PROJECT NARRATIVE AND DRAINAGE REPORT

ALLEN & MAJOR ASSOCIATES, INC.

The Residence at Thoreau
275 Forest Ridge Road
Concord, Massachusetts



APPLICANT:
Thoreau Residences, LLC
275 Forest Ridge Road
Concord, Massachusetts 01742

PREPARED BY:
Allen & Major Associates, Inc.
10 Main Street
Lakeville, Massachusetts 02347

Issued: December 20, 2023
Revised: February 28, 2025

allenmajor.com

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A&M PROJECT NO.:
1670-24



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The information presented herein this report has been a collaborative effort from the various members/personnel of the Project Team.	

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SECTION 1.0 PROJECT SUMMARY

1.1 INTRODUCTION

The applicant, Thoreau Residences, LLC, is submitting a comprehensive permit application in accordance with Massachusetts General Law chapter 40B, Sections 20-23 for construction of a multi-family residential development located off Forest Ridge Road in the Town of Concord, Massachusetts consisting of 237 residential units on approximately 13 acres as shown on the Site Development Drawings. The proposed project will include site clearing and necessary earthwork for the construction of two (2) multi-story structures (five story buildings), four (4) detached parking garages, exterior surface parking areas, amenities and all supporting site features and infrastructure required of the development. The two five-story residential buildings will include a mix of studio, 1-bed, 2-bed, and 3-bed units. Each building will be serviced with two elevators. Also included is a shared leasing office in one of the buildings, with an outdoor pool, dog park, fire pit, BBQ grills, and playground area. The project will be serviced by municipal water, a private on-site sewer collection and treatment system, and private underground utilities consisting of electrical service and tele-communication/cable services.

The purpose of this project narrative and drainage report is to provide a detailed review of the locus, potential project impacts, and stormwater as it pertains to the existing conditions and proposed development. The report will show by means of narrative, calculations, and exhibits that appropriate best management practices have been used to mitigate the impacts from the proposed development. The report will demonstrate that the proposed site development reduces the peak stormwater discharge rates at the three (3) existing design points. Further, the report will show that the proposed stormwater management system complies with the ten (10) stormwater standards as presented in the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Regulations and MA MS4 General Permit regulations.

1.2 SITE CATEGORIZATION FOR STORMWATER REGULATIONS

The proposed project is considered a new development under the MassDEP Stormwater Management Standards. The proposed development will provide a Stormwater Management System consisting of deep sump hooded catch basins, manholes, piping, grass swales, water quality structures, subsurface infiltration systems and an infiltration basin located on the easterly portion of the site. Stormwater will be directed to catch basins located throughout the site, piped through a water quality structure and into one of the proposed systems. The subsurface systems have been designed with outlet control structures to meet pre-development conditions and to recharge the required stormwater volume for the entire site.

SECTION 2.0
EXISTING CONDITIONS

2.1 SITE LOCATION AND ACCESS

The subject property (the "Property") is comprised of a large tract of land located at 275 Forest Ridge Road in the Town of Concord which is in the easterly portion of Massachusetts in the center of Middlesex County. Concord is part of the Greater Boston region. The adjacent towns are Carlise and Bedford to the north, Lincoln to the east, Sudbury to the south, and Acton to the west. Concord is approximately 13 miles south of Lowell, 19 miles west of Boston and 23 miles south of Nashua, New Hampshire. The Property has legal frontage on Forest Ridge Road, which runs north/south. The site is located approximately 2,100-ft southerly of Main Street (Route 62) which runs east/west and is a main roadway, refer to Figure 1, which shows the entire Property, outlined in yellow. The red line bifurcating the property represents the division of the lot for the proposed multi-family development that will be sought through the Approval Not Required (ANR) process by the Zoning Board of Appeals pursuant to the Comprehensive Permit Process.



Figure 1 – Locus Map (Bing Map)

The entire Property is approximately 33.05 acres in size. The northerly portion of the lot once divided will be approximately 13.09 acres and the remaining land at approximately 19.96 acres. The property is currently being utilized as a sports complex known as the Thoreau Club. The property contains various structures and parking areas, refer to Figure 2 below, which shows the entire property, outlined in red. The Property is currently located within the Limited Industrial Park 2 Districts (LIP#2) according to the most recent zoning map of the Town of Concord. Adjacent to the property, along the easterly property

line, is the Residence A Zoning District. The property is also located with the Groundwater Conservancy District.

2.2 EXISTING SITE CONDITIONS

The Property is comprised of one (1) lot totaling approximately 33.05 acres in size as affirmed by an on the ground property survey prepared by Allen & Major Associates, Inc. The current lots are identified on the Town of Concord's tax maps as Lot 2970-1-5 on Map B12 and B13. The multi-family development will be located on the northerly portion of the site and contain 13.09 acres subject to the aforementioned ANR. Figure 2 below shows the entire property outlined in yellow, with a red line representing the newly created lot.

The portion of the site for the multi-family development currently includes multiple smaller buildings and cabins, a pool area, and a private on-site wastewater treatment facility with a leaching field. The site is mostly wooded, with some grass cover and dirt paths. The site has sewer, water, electric, and drainage lines servicing the existing buildings.



Figure 2 - Locus Map (MassGIS 2021 Aerial)

Forest Ridge Road is a private dead-end street with a cul-de-sac turnaround. Forest Ridge Road is a two (2) lane road with one (1) lane in each direction. The road is paved, approximately 24 feet wide with varying curb types consisting of either granite curb or bituminous concrete berm on each side. The centerline of the road consists of a single

yellow line. A bituminous concrete sidewalk is located on the southerly side of Forest Ridge Road and is separated from the travel way by a grass strip. Forest Ridge Road forms a "T" intersection with Main Street (Route 62) and is controlled with a stop sign on Forest Ridge Road. Main Street is considered a major road with one (1) lane in each direction.

The site is located on the Maynard USGS Quadrangle map. The site topography is well sloped across the site. The site slopes in all directions towards several depressions located throughout the property. The high point is at elevation of 210± with a low point at elevation 163±. There are several natural drainage depression kettle holes located on the property and one constructed stormwater basin located near the pool.

2.3 WATERSHED

The property falls within the Concord Watershed with a drainage area of approximately 400 square miles. The Concord Watershed is part of a larger watershed identified as the Sudbury, Assabet and Concord (SuAsCo) Watershed. The Assabet and Sudbury Rivers start in Westborough and flow northerly until they merge at Egg Rock in Concord, MA flowing northerly to the Merrimack River in Lowell, MA and eventually into the ocean at Plum Island in Newburyport, MA.

2.4 EXISTING SOIL CONDITIONS

The underlying soils have been mapped by the U.S. Department of Agriculture, Natural Resource Conservation Service (NRCS) for Middlesex County, Massachusetts Southern Part and consist of the following:

- 253C – Hinckley loamy sand, 8% to 15 % slopes;
- 253D – Hinckley loamy sand, 15% to 25 % slopes;
  - Hinckley soil consists of gravelly loamy sands underlined by very gravelly sand. This soil is part of the HSG A, excessively drained, very low runoff with a depth to water table greater than 80 inches.
- 254A – Merrimac fine sandy loam, 0% to 3% slopes;
- 254B – Merrimac fine sandy loam, 3% to 8% slopes;
  - Merrimac soil consists of fine sandy loam underlined by gravelly loamy sand to very gravelly sand. This soil is part of the HSG A, excessively drained, very low runoff with a depth to water table greater than 80 inches.
- 255B – Windsor loamy sand, 3% to 8% slopes;
  - Windsor soil consists of loamy sand underlined by sand. This soil is part of the HSG A, excessively drained, very low runoff with a depth to water table greater than 80 inches.



Figure 3 – Soil's Map (USDA-NRCS)

The entire development is located with Hydrologic Soil Group (HSG A), which are somewhat excessively drained soils with a high infiltration rate and a high-water table greater than 80 inches below the surface.

Haley Aldrich is the geotechnical engineer of record for the project and has conducted approximately 18 test pits and 5 borings on the property to confirm the onsite soil conditions. The soil borings were drilled and sampled to depths ranging from 16-ft to 51-ft below the existing ground surface. Test pits were excavated to depths ranging from

5-ft to 11-ft below existing ground surface. Haley Aldrich has prepared a preliminary geotechnical report dated June 2024 for the proposed multi-family development.

2.5 FEMA FLOODPLAIN

The Flood Insurance Rate Map (FIRM) (Map Number 25017C0358F & 25017C0366F) for the Town of Concord dated July 7, 2014, indicates the entire property lies within FEMA Zone X, refer to Figure below. The FEMA Zone X which is defined as "*areas determined to be outside the 0.2% annual chance floodplain*". There are no development restrictions and performance standards associated with work within Zone X.

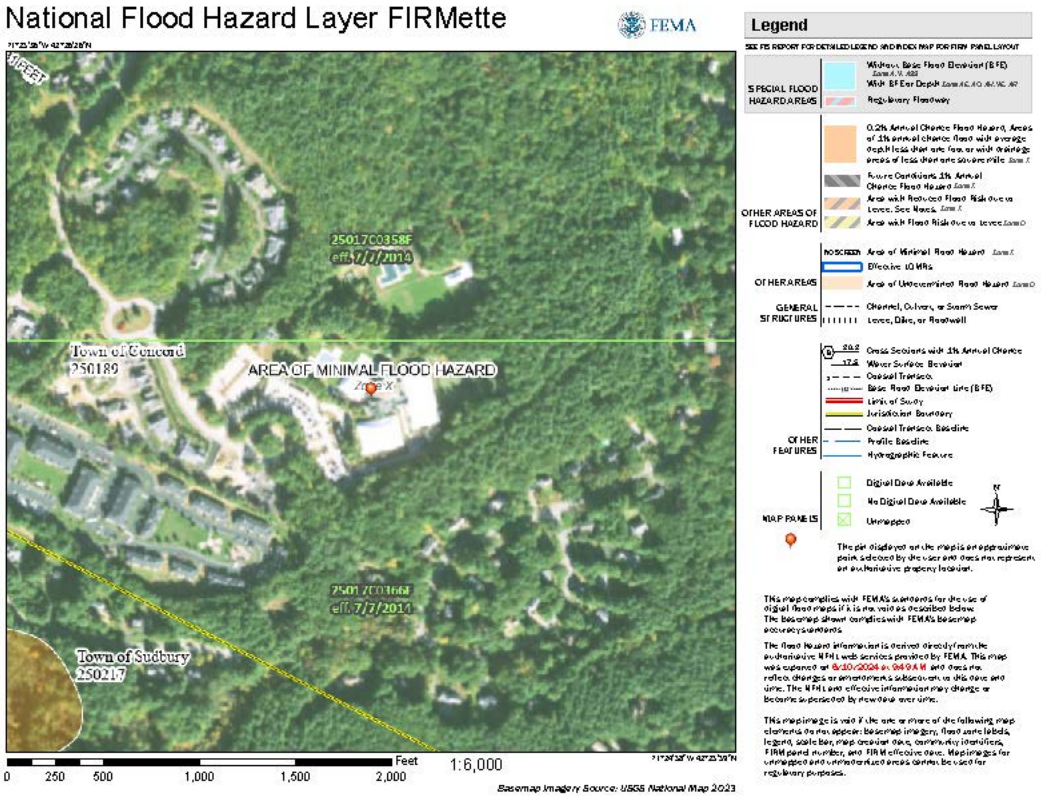


Figure 4 – FEMA FIRMette (Map 25017C0358F & 25017C0366F dated July 7, 2014)

2.6 ENVIRONMENTALLY SENSITIVE ZONES

The Commonwealth of Massachusetts asserts control over numerous protected and regulated areas including Areas of Critical Environmental Concern (ACEC); Outstanding Resource Waters (ORWs); areas protected under the Wetlands Protection Act and the Rivers Protection Act, as well as Natural Heritage & Endangered Species Program (NHESP) Priority and Protected Habitat for rare and endangered species.

According to the MassMapper website, via the interactive MassMapper, the site has the following environmental sensitive zones on the property.

- The easterly portion of the property is located within a Wellhead Protection Area Zone II Public Water Supply ID 3067000 associated with the Concord Water Department. A Zone II is defined as "*that area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated (180 days of pumping at safe yield, with no recharge from precipitation). It is bounded by the groundwater divides which result from pumping the well and by the contact of the aquifer with less permeable materials such as till or bedrock. In some cases, streams or lakes may act as recharge boundaries. In all cases, Zone IIs shall extend up gradient to its point of intersection with prevailing hydrogeologic boundaries (a groundwater flow divide, a contact with till or bedrock, or a recharge boundary)*".
- The site is not located within, or adjacent to, an ACEC, ORW, or estimated or priority habitat areas defined by NHESP.

2.7 EXISTING STORMWATER PATTERNS

In order to compare the difference between pre- and post-development peak flows and run-off volumes, existing and proposed watersheds were developed. The design points for existing watersheds were established as the outer limits of the property and/or the municipal drainage system to ensure proper analysis from pre- to post-development conditions. All flow paths represent the longest time of concentration for stormwater runoff. The site topography is well defined, and all runoff is directed towards the existing depressions, stormwater basin or off-site. A total of nine (9) watersheds have been defined for the site and are as follows:

- Watershed E-1 is located on the northerly side of the property and is 12,582 sf in size. Watershed E-1 consists of woodlands with good groundcover and some dirt roads/trails. Stormwater currently drains by overland flow offsite to the north into a natural depression located off-site.
- Watershed E-2 is also located at the northeast corner of the property and is 32,388 sf in size. Watershed E-2 consists of woodlands with good groundcover and a small cabin. Stormwater currently drains by overland flow offsite to the northeast into a natural depression located off-site.
- Watershed E-3 is located on the easterly side of the property and is 89,563 sf in size. Watershed E-3 consists of woodlands, with good groundcover, some small cabins and dirt roads/trails. Stormwater currently drains by overland flow offsite to the east into a natural depression located off-site.
- Watershed E-4 is also located on the easterly side of the property and is 39,239 sf in size. Watershed E-4 consists of woodlands, with good groundcover and dirt roads/trails. Stormwater currently drains by overland flow offsite to the east into a natural depression located off-site.

- Watershed E-5 is located on the southerly side of the property and is 198,882 sf in size. Watershed E-5 consists of woodlands and landscape areas, with good groundcover, dirt roads/trails, and impervious areas consisting of buildings and parking areas. Stormwater currently drains by overland flow offsite to the south.
- Watershed E-6 is located on the westerly side of the property and is 260,839 sf in size. Watershed E-6 consists of woodlands and landscape areas, with good groundcover, impervious areas consisting of buildings and parking areas and portions of Forest Ridge Road. Off-site drainage associated with the back of the townhouse units on Sweet Birch Lane drain onto Forest Ridge Road. Stormwater currently drains by overland flow to several catch basins and eventually drains into the existing stormwater basin at the northwest corner of the property.
- Watershed E-7 is located on the westerly side of the property and is 122,430 sf in size. Watershed E-7 consists of woodlands and landscape areas, with good groundcover and impervious areas consisting of buildings, parking areas. Off-site drainage associated with the back of the townhouse units on Black Birch Lane drain onto the lot. Stormwater currently drains by overland flow to several catch basins and eventually drains into the existing stormwater basin at the northwest corner of the property.
- Watershed E-8 is centrally located on the property and is 784,340 sf in size. Watershed E-8 consists of woodlands and landscape areas, with good groundcover and impervious areas consisting of several buildings, tennis courts, patios and pools. Off-site drainage associated with the back of the townhouse units on Black Birch Lane drain onto the lot. Stormwater currently drains by overland flow to several area drains and swales and eventually drains into the existing stormwater basin located near the northerly pool.
- Watershed E-9 is located on the northerly side of the property and is 110,647 sf in size. Watershed E-9 consists of woodlands with good groundcover, small cabin and some dirt roads/trails. Stormwater currently drains by overland flow to an existing natural depression.

See the rear of this report for a copy of the Existing Watershed Plan (EWS-1).

2.8 EXISTING SITE UTILITIES

The Site has access to several utilities which are located within Forest Ridge Road and within the site consisting of municipal water, drainage, gas and electrical services and a private on-site wastewater treatment facility. The existing sewer system consists of several six (6) inch mains connecting the various structures and flows via gravity to the on-site wastewater treatment facility centrally located on the property. The on-site wastewater treatment facility is located between the Drama Hut and the northerly pool. The system consists of several treatment tanks, two (2) Bioclere units, Dynasand Sand Filter, pump

chamber and a pressure distribution leaching field. The wastewater treatment facility was designed for 16,000 GPD and is subject to a Groundwater Discharge Permit #646-2 as issued by MassDEP.

The municipal water system consists of a twelve (12) inch water main on the easterly side of Forest Ridge Road. Several water service lines are located within the development providing services to various structures. Several fire hydrants are located within close proximity to the site and within the site. A&M coordinated with the water department and conducted a hydrant flow test on February 27, 2024. The static pressure was 60 psi with a residual pressure of 42 psi.

Underground electrical and telecommunication services are located on the westerly side of Forest Ridge Road and throughout the development providing service to the various structures. Concord Municipal Light Plant is a municipally owned, public power utility company offering electric and broadband internet services to the Town. Verizon, Comcast and Crown Castle supply the Town with communication/cable services via underground conduits.

National Grid Gas is the gas provider for the Town of Concord. An eight (8) inch intermediate pressure gas main is located on the westerly and easterly side of Forest Ridge Road. Additional gas service lines are located throughout the site providing gas to the various structures.

SECTION 3.0
PROPOSED CONDITIONS

3.1 PROPOSED OVERVIEW

The applicant, Thoreau Residences, LLC, is submitting a comprehensive permit application in accordance with Massachusetts General Laws chapter 40B, Sections 20-23 for construction of a multi-family residential development located off Forest Ridge Road in the Town of Concord, Massachusetts consisting of a total of 237 residential units on approximately 13.09 acres as shown on the Site Development Drawings. The proposed project will include site clearing and necessary earthwork for the construction of two (2) multi-story structures (five story buildings), four (4) detached parking garages, exterior surface parking areas, amenities and all supporting site features and infrastructure required of the development. The two five-story residential buildings will include a mix of studio, 1-bed, 2-bed, and 3-bed units. Each building will be serviced by elevators. Also included is a shared leasing office in one of the buildings, with an outdoor pool, dog park, fire pit, BBQ grills, and playground area. The project will be serviced by municipal water, a private on-site sewer, private underground utilities consisting of electrical service and tele-communication/cable services. The layout is shown below in Figure 5.



Figure 5 – MassGIS Aerial Map with Proposed Overlay

Building A is proposed to include 120 units with a footprint area of 29,716 square feet and will also provide a common area amenity space and leasing office. Building B is proposed to include 117 units with a footprint area of 28,306 s.f. The site layout has been designed to allow for full vehicular and pedestrian circulation around the entire project. This allows for shared use of all parking facilities for residents of the project as well as full circulation for emergency apparatus vehicles. The outer perimeter of the project is the surface and detached garages designed to transition into the multi-family project. 340 standard exterior parking spaces dimensioned at 9 feet by 18 feet are provided, 12 of which will be compliant with the Americans with Disabilities Act (ADA) and the Massachusetts Architectural Access Board (MAAB) and distributed across the site including at amenity areas. 40 detached garage spaces are provided within the four (4) perimeter garages around the site. The total parking count for the site is 380 spaces for a parking ratio of 1.60 spaces per unit. The project also has allocated 29 future/reserve parking spaces in the northeast corner near the wastewater treatment facility, which would bring the total parking space to 409 for a parking ratio of 1.72 spaces per unit. The project will provide designated spaces for Electric Car Charging. As Concord is a stretch code adopted community, ECV spaces shall be provided at initial occupancy with accommodations for scalability.

The clubhouse/amenity area will be located within Building A opposite the main entrance into the site. The exterior amenity area/pool is proposed and situated on the northerly side of Building A. A central courtyard will be provided on the westerly side of Building B. Sidewalks are provided throughout allowing for connectivity to the main activity center of the project. Numerous seating areas and gathering spaces shall be provided. The Site Development Drawings provide a general schematic of anticipated amenity areas but are subject to final design. Amenities that are equally beneficial to the residents but those that are louder by function are located outside the courtyard. These include a dog park area and general open lawn recreational areas. Trash and recycling will be handled internally to each building and a private hauling company will take care of disposing of the trash in accordance with local, state and federal regulations. Connectivity to parking fields and across roadways are marked with pedestrian crosswalks in conformance with the Manual on Uniform Traffic Control Devices (MUTCD). Direction signage will be included for internal navigation of the site.

All points of the site are accessibly compliant with ramps and crosswalk designations throughout. This includes a sidewalk extension to Forest Ridge Road. A 5-foot-wide sidewalk is proposed along the northerly side of the main site driveway. The applicant will work with the Concord school system on providing school bus accommodations for any school aged children, however, it is anticipated that the bus service provider may not enter the private property and require stopping on Forest Ridge Road.

The central driveway is designed to be an attractive and welcoming experience for residents. The driveway provides for 2–12-foot lanes (ingress and egress) and an 8-foot wide center median which will be fully landscaped.

The proposed project is serviced by a single access point. Single entry points are subject to review by the Concord Fire Department to ensure access is maintained under emergency conditions. To accommodate this, a divided boulevard road is proposed that should an emergency situation occur, and a portion of the driveway is unavailable, the remaining lane would be accessible for responding vehicles or emergency egress from the site. The applicant will work with the Concord Fire Department on the site planning details as permitting commences through the Zoning Board of Appeals.

The entirety of the project will be illuminated with a multi-tiered lighting program that provides minimum foot candles through the drive aisle and courtyard for vehicular and pedestrian movements. All fixtures shall be LED and dark sky compliant with necessary shielding for full light cut off where appropriate.

Snow management areas have been provided around the perimeter of the surface parking and designated within islands. In the event the site ever reaches snow storage capacity, snow shall only be removed from the site in accordance with the MassDEP snow removal policies and only be transported to designated locations. It is anticipated the applicant will be required to remove snow from the site during heavier events or back-to-back snow events.

The site is designed to meet or exceed emergency response requirements in accordance with the National Fire Protection Association Fire Code ("NFPA 1") and 527 CMR 18 ("the Massachusetts Amendments"). All internal driveways meet the corner radii, width, and grade requirements as specified. Emergency apparatus access to the fronts of each building is provided to allow for access to emergency alarm panels and storz connections. Additional information on internal life safety measures shall be provided as part of building permit drawings. Where direct access to portions of the site from a staged a response vehicle is not provided, all points of each building are located within a distance of 250 feet to a potential staged emergency response vehicle in accordance with the codes for sprinklered buildings. All residential buildings shall be provided with a fire sprinkler system. Fire service hydrants are located around the site at intervals no greater than 500 feet. As noted with the site driveway, the applicant continues to work with the Concord Fire Department on specific Department needs.

Other site improvements include landscape areas, underground utilities, municipal water, private wastewater treatment facility and a new stormwater management systems. The proposed stormwater management plan calls for the use of appropriate best

management practices, including grass swales, deep sump hooded catch basins, several water quality structures, an infiltration basin and a subsurface infiltration system. The subsurface infiltration systems will consist of Stormtech SC-740 Chambers with an Isolator Row. The system has been designed with infiltration and an outlet control structure. The outlet control structures have been designed to match pre-development conditions for peak discharge rates and runoff volumes. The combination of these BMP's will remove greater than 80% of Total Suspended Solids from anticipated stormwater runoff.

3.2 PROPOSED STORMWATER PATTERNS

The drainage patterns under proposed conditions will maintain the same design points and designations under existing conditions with a sub-watershed breakdown including a total of fourteen (14) drainage areas. Some of the existing watershed areas have been modified due to grading of the proposed development. The study concluded that the proposed rates of runoff at the design points are less than the existing conditions analysis. The breakdown is as follows:

- Watershed P-1 is the remnants of Watershed E-1 as modified by the proposed grading for the development and is approximately 8,787 sf in size. Watershed P-1 consists of woodlands and landscape areas with good groundcover. Stormwater will continue to drain by overland flow offsite to the north into a natural depression located off-site.
- Watershed P-2A is the remnants of Watershed E-2 as modified by the proposed grading for the development and is approximately 14,405 sf in size. Watershed P-2A consists of woodlands and landscape areas with good groundcover. Stormwater will continue to drain by overland flow to the northeast into a natural depression located off-site.
- Watershed P-2B is the remnants of Watershed E-2 as modified by the proposed grading for the development and is approximately 13,129 sf in size. Watershed P-2B consists of woodlands and landscape areas with good groundcover. Stormwater will continue to drain by overland flow to the northeast into a natural depression located off-site.
- Watershed P-3 is the remnants of Watershed E-3 as modified by the proposed grading for the development and is approximately 22,271 sf in size. Watershed P-3 consists of woodlands and grass/landscape area with good groundcover. Stormwater will continue to drain by overland flow offsite to the east into a natural depression located off-site.
- Watershed P-4 is the same as Watershed E-4. No change under proposed conditions. Watershed was included to provide a true comparison with pre-development conditions.

- Watershed P-5 is the same as Watershed E-5. No change under proposed conditions. Watershed was included to provide a true comparison with pre-development conditions.
- Watershed P-6 is the remnants of Watershed E-6 as modified by the proposed grading for the development and is approximately 241,179 sf in size. Watershed P-6 consists of woodlands and landscape areas, with good groundcover, impervious areas consisting of buildings and parking areas and portions of Forest Ridge Road. Stormwater will continue to drain by overland flow to several catch basins and eventually drains into the existing stormwater basin at the northwest corner of the property.
- Watershed P-7 is the remnants of Watershed E-7 as modified by the proposed grading for the development and is approximately 132,158 sf in size. Watershed P-7 consists of woodlands and landscape areas, with good groundcover and impervious areas consisting of the revised parking lot and a portion of the newly created access driveway. Stormwater will continue to drain by overland flow to several catch basins and eventually drains into the existing stormwater basin at the northwest corner of the property. Stormwater associated with the new driveway will be routed through a water quality structure prior to discharging into the existing stormwater basin.
- Watershed P-8A is the remnants of Watershed E-8 as modified by the proposed grading for the development and is approximately 64,700 sf in size. Watershed P-8A consists of woodlands and grass/landscape area with good groundcover. Stormwater will drain by overland into a newly created depression located on-site along the edge of the new access driveway. Stormwater will be collected within the depression and piped into a sub-surface infiltration system via two flared ends.
- Watershed P-8B is the remnants of Watershed E-8 as modified by the proposed grading for the development and is approximately 379,332 sf in size. Watershed P-8B consists of woodlands and grass/landscape area with good groundcover, impervious surface associated with the existing buildings, tennis courts, patios and pools. Stormwater will continue to drain by overland flow to several area drains and swales and eventually into the newly created infiltration basin located near the new property line separating the multi-family development from the current club.
- Watershed P-9 is the remnants of Watershed E-9 as modified by the proposed grading for the development and is approximately 61,741 sf in size. Watershed P-9 consists of woodlands and grass/landscape area with good groundcover. Stormwater will continue to drain by overland into a natural depression located on-site.
- Watershed P-10 is associated with the proposed development and is 475,346 sf in size. Watershed P-10 consists of woodlands and grass/landscape area with good groundcover and impervious surfaces (parking lot, drive aisles, and sidewalks).

Stormwater will be directed to a series of deep sump and hooded catch basins, piped through a water quality structure and into a sub-surface infiltration system. Sub-surface infiltration system will also be interconnected with an infiltration basin via a 24-inch equalizer pipe

See the rear of this report for a copy of the Proposed Watershed Plan (PWS-1).

Design Point #1 – Off-Site N'ly Property Line

Table 3.2.A – Design Point 1 Existing vs Proposed peak rate of runoff to Off-site N'ly Property Line

Design Storm	Existing (cfs)	Proposed (cfs)	Difference (cfs)
2-year	0.00	0.00	0.00 (0.0%)
10-year	0.00	0.00	0.00 (0.0%)
25-year	0.01	0.01	0.00 (0.0%)
100-year	0.24	0.10	-0.14 (58.3%)

Table 3.2.B – Design Point 1 Existing vs Proposed runoff volume to Off-site N'ly Property Line

Design Storm	Existing (ac-ft)	Proposed (ac-ft)	Difference (ac-ft)
2-year	0.000	0.000	0.000 (0.0%)
10-year	0.001	0.000	-0.001 (100.0%)
25-year	0.009	0.003	-0.006 (66.7%)
100-year	0.052	0.024	-0.028 (53.8%)

Design Point #2 – Off-Site E'ly Property Line

Table 3.2.C – Design Point 2 Existing vs Proposed peak rate of runoff to Off-site E'ly Property Line

Design Storm	Existing (cfs)	Proposed (cfs)	Difference (cfs)
2-year	0.00	0.00	0.00 (0.0%)
10-year	0.00	0.00	0.00 (0.0%)
25-year	0.03	0.01	-0.02 (66.7%)
100-year	0.49	0.17	-0.32 (65.3%)

Table 3.2.D – Design Point 2 Existing vs Proposed runoff volume to Off-site E'ly Property Line

Design Storm	Existing (ac-ft)	Proposed (ac-ft)	Difference (ac-ft)
2-year	0.000	0.000	0.000 (0.0%)
10-year	0.001	0.000	-0.001 (100.0%)
25-year	0.018	0.006	-0.012 (66.7%)
100-year	0.106	0.038	-0.068 (64.1%)

Design Point #3 – Existing Depression 1 (No Change)

Table 3.2.E – Design Point 3 Existing vs Proposed peak rate of runoff to Existing Depression 1

Design Storm	Existing (cfs)	Proposed (cfs)	Difference (cfs)
2-year	0.00	0.00	0.0 (0.0%)
10-year	0.00	0.00	0.0 (0.0%)
25-year	0.01	0.01	0.0 (0.0%)
100-year	0.20	0.20	0.0 (0.0%)

Table 3.2.F – Design Point 3 Existing vs Proposed runoff volume to Existing Depression 1

Design Storm	Existing (ac-ft)	Proposed (ac-ft)	Difference (ac-ft)
2-year	0.000	0.000	0.000 (0.0%)
10-year	0.000	0.000	0.000 (0.0%)
25-year	0.008	0.008	0.000 (0.0%)
100-year	0.046	0.046	0.000 (0.0%)

Design Point #4 – Off-Site S'ly Property Line (No Change)

Table 3.2.G – Design Point 4 Existing vs Proposed peak rate of runoff to Off-Site S'ly Property Line

Design Storm	Existing (cfs)	Proposed (cfs)	Difference (cfs)
2-year	0.07	0.07	0.0 (0.0%)
10-year	1.18	1.18	0.0 (0.0%)
25-year	2.97	2.97	0.0 (0.0%)
100-year	8.07	8.07	0.0 (0.0%)

Table 3.2.H – Design Point 4 Existing vs Proposed runoff volume to Off-Site S'ly Property Line

Design Storm	Existing (ac-ft)	Proposed (ac-ft)	Difference (ac-ft)
2-year	0.041	0.041	0.000 (0.0%)
10-year	0.207	0.207	0.000 (0.0%)
25-year	0.398	0.398	0.000 (0.0%)
100-year	0.903	0.903	0.000 (0.0%)

Design Point #5 – Existing Drainage Basin/Easement

Table 3.2.I – Design Point 5 Existing vs Proposed peak rate of runoff to Existing Drainage Basin/Easement

Design Storm	Existing (cfs)	Proposed (cfs)	Difference (cfs)
2-year	4.55	4.55	0.00 (0.0%)
10-year	10.63	10.21	-0.42 (3.9%)
25-year	16.66	15.16	-1.50 (9.0%)
100-year	30.53	27.70	-2.83 (9.3%)

Table 3.2.J – Design Point 5 Existing vs Proposed runoff volume to Existing Drainage Basin/Easement

Design Storm	Existing (ac-ft)	Proposed (ac-ft)	Difference (ac-ft)
2-year	0.464	0.449	-0.015 (3.2%)
10-year	1.059	0.979	-0.080 (7.6%)
25-year	1.614	1.479	-0.135 (8.4%)
100-year	2.896	2.645	-0.251 (8.7%)

Design Point #6 – Infiltration Basin Club

Table 3.2.K – Design Point 6 Existing vs Proposed peak rate of runoff to Infiltration Basin Club

Design Storm	Existing (cfs)	Proposed (cfs)	Difference (cfs)
2-year	0.07	0.02	-0.05 (71.4%)
10-year	1.76	0.70	-1.06 (60.2%)
25-year	5.90	2.58	-3.32 (56.3%)
100-year	20.36	9.58	-10.78 (52.9%)

Table 3.2.L – Design Point 6 Existing vs Proposed runoff volume to Infiltration Basin Club

Design Storm	Existing (ac-ft)	Proposed (ac-ft)	Difference (ac-ft)
2-year	0.050	0.017	-0.033 (66.0%)
10-year	0.493	0.211	-0.282 (57.2%)
25-year	1.085	0.481	-0.604 (55.6%)
100-year	2.765	1.262	-1.503 (54.3%)

Design Point #7 – Existing Depression 2

Table 3.2.M – Design Point 7 Existing vs Proposed peak rate of runoff to Existing Depression 2

Design Storm	Existing (cfs)	Proposed (cfs)	Difference (cfs)
2-year	0.00	0.00	0.0 (0.0%)
10-year	0.03	0.00	-0.03 (100.0%)
25-year	0.16	0.03	-0.13 (81.2%)
100-year	1.31	0.38	-0.93 (70.9%)

Table 3.2.N – Design Point 7 Existing vs Proposed runoff volume to Existing Depression 2

Design Storm	Existing (ac-ft)	Proposed (ac-ft)	Difference (ac-ft)
2-year	0.000	0.000	0.000 (0.0%)
10-year	0.017	0.002	-0.015 (88.2%)
25-year	0.062	0.016	-0.046 (74.2%)
100-year	0.223	0.083	-0.140 (62.8%)

3.3 DRAINAGE ANALYSIS METHODOLOGY

The peak rate of runoff was determined using techniques and data found in the following:

1. Urban Hydrology for Small Watersheds – Technical Release 55 by the United States Department of Agriculture Soils Conservation Service, June 1986. Runoff curve numbers and 24-hour precipitation values were obtained from this reference.

2. HydroCAD© Stormwater Modeling System by HydroCAD Software Solutions LLC, version 10.20-5c. The HydroCAD program was used to generate the runoff hydrographs for the watershed areas, to determine discharge/stage/storage characteristics for the infiltration systems, to perform drainage routing and to combine the results of the runoff hydrographs.

3. Soil Survey of Middlesex County, Massachusetts by United States Department of Agriculture, National Resource Conservation Service. Soil types and boundaries were obtained from this reference.

4. Rainfall Data for each of the storm events was based on data published by

Northeast Regional Climate Center Atlas of Precipitation Extremes for the Northeastern United States and Southeastern Canada (Cornell Atlas) for Concord, MA. The precipitation values are shown in the following table:

Table 3.3.1 – Rainfall (Cornell Atlas)

2-year	10-year	25-year	100-year
3.10 inches	4.62 inches	5.80 inches	8.20 inches

3.4 CLOSED DRAINAGE SYSTEM COMPUTATIONAL METHODS

The closed drainage system calculations determine the rate of runoff, the time of concentration and the rainfall intensity for the drainage basin. The calculations have been performed for the 100-year storm event. The following standards will be used:

1. The Rational Formula (Q =CIA) was used to determine the flow to each structure.
   Q = Flow cubic feet per second (CFS)
   C = Runoff coefficients
   I = Rainfall Intensity (inches per hour)
   A = Drainage Area (acres)

2. The runoff coefficients used are as follows:
   Impervious (pavement and roofs) = 0.9
   Grassed = 0.30
   Bare Ground and gravel = 0.50
   Landscape = 0.3
   Wooded = 0.2

3. The intensity for each area was determined by the Steel Formula for a 100-year frequency storm. The Steel Formula is:
   I = k/(t+b)
   I = Intensity
   k = 290 (100 yr)
   t = Time of Concentration
   b = 31 (100 yr)

4. The times of concentration were calculated using a nomograph provided in "Design, Volume 1," by Seelye, 1960. A minimum time of concentration of six (6) minutes was utilized.

5. The Manning's formula was utilized to calculate the capacity of the individual pipes in the closed drainage system. The Manning's formula is:

$Q = (Ap)\ (1.486/n)\ (s^{1/2})\ (h^{2/3})$
Q = Flow in CFS
Ap = Cross-sectional area of the pipe (square feet)
n = Roughness coefficient
s = slope of the pipe (ft/ft)
h = hydraulic radius

The closed drainage system shall be designed to handle the design flow as calculated, as well as maintaining a design velocity of between 2.0 feet per second (fps) (cleansing velocity at pipe half full conditions) and 12.0 fps.

3.5 EROSION AND SEDIMENT CONTROL

The site will be enclosed with a straw wattle and/or fiber roll barrier to prevent incidental conveyance of sediment from disturbed areas off-site or into the existing drainage system during construction. All existing drainage inlets within the public right of way adjacent to the site that are to remain shall have silt sacks installed prior to any construction activities. Stabilized construction entrances shall be installed as part of the construction and will be maintained until the site has been stabilized. The erosion control measures will remain in place until all construction activities are complete, and all disturbed areas have been stabilized. The primary construction access will be through the main site driveway as proposed.

Given the site's unique topography, it is anticipated that slope stabilization fabrics and mid-slope erosion barriers will be necessary to minimize erosion potential during construction. The contractor will be required to inspect all controls regularly to ensure that they are working properly and to see if they need to be cleaned and/or replaced on an as-needed basis. The proposed project will disturb more than one (1) acre of land and potentially discharge into a municipal system, therefore the project will require the filing of a National Pollutant Discharge Elimination System (NPDES) Stormwater Construction General Permit. A stormwater Pollution Prevention Plan (SWPPP) will be prepared prior to any construction activity. The SWPPP will prescribe in detail the performance standards the contractor will be required to implement, as needed, during construction. The SWPPP will be maintained at the construction trailer on-site throughout the duration of construction. The SWPPP shall outline acceptable temporary stabilization measures to prevent incidental transport of sediment to off-site areas.

Slopes shown on the Site Development Drawings may include the applicant of slope stabilization adhesives, rip-rap, or other anchored in place fabric applications. The recommended solution will be implemented and identified on the final plans.

3.6 SITE UTILITIES

Private On-Site Wastewater Treatment Facility

The project site is located in an area that is not serviced by a municipal sewer system, therefore the proposed development will rely on a new subsurface disposal system (SSDS) which will consist of an effluent pump chamber, pump station, and an underground leaching field located onsite. A wastewater control house is provided that will allow for the routine monitoring of the system, the influent and effluent, and the chemical injection systems for biological treatment. The system will need to be designed and permitted in accordance with MassDEP Guidelines for the Design, Construction, Operation and Maintenance of Small Treatment Facilities with Land Disposal revised July 2018. The system will be designed by Fuss & O'Neill and approved through a MassDEP Groundwater Discharge Permit subsequent to a hydrogeological evaluation approval process.

The proposed residential development is anticipated to have 97 one-bedroom units, 116 two-bedroom units, and 24 three-bedroom units; totaling 401 bedrooms. The amenity space/office is approximately 9,647 sf. The proposed sewer flows are estimated to be 44,834 gallons per day based on 314 CMR 7.00 and 310 CMR 15.00. The sewage flows were calculated as follows:

Calculated Sewage Flows per The State Environmental Code, Title V (Proposed Development)

Type of Establishment	Min. Flow	Size	Calculated Flow	Design Flow
Residential	110 gpd/bedroom	401 bedrooms	44,110 gpd	44,110 gpd
Office (Clubhouse)	75 gpd/1000 sf min of 200 gpd	9,647 sf	723.5 gpd	724 gpd
Total Flow				**44,834 gpd**

The site plans currently show the approximate location of the new wastewater treatment building, tank locations and approximate leaching fields. Final layouts are subject to actual design plans prepared by Fuss & O'Neill and MassDEP approval. Final sewer service building discharge locations will be determined in conjunction with the plumbing engineers during design development. The plans currently depict an approximate location for the discharge point. The proposed 8-inch sewer main within the development will flow via gravity down to the treatment building along the easterly portion of the site.

Water

The project site is located in an area that is serviced by the Town of Concord's water system which is locally owned and operated. The proposed development is proposing to connect to the existing 12" water main located on the easterly side of Forest Ridge

Road. The proposed project water consumption is calculated at 49,317 gpd based on average sewage flow noted above plus 10%. Final fire and water services size and locations will need to be determined in conjunction with the plumbing engineers during design development. The project would also include irrigation through the municipal water system if allowed by the Town of Concord.

The site shall be serviced by a 8" Class 52 ductile iron pipe valved connection into the existing main within Forest Ridge Road. The 8" water service main shall traverse the southerly side of the main access driveway. The 8" main will be internally looped around the proposed buildings. Each building shall be provided with a domestic tap and fire service tap off the distribution main. The domestic services shall be sized upon review by the plumbing engineers and the fire services shall be sized upon review by the fire protection engineers. All construction of the water works shall be in accordance with the Water Department specifications. Where the water services terminate, a hydrant will be located for flushing purposes and to avoid stagnation.

Other Utilities

Electric

Concord Municipal Light Plant is a municipally owned, public power utility company offering electric and broadband internet services to the Town. The site plans are currently showing the connection to an existing electric manhole within Forest Ridge Road. The primary duct bank will be routed through the site to several transformers proposed adjacent to each building. Secondary duct banks will be coordinated from the transformer into the electric room. The final size of duct bank and number of conduits will be determined by the electrical engineer. Coordination with Concord Municipal Light Plant will determine the final layout of service transformers, switchgear, and other gear necessary for construction and operation in accordance with their specifications. The project is being reviewed for the opportunity to be all electric as preferred by current Stretch Code standards.

Gas

National Grid Gas is the gas provider for the Town of Concord. An eight (8) inch intermediate pressure gas main is located on the westerly and easterly side of Forest Ridge Road. Additional gas service lines are located throughout the site providing gas to the various structures. The project does not anticipate the use of gas, but the applicant reserves its right to potentially providing limited gas services for the grills and fireplaces within the amenity areas. The final size of the gas service will be determined by the plumbing engineer and coordinated with National Grid Gas.

Telecommunications

Verizon, Comcast and Crown Castle supply the Town with communication/cable lines that can be either overhead cables or underground conduits with a local preference for underground conduit routing. Concord Municipal Light Plant has broadband service in the vicinity of the site. The applicant shall provide service options through one of the providers depending on availability.

Security

The applicant shall provide onsite security through a private provider. This may include alarms, alarm monitoring, and closed-circuit security cameras. This will be determined at a future time.

3.7 TRANSPORTATION

A Traffic Impact Assessment has been prepared by MDM Transportation Consultants, Inc dated October 2024 to assess traffic and transportation issues associated with the project as amended to reflect the current unit mix. This is provided under separate cover.

SECTION 4.0
STORMWATER MANAGEMENT

4.1 MASSDEP STORMWATER PERFORMANCE STANDARDS

The MassDEP Stormwater Management Policy was developed to improve water quality by implementing performance standards for storm water management. The following section outlines how the proposed Stormwater Management System meets the standards set forth by the Policy.

BMP's implemented in the design include –

- Deep Sump and Hooded Catch Basins
- Drainage Manholes
- Grass Swale
- Water Quality Structures/Hydrodynamic separators
- Subsurface Infiltration Systems (Stormtech SC-740 Chambers)
- Stormtech Isolator Row
- Infiltration Basin
- Specific maintenance schedule

Stormwater Best Management Practices have been incorporated into the design of the project to mitigate the anticipated pollutant loading. An Operations and Maintenance Plan has been developed for the project, which addresses the long-term maintenance requirements of the proposed system.

Temporary erosion and sedimentation controls will be incorporated into the construction phase of the project. These temporary controls may include straw wattles and/or silt fence barriers, inlet sediment traps, slope stabilization, and stabilized construction entrances.

The Massachusetts Department of Environmental Protection has established ten (10) Stormwater Management Standards. A project that meets or exceeds the standards is presumed to satisfy the regulatory requirements regarding stormwater management. The proposed development is considered a redevelopment under the MassDEP Stormwater Management Standards.

The Standards are enumerated below as well as descriptions and supporting calculations as to how the Project will comply with the Standards:

Standard 1

No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

The proposed development will not introduce any new stormwater conveyances (e.g. outfalls) that discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth. The proposed stormwater management system will consist of deep sump and hooded catch basins, several water quality structures, and subsurface infiltration systems. All discharges from impervious surfaces within the development (parking and drive aisles) will be treated prior to discharging into the subsurface

infiltration systems and infiltrating into the surround soils. Energy dissipater pads are provided at the end of each flared end section.

Standard 2

Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.

The proposed development has been designed so that the post-development peak discharge rates do not exceed the pre-development condition. Calculations have been provided to show that the proposed development will not cause an increase in peak discharge rates. Refer to the HydroCAD calculations provided within Appendix A of this report for detailed breakdowns.

Standard 3

Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

The existing annual recharge for the site will be exceeded in the developed condition. Subsurface infiltration chambers will be designed to meet this requirement. All Infiltration Systems were designed using the "Static" Method per the MassDEP Stormwater Management Standards, Volume 3, Chapter 1.

The USDA Soil Survey of Middlesex County was used to determine soil types on site.

The required recharge rates for each soil classification are as follows:

Table 4.1 – Recharge Volume per Hydrologic Soil Group (HSG)

	HSG A	HSG B	HSG C	HSG D
Required Recharge	0.60 inches	0.35 inches	0.25 inches	0.10 inches

Table 4.2 – Proposed Impervious Surface

Site	Total Area	HSG A	HSG B	HSG C	HSG D
Building Roof	76,512 sf	76,512 sf	0 sf	0 sf	0 sf
Pavement/sidewalk	173,773 sf	173,773 sf-	0 sf	0 sf	0 sf
Total Impervious Area	250,285 sf	250,285 sf-	0 sf	0 sf	0 sf

Under proposed conditions, the multi-family project will have a total of 250,285 sf of new impervious surface area. All runoff that flows from roadways and parking areas will be collected by the proposed closed drainage system and directed into the subsurface infiltration systems located throughout the development. Roof runoff will be collected via a separate drainage system and directed into the subsurface infiltration system. The required recharge volume is given by the following equation:

R_v = F x IA (Equation 1 Stormwater Handbook Volume 3)

where R_v = Required Recharge Volume, ft^3
F = Target Depth factor
IA = Impervious drainage area
R_v = F x IA
= (0.60 inches)(1 foot/12 inches)(250,285 sf)
=12,514 cubic feet

The cumulative volume within the subsurface system and infiltration basin is approximately 70,927cubic feet at elevation 175.50 which exceeds the required volume of 12,514 cubic feet.

MA MS4 General Permit requires the project to retain and infiltrate the volume of 1 inch for new development and/or remove 90% of the average annual post-construction impervious area on the site and 60% of the average annual load of Total Phosphorous (TP) generated from the post-construction impervious area on the site.

The calculated recharge is V= (1")(1'/12")(250,285 sf) = 20,857 cf.

The cumulative volume within the subsurface system and infiltration basin is approximately 70,927cubic feet at elevation 175.50 which exceeds the required volume of 20,587 cubic feet.

The basin drawdown time is defined as:

$Time_{drawdown} = R_v / (K)$(bottom area)

where R_v = Required Recharge Volume, cf
K = Saturated Hydraulic Conductivity (Rawls Table)
Bottom area = Bottom area of recharge structure

Table 4.3 – Drawdown Calculation

System	R_v	K	Bottom Area	$Time_{drawdown}$
Sub-Surface Sys	70,927 cf	8.27 in/hr	28,976 sf	3.6 hrs
Note: Volume for drawdown is based on the volume from HydroCAD at elevation 75.5.				

Standard 4

Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This standard is met when:

- *Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;*
- *Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and*
- *Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*

The proposed stormwater management systems are designed so that the 80% TSS removal standard will be met for each drainage area. Standard #4 is met when structural stormwater best management practices are sized to capture and treat the required water quality volume and pretreatment is provided in accordance with the Massachusetts Stormwater Handbook. Standard #4 also requires that suitable source control measures are identified in the Long Term Pollution Prevention Plan. The 80% TSS removal standard will be met using some combination of the following: street sweeping, deep sump hooded catch basins, water quality structure and a subsurface infiltration consisting of Stormtech chambers.

The water quality volume for the site development will be captured and treated using a proprietary separator. All systems will be sized to meet the water quality flow rate for the 1" storm event, due to the presence of rapid infiltration soils.

TSS Removal Credits for Street Sweeping (Massachusetts Stormwater Handbook Volume 2 Chapter 1)

TSS Removal Rate	High Efficiency Vacuum Sweeper – Frequency of Sweeping	Regenerative Air Sweeper – Frequency of Sweeping	Mechanical Sweeper (Rotary Broom)
5%	Quarterly Average, with sweeping scheduled primarily in spring and fall.	Quarterly Average, with sweeping scheduled primarily in spring and fall.	Monthly Average, with sweeping scheduled primarily in spring and fall.

TSS Removal Calculation Worksheet – Sub-Surface Infiltration System Prior to Infiltration				
A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load	Amount Removed (B*C)	Remaining Load (C-D)
Deep Sump Hooded Catch Basin	25%	1.00	0.25	0.75
Proprietary Separator	50%*	0.75	0.375	0.375
			Total TSS Removal prior to infiltration	**62.5% (44% Required)**

*Proprietary TSS removal rates have been capped at 50% though manufacturer studies report more effectiveness.

TSS Removal Calculation Worksheet – Sub-Surface Infiltration Systems				
A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load	Amount Removed (B*C)	Remaining Load (C-D)
Deep Sump Hooded Catch Basin	25%	1.00	0.25	0.75
Proprietary Separator	50%*	0.75	0.375	0.375
Sub-Surface infiltration with Isolator Row	80%	0.375	0.30	0.075
			Total TSS Removal	**92.5%**

*Proprietary TSS removal rates have been capped at 50% though manufacturer studies report more effectiveness.

TSS Removal Calculation Worksheet – Driveway to Ex. Infiltration Basin				
A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load	Amount Removed (B*C)	Remaining Load (C-D)
Deep Sump Hooded Catch Basin	25%	1.00	0.25	0.75
Ex. Infiltration Basin with Proprietary Separator	80%	0.75	0.60	0.15
			Total TSS Removal	**85.0%**

Standard 5

For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

The proposed development is considered a source of higher potential pollutant loads because the proposed parking area is considered a high-intensity parking area (over 1,000 vehicle trips per day). Pre-treatment and source reduction are provided to the maximum extent practicable. The drainage system will be designed to treat 1" water quality volume and provide a minimum 44% TSS removal prior to discharge to an infiltration device. The SMS will be designed with deep-sump hooded catch basins and water quality structures to provide the 44% TSS removal prior to recharge.

Standard 6

Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural

stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.

The project development is located within a Wellhead Protection Area Zone II which is associated with the Public Water Supply Well D 3067000 associated with the Concord Water Department. The drainage system will be designed to treat 1" water quality volume and provide a minimum 44% TSS removal prior to discharge to an infiltration device. The SMS will be designed with deep-sump hooded catch basins and hydrodynamic separators to provide the 44% TSS removal prior to recharge.

Standard 7

A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

This project multi-family development has been classified as a new development, therefore not applicable.

Standard 8

A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

A plan to control construction-related impacts, including erosion, sedimentation and other pollutant sources during construction and land disturbance activities will be developed. The proponent will prepare and submit a Stormwater Pollution Prevention Plan (SWPPP) prior to commencement of construction activities.

Standard 9

A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.

A Long-Term Operation & Maintenance (O&M) Plan has been developed for the proposed stormwater management system and is included within this document. See Appendix C of this report.

Standard 10

All illicit discharges to the stormwater management system are prohibited.

There are no expected illicit discharges to the stormwater management system. The applicant will submit the Illicit Discharge Compliance Statement prior to the discharge of stormwater runoff to the post-construction stormwater best management practices.

See the next page for the MassDEP Stormwater Checklist.

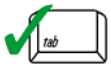
MassDEP Stormwater Checklist

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.





A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

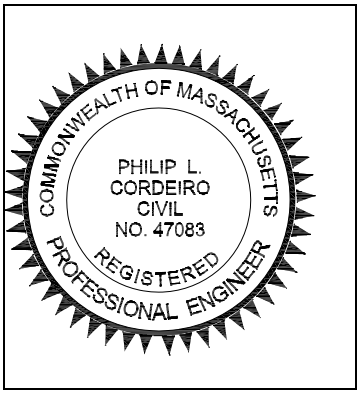
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



Digitally signed by Philip Cordeiro
Date: 2025.03.05 10:47:25-05'00'

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

☒ No disturbance to any Wetland Resource Areas

☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)

☐ Reduced Impervious Area (Redevelopment Only)

☐ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

- ☐ Credit 1
- ☐ Credit 2
- ☐ Credit 3

☐ Use of "country drainage" versus curb and gutter conveyance and pipe

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☒ Grass Channel

☐ Green Roof

☐ Other (describe): _____

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth

☐ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☒ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☒ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☒ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☒ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☒ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☒ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☒ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☒ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☒ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☒ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☒ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

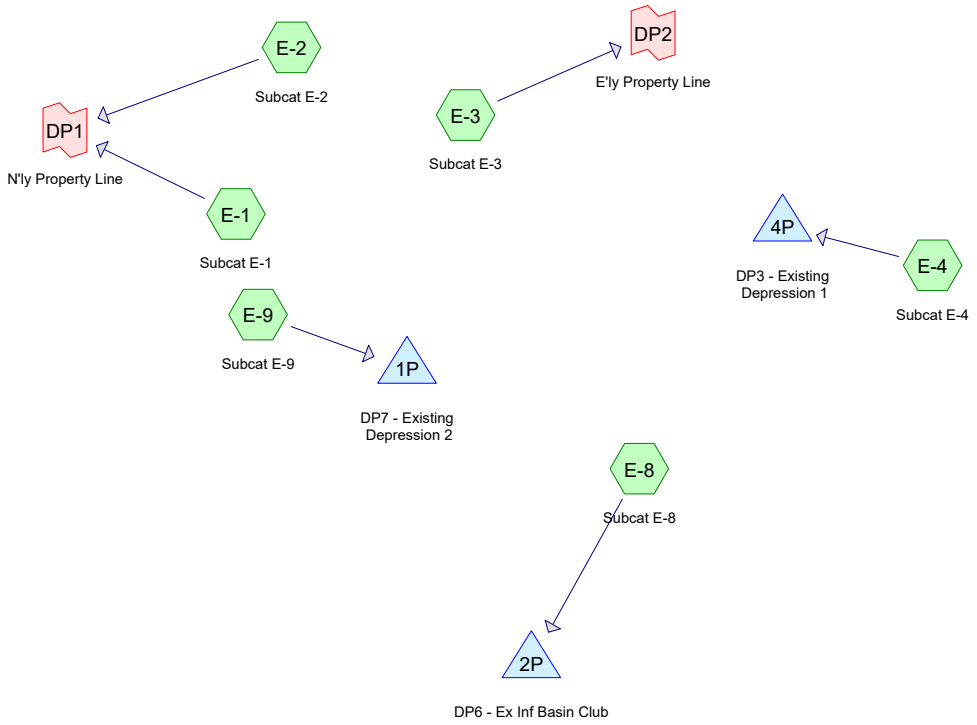
☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

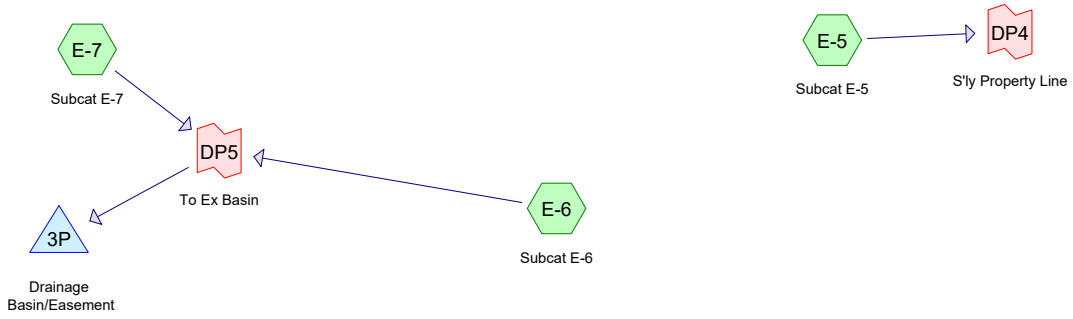
☐ An Illicit Discharge Compliance Statement is attached;

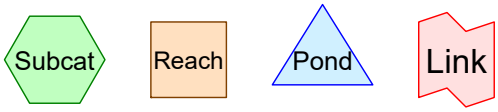
☒ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

APPENDIX A
HydroCAD

PRE-DEVELOPMENT







Routing Diagram for 1670-24 Existing Hydrocad
Prepared by Allen & Major Associates, Inc, Printed 2/28/2025
HydroCAD® 10.20-6a s/n 02881 © 2024 HydroCAD Software Solutions LLC

Project Notes

Rainfall events imported from "NRCS-Rain.txt" for 4067 MA Concord Middlesex County Central
Rainfall events imported from "Atlas-14-Rain.txt" for 444 MA Middlesex Central
Rainfall events imported from "NRCS-Rain.txt" for 4067 MA Concord Middlesex County Central

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC	P2 (inches)
1	2-Year	Type III 24-hr		Default	24.00	1	3.10	2	3.10
2	10-Year	Type III 24-hr		Default	24.00	1	4.62	2	3.10
3	25-Year	Type III 24-hr		Default	24.00	1	5.80	2	3.10
4	100-Year	Type III 24-hr		Default	24.00	1	8.20	2	3.10

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
4.681	54	1/2 acre lots, 25% imp, HSG A (E-6, E-7, E-8, E-9)
6.919	39	>75% Grass cover, Good, HSG A (E-5, E-6, E-7, E-8, E-9)
1.124	72	Dirt roads, HSG A (E-1, E-3, E-4, E-5, E-6, E-7, E-8, E-9)
3.485	98	Paved parking, HSG A (E-5, E-6, E-7)
2.128	98	Roofs, HSG A (E-2, E-3, E-5, E-7, E-8, E-9)
2.196	98	Unconnected pavement, HSG A (E-5, E-6, E-7, E-8)
17.367	30	Woods, Good, HSG A (E-1, E-2, E-3, E-4, E-5, E-6, E-7, E-8, E-9)
37.900	**50**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
37.900	HSG A	E-1, E-2, E-3, E-4, E-5, E-6, E-7, E-8, E-9
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
37.900		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
4.681	0.000	0.000	0.000	0.000	4.681	1/2 acre lots, 25% imp	E-6, E-7, E-8, E-9
6.919	0.000	0.000	0.000	0.000	6.919	>75% Grass cover, Good	E-5, E-6, E-7, E-8, E-9
1.124	0.000	0.000	0.000	0.000	1.124	Dirt roads	E-1, E-3, E-4, E-5, E-6, E-7, E-8, E-9
3.485	0.000	0.000	0.000	0.000	3.485	Paved parking	E-5, E-6, E-7
2.128	0.000	0.000	0.000	0.000	2.128	Roofs	E-2, E-3, E-5, E-7, E-8, E-9
2.196	0.000	0.000	0.000	0.000	2.196	Unconnected pavement	E-5, E-6, E-7, E-8
17.367	0.000	0.000	0.000	0.000	17.367	Woods, Good	E-1, E-2, E-3, E-4, E-5, E-6, E-7, E-8, E-9
37.900	**0.000**	**0.000**	**0.000**	**0.000**	**37.900**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	E-6	0.00	0.00	60.0	0.0600	0.013	0.0	15.0	0.0	

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Subcat E-1 Runoff Area=12,581 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=188' Tc=8.8 min CN=36 Runoff=0.00 cfs 0.000 af

Subcatchment E-2: Subcat E-2 Runoff Area=32,388 sf 0.29% Impervious Runoff Depth=0.00"
Flow Length=230' Tc=7.5 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment E-3: Subcat E-3 Runoff Area=89,563 sf 1.52% Impervious Runoff Depth=0.00"
Flow Length=341' Tc=10.6 min CN=32 Runoff=0.00 cfs 0.000 af

Subcatchment E-4: Subcat E-4 Runoff Area=39,239 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=214' Tc=15.8 min CN=32 Runoff=0.00 cfs 0.000 af

Subcatchment E-5: Subcat E-5 Runoff Area=198,881 sf 26.41% Impervious Runoff Depth=0.11"
Flow Length=270' Tc=18.4 min UI Adjusted CN=50 Runoff=0.07 cfs 0.041 af

Subcatchment E-6: Subcat E-6 Runoff Area=260,840 sf 59.51% Impervious Runoff Depth=0.92"
Flow Length=314' Tc=14.4 min CN=73 Runoff=4.55 cfs 0.459 af

Subcatchment E-7: Subcat E-7 Runoff Area=122,430 sf 13.61% Impervious Runoff Depth=0.02"
Flow Length=248' Tc=8.0 min CN=44 Runoff=0.01 cfs 0.005 af

Subcatchment E-8: Subcat E-8 Runoff Area=784,340 sf 20.31% Impervious Runoff Depth=0.03"
Flow Length=879' Tc=24.7 min UI Adjusted CN=45 Runoff=0.07 cfs 0.050 af

Subcatchment E-9: Subcat E-9 Runoff Area=110,648 sf 5.39% Impervious Runoff Depth=0.00"
Flow Length=443' Tc=20.3 min CN=37 Runoff=0.00 cfs 0.000 af

Pond 1P: DP7 - Existing Depression 2 Peak Elev=163.00' Storage=0 cf Inflow=0.00 cfs 0.000 af
Discarded=0.00 cfs 0.000 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

Pond 2P: DP6 - Ex Inf Basin Club Peak Elev=159.17' Storage=177 cf Inflow=0.07 cfs 0.050 af
Discarded=0.06 cfs 0.050 af Primary=0.00 cfs 0.000 af Outflow=0.06 cfs 0.050 af

Pond 3P: Drainage Basin/Easement Peak Elev=176.89' Storage=10,478 cf Inflow=4.55 cfs 0.464 af
Discarded=0.34 cfs 0.464 af Primary=0.00 cfs 0.000 af Outflow=0.34 cfs 0.464 af

Pond 4P: DP3 - Existing Depression 1 Peak Elev=193.00' Storage=0 cf Inflow=0.00 cfs 0.000 af
Discarded=0.00 cfs 0.000 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

Link DP1: N'ly Property Line Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link DP2: E'ly Property Line Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link DP4: S'ly Property Line Inflow=0.07 cfs 0.041 af
Primary=0.07 cfs 0.041 af

Link DP5: To Ex Basin

Inflow=4.55 cfs 0.464 af
Primary=4.55 cfs 0.464 af

Total Runoff Area = 37.900 ac Runoff Volume = 0.556 af Average Runoff Depth = 0.18"
76.31% Pervious = 28.920 ac 23.69% Impervious = 8.979 ac

Summary for Subcatchment E-1: Subcat E-1

[45] Hint: Runoff=Zero

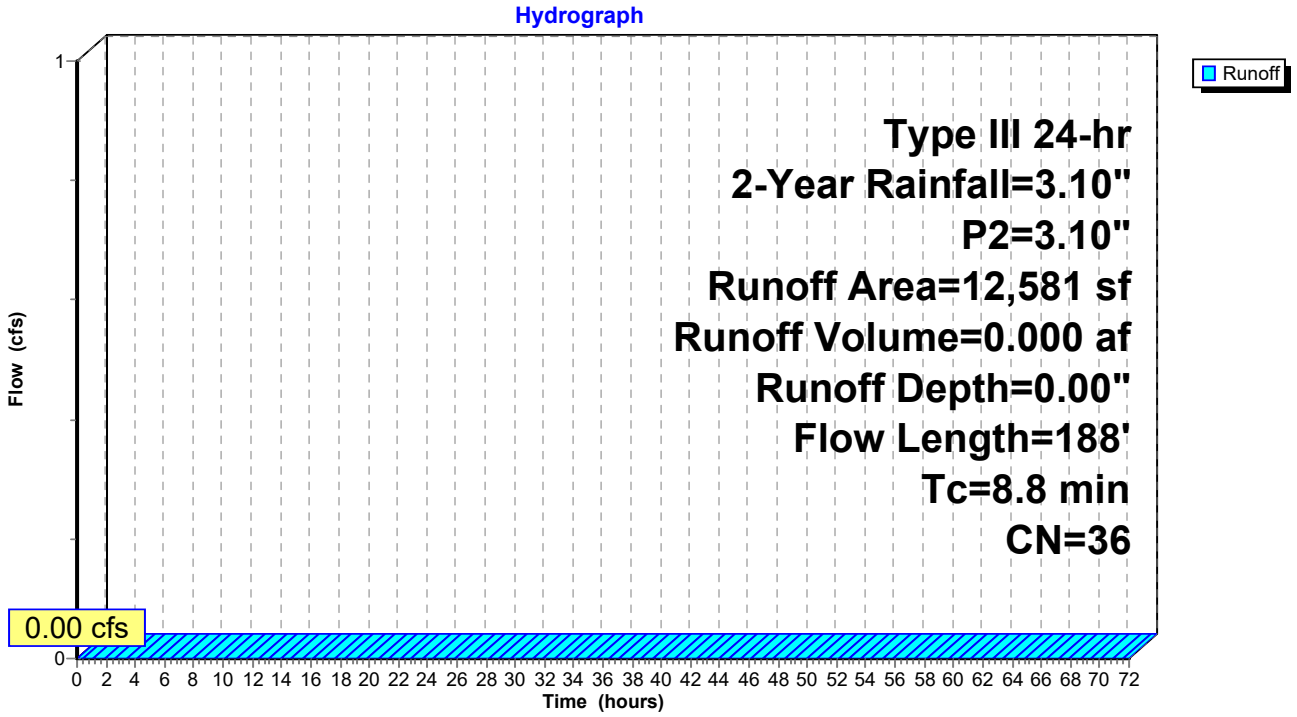
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link DP1 : N'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10", P2=3.10"

Area (sf)	CN	Description
10,635	30	Woods, Good, HSG A
1,947	72	Dirt roads, HSG A
12,581	36	Weighted Average
12,581		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	50	0.0900	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.7	55	0.2540	1.26		**Shallow Concentrated Flow, B-C** Forest w/Heavy Litter Kv= 2.5 fps
0.1	15	0.0660	2.57		**Shallow Concentrated Flow, C-D** Nearly Bare & Untilled Kv= 10.0 fps
0.3	18	0.1380	0.93		**Shallow Concentrated Flow, D-E** Forest w/Heavy Litter Kv= 2.5 fps
0.1	14	0.0570	2.39		**Shallow Concentrated Flow, E-F** Nearly Bare & Untilled Kv= 10.0 fps
0.7	36	0.1250	0.88		**Shallow Concentrated Flow, F-G** Forest w/Heavy Litter Kv= 2.5 fps
8.8	188	Total			

Subcatchment E-1: Subcat E-1



Summary for Subcatchment E-2: Subcat E-2

[45] Hint: Runoff=Zero

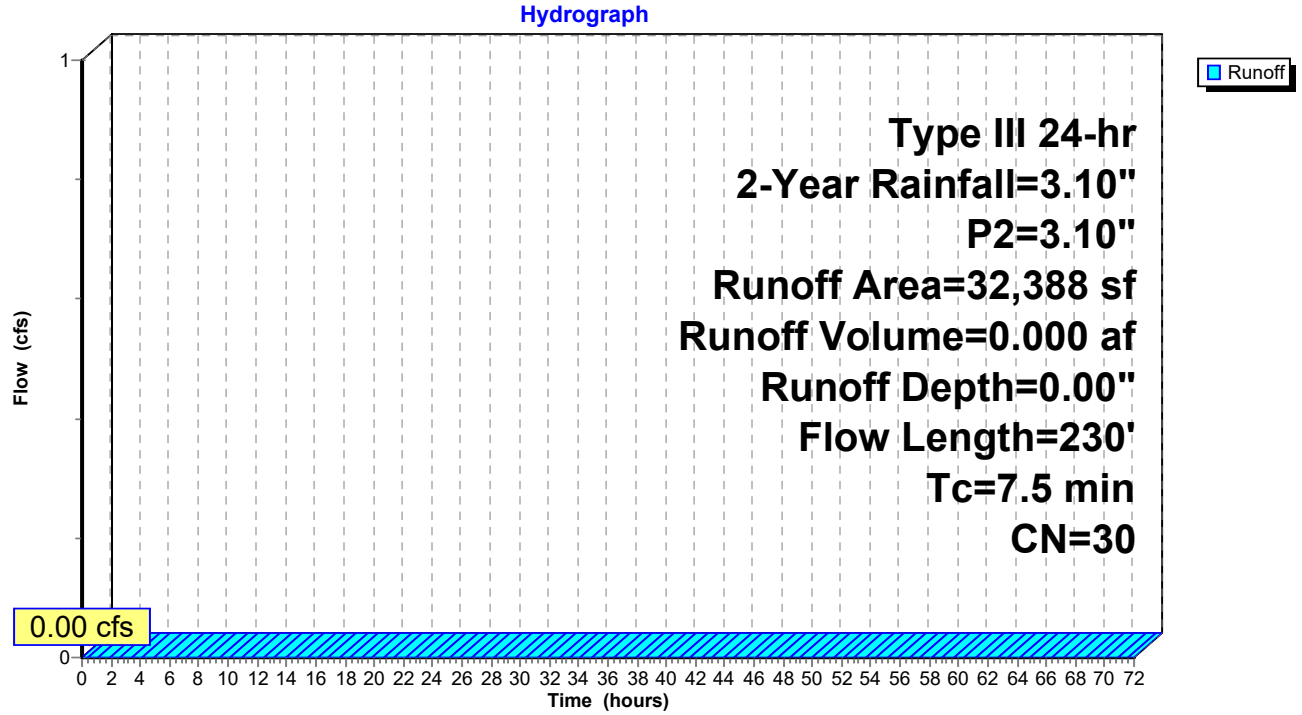
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link DP1 : N'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10", P2=3.10"

Area (sf)	CN	Description
95	98	Roofs, HSG A
32,293	30	Woods, Good, HSG A
32,388	30	Weighted Average
32,293		99.71% Pervious Area
95		0.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	50	0.1800	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.7	92	0.1950	2.21		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.6	88	0.0340	0.92		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
7.5	230	Total			

