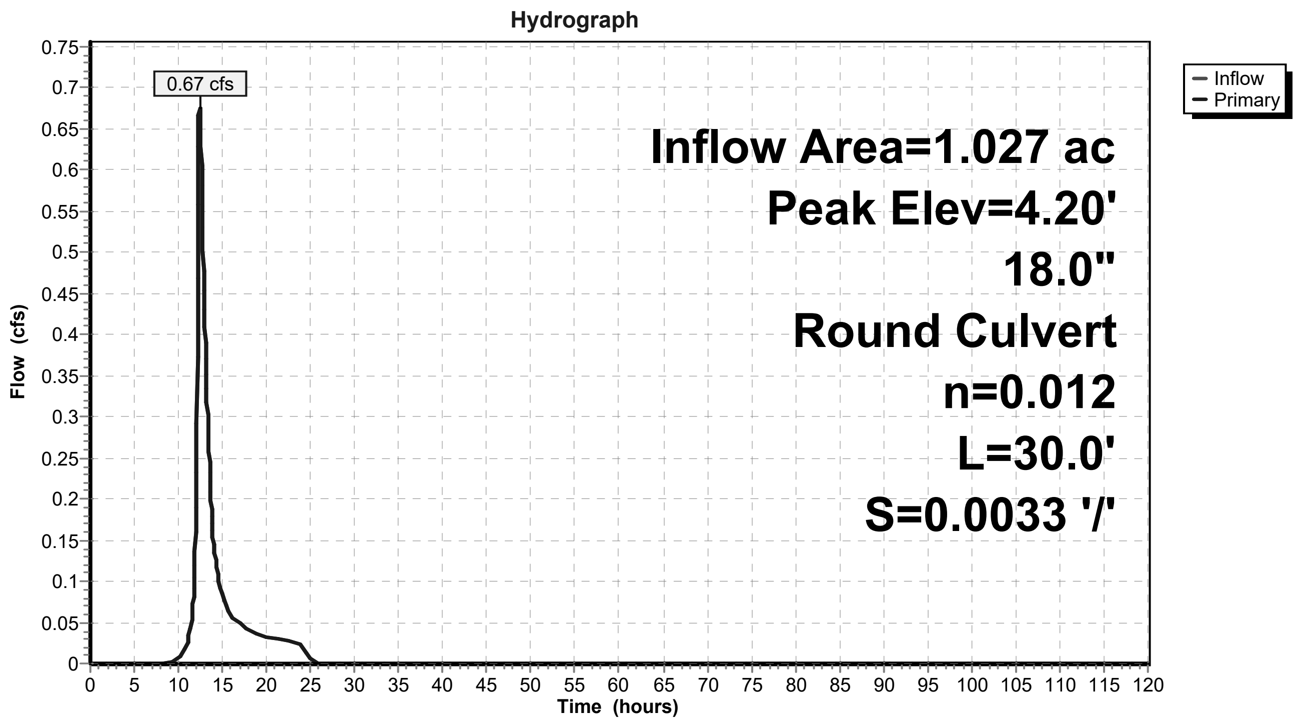
Inflow Area = 1.027 ac, 26.93% Impervious, Inflow Depth = 1.28" for 1-YEAR event
Inflow = 0.67 cfs @ 12.40 hrs, Volume= 0.110 af
Outflow = 0.67 cfs @ 12.40 hrs, Volume= 0.110 af, Atten= 0%, Lag= 0.0 min
Primary = 0.67 cfs @ 12.40 hrs, Volume= 0.110 af
Routed to Pond CB-14 : CB-14

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 4.20' @ 12.55 hrs
Flood Elev= 6.74'

Device	Routing	Invert	Outlet Devices
#1	Primary	3.04'	**18.0" Round RCP_Round 18"** L= 30.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 3.04' / 2.94' S= 0.0033 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=0.46 cfs @ 12.40 hrs HW=4.15' TW=4.14' (Dynamic Tailwater)
1=RCP_Round 18" (Outlet Controls 0.46 cfs @ 0.46 fps)

Pond CB-15: CB-15



Summary for Pond CB-16: CB-16

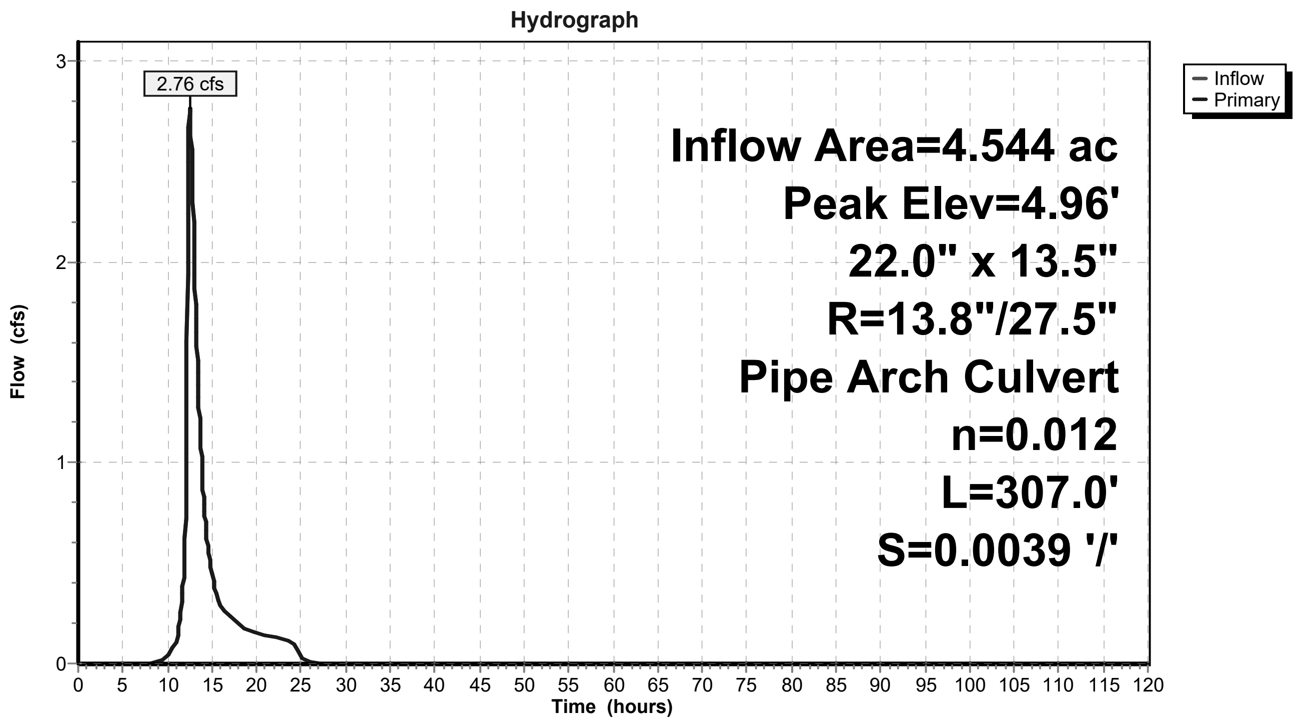
Inflow Area = 4.544 ac, 33.28% Impervious, Inflow Depth = 1.37" for 1-YEAR event
Inflow = 2.76 cfs @ 12.50 hrs, Volume= 0.519 af
Outflow = 2.76 cfs @ 12.50 hrs, Volume= 0.519 af, Atten= 0%, Lag= 0.0 min
Primary = 2.76 cfs @ 12.50 hrs, Volume= 0.519 af
Routed to Pond CB-14 : CB-14

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 4.96' @ 12.51 hrs
Flood Elev= 9.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	4.14'	**22.0" W x 13.5" H, R=13.8"/27.5" Pipe Arch RCP_Arch 22x14** L= 307.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 4.14' / 2.94' S= 0.0039 '/' Cc= 0.900 n= 0.012, Flow Area= 1.65 sf

Primary OutFlow Max=2.78 cfs @ 12.50 hrs HW=4.96' TW=4.18' (Dynamic Tailwater)
1=RCP_Arch 22x14 (Outlet Controls 2.78 cfs @ 2.85 fps)

Pond CB-16: CB-16



Summary for Pond CB-17: CB-17

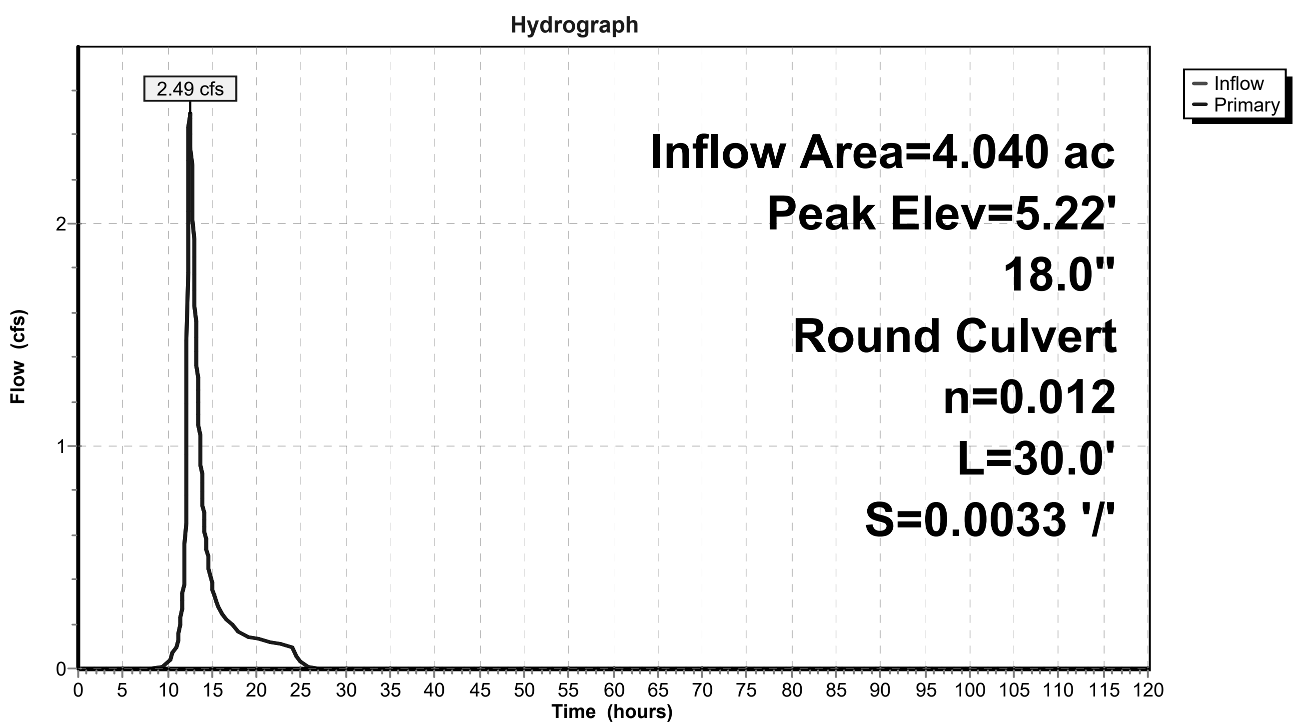
Inflow Area = 4.040 ac, 30.74% Impervious, Inflow Depth = 1.35" for 1-YEAR event
Inflow = 2.49 cfs @ 12.48 hrs, Volume= 0.454 af
Outflow = 2.49 cfs @ 12.48 hrs, Volume= 0.454 af, Atten= 0%, Lag= 0.0 min
Primary = 2.49 cfs @ 12.48 hrs, Volume= 0.454 af
Routed to Pond CB-16 : CB-16

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 5.22' @ 12.50 hrs
Flood Elev= 9.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	4.24'	**18.0" Round RCP_Round 18"** L= 30.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 4.24' / 4.14' S= 0.0033 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=2.46 cfs @ 12.48 hrs HW=5.21' TW=4.96' (Dynamic Tailwater)
└─**1=RCP_Round 18"** (Outlet Controls 2.46 cfs @ 2.88 fps)

Pond CB-17: CB-17



Summary for Pond CB-2: CB-2

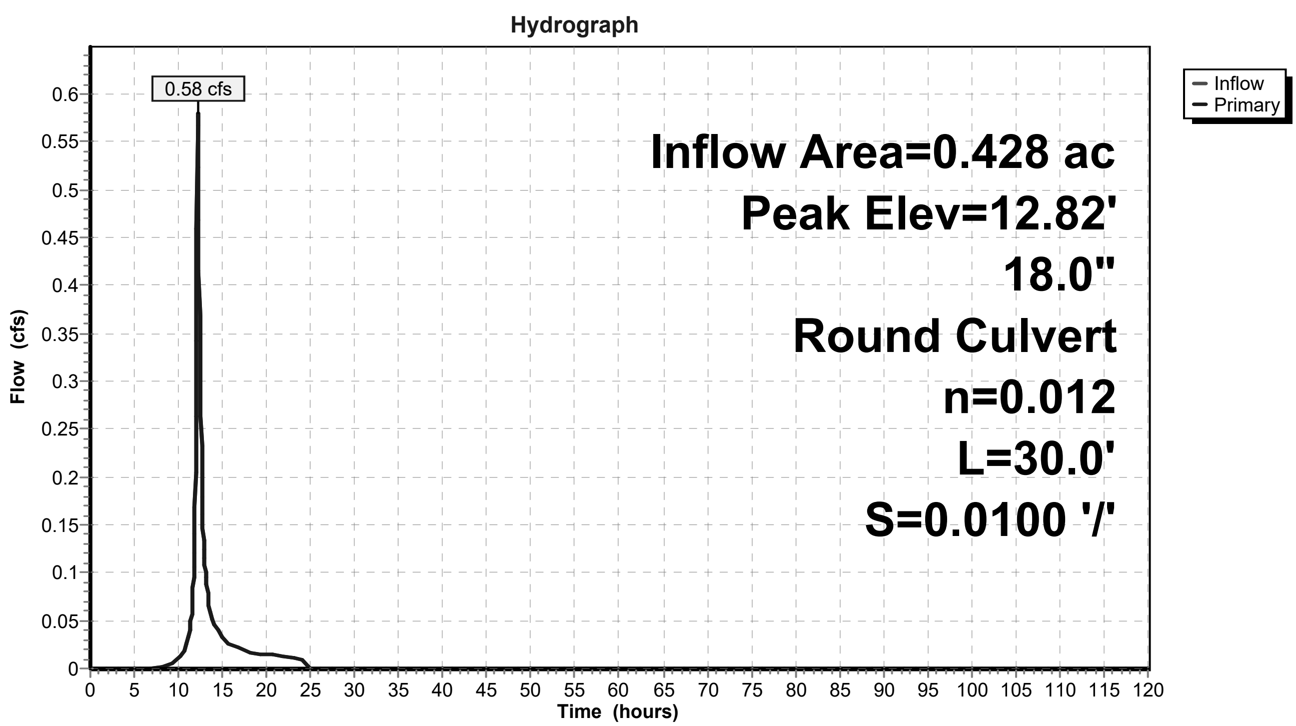
Inflow Area = 0.428 ac, 62.33% Impervious, Inflow Depth = 1.56" for 1-YEAR event
Inflow = 0.58 cfs @ 12.18 hrs, Volume= 0.056 af
Outflow = 0.58 cfs @ 12.18 hrs, Volume= 0.056 af, Atten= 0%, Lag= 0.0 min
Primary = 0.58 cfs @ 12.18 hrs, Volume= 0.056 af
Routed to Pond CB-10 : CB-10

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 12.82' @ 12.18 hrs
Flood Elev= 14.98'

Device	Routing	Invert	Outlet Devices
#1	Primary	12.48'	**18.0" Round RCP_Round 18"** L= 30.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 12.48' / 12.18' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=0.57 cfs @ 12.18 hrs HW=12.82' TW=11.25' (Dynamic Tailwater)
1=RCP_Round 18" (Barrel Controls 0.57 cfs @ 2.87 fps)

Pond CB-2: CB-2



Summary for Pond CB-3: CB-3

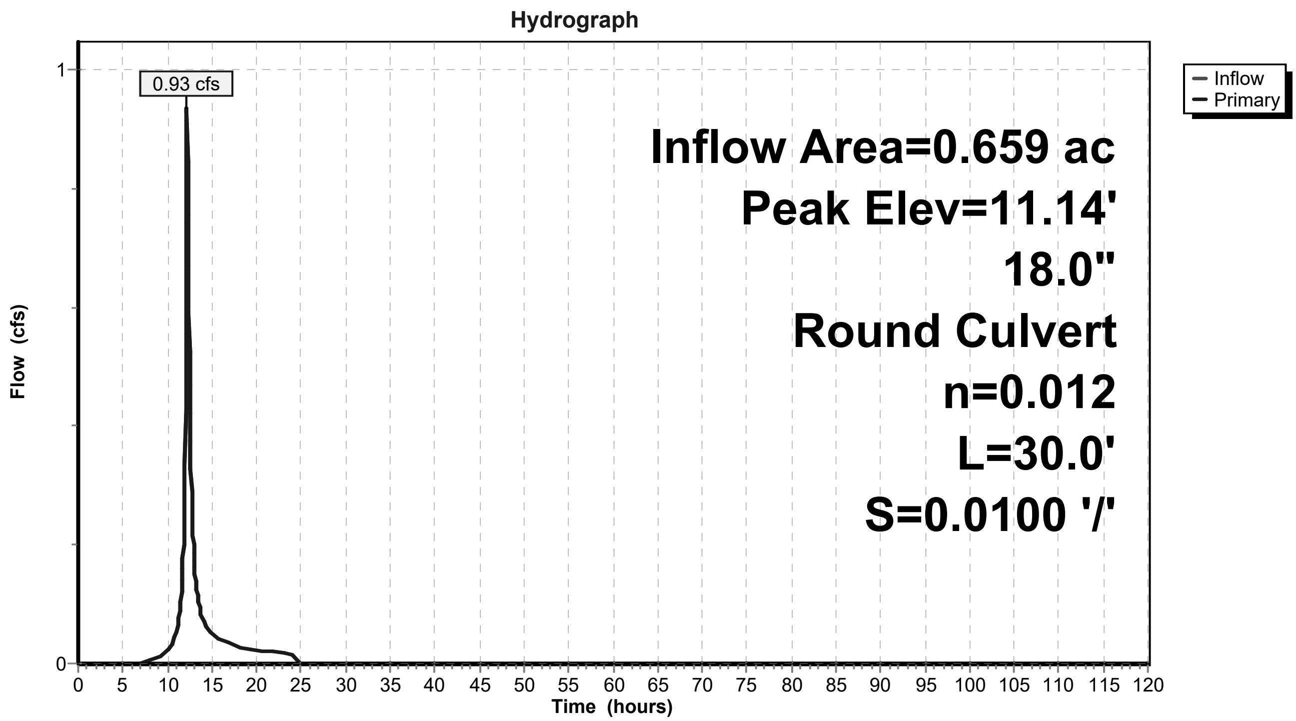
Inflow Area = 0.659 ac, 55.35% Impervious, Inflow Depth = 1.64" for 1-YEAR event
Inflow = 0.93 cfs @ 12.18 hrs, Volume= 0.090 af
Outflow = 0.93 cfs @ 12.18 hrs, Volume= 0.090 af, Atten= 0%, Lag= 0.0 min
Primary = 0.93 cfs @ 12.18 hrs, Volume= 0.090 af
Routed to Pond CB-9 : CB-9

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 11.14' @ 12.18 hrs
Flood Elev= 13.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	10.70'	**18.0" Round RCP_Round 18"** L= 30.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 10.70' / 10.40' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=0.92 cfs @ 12.18 hrs HW=11.14' TW=10.69' (Dynamic Tailwater)
1=RCP_Round 18" (Barrel Controls 0.92 cfs @ 3.19 fps)

Pond CB-3: CB-3



Summary for Pond CB-4: CB-4

Inflow Area = 0.882 ac, 56.67% Impervious, Inflow Depth = 1.56" for 1-YEAR event
Inflow = 1.09 cfs @ 12.21 hrs, Volume= 0.115 af
Outflow = 1.09 cfs @ 12.21 hrs, Volume= 0.115 af, Atten= 0%, Lag= 0.0 min
Primary = 1.09 cfs @ 12.21 hrs, Volume= 0.115 af
Routed to Pond CB-8 : CB-8
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond CB-5 : CB-5

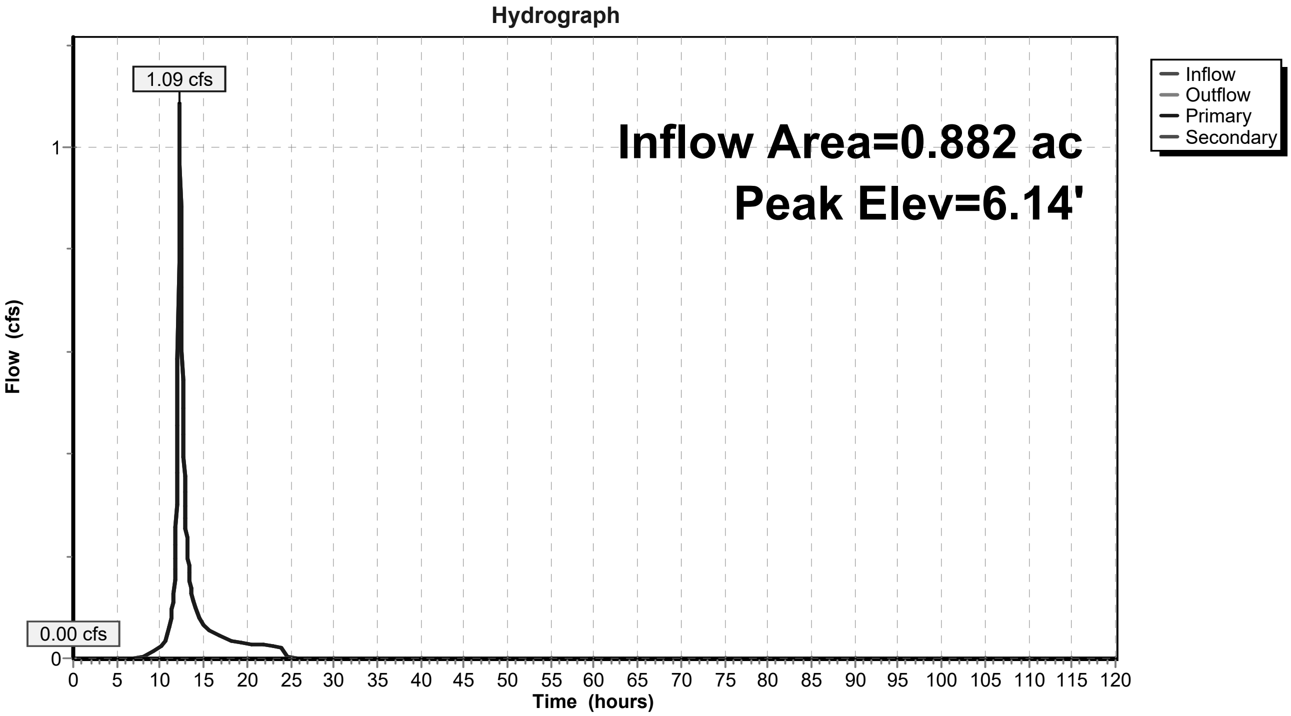
Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 6.14' @ 12.35 hrs
Flood Elev= 10.44'

Device	Routing	Invert	Outlet Devices
#1	Primary	5.16'	**18.0" Round RCP_Round 18"** L= 30.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 5.16' / 4.86' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf
#2	Secondary	10.43'	**5.0' long x 392.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.87 cfs @ 12.21 hrs HW=6.07' TW=6.04' (Dynamic Tailwater)
1=RCP_Round 18" (Outlet Controls 0.87 cfs @ 1.10 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=5.16' TW=2.74' (Dynamic Tailwater)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond CB-4: CB-4



Hydrograph
1.09 cfs
0.00 cfs
Inflow Area=0.882 ac
Peak Elev=6.14'
Inflow
Outflow
Primary
Secondary
Flow (cfs)
Time (hours)
0
1
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120

Summary for Pond CB-5: CB-5

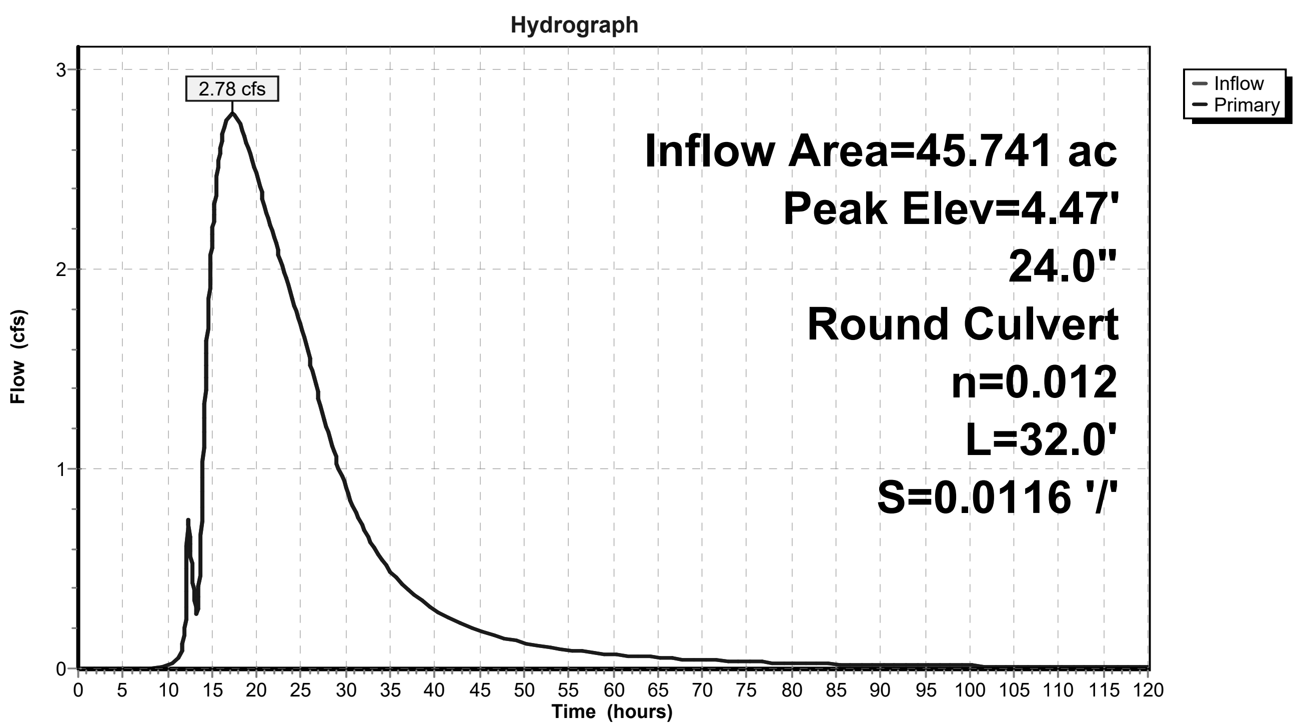
Inflow Area = 45.741 ac, 2.73% Impervious, Inflow Depth > 0.92" for 1-YEAR event
Inflow = 2.78 cfs @ 17.27 hrs, Volume= 3.505 af
Outflow = 2.78 cfs @ 17.27 hrs, Volume= 3.505 af, Atten= 0%, Lag= 0.0 min
Primary = 2.78 cfs @ 17.27 hrs, Volume= 3.505 af
Routed to Pond CB-6 : CB-6

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 4.47' @ 12.49 hrs
Flood Elev= 6.84'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.74'	**24.0" Round RCP_Round 24"** L= 32.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2.74' / 2.37' S= 0.0116 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf

Primary OutFlow Max=2.79 cfs @ 17.27 hrs HW=3.88' TW=3.74' (Dynamic Tailwater)
└**1=RCP_Round 24"** (Outlet Controls 2.79 cfs @ 2.17 fps)

Pond CB-5: CB-5



Summary for Pond CB-6: CB-6

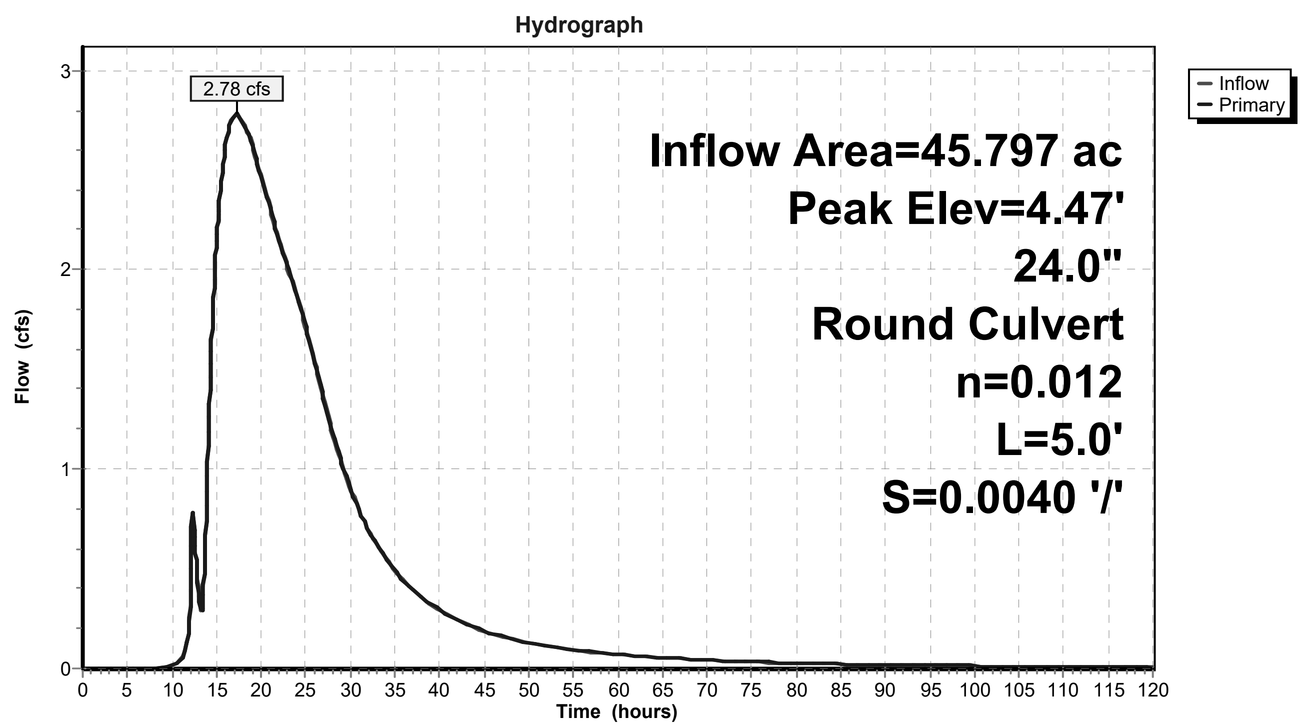
Inflow Area = 45.797 ac, 2.84% Impervious, Inflow Depth > 0.92" for 1-YEAR event
Inflow = 2.78 cfs @ 17.26 hrs, Volume= 3.515 af
Outflow = 2.78 cfs @ 17.25 hrs, Volume= 3.515 af, Atten= 0%, Lag= 0.0 min
Primary = 2.78 cfs @ 17.25 hrs, Volume= 3.515 af
Routed to Pond MH-1 : MANHOLE-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 4.47' @ 12.46 hrs
Flood Elev= 6.88'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.37'	**24.0" Round RCP_Round 24"** L= 5.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2.37' / 2.35' S= 0.0040 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf

Primary OutFlow Max=2.79 cfs @ 17.25 hrs HW=3.75' TW=3.67' (Dynamic Tailwater)
1=RCP_Round 24" (Outlet Controls 2.79 cfs @ 1.71 fps)

Pond CB-6: CB-6



Summary for Pond CB-7: CB-7

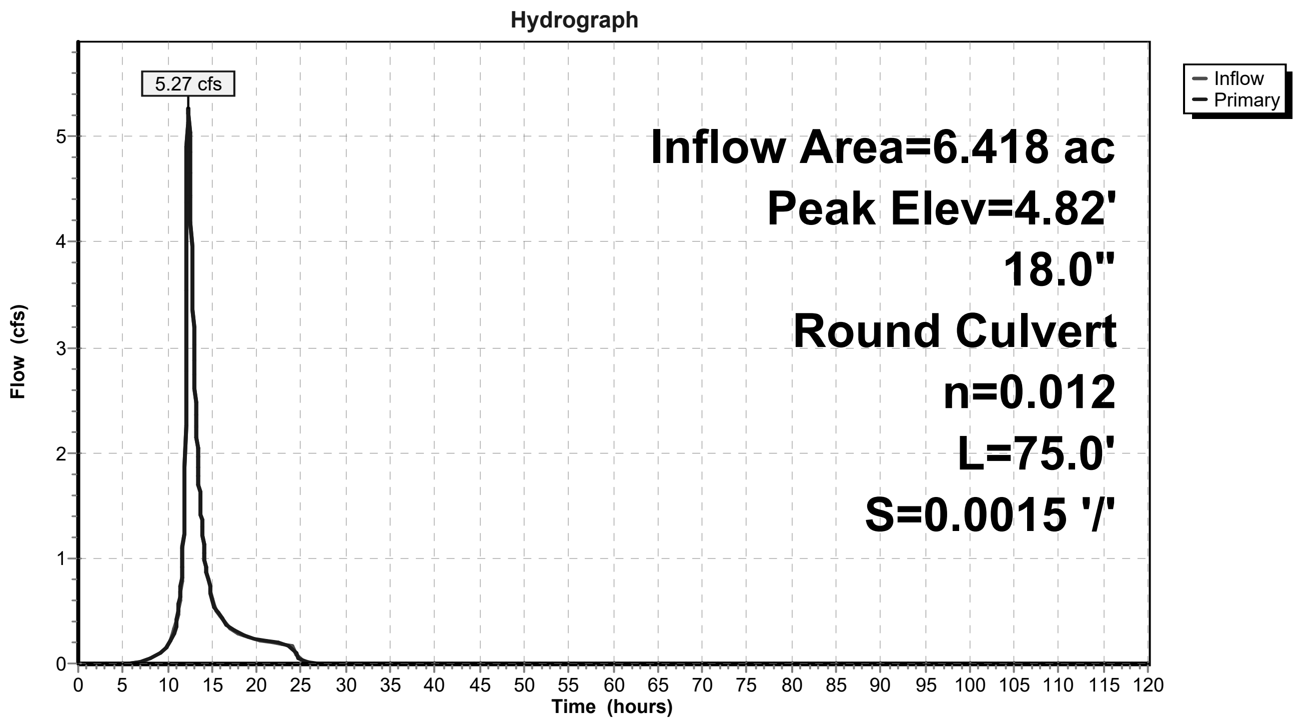
Inflow Area = 6.418 ac, 63.74% Impervious, Inflow Depth = 1.67" for 1-YEAR event
Inflow = 5.27 cfs @ 12.33 hrs, Volume= 0.892 af
Outflow = 5.27 cfs @ 12.33 hrs, Volume= 0.892 af, Atten= 0%, Lag= 0.0 min
Primary = 5.27 cfs @ 12.33 hrs, Volume= 0.892 af
Routed to Pond MH-1 : MANHOLE-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 4.82' @ 12.41 hrs
Flood Elev= 7.62'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.46'	**18.0" Round Round 18"** L= 75.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2.46' / 2.35' S= 0.0015 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=5.13 cfs @ 12.33 hrs HW=4.78' TW=4.42' (Dynamic Tailwater)
└—**1=Round 18"** (Inlet Controls 5.13 cfs @ 2.90 fps)

Pond CB-7: CB-7



Summary for Pond CB-8: CB-8

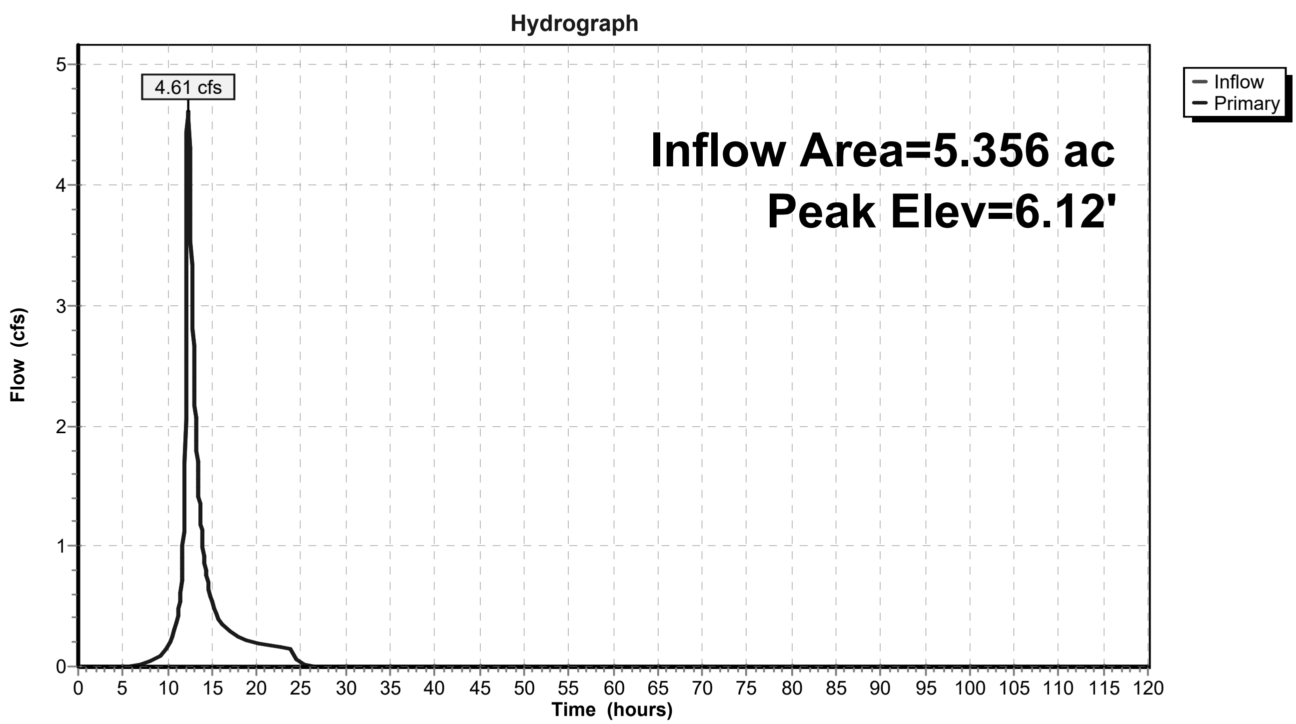
Inflow Area = 5.356 ac, 66.27% Impervious, Inflow Depth = 1.72" for 1-YEAR event
Inflow = 4.61 cfs @ 12.30 hrs, Volume= 0.766 af
Outflow = 4.61 cfs @ 12.30 hrs, Volume= 0.766 af, Atten= 0%, Lag= 0.0 min
Primary = 4.61 cfs @ 12.30 hrs, Volume= 0.766 af
Routed to Pond CB-7 : CB-7

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 6.12' @ 12.36 hrs
Flood Elev= 9.98'

Device	Routing	Invert	Outlet Devices
#1	Primary	4.86'	**18.0" Round RCP_Round 18"** L= 320.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 4.86' / 2.46' S= 0.0075 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf
#2	Primary	9.97'	**4.0' long x 322.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=4.53 cfs @ 12.30 hrs HW=6.11' TW=4.74' (Dynamic Tailwater)
1=RCP_Round 18" (Outlet Controls 4.53 cfs @ 3.92 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond CB-8: CB-8



Summary for Pond CB-9: CB-9

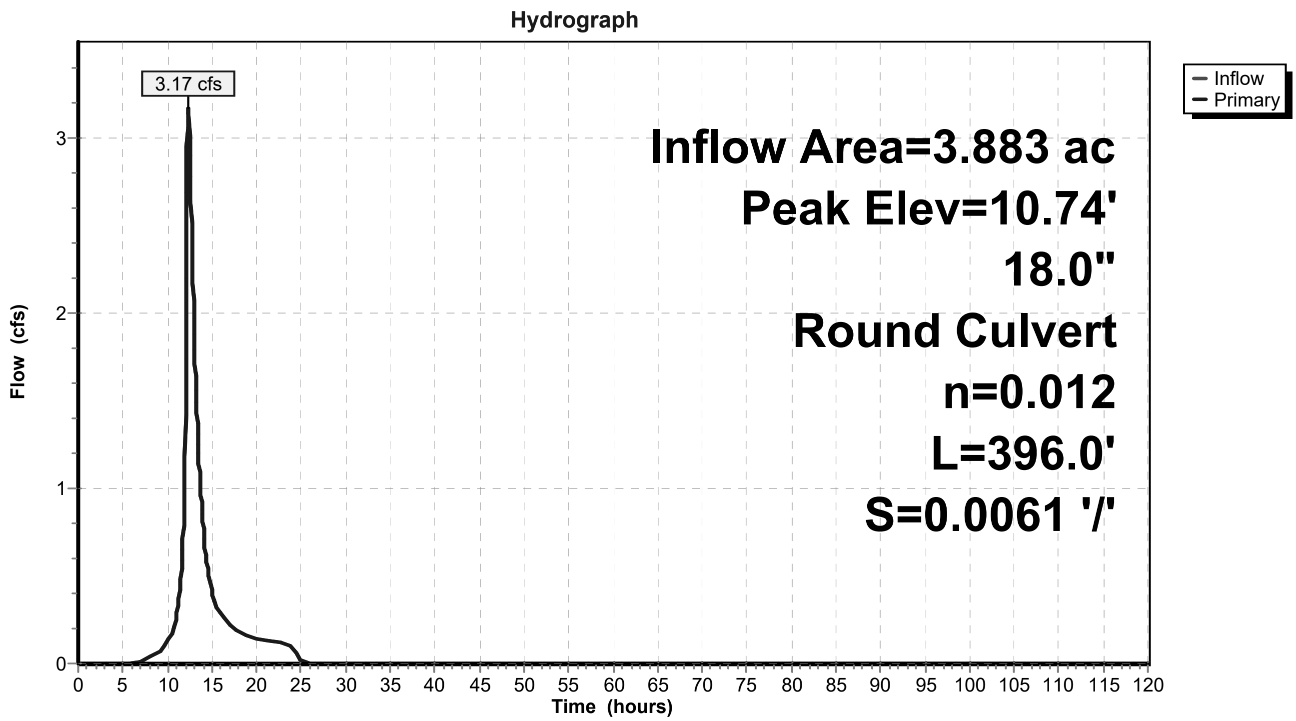
Inflow Area = 3.883 ac, 69.52% Impervious, Inflow Depth = 1.77" for 1-YEAR event
Inflow = 3.17 cfs @ 12.36 hrs, Volume= 0.574 af
Outflow = 3.17 cfs @ 12.36 hrs, Volume= 0.574 af, Atten= 0%, Lag= 0.0 min
Primary = 3.17 cfs @ 12.36 hrs, Volume= 0.574 af
Routed to Pond CB-8 : CB-8

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 10.74' @ 12.36 hrs
Flood Elev= 12.42'

Device	Routing	Invert	Outlet Devices
#1	Primary	9.89'	**18.0" Round RCP_Round 18"** L= 396.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.89' / 7.47' S= 0.0061 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=3.17 cfs @ 12.36 hrs HW=10.74' TW=6.12' (Dynamic Tailwater)
└─**1=RCP_Round 18"** (Barrel Controls 3.17 cfs @ 4.43 fps)

Pond CB-9: CB-9



Summary for Pond MH-1: MANHOLE-1

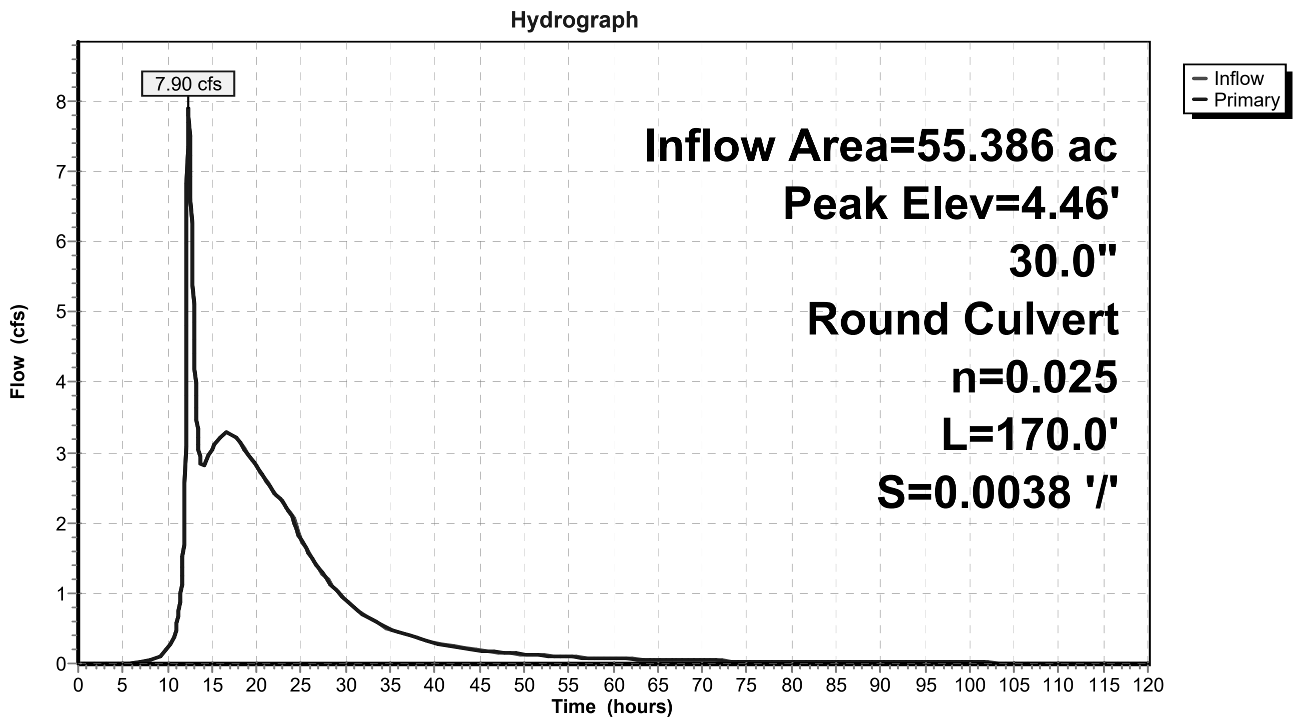
Inflow Area = 55.386 ac, 10.83% Impervious, Inflow Depth > 1.03" for 1-YEAR event
Inflow = 7.90 cfs @ 12.37 hrs, Volume= 4.761 af
Outflow = 7.90 cfs @ 12.37 hrs, Volume= 4.761 af, Atten= 0%, Lag= 0.0 min
Primary = 7.90 cfs @ 12.37 hrs, Volume= 4.761 af
Routed to Pond MH-2 : MANHOLE-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 4.46' @ 12.44 hrs
Flood Elev= 6.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.35'	**30.0" Round CMP_Round 30"** L= 170.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2.35' / 1.70' S= 0.0038 '/' Cc= 0.900 n= 0.025, Flow Area= 4.91 sf

Primary OutFlow Max=7.66 cfs @ 12.37 hrs HW=4.45' TW=3.89' (Dynamic Tailwater)
↑—**1=CMP_Round 30"** (Outlet Controls 7.66 cfs @ 2.36 fps)

Pond MH-1: MANHOLE-1



Summary for Pond MH-2: MANHOLE-2

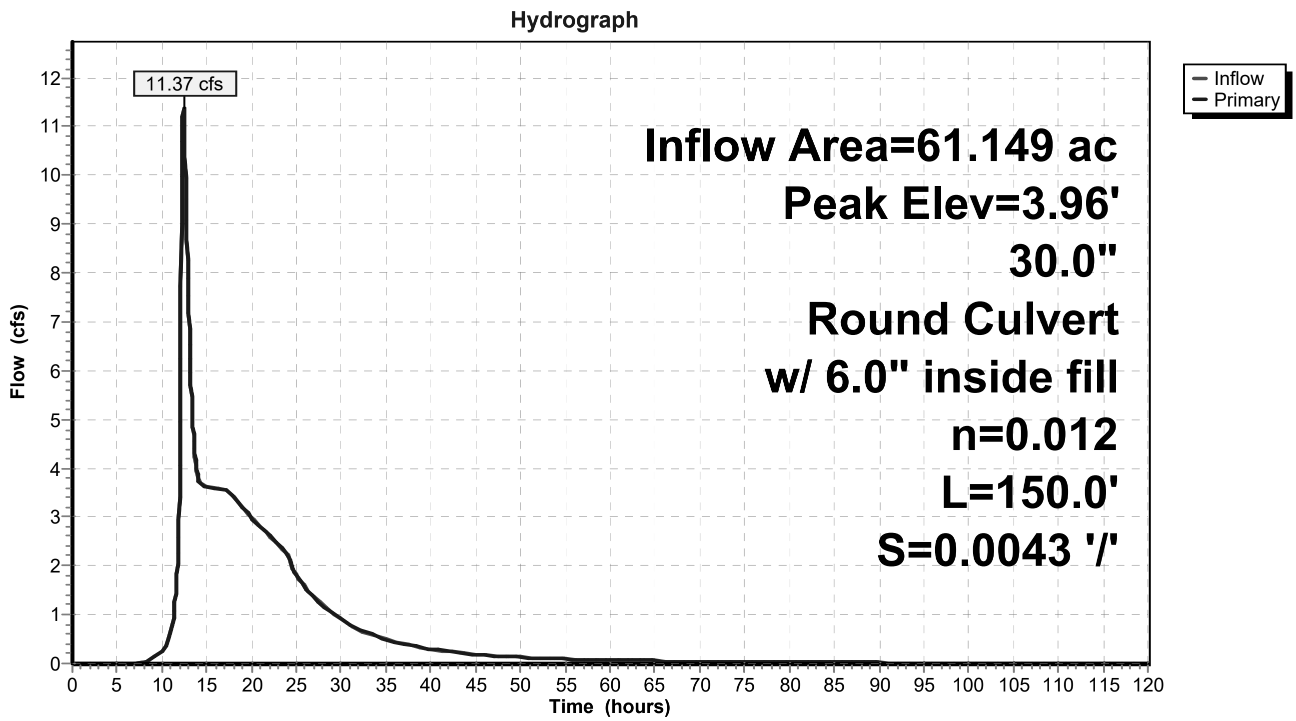
Inflow Area = 61.149 ac, 12.98% Impervious, Inflow Depth > 1.06" for 1-YEAR event
Inflow = 11.37 cfs @ 12.41 hrs, Volume= 5.421 af
Outflow = 11.37 cfs @ 12.41 hrs, Volume= 5.421 af, Atten= 0%, Lag= 0.0 min
Primary = 11.37 cfs @ 12.41 hrs, Volume= 5.421 af
Routed to Pond 40P : C-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 3.96' @ 12.57 hrs
Flood Elev= 6.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.20'	**30.0" Round Culvert w/ 6.0" inside fill** L= 150.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1.70' / 1.06' S= 0.0043 '/' Cc= 0.900 n= 0.012, Flow Area= 4.21 sf

Primary OutFlow Max=11.35 cfs @ 12.41 hrs HW=3.92' TW=3.36' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 11.35 cfs @ 3.71 fps)

Pond MH-2: MANHOLE-2



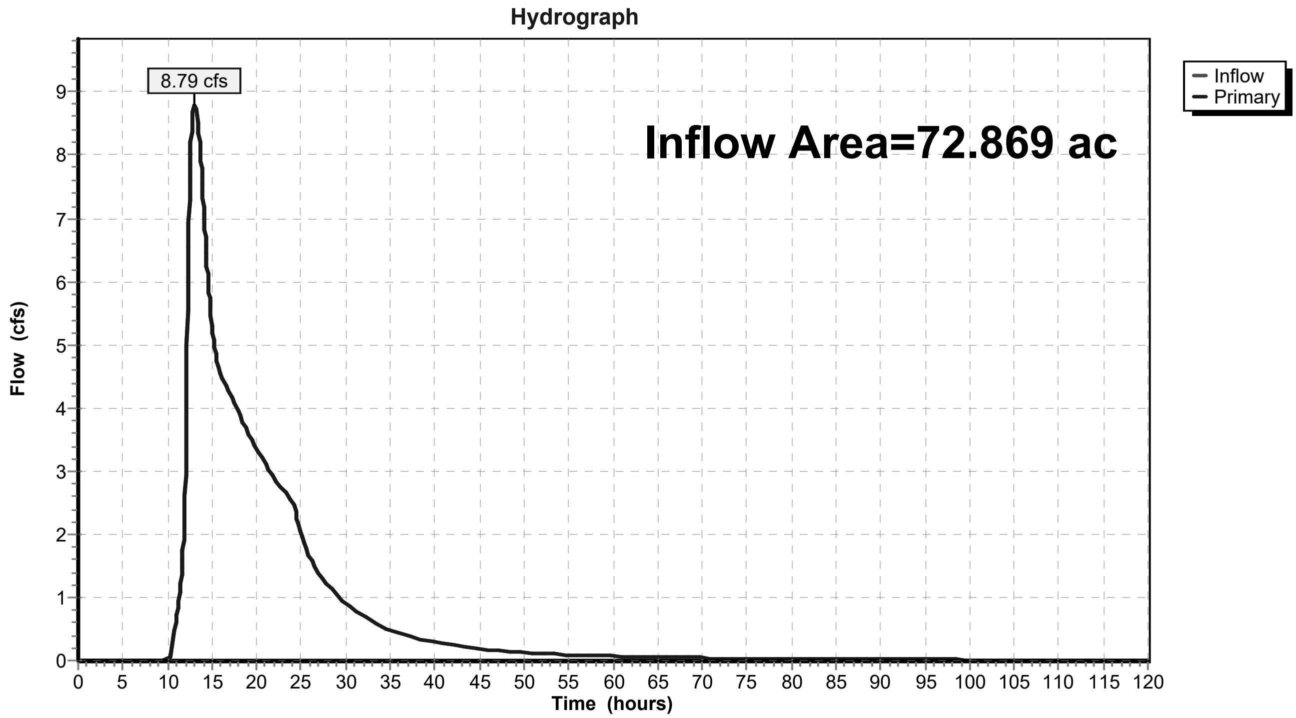
Summary for Link 43L: MHHW

Inflow Area = 72.869 ac, 12.41% Impervious, Inflow Depth > 1.00" for 1-YEAR event
Inflow = 8.79 cfs @ 13.07 hrs, Volume= 6.100 af
Primary = 8.79 cfs @ 13.07 hrs, Volume= 6.100 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs

Fixed water surface Elevation= 2.89'

Link 43L: MHHW



Time span=0.00-120.00 hrs, dt=0.05 hrs, 2401 points x 2
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: CB-1 Runoff Area=60,375 sf 76.98% Impervious Runoff Depth=4.28"
Flow Length=714' Tc=30.6 min CN=92 Runoff=2.65 cfs 0.495 af

Subcatchment2S: CB-11 Runoff Area=32,762 sf 66.90% Impervious Runoff Depth=4.07"
Flow Length=374' Tc=40.3 min CN=90 Runoff=1.17 cfs 0.255 af

Subcatchment3S: CB-2 Runoff Area=18,624 sf 62.33% Impervious Runoff Depth=3.86"
Flow Length=82' Tc=8.9 min CN=88 Runoff=1.40 cfs 0.138 af

Subcatchment4S: CB-10 Runoff Area=11,778 sf 68.53% Impervious Runoff Depth=4.07"
Flow Length=200' Tc=34.9 min CN=90 Runoff=0.46 cfs 0.092 af

Subcatchment5S: CB-3 Runoff Area=28,691 sf 55.35% Impervious Runoff Depth=3.96"
Flow Length=339' Tc=9.0 min CN=89 Runoff=2.20 cfs 0.218 af

Subcatchment6S: CB-9 Runoff Area=16,934 sf 80.61% Impervious Runoff Depth=4.39"
Flow Length=347' Tc=22.0 min CN=93 Runoff=0.91 cfs 0.142 af

Subcatchment7S: CB-4 Runoff Area=38,400 sf 56.67% Impervious Runoff Depth=3.86"
Flow Length=125' Tc=11.2 min CN=88 Runoff=2.63 cfs 0.284 af

Subcatchment8S: CB-8 Runoff Area=25,733 sf 59.19% Impervious Runoff Depth=3.86"
Flow Length=273' Tc=21.5 min CN=88 Runoff=1.26 cfs 0.190 af

Subcatchment9S: CB-5 Runoff Area=39,037 sf 49.18% Impervious Runoff Depth=3.65"
Flow Length=429' Tc=19.5 min CN=86 Runoff=1.93 cfs 0.273 af

Subcatchment10S: CB-7 Runoff Area=46,251 sf 51.01% Impervious Runoff Depth=3.65"
Flow Length=465' Tc=27.4 min CN=86 Runoff=1.89 cfs 0.323 af

Subcatchment11S: CB-6 Runoff Area=2,434 sf 88.34% Impervious Runoff Depth=4.62"
Flow Length=10' Slope=0.0020 '/' Tc=5.6 min CN=95 Runoff=0.25 cfs 0.022 af

Subcatchment12S: CB-13 Runoff Area=132,969 sf 18.61% Impervious Runoff Depth=3.55"
Flow Length=709' Tc=29.7 min CN=85 Runoff=5.03 cfs 0.904 af

Subcatchment13S: CB-12 Runoff Area=5,191 sf 33.31% Impervious Runoff Depth=3.26"
Flow Length=71' Slope=0.0127 '/' Tc=12.8 min CN=82 Runoff=0.28 cfs 0.032 af

Subcatchment14S: CB-14 Runoff Area=8,326 sf 77.79% Impervious Runoff Depth=4.39"
Flow Length=120' Slope=0.0034 '/' Tc=33.0 min CN=93 Runoff=0.35 cfs 0.070 af

Subcatchment15S: CB-15 Runoff Area=44,745 sf 26.93% Impervious Runoff Depth=3.45"
Flow Length=478' Tc=24.3 min CN=84 Runoff=1.85 cfs 0.296 af

Subcatchment16S: CB-16 Runoff Area=21,986 sf 53.58% Impervious Runoff Depth=3.86"
Flow Length=139' Tc=42.6 min CN=88 Runoff=0.73 cfs 0.162 af

Subcatchment17S: CB-17 Runoff Area=175,968 sf 30.74% Impervious Runoff Depth=3.55"
Flow Length=574' Tc=29.7 min CN=85 Runoff=6.66 cfs 1.196 af

Subcatchment18S: D-8 Runoff Area=510,532 sf 9.48% Impervious Runoff Depth=2.52"
Flow Length=624' Tc=66.3 min CN=74 Runoff=8.07 cfs 2.466 af

Subcatchment19S: LOW POINT BEHIND Runoff Area=726,316 sf 8.66% Impervious Runoff Depth=3.26"
Flow Length=992' Tc=44.2 min CN=82 Runoff=19.82 cfs 4.528 af

Subcatchment44S: W-1 Runoff Area=80,729 sf 0.00% Impervious Runoff Depth=2.79"
Flow Length=473' Tc=35.1 min CN=77 Runoff=2.16 cfs 0.431 af

Subcatchment45S: W-2 Runoff Area=1,571,690 sf 0.83% Impervious Runoff Depth=3.16"
Flow Length=1,444' Tc=71.4 min CN=81 Runoff=30.38 cfs 9.509 af

Subcatchment46S: w-3 Runoff Area=301,007 sf 7.39% Impervious Runoff Depth=3.16"
Flow Length=607' Tc=44.8 min CN=81 Runoff=7.90 cfs 1.821 af

Reach 48R: (new Reach) Avg. Flow Depth=2.36' Max Vel=2.03 fps Inflow=11.76 cfs 10.930 af
n=0.050 L=304.0' S=0.0058 '/' Capacity=13.73 cfs Outflow=11.76 cfs 10.930 af

Pond 40P: C-1 Peak Elev=4.30' Storage=41,959 cf Inflow=31.63 cfs 18.457 af
Outflow=29.98 cfs 18.423 af

Pond 44P: Culvert @ ditch Peak Elev=7.51' Inflow=11.76 cfs 10.930 af
Primary=11.65 cfs 10.912 af Secondary=0.23 cfs 0.017 af Outflow=11.79 cfs 10.930 af

Pond 46P: Farm Pond Peak Elev=8.36' Storage=18,735 cf Inflow=2.16 cfs 0.431 af
Outflow=0.64 cfs 0.127 af

Pond 47P: W-2 Peak Elev=9.14' Storage=125,927 cf Inflow=30.38 cfs 9.636 af
Outflow=14.37 cfs 9.636 af

Pond 48P: w-3 Peak Elev=9.11' Storage=134,974 cf Inflow=20.56 cfs 11.458 af
Outflow=11.76 cfs 10.930 af

Pond CB-1: CB-1 Peak Elev=14.03' Inflow=2.65 cfs 0.495 af
18.0" Round Culvert n=0.012 L=34.0' S=0.0100 '/' Outflow=2.65 cfs 0.495 af

Pond CB-10: CB-10 Peak Elev=13.40' Inflow=4.95 cfs 0.979 af
18.0" Round Culvert n=0.012 L=403.0' S=0.0011 '/' Outflow=4.95 cfs 0.979 af

Pond CB-11: CB-11 Peak Elev=13.94' Inflow=3.76 cfs 0.750 af
18.0" Round Culvert n=0.012 L=400.0' S=0.0013 '/' Outflow=3.76 cfs 0.750 af

Pond CB-12: CB-12 Peak Elev=7.67' Inflow=5.24 cfs 0.936 af
Primary=4.56 cfs 0.907 af Secondary=1.41 cfs 0.029 af Outflow=5.24 cfs 0.936 af

Pond CB-13: CB-13 Peak Elev=8.23' Inflow=5.03 cfs 0.904 af
Outflow=5.03 cfs 0.904 af

Pond CB-14: CB-14 Peak Elev=7.19' Inflow=9.47 cfs 1.724 af
18.0" Round Culvert n=0.012 L=12.0' S=0.0083 '/' Outflow=9.47 cfs 1.724 af

Pond CB-15: CB-15 Peak Elev=7.28' Inflow=1.85 cfs 0.296 af
18.0" Round Culvert n=0.012 L=30.0' S=0.0033 '/' Outflow=1.85 cfs 0.296 af

Pond CB-16: CB-16 Peak Elev=9.33' Inflow=7.33 cfs 1.359 af
22.0" x 13.5", R=13.8"/27.5" Pipe Arch Culvert n=0.012 L=307.0' S=0.0039 '/' Outflow=7.33 cfs 1.359 af

Pond CB-17: CB-17 Peak Elev=9.85' Inflow=6.66 cfs 1.196 af
18.0" Round Culvert n=0.012 L=30.0' S=0.0033 '/' Outflow=6.66 cfs 1.196 af

Pond CB-2: CB-2 Peak Elev=13.46' Inflow=1.40 cfs 0.138 af
18.0" Round Culvert n=0.012 L=30.0' S=0.0100 '/' Outflow=1.40 cfs 0.138 af

Pond CB-3: CB-3 Peak Elev=12.51' Inflow=2.20 cfs 0.218 af
18.0" Round Culvert n=0.012 L=30.0' S=0.0100 '/' Outflow=2.20 cfs 0.218 af

Pond CB-4: CB-4 Peak Elev=10.53' Inflow=2.63 cfs 0.284 af
Primary=2.63 cfs 0.278 af Secondary=0.43 cfs 0.005 af Outflow=2.63 cfs 0.284 af

Pond CB-5: CB-5 Peak Elev=7.49' Inflow=11.90 cfs 11.208 af
24.0" Round Culvert n=0.012 L=32.0' S=0.0116 '/' Outflow=11.90 cfs 11.208 af

Pond CB-6: CB-6 Peak Elev=7.49' Inflow=11.91 cfs 11.229 af
24.0" Round Culvert n=0.012 L=5.0' S=0.0040 '/' Outflow=11.93 cfs 11.229 af

Pond CB-7: CB-7 Peak Elev=9.40' Inflow=12.35 cfs 2.131 af
18.0" Round Culvert n=0.012 L=75.0' S=0.0015 '/' Outflow=12.35 cfs 2.131 af

Pond CB-8: CB-8 Peak Elev=10.50' Inflow=10.81 cfs 1.807 af
Outflow=10.81 cfs 1.807 af

Pond CB-9: CB-9 Peak Elev=12.49' Inflow=7.25 cfs 1.339 af
18.0" Round Culvert n=0.012 L=396.0' S=0.0061 '/' Outflow=7.25 cfs 1.339 af

Pond MH-1: MANHOLE-1 Peak Elev=7.45' Inflow=18.75 cfs 14.267 af
30.0" Round Culvert n=0.025 L=170.0' S=0.0038 '/' Outflow=18.75 cfs 14.267 af

Pond MH-2: MANHOLE-2 Peak Elev=6.01' Inflow=27.44 cfs 15.991 af
30.0" Round Culvert w/ 6.0" inside fill n=0.012 L=150.0' S=0.0043 '/' Outflow=27.44 cfs 15.991 af

Link 43L: MHHW Inflow=29.98 cfs 18.423 af
Primary=29.98 cfs 18.423 af

Total Runoff Area = 89.543 ac Runoff Volume = 23.846 af Average Runoff Depth = 3.20"
88.29% Pervious = 79.053 ac 11.71% Impervious = 10.490 ac

Summary for Subcatchment 1S: CB-1

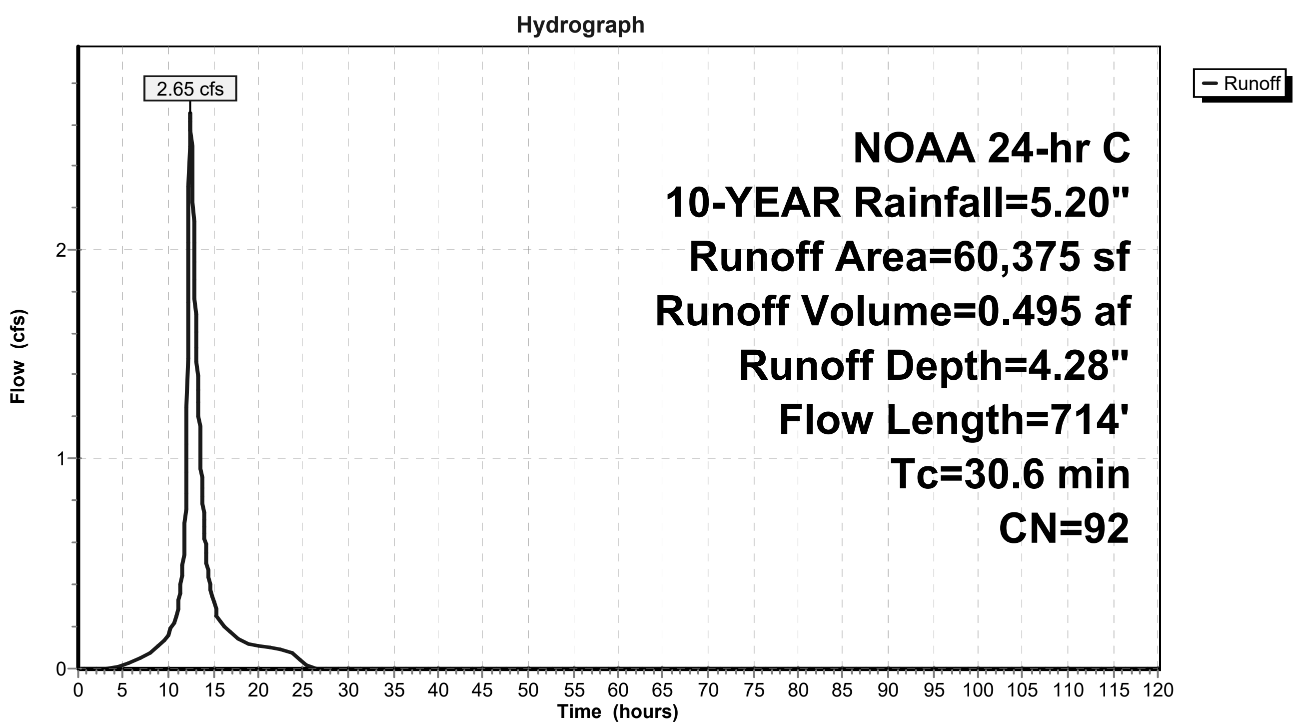
Runoff = 2.65 cfs @ 12.45 hrs, Volume= 0.495 af, Depth= 4.28"
Routed to Pond CB-1 : CB-1

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-YEAR Rainfall=5.20"

Area (sf)	CN	Description
46,198	98	Paved roads w/curbs & sewers, HSG C
13,058	74	>75% Grass cover, Good, HSG C
1,119	80	1/2 acre lots, 25% imp, HSG C
60,375	92	Weighted Average
13,897		23.02% Pervious Area
46,478		76.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.4	70	0.0050	0.06		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
12.2	644	0.0015	0.88	0.88	**Parabolic Channel, D-1** W=3.00' D=0.50' Area=1.0 sf Perim=3.2' n= 0.030 Earth, dense weeds
30.6	714	Total			

Subcatchment 1S: CB-1



Summary for Subcatchment 2S: CB-11

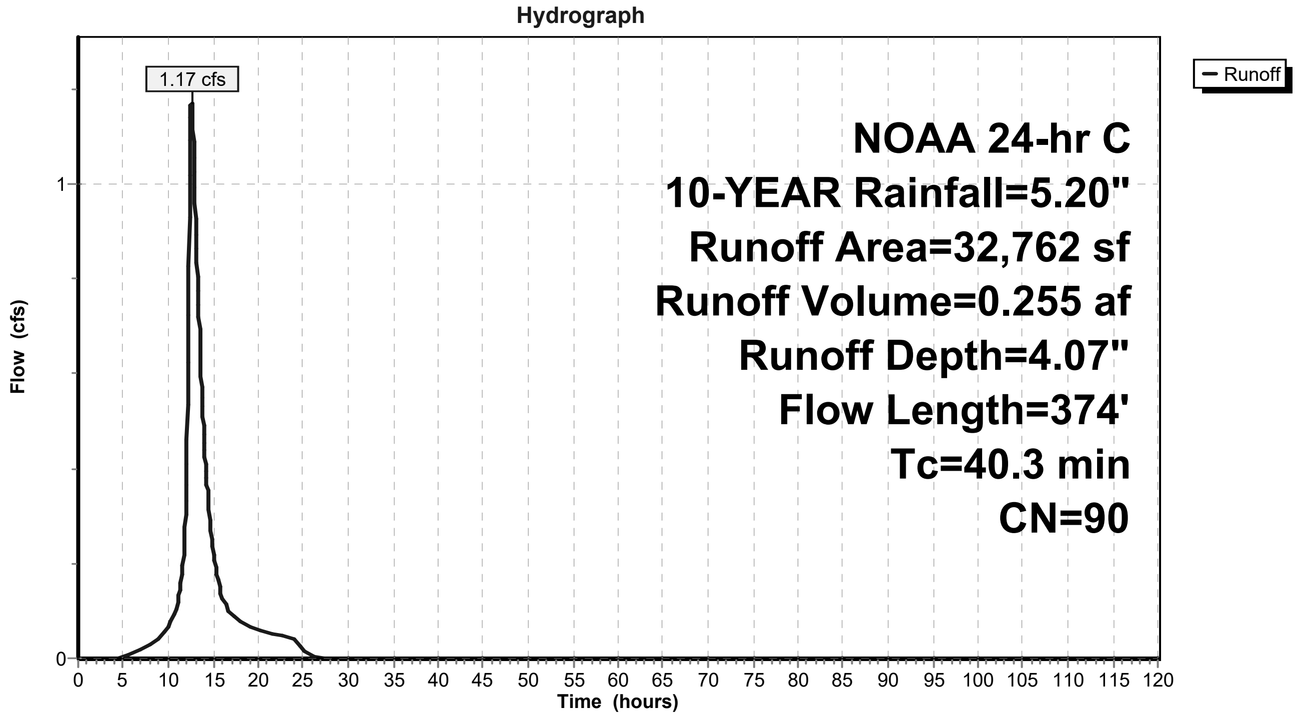
Runoff = 1.17 cfs @ 12.58 hrs, Volume= 0.255 af, Depth= 4.07"
Routed to Pond CB-11 : CB-11

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-YEAR Rainfall=5.20"

Area (sf)	CN	Description
18,046	98	Paved roads w/curbs & sewers, HSG C
3,852	81	1/3 acre lots, 30% imp, HSG C
10,864	80	1/2 acre lots, 25% imp, HSG C
32,762	90	Weighted Average
10,844		33.10% Pervious Area
21,918		66.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.8	150	0.0050	0.07		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.30"
0.6	40	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
5.9	184	0.0051	0.52	0.21	**Parabolic Channel, D-2** W=1.20' D=0.50' Area=0.4 sf Perim=1.6' n= 0.080 Earth, long dense weeds
40.3	374	Total			

Subcatchment 2S: CB-11



Summary for Subcatchment 3S: CB-2

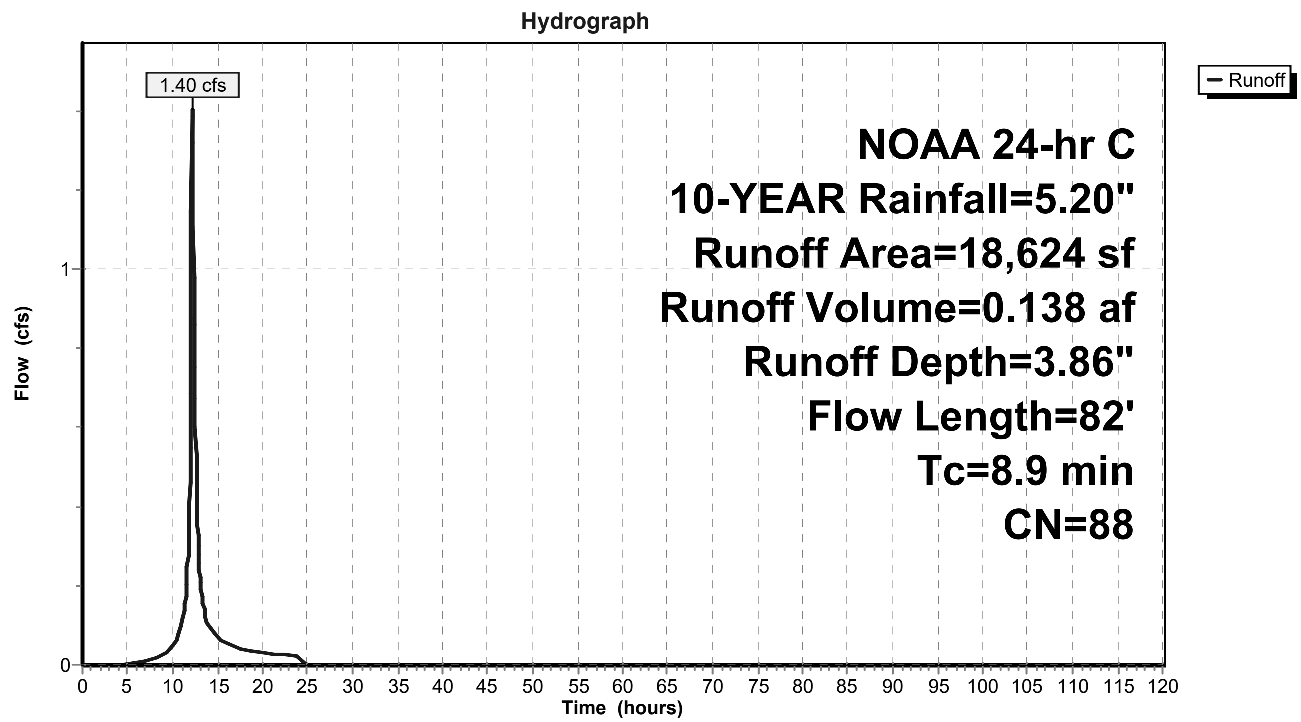
Runoff = 1.40 cfs @ 12.18 hrs, Volume= 0.138 af, Depth= 3.86"
Routed to Pond CB-2 : CB-2

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-YEAR Rainfall=5.20"

Area (sf)	CN	Description
11,190	98	Paved roads w/curbs & sewers, HSG C
5,757	72	Woods/grass comb., Good, HSG C
1,677	80	1/2 acre lots, 25% imp, HSG C
18,624	88	Weighted Average
7,015		37.67% Pervious Area
11,609		62.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0200	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
0.8	32	0.0010	0.64		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
8.9	82	Total			

Subcatchment 3S: CB-2



Summary for Subcatchment 4S: CB-10

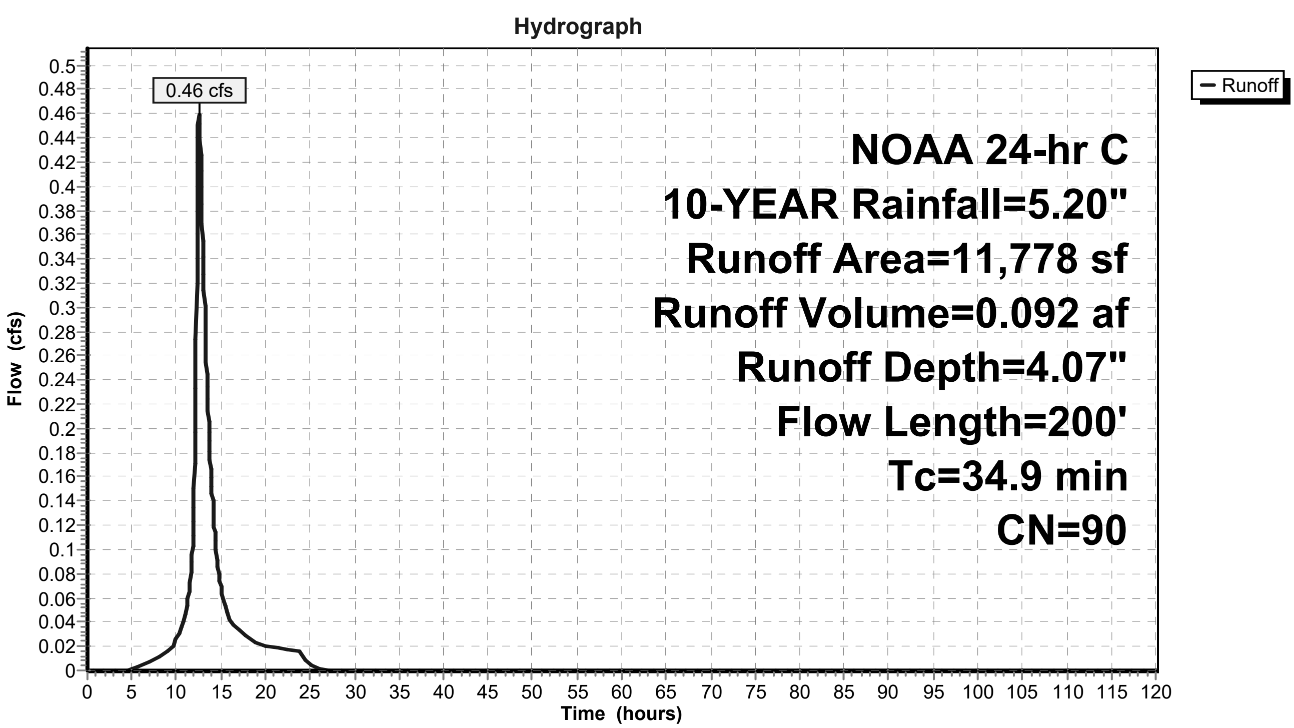
Runoff = 0.46 cfs @ 12.51 hrs, Volume= 0.092 af, Depth= 4.07"
Routed to Pond CB-10 : CB-10

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-YEAR Rainfall=5.20"

Area (sf)	CN	Description
5,998	98	Paved roads w/curbs & sewers, HSG C
4,835	83	1/4 acre lots, 38% imp, HSG C
945	80	1/2 acre lots, 25% imp, HSG C
11,778	90	Weighted Average
3,706		31.47% Pervious Area
8,072		68.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.0	43	0.0012	0.03		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
12.9	157	0.0001	0.20		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
34.9	200	Total			

Subcatchment 4S: CB-10



Summary for Subcatchment 5S: CB-3

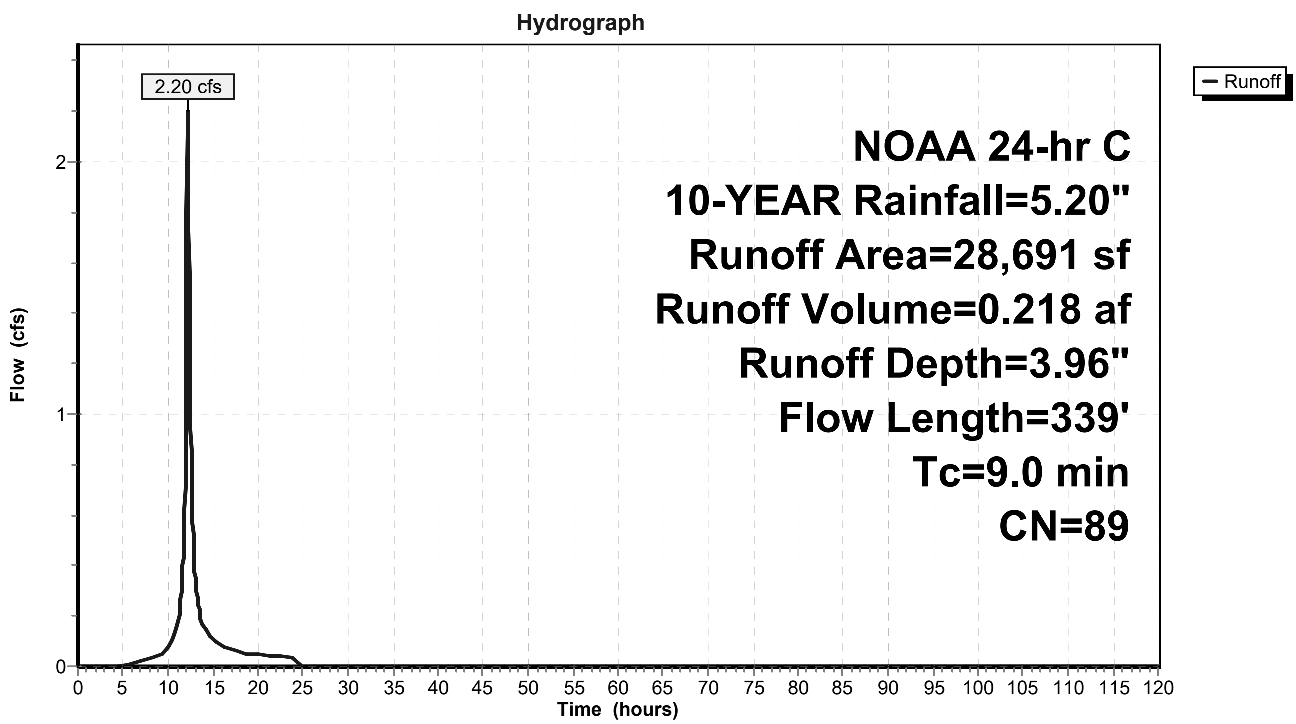
Runoff = 2.20 cfs @ 12.18 hrs, Volume= 0.218 af, Depth= 3.96"
Routed to Pond CB-3 : CB-3

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-YEAR Rainfall=5.20"

Area (sf)	CN	Description
12,824	98	Paved roads w/curbs & sewers, HSG C
6,927	82	Row crops, SR + CR, Good, HSG C
6,318	83	1/4 acre lots, 38% imp, HSG C
2,622	80	1/2 acre lots, 25% imp, HSG C
28,691	89	Weighted Average
12,811		44.65% Pervious Area
15,880		55.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	26	0.0200	0.12		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
5.4	313	0.0050	0.96	0.16	**Parabolic Channel,** W=0.50' D=0.50' Area=0.2 sf Perim=1.2' n= 0.030 Earth, grassed & winding
9.0	339	Total			

Subcatchment 5S: CB-3



Summary for Subcatchment 6S: CB-9

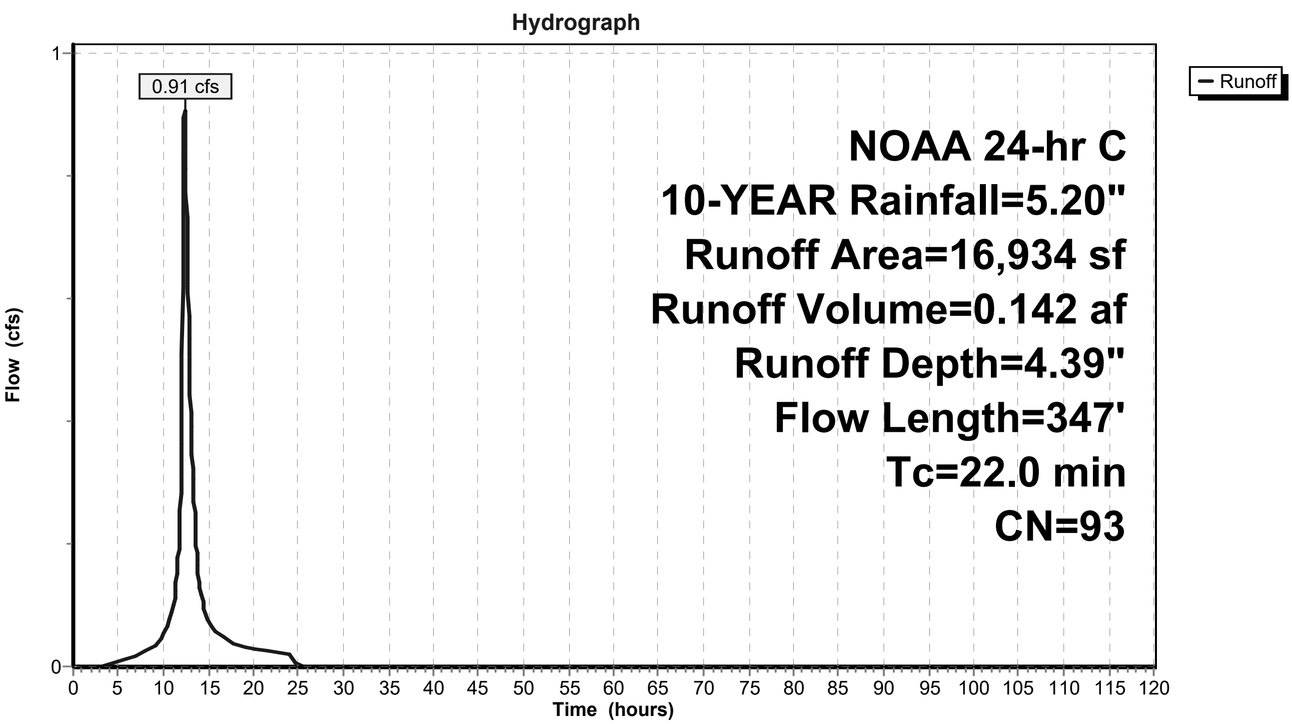
Runoff = 0.91 cfs @ 12.34 hrs, Volume= 0.142 af, Depth= 4.39"
Routed to Pond CB-9 : CB-9

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-YEAR Rainfall=5.20"

Area (sf)	CN	Description
11,659	98	Paved roads w/curbs & sewers, HSG C
1,125	72	Woods/grass comb., Good, HSG C
1,923	83	1/4 acre lots, 38% imp, HSG C
1,148	81	1/3 acre lots, 30% imp, HSG C
1,079	94	Urban commercial, 85% imp, HSG C
16,934	93	Weighted Average
3,283		19.39% Pervious Area
13,651		80.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.6	110	0.0106	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
2.4	237	0.0066	1.65		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
22.0	347	Total			

Subcatchment 6S: CB-9



Summary for Subcatchment 7S: CB-4

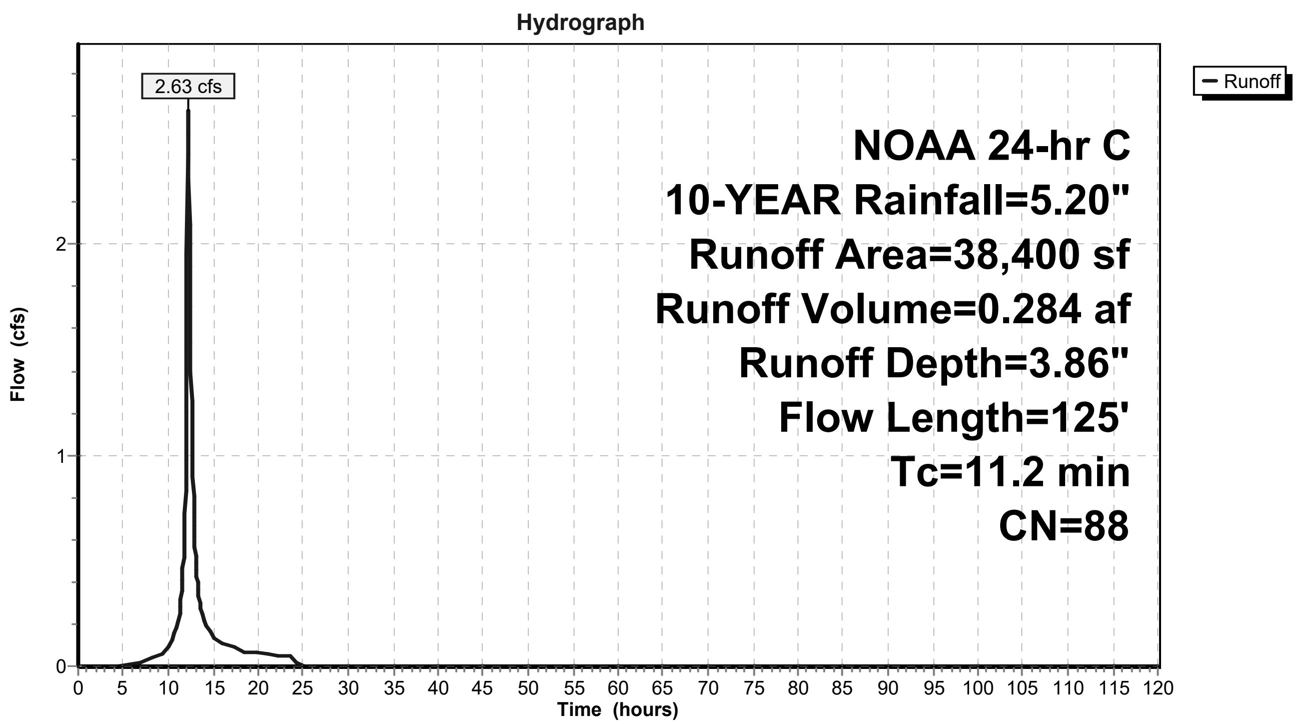
Runoff = 2.63 cfs @ 12.21 hrs, Volume= 0.284 af, Depth= 3.86"
Routed to Pond CB-4 : CB-4

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-YEAR Rainfall=5.20"

Area (sf)	CN	Description
11,566	98	Paved roads w/curbs & sewers, HSG C
26,834	83	1/4 acre lots, 38% imp, HSG C
38,400	88	Weighted Average
16,637		43.33% Pervious Area
21,763		56.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	88	0.0300	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
0.4	37	0.0059	1.56		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
11.2	125	Total			

Subcatchment 7S: CB-4



Summary for Subcatchment 8S: CB-8

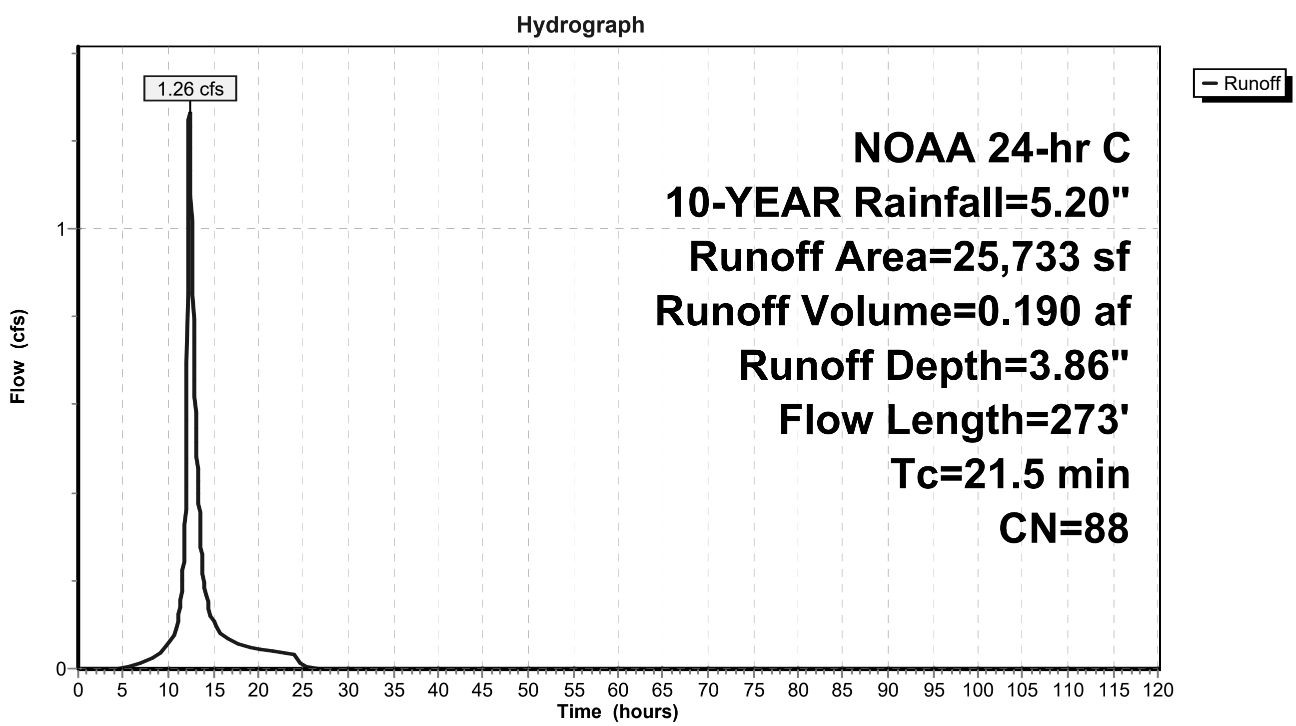
Runoff = 1.26 cfs @ 12.34 hrs, Volume= 0.190 af, Depth= 3.86"
Routed to Pond CB-8 : CB-8

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-YEAR Rainfall=5.20"

Area (sf)	CN	Description
10,976	98	Paved parking, HSG C
1,828	81	1/3 acre lots, 30% imp, HSG C
12,139	80	1/2 acre lots, 25% imp, HSG C
790	94	Urban commercial, 85% imp, HSG C
25,733	88	Weighted Average
10,502		40.81% Pervious Area
15,231		59.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.0	108	0.0096	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
1.5	165	0.0078	1.79		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
21.5	273	Total			

Subcatchment 8S: CB-8



Summary for Subcatchment 9S: CB-5

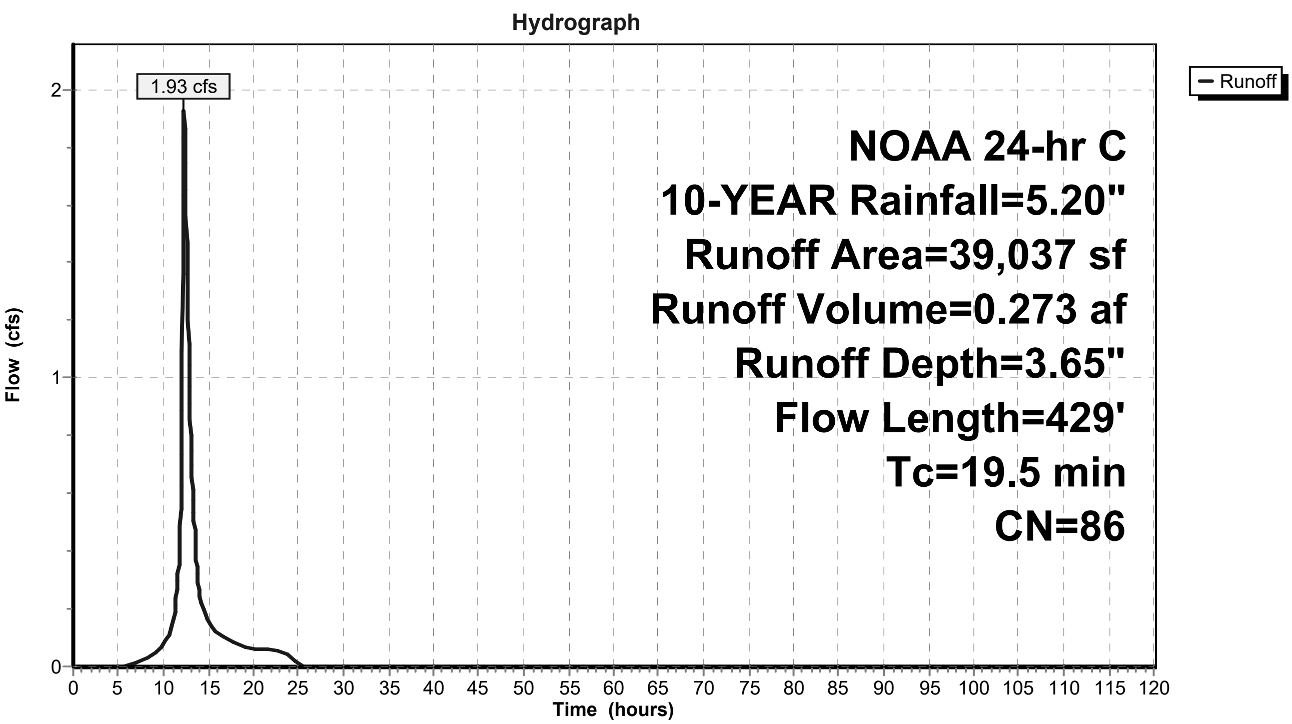
Runoff = 1.93 cfs @ 12.32 hrs, Volume= 0.273 af, Depth= 3.65"
Routed to Pond CB-5 : CB-5

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-YEAR Rainfall=5.20"

Area (sf)	CN	Description
10,204	98	Paved roads w/curbs & sewers, HSG C
9,715	83	1/4 acre lots, 38% imp, HSG C
10,479	81	1/3 acre lots, 30% imp, HSG C
5,019	80	1/2 acre lots, 25% imp, HSG C
3,620	85	1/2 acre lots, 25% imp, HSG D
39,037	86	Weighted Average
19,838		50.82% Pervious Area
19,199		49.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	137	0.0233	0.13		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
2.5	292	0.0090	1.93		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
19.5	429	Total			

Subcatchment 9S: CB-5



Summary for Subcatchment 10S: CB-7

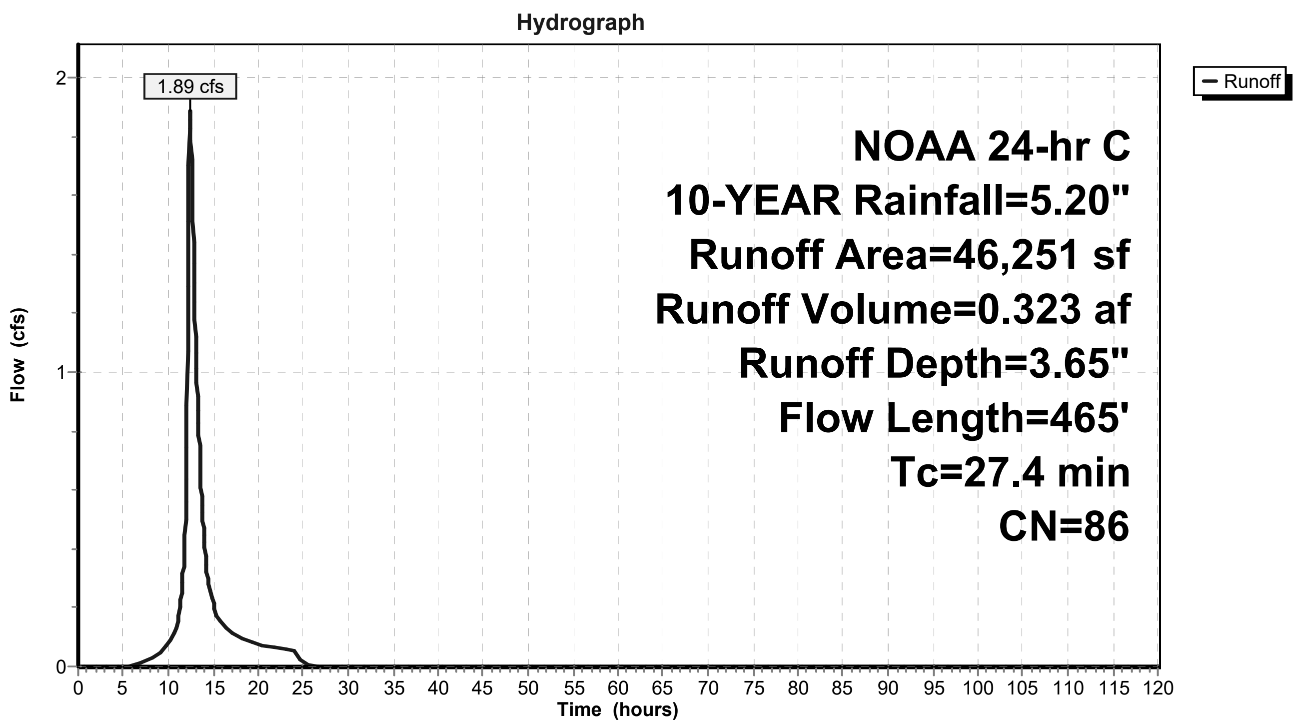
Runoff = 1.89 cfs @ 12.42 hrs, Volume= 0.323 af, Depth= 3.65"
Routed to Pond CB-7 : CB-7

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-YEAR Rainfall=5.20"

Area (sf)	CN	Description
10,245	98	Paved roads w/curbs & sewers, HSG C
33,447	83	1/4 acre lots, 38% imp, HSG C
2,559	80	1/2 acre lots, 25% imp, HSG C
46,251	86	Weighted Average
22,656		48.99% Pervious Area
23,595		51.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.5	150	0.0112	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
0.3	32	0.0112	1.70		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.6	283	0.0078	1.79		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
27.4	465	Total			

Subcatchment 10S: CB-7



Summary for Subcatchment 11S: CB-6

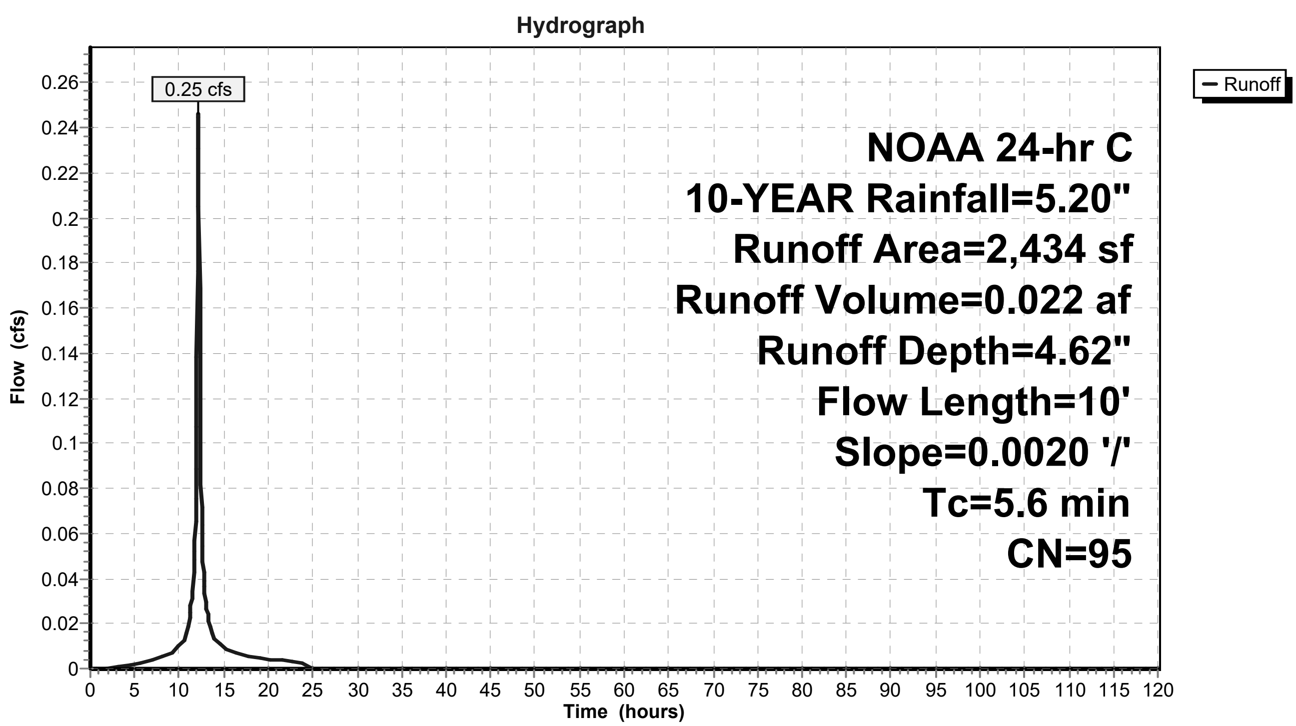
Runoff = 0.25 cfs @ 12.14 hrs, Volume= 0.022 af, Depth= 4.62"
Routed to Pond CB-6 : CB-6

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-YEAR Rainfall=5.20"

Area (sf)	CN	Description
2,137	98	Paved roads w/curbs & sewers, HSG C
35	83	1/4 acre lots, 38% imp, HSG C
262	74	>75% Grass cover, Good, HSG C
2,434	95	Weighted Average
284		11.66% Pervious Area
2,150		88.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	10	0.0020	0.03		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"

Subcatchment 11S: CB-6



Summary for Subcatchment 12S: CB-13

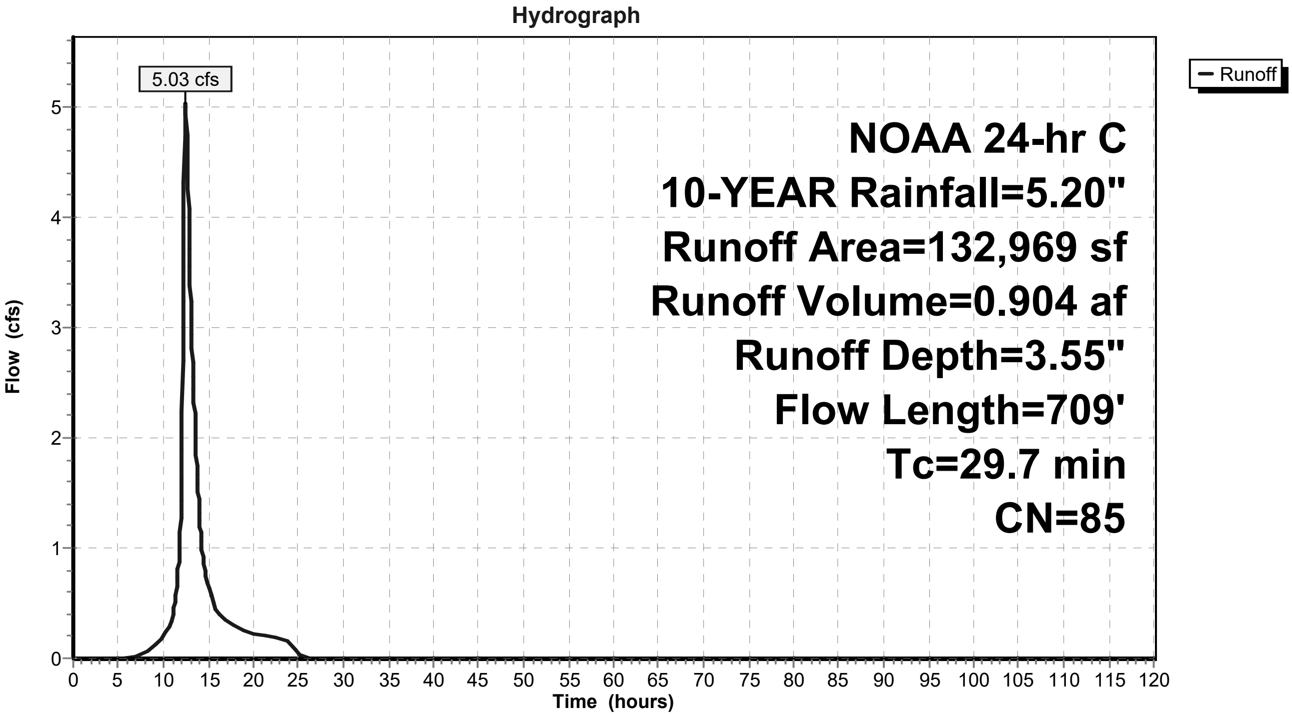
Runoff = 5.03 cfs @ 12.46 hrs, Volume= 0.904 af, Depth= 3.55"
Routed to Pond CB-13 : CB-13

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-YEAR Rainfall=5.20"

Area (sf)	CN	Description
21,153	98	Paved roads w/curbs & sewers, HSG C
102,369	82	Row crops, SR + CR, Good, HSG C
9,447	83	1/4 acre lots, 38% imp, HSG C
132,969	85	Weighted Average
108,226		81.39% Pervious Area
24,743		18.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.1	150	0.0073	0.11		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
5.0	269	0.0101	0.90		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
1.9	187	0.0069	1.68	3.35	**Parabolic Channel, D-6** W=6.00' D=0.50' Area=2.0 sf Perim=6.1' n= 0.035 Earth, dense weeds
0.4	34	0.0030	1.47	0.40	**Pipe Channel,** 10.0" Round w/ 5.0" inside fill Area= 0.3 sf Perim= 2.1' r= 0.13' n= 0.014 Concrete pipe, finished
0.3	69	0.0199	4.37	17.48	**Parabolic Channel,** W=6.00' D=1.00' Area=4.0 sf Perim=6.4' n= 0.035 Earth, dense weeds
29.7	709	Total			

Subcatchment 12S: CB-13



Summary for Subcatchment 13S: CB-12

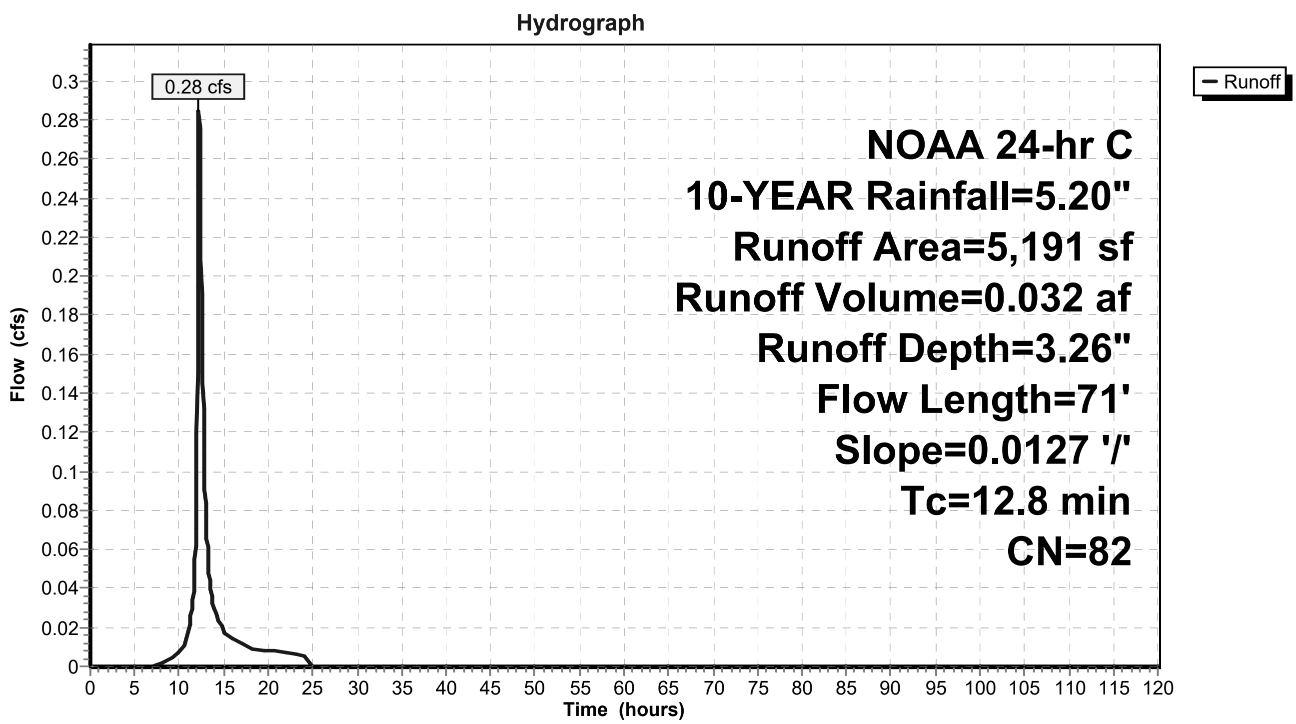
Runoff = 0.28 cfs @ 12.23 hrs, Volume= 0.032 af, Depth= 3.26"
Routed to Pond CB-12 : CB-12

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-YEAR Rainfall=5.20"

Area (sf)	CN	Description
1,729	98	Paved roads w/curbs & sewers, HSG C
3,462	74	>75% Grass cover, Good, HSG C
5,191	82	Weighted Average
3,462		66.69% Pervious Area
1,729		33.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	71	0.0127	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"

Subcatchment 13S: CB-12



Summary for Subcatchment 14S: CB-14

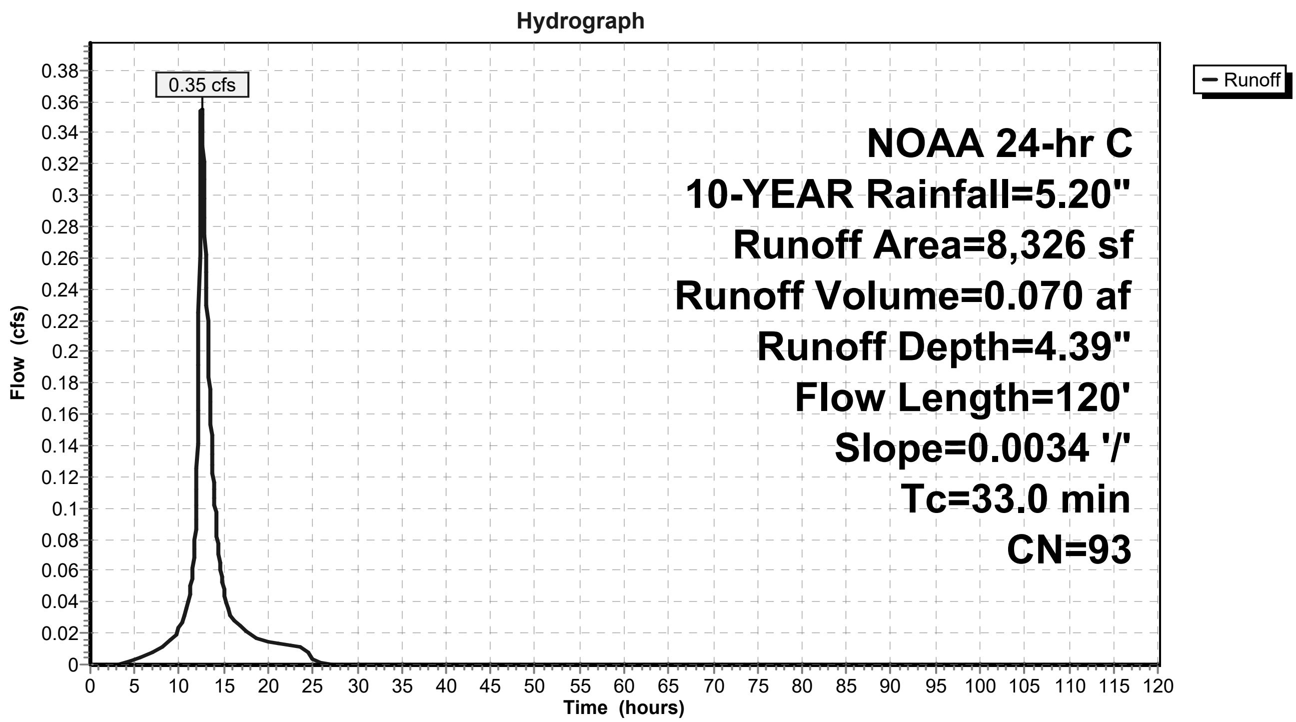
Runoff = 0.35 cfs @ 12.48 hrs, Volume= 0.070 af, Depth= 4.39"
Routed to Pond CB-14 : CB-14

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-YEAR Rainfall=5.20"

Area (sf)	CN	Description
6,418	98	Paved roads w/curbs & sewers, HSG C
1,849	74	>75% Grass cover, Good, HSG C
59	98	Paved roads w/curbs & sewers, HSG D
8,326	93	Weighted Average
1,849		22.21% Pervious Area
6,477		77.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.0	120	0.0034	0.06		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"

Subcatchment 14S: CB-14



Summary for Subcatchment 15S: CB-15

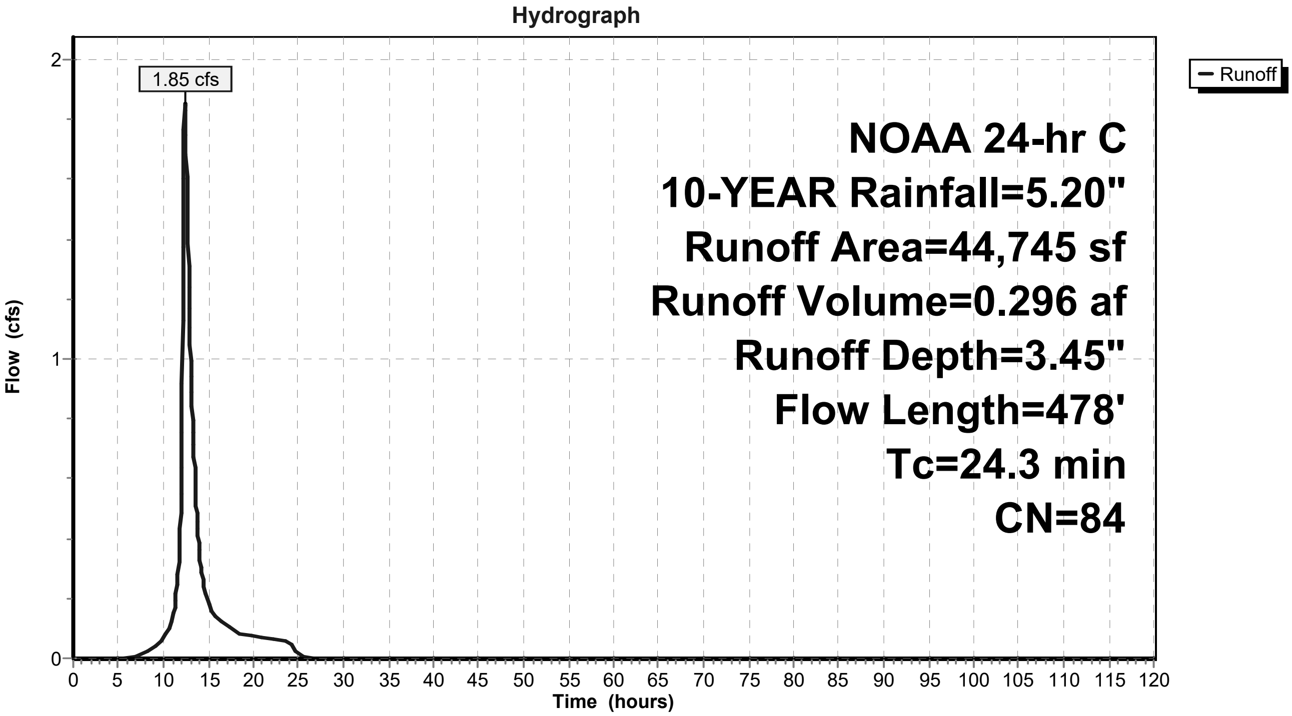
Runoff = 1.85 cfs @ 12.38 hrs, Volume= 0.296 af, Depth= 3.45"
Routed to Pond CB-15 : CB-15

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-YEAR Rainfall=5.20"

Area (sf)	CN	Description
3,608	98	Paved roads w/curbs & sewers, HSG C
14,612	82	Row crops, SR + CR, Good, HSG C
4,652	83	1/4 acre lots, 38% imp, HSG C
10,561	80	1/2 acre lots, 25% imp, HSG C
684	98	Paved roads w/curbs & sewers, HSG C
5,318	87	1/4 acre lots, 38% imp, HSG D
5,310	85	1/2 acre lots, 25% imp, HSG D
44,745	84	Weighted Average
32,697		73.07% Pervious Area
12,048		26.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.6	150	0.0129	0.14		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
0.1	4	0.0129	1.02		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
2.2	270	0.0167	2.08		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
4.4	54	0.0001	0.20		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
24.3	478	Total			

Subcatchment 15S: CB-15



Summary for Subcatchment 16S: CB-16

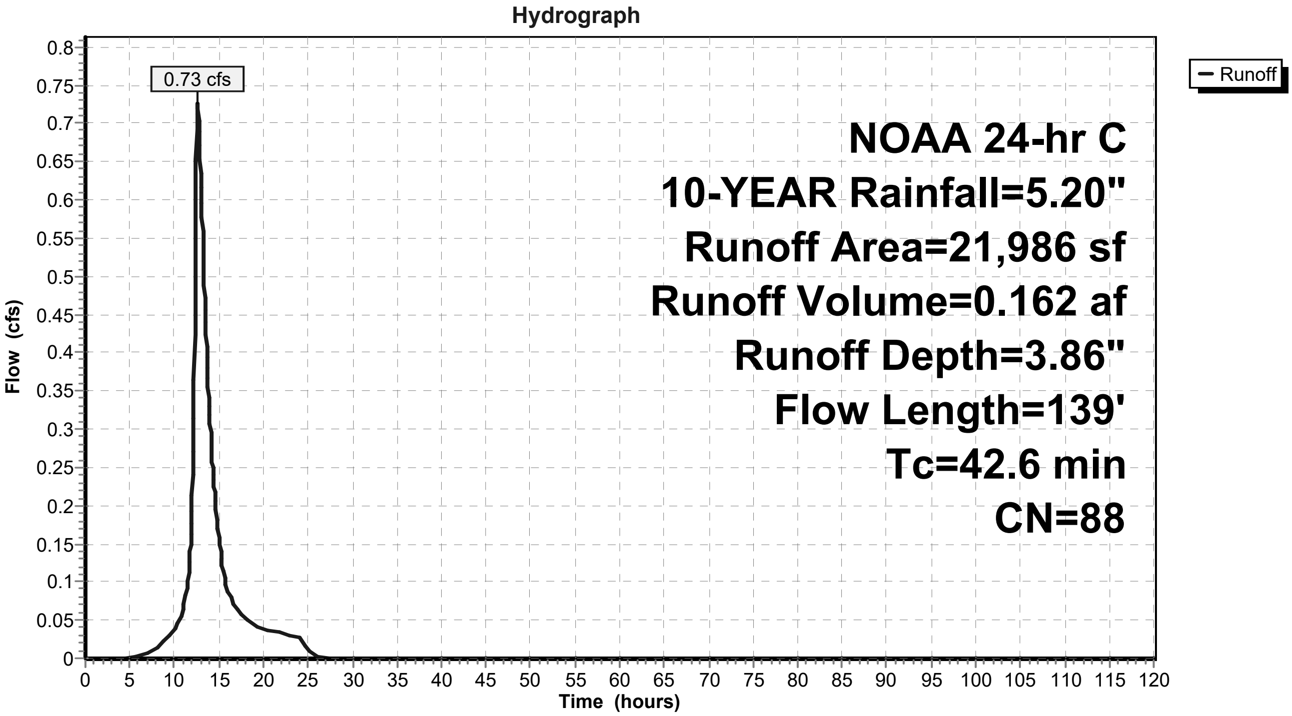
Runoff = 0.73 cfs @ 12.62 hrs, Volume= 0.162 af, Depth= 3.86"
Routed to Pond CB-16 : CB-16

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-YEAR Rainfall=5.20"

Area (sf)	CN	Description
7,490	98	Paved roads w/curbs & sewers, HSG C
2,534	74	>75% Grass cover, Good, HSG C
728	83	1/4 acre lots, 38% imp, HSG C
1,489	81	1/3 acre lots, 30% imp, HSG C
2,781	80	1/2 acre lots, 25% imp, HSG C
2,781	98	Paved roads w/curbs & sewers, HSG D
3,870	80	>75% Grass cover, Good, HSG D
82	70	1/2 acre lots, 25% imp, HSG B
231	72	1/3 acre lots, 30% imp, HSG B
21,986	88	Weighted Average
10,207		46.42% Pervious Area
11,779		53.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.8	44	0.0004	0.02		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
7.8	95	0.0001	0.20		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
42.6	139	Total			

Subcatchment 16S: CB-16



Summary for Subcatchment 17S: CB-17

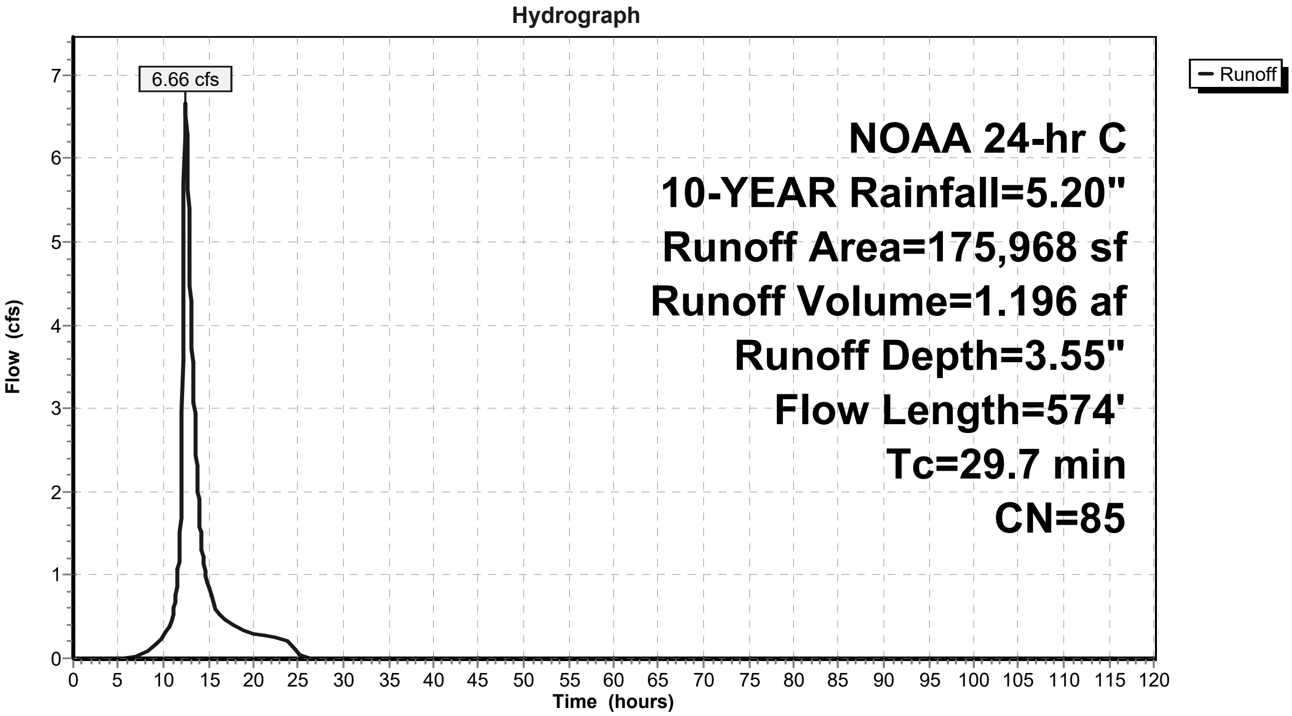
Runoff = 6.66 cfs @ 12.46 hrs, Volume= 1.196 af, Depth= 3.55"
Routed to Pond CB-17 : CB-17

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-YEAR Rainfall=5.20"

Area (sf)	CN	Description
24,112	98	Paved roads w/curbs & sewers, HSG C
77,330	82	Row crops, SR + CR, Good, HSG C
68,554	83	1/4 acre lots, 38% imp, HSG C
3,251	98	Paved roads w/curbs & sewers, HSG D
11	87	1/4 acre lots, 38% imp, HSG D
2,710	85	1/2 acre lots, 25% imp, HSG D
175,968	85	Weighted Average
121,873		69.26% Pervious Area
54,095		30.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.6	150	0.0087	0.12		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
0.6	32	0.0087	0.84		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
1.5	201	0.0198	2.27		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
7.0	191	0.0005	0.45		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
29.7	574	Total			

Subcatchment 17S: CB-17



Summary for Subcatchment 18S: D-8

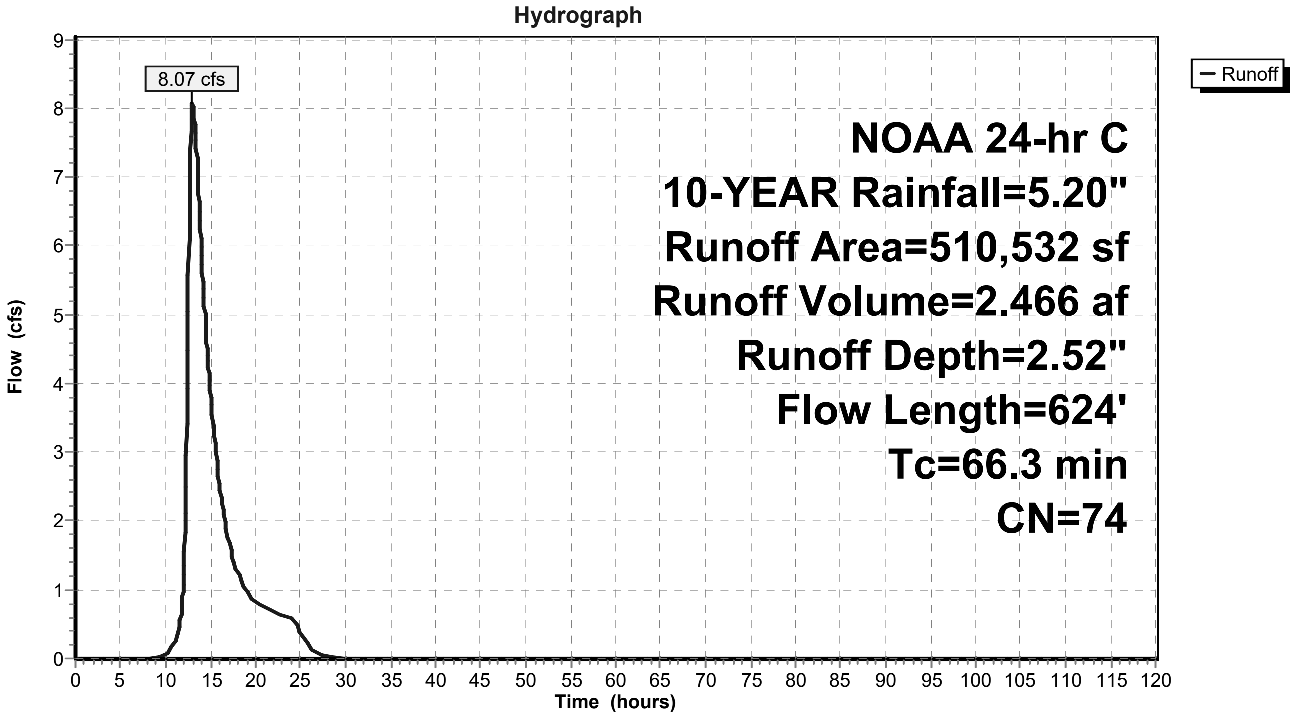
Runoff = 8.07 cfs @ 12.99 hrs, Volume= 2.466 af, Depth= 2.52"
Routed to Pond 40P : C-1

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-YEAR Rainfall=5.20"

Area (sf)	CN	Description
20,906	61	>75% Grass cover, Good, HSG B
34,255	75	1/4 acre lots, 38% imp, HSG B
19,157	72	1/3 acre lots, 30% imp, HSG B
15,536	70	1/2 acre lots, 25% imp, HSG B
8,099	68	1 acre lots, 20% imp, HSG B
2,079	98	Paved roads w/curbs & sewers, HSG C
338,487	74	>75% Grass cover, Good, HSG C
39,648	83	1/4 acre lots, 38% imp, HSG C
8,414	81	1/3 acre lots, 30% imp, HSG C
5,839	80	1/2 acre lots, 25% imp, HSG C
14,980	79	1 acre lots, 20% imp, HSG C
3,132	80	>75% Grass cover, Good, HSG D
510,532	74	Weighted Average
462,139		90.52% Pervious Area
48,393		9.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.9	150	0.0133	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
3.1	353	0.0142	1.92		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
40.3	121	0.0001	0.05		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
66.3	624	Total			

Subcatchment 18S: D-8



Summary for Subcatchment 19S: LOW POINT BEHIND CAR LOT

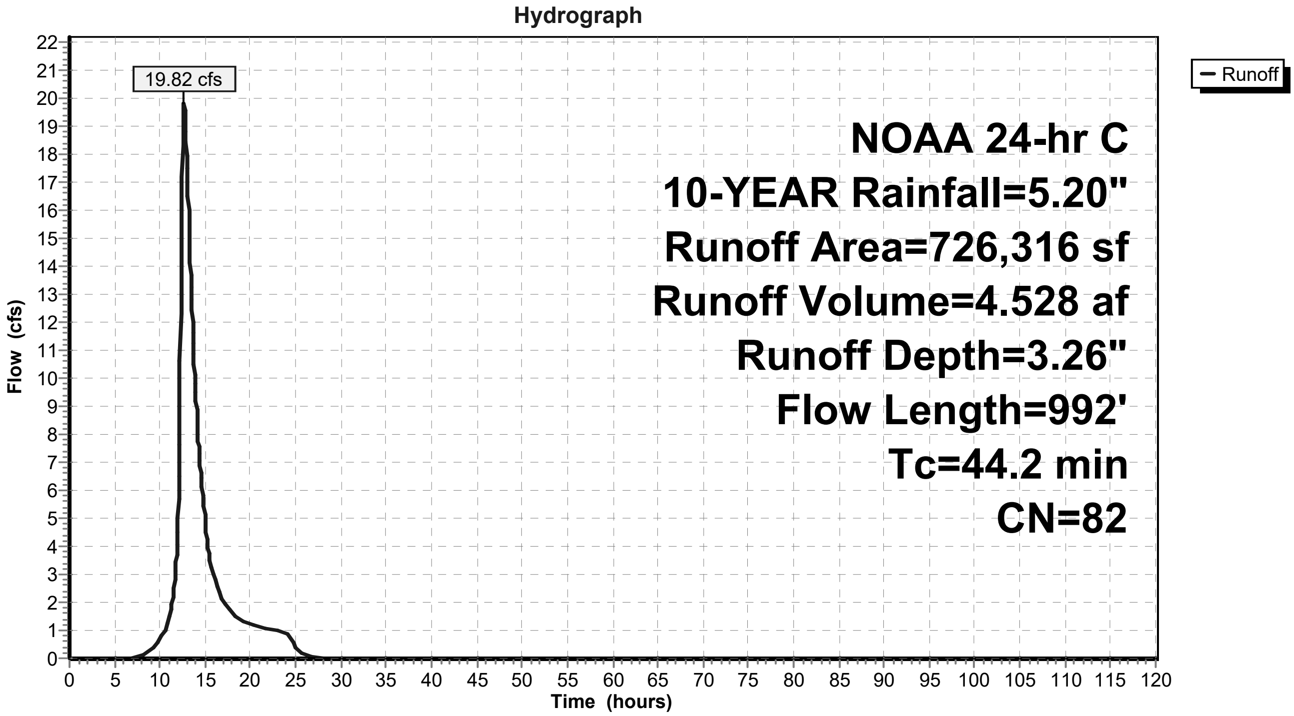
Runoff = 19.82 cfs @ 12.66 hrs, Volume= 4.528 af, Depth= 3.26"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-YEAR Rainfall=5.20"

Area (sf)	CN	Description
574,884	82	Row crops, SR + CR, Good, HSG C
42,712	83	1/4 acre lots, 38% imp, HSG C
42,050	81	1/3 acre lots, 30% imp, HSG C
37,738	80	1/2 acre lots, 25% imp, HSG C
28,932	94	Urban commercial, 85% imp, HSG C
726,316	82	Weighted Average
663,444		91.34% Pervious Area
62,872		8.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	150	0.0067	0.12		**Sheet Flow,**
					Grass: Short n= 0.150 P2= 3.30"
3.4	160	0.0125	0.78		**Shallow Concentrated Flow, Grass flow**
					Short Grass Pasture Kv= 7.0 fps
15.5	368	0.0063	0.40		**Shallow Concentrated Flow, Forested area**
					Woodland Kv= 5.0 fps
4.6	314	0.0159	1.13		**Shallow Concentrated Flow, farm field**
					Cultivated Straight Rows Kv= 9.0 fps
44.2	992	Total			

Subcatchment 19S: LOW POINT BEHIND CAR LOT



Summary for Subcatchment 44S: W-1

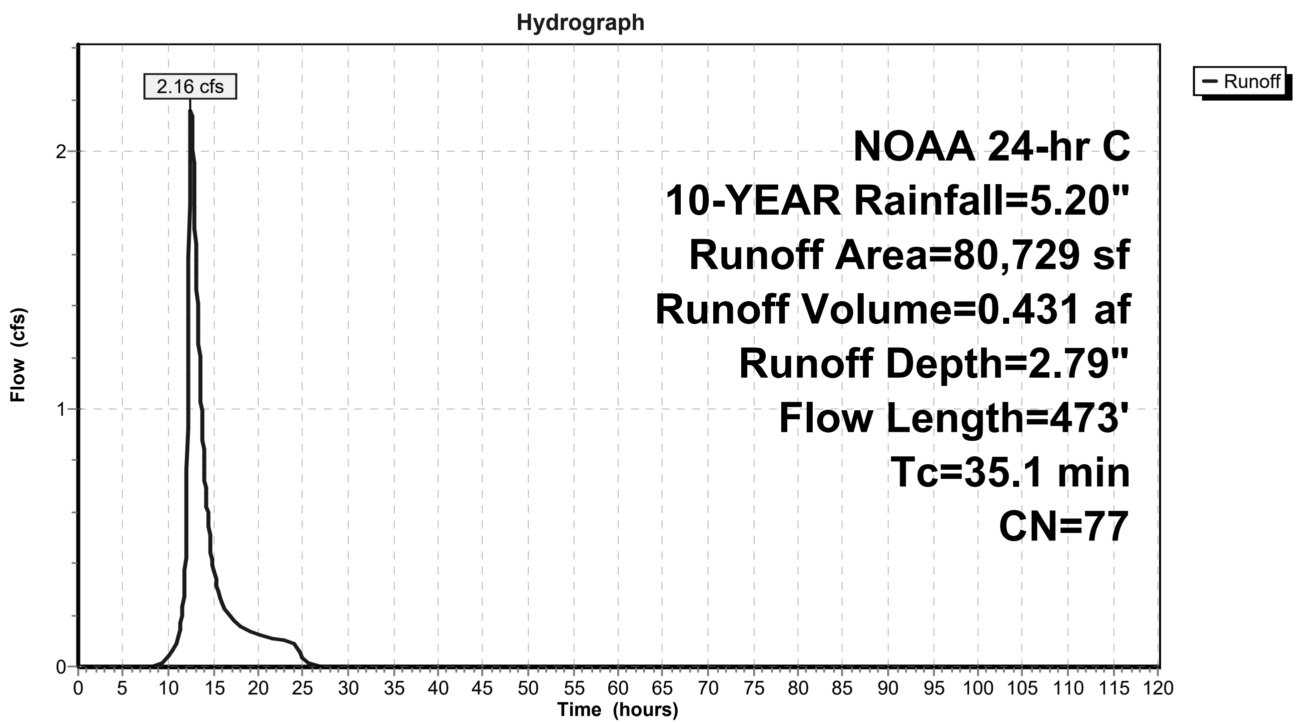
Runoff = 2.16 cfs @ 12.55 hrs, Volume= 0.431 af, Depth= 2.79"
Routed to Pond 46P : Farm Pond

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-YEAR Rainfall=5.20"

Area (sf)	CN	Description
978	48	Brush, Good, HSG B
56,376	82	Row crops, SR + CR, Good, HSG C
17,219	65	Brush, Good, HSG C
6,156	73	Brush, Good, HSG D
80,729	77	Weighted Average
80,729		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.1	150	0.0067	0.08		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
4.3	279	0.0143	1.08		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
0.7	44	0.0450	1.06		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
35.1	473	Total			

Subcatchment 44S: W-1



Summary for Subcatchment 45S: W-2

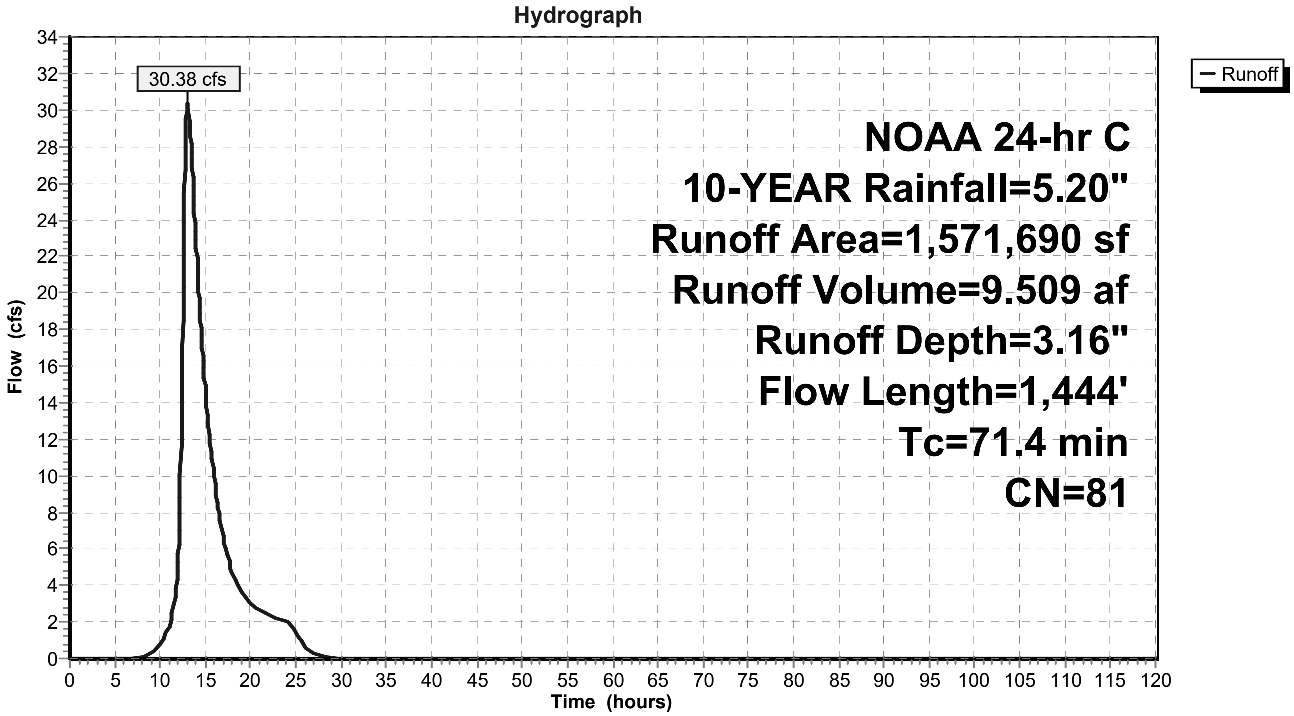
Runoff = 30.38 cfs @ 13.02 hrs, Volume= 9.509 af, Depth= 3.16"
Routed to Pond 47P : W-2

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-YEAR Rainfall=5.20"

Area (sf)	CN	Description
1,251,599	82	Row crops, SR + CR, Good, HSG C
41,690	72	Woods/grass comb., Good, HSG C
177,558	75	Row crops, SR + CR, Good, HSG B
24,058	83	1/4 acre lots, 38% imp, HSG C
15,439	80	1/2 acre lots, 25% imp, HSG C
61,346	73	Brush, Good, HSG D
1,571,690	81	Weighted Average
1,558,688		99.17% Pervious Area
13,002		0.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.1	150	0.0020	0.07		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
18.2	730	0.0055	0.67		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
3.9	94	0.0063	0.40		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.2	470	0.0051	0.64		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
71.4	1,444	Total			

Subcatchment 45S: W-2



Summary for Subcatchment 46S: w-3

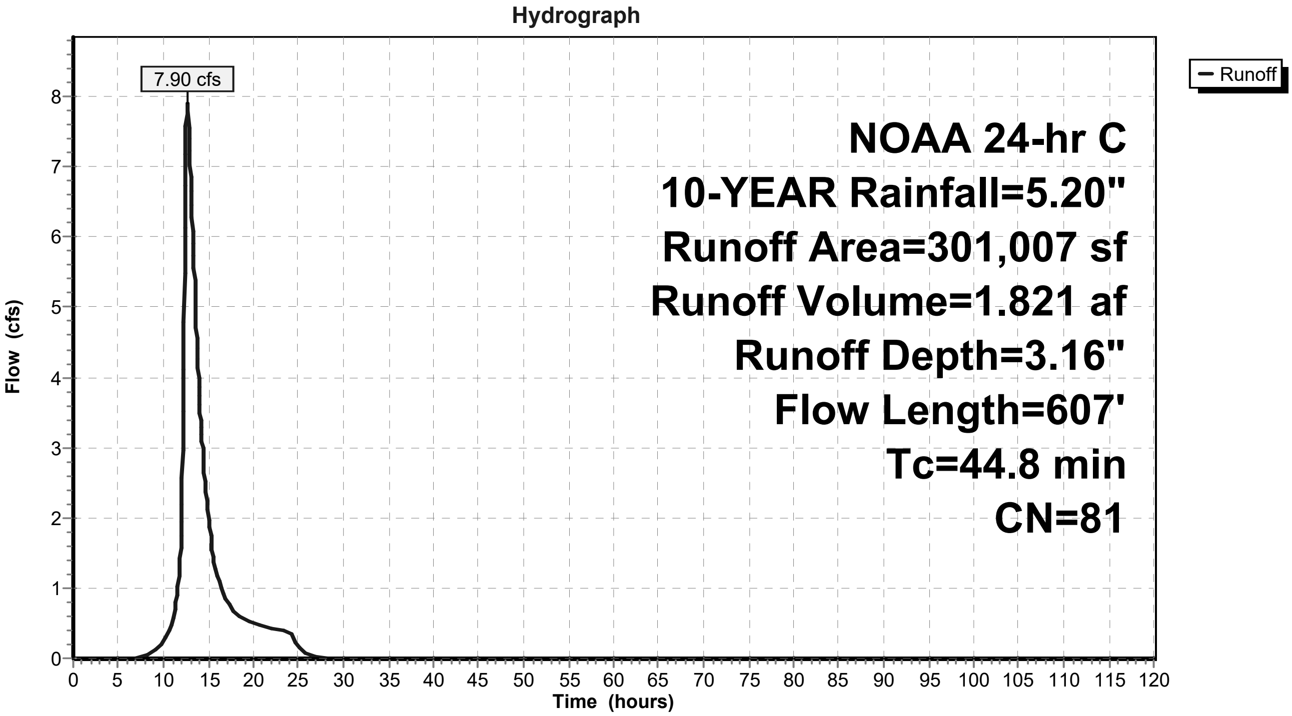
Runoff = 7.90 cfs @ 12.67 hrs, Volume= 1.821 af, Depth= 3.16"
Routed to Pond 48P : w-3

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 10-YEAR Rainfall=5.20"

Area (sf)	CN	Description
178,174	82	Row crops, SR + CR, Good, HSG C
32,241	83	1/4 acre lots, 38% imp, HSG C
15,039	81	1/3 acre lots, 30% imp, HSG C
4,043	80	1/2 acre lots, 25% imp, HSG C
55,172	73	Brush, Good, HSG D
434	87	1/4 acre lots, 38% imp, HSG D
6,581	86	1/3 acre lots, 30% imp, HSG D
9,323	85	1/2 acre lots, 25% imp, HSG D
301,007	81	Weighted Average
278,763		92.61% Pervious Area
22,244		7.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.1	150	0.0020	0.07		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
6.2	400	0.0141	1.07		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
1.5	57	0.0158	0.63		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
44.8	607	Total			

Subcatchment 46S: w-3



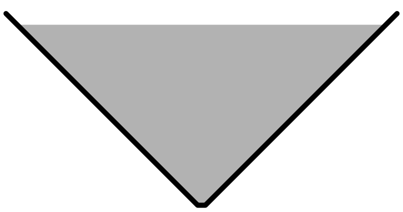
Summary for Reach 48R: (new Reach)

Inflow Area = 44.844 ac, 1.80% Impervious, Inflow Depth > 2.92" for 10-YEAR event
Inflow = 11.76 cfs @ 15.88 hrs, Volume= 10.930 af
Outflow = 11.76 cfs @ 15.91 hrs, Volume= 10.930 af, Atten= 0%, Lag= 1.9 min
Routed to Pond 44P : Culvert @ ditch

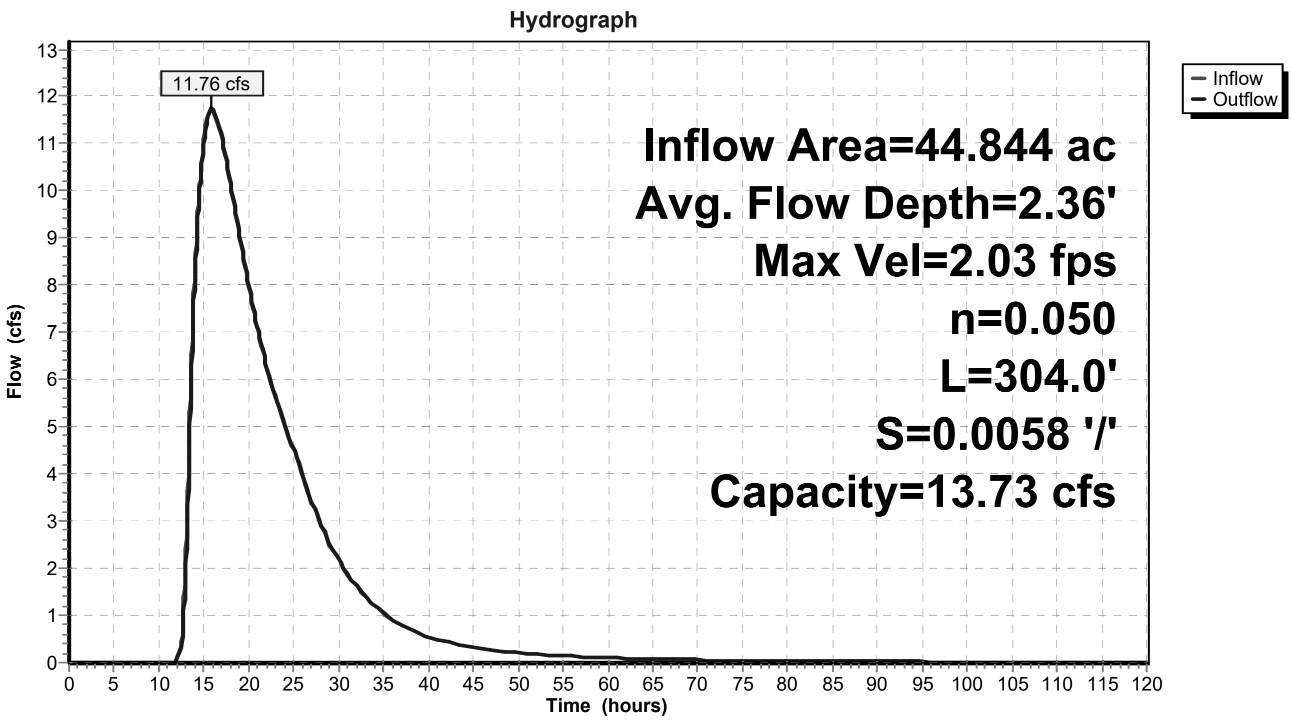
Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Max. Velocity= 2.03 fps, Min. Travel Time= 2.5 min
Avg. Velocity = 0.77 fps, Avg. Travel Time= 6.5 min

Peak Storage= 1,759 cf @ 15.91 hrs
Average Depth at Peak Storage= 2.36' , Surface Width= 4.81'
Bank-Full Depth= 2.50' Flow Area= 6.5 sf, Capacity= 13.73 cfs

0.10' x 2.50' deep channel, n= 0.050
Side Slope Z-value= 1.00 '/' Top Width= 5.10'
Length= 304.0' Slope= 0.0058 '/'
Inlet Invert= 6.75', Outlet Invert= 5.00'



Reach 48R: (new Reach)



Summary for Pond 40P: C-1

Inflow Area = 72.869 ac, 12.41% Impervious, Inflow Depth > 3.04" for 10-YEAR event
Inflow = 31.63 cfs @ 12.51 hrs, Volume= 18.457 af
Outflow = 29.98 cfs @ 12.79 hrs, Volume= 18.423 af, Atten= 5%, Lag= 16.8 min
Primary = 29.98 cfs @ 12.79 hrs, Volume= 18.423 af
Routed to Link 43L : MHHW

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Starting Elev= 2.70' Surf.Area= 6,440 sf Storage= 4,293 cf
Peak Elev= 4.30' @ 12.79 hrs Surf.Area= 46,809 sf Storage= 41,959 cf (37,665 cf above start)
Flood Elev= 5.50' Surf.Area= 101,376 sf Storage= 128,769 cf (124,476 cf above start)

Plug-Flow detention time= 54.2 min calculated for 18.317 af (99% of inflow)
Center-of-Mass det. time= 24.6 min (1,187.3 - 1,162.7)