Subcatchment E-2: Subcat E-2



Summary for Subcatchment E-3: Subcat E-3

[45] Hint: Runoff=Zero

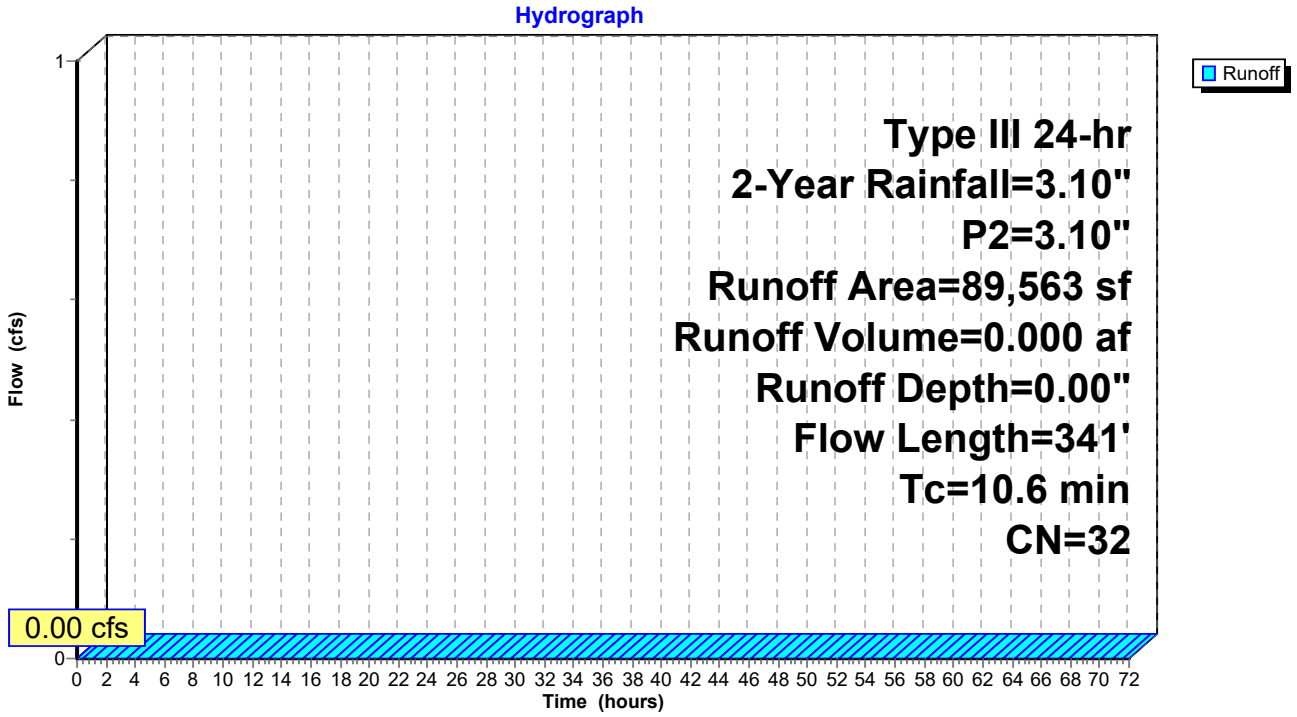
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link DP2 : E'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10", P2=3.10"

Area (sf)	CN	Description
85,130	30	Woods, Good, HSG A
1,365	98	Roofs, HSG A
3,068	72	Dirt roads, HSG A
89,563	32	Weighted Average
88,198		98.48% Pervious Area
1,365		1.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0800	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	74	0.2160	2.32		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.6	60	0.0250	1.58		**Shallow Concentrated Flow, C-D** Nearly Bare & Untilled Kv= 10.0 fps
2.3	157	0.0510	1.13		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
10.6	341	Total			

Subcatchment E-3: Subcat E-3



Summary for Subcatchment E-4: Subcat E-4

[45] Hint: Runoff=Zero

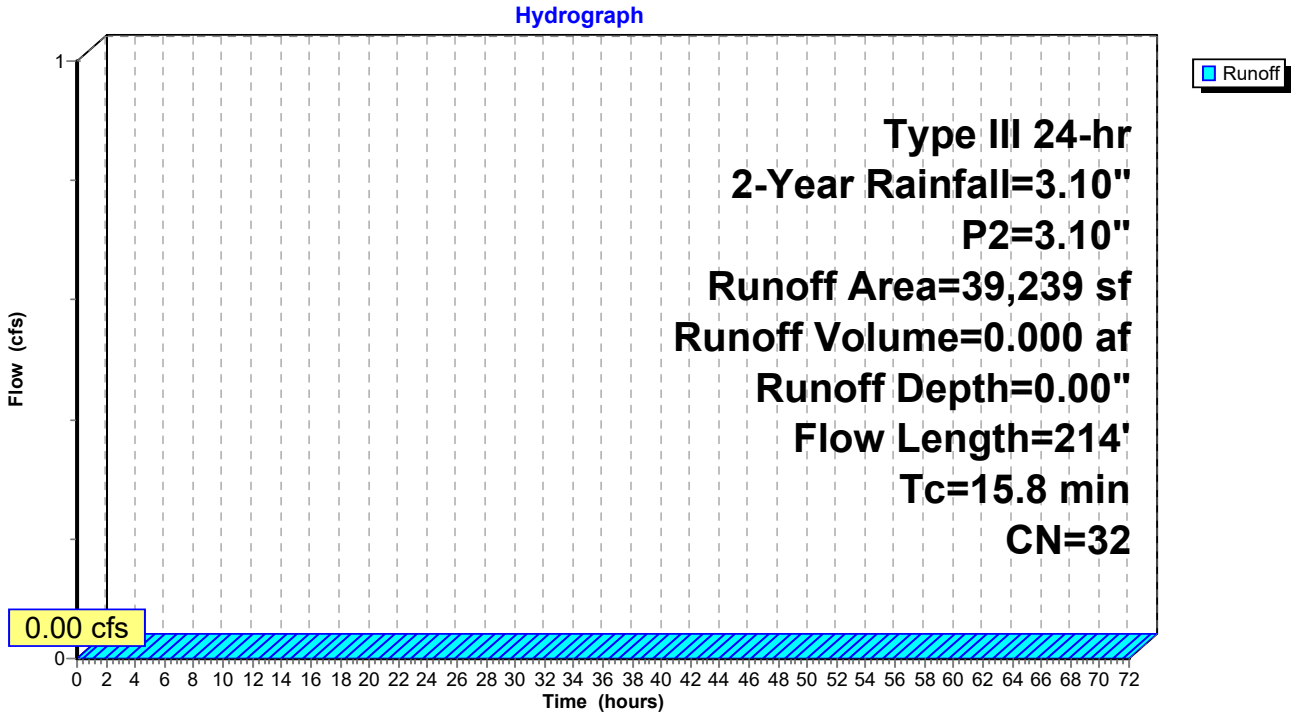
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Pond 4P : DP3 - Existing Depression 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10", P2=3.10"

Area (sf)	CN	Description
37,500	30	Woods, Good, HSG A
1,739	72	Dirt roads, HSG A
39,239	32	Weighted Average
39,239		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	50	0.0300	0.08		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.7	29	0.0200	0.71		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.2	10	0.0100	1.00		**Shallow Concentrated Flow, C-D** Nearly Bare & Untilled Kv= 10.0 fps
4.2	125	0.0100	0.50		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
15.8	214	Total			

Subcatchment E-4: Subcat E-4



Summary for Subcatchment E-5: Subcat E-5

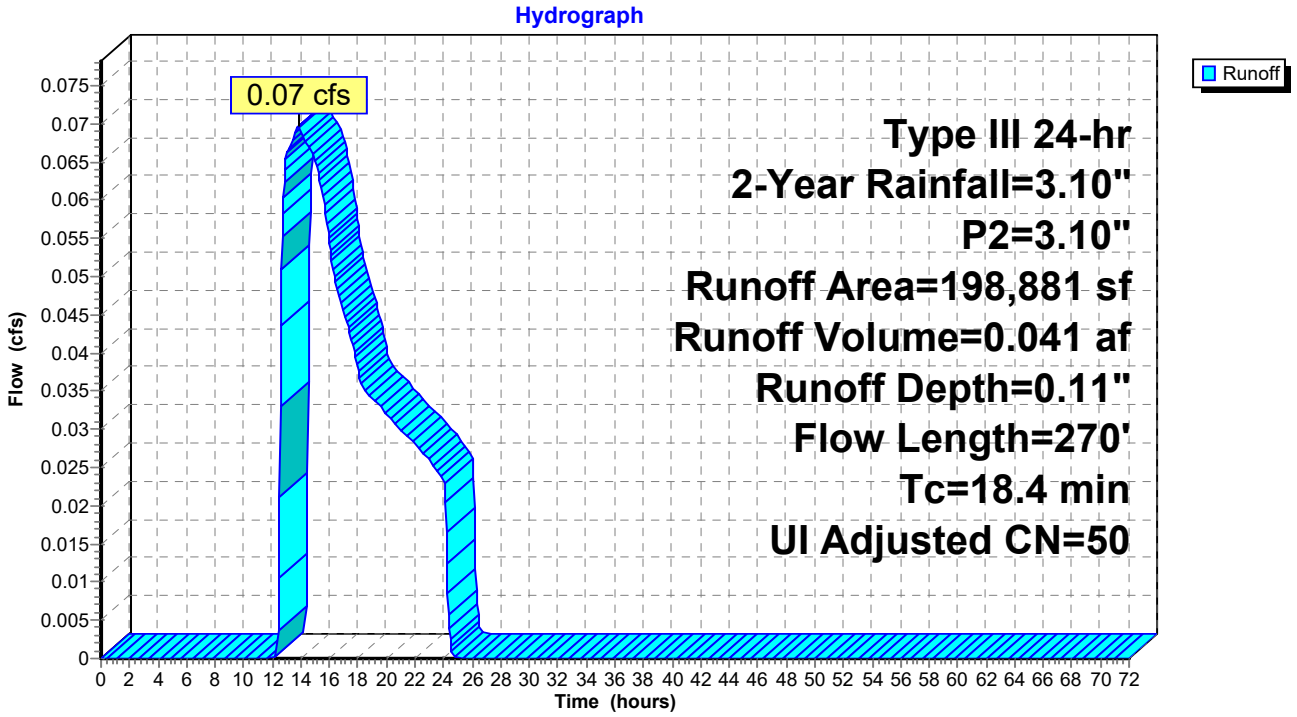
Runoff = 0.07 cfs @ 13.83 hrs, Volume= 0.041 af, Depth= 0.11"
Routed to Link DP4 : S'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10", P2=3.10"

Area (sf)	CN	Adj	Description
99,401	30		Woods, Good, HSG A
33,545	39		>75% Grass cover, Good, HSG A
13,415	72		Dirt roads, HSG A
14,517	98		Unconnected pavement, HSG A
16,302	98		Paved parking, HSG A
21,702	98		Roofs, HSG A
198,881	52	50	Weighted Average, UI Adjusted
146,360			73.59% Pervious Area
52,521			26.41% Impervious Area
14,517			27.64% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
5.6	184	0.0120	0.55		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.3	36	0.0500	2.24		**Shallow Concentrated Flow, C-D** Nearly Bare & Untilled Kv= 10.0 fps
18.4	270	Total			

Subcatchment E-5: Subcat E-5



Summary for Subcatchment E-6: Subcat E-6

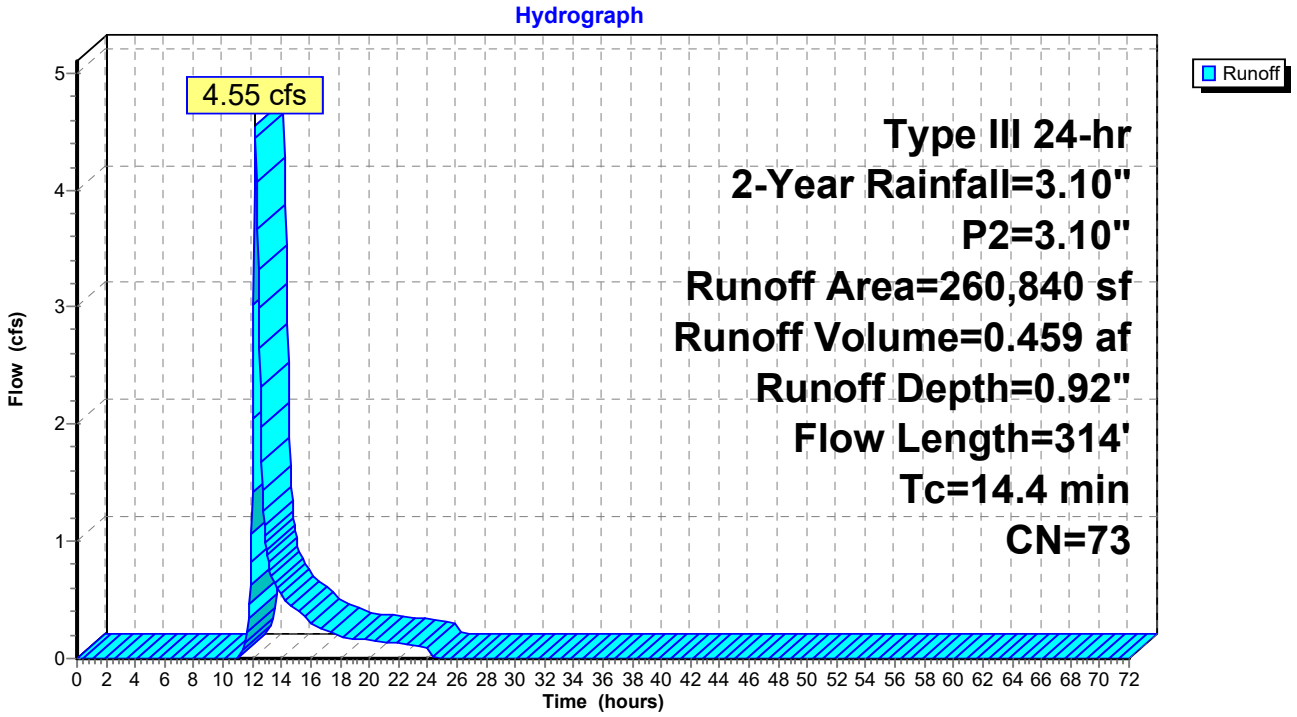
Runoff = 4.55 cfs @ 12.22 hrs, Volume= 0.459 af, Depth= 0.92"
Routed to Link DP5 : To Ex Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10", P2=3.10"

Area (sf)	CN	Description
20,963	30	Woods, Good, HSG A
56,497	39	>75% Grass cover, Good, HSG A
37,489	54	1/2 acre lots, 25% imp, HSG A
10,331	98	Unconnected pavement, HSG A
135,515	98	Paved parking, HSG A
44	72	Dirt roads, HSG A
260,840	73	Weighted Average
105,622		40.49% Pervious Area
155,218		59.51% Impervious Area
10,331		6.66% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	32	0.0100	0.05		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
1.6	18	0.1700	0.19		**Sheet Flow, B-C** Grass: Dense n= 0.240 P2= 3.10"
0.2	22	0.0600	1.71		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.9	182	0.0300	3.52		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
0.1	60	0.0600	12.89	15.82	**Pipe Channel, E-F** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
14.4	314	Total			

Subcatchment E-6: Subcat E-6



Summary for Subcatchment E-7: Subcat E-7

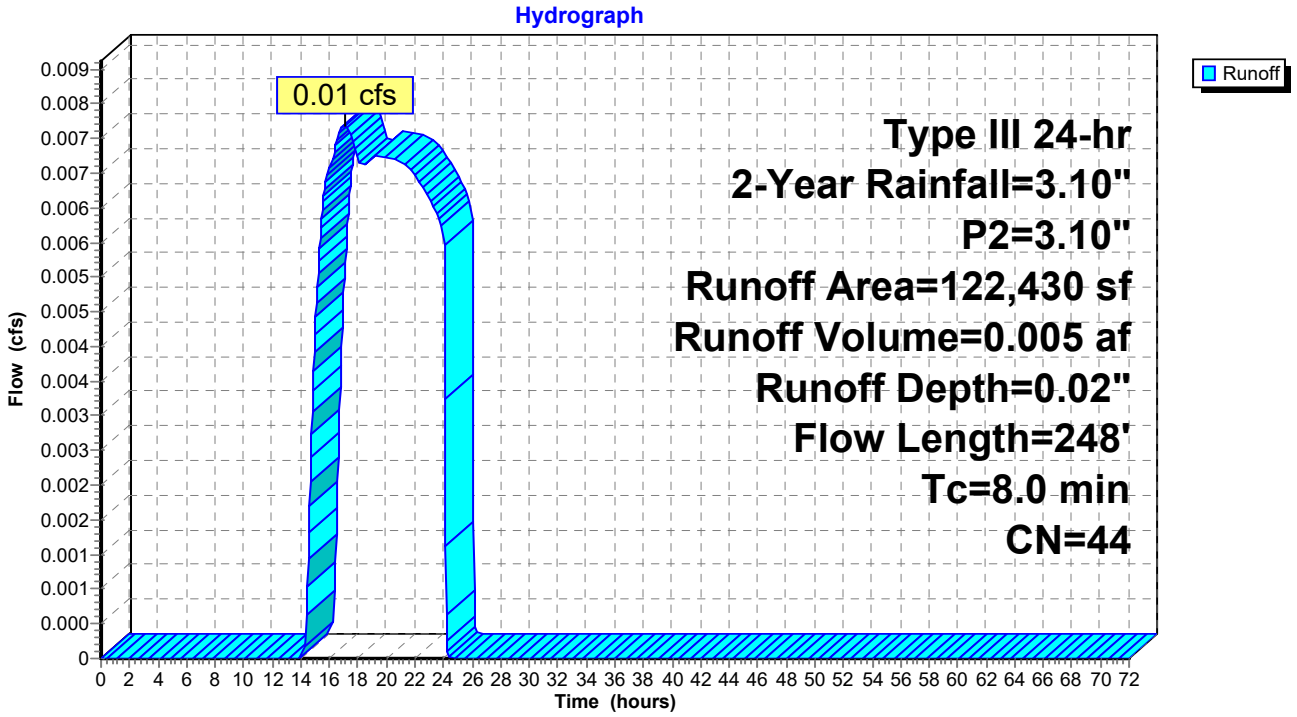
Runoff = 0.01 cfs @ 17.08 hrs, Volume= 0.005 af, Depth= 0.02"
Routed to Link DP5 : To Ex Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10", P2=3.10"

Area (sf)	CN	Description
63,907	30	Woods, Good, HSG A
5,285	39	>75% Grass cover, Good, HSG A
41,116	54	1/2 acre lots, 25% imp, HSG A
1,088	98	Unconnected pavement, HSG A
5,286	98	Roofs, HSG A
5,740	72	Dirt roads, HSG A
8	98	Paved parking, HSG A
122,430	44	Weighted Average
105,770		86.39% Pervious Area
16,661		13.61% Impervious Area
1,088		6.53% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
0.9	72	0.0400	1.40		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.8	126	0.2500	2.50		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
8.0	248	Total			

Subcatchment E-7: Subcat E-7



Summary for Subcatchment E-8: Subcat E-8

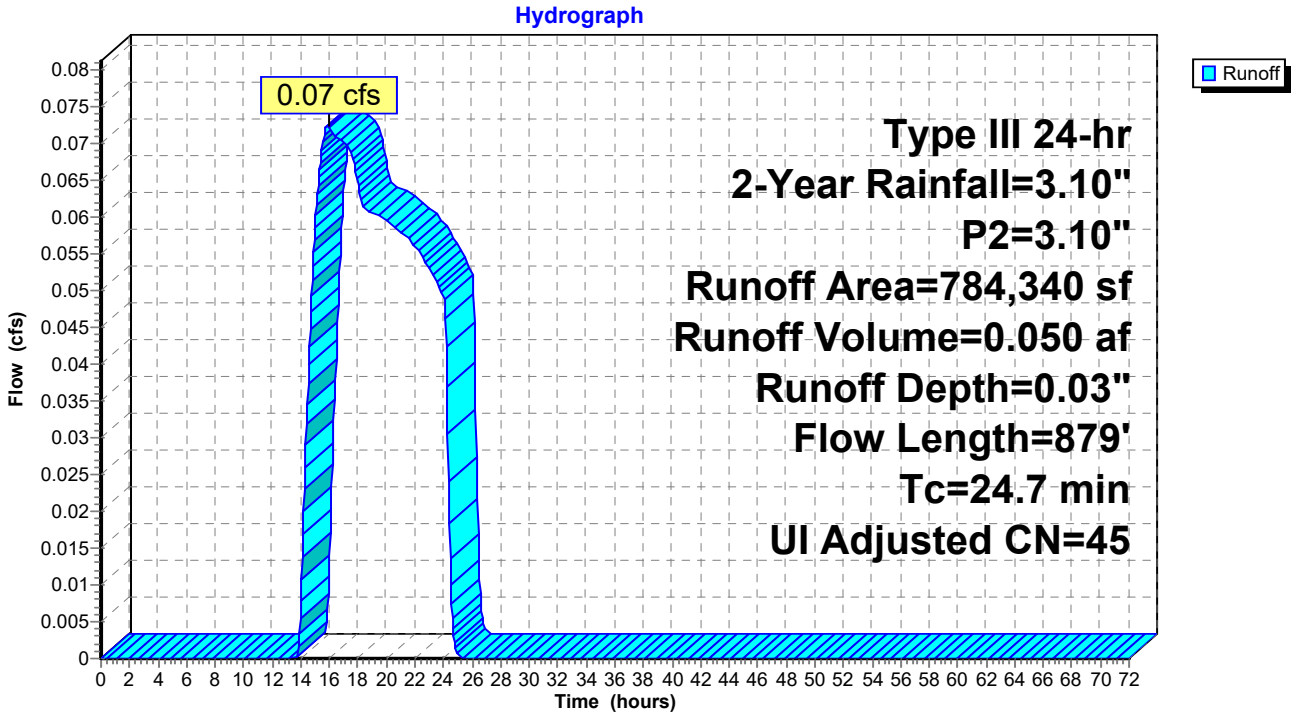
Runoff = 0.07 cfs @ 15.91 hrs, Volume= 0.050 af, Depth= 0.03"
Routed to Pond 2P : DP6 - Ex Inf Basin Club

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10", P2=3.10"

Area (sf)	CN	Adj	Description
322,022	30		Woods, Good, HSG A
206,044	39		>75% Grass cover, Good, HSG A
103,904	54		1/2 acre lots, 25% imp, HSG A
19,026	72		Dirt roads, HSG A
69,702	98		Unconnected pavement, HSG A
63,642	98		Roofs, HSG A
784,340	48	45	Weighted Average, UI Adjusted
625,021			79.69% Pervious Area
159,319			20.31% Impervious Area
69,702			43.75% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
1.2	83	0.0570	1.19		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
6.9	354	0.0150	0.86		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
4.1	392	0.1000	1.58		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
24.7	879	Total			

Subcatchment E-8: Subcat E-8



Summary for Subcatchment E-9: Subcat E-9

[45] Hint: Runoff=Zero

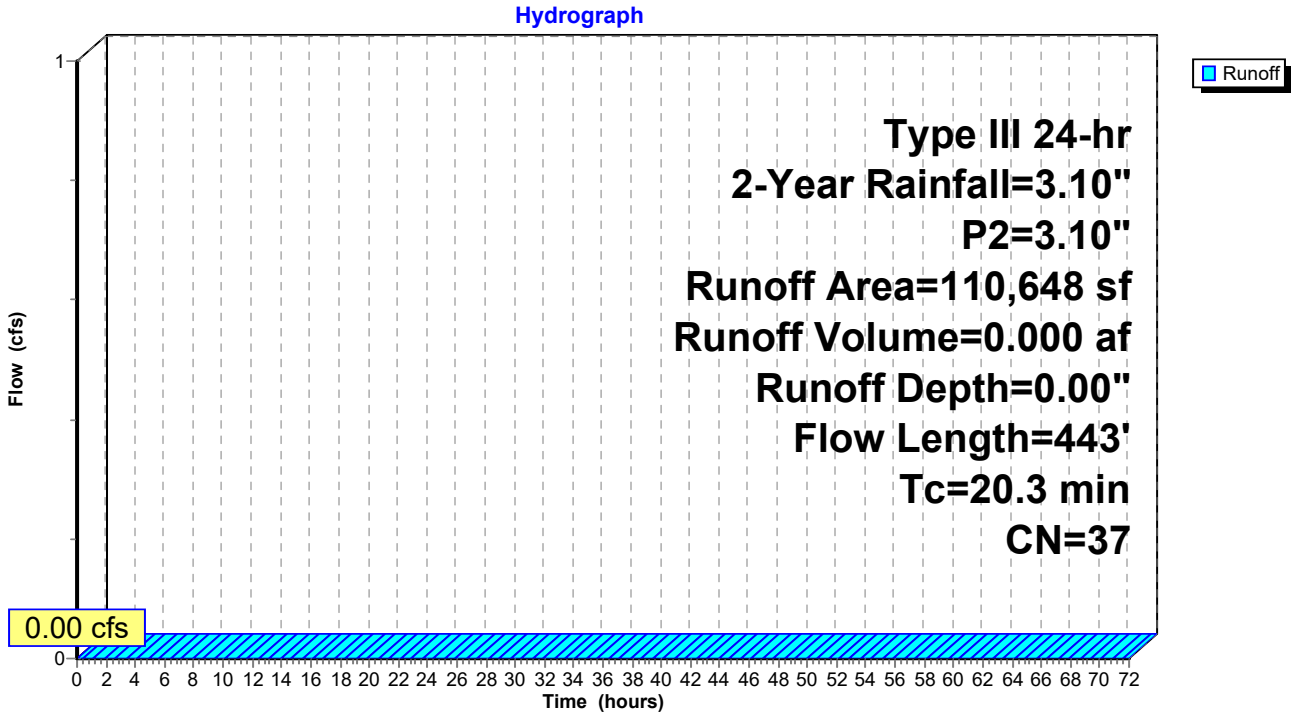
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Pond 1P : DP7 - Existing Depression 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.10", P2=3.10"

Area (sf)	CN	Description
84,652	30	Woods, Good, HSG A
13	39	>75% Grass cover, Good, HSG A
21,381	54	1/2 acre lots, 25% imp, HSG A
621	98	Roofs, HSG A
3,980	72	Dirt roads, HSG A
110,648	37	Weighted Average
104,681		94.61% Pervious Area
5,967		5.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	50	0.0125	0.06		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
3.3	149	0.0226	0.75		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.9	244	0.1800	2.12		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
20.3	443	Total			

Subcatchment E-9: Subcat E-9



Summary for Pond 1P: DP7 - Existing Depression 2

Inflow Area = 2.540 ac, 5.39% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 163.00' @ 0.00 hrs Surf.Area= 333 sf Storage= 0 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	163.00'	93,839 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

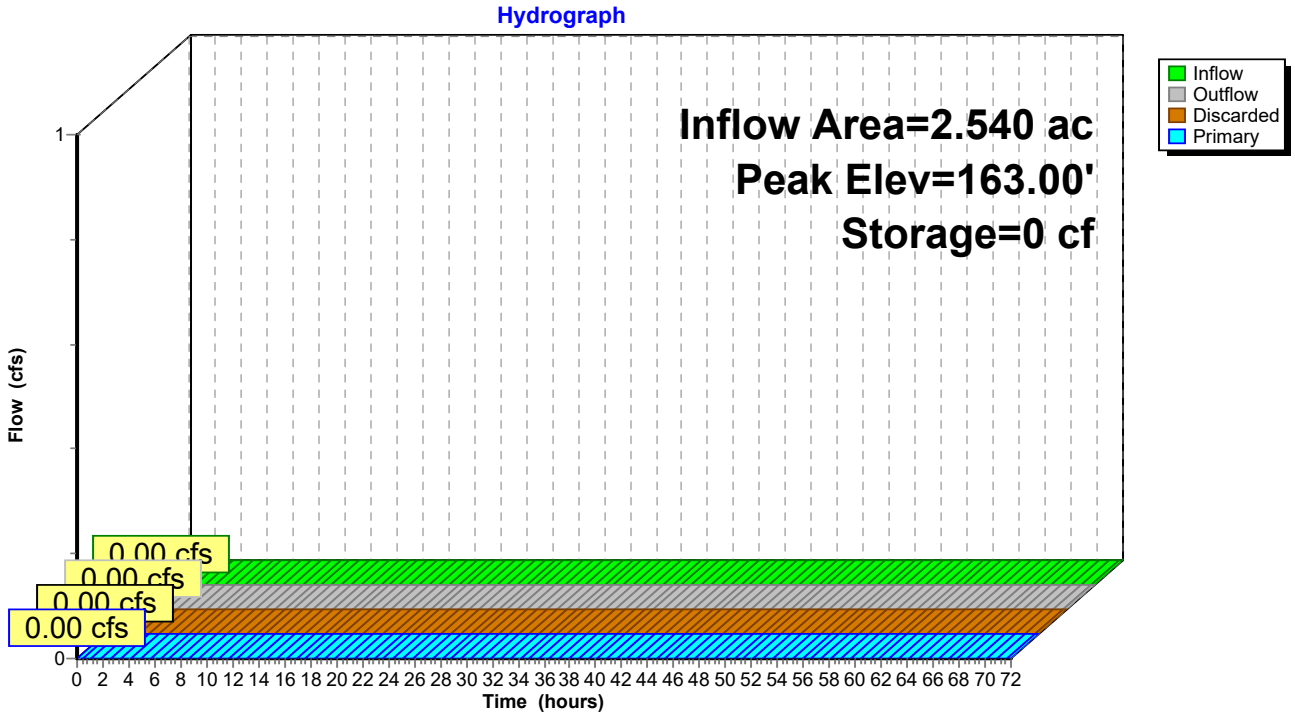
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
163.00	333	75.0	0	0	333
164.00	1,602	160.0	888	888	1,927
165.00	2,975	219.0	2,253	3,142	3,716
166.00	4,470	279.0	3,697	6,839	6,107
167.00	6,302	338.0	5,360	12,199	9,020
168.00	8,505	396.0	7,376	19,575	12,428
169.00	10,882	448.0	9,669	29,244	15,946
170.00	13,282	490.0	12,062	41,306	19,116
171.00	15,858	534.0	14,551	55,857	22,738
172.00	18,847	583.0	17,331	73,188	27,129
173.00	22,508	622.0	20,650	93,839	30,917

Device	Routing	Invert	Outlet Devices
#1	Primary	172.90'	**10.0' long x 50.0' 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
#2	Discarded	163.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=163.00' (Free Discharge)
↑—**2=Exfiltration** (Passes 0.00 cfs of 0.02 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=163.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: DP7 - Existing Depression 2



Summary for Pond 2P: DP6 - Ex Inf Basin Club

Inflow Area = 18.006 ac, 20.31% Impervious, Inflow Depth = 0.03" for 2-Year event
Inflow = 0.07 cfs @ 15.91 hrs, Volume= 0.050 af
Outflow = 0.06 cfs @ 18.16 hrs, Volume= 0.050 af, Atten= 13%, Lag= 135.2 min
Discarded = 0.06 cfs @ 18.16 hrs, Volume= 0.050 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 159.17' @ 18.16 hrs Surf.Area= 1,128 sf Storage= 177 cf

Plug-Flow detention time= 38.6 min calculated for 0.050 af (100% of inflow)
Center-of-Mass det. time= 38.4 min (1,185.1 - 1,146.7)

Volume	Invert	Avail.Storage	Storage Description
#1	159.00'	100,011 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

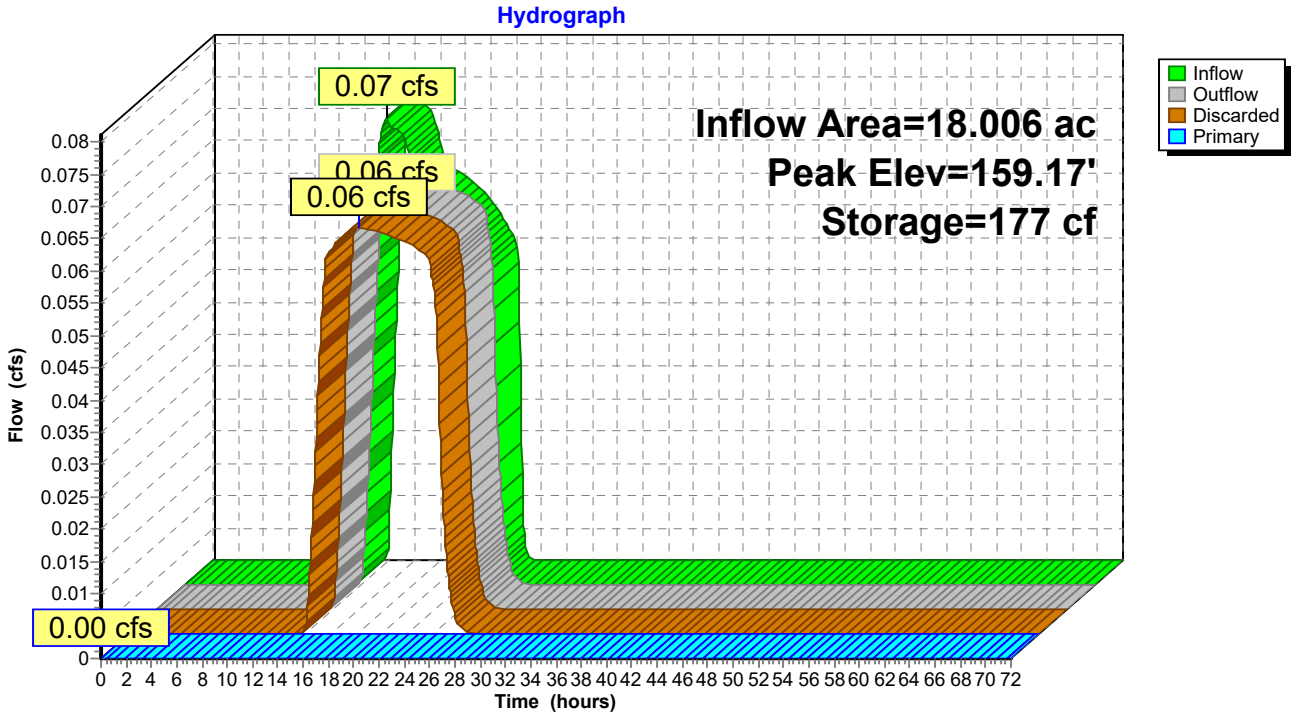
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
159.00	934	176.0	0	0	934
160.00	2,320	278.0	1,575	1,575	4,626
161.00	3,563	292.0	2,919	4,495	5,322
162.00	4,546	305.0	4,045	8,539	6,008
163.00	5,553	339.0	5,041	13,580	7,780
164.00	6,677	374.0	6,106	19,687	9,798
165.00	8,367	426.0	7,506	27,193	13,132
166.00	12,063	523.0	10,159	37,352	20,473
167.00	17,347	642.0	14,625	51,977	31,520
168.00	23,464	806.0	20,329	72,306	50,432
169.00	32,175	988.0	27,705	100,011	76,430

Device	Routing	Invert	Outlet Devices
#1	Primary	167.99'	**10.0' long x 50.0' 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
#2	Discarded	159.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.06 cfs @ 18.16 hrs HW=159.17' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=159.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: DP6 - Ex Inf Basin Club



Summary for Pond 3P: Drainage Basin/Easement

Inflow Area = 8.799 ac, 44.85% Impervious, Inflow Depth = 0.63" for 2-Year event
Inflow = 4.55 cfs @ 12.22 hrs, Volume= 0.464 af
Outflow = 0.34 cfs @ 15.77 hrs, Volume= 0.464 af, Atten= 92%, Lag= 213.2 min
Discarded = 0.34 cfs @ 15.77 hrs, Volume= 0.464 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 176.89' @ 15.77 hrs Surf.Area= 6,128 sf Storage= 10,478 cf

Plug-Flow detention time= 389.4 min calculated for 0.464 af (100% of inflow)
Center-of-Mass det. time= 389.6 min (1,268.3 - 878.7)

Volume	Invert	Avail.Storage	Storage Description
#1	174.00'	345,539 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

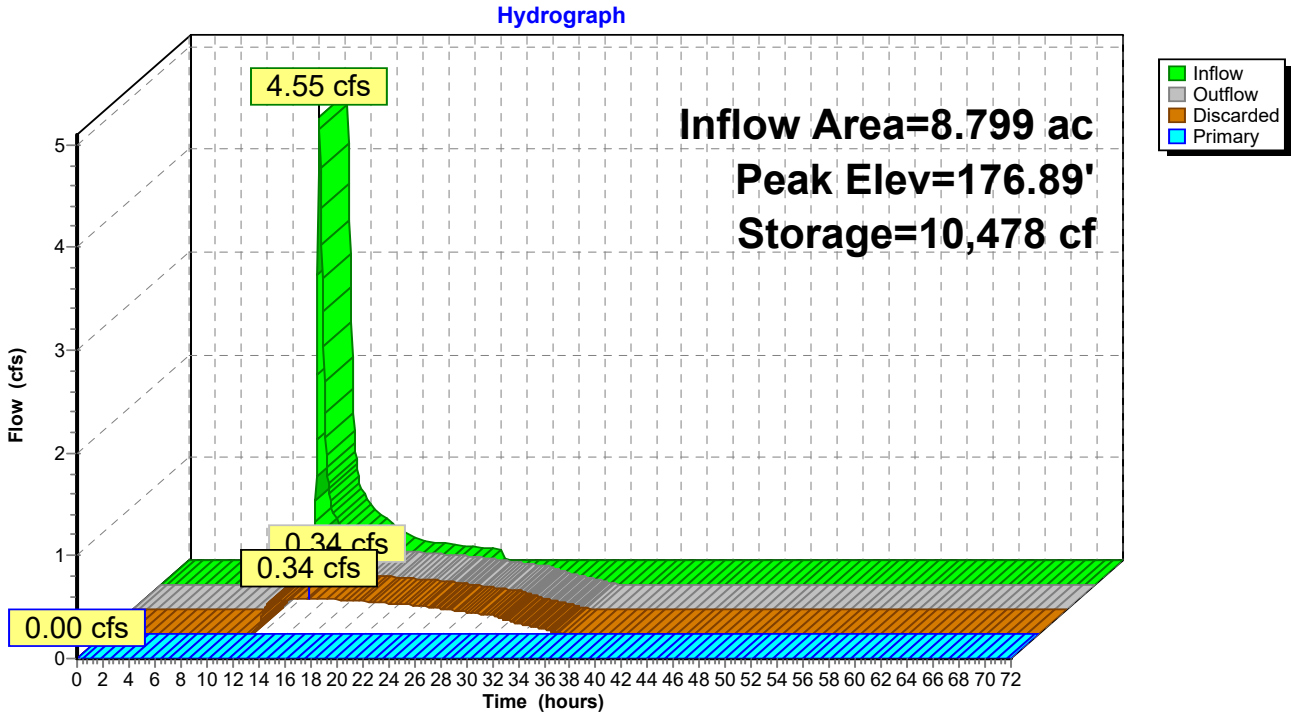
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
174.00	491	104.0	0	0	491
175.00	3,251	224.0	1,668	1,668	3,627
176.00	4,753	273.0	3,978	5,647	5,581
177.00	6,309	310.0	5,513	11,159	7,322
178.00	7,641	346.0	6,964	18,124	9,230
179.00	8,869	377.0	8,247	26,371	11,050
180.00	10,188	402.0	9,521	35,892	12,648
181.00	11,953	430.0	11,059	46,951	14,548
182.00	14,143	463.0	13,033	59,983	16,935
183.00	16,525	499.0	15,319	75,302	19,733
184.00	19,118	519.0	17,806	93,108	21,431
185.00	21,426	604.0	20,261	113,369	29,048
186.00	23,221	589.0	22,317	135,686	30,592
187.00	24,868	608.0	24,040	159,726	32,498
188.00	26,530	627.0	25,695	185,421	34,465
189.00	28,209	646.0	27,365	212,786	36,492
190.00	30,172	674.0	29,185	241,971	39,506
191.00	32,732	704.0	31,443	273,414	42,867
192.00	36,071	766.0	34,388	307,802	50,157
193.00	39,428	897.0	37,737	345,539	67,513

Device	Routing	Invert	Outlet Devices
#1	Primary	192.90'	**10.0' long x 50.0' 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
#2	Discarded	174.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.34 cfs @ 15.77 hrs HW=176.89' (Free Discharge)
↑└**2=Exfiltration** (Exfiltration Controls 0.34 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=174.00' (Free Discharge)
↑└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Drainage Basin/Easement



Summary for Pond 4P: DP3 - Existing Depression 1

Inflow Area = 0.901 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to nonexistent node SP4

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 193.00' @ 0.00 hrs Surf.Area= 30 sf Storage= 0 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	193.00'	17,265 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

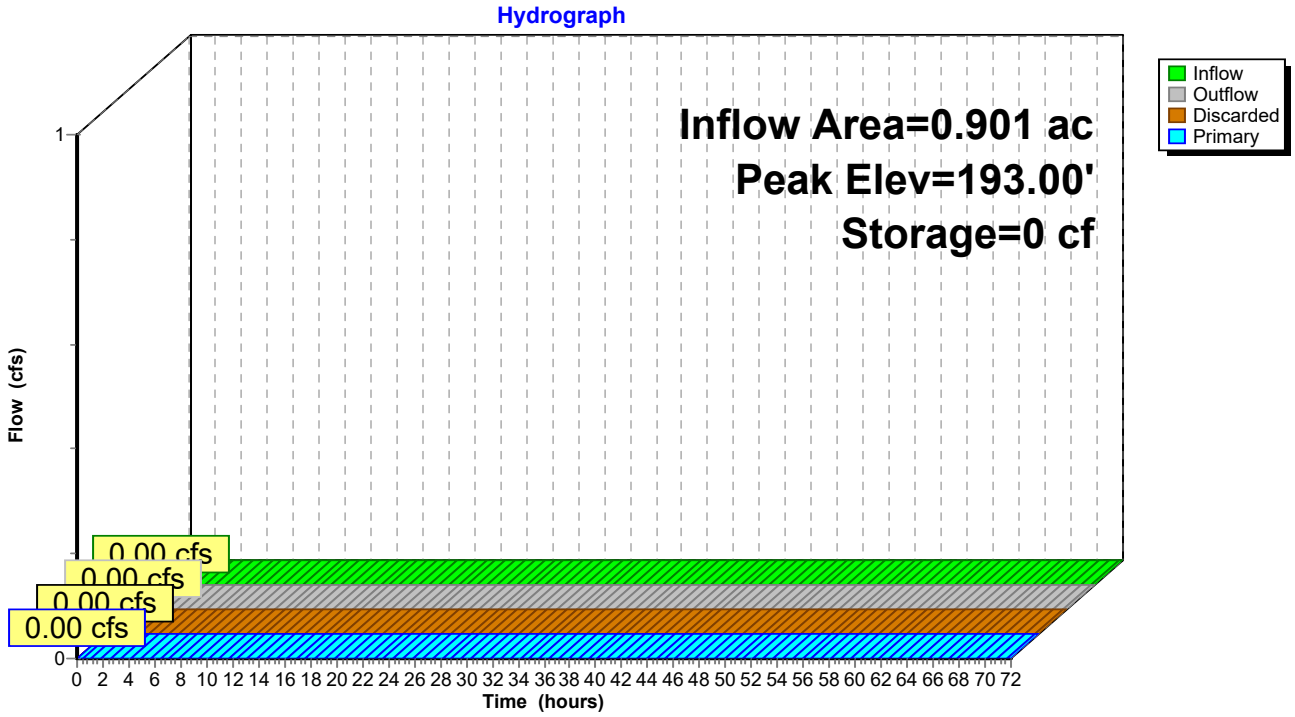
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
193.00	30	100.0	0	0	30
194.00	1,087	159.0	433	433	1,253
195.00	2,356	217.0	1,681	2,114	2,998
196.00	3,959	276.0	3,123	5,237	5,326
197.00	5,956	339.0	4,924	10,160	8,425
198.00	8,319	398.0	7,105	17,265	11,905

Device	Routing	Invert	Outlet Devices
#1	Primary	197.90'	**10.0' long x 20.0' 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
#2	Discarded	193.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=193.00' (Free Discharge)
↑—**2=Exfiltration** (Passes 0.00 cfs of 0.00 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=193.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 4P: DP3 - Existing Depression 1

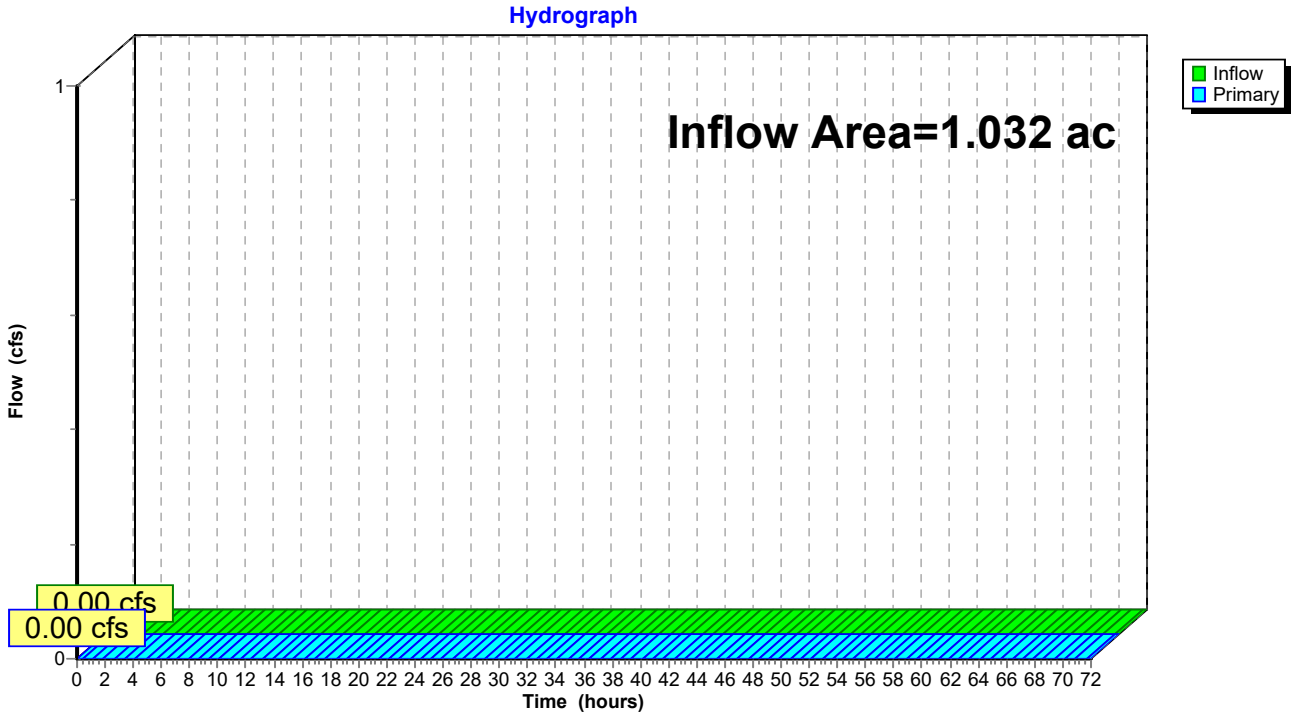


Summary for Link DP1: N'ly Property Line

Inflow Area = 1.032 ac, 0.21% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP1: N'ly Property Line

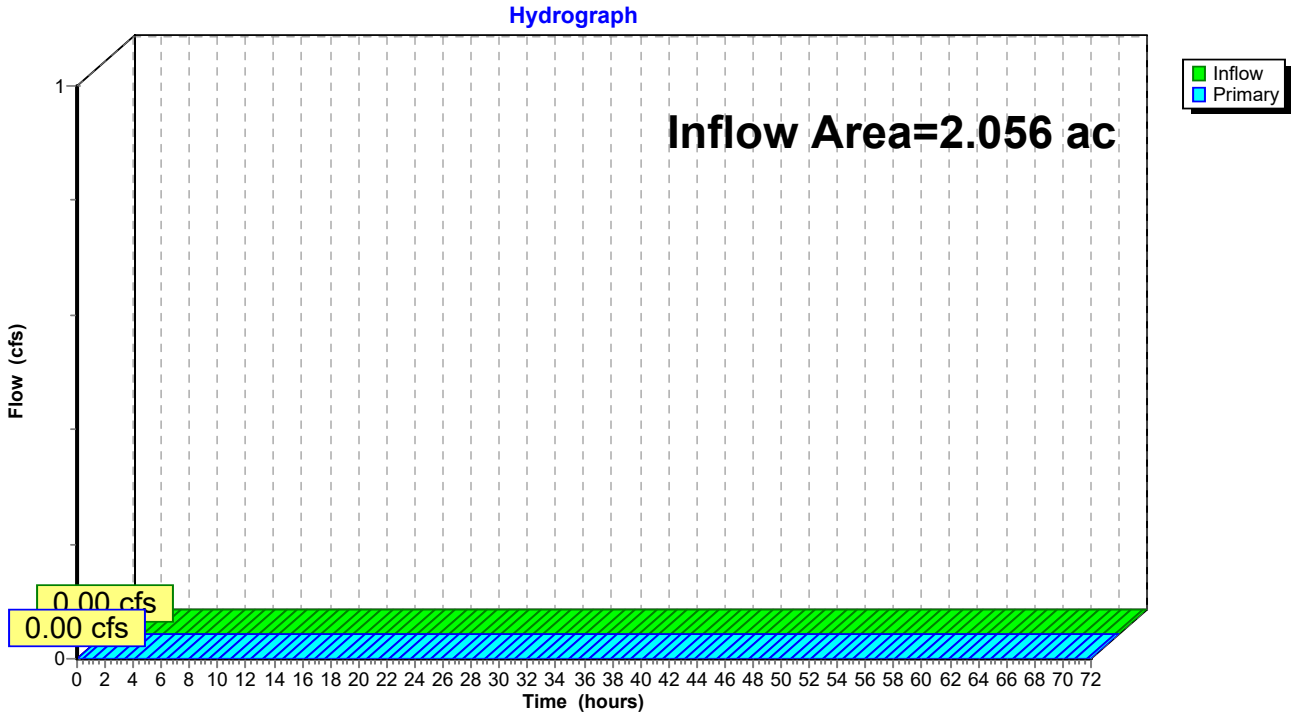


Summary for Link DP2: E'ly Property Line

Inflow Area = 2.056 ac, 1.52% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP2: E'ly Property Line

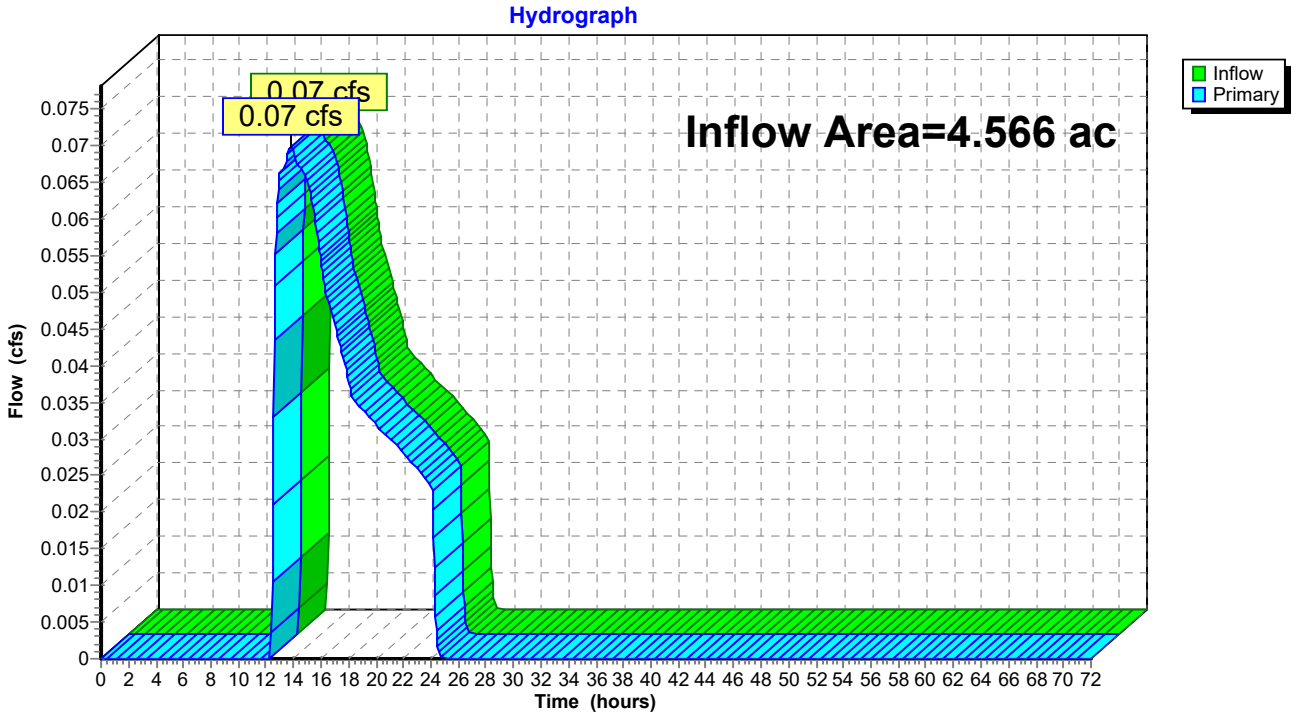


Summary for Link DP4: S'ly Property Line

Inflow Area = 4.566 ac, 26.41% Impervious, Inflow Depth = 0.11" for 2-Year event
Inflow = 0.07 cfs @ 13.83 hrs, Volume= 0.041 af
Primary = 0.07 cfs @ 13.83 hrs, Volume= 0.041 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP4: S'ly Property Line

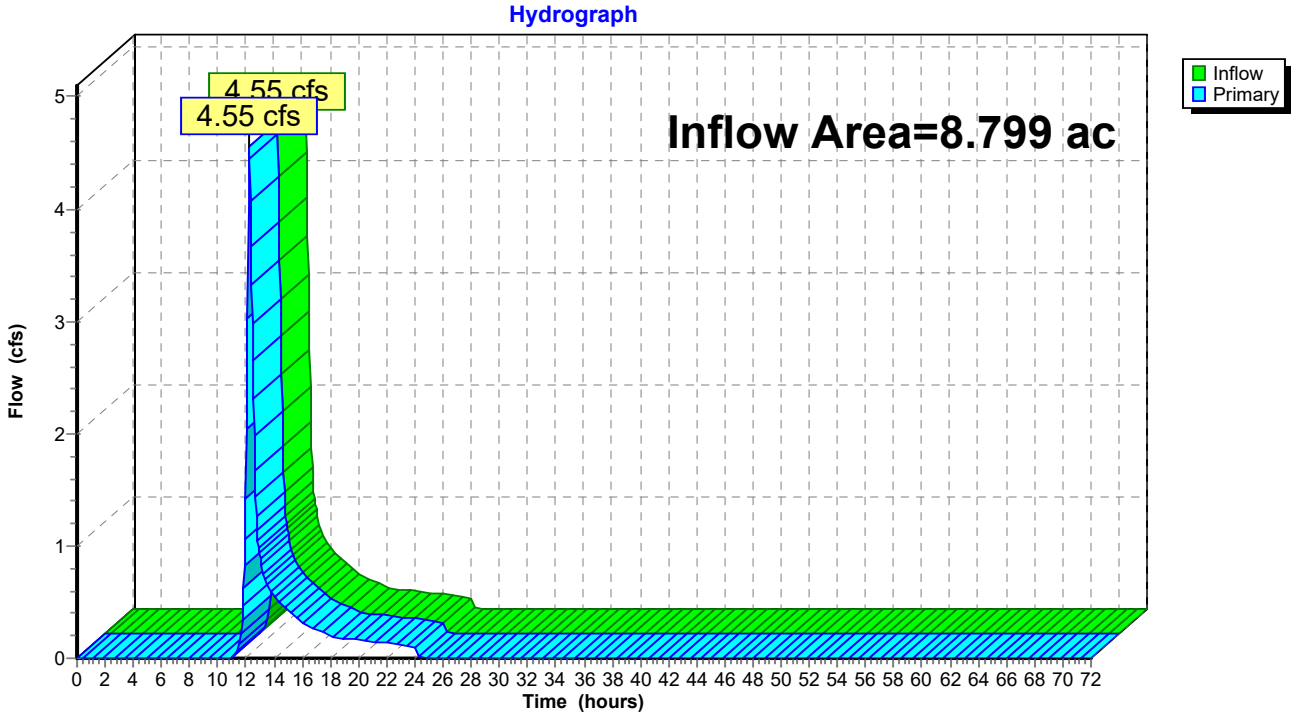


Summary for Link DP5: To Ex Basin

Inflow Area = 8.799 ac, 44.85% Impervious, Inflow Depth = 0.63" for 2-Year event
Inflow = 4.55 cfs @ 12.22 hrs, Volume= 0.464 af
Primary = 4.55 cfs @ 12.22 hrs, Volume= 0.464 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 3P : Drainage Basin/Easement

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP5: To Ex Basin



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Subcat E-1 Runoff Area=12,581 sf 0.00% Impervious Runoff Depth=0.06"
Flow Length=188' Tc=8.8 min CN=36 Runoff=0.00 cfs 0.001 af

Subcatchment E-2: Subcat E-2 Runoff Area=32,388 sf 0.29% Impervious Runoff Depth=0.00"
Flow Length=230' Tc=7.5 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment E-3: Subcat E-3 Runoff Area=89,563 sf 1.52% Impervious Runoff Depth=0.01"
Flow Length=341' Tc=10.6 min CN=32 Runoff=0.00 cfs 0.001 af

Subcatchment E-4: Subcat E-4 Runoff Area=39,239 sf 0.00% Impervious Runoff Depth=0.01"
Flow Length=214' Tc=15.8 min CN=32 Runoff=0.00 cfs 0.000 af

Subcatchment E-5: Subcat E-5 Runoff Area=198,881 sf 26.41% Impervious Runoff Depth=0.54"
Flow Length=270' Tc=18.4 min UI Adjusted CN=50 Runoff=1.18 cfs 0.207 af

Subcatchment E-6: Subcat E-6 Runoff Area=260,840 sf 59.51% Impervious Runoff Depth=1.99"
Flow Length=314' Tc=14.4 min CN=73 Runoff=10.50 cfs 0.991 af

Subcatchment E-7: Subcat E-7 Runoff Area=122,430 sf 13.61% Impervious Runoff Depth=0.29"
Flow Length=248' Tc=8.0 min CN=44 Runoff=0.28 cfs 0.068 af

Subcatchment E-8: Subcat E-8 Runoff Area=784,340 sf 20.31% Impervious Runoff Depth=0.33"
Flow Length=879' Tc=24.7 min UI Adjusted CN=45 Runoff=1.76 cfs 0.493 af

Subcatchment E-9: Subcat E-9 Runoff Area=110,648 sf 5.39% Impervious Runoff Depth=0.08"
Flow Length=443' Tc=20.3 min CN=37 Runoff=0.03 cfs 0.017 af

Pond 1P: DP7 - Existing Depression 2 Peak Elev=163.12' Storage=46 cf Inflow=0.03 cfs 0.017 af
Discarded=0.02 cfs 0.017 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.017 af

Pond 2P: DP6 - Ex Inf Basin Club Peak Elev=162.48' Storage=10,845 cf Inflow=1.76 cfs 0.493 af
Discarded=0.28 cfs 0.493 af Primary=0.00 cfs 0.000 af Outflow=0.28 cfs 0.493 af

Pond 3P: Drainage Basin/Easement Peak Elev=179.25' Storage=28,655 cf Inflow=10.63 cfs 1.059 af
Discarded=0.51 cfs 1.059 af Primary=0.00 cfs 0.000 af Outflow=0.51 cfs 1.059 af

Pond 4P: DP3 - Existing Depression 1 Peak Elev=193.02' Storage=1 cf Inflow=0.00 cfs 0.000 af
Discarded=0.00 cfs 0.000 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

Link DP1: N'ly Property Line Inflow=0.00 cfs 0.001 af
Primary=0.00 cfs 0.001 af

Link DP2: E'ly Property Line Inflow=0.00 cfs 0.001 af
Primary=0.00 cfs 0.001 af

Link DP4: S'ly Property Line Inflow=1.18 cfs 0.207 af
Primary=1.18 cfs 0.207 af

Link DP5: To Ex Basin

Inflow=10.63 cfs 1.059 af
Primary=10.63 cfs 1.059 af

Total Runoff Area = 37.900 ac Runoff Volume = 1.780 af Average Runoff Depth = 0.56"
76.31% Pervious = 28.920 ac 23.69% Impervious = 8.979 ac

Summary for Subcatchment E-1: Subcat E-1

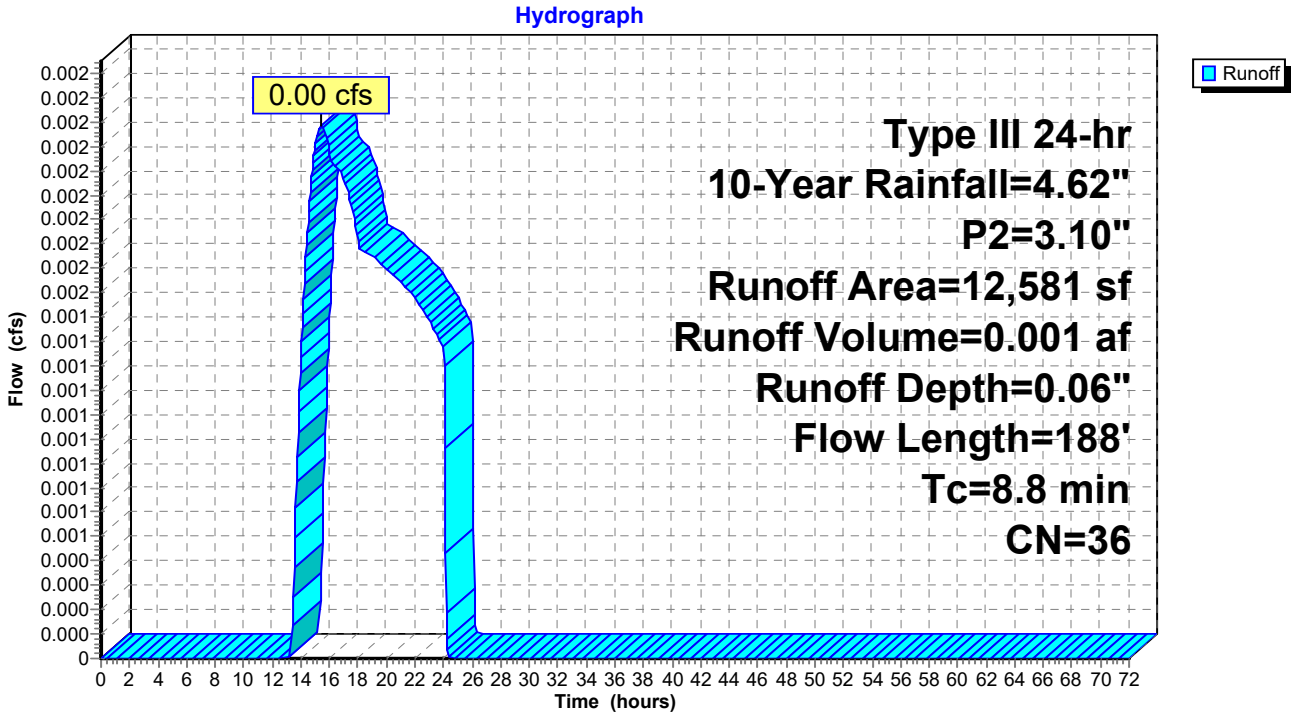
Runoff = 0.00 cfs @ 15.46 hrs, Volume= 0.001 af, Depth= 0.06"
Routed to Link DP1 : N'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.62", P2=3.10"

Area (sf)	CN	Description
10,635	30	Woods, Good, HSG A
1,947	72	Dirt roads, HSG A
12,581	36	Weighted Average
12,581		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	50	0.0900	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.7	55	0.2540	1.26		**Shallow Concentrated Flow, B-C** Forest w/Heavy Litter Kv= 2.5 fps
0.1	15	0.0660	2.57		**Shallow Concentrated Flow, C-D** Nearly Bare & Untilled Kv= 10.0 fps
0.3	18	0.1380	0.93		**Shallow Concentrated Flow, D-E** Forest w/Heavy Litter Kv= 2.5 fps
0.1	14	0.0570	2.39		**Shallow Concentrated Flow, E-F** Nearly Bare & Untilled Kv= 10.0 fps
0.7	36	0.1250	0.88		**Shallow Concentrated Flow, F-G** Forest w/Heavy Litter Kv= 2.5 fps
8.8	188	Total			

Subcatchment E-1: Subcat E-1



Summary for Subcatchment E-2: Subcat E-2

[45] Hint: Runoff=Zero

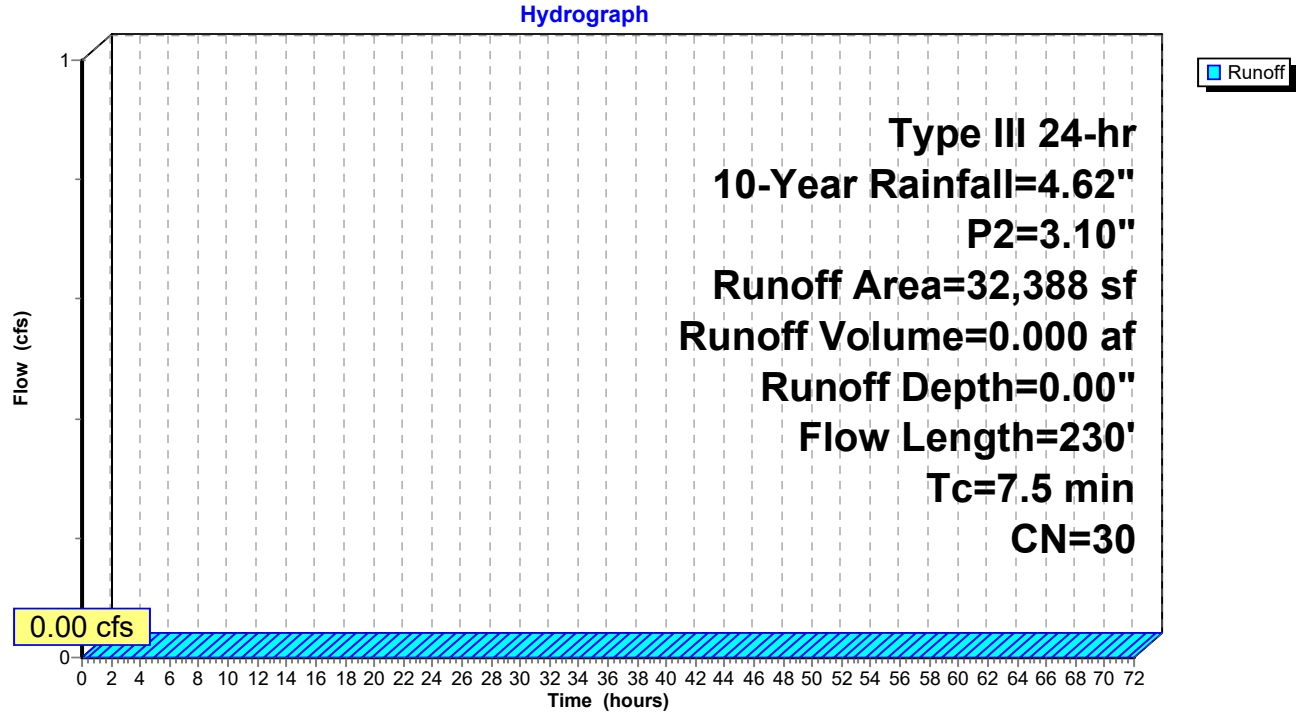
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link DP1 : N'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.62", P2=3.10"

Area (sf)	CN	Description
95	98	Roofs, HSG A
32,293	30	Woods, Good, HSG A
32,388	30	Weighted Average
32,293		99.71% Pervious Area
95		0.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	50	0.1800	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.7	92	0.1950	2.21		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.6	88	0.0340	0.92		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
7.5	230	Total			

Subcatchment E-2: Subcat E-2



Summary for Subcatchment E-3: Subcat E-3

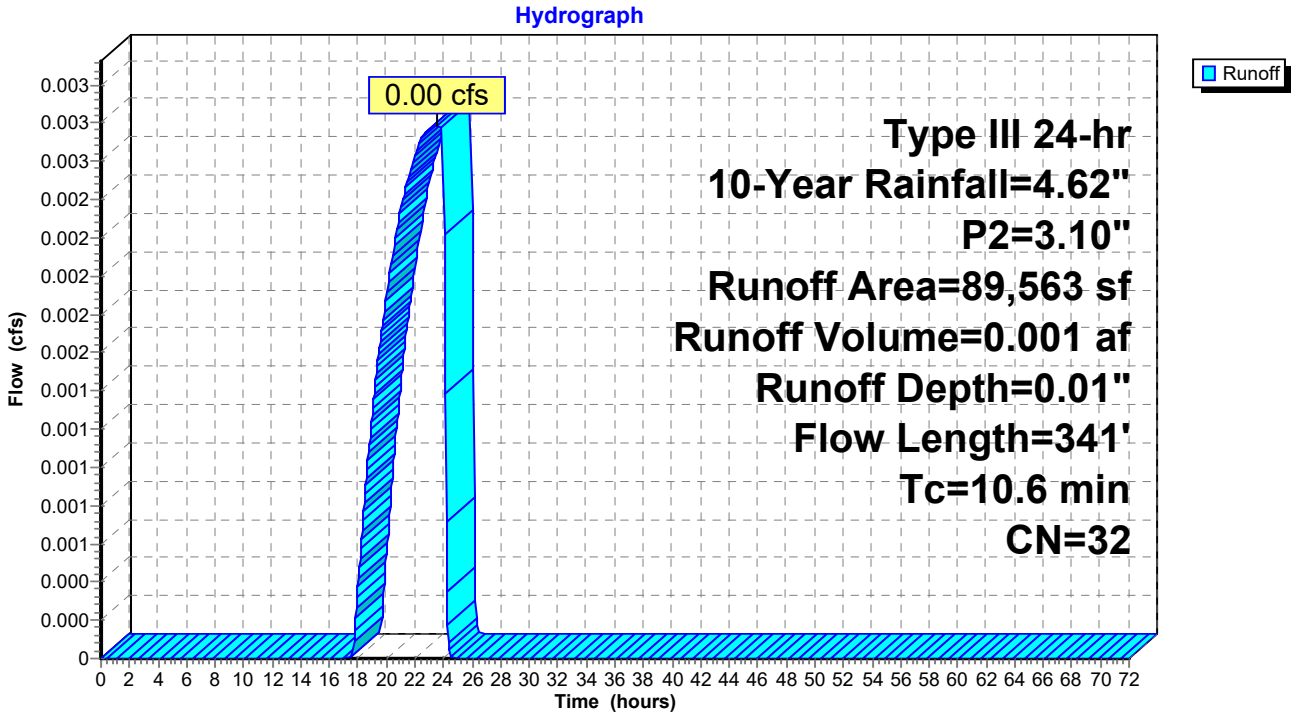
Runoff = 0.00 cfs @ 23.49 hrs, Volume= 0.001 af, Depth= 0.01"
Routed to Link DP2 : E'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.62", P2=3.10"

Area (sf)	CN	Description
85,130	30	Woods, Good, HSG A
1,365	98	Roofs, HSG A
3,068	72	Dirt roads, HSG A
89,563	32	Weighted Average
88,198		98.48% Pervious Area
1,365		1.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0800	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	74	0.2160	2.32		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.6	60	0.0250	1.58		**Shallow Concentrated Flow, C-D** Nearly Bare & Untilled Kv= 10.0 fps
2.3	157	0.0510	1.13		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
10.6	341	Total			