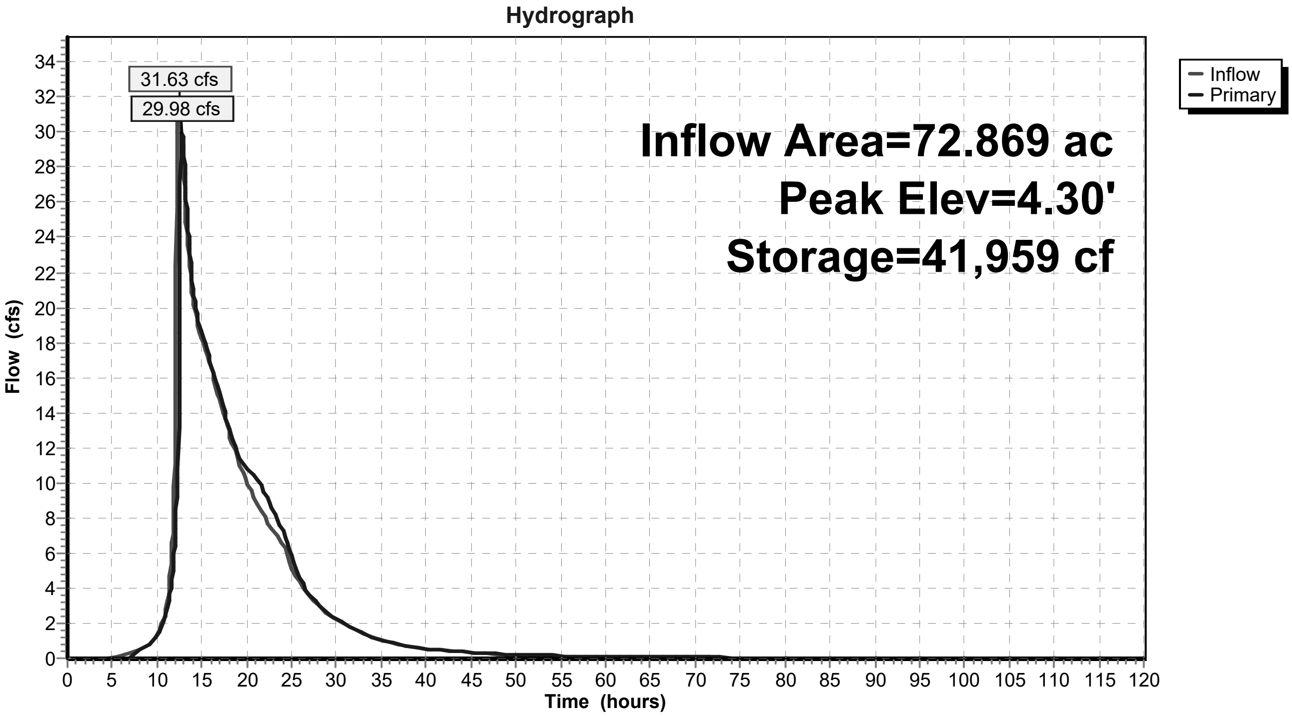
Volume	Invert	Avail.Storage	Storage Description
#1	0.70'	128,769 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
0.70	0	0.0	0	0	0
2.70	6,440	1,626.0	4,293	4,293	210,399
5.50	101,376	2,163.2	124,476	128,769	372,471

Device	Routing	Invert	Outlet Devices
#1	Primary	0.84'	**18.0" Round Culvert X 2.00 w/ 6.0" inside fill** L= 25.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 0.34' / 0.09' S= 0.0100 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.25 sf
#2	Primary	4.04'	**50.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=29.97 cfs @ 12.79 hrs HW=4.30' TW=2.89' (Dynamic Tailwater)
1=Culvert (Outlet Controls 12.15 cfs @ 4.85 fps)
2=Broad-Crested Rectangular Weir (Weir Controls 17.82 cfs @ 1.37 fps)

Pond 40P: C-1


Hydrograph
31.63 cfs
29.98 cfs
Inflow
Primary
Inflow Area=72.869 ac
Peak Elev=4.30'
Storage=41,959 cf
Flow (cfs)
Time (hours)

Summary for Pond 44P: Culvert @ ditch

Inflow Area = 44.844 ac, 1.80% Impervious, Inflow Depth > 2.92" for 10-YEAR event
Inflow = 11.76 cfs @ 15.91 hrs, Volume= 10.930 af
Outflow = 11.79 cfs @ 15.90 hrs, Volume= 10.930 af, Atten= 0%, Lag= 0.0 min
Primary = 11.65 cfs @ 16.30 hrs, Volume= 10.912 af
Routed to Pond CB-5 : CB-5
Secondary = 0.23 cfs @ 15.75 hrs, Volume= 0.017 af
Routed to Pond CB-5 : CB-5

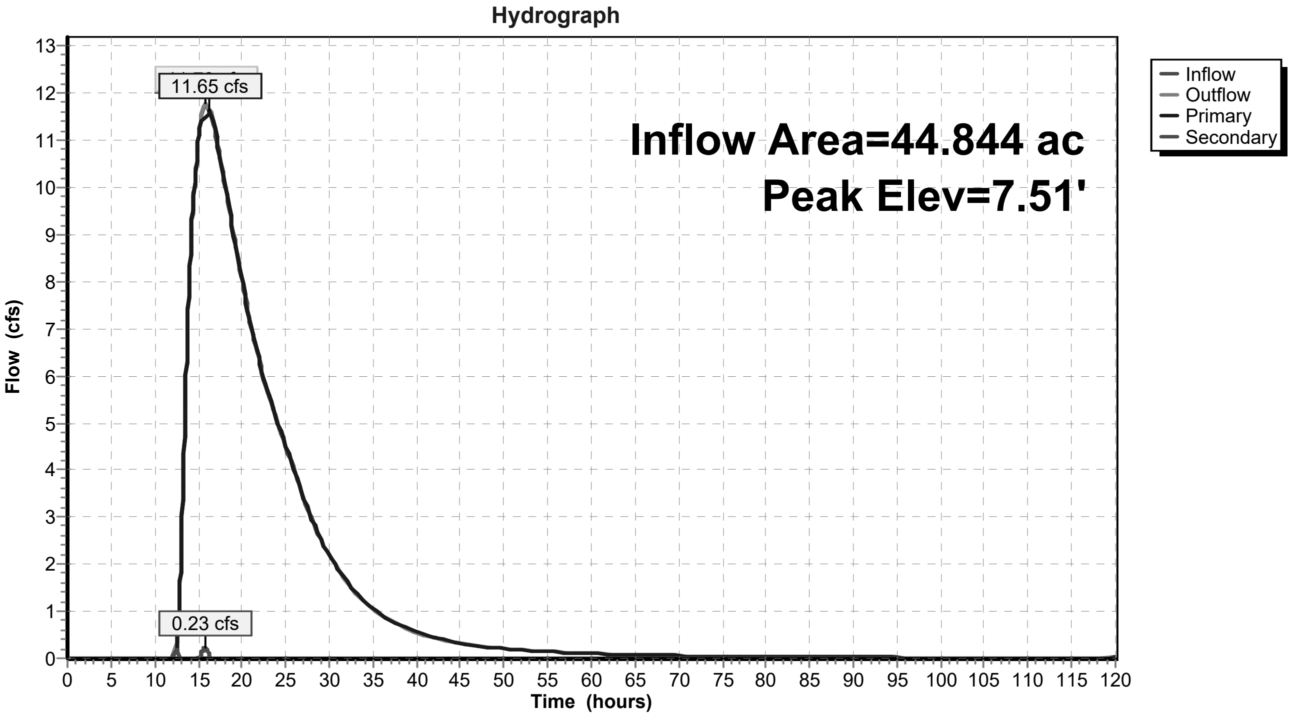
Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 7.51' @ 12.46 hrs
Flood Elev= 7.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	5.00'	**24.0" Round Culvert** L= 20.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 5.00' / 4.34' S= 0.0330 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Secondary	7.00'	**6.0' long x 12.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Primary OutFlow Max=11.63 cfs @ 16.30 hrs HW=7.02' TW=6.58' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 11.63 cfs @ 4.56 fps)

Secondary OutFlow Max=0.23 cfs @ 15.75 hrs HW=7.06' TW=6.65' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 0.23 cfs @ 0.64 fps)

Pond 44P: Culvert @ ditch



Summary for Pond 46P: Farm Pond

Inflow Area = 1.853 ac, 0.00% Impervious, Inflow Depth = 2.79" for 10-YEAR event
Inflow = 2.16 cfs @ 12.55 hrs, Volume= 0.431 af
Outflow = 0.64 cfs @ 26.65 hrs, Volume= 0.127 af, Atten= 70%, Lag= 846.2 min
Primary = 0.64 cfs @ 26.65 hrs, Volume= 0.127 af
Routed to Pond 47P : W-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 8.36' @ 25.25 hrs Surf.Area= 14,180 sf Storage= 18,735 cf

Plug-Flow detention time= 944.0 min calculated for 0.127 af (29% of inflow)
Center-of-Mass det. time= 796.2 min (1,675.8 - 879.6)

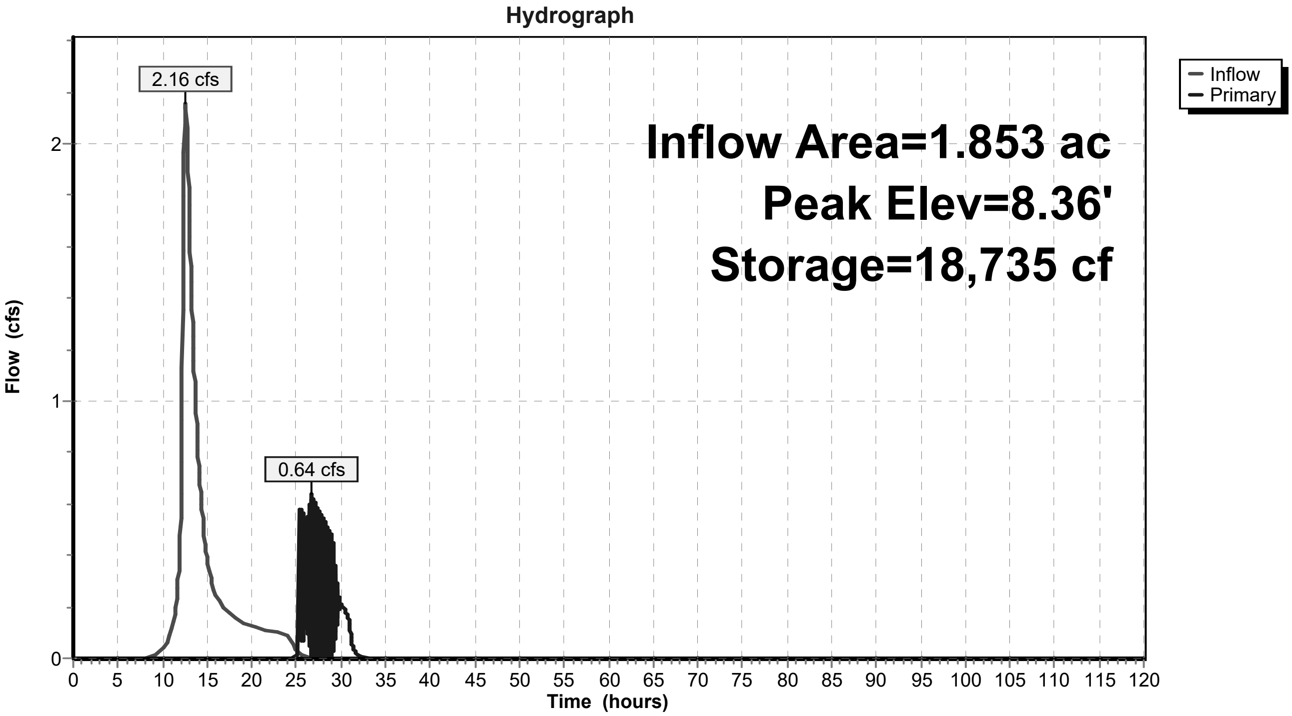
Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	37,392 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
4.00	0	0.0	0	0	0
8.00	10,722	446.1	14,296	14,296	15,861
9.00	21,600	638.0	15,847	30,143	32,426
10.00	1	1.0	7,249	37,392	64,819

Device	Routing	Invert	Outlet Devices
#1	Primary	7.90'	**25.0' long x 35.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=2.56 cfs @ 26.65 hrs HW=8.24' TW=8.24' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Weir Controls 2.56 cfs @ 0.30 fps)

Pond 46P: Farm Pond



Summary for Pond 47P: W-2

Inflow Area = 37.934 ac, 0.79% Impervious, Inflow Depth = 3.05" for 10-YEAR event
Inflow = 30.38 cfs @ 13.02 hrs, Volume= 9.636 af
Outflow = 14.37 cfs @ 13.30 hrs, Volume= 9.636 af, Atten= 53%, Lag= 16.5 min
Primary = 14.37 cfs @ 13.30 hrs, Volume= 9.636 af
Routed to Pond 48P : w-3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Starting Elev= 7.00' Surf.Area= 7,186 sf Storage= 7,186 cf
Peak Elev= 9.14' @ 15.77 hrs Surf.Area= 86,643 sf Storage= 125,927 cf (118,741 cf above start)
Flood Elev= 9.00' Surf.Area= 116,660 sf Storage= 111,889 cf (104,703 cf above start)

Plug-Flow detention time= 220.6 min calculated for 9.467 af (98% of inflow)
Center-of-Mass det. time= 199.9 min (1,134.5 - 934.6)

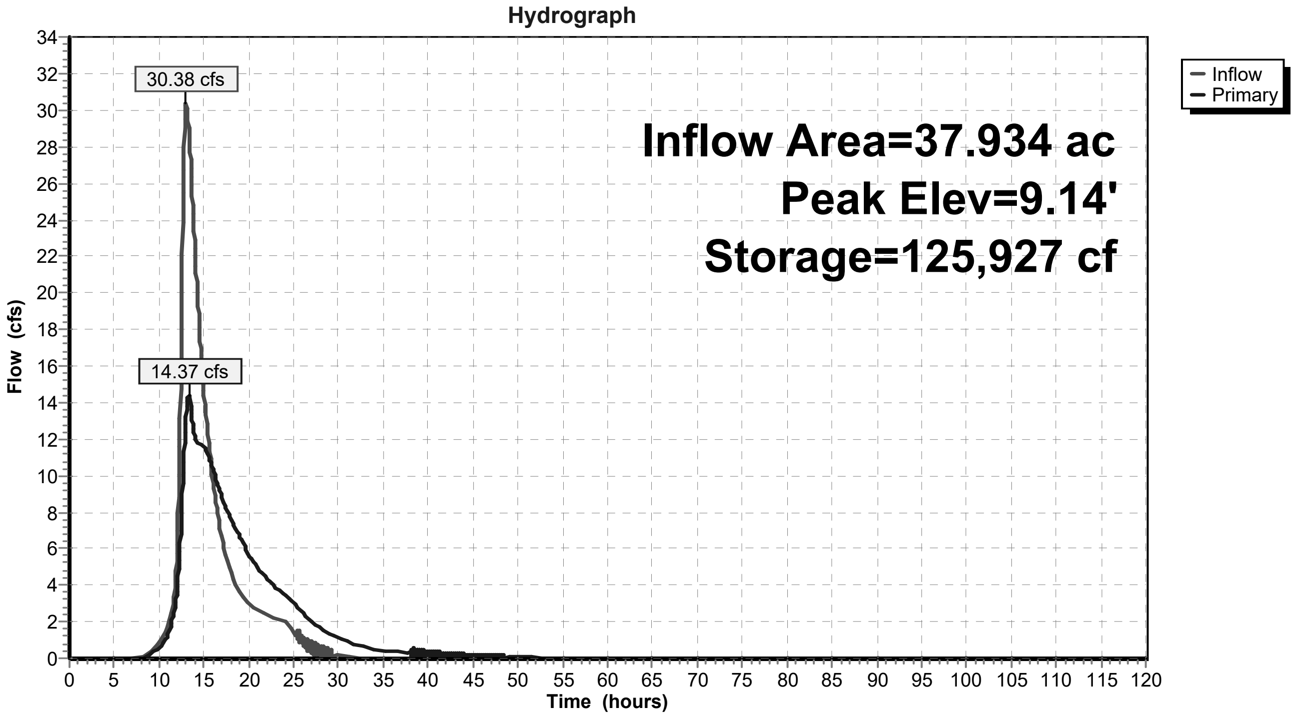
Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	150,890 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
4.00	0	0.0	0	0	0
7.00	7,186	362.8	7,186	7,186	10,488
8.00	48,289	1,234.1	24,701	31,887	121,214
9.00	116,660	1,809.4	80,002	111,889	260,556
10.00	1	1.0	39,001	150,890	521,089

Device	Routing	Invert	Outlet Devices
#1	Primary	7.00'	**5.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=14.42 cfs @ 13.30 hrs HW=8.55' TW=8.35' (Dynamic Tailwater)
1=Broad-Crested Rectangular Weir (Weir Controls 14.42 cfs @ 1.86 fps)

Pond 47P: W-2


Hydrograph
30.38 cfs
14.37 cfs
Inflow
Primary
Inflow Area=37.934 ac
Peak Elev=9.14'
Storage=125,927 cf
Flow (cfs)
Time (hours)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120

Summary for Pond 48P: w-3

Inflow Area = 44.844 ac, 1.80% Impervious, Inflow Depth = 3.07" for 10-YEAR event
Inflow = 20.56 cfs @ 13.16 hrs, Volume= 11.458 af
Outflow = 11.76 cfs @ 15.88 hrs, Volume= 10.930 af, Atten= 43%, Lag= 163.1 min
Primary = 11.76 cfs @ 15.88 hrs, Volume= 10.930 af
Routed to Reach 48R : (new Reach)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 9.11' @ 15.88 hrs Surf.Area= 66,511 sf Storage= 134,974 cf

Plug-Flow detention time= 324.5 min calculated for 10.930 af (95% of inflow)
Center-of-Mass det. time= 266.8 min (1,361.4 - 1,094.7)

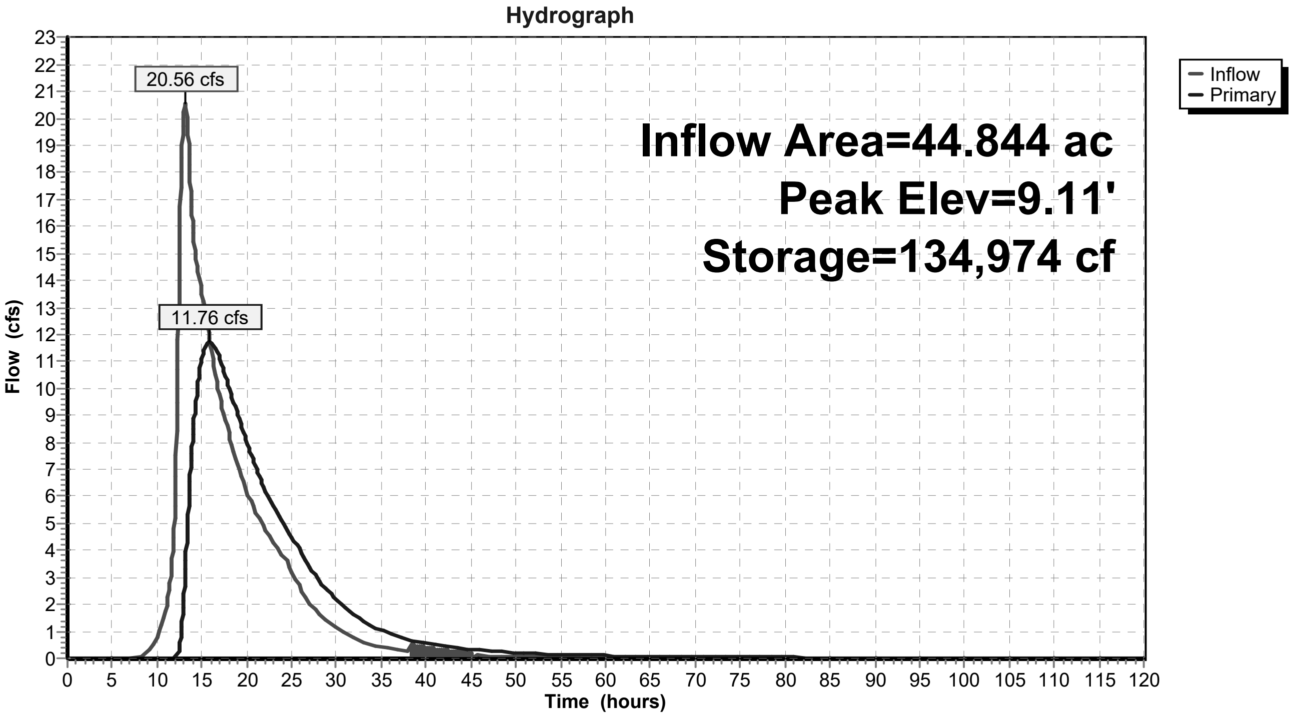
Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	210,516 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
4.00	0	0.0	0	0	0
7.00	26,232	838.7	26,232	26,232	55,990
8.00	54,023	958.7	39,300	65,532	73,178
9.00	70,709	1,081.7	62,179	127,711	93,175
12.50	1	1.0	82,805	210,516	186,306

Device	Routing	Invert	Outlet Devices
#1	Primary	6.75'	**Channel/Reach** using Reach 48R: (new Reach)

Primary OutFlow Max=11.76 cfs @ 15.88 hrs HW=9.11' TW=9.11' (Dynamic Tailwater)
└─**1=Channel/Reach** (Channel Controls 11.76 cfs @ 2.03 fps)

Pond 48P: w-3


Hydrograph
Inflow
Primary
20.56 cfs
11.76 cfs
Inflow Area=44.844 ac
Peak Elev=9.11'
Storage=134,974 cf
Flow (cfs)
Time (hours)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120

Summary for Pond CB-1: CB-1

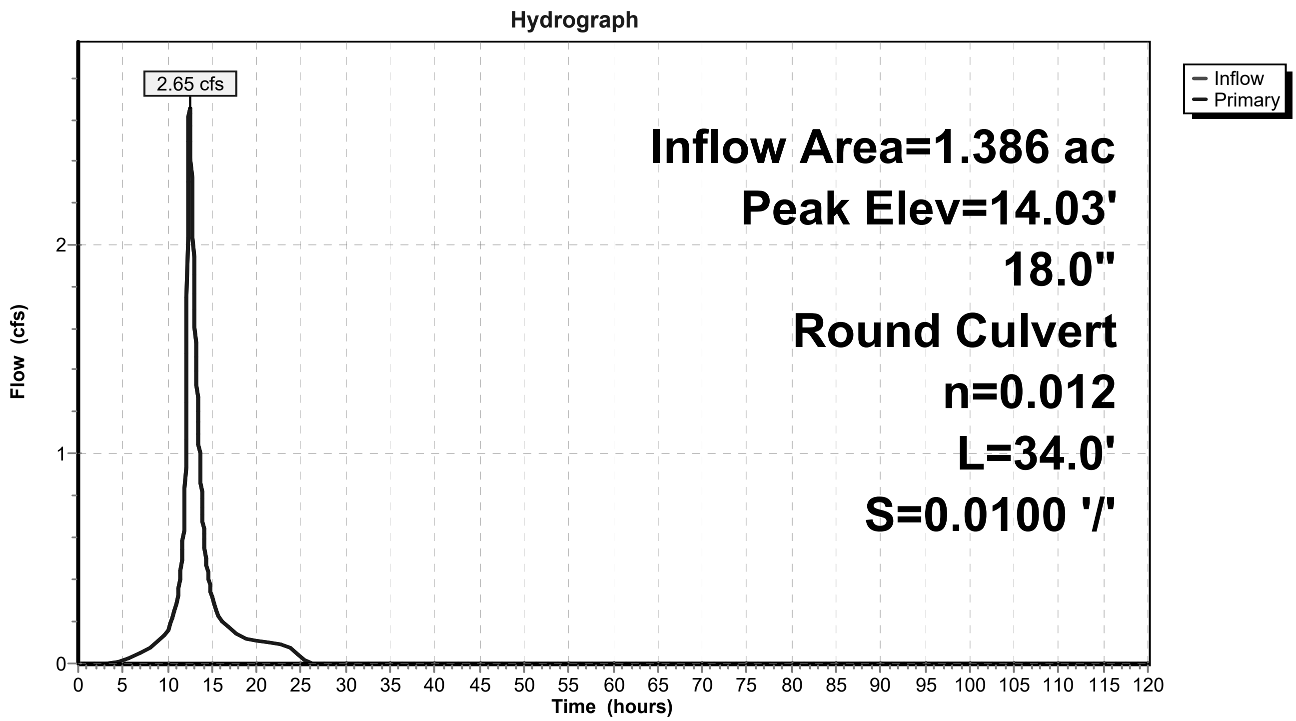
Inflow Area = 1.386 ac, 76.98% Impervious, Inflow Depth = 4.28" for 10-YEAR event
Inflow = 2.65 cfs @ 12.45 hrs, Volume= 0.495 af
Outflow = 2.65 cfs @ 12.45 hrs, Volume= 0.495 af, Atten= 0%, Lag= 0.0 min
Primary = 2.65 cfs @ 12.45 hrs, Volume= 0.495 af
Routed to Pond CB-11 : CB-11

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 14.03' @ 12.44 hrs
Flood Elev= 15.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	12.50'	**18.0" Round RCP_Round 18"** L= 34.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 12.50' / 12.16' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=2.87 cfs @ 12.45 hrs HW=14.02' TW=13.90' (Dynamic Tailwater)
1=RCP_Round 18" (Outlet Controls 2.87 cfs @ 1.99 fps)

Pond CB-1: CB-1



Summary for Pond CB-10: CB-10

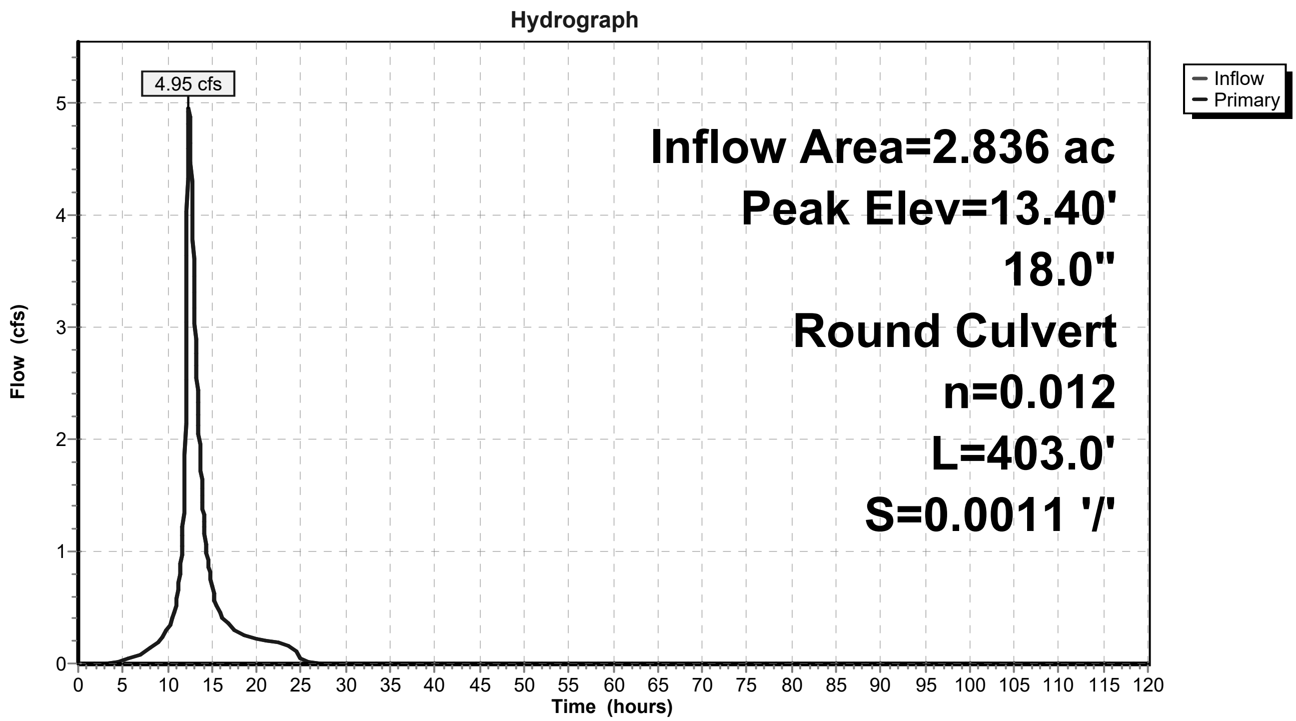
Inflow Area = 2.836 ac, 71.29% Impervious, Inflow Depth = 4.14" for 10-YEAR event
Inflow = 4.95 cfs @ 12.44 hrs, Volume= 0.979 af
Outflow = 4.95 cfs @ 12.44 hrs, Volume= 0.979 af, Atten= 0%, Lag= 0.0 min
Primary = 4.95 cfs @ 12.44 hrs, Volume= 0.979 af
Routed to Pond CB-9 : CB-9

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 13.40' @ 12.38 hrs
Flood Elev= 15.05'

Device	Routing	Invert	Outlet Devices
#1	Primary	10.34'	**18.0" Round RCP_Round 18"** L= 403.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 10.34' / 9.89' S= 0.0011 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=4.97 cfs @ 12.44 hrs HW=13.30' TW=12.35' (Dynamic Tailwater)
1=RCP_Round 18" (Outlet Controls 4.97 cfs @ 2.81 fps)

Pond CB-10: CB-10



Summary for Pond CB-11: CB-11

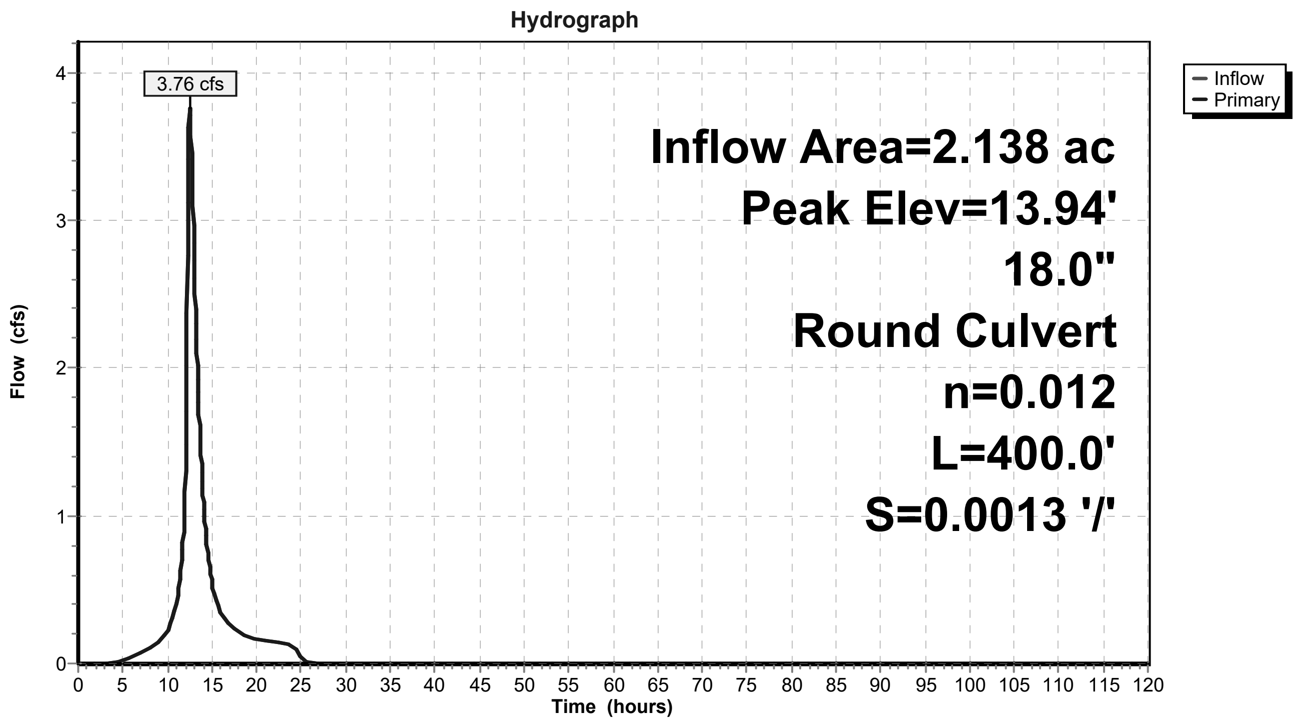
Inflow Area = 2.138 ac, 73.44% Impervious, Inflow Depth = 4.21" for 10-YEAR event
Inflow = 3.76 cfs @ 12.49 hrs, Volume= 0.750 af
Outflow = 3.76 cfs @ 12.49 hrs, Volume= 0.750 af, Atten= 0%, Lag= 0.0 min
Primary = 3.76 cfs @ 12.49 hrs, Volume= 0.750 af
Routed to Pond CB-10 : CB-10

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 13.94' @ 12.42 hrs
Flood Elev= 15.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	10.84'	**18.0" Round Culvert** L= 400.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 10.84' / 10.34' S= 0.0013 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=4.19 cfs @ 12.49 hrs HW=13.81' TW=13.14' (Dynamic Tailwater)
1=Culvert (Outlet Controls 4.19 cfs @ 2.37 fps)

Pond CB-11: CB-11



Summary for Pond CB-12: CB-12

Inflow Area = 3.172 ac, 19.16% Impervious, Inflow Depth = 3.54" for 10-YEAR event
Inflow = 5.24 cfs @ 12.45 hrs, Volume= 0.936 af
Outflow = 5.24 cfs @ 12.45 hrs, Volume= 0.936 af, Atten= 0%, Lag= 0.0 min
Primary = 4.56 cfs @ 12.68 hrs, Volume= 0.907 af
Routed to Pond MH-1 : MANHOLE-1
Secondary = 1.41 cfs @ 12.42 hrs, Volume= 0.029 af

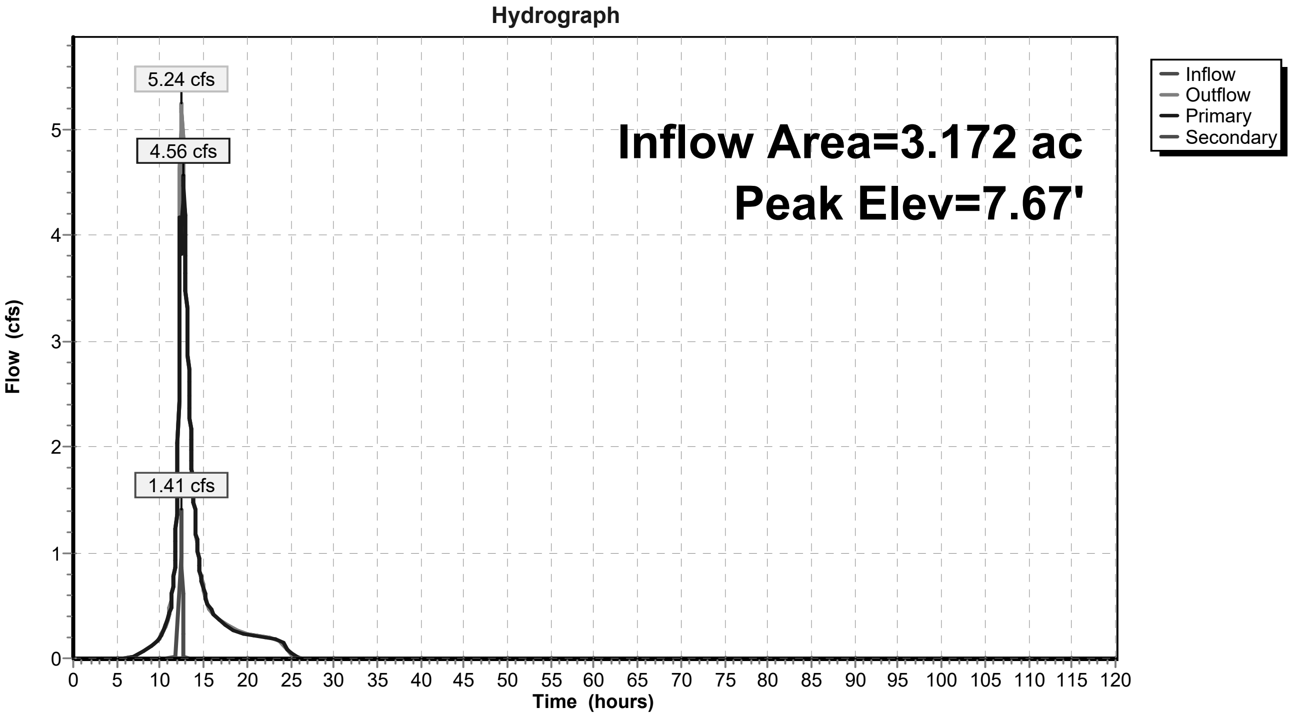
Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 7.67' @ 12.42 hrs
Flood Elev= 6.97'

Device	Routing	Invert	Outlet Devices
#1	Primary	3.13'	**18.0" Round Culvert** L= 32.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 3.13' / 2.35' S= 0.0244 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf
#2	Secondary	7.25'	**2.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=5.15 cfs @ 12.68 hrs HW=7.30' TW=6.94' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 5.15 cfs @ 2.91 fps)

Secondary OutFlow Max=1.35 cfs @ 12.42 hrs HW=7.66' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 1.35 cfs @ 1.66 fps)

Pond CB-12: CB-12



Summary for Pond CB-13: CB-13

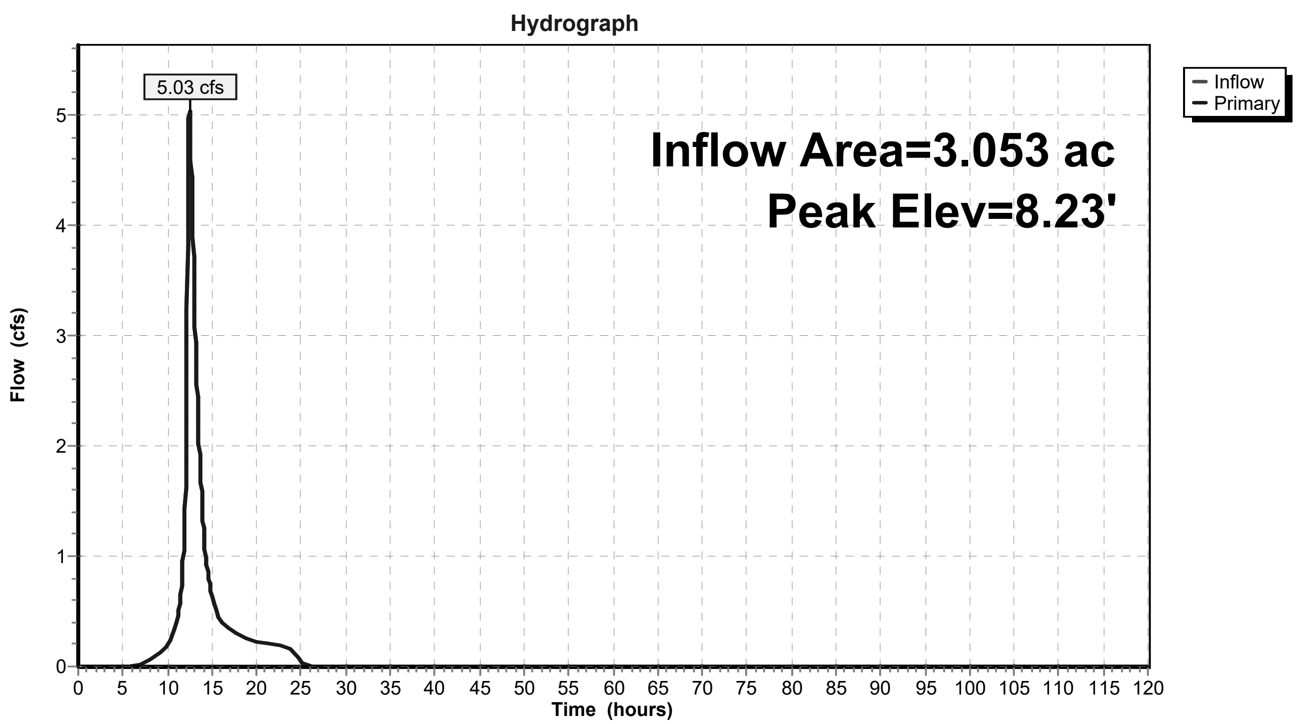
Inflow Area = 3.053 ac, 18.61% Impervious, Inflow Depth = 3.55" for 10-YEAR event
Inflow = 5.03 cfs @ 12.46 hrs, Volume= 0.904 af
Outflow = 5.03 cfs @ 12.46 hrs, Volume= 0.904 af, Atten= 0%, Lag= 0.0 min
Primary = 5.03 cfs @ 12.46 hrs, Volume= 0.904 af
Routed to Pond CB-12 : CB-12

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 8.23' @ 12.45 hrs
Flood Elev= 7.93'

Device	Routing	Invert	Outlet Devices
#1	Primary	4.85'	**18.0" Round RCP_Round 18" w/ 9.0" inside fill** L= 40.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 4.10' / 3.13' S= 0.0242 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.88 sf
#2	Primary	7.93'	**4.0' long x 40.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=5.05 cfs @ 12.46 hrs HW=8.23' TW=7.64' (Dynamic Tailwater)
1=RCP_Round 18" (Inlet Controls 3.26 cfs @ 3.69 fps)
2=Broad-Crested Rectangular Weir (Weir Controls 1.79 cfs @ 1.48 fps)

Pond CB-13: CB-13



Summary for Pond CB-14: CB-14

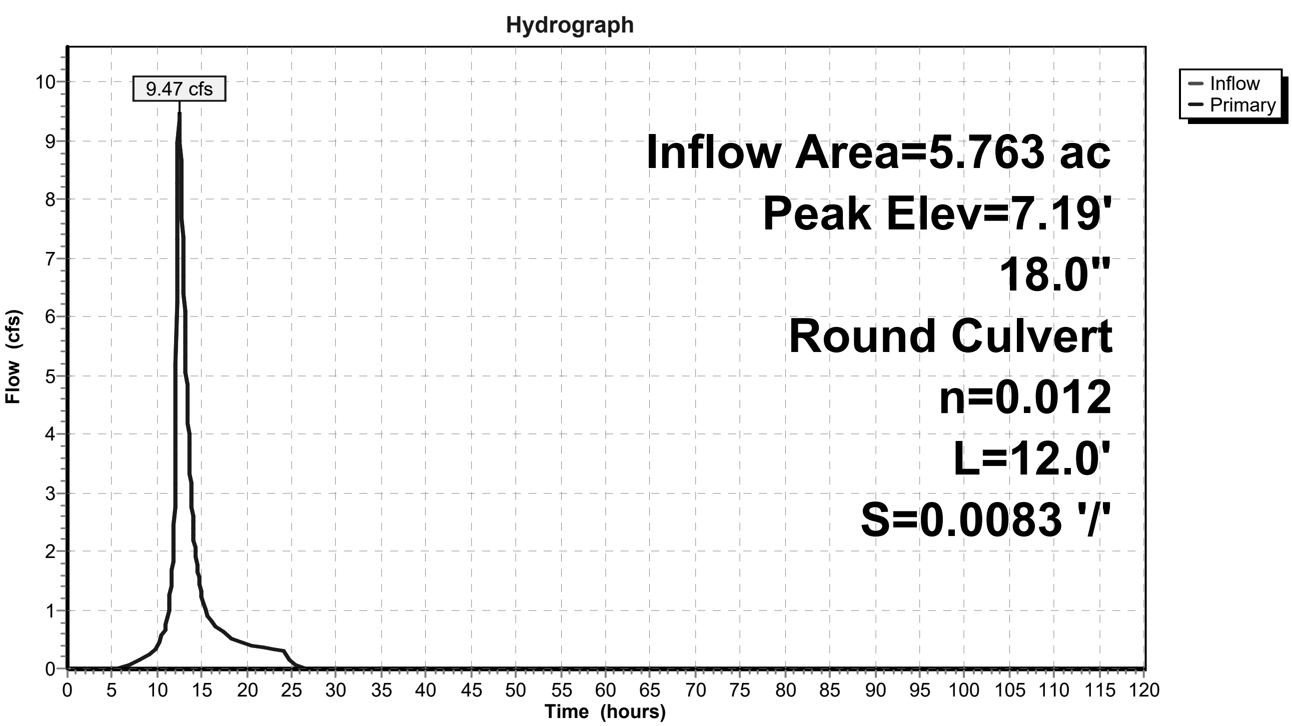
Inflow Area = 5.763 ac, 33.62% Impervious, Inflow Depth = 3.59" for 10-YEAR event
Inflow = 9.47 cfs @ 12.46 hrs, Volume= 1.724 af
Outflow = 9.47 cfs @ 12.46 hrs, Volume= 1.724 af, Atten= 0%, Lag= 0.0 min
Primary = 9.47 cfs @ 12.46 hrs, Volume= 1.724 af
Routed to Pond MH-2 : MANHOLE-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 7.19' @ 12.48 hrs
Flood Elev= 6.16'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.94'	**18.0" Round RCP_Round 18"** L= 12.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2.94' / 2.84' S= 0.0083 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=9.18 cfs @ 12.46 hrs HW=7.17' TW=6.01' (Dynamic Tailwater)
1=RCP_Round 18" (Inlet Controls 9.18 cfs @ 5.19 fps)

Pond CB-14: CB-14



Summary for Pond CB-15: CB-15

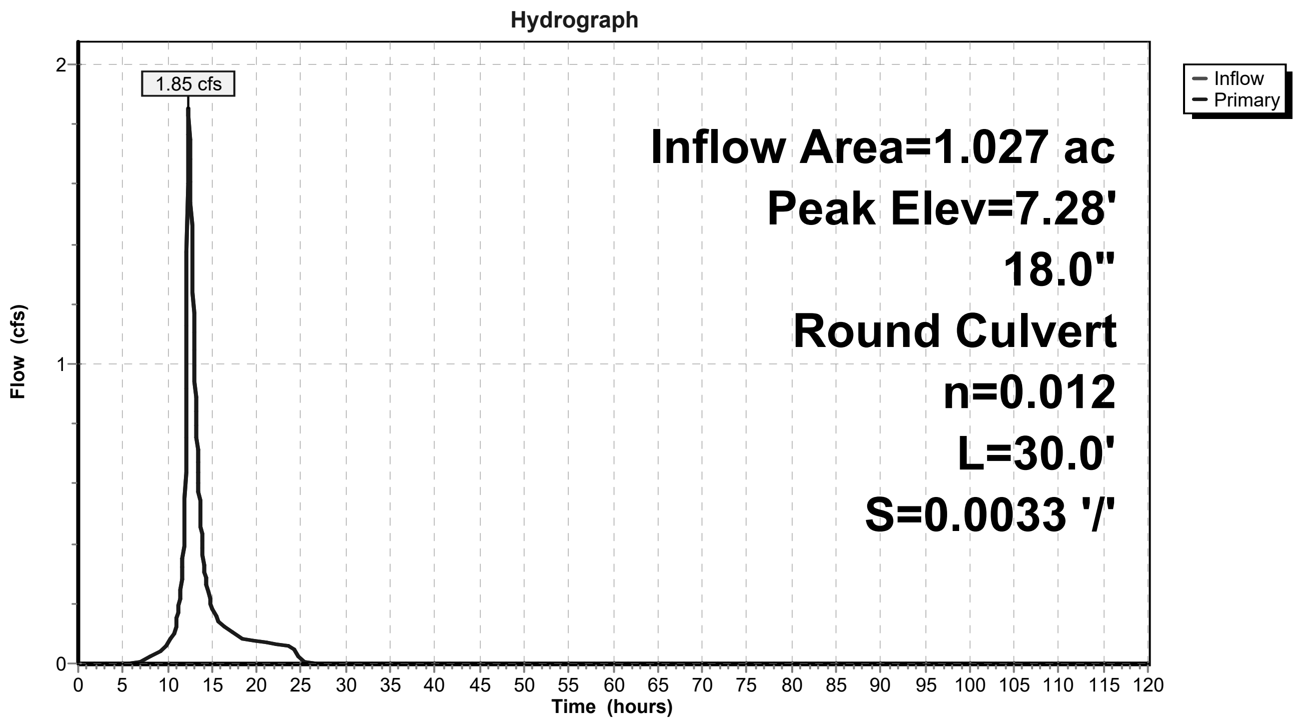
Inflow Area = 1.027 ac, 26.93% Impervious, Inflow Depth = 3.45" for 10-YEAR event
Inflow = 1.85 cfs @ 12.38 hrs, Volume= 0.296 af
Outflow = 1.85 cfs @ 12.38 hrs, Volume= 0.296 af, Atten= 0%, Lag= 0.0 min
Primary = 1.85 cfs @ 12.38 hrs, Volume= 0.296 af
Routed to Pond CB-14 : CB-14

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 7.28' @ 12.48 hrs
Flood Elev= 6.74'

Device	Routing	Invert	Outlet Devices
#1	Primary	3.04'	**18.0" Round RCP_Round 18"** L= 30.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 3.04' / 2.94' S= 0.0033 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=0.89 cfs @ 12.38 hrs HW=7.06' TW=7.04' (Dynamic Tailwater)
↑—**1=RCP_Round 18"** (Inlet Controls 0.89 cfs @ 0.50 fps)

Pond CB-15: CB-15



Summary for Pond CB-16: CB-16

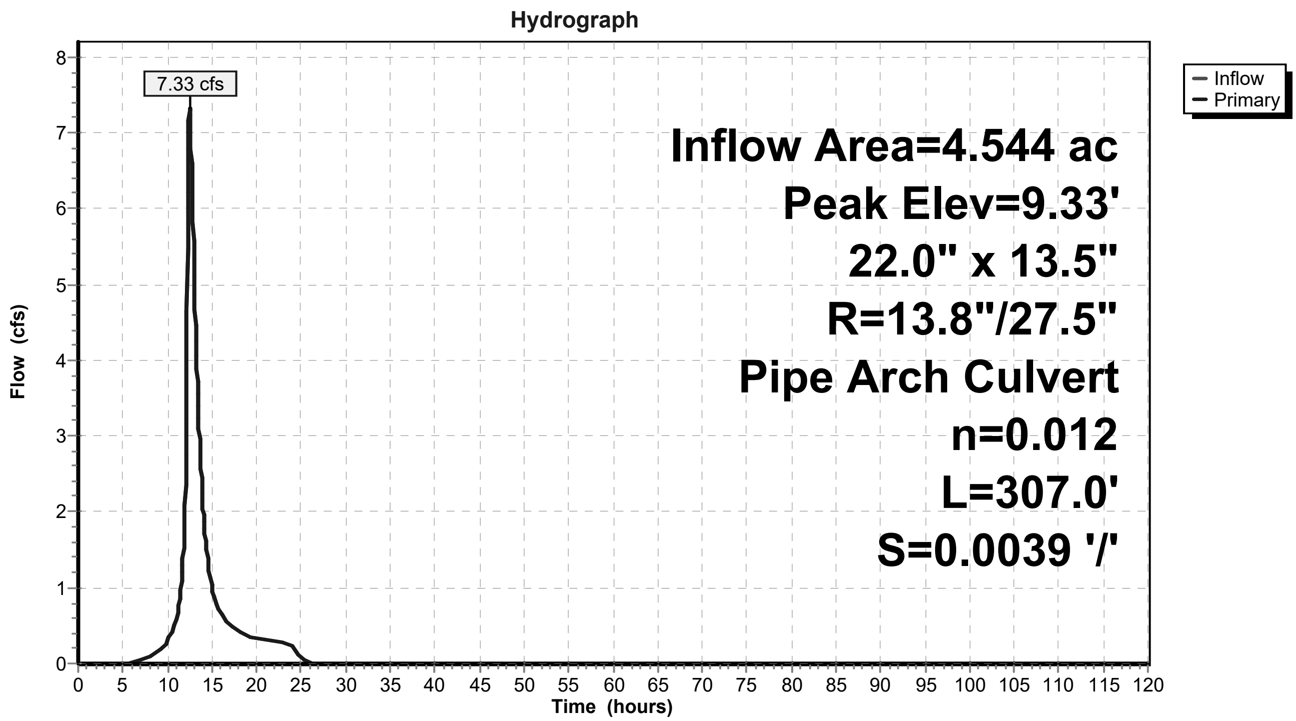
Inflow Area = 4.544 ac, 33.28% Impervious, Inflow Depth = 3.59" for 10-YEAR event
Inflow = 7.33 cfs @ 12.47 hrs, Volume= 1.359 af
Outflow = 7.33 cfs @ 12.47 hrs, Volume= 1.359 af, Atten= 0%, Lag= 0.0 min
Primary = 7.33 cfs @ 12.47 hrs, Volume= 1.359 af
Routed to Pond CB-14 : CB-14

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 9.33' @ 12.47 hrs
Flood Elev= 9.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	4.14'	**22.0" W x 13.5" H, R=13.8"/27.5" Pipe Arch RCP_Arch 22x14** L= 307.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 4.14' / 2.94' S= 0.0039 '/' Cc= 0.900 n= 0.012, Flow Area= 1.65 sf

Primary OutFlow Max=7.40 cfs @ 12.47 hrs HW=9.31' TW=7.18' (Dynamic Tailwater)
↑—**1=RCP_Arch 22x14** (Outlet Controls 7.40 cfs @ 4.48 fps)

Pond CB-16: CB-16



Summary for Pond CB-17: CB-17

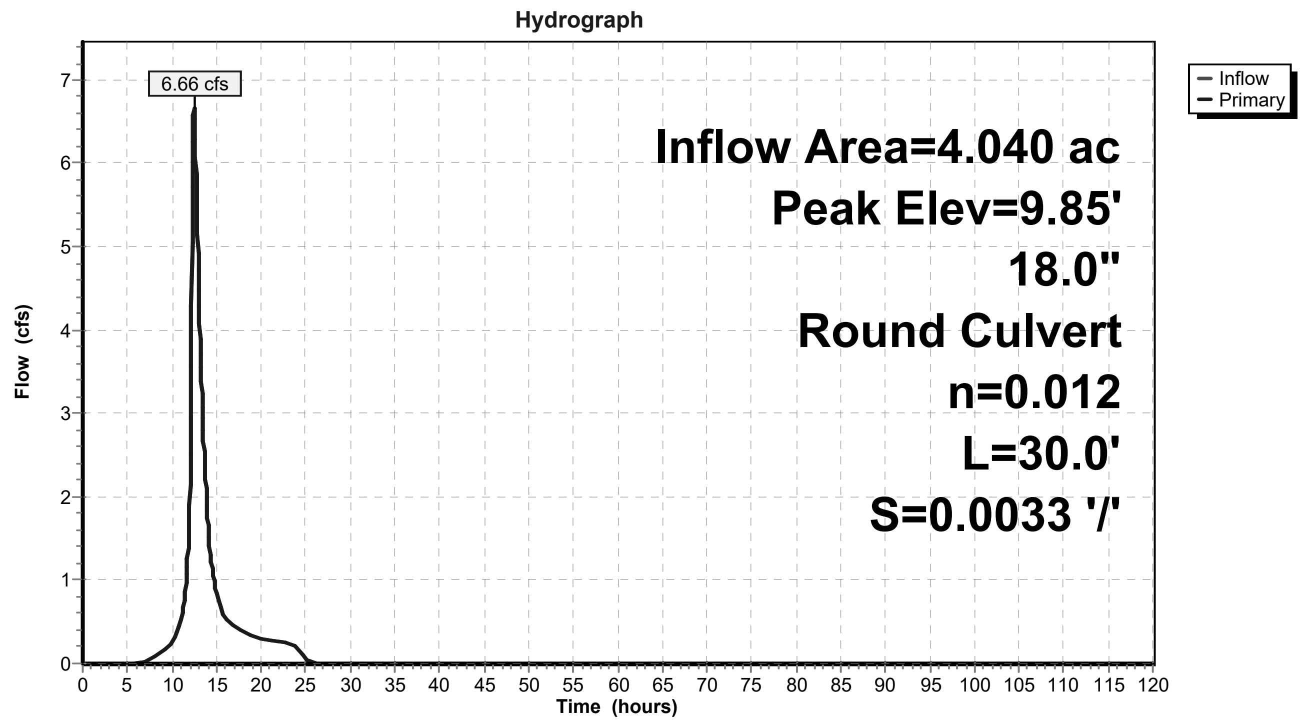
Inflow Area = 4.040 ac, 30.74% Impervious, Inflow Depth = 3.55" for 10-YEAR event
Inflow = 6.66 cfs @ 12.46 hrs, Volume= 1.196 af
Outflow = 6.66 cfs @ 12.46 hrs, Volume= 1.196 af, Atten= 0%, Lag= 0.0 min
Primary = 6.66 cfs @ 12.46 hrs, Volume= 1.196 af
Routed to Pond CB-16 : CB-16

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 9.85' @ 12.49 hrs
Flood Elev= 9.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	4.24'	**18.0" Round RCP_Round 18"** L= 30.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 4.24' / 4.14' S= 0.0033 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=6.15 cfs @ 12.46 hrs HW=9.83' TW=9.31' (Dynamic Tailwater)
1=RCP_Round 18" (Inlet Controls 6.15 cfs @ 3.48 fps)

Pond CB-17: CB-17



Summary for Pond CB-2: CB-2

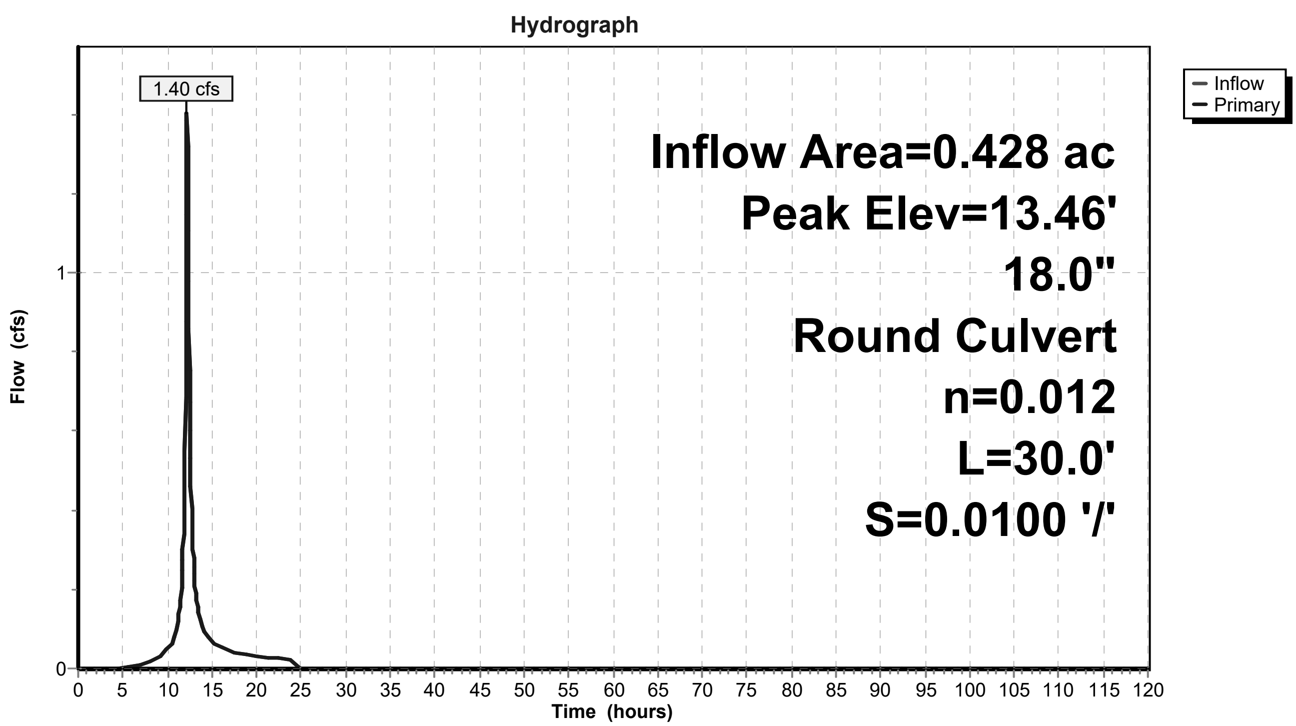
Inflow Area = 0.428 ac, 62.33% Impervious, Inflow Depth = 3.86" for 10-YEAR event
Inflow = 1.40 cfs @ 12.18 hrs, Volume= 0.138 af
Outflow = 1.40 cfs @ 12.18 hrs, Volume= 0.138 af, Atten= 0%, Lag= 0.0 min
Primary = 1.40 cfs @ 12.18 hrs, Volume= 0.138 af
Routed to Pond CB-10 : CB-10

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 13.46' @ 12.40 hrs
Flood Elev= 14.98'

Device	Routing	Invert	Outlet Devices
#1	Primary	12.48'	**18.0" Round RCP_Round 18"** L= 30.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 12.48' / 12.18' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=1.38 cfs @ 12.18 hrs HW=13.03' TW=12.00' (Dynamic Tailwater)
1=RCP_Round 18" (Barrel Controls 1.38 cfs @ 3.47 fps)

Pond CB-2: CB-2



Summary for Pond CB-3: CB-3

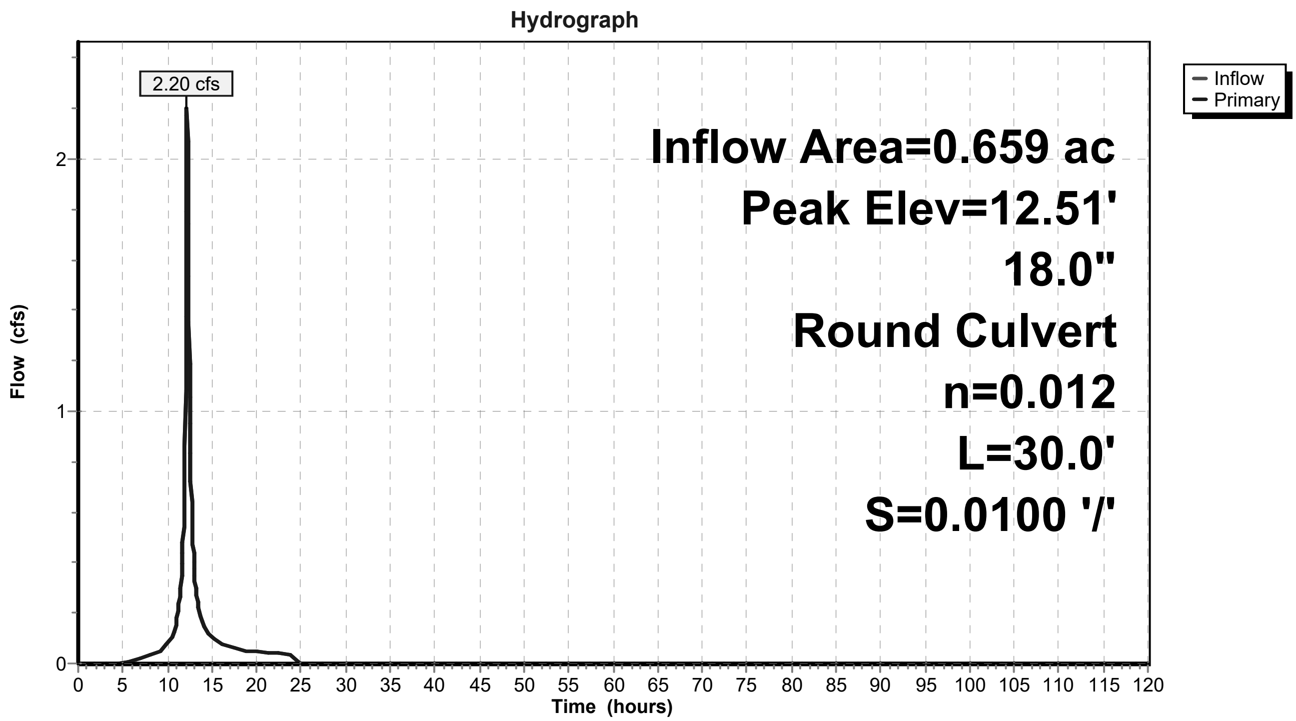
Inflow Area = 0.659 ac, 55.35% Impervious, Inflow Depth = 3.96" for 10-YEAR event
Inflow = 2.20 cfs @ 12.18 hrs, Volume= 0.218 af
Outflow = 2.20 cfs @ 12.18 hrs, Volume= 0.218 af, Atten= 0%, Lag= 0.0 min
Primary = 2.20 cfs @ 12.18 hrs, Volume= 0.218 af
Routed to Pond CB-9 : CB-9

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 12.51' @ 12.36 hrs
Flood Elev= 13.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	10.70'	**18.0" Round RCP_Round 18"** L= 30.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 10.70' / 10.40' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=1.27 cfs @ 12.18 hrs HW=11.64' TW=11.56' (Dynamic Tailwater)
└─**1=RCP_Round 18"** (Outlet Controls 1.27 cfs @ 1.55 fps)

Pond CB-3: CB-3



Summary for Pond CB-4: CB-4

Inflow Area = 0.882 ac, 56.67% Impervious, Inflow Depth = 3.86" for 10-YEAR event
Inflow = 2.63 cfs @ 12.21 hrs, Volume= 0.284 af
Outflow = 2.63 cfs @ 12.21 hrs, Volume= 0.284 af, Atten= 0%, Lag= 0.0 min
Primary = 2.63 cfs @ 12.21 hrs, Volume= 0.278 af
Routed to Pond CB-8 : CB-8
Secondary = 0.43 cfs @ 12.36 hrs, Volume= 0.005 af
Routed to Pond CB-5 : CB-5

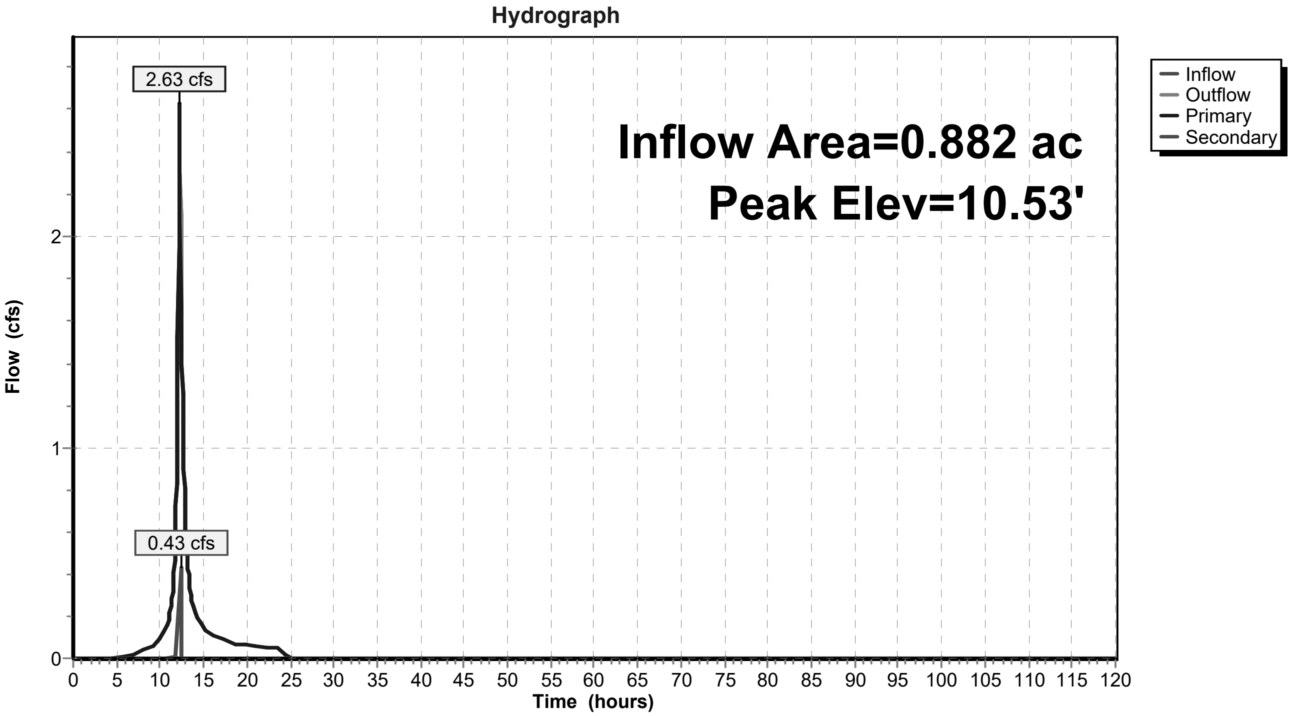
Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 10.53' @ 12.36 hrs
Flood Elev= 10.44'

Device	Routing	Invert	Outlet Devices
#1	Primary	5.16'	**18.0" Round RCP_Round 18"** L= 30.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 5.16' / 4.86' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf
#2	Secondary	10.43'	**5.0' long x 392.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.00 cfs @ 12.21 hrs HW=10.25' TW=10.26' (Dynamic Tailwater)
└─**1=RCP_Round 18"** (Controls 0.00 cfs)

Secondary OutFlow Max=0.41 cfs @ 12.36 hrs HW=10.53' TW=7.41' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir**(Weir Controls 0.41 cfs @ 0.84 fps)

Pond CB-4: CB-4


Hydrograph
2.63 cfs
0.43 cfs
Inflow Area=0.882 ac
Peak Elev=10.53'
Inflow
Outflow
Primary
Secondary
Flow (cfs)
0
1
2
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120
Time (hours)

Summary for Pond CB-5: CB-5

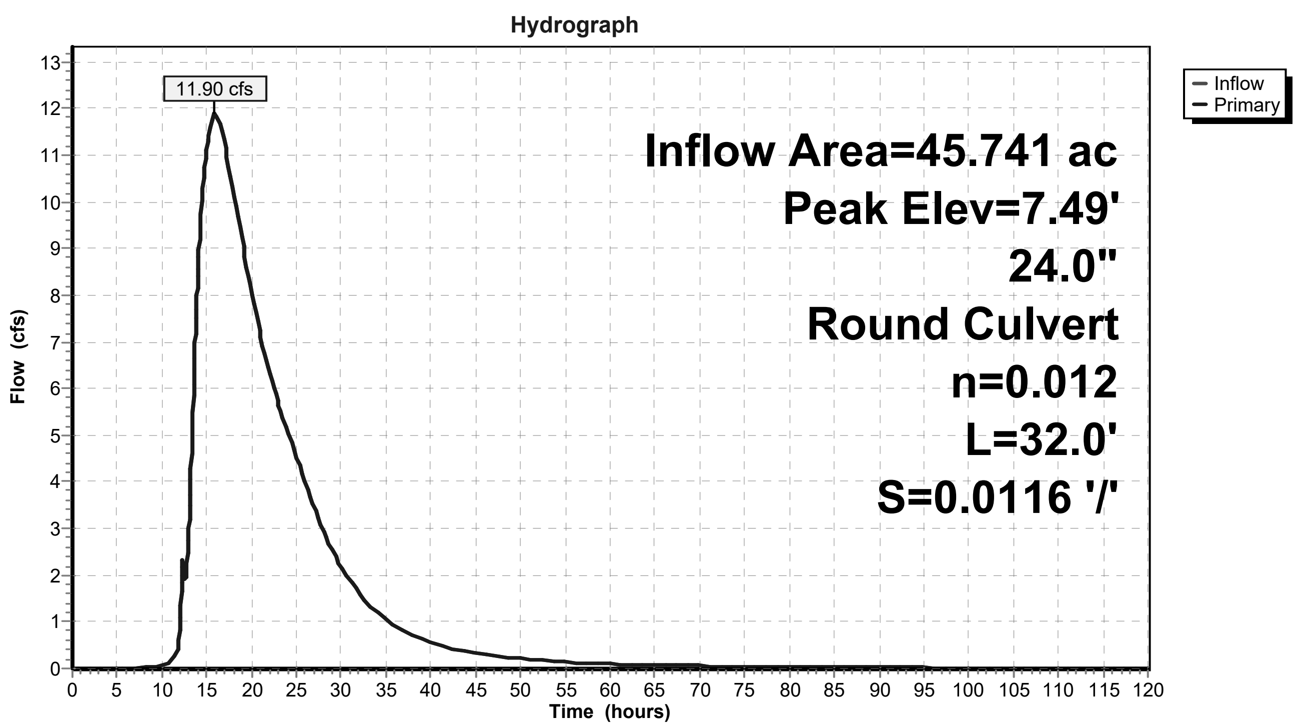
Inflow Area = 45.741 ac, 2.73% Impervious, Inflow Depth > 2.94" for 10-YEAR event
Inflow = 11.90 cfs @ 15.90 hrs, Volume= 11.208 af
Outflow = 11.90 cfs @ 15.90 hrs, Volume= 11.208 af, Atten= 0%, Lag= 0.0 min
Primary = 11.90 cfs @ 15.90 hrs, Volume= 11.208 af
Routed to Pond CB-6 : CB-6

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 7.49' @ 12.44 hrs
Flood Elev= 6.84'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.74'	**24.0" Round RCP_Round 24"** L= 32.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2.74' / 2.37' S= 0.0116 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf

Primary OutFlow Max=11.83 cfs @ 15.90 hrs HW=6.64' TW=6.03' (Dynamic Tailwater)
1=RCP_Round 24" (Inlet Controls 11.83 cfs @ 3.77 fps)

Pond CB-5: CB-5



Summary for Pond CB-6: CB-6

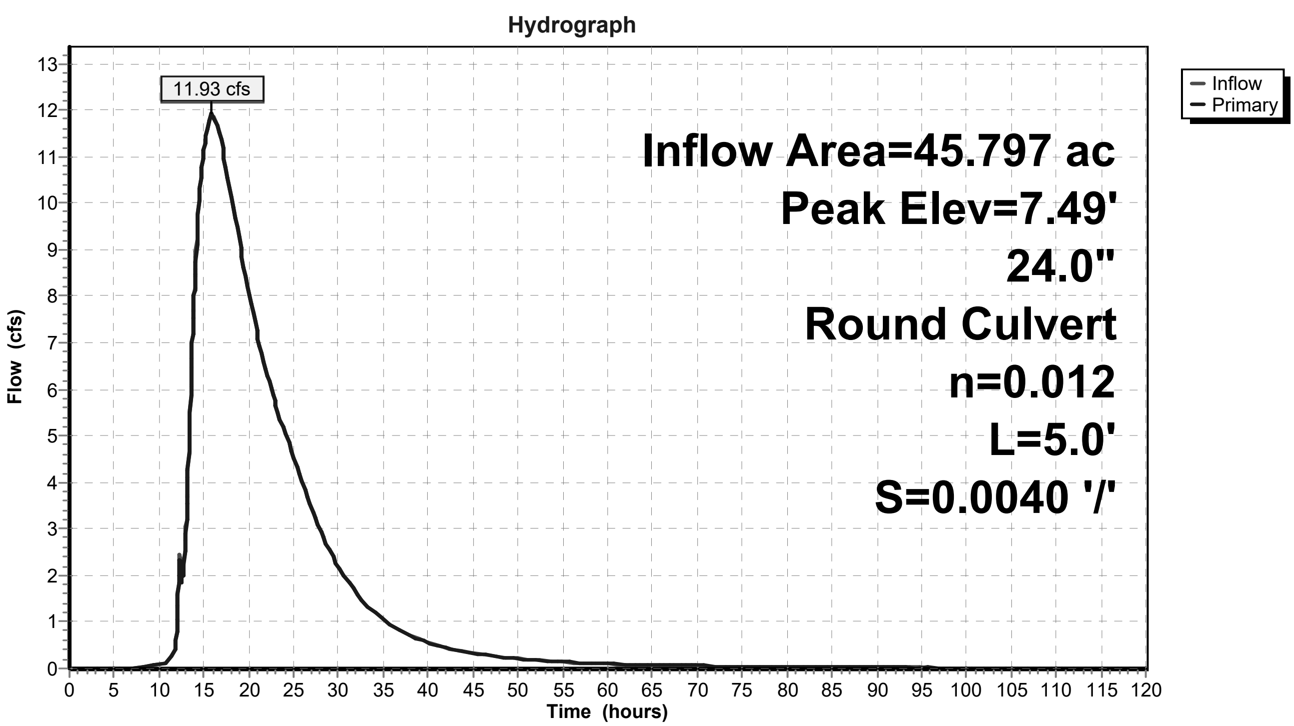
Inflow Area = 45.797 ac, 2.84% Impervious, Inflow Depth > 2.94" for 10-YEAR event
Inflow = 11.91 cfs @ 15.90 hrs, Volume= 11.229 af
Outflow = 11.93 cfs @ 15.90 hrs, Volume= 11.229 af, Atten= 0%, Lag= 0.0 min
Primary = 11.93 cfs @ 15.90 hrs, Volume= 11.229 af
Routed to Pond MH-1 : MANHOLE-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 7.49' @ 12.41 hrs
Flood Elev= 6.88'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.37'	**24.0" Round RCP_Round 24"** L= 5.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2.37' / 2.35' S= 0.0040 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf

Primary OutFlow Max=11.90 cfs @ 15.90 hrs HW=6.03' TW=5.41' (Dynamic Tailwater)
1=RCP_Round 24" (Inlet Controls 11.90 cfs @ 3.79 fps)

Pond CB-6: CB-6



Summary for Pond CB-7: CB-7

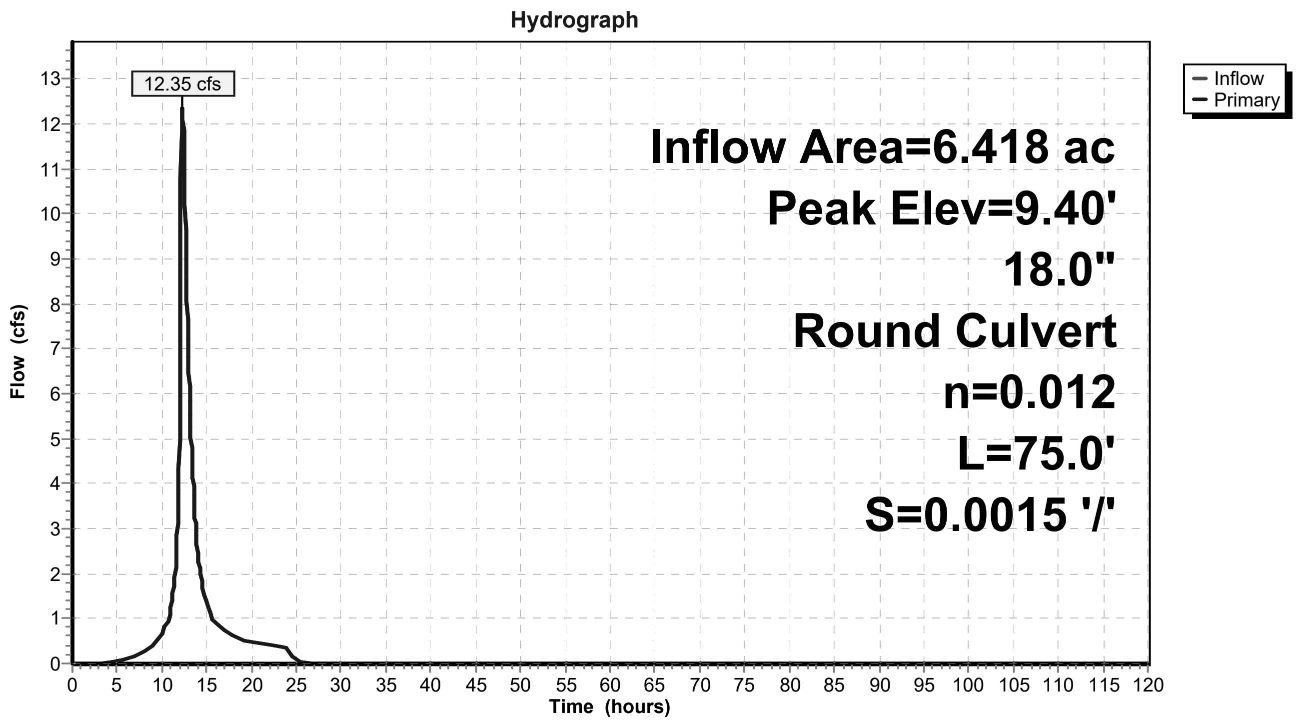
Inflow Area = 6.418 ac, 63.74% Impervious, Inflow Depth = 3.98" for 10-YEAR event
Inflow = 12.35 cfs @ 12.27 hrs, Volume= 2.131 af
Outflow = 12.35 cfs @ 12.27 hrs, Volume= 2.131 af, Atten= 0%, Lag= 0.0 min
Primary = 12.35 cfs @ 12.27 hrs, Volume= 2.131 af
Routed to Pond MH-1 : MANHOLE-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 9.40' @ 12.39 hrs
Flood Elev= 7.62'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.46'	**18.0" Round Round 18"** L= 75.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2.46' / 2.35' S= 0.0015 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=11.59 cfs @ 12.27 hrs HW=8.95' TW=7.09' (Dynamic Tailwater)
↑—**1=Round 18"** (Inlet Controls 11.59 cfs @ 6.56 fps)

Pond CB-7: CB-7



Summary for Pond CB-8: CB-8

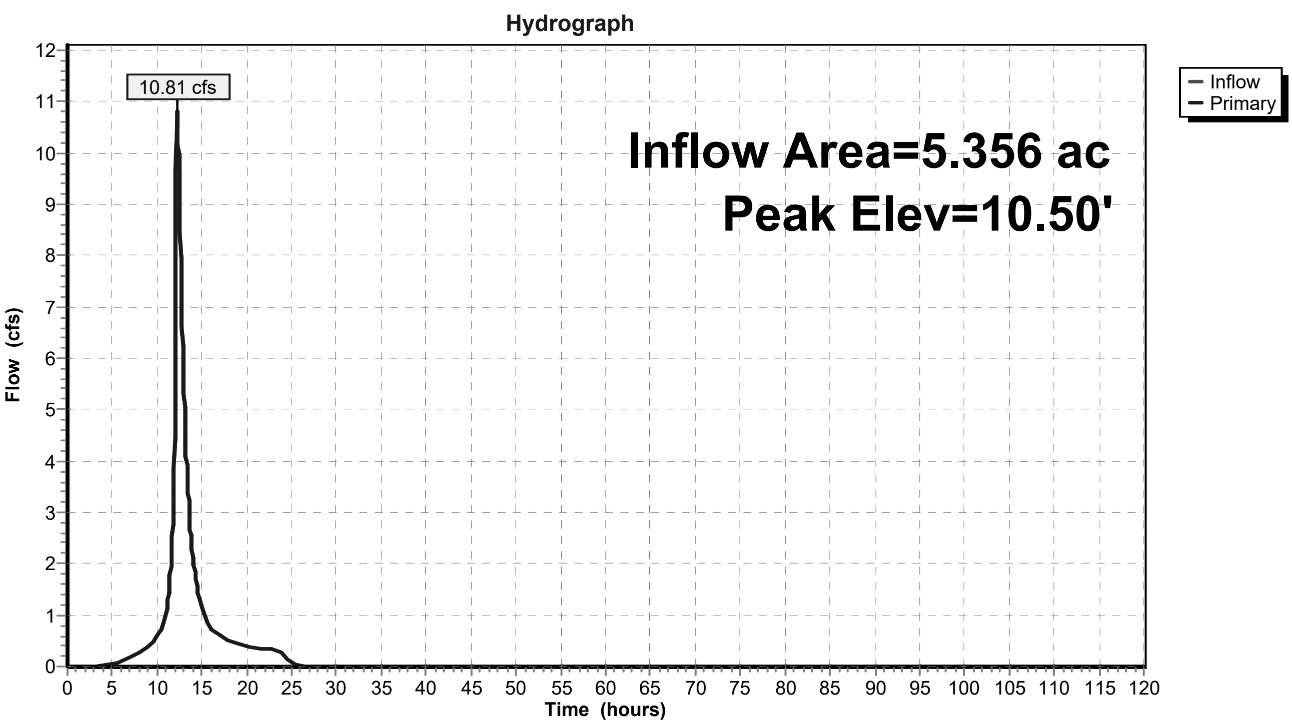
Inflow Area = 5.356 ac, 66.27% Impervious, Inflow Depth = 4.05" for 10-YEAR event
Inflow = 10.81 cfs @ 12.25 hrs, Volume= 1.807 af
Outflow = 10.81 cfs @ 12.25 hrs, Volume= 1.807 af, Atten= 0%, Lag= 0.0 min
Primary = 10.81 cfs @ 12.25 hrs, Volume= 1.807 af
Routed to Pond CB-7 : CB-7

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 10.50' @ 12.35 hrs
Flood Elev= 9.98'

Device	Routing	Invert	Outlet Devices
#1	Primary	4.86'	**18.0" Round RCP_Round 18"** L= 320.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 4.86' / 2.46' S= 0.0075 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf
#2	Primary	9.97'	**4.0' long x 322.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=10.18 cfs @ 12.25 hrs HW=10.40' TW=8.73' (Dynamic Tailwater)
1=RCP_Round 18" (Outlet Controls 7.19 cfs @ 4.07 fps)
2=Broad-Crested Rectangular Weir (Weir Controls 2.99 cfs @ 1.76 fps)

Pond CB-8: CB-8



Summary for Pond CB-9: CB-9

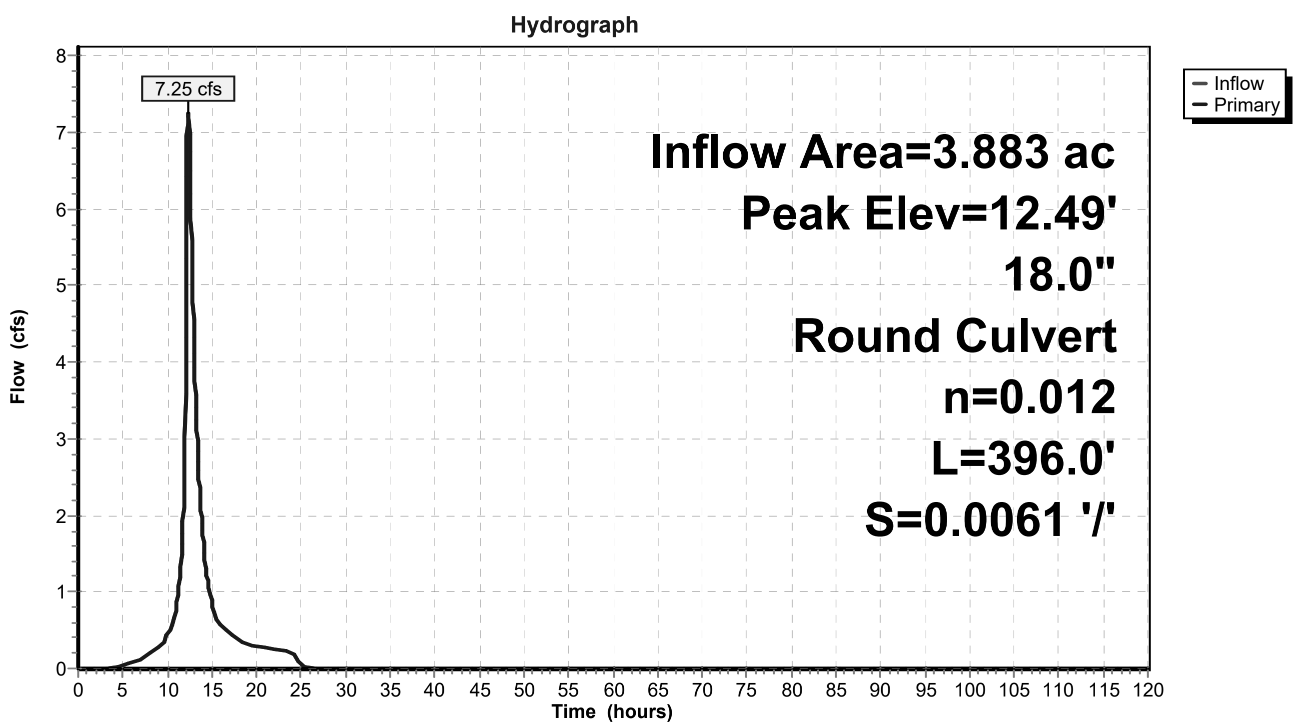
Inflow Area = 3.883 ac, 69.52% Impervious, Inflow Depth = 4.14" for 10-YEAR event
Inflow = 7.25 cfs @ 12.33 hrs, Volume= 1.339 af
Outflow = 7.25 cfs @ 12.33 hrs, Volume= 1.339 af, Atten= 0%, Lag= 0.0 min
Primary = 7.25 cfs @ 12.33 hrs, Volume= 1.339 af
Routed to Pond CB-8 : CB-8

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 12.49' @ 12.35 hrs
Flood Elev= 12.42'

Device	Routing	Invert	Outlet Devices
#1	Primary	9.89'	**18.0" Round RCP_Round 18"** L= 396.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.89' / 7.47' S= 0.0061 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=7.20 cfs @ 12.33 hrs HW=12.47' TW=10.50' (Dynamic Tailwater)
└─**1=RCP_Round 18"** (Outlet Controls 7.20 cfs @ 4.07 fps)

Pond CB-9: CB-9



Summary for Pond MH-1: MANHOLE-1

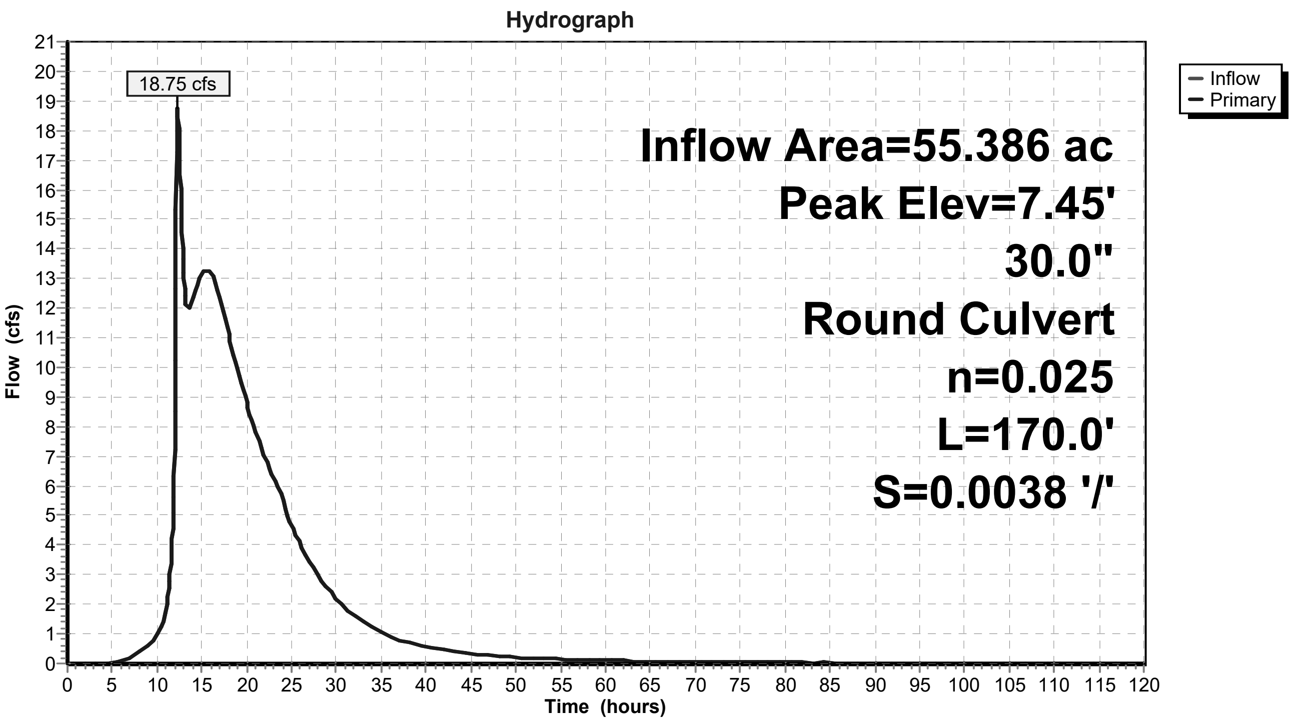
Inflow Area = 55.386 ac, 10.83% Impervious, Inflow Depth > 3.09" for 10-YEAR event
Inflow = 18.75 cfs @ 12.30 hrs, Volume= 14.267 af
Outflow = 18.75 cfs @ 12.30 hrs, Volume= 14.267 af, Atten= 0%, Lag= 0.0 min
Primary = 18.75 cfs @ 12.30 hrs, Volume= 14.267 af
Routed to Pond MH-2 : MANHOLE-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 7.45' @ 12.40 hrs
Flood Elev= 6.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.35'	**30.0" Round CMP_Round 30"** L= 170.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2.35' / 1.70' S= 0.0038 '/' Cc= 0.900 n= 0.025, Flow Area= 4.91 sf

Primary OutFlow Max=18.44 cfs @ 12.30 hrs HW=7.35' TW=5.75' (Dynamic Tailwater)
└─**1=CMP_Round 30"** (Outlet Controls 18.44 cfs @ 3.76 fps)

Pond MH-1: MANHOLE-1



Summary for Pond MH-2: MANHOLE-2

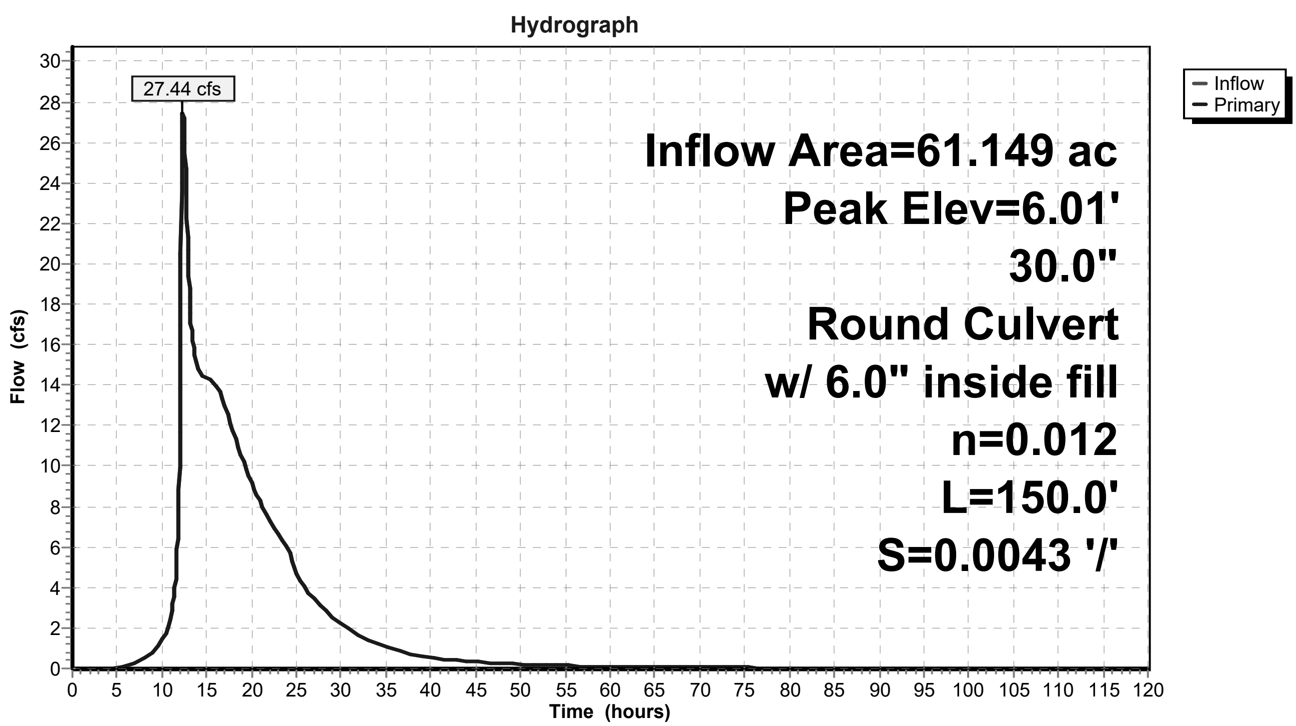
Inflow Area = 61.149 ac, 12.98% Impervious, Inflow Depth > 3.14" for 10-YEAR event
Inflow = 27.44 cfs @ 12.37 hrs, Volume= 15.991 af
Outflow = 27.44 cfs @ 12.37 hrs, Volume= 15.991 af, Atten= 0%, Lag= 0.0 min
Primary = 27.44 cfs @ 12.37 hrs, Volume= 15.991 af
Routed to Pond 40P : C-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 6.01' @ 12.46 hrs
Flood Elev= 6.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.20'	**30.0" Round Culvert w/ 6.0" inside fill** L= 150.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1.70' / 1.06' S= 0.0043 '/' Cc= 0.900 n= 0.012, Flow Area= 4.21 sf

Primary OutFlow Max=27.39 cfs @ 12.37 hrs HW=5.94' TW=4.05' (Dynamic Tailwater)
1=Culvert (Outlet Controls 27.39 cfs @ 6.51 fps)

Pond MH-2: MANHOLE-2



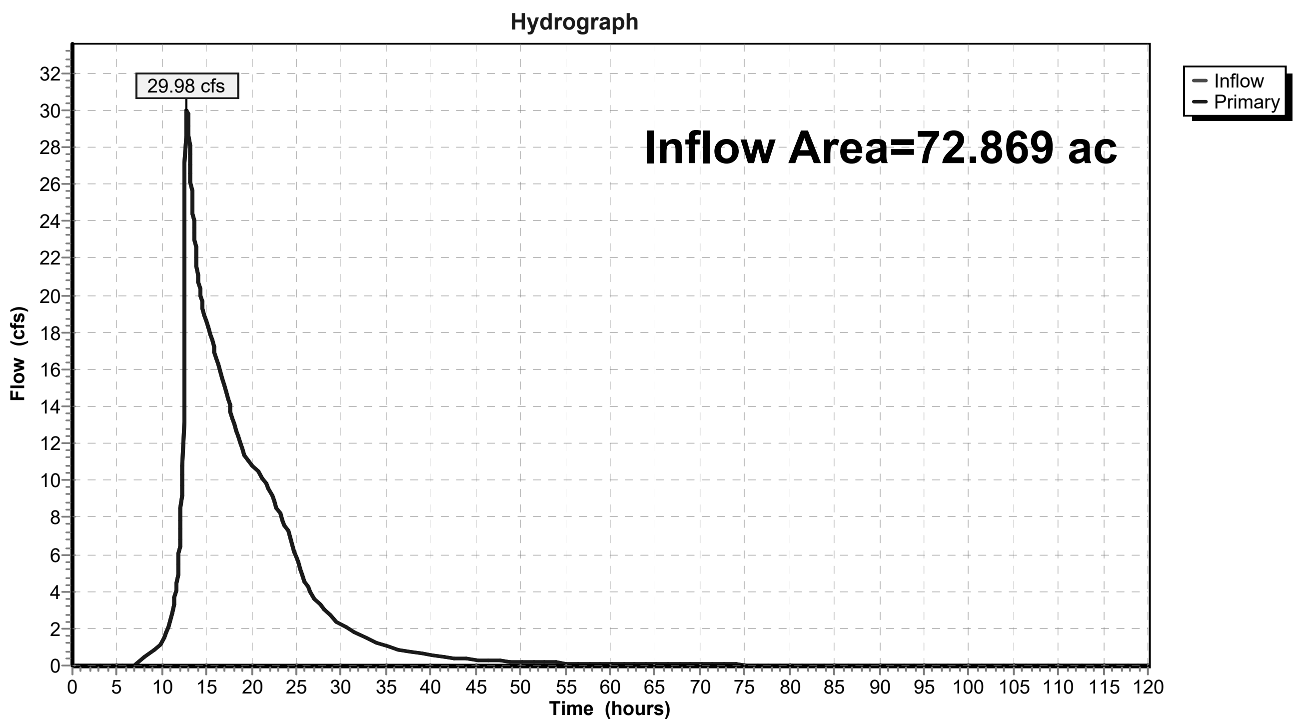
Summary for Link 43L: MHHW

Inflow Area = 72.869 ac, 12.41% Impervious, Inflow Depth > 3.03" for 10-YEAR event
Inflow = 29.98 cfs @ 12.79 hrs, Volume= 18.423 af
Primary = 29.98 cfs @ 12.79 hrs, Volume= 18.423 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs

Fixed water surface Elevation= 2.89'

Link 43L: MHHW



Time span=0.00-120.00 hrs, dt=0.05 hrs, 2401 points x 2
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: CB-1 Runoff Area=60,375 sf 76.98% Impervious Runoff Depth=5.56"
Flow Length=714' Tc=30.6 min CN=92 Runoff=3.40 cfs 0.642 af

Subcatchment2S: CB-11 Runoff Area=32,762 sf 66.90% Impervious Runoff Depth=5.33"
Flow Length=374' Tc=40.3 min CN=90 Runoff=1.52 cfs 0.334 af

Subcatchment3S: CB-2 Runoff Area=18,624 sf 62.33% Impervious Runoff Depth=5.11"
Flow Length=82' Tc=8.9 min CN=88 Runoff=1.85 cfs 0.182 af

Subcatchment4S: CB-10 Runoff Area=11,778 sf 68.53% Impervious Runoff Depth=5.33"
Flow Length=200' Tc=34.9 min CN=90 Runoff=0.60 cfs 0.120 af

Subcatchment5S: CB-3 Runoff Area=28,691 sf 55.35% Impervious Runoff Depth=5.22"
Flow Length=339' Tc=9.0 min CN=89 Runoff=2.86 cfs 0.287 af

Subcatchment6S: CB-9 Runoff Area=16,934 sf 80.61% Impervious Runoff Depth=5.68"
Flow Length=347' Tc=22.0 min CN=93 Runoff=1.16 cfs 0.184 af

Subcatchment7S: CB-4 Runoff Area=38,400 sf 56.67% Impervious Runoff Depth=5.11"
Flow Length=125' Tc=11.2 min CN=88 Runoff=3.44 cfs 0.375 af

Subcatchment8S: CB-8 Runoff Area=25,733 sf 59.19% Impervious Runoff Depth=5.11"
Flow Length=273' Tc=21.5 min CN=88 Runoff=1.65 cfs 0.251 af

Subcatchment9S: CB-5 Runoff Area=39,037 sf 49.18% Impervious Runoff Depth=4.89"
Flow Length=429' Tc=19.5 min CN=86 Runoff=2.55 cfs 0.365 af

Subcatchment10S: CB-7 Runoff Area=46,251 sf 51.01% Impervious Runoff Depth=4.89"
Flow Length=465' Tc=27.4 min CN=86 Runoff=2.51 cfs 0.432 af

Subcatchment11S: CB-6 Runoff Area=2,434 sf 88.34% Impervious Runoff Depth=5.91"
Flow Length=10' Slope=0.0020 '/' Tc=5.6 min CN=95 Runoff=0.31 cfs 0.028 af

Subcatchment12S: CB-13 Runoff Area=132,969 sf 18.61% Impervious Runoff Depth=4.78"
Flow Length=709' Tc=29.7 min CN=85 Runoff=6.73 cfs 1.215 af

Subcatchment13S: CB-12 Runoff Area=5,191 sf 33.31% Impervious Runoff Depth=4.45"
Flow Length=71' Slope=0.0127 '/' Tc=12.8 min CN=82 Runoff=0.39 cfs 0.044 af

Subcatchment14S: CB-14 Runoff Area=8,326 sf 77.79% Impervious Runoff Depth=5.68"
Flow Length=120' Slope=0.0034 '/' Tc=33.0 min CN=93 Runoff=0.45 cfs 0.090 af

Subcatchment15S: CB-15 Runoff Area=44,745 sf 26.93% Impervious Runoff Depth=4.67"
Flow Length=478' Tc=24.3 min CN=84 Runoff=2.49 cfs 0.399 af

Subcatchment16S: CB-16 Runoff Area=21,986 sf 53.58% Impervious Runoff Depth=5.11"
Flow Length=139' Tc=42.6 min CN=88 Runoff=0.95 cfs 0.215 af

Subcatchment17S: CB-17 Runoff Area=175,968 sf 30.74% Impervious Runoff Depth=4.78"
Flow Length=574' Tc=29.7 min CN=85 Runoff=8.90 cfs 1.608 af

Subcatchment18S: D-8 Runoff Area=510,532 sf 9.48% Impervious Runoff Depth=3.61"
Flow Length=624' Tc=66.3 min CN=74 Runoff=11.74 cfs 3.525 af

Subcatchment19S: LOW POINT BEHIND Runoff Area=726,316 sf 8.66% Impervious Runoff Depth=4.45"
Flow Length=992' Tc=44.2 min CN=82 Runoff=27.08 cfs 6.183 af

Subcatchment44S: W-1 Runoff Area=80,729 sf 0.00% Impervious Runoff Depth=3.92"
Flow Length=473' Tc=35.1 min CN=77 Runoff=3.05 cfs 0.605 af

Subcatchment45S: W-2 Runoff Area=1,571,690 sf 0.83% Impervious Runoff Depth=4.34"
Flow Length=1,444' Tc=71.4 min CN=81 Runoff=41.89 cfs 13.055 af

Subcatchment46S: w-3 Runoff Area=301,007 sf 7.39% Impervious Runoff Depth=4.34"
Flow Length=607' Tc=44.8 min CN=81 Runoff=10.87 cfs 2.500 af

Reach 48R: (new Reach) Avg. Flow Depth=2.50' Max Vel=2.11 fps Inflow=13.73 cfs 15.328 af
n=0.050 L=304.0' S=0.0058 '/' Capacity=13.73 cfs Outflow=13.73 cfs 15.328 af

Pond 40P: C-1 Peak Elev=4.38' Storage=45,639 cf Inflow=39.31 cfs 25.302 af
Outflow=38.77 cfs 25.268 af

Pond 44P: Culvert @ ditch Peak Elev=9.03' Inflow=13.73 cfs 15.328 af
Primary=11.78 cfs 11.266 af Secondary=10.47 cfs 4.062 af Outflow=13.73 cfs 15.328 af

Pond 46P: Farm Pond Peak Elev=8.78' Storage=25,671 cf Inflow=3.05 cfs 0.605 af
Outflow=1.14 cfs 0.301 af

Pond 47P: W-2 Peak Elev=11.71' Storage=150,890 cf Inflow=41.89 cfs 13.357 af
Outflow=24.32 cfs 13.357 af

Pond 48P: w-3 Peak Elev=11.71' Storage=209,511 cf Inflow=28.19 cfs 15.857 af
Outflow=13.73 cfs 15.328 af

Pond CB-1: CB-1 Peak Elev=17.11' Inflow=3.40 cfs 0.642 af
18.0" Round Culvert n=0.012 L=34.0' S=0.0100 '/' Outflow=3.40 cfs 0.642 af

Pond CB-10: CB-10 Peak Elev=16.06' Inflow=6.39 cfs 1.279 af
18.0" Round Culvert n=0.012 L=403.0' S=0.0011 '/' Outflow=6.39 cfs 1.279 af

Pond CB-11: CB-11 Peak Elev=16.96' Inflow=4.84 cfs 0.977 af
18.0" Round Culvert n=0.012 L=400.0' S=0.0013 '/' Outflow=4.84 cfs 0.977 af

Pond CB-12: CB-12 Peak Elev=8.45' Inflow=7.01 cfs 1.259 af
Primary=4.07 cfs 0.934 af Secondary=7.05 cfs 0.325 af Outflow=7.01 cfs 1.259 af

Pond CB-13: CB-13 Peak Elev=8.66' Inflow=6.73 cfs 1.215 af
Outflow=6.73 cfs 1.215 af

Pond CB-14: CB-14 Peak Elev=8.96' Inflow=12.64 cfs 2.312 af
18.0" Round Culvert n=0.012 L=12.0' S=0.0083 '/' Outflow=12.64 cfs 2.312 af

Pond CB-15: CB-15 Peak Elev=9.11' Inflow=2.49 cfs 0.399 af
18.0" Round Culvert n=0.012 L=30.0' S=0.0033 '/' Outflow=2.49 cfs 0.399 af

Pond CB-16: CB-16 Peak Elev=12.75' Inflow=9.78 cfs 1.823 af
22.0" x 13.5", R=13.8"/27.5" Pipe Arch Culvert n=0.012 L=307.0' S=0.0039 '/' Outflow=9.78 cfs 1.823 af

Pond CB-17: CB-17 Peak Elev=13.79' Inflow=8.90 cfs 1.608 af
18.0" Round Culvert n=0.012 L=30.0' S=0.0033 '/' Outflow=8.90 cfs 1.608 af

Pond CB-2: CB-2 Peak Elev=16.08' Inflow=1.85 cfs 0.182 af
18.0" Round Culvert n=0.012 L=30.0' S=0.0100 '/' Outflow=1.85 cfs 0.182 af

Pond CB-3: CB-3 Peak Elev=14.57' Inflow=2.86 cfs 0.287 af
18.0" Round Culvert n=0.012 L=30.0' S=0.0100 '/' Outflow=2.86 cfs 0.287 af

Pond CB-4: CB-4 Peak Elev=10.83' Inflow=3.44 cfs 0.375 af
Primary=2.76 cfs 0.279 af Secondary=3.35 cfs 0.097 af Outflow=3.44 cfs 0.375 af

Pond CB-5: CB-5 Peak Elev=9.00' Inflow=14.05 cfs 15.790 af
24.0" Round Culvert n=0.012 L=32.0' S=0.0116 '/' Outflow=14.05 cfs 15.790 af

Pond CB-6: CB-6 Peak Elev=8.73' Inflow=14.07 cfs 15.817 af
24.0" Round Culvert n=0.012 L=5.0' S=0.0040 '/' Outflow=14.08 cfs 15.817 af

Pond CB-7: CB-7 Peak Elev=11.05' Inflow=13.67 cfs 2.713 af
18.0" Round Culvert n=0.012 L=75.0' S=0.0015 '/' Outflow=13.67 cfs 2.713 af

Pond CB-8: CB-8 Peak Elev=11.25' Inflow=12.19 cfs 2.280 af
Outflow=12.19 cfs 2.280 af

Pond CB-9: CB-9 Peak Elev=14.49' Inflow=9.37 cfs 1.749 af
18.0" Round Culvert n=0.012 L=396.0' S=0.0061 '/' Outflow=9.37 cfs 1.749 af

Pond MH-1: MANHOLE-1 Peak Elev=8.57' Inflow=20.93 cfs 19.464 af
30.0" Round Culvert n=0.025 L=170.0' S=0.0038 '/' Outflow=20.93 cfs 19.464 af

Pond MH-2: MANHOLE-2 Peak Elev=6.82' Inflow=32.13 cfs 21.776 af
30.0" Round Culvert w/ 6.0" inside fill n=0.012 L=150.0' S=0.0043 '/' Outflow=32.13 cfs 21.776 af

Link 43L: MHHW Inflow=38.77 cfs 25.268 af
Primary=38.77 cfs 25.268 af

Total Runoff Area = 89.543 ac Runoff Volume = 32.642 af Average Runoff Depth = 4.37"
88.29% Pervious = 79.053 ac 11.71% Impervious = 10.490 ac

Summary for Subcatchment 1S: CB-1

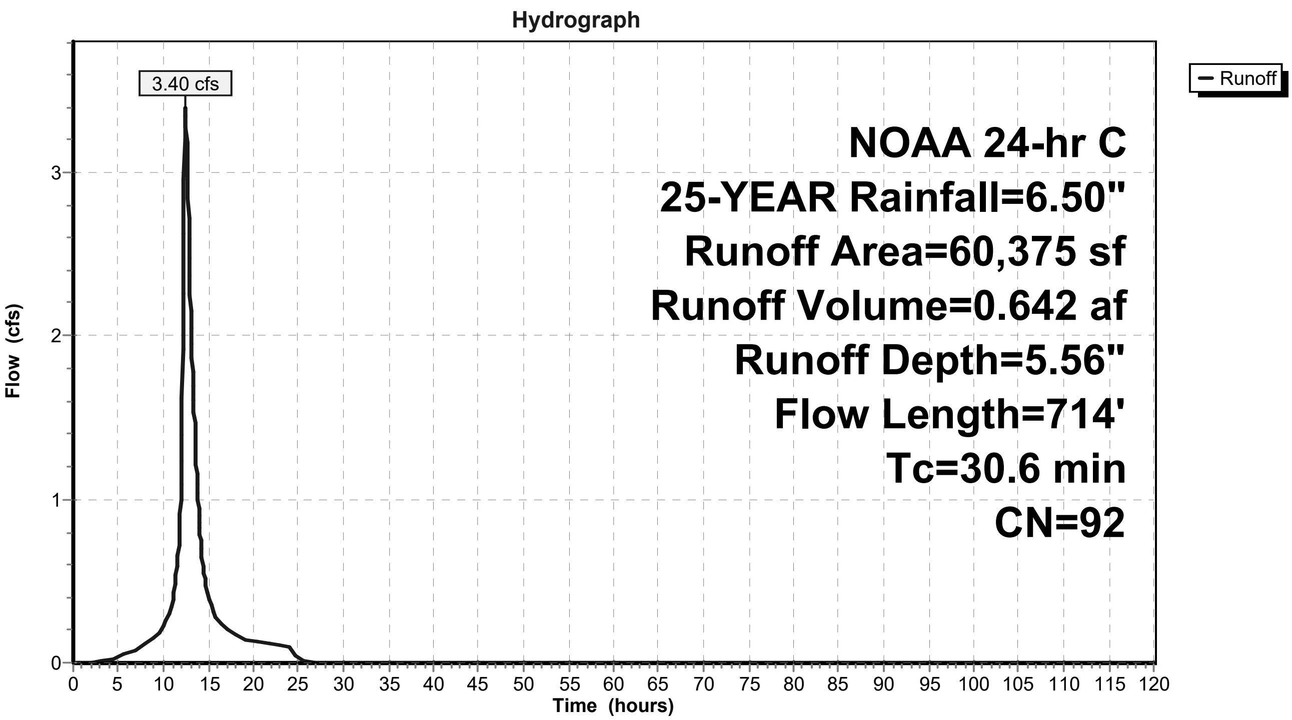
Runoff = 3.40 cfs @ 12.45 hrs, Volume= 0.642 af, Depth= 5.56"
Routed to Pond CB-1 : CB-1

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-YEAR Rainfall=6.50"

Area (sf)	CN	Description
46,198	98	Paved roads w/curbs & sewers, HSG C
13,058	74	>75% Grass cover, Good, HSG C
1,119	80	1/2 acre lots, 25% imp, HSG C
60,375	92	Weighted Average
13,897		23.02% Pervious Area
46,478		76.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.4	70	0.0050	0.06		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
12.2	644	0.0015	0.88	0.88	**Parabolic Channel, D-1** W=3.00' D=0.50' Area=1.0 sf Perim=3.2' n= 0.030 Earth, dense weeds
30.6	714	Total			

Subcatchment 1S: CB-1



Summary for Subcatchment 2S: CB-11

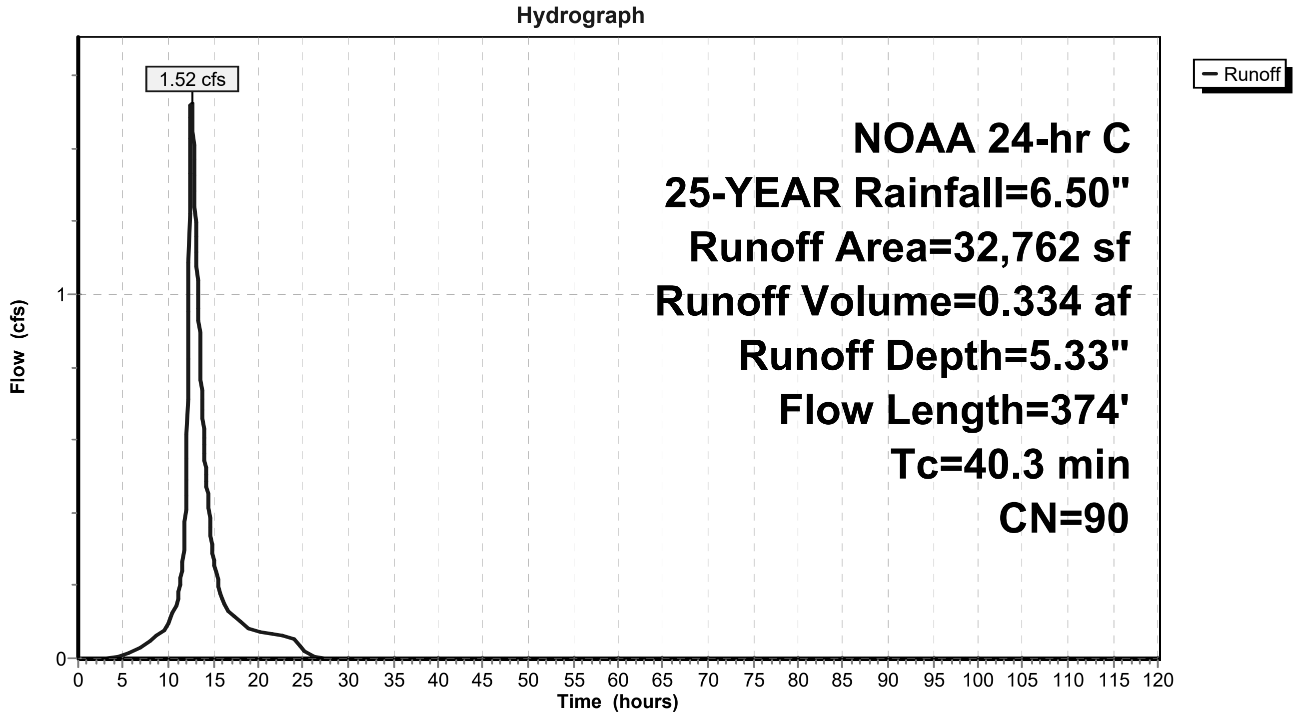
Runoff = 1.52 cfs @ 12.57 hrs, Volume= 0.334 af, Depth= 5.33"
Routed to Pond CB-11 : CB-11

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-YEAR Rainfall=6.50"

Area (sf)	CN	Description
18,046	98	Paved roads w/curbs & sewers, HSG C
3,852	81	1/3 acre lots, 30% imp, HSG C
10,864	80	1/2 acre lots, 25% imp, HSG C
32,762	90	Weighted Average
10,844		33.10% Pervious Area
21,918		66.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.8	150	0.0050	0.07		**Sheet Flow, Sheet Flow** Grass: Dense n= 0.240 P2= 3.30"
0.6	40	0.0050	1.14		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
5.9	184	0.0051	0.52	0.21	**Parabolic Channel, D-2** W=1.20' D=0.50' Area=0.4 sf Perim=1.6' n= 0.080 Earth, long dense weeds
40.3	374	Total			

Subcatchment 2S: CB-11



Summary for Subcatchment 3S: CB-2

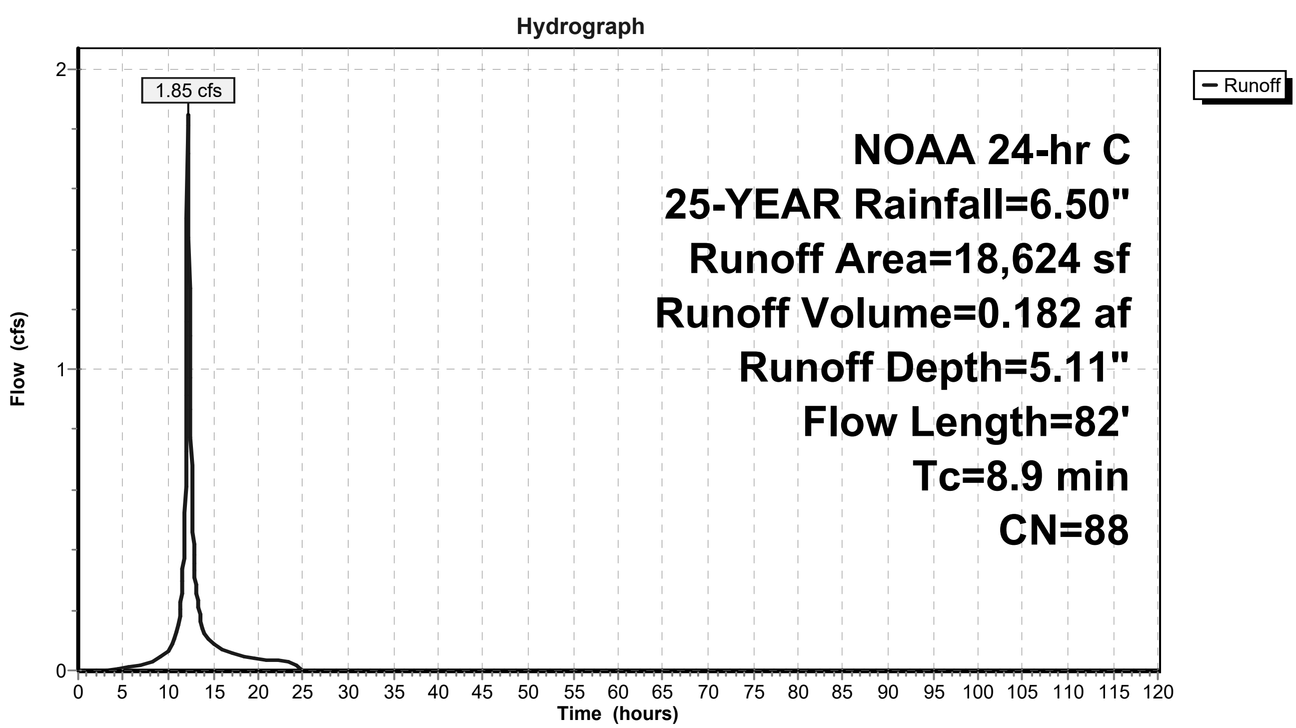
Runoff = 1.85 cfs @ 12.17 hrs, Volume= 0.182 af, Depth= 5.11"
Routed to Pond CB-2 : CB-2

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-YEAR Rainfall=6.50"

Area (sf)	CN	Description
11,190	98	Paved roads w/curbs & sewers, HSG C
5,757	72	Woods/grass comb., Good, HSG C
1,677	80	1/2 acre lots, 25% imp, HSG C
18,624	88	Weighted Average
7,015		37.67% Pervious Area
11,609		62.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0200	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
0.8	32	0.0010	0.64		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
8.9	82	Total			

Subcatchment 3S: CB-2



Summary for Subcatchment 4S: CB-10

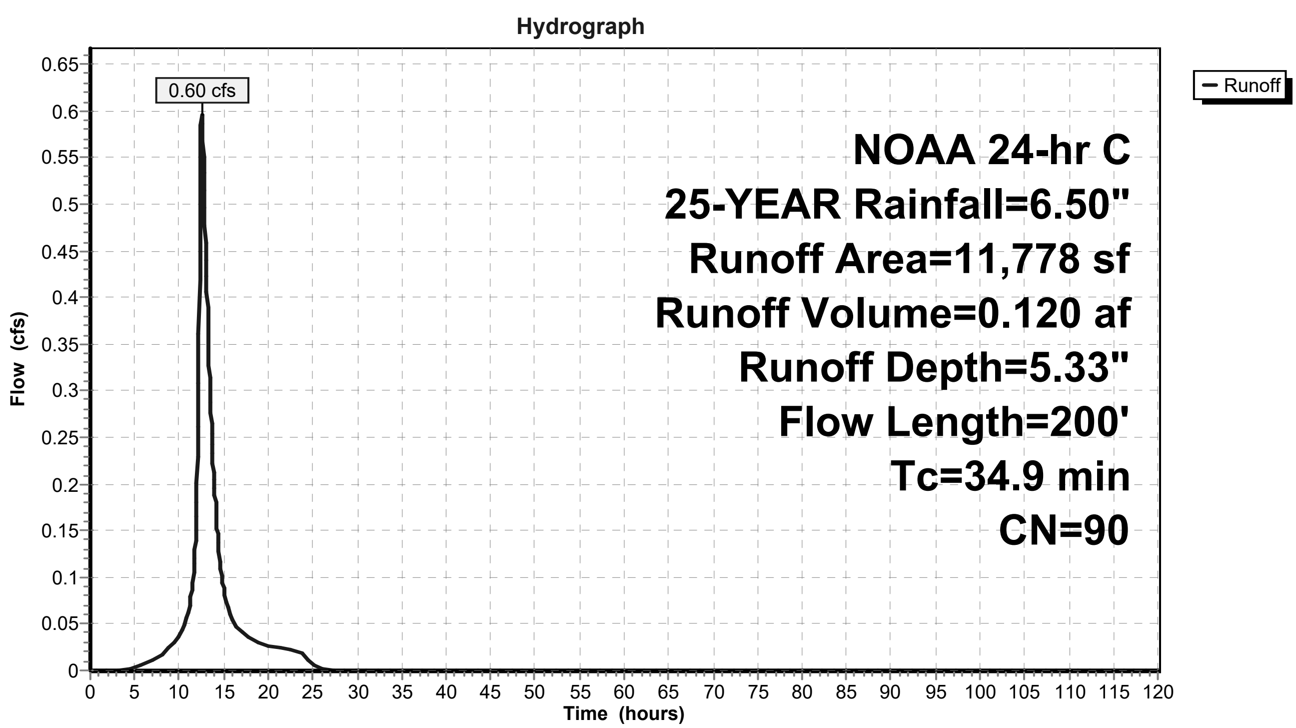
Runoff = 0.60 cfs @ 12.51 hrs, Volume= 0.120 af, Depth= 5.33"
Routed to Pond CB-10 : CB-10

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-YEAR Rainfall=6.50"

Area (sf)	CN	Description
5,998	98	Paved roads w/curbs & sewers, HSG C
4,835	83	1/4 acre lots, 38% imp, HSG C
945	80	1/2 acre lots, 25% imp, HSG C
11,778	90	Weighted Average
3,706		31.47% Pervious Area
8,072		68.53% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.0	43	0.0012	0.03		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
12.9	157	0.0001	0.20		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
34.9	200	Total			

Subcatchment 4S: CB-10



Summary for Subcatchment 5S: CB-3

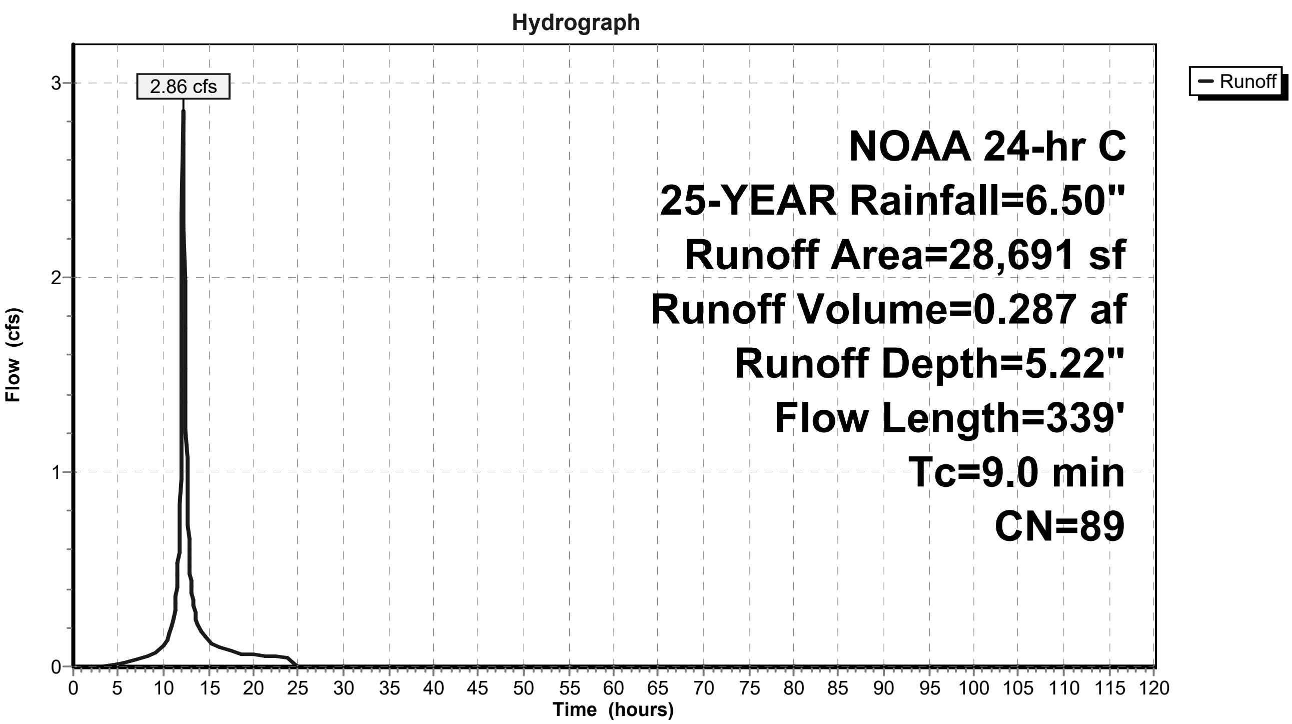
Runoff = 2.86 cfs @ 12.18 hrs, Volume= 0.287 af, Depth= 5.22"
Routed to Pond CB-3 : CB-3

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-YEAR Rainfall=6.50"

Area (sf)	CN	Description
12,824	98	Paved roads w/curbs & sewers, HSG C
6,927	82	Row crops, SR + CR, Good, HSG C
6,318	83	1/4 acre lots, 38% imp, HSG C
2,622	80	1/2 acre lots, 25% imp, HSG C
28,691	89	Weighted Average
12,811		44.65% Pervious Area
15,880		55.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	26	0.0200	0.12		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
5.4	313	0.0050	0.96	0.16	**Parabolic Channel,** W=0.50' D=0.50' Area=0.2 sf Perim=1.2' n= 0.030 Earth, grassed & winding
9.0	339	Total			

Subcatchment 5S: CB-3



Summary for Subcatchment 6S: CB-9

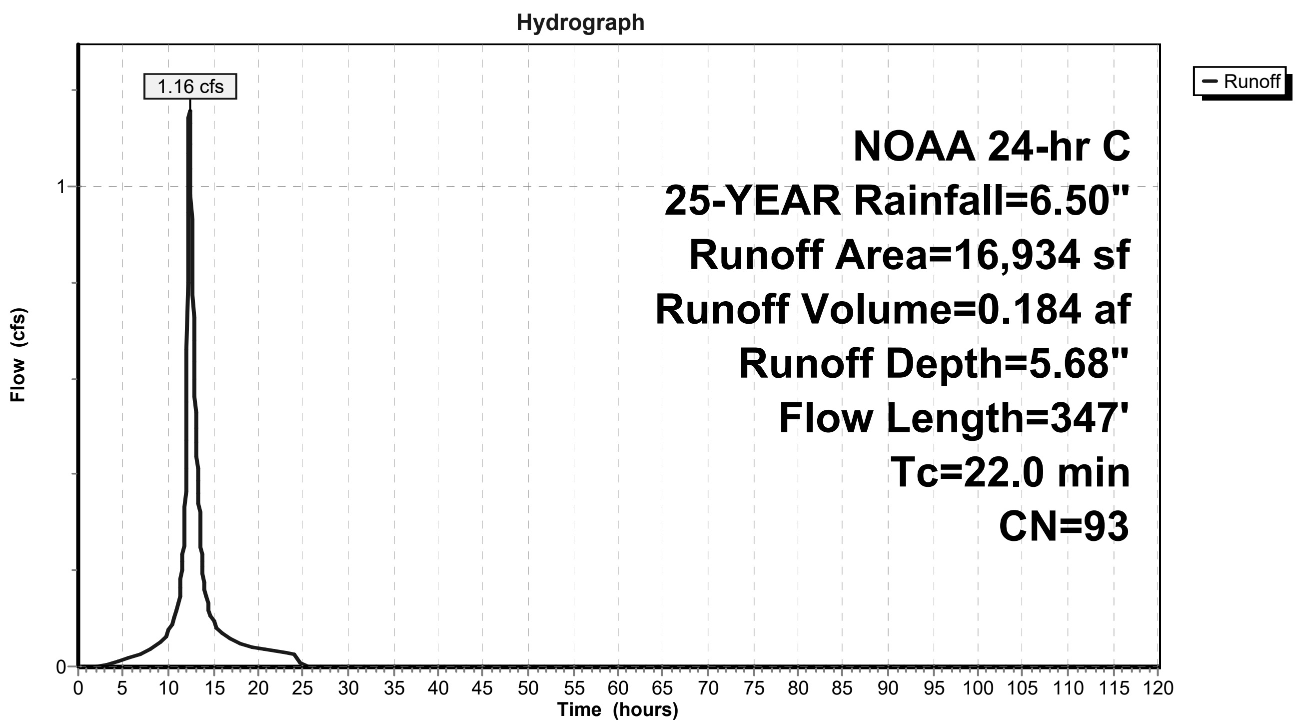
Runoff = 1.16 cfs @ 12.34 hrs, Volume= 0.184 af, Depth= 5.68"
Routed to Pond CB-9 : CB-9

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-YEAR Rainfall=6.50"

Area (sf)	CN	Description
11,659	98	Paved roads w/curbs & sewers, HSG C
1,125	72	Woods/grass comb., Good, HSG C
1,923	83	1/4 acre lots, 38% imp, HSG C
1,148	81	1/3 acre lots, 30% imp, HSG C
1,079	94	Urban commercial, 85% imp, HSG C
16,934	93	Weighted Average
3,283		19.39% Pervious Area
13,651		80.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.6	110	0.0106	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
2.4	237	0.0066	1.65		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
22.0	347	Total			

Subcatchment 6S: CB-9



Summary for Subcatchment 7S: CB-4

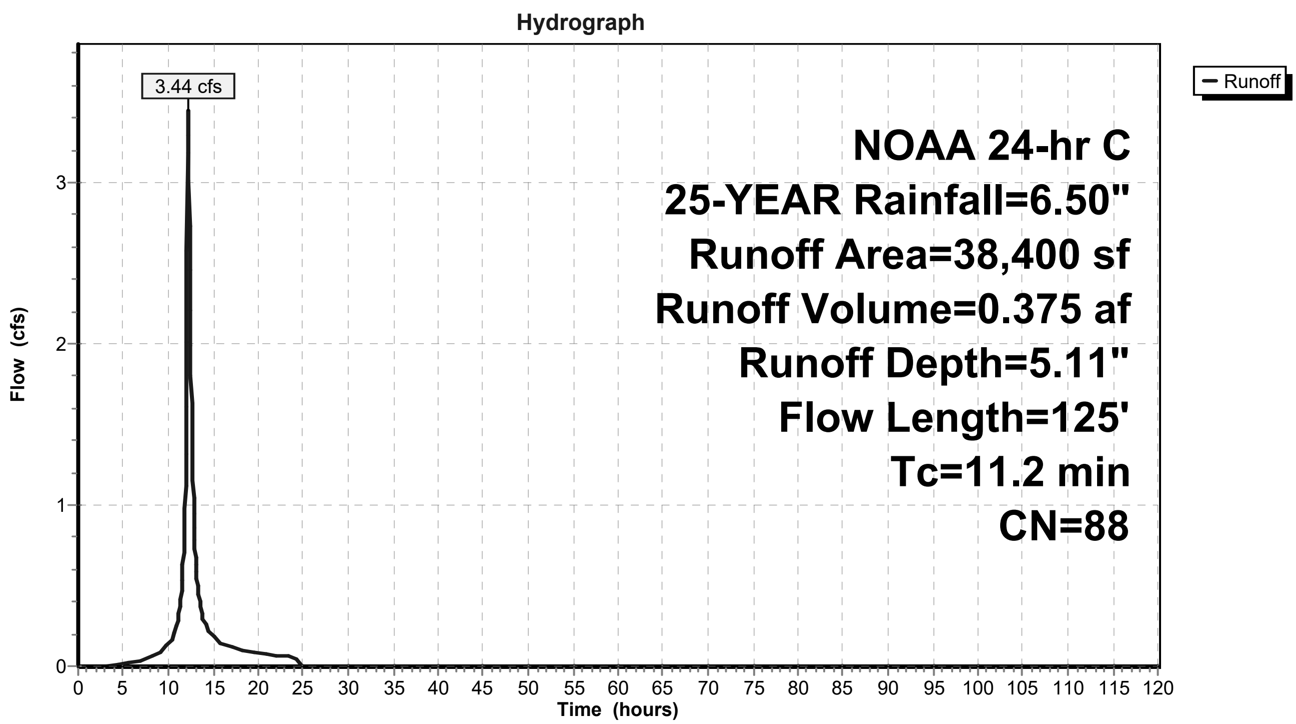
Runoff = 3.44 cfs @ 12.21 hrs, Volume= 0.375 af, Depth= 5.11"
Routed to Pond CB-4 : CB-4

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-YEAR Rainfall=6.50"

Area (sf)	CN	Description
11,566	98	Paved roads w/curbs & sewers, HSG C
26,834	83	1/4 acre lots, 38% imp, HSG C
38,400	88	Weighted Average
16,637		43.33% Pervious Area
21,763		56.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	88	0.0300	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
0.4	37	0.0059	1.56		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
11.2	125	Total			

Subcatchment 7S: CB-4



Summary for Subcatchment 8S: CB-8

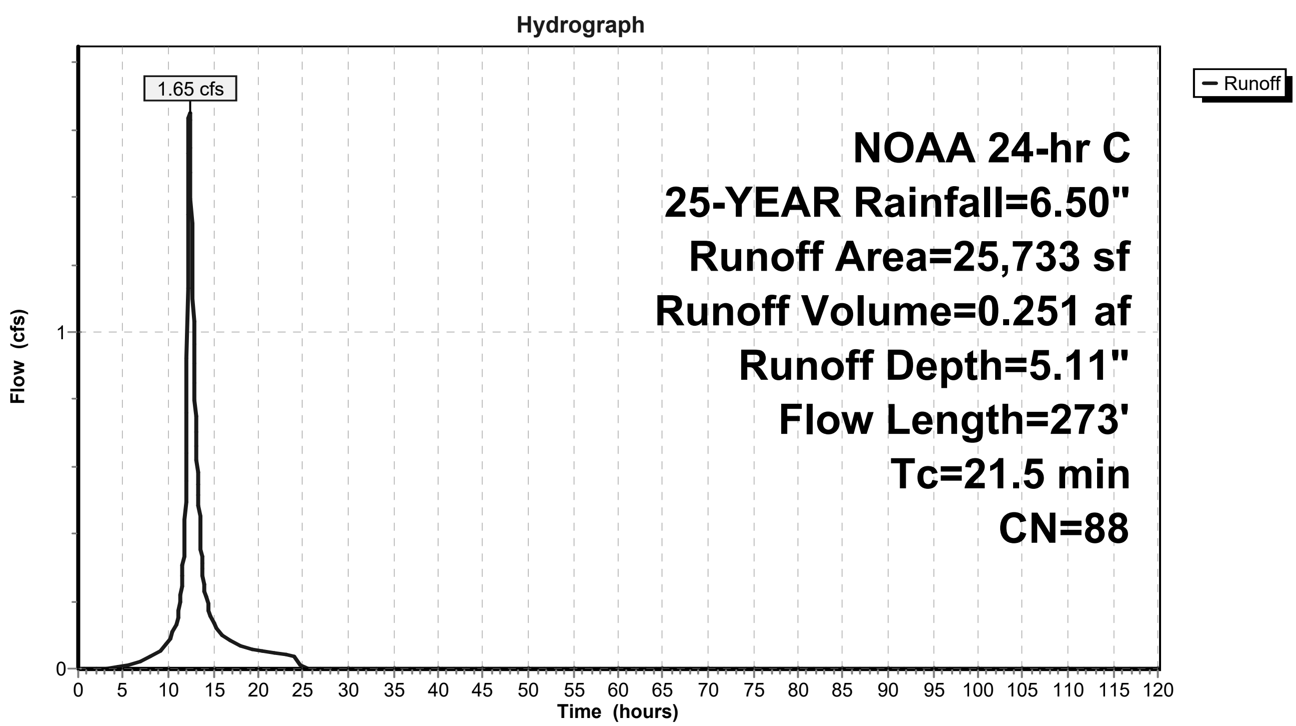
Runoff = 1.65 cfs @ 12.34 hrs, Volume= 0.251 af, Depth= 5.11"
Routed to Pond CB-8 : CB-8

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-YEAR Rainfall=6.50"

Area (sf)	CN	Description
10,976	98	Paved parking, HSG C
1,828	81	1/3 acre lots, 30% imp, HSG C
12,139	80	1/2 acre lots, 25% imp, HSG C
790	94	Urban commercial, 85% imp, HSG C
25,733	88	Weighted Average
10,502		40.81% Pervious Area
15,231		59.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.0	108	0.0096	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
1.5	165	0.0078	1.79		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
21.5	273	Total			

Subcatchment 8S: CB-8



Summary for Subcatchment 9S: CB-5

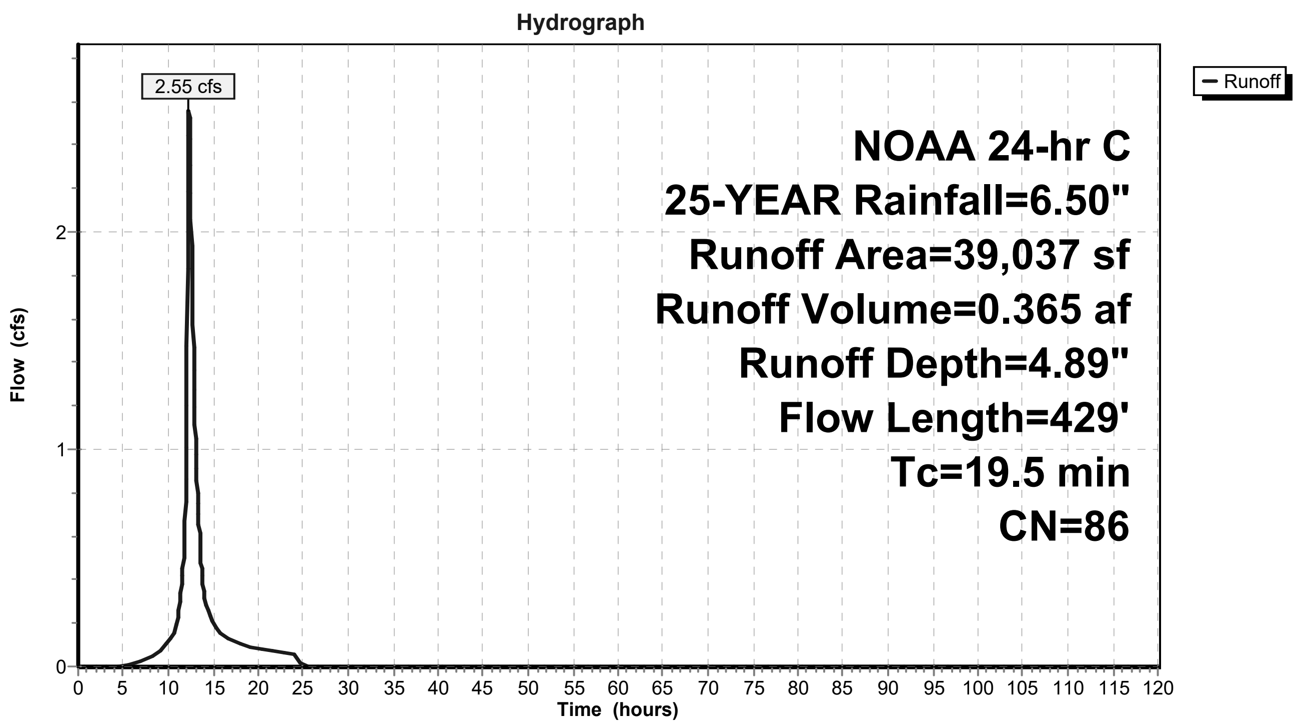
Runoff = 2.55 cfs @ 12.31 hrs, Volume= 0.365 af, Depth= 4.89"
Routed to Pond CB-5 : CB-5

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-YEAR Rainfall=6.50"

Area (sf)	CN	Description
10,204	98	Paved roads w/curbs & sewers, HSG C
9,715	83	1/4 acre lots, 38% imp, HSG C
10,479	81	1/3 acre lots, 30% imp, HSG C
5,019	80	1/2 acre lots, 25% imp, HSG C
3,620	85	1/2 acre lots, 25% imp, HSG D
39,037	86	Weighted Average
19,838		50.82% Pervious Area
19,199		49.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	137	0.0233	0.13		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
2.5	292	0.0090	1.93		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
19.5	429	Total			

Subcatchment 9S: CB-5



Summary for Subcatchment 10S: CB-7

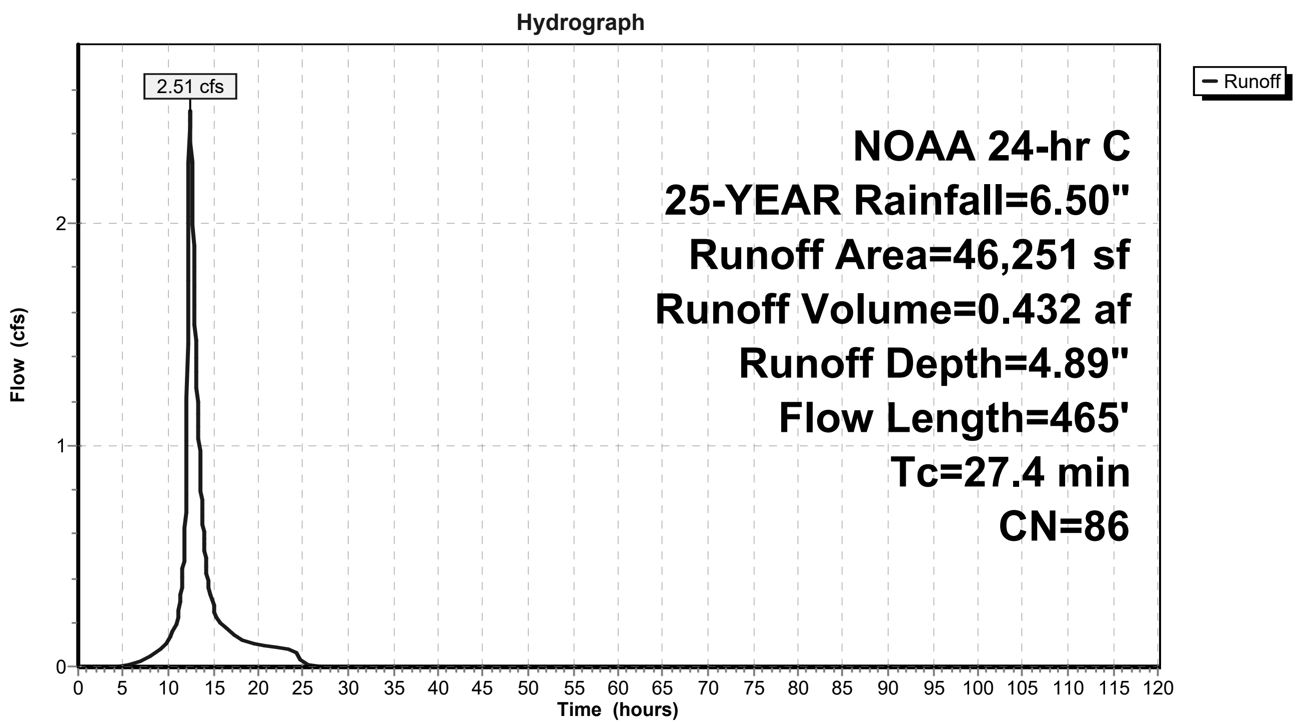
Runoff = 2.51 cfs @ 12.42 hrs, Volume= 0.432 af, Depth= 4.89"
Routed to Pond CB-7 : CB-7

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-YEAR Rainfall=6.50"

Area (sf)	CN	Description
10,245	98	Paved roads w/curbs & sewers, HSG C
33,447	83	1/4 acre lots, 38% imp, HSG C
2,559	80	1/2 acre lots, 25% imp, HSG C
46,251	86	Weighted Average
22,656		48.99% Pervious Area
23,595		51.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.5	150	0.0112	0.10		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
0.3	32	0.0112	1.70		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.6	283	0.0078	1.79		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
27.4	465	Total			

Subcatchment 10S: CB-7



Summary for Subcatchment 11S: CB-6

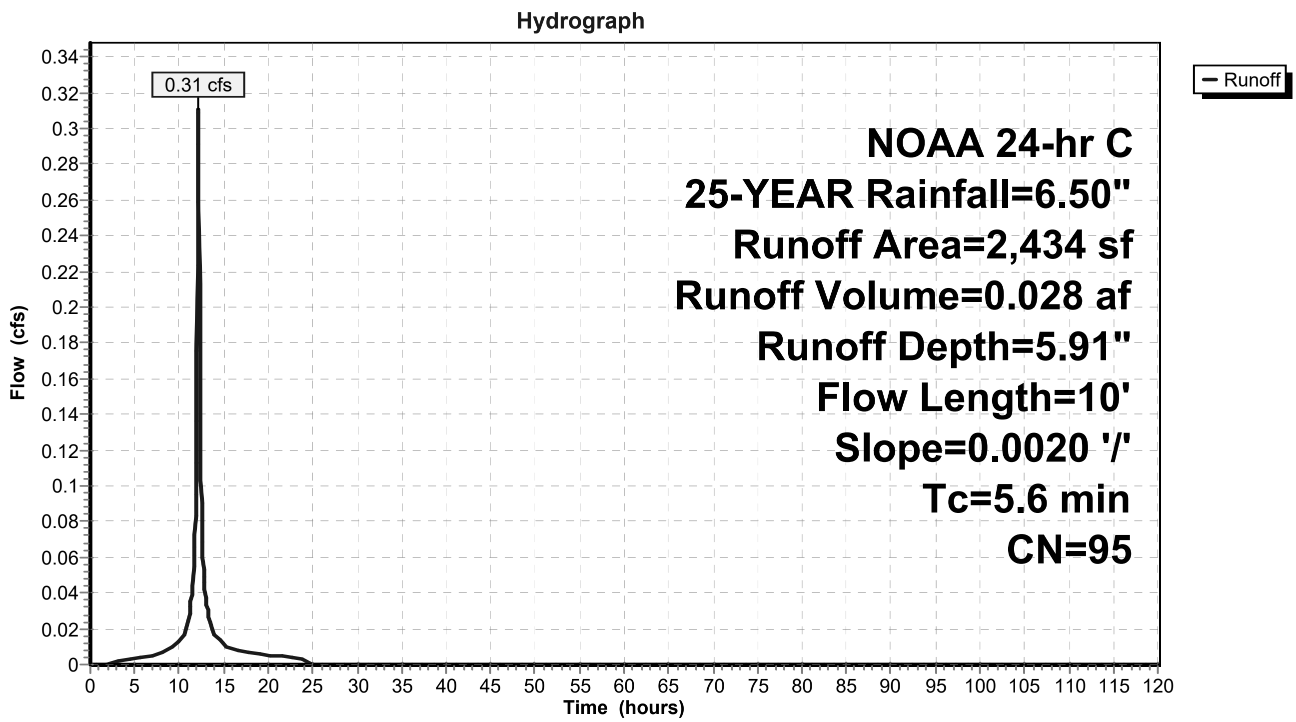
Runoff = 0.31 cfs @ 12.14 hrs, Volume= 0.028 af, Depth= 5.91"
Routed to Pond CB-6 : CB-6

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-YEAR Rainfall=6.50"

Area (sf)	CN	Description
2,137	98	Paved roads w/curbs & sewers, HSG C
35	83	1/4 acre lots, 38% imp, HSG C
262	74	>75% Grass cover, Good, HSG C
2,434	95	Weighted Average
284		11.66% Pervious Area
2,150		88.34% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	10	0.0020	0.03		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"

Subcatchment 11S: CB-6



Summary for Subcatchment 12S: CB-13

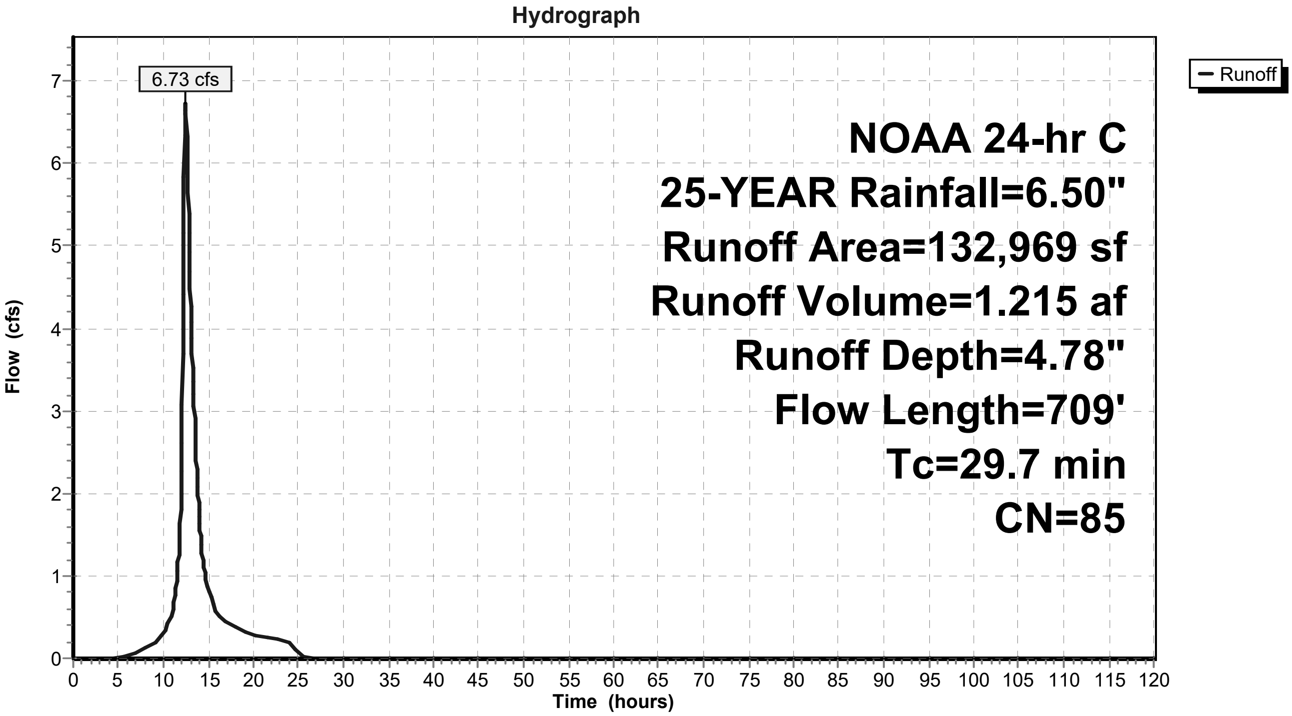
Runoff = 6.73 cfs @ 12.45 hrs, Volume= 1.215 af, Depth= 4.78"
Routed to Pond CB-13 : CB-13

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-YEAR Rainfall=6.50"

Area (sf)	CN	Description
21,153	98	Paved roads w/curbs & sewers, HSG C
102,369	82	Row crops, SR + CR, Good, HSG C
9,447	83	1/4 acre lots, 38% imp, HSG C
132,969	85	Weighted Average
108,226		81.39% Pervious Area
24,743		18.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.1	150	0.0073	0.11		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
5.0	269	0.0101	0.90		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
1.9	187	0.0069	1.68	3.35	**Parabolic Channel, D-6** W=6.00' D=0.50' Area=2.0 sf Perim=6.1' n= 0.035 Earth, dense weeds
0.4	34	0.0030	1.47	0.40	**Pipe Channel,** 10.0" Round w/ 5.0" inside fill Area= 0.3 sf Perim= 2.1' r= 0.13' n= 0.014 Concrete pipe, finished
0.3	69	0.0199	4.37	17.48	**Parabolic Channel,** W=6.00' D=1.00' Area=4.0 sf Perim=6.4' n= 0.035 Earth, dense weeds
29.7	709	Total			