Subcatchment E-3: Subcat E-3



Summary for Subcatchment E-4: Subcat E-4

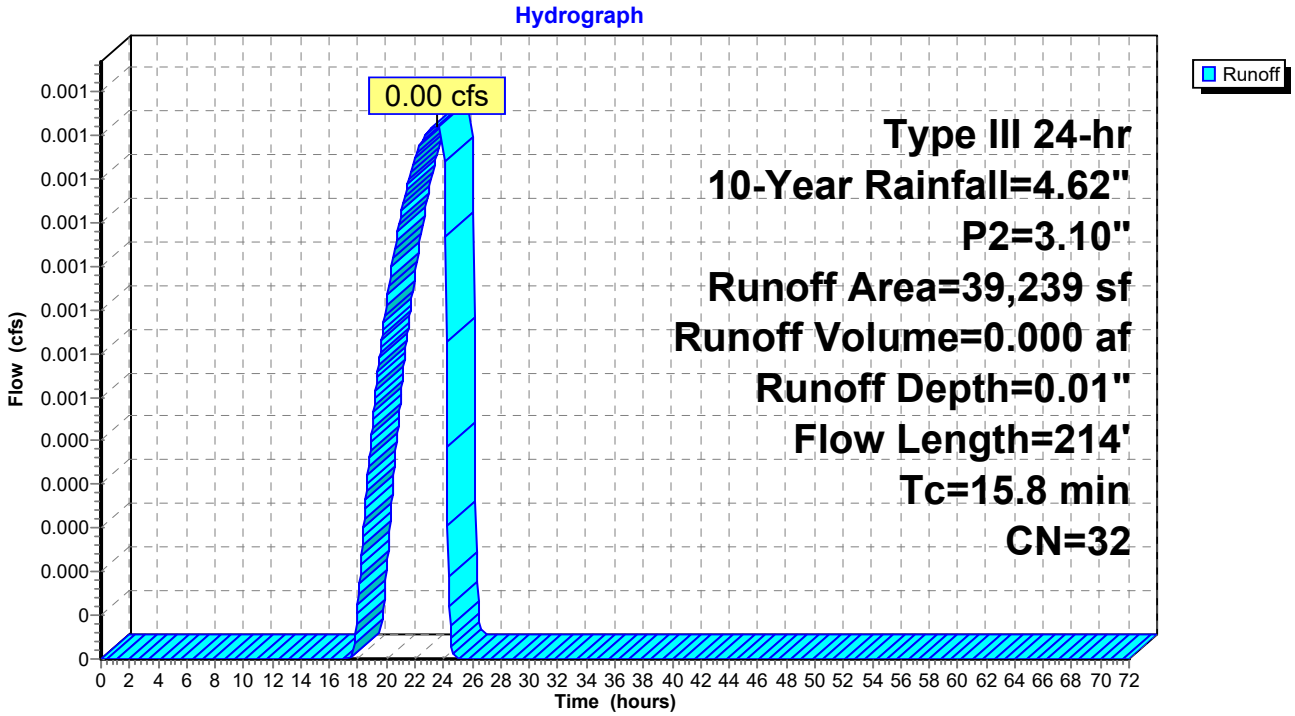
Runoff = 0.00 cfs @ 23.59 hrs, Volume= 0.000 af, Depth= 0.01"
Routed to Pond 4P : DP3 - Existing Depression 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.62", P2=3.10"

Area (sf)	CN	Description
37,500	30	Woods, Good, HSG A
1,739	72	Dirt roads, HSG A
39,239	32	Weighted Average
39,239		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	50	0.0300	0.08		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.7	29	0.0200	0.71		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.2	10	0.0100	1.00		**Shallow Concentrated Flow, C-D** Nearly Bare & Untilled Kv= 10.0 fps
4.2	125	0.0100	0.50		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
15.8	214	Total			

Subcatchment E-4: Subcat E-4



Summary for Subcatchment E-5: Subcat E-5

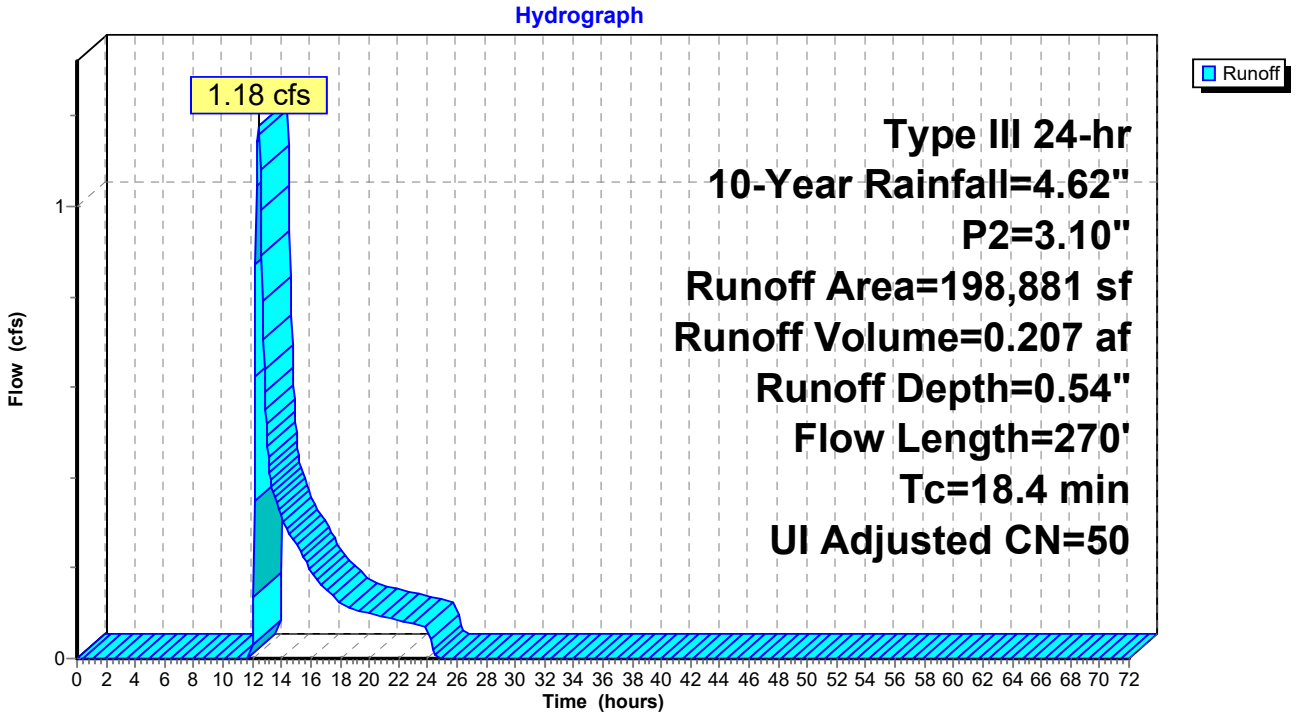
Runoff = 1.18 cfs @ 12.42 hrs, Volume= 0.207 af, Depth= 0.54"
Routed to Link DP4 : S'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.62", P2=3.10"

Area (sf)	CN	Adj	Description
99,401	30		Woods, Good, HSG A
33,545	39		>75% Grass cover, Good, HSG A
13,415	72		Dirt roads, HSG A
14,517	98		Unconnected pavement, HSG A
16,302	98		Paved parking, HSG A
21,702	98		Roofs, HSG A
198,881	52	50	Weighted Average, UI Adjusted
146,360			73.59% Pervious Area
52,521			26.41% Impervious Area
14,517			27.64% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
5.6	184	0.0120	0.55		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.3	36	0.0500	2.24		**Shallow Concentrated Flow, C-D** Nearly Bare & Untilled Kv= 10.0 fps
18.4	270	Total			

Subcatchment E-5: Subcat E-5



Summary for Subcatchment E-6: Subcat E-6

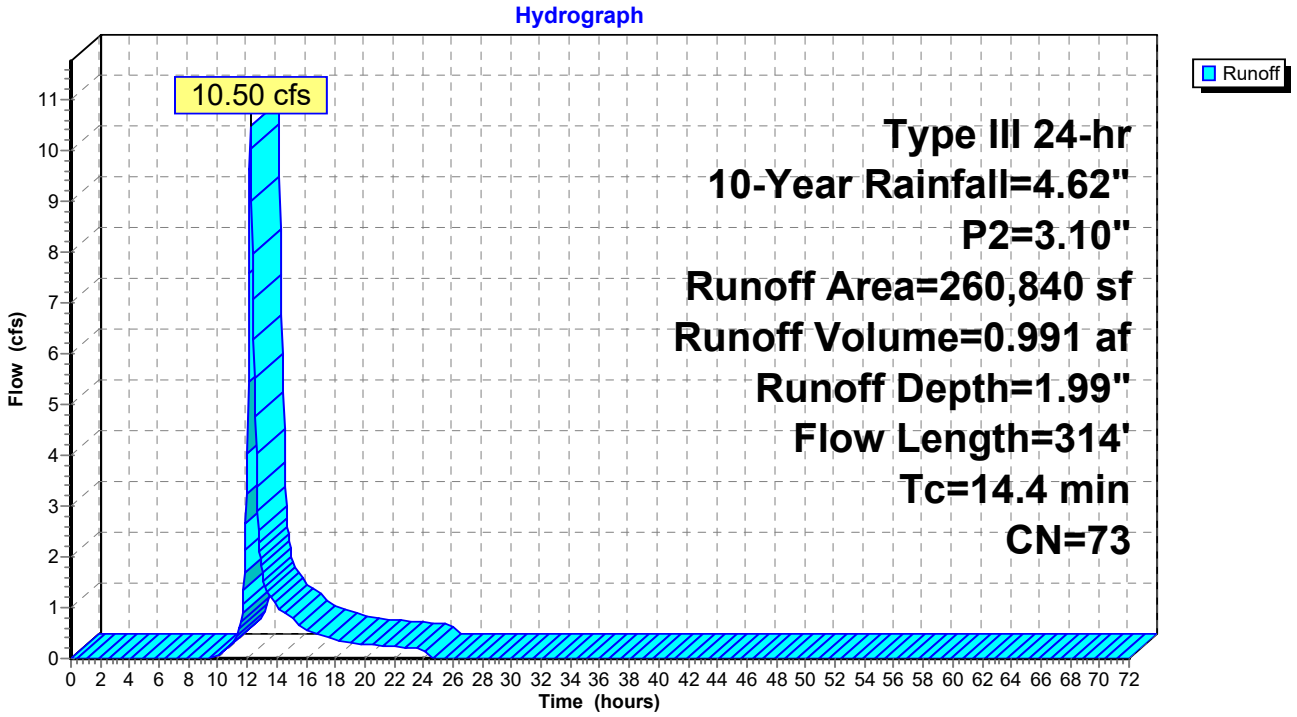
Runoff = 10.50 cfs @ 12.21 hrs, Volume= 0.991 af, Depth= 1.99"
Routed to Link DP5 : To Ex Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.62", P2=3.10"

Area (sf)	CN	Description
20,963	30	Woods, Good, HSG A
56,497	39	>75% Grass cover, Good, HSG A
37,489	54	1/2 acre lots, 25% imp, HSG A
10,331	98	Unconnected pavement, HSG A
135,515	98	Paved parking, HSG A
44	72	Dirt roads, HSG A
260,840	73	Weighted Average
105,622		40.49% Pervious Area
155,218		59.51% Impervious Area
10,331		6.66% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	32	0.0100	0.05		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
1.6	18	0.1700	0.19		**Sheet Flow, B-C** Grass: Dense n= 0.240 P2= 3.10"
0.2	22	0.0600	1.71		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.9	182	0.0300	3.52		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
0.1	60	0.0600	12.89	15.82	**Pipe Channel, E-F** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
14.4	314	Total			

Subcatchment E-6: Subcat E-6



Summary for Subcatchment E-7: Subcat E-7

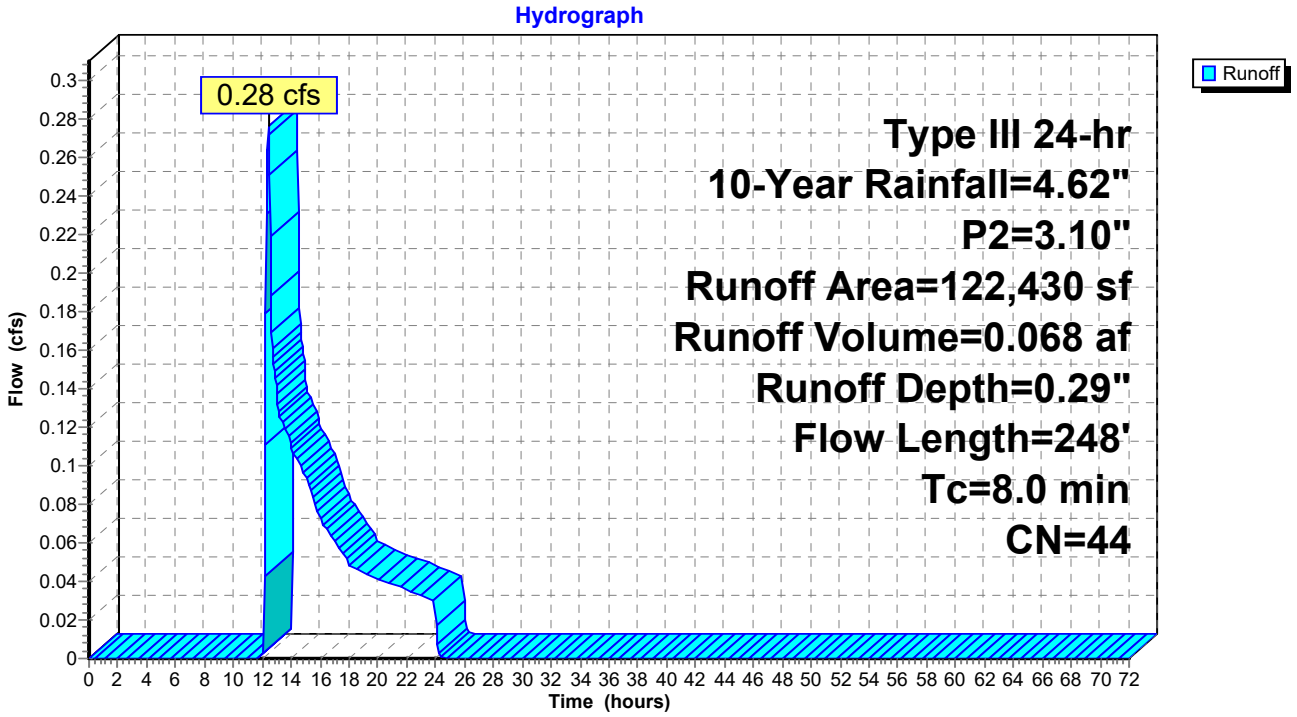
Runoff = 0.28 cfs @ 12.41 hrs, Volume= 0.068 af, Depth= 0.29"
Routed to Link DP5 : To Ex Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.62", P2=3.10"

Area (sf)	CN	Description
63,907	30	Woods, Good, HSG A
5,285	39	>75% Grass cover, Good, HSG A
41,116	54	1/2 acre lots, 25% imp, HSG A
1,088	98	Unconnected pavement, HSG A
5,286	98	Roofs, HSG A
5,740	72	Dirt roads, HSG A
8	98	Paved parking, HSG A
122,430	44	Weighted Average
105,770		86.39% Pervious Area
16,661		13.61% Impervious Area
1,088		6.53% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
0.9	72	0.0400	1.40		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.8	126	0.2500	2.50		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
8.0	248	Total			

Subcatchment E-7: Subcat E-7



Summary for Subcatchment E-8: Subcat E-8

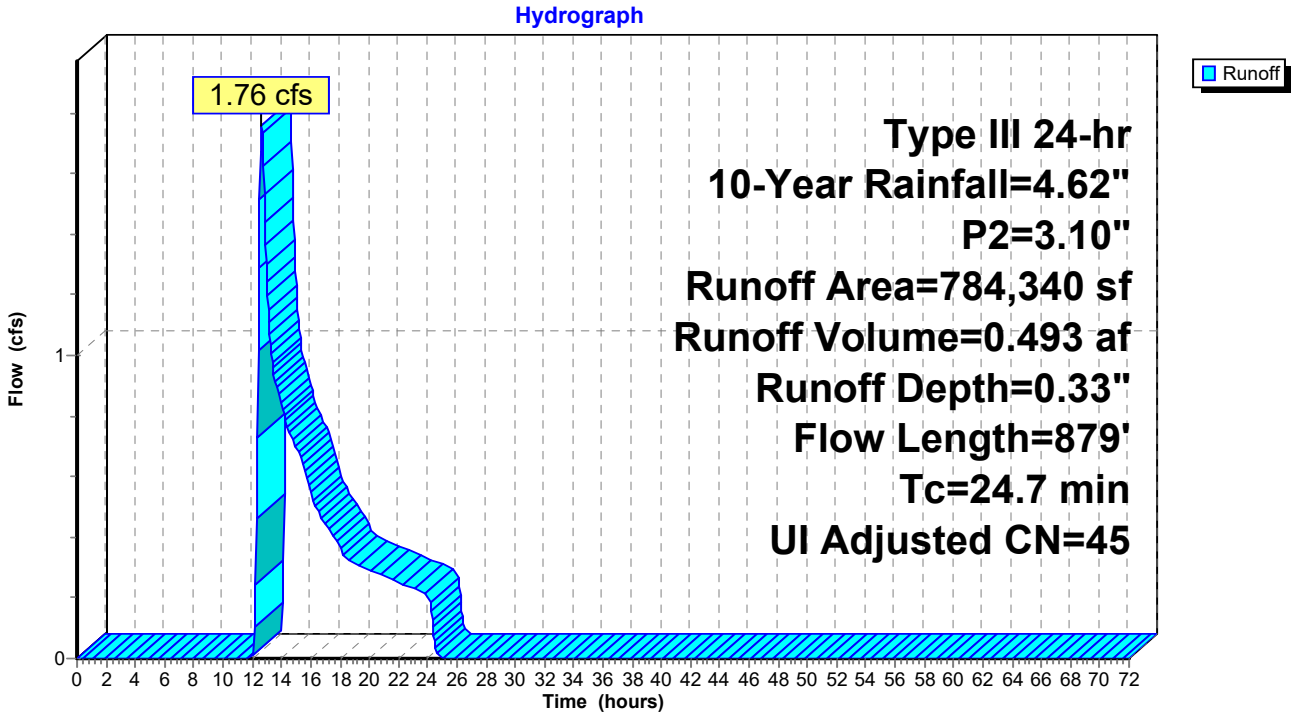
Runoff = 1.76 cfs @ 12.63 hrs, Volume= 0.493 af, Depth= 0.33"
Routed to Pond 2P : DP6 - Ex Inf Basin Club

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.62", P2=3.10"

Area (sf)	CN	Adj	Description
322,022	30		Woods, Good, HSG A
206,044	39		>75% Grass cover, Good, HSG A
103,904	54		1/2 acre lots, 25% imp, HSG A
19,026	72		Dirt roads, HSG A
69,702	98		Unconnected pavement, HSG A
63,642	98		Roofs, HSG A
784,340	48	45	Weighted Average, UI Adjusted
625,021			79.69% Pervious Area
159,319			20.31% Impervious Area
69,702			43.75% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
1.2	83	0.0570	1.19		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
6.9	354	0.0150	0.86		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
4.1	392	0.1000	1.58		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
24.7	879	Total			

Subcatchment E-8: Subcat E-8



Summary for Subcatchment E-9: Subcat E-9

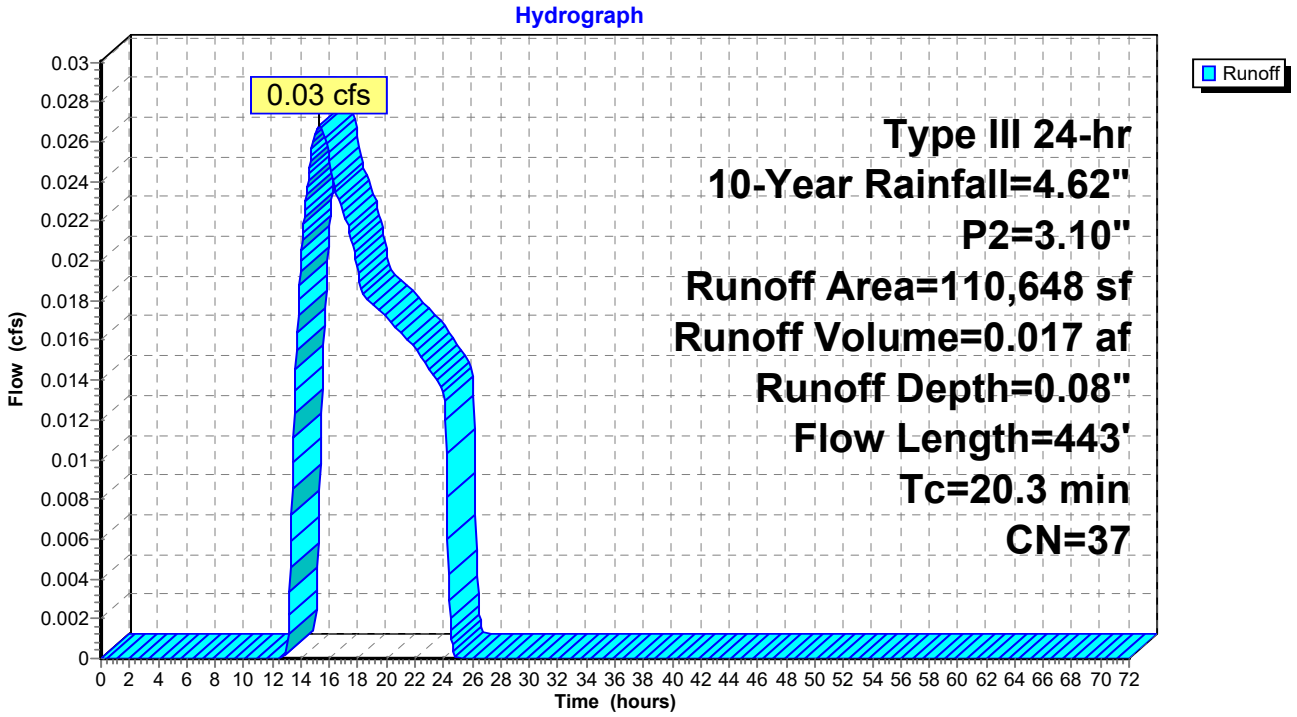
Runoff = 0.03 cfs @ 15.31 hrs, Volume= 0.017 af, Depth= 0.08"
Routed to Pond 1P : DP7 - Existing Depression 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.62", P2=3.10"

Area (sf)	CN	Description
84,652	30	Woods, Good, HSG A
13	39	>75% Grass cover, Good, HSG A
21,381	54	1/2 acre lots, 25% imp, HSG A
621	98	Roofs, HSG A
3,980	72	Dirt roads, HSG A
110,648	37	Weighted Average
104,681		94.61% Pervious Area
5,967		5.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	50	0.0125	0.06		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
3.3	149	0.0226	0.75		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.9	244	0.1800	2.12		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
20.3	443	Total			

Subcatchment E-9: Subcat E-9



Summary for Pond 1P: DP7 - Existing Depression 2

Inflow Area = 2.540 ac, 5.39% Impervious, Inflow Depth = 0.08" for 10-Year event
Inflow = 0.03 cfs @ 15.31 hrs, Volume= 0.017 af
Outflow = 0.02 cfs @ 16.15 hrs, Volume= 0.017 af, Atten= 9%, Lag= 50.6 min
Discarded = 0.02 cfs @ 16.15 hrs, Volume= 0.017 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 163.12' @ 16.15 hrs Surf.Area= 436 sf Storage= 46 cf

Plug-Flow detention time= 28.1 min calculated for 0.017 af (100% of inflow)
Center-of-Mass det. time= 27.9 min (1,126.1 - 1,098.2)

Volume	Invert	Avail.Storage	Storage Description
#1	163.00'	93,839 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

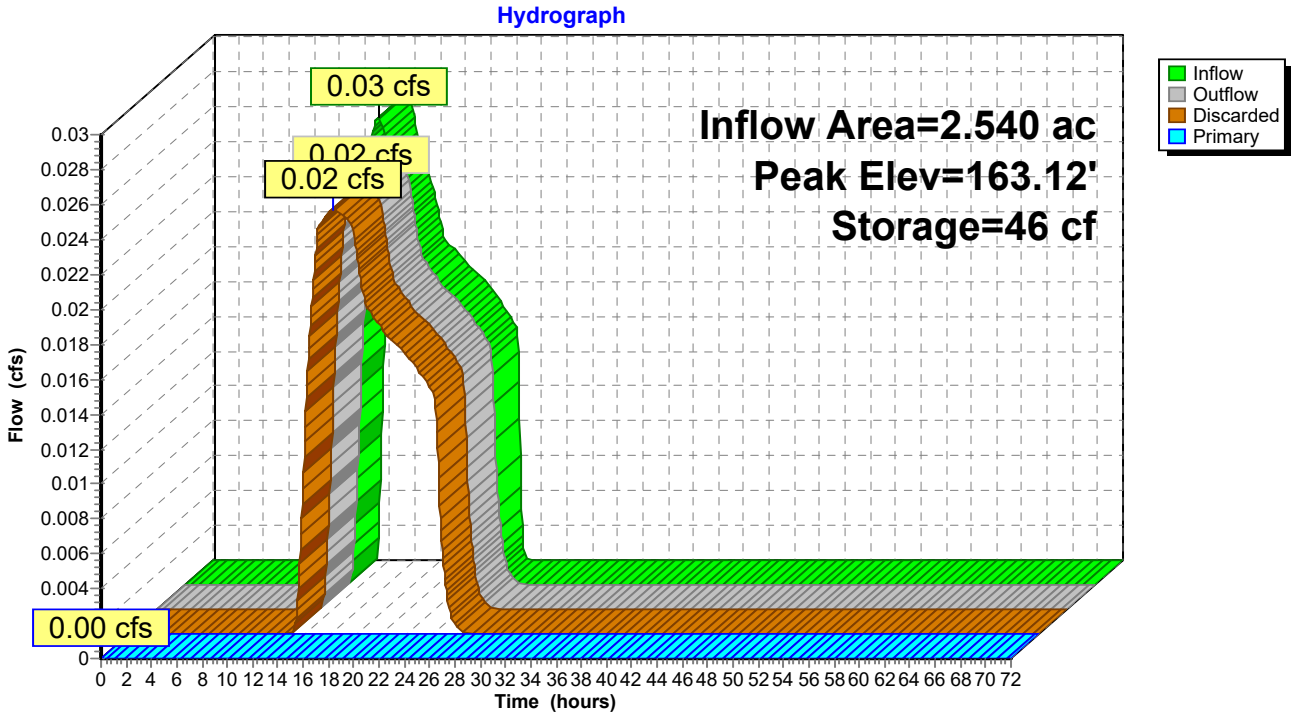
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
163.00	333	75.0	0	0	333
164.00	1,602	160.0	888	888	1,927
165.00	2,975	219.0	2,253	3,142	3,716
166.00	4,470	279.0	3,697	6,839	6,107
167.00	6,302	338.0	5,360	12,199	9,020
168.00	8,505	396.0	7,376	19,575	12,428
169.00	10,882	448.0	9,669	29,244	15,946
170.00	13,282	490.0	12,062	41,306	19,116
171.00	15,858	534.0	14,551	55,857	22,738
172.00	18,847	583.0	17,331	73,188	27,129
173.00	22,508	622.0	20,650	93,839	30,917

Device	Routing	Invert	Outlet Devices
#1	Primary	172.90'	**10.0' long x 50.0' 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
#2	Discarded	163.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.02 cfs @ 16.15 hrs HW=163.12' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=163.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: DP7 - Existing Depression 2



Summary for Pond 2P: DP6 - Ex Inf Basin Club

Inflow Area = 18.006 ac, 20.31% Impervious, Inflow Depth = 0.33" for 10-Year event
Inflow = 1.76 cfs @ 12.63 hrs, Volume= 0.493 af
Outflow = 0.28 cfs @ 20.53 hrs, Volume= 0.493 af, Atten= 84%, Lag= 474.2 min
Discarded = 0.28 cfs @ 20.53 hrs, Volume= 0.493 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 162.48' @ 20.53 hrs Surf.Area= 5,019 sf Storage= 10,845 cf

Plug-Flow detention time= 496.9 min calculated for 0.493 af (100% of inflow)
Center-of-Mass det. time= 496.6 min (1,476.8 - 980.2)

Volume	Invert	Avail.Storage	Storage Description
#1	159.00'	100,011 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

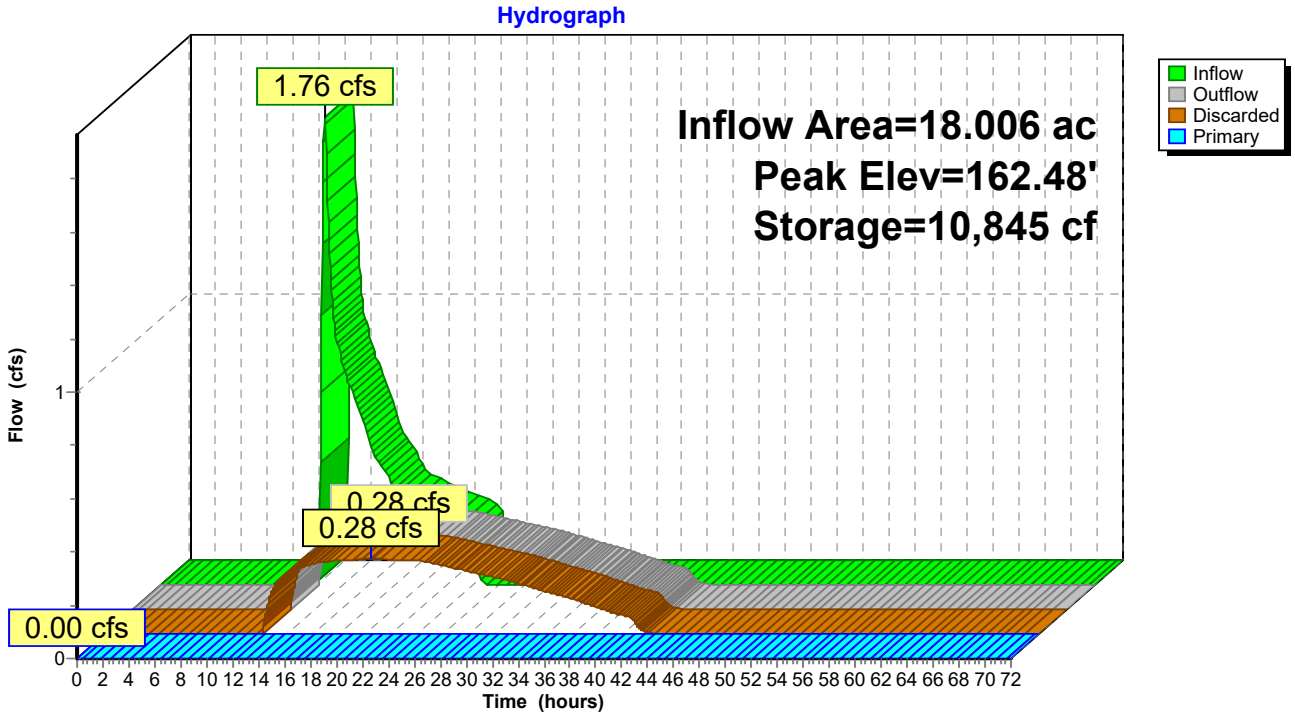
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
159.00	934	176.0	0	0	934
160.00	2,320	278.0	1,575	1,575	4,626
161.00	3,563	292.0	2,919	4,495	5,322
162.00	4,546	305.0	4,045	8,539	6,008
163.00	5,553	339.0	5,041	13,580	7,780
164.00	6,677	374.0	6,106	19,687	9,798
165.00	8,367	426.0	7,506	27,193	13,132
166.00	12,063	523.0	10,159	37,352	20,473
167.00	17,347	642.0	14,625	51,977	31,520
168.00	23,464	806.0	20,329	72,306	50,432
169.00	32,175	988.0	27,705	100,011	76,430

Device	Routing	Invert	Outlet Devices
#1	Primary	167.99'	**10.0' long x 50.0' 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
#2	Discarded	159.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.28 cfs @ 20.53 hrs HW=162.48' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.28 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=159.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: DP6 - Ex Inf Basin Club



Summary for Pond 3P: Drainage Basin/Easement

Inflow Area = 8.799 ac, 44.85% Impervious, Inflow Depth = 1.44" for 10-Year event
Inflow = 10.63 cfs @ 12.21 hrs, Volume= 1.059 af
Outflow = 0.51 cfs @ 16.99 hrs, Volume= 1.059 af, Atten= 95%, Lag= 287.0 min
Discarded = 0.51 cfs @ 16.99 hrs, Volume= 1.059 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 179.25' @ 16.99 hrs Surf.Area= 9,194 sf Storage= 28,655 cf

Plug-Flow detention time= 684.6 min calculated for 1.059 af (100% of inflow)
Center-of-Mass det. time= 685.1 min (1,544.8 - 859.7)

Volume	Invert	Avail.Storage	Storage Description
#1	174.00'	345,539 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

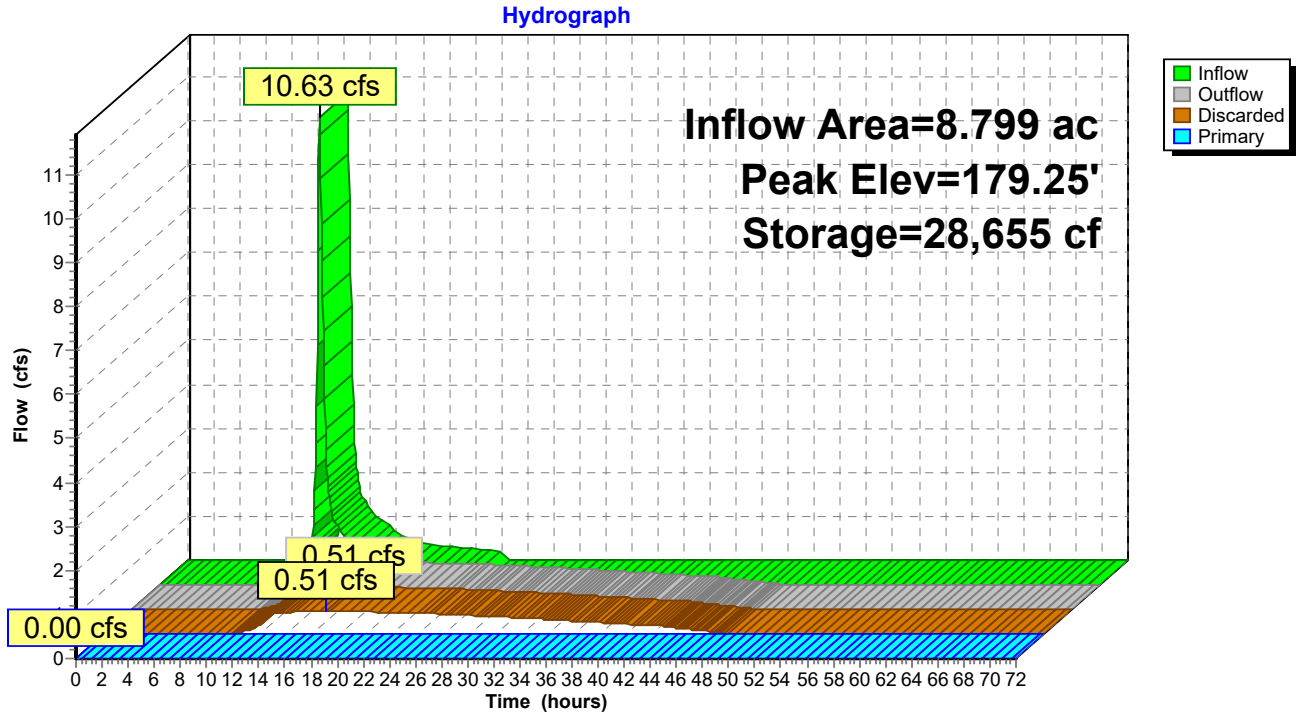
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
174.00	491	104.0	0	0	491
175.00	3,251	224.0	1,668	1,668	3,627
176.00	4,753	273.0	3,978	5,647	5,581
177.00	6,309	310.0	5,513	11,159	7,322
178.00	7,641	346.0	6,964	18,124	9,230
179.00	8,869	377.0	8,247	26,371	11,050
180.00	10,188	402.0	9,521	35,892	12,648
181.00	11,953	430.0	11,059	46,951	14,548
182.00	14,143	463.0	13,033	59,983	16,935
183.00	16,525	499.0	15,319	75,302	19,733
184.00	19,118	519.0	17,806	93,108	21,431
185.00	21,426	604.0	20,261	113,369	29,048
186.00	23,221	589.0	22,317	135,686	30,592
187.00	24,868	608.0	24,040	159,726	32,498
188.00	26,530	627.0	25,695	185,421	34,465
189.00	28,209	646.0	27,365	212,786	36,492
190.00	30,172	674.0	29,185	241,971	39,506
191.00	32,732	704.0	31,443	273,414	42,867
192.00	36,071	766.0	34,388	307,802	50,157
193.00	39,428	897.0	37,737	345,539	67,513

Device	Routing	Invert	Outlet Devices
#1	Primary	192.90'	**10.0' long x 50.0' 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
#2	Discarded	174.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.51 cfs @ 16.99 hrs HW=179.25' (Free Discharge)
↑**2=Exfiltration** (Exfiltration Controls 0.51 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=174.00' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Drainage Basin/Easement



Summary for Pond 4P: DP3 - Existing Depression 1

Inflow Area = 0.901 ac, 0.00% Impervious, Inflow Depth = 0.01" for 10-Year event
Inflow = 0.00 cfs @ 23.59 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 23.79 hrs, Volume= 0.000 af, Atten= 0%, Lag= 11.8 min
Discarded = 0.00 cfs @ 23.79 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to nonexistent node SP4

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 193.02' @ 23.79 hrs Surf.Area= 37 sf Storage= 1 cf

Plug-Flow detention time= 12.2 min calculated for 0.000 af (100% of inflow)
Center-of-Mass det. time= 12.1 min (1,313.9 - 1,301.8)

Volume	Invert	Avail.Storage	Storage Description
#1	193.00'	17,265 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

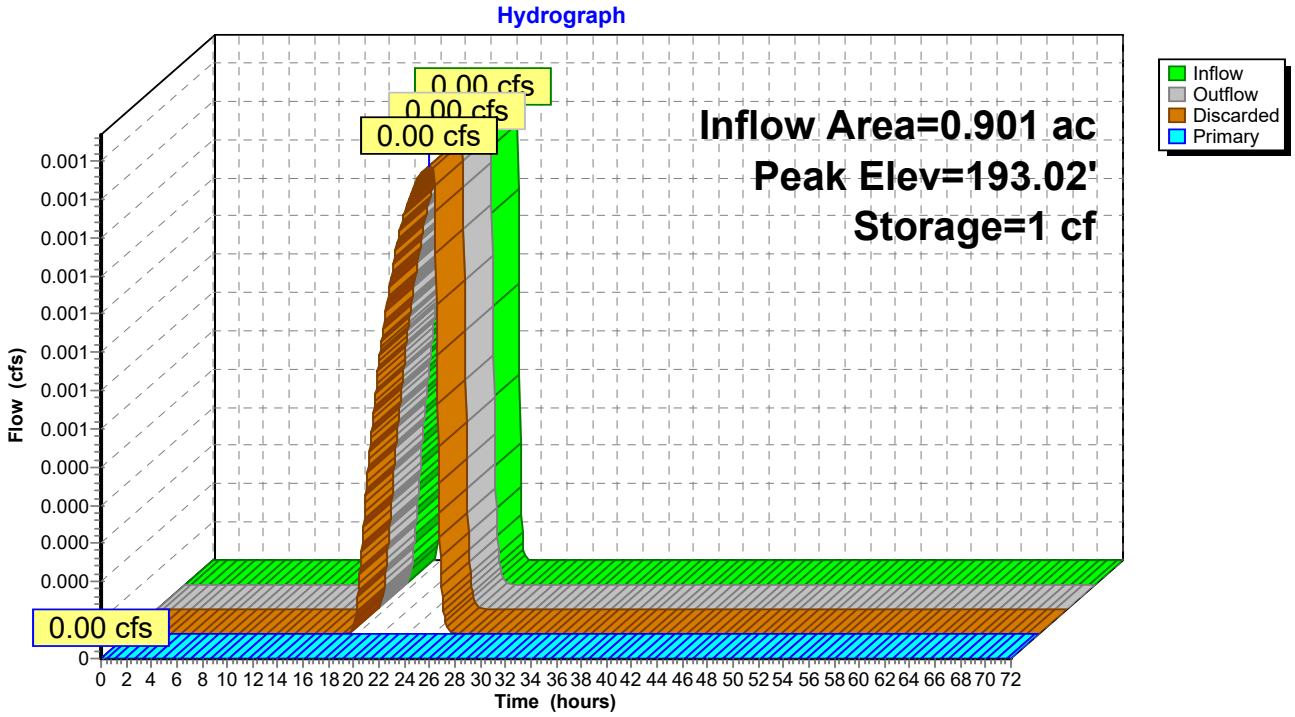
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
193.00	30	100.0	0	0	30
194.00	1,087	159.0	433	433	1,253
195.00	2,356	217.0	1,681	2,114	2,998
196.00	3,959	276.0	3,123	5,237	5,326
197.00	5,956	339.0	4,924	10,160	8,425
198.00	8,319	398.0	7,105	17,265	11,905

Device	Routing	Invert	Outlet Devices
#1	Primary	197.90'	**10.0' long x 20.0' 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
#2	Discarded	193.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 23.79 hrs HW=193.02' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=193.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 4P: DP3 - Existing Depression 1

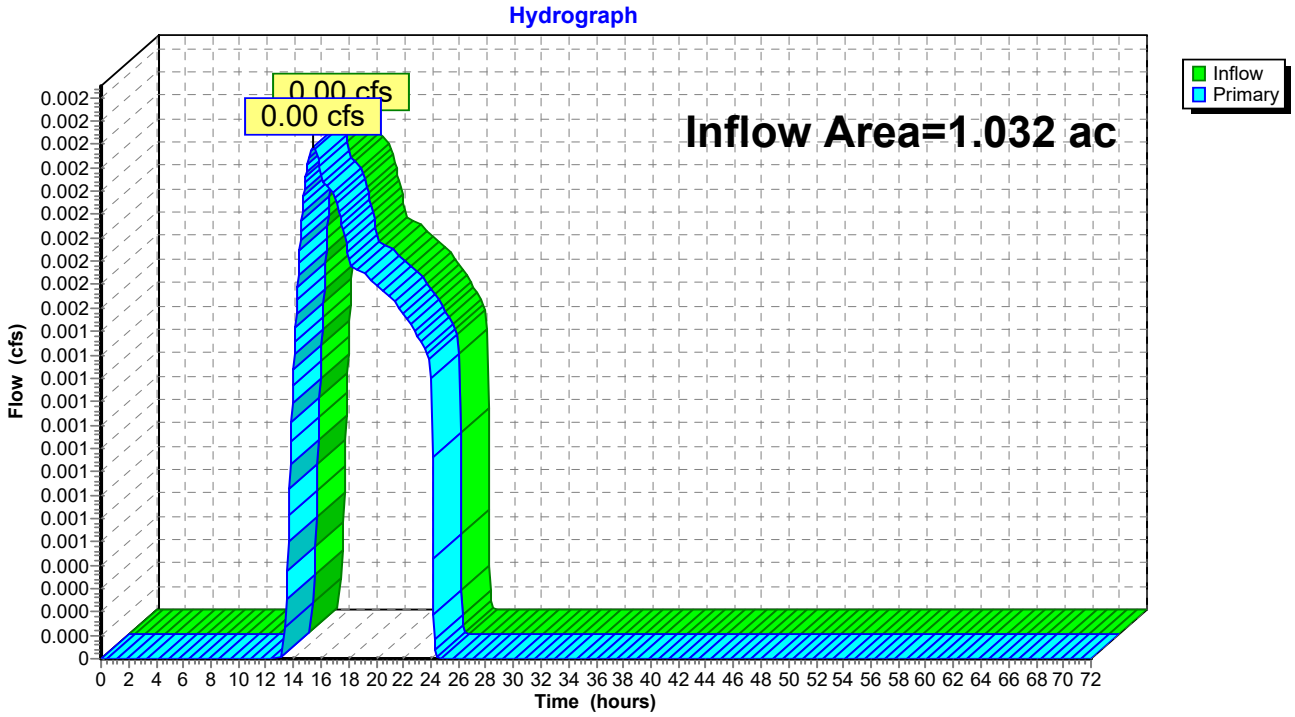


Summary for Link DP1: N'ly Property Line

Inflow Area = 1.032 ac, 0.21% Impervious, Inflow Depth = 0.02" for 10-Year event
Inflow = 0.00 cfs @ 15.46 hrs, Volume= 0.001 af
Primary = 0.00 cfs @ 15.46 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP1: N'ly Property Line

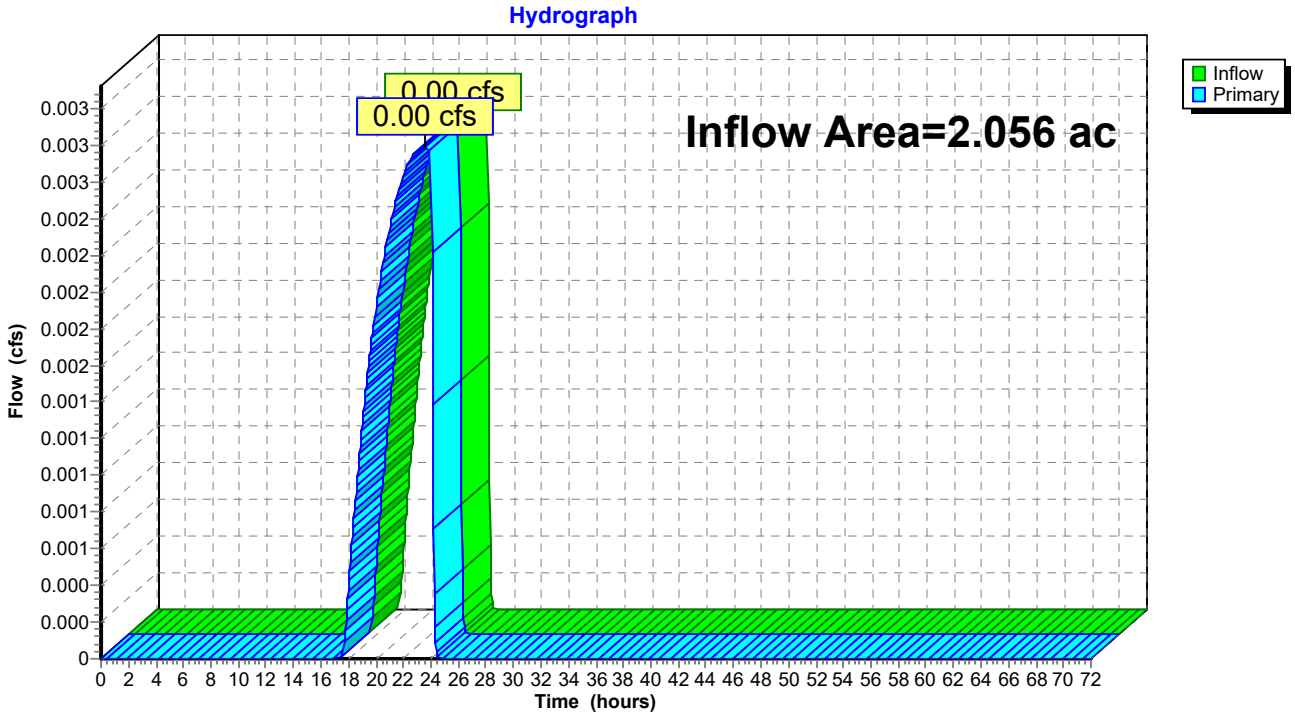


Summary for Link DP2: E'ly Property Line

Inflow Area = 2.056 ac, 1.52% Impervious, Inflow Depth = 0.01" for 10-Year event
Inflow = 0.00 cfs @ 23.49 hrs, Volume= 0.001 af
Primary = 0.00 cfs @ 23.49 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP2: E'ly Property Line

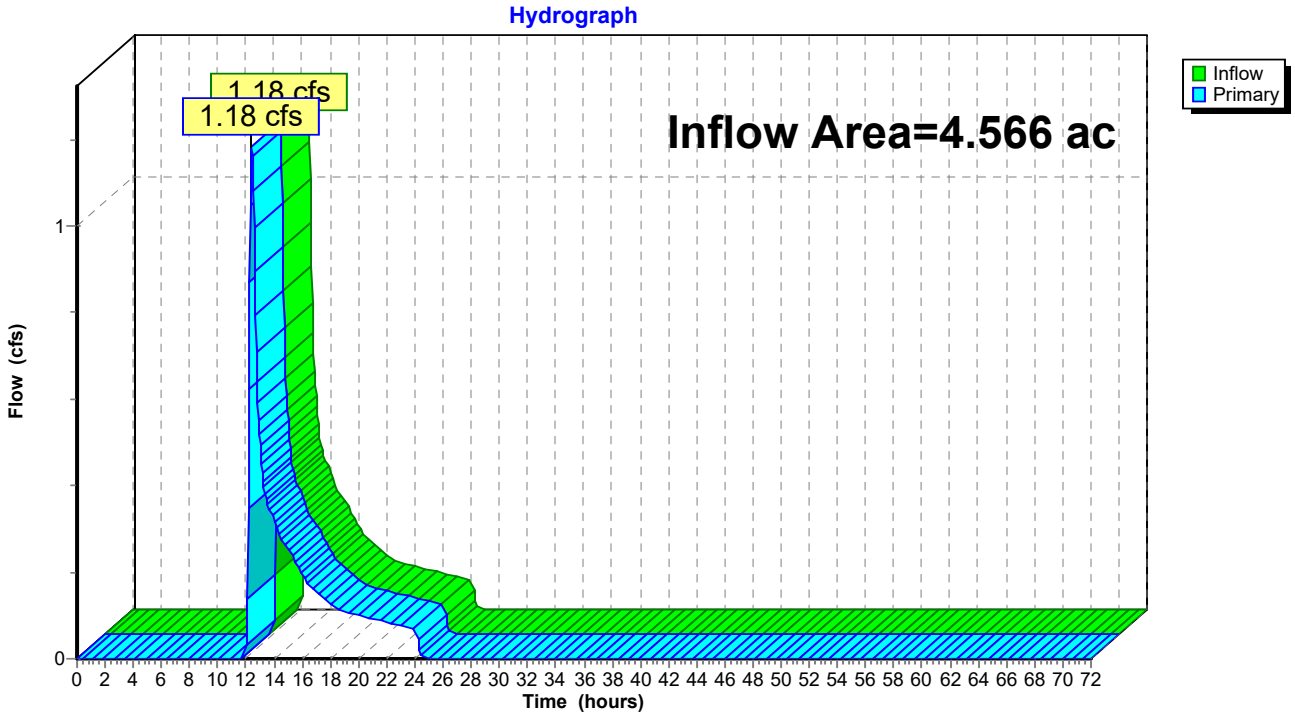


Summary for Link DP4: S'ly Property Line

Inflow Area = 4.566 ac, 26.41% Impervious, Inflow Depth = 0.54" for 10-Year event
Inflow = 1.18 cfs @ 12.42 hrs, Volume= 0.207 af
Primary = 1.18 cfs @ 12.42 hrs, Volume= 0.207 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP4: S'ly Property Line

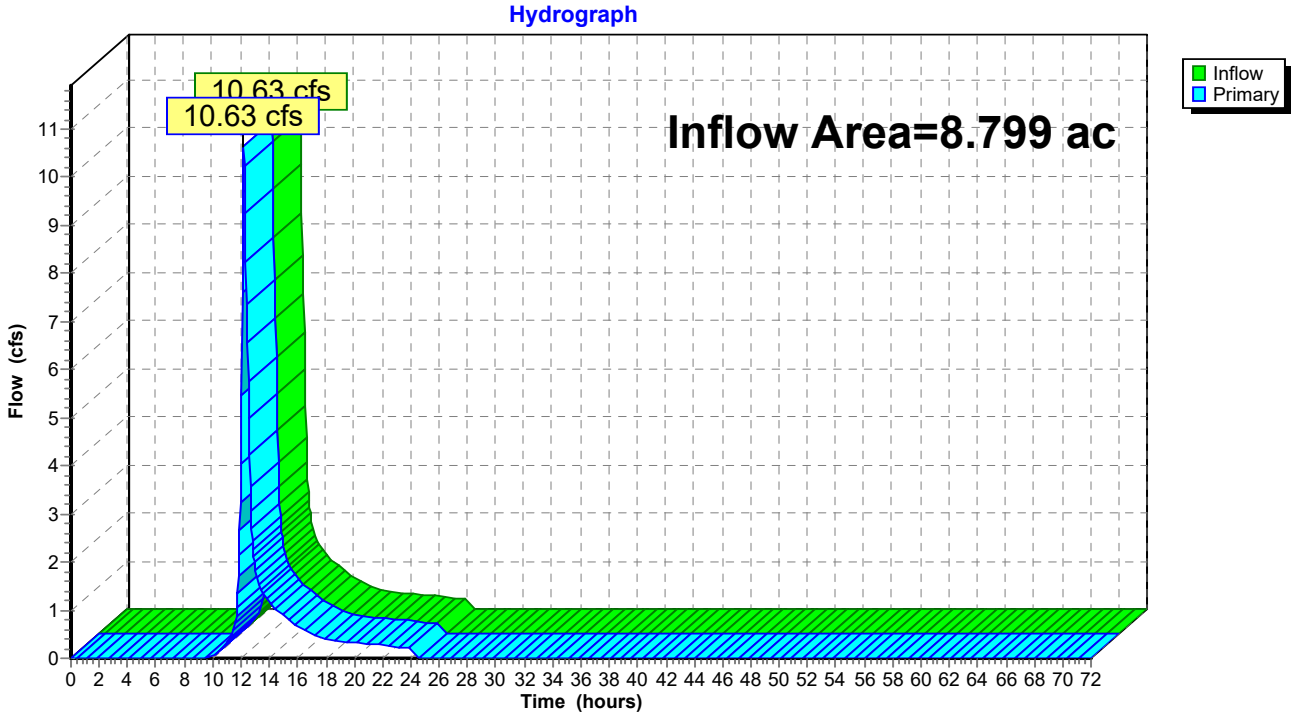


Summary for Link DP5: To Ex Basin

Inflow Area = 8.799 ac, 44.85% Impervious, Inflow Depth = 1.44" for 10-Year event
Inflow = 10.63 cfs @ 12.21 hrs, Volume= 1.059 af
Primary = 10.63 cfs @ 12.21 hrs, Volume= 1.059 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 3P : Drainage Basin/Easement

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP5: To Ex Basin



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Subcat E-1 Runoff Area=12,581 sf 0.00% Impervious Runoff Depth=0.25"
Flow Length=188' Tc=8.8 min CN=36 Runoff=0.01 cfs 0.006 af

Subcatchment E-2: Subcat E-2 Runoff Area=32,388 sf 0.29% Impervious Runoff Depth=0.05"
Flow Length=230' Tc=7.5 min CN=30 Runoff=0.00 cfs 0.003 af

Subcatchment E-3: Subcat E-3 Runoff Area=89,563 sf 1.52% Impervious Runoff Depth=0.11"
Flow Length=341' Tc=10.6 min CN=32 Runoff=0.03 cfs 0.018 af

Subcatchment E-4: Subcat E-4 Runoff Area=39,239 sf 0.00% Impervious Runoff Depth=0.11"
Flow Length=214' Tc=15.8 min CN=32 Runoff=0.01 cfs 0.008 af

Subcatchment E-5: Subcat E-5 Runoff Area=198,881 sf 26.41% Impervious Runoff Depth=1.05"
Flow Length=270' Tc=18.4 min UI Adjusted CN=50 Runoff=2.97 cfs 0.398 af

Subcatchment E-6: Subcat E-6 Runoff Area=260,840 sf 59.51% Impervious Runoff Depth=2.92"
Flow Length=314' Tc=14.4 min CN=73 Runoff=15.65 cfs 1.459 af

Subcatchment E-7: Subcat E-7 Runoff Area=122,430 sf 13.61% Impervious Runoff Depth=0.66"
Flow Length=248' Tc=8.0 min CN=44 Runoff=1.01 cfs 0.155 af

Subcatchment E-8: Subcat E-8 Runoff Area=784,340 sf 20.31% Impervious Runoff Depth=0.72"
Flow Length=879' Tc=24.7 min UI Adjusted CN=45 Runoff=5.90 cfs 1.085 af

Subcatchment E-9: Subcat E-9 Runoff Area=110,648 sf 5.39% Impervious Runoff Depth=0.30"
Flow Length=443' Tc=20.3 min CN=37 Runoff=0.16 cfs 0.062 af

Pond 1P: DP7 - Existing Depression 2 Peak Elev=163.82' Storage=632 cf Inflow=0.16 cfs 0.062 af
Discarded=0.07 cfs 0.062 af Primary=0.00 cfs 0.000 af Outflow=0.07 cfs 0.062 af

Pond 2P: DP6 - Ex Inf Basin Club Peak Elev=165.17' Storage=28,682 cf Inflow=5.90 cfs 1.085 af
Discarded=0.50 cfs 1.085 af Primary=0.00 cfs 0.000 af Outflow=0.50 cfs 1.085 af

Pond 3P: Drainage Basin/Easement Peak Elev=180.97' Storage=46,540 cf Inflow=16.66 cfs 1.614 af
Discarded=0.66 cfs 1.614 af Primary=0.00 cfs 0.000 af Outflow=0.66 cfs 1.614 af

Pond 4P: DP3 - Existing Depression 1 Peak Elev=193.31' Storage=31 cf Inflow=0.01 cfs 0.008 af
Discarded=0.01 cfs 0.008 af Primary=0.00 cfs 0.000 af Outflow=0.01 cfs 0.008 af

Link DP1: N'ly Property Line Inflow=0.01 cfs 0.009 af
Primary=0.01 cfs 0.009 af

Link DP2: E'ly Property Line Inflow=0.03 cfs 0.018 af
Primary=0.03 cfs 0.018 af

Link DP4: S'ly Property Line Inflow=2.97 cfs 0.398 af
Primary=2.97 cfs 0.398 af

Link DP5: To Ex Basin

Inflow=16.66 cfs 1.614 af
Primary=16.66 cfs 1.614 af

Total Runoff Area = 37.900 ac Runoff Volume = 3.195 af Average Runoff Depth = 1.01"
76.31% Pervious = 28.920 ac 23.69% Impervious = 8.979 ac

Summary for Subcatchment E-1: Subcat E-1

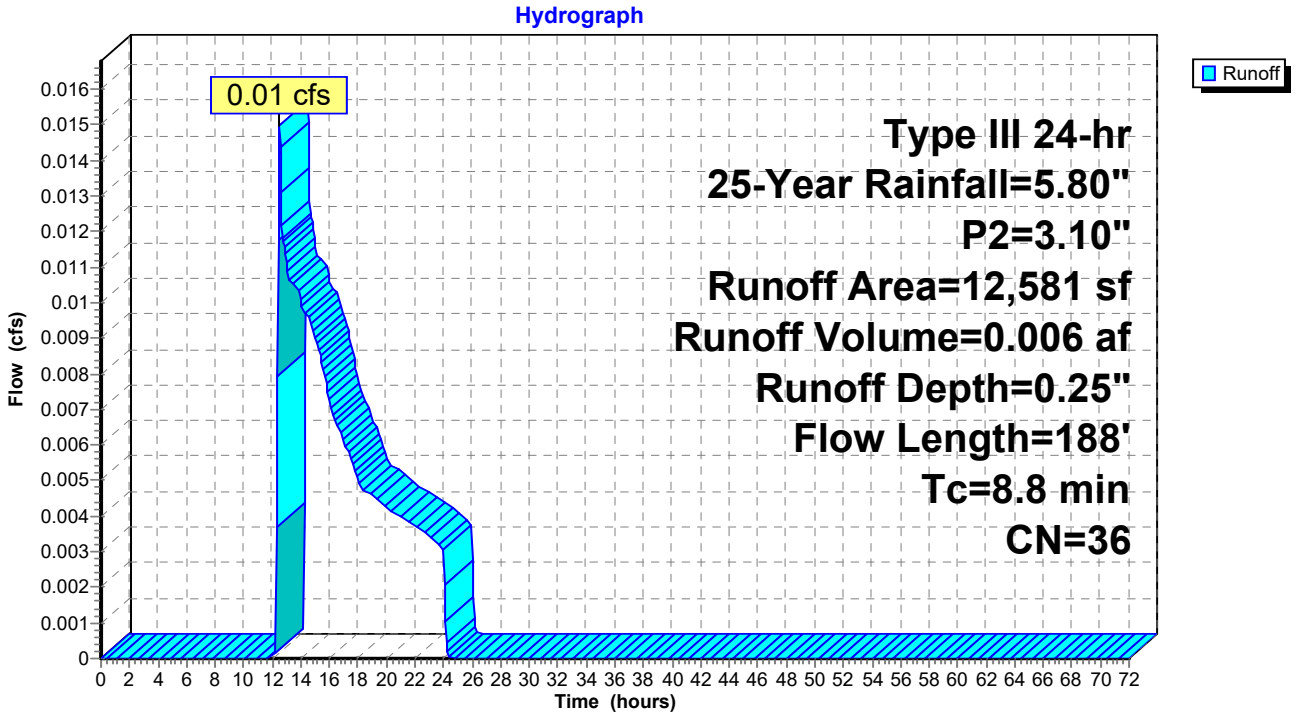
Runoff = 0.01 cfs @ 12.50 hrs, Volume= 0.006 af, Depth= 0.25"
Routed to Link DP1 : N'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.80", P2=3.10"

Area (sf)	CN	Description
10,635	30	Woods, Good, HSG A
1,947	72	Dirt roads, HSG A
12,581	36	Weighted Average
12,581		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	50	0.0900	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.7	55	0.2540	1.26		**Shallow Concentrated Flow, B-C** Forest w/Heavy Litter Kv= 2.5 fps
0.1	15	0.0660	2.57		**Shallow Concentrated Flow, C-D** Nearly Bare & Untilled Kv= 10.0 fps
0.3	18	0.1380	0.93		**Shallow Concentrated Flow, D-E** Forest w/Heavy Litter Kv= 2.5 fps
0.1	14	0.0570	2.39		**Shallow Concentrated Flow, E-F** Nearly Bare & Untilled Kv= 10.0 fps
0.7	36	0.1250	0.88		**Shallow Concentrated Flow, F-G** Forest w/Heavy Litter Kv= 2.5 fps
8.8	188	Total			

Subcatchment E-1: Subcat E-1



Summary for Subcatchment E-2: Subcat E-2

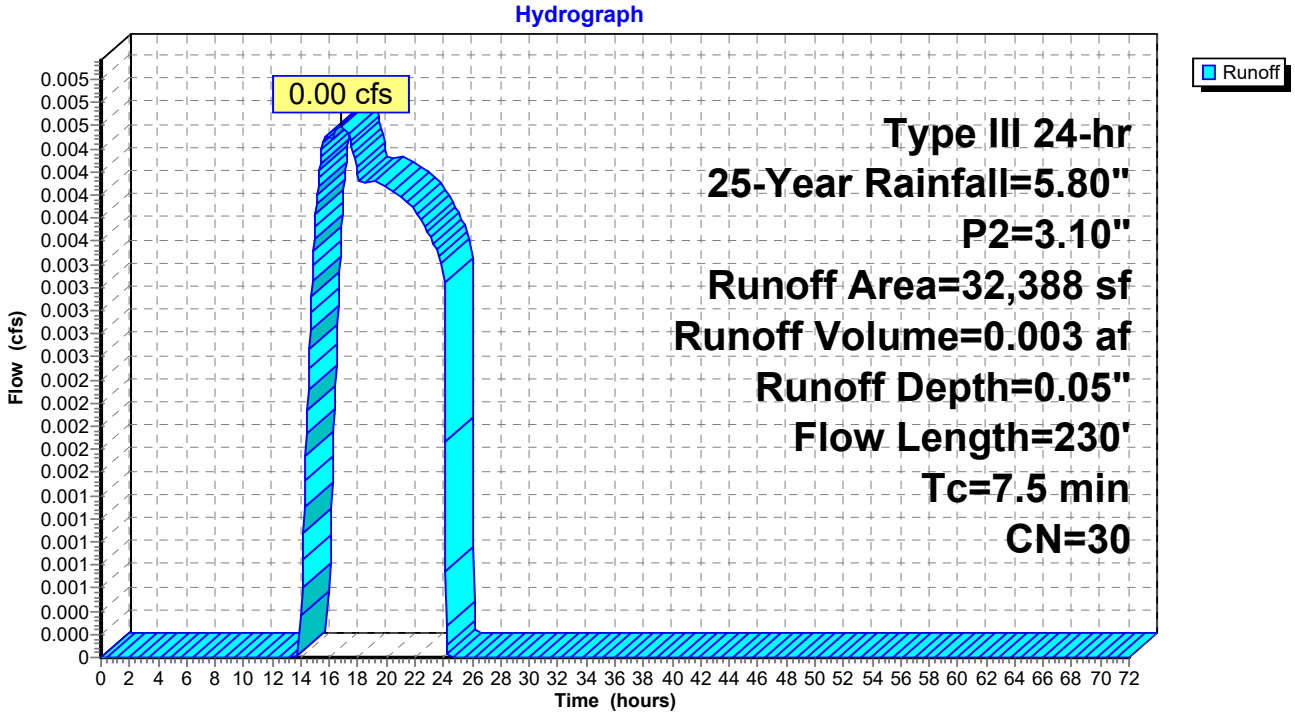
Runoff = 0.00 cfs @ 16.81 hrs, Volume= 0.003 af, Depth= 0.05"
Routed to Link DP1 : N'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.80", P2=3.10"

Area (sf)	CN	Description
95	98	Roofs, HSG A
32,293	30	Woods, Good, HSG A
32,388	30	Weighted Average
32,293		99.71% Pervious Area
95		0.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	50	0.1800	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.7	92	0.1950	2.21		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.6	88	0.0340	0.92		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
7.5	230	Total			

Subcatchment E-2: Subcat E-2



Summary for Subcatchment E-3: Subcat E-3

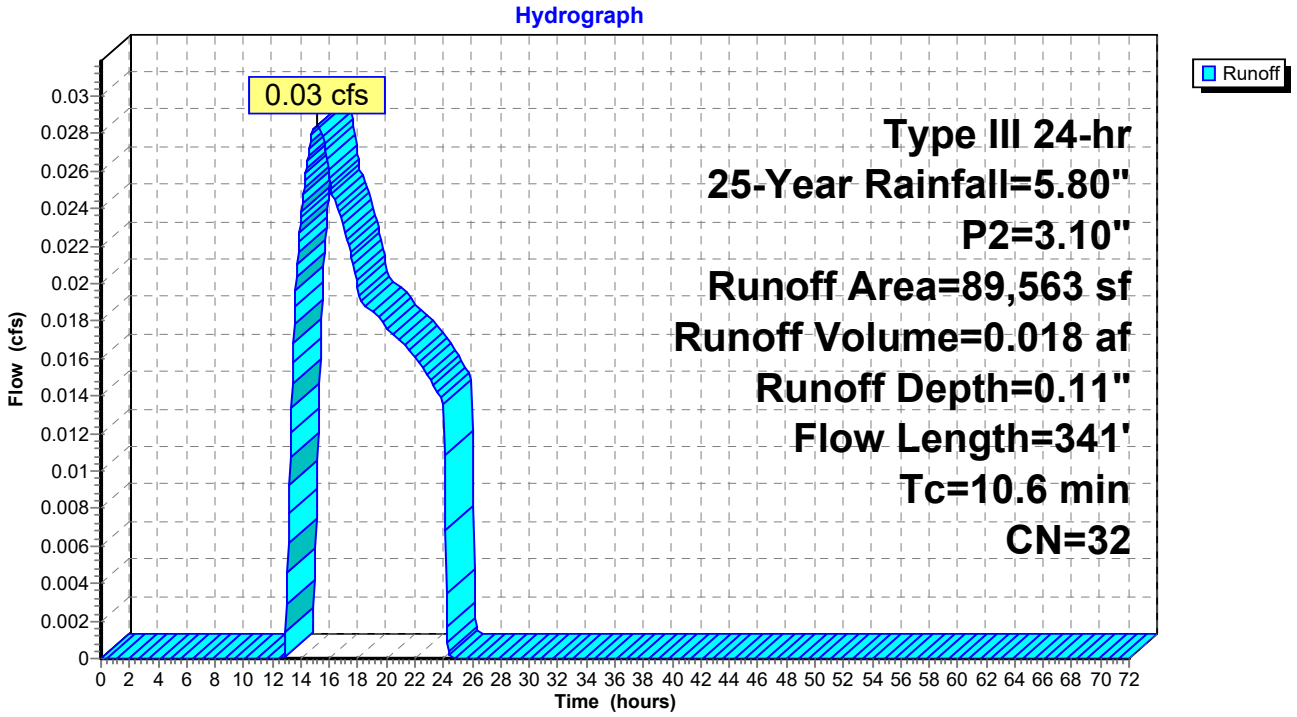
Runoff = 0.03 cfs @ 15.12 hrs, Volume= 0.018 af, Depth= 0.11"
Routed to Link DP2 : E'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.80", P2=3.10"

Area (sf)	CN	Description
85,130	30	Woods, Good, HSG A
1,365	98	Roofs, HSG A
3,068	72	Dirt roads, HSG A
89,563	32	Weighted Average
88,198		98.48% Pervious Area
1,365		1.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0800	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	74	0.2160	2.32		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.6	60	0.0250	1.58		**Shallow Concentrated Flow, C-D** Nearly Bare & Untilled Kv= 10.0 fps
2.3	157	0.0510	1.13		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
10.6	341	Total			

Subcatchment E-3: Subcat E-3



Summary for Subcatchment E-4: Subcat E-4

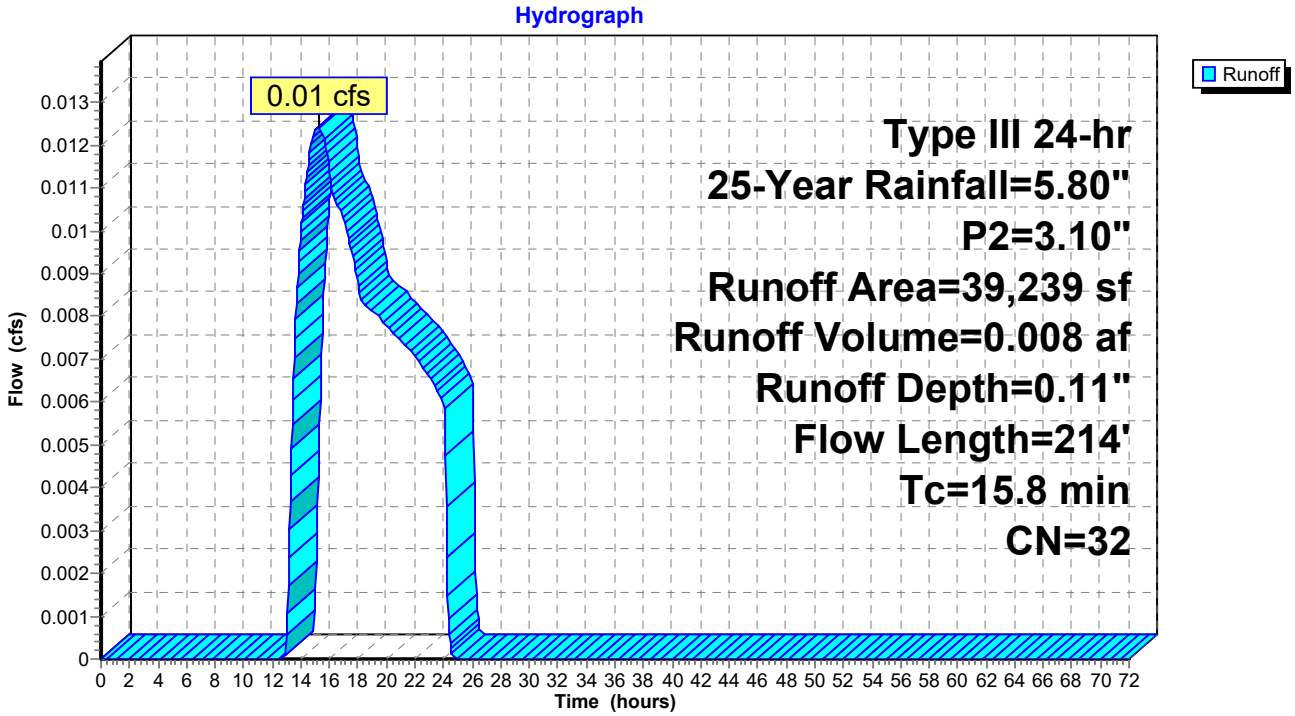
Runoff = 0.01 cfs @ 15.20 hrs, Volume= 0.008 af, Depth= 0.11"
Routed to Pond 4P : DP3 - Existing Depression 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.80", P2=3.10"