Subcatchment 12S: CB-13



Summary for Subcatchment 13S: CB-12

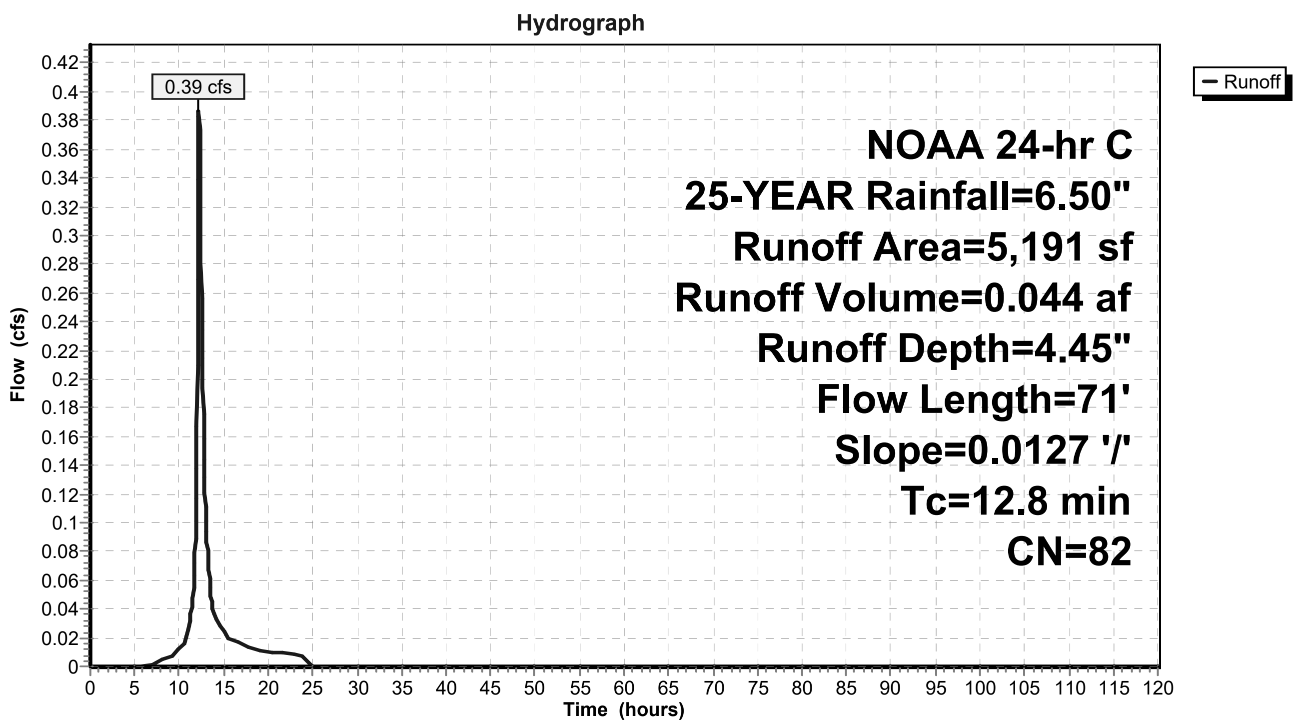
Runoff = 0.39 cfs @ 12.23 hrs, Volume= 0.044 af, Depth= 4.45"
Routed to Pond CB-12 : CB-12

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-YEAR Rainfall=6.50"

Area (sf)	CN	Description
1,729	98	Paved roads w/curbs & sewers, HSG C
3,462	74	>75% Grass cover, Good, HSG C
5,191	82	Weighted Average
3,462		66.69% Pervious Area
1,729		33.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.8	71	0.0127	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"

Subcatchment 13S: CB-12



Summary for Subcatchment 14S: CB-14

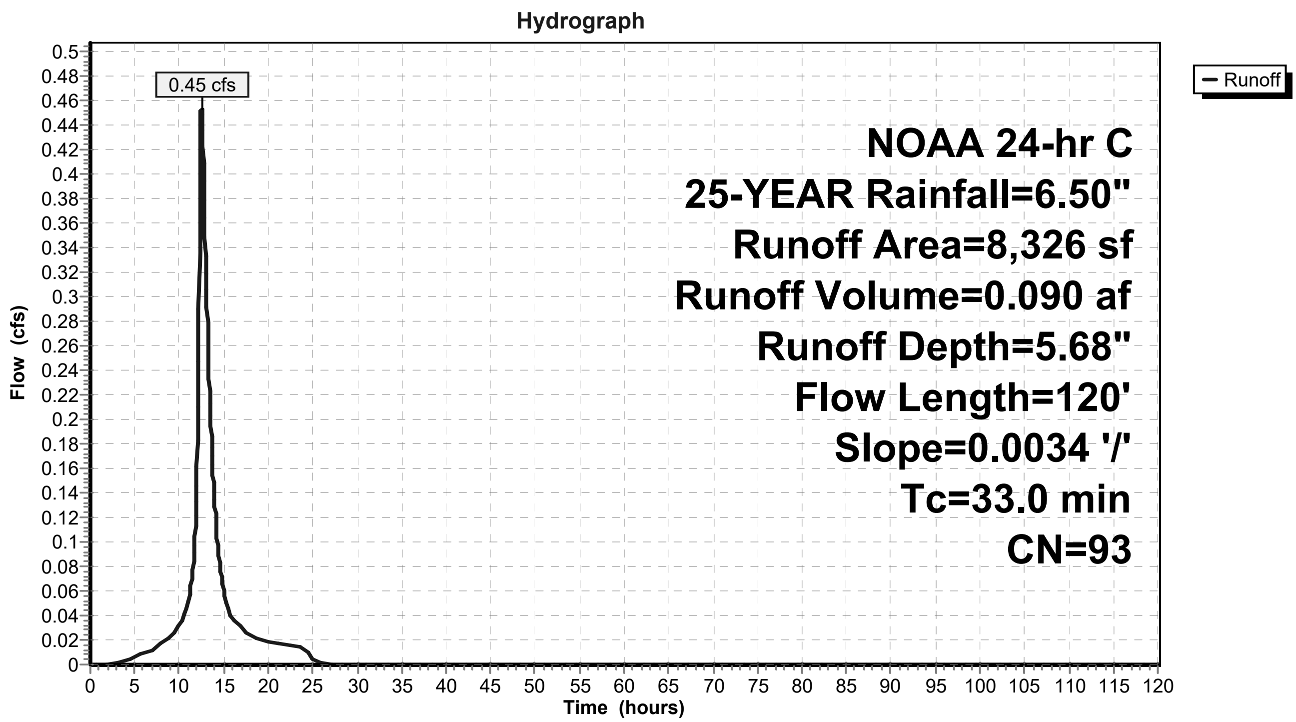
Runoff = 0.45 cfs @ 12.48 hrs, Volume= 0.090 af, Depth= 5.68"
Routed to Pond CB-14 : CB-14

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-YEAR Rainfall=6.50"

Area (sf)	CN	Description
6,418	98	Paved roads w/curbs & sewers, HSG C
1,849	74	>75% Grass cover, Good, HSG C
59	98	Paved roads w/curbs & sewers, HSG D
8,326	93	Weighted Average
1,849		22.21% Pervious Area
6,477		77.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.0	120	0.0034	0.06		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"

Subcatchment 14S: CB-14



Summary for Subcatchment 15S: CB-15

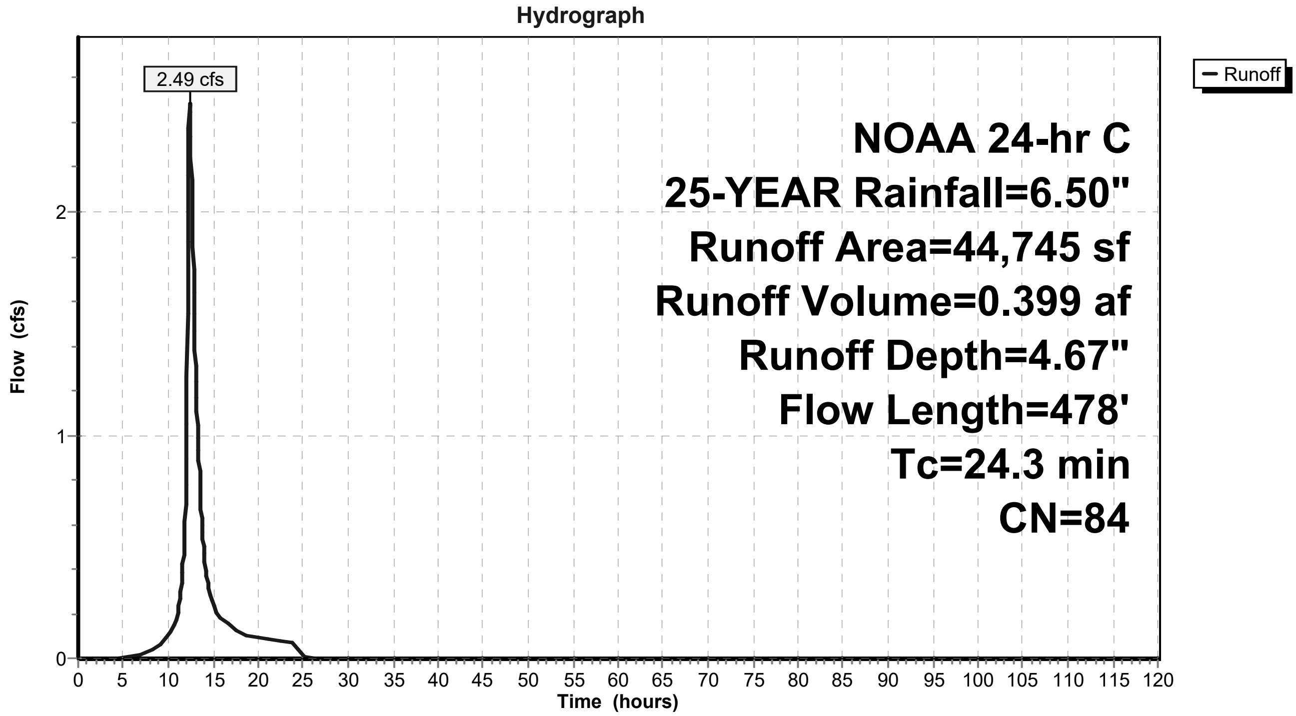
Runoff = 2.49 cfs @ 12.38 hrs, Volume= 0.399 af, Depth= 4.67"
Routed to Pond CB-15 : CB-15

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-YEAR Rainfall=6.50"

Area (sf)	CN	Description
3,608	98	Paved roads w/curbs & sewers, HSG C
14,612	82	Row crops, SR + CR, Good, HSG C
4,652	83	1/4 acre lots, 38% imp, HSG C
10,561	80	1/2 acre lots, 25% imp, HSG C
684	98	Paved roads w/curbs & sewers, HSG C
5,318	87	1/4 acre lots, 38% imp, HSG D
5,310	85	1/2 acre lots, 25% imp, HSG D
44,745	84	Weighted Average
32,697		73.07% Pervious Area
12,048		26.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.6	150	0.0129	0.14		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
0.1	4	0.0129	1.02		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
2.2	270	0.0167	2.08		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
4.4	54	0.0001	0.20		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
24.3	478	Total			

Subcatchment 15S: CB-15



Summary for Subcatchment 16S: CB-16

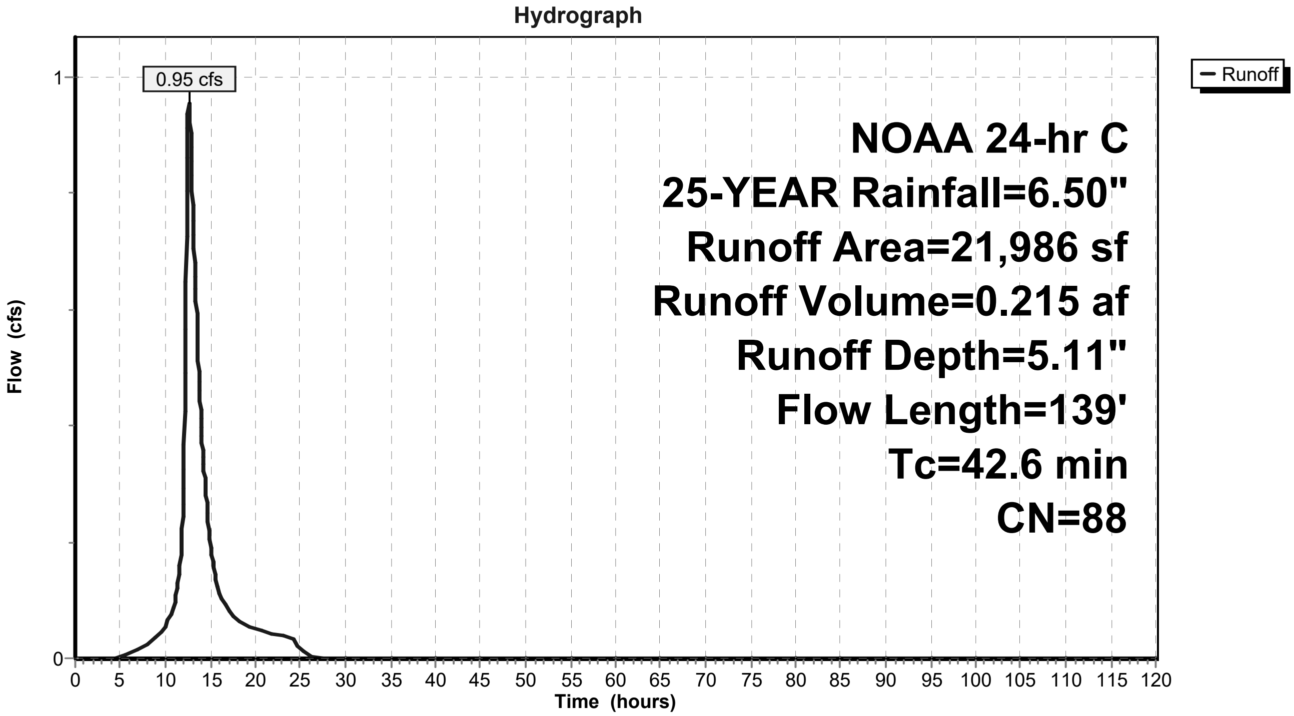
Runoff = 0.95 cfs @ 12.61 hrs, Volume= 0.215 af, Depth= 5.11"
Routed to Pond CB-16 : CB-16

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-YEAR Rainfall=6.50"

Area (sf)	CN	Description
7,490	98	Paved roads w/curbs & sewers, HSG C
2,534	74	>75% Grass cover, Good, HSG C
728	83	1/4 acre lots, 38% imp, HSG C
1,489	81	1/3 acre lots, 30% imp, HSG C
2,781	80	1/2 acre lots, 25% imp, HSG C
2,781	98	Paved roads w/curbs & sewers, HSG D
3,870	80	>75% Grass cover, Good, HSG D
82	70	1/2 acre lots, 25% imp, HSG B
231	72	1/3 acre lots, 30% imp, HSG B
21,986	88	Weighted Average
10,207		46.42% Pervious Area
11,779		53.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.8	44	0.0004	0.02		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
7.8	95	0.0001	0.20		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
42.6	139	Total			

Subcatchment 16S: CB-16



Summary for Subcatchment 17S: CB-17

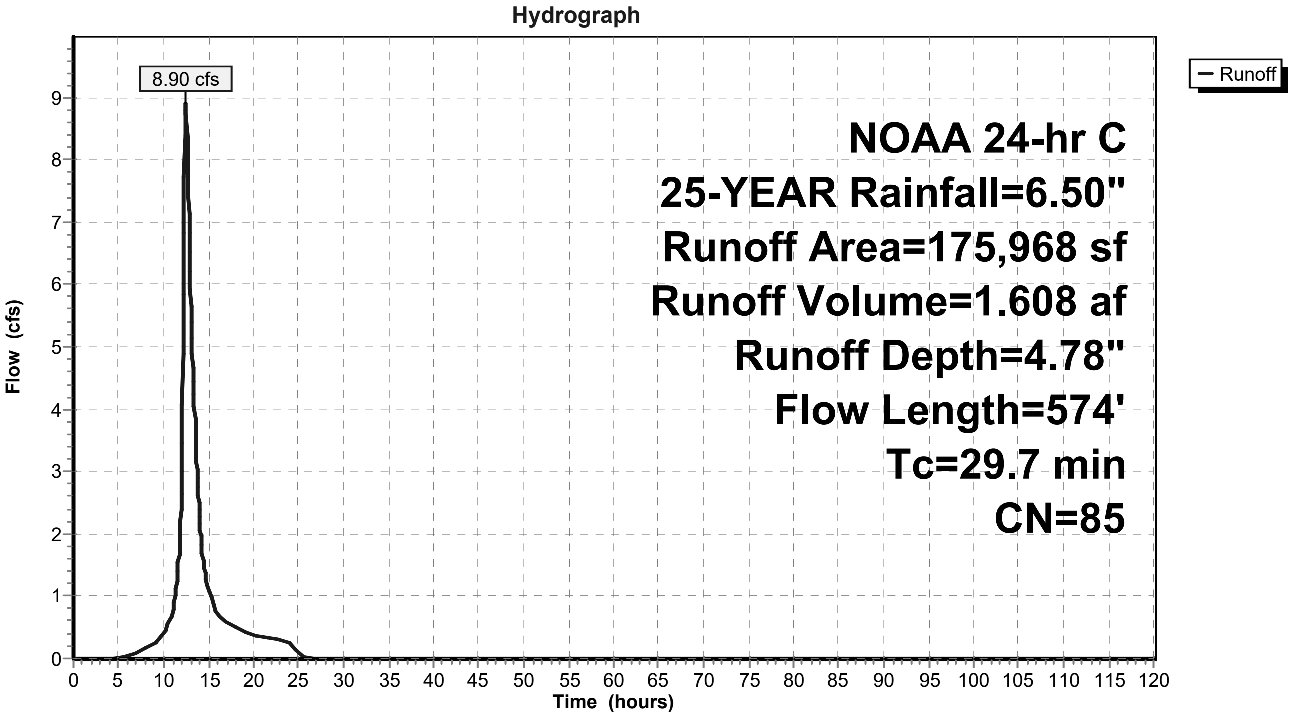
Runoff = 8.90 cfs @ 12.45 hrs, Volume= 1.608 af, Depth= 4.78"
Routed to Pond CB-17 : CB-17

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-YEAR Rainfall=6.50"

Area (sf)	CN	Description
24,112	98	Paved roads w/curbs & sewers, HSG C
77,330	82	Row crops, SR + CR, Good, HSG C
68,554	83	1/4 acre lots, 38% imp, HSG C
3,251	98	Paved roads w/curbs & sewers, HSG D
11	87	1/4 acre lots, 38% imp, HSG D
2,710	85	1/2 acre lots, 25% imp, HSG D
175,968	85	Weighted Average
121,873		69.26% Pervious Area
54,095		30.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.6	150	0.0087	0.12		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
0.6	32	0.0087	0.84		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
1.5	201	0.0198	2.27		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
7.0	191	0.0005	0.45		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
29.7	574	Total			

Subcatchment 17S: CB-17



Summary for Subcatchment 18S: D-8

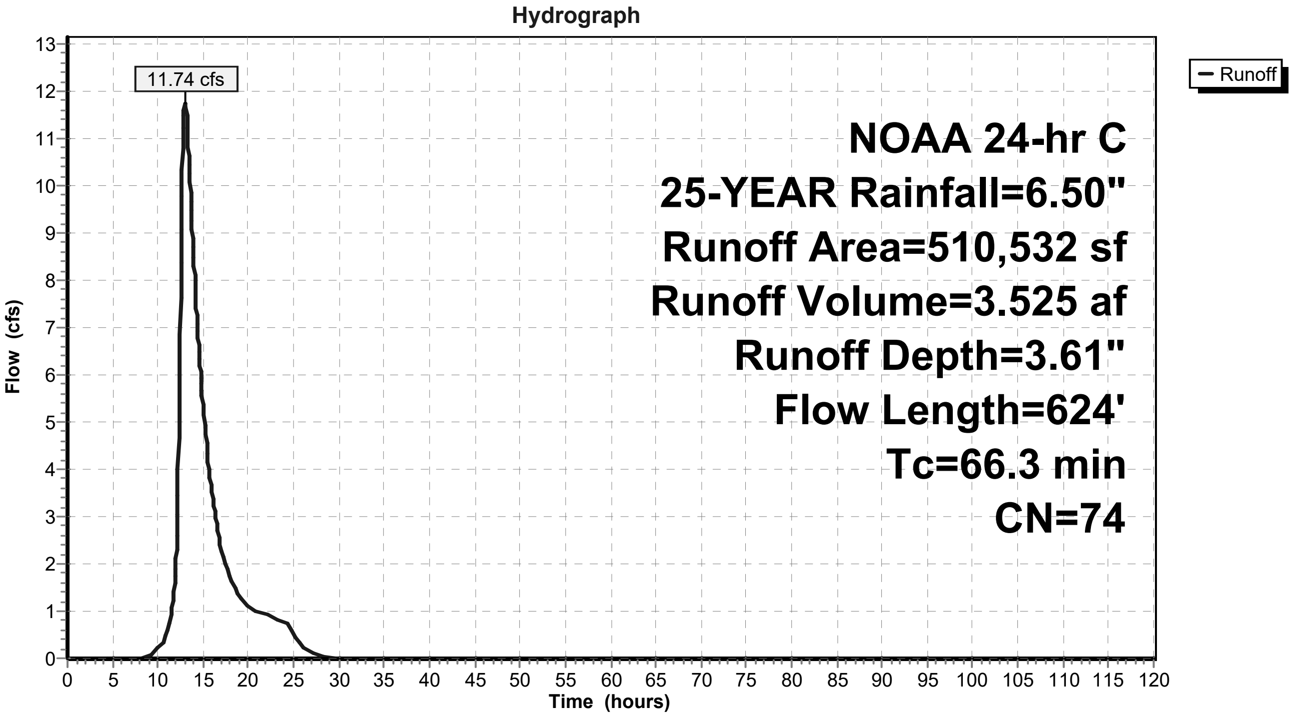
Runoff = 11.74 cfs @ 12.97 hrs, Volume= 3.525 af, Depth= 3.61"
Routed to Pond 40P : C-1

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-YEAR Rainfall=6.50"

Area (sf)	CN	Description
20,906	61	>75% Grass cover, Good, HSG B
34,255	75	1/4 acre lots, 38% imp, HSG B
19,157	72	1/3 acre lots, 30% imp, HSG B
15,536	70	1/2 acre lots, 25% imp, HSG B
8,099	68	1 acre lots, 20% imp, HSG B
2,079	98	Paved roads w/curbs & sewers, HSG C
338,487	74	>75% Grass cover, Good, HSG C
39,648	83	1/4 acre lots, 38% imp, HSG C
8,414	81	1/3 acre lots, 30% imp, HSG C
5,839	80	1/2 acre lots, 25% imp, HSG C
14,980	79	1 acre lots, 20% imp, HSG C
3,132	80	>75% Grass cover, Good, HSG D
510,532	74	Weighted Average
462,139		90.52% Pervious Area
48,393		9.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.9	150	0.0133	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
3.1	353	0.0142	1.92		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
40.3	121	0.0001	0.05		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
66.3	624	Total			

Subcatchment 18S: D-8



Summary for Subcatchment 19S: LOW POINT BEHIND CAR LOT

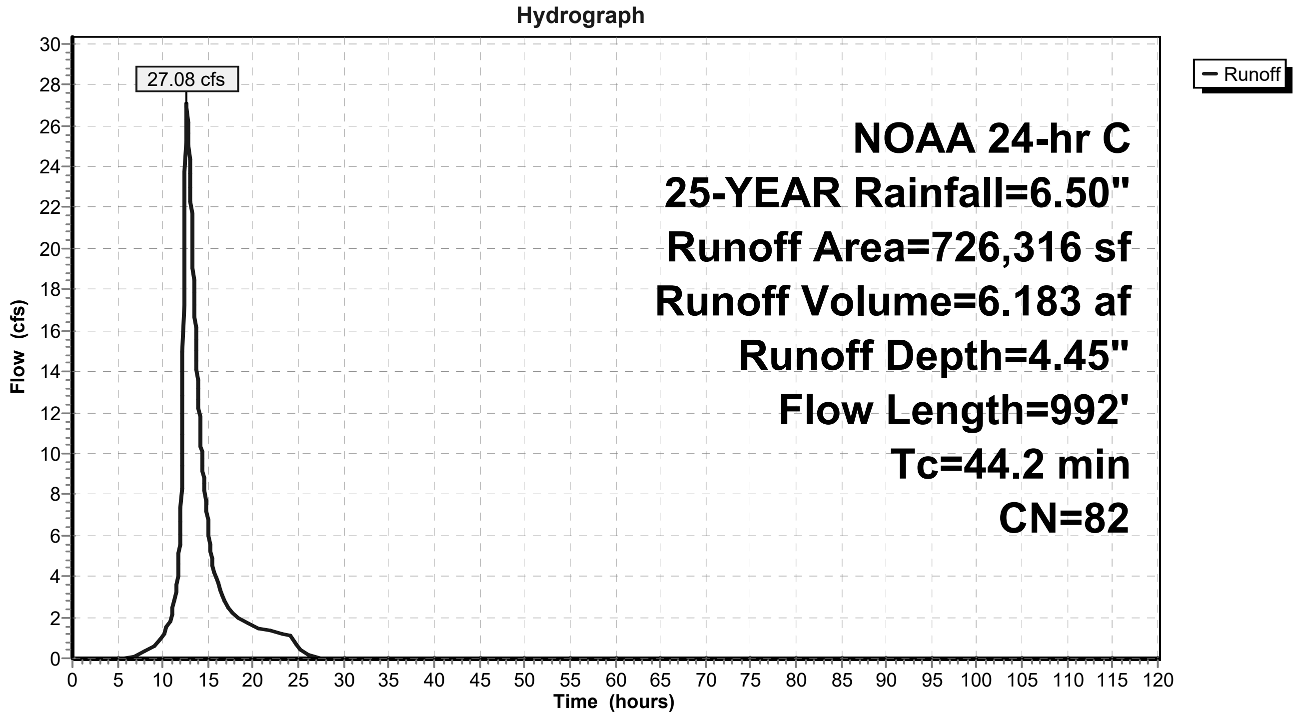
Runoff = 27.08 cfs @ 12.65 hrs, Volume= 6.183 af, Depth= 4.45"

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-YEAR Rainfall=6.50"

Area (sf)	CN	Description
574,884	82	Row crops, SR + CR, Good, HSG C
42,712	83	1/4 acre lots, 38% imp, HSG C
42,050	81	1/3 acre lots, 30% imp, HSG C
37,738	80	1/2 acre lots, 25% imp, HSG C
28,932	94	Urban commercial, 85% imp, HSG C
726,316	82	Weighted Average
663,444		91.34% Pervious Area
62,872		8.66% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	150	0.0067	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
3.4	160	0.0125	0.78		**Shallow Concentrated Flow, Grass flow** Short Grass Pasture Kv= 7.0 fps
15.5	368	0.0063	0.40		**Shallow Concentrated Flow, Forested area** Woodland Kv= 5.0 fps
4.6	314	0.0159	1.13		**Shallow Concentrated Flow, farm field** Cultivated Straight Rows Kv= 9.0 fps
44.2	992	Total			

Subcatchment 19S: LOW POINT BEHIND CAR LOT



Summary for Subcatchment 44S: W-1

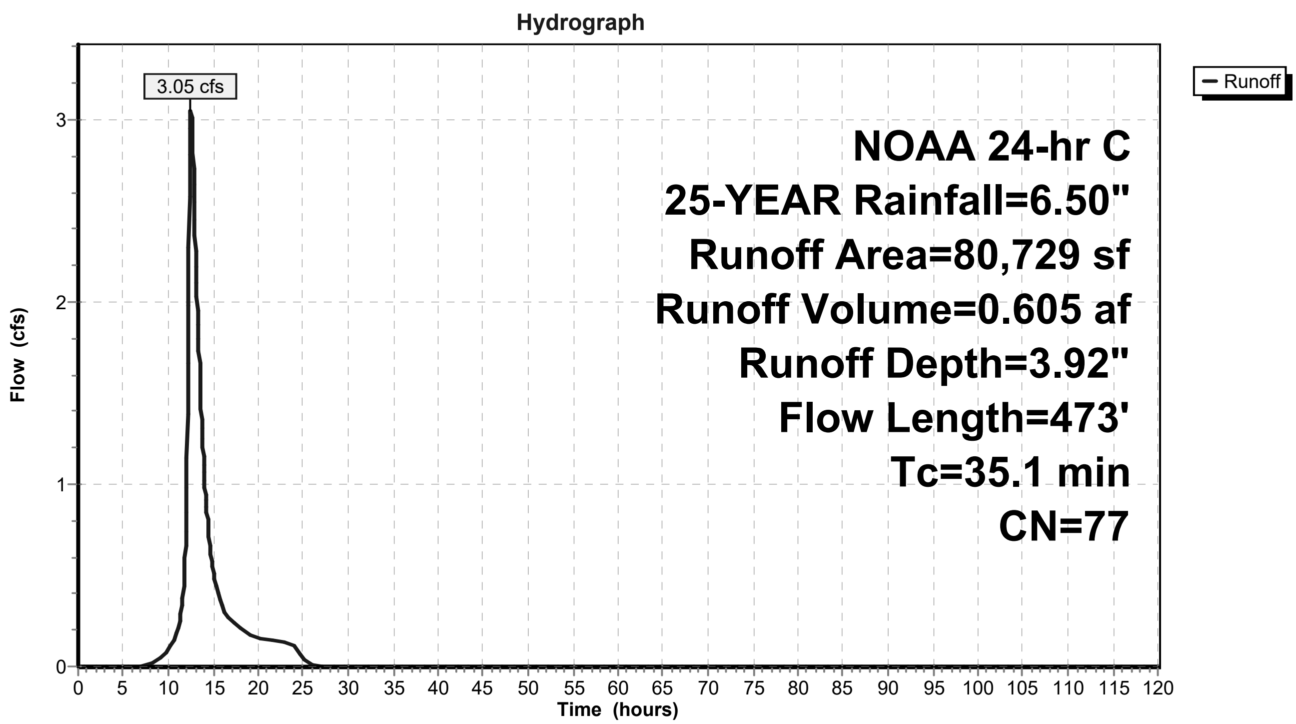
Runoff = 3.05 cfs @ 12.54 hrs, Volume= 0.605 af, Depth= 3.92"
Routed to Pond 46P : Farm Pond

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-YEAR Rainfall=6.50"

Area (sf)	CN	Description
978	48	Brush, Good, HSG B
56,376	82	Row crops, SR + CR, Good, HSG C
17,219	65	Brush, Good, HSG C
6,156	73	Brush, Good, HSG D
80,729	77	Weighted Average
80,729		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.1	150	0.0067	0.08		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.30"
4.3	279	0.0143	1.08		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
0.7	44	0.0450	1.06		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
35.1	473	Total			

Subcatchment 44S: W-1



Summary for Subcatchment 45S: W-2

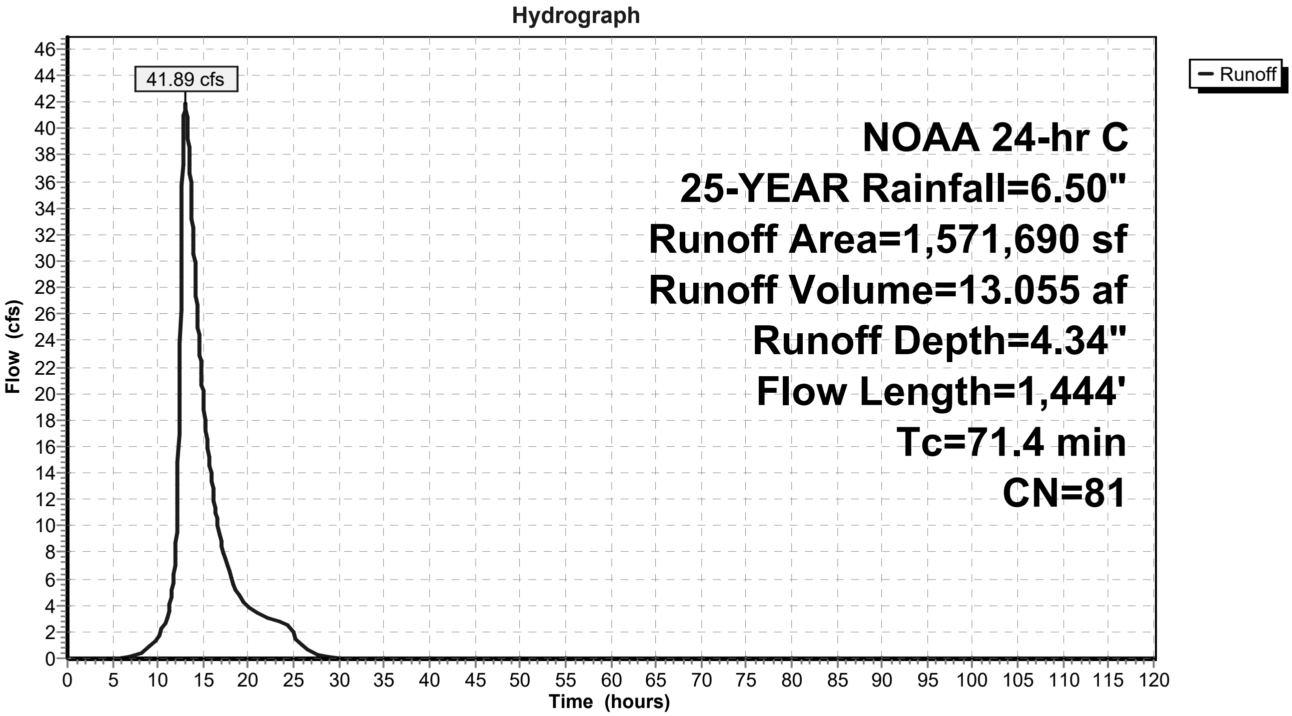
Runoff = 41.89 cfs @ 13.02 hrs, Volume= 13.055 af, Depth= 4.34"
Routed to Pond 47P : W-2

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-YEAR Rainfall=6.50"

Area (sf)	CN	Description
1,251,599	82	Row crops, SR + CR, Good, HSG C
41,690	72	Woods/grass comb., Good, HSG C
177,558	75	Row crops, SR + CR, Good, HSG B
24,058	83	1/4 acre lots, 38% imp, HSG C
15,439	80	1/2 acre lots, 25% imp, HSG C
61,346	73	Brush, Good, HSG D
1,571,690	81	Weighted Average
1,558,688		99.17% Pervious Area
13,002		0.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.1	150	0.0020	0.07		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
18.2	730	0.0055	0.67		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
3.9	94	0.0063	0.40		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
12.2	470	0.0051	0.64		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
71.4	1,444	Total			

Subcatchment 45S: W-2



Summary for Subcatchment 46S: w-3

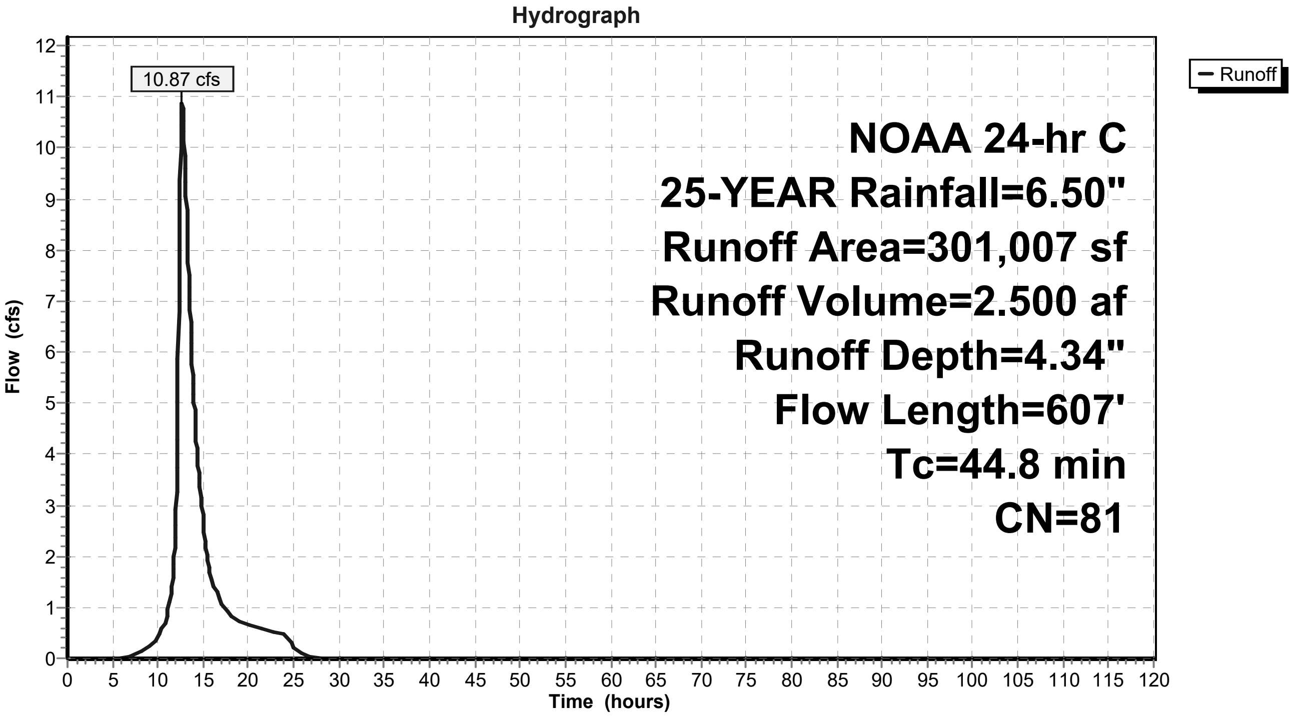
Runoff = 10.87 cfs @ 12.66 hrs, Volume= 2.500 af, Depth= 4.34"
Routed to Pond 48P : w-3

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
NOAA 24-hr C 25-YEAR Rainfall=6.50"

Area (sf)	CN	Description
178,174	82	Row crops, SR + CR, Good, HSG C
32,241	83	1/4 acre lots, 38% imp, HSG C
15,039	81	1/3 acre lots, 30% imp, HSG C
4,043	80	1/2 acre lots, 25% imp, HSG C
55,172	73	Brush, Good, HSG D
434	87	1/4 acre lots, 38% imp, HSG D
6,581	86	1/3 acre lots, 30% imp, HSG D
9,323	85	1/2 acre lots, 25% imp, HSG D
301,007	81	Weighted Average
278,763		92.61% Pervious Area
22,244		7.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
37.1	150	0.0020	0.07		**Sheet Flow,** Cultivated: Residue>20% n= 0.170 P2= 3.30"
6.2	400	0.0141	1.07		**Shallow Concentrated Flow,** Cultivated Straight Rows Kv= 9.0 fps
1.5	57	0.0158	0.63		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
44.8	607	Total			

Subcatchment 46S: w-3



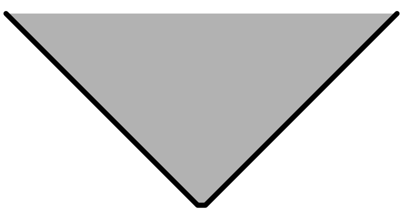
Summary for Reach 48R: (new Reach)

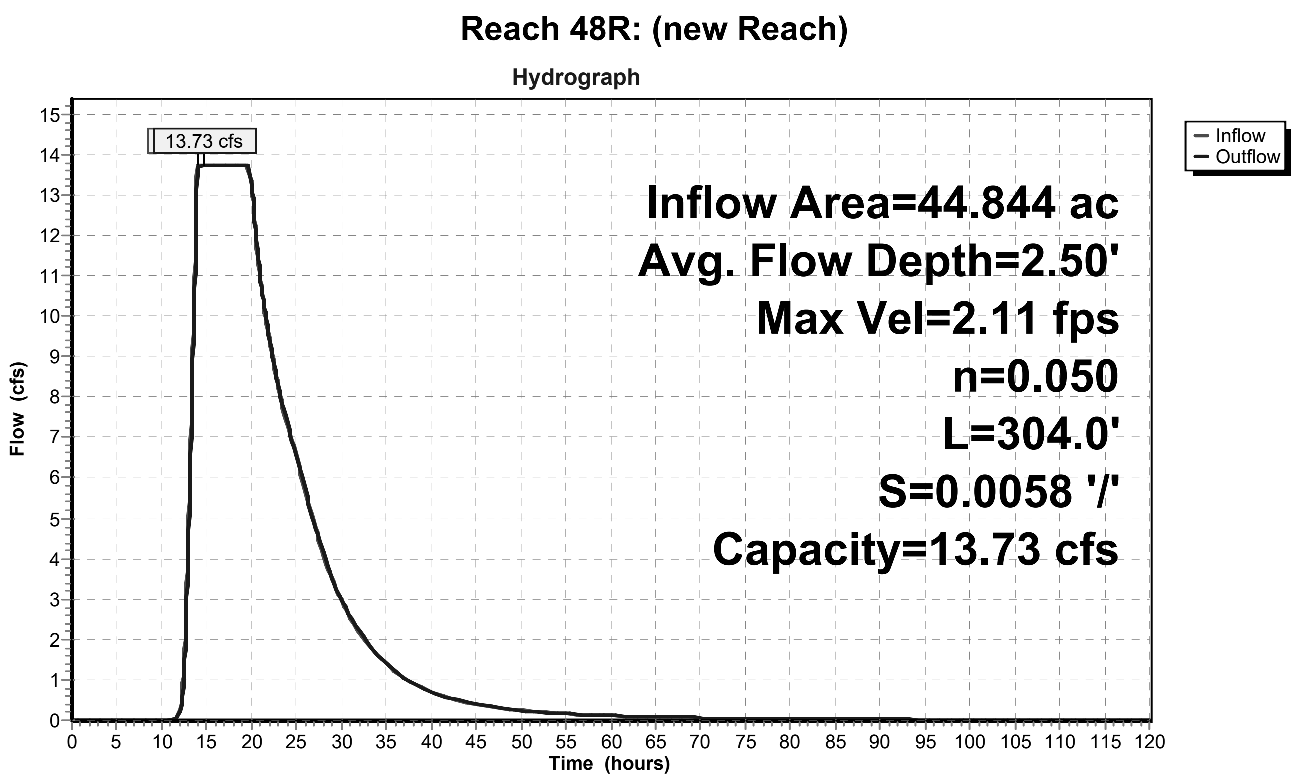
Inflow Area = 44.844 ac, 1.80% Impervious, Inflow Depth > 4.10" for 25-YEAR event
Inflow = 13.73 cfs @ 14.00 hrs, Volume= 15.328 af
Outflow = 13.73 cfs @ 14.65 hrs, Volume= 15.328 af, Atten= 0%, Lag= 39.0 min
Routed to Pond 44P : Culvert @ ditch

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Max. Velocity= 2.11 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 0.82 fps, Avg. Travel Time= 6.2 min

Peak Storage= 1,976 cf @ 14.65 hrs
Average Depth at Peak Storage= 2.50' , Surface Width= 5.10'
Bank-Full Depth= 2.50' Flow Area= 6.5 sf, Capacity= 13.73 cfs

0.10' x 2.50' deep channel, n= 0.050
Side Slope Z-value= 1.00 '/' Top Width= 5.10'
Length= 304.0' Slope= 0.0058 '/'
Inlet Invert= 6.75', Outlet Invert= 5.00'





Summary for Pond 40P: C-1

Inflow Area = 72.869 ac, 12.41% Impervious, Inflow Depth > 4.17" for 25-YEAR event
Inflow = 39.31 cfs @ 12.67 hrs, Volume= 25.302 af
Outflow = 38.77 cfs @ 12.84 hrs, Volume= 25.268 af, Atten= 1%, Lag= 9.9 min
Primary = 38.77 cfs @ 12.84 hrs, Volume= 25.268 af
Routed to Link 43L : MHHW

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Starting Elev= 2.70' Surf.Area= 6,440 sf Storage= 4,293 cf
Peak Elev= 4.38' @ 12.84 hrs Surf.Area= 49,660 sf Storage= 45,639 cf (41,346 cf above start)
Flood Elev= 5.50' Surf.Area= 101,376 sf Storage= 128,769 cf (124,476 cf above start)

Plug-Flow detention time= 46.9 min calculated for 25.169 af (99% of inflow)
Center-of-Mass det. time= 23.7 min (1,178.8 - 1,155.1)

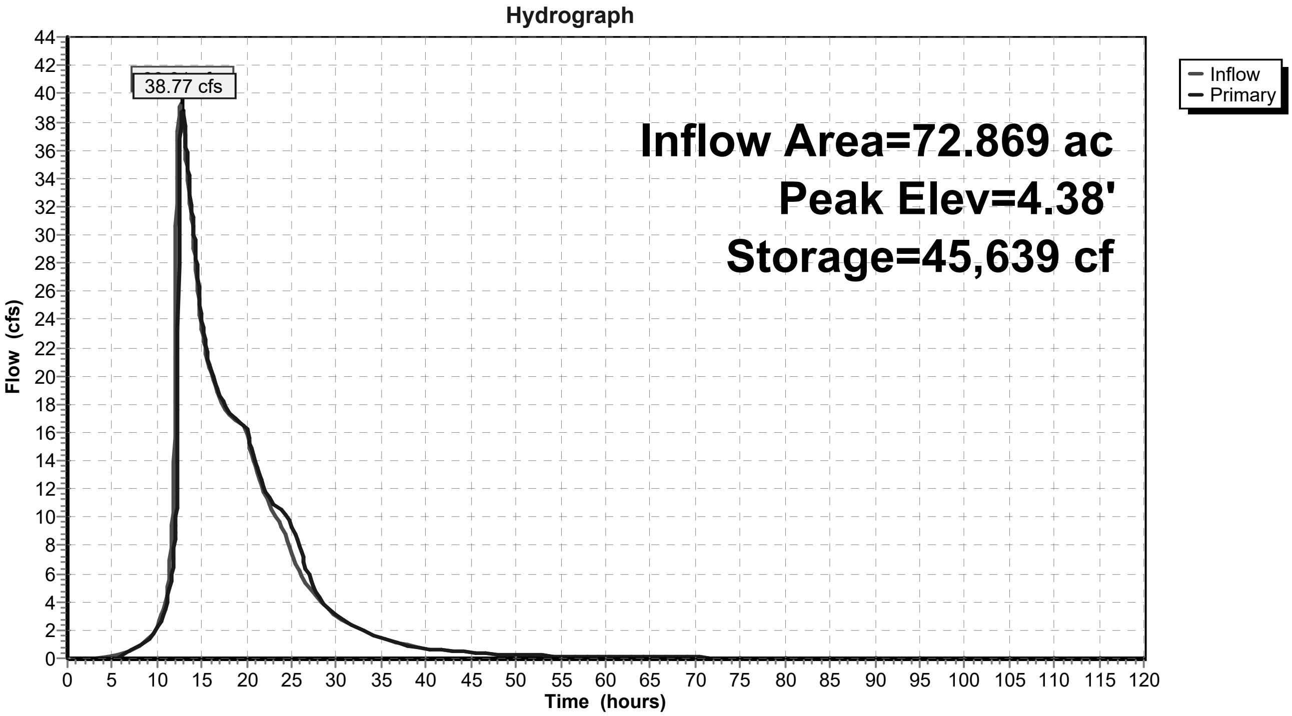
Volume	Invert	Avail.Storage	Storage Description
#1	0.70'	128,769 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
0.70	0	0.0	0	0	0
2.70	6,440	1,626.0	4,293	4,293	210,399
5.50	101,376	2,163.2	124,476	128,769	372,471

Device	Routing	Invert	Outlet Devices
#1	Primary	0.84'	**18.0" Round Culvert X 2.00 w/ 6.0" inside fill** L= 25.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 0.34' / 0.09' S= 0.0100 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 1.25 sf
#2	Primary	4.04'	**50.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=38.76 cfs @ 12.84 hrs HW=4.38' TW=2.89' (Dynamic Tailwater)
1=Culvert (Outlet Controls 12.47 cfs @ 4.98 fps)
2=Broad-Crested Rectangular Weir (Weir Controls 26.28 cfs @ 1.56 fps)

Pond 40P: C-1


Hydrograph
38.77 cfs
Inflow
Primary
Inflow Area=72.869 ac
Peak Elev=4.38'
Storage=45,639 cf
Flow (cfs)
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
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120

Summary for Pond 44P: Culvert @ ditch

Inflow Area = 44.844 ac, 1.80% Impervious, Inflow Depth > 4.10" for 25-YEAR event
Inflow = 13.73 cfs @ 14.65 hrs, Volume= 15.328 af
Outflow = 13.73 cfs @ 15.05 hrs, Volume= 15.328 af, Atten= 0%, Lag= 24.0 min
Primary = 11.78 cfs @ 20.53 hrs, Volume= 11.266 af
Routed to Pond CB-5 : CB-5
Secondary = 10.47 cfs @ 14.04 hrs, Volume= 4.062 af
Routed to Pond CB-5 : CB-5

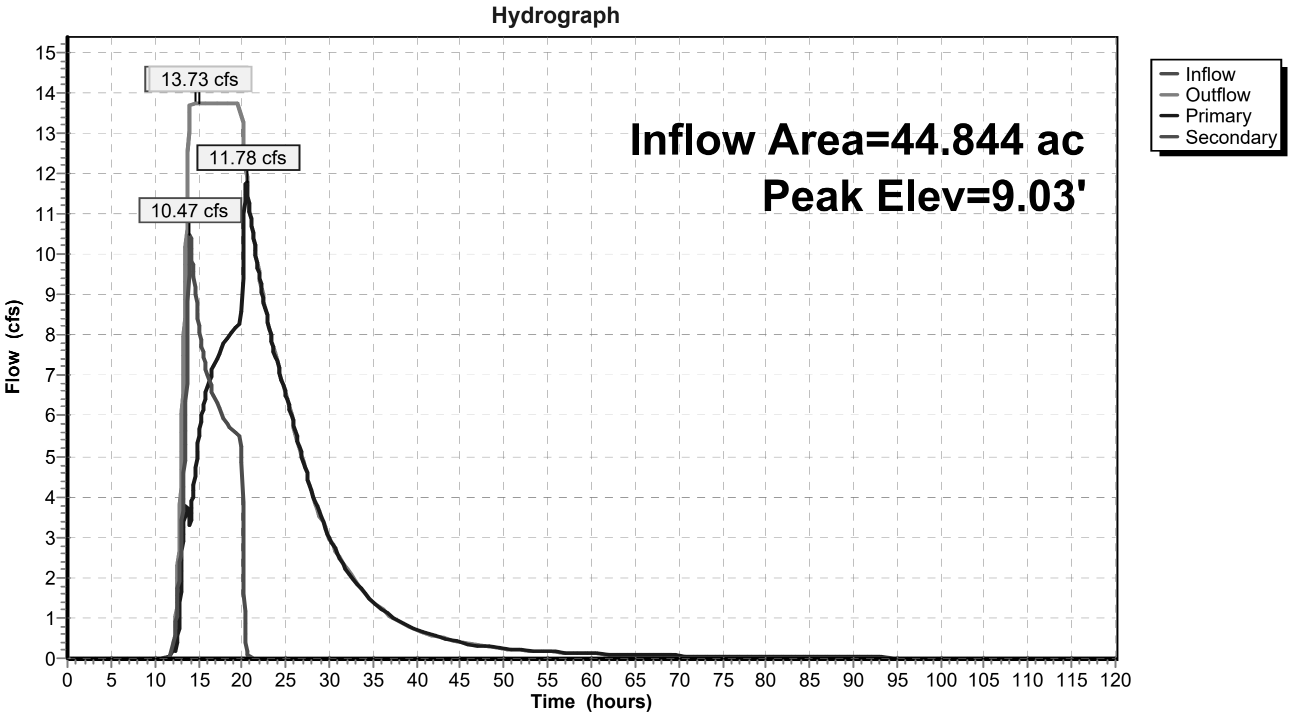
Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 9.03' @ 14.04 hrs
Flood Elev= 7.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	5.00'	**24.0" Round Culvert** L= 20.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 5.00' / 4.34' S= 0.0330 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Secondary	7.00'	**6.0' long x 12.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Primary OutFlow Max=12.01 cfs @ 20.53 hrs HW=7.04' TW=6.58' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 12.01 cfs @ 4.66 fps)

Secondary OutFlow Max=11.88 cfs @ 14.04 hrs HW=9.02' TW=8.98' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 11.88 cfs @ 0.98 fps)

Pond 44P: Culvert @ ditch



Summary for Pond 46P: Farm Pond

Inflow Area = 1.853 ac, 0.00% Impervious, Inflow Depth = 3.92" for 25-YEAR event
Inflow = 3.05 cfs @ 12.54 hrs, Volume= 0.605 af
Outflow = 1.14 cfs @ 23.70 hrs, Volume= 0.301 af, Atten= 63%, Lag= 669.8 min
Primary = 1.14 cfs @ 23.70 hrs, Volume= 0.301 af
Routed to Pond 47P : W-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 8.78' @ 23.31 hrs Surf.Area= 18,869 sf Storage= 25,671 cf

Plug-Flow detention time= 895.0 min calculated for 0.301 af (50% of inflow)
Center-of-Mass det. time= 770.5 min (1,640.2 - 869.7)

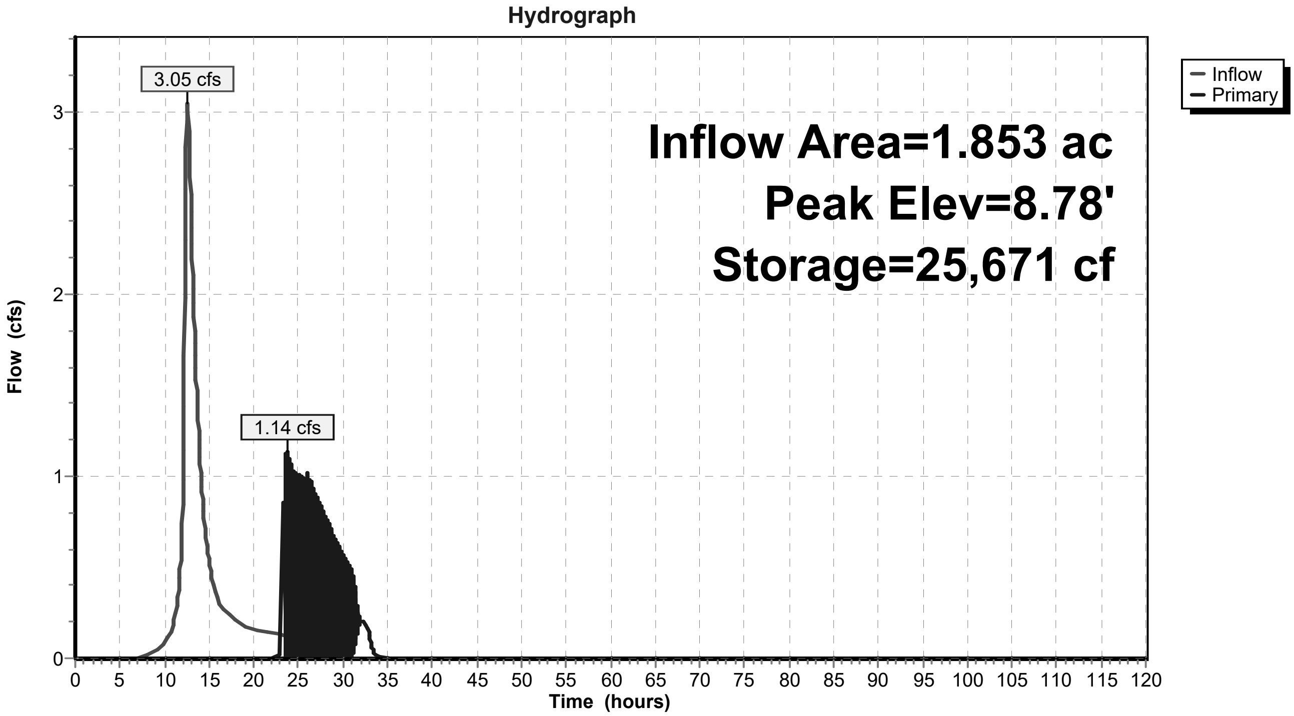
Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	37,392 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
4.00	0	0.0	0	0	0
8.00	10,722	446.1	14,296	14,296	15,861
9.00	21,600	638.0	15,847	30,143	32,426
10.00	1	1.0	7,249	37,392	64,819

Device	Routing	Invert	Outlet Devices
#1	Primary	7.90'	**25.0' long x 35.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=3.37 cfs @ 23.70 hrs HW=8.75' TW=8.75' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 3.37 cfs @ 0.16 fps)

Pond 46P: Farm Pond



Summary for Pond 47P: W-2

Inflow Area = 37.934 ac, 0.79% Impervious, Inflow Depth = 4.23" for 25-YEAR event
Inflow = 41.89 cfs @ 13.02 hrs, Volume= 13.357 af
Outflow = 24.32 cfs @ 14.43 hrs, Volume= 13.357 af, Atten= 42%, Lag= 84.4 min
Primary = 24.32 cfs @ 14.43 hrs, Volume= 13.357 af
Routed to Pond 48P : w-3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Starting Elev= 7.00' Surf.Area= 7,186 sf Storage= 7,186 cf
Peak Elev= 11.71' @ 16.14 hrs Surf.Area= 1 sf Storage= 150,890 cf (143,704 cf above start)
Flood Elev= 9.00' Surf.Area= 116,660 sf Storage= 111,889 cf (104,703 cf above start)

Plug-Flow detention time= 218.6 min calculated for 13.192 af (99% of inflow)
Center-of-Mass det. time= 200.4 min (1,132.2 - 931.9)

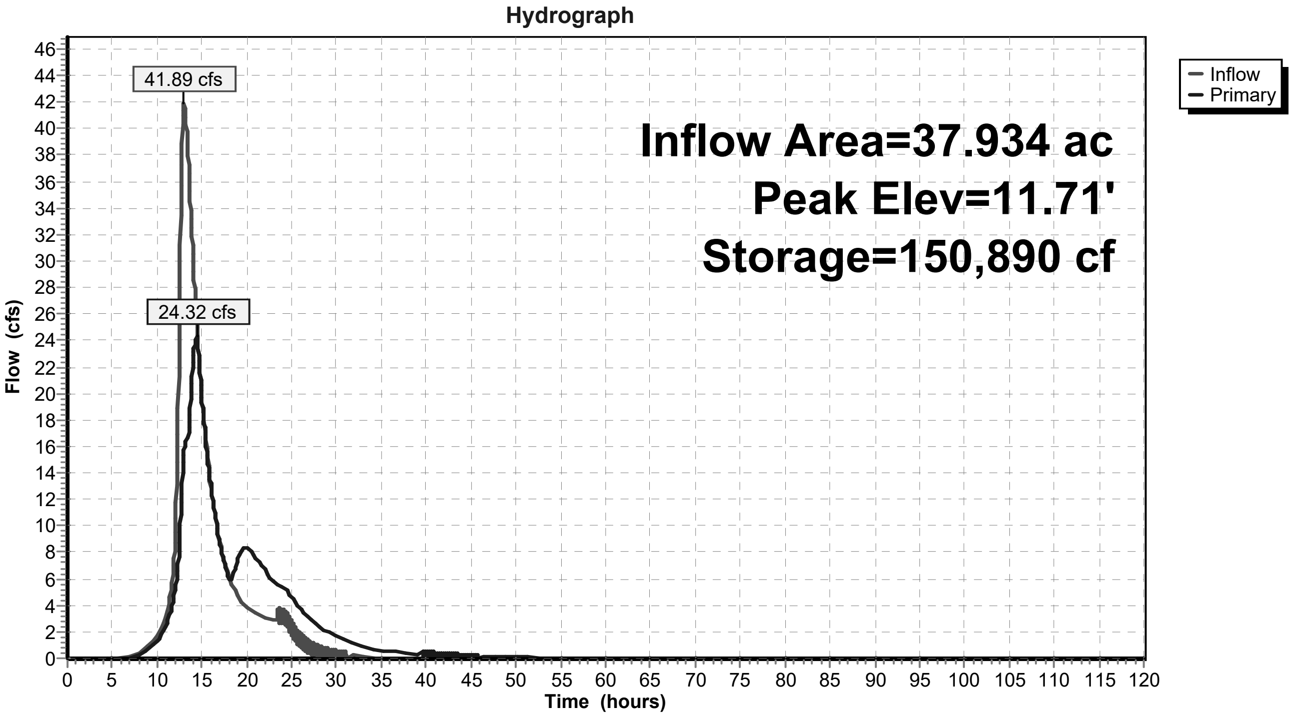
Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	150,890 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
4.00	0	0.0	0	0	0
7.00	7,186	362.8	7,186	7,186	10,488
8.00	48,289	1,234.1	24,701	31,887	121,214
9.00	116,660	1,809.4	80,002	111,889	260,556
10.00	1	1.0	39,001	150,890	521,089

Device	Routing	Invert	Outlet Devices
#1	Primary	7.00'	**5.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=24.61 cfs @ 14.43 hrs HW=9.83' TW=9.73' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 24.61 cfs @ 1.74 fps)

Pond 47P: W-2


Hydrograph
41.89 cfs
24.32 cfs
Inflow
Primary
Inflow Area=37.934 ac
Peak Elev=11.71'
Storage=150,890 cf
Flow (cfs)
Time (hours)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120
2
4
6
8
12
14
16
18
22
24
26
28
32
34
36
38
42
44
46

Summary for Pond 48P: w-3

Inflow Area = 44.844 ac, 1.80% Impervious, Inflow Depth = 4.24" for 25-YEAR event
Inflow = 28.19 cfs @ 14.37 hrs, Volume= 15.857 af
Outflow = 13.73 cfs @ 14.00 hrs, Volume= 15.328 af, Atten= 51%, Lag= 0.0 min
Primary = 13.73 cfs @ 14.00 hrs, Volume= 15.328 af
Routed to Reach 48R : (new Reach)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 11.71' @ 16.14 hrs Surf.Area= 3,734 sf Storage= 209,511 cf

Plug-Flow detention time= 294.6 min calculated for 15.328 af (97% of inflow)
Center-of-Mass det. time= 249.2 min (1,340.8 - 1,091.6)

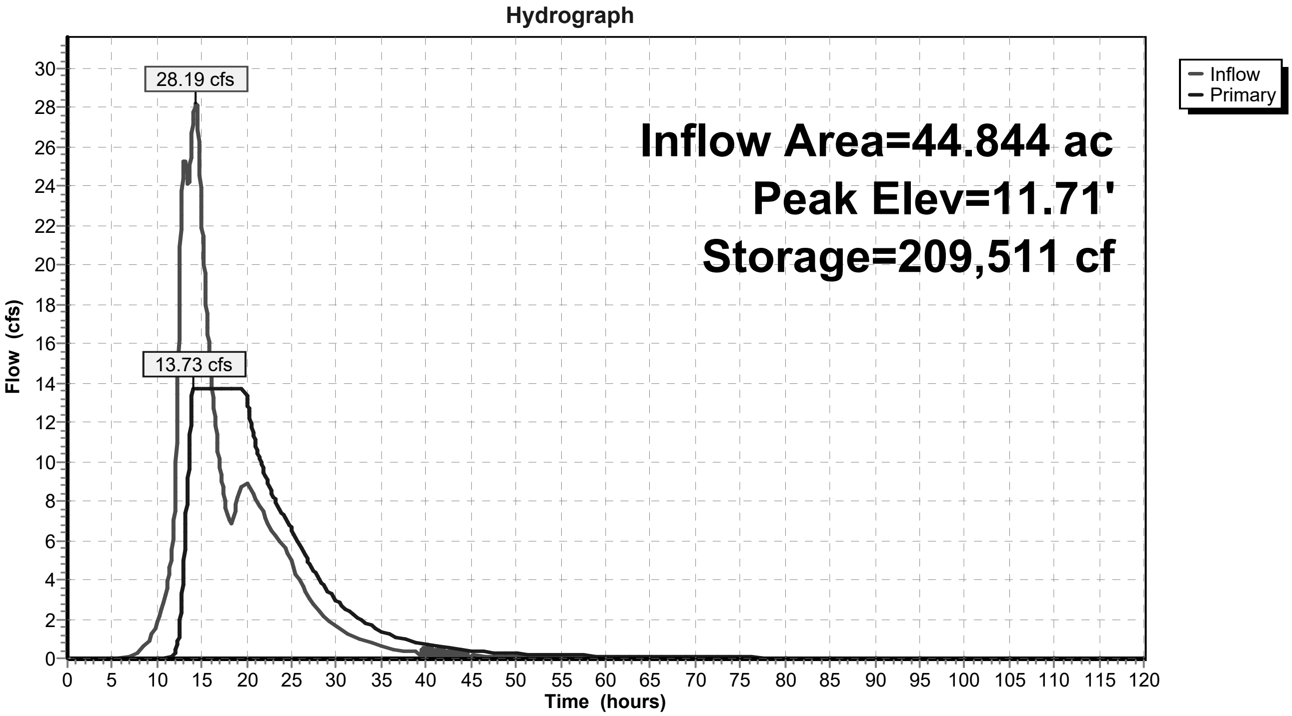
Volume	Invert	Avail.Storage	Storage Description
#1	4.00'	210,516 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
4.00	0	0.0	0	0	0
7.00	26,232	838.7	26,232	26,232	55,990
8.00	54,023	958.7	39,300	65,532	73,178
9.00	70,709	1,081.7	62,179	127,711	93,175
12.50	1	1.0	82,805	210,516	186,306

Device	Routing	Invert	Outlet Devices
#1	Primary	6.75'	**Channel/Reach** using Reach 48R: (new Reach)

Primary OutFlow Max=13.73 cfs @ 14.00 hrs HW=9.30' TW=9.25' (Dynamic Tailwater)
└─**1=Channel/Reach** (Channel Controls 13.73 cfs @ 2.11 fps)

Pond 48P: w-3


Hydrograph
28.19 cfs
13.73 cfs
Inflow
Primary
Inflow Area=44.844 ac
Peak Elev=11.71'
Storage=209,511 cf
Flow (cfs)
Time (hours)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120

Summary for Pond CB-1: CB-1

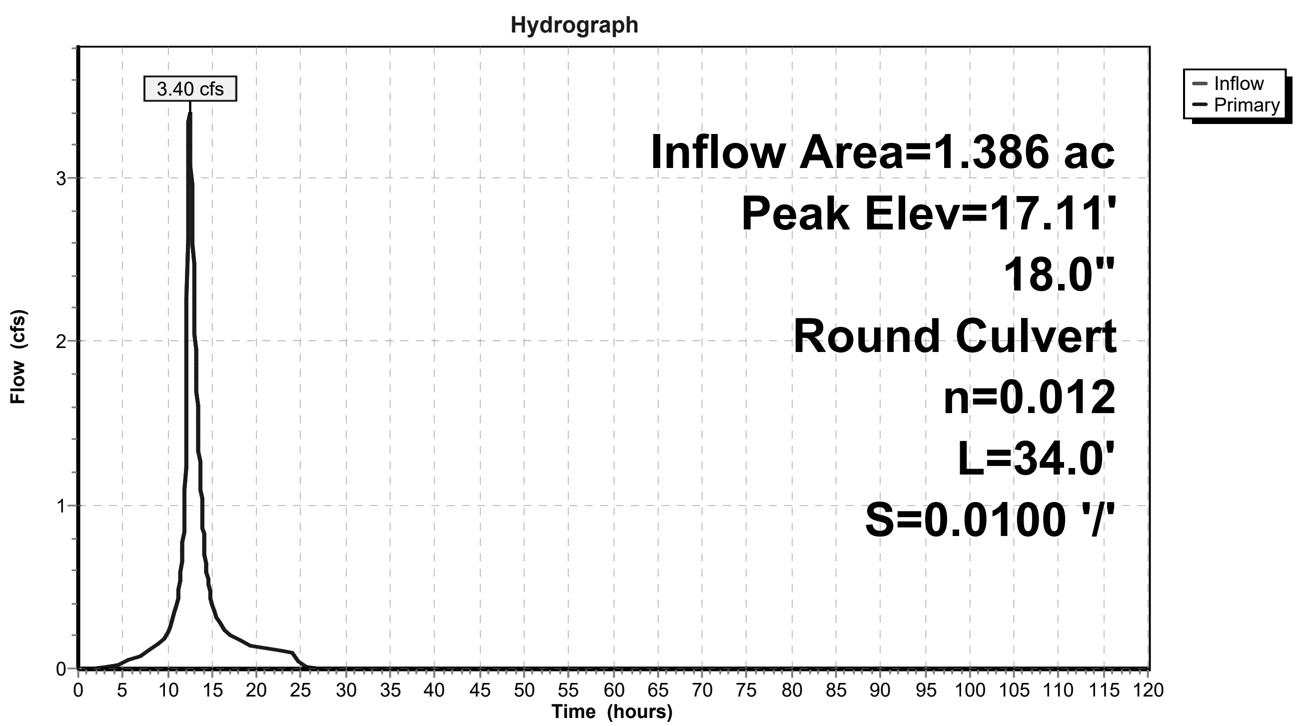
Inflow Area = 1.386 ac, 76.98% Impervious, Inflow Depth = 5.56" for 25-YEAR event
Inflow = 3.40 cfs @ 12.45 hrs, Volume= 0.642 af
Outflow = 3.40 cfs @ 12.45 hrs, Volume= 0.642 af, Atten= 0%, Lag= 0.0 min
Primary = 3.40 cfs @ 12.45 hrs, Volume= 0.642 af
Routed to Pond CB-11 : CB-11

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 17.11' @ 12.44 hrs
Flood Elev= 15.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	12.50'	**18.0" Round RCP_Round 18"** L= 34.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 12.50' / 12.16' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=3.38 cfs @ 12.45 hrs HW=17.10' TW=16.94' (Dynamic Tailwater)
1=RCP_Round 18" (Inlet Controls 3.38 cfs @ 1.91 fps)

Pond CB-1: CB-1



Summary for Pond CB-10: CB-10

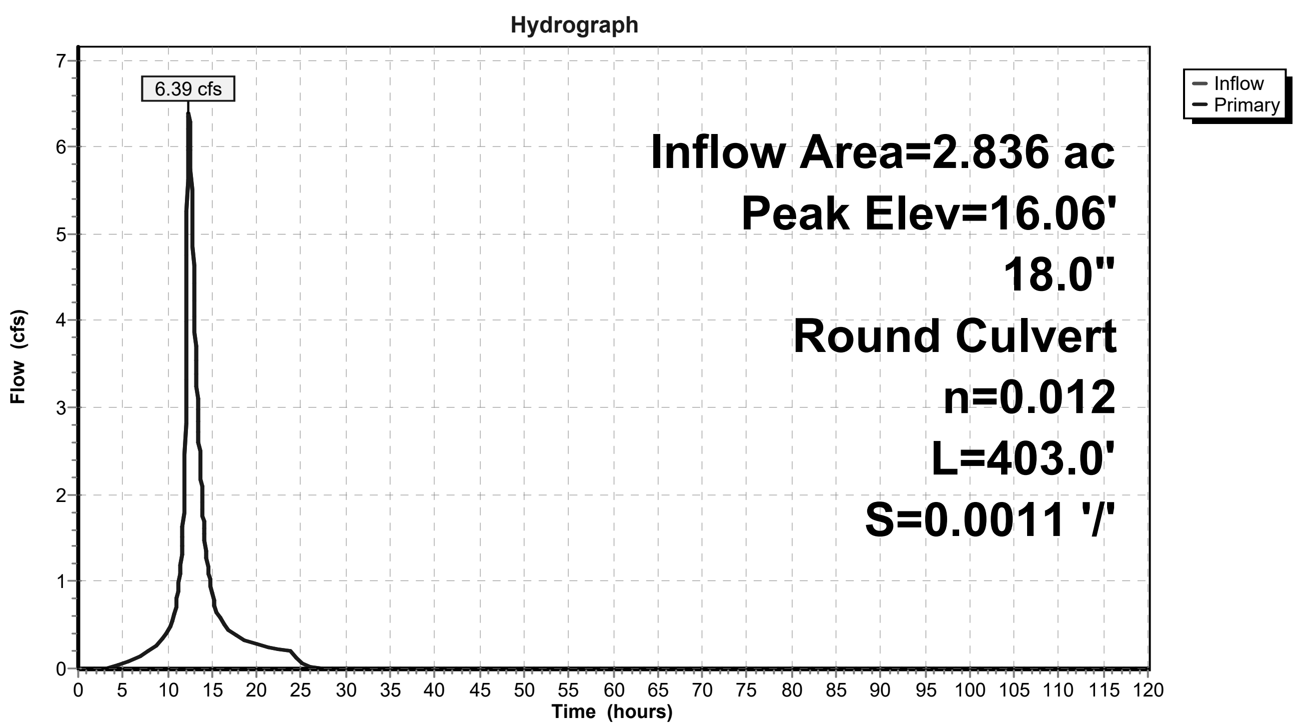
Inflow Area = 2.836 ac, 71.29% Impervious, Inflow Depth = 5.41" for 25-YEAR event
Inflow = 6.39 cfs @ 12.44 hrs, Volume= 1.279 af
Outflow = 6.39 cfs @ 12.44 hrs, Volume= 1.279 af, Atten= 0%, Lag= 0.0 min
Primary = 6.39 cfs @ 12.44 hrs, Volume= 1.279 af
Routed to Pond CB-9 : CB-9

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 16.06' @ 12.39 hrs
Flood Elev= 15.05'

Device	Routing	Invert	Outlet Devices
#1	Primary	10.34'	**18.0" Round RCP_Round 18"** L= 403.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 10.34' / 9.89' S= 0.0011 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=6.39 cfs @ 12.44 hrs HW=15.88' TW=14.30' (Dynamic Tailwater)
└─**1=RCP_Round 18"** (Outlet Controls 6.39 cfs @ 3.61 fps)

Pond CB-10: CB-10



Summary for Pond CB-11: CB-11

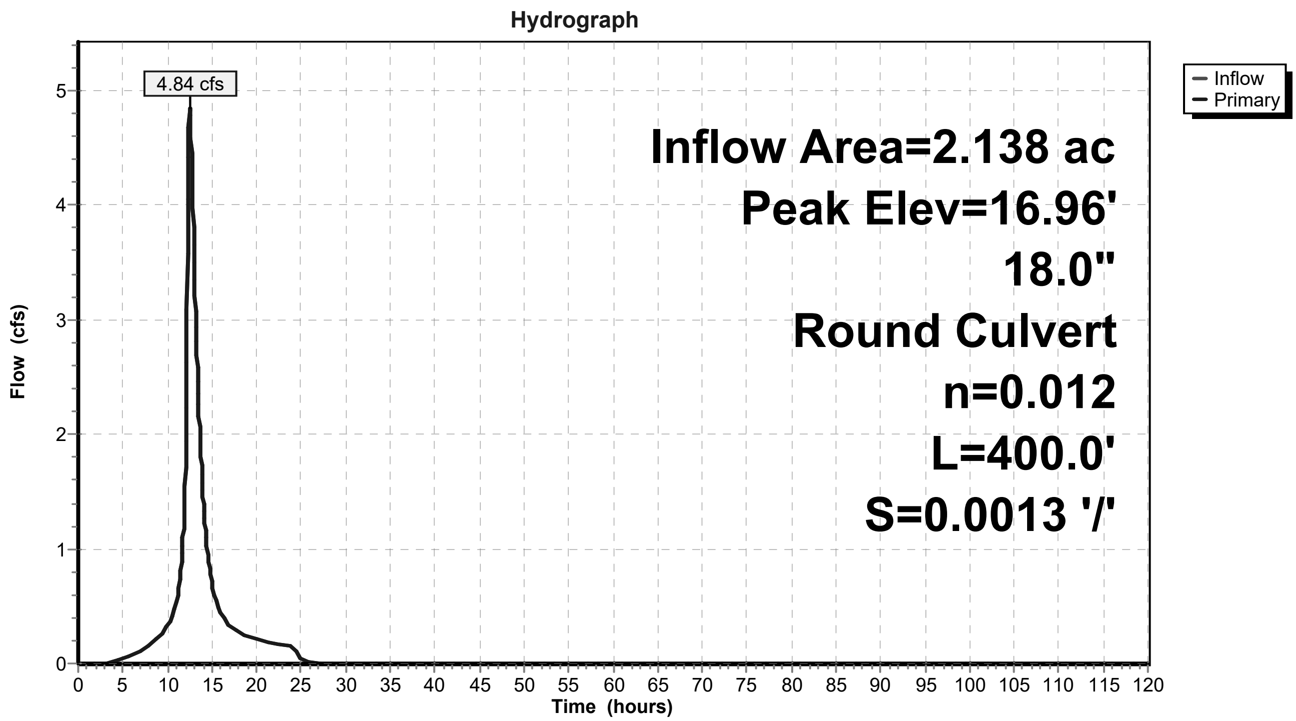
Inflow Area = 2.138 ac, 73.44% Impervious, Inflow Depth = 5.48" for 25-YEAR event
Inflow = 4.84 cfs @ 12.49 hrs, Volume= 0.977 af
Outflow = 4.84 cfs @ 12.49 hrs, Volume= 0.977 af, Atten= 0%, Lag= 0.0 min
Primary = 4.84 cfs @ 12.49 hrs, Volume= 0.977 af
Routed to Pond CB-10 : CB-10

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 16.96' @ 12.44 hrs
Flood Elev= 15.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	10.84'	**18.0" Round Culvert** L= 400.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 10.84' / 10.34' S= 0.0013 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=5.48 cfs @ 12.49 hrs HW=16.74' TW=15.58' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 5.48 cfs @ 3.10 fps)

Pond CB-11: CB-11



Summary for Pond CB-12: CB-12

Inflow Area = 3.172 ac, 19.16% Impervious, Inflow Depth = 4.76" for 25-YEAR event
Inflow = 7.01 cfs @ 12.44 hrs, Volume= 1.259 af
Outflow = 7.01 cfs @ 12.44 hrs, Volume= 1.259 af, Atten= 0%, Lag= 0.0 min
Primary = 4.07 cfs @ 12.14 hrs, Volume= 0.934 af
Routed to Pond MH-1 : MANHOLE-1
Secondary = 7.05 cfs @ 12.43 hrs, Volume= 0.325 af