Area (sf)	CN	Description
37,500	30	Woods, Good, HSG A
1,739	72	Dirt roads, HSG A
39,239	32	Weighted Average
39,239		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	50	0.0300	0.08		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.7	29	0.0200	0.71		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.2	10	0.0100	1.00		**Shallow Concentrated Flow, C-D** Nearly Bare & Untilled Kv= 10.0 fps
4.2	125	0.0100	0.50		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
15.8	214	Total			

Subcatchment E-4: Subcat E-4



Summary for Subcatchment E-5: Subcat E-5

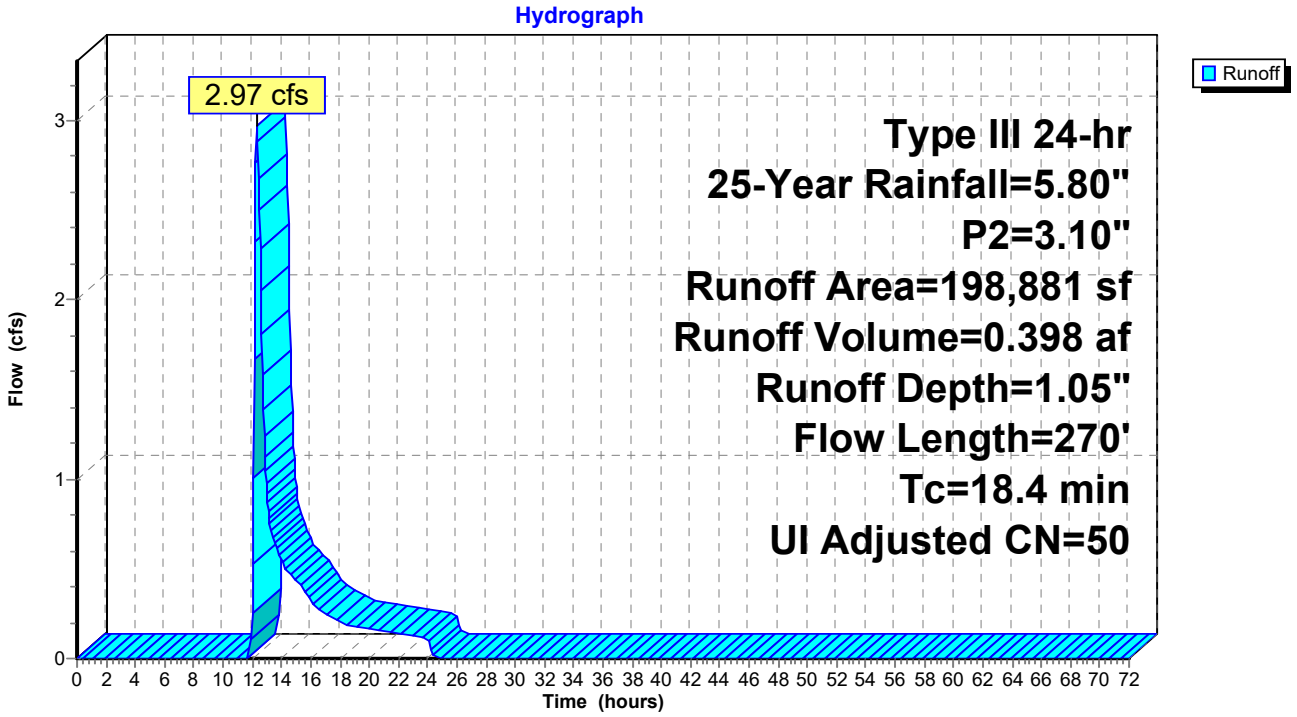
Runoff = 2.97 cfs @ 12.32 hrs, Volume= 0.398 af, Depth= 1.05"
Routed to Link DP4 : S'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.80", P2=3.10"

Area (sf)	CN	Adj	Description
99,401	30		Woods, Good, HSG A
33,545	39		>75% Grass cover, Good, HSG A
13,415	72		Dirt roads, HSG A
14,517	98		Unconnected pavement, HSG A
16,302	98		Paved parking, HSG A
21,702	98		Roofs, HSG A
198,881	52	50	Weighted Average, UI Adjusted
146,360			73.59% Pervious Area
52,521			26.41% Impervious Area
14,517			27.64% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
5.6	184	0.0120	0.55		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.3	36	0.0500	2.24		**Shallow Concentrated Flow, C-D** Nearly Bare & Untilled Kv= 10.0 fps
18.4	270	Total			

Subcatchment E-5: Subcat E-5



Summary for Subcatchment E-6: Subcat E-6

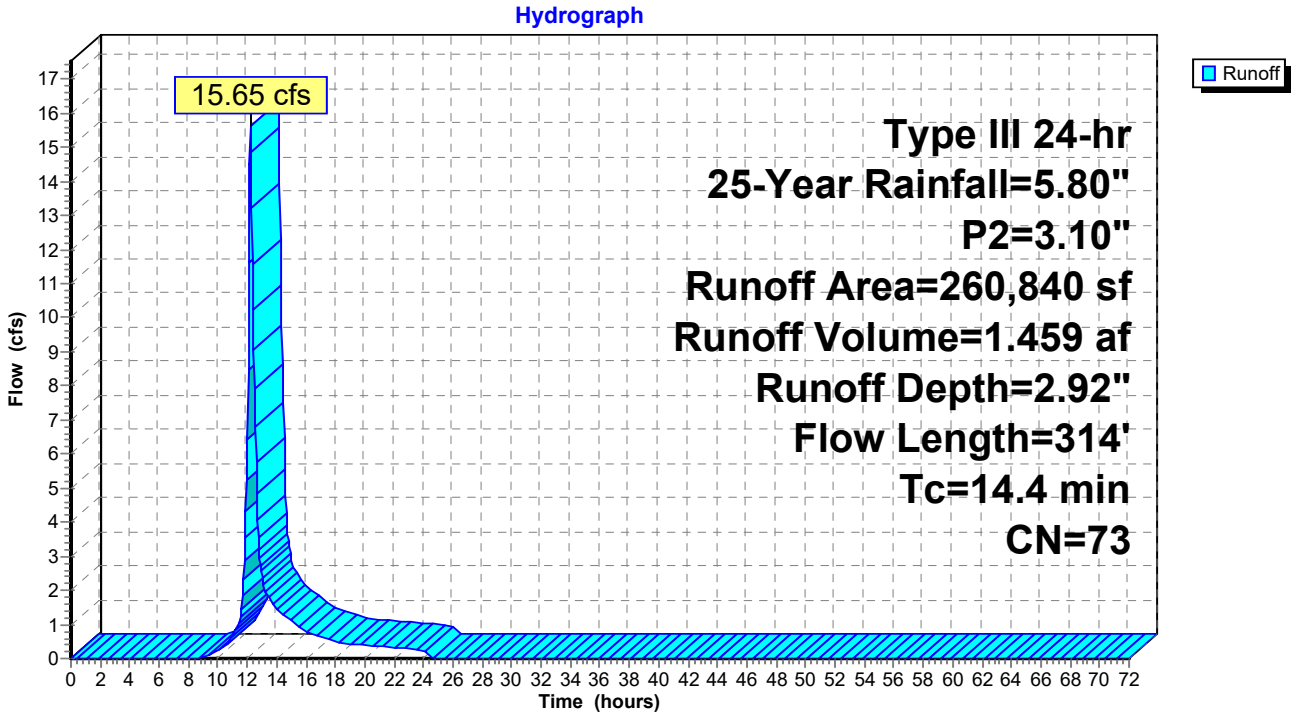
Runoff = 15.65 cfs @ 12.20 hrs, Volume= 1.459 af, Depth= 2.92"
Routed to Link DP5 : To Ex Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.80", P2=3.10"

Area (sf)	CN	Description
20,963	30	Woods, Good, HSG A
56,497	39	>75% Grass cover, Good, HSG A
37,489	54	1/2 acre lots, 25% imp, HSG A
10,331	98	Unconnected pavement, HSG A
135,515	98	Paved parking, HSG A
44	72	Dirt roads, HSG A
260,840	73	Weighted Average
105,622		40.49% Pervious Area
155,218		59.51% Impervious Area
10,331		6.66% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	32	0.0100	0.05		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
1.6	18	0.1700	0.19		**Sheet Flow, B-C** Grass: Dense n= 0.240 P2= 3.10"
0.2	22	0.0600	1.71		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.9	182	0.0300	3.52		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
0.1	60	0.0600	12.89	15.82	**Pipe Channel, E-F** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
14.4	314	Total			

Subcatchment E-6: Subcat E-6



Summary for Subcatchment E-7: Subcat E-7

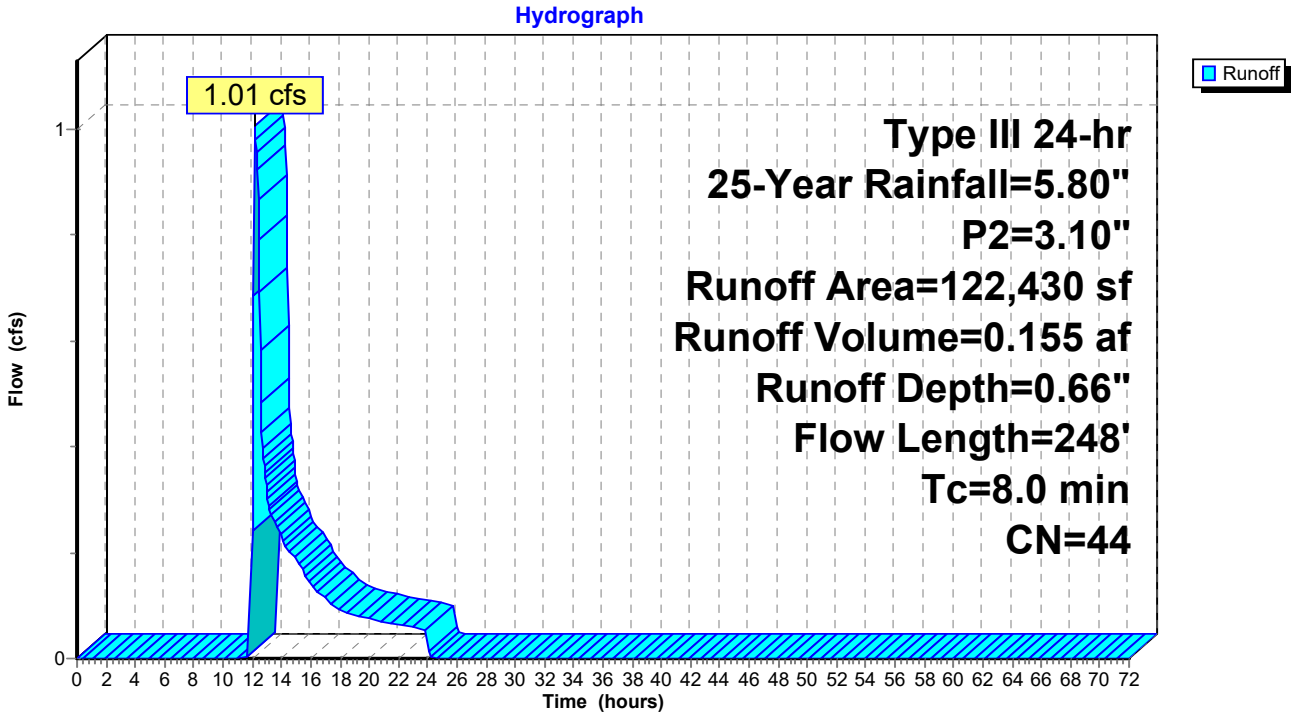
Runoff = 1.01 cfs @ 12.20 hrs, Volume= 0.155 af, Depth= 0.66"
Routed to Link DP5 : To Ex Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.80", P2=3.10"

Area (sf)	CN	Description
63,907	30	Woods, Good, HSG A
5,285	39	>75% Grass cover, Good, HSG A
41,116	54	1/2 acre lots, 25% imp, HSG A
1,088	98	Unconnected pavement, HSG A
5,286	98	Roofs, HSG A
5,740	72	Dirt roads, HSG A
8	98	Paved parking, HSG A
122,430	44	Weighted Average
105,770		86.39% Pervious Area
16,661		13.61% Impervious Area
1,088		6.53% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
0.9	72	0.0400	1.40		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.8	126	0.2500	2.50		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
8.0	248	Total			

Subcatchment E-7: Subcat E-7



Summary for Subcatchment E-8: Subcat E-8

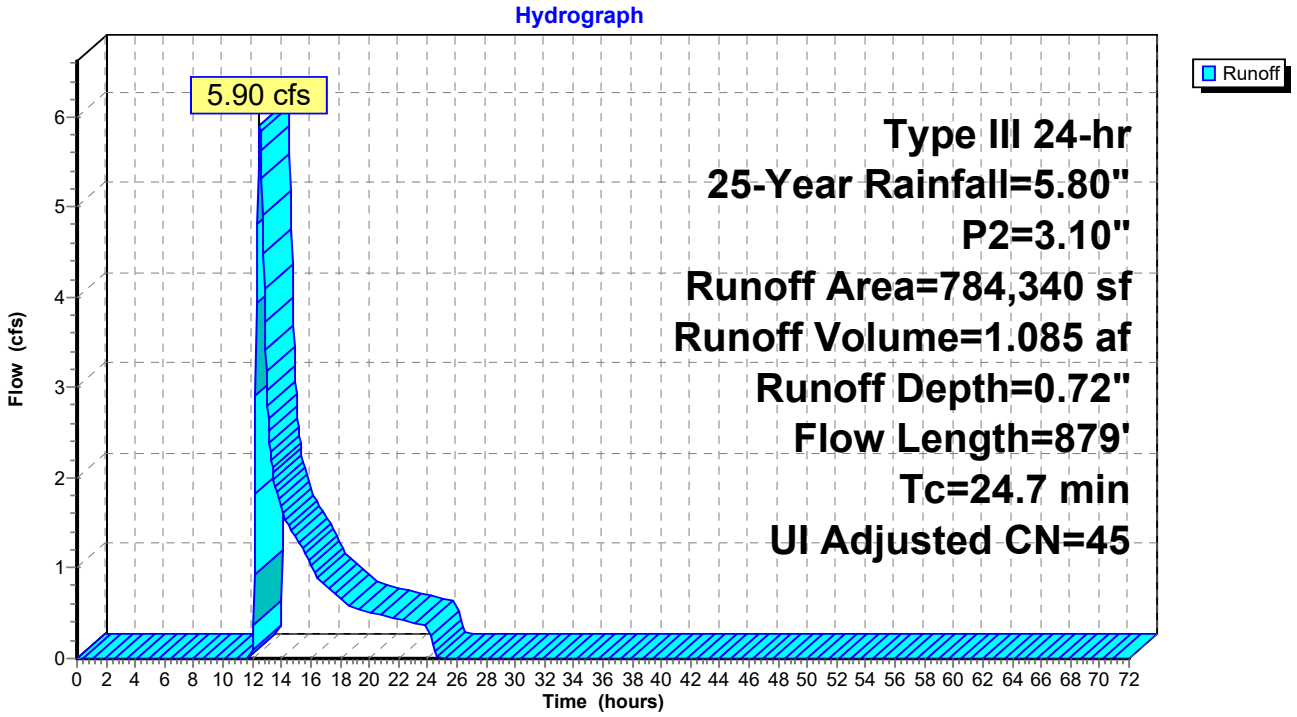
Runoff = 5.90 cfs @ 12.51 hrs, Volume= 1.085 af, Depth= 0.72"
Routed to Pond 2P : DP6 - Ex Inf Basin Club

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.80", P2=3.10"

Area (sf)	CN	Adj	Description
322,022	30		Woods, Good, HSG A
206,044	39		>75% Grass cover, Good, HSG A
103,904	54		1/2 acre lots, 25% imp, HSG A
19,026	72		Dirt roads, HSG A
69,702	98		Unconnected pavement, HSG A
63,642	98		Roofs, HSG A
784,340	48	45	Weighted Average, UI Adjusted
625,021			79.69% Pervious Area
159,319			20.31% Impervious Area
69,702			43.75% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
1.2	83	0.0570	1.19		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
6.9	354	0.0150	0.86		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
4.1	392	0.1000	1.58		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
24.7	879	Total			

Subcatchment E-8: Subcat E-8



Summary for Subcatchment E-9: Subcat E-9

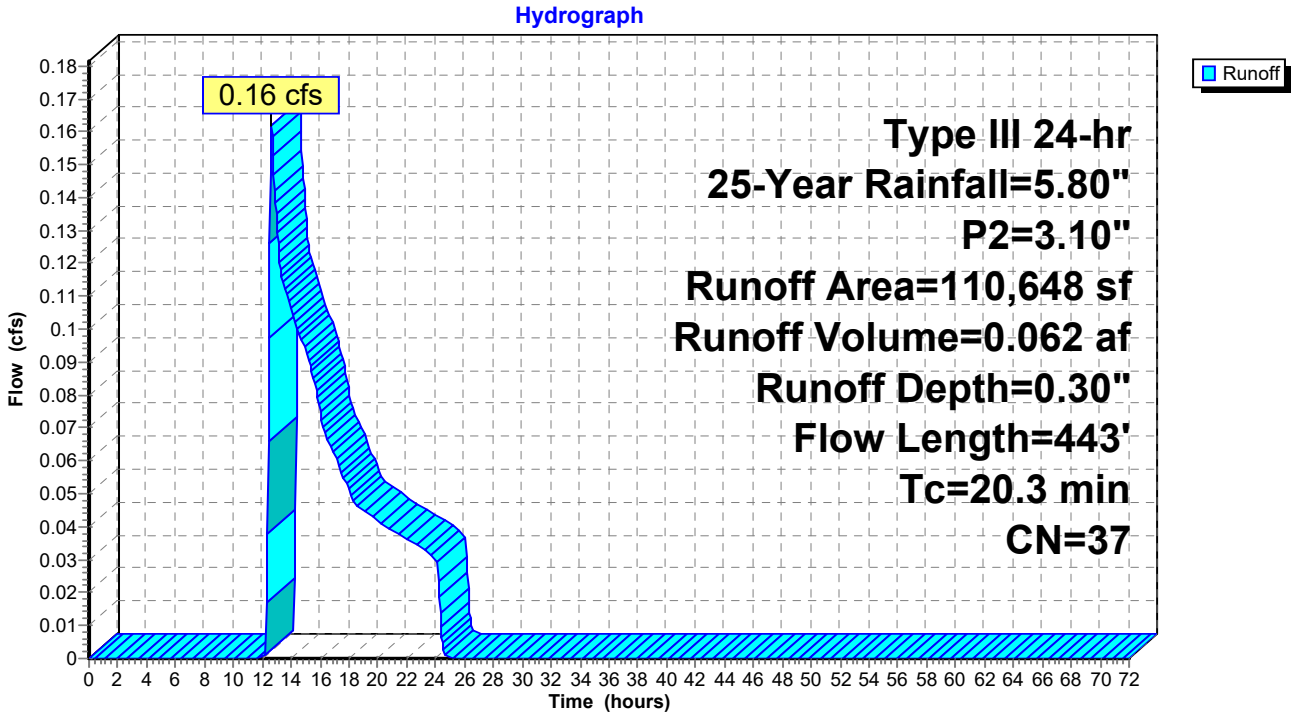
Runoff = 0.16 cfs @ 12.65 hrs, Volume= 0.062 af, Depth= 0.30"
Routed to Pond 1P : DP7 - Existing Depression 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.80", P2=3.10"

Area (sf)	CN	Description
84,652	30	Woods, Good, HSG A
13	39	>75% Grass cover, Good, HSG A
21,381	54	1/2 acre lots, 25% imp, HSG A
621	98	Roofs, HSG A
3,980	72	Dirt roads, HSG A
110,648	37	Weighted Average
104,681		94.61% Pervious Area
5,967		5.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	50	0.0125	0.06		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
3.3	149	0.0226	0.75		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.9	244	0.1800	2.12		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
20.3	443	Total			

Subcatchment E-9: Subcat E-9



Summary for Pond 1P: DP7 - Existing Depression 2

Inflow Area = 2.540 ac, 5.39% Impervious, Inflow Depth = 0.30" for 25-Year event
Inflow = 0.16 cfs @ 12.65 hrs, Volume= 0.062 af
Outflow = 0.07 cfs @ 16.10 hrs, Volume= 0.062 af, Atten= 55%, Lag= 207.4 min
Discarded = 0.07 cfs @ 16.10 hrs, Volume= 0.062 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 163.82' @ 16.10 hrs Surf.Area= 1,310 sf Storage= 632 cf

Plug-Flow detention time= 118.7 min calculated for 0.062 af (100% of inflow)
Center-of-Mass det. time= 118.5 min (1,121.6 - 1,003.1)

Volume	Invert	Avail.Storage	Storage Description
#1	163.00'	93,839 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

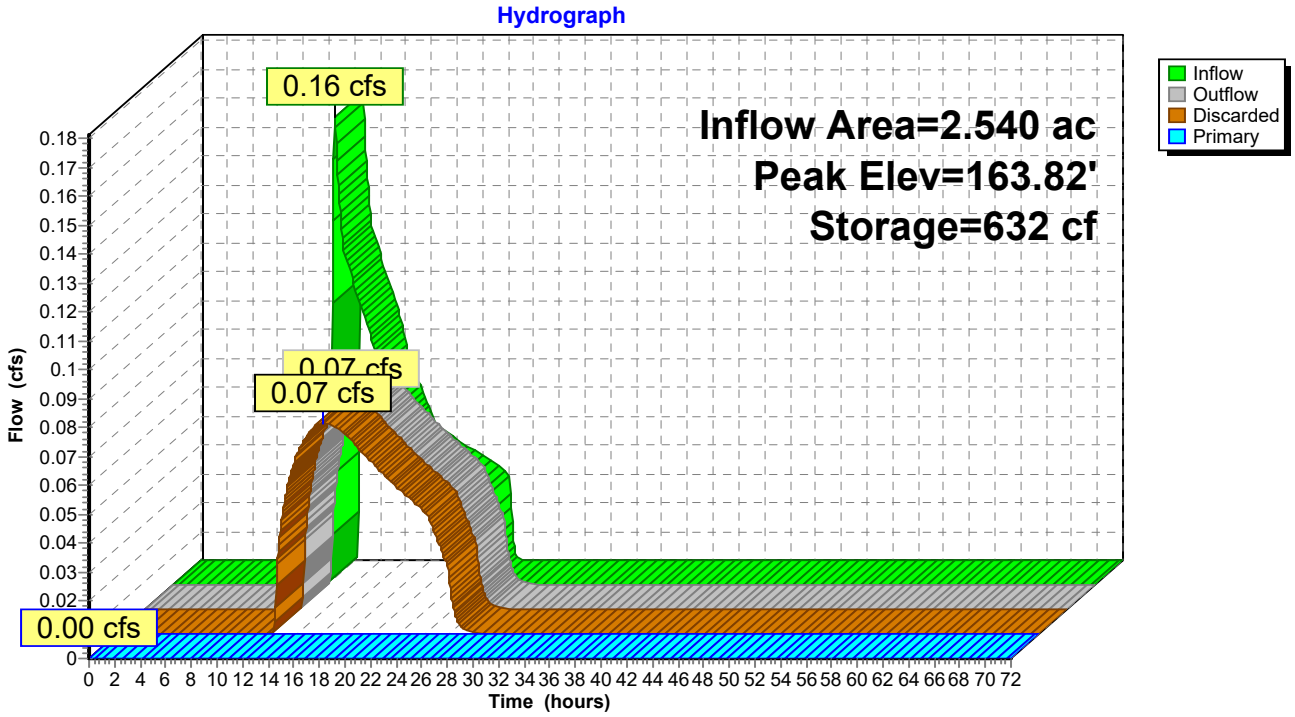
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
163.00	333	75.0	0	0	333
164.00	1,602	160.0	888	888	1,927
165.00	2,975	219.0	2,253	3,142	3,716
166.00	4,470	279.0	3,697	6,839	6,107
167.00	6,302	338.0	5,360	12,199	9,020
168.00	8,505	396.0	7,376	19,575	12,428
169.00	10,882	448.0	9,669	29,244	15,946
170.00	13,282	490.0	12,062	41,306	19,116
171.00	15,858	534.0	14,551	55,857	22,738
172.00	18,847	583.0	17,331	73,188	27,129
173.00	22,508	622.0	20,650	93,839	30,917

Device	Routing	Invert	Outlet Devices
#1	Primary	172.90'	**10.0' long x 50.0' 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
#2	Discarded	163.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.07 cfs @ 16.10 hrs HW=163.82' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=163.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: DP7 - Existing Depression 2



Summary for Pond 2P: DP6 - Ex Inf Basin Club

Inflow Area = 18.006 ac, 20.31% Impervious, Inflow Depth = 0.72" for 25-Year event
Inflow = 5.90 cfs @ 12.51 hrs, Volume= 1.085 af
Outflow = 0.50 cfs @ 20.38 hrs, Volume= 1.085 af, Atten= 92%, Lag= 472.5 min
Discarded = 0.50 cfs @ 20.38 hrs, Volume= 1.085 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 165.17' @ 20.38 hrs Surf.Area= 8,955 sf Storage= 28,682 cf

Plug-Flow detention time= 778.9 min calculated for 1.084 af (100% of inflow)
Center-of-Mass det. time= 779.6 min (1,718.9 - 939.3)

Volume	Invert	Avail.Storage	Storage Description
#1	159.00'	100,011 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

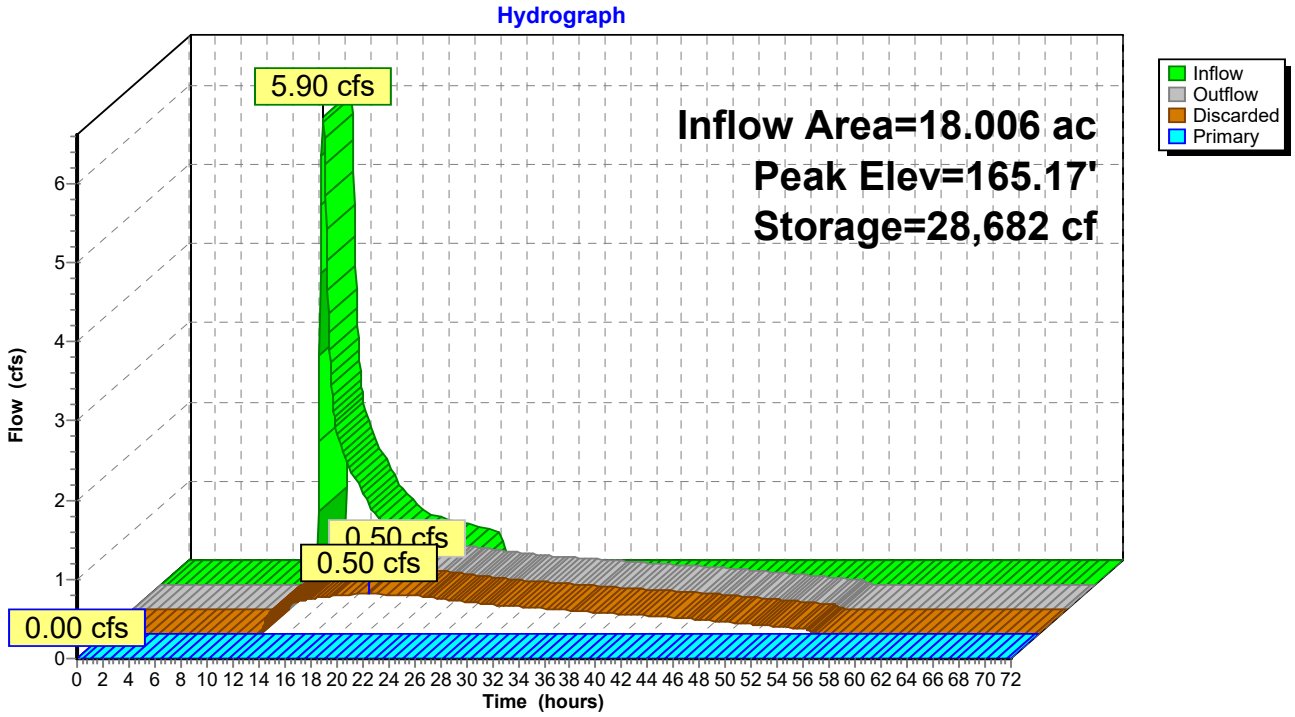
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
159.00	934	176.0	0	0	934
160.00	2,320	278.0	1,575	1,575	4,626
161.00	3,563	292.0	2,919	4,495	5,322
162.00	4,546	305.0	4,045	8,539	6,008
163.00	5,553	339.0	5,041	13,580	7,780
164.00	6,677	374.0	6,106	19,687	9,798
165.00	8,367	426.0	7,506	27,193	13,132
166.00	12,063	523.0	10,159	37,352	20,473
167.00	17,347	642.0	14,625	51,977	31,520
168.00	23,464	806.0	20,329	72,306	50,432
169.00	32,175	988.0	27,705	100,011	76,430

Device	Routing	Invert	Outlet Devices
#1	Primary	167.99'	**10.0' long x 50.0' 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
#2	Discarded	159.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.50 cfs @ 20.38 hrs HW=165.17' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.50 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=159.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: DP6 - Ex Inf Basin Club



Summary for Pond 3P: Drainage Basin/Easement

Inflow Area = 8.799 ac, 44.85% Impervious, Inflow Depth = 2.20" for 25-Year event
Inflow = 16.66 cfs @ 12.20 hrs, Volume= 1.614 af
Outflow = 0.66 cfs @ 17.43 hrs, Volume= 1.614 af, Atten= 96%, Lag= 313.4 min
Discarded = 0.66 cfs @ 17.43 hrs, Volume= 1.614 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 180.97' @ 17.43 hrs Surf.Area= 11,890 sf Storage= 46,540 cf

Plug-Flow detention time= 871.4 min calculated for 1.613 af (100% of inflow)
Center-of-Mass det. time= 872.2 min (1,721.3 - 849.1)

Volume	Invert	Avail.Storage	Storage Description
#1	174.00'	345,539 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

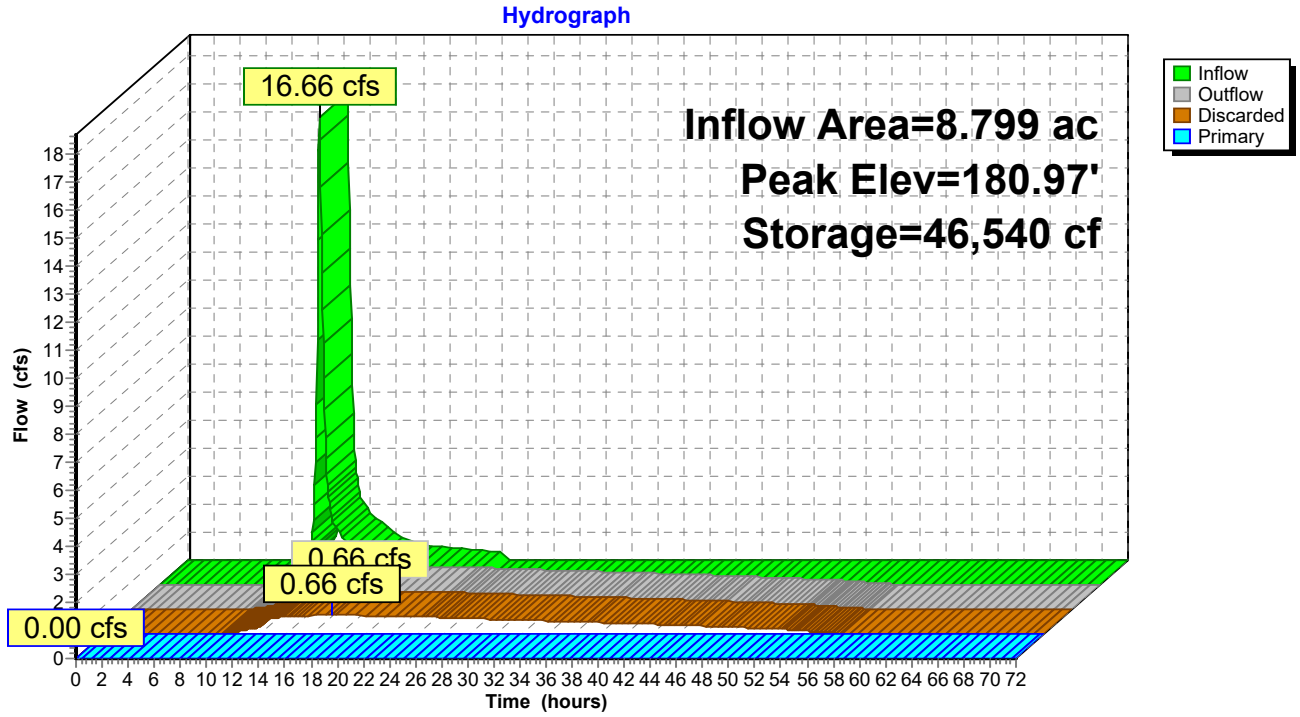
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
174.00	491	104.0	0	0	491
175.00	3,251	224.0	1,668	1,668	3,627
176.00	4,753	273.0	3,978	5,647	5,581
177.00	6,309	310.0	5,513	11,159	7,322
178.00	7,641	346.0	6,964	18,124	9,230
179.00	8,869	377.0	8,247	26,371	11,050
180.00	10,188	402.0	9,521	35,892	12,648
181.00	11,953	430.0	11,059	46,951	14,548
182.00	14,143	463.0	13,033	59,983	16,935
183.00	16,525	499.0	15,319	75,302	19,733
184.00	19,118	519.0	17,806	93,108	21,431
185.00	21,426	604.0	20,261	113,369	29,048
186.00	23,221	589.0	22,317	135,686	30,592
187.00	24,868	608.0	24,040	159,726	32,498
188.00	26,530	627.0	25,695	185,421	34,465
189.00	28,209	646.0	27,365	212,786	36,492
190.00	30,172	674.0	29,185	241,971	39,506
191.00	32,732	704.0	31,443	273,414	42,867
192.00	36,071	766.0	34,388	307,802	50,157
193.00	39,428	897.0	37,737	345,539	67,513

Device	Routing	Invert	Outlet Devices
#1	Primary	192.90'	**10.0' long x 50.0' 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
#2	Discarded	174.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.66 cfs @ 17.43 hrs HW=180.97' (Free Discharge)
↑**2=Exfiltration** (Exfiltration Controls 0.66 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=174.00' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Drainage Basin/Easement



Summary for Pond 4P: DP3 - Existing Depression 1

Inflow Area = 0.901 ac, 0.00% Impervious, Inflow Depth = 0.11" for 25-Year event
Inflow = 0.01 cfs @ 15.20 hrs, Volume= 0.008 af
Outflow = 0.01 cfs @ 16.23 hrs, Volume= 0.008 af, Atten= 12%, Lag= 61.7 min
Discarded = 0.01 cfs @ 16.23 hrs, Volume= 0.008 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to nonexistent node SP4

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 193.31' @ 16.23 hrs Surf.Area= 195 sf Storage= 31 cf

Plug-Flow detention time= 40.6 min calculated for 0.008 af (100% of inflow)
Center-of-Mass det. time= 40.6 min (1,131.2 - 1,090.6)

Volume	Invert	Avail.Storage	Storage Description
#1	193.00'	17,265 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

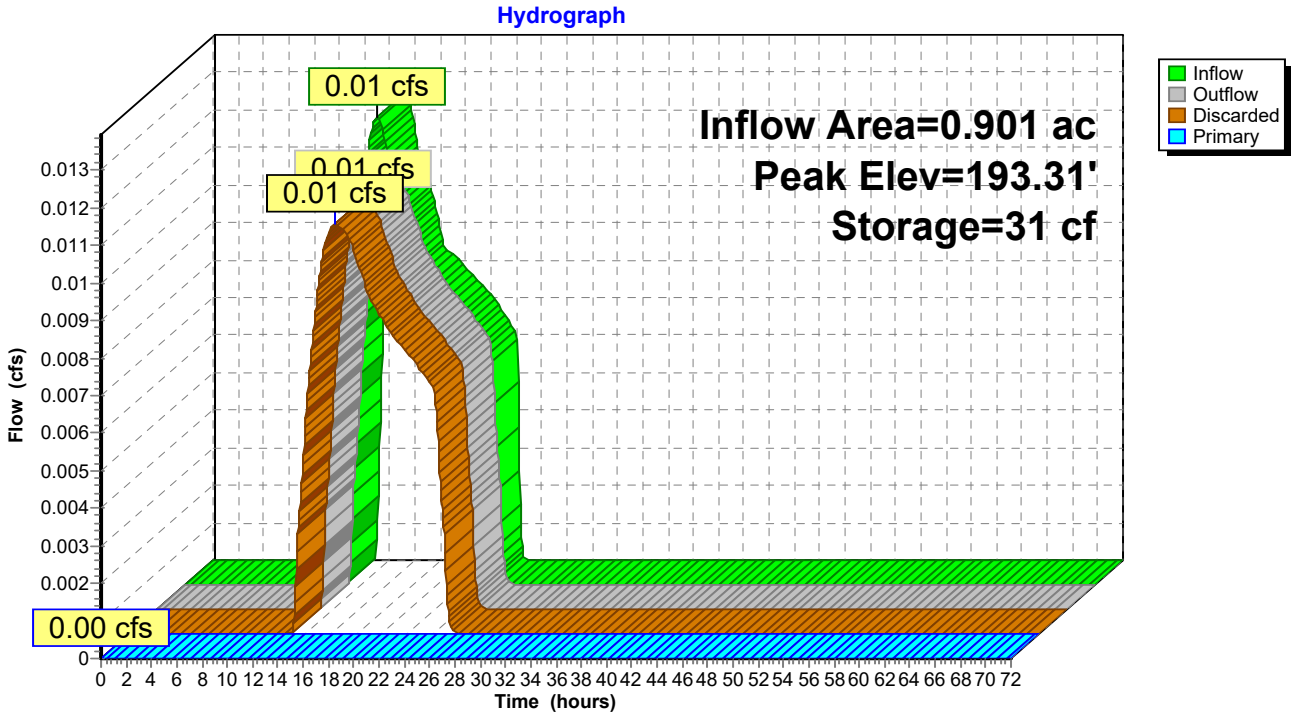
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
193.00	30	100.0	0	0	30
194.00	1,087	159.0	433	433	1,253
195.00	2,356	217.0	1,681	2,114	2,998
196.00	3,959	276.0	3,123	5,237	5,326
197.00	5,956	339.0	4,924	10,160	8,425
198.00	8,319	398.0	7,105	17,265	11,905

Device	Routing	Invert	Outlet Devices
#1	Primary	197.90'	**10.0' long x 20.0' 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
#2	Discarded	193.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 16.23 hrs HW=193.31' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=193.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 4P: DP3 - Existing Depression 1

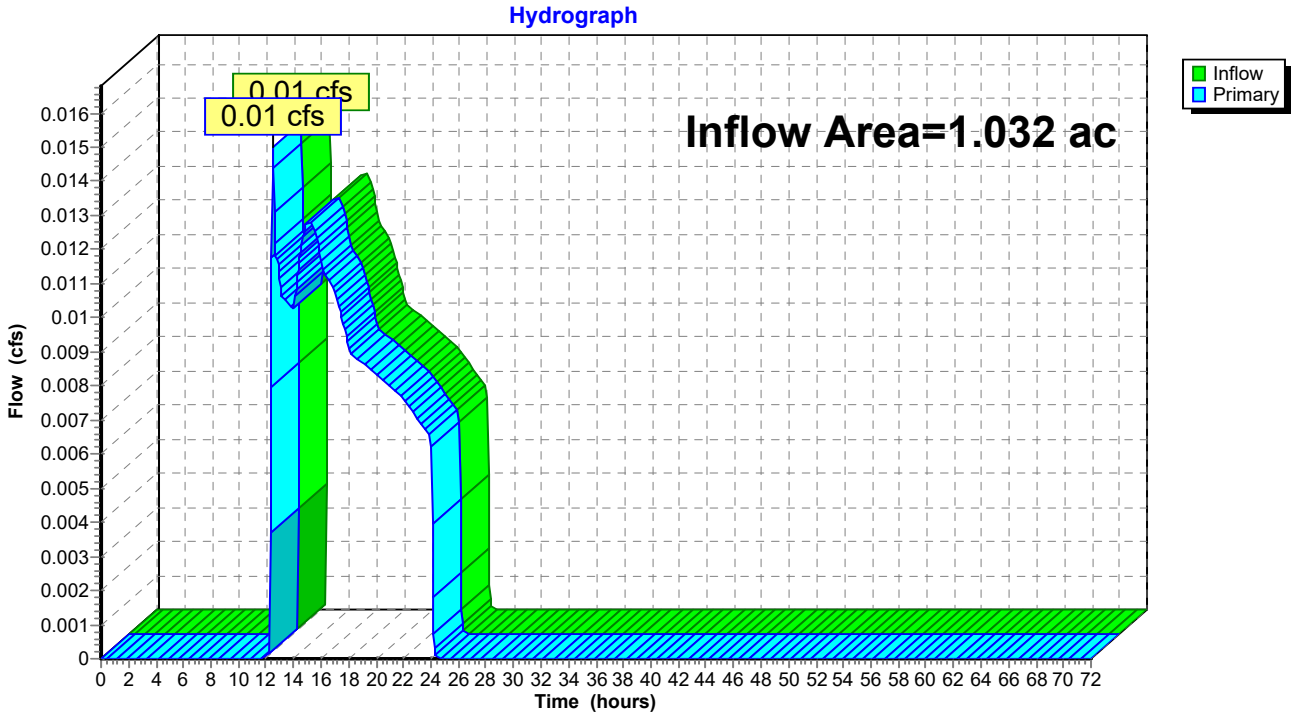


Summary for Link DP1: N'ly Property Line

Inflow Area = 1.032 ac, 0.21% Impervious, Inflow Depth = 0.11" for 25-Year event
Inflow = 0.01 cfs @ 12.50 hrs, Volume= 0.009 af
Primary = 0.01 cfs @ 12.50 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP1: N'ly Property Line

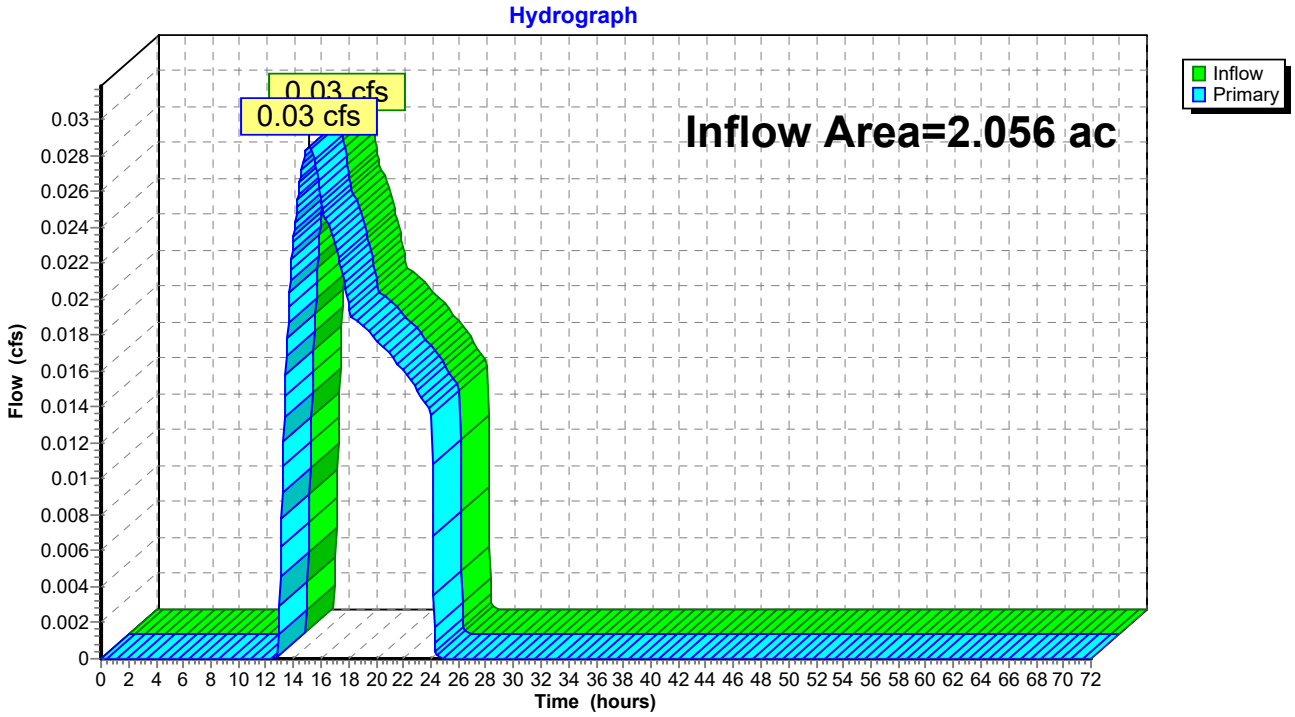


Summary for Link DP2: E'ly Property Line

Inflow Area = 2.056 ac, 1.52% Impervious, Inflow Depth = 0.11" for 25-Year event
Inflow = 0.03 cfs @ 15.12 hrs, Volume= 0.018 af
Primary = 0.03 cfs @ 15.12 hrs, Volume= 0.018 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP2: E'ly Property Line

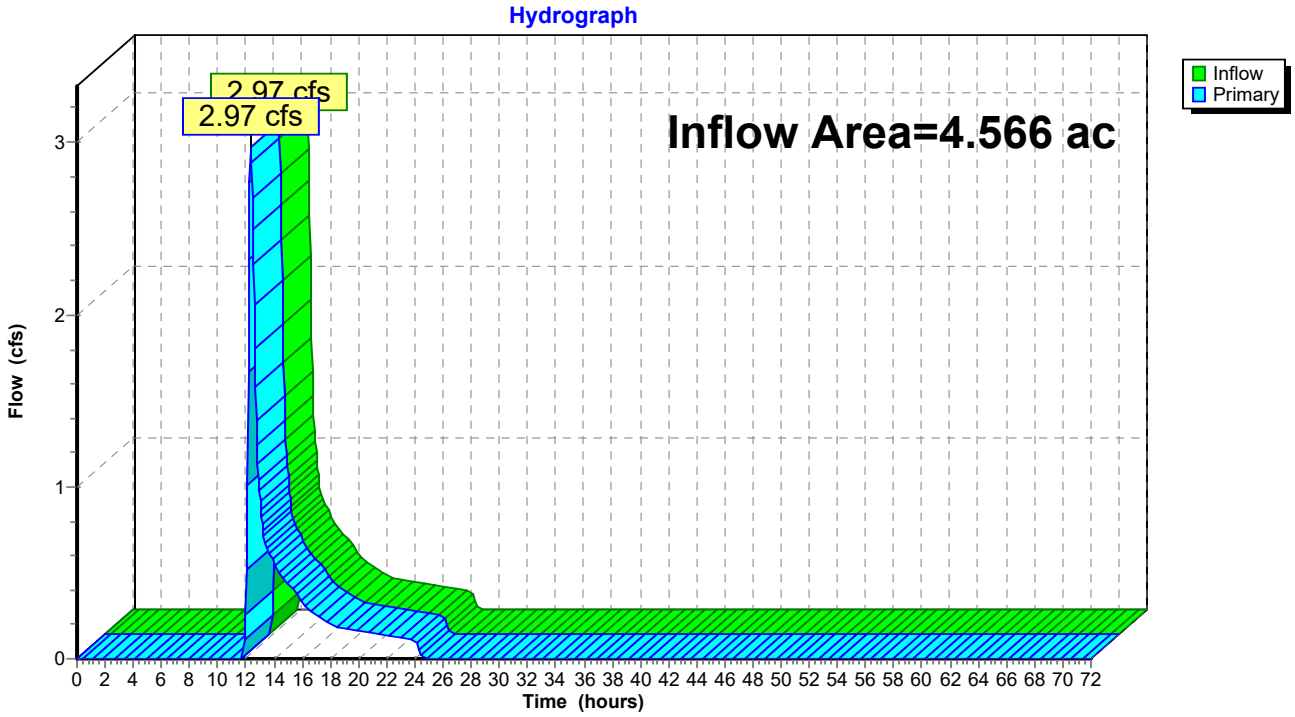


Summary for Link DP4: S'ly Property Line

Inflow Area = 4.566 ac, 26.41% Impervious, Inflow Depth = 1.05" for 25-Year event
Inflow = 2.97 cfs @ 12.32 hrs, Volume= 0.398 af
Primary = 2.97 cfs @ 12.32 hrs, Volume= 0.398 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP4: S'ly Property Line

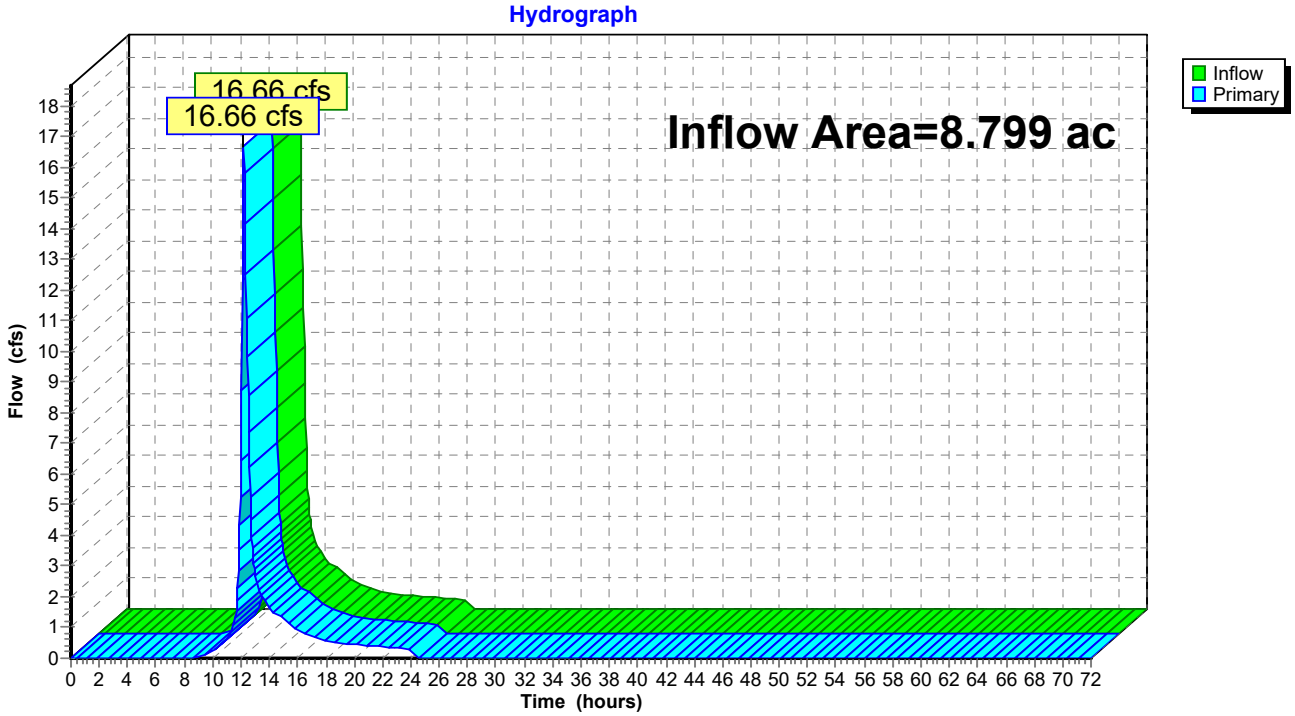


Summary for Link DP5: To Ex Basin

Inflow Area = 8.799 ac, 44.85% Impervious, Inflow Depth = 2.20" for 25-Year event
Inflow = 16.66 cfs @ 12.20 hrs, Volume= 1.614 af
Primary = 16.66 cfs @ 12.20 hrs, Volume= 1.614 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 3P : Drainage Basin/Easement

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP5: To Ex Basin



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Subcat E-1 Runoff Area=12,581 sf 0.00% Impervious Runoff Depth=0.96"
Flow Length=188' Tc=8.8 min CN=36 Runoff=0.15 cfs 0.023 af

Subcatchment E-2: Subcat E-2 Runoff Area=32,388 sf 0.29% Impervious Runoff Depth=0.46"
Flow Length=230' Tc=7.5 min CN=30 Runoff=0.11 cfs 0.029 af

Subcatchment E-3: Subcat E-3 Runoff Area=89,563 sf 1.52% Impervious Runoff Depth=0.62"
Flow Length=341' Tc=10.6 min CN=32 Runoff=0.49 cfs 0.106 af

Subcatchment E-4: Subcat E-4 Runoff Area=39,239 sf 0.00% Impervious Runoff Depth=0.62"
Flow Length=214' Tc=15.8 min CN=32 Runoff=0.20 cfs 0.046 af

Subcatchment E-5: Subcat E-5 Runoff Area=198,881 sf 26.41% Impervious Runoff Depth=2.37"
Flow Length=270' Tc=18.4 min UI Adjusted CN=50 Runoff=8.07 cfs 0.903 af

Subcatchment E-6: Subcat E-6 Runoff Area=260,840 sf 59.51% Impervious Runoff Depth=4.99"
Flow Length=314' Tc=14.4 min CN=73 Runoff=26.75 cfs 2.489 af

Subcatchment E-7: Subcat E-7 Runoff Area=122,430 sf 13.61% Impervious Runoff Depth=1.74"
Flow Length=248' Tc=8.0 min CN=44 Runoff=4.32 cfs 0.407 af

Subcatchment E-8: Subcat E-8 Runoff Area=784,340 sf 20.31% Impervious Runoff Depth=1.84"
Flow Length=879' Tc=24.7 min UI Adjusted CN=45 Runoff=20.36 cfs 2.765 af

Subcatchment E-9: Subcat E-9 Runoff Area=110,648 sf 5.39% Impervious Runoff Depth=1.05"
Flow Length=443' Tc=20.3 min CN=37 Runoff=1.31 cfs 0.223 af

Pond 1P: DP7 - Existing Depression 2 Peak Elev=165.30' Storage=4,111 cf Inflow=1.31 cfs 0.223 af
Discarded=0.19 cfs 0.223 af Primary=0.00 cfs 0.000 af Outflow=0.19 cfs 0.223 af

Pond 2P: DP6 - Ex Inf Basin Club Peak Elev=168.04' Storage=73,173 cf Inflow=20.36 cfs 2.765 af
Discarded=1.33 cfs 2.710 af Primary=0.38 cfs 0.055 af Outflow=1.70 cfs 2.765 af

Pond 3P: Drainage Basin/Easement Peak Elev=183.74' Storage=88,170 cf Inflow=30.53 cfs 2.896 af
Discarded=1.03 cfs 2.896 af Primary=0.00 cfs 0.000 af Outflow=1.03 cfs 2.896 af

Pond 4P: DP3 - Existing Depression 1 Peak Elev=194.02' Storage=458 cf Inflow=0.20 cfs 0.046 af
Discarded=0.06 cfs 0.046 af Primary=0.00 cfs 0.000 af Outflow=0.06 cfs 0.046 af

Link DP1: N'ly Property Line Inflow=0.24 cfs 0.052 af
Primary=0.24 cfs 0.052 af

Link DP2: E'ly Property Line Inflow=0.49 cfs 0.106 af
Primary=0.49 cfs 0.106 af

Link DP4: S'ly Property Line Inflow=8.07 cfs 0.903 af
Primary=8.07 cfs 0.903 af

Link DP5: To Ex Basin

Inflow=30.53 cfs 2.896 af
Primary=30.53 cfs 2.896 af

Total Runoff Area = 37.900 ac Runoff Volume = 6.991 af Average Runoff Depth = 2.21"
76.31% Pervious = 28.920 ac 23.69% Impervious = 8.979 ac

Summary for Subcatchment E-1: Subcat E-1

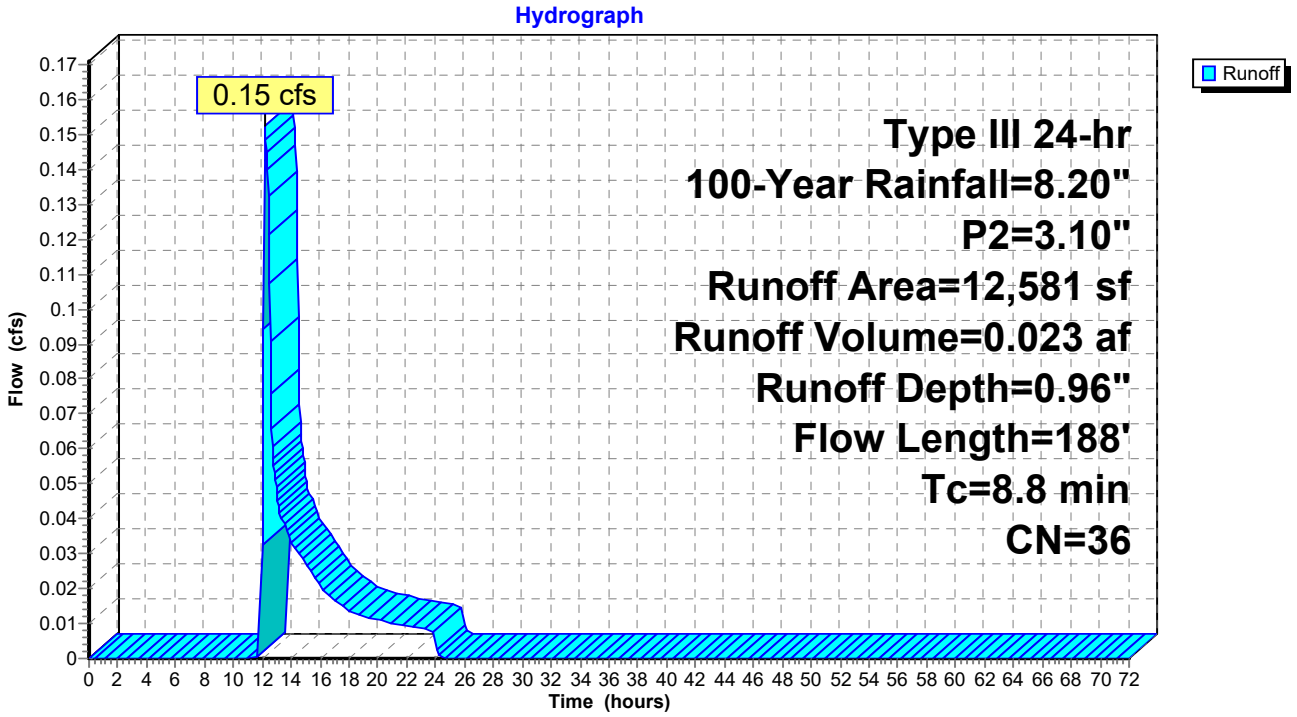
Runoff = 0.15 cfs @ 12.21 hrs, Volume= 0.023 af, Depth= 0.96"
Routed to Link DP1 : N'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.20", P2=3.10"

Area (sf)	CN	Description
10,635	30	Woods, Good, HSG A
1,947	72	Dirt roads, HSG A
12,581	36	Weighted Average
12,581		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	50	0.0900	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.7	55	0.2540	1.26		**Shallow Concentrated Flow, B-C** Forest w/Heavy Litter Kv= 2.5 fps
0.1	15	0.0660	2.57		**Shallow Concentrated Flow, C-D** Nearly Bare & Untilled Kv= 10.0 fps
0.3	18	0.1380	0.93		**Shallow Concentrated Flow, D-E** Forest w/Heavy Litter Kv= 2.5 fps
0.1	14	0.0570	2.39		**Shallow Concentrated Flow, E-F** Nearly Bare & Untilled Kv= 10.0 fps
0.7	36	0.1250	0.88		**Shallow Concentrated Flow, F-G** Forest w/Heavy Litter Kv= 2.5 fps
8.8	188	Total			

Subcatchment E-1: Subcat E-1



Summary for Subcatchment E-2: Subcat E-2

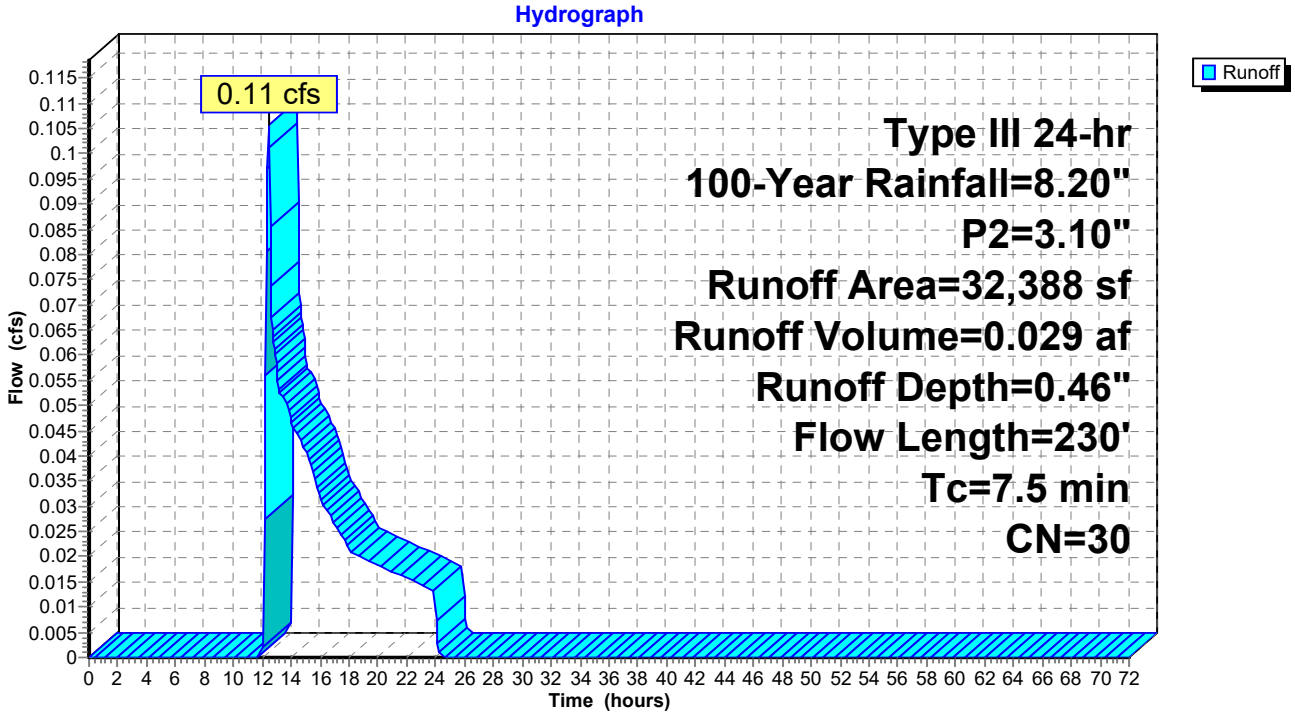
Runoff = 0.11 cfs @ 12.42 hrs, Volume= 0.029 af, Depth= 0.46"
Routed to Link DP1 : N'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.20", P2=3.10"

Area (sf)	CN	Description
95	98	Roofs, HSG A
32,293	30	Woods, Good, HSG A
32,388	30	Weighted Average
32,293		99.71% Pervious Area
95		0.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	50	0.1800	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.7	92	0.1950	2.21		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.6	88	0.0340	0.92		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
7.5	230	Total			

Subcatchment E-2: Subcat E-2



Summary for Subcatchment E-3: Subcat E-3

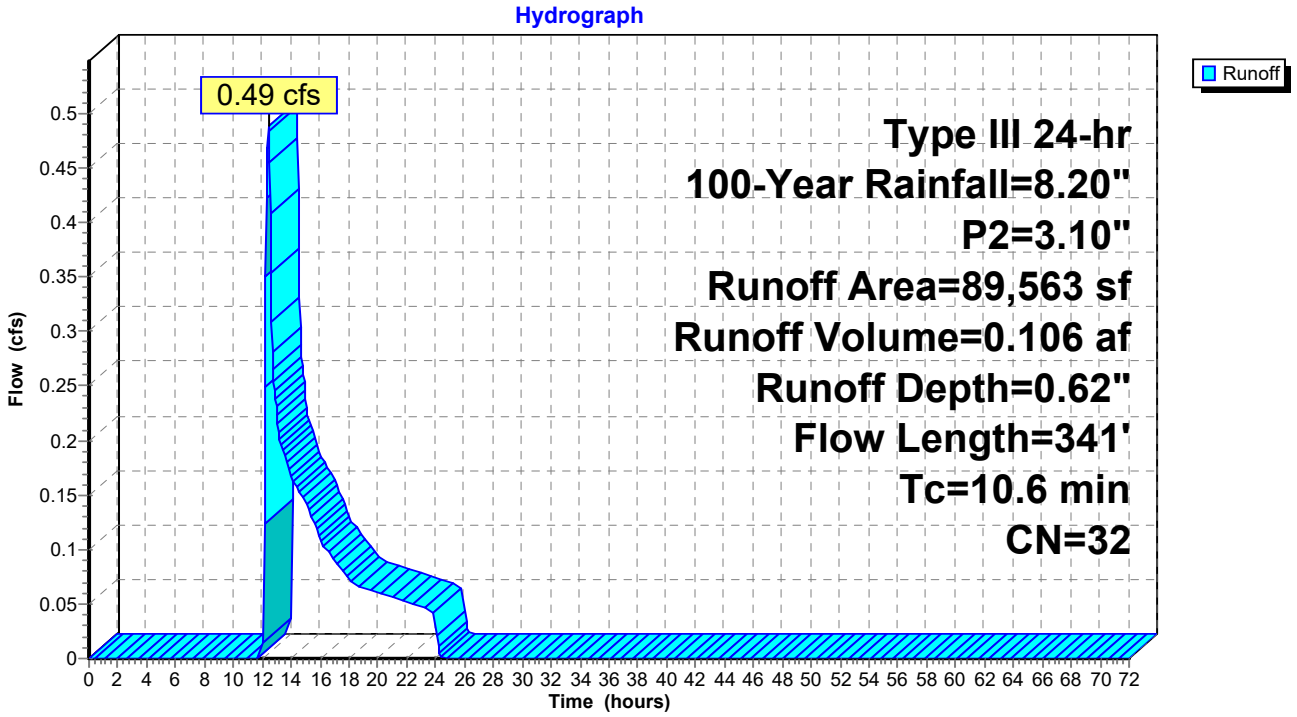
Runoff = 0.49 cfs @ 12.41 hrs, Volume= 0.106 af, Depth= 0.62"
Routed to Link DP2 : E'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.20", P2=3.10"

Area (sf)	CN	Description
85,130	30	Woods, Good, HSG A
1,365	98	Roofs, HSG A
3,068	72	Dirt roads, HSG A
89,563	32	Weighted Average
88,198		98.48% Pervious Area
1,365		1.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0800	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	74	0.2160	2.32		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.6	60	0.0250	1.58		**Shallow Concentrated Flow, C-D** Nearly Bare & Untilled Kv= 10.0 fps
2.3	157	0.0510	1.13		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
10.6	341	Total			

Subcatchment E-3: Subcat E-3



Summary for Subcatchment E-4: Subcat E-4

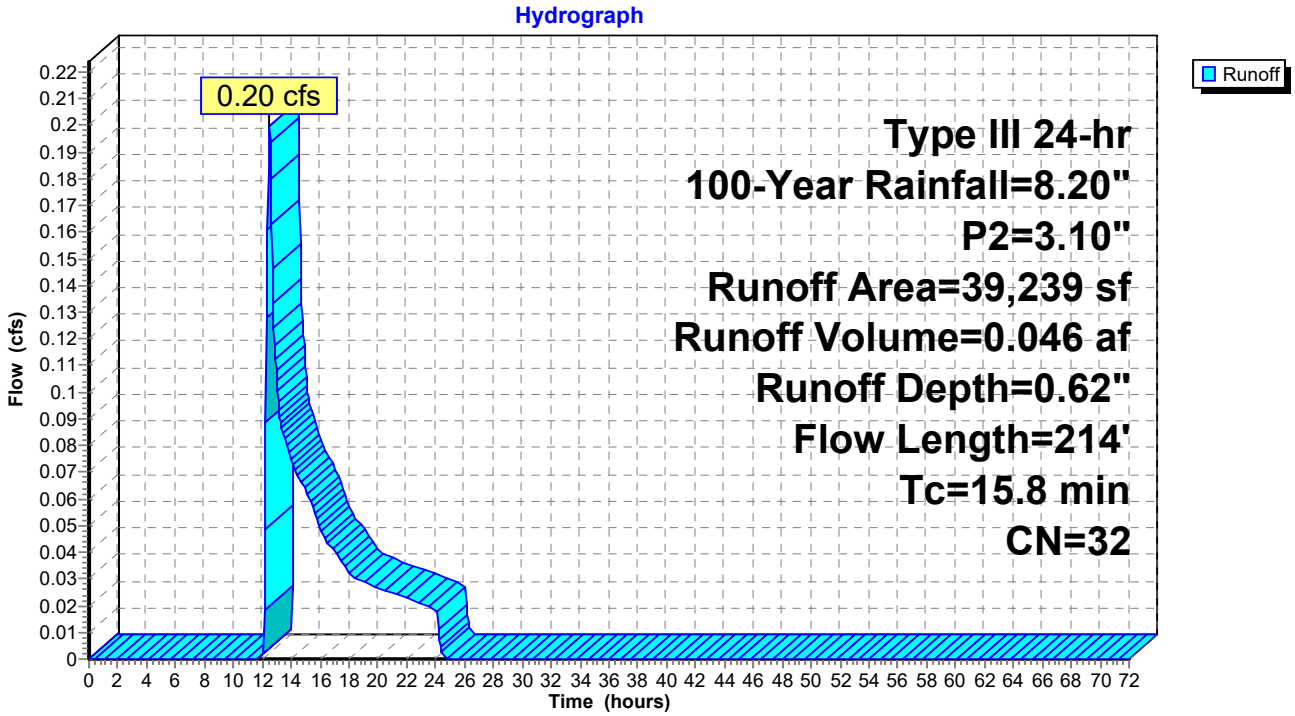
Runoff = 0.20 cfs @ 12.49 hrs, Volume= 0.046 af, Depth= 0.62"
Routed to Pond 4P : DP3 - Existing Depression 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.20", P2=3.10"

Area (sf)	CN	Description
37,500	30	Woods, Good, HSG A
1,739	72	Dirt roads, HSG A
39,239	32	Weighted Average
39,239		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	50	0.0300	0.08		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.7	29	0.0200	0.71		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.2	10	0.0100	1.00		**Shallow Concentrated Flow, C-D** Nearly Bare & Untilled Kv= 10.0 fps
4.2	125	0.0100	0.50		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
15.8	214	Total			

Subcatchment E-4: Subcat E-4



Summary for Subcatchment E-5: Subcat E-5

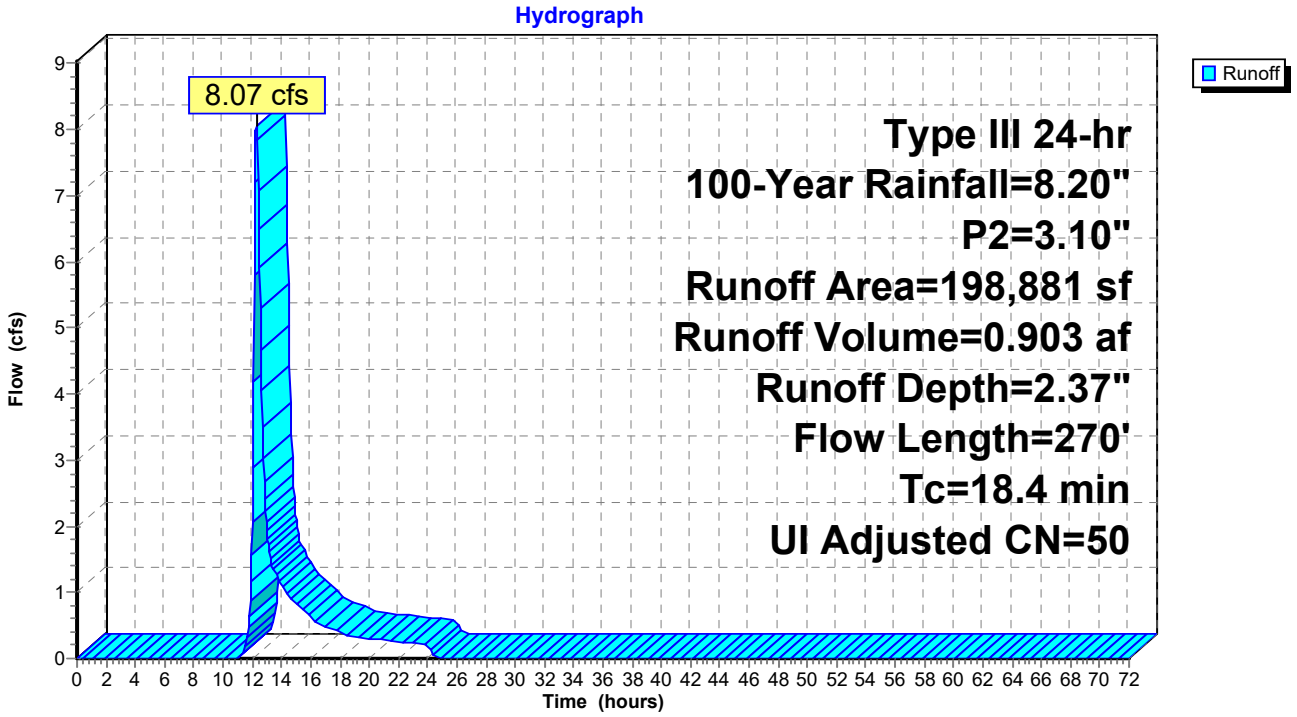
Runoff = 8.07 cfs @ 12.28 hrs, Volume= 0.903 af, Depth= 2.37"
Routed to Link DP4 : S'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.20", P2=3.10"

Area (sf)	CN	Adj	Description
99,401	30		Woods, Good, HSG A
33,545	39		>75% Grass cover, Good, HSG A
13,415	72		Dirt roads, HSG A
14,517	98		Unconnected pavement, HSG A
16,302	98		Paved parking, HSG A
21,702	98		Roofs, HSG A
198,881	52	50	Weighted Average, UI Adjusted
146,360			73.59% Pervious Area
52,521			26.41% Impervious Area
14,517			27.64% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
5.6	184	0.0120	0.55		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.3	36	0.0500	2.24		**Shallow Concentrated Flow, C-D** Nearly Bare & Untilled Kv= 10.0 fps
18.4	270	Total			

Subcatchment E-5: Subcat E-5



Summary for Subcatchment E-6: Subcat E-6

[47] Hint: Peak is 169% of capacity of segment #5

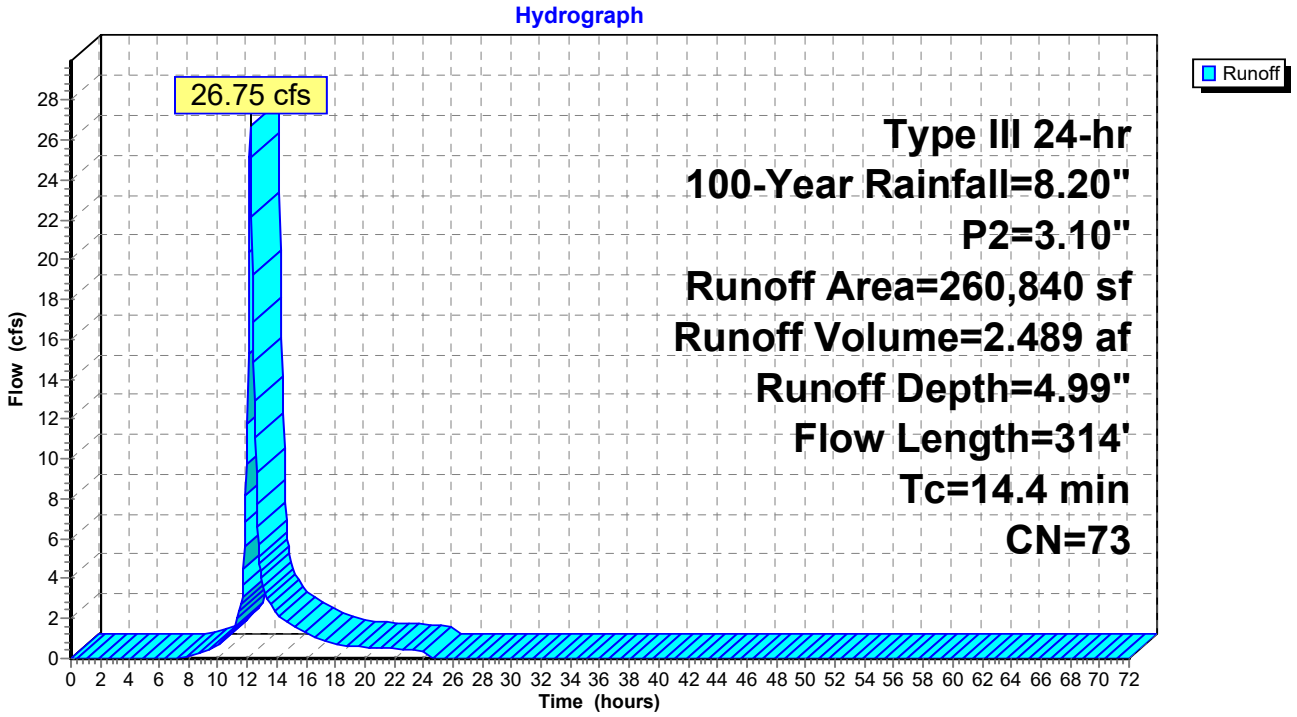
Runoff = 26.75 cfs @ 12.20 hrs, Volume= 2.489 af, Depth= 4.99"
Routed to Link DP5 : To Ex Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.20", P2=3.10"

Area (sf)	CN	Description
20,963	30	Woods, Good, HSG A
56,497	39	>75% Grass cover, Good, HSG A
37,489	54	1/2 acre lots, 25% imp, HSG A
10,331	98	Unconnected pavement, HSG A
135,515	98	Paved parking, HSG A
44	72	Dirt roads, HSG A
260,840	73	Weighted Average
105,622		40.49% Pervious Area
155,218		59.51% Impervious Area
10,331		6.66% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	32	0.0100	0.05		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
1.6	18	0.1700	0.19		**Sheet Flow, B-C** Grass: Dense n= 0.240 P2= 3.10"
0.2	22	0.0600	1.71		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.9	182	0.0300	3.52		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
0.1	60	0.0600	12.89	15.82	**Pipe Channel, E-F** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
14.4	314	Total			

Subcatchment E-6: Subcat E-6



Summary for Subcatchment E-7: Subcat E-7

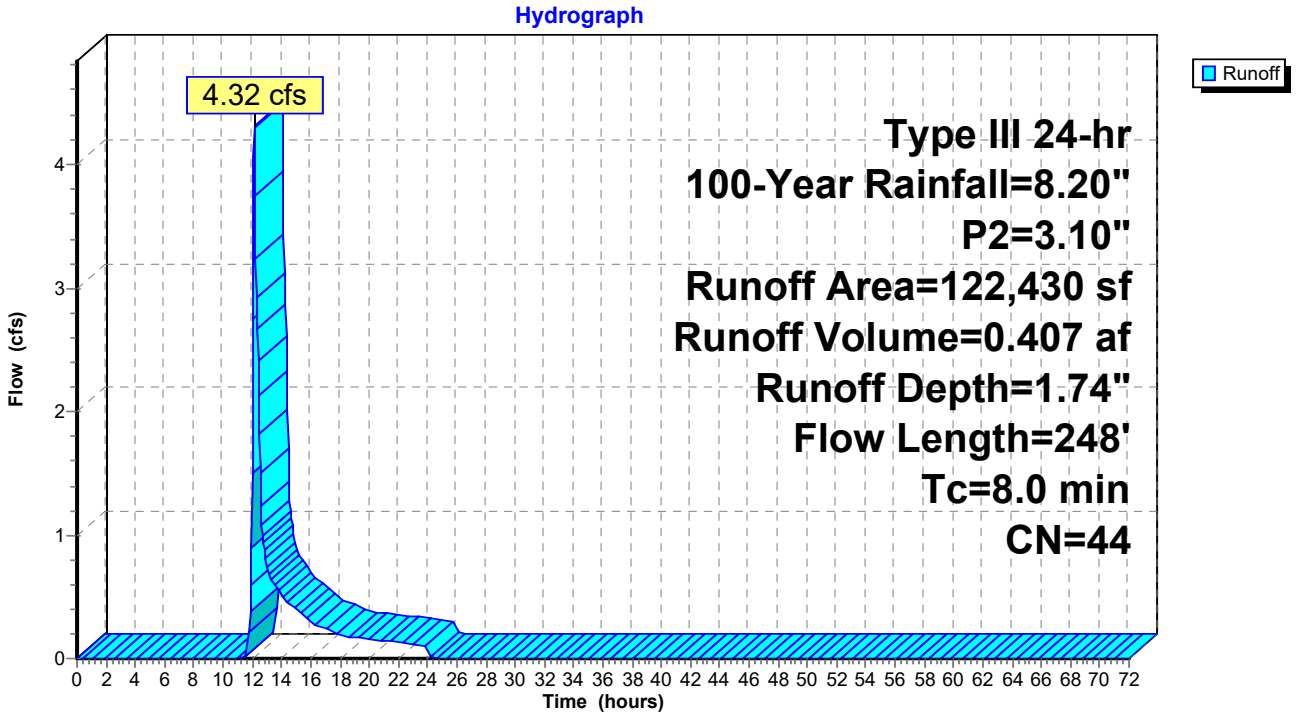
Runoff = 4.32 cfs @ 12.14 hrs, Volume= 0.407 af, Depth= 1.74"
Routed to Link DP5 : To Ex Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.20", P2=3.10"

Area (sf)	CN	Description
63,907	30	Woods, Good, HSG A
5,285	39	>75% Grass cover, Good, HSG A
41,116	54	1/2 acre lots, 25% imp, HSG A
1,088	98	Unconnected pavement, HSG A
5,286	98	Roofs, HSG A
5,740	72	Dirt roads, HSG A
8	98	Paved parking, HSG A
122,430	44	Weighted Average
105,770		86.39% Pervious Area
16,661		13.61% Impervious Area
1,088		6.53% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
0.9	72	0.0400	1.40		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.8	126	0.2500	2.50		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
8.0	248	Total			

Subcatchment E-7: Subcat E-7



Summary for Subcatchment E-8: Subcat E-8

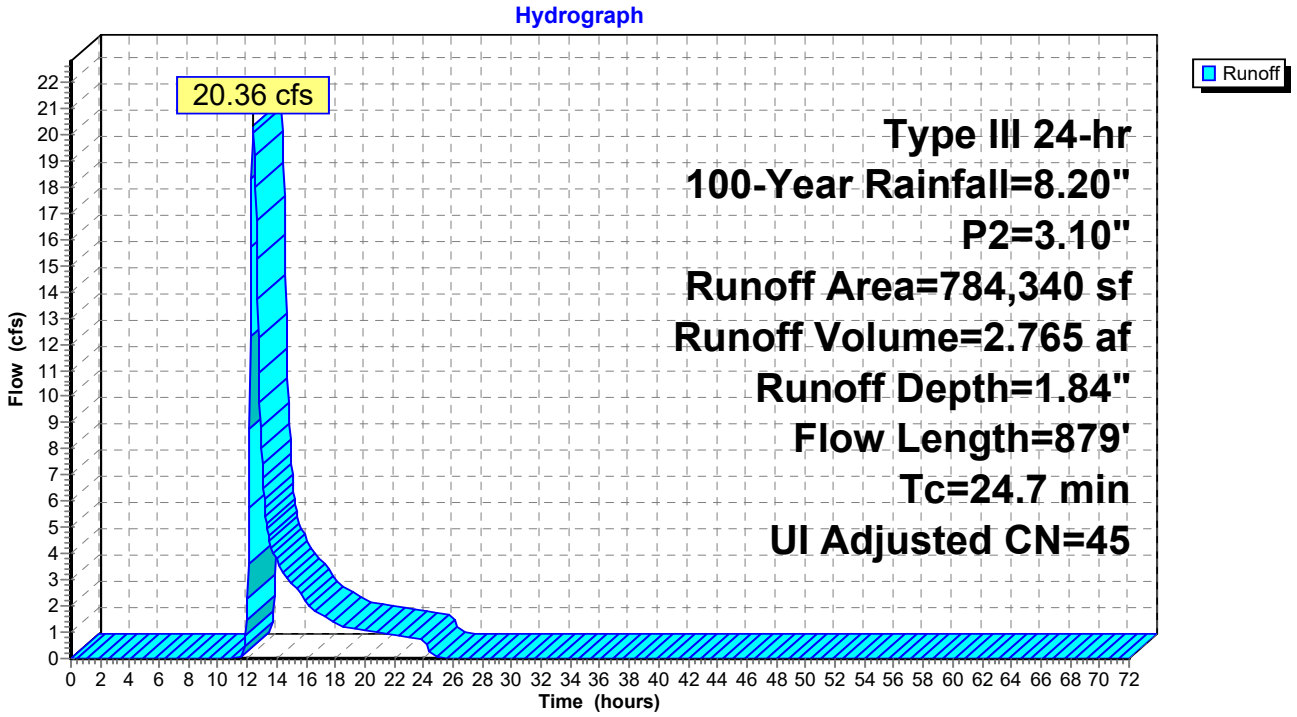
Runoff = 20.36 cfs @ 12.41 hrs, Volume= 2.765 af, Depth= 1.84"
Routed to Pond 2P : DP6 - Ex Inf Basin Club

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.20", P2=3.10"

Area (sf)	CN	Adj	Description
322,022	30		Woods, Good, HSG A
206,044	39		>75% Grass cover, Good, HSG A
103,904	54		1/2 acre lots, 25% imp, HSG A
19,026	72		Dirt roads, HSG A
69,702	98		Unconnected pavement, HSG A
63,642	98		Roofs, HSG A
784,340	48	45	Weighted Average, UI Adjusted
625,021			79.69% Pervious Area
159,319			20.31% Impervious Area
69,702			43.75% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
1.2	83	0.0570	1.19		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
6.9	354	0.0150	0.86		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
4.1	392	0.1000	1.58		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
24.7	879	Total			

Subcatchment E-8: Subcat E-8



Summary for Subcatchment E-9: Subcat E-9

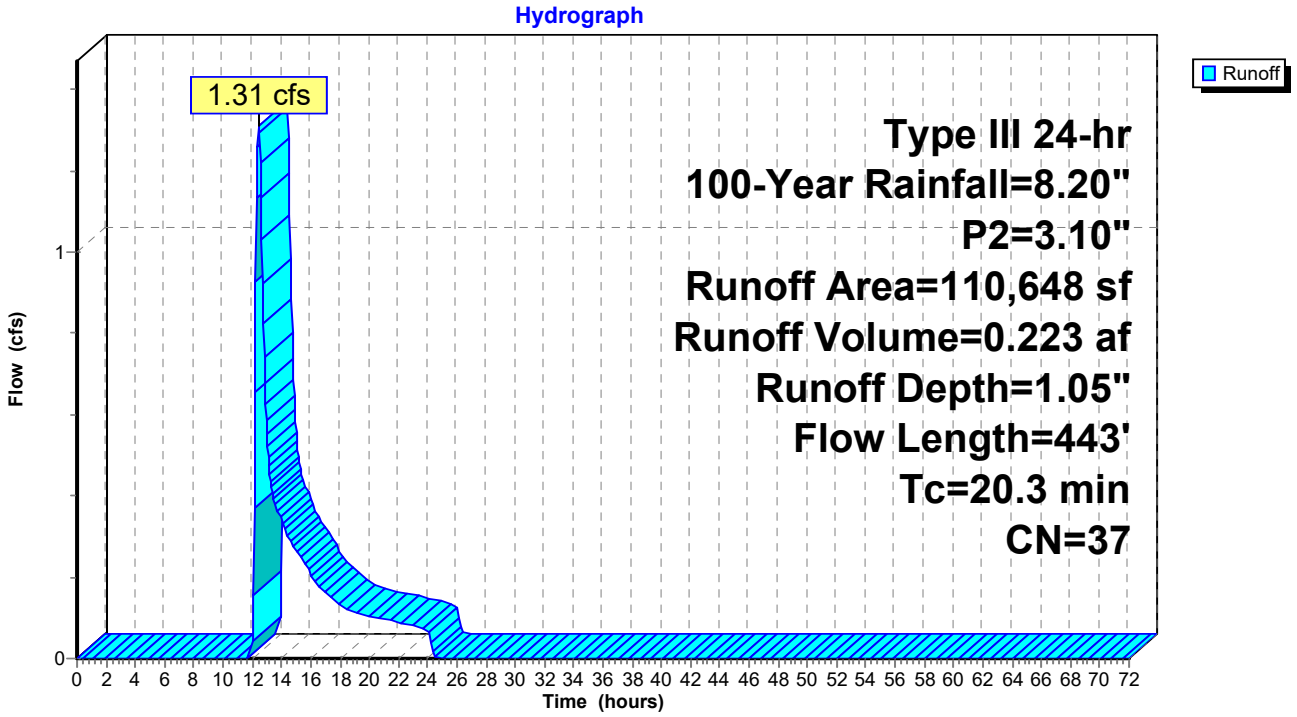
Runoff = 1.31 cfs @ 12.43 hrs, Volume= 0.223 af, Depth= 1.05"
Routed to Pond 1P : DP7 - Existing Depression 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.20", P2=3.10"

Area (sf)	CN	Description
84,652	30	Woods, Good, HSG A
13	39	>75% Grass cover, Good, HSG A
21,381	54	1/2 acre lots, 25% imp, HSG A
621	98	Roofs, HSG A
3,980	72	Dirt roads, HSG A
110,648	37	Weighted Average
104,681		94.61% Pervious Area
5,967		5.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	50	0.0125	0.06		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
3.3	149	0.0226	0.75		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.9	244	0.1800	2.12		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
20.3	443	Total			

Subcatchment E-9: Subcat E-9



Summary for Pond 1P: DP7 - Existing Depression 2

Inflow Area = 2.540 ac, 5.39% Impervious, Inflow Depth = 1.05" for 100-Year event
Inflow = 1.31 cfs @ 12.43 hrs, Volume= 0.223 af
Outflow = 0.19 cfs @ 16.24 hrs, Volume= 0.223 af, Atten= 86%, Lag= 228.8 min
Discarded = 0.19 cfs @ 16.24 hrs, Volume= 0.223 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 165.30' @ 16.24 hrs Surf.Area= 3,398 sf Storage= 4,111 cf

Plug-Flow detention time= 293.4 min calculated for 0.223 af (100% of inflow)
Center-of-Mass det. time= 293.2 min (1,226.4 - 933.2)

Volume	Invert	Avail.Storage	Storage Description
#1	163.00'	93,839 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

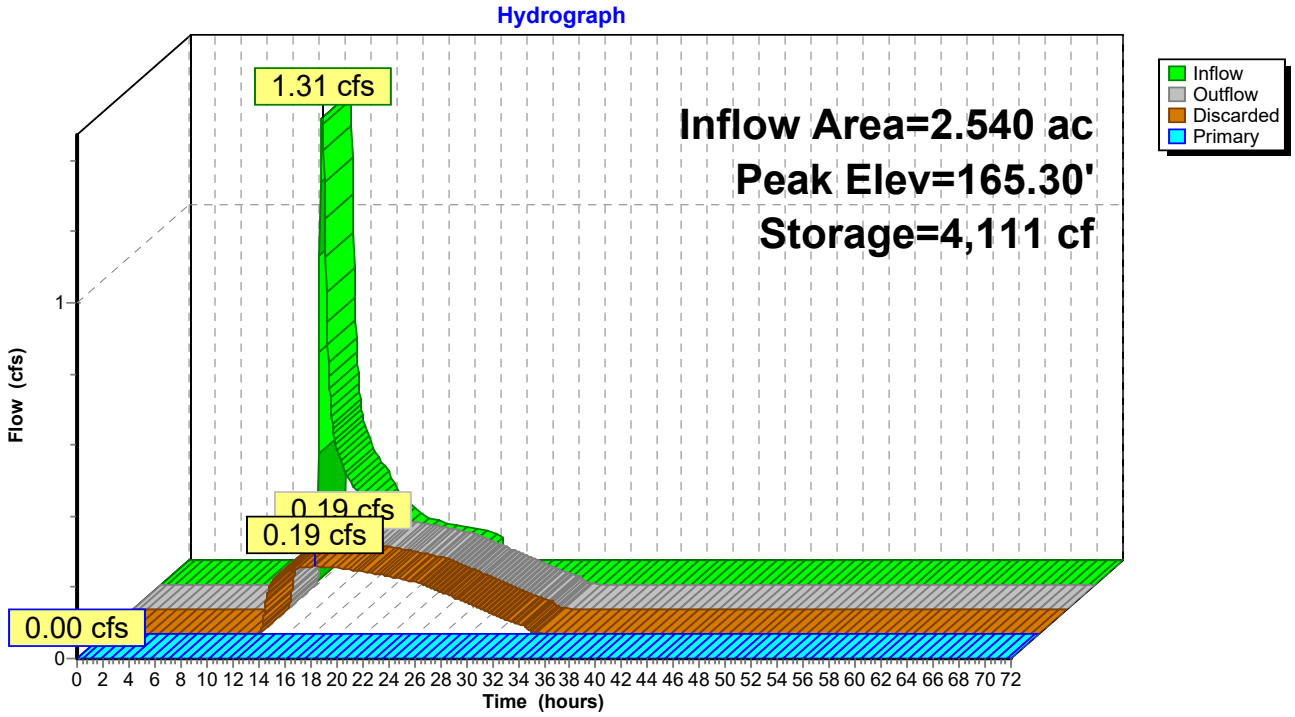
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
163.00	333	75.0	0	0	333
164.00	1,602	160.0	888	888	1,927
165.00	2,975	219.0	2,253	3,142	3,716
166.00	4,470	279.0	3,697	6,839	6,107
167.00	6,302	338.0	5,360	12,199	9,020
168.00	8,505	396.0	7,376	19,575	12,428
169.00	10,882	448.0	9,669	29,244	15,946
170.00	13,282	490.0	12,062	41,306	19,116
171.00	15,858	534.0	14,551	55,857	22,738
172.00	18,847	583.0	17,331	73,188	27,129
173.00	22,508	622.0	20,650	93,839	30,917

Device	Routing	Invert	Outlet Devices
#1	Primary	172.90'	**10.0' long x 50.0' 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
#2	Discarded	163.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.19 cfs @ 16.24 hrs HW=165.30' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=163.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: DP7 - Existing Depression 2



Summary for Pond 2P: DP6 - Ex Inf Basin Club

Inflow Area = 18.006 ac, 20.31% Impervious, Inflow Depth = 1.84" for 100-Year event
Inflow = 20.36 cfs @ 12.41 hrs, Volume= 2.765 af
Outflow = 1.70 cfs @ 16.94 hrs, Volume= 2.765 af, Atten= 92%, Lag= 272.0 min
Discarded = 1.33 cfs @ 16.94 hrs, Volume= 2.710 af
Primary = 0.38 cfs @ 16.94 hrs, Volume= 0.055 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 168.04' @ 16.94 hrs Surf.Area= 23,760 sf Storage= 73,173 cf

Plug-Flow detention time= 839.2 min calculated for 2.765 af (100% of inflow)
Center-of-Mass det. time= 839.2 min (1,740.8 - 901.6)

Volume	Invert	Avail.Storage	Storage Description
#1	159.00'	100,011 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

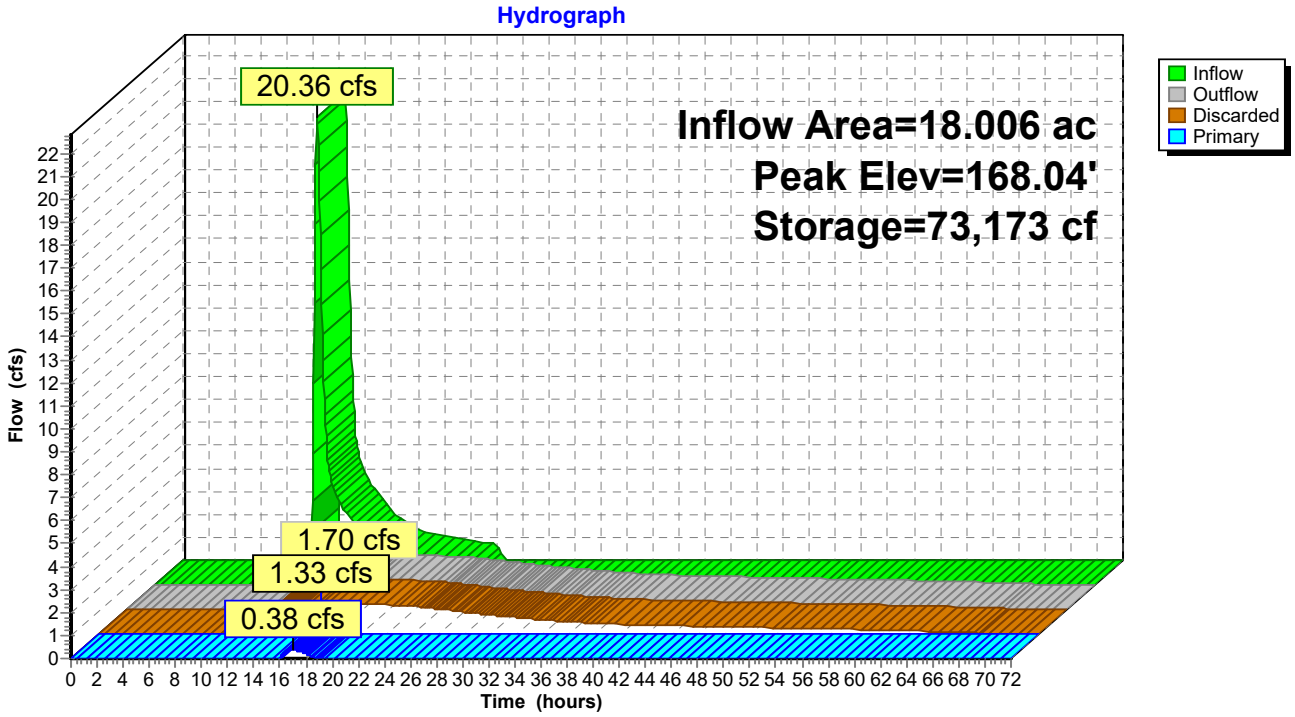
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
159.00	934	176.0	0	0	934
160.00	2,320	278.0	1,575	1,575	4,626
161.00	3,563	292.0	2,919	4,495	5,322
162.00	4,546	305.0	4,045	8,539	6,008
163.00	5,553	339.0	5,041	13,580	7,780
164.00	6,677	374.0	6,106	19,687	9,798
165.00	8,367	426.0	7,506	27,193	13,132
166.00	12,063	523.0	10,159	37,352	20,473
167.00	17,347	642.0	14,625	51,977	31,520
168.00	23,464	806.0	20,329	72,306	50,432
169.00	32,175	988.0	27,705	100,011	76,430

Device	Routing	Invert	Outlet Devices
#1	Primary	167.99'	**10.0' long x 50.0' 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
#2	Discarded	159.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.33 cfs @ 16.94 hrs HW=168.04' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 1.33 cfs)

Primary OutFlow Max=0.27 cfs @ 16.94 hrs HW=168.04' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.27 cfs @ 0.58 fps)

Pond 2P: DP6 - Ex Inf Basin Club



Summary for Pond 3P: Drainage Basin/Easement

Inflow Area = 8.799 ac, 44.85% Impervious, Inflow Depth = 3.95" for 100-Year event
Inflow = 30.53 cfs @ 12.19 hrs, Volume= 2.896 af
Outflow = 1.03 cfs @ 17.64 hrs, Volume= 2.896 af, Atten= 97%, Lag= 326.8 min
Discarded = 1.03 cfs @ 17.64 hrs, Volume= 2.896 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 183.74' @ 17.64 hrs Surf.Area= 18,417 sf Storage= 88,170 cf

Plug-Flow detention time= 1,112.0 min calculated for 2.894 af (100% of inflow)
Center-of-Mass det. time= 1,113.1 min (1,947.4 - 834.3)

Volume	Invert	Avail.Storage	Storage Description
#1	174.00'	345,539 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

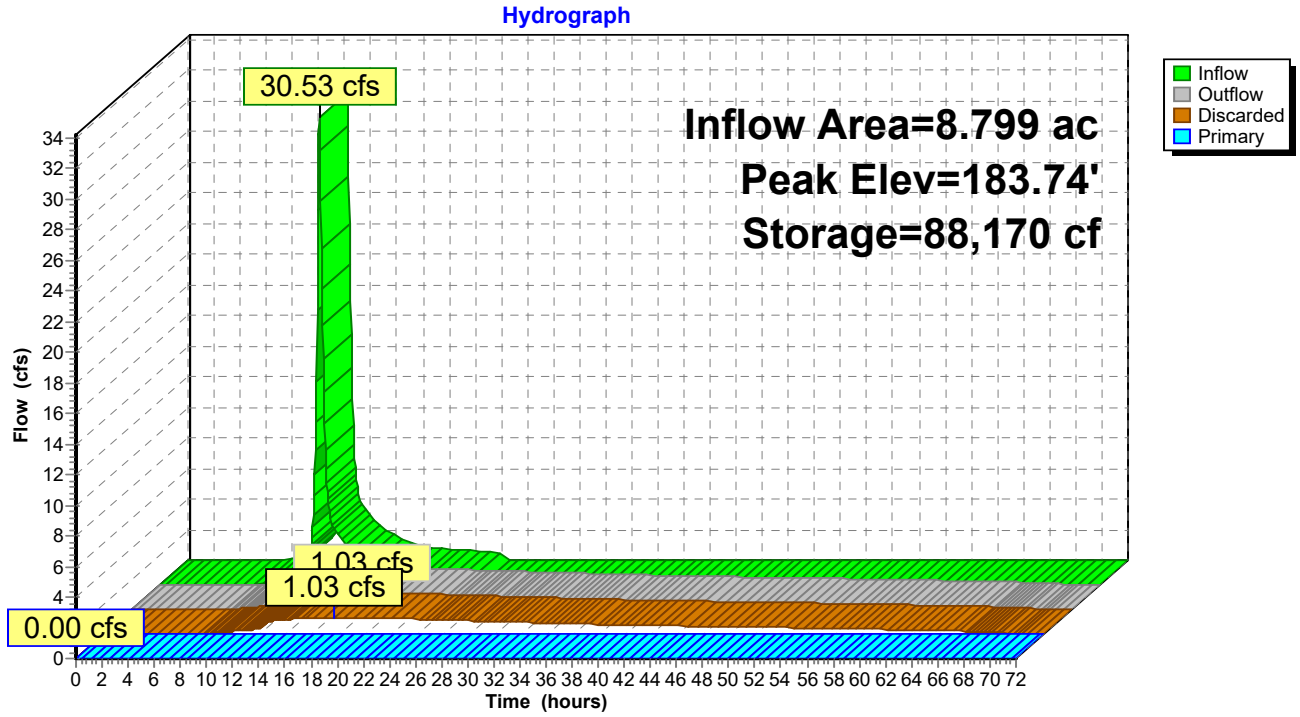
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
174.00	491	104.0	0	0	491
175.00	3,251	224.0	1,668	1,668	3,627
176.00	4,753	273.0	3,978	5,647	5,581
177.00	6,309	310.0	5,513	11,159	7,322
178.00	7,641	346.0	6,964	18,124	9,230
179.00	8,869	377.0	8,247	26,371	11,050
180.00	10,188	402.0	9,521	35,892	12,648
181.00	11,953	430.0	11,059	46,951	14,548
182.00	14,143	463.0	13,033	59,983	16,935
183.00	16,525	499.0	15,319	75,302	19,733
184.00	19,118	519.0	17,806	93,108	21,431
185.00	21,426	604.0	20,261	113,369	29,048
186.00	23,221	589.0	22,317	135,686	30,592
187.00	24,868	608.0	24,040	159,726	32,498
188.00	26,530	627.0	25,695	185,421	34,465
189.00	28,209	646.0	27,365	212,786	36,492
190.00	30,172	674.0	29,185	241,971	39,506
191.00	32,732	704.0	31,443	273,414	42,867
192.00	36,071	766.0	34,388	307,802	50,157
193.00	39,428	897.0	37,737	345,539	67,513

Device	Routing	Invert	Outlet Devices
#1	Primary	192.90'	**10.0' long x 50.0' 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
#2	Discarded	174.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.03 cfs @ 17.64 hrs HW=183.74' (Free Discharge)
↑**2=Exfiltration** (Exfiltration Controls 1.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=174.00' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Drainage Basin/Easement



Summary for Pond 4P: DP3 - Existing Depression 1

Inflow Area = 0.901 ac, 0.00% Impervious, Inflow Depth = 0.62" for 100-Year event
Inflow = 0.20 cfs @ 12.49 hrs, Volume= 0.046 af
Outflow = 0.06 cfs @ 15.12 hrs, Volume= 0.046 af, Atten= 69%, Lag= 157.5 min
Discarded = 0.06 cfs @ 15.12 hrs, Volume= 0.046 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to nonexistent node SP4

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 194.02' @ 15.12 hrs Surf.Area= 1,111 sf Storage= 458 cf

Plug-Flow detention time= 103.0 min calculated for 0.046 af (100% of inflow)
Center-of-Mass det. time= 103.0 min (1,070.4 - 967.3)

Volume	Invert	Avail.Storage	Storage Description
#1	193.00'	17,265 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

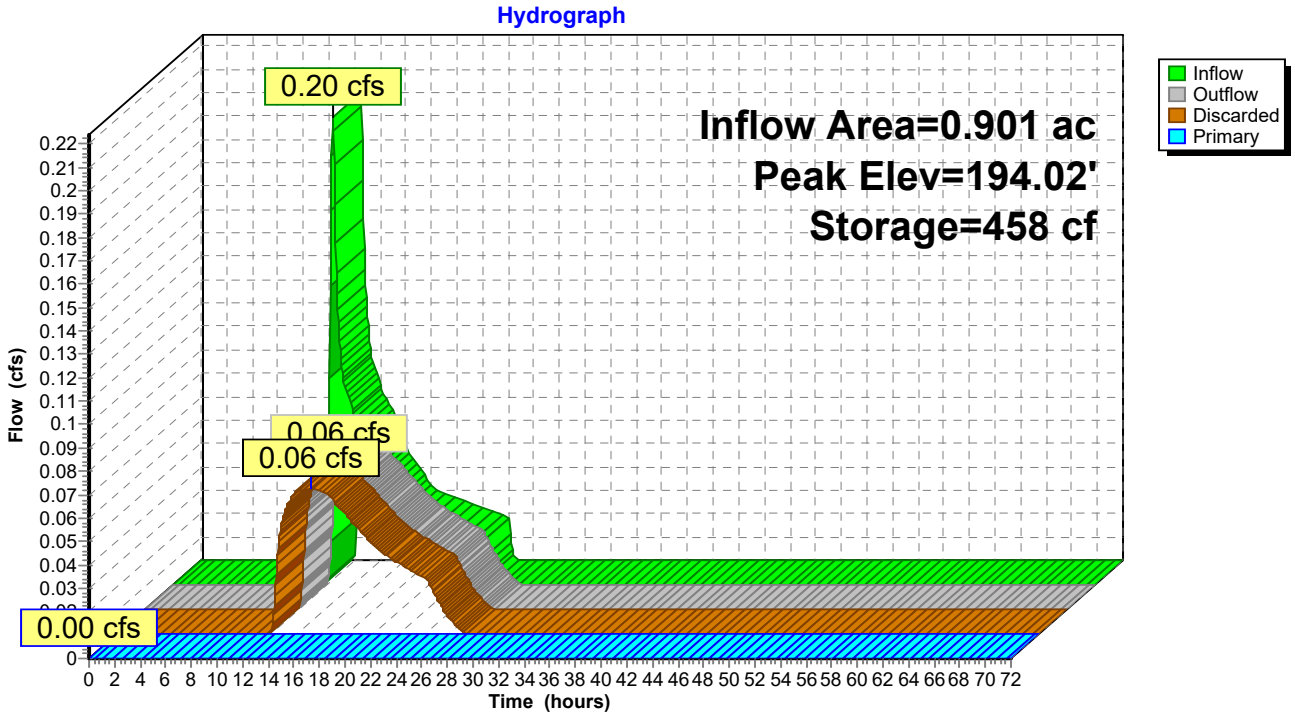
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
193.00	30	100.0	0	0	30
194.00	1,087	159.0	433	433	1,253
195.00	2,356	217.0	1,681	2,114	2,998
196.00	3,959	276.0	3,123	5,237	5,326
197.00	5,956	339.0	4,924	10,160	8,425
198.00	8,319	398.0	7,105	17,265	11,905

Device	Routing	Invert	Outlet Devices
#1	Primary	197.90'	**10.0' long x 20.0' 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
#2	Discarded	193.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.06 cfs @ 15.12 hrs HW=194.02' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.06 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=193.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 4P: DP3 - Existing Depression 1

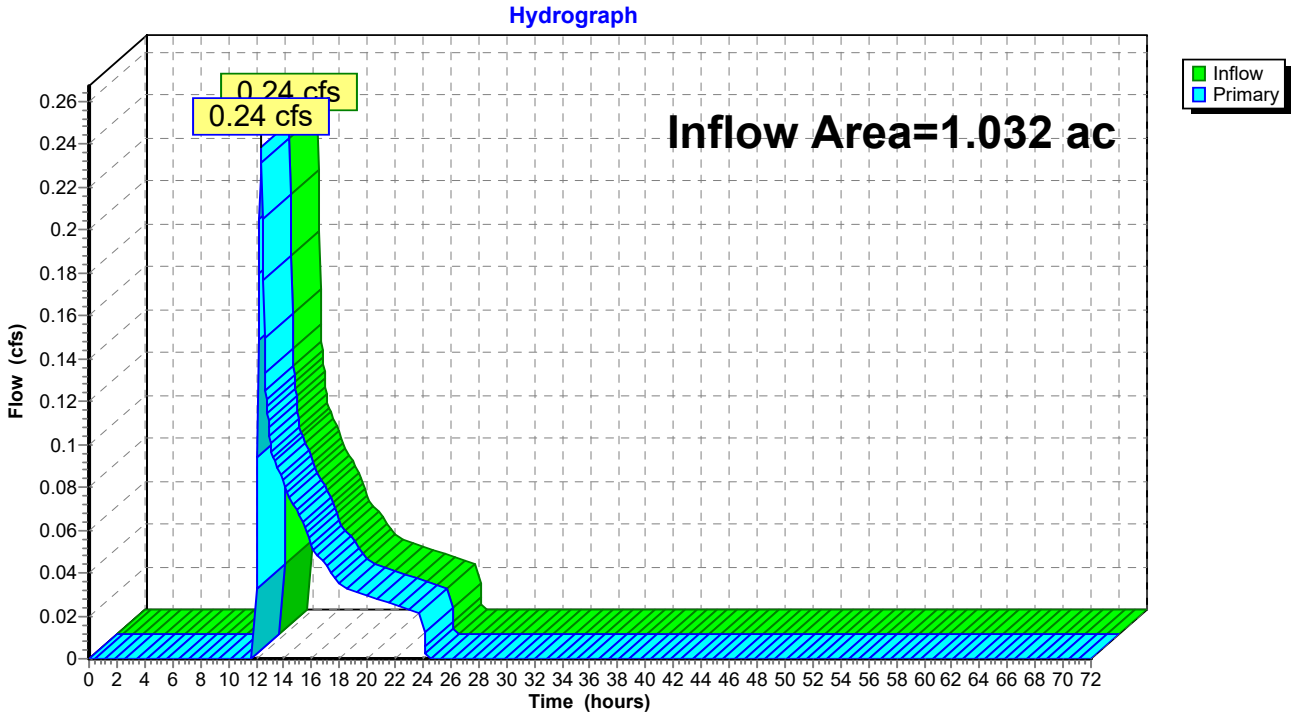


Summary for Link DP1: N'ly Property Line

Inflow Area = 1.032 ac, 0.21% Impervious, Inflow Depth = 0.60" for 100-Year event
Inflow = 0.24 cfs @ 12.37 hrs, Volume= 0.052 af
Primary = 0.24 cfs @ 12.37 hrs, Volume= 0.052 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP1: N'ly Property Line

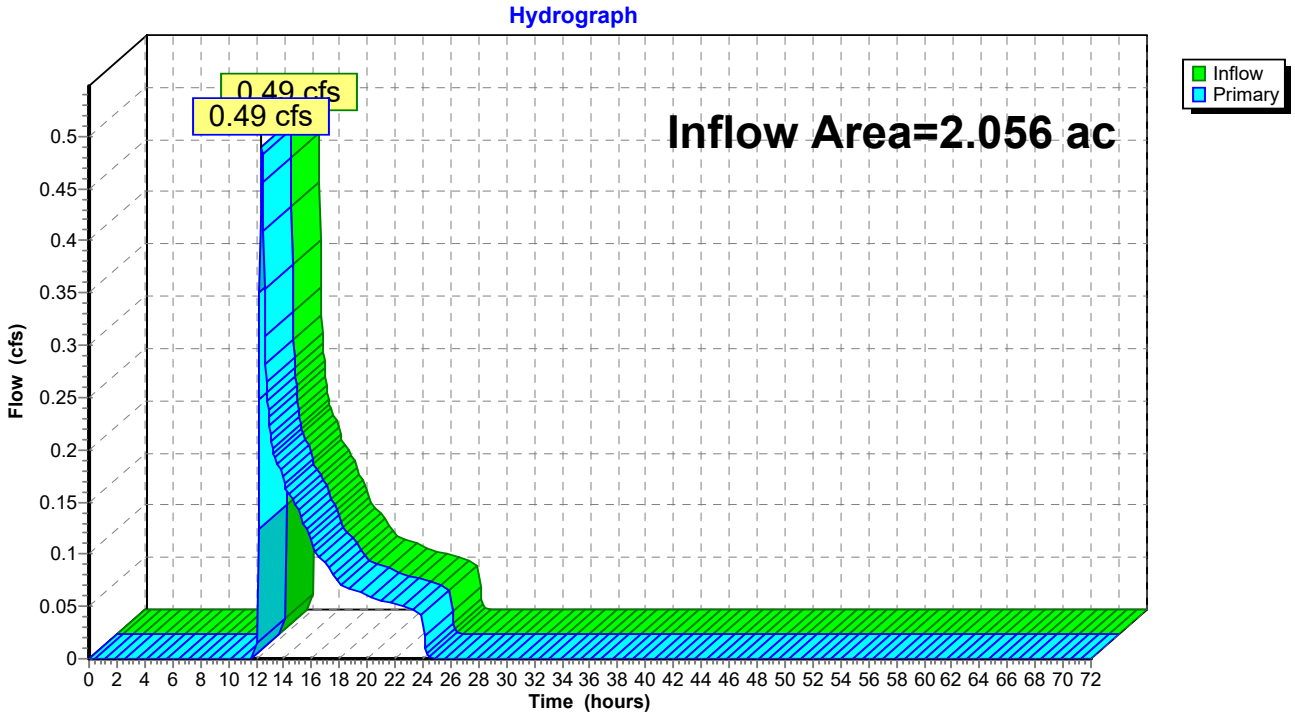


Summary for Link DP2: E'ly Property Line

Inflow Area = 2.056 ac, 1.52% Impervious, Inflow Depth = 0.62" for 100-Year event
Inflow = 0.49 cfs @ 12.41 hrs, Volume= 0.106 af
Primary = 0.49 cfs @ 12.41 hrs, Volume= 0.106 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP2: E'ly Property Line

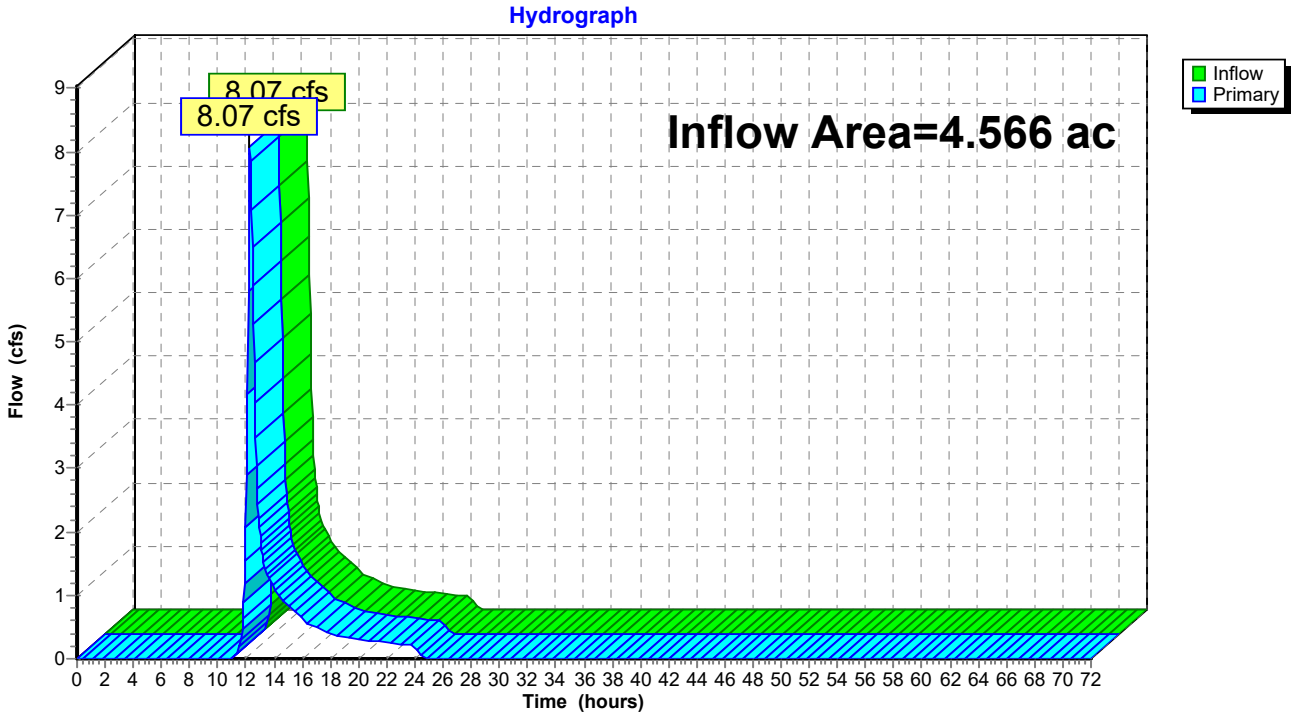


Summary for Link DP4: S'ly Property Line

Inflow Area = 4.566 ac, 26.41% Impervious, Inflow Depth = 2.37" for 100-Year event
Inflow = 8.07 cfs @ 12.28 hrs, Volume= 0.903 af
Primary = 8.07 cfs @ 12.28 hrs, Volume= 0.903 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP4: S'ly Property Line

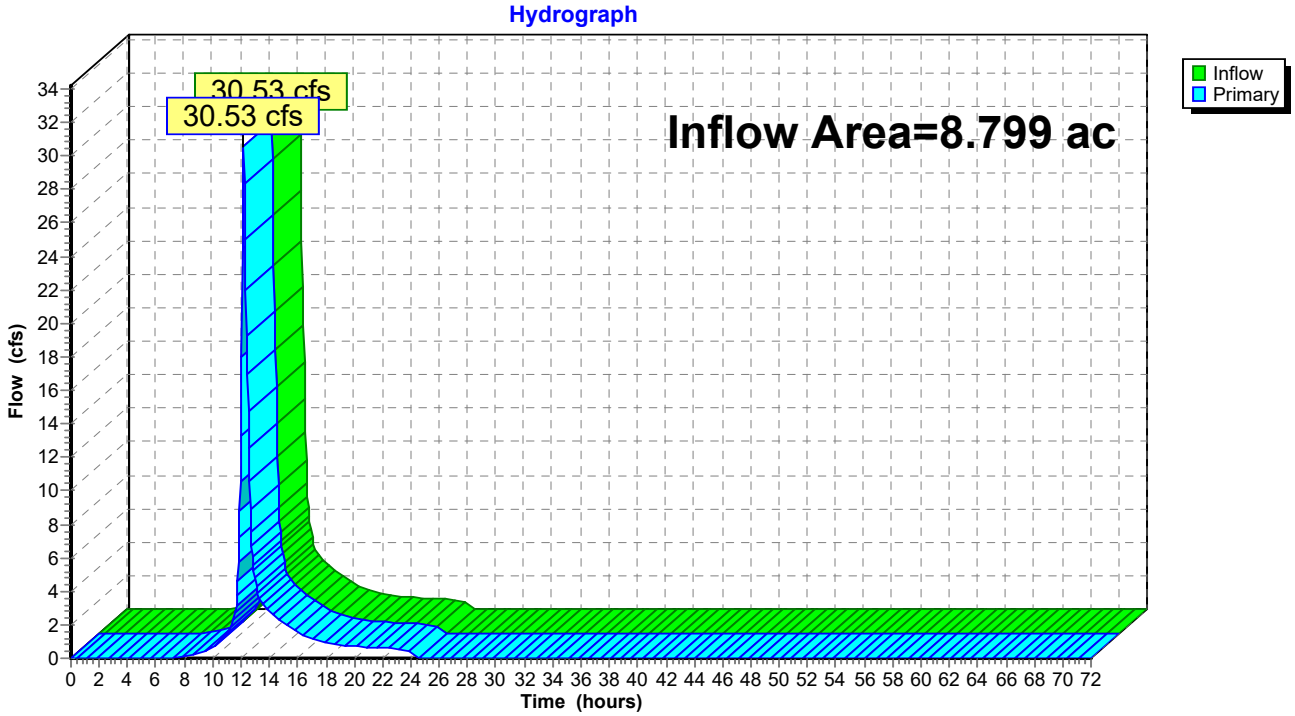


Summary for Link DP5: To Ex Basin

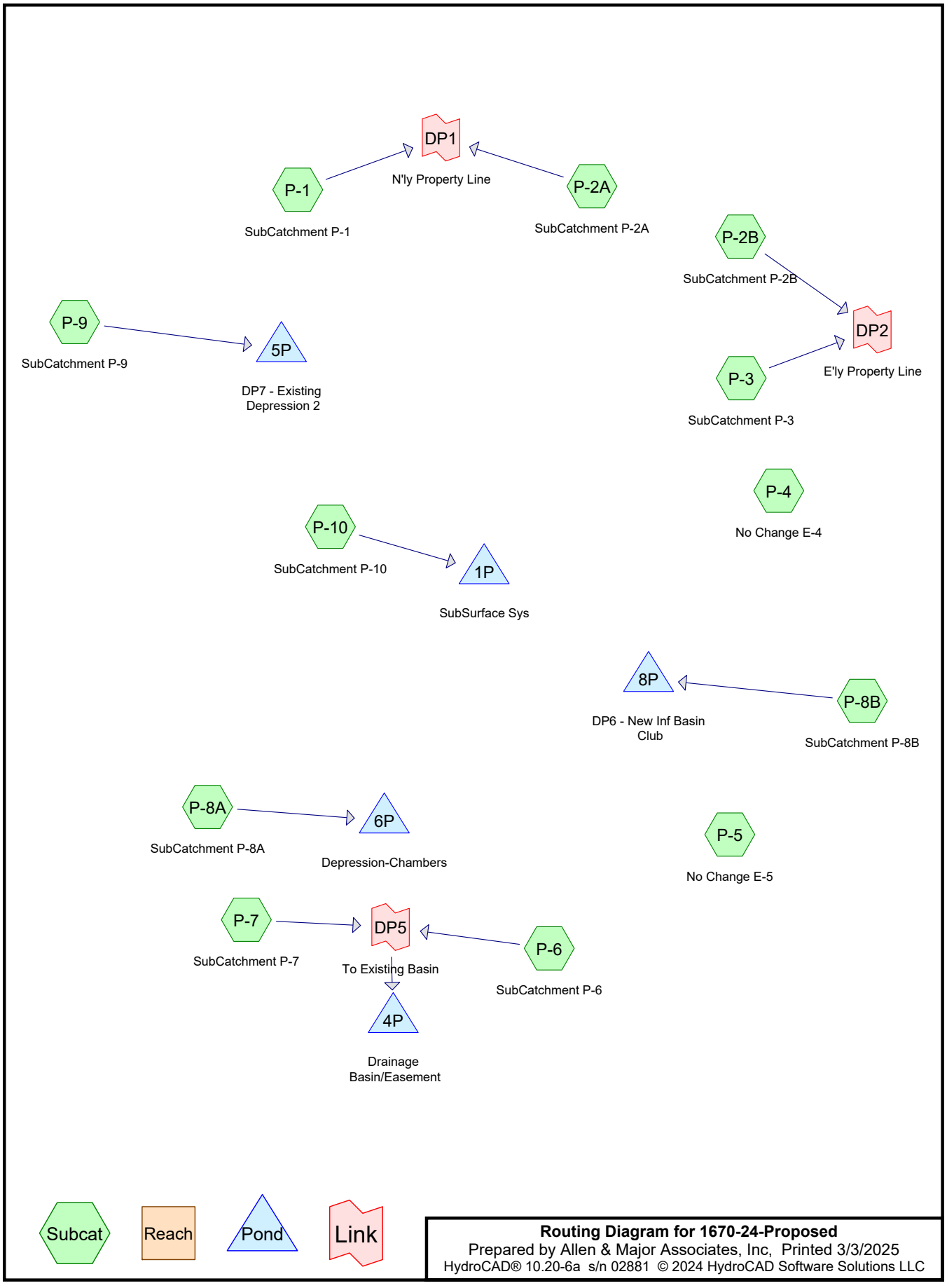
Inflow Area = 8.799 ac, 44.85% Impervious, Inflow Depth = 3.95" for 100-Year event
Inflow = 30.53 cfs @ 12.19 hrs, Volume= 2.896 af
Primary = 30.53 cfs @ 12.19 hrs, Volume= 2.896 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 3P : Drainage Basin/Easement

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP5: To Ex Basin



POST-DEVELOPMENT



Routing Diagram for 1670-24-Proposed
Prepared by Allen & Major Associates, Inc, Printed 3/3/2025
HydroCAD® 10.20-6a s/n 02881 © 2024 HydroCAD Software Solutions LLC

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC	P2 (inches)
1	2-yr	Type III 24-hr		Default	24.00	1	3.10	2	3.10
2	10-yr	Type III 24-hr		Default	24.00	1	4.62	2	3.10
3	25-yr	Type III 24-hr		Default	24.00	1	5.80	2	3.10
4	100-yr	Type III 24-hr		Default	24.00	1	8.20	2	3.10

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.815	54	1/2 acre lots, 25% imp, HSG A (P-6)
1.214	61	1/4 acre lots, 38% imp, HSG A (P-10, P-8A)
9.639	39	>75% Grass cover, Good, HSG A (P-1, P-10, P-2A, P-2B, P-3, P-5, P-6, P-7, P-8A, P-8B, P-9)
0.348	72	Dirt roads, HSG A (P-4, P-5)
7.693	98	Paved parking, HSG A (P-10, P-5, P-6, P-7)
2.255	98	Roofs, HSG A (P-10, P-5)
1.533	98	Unconnected pavement, HSG A (P-5, P-8B)
1.082	98	Unconnected roofs, HSG A (P-8B)
0.455	98	Water Surface, HSG A (P-10, P-8A, P-8B, P-9)
12.873	30	Woods, Good, HSG A (P-1, P-10, P-2A, P-2B, P-3, P-4, P-5, P-6, P-7, P-8A, P-8B, P-9)
37.906	**58**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
37.906	HSG A	P-1, P-10, P-2A, P-2B, P-3, P-4, P-5, P-6, P-7, P-8A, P-8B, P-9
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
37.906		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.815	0.000	0.000	0.000	0.000	0.815	1/2 acre lots, 25% imp	P-6
1.214	0.000	0.000	0.000	0.000	1.214	1/4 acre lots, 38% imp	P-10, P-8A
9.639	0.000	0.000	0.000	0.000	9.639	>75% Grass cover, Good	P-1, P-10, P-2A, P-2B, P-3, P-5, P-6, P-7, P-8A, P-8B, P-9
0.348	0.000	0.000	0.000	0.000	0.348	Dirt roads	P-4, P-5
7.693	0.000	0.000	0.000	0.000	7.693	Paved parking	P-10, P-5, P-6, P-7
2.255	0.000	0.000	0.000	0.000	2.255	Roofs	P-10, P-5
1.533	0.000	0.000	0.000	0.000	1.533	Unconnected pavement	P-5, P-8B
1.082	0.000	0.000	0.000	0.000	1.082	Unconnected roofs	P-8B
0.455	0.000	0.000	0.000	0.000	0.455	Water Surface	P-10, P-8A, P-8B, P-9
12.873	0.000	0.000	0.000	0.000	12.873	Woods, Good	P-1, P-10, P-2A, P-2B, P-3, P-4, P-5, P-6, P-7, P-8A, P-8B, P-9
37.906	**0.000**	**0.000**	**0.000**	**0.000**	**37.906**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	P-10	0.00	0.00	111.0	0.0100	0.012	0.0	12.0	0.0	
2	P-10	0.00	0.00	81.0	0.0060	0.012	0.0	15.0	0.0	
3	P-10	0.00	0.00	72.0	0.0075	0.012	0.0	15.0	0.0	
4	P-10	0.00	0.00	70.0	0.0060	0.012	0.0	18.0	0.0	
5	P-6	0.00	0.00	123.0	0.0150	0.012	0.0	12.0	0.0	
6	P-6	0.00	0.00	115.0	0.0500	0.025	0.0	15.0	0.0	

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: SubCatchment P-1 Runoff Area=8,787 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=114' Tc=5.6 min CN=31 Runoff=0.00 cfs 0.000 af

Subcatchment P-10: SubCatchment P-10 Runoff Area=475,346 sf 56.27% Impervious Runoff Depth=0.82"
Flow Length=740' Tc=22.5 min CN=71 Runoff=6.00 cfs 0.744 af

Subcatchment P-2A: SubCatchment P-2A Runoff Area=14,405 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=81' Tc=7.6 min CN=31 Runoff=0.00 cfs 0.000 af

Subcatchment P-2B: SubCatchment P-2B Runoff Area=13,129 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=68' Tc=7.2 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment P-3: SubCatchment P-3 Runoff Area=22,271 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=181' Tc=5.8 min CN=32 Runoff=0.00 cfs 0.000 af

Subcatchment P-4: No Change E-4 Runoff Area=39,239 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=214' Tc=15.8 min CN=32 Runoff=0.00 cfs 0.000 af

Subcatchment P-5: No Change E-5 Runoff Area=198,882 sf 26.41% Impervious Runoff Depth=0.11"
Flow Length=270' Tc=18.4 min UI Adjusted CN=50 Runoff=0.07 cfs 0.041 af

Subcatchment P-6: SubCatchment P-6 Runoff Area=241,179 sf 60.39% Impervious Runoff Depth=0.97"
Flow Length=332' Tc=14.1 min CN=74 Runoff=4.55 cfs 0.449 af

Subcatchment P-7: SubCatchment P-7 Runoff Area=132,158 sf 6.78% Impervious Runoff Depth=0.00"
Flow Length=248' Tc=8.0 min CN=38 Runoff=0.00 cfs 0.000 af

Subcatchment P-8A: SubCatchment P-8A Runoff Area=64,700 sf 19.02% Impervious Runoff Depth=0.05"
Flow Length=227' Tc=10.1 min CN=46 Runoff=0.01 cfs 0.006 af

Subcatchment P-8B: SubCatchment P-8B Runoff Area=379,332 sf 28.54% Impervious Runoff Depth=0.02"
Flow Length=631' Tc=21.6 min UI Adjusted CN=44 Runoff=0.02 cfs 0.017 af

Subcatchment P-9: SubCatchment P-9 Runoff Area=61,741 sf 1.30% Impervious Runoff Depth=0.00"
Flow Length=199' Tc=18.4 min CN=33 Runoff=0.00 cfs 0.000 af

Pond 1P: SubSurface Sys Peak Elev=172.19' Storage=1,807 cf Inflow=6.00 cfs 0.744 af
Outflow=4.47 cfs 0.744 af

Pond 4P: Drainage Basin/Easement Peak Elev=176.81' Storage=10,255 cf Inflow=4.55 cfs 0.449 af
Discarded=0.34 cfs 0.449 af Primary=0.00 cfs 0.000 af Outflow=0.34 cfs 0.449 af

Pond 5P: DP7 - Existing Depression 2 Peak Elev=172.00' Storage=0 cf Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Pond 6P: Depression-Chambers Peak Elev=176.50' Storage=1 cf Inflow=0.01 cfs 0.006 af
Outflow=0.01 cfs 0.006 af

Pond 8P: DP6 - New Inf Basin Club Peak Elev=167.00' Storage=5 cf Inflow=0.02 cfs 0.017 af
Outflow=0.02 cfs 0.017 af

Link DP1: N'ly Property Line Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link DP2: E'ly Property Line Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link DP5: To Existing Basin Inflow=4.55 cfs 0.449 af
Primary=4.55 cfs 0.449 af

Total Runoff Area = 37.906 ac Runoff Volume = 1.257 af Average Runoff Depth = 0.40"
63.90% Pervious = 24.223 ac 36.10% Impervious = 13.682 ac

Summary for Subcatchment P-1: SubCatchment P-1

[49] Hint: Tc<2dt may require smaller dt
[45] Hint: Runoff=Zero

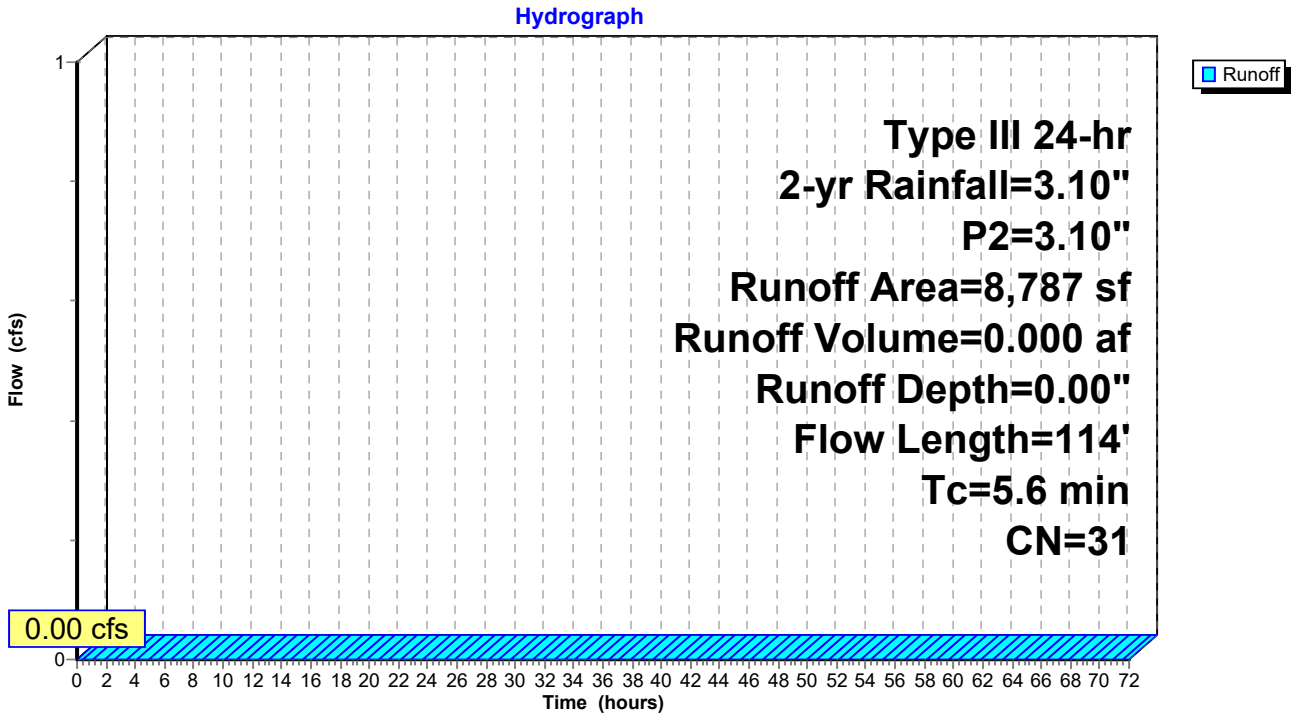
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link DP1 : N'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10", P2=3.10"

Area (sf)	CN	Description
7,342	30	Woods, Good, HSG A
1,445	39	>75% Grass cover, Good, HSG A
8,787	31	Weighted Average
8,787		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.1900	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	64	0.2100	2.29		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
5.6	114	Total			

Subcatchment P-1: SubCatchment P-1



Summary for Subcatchment P-10: SubCatchment P-10

[47] Hint: Peak is 156% of capacity of segment #6
[47] Hint: Peak is 111% of capacity of segment #7

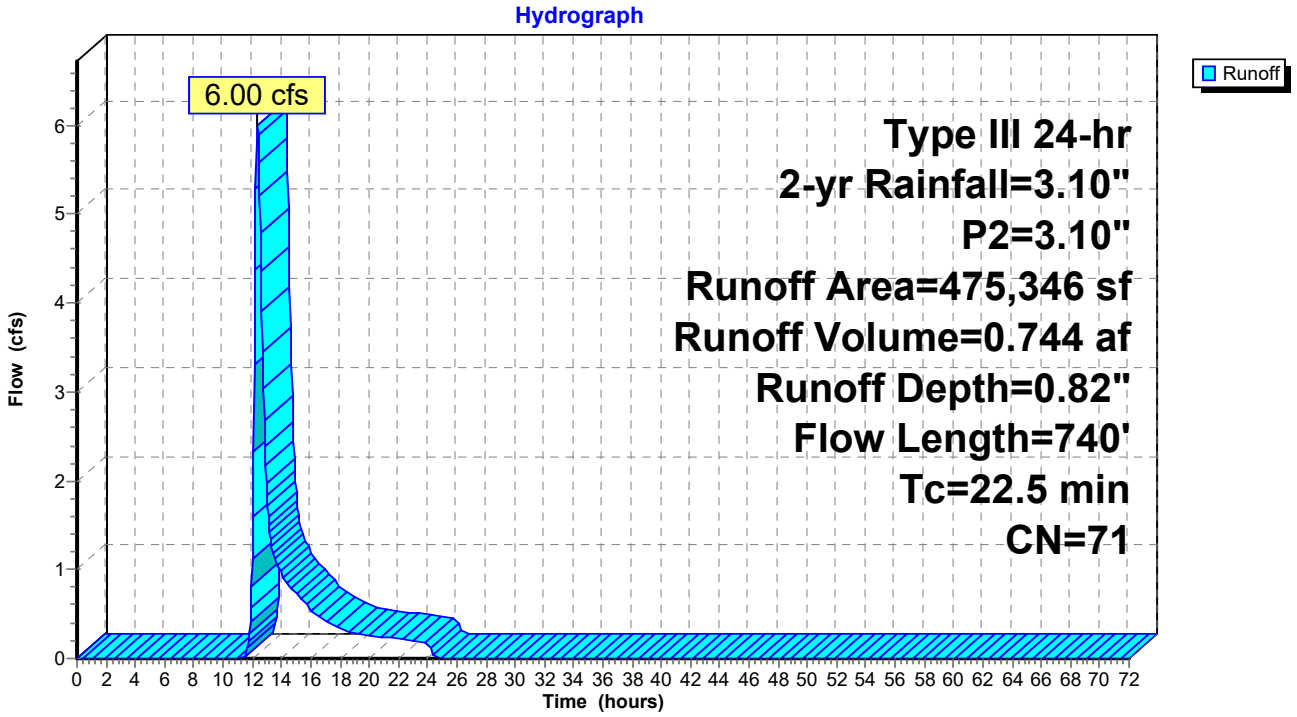
Runoff = 6.00 cfs @ 12.36 hrs, Volume= 0.744 af, Depth= 0.82"
Routed to Pond 1P : SubSurface Sys

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10", P2=3.10"

Area (sf)	CN	Description
66,746	30	Woods, Good, HSG A
125,013	39	>75% Grass cover, Good, HSG A
76,512	98	Roofs, HSG A
173,050	98	Paved parking, HSG A
8,075	98	Water Surface, HSG A
25,950	61	1/4 acre lots, 38% imp, HSG A
475,346	71	Weighted Average
207,848		43.73% Pervious Area
267,498		56.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	50	0.0125	0.06		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
4.7	156	0.0125	0.56		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.1	131	0.1500	1.94		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
0.2	9	0.0200	0.99		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
0.3	60	0.0300	3.52		**Shallow Concentrated Flow, E-F** Paved Kv= 20.3 fps
0.4	111	0.0100	4.91	3.86	**Pipe Channel, F-G** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.3	81	0.0060	4.42	5.42	**Pipe Channel, G-H** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012
0.2	72	0.0075	4.94	6.06	**Pipe Channel, H-I** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012
0.2	70	0.0060	4.99	8.81	**Pipe Channel, I-J** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012
22.5	740	Total			