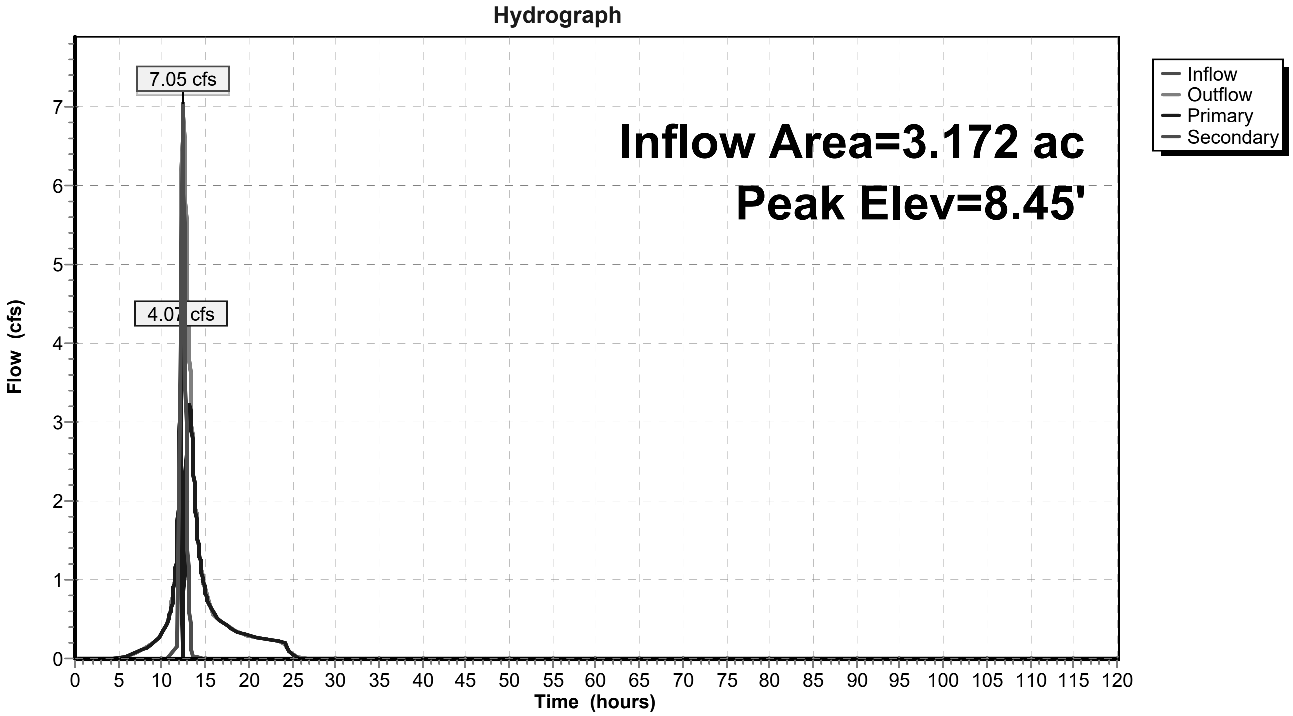
Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 8.45' @ 12.43 hrs
Flood Elev= 6.97'

Device	Routing	Invert	Outlet Devices
#1	Primary	3.13'	**18.0" Round Culvert** L= 32.0' RCP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 3.13' / 2.35' S= 0.0244 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf
#2	Secondary	7.25'	**2.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=0.00 cfs @ 12.14 hrs HW=6.97' TW=7.31' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Secondary OutFlow Max=6.99 cfs @ 12.43 hrs HW=8.44' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 6.99 cfs @ 2.94 fps)

Pond CB-12: CB-12



Summary for Pond CB-13: CB-13

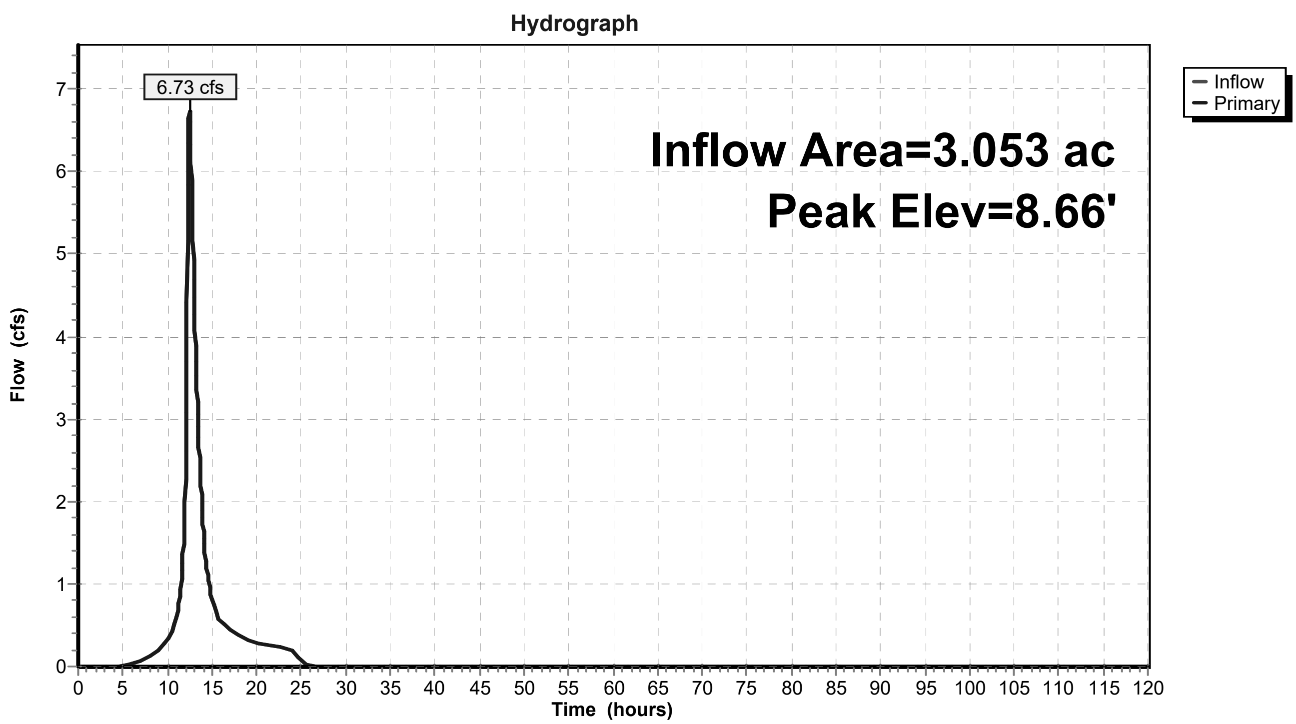
Inflow Area = 3.053 ac, 18.61% Impervious, Inflow Depth = 4.78" for 25-YEAR event
Inflow = 6.73 cfs @ 12.45 hrs, Volume= 1.215 af
Outflow = 6.73 cfs @ 12.45 hrs, Volume= 1.215 af, Atten= 0%, Lag= 0.0 min
Primary = 6.73 cfs @ 12.45 hrs, Volume= 1.215 af
Routed to Pond CB-12 : CB-12

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 8.66' @ 12.44 hrs
Flood Elev= 7.93'

Device	Routing	Invert	Outlet Devices
#1	Primary	4.85'	**18.0" Round RCP_Round 18" w/ 9.0" inside fill** L= 40.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 4.10' / 3.13' S= 0.0242 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.88 sf
#2	Primary	7.93'	**4.0' long x 40.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=6.73 cfs @ 12.45 hrs HW=8.66' TW=8.44' (Dynamic Tailwater)
1=RCP_Round 18" (Inlet Controls 2.00 cfs @ 2.26 fps)
2=Broad-Crested Rectangular Weir (Weir Controls 4.73 cfs @ 1.62 fps)

Pond CB-13: CB-13



Summary for Pond CB-14: CB-14

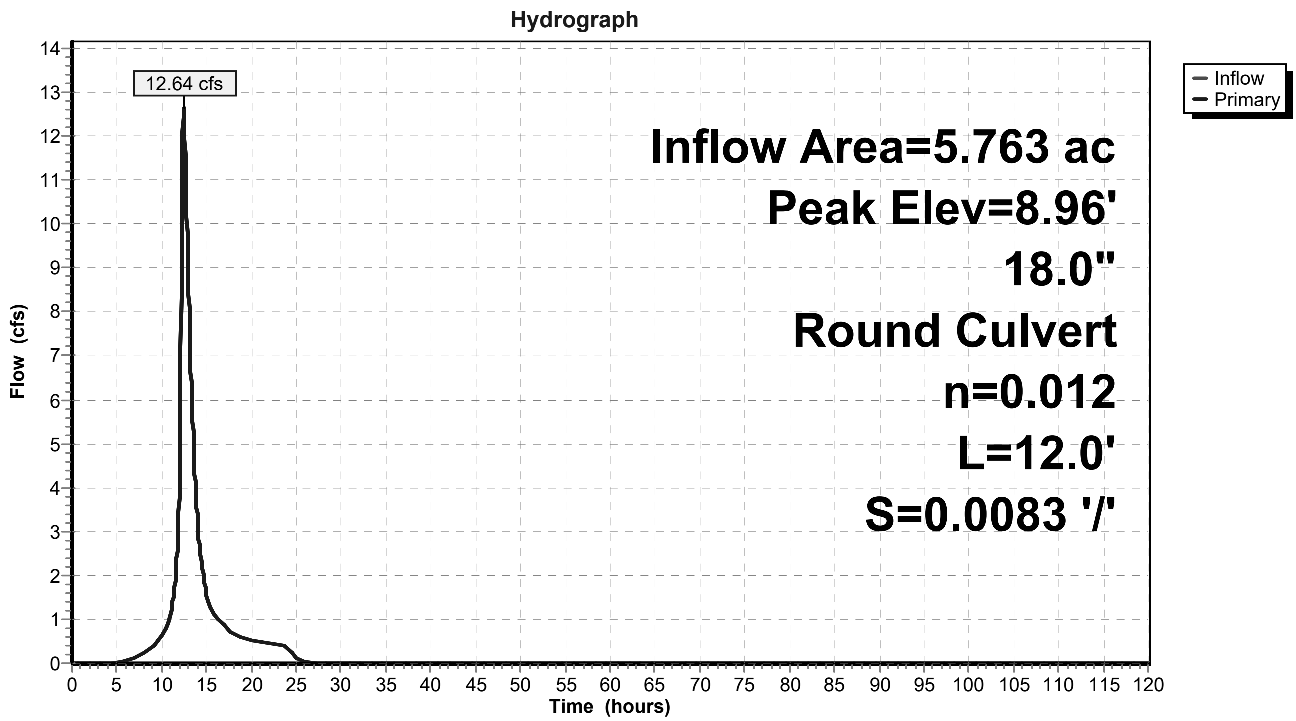
Inflow Area = 5.763 ac, 33.62% Impervious, Inflow Depth = 4.82" for 25-YEAR event
Inflow = 12.64 cfs @ 12.45 hrs, Volume= 2.312 af
Outflow = 12.64 cfs @ 12.45 hrs, Volume= 2.312 af, Atten= 0%, Lag= 0.0 min
Primary = 12.64 cfs @ 12.45 hrs, Volume= 2.312 af
Routed to Pond MH-2 : MANHOLE-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 8.96' @ 12.44 hrs
Flood Elev= 6.16'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.94'	**18.0" Round RCP_Round 18"** L= 12.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2.94' / 2.84' S= 0.0083 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=12.55 cfs @ 12.45 hrs HW=8.96' TW=6.78' (Dynamic Tailwater)
1=RCP_Round 18" (Inlet Controls 12.55 cfs @ 7.10 fps)

Pond CB-14: CB-14



Summary for Pond CB-15: CB-15

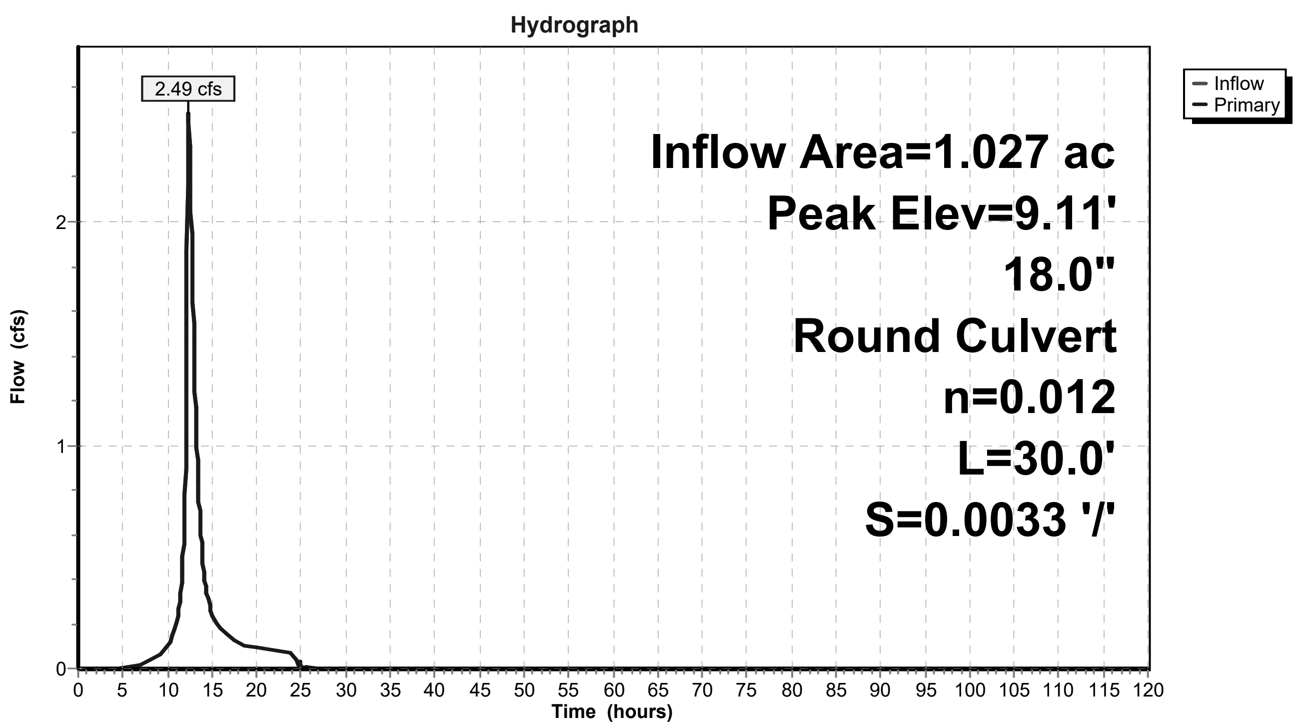
Inflow Area = 1.027 ac, 26.93% Impervious, Inflow Depth = 4.67" for 25-YEAR event
Inflow = 2.49 cfs @ 12.38 hrs, Volume= 0.399 af
Outflow = 2.49 cfs @ 12.38 hrs, Volume= 0.399 af, Atten= 0%, Lag= 0.0 min
Primary = 2.49 cfs @ 12.38 hrs, Volume= 0.399 af
Routed to Pond CB-14 : CB-14

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 9.11' @ 12.45 hrs
Flood Elev= 6.74'

Device	Routing	Invert	Outlet Devices
#1	Primary	3.04'	**18.0" Round RCP_Round 18"** L= 30.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 3.04' / 2.94' S= 0.0033 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=2.75 cfs @ 12.38 hrs HW=8.91' TW=8.81' (Dynamic Tailwater)
1=RCP_Round 18" (Inlet Controls 2.75 cfs @ 1.56 fps)

Pond CB-15: CB-15



Summary for Pond CB-16: CB-16

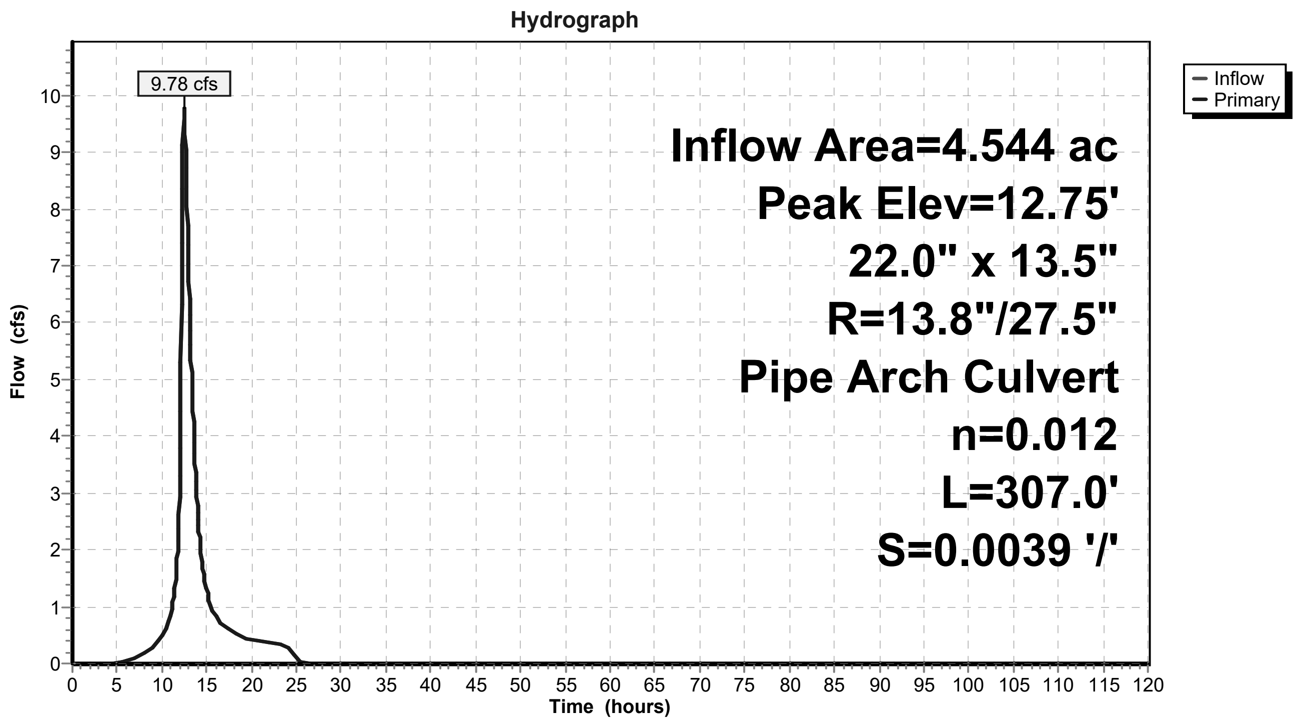
Inflow Area = 4.544 ac, 33.28% Impervious, Inflow Depth = 4.81" for 25-YEAR event
Inflow = 9.78 cfs @ 12.47 hrs, Volume= 1.823 af
Outflow = 9.78 cfs @ 12.47 hrs, Volume= 1.823 af, Atten= 0%, Lag= 0.0 min
Primary = 9.78 cfs @ 12.47 hrs, Volume= 1.823 af
Routed to Pond CB-14 : CB-14

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 12.75' @ 12.46 hrs
Flood Elev= 9.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	4.14'	**22.0" W x 13.5" H, R=13.8"/27.5" Pipe Arch RCP_Arch 22x14** L= 307.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 4.14' / 2.94' S= 0.0039 '/' Cc= 0.900 n= 0.012, Flow Area= 1.65 sf

Primary OutFlow Max=9.84 cfs @ 12.47 hrs HW=12.71' TW=8.94' (Dynamic Tailwater)
└─**1=RCP_Arch 22x14** (Outlet Controls 9.84 cfs @ 5.96 fps)

Pond CB-16: CB-16



Summary for Pond CB-17: CB-17

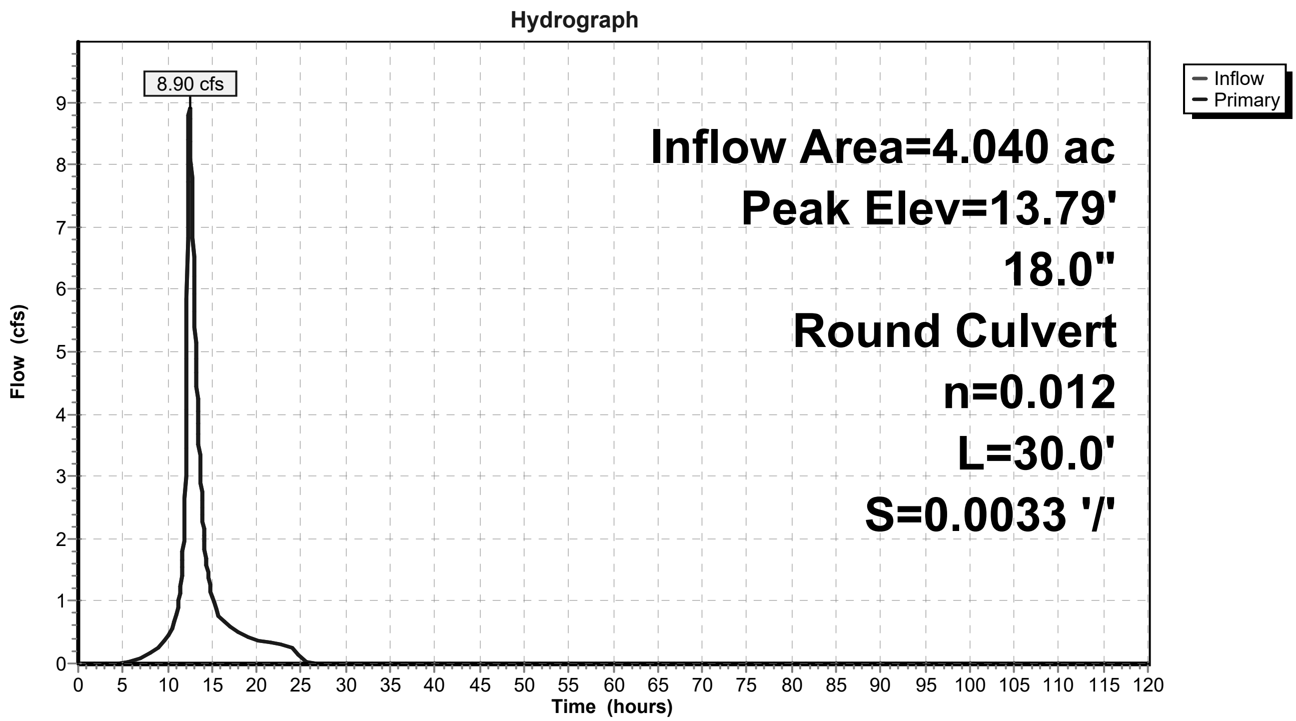
Inflow Area = 4.040 ac, 30.74% Impervious, Inflow Depth = 4.78" for 25-YEAR event
Inflow = 8.90 cfs @ 12.45 hrs, Volume= 1.608 af
Outflow = 8.90 cfs @ 12.45 hrs, Volume= 1.608 af, Atten= 0%, Lag= 0.0 min
Primary = 8.90 cfs @ 12.45 hrs, Volume= 1.608 af
Routed to Pond CB-16 : CB-16

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 13.79' @ 12.47 hrs
Flood Elev= 9.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	4.24'	**18.0" Round RCP_Round 18"** L= 30.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 4.24' / 4.14' S= 0.0033 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=8.56 cfs @ 12.45 hrs HW=13.75' TW=12.73' (Dynamic Tailwater)
└─**1=RCP_Round 18"** (Inlet Controls 8.56 cfs @ 4.84 fps)

Pond CB-17: CB-17



Summary for Pond CB-2: CB-2

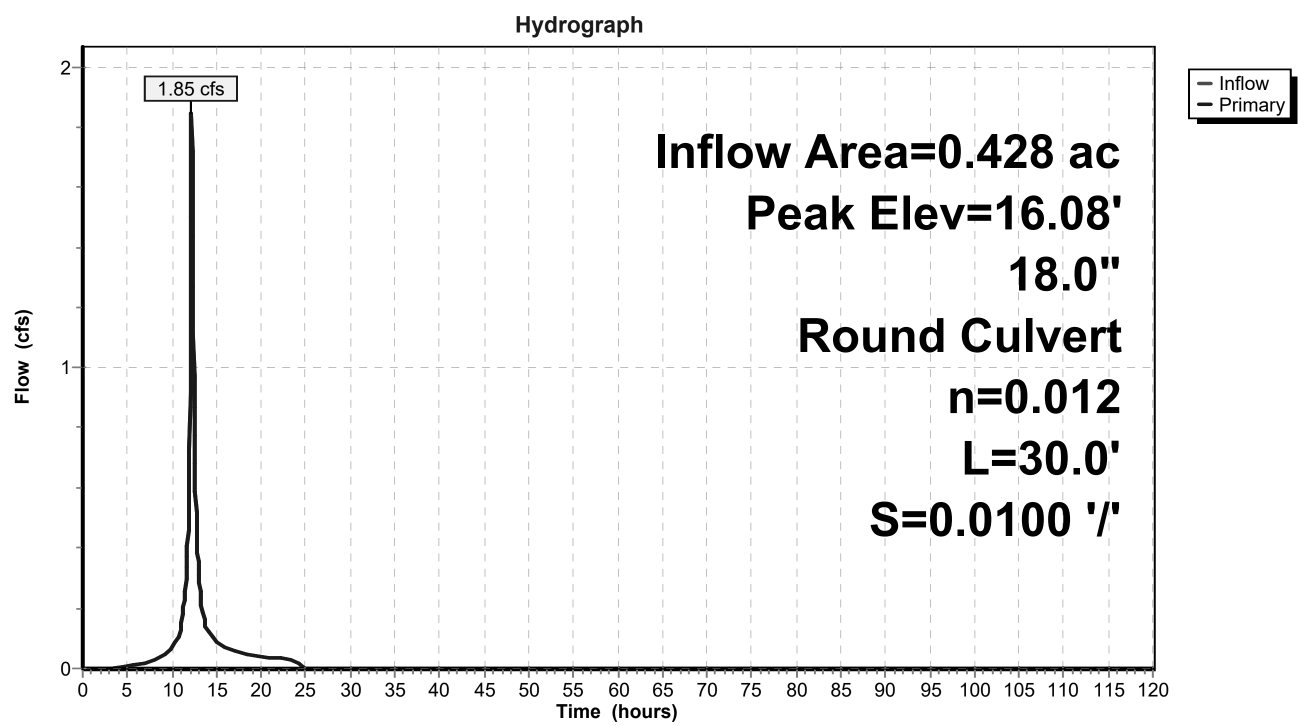
Inflow Area = 0.428 ac, 62.33% Impervious, Inflow Depth = 5.11" for 25-YEAR event
Inflow = 1.85 cfs @ 12.17 hrs, Volume= 0.182 af
Outflow = 1.85 cfs @ 12.17 hrs, Volume= 0.182 af, Atten= 0%, Lag= 0.0 min
Primary = 1.85 cfs @ 12.17 hrs, Volume= 0.182 af
Routed to Pond CB-10 : CB-10

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 16.08' @ 12.44 hrs
Flood Elev= 14.98'

Device	Routing	Invert	Outlet Devices
#1	Primary	12.48'	**18.0" Round RCP_Round 18"** L= 30.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 12.48' / 12.18' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=0.00 cfs @ 12.17 hrs HW=13.67' TW=14.23' (Dynamic Tailwater)
1=RCP_Round 18" (Controls 0.00 cfs)

Pond CB-2: CB-2



Summary for Pond CB-3: CB-3

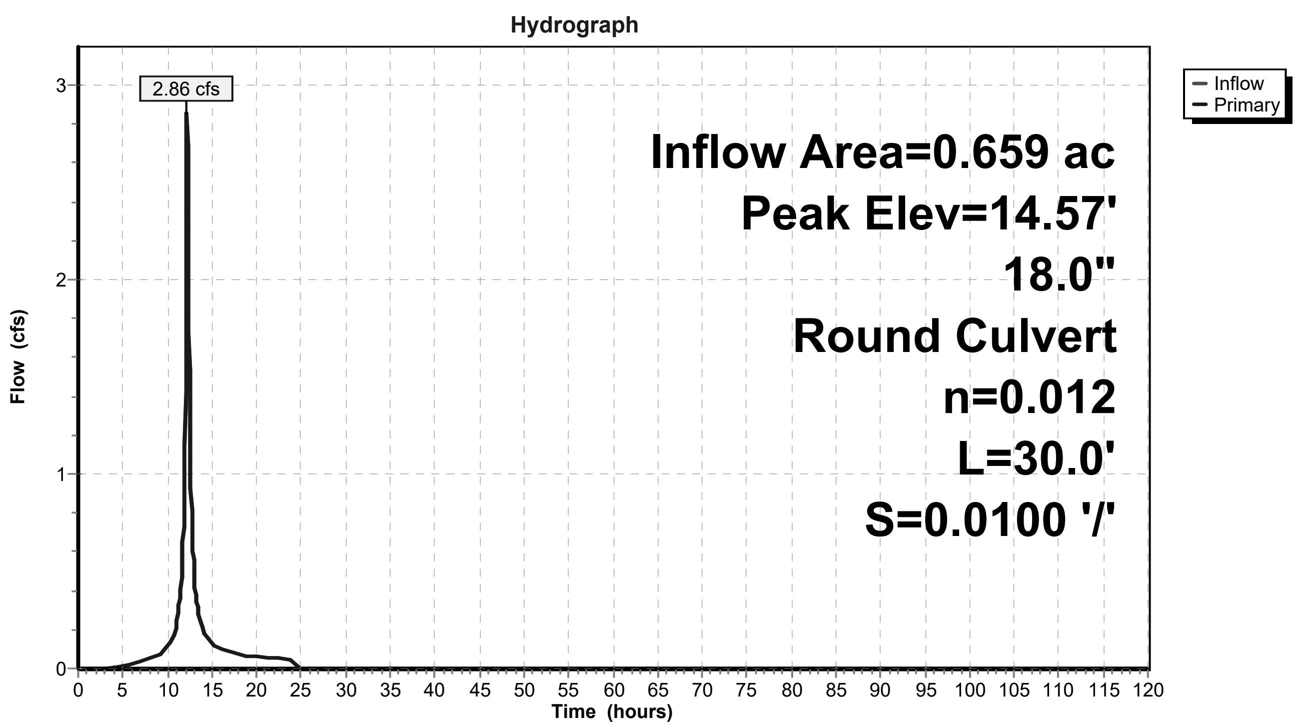
Inflow Area = 0.659 ac, 55.35% Impervious, Inflow Depth = 5.22" for 25-YEAR event
Inflow = 2.86 cfs @ 12.18 hrs, Volume= 0.287 af
Outflow = 2.86 cfs @ 12.18 hrs, Volume= 0.287 af, Atten= 0%, Lag= 0.0 min
Primary = 2.86 cfs @ 12.18 hrs, Volume= 0.287 af
Routed to Pond CB-9 : CB-9

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 14.57' @ 12.38 hrs
Flood Elev= 13.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	10.70'	**18.0" Round RCP_Round 18"** L= 30.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 10.70' / 10.40' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=0.00 cfs @ 12.18 hrs HW=13.38' TW=13.47' (Dynamic Tailwater)
1=RCP_Round 18" (Controls 0.00 cfs)

Pond CB-3: CB-3



Summary for Pond CB-4: CB-4

Inflow Area = 0.882 ac, 56.67% Impervious, Inflow Depth = 5.11" for 25-YEAR event
Inflow = 3.44 cfs @ 12.21 hrs, Volume= 0.375 af
Outflow = 3.44 cfs @ 12.21 hrs, Volume= 0.375 af, Atten= 0%, Lag= 0.0 min
Primary = 2.76 cfs @ 12.13 hrs, Volume= 0.279 af
Routed to Pond CB-8 : CB-8
Secondary = 3.35 cfs @ 12.27 hrs, Volume= 0.097 af
Routed to Pond CB-5 : CB-5

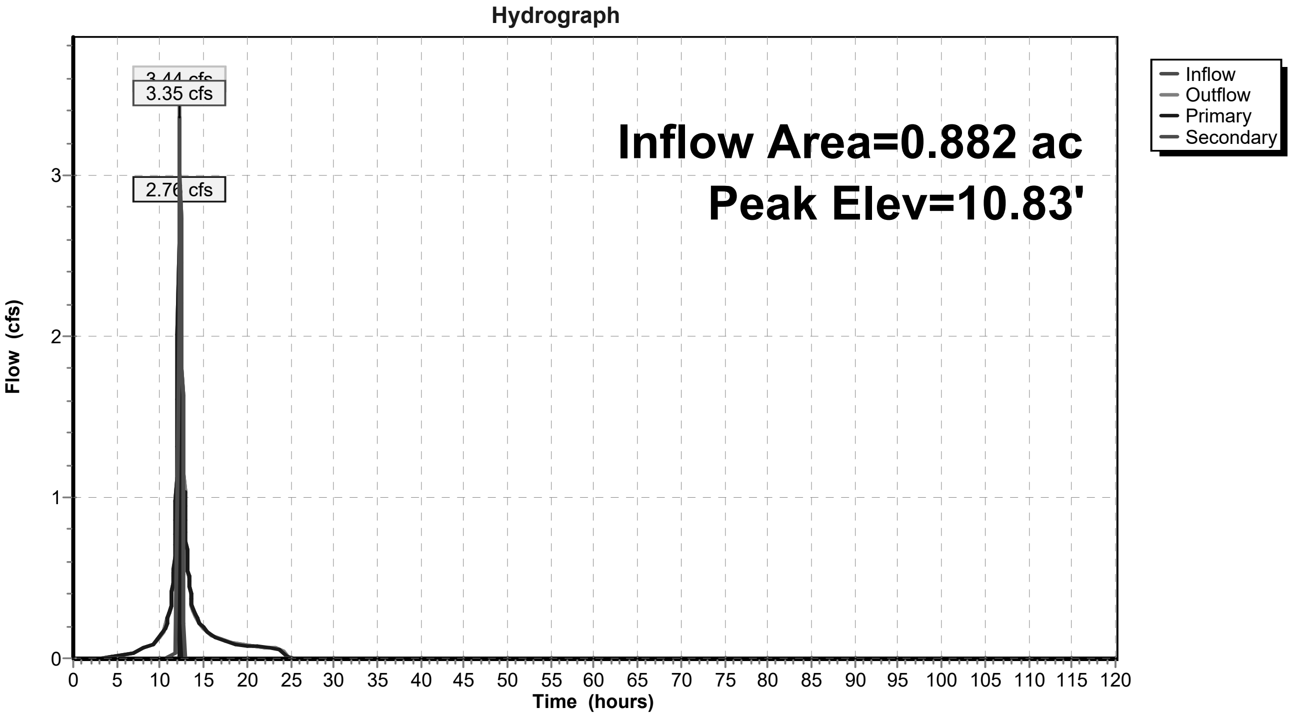
Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 10.83' @ 12.27 hrs
Flood Elev= 10.44'

Device	Routing	Invert	Outlet Devices
#1	Primary	5.16'	**18.0" Round RCP_Round 18"** L= 30.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 5.16' / 4.86' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf
#2	Secondary	10.43'	**5.0' long x 392.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.00 cfs @ 12.13 hrs HW=10.33' TW=10.40' (Dynamic Tailwater)
1=RCP_Round 18" (Controls 0.00 cfs)

Secondary OutFlow Max=3.20 cfs @ 12.27 hrs HW=10.81' TW=8.44' (Dynamic Tailwater)
2=Broad-Crested Rectangular Weir (Weir Controls 3.20 cfs @ 1.67 fps)

Pond CB-4: CB-4


Hydrograph
3.44 cfs
3.35 cfs
2.76 cfs
Inflow Area=0.882 ac
Peak Elev=10.83'
Inflow
Outflow
Primary
Secondary
Flow (cfs)
Time (hours)
0
1
2
3
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120

Summary for Pond CB-5: CB-5

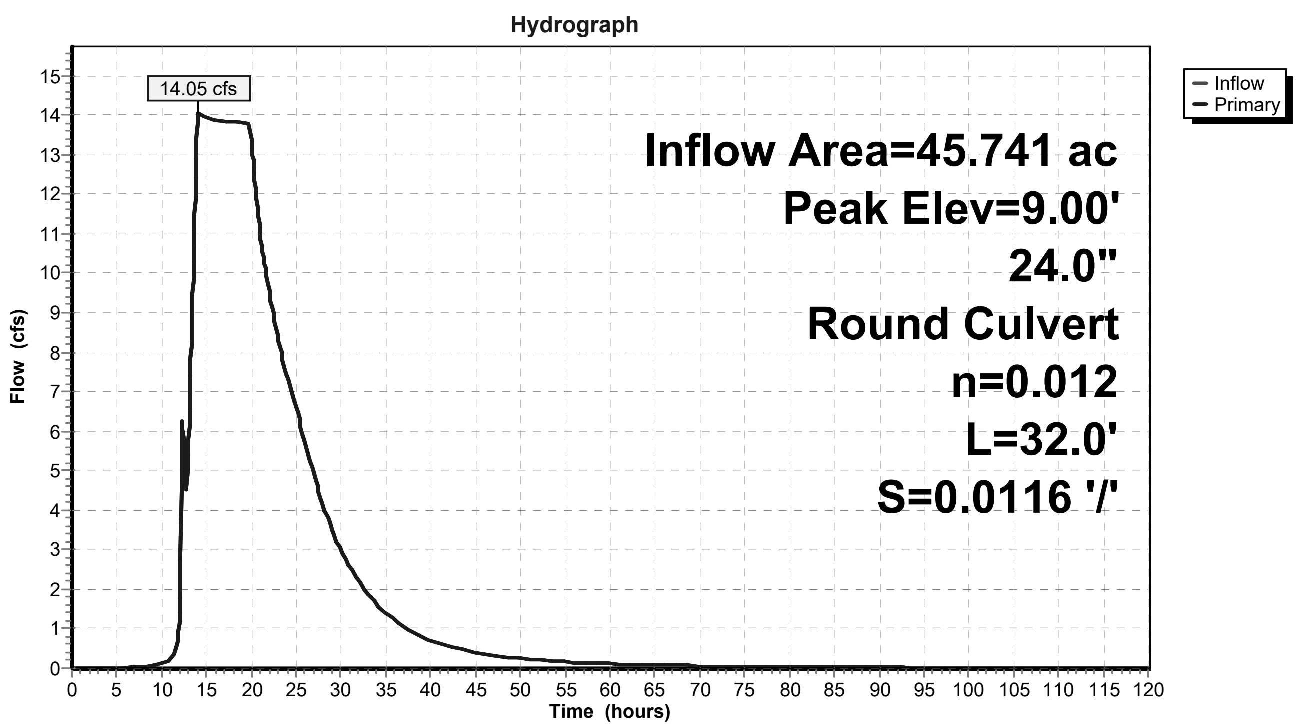
Inflow Area = 45.741 ac, 2.73% Impervious, Inflow Depth > 4.14" for 25-YEAR event
Inflow = 14.05 cfs @ 14.04 hrs, Volume= 15.790 af
Outflow = 14.05 cfs @ 14.04 hrs, Volume= 15.790 af, Atten= 0%, Lag= 0.0 min
Primary = 14.05 cfs @ 14.04 hrs, Volume= 15.790 af
Routed to Pond CB-6 : CB-6

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 9.00' @ 14.01 hrs
Flood Elev= 6.84'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.74'	**24.0" Round RCP_Round 24"** L= 32.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2.74' / 2.37' S= 0.0116 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf

Primary OutFlow Max=14.33 cfs @ 14.04 hrs HW=8.98' TW=8.08' (Dynamic Tailwater)
└─1=RCP_Round 24" (Inlet Controls 14.33 cfs @ 4.56 fps)

Pond CB-5: CB-5



Summary for Pond CB-6: CB-6

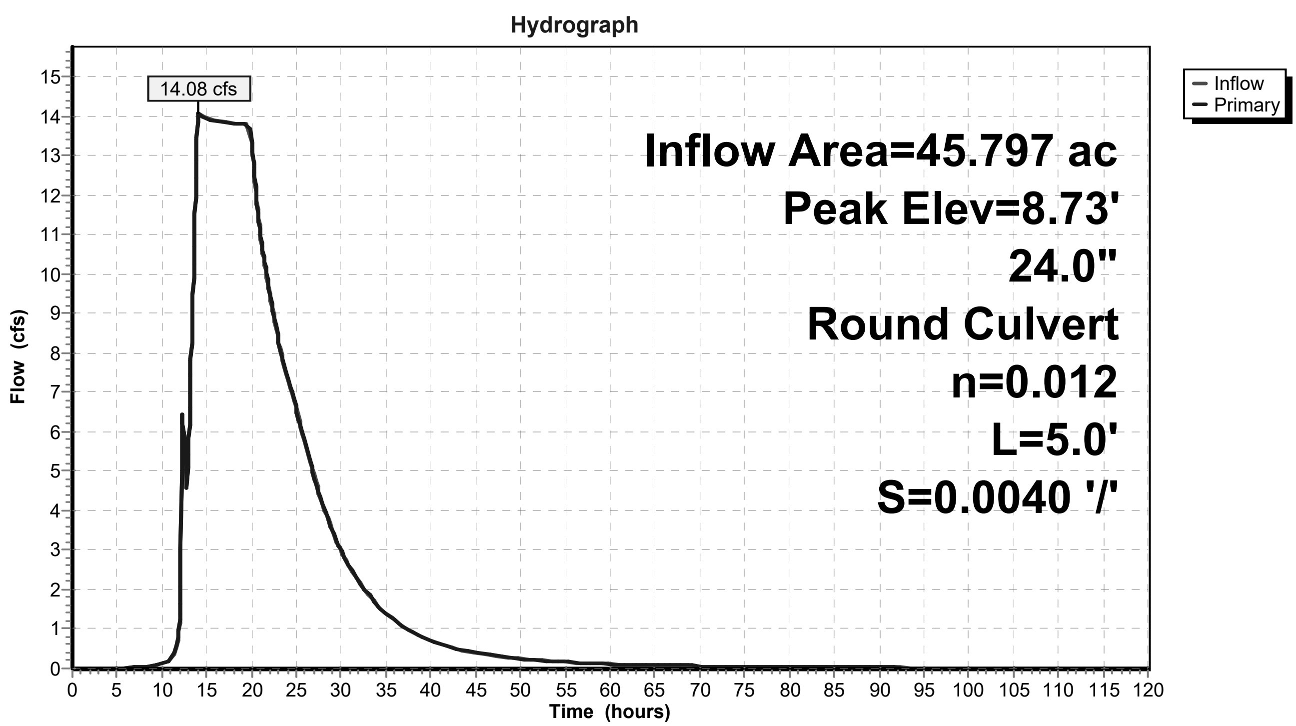
Inflow Area = 45.797 ac, 2.84% Impervious, Inflow Depth > 4.14" for 25-YEAR event
Inflow = 14.07 cfs @ 14.04 hrs, Volume= 15.817 af
Outflow = 14.08 cfs @ 14.00 hrs, Volume= 15.817 af, Atten= 0%, Lag= 0.0 min
Primary = 14.08 cfs @ 14.00 hrs, Volume= 15.817 af
Routed to Pond MH-1 : MANHOLE-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 8.73' @ 12.37 hrs
Flood Elev= 6.88'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.37'	**24.0" Round RCP_Round 24"** L= 5.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2.37' / 2.35' S= 0.0040 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 3.14 sf

Primary OutFlow Max=14.19 cfs @ 14.00 hrs HW=8.13' TW=7.25' (Dynamic Tailwater)
└─**1=RCP_Round 24"** (Inlet Controls 14.19 cfs @ 4.52 fps)

Pond CB-6: CB-6



Summary for Pond CB-7: CB-7

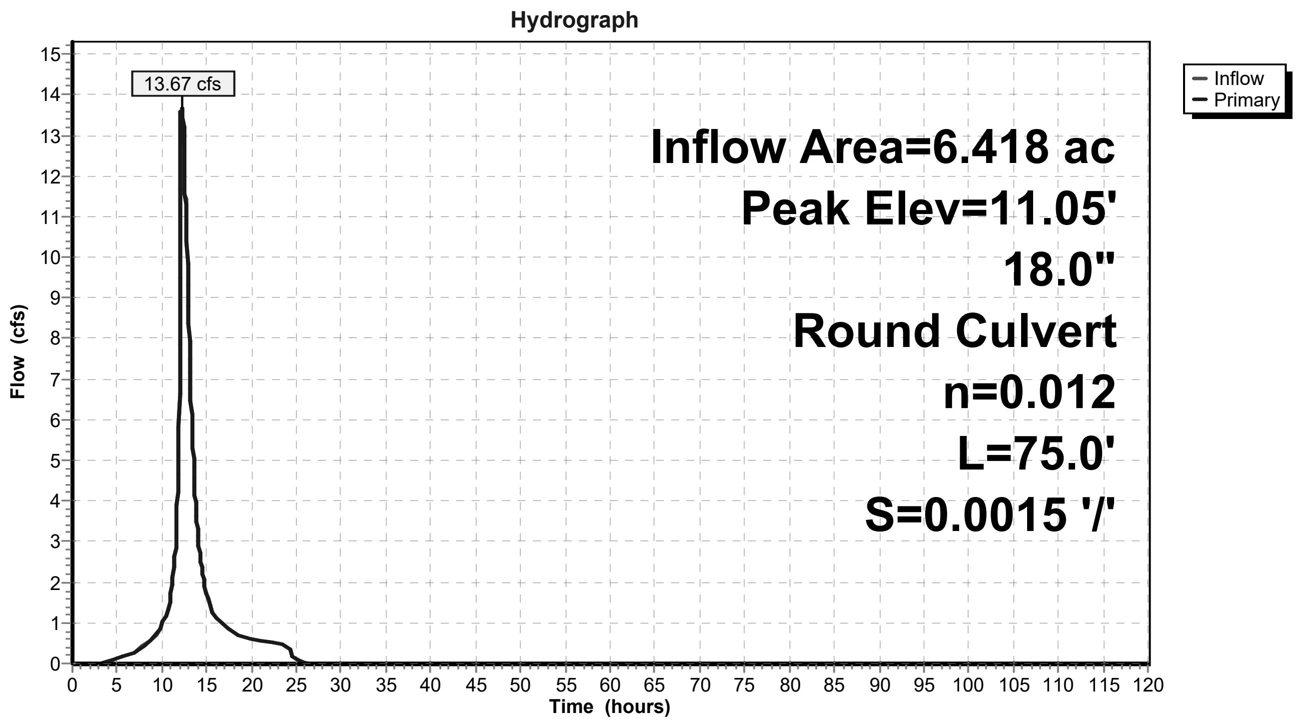
Inflow Area = 6.418 ac, 63.74% Impervious, Inflow Depth = 5.07" for 25-YEAR event
Inflow = 13.67 cfs @ 12.32 hrs, Volume= 2.713 af
Outflow = 13.67 cfs @ 12.32 hrs, Volume= 2.713 af, Atten= 0%, Lag= 0.0 min
Primary = 13.67 cfs @ 12.32 hrs, Volume= 2.713 af
Routed to Pond MH-1 : MANHOLE-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 11.05' @ 12.36 hrs
Flood Elev= 7.62'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.46'	**18.0" Round Round 18"** L= 75.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2.46' / 2.35' S= 0.0015 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=13.02 cfs @ 12.32 hrs HW=10.87' TW=8.53' (Dynamic Tailwater)
└─**1=Round 18"** (Inlet Controls 13.02 cfs @ 7.37 fps)

Pond CB-7: CB-7



Summary for Pond CB-8: CB-8

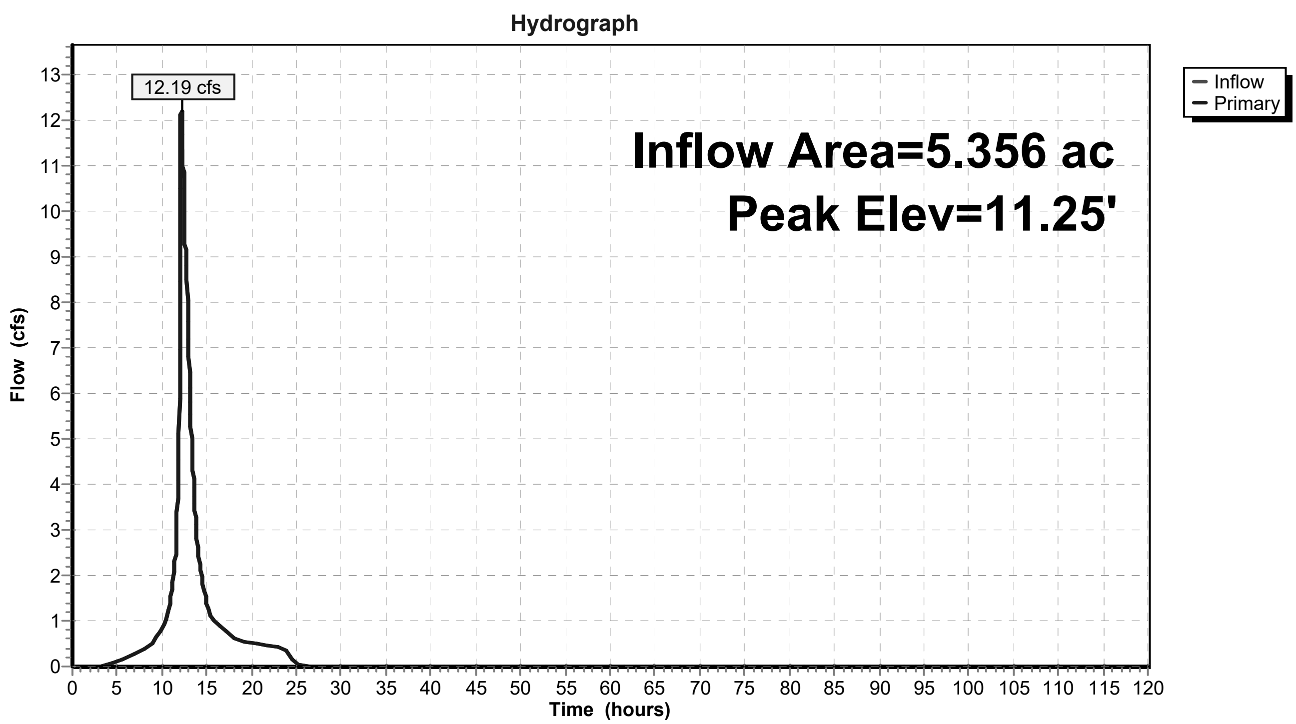
Inflow Area = 5.356 ac, 66.27% Impervious, Inflow Depth = 5.11" for 25-YEAR event
Inflow = 12.19 cfs @ 12.16 hrs, Volume= 2.280 af
Outflow = 12.19 cfs @ 12.16 hrs, Volume= 2.280 af, Atten= 0%, Lag= 0.0 min
Primary = 12.19 cfs @ 12.16 hrs, Volume= 2.280 af
Routed to Pond CB-7 : CB-7

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 11.25' @ 12.35 hrs
Flood Elev= 9.98'

Device	Routing	Invert	Outlet Devices
#1	Primary	4.86'	**18.0" Round RCP_Round 18"** L= 320.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 4.86' / 2.46' S= 0.0075 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf
#2	Primary	9.97'	**4.0' long x 322.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=11.51 cfs @ 12.16 hrs HW=10.68' TW=9.85' (Dynamic Tailwater)
1=RCP_Round 18" (Outlet Controls 5.08 cfs @ 2.87 fps)
2=Broad-Crested Rectangular Weir (Weir Controls 6.44 cfs @ 2.25 fps)

Pond CB-8: CB-8



Summary for Pond CB-9: CB-9

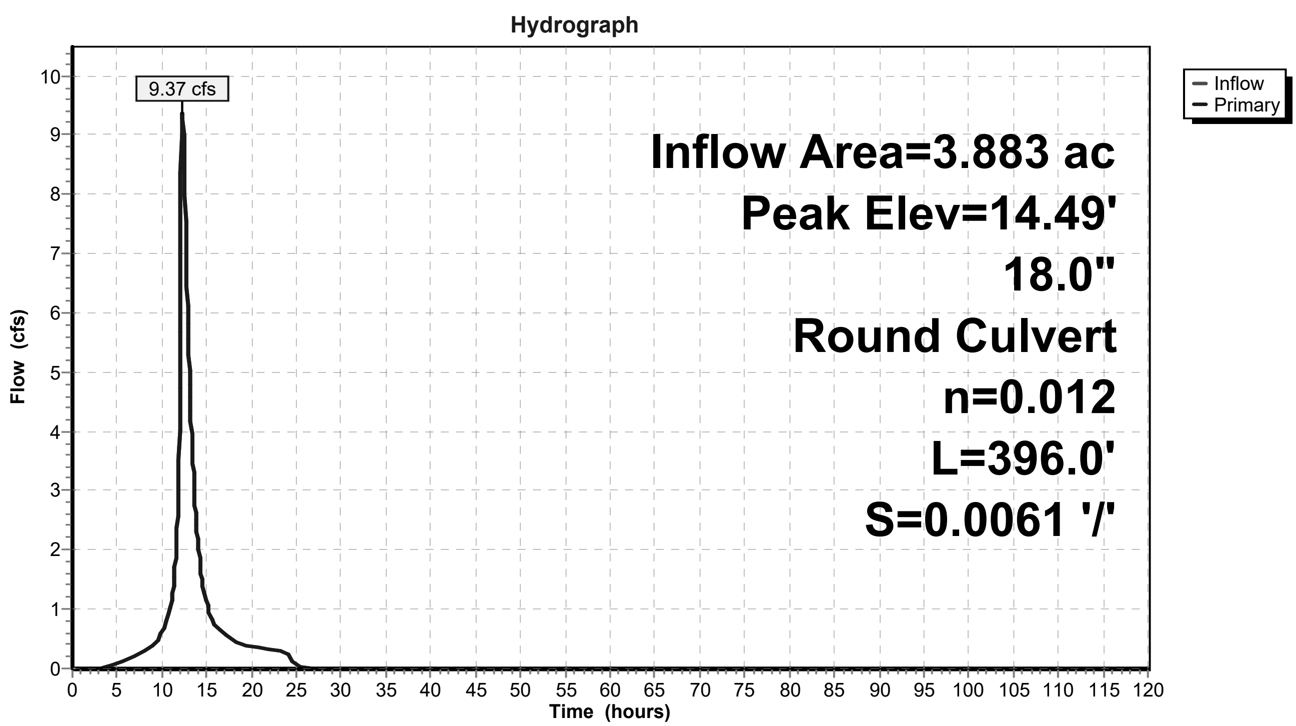
Inflow Area = 3.883 ac, 69.52% Impervious, Inflow Depth = 5.41" for 25-YEAR event
Inflow = 9.37 cfs @ 12.33 hrs, Volume= 1.749 af
Outflow = 9.37 cfs @ 12.33 hrs, Volume= 1.749 af, Atten= 0%, Lag= 0.0 min
Primary = 9.37 cfs @ 12.33 hrs, Volume= 1.749 af
Routed to Pond CB-8 : CB-8

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 14.49' @ 12.39 hrs
Flood Elev= 12.42'

Device	Routing	Invert	Outlet Devices
#1	Primary	9.89'	**18.0" Round RCP_Round 18"** L= 396.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.89' / 7.47' S= 0.0061 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.77 sf

Primary OutFlow Max=9.03 cfs @ 12.33 hrs HW=14.31' TW=11.20' (Dynamic Tailwater)
1=RCP_Round 18" (Outlet Controls 9.03 cfs @ 5.11 fps)

Pond CB-9: CB-9



Summary for Pond MH-1: MANHOLE-1

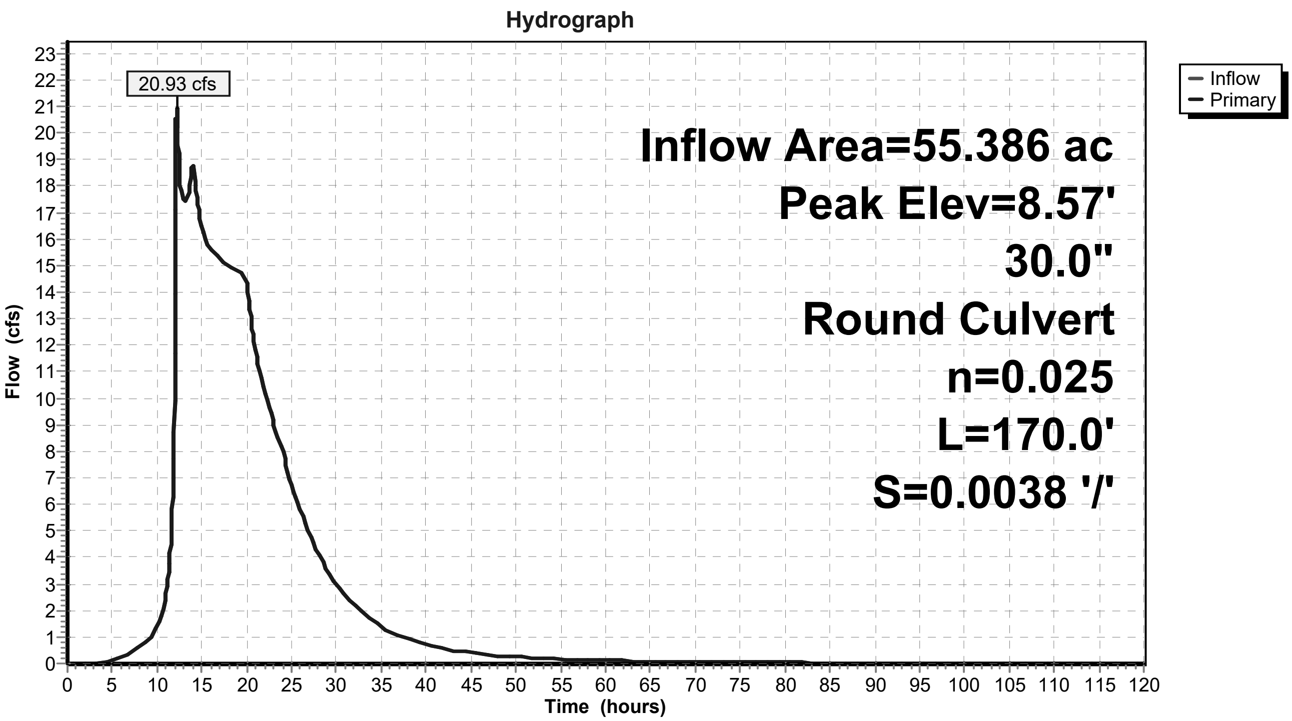
Inflow Area = 55.386 ac, 10.83% Impervious, Inflow Depth > 4.22" for 25-YEAR event
Inflow = 20.93 cfs @ 12.29 hrs, Volume= 19.464 af
Outflow = 20.93 cfs @ 12.29 hrs, Volume= 19.464 af, Atten= 0%, Lag= 0.0 min
Primary = 20.93 cfs @ 12.29 hrs, Volume= 19.464 af
Routed to Pond MH-2 : MANHOLE-2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 8.57' @ 12.31 hrs
Flood Elev= 6.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.35'	**30.0" Round CMP_Round 30"** L= 170.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 2.35' / 1.70' S= 0.0038 '/' Cc= 0.900 n= 0.025, Flow Area= 4.91 sf

Primary OutFlow Max=19.73 cfs @ 12.29 hrs HW=8.51' TW=6.68' (Dynamic Tailwater)
1=CMP_Round 30" (Outlet Controls 19.73 cfs @ 4.02 fps)

Pond MH-1: MANHOLE-1



Summary for Pond MH-2: MANHOLE-2

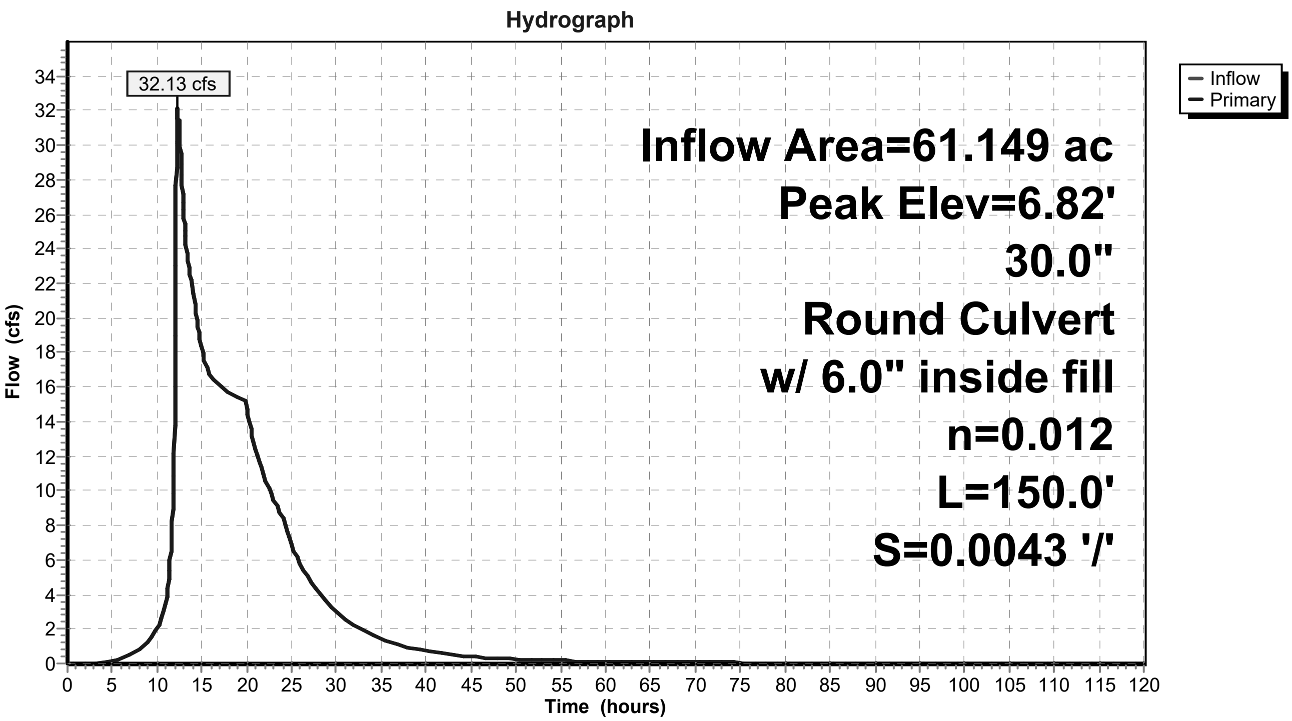
Inflow Area = 61.149 ac, 12.98% Impervious, Inflow Depth > 4.27" for 25-YEAR event
Inflow = 32.13 cfs @ 12.32 hrs, Volume= 21.776 af
Outflow = 32.13 cfs @ 12.32 hrs, Volume= 21.776 af, Atten= 0%, Lag= 0.0 min
Primary = 32.13 cfs @ 12.32 hrs, Volume= 21.776 af
Routed to Pond 40P : C-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 6.82' @ 12.41 hrs
Flood Elev= 6.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	2.20'	**30.0" Round Culvert w/ 6.0" inside fill** L= 150.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1.70' / 1.06' S= 0.0043 '/' Cc= 0.900 n= 0.012, Flow Area= 4.21 sf

Primary OutFlow Max=31.88 cfs @ 12.32 hrs HW=6.75' TW=4.19' (Dynamic Tailwater)
1=Culvert (Outlet Controls 31.88 cfs @ 7.57 fps)

Pond MH-2: MANHOLE-2

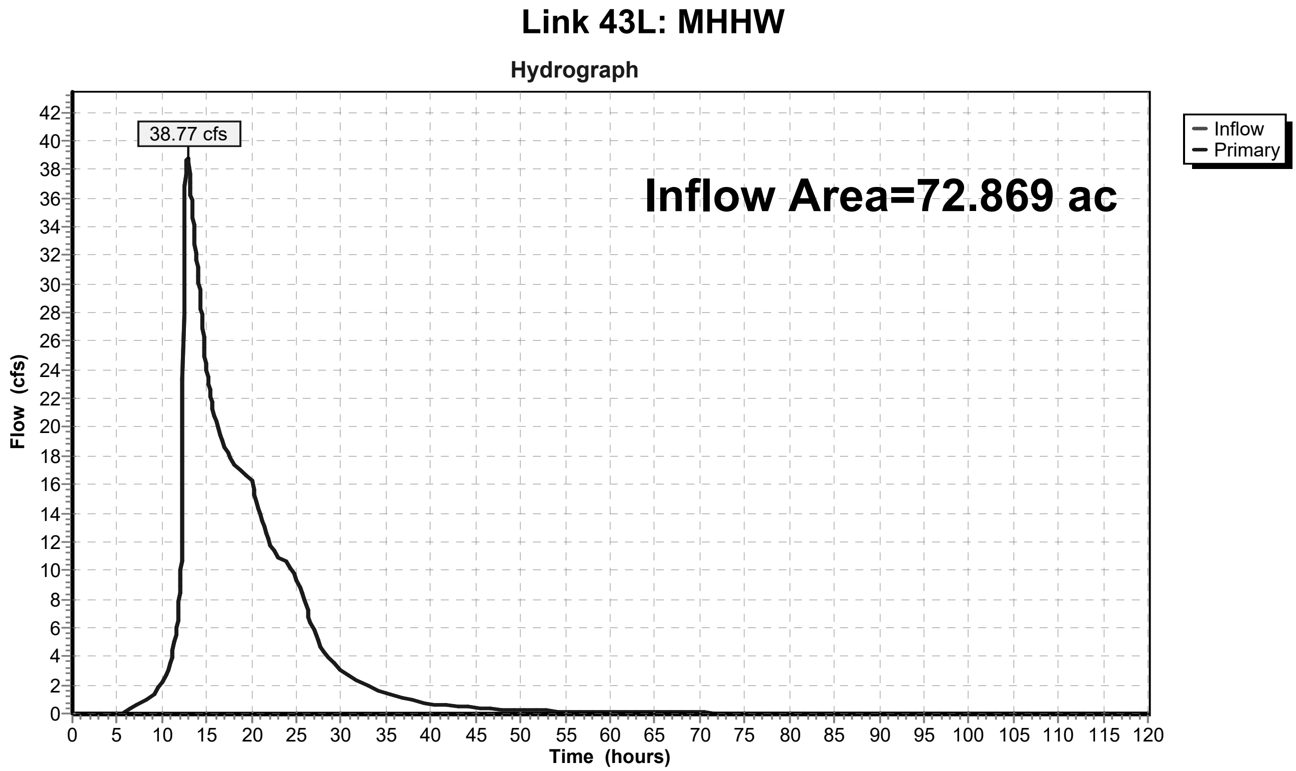


Summary for Link 43L: MHHW

Inflow Area = 72.869 ac, 12.41% Impervious, Inflow Depth > 4.16" for 25-YEAR event
Inflow = 38.77 cfs @ 12.84 hrs, Volume= 25.268 af
Primary = 38.77 cfs @ 12.84 hrs, Volume= 25.268 af, Atten= 0%, Lag= 0.0 min

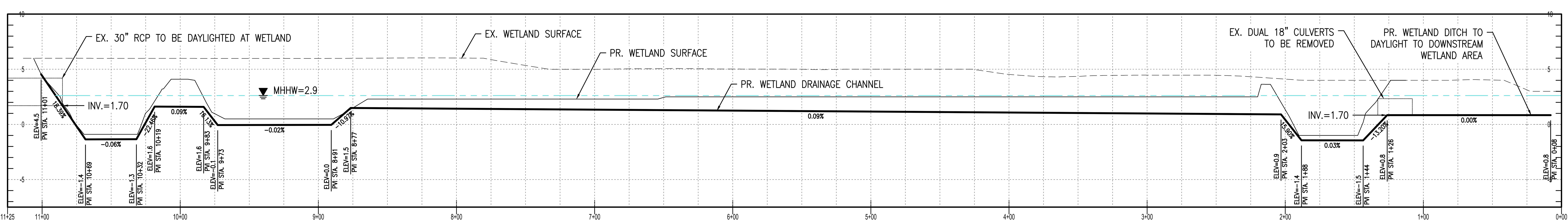
Primary outflow = Inflow, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs

Fixed water surface Elevation= 2.89'



APPENDIX D

CONCEPTUAL WETLANDS RESTORATION DESIGN



WETLAND PROFILE
VERTICAL SCALE: 1" = 5'
HORIZONTAL SCALE: 1" = 40'

PRELIMINARY NOT FOR CONSTRUCTION

DUFFIELD ASSOCIATES
Soil, Water & the Environment
5400 LIMESTONE ROAD
WILMINGTON, DE 19808-1232
TEL. 302.239.6634
FAX 302.239.8485
OFFICES IN DELAWARE, MARYLAND,
PENNSYLVANIA AND NEW JERSEY
WEB: HTTP://DUFFNET.COM
E-MAIL: DUFFIELD@DUFFNET.COM

CHECKED BY: SKC
FILE NAME:
DESIGNED BY: CWS
DRAWN BY: CWS

No.	REVISION	CHKD BY	DATE

WETLAND CONCEPTUAL PLAN

LITTLE CREEK CONCEPTUAL RESILIENCE PLAN

TOWN OF LITTLE CREEK ~ DELEWARE

DATE: 27 SEPTEMBER 2021
SCALE: AS NOTED
PROJECT NO. DUF002
SHEET: 1 (OF 1)

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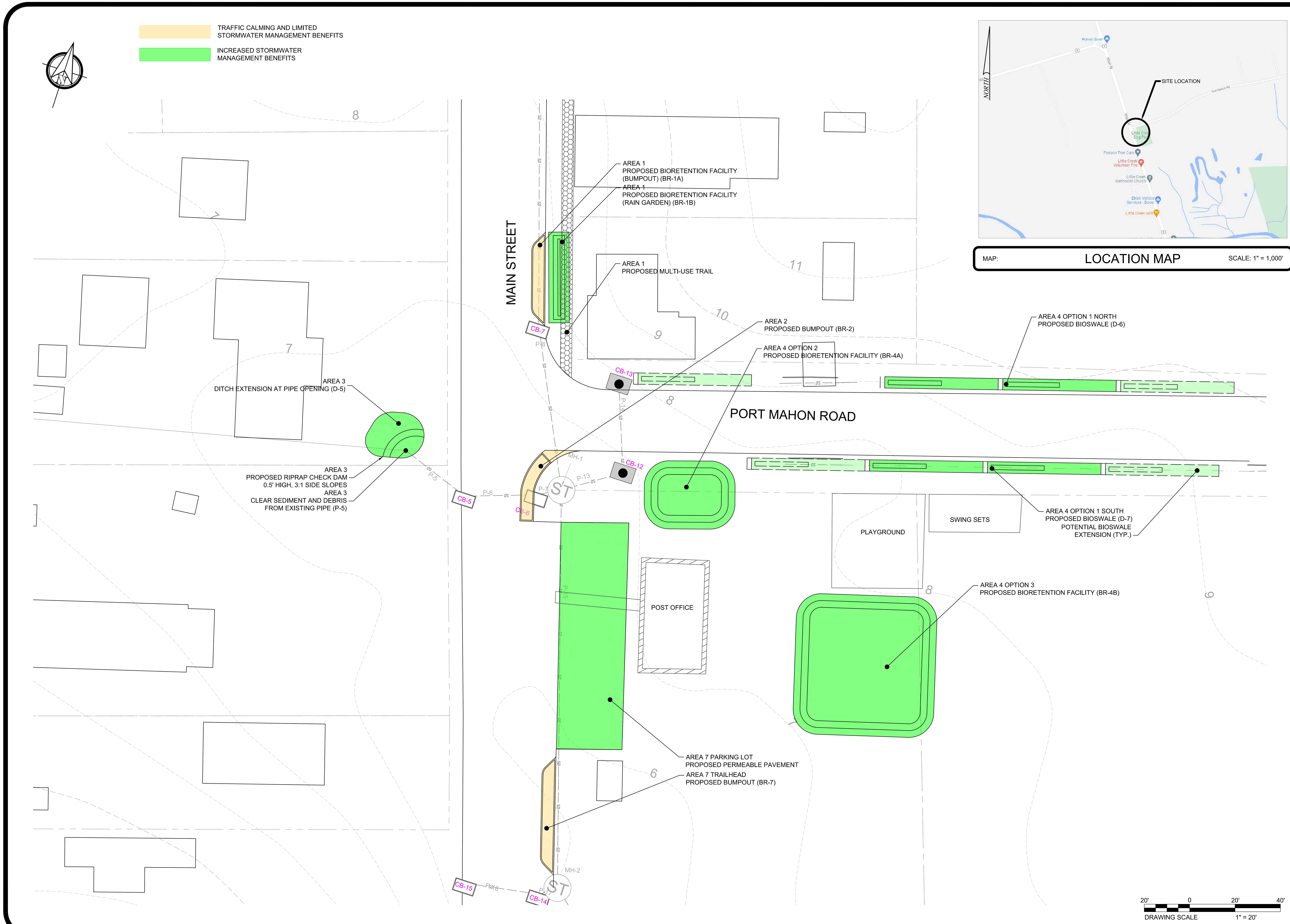
APPENDIX E

CONCEPTUAL GREEN INFRASTRUCTURE DESIGN



DUFFIELD ASSOCIATES
Soil, Water & the Environment

5400 LIMESTONE ROAD
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OFFICES IN DELAWARE, MARYLAND, PENNSYLVANIA AND NEW JERSEY

WEB: HTTP://DUFFNET.COM
E-MAIL: DUFFIELD@DUFFNET.COM

DESIGNED BY: TRD	CHECKED BY: ASL
DRAWN BY: TRD	FILE NAME: GSI_13027BA.dwg

No.	REVISION	CHK'D BY DATE

PRELIMINARY NOT FOR CONSTRUCTION

CONCEPTUAL PLAN FOR
GREEN STORMWATER INFRASTRUCTURE
LITTLE CREEK DELAWARE FLOOD MITIGATION PROJECT
TOWN OF LITTLE CREEK ~ KENT COUNTY ~ DELAWARE

DATE: 04 JANUARY 2022
SCALE: 1" = 20'
PROJECT NO. 13027.BA
SHEET: 1 OF 1

APPENDIX F

ENGINEER'S OPINION OF PROBABLE COST

DUFFIELD ASSOCIATES
Soil, Water & the Environment

Project: Little Creek Storm Drain Piping Upgrade

Project No: 13027.BA

12/27/2021

PJM

Project Manager: S. Cruz

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL
	AREA 1 - BR-1A PROPOSED BUMPOUT				
1	EX STORM DRAIN PIPE - REMOVAL	**476**	**LF**	$ 12.00	$ 5,712.00
2	PAVEMENT - SAWCUT	**1103**	**LF**	$ 15.00	$ 16,545.00
3	PAVEMENT - REMOVAL	**144**	**SY**	$ 50.00	$ 7,200.00
4	INLET - REMOVAL	**7**	**EACH**	$ 1,000.00	$ 7,000.00
5	CURB - REMOVAL	**64**	**LF**	$ 4.00	$ 256.00
6	CONCRETE SIDEWALK - REMOVAL	**2486**	**SF**	$ 2.00	$ 4,972.00
7	42-INCH CLASS III RCP	**320**	**LF**	$ 150.00	$ 48,000.00
8	30-INCH CLASS III RCP	**27**	**LF**	$ 100.00	$ 2,700.00
9	24-INCH CLASS III RCP	**119**	**LF**	$ 80.00	$ 9,520.00
10	GABC	**295**	**TONS**	$ 80.00	$ 23,600.00
11	INLETS/MANHOLES	**7**	**EACH**	$ 4,000.00	$ 28,000.00
12	PAVEMENT RESTORATION (DEEP TRENCH)	**342**	**SY-IN**	$ 60.00	$ 20,520.00
13	SEED AND STABILIZATION	**228**	**SY**	$ 0.80	$ 182.40
			SUBTOTAL		**$ 174,207.40**
	INCIDENTALUMP				
1	MOBILIZATION	1	LUMP	$ 8,500.00	$ 8,500.00
2	EROSION AND SEDIMENTATION CONTROL MEASURES	1	LUMP	$ 2,000.00	$ 2,000.00
3	TRAFFIC CONTROL	14	DAYS	$ 1,500.00	$ 21,000.00
4	CONSTRUCTION STAKING	1	LUMP	$ 3,500.00	$ 3,500.00
			SUBTOTAL		$ 35,000.00
			CONSTRUCTION SUBTOTAL		$209,207.40
			CONTINGENCY (20%)		$41,841.48
			CONSTRUCTION TOTAL		**$251,048.88**

ESTIMATE CREATED USING ACTUAL COSTS FROM SIMILAR PROJECTS.

SINCE THE ENGINEER HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, OR EQUIPMENT, OVER THE CONTRACTOR'S METHOD OF DETERMINING PRICES; OR OVER THE COMPETITIVE BIDDING OR MARKET CONDITIONS; THE ESTIMATE OF CONSTRUCTION COST HEREIN IS MADE ON THE BASIS OF HIS BEST JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY, THE ENGINEER CANNOT, AND DOES NOT, GUARANTEE THAT BIDS OF THE PROJECT CONSTRUCTION COST WILL NOT VARY FROM THIS ESTIMATE.