Subcatchment P-10: SubCatchment P-10



Summary for Subcatchment P-2A: SubCatchment P-2A

[45] Hint: Runoff=Zero

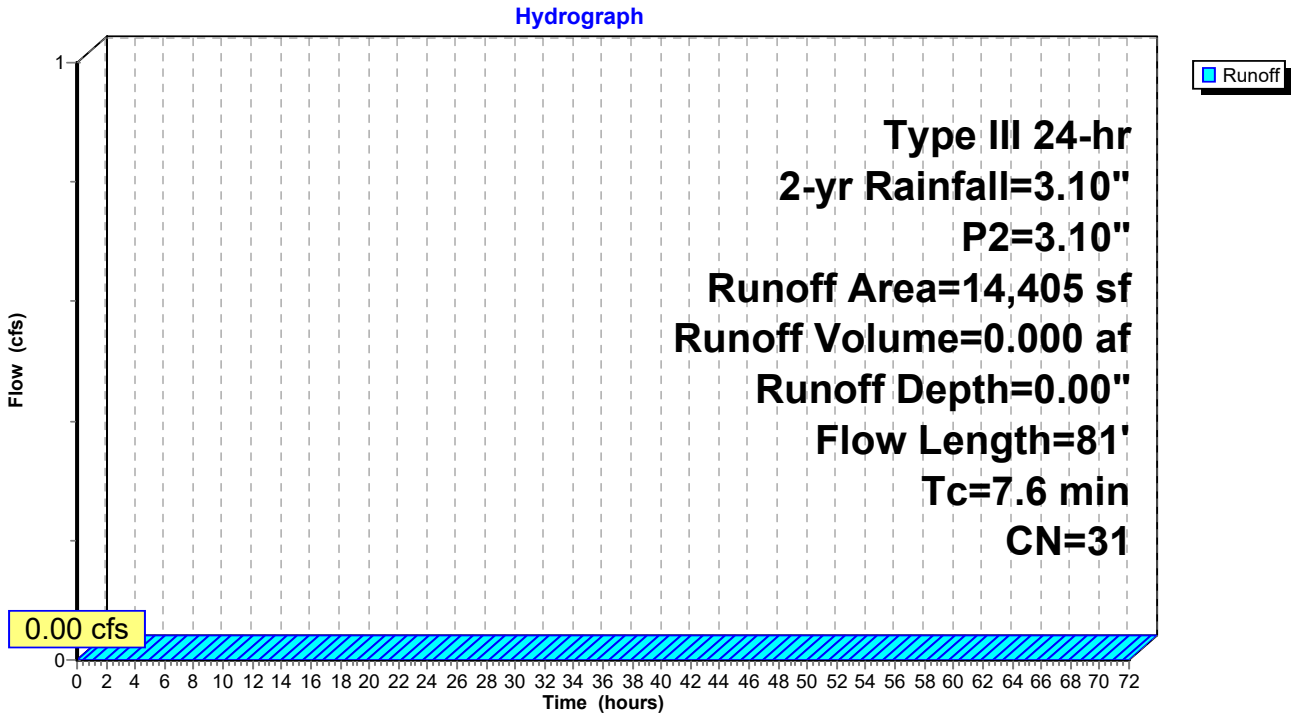
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link DP1 : N'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10", P2=3.10"

Area (sf)	CN	Description
13,193	30	Woods, Good, HSG A
1,212	39	>75% Grass cover, Good, HSG A
14,405	31	Weighted Average
14,405		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0800	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.4	31	0.0680	1.30		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
7.6	81	Total			

Subcatchment P-2A: SubCatchment P-2A



Summary for Subcatchment P-2B: SubCatchment P-2B

[45] Hint: Runoff=Zero

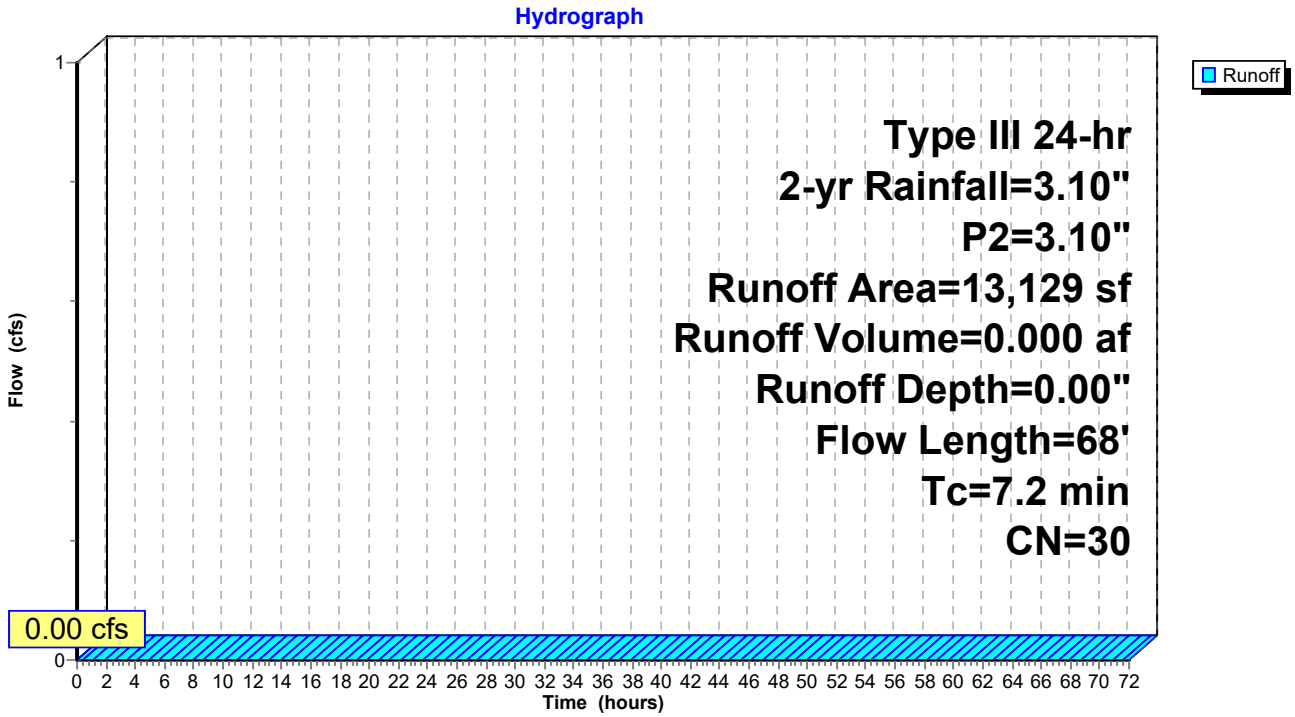
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link DP2 : E'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10", P2=3.10"

Area (sf)	CN	Description
12,906	30	Woods, Good, HSG A
223	39	>75% Grass cover, Good, HSG A
13,129	30	Weighted Average
13,129		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0860	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.2	18	0.0770	1.39		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
7.2	68	Total			

Subcatchment P-2B: SubCatchment P-2B



Summary for Subcatchment P-3: SubCatchment P-3

[49] Hint: Tc<2dt may require smaller dt
[45] Hint: Runoff=Zero

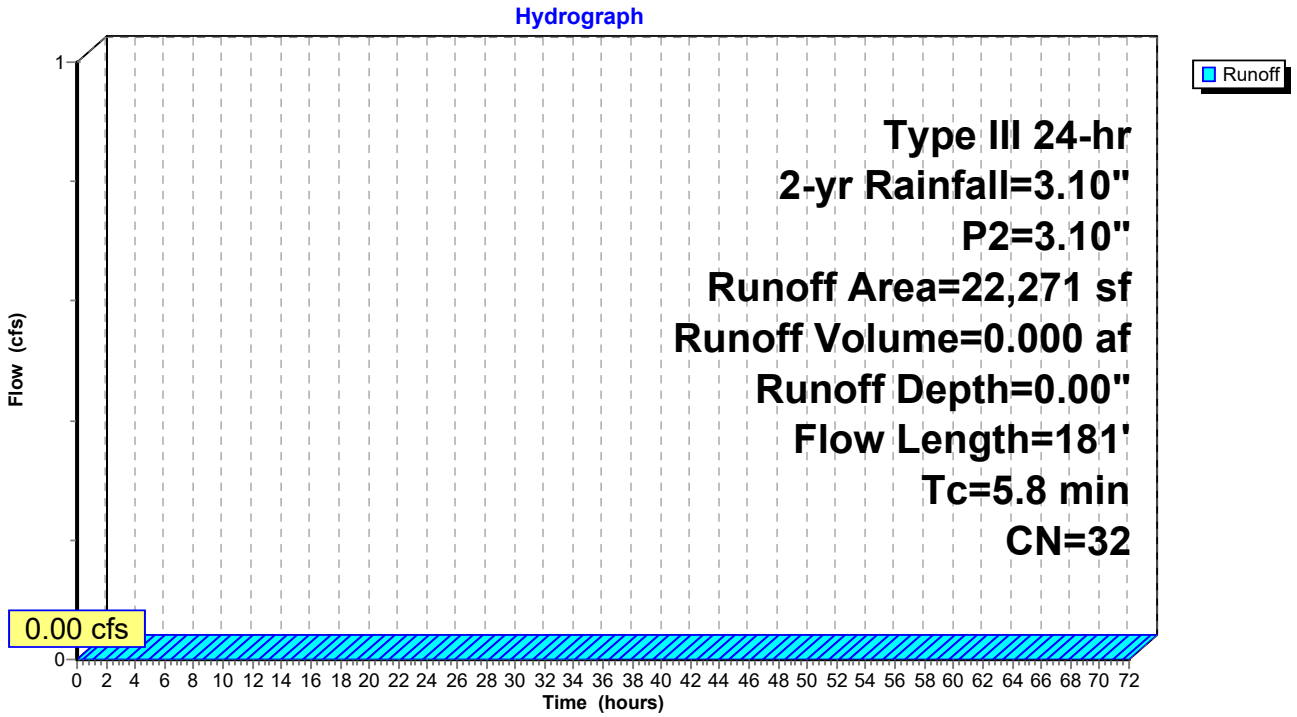
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link DP2 : E'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10", P2=3.10"

Area (sf)	CN	Description
16,687	30	Woods, Good, HSG A
5,584	39	>75% Grass cover, Good, HSG A
22,271	32	Weighted Average
22,271		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.2200	0.17		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
1.0	131	0.2000	2.24		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
5.8	181	Total			

Subcatchment P-3: SubCatchment P-3



Summary for Subcatchment P-4: No Change E-4

[45] Hint: Runoff=Zero

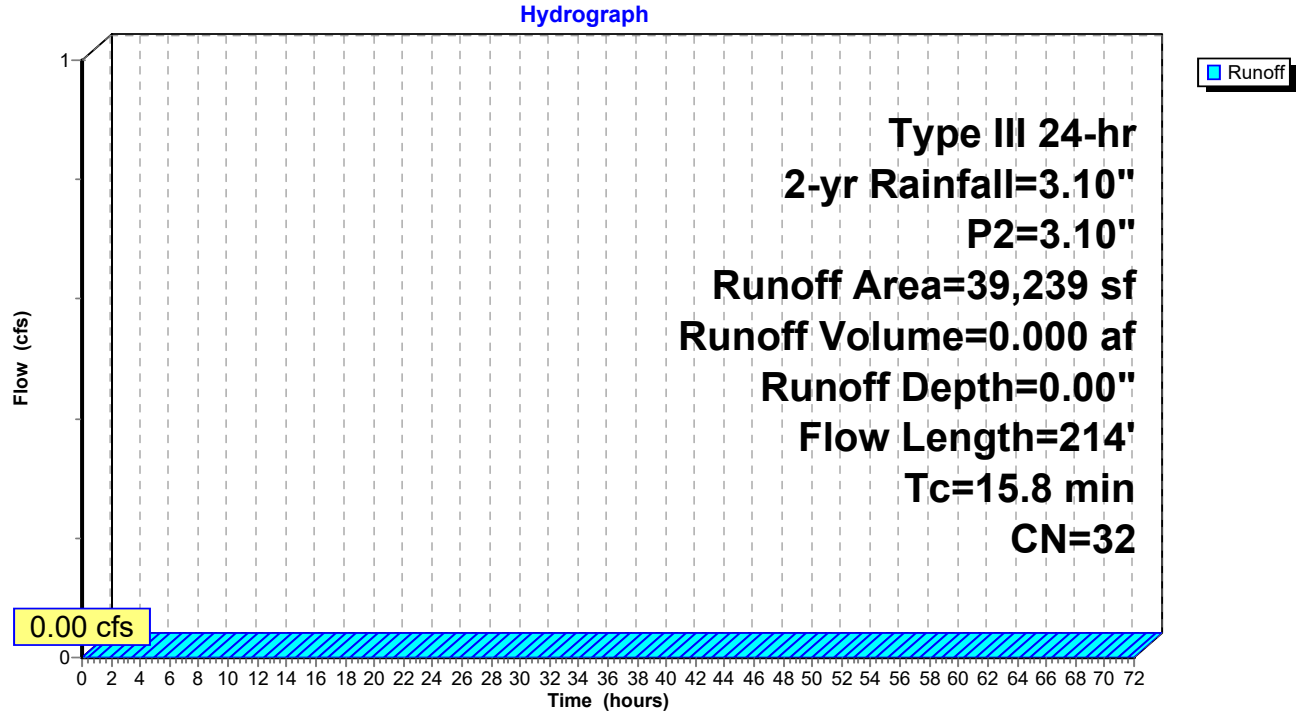
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10", P2=3.10"

Area (sf)	CN	Description
37,500	30	Woods, Good, HSG A
1,739	72	Dirt roads, HSG A
39,239	32	Weighted Average
39,239		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	50	0.0300	0.08		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.7	29	0.0200	0.71		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.2	10	0.0100	1.00		**Shallow Concentrated Flow, C-D** Nearly Bare & Untilled Kv= 10.0 fps
4.2	125	0.0100	0.50		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
15.8	214	Total			

Subcatchment P-4: No Change E-4



Summary for Subcatchment P-5: No Change E-5

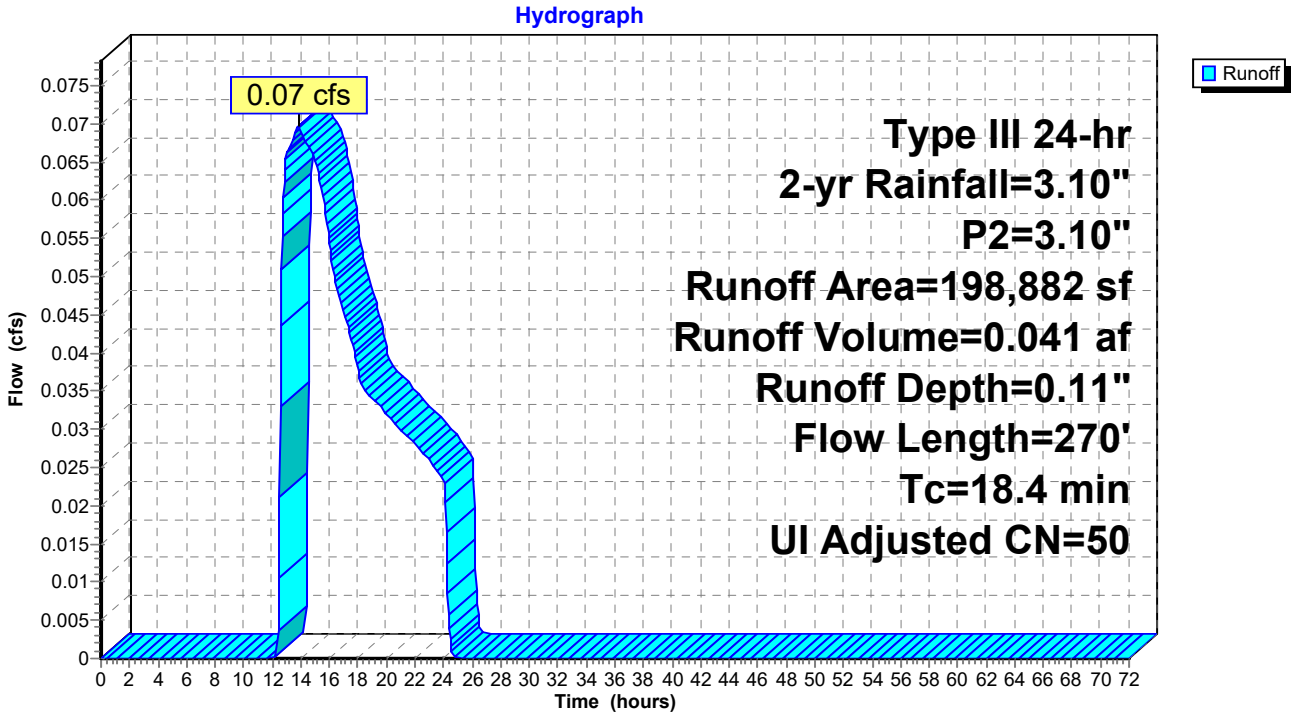
Runoff = 0.07 cfs @ 13.83 hrs, Volume= 0.041 af, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10", P2=3.10"

Area (sf)	CN	Adj	Description
99,401	30		Woods, Good, HSG A
33,545	39		>75% Grass cover, Good, HSG A
13,415	72		Dirt roads, HSG A
14,517	98		Unconnected pavement, HSG A
16,302	98		Paved parking, HSG A
21,702	98		Roofs, HSG A
198,882	52	50	Weighted Average, UI Adjusted
146,361			73.59% Pervious Area
52,521			26.41% Impervious Area
14,517			27.64% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		**Sheet Flow, A_B** Woods: Light underbrush n= 0.400 P2= 3.10"
5.6	184	0.0120	0.55		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.3	36	0.0500	2.24		**Shallow Concentrated Flow, C-D** Nearly Bare & Untilled Kv= 10.0 fps
18.4	270	Total			

Subcatchment P-5: No Change E-5



Summary for Subcatchment P-6: SubCatchment P-6

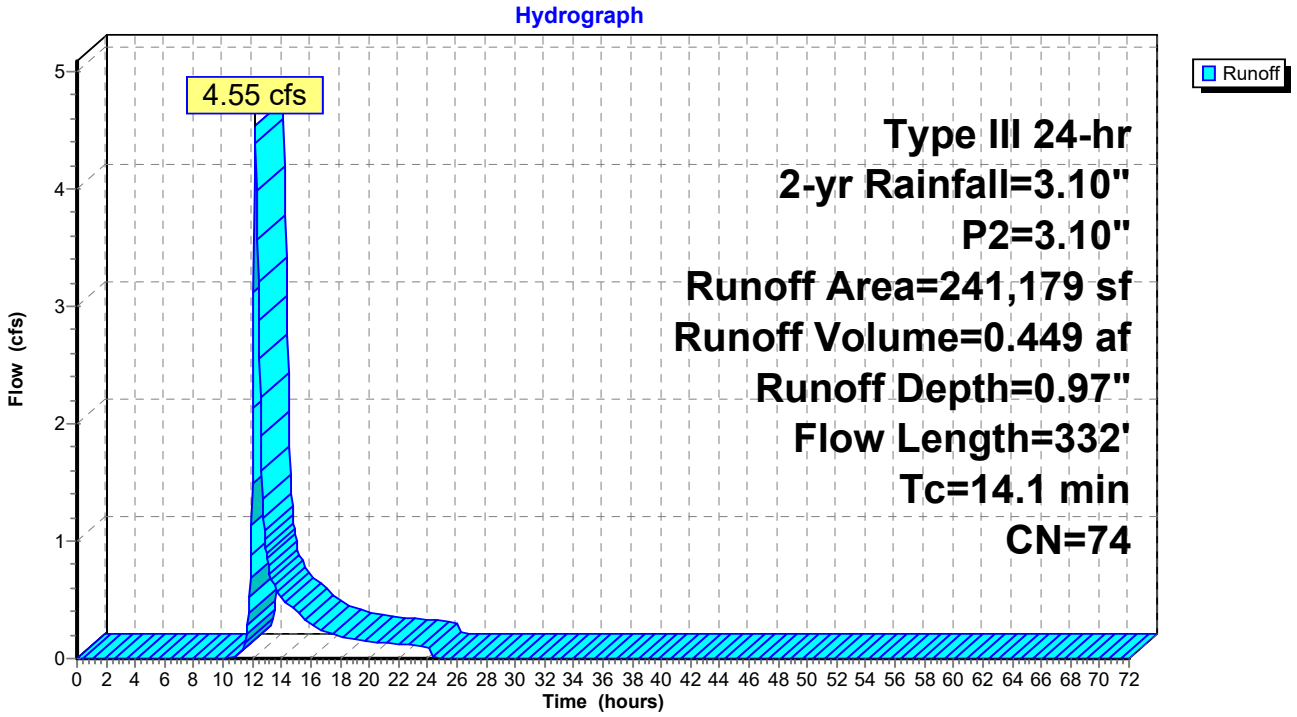
Runoff = 4.55 cfs @ 12.21 hrs, Volume= 0.449 af, Depth= 0.97"
Routed to Link DP5 : To Existing Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10", P2=3.10"

Area (sf)	CN	Description
19,085	30	Woods, Good, HSG A
49,824	39	>75% Grass cover, Good, HSG A
136,787	98	Paved parking, HSG A
35,483	54	1/2 acre lots, 25% imp, HSG A
241,179	74	Weighted Average
95,521		39.61% Pervious Area
145,658		60.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	32	0.0100	0.05		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
1.6	18	0.1700	0.19		**Sheet Flow, B-C** Grass: Dense n= 0.240 P2= 3.10"
0.1	5	0.0200	0.99		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.2	39	0.0300	3.52		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
0.3	123	0.0150	6.02	4.73	**Pipe Channel, E-F** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.3	115	0.0500	6.12	7.51	**Pipe Channel, F-G** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.025 Corrugated metal
14.1	332	Total			

Subcatchment P-6: SubCatchment P-6



Summary for Subcatchment P-7: SubCatchment P-7

[45] Hint: Runoff=Zero

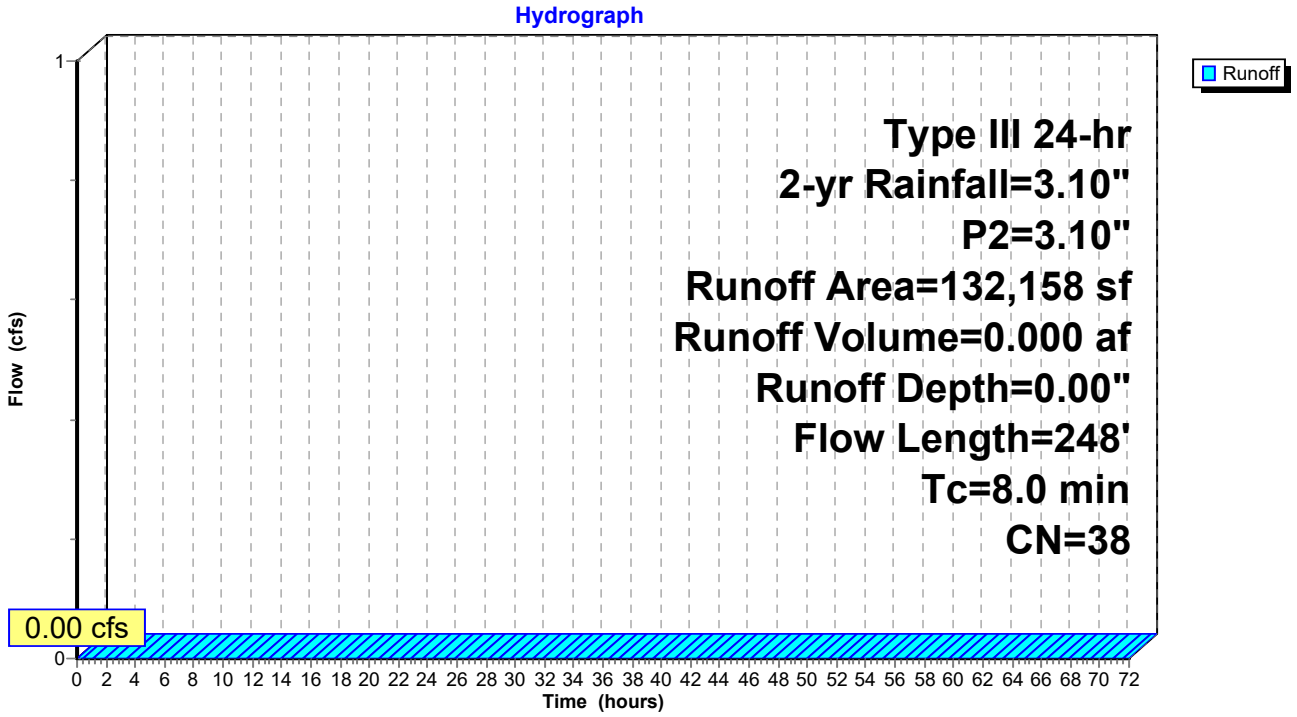
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link DP5 : To Existing Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10", P2=3.10"

Area (sf)	CN	Description
73,049	30	Woods, Good, HSG A
50,149	39	>75% Grass cover, Good, HSG A
8,960	98	Paved parking, HSG A
132,158	38	Weighted Average
123,198		93.22% Pervious Area
8,960		6.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
0.9	72	0.0400	1.40		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.8	126	0.2500	2.50		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
8.0	248	Total			

Subcatchment P-7: SubCatchment P-7



Summary for Subcatchment P-8A: SubCatchment P-8A

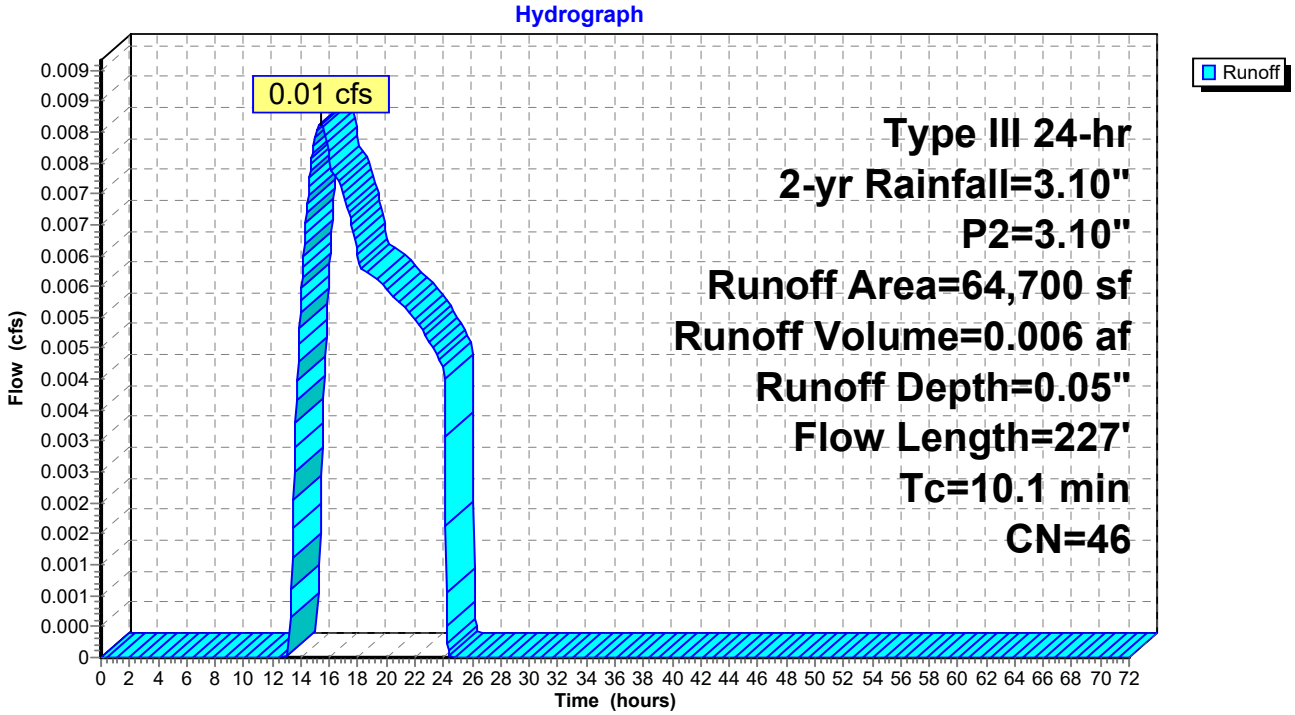
Runoff = 0.01 cfs @ 15.35 hrs, Volume= 0.006 af, Depth= 0.05"
Routed to Pond 6P : Depression-Chambers

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10", P2=3.10"

Area (sf)	CN	Description
26,938	61	1/4 acre lots, 38% imp, HSG A
31,395	30	Woods, Good, HSG A
4,300	39	>75% Grass cover, Good, HSG A
2,067	98	Water Surface, HSG A
64,700	46	Weighted Average
52,397		80.98% Pervious Area
12,303		19.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
1.0	57	0.0200	0.99		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.8	120	0.2400	2.45		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
10.1	227	Total			

Subcatchment P-8A: SubCatchment P-8A



Summary for Subcatchment P-8B: SubCatchment P-8B

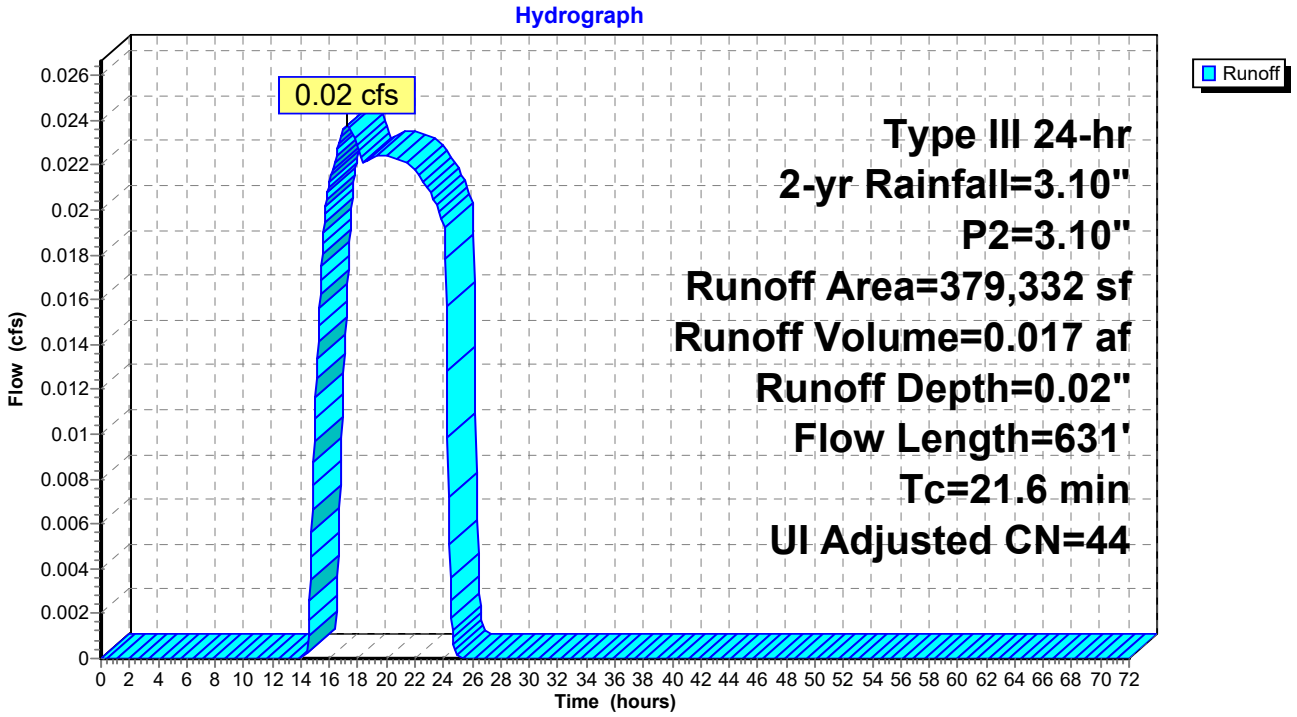
Runoff = 0.02 cfs @ 17.29 hrs, Volume= 0.017 af, Depth= 0.02"
Routed to Pond 8P : DP6 - New Inf Basin Club

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10", P2=3.10"

Area (sf)	CN	Adj	Description
137,313	30		Woods, Good, HSG A
133,757	39		>75% Grass cover, Good, HSG A
47,139	98		Unconnected roofs, HSG A
52,252	98		Unconnected pavement, HSG A
8,871	98		Water Surface, HSG A
379,332	53	44	Weighted Average, UI Adjusted
271,070			71.46% Pervious Area
108,262			28.54% Impervious Area
99,391			91.81% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
1.2	83	0.0570	1.19		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
6.9	354	0.0150	0.86		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.9	122	0.2280	2.39		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
0.1	22	0.3300	4.02		**Shallow Concentrated Flow, E-F** Short Grass Pasture Kv= 7.0 fps
21.6	631	Total			

Subcatchment P-8B: SubCatchment P-8B



Summary for Subcatchment P-9: SubCatchment P-9

[45] Hint: Runoff=Zero

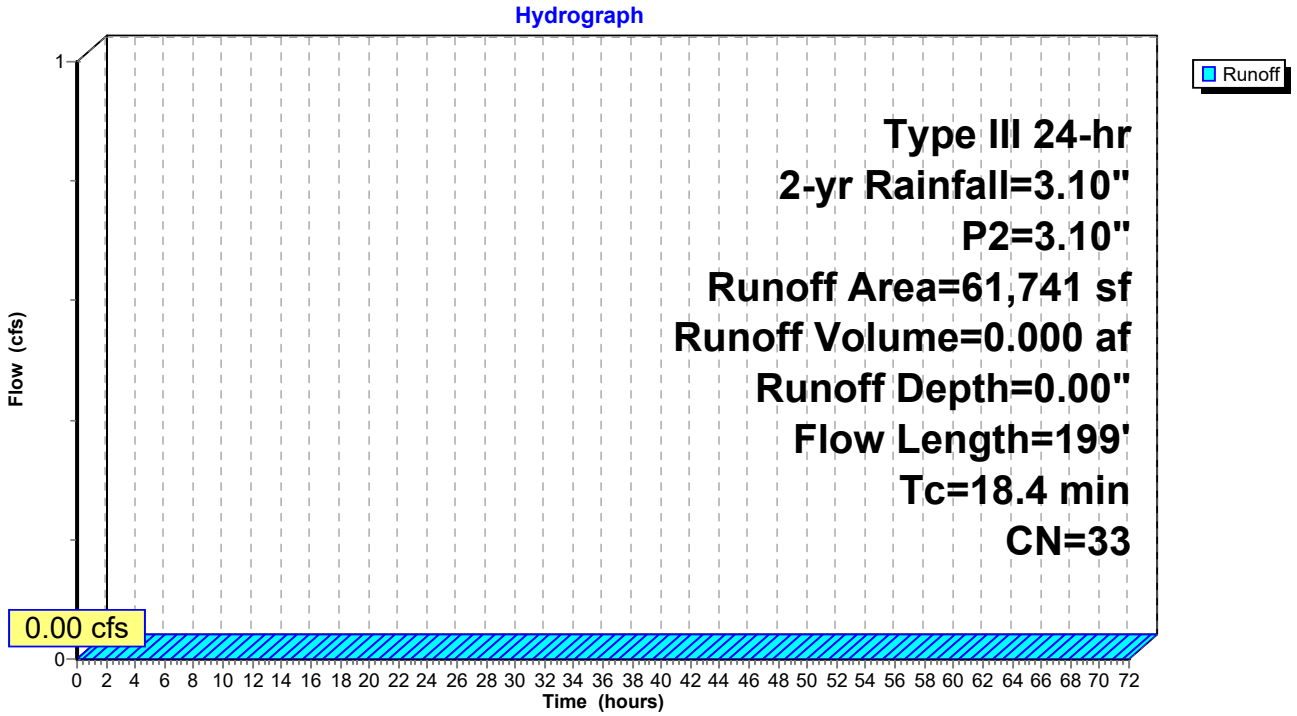
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Pond 5P : DP7 - Existing Depression 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10", P2=3.10"

Area (sf)	CN	Description
46,123	30	Woods, Good, HSG A
14,817	39	>75% Grass cover, Good, HSG A
801	98	Water Surface, HSG A
61,741	33	Weighted Average
60,940		98.70% Pervious Area
801		1.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	50	0.0125	0.06		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
3.3	149	0.0226	0.75		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
18.4	199	Total			

Subcatchment P-9: SubCatchment P-9



Summary for Pond 1P: SubSurface Sys

Inflow Area = 10.912 ac, 56.27% Impervious, Inflow Depth = 0.82" for 2-yr event
Inflow = 6.00 cfs @ 12.36 hrs, Volume= 0.744 af
Outflow = 4.47 cfs @ 12.25 hrs, Volume= 0.744 af, Atten= 25%, Lag= 0.0 min
Discarded = 4.47 cfs @ 12.25 hrs, Volume= 0.744 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 172.19' @ 12.59 hrs Surf.Area= 23,366 sf Storage= 1,807 cf

Plug-Flow detention time= 2.9 min calculated for 0.744 af (100% of inflow)
Center-of-Mass det. time= 2.9 min (892.8 - 889.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	172.00'	5,168 cf	**44.25'W x 131.78'L x 3.50'H Field A** 20,409 cf Overall - 7,490 cf Embedded = 12,919 cf x 40.0% Voids
#2A	172.50'	7,490 cf	**ADS_StormTech SC-740 b +Cap** x 162 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 162 Chambers in 9 Rows Cap Storage= 2.7 cf x 2 x 9 rows = 47.8 cf
#3	172.50'	43,645 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
#4D	172.00'	3,915 cf	**30.00'W x 146.02'L x 3.50'H Field B** 15,332 cf Overall - 5,545 cf Embedded = 9,787 cf x 40.0% Voids
#5D	172.50'	5,545 cf	**ADS_StormTech SC-740 b +Cap** x 120 Inside #4 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 120 Chambers in 6 Rows Cap Storage= 2.7 cf x 2 x 6 rows = 31.9 cf
#6B	172.00'	4,492 cf	**49.00'W x 103.30'L x 3.50'H Field C** 17,715 cf Overall - 6,485 cf Embedded = 11,231 cf x 40.0% Voids
#7B	172.50'	6,485 cf	**ADS_StormTech SC-740 b +Cap** x 140 Inside #6 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 140 Chambers in 10 Rows Cap Storage= 2.7 cf x 2 x 10 rows = 53.1 cf
#8C	172.00'	4,292 cf	**30.00'W x 160.26'L x 3.50'H Field D** 16,827 cf Overall - 6,096 cf Embedded = 10,731 cf x 40.0% Voids
#9C	172.50'	6,096 cf	**ADS_StormTech SC-740 b +Cap** x 132 Inside #8 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 132 Chambers in 6 Rows Cap Storage= 2.7 cf x 2 x 6 rows = 31.9 cf
#10E	172.00'	2,974 cf	**20.50'W x 160.26'L x 3.50'H Field E** 11,498 cf Overall - 4,064 cf Embedded = 7,434 cf x 40.0% Voids
#11E	172.50'	4,064 cf	**ADS_StormTech SC-740 b +Cap** x 88 Inside #10 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 88 Chambers in 4 Rows Cap Storage= 2.7 cf x 2 x 4 rows = 21.2 cf
		94,165 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group D created with Chamber Wizard
Storage Group B created with Chamber Wizard
Storage Group C created with Chamber Wizard
Storage Group E created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
172.50	5,320	0	0
173.00	5,843	2,791	2,791
174.00	6,931	6,387	9,178
175.00	8,075	7,503	16,681
176.00	9,276	8,676	25,356
177.00	10,534	9,905	35,261
177.76	11,528	8,384	43,645

Device	Routing	Invert	Outlet Devices
#1	Discarded	172.00'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=4.47 cfs @ 12.25 hrs HW=172.06' (Free Discharge)
1=Exfiltration (Exfiltration Controls 4.47 cfs)

Pond 1P: SubSurface Sys - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 b +Cap (ADS StormTech® SC-740 with cap storage)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 9 rows = 47.8 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

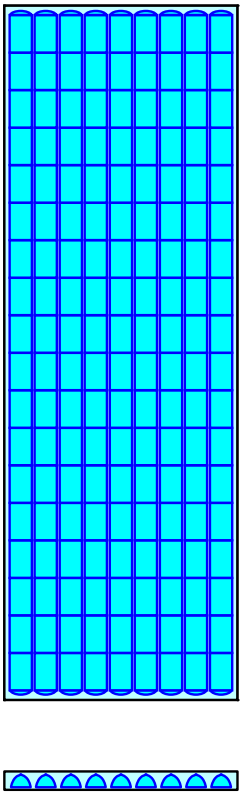
18 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 129.78' Row Length +12.0" End Stone x 2 = 131.78' Base Length
9 Rows x 51.0" Wide + 6.0" Spacing x 8 + 12.0" Side Stone x 2 = 44.25' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

162 Chambers x 45.9 cf + 2.7 cf Cap Volume x 2 x 9 Rows = 7,490.1 cf Chamber Storage

20,408.9 cf Field - 7,490.1 cf Chambers = 12,918.8 cf Stone x 40.0% Voids = 5,167.5 cf Stone Storage

Chamber Storage + Stone Storage = 12,657.6 cf = 0.291 af
Overall Storage Efficiency = 62.0%
Overall System Size = 131.78' x 44.25' x 3.50'

162 Chambers
755.9 cy Field
478.5 cy Stone



Pond 1P: SubSurface Sys - Chamber Wizard Field B

Chamber Model = ADS_StormTech SC-740 b +Cap (ADS StormTech® SC-740 with cap storage)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 6 rows = 31.9 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

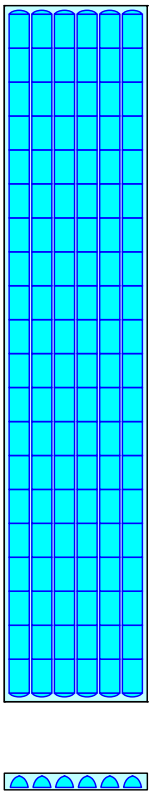
20 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 144.02' Row Length +12.0" End Stone x 2 = 146.02' Base Length
6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.00' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

120 Chambers x 45.9 cf + 2.7 cf Cap Volume x 2 x 6 Rows = 5,544.7 cf Chamber Storage

15,331.8 cf Field - 5,544.7 cf Chambers = 9,787.1 cf Stone x 40.0% Voids = 3,914.8 cf Stone Storage

Chamber Storage + Stone Storage = 9,459.5 cf = 0.217 af
Overall Storage Efficiency = 61.7%
Overall System Size = 146.02' x 30.00' x 3.50'

120 Chambers
567.8 cy Field
362.5 cy Stone



Pond 1P: SubSurface Sys - Chamber Wizard Field C

Chamber Model = ADS_StormTech SC-740 b +Cap (ADS StormTech® SC-740 with cap storage)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 10 rows = 53.1 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

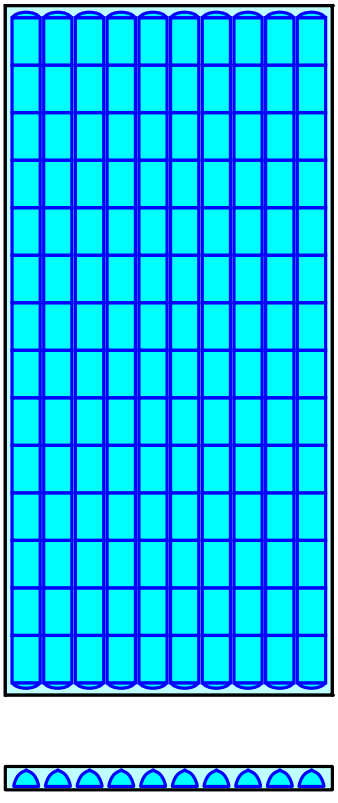
14 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 101.30' Row Length +12.0" End Stone x 2 = 103.30' Base Length
10 Rows x 51.0" Wide + 6.0" Spacing x 9 + 12.0" Side Stone x 2 = 49.00' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

140 Chambers x 45.9 cf + 2.7 cf Cap Volume x 2 x 10 Rows = 6,484.7 cf Chamber Storage

17,715.4 cf Field - 6,484.7 cf Chambers = 11,230.7 cf Stone x 40.0% Voids = 4,492.3 cf Stone Storage

Chamber Storage + Stone Storage = 10,977.0 cf = 0.252 af
Overall Storage Efficiency = 62.0%
Overall System Size = 103.30' x 49.00' x 3.50'

140 Chambers
656.1 cy Field
416.0 cy Stone



Pond 1P: SubSurface Sys - Chamber Wizard Field D

Chamber Model = ADS_StormTech SC-740 b +Cap (ADS StormTech® SC-740 with cap storage)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 6 rows = 31.9 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

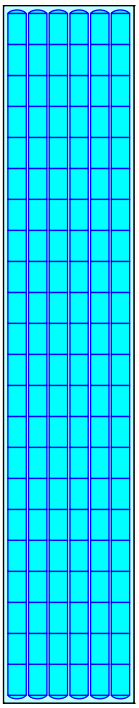
22 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 158.26' Row Length +12.0" End Stone x 2 = 160.26' Base Length
6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.00' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

132 Chambers x 45.9 cf + 2.7 cf Cap Volume x 2 x 6 Rows = 6,095.9 cf Chamber Storage

16,827.0 cf Field - 6,095.9 cf Chambers = 10,731.0 cf Stone x 40.0% Voids = 4,292.4 cf Stone Storage

Chamber Storage + Stone Storage = 10,388.3 cf = 0.238 af
Overall Storage Efficiency = 61.7%
Overall System Size = 160.26' x 30.00' x 3.50'

132 Chambers
623.2 cy Field
397.4 cy Stone





Pond 1P: SubSurface Sys - Chamber Wizard Field E

Chamber Model = ADS_StormTech SC-740 b +Cap (ADS StormTech® SC-740 with cap storage)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 4 rows = 21.2 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

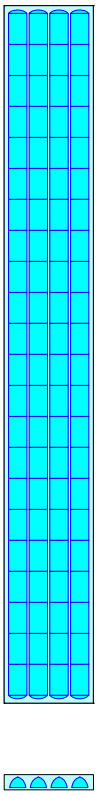
22 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 158.26' Row Length +12.0" End Stone x 2 = 160.26' Base Length
4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

88 Chambers x 45.9 cf + 2.7 cf Cap Volume x 2 x 4 Rows = 4,064.0 cf Chamber Storage

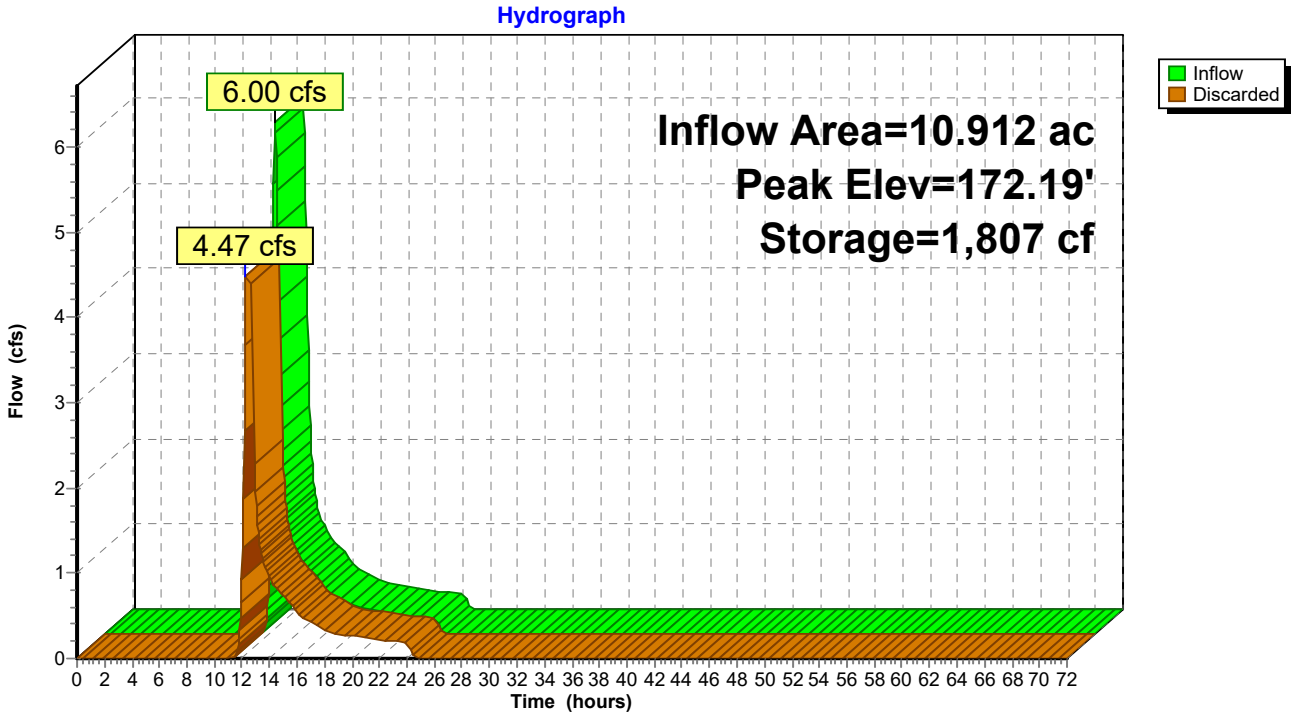
11,498.4 cf Field - 4,064.0 cf Chambers = 7,434.5 cf Stone x 40.0% Voids = 2,973.8 cf Stone Storage

Chamber Storage + Stone Storage = 7,037.7 cf = 0.162 af
Overall Storage Efficiency = 61.2%
Overall System Size = 160.26' x 20.50' x 3.50'

88 Chambers
425.9 cy Field
275.4 cy Stone



Pond 1P: SubSurface Sys



Summary for Pond 4P: Drainage Basin/Easement

Inflow Area = 8.571 ac, 41.42% Impervious, Inflow Depth = 0.63" for 2-yr event
Inflow = 4.55 cfs @ 12.21 hrs, Volume= 0.449 af
Outflow = 0.34 cfs @ 15.63 hrs, Volume= 0.449 af, Atten= 93%, Lag= 205.1 min
Discarded = 0.34 cfs @ 15.63 hrs, Volume= 0.449 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to nonexistent node SP6

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 176.81' @ 15.63 hrs Surf.Area= 6,019 sf Storage= 10,255 cf

Plug-Flow detention time= 385.5 min calculated for 0.448 af (100% of inflow)
Center-of-Mass det. time= 385.7 min (1,257.3 - 871.6)

Volume	Invert	Avail.Storage	Storage Description
#1	174.00'	345,939 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

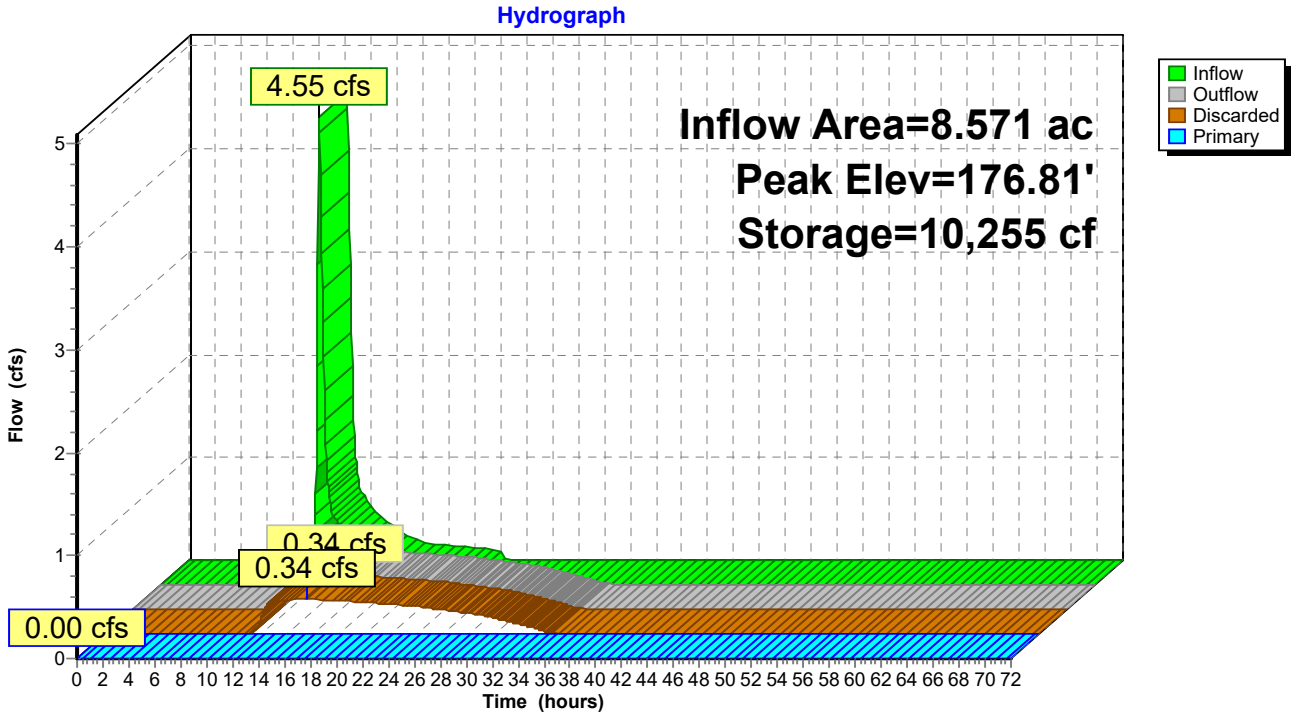
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
174.00	491	0	0
175.00	3,251	1,871	1,871
176.00	4,753	4,002	5,873
177.00	6,309	5,531	11,404
178.00	7,641	6,975	18,379
179.00	8,869	8,255	26,634
180.00	10,188	9,529	36,163
181.00	11,953	11,071	47,233
182.00	14,143	13,048	60,281
183.00	16,525	15,334	75,615
184.00	19,118	17,822	93,437
185.00	21,426	20,272	113,709
186.00	23,221	22,324	136,032
187.00	24,868	24,045	160,077
188.00	26,530	25,699	185,776
189.00	28,209	27,370	213,145
190.00	30,172	29,191	242,336
191.00	32,732	31,452	273,788
192.00	36,071	34,402	308,189
193.00	39,428	37,750	345,939

Device	Routing	Invert	Outlet Devices
#1	Primary	192.90'	**10.0' long x 50.0' 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
#2	Discarded	174.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.34 cfs @ 15.63 hrs HW=176.81' (Free Discharge)
↑**2=Exfiltration** (Exfiltration Controls 0.34 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=174.00' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 4P: Drainage Basin/Easement



Summary for Pond 5P: DP7 - Existing Depression 2

Inflow Area = 1.417 ac, 1.30% Impervious, Inflow Depth = 0.00" for 2-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 172.00' @ 0.00 hrs Surf.Area= 67 sf Storage= 0 cf

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

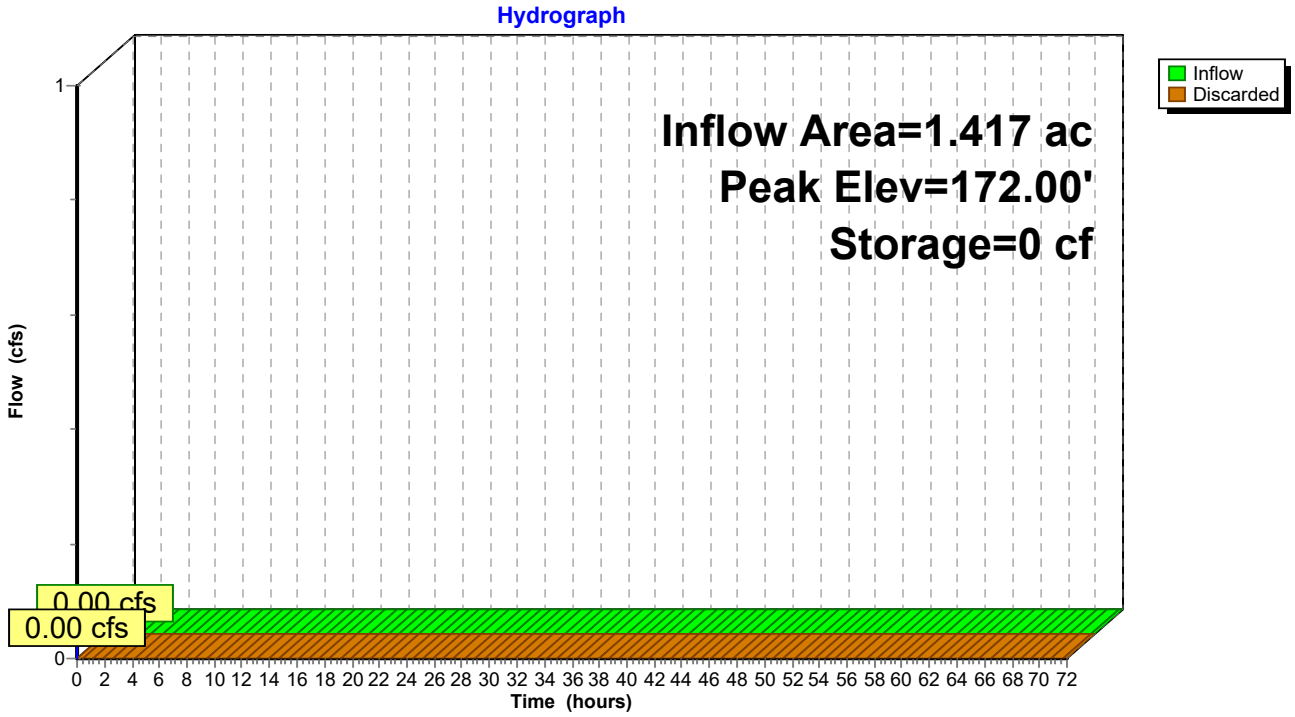
Volume	Invert	Avail.Storage	Storage Description
#1	172.00'	6,418 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
172.00	67	0	0
174.00	1,456	1,523	1,523
175.50	5,070	4,895	6,418

Device	Routing	Invert	Outlet Devices
#1	Discarded	172.00'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=172.00' (Free Discharge)
↑**1=Exfiltration** (Passes 0.00 cfs of 0.01 cfs potential flow)

Pond 5P: DP7 - Existing Depression 2



Summary for Pond 6P: Depression-Chambers

Inflow Area = 1.485 ac, 19.02% Impervious, Inflow Depth = 0.05" for 2-yr event
Inflow = 0.01 cfs @ 15.35 hrs, Volume= 0.006 af
Outflow = 0.01 cfs @ 15.38 hrs, Volume= 0.006 af, Atten= 0%, Lag= 2.0 min
Discarded = 0.01 cfs @ 15.38 hrs, Volume= 0.006 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 176.50' @ 15.38 hrs Surf.Area= 1,534 sf Storage= 1 cf

Plug-Flow detention time= 1.9 min calculated for 0.006 af (100% of inflow)
Center-of-Mass det. time= 1.9 min (1,107.2 - 1,105.3)

Volume	Invert	Avail.Storage	Storage Description
#1	179.50'	1,835 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2A	176.50'	1,404 cf	**20.50'W x 74.82'L x 3.50'H Field A** 5,368 cf Overall - 1,859 cf Embedded = 3,509 cf x 40.0% Voids
#3A	177.00'	1,859 cf	**ADS_StormTech SC-740 b +Cap** x 40 Inside #2 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 40 Chambers in 4 Rows Cap Storage= 2.7 cf x 2 x 4 rows = 21.2 cf
		5,098 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
179.50	59	0	0
180.00	195	64	64
181.00	803	499	563
182.00	1,742	1,273	1,835

Device	Routing	Invert	Outlet Devices
#1	Discarded	176.50'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.29 cfs @ 15.38 hrs HW=176.50' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.29 cfs)

Pond 6P: Depression-Chambers - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 b +Cap (ADS StormTech® SC-740 with cap storage)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 4 rows = 21.2 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

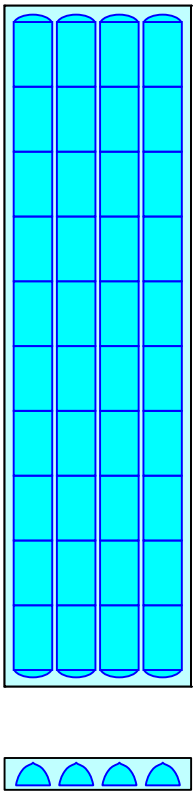
10 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 72.82' Row Length +12.0" End Stone x 2 = 74.82' Base Length
4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

40 Chambers x 45.9 cf + 2.7 cf Cap Volume x 2 x 4 Rows = 1,858.8 cf Chamber Storage

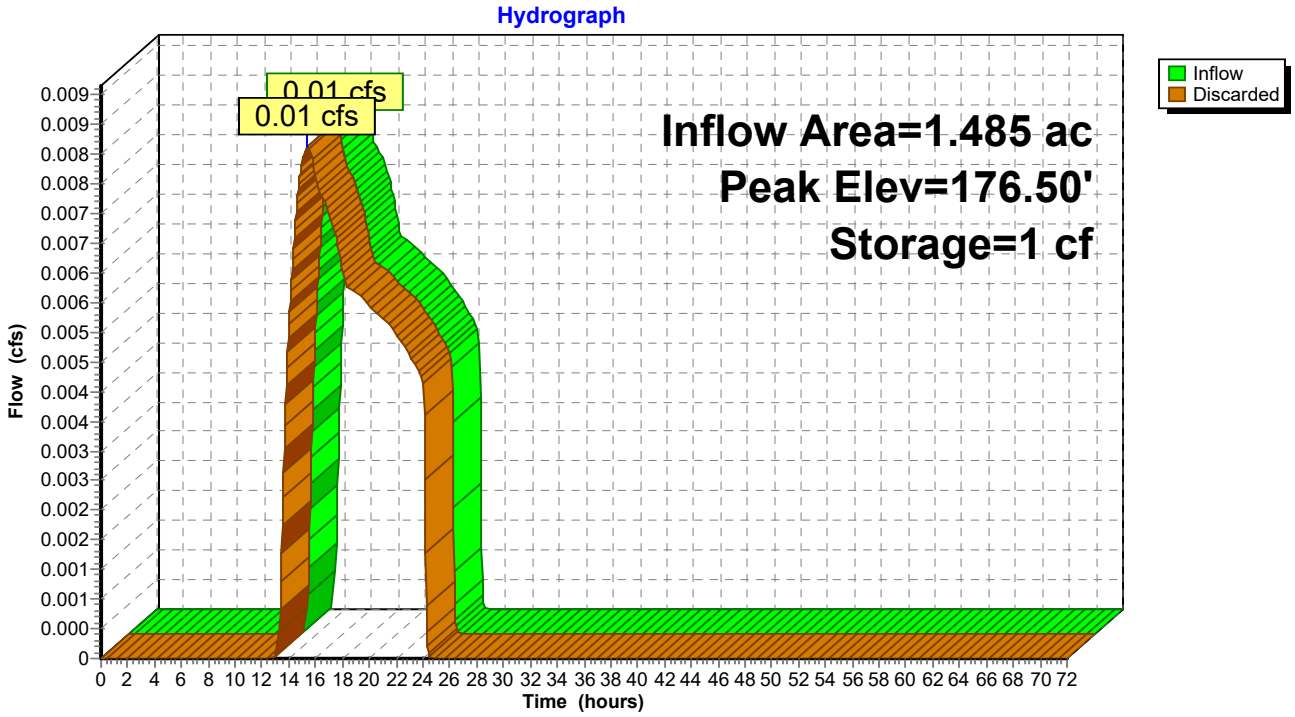
5,368.1 cf Field - 1,858.8 cf Chambers = 3,509.3 cf Stone x 40.0% Voids = 1,403.7 cf Stone Storage

Chamber Storage + Stone Storage = 3,262.5 cf = 0.075 af
Overall Storage Efficiency = 60.8%
Overall System Size = 74.82' x 20.50' x 3.50'

40 Chambers
198.8 cy Field
130.0 cy Stone



Pond 6P: Depression-Chambers



Summary for Pond 8P: DP6 - New Inf Basin Club

Inflow Area = 8.708 ac, 28.54% Impervious, Inflow Depth = 0.02" for 2-yr event
Inflow = 0.02 cfs @ 17.29 hrs, Volume= 0.017 af
Outflow = 0.02 cfs @ 17.35 hrs, Volume= 0.017 af, Atten= 0%, Lag= 3.5 min
Discarded = 0.02 cfs @ 17.35 hrs, Volume= 0.017 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 167.00' @ 17.35 hrs Surf.Area= 4,171 sf Storage= 5 cf

Plug-Flow detention time= 3.5 min calculated for 0.017 af (100% of inflow)
Center-of-Mass det. time= 3.5 min (1,180.0 - 1,176.5)

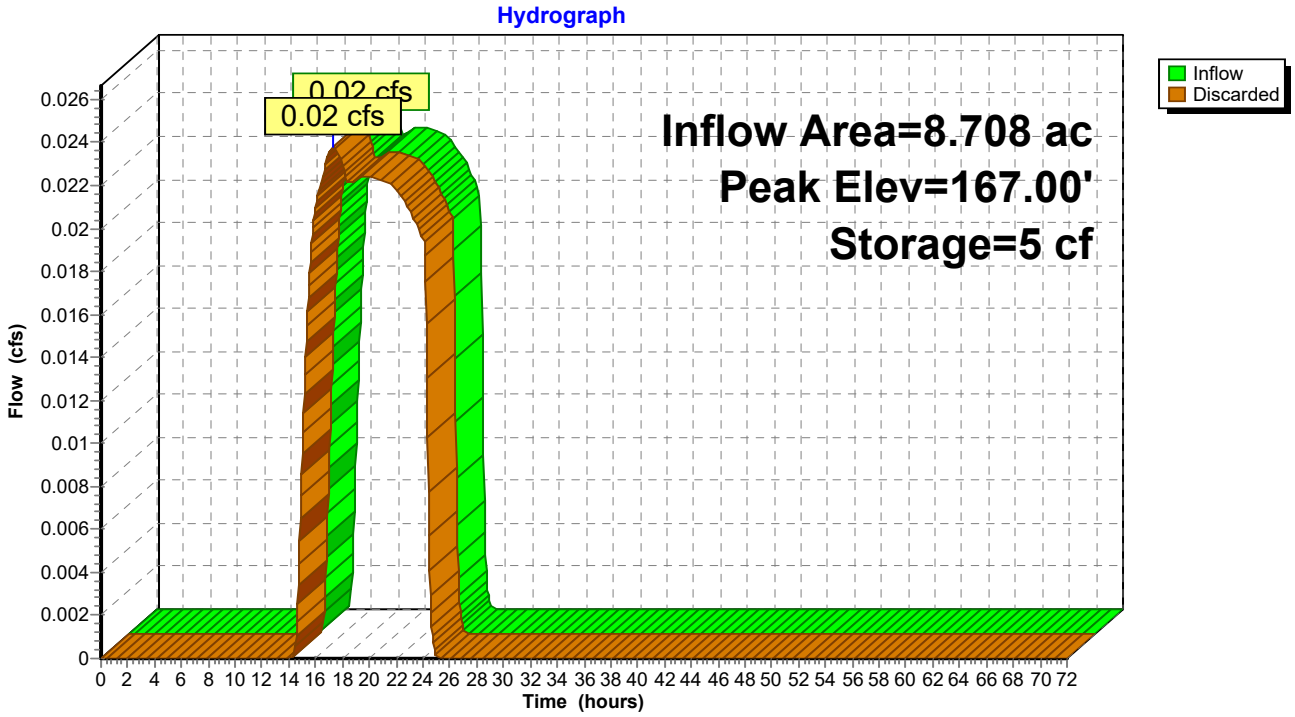
Volume	Invert	Avail.Storage	Storage Description
#1	167.00'	28,802 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
167.00	4,169	0	0
168.00	5,514	4,842	4,842
169.00	7,024	6,269	11,111
170.00	8,871	7,948	19,058
171.00	10,617	9,744	28,802

Device	Routing	Invert	Outlet Devices
#1	Discarded	167.00'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.80 cfs @ 17.35 hrs HW=167.00' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.80 cfs)

Pond 8P: DP6 - New Inf Basin Club

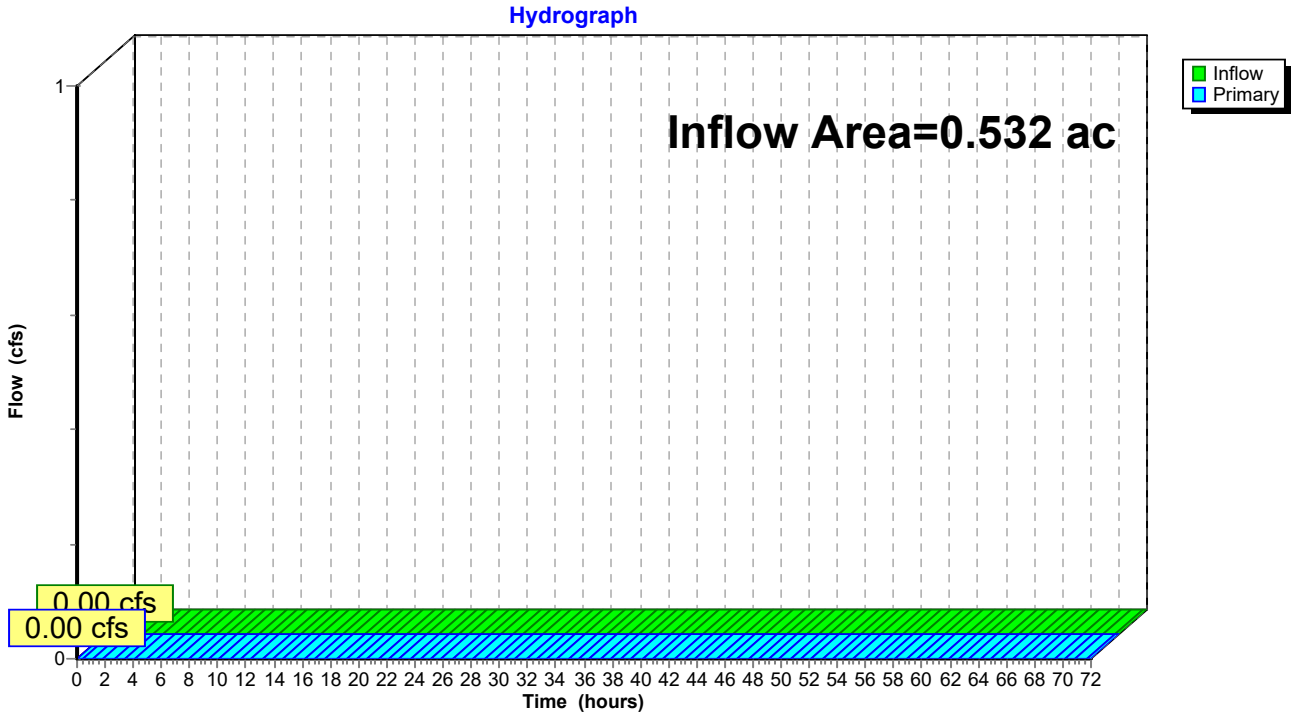


Summary for Link DP1: N'ly Property Line

Inflow Area = 0.532 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP1: N'ly Property Line

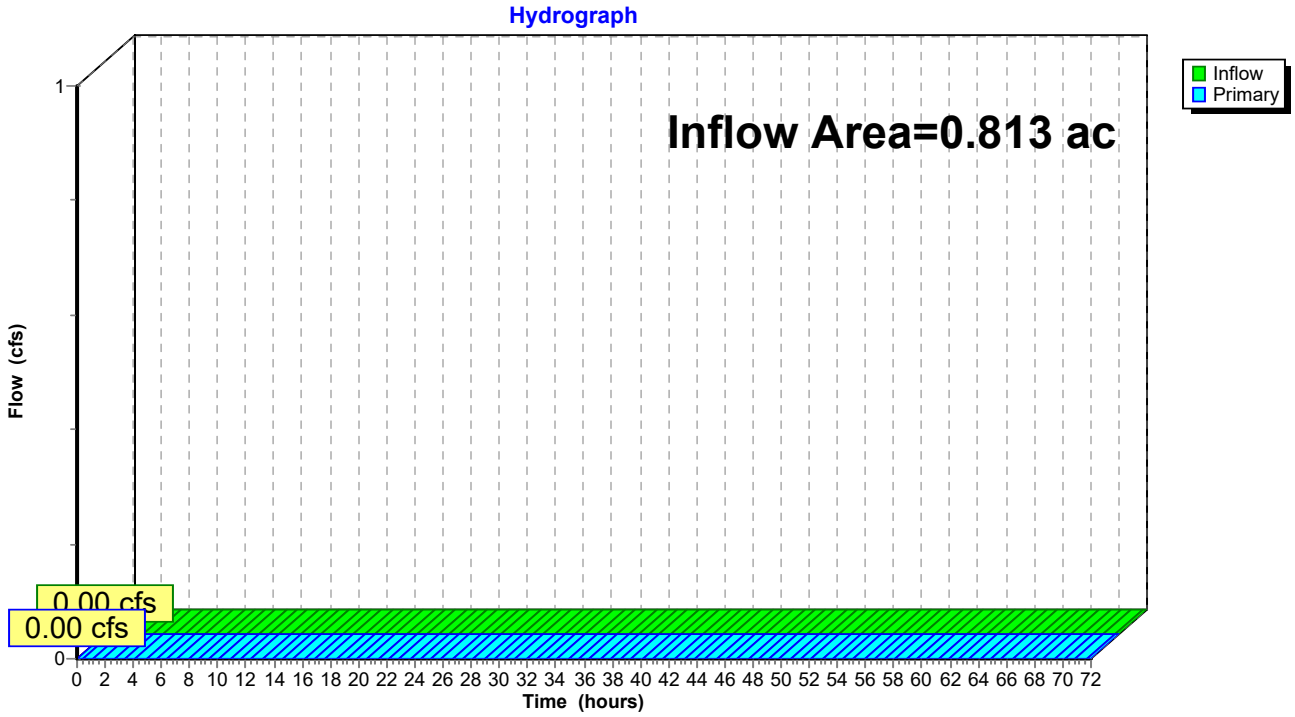


Summary for Link DP2: E'ly Property Line

Inflow Area = 0.813 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP2: E'ly Property Line

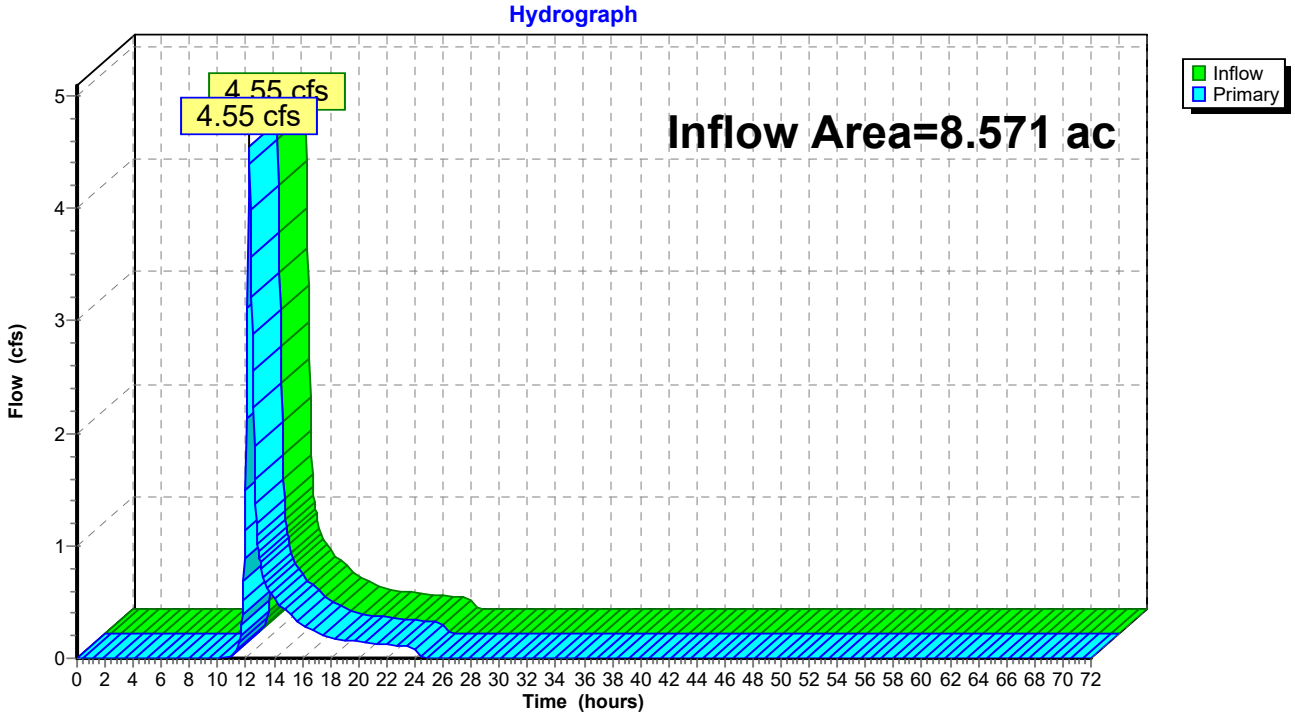


Summary for Link DP5: To Existing Basin

Inflow Area = 8.571 ac, 41.42% Impervious, Inflow Depth = 0.63" for 2-yr event
Inflow = 4.55 cfs @ 12.21 hrs, Volume= 0.449 af
Primary = 4.55 cfs @ 12.21 hrs, Volume= 0.449 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 4P : Drainage Basin/Easement

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP5: To Existing Basin



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: SubCatchment P-1 Runoff Area=8,787 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=114' Tc=5.6 min CN=31 Runoff=0.00 cfs 0.000 af

Subcatchment P-10: SubCatchment P-10 Runoff Area=475,346 sf 56.27% Impervious Runoff Depth=1.83"
Flow Length=740' Tc=22.5 min CN=71 Runoff=14.62 cfs 1.668 af

Subcatchment P-2A: SubCatchment P-2A Runoff Area=14,405 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=81' Tc=7.6 min CN=31 Runoff=0.00 cfs 0.000 af

Subcatchment P-2B: SubCatchment P-2B Runoff Area=13,129 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=68' Tc=7.2 min CN=30 Runoff=0.00 cfs 0.000 af

Subcatchment P-3: SubCatchment P-3 Runoff Area=22,271 sf 0.00% Impervious Runoff Depth=0.01"
Flow Length=181' Tc=5.8 min CN=32 Runoff=0.00 cfs 0.000 af

Subcatchment P-4: No Change E-4 Runoff Area=39,239 sf 0.00% Impervious Runoff Depth=0.01"
Flow Length=214' Tc=15.8 min CN=32 Runoff=0.00 cfs 0.000 af

Subcatchment P-5: No Change E-5 Runoff Area=198,882 sf 26.41% Impervious Runoff Depth=0.54"
Flow Length=270' Tc=18.4 min UI Adjusted CN=50 Runoff=1.18 cfs 0.207 af

Subcatchment P-6: SubCatchment P-6 Runoff Area=241,179 sf 60.39% Impervious Runoff Depth=2.07"
Flow Length=332' Tc=14.1 min CN=74 Runoff=10.21 cfs 0.953 af

Subcatchment P-7: SubCatchment P-7 Runoff Area=132,158 sf 6.78% Impervious Runoff Depth=0.10"
Flow Length=248' Tc=8.0 min CN=38 Runoff=0.04 cfs 0.026 af

Subcatchment P-8A: SubCatchment P-8A Runoff Area=64,700 sf 19.02% Impervious Runoff Depth=0.37"
Flow Length=227' Tc=10.1 min CN=46 Runoff=0.22 cfs 0.046 af

Subcatchment P-8B: SubCatchment P-8B Runoff Area=379,332 sf 28.54% Impervious Runoff Depth=0.29"
Flow Length=631' Tc=21.6 min UI Adjusted CN=44 Runoff=0.70 cfs 0.211 af

Subcatchment P-9: SubCatchment P-9 Runoff Area=61,741 sf 1.30% Impervious Runoff Depth=0.01"
Flow Length=199' Tc=18.4 min CN=33 Runoff=0.00 cfs 0.002 af

Pond 1P: SubSurface Sys Peak Elev=172.91' Storage=14,955 cf Inflow=14.62 cfs 1.668 af
Outflow=5.57 cfs 1.668 af

Pond 4P: Drainage Basin/Easement Peak Elev=178.96' Storage=26,245 cf Inflow=10.21 cfs 0.979 af
Discarded=0.49 cfs 0.979 af Primary=0.00 cfs 0.000 af Outflow=0.49 cfs 0.979 af

Pond 5P: DP7 - Existing Depression 2 Peak Elev=172.01' Storage=0 cf Inflow=0.00 cfs 0.002 af
Outflow=0.00 cfs 0.002 af

Pond 6P: Depression-Chambers Peak Elev=176.54' Storage=25 cf Inflow=0.22 cfs 0.046 af
Outflow=0.22 cfs 0.046 af

Pond 8P: DP6 - New Inf Basin Club Peak Elev=167.03' Storage=140 cf Inflow=0.70 cfs 0.211 af
Outflow=0.68 cfs 0.211 af

Link DP1: N'ly Property Line Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link DP2: E'ly Property Line Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link DP5: To Existing Basin Inflow=10.21 cfs 0.979 af
Primary=10.21 cfs 0.979 af

Total Runoff Area = 37.906 ac Runoff Volume = 3.113 af Average Runoff Depth = 0.99"
63.90% Pervious = 24.223 ac 36.10% Impervious = 13.682 ac

Summary for Subcatchment P-1: SubCatchment P-1

[49] Hint: Tc<2dt may require smaller dt

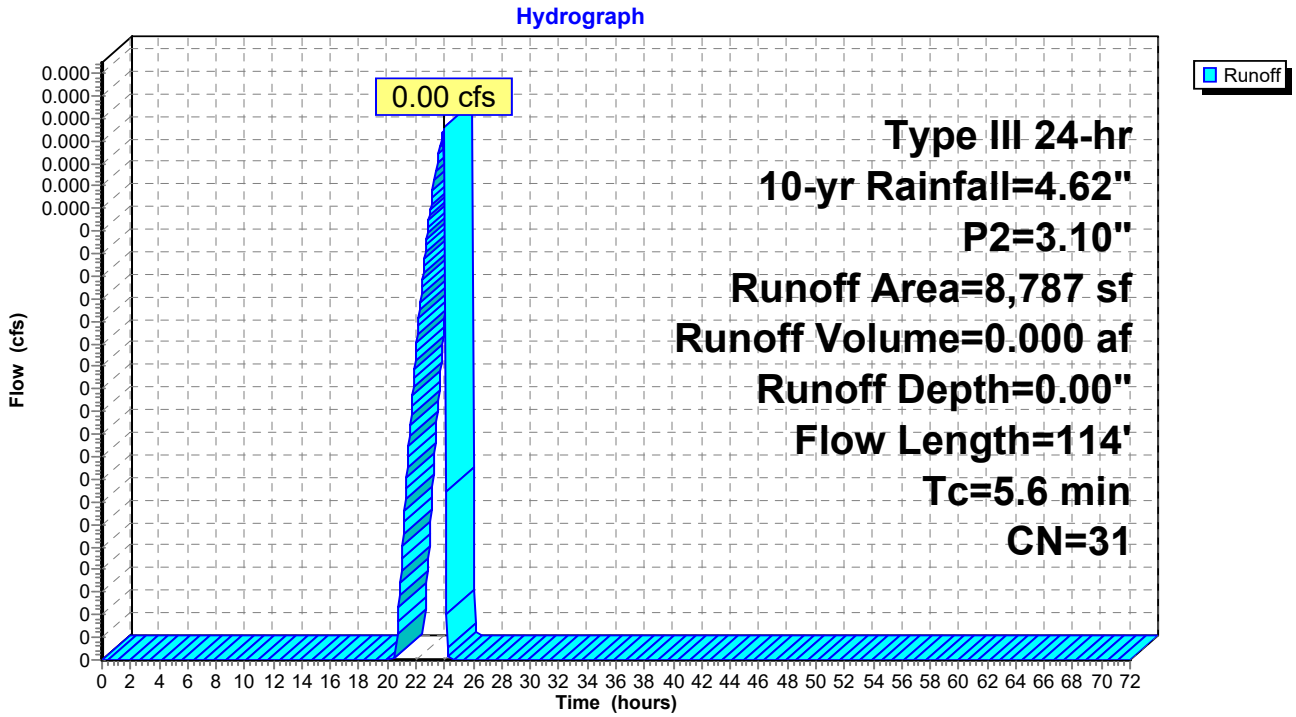
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link DP1 : N'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.62", P2=3.10"

Area (sf)	CN	Description
7,342	30	Woods, Good, HSG A
1,445	39	>75% Grass cover, Good, HSG A
8,787	31	Weighted Average
8,787		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.1900	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	64	0.2100	2.29		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
5.6	114	Total			

Subcatchment P-1: SubCatchment P-1


Hydrograph
Runoff
0.00 cfs
Type III 24-hr
10-yr Rainfall=4.62"
P2=3.10"
Runoff Area=8,787 sf
Runoff Volume=0.000 af
Runoff Depth=0.00"
Flow Length=114'
Tc=5.6 min
CN=31
Flow (cfs)
0.000
0.000
0.000
0.000
0.000
0.000
0.000
0
0
0

Summary for Subcatchment P-10: SubCatchment P-10

[47] Hint: Peak is 379% of capacity of segment #6
[47] Hint: Peak is 270% of capacity of segment #7
[47] Hint: Peak is 241% of capacity of segment #8
[47] Hint: Peak is 166% of capacity of segment #9

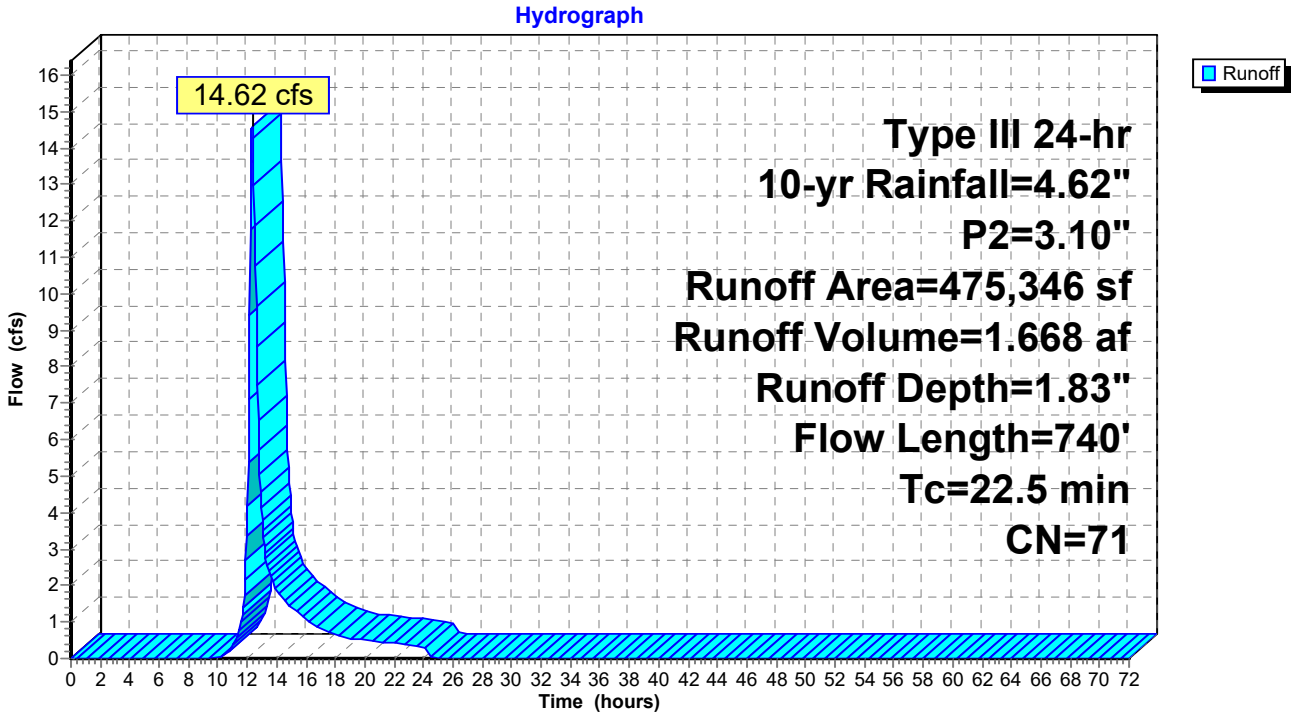
Runoff = 14.62 cfs @ 12.33 hrs, Volume= 1.668 af, Depth= 1.83"
Routed to Pond 1P : SubSurface Sys

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.62", P2=3.10"

Area (sf)	CN	Description
66,746	30	Woods, Good, HSG A
125,013	39	>75% Grass cover, Good, HSG A
76,512	98	Roofs, HSG A
173,050	98	Paved parking, HSG A
8,075	98	Water Surface, HSG A
25,950	61	1/4 acre lots, 38% imp, HSG A
475,346	71	Weighted Average
207,848		43.73% Pervious Area
267,498		56.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	50	0.0125	0.06		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
4.7	156	0.0125	0.56		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.1	131	0.1500	1.94		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
0.2	9	0.0200	0.99		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
0.3	60	0.0300	3.52		**Shallow Concentrated Flow, E-F** Paved Kv= 20.3 fps
0.4	111	0.0100	4.91	3.86	**Pipe Channel, F-G** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.3	81	0.0060	4.42	5.42	**Pipe Channel, G-H** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012
0.2	72	0.0075	4.94	6.06	**Pipe Channel, H-I** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012
0.2	70	0.0060	4.99	8.81	**Pipe Channel, I-J** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012
22.5	740	Total			

Subcatchment P-10: SubCatchment P-10



Summary for Subcatchment P-2A: SubCatchment P-2A

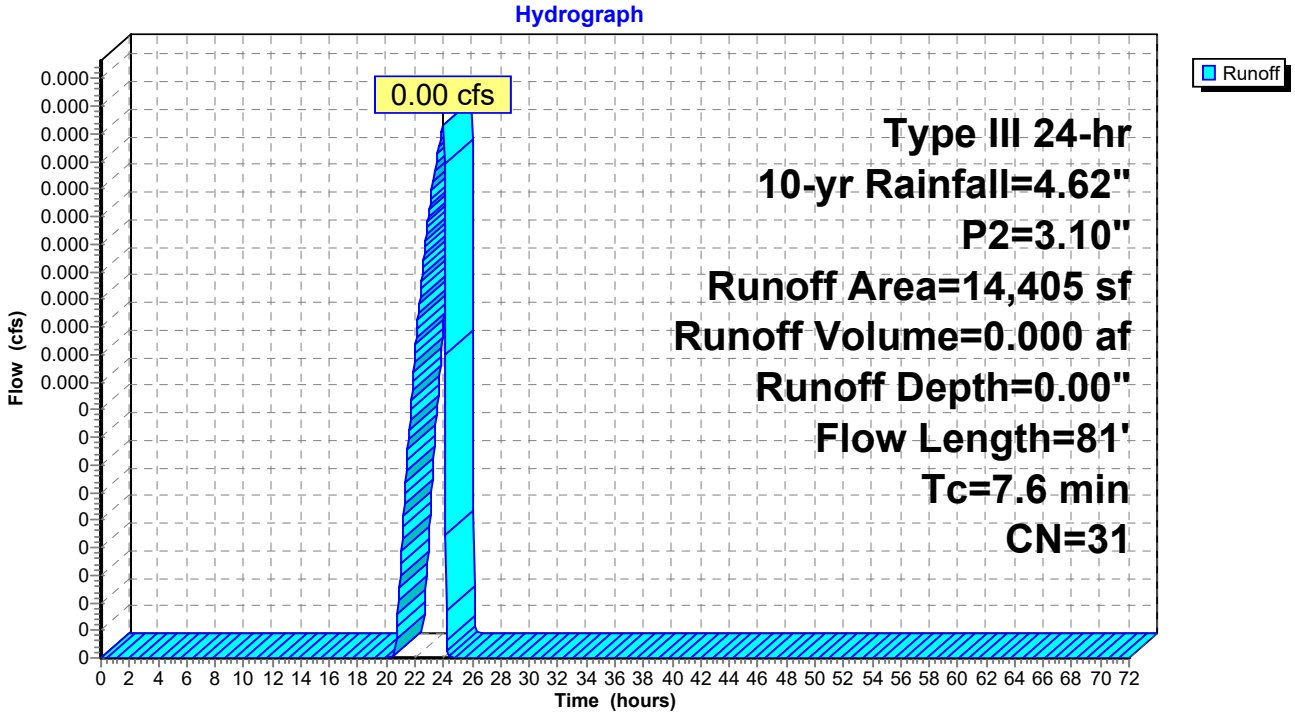
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link DP1 : N'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.62", P2=3.10"

Area (sf)	CN	Description
13,193	30	Woods, Good, HSG A
1,212	39	>75% Grass cover, Good, HSG A
14,405	31	Weighted Average
14,405		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0800	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.4	31	0.0680	1.30		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
7.6	81	Total			

Subcatchment P-2A: SubCatchment P-2A



Summary for Subcatchment P-2B: SubCatchment P-2B

[45] Hint: Runoff=Zero

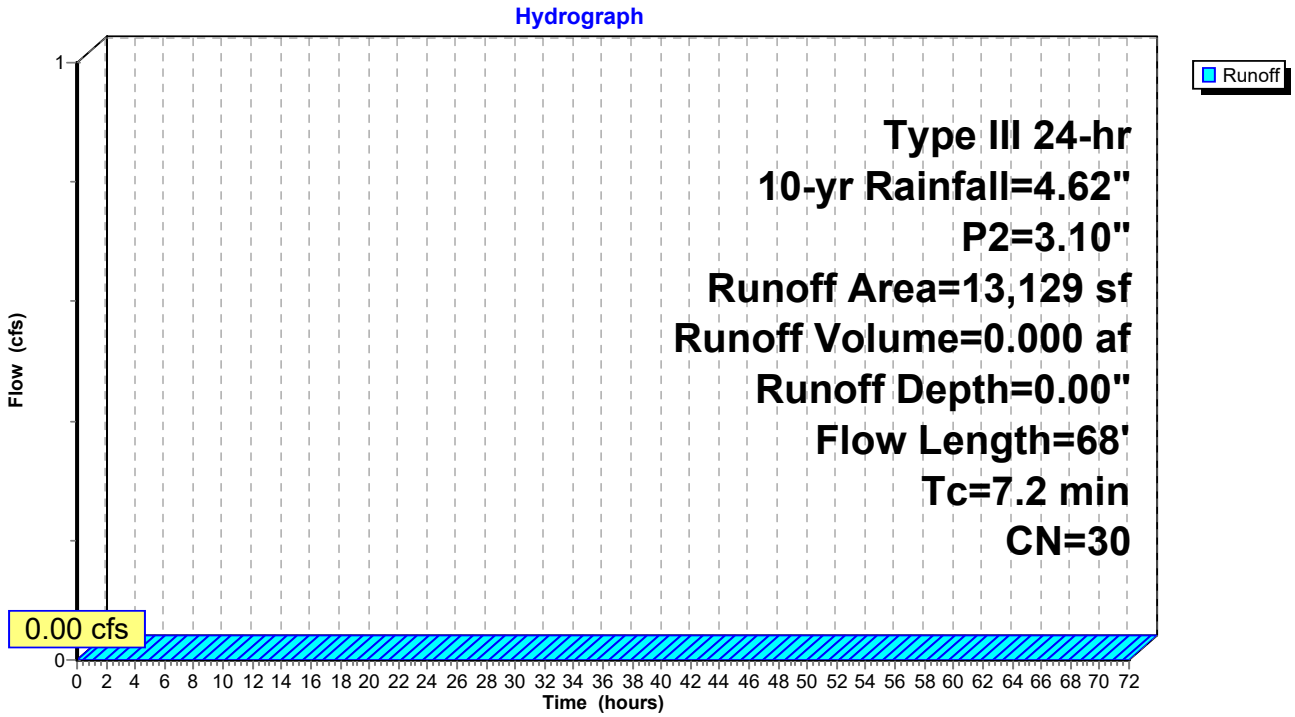
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link DP2 : E'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.62", P2=3.10"

Area (sf)	CN	Description
12,906	30	Woods, Good, HSG A
223	39	>75% Grass cover, Good, HSG A
13,129	30	Weighted Average
13,129		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0860	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.2	18	0.0770	1.39		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
7.2	68	Total			

Subcatchment P-2B: SubCatchment P-2B



Summary for Subcatchment P-3: SubCatchment P-3

[49] Hint: Tc<2dt may require smaller dt

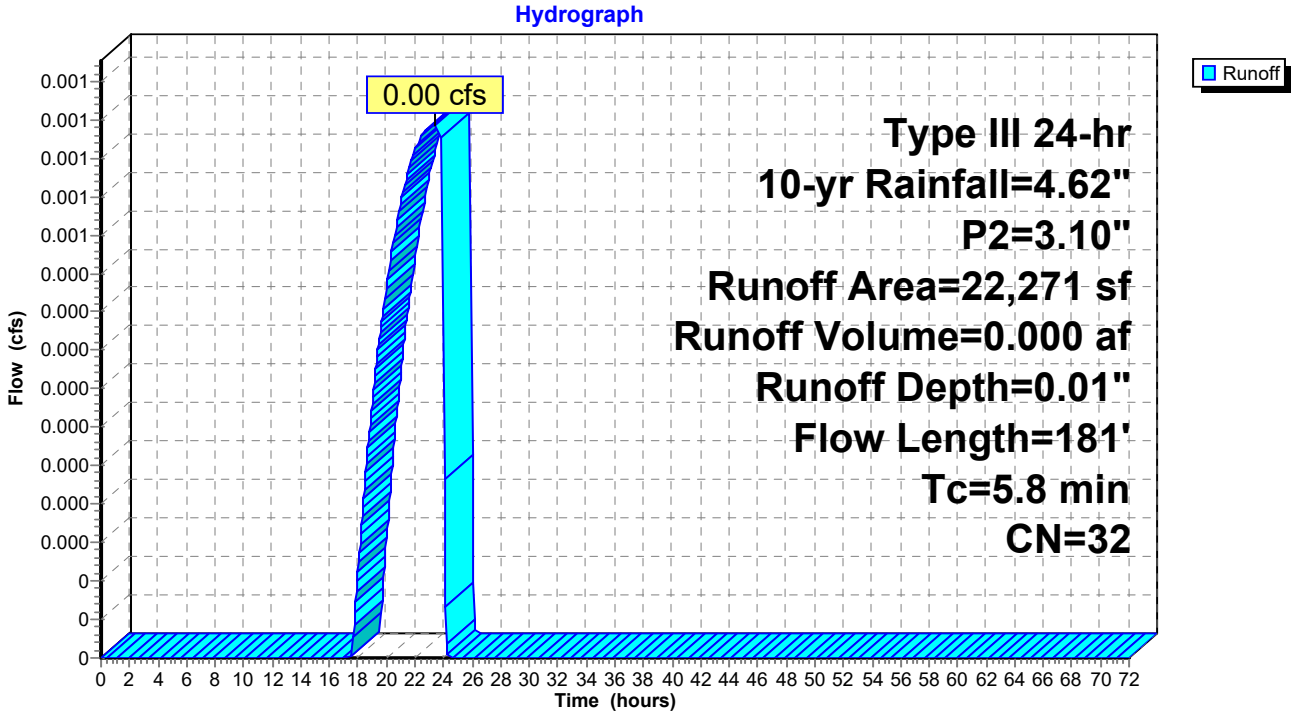
Runoff = 0.00 cfs @ 23.43 hrs, Volume= 0.000 af, Depth= 0.01"
Routed to Link DP2 : E'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.62", P2=3.10"

Area (sf)	CN	Description
16,687	30	Woods, Good, HSG A
5,584	39	>75% Grass cover, Good, HSG A
22,271	32	Weighted Average
22,271		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.2200	0.17		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
1.0	131	0.2000	2.24		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
5.8	181	Total			

Subcatchment P-3: SubCatchment P-3



Summary for Subcatchment P-4: No Change E-4

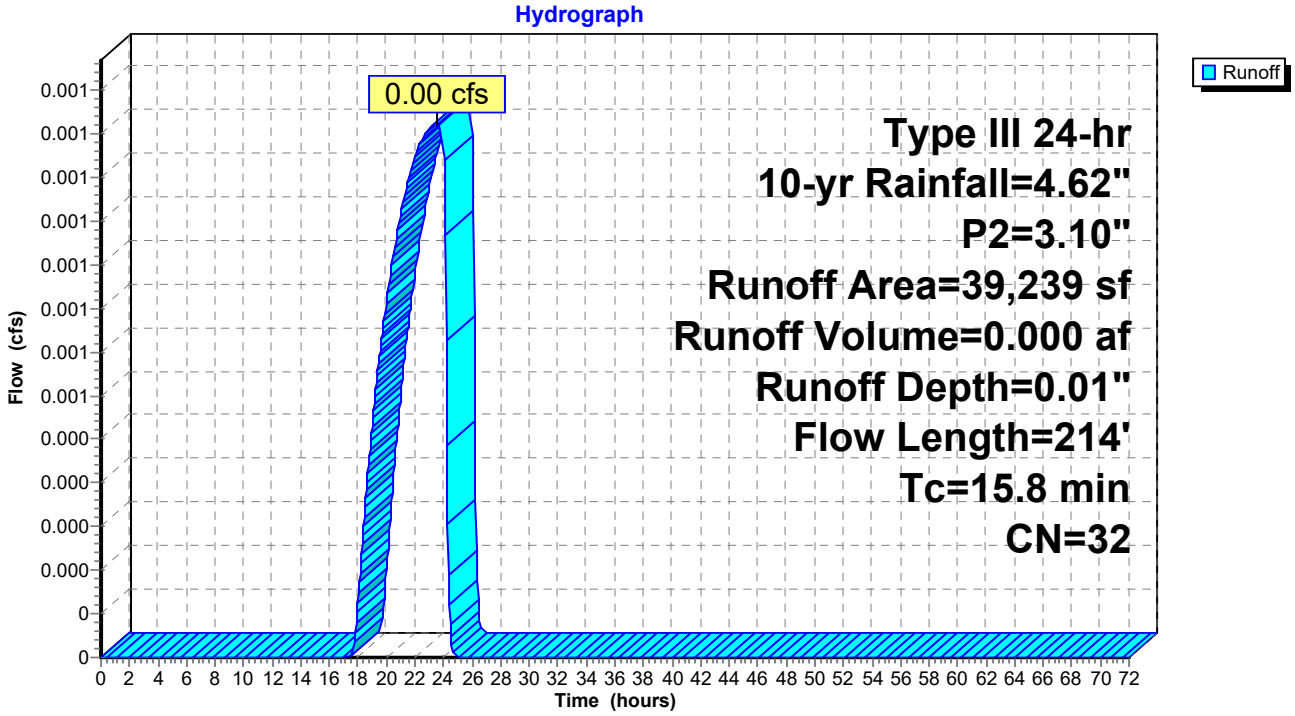
Runoff = 0.00 cfs @ 23.59 hrs, Volume= 0.000 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.62", P2=3.10"

Area (sf)	CN	Description
37,500	30	Woods, Good, HSG A
1,739	72	Dirt roads, HSG A
39,239	32	Weighted Average
39,239		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	50	0.0300	0.08		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.7	29	0.0200	0.71		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.2	10	0.0100	1.00		**Shallow Concentrated Flow, C-D** Nearly Bare & Untilled Kv= 10.0 fps
4.2	125	0.0100	0.50		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
15.8	214	Total			

Subcatchment P-4: No Change E-4



Summary for Subcatchment P-5: No Change E-5

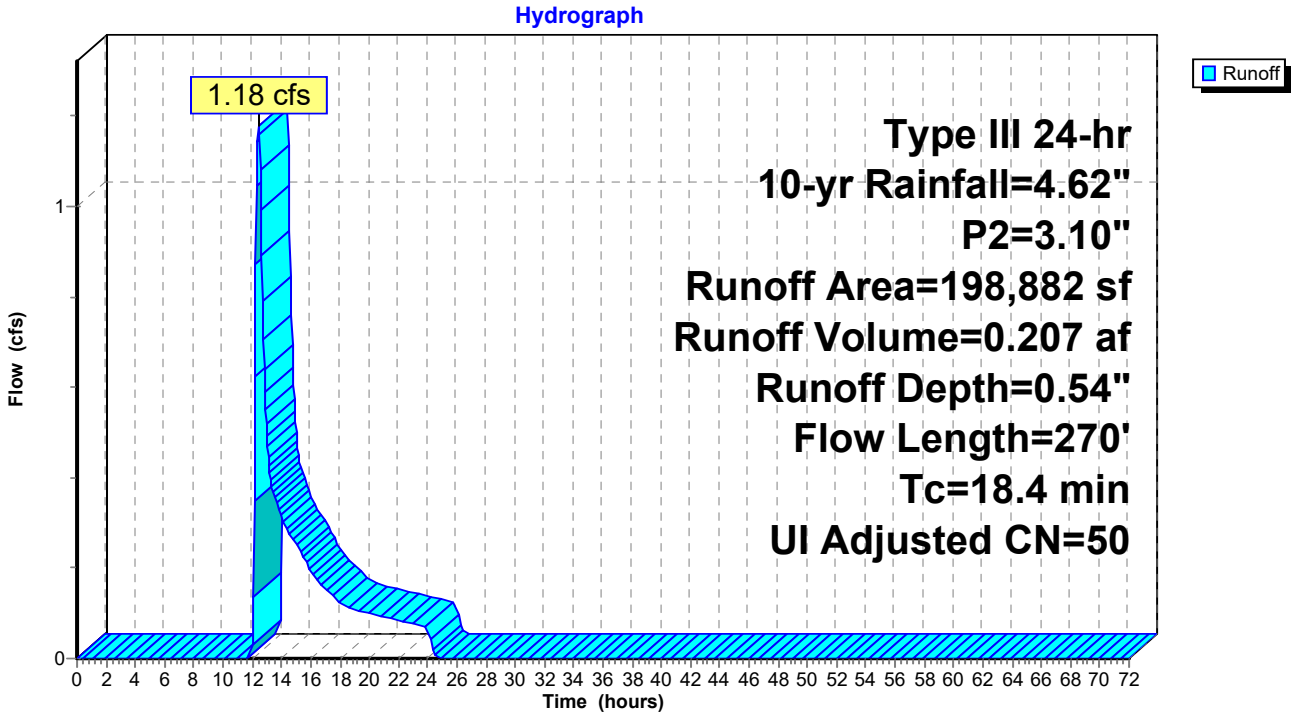
Runoff = 1.18 cfs @ 12.42 hrs, Volume= 0.207 af, Depth= 0.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.62", P2=3.10"

Area (sf)	CN	Adj	Description
99,401	30		Woods, Good, HSG A
33,545	39		>75% Grass cover, Good, HSG A
13,415	72		Dirt roads, HSG A
14,517	98		Unconnected pavement, HSG A
16,302	98		Paved parking, HSG A
21,702	98		Roofs, HSG A
198,882	52	50	Weighted Average, UI Adjusted
146,361			73.59% Pervious Area
52,521			26.41% Impervious Area
14,517			27.64% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		**Sheet Flow, A_B** Woods: Light underbrush n= 0.400 P2= 3.10"
5.6	184	0.0120	0.55		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.3	36	0.0500	2.24		**Shallow Concentrated Flow, C-D** Nearly Bare & Untilled Kv= 10.0 fps
18.4	270	Total			

Subcatchment P-5: No Change E-5



Summary for Subcatchment P-6: SubCatchment P-6

[47] Hint: Peak is 216% of capacity of segment #5
[47] Hint: Peak is 136% of capacity of segment #6

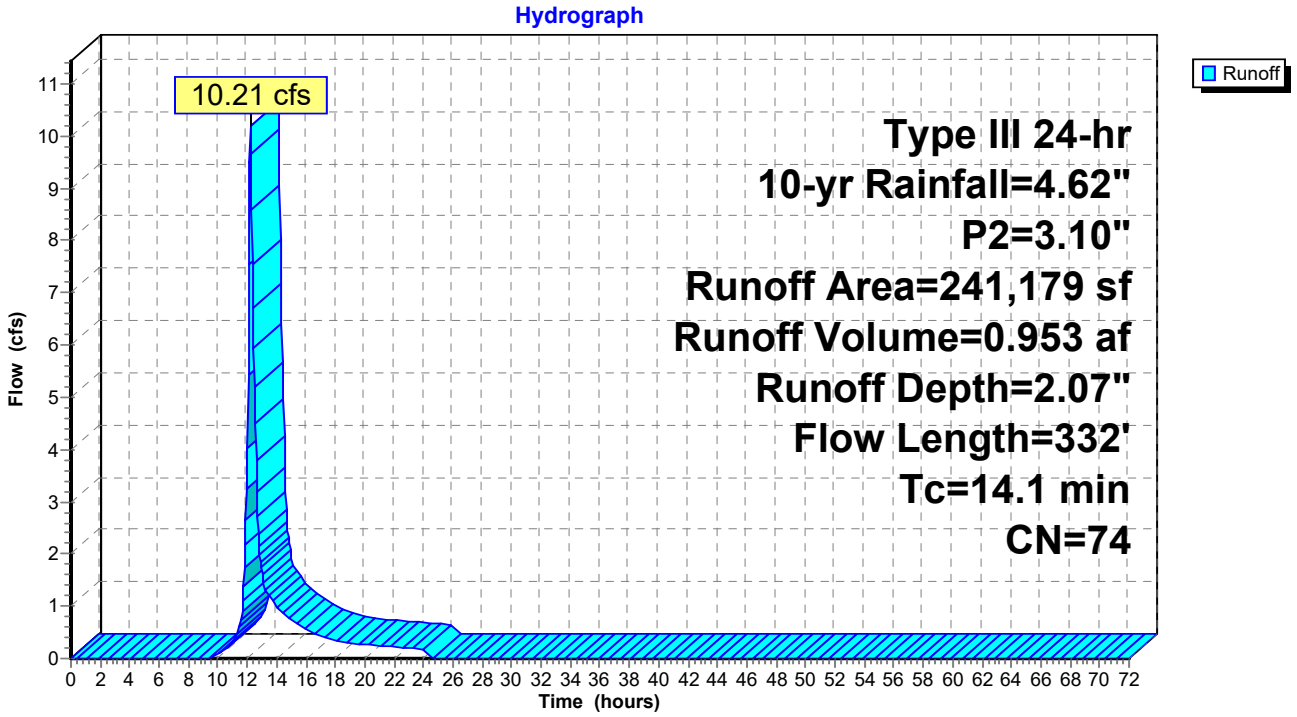
Runoff = 10.21 cfs @ 12.20 hrs, Volume= 0.953 af, Depth= 2.07"
Routed to Link DP5 : To Existing Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.62", P2=3.10"

Area (sf)	CN	Description
19,085	30	Woods, Good, HSG A
49,824	39	>75% Grass cover, Good, HSG A
136,787	98	Paved parking, HSG A
35,483	54	1/2 acre lots, 25% imp, HSG A
241,179	74	Weighted Average
95,521		39.61% Pervious Area
145,658		60.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	32	0.0100	0.05		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
1.6	18	0.1700	0.19		**Sheet Flow, B-C** Grass: Dense n= 0.240 P2= 3.10"
0.1	5	0.0200	0.99		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.2	39	0.0300	3.52		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
0.3	123	0.0150	6.02	4.73	**Pipe Channel, E-F** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.3	115	0.0500	6.12	7.51	**Pipe Channel, F-G** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.025 Corrugated metal
14.1	332	Total			

Subcatchment P-6: SubCatchment P-6



Summary for Subcatchment P-7: SubCatchment P-7

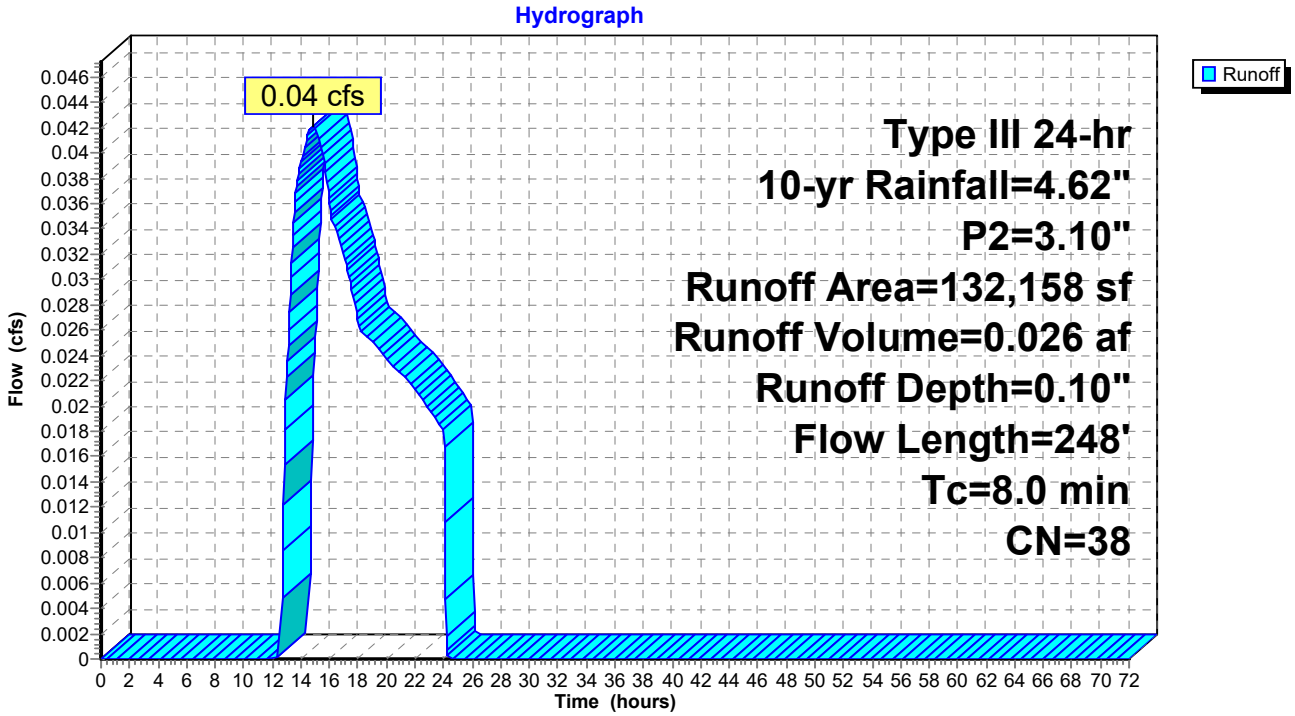
Runoff = 0.04 cfs @ 14.83 hrs, Volume= 0.026 af, Depth= 0.10"
Routed to Link DP5 : To Existing Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.62", P2=3.10"

Area (sf)	CN	Description
73,049	30	Woods, Good, HSG A
50,149	39	>75% Grass cover, Good, HSG A
8,960	98	Paved parking, HSG A
132,158	38	Weighted Average
123,198		93.22% Pervious Area
8,960		6.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
0.9	72	0.0400	1.40		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.8	126	0.2500	2.50		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
8.0	248	Total			

Subcatchment P-7: SubCatchment P-7



Summary for Subcatchment P-8A: SubCatchment P-8A

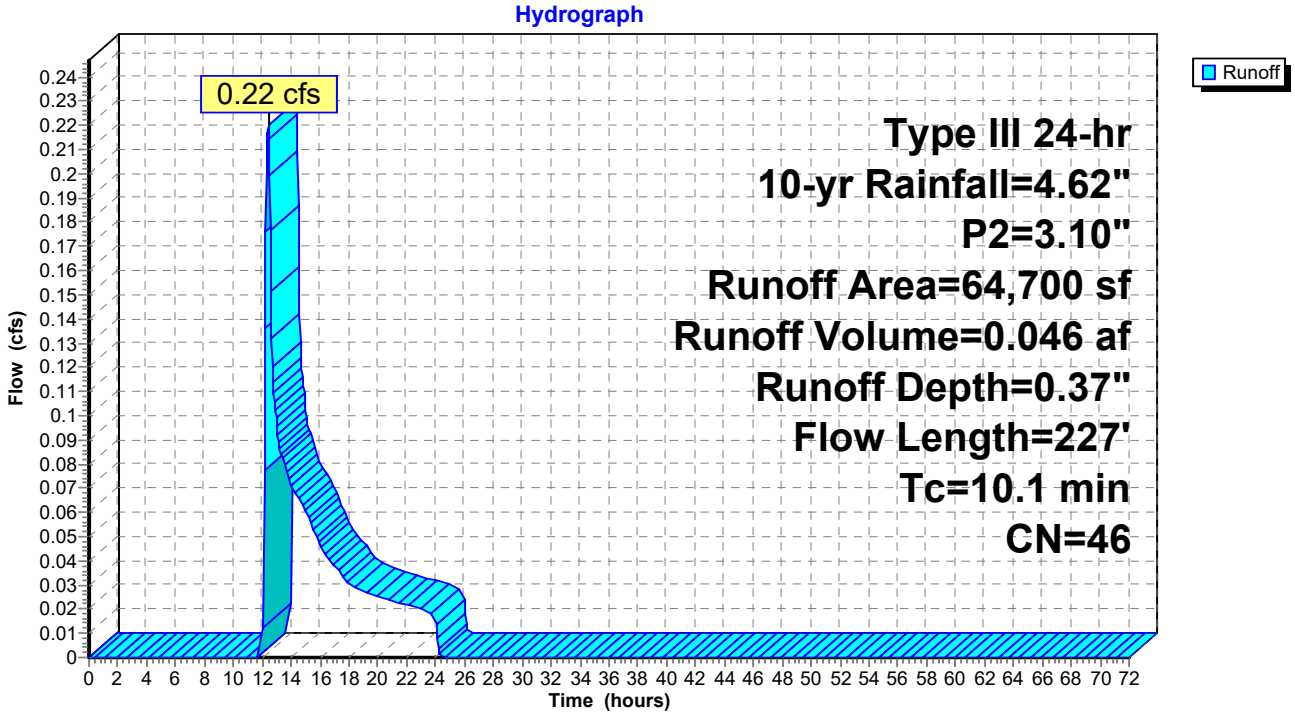
Runoff = 0.22 cfs @ 12.40 hrs, Volume= 0.046 af, Depth= 0.37"
Routed to Pond 6P : Depression-Chambers

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.62", P2=3.10"

Area (sf)	CN	Description
26,938	61	1/4 acre lots, 38% imp, HSG A
31,395	30	Woods, Good, HSG A
4,300	39	>75% Grass cover, Good, HSG A
2,067	98	Water Surface, HSG A
64,700	46	Weighted Average
52,397		80.98% Pervious Area
12,303		19.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
1.0	57	0.0200	0.99		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.8	120	0.2400	2.45		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
10.1	227	Total			

Subcatchment P-8A: SubCatchment P-8A



Summary for Subcatchment P-8B: SubCatchment P-8B

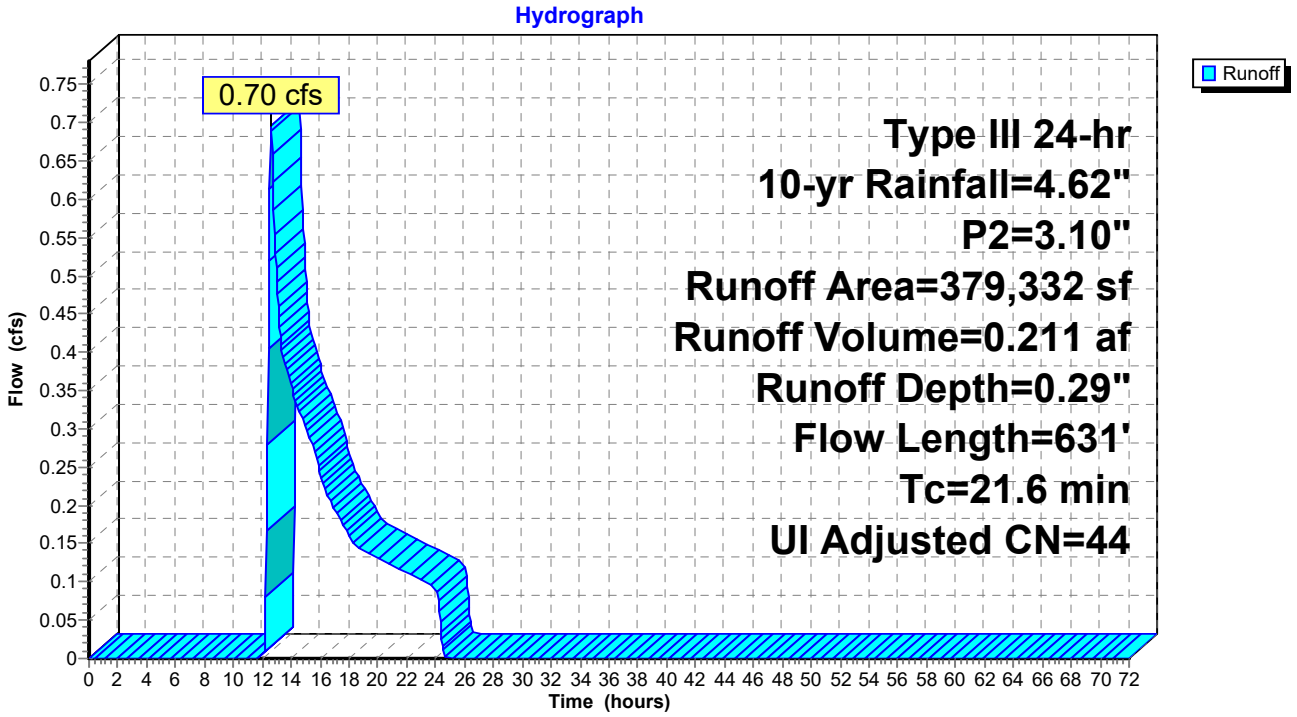
Runoff = 0.70 cfs @ 12.61 hrs, Volume= 0.211 af, Depth= 0.29"
Routed to Pond 8P : DP6 - New Inf Basin Club

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.62", P2=3.10"

Area (sf)	CN	Adj	Description
137,313	30		Woods, Good, HSG A
133,757	39		>75% Grass cover, Good, HSG A
47,139	98		Unconnected roofs, HSG A
52,252	98		Unconnected pavement, HSG A
8,871	98		Water Surface, HSG A
379,332	53	44	Weighted Average, UI Adjusted
271,070			71.46% Pervious Area
108,262			28.54% Impervious Area
99,391			91.81% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
1.2	83	0.0570	1.19		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
6.9	354	0.0150	0.86		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.9	122	0.2280	2.39		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
0.1	22	0.3300	4.02		**Shallow Concentrated Flow, E-F** Short Grass Pasture Kv= 7.0 fps
21.6	631	Total			

Subcatchment P-8B: SubCatchment P-8B



Summary for Subcatchment P-9: SubCatchment P-9

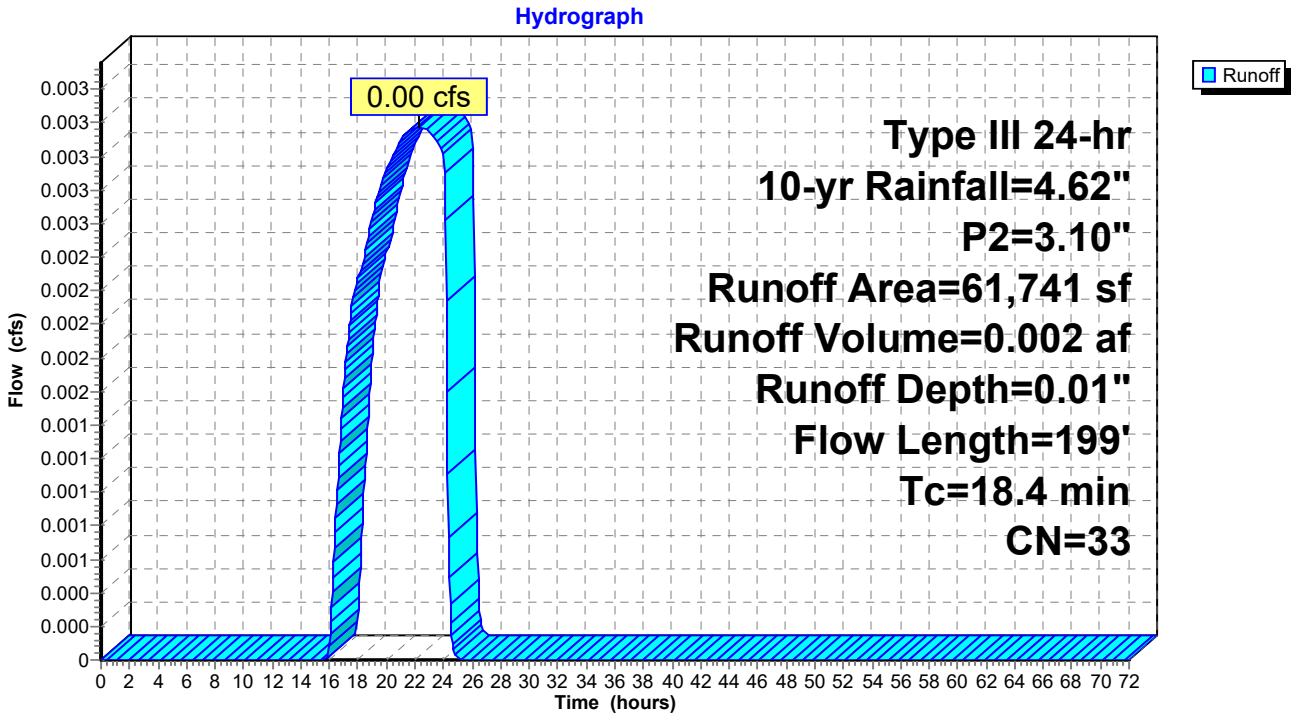
Runoff = 0.00 cfs @ 22.21 hrs, Volume= 0.002 af, Depth= 0.01"
Routed to Pond 5P : DP7 - Existing Depression 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.62", P2=3.10"

Area (sf)	CN	Description
46,123	30	Woods, Good, HSG A
14,817	39	>75% Grass cover, Good, HSG A
801	98	Water Surface, HSG A
61,741	33	Weighted Average
60,940		98.70% Pervious Area
801		1.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	50	0.0125	0.06		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
3.3	149	0.0226	0.75		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
18.4	199	Total			

Subcatchment P-9: SubCatchment P-9



Summary for Pond 1P: SubSurface Sys

Inflow Area = 10.912 ac, 56.27% Impervious, Inflow Depth = 1.83" for 10-yr event
Inflow = 14.62 cfs @ 12.33 hrs, Volume= 1.668 af
Outflow = 5.57 cfs @ 12.81 hrs, Volume= 1.668 af, Atten= 62%, Lag= 29.0 min
Discarded = 5.57 cfs @ 12.81 hrs, Volume= 1.668 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 172.91' @ 12.81 hrs Surf.Area= 29,116 sf Storage= 14,955 cf

Plug-Flow detention time= 16.9 min calculated for 1.666 af (100% of inflow)
Center-of-Mass det. time= 16.8 min (881.5 - 864.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	172.00'	5,168 cf	**44.25'W x 131.78'L x 3.50'H Field A** 20,409 cf Overall - 7,490 cf Embedded = 12,919 cf x 40.0% Voids
#2A	172.50'	7,490 cf	**ADS_StormTech SC-740 b +Cap** x 162 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 162 Chambers in 9 Rows Cap Storage= 2.7 cf x 2 x 9 rows = 47.8 cf
#3	172.50'	43,645 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
#4D	172.00'	3,915 cf	**30.00'W x 146.02'L x 3.50'H Field B** 15,332 cf Overall - 5,545 cf Embedded = 9,787 cf x 40.0% Voids
#5D	172.50'	5,545 cf	**ADS_StormTech SC-740 b +Cap** x 120 Inside #4 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 120 Chambers in 6 Rows Cap Storage= 2.7 cf x 2 x 6 rows = 31.9 cf
#6B	172.00'	4,492 cf	**49.00'W x 103.30'L x 3.50'H Field C** 17,715 cf Overall - 6,485 cf Embedded = 11,231 cf x 40.0% Voids
#7B	172.50'	6,485 cf	**ADS_StormTech SC-740 b +Cap** x 140 Inside #6 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 140 Chambers in 10 Rows Cap Storage= 2.7 cf x 2 x 10 rows = 53.1 cf
#8C	172.00'	4,292 cf	**30.00'W x 160.26'L x 3.50'H Field D** 16,827 cf Overall - 6,096 cf Embedded = 10,731 cf x 40.0% Voids
#9C	172.50'	6,096 cf	**ADS_StormTech SC-740 b +Cap** x 132 Inside #8 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 132 Chambers in 6 Rows Cap Storage= 2.7 cf x 2 x 6 rows = 31.9 cf
#10E	172.00'	2,974 cf	**20.50'W x 160.26'L x 3.50'H Field E** 11,498 cf Overall - 4,064 cf Embedded = 7,434 cf x 40.0% Voids
#11E	172.50'	4,064 cf	**ADS_StormTech SC-740 b +Cap** x 88 Inside #10 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 88 Chambers in 4 Rows Cap Storage= 2.7 cf x 2 x 4 rows = 21.2 cf
		94,165 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group D created with Chamber Wizard
Storage Group B created with Chamber Wizard
Storage Group C created with Chamber Wizard
Storage Group E created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
172.50	5,320	0	0
173.00	5,843	2,791	2,791
174.00	6,931	6,387	9,178
175.00	8,075	7,503	16,681
176.00	9,276	8,676	25,356
177.00	10,534	9,905	35,261
177.76	11,528	8,384	43,645

Device	Routing	Invert	Outlet Devices
#1	Discarded	172.00'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=5.57 cfs @ 12.81 hrs HW=172.91' (Free Discharge)
1=Exfiltration (Exfiltration Controls 5.57 cfs)

Pond 1P: SubSurface Sys - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 b +Cap (ADS StormTech® SC-740 with cap storage)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 9 rows = 47.8 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

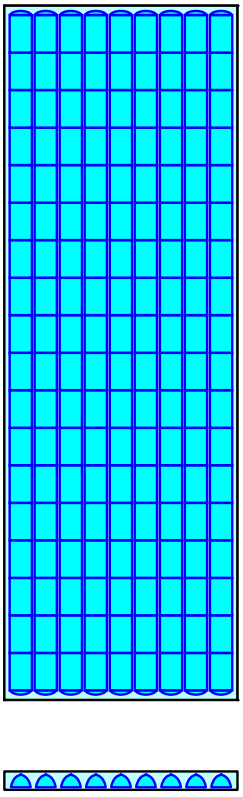
18 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 129.78' Row Length +12.0" End Stone x 2 = 131.78' Base Length
9 Rows x 51.0" Wide + 6.0" Spacing x 8 + 12.0" Side Stone x 2 = 44.25' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

162 Chambers x 45.9 cf + 2.7 cf Cap Volume x 2 x 9 Rows = 7,490.1 cf Chamber Storage

20,408.9 cf Field - 7,490.1 cf Chambers = 12,918.8 cf Stone x 40.0% Voids = 5,167.5 cf Stone Storage

Chamber Storage + Stone Storage = 12,657.6 cf = 0.291 af
Overall Storage Efficiency = 62.0%
Overall System Size = 131.78' x 44.25' x 3.50'

162 Chambers
755.9 cy Field
478.5 cy Stone



Pond 1P: SubSurface Sys - Chamber Wizard Field B

Chamber Model = ADS_StormTech SC-740 b +Cap (ADS StormTech® SC-740 with cap storage)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 6 rows = 31.9 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

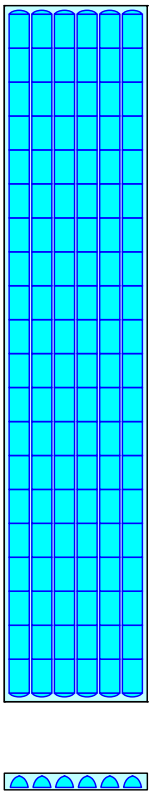
20 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 144.02' Row Length +12.0" End Stone x 2 = 146.02' Base Length
6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.00' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

120 Chambers x 45.9 cf + 2.7 cf Cap Volume x 2 x 6 Rows = 5,544.7 cf Chamber Storage

15,331.8 cf Field - 5,544.7 cf Chambers = 9,787.1 cf Stone x 40.0% Voids = 3,914.8 cf Stone Storage

Chamber Storage + Stone Storage = 9,459.5 cf = 0.217 af
Overall Storage Efficiency = 61.7%
Overall System Size = 146.02' x 30.00' x 3.50'

120 Chambers
567.8 cy Field
362.5 cy Stone



Pond 1P: SubSurface Sys - Chamber Wizard Field C

Chamber Model = ADS_StormTech SC-740 b +Cap (ADS StormTech® SC-740 with cap storage)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 10 rows = 53.1 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

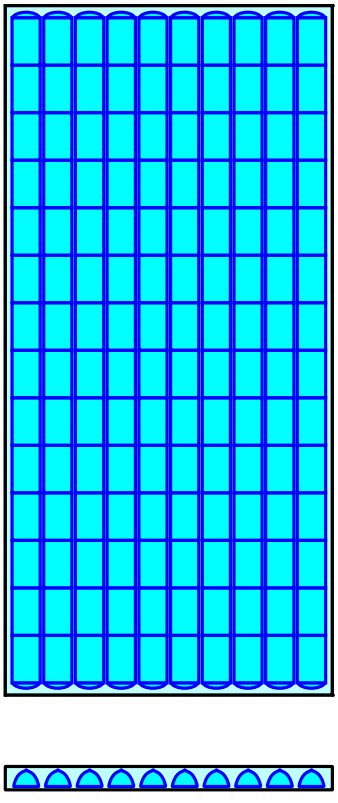
14 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 101.30' Row Length +12.0" End Stone x 2 = 103.30' Base Length
10 Rows x 51.0" Wide + 6.0" Spacing x 9 + 12.0" Side Stone x 2 = 49.00' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

140 Chambers x 45.9 cf + 2.7 cf Cap Volume x 2 x 10 Rows = 6,484.7 cf Chamber Storage

17,715.4 cf Field - 6,484.7 cf Chambers = 11,230.7 cf Stone x 40.0% Voids = 4,492.3 cf Stone Storage

Chamber Storage + Stone Storage = 10,977.0 cf = 0.252 af
Overall Storage Efficiency = 62.0%
Overall System Size = 103.30' x 49.00' x 3.50'

140 Chambers
656.1 cy Field
416.0 cy Stone



Pond 1P: SubSurface Sys - Chamber Wizard Field D

Chamber Model = ADS_StormTech SC-740 b +Cap (ADS StormTech® SC-740 with cap storage)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 6 rows = 31.9 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

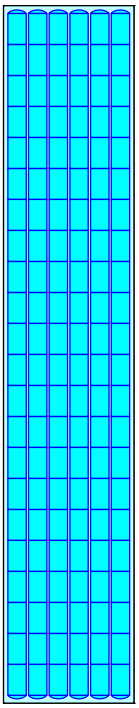
22 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 158.26' Row Length +12.0" End Stone x 2 = 160.26' Base Length
6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.00' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

132 Chambers x 45.9 cf + 2.7 cf Cap Volume x 2 x 6 Rows = 6,095.9 cf Chamber Storage

16,827.0 cf Field - 6,095.9 cf Chambers = 10,731.0 cf Stone x 40.0% Voids = 4,292.4 cf Stone Storage

Chamber Storage + Stone Storage = 10,388.3 cf = 0.238 af
Overall Storage Efficiency = 61.7%
Overall System Size = 160.26' x 30.00' x 3.50'

132 Chambers
623.2 cy Field
397.4 cy Stone





Pond 1P: SubSurface Sys - Chamber Wizard Field E

Chamber Model = ADS_StormTech SC-740 b +Cap (ADS StormTech® SC-740 with cap storage)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 4 rows = 21.2 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

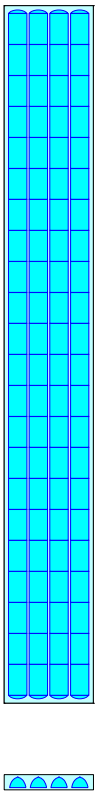
22 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 158.26' Row Length +12.0" End Stone x 2 = 160.26' Base Length
4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

88 Chambers x 45.9 cf + 2.7 cf Cap Volume x 2 x 4 Rows = 4,064.0 cf Chamber Storage

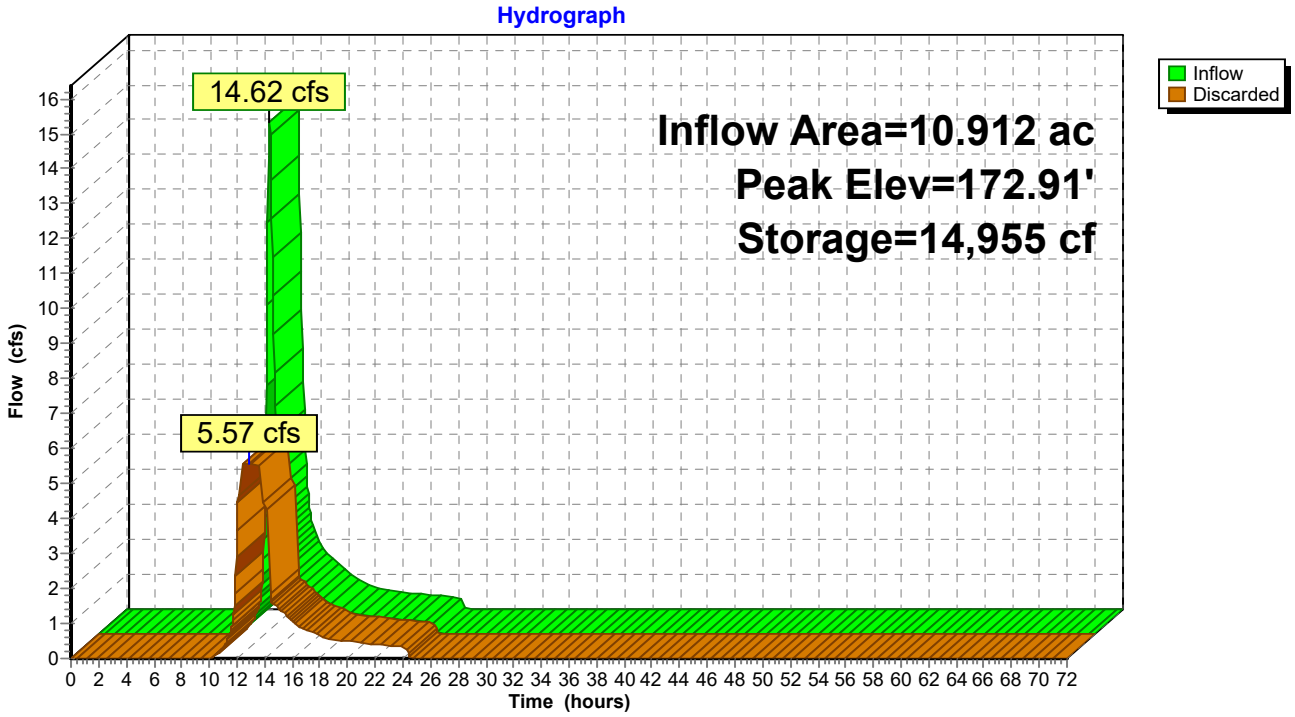
11,498.4 cf Field - 4,064.0 cf Chambers = 7,434.5 cf Stone x 40.0% Voids = 2,973.8 cf Stone Storage

Chamber Storage + Stone Storage = 7,037.7 cf = 0.162 af
Overall Storage Efficiency = 61.2%
Overall System Size = 160.26' x 20.50' x 3.50'

88 Chambers
425.9 cy Field
275.4 cy Stone



Pond 1P: SubSurface Sys



Summary for Pond 4P: Drainage Basin/Easement

Inflow Area = 8.571 ac, 41.42% Impervious, Inflow Depth = 1.37" for 10-yr event
Inflow = 10.21 cfs @ 12.20 hrs, Volume= 0.979 af
Outflow = 0.49 cfs @ 16.64 hrs, Volume= 0.979 af, Atten= 95%, Lag= 266.4 min
Discarded = 0.49 cfs @ 16.64 hrs, Volume= 0.979 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to nonexistent node SP6

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 178.96' @ 16.64 hrs Surf.Area= 8,815 sf Storage= 26,245 cf

Plug-Flow detention time= 653.3 min calculated for 0.979 af (100% of inflow)
Center-of-Mass det. time= 653.0 min (1,507.7 - 854.7)

Volume	Invert	Avail.Storage	Storage Description
#1	174.00'	345,939 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