DUFFIELD ASSOCIATES
Soil, Water & the Environment

Project: Little Creek Wetland Concept
Project No: 13027.BA
Date: 09/21/2021
Prepared By: T. DOLGOS
Project Manager: S. Cruz

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL
	AREA 1 - BR-1A PROPOSED BUMPOUT				
1	EXCAVATION (ROW)	**17**	**CY**	$ 10.00	$ 170.00
2	SPOIL, OFF SITE	**17**	**CY**	$ 40.00	$ 680.00
3	BACKFILL (STORMWATER SOIL)	**3**	**CY**	$ 109.00	$ 327.00
4	CURB FOR BUMPOUT	**87**	**LF**	$ 42.00	$ 3,654.00
5	OUTLET STRUCTURE (CONCRETE INLET BOX)	**1**	**EACH**	$ 1,100.00	$ 1,100.00
6	LANDSCAPING (SEEDING, PLANTS, MULCH)	**19**	**SY**	$ 17.00	$ 323.00
			SUBTOTAL		$ 6,254.00
	AREA 1 - BR-1B PROPOSED BIORETENTION FACILITY				
1	EXCAVATION (ROW)	**17**	**CY**	$ 10.00	$ 170.00
2	SPOIL, OFF SITE	**17**	**CY**	$ 40.00	$ 680.00
3	BACKFILL (STORMWATER SOIL)	**3**	**CY**	$ 109.00	$ 327.00
4	OUTLET STRUCTURE (CONCRETE INLET BOX)	**1**	**EACH**	$ 1,100.00	$ 1,100.00
5	LANDSCAPING (SEEDING AND SHRUBS)	**40**	**SY**	$ 17.00	$ 680.00
			SUBTOTAL		$ 2,957.00
	AREA 1 - Multi-Use Trail				
1	MULTI-USE TRAIL (CONCRETE AND SUBBASE)	**56**	**SY**	$ 112.50	$ 6,300.00
2	MULTI-USE TRAIL COORDINATION	**1**	**LUMP**	$ 5,000.00	$ 5,000.00
3	EXCAVATION (ROW)	**19**	**CY**	$ 10.00	$ 190.00
4	SPOIL, OFF SITE	**19**	**CY**	$ 40.00	$ 760.00
5	GRADING	**1**	**LUMP**	$ 7,500.00	$ 7,500.00
			SUBTOTAL		$ 19,750.00
	AREA 2 - BR-2 PROPOSED BUMPOUT				
1	EXCAVATION (ROW)	**31**	**CY**	$ 10.00	$ 310.00
2	SPOIL, OFF SITE	**31**	**CY**	$ 40.00	$ 1,240.00
3	BACKFILL (STORMWATER SOIL)	**21**	**CY**	$ 109.00	$ 2,289.00
4	CURB FOR BUMPOUT	**129**	**LF**	$ 42.00	$ 5,418.00
5	OUTLET STRUCTURE (CONCRETE INLET BOX)	**1**	**EACH**	$ 1,100.00	$ 1,100.00
6	LANDSCAPING (SEEDING AND SHRUBS)	**31**	**SY**	$ 17.00	$ 527.00
			SUBTOTAL		$ 10,884.00
	AREA 3 - D-5 DITCH IMPROVEMENTS				
1	EXCAVATION (ROW)	**47**	**CY**	$ 10.00	$ 470.00
2	SPOIL, OFF SITE	**47**	**CY**	$ 40.00	$ 1,880.00
3	BACKFILL (STORMWATER SOIL)	**31**	**CY**	$ 109.00	$ 3,379.00
4	RIPRAP FOR CHECK DAM (R-4)	**2**	**CY**	$ 85.00	$ 170.00
5	LANDSCAPING (SEEDING)	**47**	**SY**	$ 3.00	$ 141.00
			SUBTOTAL		$ 6,040.00
	AREA 4 - D-6 BIOSWALE				
1	EXCAVATION (ROW)	**18**	**CY**	$ 10.00	$ 180.00
2	SPOIL, OFF SITE	**18**	**CY**	$ 40.00	$ 720.00
3	BACKFILL (STORMWATER SOIL)	**7**	**CY**	$ 109.00	$ 763.00
4	RIPRAP FOR CHECK DAM (R-4)	**87**	**LF**	$ 42.00	$ 3,654.00
5	LANDSCAPING (SEEDING, PLANTS, MULCH)	**56**	**SY**	$ 17.00	$ 952.00
			SUBTOTAL		$ 6,269.00
	AREA 4 - D-7 BIOSWALE				
1	EXCAVATION (ROW)	**18**	**CY**	$ 10.00	$ 180.00
2	SPOIL, OFF SITE	**18**	**CY**	$ 40.00	$ 720.00
3	BACKFILL (STORMWATER SOIL)	**7**	**CY**	$ 109.00	$ 763.00
4	RIPRAP FOR CHECK DAM (R-4)	**87**	**LF**	$ 42.00	$ 3,654.00
5	LANDSCAPING (SEEDING, PLANTS, MULCH)	**56**	**SY**	$ 17.00	$ 952.00
			SUBTOTAL		$ 6,269.00
	BR-4A PROPOSED BIORETENTION FACILITY				
1	EXCAVATION (ROW)	**17**	**CY**	$ 10.00	$ 170.00
2	SPOIL, OFF SITE	**17**	**CY**	$ 40.00	$ 680.00
3	BACKFILL (STORMWATER SOIL)	**3**	**CY**	$ 109.00	$ 327.00
4	OUTLET STRUCTURE (CONCRETE INLET BOX)	**1**	**EACH**	$ 1,100.00	$ 1,100.00
5	LANDSCAPING (SEEDING AND SHRUBS)	**122**	**SY**	$ 40.00	$ 4,880.00
			SUBTOTAL		$ 7,157.00
	BR-4B PROPOSED BIORETENTION FACILITY				
1	EXCAVATION (ROW)	**413**	**CY**	$ 10.00	$ 4,130.00
2	SPOIL, OFF SITE	**413**	**CY**	$ 40.00	$ 16,520.00

3	BACKFILL (STORMWATER SOIL)	**184**	**CY**	$ 109.00	$ 20,056.00
4	NEW JUNCTION BOXES (CONCRETE INLET BOX)	**2**	**EACH**	$ 1,100.00	$ 2,200.00
5	OUTLET STRUCTURE (CONCRETE INLET BOX)	**1**	**EACH**	$ 1,100.00	$ 1,100.00
6	LANDSCAPING (SEEDING AND SHRUBS)	**416**	**SY**	$ 40.00	$ 16,640.00
7	DISTRIBUTION PIPING TO BASIN (12" SOLID HDPE, INCLUDES FITTINGS AND FIXTURES, EXCAVATION, PLACING AND FURNISHING OF STONE BEDDING, AND BACKFILL AROUND PIPE	**104**	**LF**	$ 55.00	$ 5,720.00
8	ASPHALT ROADWAY REPLACEMENT	**10**	**SY**	$ 54.00	$ 540.00
9	INFLOW STRUCTURE (HEADWALL, ENERGY DISSIPATOR)	**1**	**LUMP**	$ 3,600.00	$ 3,600.00
				SUBTOTAL	$ 70,506.00
	AREA 7 - POROUS PAVEMENT				
1	EXCAVATION (EXISTING PARKING LOT)	**327**	**CY**	$ 10.00	$ 3,270.00
2	SPOIL, OFF SITE	**327**	**CY**	$ 40.00	$ 13,080.00
3	BACKFILL (STONE BASE)	**109**	**CY**	$ 75.00	$ 8,175.00
4	POROUS PAVING (INCLUDES 4.5" POROUS BINDER COURSE, 1.5" POROUS WEARING COURSE, ASPHLAT EDGE, AND TESTING)	**327**	**SY**	$ 52.00	$ 17,004.00
5	SEALING AND STRIPING	**1**	**LUMP**	$ 578.00	$ 578.00
				SUBTOTAL	$ 42,107.00
	AREA 7 - BR-7 PROPOSED BUMPOUT				
1	EXCAVATION (ROW)	**25**	**CY**	$ 10.00	$ 250.00
2	SPOIL, OFF SITE	**25**	**CY**	$ 40.00	$ 1,000.00
3	BACKFILL (STORMWATER SOIL)	**17**	**CY**	$ 109.00	$ 1,853.00
4	CURB FOR BUMPOUT	**109**	**LF**	$ 42.00	$ 4,578.00
5	OUTLET STRUCTURE (CONCRETE INLET BOX)	**1**	**EACH**	$ 1,100.00	$ 1,100.00
6	LANDSCAPING (SEEDING AND SHRUBS)	**25**	**SY**	$ 17.00	$ 425.00
				SUBTOTAL	$ 9,206.00
				PROPOSED GSI SUBTOTAL	$ 187,399.00
	INCIDENTALUMP				
1	GEOTECHNICAL INVESTIGATION	1	LUMP	$ 20,000.00	$ 20,000.00
2	EROSION AND SEDIMENTATION CONTROL MEASURES	1	LUMP	$ 12,000.00	$ 12,000.00
3	WATER MANAGEMENT	1	LUMP	$ 20,000.00	$ 20,000.00
4	CONSTRUCTION STAKING	1	LUMP	$ 3,000.00	$ 3,000.00
5	MOBILIZATION	1	LUMP	$ 18,800.00	$ 18,800.00
				CONSTRUCTION SUBTOTAL	$261,199.00
				CONTINGENCY (20%)	$52,239.80
				CONSTRUCTION TOTAL	**$313,438.80**

ESTIMATE CREATED USING ACTUAL COSTS FROM SIMILAR PROJECTS.

SINCE THE ENGINEER HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, OR EQUIPMENT, OVER THE CONTRACTOR'S METHOD OF DETERMINING PRICES; OR OVER THE COMPETITIVE BIDDING OR MARKET CONDITIONS; THE ESTIMATE OF CONSTRUCTION COST HEREIN IS MADE ON THE BASIS OF HIS BEST JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY, THE ENGINEER CANNOT, AND DOES NOT, GUARANTEE THAT BIDS OF THE PROJECT CONSTRUCTION COST WILL NOT VARY FROM THIS ESTIMATE.

DUFFIELD ASSOCIATES
Soil, Water & the Environment

Project: Little Creek Wetland Concept
Project No: DUF002
Date: 09/15/2021
Prepared By: C. Smith
Project Manager: S. Cruz

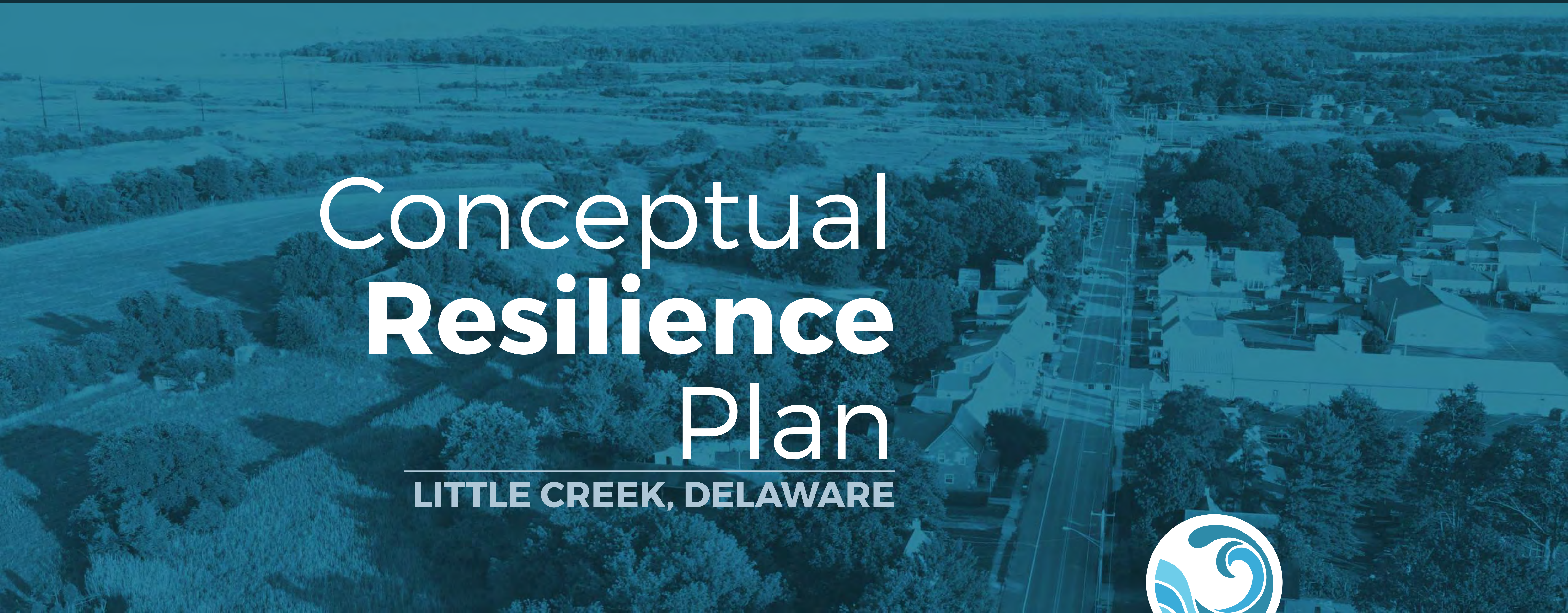
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL
	SITE				
1	PIPE REMOVED, 30"	120	LF	$ 20.00	$ 2,400.00
2	PIPE REMOVED, 18" - SPECIAL	50	LF	$ 50.00	$ 2,500.00
3	30" CHECKMATE VALVE	1	EACH	$ 20,978.00	$ 20,978.00
4	ROCK CHANNEL PROTECTION, WITH FABRIC	35	CY	$ 85.00	$ 2,975.00
5	6" CULVERT (BERM DRAIN)	42	LF	$ 20.09	$ 843.78
6	6" CHECKMATE VALVE	2	EACH	$ 1,660.00	$ 3,320.00
7	TOPSOIL STRIP (REMOVE INVASIVE SPECIES)	1251	CY	$ 14.00	$ 17,514.00
8	EXCAVATION (WETLAND AREA)	4704	CY	$ 10.00	$ 47,040.00
9	EMBANKMENT (BERM)	670	CY	$ 12.00	$ 8,040.00
10	SPOIL, OF SITE	5285	CY	$ 40.00	$ 211,400.00
	PLANTING				
11	EMERGENT WETLAND PLANTING (LOW MARSH)	0.85	AC	$ 5,600.00	$ 4,760.00
12	EMERGENT WETLAND PLANTING (HIGH MARSH)	1.13	AC	$ 3,200.00	$ 3,616.00
13	TURF GRASS SEEDING AND MULCHING	0.7	AC	$ 3,140.00	$ 2,198.00
14	POST RESTORATION INVASIVE SPECIES TREATMENT	2	AC	$ 2,000.00	$ 4,000.00
	EROSION CONTROL				
15	REINFORCED SILT FENCE	2260	LF	$ 3.00	$ 6,780.00
16	STABILIZED CONSTRUCTION ENTRANCE	1	LUMP	$ 3,000.00	$ 3,000.00
17	MISC. CONTROLS	1	LUMP	$ 6,000.00	$ 6,000.00
18	EROSION CONTROL BLANKET	9580	SY	$ 1.25	$ 11,975.00
	INCIDENTALS				
19	WATER MANAGEMENT	1	LUMP	$ 20,000.00	$ 20,000.00
20	CONSTRUCTION STAKING	1	LUMP	$ 3,000.00	$ 3,000.00
21	MOBILIZATION	1	LUMP	$ 36,000.00	$ 36,000.00
				CONSTRUCTION SUBTOTAL	$418,339.78
				CONTINGENCY (20%)	$83,667.96
				CONSTRUCTION TOTAL	**$502,007.74**

ESTIMATE CREATED USING ACTUAL COSTS FROM SIMILAR PROJECTS.

SINCE THE ENGINEER HAS NO CONTROL OVER THE COST OF LABOR, MATERIALS, OR EQUIPMENT, OVER THE CONTRACTOR'S METHOD OF DETERMINING PRICES; OR OVER THE COMPETITIVE BIDDING OR MARKET CONDITIONS; THE ESTIMATE OF CONSTRUCTION COST HEREIN IS MADE ON THE BASIS OF HIS BEST JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY, THE ENGINEER CANNOT, AND DOES NOT, GUARANTEE THAT BIDS OF THE PROJECT CONSTRUCTION COST WILL NOT VARY FROM THIS ESTIMATE.

APPENDIX G

CRDS – CONCEPTUAL RESILIENCE PLAN



Conceptual **Resilience** Plan

LITTLE CREEK, DELAWARE

Prepared for the Town of Little Creek
and Presented August 3, 2020

CRDS
COASTAL RESILIENCE
DESIGN STUDIO

The Coastal Resilience Design Studio (CRDS) is an interdisciplinary team of student designers, researchers and engineers exploring creative and thoughtful solutions to the many challenges facing Delaware's coastal communities.

The CRDS equips communities with tools, designs, and adaptation strategies aimed at mitigating disruptions from short-term hazardous events and long-term environmental changes.

Our Team

Jules Bruck, Principal & Founder

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Please visit our webpage to view our past and ongoing projects and for contact information online at:

https://sites.udel.edu/bsla-crds/

CONTENTS

INTRODUCTION

PRIMARY OBJECTIVES

The Town of Little Creek is a coastal community vulnerable to and experiencing the impacts of sea level rise. Residents of Little Creek envision maintaining small-town character and providing opportunities to showcase the town's maritime history "while allowing for modest growth and redevelopment that is consistent with its rural surroundings, while adapting to sea level rise" (Comprehensive Plan, 2016). The CRDS is collaborating with the Town of Little Creek to develop a Concept Plan that addresses flooding and quality of life for residents centered on the specific needs and desires outlined in a thorough community survey (the Town of Little Creek Working Waterfronts Initiative). **The primary project objectives, based on the identified community needs, include:**

- Addressing hydrological issues and recurring flooding of roadways and commercial properties,
- Establishing connectivity within the town to local amenities and to surrounding amenities including the Little Creek Wildlife Area, Port Mahon, Pickering Beach, Kitt's Hummock, and the Ted Harvey Conservation Area, and
- Designing safer 'complete streets', which Smart Growth America defines as streets "designed and operated to enable safe access for all users, including pedestrians, bicyclists, motorists and transit riders of all ages and abilities", with a focus on green infrastructure and traffic calming.

TOWN OF LITTLE CREEK BACKGROUND

Little Creek is a small, rural community located in eastern Kent County, DE between the City of Dover and the Delaware Bay. The town was established as a commercial shipping hub for the city of Dover and was very productive in the 1800's with thriving oyster and canning industries. The success of the oyster industry in Little Creek began to fade by the start of the 20th century, leaving few economic opportunities in the town (History of Little Creek, n.d.). The town is approximately 65 acres, broken into 122 parcels. Current demographic data from Environics Spotlight indicate there are 187 current residents and 78 households. The median age is 49.1. Situated just north of the Little River, Little Creek has a rich maritime history and in 2007 became a destination stop along Delaware's Bayshore Scenic Byway, designated as one of the seven "discovery zones" residing along a waterway (Delaware Bayshore Byway Corridor Management Plan, 2020). As such, the town is an asset to preserving the scenic viewshed and natural qualities of the American landscape envisioned as part of the Obama Administration's Great Outdoors Initiative.

Delaware's coastal wetlands are recognized for significant ecological and habitat value at a global scale, including by the Nature Conservancy and the National Audubon Society. Relevant designations given to the Delaware Bay area include Migratory Shorebird Site of Hemispheric Importance, Wetland of International Significance, and Important Bird Area of Global Significance (Delaware Bayshore, 2020). Over 400 species of birds and other wildlife, including horseshoe crab, osprey, and bald eagle reside in this area and rely on the health of the wetland. Disturbance in this habitat has allowed for invasive Phragmites australis to colonize and become a significant threat to biodiversity.

Active land use within the town is primarily residential with several commercial and civic enterprises, such as a public accessible boat ramp and dog park. The surrounding areas are agricultural land and protected wetlands. Glenn Gauvry, current Mayor of Little Creek, represents the town acting as the client and main point of contact for CRDS with respect to this project.

RESIDENT CONCERNS

A community questionnaire conducted in 2015 for the Working Waterfronts Initiative provided a platform for residents to voice several needs and concerns. Residents would like to preserve Little Creek's small-town rural atmosphere, restore working and recreational use to the Little River, and address resiliency in relation to sea level rise. Other identified concerns included stormwater management, mosquito control, truck traffic on Main Street (Route 9), and a lack of bike routes.

Residents expressed desires for a town park and a public water system.

Town residents have voiced concerns about truck traffic and overall speeding through the town. Recordings of traffic count and vehicle speeds over the course of four weeks in May 2020 has reinforced the need to address these concerns. According to this data, 60% of vehicles recorded were traveling faster than the 25 MPH speed limit.

As part of the community questionnaire, residents were asked about the threat of sea level rise. All but one of 39 respondents believe that sea level rise is occurring and is a threat to the town. In addition, 91% of respondents support government spending on resilience projects (Comprehensive Plan, 2016).

The CRDS's involvement will promote the vision of town residents and reflect the needs identified by the community.

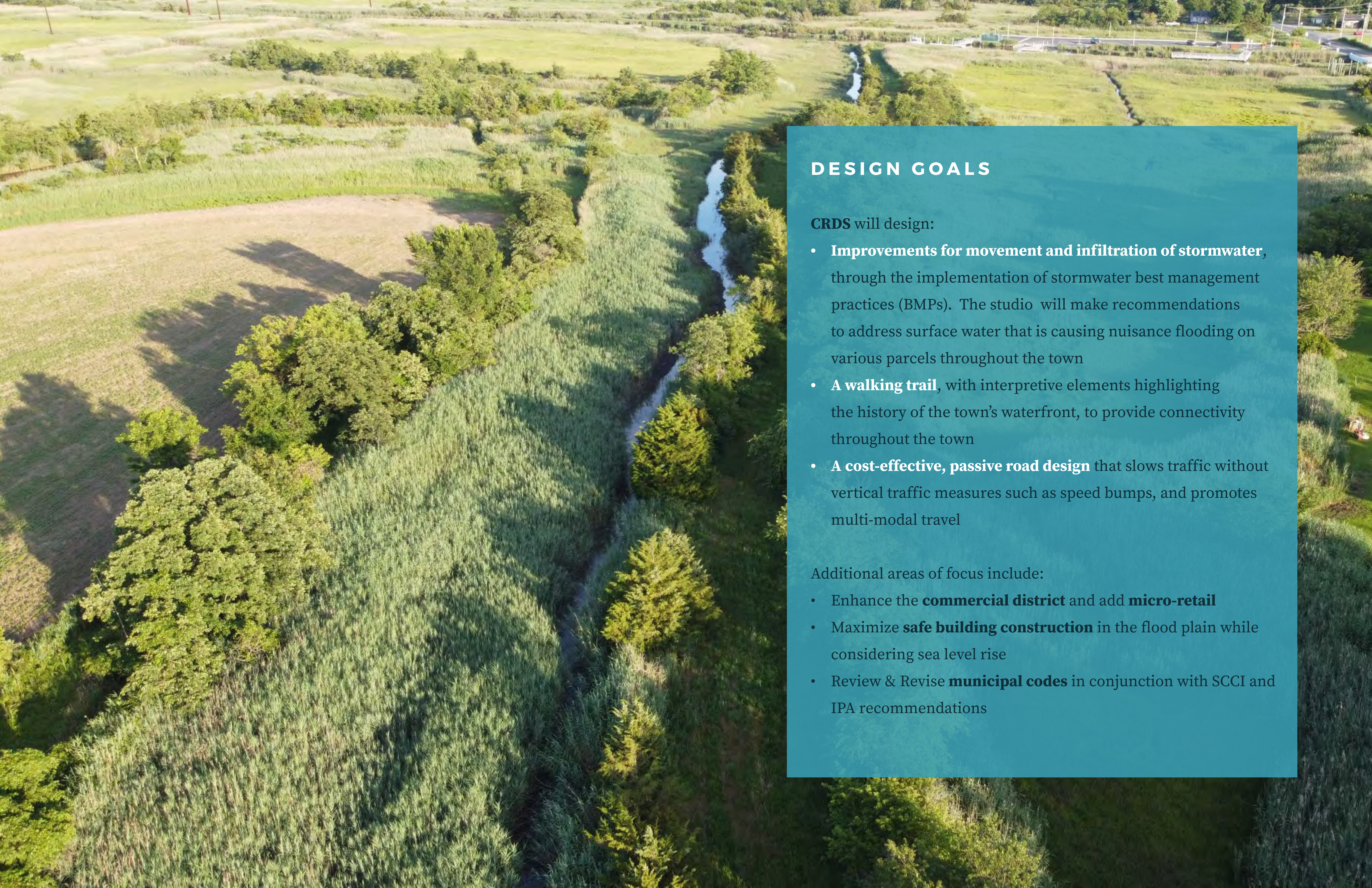
HYDROLOGICAL ISSUES

There is significant flooding in Little Creek after rain events. Damaged stormwater infrastructure and sediment build-up have greatly reduced the effectiveness of four existing discharge areas along the eastern edge of the town. Flooding at the intersection of Main St. and Port Mahon Rd. can be seen in Figure 2.

The presence of an upstream dam built on private property in the 1970's and reduced use of the waterways may have caused decreased flow and increased sedimentation in the Little River. Recent dredging of the river east of the Little Creek Bridge was conducted in 2015 to facilitate flow at the cost of approximately $1,000,010 in state funds and will be required as siltation continues. The Little Creek Fire Department uses the Little River to access the Delaware Bay for rescue missions, so dredging is tied to public safety as well as the fishing and recreation economy (Delaware DNREC, 2015)

ADDITIONAL RESEARCH

To address the recurring issues noted above, the CRDS must gather and analyze additional existing conditions information. This includes current stormwater drainage features and flows, erosion and degradation along the Little Creek, percentage of impervious cover, analysis of possible impervious removal, effective areas for green infrastructure implementation, and feasible connectivity routes. Additionally, CRDS must conduct reviews of precedent cases for horizontal traffic calming solutions and small-scale dam removal consequences to justify proposed ideas.



DESIGN GOALS

CRDS will design:

- **Improvements for movement and infiltration of stormwater**, through the implementation of stormwater best management practices (BMPs). The studio will make recommendations to address surface water that is causing nuisance flooding on various parcels throughout the town
- **A walking trail**, with interpretive elements highlighting the history of the town's waterfront, to provide connectivity throughout the town
- **A cost-effective, passive road design** that slows traffic without vertical traffic measures such as speed bumps, and promotes multi-modal travel

Additional areas of focus include:

- Enhance the **commercial district** and add **micro-retail**
- Maximize **safe building construction** in the flood plain while considering sea level rise
- Review & Revise **municipal codes** in conjunction with SCCI and IPA recommendations

Community Branding

CRDS
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DESIGN STUDIO

COLOR PALETTE

BRAND TYPEFACES

I am your Primary Typeface

I am your Secondary Typeface

I am your Accent Typeface

BRAND STATEMENT

Nestled on the shore of the Little River is a small coastal community with a rich maritime history and a strong agricultural heritage. As a jewel along the Bayshore Byway in the tidal marshes of Kent County, our 187 full time residents cherish authentic small town life and from the halls of our Fire Company to our old Stone Tavern, our history and dedication to our neighbors is evident. We are proud of the place we call home, a place where being small is in our nature.

WAYFINDING SIGNAGE

PRIMARY GATEWAYS

These gateways are the primary intersection points and main entry ways to town. They need to be highly visible and introduce the brand.

BUILDING MARKERS

The markers can be either wall mounted or monument style and denote important landmarks in the downtown district.

PARKING SIGNAGE

Identifying parking is important in creating a parking system in downtown. Visitors are more likely to walk a block or two to shop if the signage system leads them directly to a public parking lot and tell them how to proceed. The parking markers can be by themselves or as attachments to trailblazer signs.

INFORMATIONAL KIOSKS

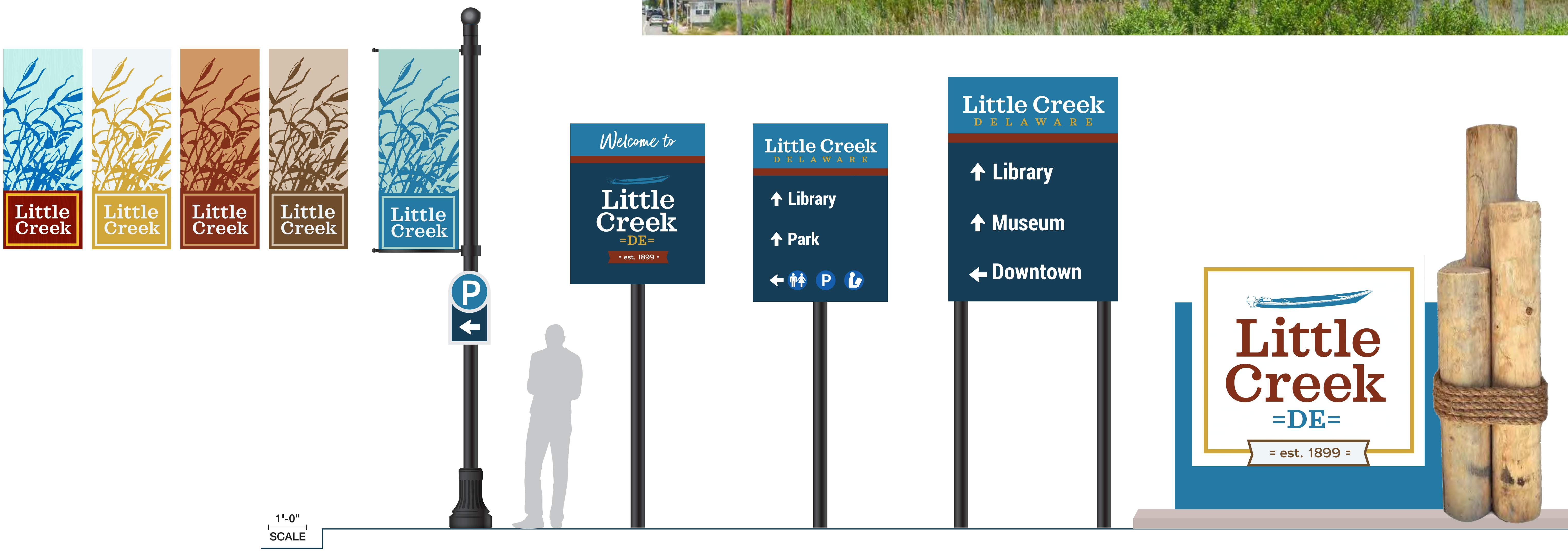
Informational kiosks serve as the transition point for vehicular traffic to pedestrian traffic. These kiosks should be located at major public parking resources and should include a map and the shopping & dining guide, along with the walking tour brochures.

TRAILBLAZERS

Trailblazers are the directing signs leading motorists to the main attractions in the area. These should have a maximum of three locations per sign and carry motorists from gateway to parking lot. Colors can be used to distinguish between different districts and can become smaller as the scale and speed of the roadway narrows.

STREET BANNERS

Banners are very popular and help to add color and movement to the lanes of travel, acting as a speed calming device. They too can be color coded by district and can promote local events, as well as promoting the brand.



The Conceptual Plan

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LITTLE CREEK, DE
MASTER PLAN

1 BUFFERED BIKE LANE
2 CROSSWALKS
3 GREEN INFRASTRUCTURE: BIOSWALE
4 GREEN INFRASTRUCTURE: BIOSWALE
5 LITTLE CREEK PARK
6 DOG PARK
7 PARKSIDE TRAILHEAD & BIOSWALE
8 MULTI-USE BIKE AND WALKING TRAIL
9 GREEN INFRASTRUCTURE: RESTORED WETLAND
10 STONE TAVERN TRAILHEAD

11 CROSSWALKS
12 PAINTED PARKING LANE
13 GREEN INFRASTRUCTURE: BIOSWALE
14 GREEN INFRASTRUCTURE: BIOSWALE
15 THE PILINGS AT WATERMAN'S VILLAGE: POP UP COMMERCIAL SPACE

16 RIVERSIDE TRAILHEAD
17 OBSERVATION TOWER
18 PLANTED MEDIAN & CROSSWALK
19 WATERMAN'S VILLAGE: COMMERCIAL SITE
20 GREEN INFRASTRUCTURE: RESTORED WETLAND

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Stormwater

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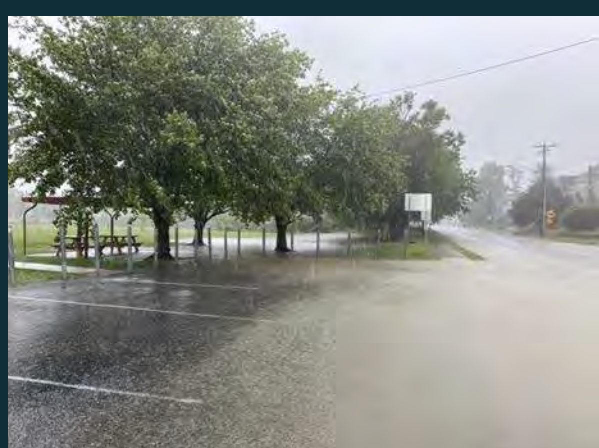
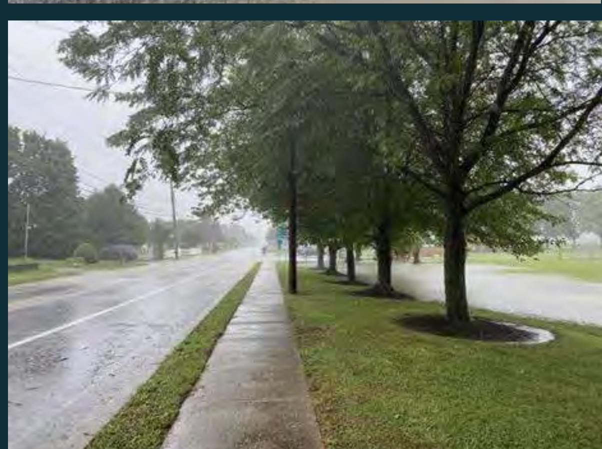
TWO YEAR STORM FLOOD EVENT





Photos taken in Little Creek on July 10, 2020 by Mayor Glenn Gauvry in the midst of a storm event generating ~3.71 inches of rainfall. This is considered a two year rain event in Kent County, or a storm of such magnitude that occurs on average once in every two years.

STORMWATER CONTROL & PLANNING

Residents of Little Creek know well the prevalent areas of flooding along Main Street. With flooding being one of Little Creek's most significant resiliency issues, a strategy to mitigate stormwater collection in streets and on private and public properties became a design priority. Addressing stormwater will not only prevent the hazards associated with today's everyday storm, but provide a buffer for tomorrow's larger storm event as climate change increases the incidence of more extreme storms.

STORMWATER OBJECTIVES

- Provide an opportunity for Little Creek to independently manage stormwater outside of existing infrastructure
- Address storm event flooding with green infrastructure treatments that convey water slowly where infiltration is not possible
- Increase residence time of water in areas where water can safely and effectively infiltrate to improve water quality and quantity

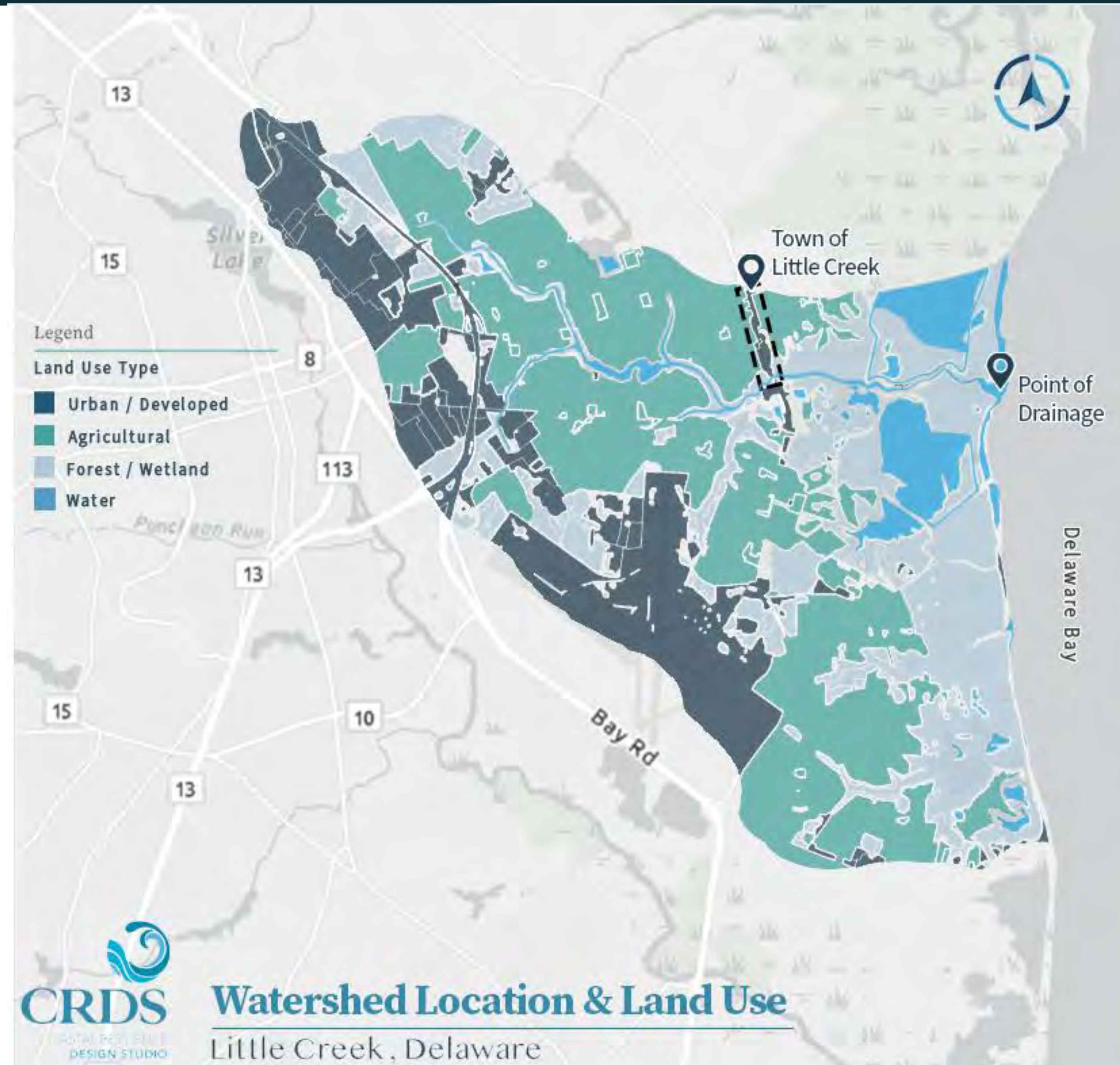
WATERSHED LOCATION AND LAND USE

The greater watershed is known as the Little Creek Watershed, which drains approximately 23 square miles to the Delaware Bay via the Little River. The mainstem of Little River is five miles long and flows east through the town of Little Creek. The lower three miles of the Little River is characterized as saline wetland habitat (Delaware Watersheds, n.d.). In the 23-mile drainage area, the dominant land use is agricultural (40%); the remainder of land uses are characterized as forest and wetland (saltwater and fresh) (32%) and urban (19%) (USGS Streamstats, n.d.).

These waterways are impacted by nutrient and bacterial pollution, with 5.5 miles of the Upper Little River and 2.9 miles of the Lower Little River listed on the Federal Clean Water Act list of Impaired Waterways: 303(d). According to the total daily maximum loads (TMDLs) established for the Little Creek Watershed by DNREC, 40% reductions in both phosphorus and nitrogen, as well as a 75% reduction in enterococcus bacterial loads must be met to restore health to the waterway.

The Little River receives inputs from mostly nonpoint sources of pollution throughout the watershed. Nonpoint source pollution is contamination from diffuse sources, such as agricultural or urban runoff. Nitrogen and phosphorus pollution stem from agricultural fertilizers and feedlots, while bacterial inputs are mainly from animal feedlots, domestic pet wastes and septic systems.

Impervious surfaces including roads, buildings, sidewalks, and parking lots cover ~8.9% of the land in the greater Little Creek Watershed and include portions of the Dover Air Force Base as well as residential developments in the city of Dover (USGS Streamstats, n.d.). Impervious surfaces have a direct impact on the town's water quality and quantity as they prevent infiltration of rain water to the groundwater aquifer and contribute to flooding.



STORMWATER FLOOD AREAS

The two main areas experiencing severe flooding due to stormwater are at the intersection of Port Mahon Road x Main St. and at Lowe St. x Main St. In the northern portion of town, flooding accumulates on the street and on the post office parking area, as well as in the park. In the southern portion of town, water accumulates on the street and on commercial property.

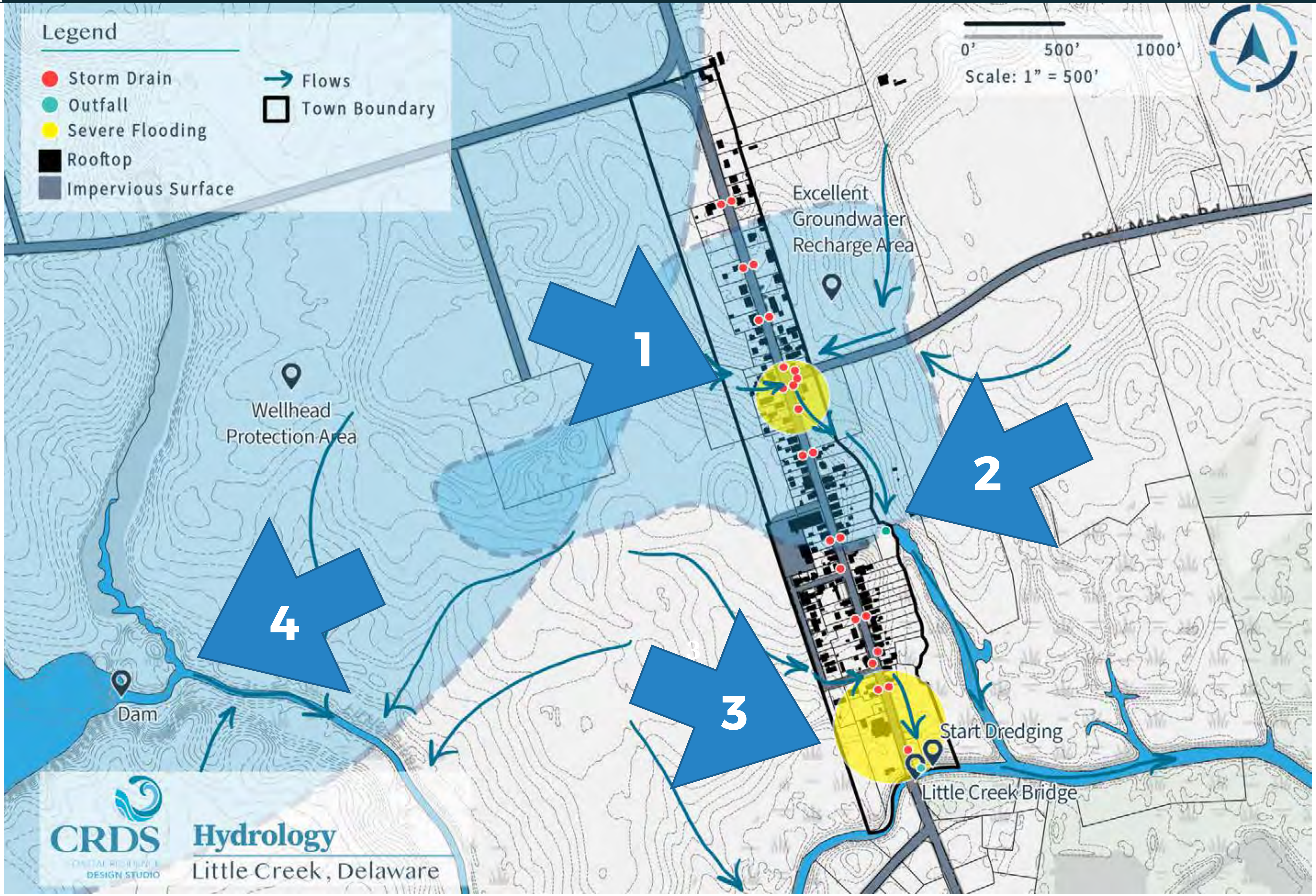
1. Runoff from neighboring farmland enters Little Creek town limits and flows through a ditch between two houses. The ditch leads via a 30" diameter culvert to the stormwater system but is overloaded and floods property and the roadway.
2. Ditches fill up along Port Mahon Road, draining toward the post office.
3. Same as photo 2, facing Main Street.
4. Flooding accumulates in the post-office parking area.
5. Pool accumulating in low areas of Little Creek Park, parallel to Main Street. A discharge pipe located within the strand of phragmites leads to a drainage way to the Little Creek, but is not functioning to allow for water movement.
6. Intersection of Lowe St. and Main St., where the Deli and future general store is located. Storm drains are full and water pools in low-lying elevation.

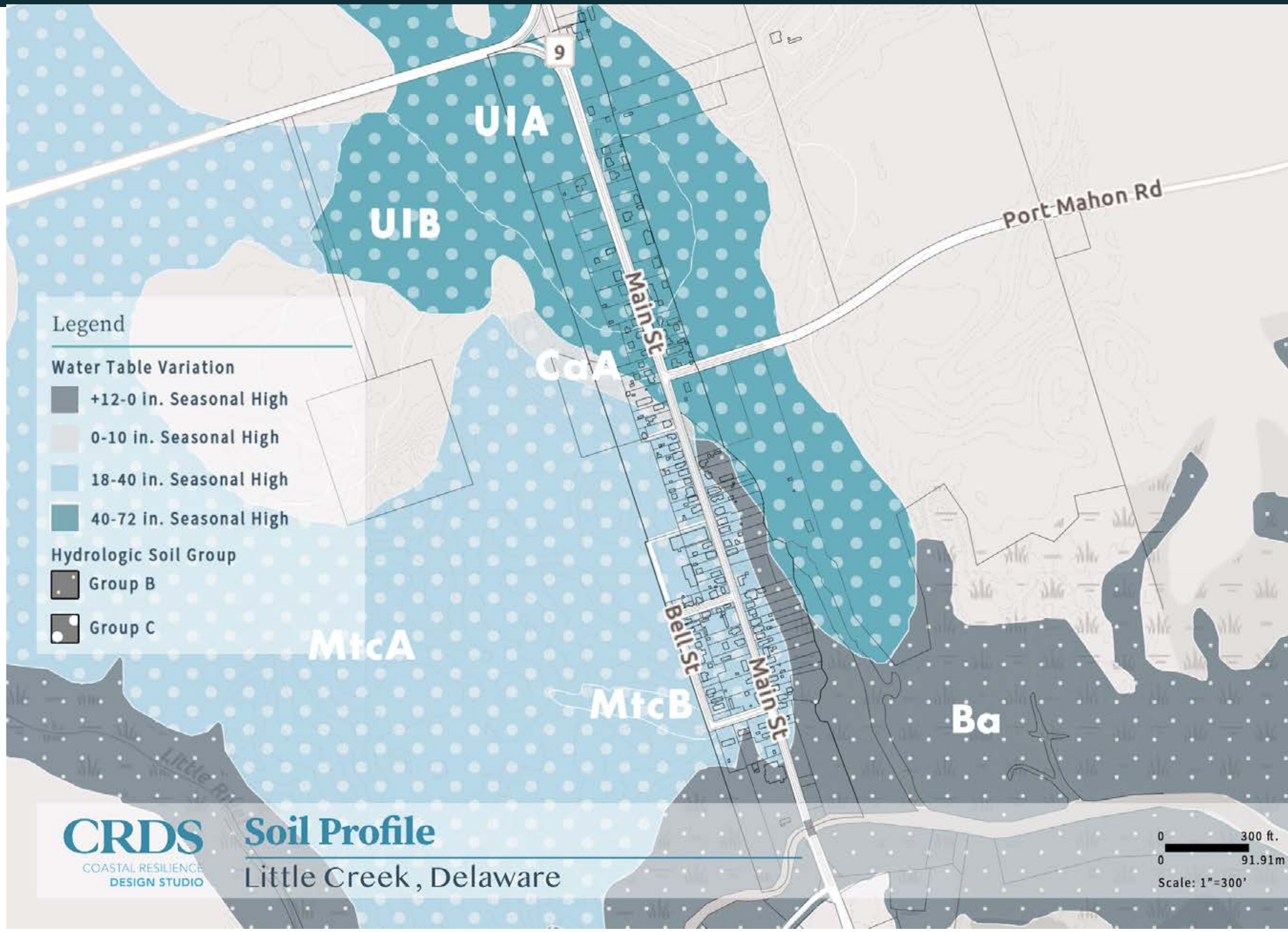
CAUSES OF STORMWATER HOTSPOTS

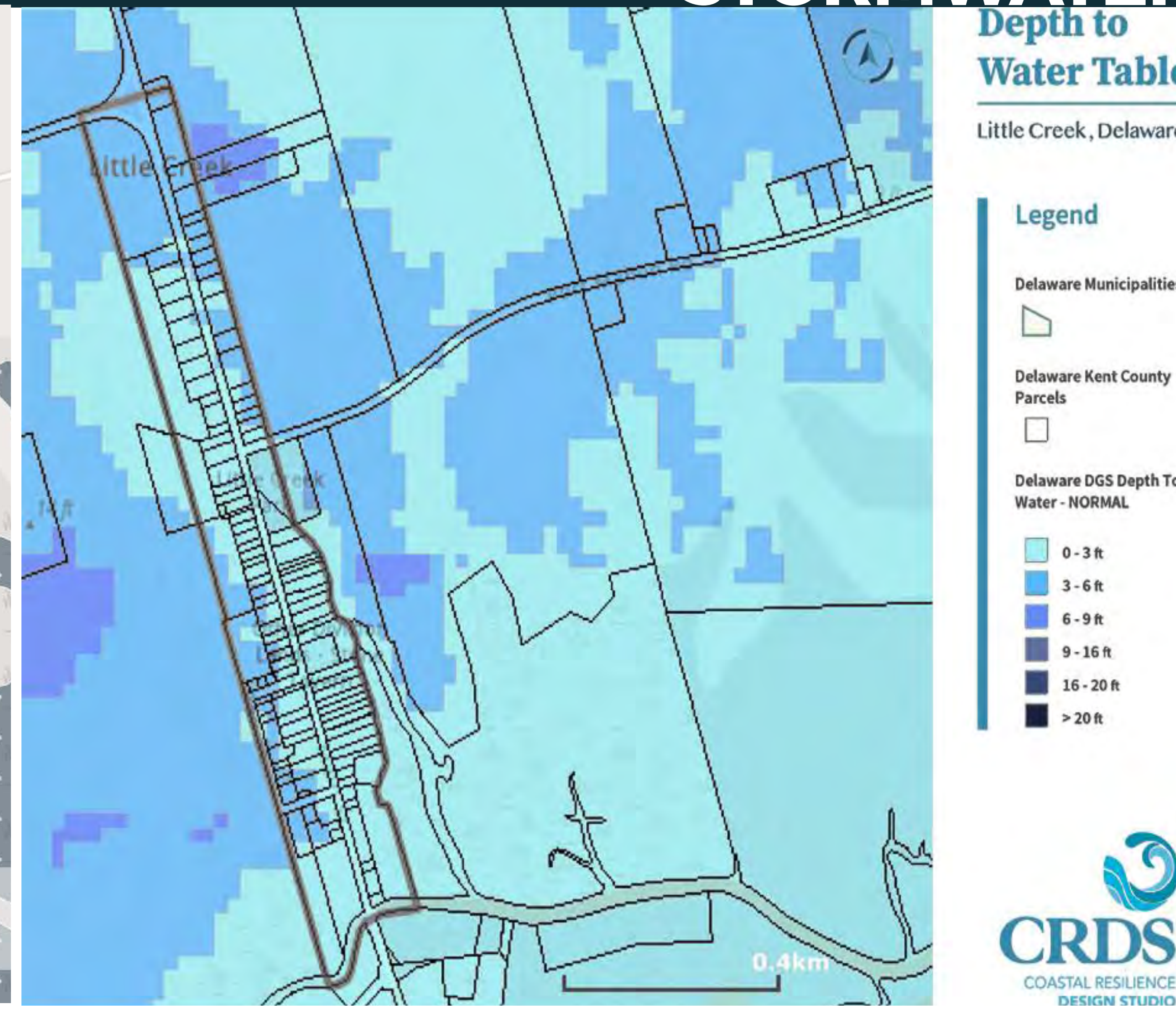
The two main areas where severe flooding occurs are highlighted in yellow. The northern flood area is influenced by surrounding agricultural runoff and subsurface drainage from an adjacent tile field drainage. Drainage enters town limits via a ditch between two private residences (arrow 1), enters the stormwater system via a storm drain across from the intersection of Port Mahon Rd. x Main St, and flows to an outfall in Little Creek Park within a stand of phragmites. This outfall is difficult to access, overcrowded with sediment and debris, and does not allow for the neccessary movement of water; this leads to large areas of pooling water at the Little Creek Park. From the stand of phragmites, water flows along a tributary toward the Little River, but is impeded by a blockage where water is constricted to flow through a small sedimented culvert (arrow 2). Above the culvert is a land bridge used by the adjacent landowner for property access.

The southern flood area (arrow 3) is influenced again by agricultural drainage but also tidally influenced by the Little River. Tidal flooding is related to sea level rise as well as sedimentation of stormwater infrastructure caused in part by an upstream private dam (arrow 4). Agricultural runoff from fields west of town drain via a swale into a ditch along Bell Street. Water accumulates and overflows, flowing past Bell Street to eventually reside in the lowest area at the intersection of Lowe Street and Main Street. Further issues with tidal flooding occur at the commercial area north of the bridge. This is believed to be caused in part by the dam constructed upstream on private property in the 1970's that has reduced the flow in the Little River and allowed sediment to block Little Creek's outfalls.

Flooding areas are exacerbated by the outdated and poorly functioning stormwater infrastructure system. More information and details regarding the stormwater infrastructure system are provided in the appendix.







DESIGN LIMITATIONS

Designing green infrastructure requires accounting for infiltration capacity at each proposed site. Both the high water table and poorly infiltrating soils established throughout Little Creek are limiting design constraints for green stormater infrastructure. The hydrologic soil group in most areas of town are group C, meaning they have poor infiltration capabilities. Additionally, the depth to the water table is very low (less than three feet) throughout most areas of town. Many green infrastructure strategies address water quality and quantity issues by allowing water to collect and infiltrate. Since the majority of water during storm events is not able to infiltrate given these constraints, the following design solutions carefully consider how to retain and covey water more slowly.

Agricultural Buffer & Swales

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DESIGN STUDIO

NORTH AGRICULTURAL BUFFER & SWALE: EXISTING CONDITIONS

Agricultural buffers and vegetated swales are two types of green infrastructure that do not have infiltration requirements to function properly; these treatments are repeated throughout the design to enhance water quality and quantity through plant uptake.

The primary location where runoff enters town is from the N-NW agricultural field that lets out to the drainage ditch within town limits (figure 4). Topography naturally drains surface waters to this ditch, and piped outfalls from tile drainage also lead subsurface flow to the ditch (figure 3).

Water runs through the ditch almost daily (figure 1), and during storm events the ditch is overwhelmed and water floods out onto the neighboring yards (figure 4). There is little buffer between the agricultural fields and the water flow (figure 2), which in part drains a natural wetland to the N-NW. The ditch is not well maintained and has been scoured deeply by moving water.

A culvert at the end of the ditch drains the flow to the stormwater system and to natural wetlands to the S-SE, but due to blockages within that system, the water does not move effectively (figure 5).

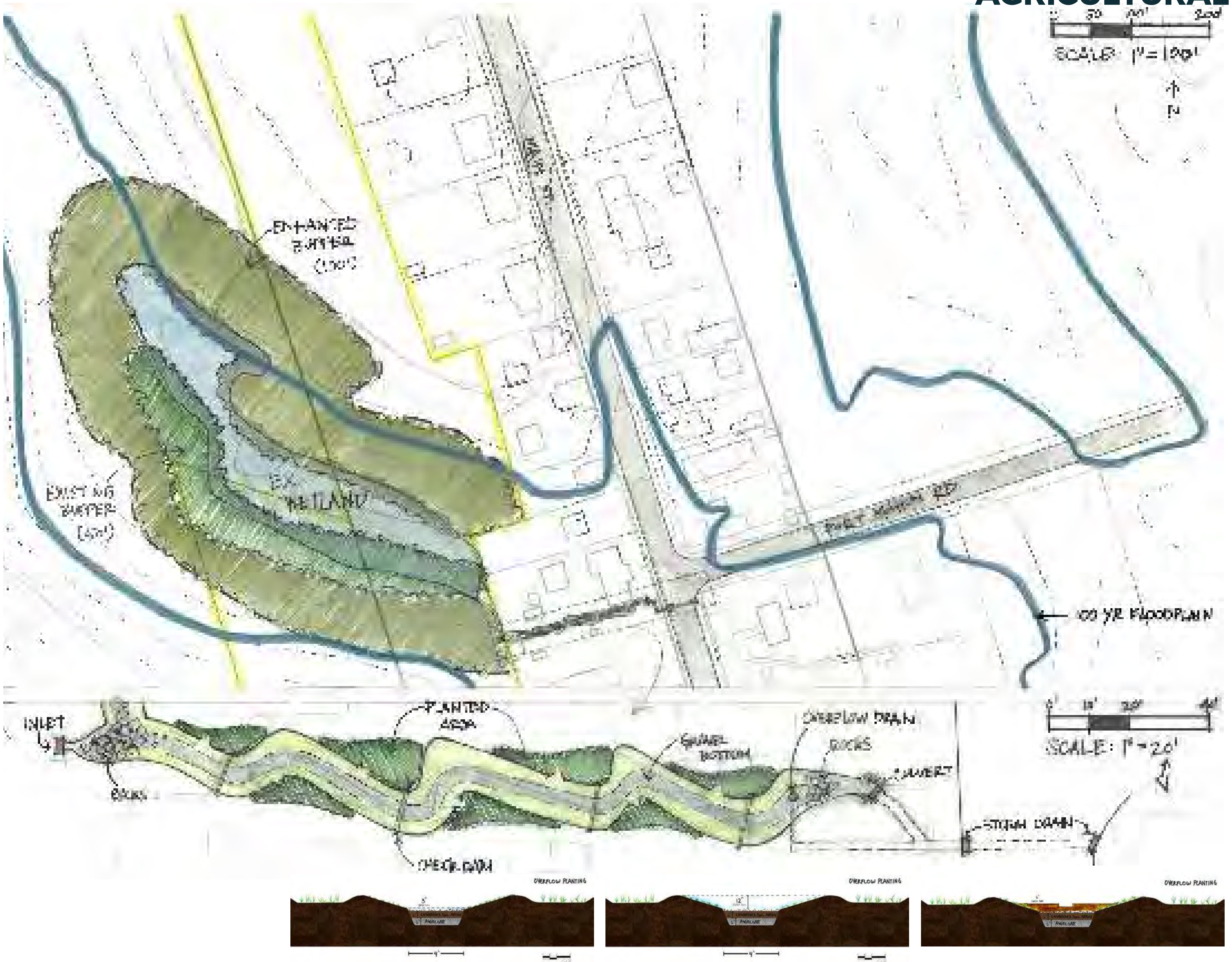
Working with surrounding agricultural land owners to enhance riparian and ditch areas would improve water conveyance, benefitting both the land owner and the Town of Little Creek.

NORTH AGRICULTURAL BUFFER & SWALE: PROGRAM

- **Increase size of existing riparian buffer** surrounding existing wetland from 50’ → 100’, increasing habitat and increasing water uptake
    - ~146,000 sq. ft. or 3.35 acres of farmland converted to shrub/forest buffer
    - Potential financial incentives to farmers via USDA CREP program which leases land long-term for conservation efforts
- **Create a bioswale with meanders**, native planted areas for overflow during storm events and check dams to slow and infiltrate water
    - Dissipate water energy with rocky inlets/ outfalls
    - Increase infiltration capacity with an engineered soil matrix
    - Include an overflow drain that leads to stormwater system
- **Enlarge size of culvert** draining the ditch

(top) Aerial image showing the drainage ditch between properties within town limits and the adjacent agricultural field.

(right) Overgrown vegetation and sediment impede water flow from the ditch through shown culvert that leads to the Little Creek stormwater system.



N. AGRICULTURAL BUFFER AND SWALE: DESIGN

This plan shows the existing buffer (dark green) around an existing wetland and a proposed enhanced buffer on agricultural property owned by two separate owners. As surface water runs off down the natural grade to the wetland, a riparian area will slow water, filter out pollutants and nutrients, and transpire water. This will enhance wildlife habitat, protect the existing wetland, and reduce flow downstream entering Little Creek.

A meandering bioswale is shown between the private residences to enhance the existing ditch. Surface water and subsurface flow from tile drainage will flowing into the ditch naturally or by inlet to a rocky forebay to dissipate water energy. Water will flow along a gravel bottom with vegetated side-slopes eventually to an enlarged culvert leading to the Little Creek stormwater system. During storm conditions, check dams will hold back and slow the water, which will flow into planted areas that become inundated during high flow conditions. An overflow drain will move excess water to the stormwater system before it is able to flood out. Sections below show the gentle slope, check dams, planting areas, engineered soil matrix, and aggregate material that improve the infiltration and safe conveyance capabilities of an enhanced bioswale during baseflow and storm flow conditions.

SOUTH VEGETATED SWALE: EXISTING CONDITIONS

To the S/SW of town, a surface swale cuts across agircultural fields west of Bell Street (below), emptying runoff into a grassy roadside ditch (figures 1 and 2). Runoff crosses Bell Street, and travels down Lowe Street, to reside in the topographic depression at the intersection of Lowe and Main Streets (figures 4 and 5).

SOUTH VEGETATED SWALE: PROGRAM

- **Create a bioswale with meanders**, native planted areas for overflow during storm events and check dams to slow and infiltrate water at the agricultural runoff outlet
- **Connect bioswale to existing riparian buffer** at the northern edge of Little River wetland
- **Implement roadside bump-out bioswales** along Lowe Street at all storm drains to hold and drain water, preventing pooling in the street

SOUTH VEGETATED SWALE: DESIGN

Agricultural runoff approaching Bell Street will enter a meandering bioswale graded to flow to an existing riparian buffer at the north edge of river-adjacent existing wetland. This swale has the potential to capture runoff from the existing fire department parking area in addition to runoff from the West.

Runoff moving down Lowe Street toward Main Street will enter roadside bioswales through curb cuts. Native plantings will enhance street beautification while functioning to hold and uptake water, as shown in the precedent image below. More information about roadside bioswales will be detailed under "Traffic Calming".


Image: Mitt Watershed Council

Little Creek Park

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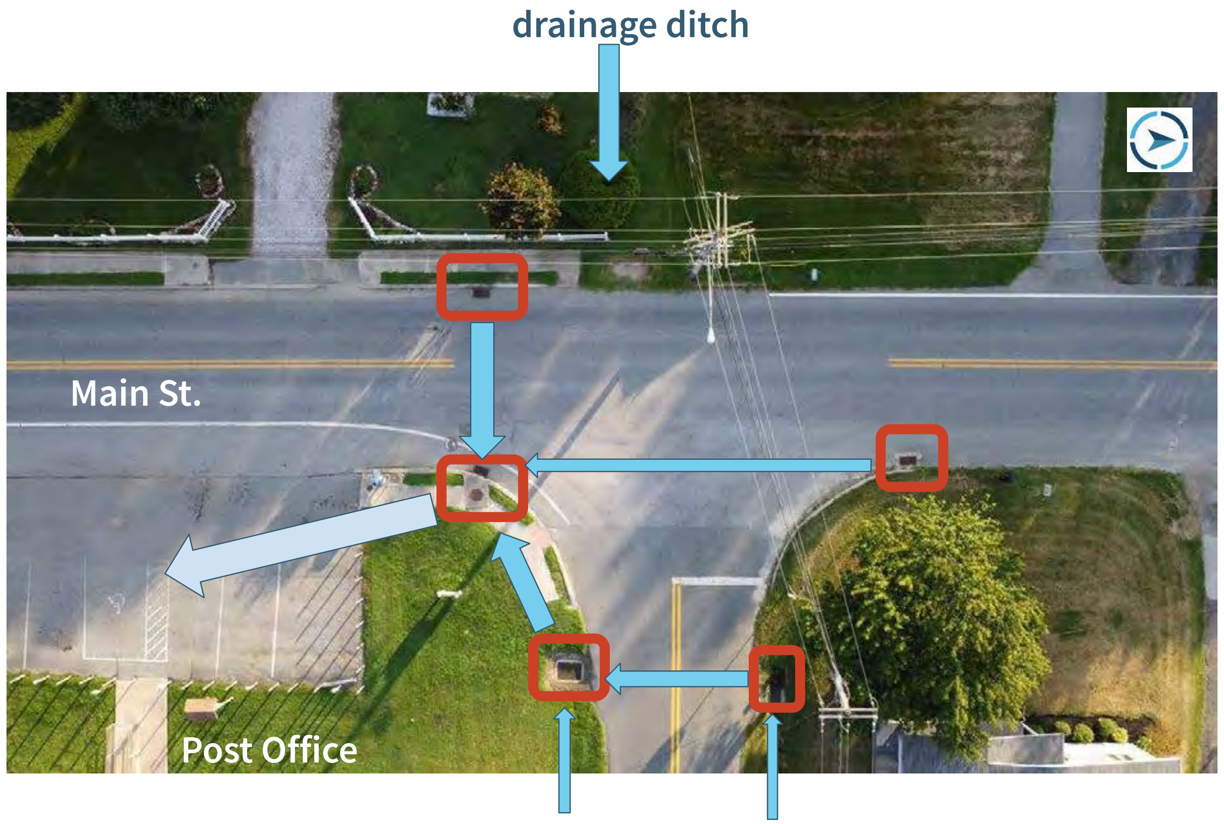
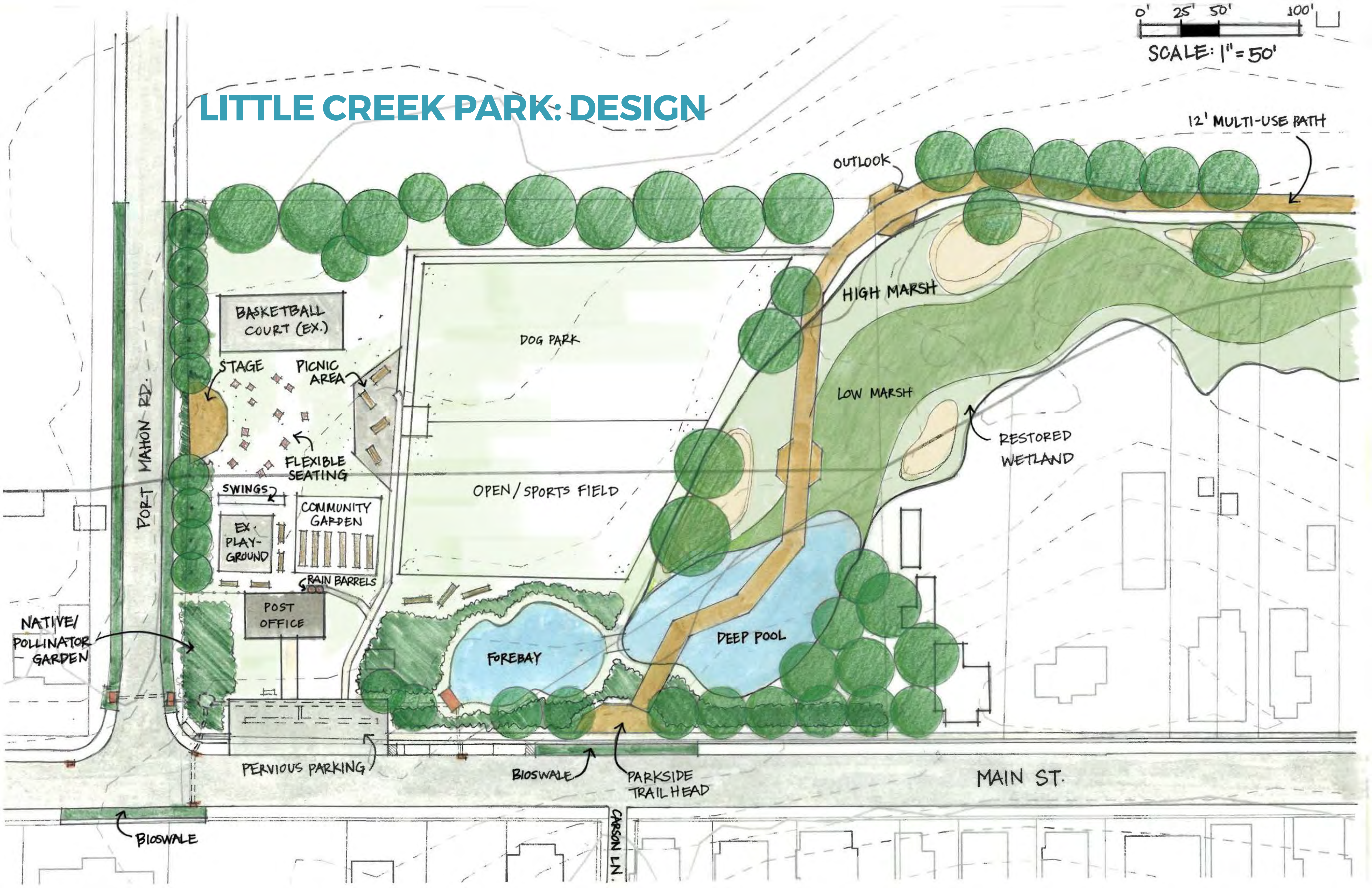
LITTLE CREEK PARK: EXISTING CONDITIONS

All existing stormwater catch basins in the northern part of town converge to one point underground beneath the Little Creek Park (above). The collected stormwater travels to an outfall amid a stand of invasive Phragmites australis, where sediment and lack of slope encourage water to collect and back up, pooling in the open space in Little Creek Park parallel to Main Street (figures 3 and 5).

Little Creek Park is already equipped with several amenities such as the playground, basketball court, seating area and dog park, which were past community-led projects (figures 2 and 4).



LITTLE CREEK PARK: DESIGN



The Little Creek Park is envisioned as a vibrant gathering space where residents and visitors can walk, play, bike, encounter wildlife, garden or just enjoy being outside and connecting with the community. A great place for families, pet lovers, or those looking to get some exercise, the park includes amenities such as a trailhead to a 12-foot wide multiuse path with outlooks above a restored wetland, native gardens, and ample seating for picnicking or watching a live performance. In addition, the park will be equipped with green infrastructure features (bioswales, rain barrels for use in the community garden and a restored wetland) that not only mitigate stormwater and promote resilience, but beautify and enhance the outdoor experience.

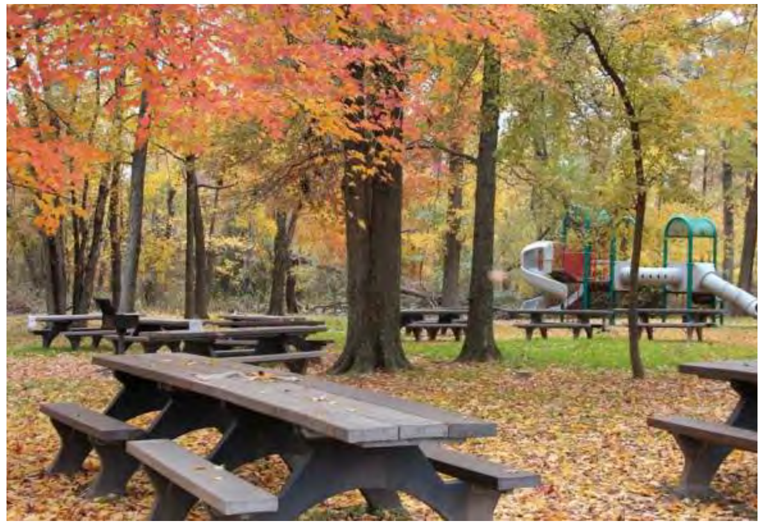
LITTLE CREEK PARK PROGRAM:

- **Convey all stormwater from inlets to a forebay** that drains to a restored wetland
- **Create a native plant / pollinator garden** with an underdrain leading water to forebay
- **Create bioswales in bump-outs** along Main St. and Port Mahon Rd. with curb cuts leading water to forebay
- **Replace post office parking lot with pervious pavement** and an underdrain that flows to the forebay
- **Update park amenities to include a fuller breadth** as noted from the LC Comprehensive Plan: multi-use trail with lookouts; bench seating; community garden; stage with moveable seating; picnic area; sports field; educational signage

The park could become a vibrant gathering space in town, with events such as Little Creek Live.

Moveable seating via Project for Public Spaces

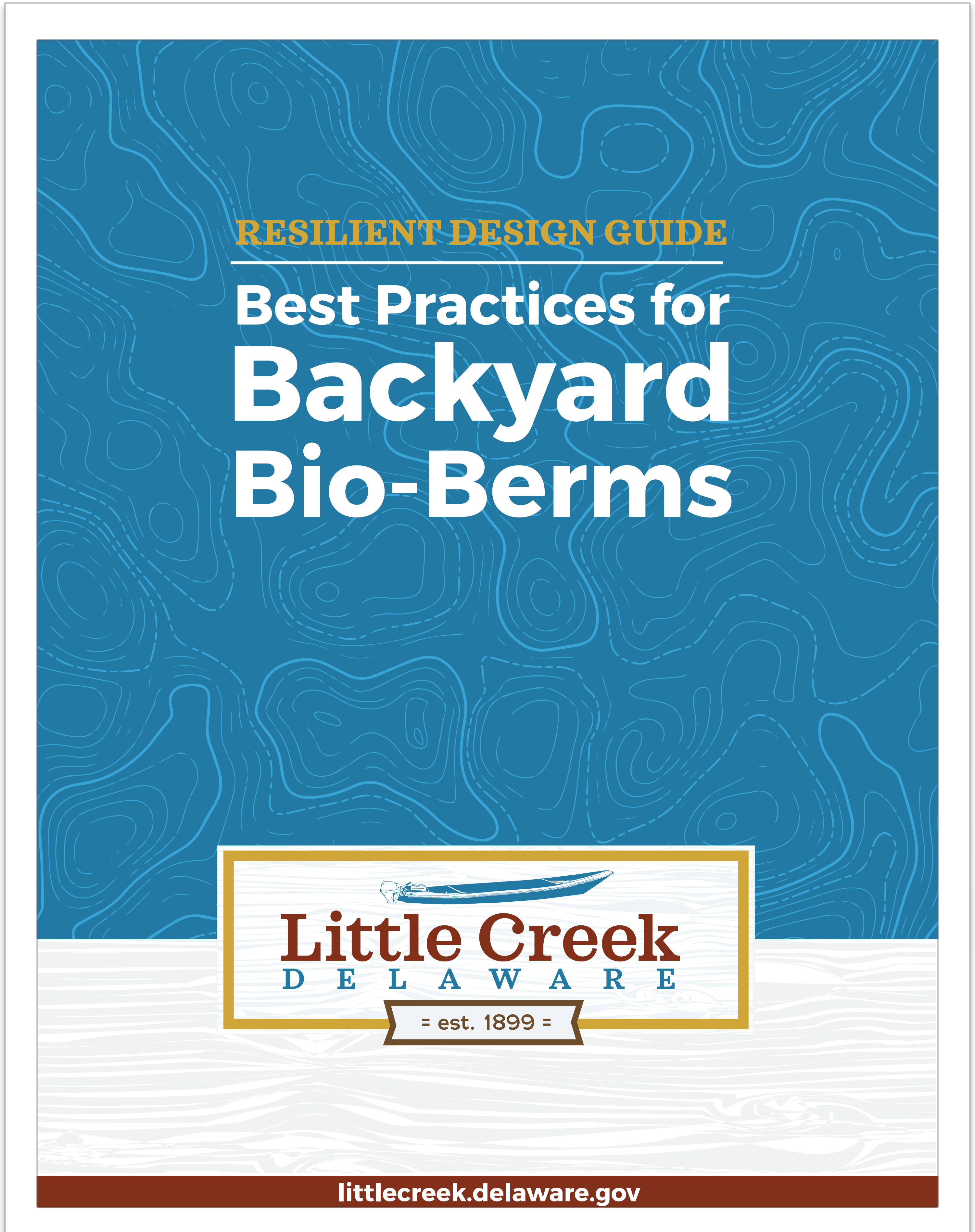
Community garden space via Greening Forward



Park picnic area via the National Park Service

Pollinator garden via Xerces Society


Restored Wetland
CRDS
COASTAL RESILIENCE
DESIGN STUDIO



RESTORED WETLAND: DEVELOPING A COMMUNITY & HOMEOWNER EDUCATION PLAN

Holistically addressing resilience for Little Creek means not only implementing green infrastructure on town property and along roadways, but encouraging property owners to protect their land and residences with natural and effective design solutions as well. A 'Resilient Design Guide: Best Practices for Backyard Bio-Berms' could be one such program to encourage homeowner education and implementation of design strategies that offer protection from sea level rise and intensified storms. Outlined topics may include the benefits of native wetland buffers, best practices for removing invasive species and collecting that biomass to create sustainable natural berms at the wetland edge, and a list of native plant species with varying light and soil condition requirements.

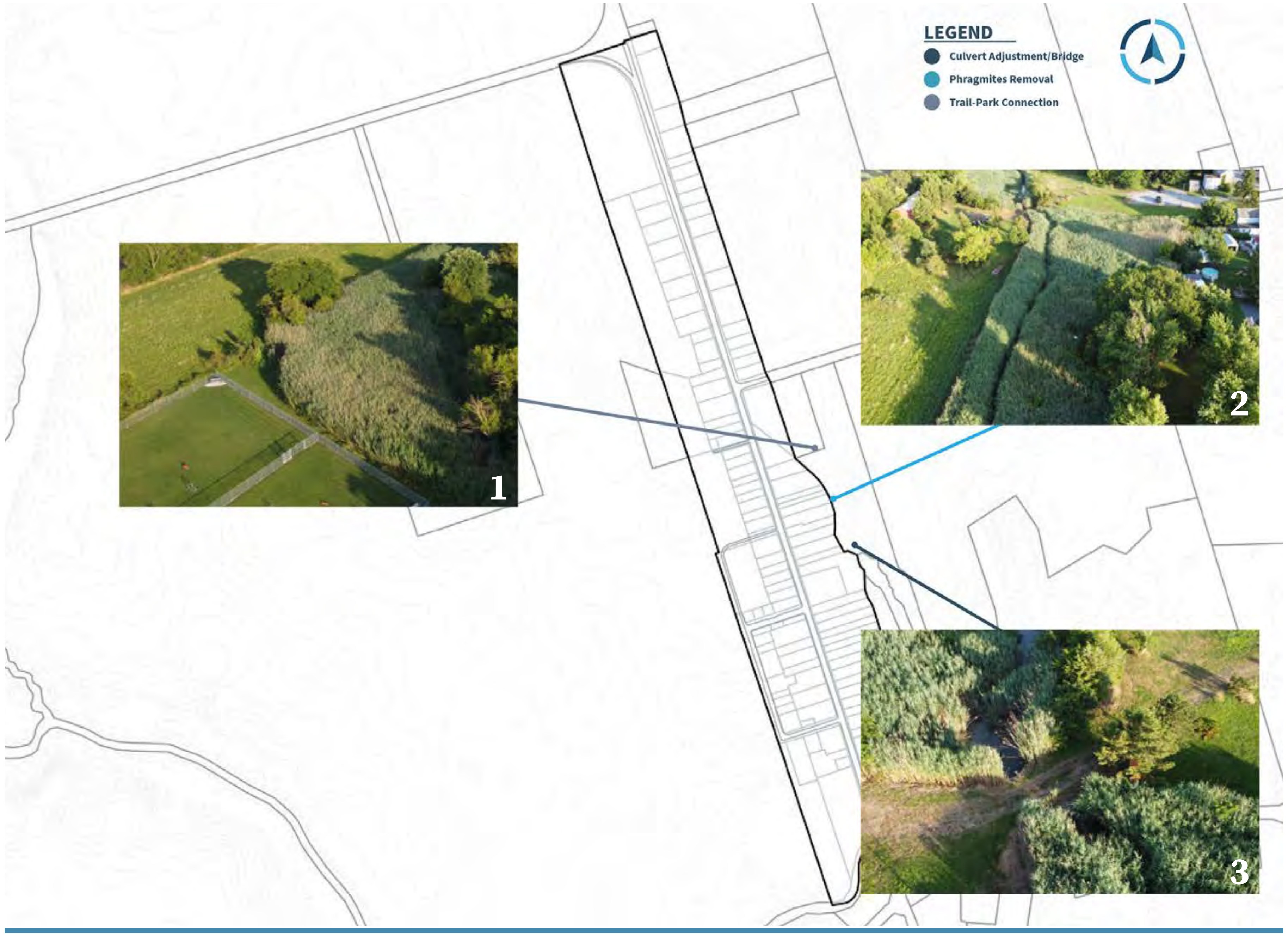
RESTORED WETLANDS

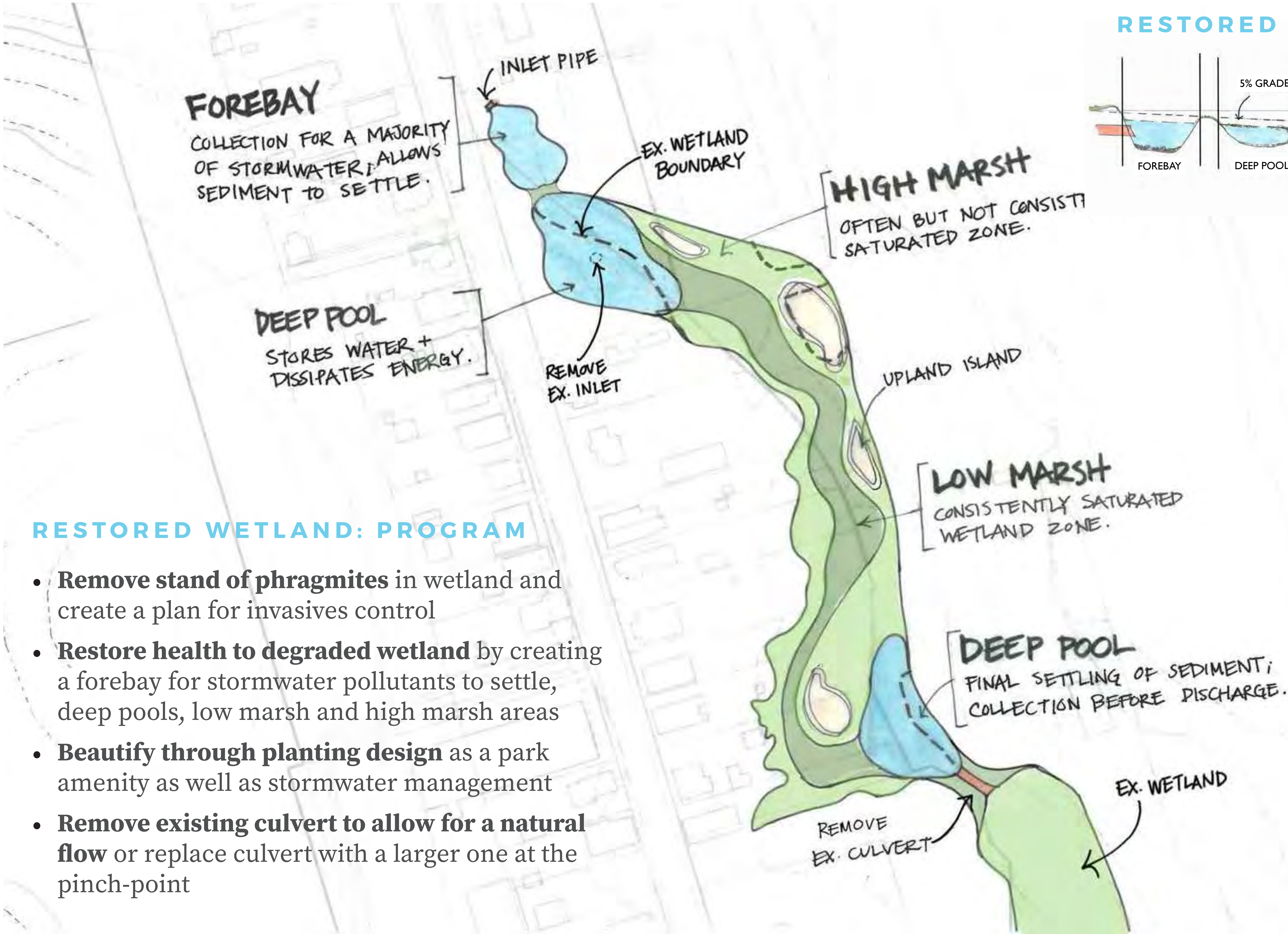
RESTORED WETLAND: EXISTING CONDITIONS

The final focus of green stormwater treatments is on restoring the native wetland that begins in Little Creek Park (figure 1). General disturbance to the native wetland environment has led to the establishment of invasive Phragmites australis as the dominant plant species, reducing biodiversity and the health of the natural ecosystem (figure 2). One major disturbance includes a pinch point where the natural flow of water from the park area has been blocked by the insertion of a land-bridge and funneled through a culvert underneath, preventing natural tidal flow (figure 3).

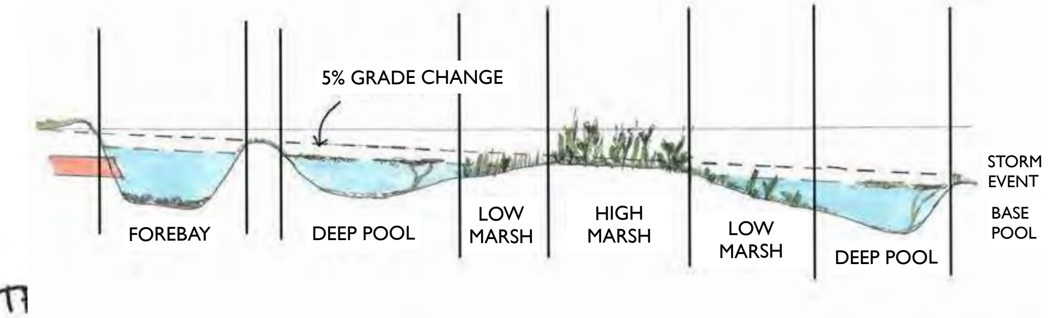
RESTORED WETLAND: DESIGN

The design of the restored wetland focuses on removing invasive species, regrading, and revegetating with a diversity of native plants throughout diverse wetland conditions. Varied water depths throughout a wetland encourage natural colonization of diverse plant species and wetland creatures to inhabit the space. Deep pools and native plants will discourage mosquito growth and encourage their natural predators. Water will flow along consistently inundated low marsh areas. High marsh areas provide a buffer for water to rise during storm events. Upland islands with trees will provide shade along the pathway, adding more niche space in this varied environment. A long term management strategy to reduce invasive pressure will be required to maintain the beauty and functionality of the design. Establishing a path that crosses the wetland at the Little Creek Park will encourage visitors to interact with a healthy wetland environment, with educational signage conveying the importance of these ecosystems. Finally, removing the existing culvert and land bridge downstream will allow the stream to flow naturally and reduce flooding upstream.

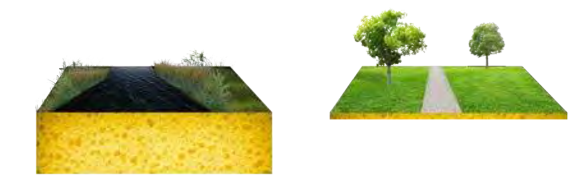




RESTORED WETLAND SECTION



Wetland Storage Capacity



RESTORED WETLAND: PROGRAM

- **Remove stand of phragmites** in wetland and create a plan for invasives control
- **Restore health to degraded wetland** by creating a forebay for stormwater pollutants to settle, deep pools, low marsh and high marsh areas
- **Beautify through planting design** as a park amenity as well as stormwater management
- **Remove existing culvert to allow for a natural flow** or replace culvert with a larger one at the pinch-point

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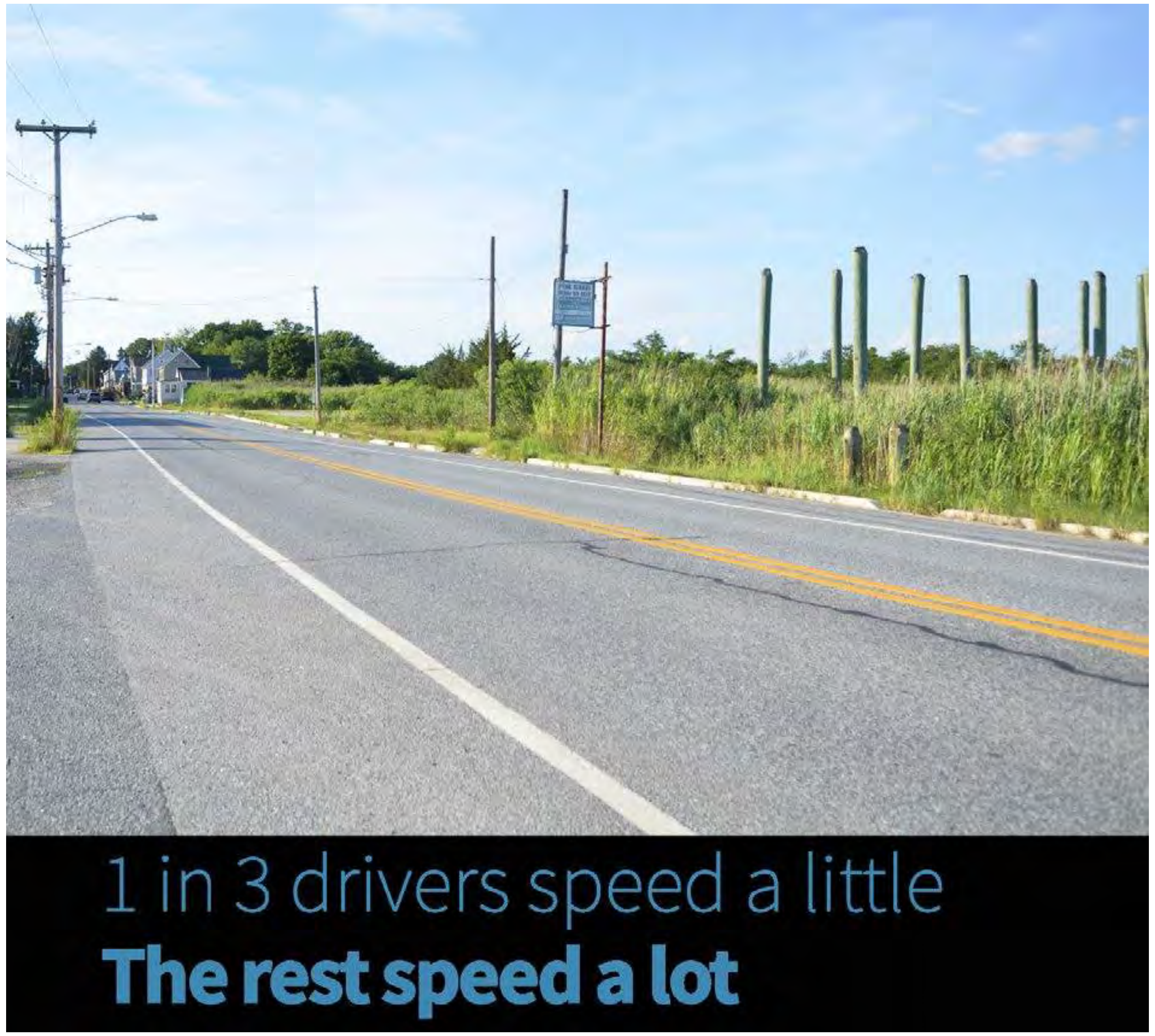
Traffic & Connectivity

CRDS
COASTAL RESILIENCE
DESIGN STUDIO

OBJECTIVES

TRAFFIC CALMING

- Address flooding issues along Main Street
- Provide traffic calming through town using the Complete Streets model
- Reconnect the community with the Little River
- Provide a walking trail and observation tower
- Improve bike access and safety
- Maintain the small town feel
- Resiliency should be a common thread in all design recommendations



TRAFFIC COUNTS

						Sheet1				
PRE COVID-19 SHUTDOWN	2020		Total cars	25-29 Mph	30-34 Mph	35-39 Mph	40-44 Mph	45-49 Mph	50 Mph and Over	Total > 29 Mp
	February 2020	Totals	24,187	7,782	7,541	3,831	3,059	1,554	420	16,405
		% of Total		32.17%	31.18%	15.84%	12.65%	6.42%	1.74%	67.83%
	35 Days	Avg per day	691							
COVID-19 SHUTDOWN	2020 March	Totals	19,485	6,958	6,195	2,967	2,150	1,040	175	12,527
		% of Total		35.71%	31.79%	15.23%	11.03%	5.34%	0.90%	64.29%
	35 Days 2020	Avg per day	557							

WHAT IS A COMPLETE STREET?

ACTIVE SIDEWALKS
Sidewalks should be smooth, wide, feel safe, and have appropriate transitions to the street, making them easy to walk or use a wheelchair on

DEDICATED BIKE LANES
Simple pavement markings creating a dedicated bike lane make both motorist and bicycle movement more predictable, and therefore safer for both. They may increase the likelihood of casual riders using bicycles for transportation

ACTIVE ROADWAY
One lane of car traffic going in each direction with a two-way-left-turn-lane (TWLTL) in the center would reduce the amount of car crashes on Government Street by providing turning vehicles a refuge from through traffic, while keeping through traffic moving more efficiently

SAFE CROSSWALKS
Clearly marked crosswalks allow pedestrians and wheelchair users to cross streets safely, while making sure cars know where to expect them

PLANTING STRIP
Street trees and landscaping slow speeding traffic, improve the aesthetics of the roadway, provide shade, and create a buffer between cars and people, making a more inviting environment for pedestrians

GREEN SPACES
Parks and public green spaces create a destination, encouraging community interaction and providing a rest from the surrounding urban environment

WHY COMPLETE STREETS IN LITTLE CREEK?

- Enhance Little Creek as a destination on the Bayshore Byway
- Increase pedestrian access and safety with crosswalks
- Enhance the community and visitor experience in the community
- Provide traffic calming and facilitate foot traffic
- Provide an opportunity for added stormwater mitigation
- Incorporate native species of plants and trees to improve stormwater absorption, enhance habitat for native wildlife, and provide locally driven beautification for the community

SIDEWALK INVENTORY

GATEWAYS

GATEWAY TREATMENTS

The current gateway entry points into Little Creek do little to encourage slowing traffic to the 25 mph posted speed limit. CRDS recommends addressing this issue in several ways. First, adding center planted medians at both the northern and southern town gateway entry points. The medians signal a change in place and a change in expected pace. Additionally, the medians will guide vehicles around a subtle lane shift, helping to slow traffic to the posted speed. Secondly, CRDS recommends adding a pedestrian crosswalk in the southern gateway median. Enhanced walkability and pedestrian safety will become very important as redevelopment begins in the commercial district. In addition, adding street banners will help to visually constrict the roadway from above and subliminally signal the arrival to a place where vehicles and pedestrians coexist.

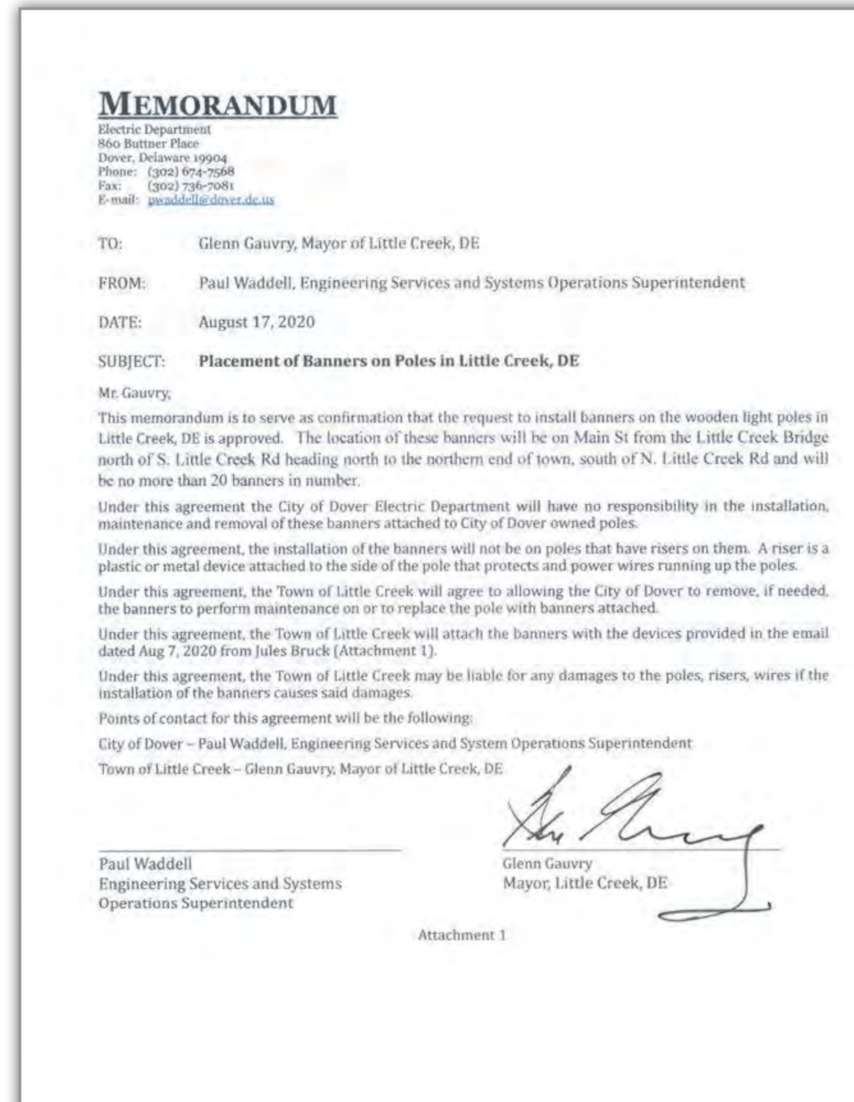
Existing Conditions

Southern Gateway entrance to Little Creek

STREET BANNERS FOR TRAFFIC CALMING

This is a photo rendering of Main Street with the addition of street banners and a painted parking lane, both treatments are designed to visually constrict the roadway and slow traffic.

A site visit took place on August 21, 2020 to locate specific poles to receive banners. The MOU from the City of Dover was used to define appropriate poles, as well as considerations such as dense foliage and distance from the roadway.



MEMORANDUM

Electric Department
860 Buttner Place
Dover, Delaware 19904
Phone: (302) 674-7568
Fax: (302) 736-7081
E-mail: pwaddell@dover.de.us

TO: Glenn Gauvry, Mayor of Little Creek, DE

FROM: Paul Waddell, Engineering Services and Systems Operations Superintendent

DATE: August 17, 2020

SUBJECT: **Placement of Banners on Poles in Little Creek, DE**

Mr. Gauvry,

This memorandum is to serve as confirmation that the request to install banners on the wooden light poles in Little Creek, DE is approved. The location of these banners will be on Main St from the Little Creek Bridge north of S. Little Creek Rd heading north to the northern end of town, south of N. Little Creek Rd and will be no more than 20 banners in number.

Under this agreement the City of Dover Electric Department will have no responsibility in the installation, maintenance and removal of these banners attached to City of Dover owned poles.

Under this agreement, the installation of the banners will not be on poles that have risers on them. A riser is a plastic or metal device attached to the side of the pole that protects and power wires running up the poles.

Under this agreement, the Town of Little Creek will agree to allowing the City of Dover to remove, if needed, the banners to perform maintenance on or to replace the pole with banners attached.

Under this agreement, the Town of Little Creek will attach the banners with the devices provided in the email dated Aug 7, 2020 from Jules Bruck (Attachment 1).

Under this agreement, the Town of Little Creek may be liable for any damages to the poles, risers, wires if the installation of the banners causes said damages.

Points of contact for this agreement will be the following:

City of Dover – Paul Waddell, Engineering Services and System Operations Superintendent

Town of Little Creek – Glenn Gauvry, Mayor of Little Creek, DE

Paul Waddell
Engineering Services and Systems
Operations Superintendent

Glenn Gauvry
Mayor, Little Creek, DE

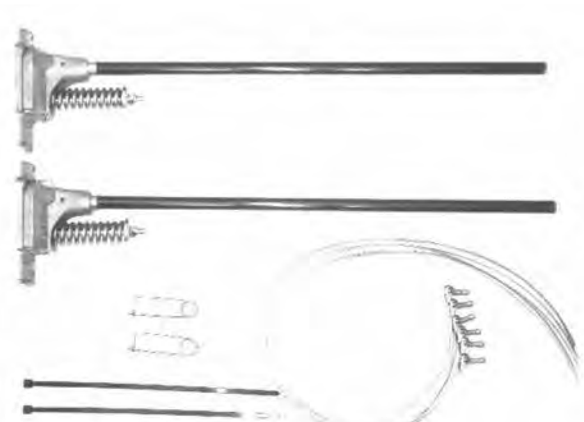
Attachment 1

Pole Numbers Identified:

4	32
7*	33
12	35
15	36
20	37
21	38*
22	39
25	40
26	42
27	43
28	44
30	46
31	

*Poles with transformer

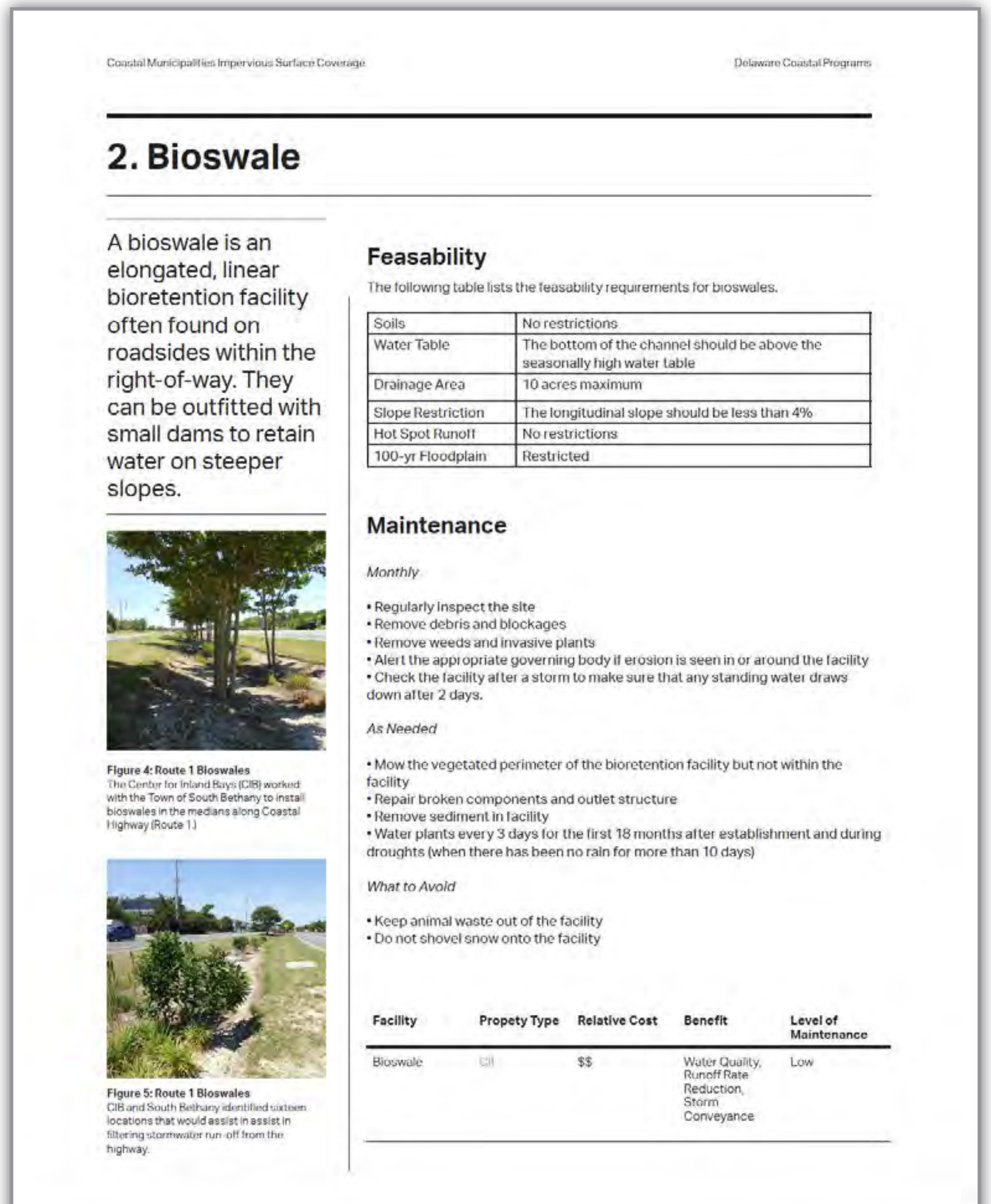
This list is a working document and is subject to final approval from the town of Little Creek and the City of Dover.



Proposed banner designs and suggested mounting hardware to affix banners to wooden utility poles using a spring mounted strap system.

WHY BIOSWALES

- When placed in the right-of-way, a bioswale performs the traffic calming function of a bump-out but also works for stormwater control.
- Poor soils + high water table constrain the design options for green infrastructure
- Slow, retain, and clean water for short periods of time before it moves into the Little River through the established stormwater system
- Low maintenance, native plantings reinforce the local aesthetic and create micro habitats



Coastal Municipalities Impervious Surface Coverage — Delaware Coastal Programs

2. Bioswale

A bioswale is an elongated, linear bioretention facility often found on roadsides within the right-of-way. They can be outfitted with small dams to retain water on steeper slopes.

Figure 4: Route 1 Bioswales
The Center for Inland Bays (CIB) worked with the Town of South Bethany to install bioswales in the medians along Coastal Highway (Route 1.)

Figure 5: Route 1 Bioswales
CIB and South Bethany identified sixteen locations that would assist in assist in filtering stormwater run-off from the highway.

Feasability

The following table lists the feasability requirements for bioswales.

Soils	No restrictions
Water Table	The bottom of the channel should be above the seasonally high water table
Drainage Area	10 acres maximum
Slope Restriction	The longitudinal slope should be less than 4%
Hot Spot Runoff	No restrictions
100-yr Floodplain	Restricted

Maintenance

Monthly

- Regularly inspect the site
- Remove debris and blockages
- Remove weeds and invasive plants
- Alert the appropriate governing body if erosion is seen in or around the facility
- Check the facility after a storm to make sure that any standing water draws down after 2 days.

As Needed

- Mow the vegetated perimeter of the bioretention facility but not within the facility
- Repair broken components and outlet structure
- Remove sediment in facility
- Water plants every 3 days for the first 18 months after establishment and during droughts (when there has been no rain for more than 10 days)

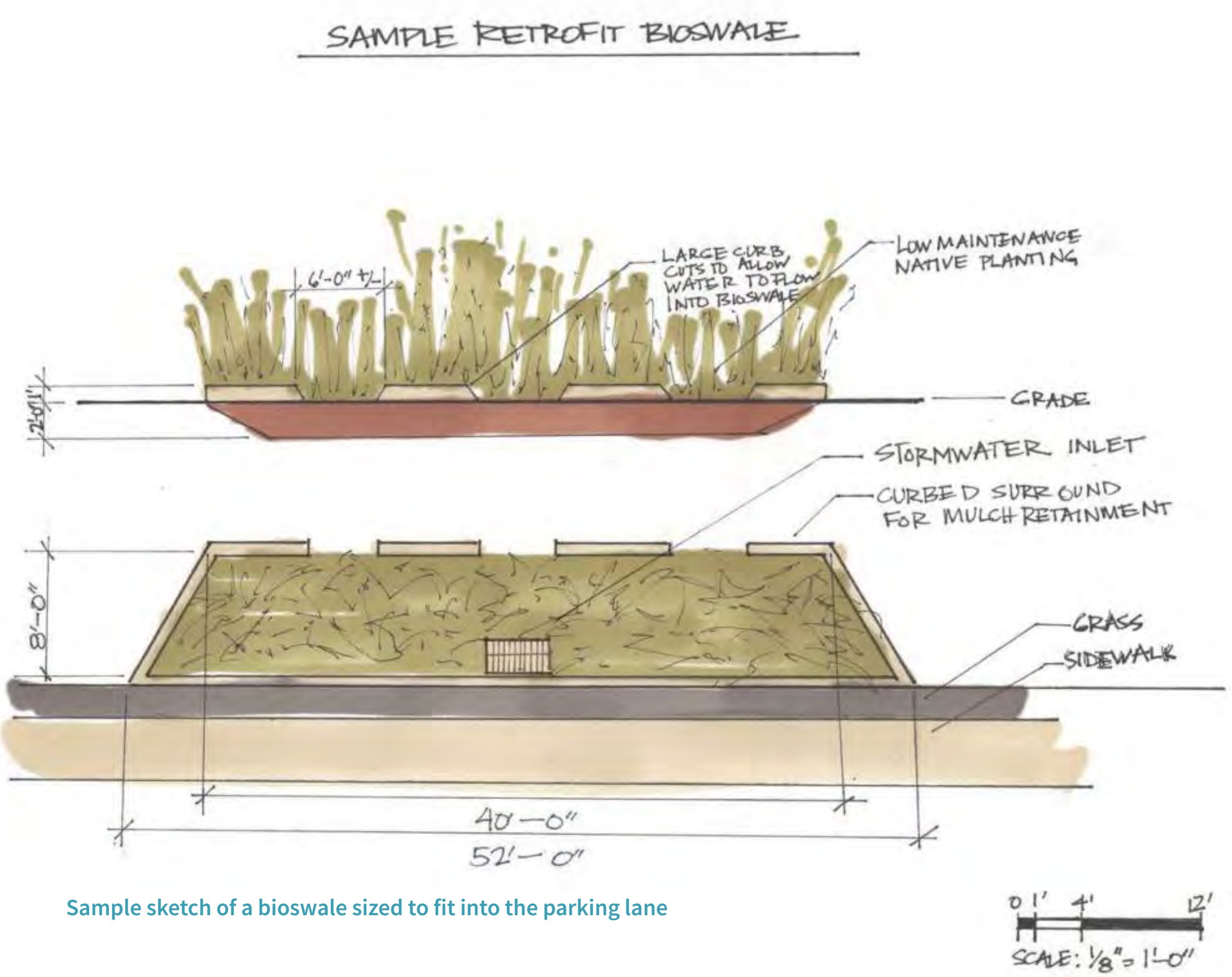
What to Avoid

- Keep animal waste out of the facility
- Do not shovel snow onto the facility

Facility	Propety Type	Relative Cost	Benefit	Level of Maintenance
Bioswale	CII	$$	Water Quality, Runoff Rate Reduction, Storm Conveyance	Low

BIOSWALES

Bioswales constrict the roadway for traffic calming



Sample sketch of a bioswale sized to fit into the parking lane

PRECEDENT STUDY

Bioswale design and Center median Installation along Highway 1

Bethany Beach, Delaware

2.1.5 Inlet Retrofits

Within N4 (South Bethany) there were many inlets located in small depression areas. Examples are provided in Figure 9. One potential retrofit to improve stormwater quality before entering the inlet is to remove the pavement and rip-rap surrounding these inlets. Grass and native vegetation can then be planted around the inlets to serve as pretreatment.

Figure 9. Inlets surrounded by rip-rap and concrete in N4 (South Bethany) that can be modified to remove the impervious cover and include grass/native vegetation pretreatment.

Bioswales

Connectivity & Traffic Calming Context Map

LITTLE CREEK, DELAWARE

CRDS recommends using bioswales in any location along Main Street where a bump-out might be needed to calm traffic.
Recommended bioswale locations are as follows:

B1: East Side of Main St. in the commercial district, retrofitting around current stormwater inlets. Exact location determined after engineering study is complete.

B2: The corner of Lowe St. and Main St. to help slow and control water from encroaching into the market parking lot.

B3: East Side of Main St. along the Little Creek Park, retrofitting around one of the current stormwater inlets near Carson Ave. Exact location determined after engineering study is complete.

B4: Located in the shoulder and right-of-way of the west side Main St. at the intersection of Port Mahon Rd. This bioswale is recommended to be in conjunction with the stormwater design for the ditch.

B5: The eastern side of Port Mahon Rd and Main St. intersection incorporating a northbound crosswalk to a shared use path.

PRECEDENT IMAGES

Bioswales have many benefits, including a reduction in strain on a city's municipal sewer system. Less water in sewers generally leads to cleaner rivers and waterways. Click through the gallery for more about Portland's bioswales.

BAYSHORE BIKEWAY

REGIONAL CONNECTION

Little Creek is less than 6 miles east of the state capitol, Dover, Delaware. Within a 7 mile radius, residents and visitors have access to multiple museums, the viewing platform at the Little Creek Wildlife Area, two public beaches, a brewery, and Dover International Speedway, home to the regional NASCAR races.

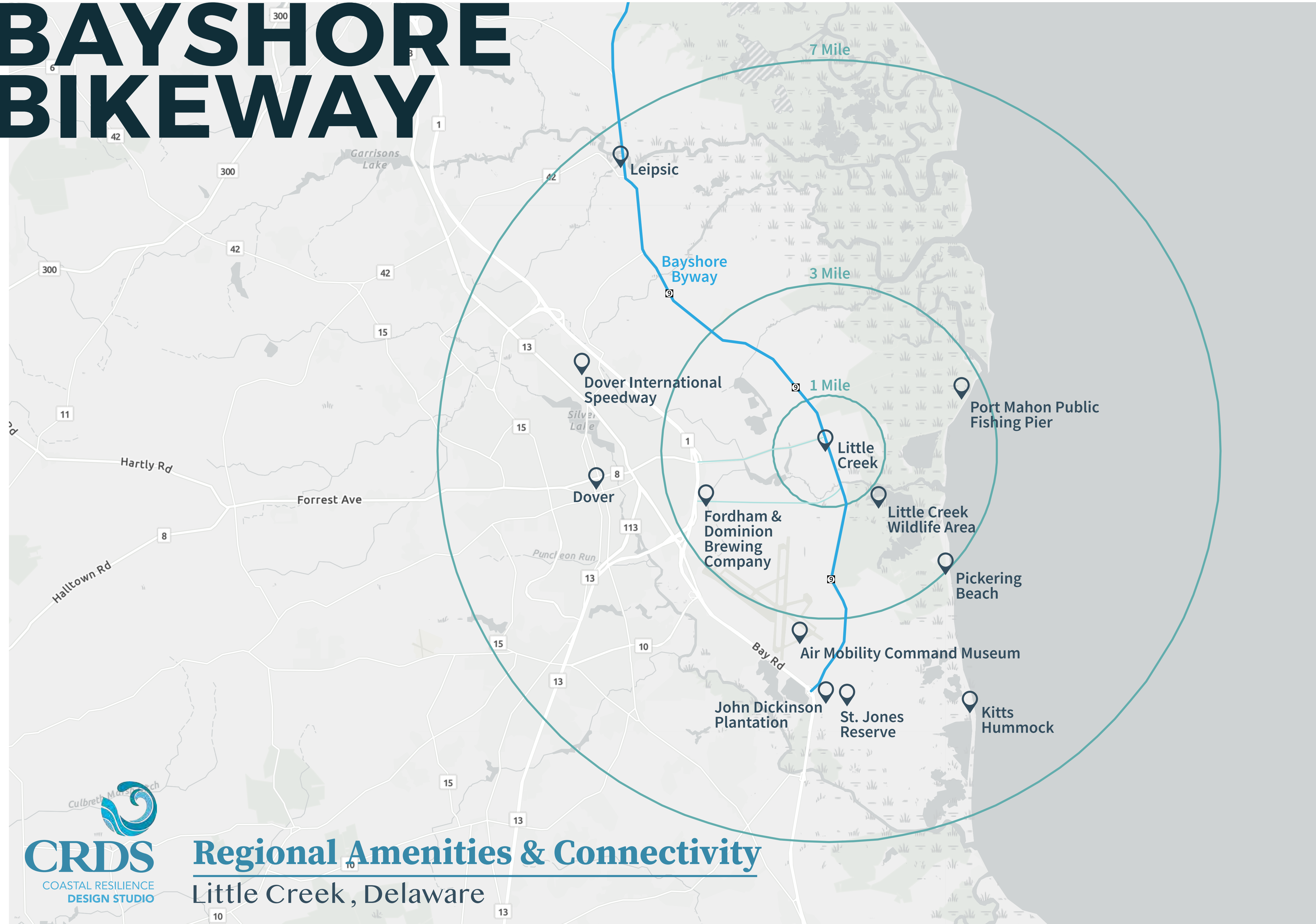
Little Creek is also a community along Delaware's Bayshore Byway. The Bayshore Byway is a scenic, two-lane road that follows the Delaware River and Bay Estuary along the largest preserved coastal marshland on the east coast. Route 9 provides great views of spring and fall bird migration.

The byway offers a "road less traveled" experience through some of Delaware's most celebrated ecological assets. t

BAYSHORE BYWAY

BAYSHORE River Towns

BAYSHORE Beaches



CRDS COASTAL RESILIENCE DESIGN STUDIO

Regional Amenities & Connectivity

Little Creek, Delaware

DELAWARE BIKE TRAIL MILES

Although Kent County has recently completed the beginning phase of the Senator Bikeway through downtown Dover, the county overall has significantly fewer dedicated bike trail miles than New Castle or Sussex Counties.

BIKE SAFETY IN LITTLE CREEK

After reviewing the road widths along Main Street, it became clear that an alternative solution would be neccessary to maintain cyclist safety. Choosing to keep the resident's on street parking and adding bioswale bump-outs for traffic calming, the roadway cannot safely accomodate a bike lane.

This analysis led to suggesting the walking trail requested by the community be enlarged in scope to become a multi-use trail through Little Creek, and an overall bikeway system beyond.


BAYSHORE
Bikeway

Elevated Boardwalk

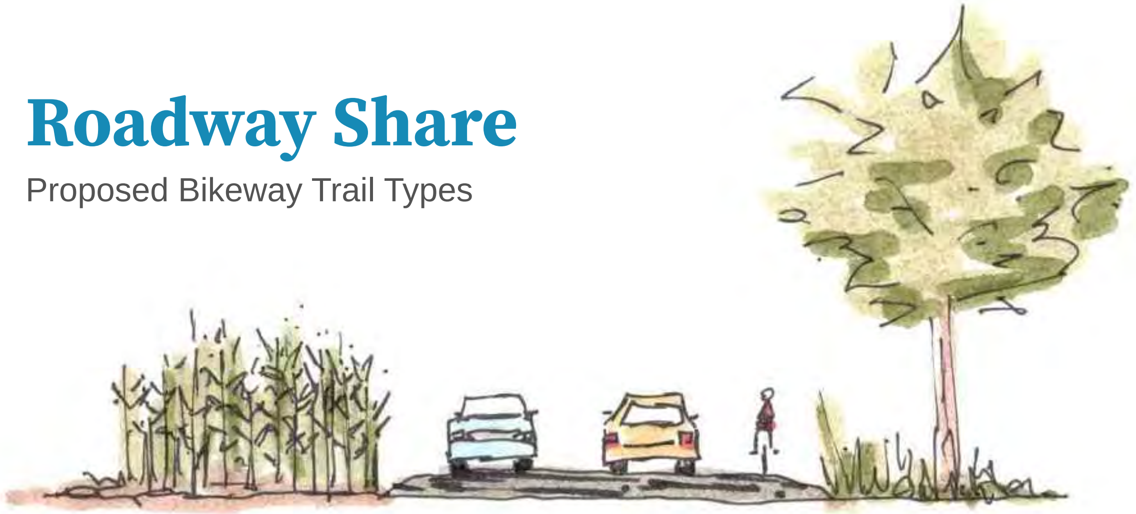
Proposed Bikeway Trail Types

Grade Level Trail

Proposed Bikeway Trail Types

Roadway Share

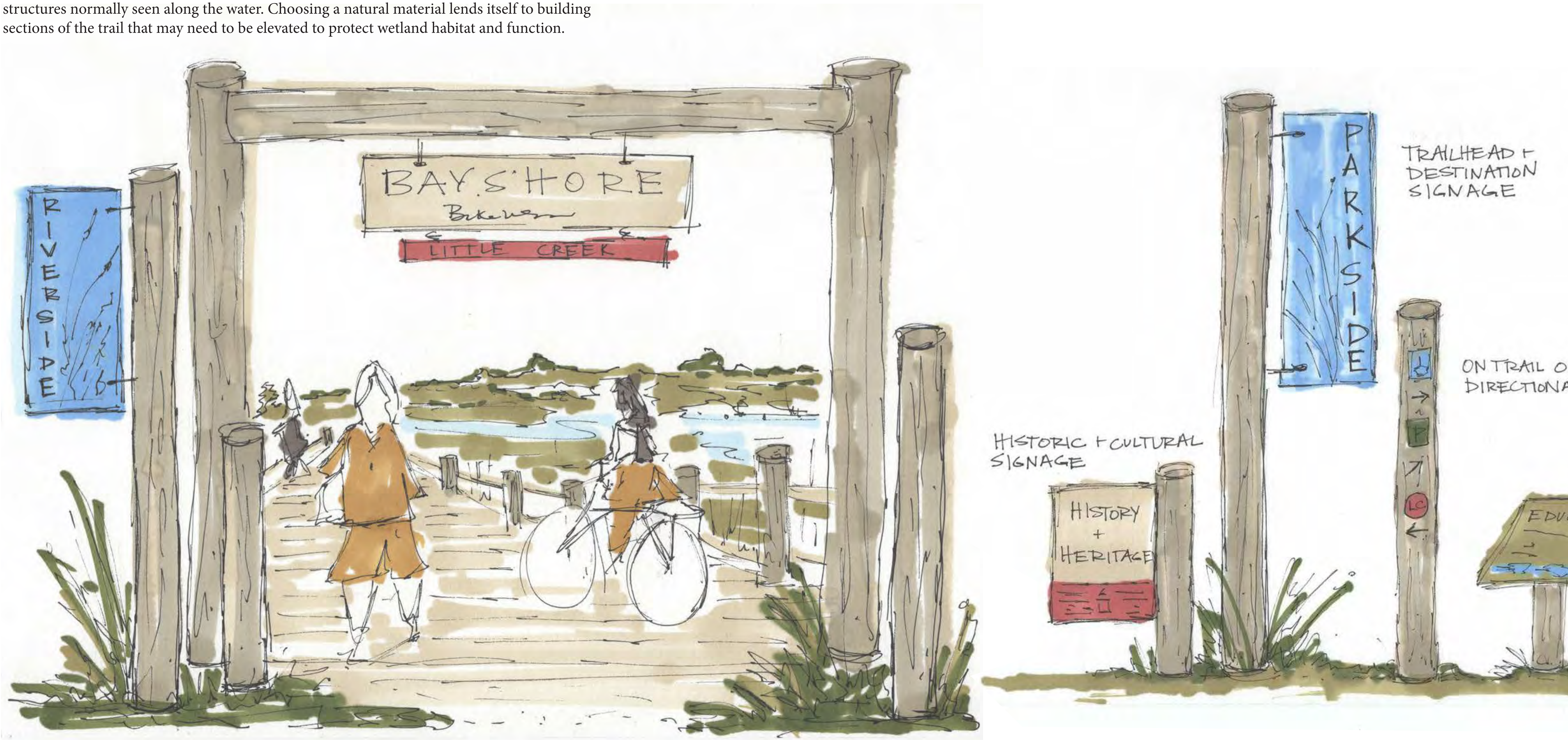
Proposed Bikeway Trail Types



BAYSHORE BIKEWAY

TRAILHEAD DESIGN

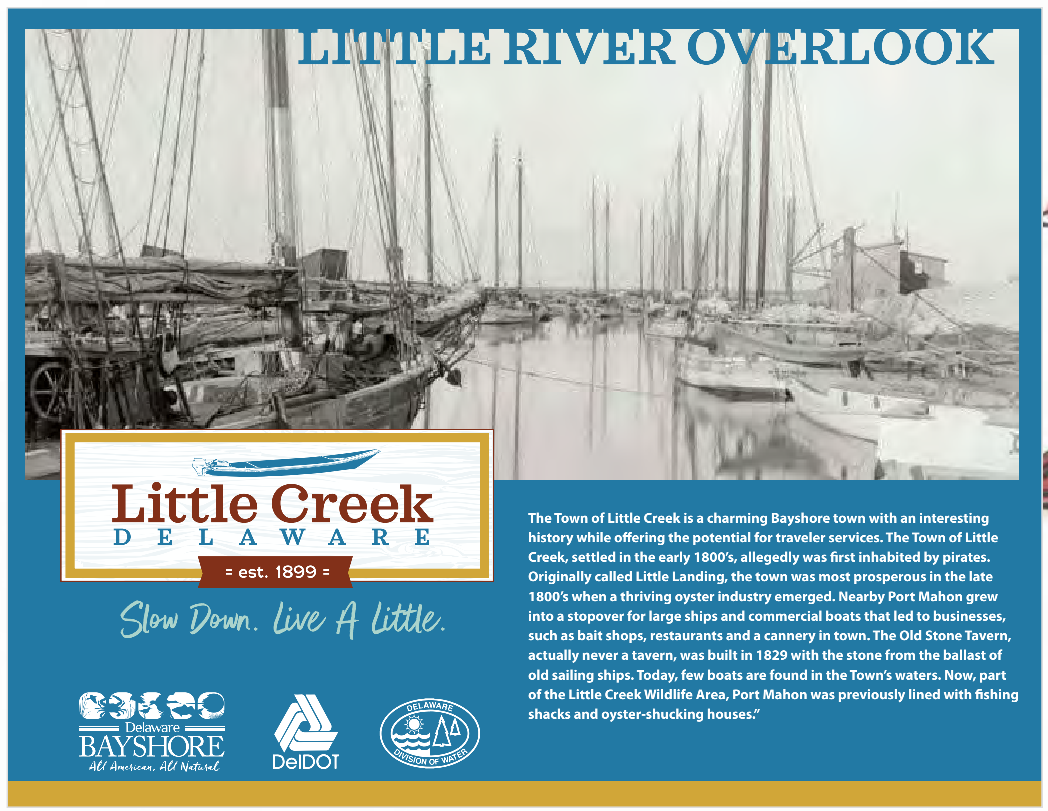
Playing off of Little Creek's signature pilings, as seen along Main Street and Port Mahon Road, the conceptual design for the Bayshore Bikeway trailheads and sign posts mimic the vertical structures normally seen along the water. Choosing a natural material lends itself to building sections of the trail that may need to be elevated to protect wetland habitat and function.



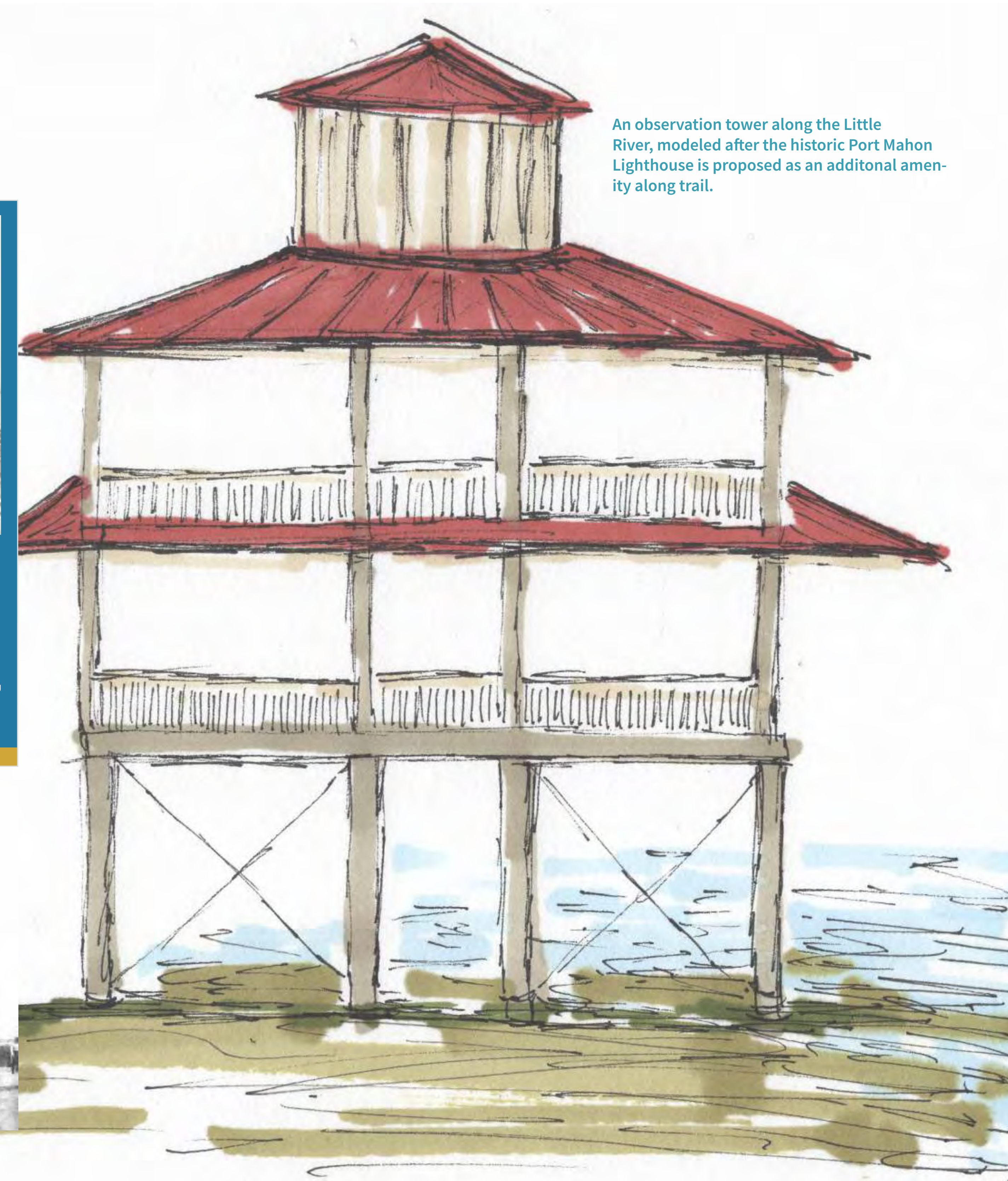
Trailhead Banner System

INTERPRETIVE SIGNAGE

Finding a new way to connect residents and visitors to the Little River is an important consideration. This is an opportunity to revisit Little Creek's maritime history through interperpretive signage along the trail.



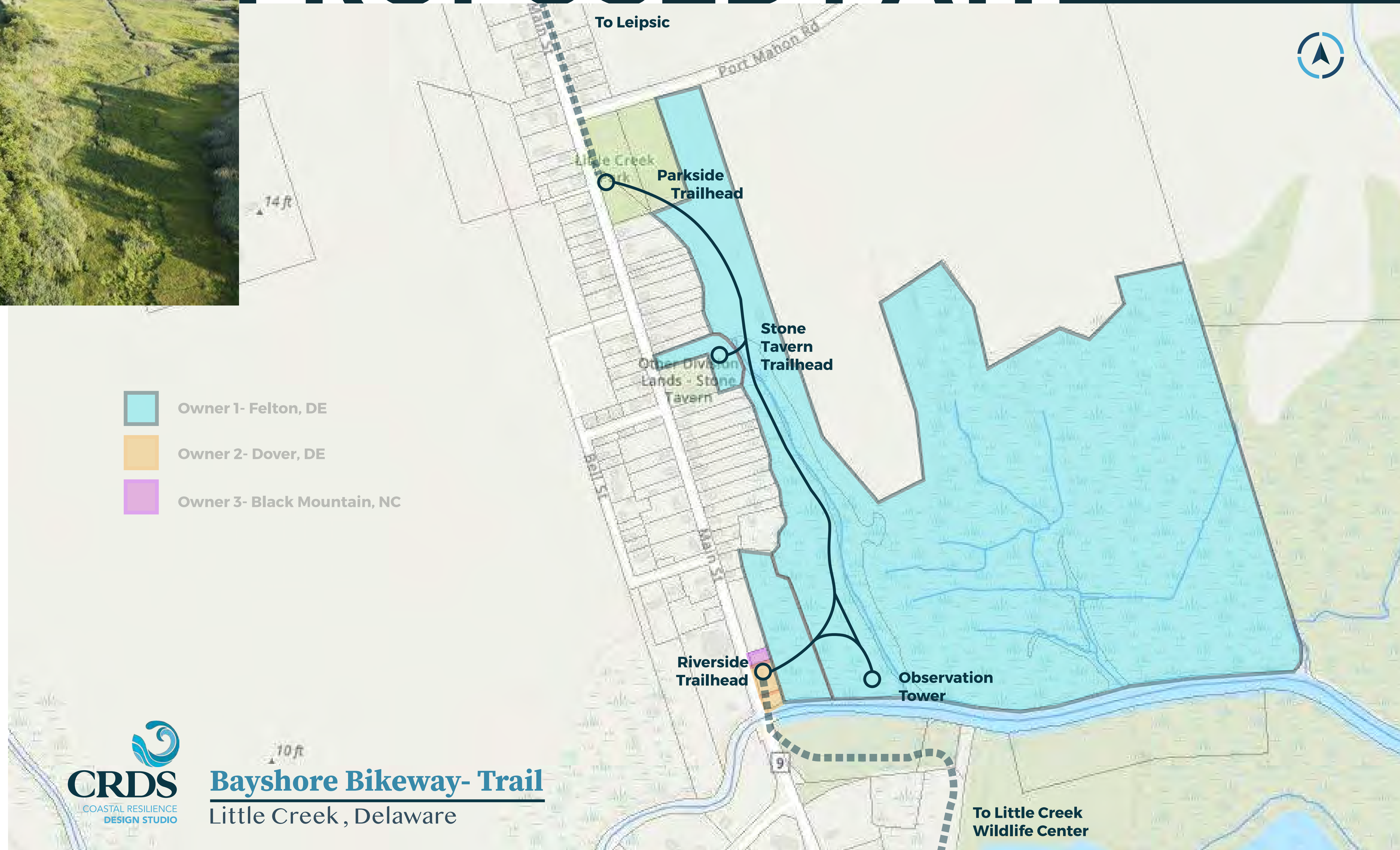
Port Mahon Lighthouse



An observation tower along the Little River, modeled after the historic Port Mahon Lighthouse is proposed as an additonal amenity along trail.

PROPOSED PATH

This aerial image shows an existing cut trail that runs along the edge of a tributary of the Little River.



TRAIL LOCATION

The proposed multi-use trail location is shown on the map along the western side of the Little River tributary.
It includes three strategically placed trail-heads and an observation tower modeled after the historic Port Mahon Lighthouse.

BEYOND BIKES

Low impact events can be a great way to build community and excitement behind the brand and subsequent projects.

BAYSHORE BYWAY Bloodthirsty 5k LITTLE CREEK, DE

Trailheads

Connectivity & Traffic Calming Context Map

LITTLE CREEK, DELAWARE

Three potential trailhead locations serve different needs for individual users, but all provide a safe and visible entry and exit to the proposed trail.

T1:RIVERSIDE

Located in the heart of the commercial district, this trailhead offers users the opportunity to explore and enjoy access to the the trail in the commercial district alonside dining, retail, kayak rentals, and weekly pop up markets. A crosswalk through the planted median on Main Street makes pedestrian access and safety a high priority and highlights a change of pace as drivers enter the town of Little Creek.

T2: STONE TAVERN

Located near the historic Stone Tavern building, accessed through an adjacent property, this trailhead serves as a midpoint entry or exit for users who do not wish, or are not able to use the full length of the trail. This could be a family with young children looking for a shorter adventure, or a local resident hopping off to go home. Because Main Street is almost entirely residential, there is not an opportunity to get off the trail at other times without encroaching on private property.

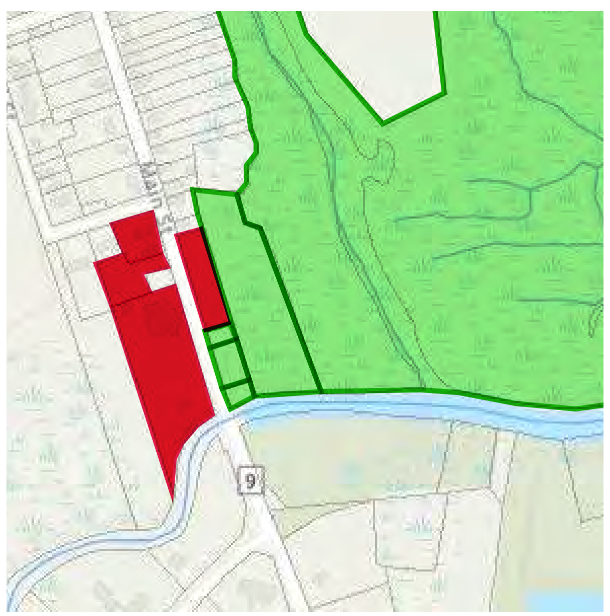
T3:PARKSIDE

Located in Little Creek Park, this trailhead location serves multiple functions. It is visible and welcoming to the residents of Little Creek as they use the current amenities nearby - the post office, dog park, playground, and other proposed park additons. This trailhead connects to the multi-use trail as it crosses over the proposed restored wetland. The restored wetland offers a vital stormwater service to the town. Adding a trailhead location here has the opportunity to elevate the infrastructure into a beautiful community park trail while also protecting it from damage and accidental mowing.

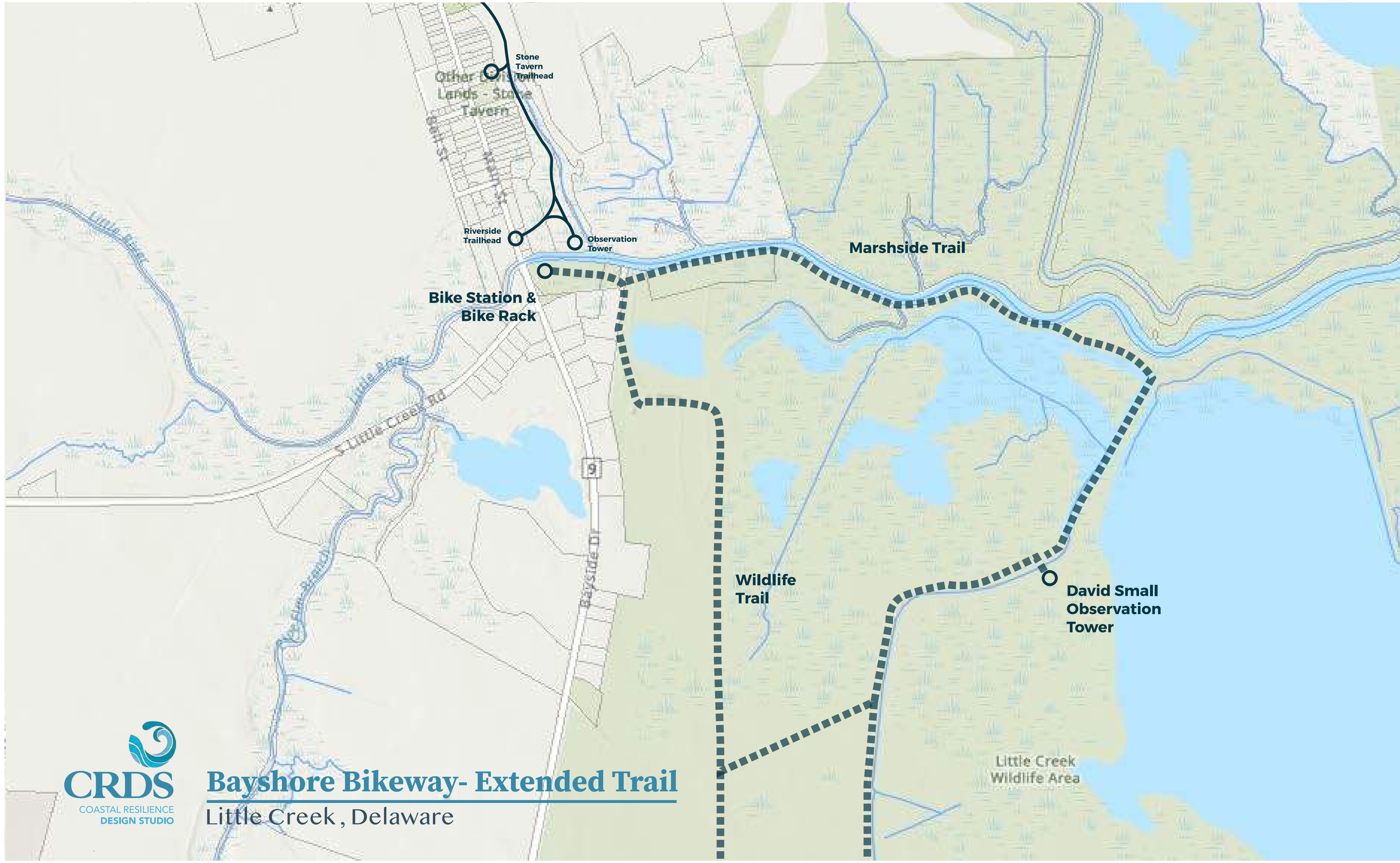
PROPOSED BIKEWAY EXTENSION

Currently, the Bayshore Byway is largely an automotive experience. CRDS is proposing phased goals aimed at connecting the bikeway south to the Little Creek Wildlife Center, and north to Leipsic, through a buffered shared path along Route 9, eventually converting to a marked sharrow lane. This would require extensive state agency coordination and cooperation to acheive an amenity of this size and scope in Kent County.

The Bikeway would offer all the Bayshore Byway communities an opportunity to offer unique biking & walking experiences in their community. The ultimate goal would be to continue the bikeway north, through all the Bayshore Byway towns, to Delaware City.



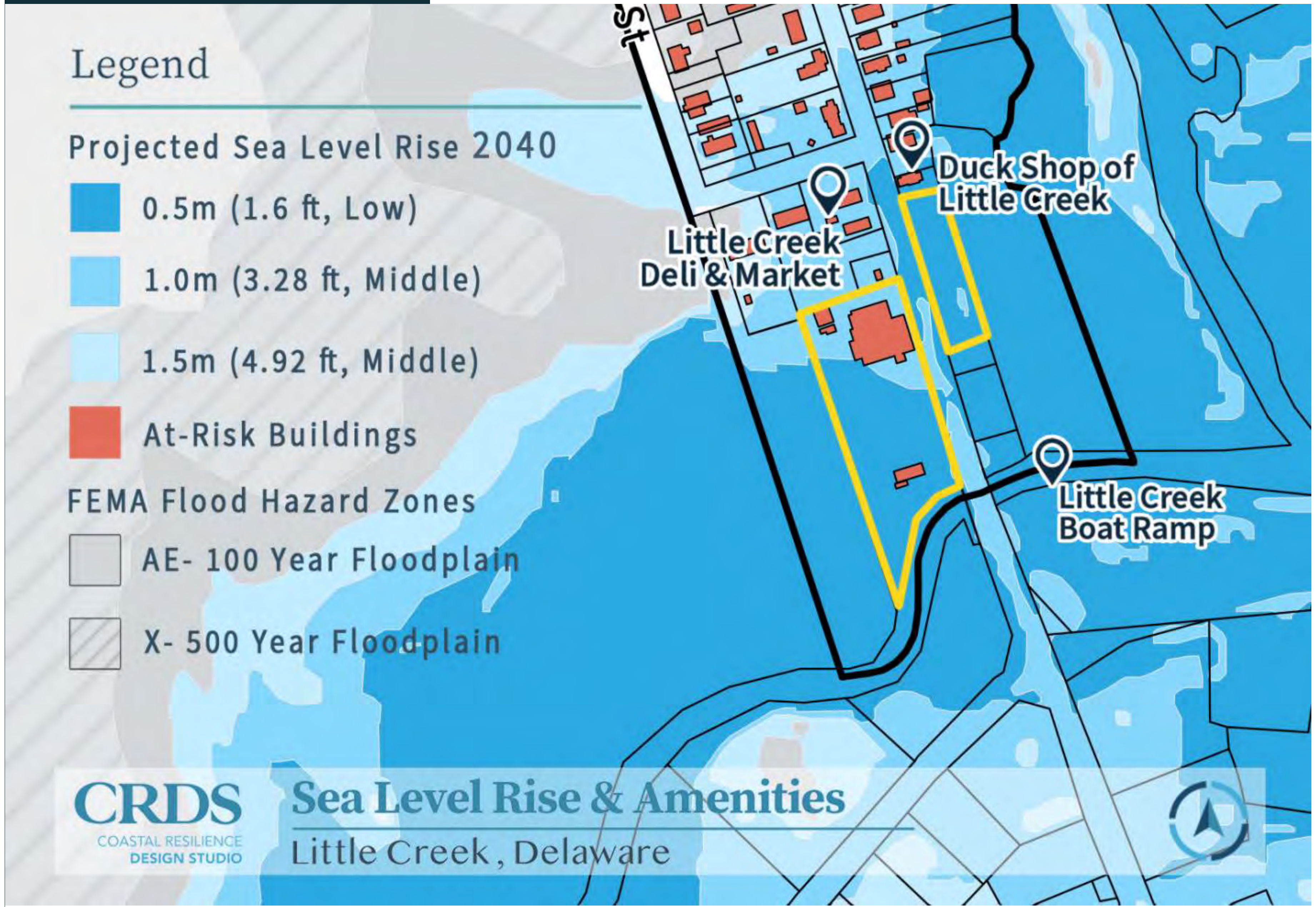
CRDS believes it is important to consider not only physical resiliency, as it relates to sea level rise and stormwater solutions, but also economic resiliency. Many of Delaware's small coastal towns were built on industries that no longer exist, or if they do, exist in dramatically smaller economic footprints. Large scale public sector investment in community amenities have the opportunity to generate the private investment that is needed.



Commercial Redevelopment

CRDS
COASTAL RESILIENCE
DESIGN STUDIO

COMMERCIAL PROPERTY UNDERSTANDING



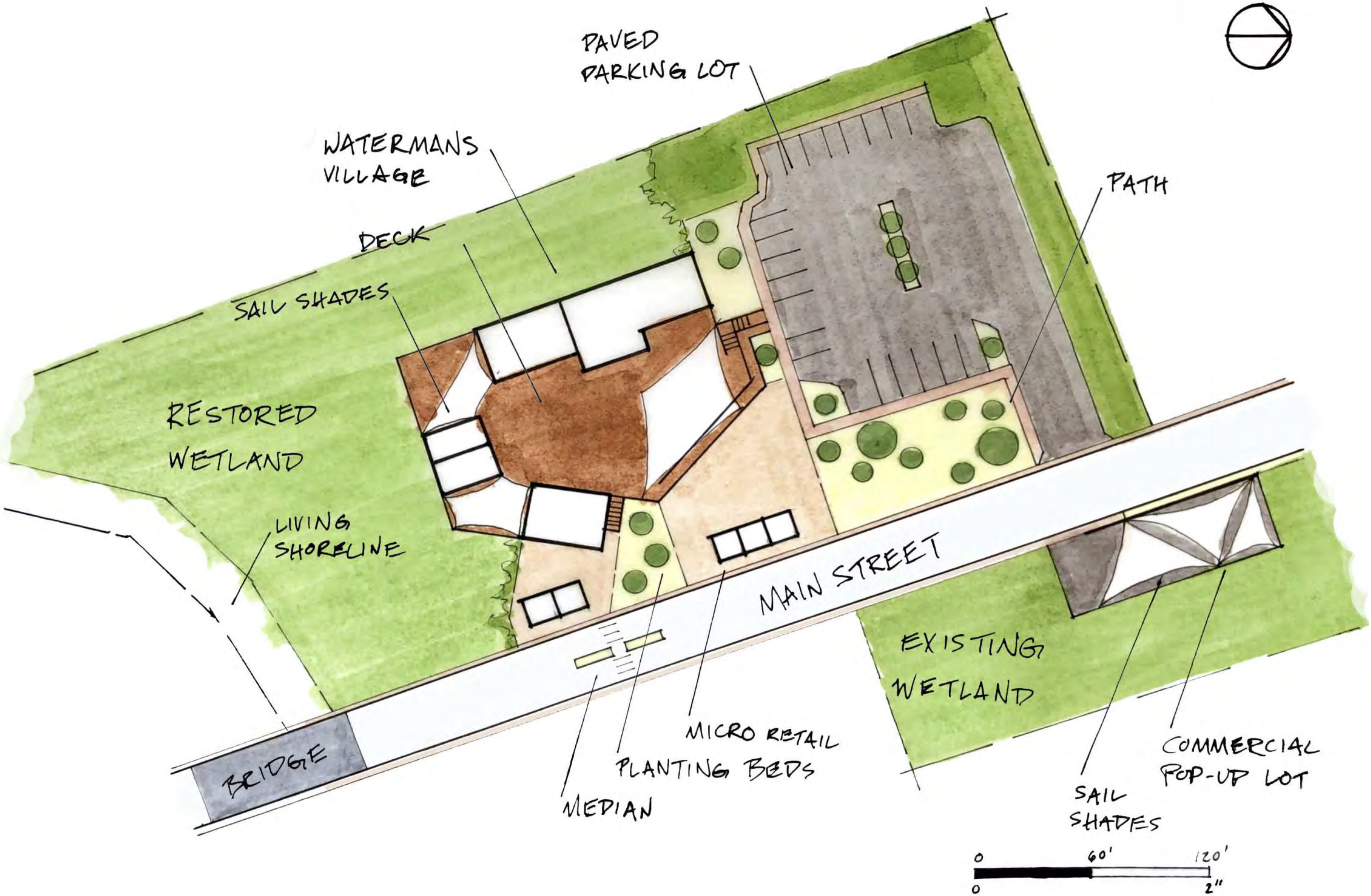
The existing Cavaliers property and adjacent Cavaliers Aux property are currently unused. These sites experience significant issues, like recurring flooding and setbacks. However, the size of the properties and proximity to the Little River offer an opportunity to establish a thriving commercial center for residents and visitors to enjoy in Little Creek.

The **Cavaliers property** contains two abandoned structures. Floodwaters from the Little River encroach on the southern end of the property, washing sediment and material onto the pavement. **Sea level rise** data predicts the majority of the property will be inundated during floods by 2040. As indicated in the existing conditions image, **62% of the property is un-developable** due to wetland and riparian buffers, as well as property setbacks. Invasive **Phragmites australis** borders the southwestern side of the parcel.

The **Cavaliers Aux property** is partially paved and located in designated wetlands. The **existing pavement is deteriorating** and overrun by vegetation in areas. **Permanent structures cannot be built** on this parcel due to Federal Emergency Management Agency wetland restrictions.

COMMERCIAL OBJECTIVES

- Incentivize private investment in Little Creek
- Create an inviting commercial district
- Establish a connection to the Little River
- Honor maritime history and small-town character
- Mitigate current and future flooding on site
- Increase wetland habitat
- Increase the riparian buffers
- Create elevated views of the Little River


PAVED
PARKING LOT
WATERMANS
VILLAGE
DECK
SAIL SHADES
PATH
RESTORED
WETLAND
LIVING
SHORELINE
MAIN STREET
EXISTING
WETLAND
BRIDGE
MICRO RETAIL
PLANTING BEDS
MEDIAN
COMMERCIAL
POP-UP LOT
SAIL
SHADES
0
60'
120'
0
2"

COMMERCIAL PROPERTY PLANS

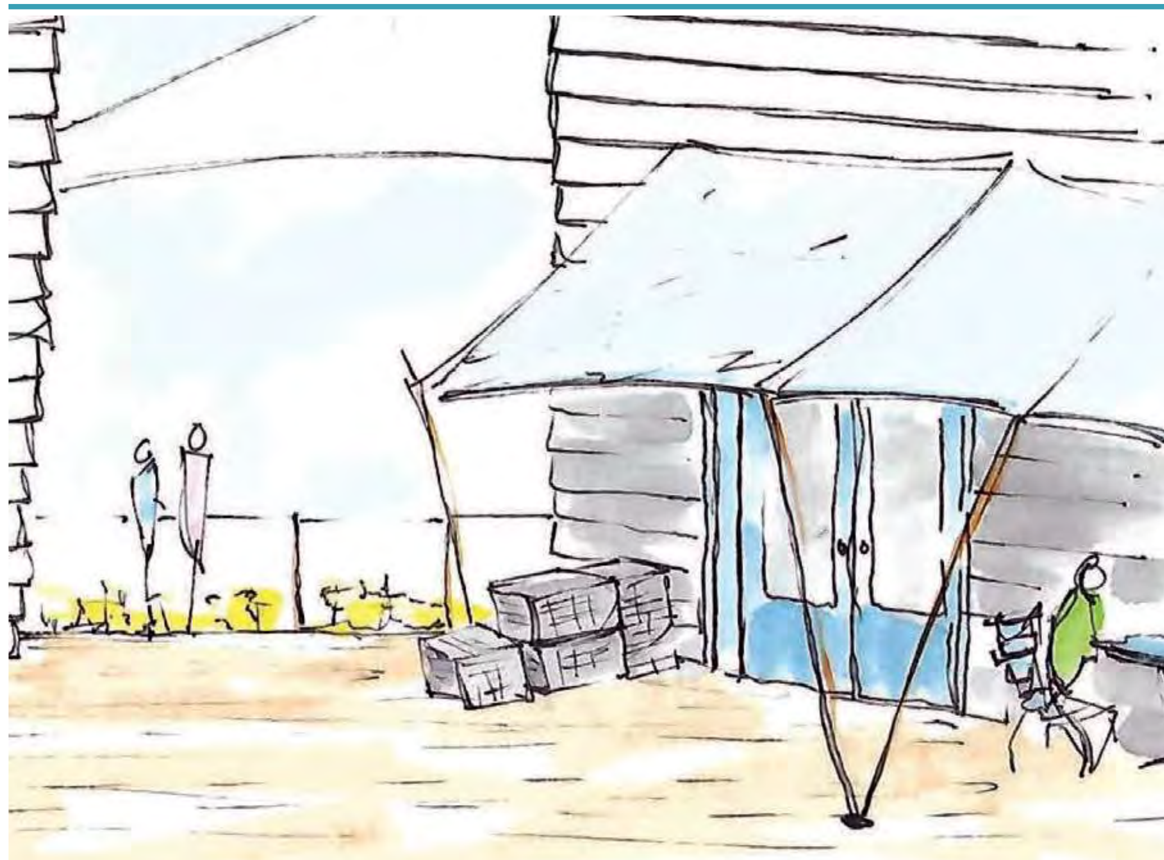
The commercial property plan transforms the Cavaliers parking lot with abandoned buildings into a modern, sustainable, and thriving center for commerce on the Little River. Residents can visit **Waterman's Village for shopping and outdoor dining** with picturesque views of the river and surrounding wetlands.

The **Pilings at Waterman's Village** (labeled as commercial pop-up lot) offers **quaint micro-retail spaces** for quick investment opportunities.

The plan also includes a **restored wetland** to offset recurring flooding and projected sea level rise. A **living shoreline** would expand habitat and improve the water quality of the Little River. In addition, **native planting beds** beautify the ground level around Waterman's Village and add to infiltration capability.

Tony's Seafood Restaurant, Marshall, CA

Structure exterior aesthetic precedent



WATERMANS VILLAGE

At Waterman's Village, five new commercial buildings encourage private investment and create an inviting shopping and dining experience. The structure is elevated on pilings to ensure its longevity in the face of flooding and sea level rise. Elevating Waterman's Village opens up sweeping views of the natural landscape and also harkens back to the local, maritime character of the Delaware Bayshore.

Waterman's Village is accessible for all, and includes shaded outdoor seating. There is ample parking to accomodate Little Creek residents and visitors along the Bayshore Byway. At ground level, five additional micro-retail spaces offer street side retail opportunities.

WATERMANS
=Village=

THE PILINGS AT WATERMAN'S VILLAGE

The Pilings at Waterman's Village is a flexible commercial design answer for FEMA restrictions. Due to the preserved wetland status on the Cavaliers Aux property, permanent structures are not permitted.
Micro-retail storefronts are impermanent structures that encourage quick investment due to their small size and scale. This solution would be perfect for small retail storefronts, a kayak rental, or a bait and tackle store. This design includes room for parking and maximizes the amount of wetland to absorb storm and flood waters.

Sail shades accompanied by market stalls could serve as an alternative or addition to micro-retail, as well. With this option, residents could enjoy farmer's markets, seafood markets, and beer gardens.

Example of micro-retail at Anchor Square in Pascagoula, Mississippi

The Pilings at Waterman's Village

MICRO-RETAIL

Small business incubators with little upfront investment

- Permitted in the floodplain
- Built on wheels
- Less than 200 sq ft
- Mobile in case of flooding
- Quaint and small town character

Above: Example of a pop-up market,
Below: Example of sail shades, by Superior Awnings

The Pilings existing parcel

The Pilings reimagined

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