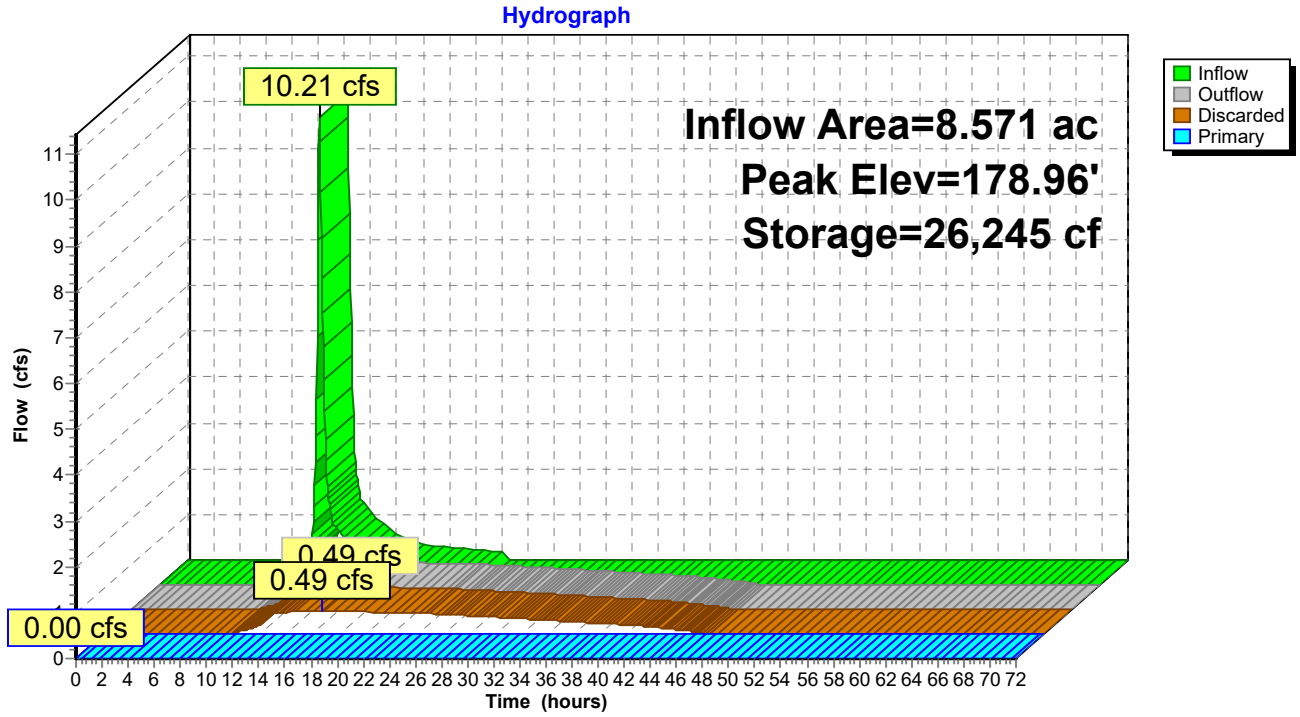
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
174.00	491	0	0
175.00	3,251	1,871	1,871
176.00	4,753	4,002	5,873
177.00	6,309	5,531	11,404
178.00	7,641	6,975	18,379
179.00	8,869	8,255	26,634
180.00	10,188	9,529	36,163
181.00	11,953	11,071	47,233
182.00	14,143	13,048	60,281
183.00	16,525	15,334	75,615
184.00	19,118	17,822	93,437
185.00	21,426	20,272	113,709
186.00	23,221	22,324	136,032
187.00	24,868	24,045	160,077
188.00	26,530	25,699	185,776
189.00	28,209	27,370	213,145
190.00	30,172	29,191	242,336
191.00	32,732	31,452	273,788
192.00	36,071	34,402	308,189
193.00	39,428	37,750	345,939

Device	Routing	Invert	Outlet Devices
#1	Primary	192.90'	**10.0' long x 50.0' 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
#2	Discarded	174.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.49 cfs @ 16.64 hrs HW=178.96' (Free Discharge)
↑**2=Exfiltration** (Exfiltration Controls 0.49 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=174.00' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 4P: Drainage Basin/Easement



Summary for Pond 5P: DP7 - Existing Depression 2

Inflow Area = 1.417 ac, 1.30% Impervious, Inflow Depth = 0.01" for 10-yr event
Inflow = 0.00 cfs @ 22.21 hrs, Volume= 0.002 af
Outflow = 0.00 cfs @ 22.25 hrs, Volume= 0.002 af, Atten= 0%, Lag= 2.4 min
Discarded = 0.00 cfs @ 22.25 hrs, Volume= 0.002 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 172.01' @ 22.25 hrs Surf.Area= 71 sf Storage= 0 cf

Plug-Flow detention time= 2.6 min calculated for 0.002 af (100% of inflow)
Center-of-Mass det. time= 2.6 min (1,246.0 - 1,243.4)

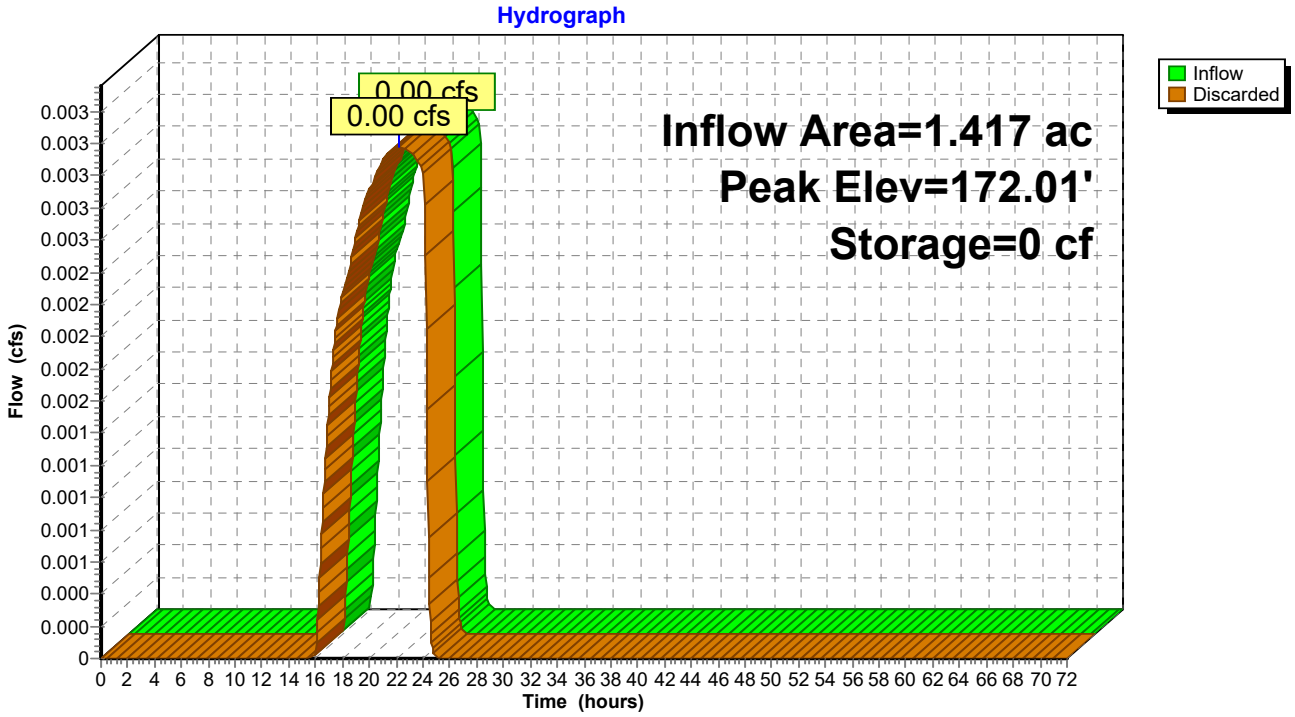
Volume	Invert	Avail.Storage	Storage Description
#1	172.00'	6,418 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
172.00	67	0	0
174.00	1,456	1,523	1,523
175.50	5,070	4,895	6,418

Device	Routing	Invert	Outlet Devices
#1	Discarded	172.00'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.01 cfs @ 22.25 hrs HW=172.01' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Pond 5P: DP7 - Existing Depression 2



Summary for Pond 6P: Depression-Chambers

Inflow Area = 1.485 ac, 19.02% Impervious, Inflow Depth = 0.37" for 10-yr event
Inflow = 0.22 cfs @ 12.40 hrs, Volume= 0.046 af
Outflow = 0.22 cfs @ 12.43 hrs, Volume= 0.046 af, Atten= 1%, Lag= 1.9 min
Discarded = 0.22 cfs @ 12.43 hrs, Volume= 0.046 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 176.54' @ 12.43 hrs Surf.Area= 1,534 sf Storage= 25 cf

Plug-Flow detention time= 1.9 min calculated for 0.046 af (100% of inflow)
Center-of-Mass det. time= 1.9 min (959.8 - 957.9)

Volume	Invert	Avail.Storage	Storage Description
#1	179.50'	1,835 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2A	176.50'	1,404 cf	**20.50'W x 74.82'L x 3.50'H Field A** 5,368 cf Overall - 1,859 cf Embedded = 3,509 cf x 40.0% Voids
#3A	177.00'	1,859 cf	**ADS_StormTech SC-740 b +Cap** x 40 Inside #2 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 40 Chambers in 4 Rows Cap Storage= 2.7 cf x 2 x 4 rows = 21.2 cf
		5,098 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
179.50	59	0	0
180.00	195	64	64
181.00	803	499	563
182.00	1,742	1,273	1,835

Device	Routing	Invert	Outlet Devices
#1	Discarded	176.50'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.29 cfs @ 12.43 hrs HW=176.54' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.29 cfs)

Pond 6P: Depression-Chambers - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 b +Cap (ADS StormTech® SC-740 with cap storage)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 4 rows = 21.2 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

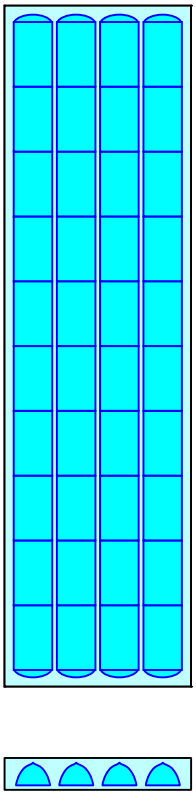
10 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 72.82' Row Length +12.0" End Stone x 2 = 74.82' Base Length
4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

40 Chambers x 45.9 cf + 2.7 cf Cap Volume x 2 x 4 Rows = 1,858.8 cf Chamber Storage

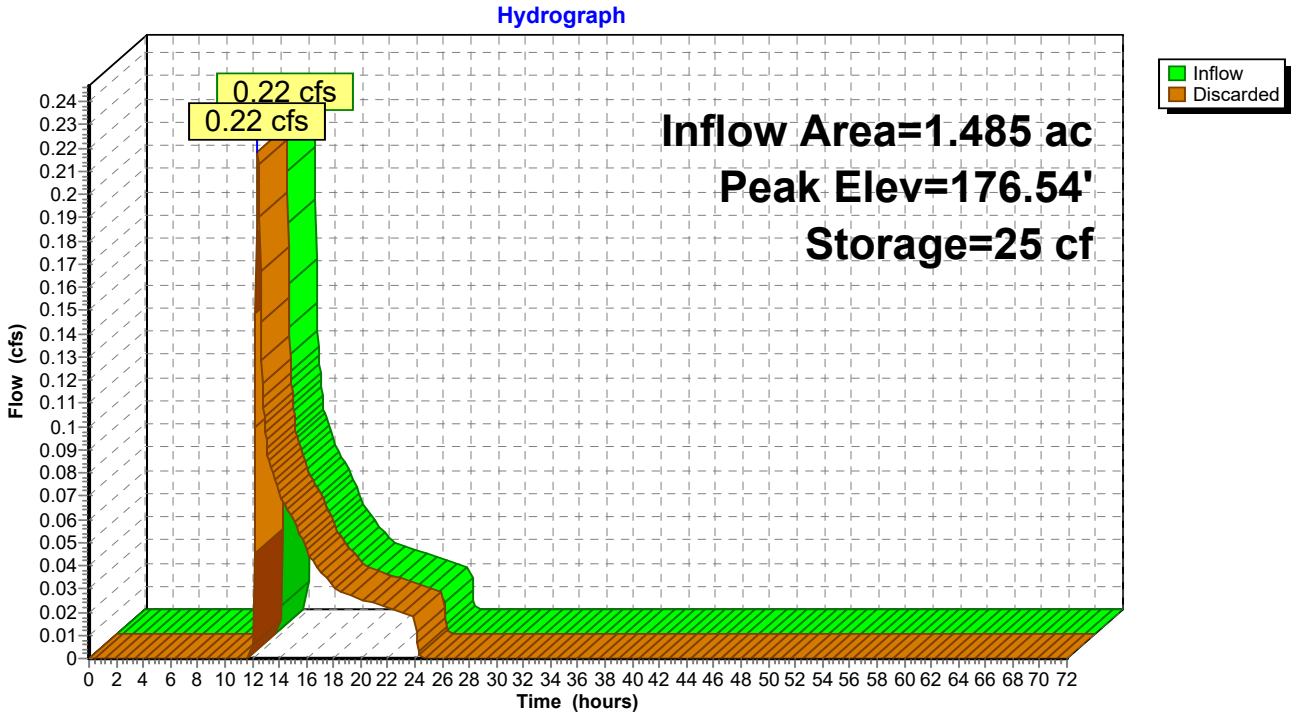
5,368.1 cf Field - 1,858.8 cf Chambers = 3,509.3 cf Stone x 40.0% Voids = 1,403.7 cf Stone Storage

Chamber Storage + Stone Storage = 3,262.5 cf = 0.075 af
Overall Storage Efficiency = 60.8%
Overall System Size = 74.82' x 20.50' x 3.50'

40 Chambers
198.8 cy Field
130.0 cy Stone



Pond 6P: Depression-Chambers



Summary for Pond 8P: DP6 - New Inf Basin Club

Inflow Area = 8.708 ac, 28.54% Impervious, Inflow Depth = 0.29" for 10-yr event
Inflow = 0.70 cfs @ 12.61 hrs, Volume= 0.211 af
Outflow = 0.68 cfs @ 12.68 hrs, Volume= 0.211 af, Atten= 3%, Lag= 3.8 min
Discarded = 0.68 cfs @ 12.68 hrs, Volume= 0.211 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 167.03' @ 12.68 hrs Surf.Area= 4,214 sf Storage= 140 cf

Plug-Flow detention time= 3.5 min calculated for 0.211 af (100% of inflow)
Center-of-Mass det. time= 3.5 min (990.5 - 987.0)

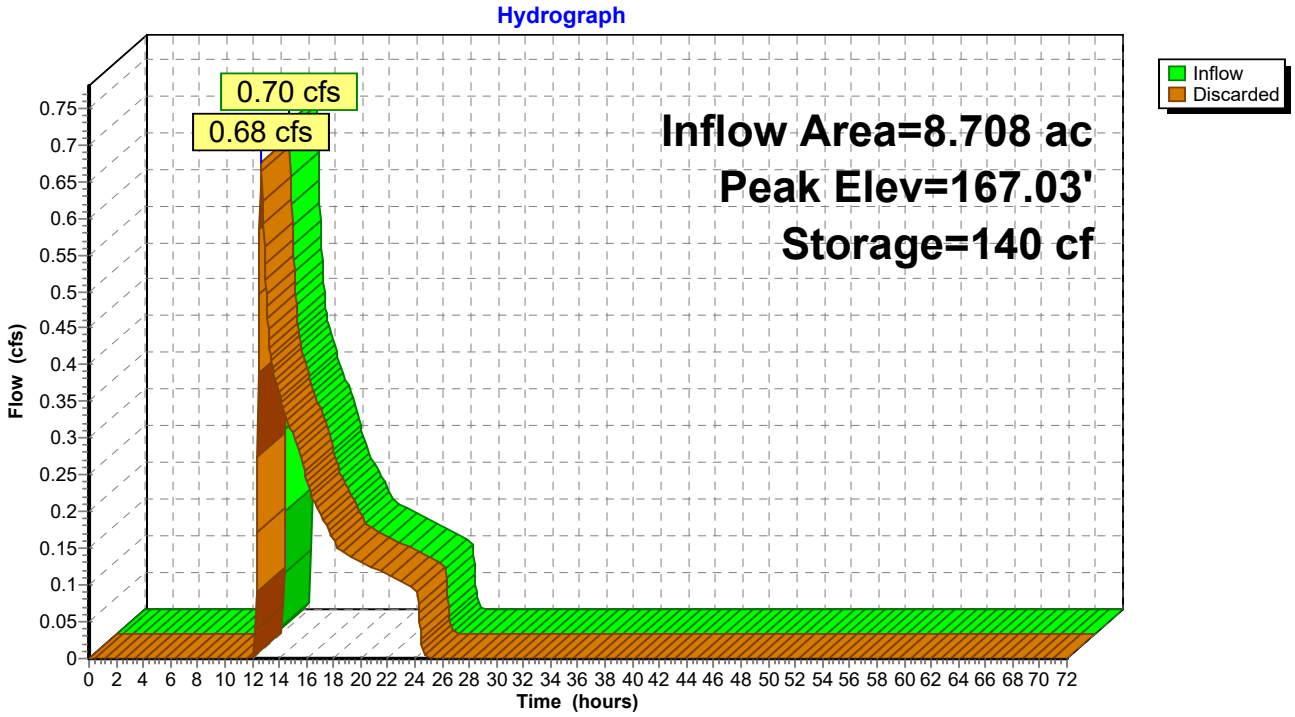
Volume	Invert	Avail.Storage	Storage Description
#1	167.00'	28,802 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
167.00	4,169	0	0
168.00	5,514	4,842	4,842
169.00	7,024	6,269	11,111
170.00	8,871	7,948	19,058
171.00	10,617	9,744	28,802

Device	Routing	Invert	Outlet Devices
#1	Discarded	167.00'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.81 cfs @ 12.68 hrs HW=167.03' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.81 cfs)

Pond 8P: DP6 - New Inf Basin Club

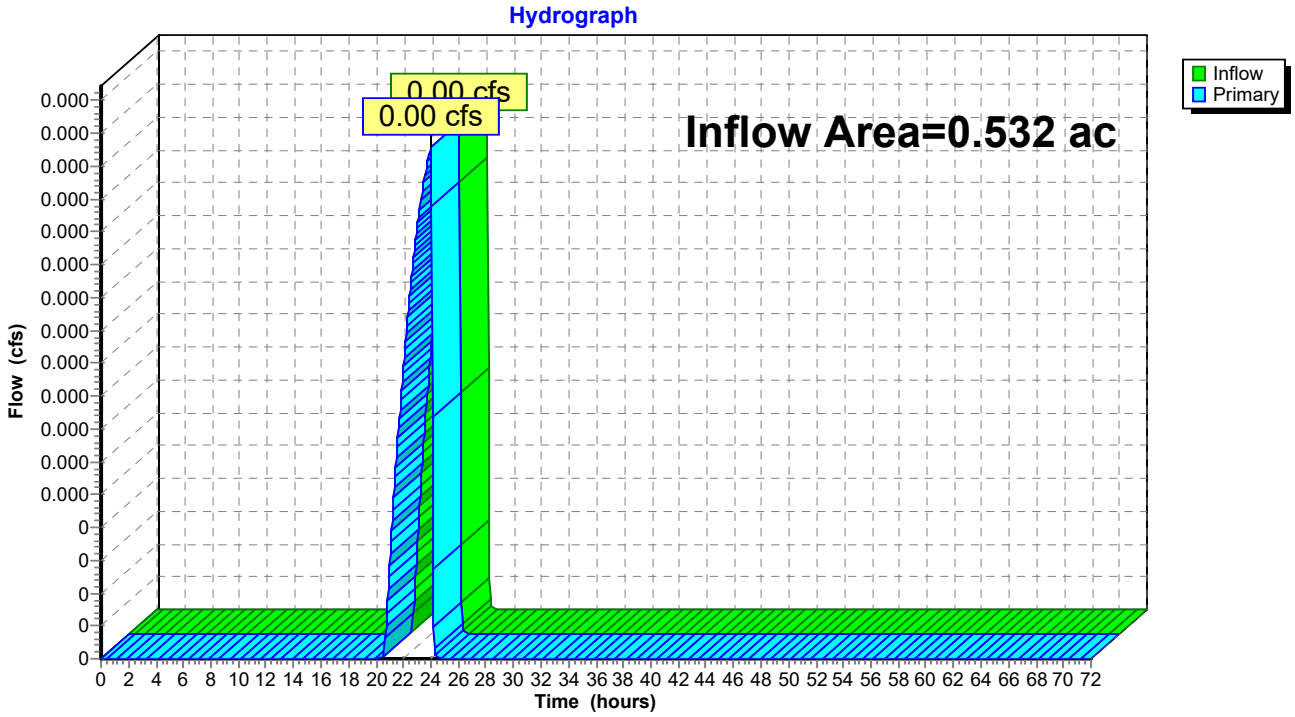


Summary for Link DP1: N'ly Property Line

Inflow Area = 0.532 ac, 0.00% Impervious, Inflow Depth = 0.00" for 10-yr event
Inflow = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP1: N'ly Property Line

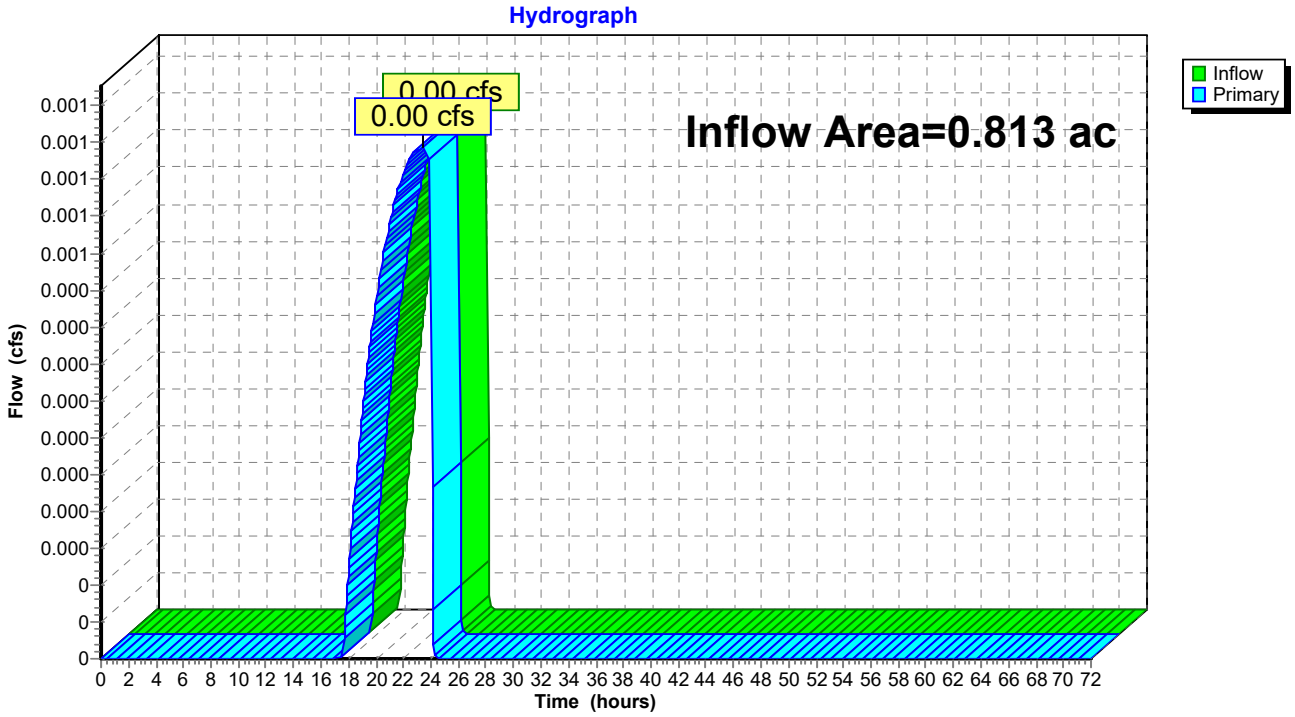


Summary for Link DP2: E'ly Property Line

Inflow Area = 0.813 ac, 0.00% Impervious, Inflow Depth = 0.00" for 10-yr event
Inflow = 0.00 cfs @ 23.43 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 23.43 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP2: E'ly Property Line

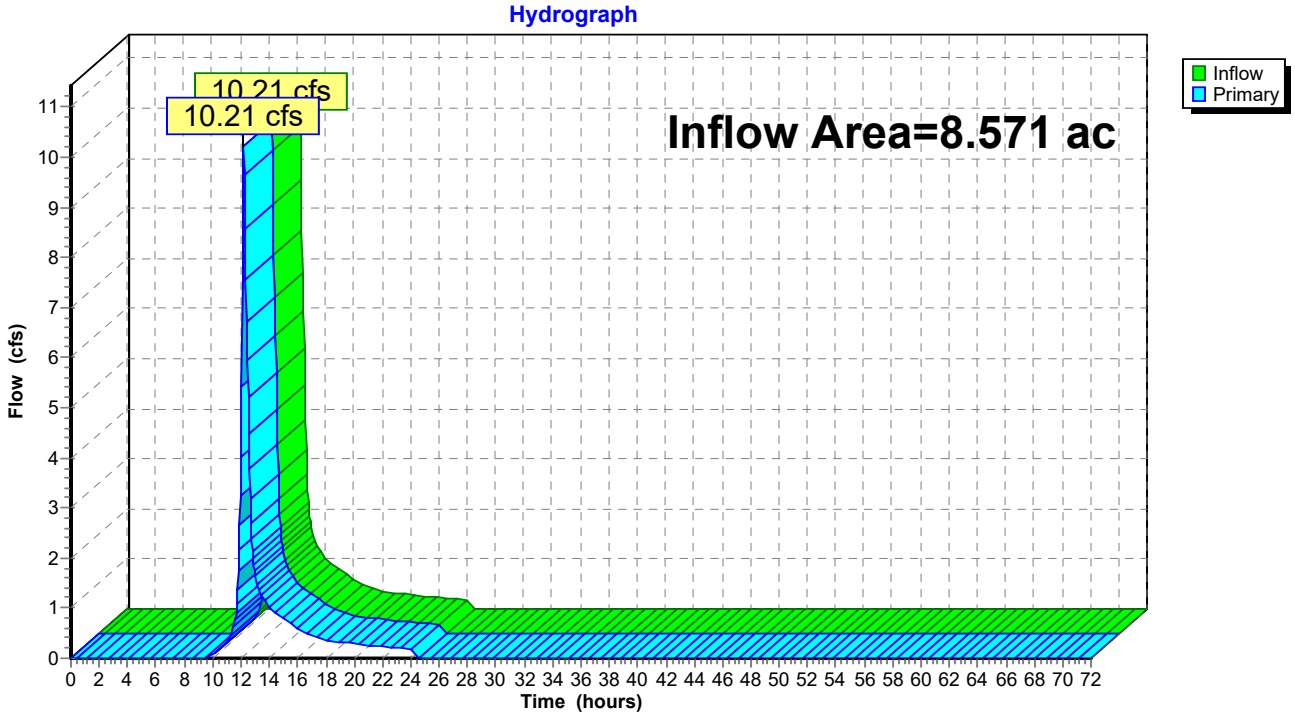


Summary for Link DP5: To Existing Basin

Inflow Area = 8.571 ac, 41.42% Impervious, Inflow Depth = 1.37" for 10-yr event
Inflow = 10.21 cfs @ 12.20 hrs, Volume= 0.979 af
Primary = 10.21 cfs @ 12.20 hrs, Volume= 0.979 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 4P : Drainage Basin/Easement

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP5: To Existing Basin



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: SubCatchment P-1 Runoff Area=8,787 sf 0.00% Impervious Runoff Depth=0.08"
Flow Length=114' Tc=5.6 min CN=31 Runoff=0.00 cfs 0.001 af

Subcatchment P-10: SubCatchment P-10 Runoff Area=475,346 sf 56.27% Impervious Runoff Depth=2.74"
Flow Length=740' Tc=22.5 min CN=71 Runoff=22.28 cfs 2.490 af

Subcatchment P-2A: SubCatchment P-2A Runoff Area=14,405 sf 0.00% Impervious Runoff Depth=0.08"
Flow Length=81' Tc=7.6 min CN=31 Runoff=0.00 cfs 0.002 af

Subcatchment P-2B: SubCatchment P-2B Runoff Area=13,129 sf 0.00% Impervious Runoff Depth=0.05"
Flow Length=68' Tc=7.2 min CN=30 Runoff=0.00 cfs 0.001 af

Subcatchment P-3: SubCatchment P-3 Runoff Area=22,271 sf 0.00% Impervious Runoff Depth=0.11"
Flow Length=181' Tc=5.8 min CN=32 Runoff=0.01 cfs 0.004 af

Subcatchment P-4: No Change E-4 Runoff Area=39,239 sf 0.00% Impervious Runoff Depth=0.11"
Flow Length=214' Tc=15.8 min CN=32 Runoff=0.01 cfs 0.008 af

Subcatchment P-5: No Change E-5 Runoff Area=198,882 sf 26.41% Impervious Runoff Depth=1.05"
Flow Length=270' Tc=18.4 min UI Adjusted CN=50 Runoff=2.97 cfs 0.398 af

Subcatchment P-6: SubCatchment P-6 Runoff Area=241,179 sf 60.39% Impervious Runoff Depth=3.02"
Flow Length=332' Tc=14.1 min CN=74 Runoff=15.06 cfs 1.392 af

Subcatchment P-7: SubCatchment P-7 Runoff Area=132,158 sf 6.78% Impervious Runoff Depth=0.34"
Flow Length=248' Tc=8.0 min CN=38 Runoff=0.33 cfs 0.086 af

Subcatchment P-8A: SubCatchment P-8A Runoff Area=64,700 sf 19.02% Impervious Runoff Depth=0.78"
Flow Length=227' Tc=10.1 min CN=46 Runoff=0.71 cfs 0.097 af

Subcatchment P-8B: SubCatchment P-8B Runoff Area=379,332 sf 28.54% Impervious Runoff Depth=0.66"
Flow Length=631' Tc=21.6 min UI Adjusted CN=44 Runoff=2.58 cfs 0.481 af

Subcatchment P-9: SubCatchment P-9 Runoff Area=61,741 sf 1.30% Impervious Runoff Depth=0.14"
Flow Length=199' Tc=18.4 min CN=33 Runoff=0.03 cfs 0.016 af

Pond 1P: SubSurface Sys Peak Elev=173.55' Storage=30,782 cf Inflow=22.28 cfs 2.490 af
Outflow=5.71 cfs 2.490 af

Pond 4P: Drainage Basin/Easement Peak Elev=180.57' Storage=42,208 cf Inflow=15.16 cfs 1.479 af
Discarded=0.62 cfs 1.479 af Primary=0.00 cfs 0.000 af Outflow=0.62 cfs 1.479 af

Pond 5P: DP7 - Existing Depression 2 Peak Elev=172.10' Storage=10 cf Inflow=0.03 cfs 0.016 af
Outflow=0.03 cfs 0.016 af

Pond 6P: Depression-Chambers Peak Elev=177.19' Storage=542 cf Inflow=0.71 cfs 0.097 af
Outflow=0.29 cfs 0.097 af

Pond 8P: DP6 - New Inf Basin Club Peak Elev=167.69' Storage=3,219 cf Inflow=2.58 cfs 0.481 af
Outflow=0.98 cfs 0.481 af

Link DP1: N'ly Property Line Inflow=0.01 cfs 0.003 af
Primary=0.01 cfs 0.003 af

Link DP2: E'ly Property Line Inflow=0.01 cfs 0.006 af
Primary=0.01 cfs 0.006 af

Link DP5: To Existing Basin Inflow=15.16 cfs 1.479 af
Primary=15.16 cfs 1.479 af

Total Runoff Area = 37.906 ac Runoff Volume = 4.978 af Average Runoff Depth = 1.58"
63.90% Pervious = 24.223 ac 36.10% Impervious = 13.682 ac

Summary for Subcatchment P-1: SubCatchment P-1

[49] Hint: Tc<2dt may require smaller dt

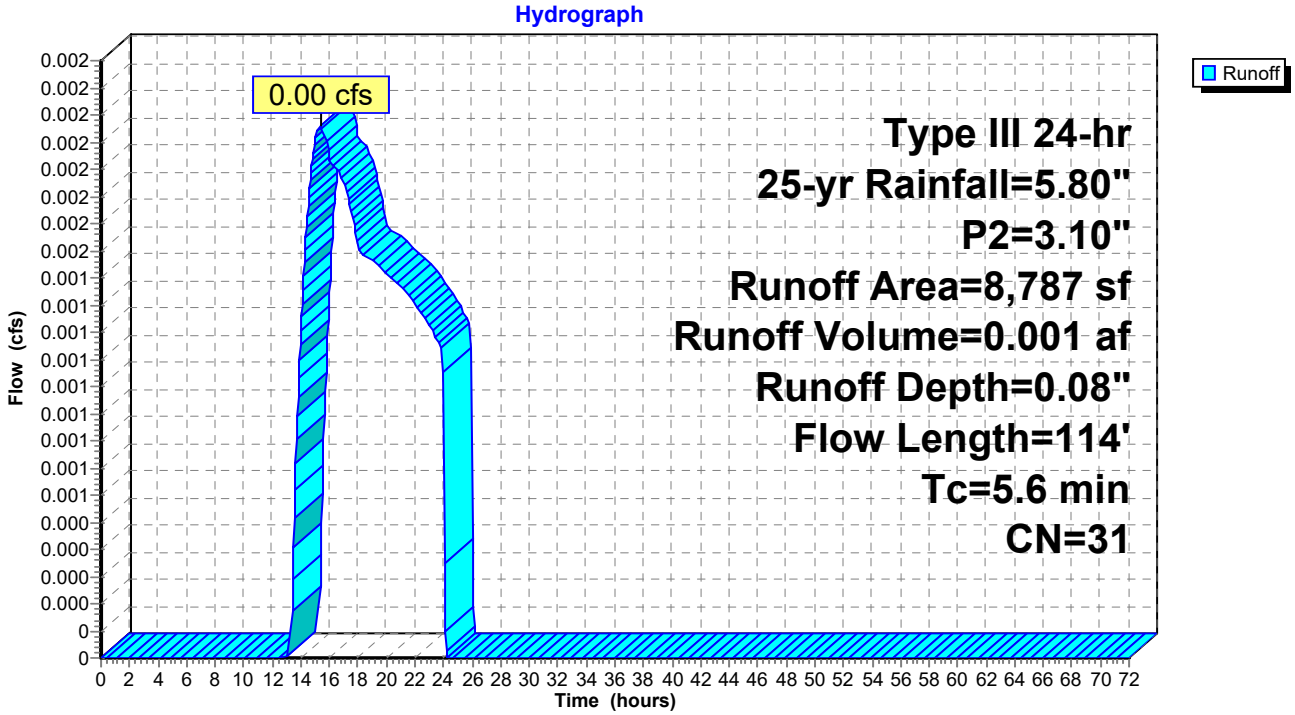
Runoff = 0.00 cfs @ 15.38 hrs, Volume= 0.001 af, Depth= 0.08"
Routed to Link DP1 : N'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.80", P2=3.10"

Area (sf)	CN	Description
7,342	30	Woods, Good, HSG A
1,445	39	>75% Grass cover, Good, HSG A
8,787	31	Weighted Average
8,787		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.1900	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	64	0.2100	2.29		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
5.6	114	Total			

Subcatchment P-1: SubCatchment P-1



Summary for Subcatchment P-10: SubCatchment P-10

[47] Hint: Peak is 577% of capacity of segment #6
[47] Hint: Peak is 411% of capacity of segment #7
[47] Hint: Peak is 368% of capacity of segment #8
[47] Hint: Peak is 253% of capacity of segment #9

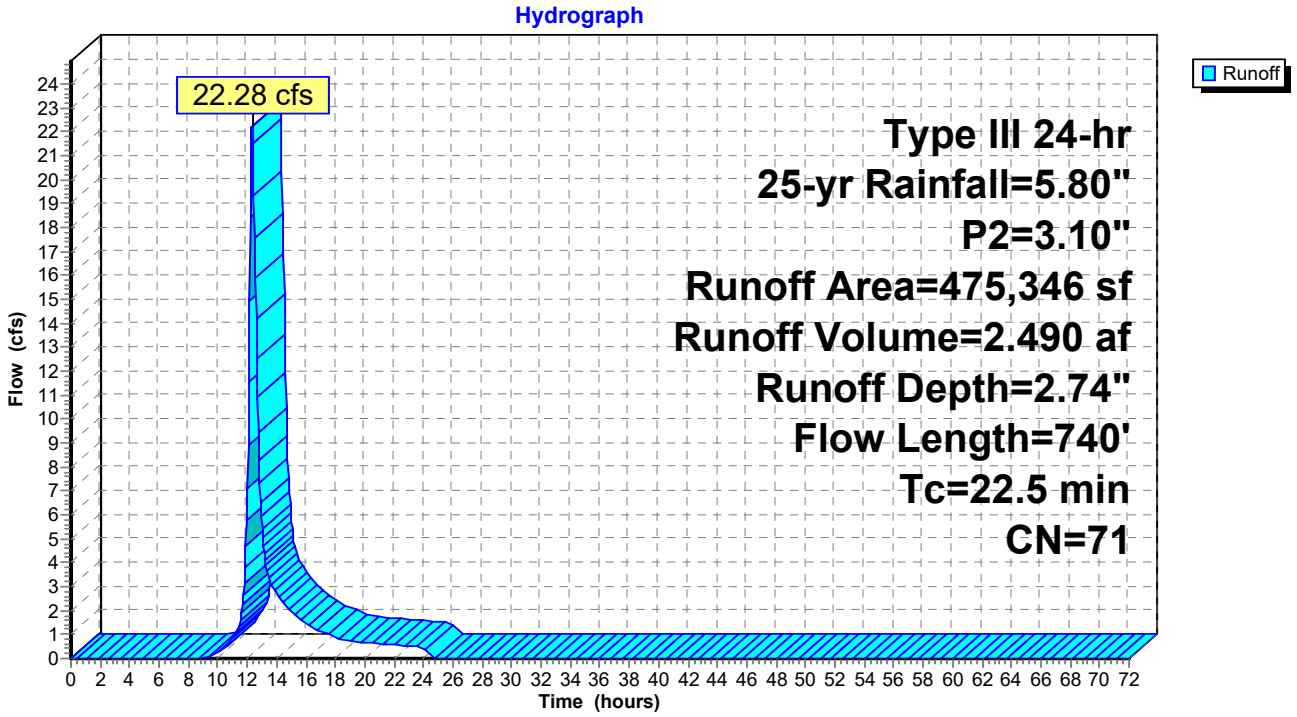
Runoff = 22.28 cfs @ 12.32 hrs, Volume= 2.490 af, Depth= 2.74"
Routed to Pond 1P : SubSurface Sys

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.80", P2=3.10"

Area (sf)	CN	Description
66,746	30	Woods, Good, HSG A
125,013	39	>75% Grass cover, Good, HSG A
76,512	98	Roofs, HSG A
173,050	98	Paved parking, HSG A
8,075	98	Water Surface, HSG A
25,950	61	1/4 acre lots, 38% imp, HSG A
475,346	71	Weighted Average
207,848		43.73% Pervious Area
267,498		56.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	50	0.0125	0.06		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
4.7	156	0.0125	0.56		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.1	131	0.1500	1.94		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
0.2	9	0.0200	0.99		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
0.3	60	0.0300	3.52		**Shallow Concentrated Flow, E-F** Paved Kv= 20.3 fps
0.4	111	0.0100	4.91	3.86	**Pipe Channel, F-G** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.3	81	0.0060	4.42	5.42	**Pipe Channel, G-H** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012
0.2	72	0.0075	4.94	6.06	**Pipe Channel, H-I** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012
0.2	70	0.0060	4.99	8.81	**Pipe Channel, I-J** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012
22.5	740	Total			

Subcatchment P-10: SubCatchment P-10



Summary for Subcatchment P-2A: SubCatchment P-2A

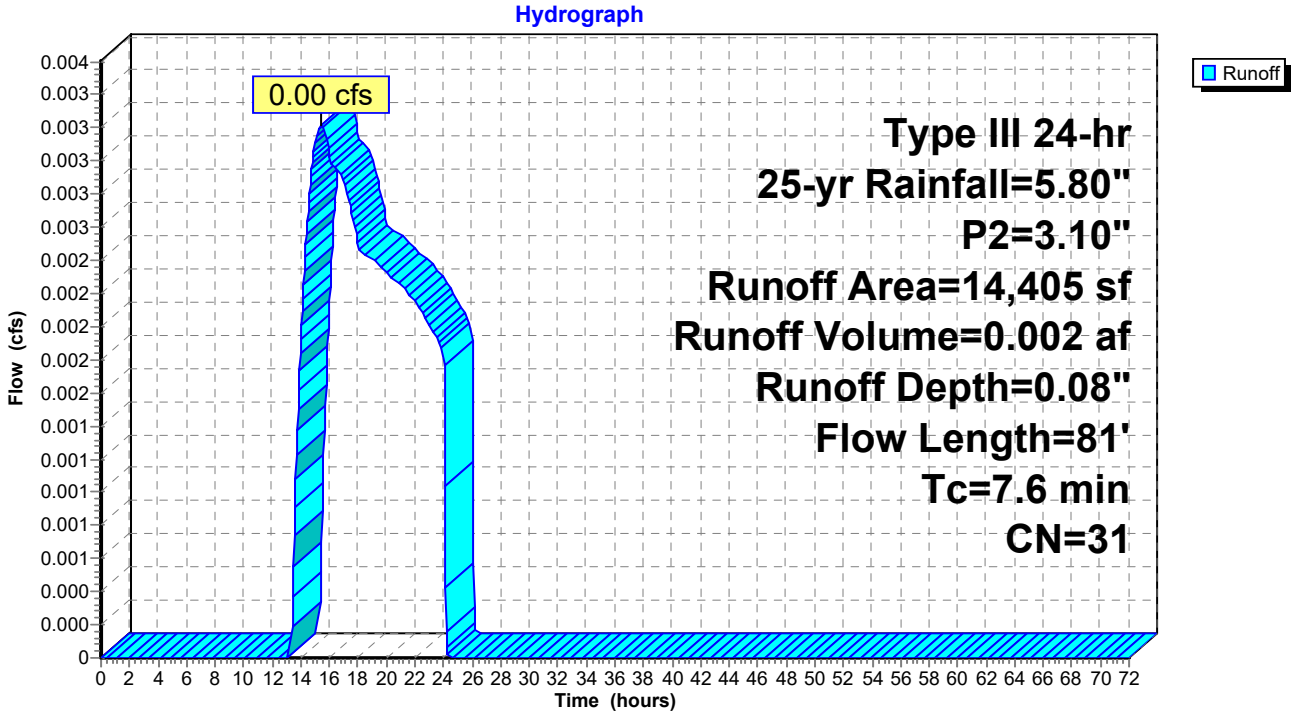
Runoff = 0.00 cfs @ 15.41 hrs, Volume= 0.002 af, Depth= 0.08"
Routed to Link DP1 : N'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.80", P2=3.10"

Area (sf)	CN	Description
13,193	30	Woods, Good, HSG A
1,212	39	>75% Grass cover, Good, HSG A
14,405	31	Weighted Average
14,405		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0800	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.4	31	0.0680	1.30		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
7.6	81	Total			

Subcatchment P-2A: SubCatchment P-2A



Summary for Subcatchment P-2B: SubCatchment P-2B

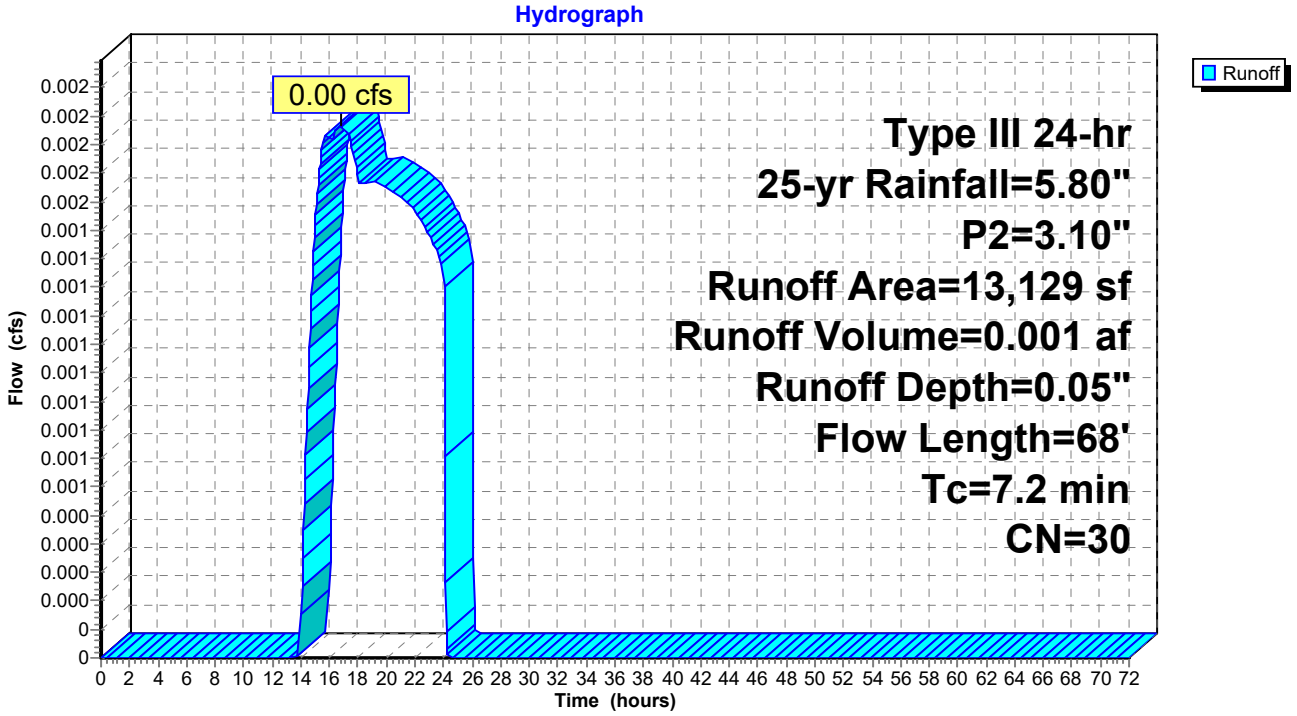
Runoff = 0.00 cfs @ 16.80 hrs, Volume= 0.001 af, Depth= 0.05"
Routed to Link DP2 : E'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.80", P2=3.10"

Area (sf)	CN	Description
12,906	30	Woods, Good, HSG A
223	39	>75% Grass cover, Good, HSG A
13,129	30	Weighted Average
13,129		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0860	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.2	18	0.0770	1.39		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
7.2	68	Total			

Subcatchment P-2B: SubCatchment P-2B



Summary for Subcatchment P-3: SubCatchment P-3

[49] Hint: Tc<2dt may require smaller dt

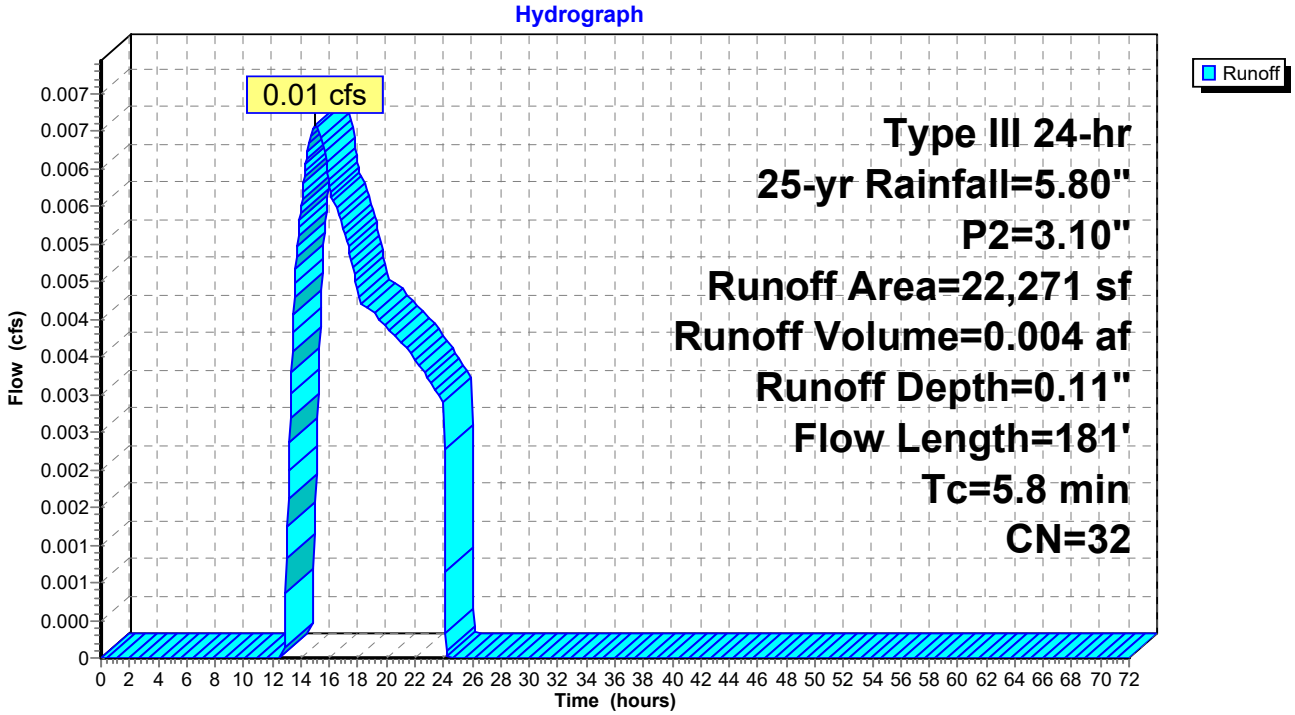
Runoff = 0.01 cfs @ 15.04 hrs, Volume= 0.004 af, Depth= 0.11"
Routed to Link DP2 : E'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.80", P2=3.10"

Area (sf)	CN	Description
16,687	30	Woods, Good, HSG A
5,584	39	>75% Grass cover, Good, HSG A
22,271	32	Weighted Average
22,271		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.2200	0.17		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
1.0	131	0.2000	2.24		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
5.8	181	Total			

Subcatchment P-3: SubCatchment P-3



Summary for Subcatchment P-4: No Change E-4

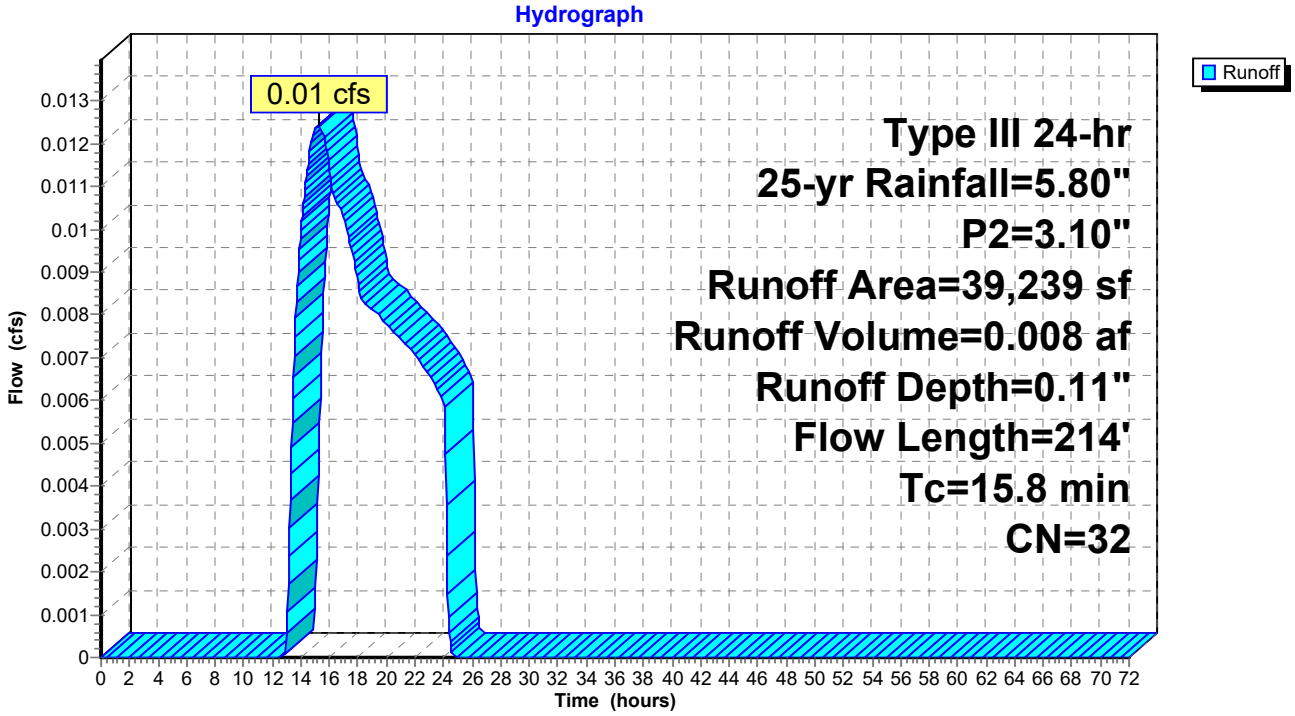
Runoff = 0.01 cfs @ 15.20 hrs, Volume= 0.008 af, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.80", P2=3.10"

Area (sf)	CN	Description
37,500	30	Woods, Good, HSG A
1,739	72	Dirt roads, HSG A
39,239	32	Weighted Average
39,239		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	50	0.0300	0.08		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.7	29	0.0200	0.71		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.2	10	0.0100	1.00		**Shallow Concentrated Flow, C-D** Nearly Bare & Untilled Kv= 10.0 fps
4.2	125	0.0100	0.50		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
15.8	214	Total			

Subcatchment P-4: No Change E-4



Summary for Subcatchment P-5: No Change E-5

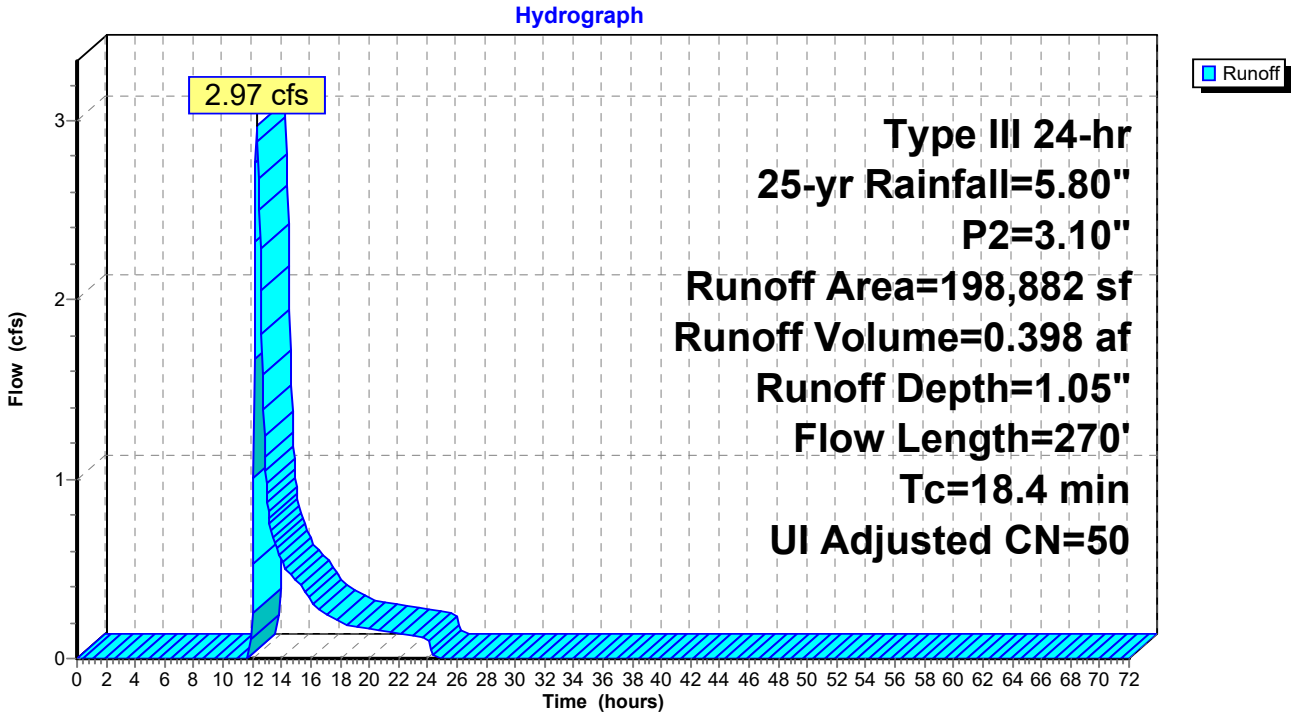
Runoff = 2.97 cfs @ 12.32 hrs, Volume= 0.398 af, Depth= 1.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.80", P2=3.10"

Area (sf)	CN	Adj	Description
99,401	30		Woods, Good, HSG A
33,545	39		>75% Grass cover, Good, HSG A
13,415	72		Dirt roads, HSG A
14,517	98		Unconnected pavement, HSG A
16,302	98		Paved parking, HSG A
21,702	98		Roofs, HSG A
198,882	52	50	Weighted Average, UI Adjusted
146,361			73.59% Pervious Area
52,521			26.41% Impervious Area
14,517			27.64% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		**Sheet Flow, A_B** Woods: Light underbrush n= 0.400 P2= 3.10"
5.6	184	0.0120	0.55		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.3	36	0.0500	2.24		**Shallow Concentrated Flow, C-D** Nearly Bare & Untilled Kv= 10.0 fps
18.4	270	Total			

Subcatchment P-5: No Change E-5



Summary for Subcatchment P-6: SubCatchment P-6

[47] Hint: Peak is 319% of capacity of segment #5
[47] Hint: Peak is 201% of capacity of segment #6

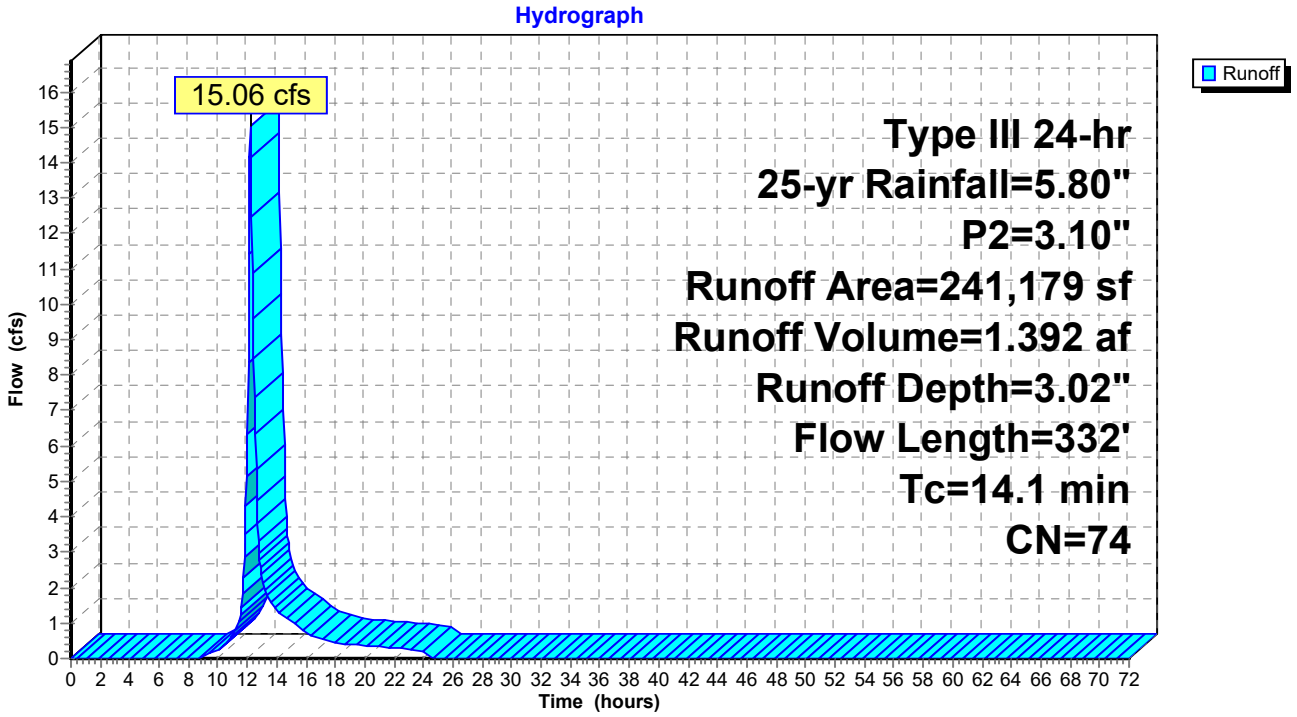
Runoff = 15.06 cfs @ 12.20 hrs, Volume= 1.392 af, Depth= 3.02"
Routed to Link DP5 : To Existing Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.80", P2=3.10"

Area (sf)	CN	Description
19,085	30	Woods, Good, HSG A
49,824	39	>75% Grass cover, Good, HSG A
136,787	98	Paved parking, HSG A
35,483	54	1/2 acre lots, 25% imp, HSG A
241,179	74	Weighted Average
95,521		39.61% Pervious Area
145,658		60.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	32	0.0100	0.05		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
1.6	18	0.1700	0.19		**Sheet Flow, B-C** Grass: Dense n= 0.240 P2= 3.10"
0.1	5	0.0200	0.99		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.2	39	0.0300	3.52		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
0.3	123	0.0150	6.02	4.73	**Pipe Channel, E-F** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.3	115	0.0500	6.12	7.51	**Pipe Channel, F-G** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.025 Corrugated metal
14.1	332	Total			

Subcatchment P-6: SubCatchment P-6



Summary for Subcatchment P-7: SubCatchment P-7

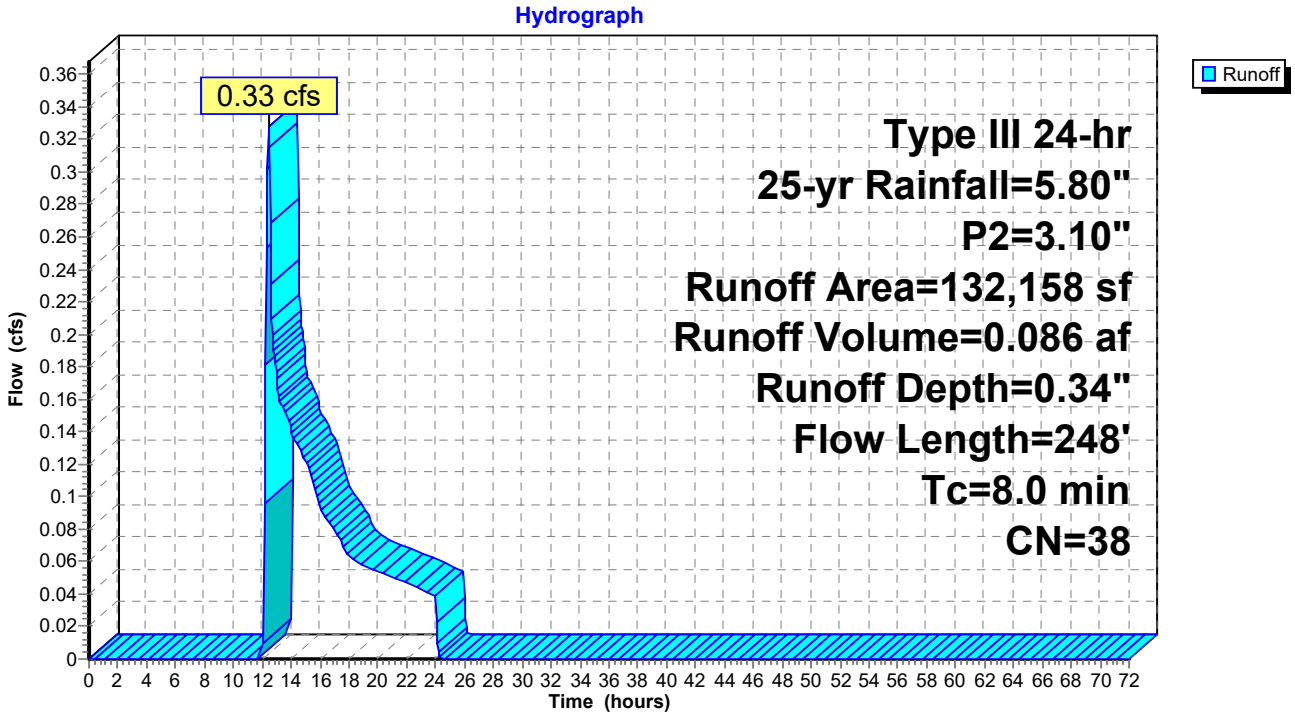
Runoff = 0.33 cfs @ 12.42 hrs, Volume= 0.086 af, Depth= 0.34"
Routed to Link DP5 : To Existing Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.80", P2=3.10"

Area (sf)	CN	Description
73,049	30	Woods, Good, HSG A
50,149	39	>75% Grass cover, Good, HSG A
8,960	98	Paved parking, HSG A
132,158	38	Weighted Average
123,198		93.22% Pervious Area
8,960		6.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
0.9	72	0.0400	1.40		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.8	126	0.2500	2.50		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
8.0	248	Total			

Subcatchment P-7: SubCatchment P-7



Summary for Subcatchment P-8A: SubCatchment P-8A

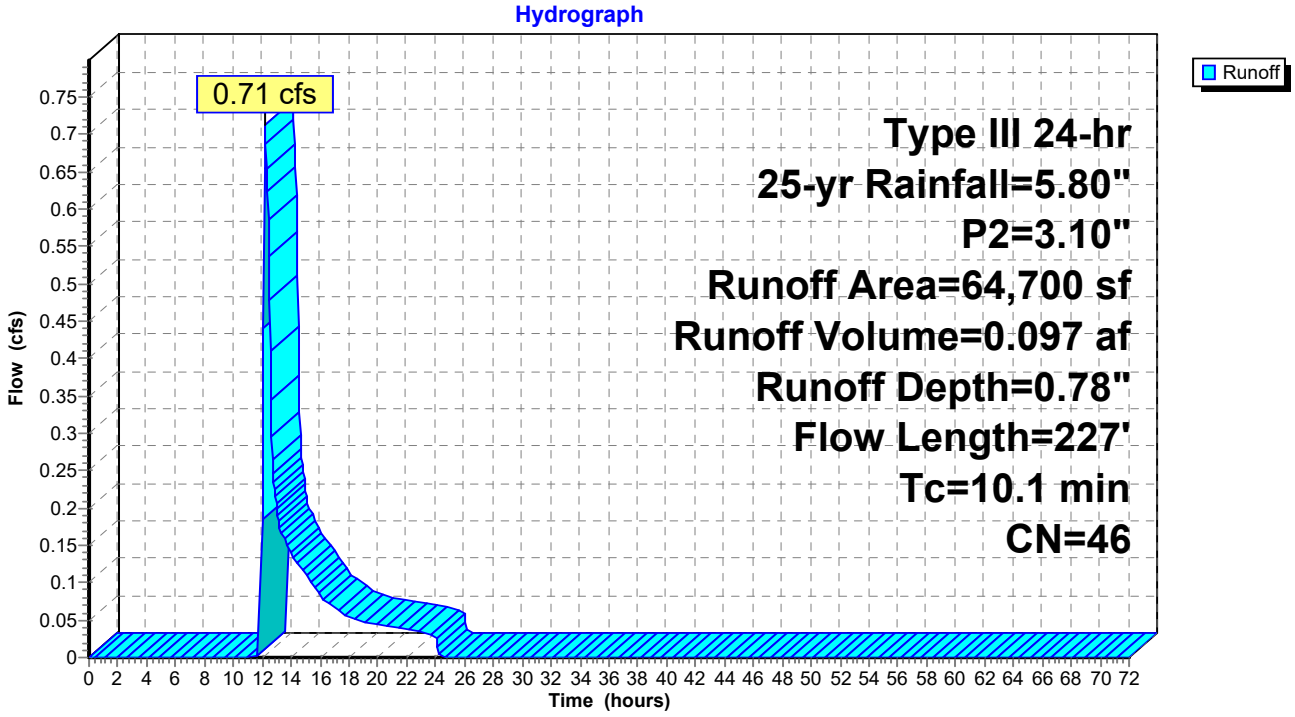
Runoff = 0.71 cfs @ 12.21 hrs, Volume= 0.097 af, Depth= 0.78"
Routed to Pond 6P : Depression-Chambers

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.80", P2=3.10"

Area (sf)	CN	Description
26,938	61	1/4 acre lots, 38% imp, HSG A
31,395	30	Woods, Good, HSG A
4,300	39	>75% Grass cover, Good, HSG A
2,067	98	Water Surface, HSG A
64,700	46	Weighted Average
52,397		80.98% Pervious Area
12,303		19.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
1.0	57	0.0200	0.99		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.8	120	0.2400	2.45		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
10.1	227	Total			

Subcatchment P-8A: SubCatchment P-8A



Summary for Subcatchment P-8B: SubCatchment P-8B

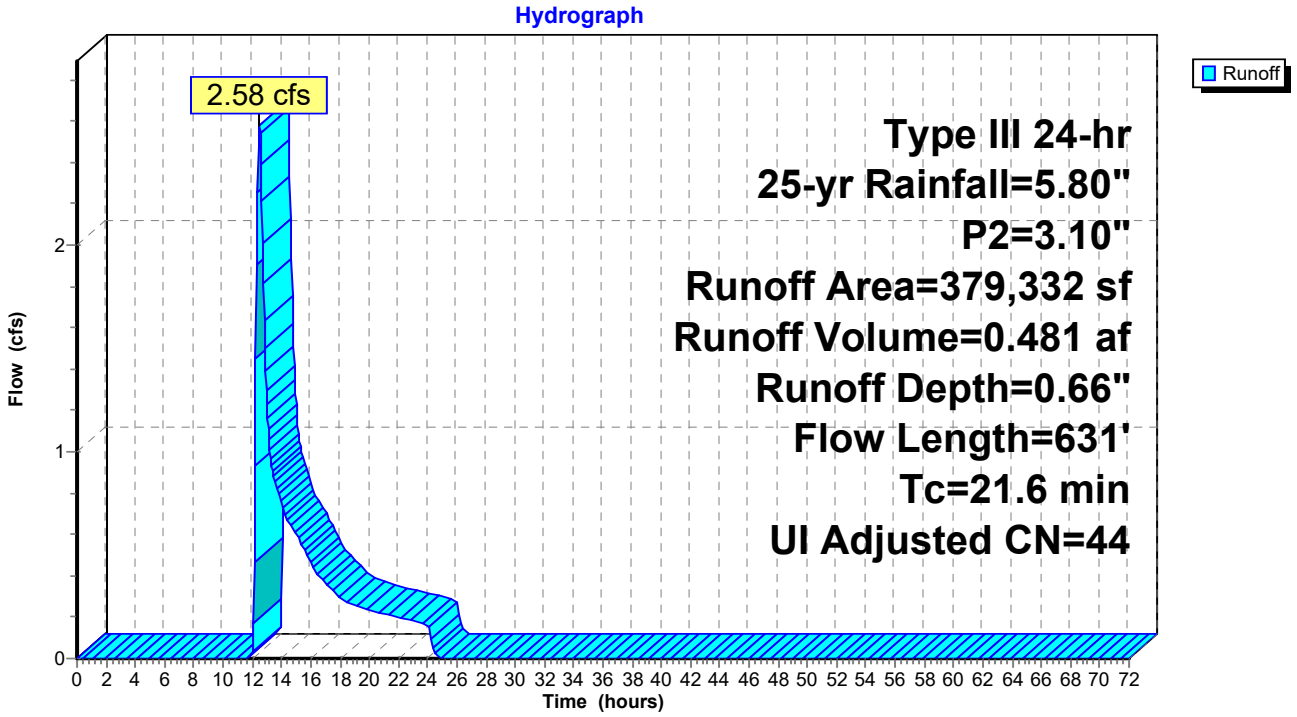
Runoff = 2.58 cfs @ 12.48 hrs, Volume= 0.481 af, Depth= 0.66"
Routed to Pond 8P : DP6 - New Inf Basin Club

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.80", P2=3.10"

Area (sf)	CN	Adj	Description
137,313	30		Woods, Good, HSG A
133,757	39		>75% Grass cover, Good, HSG A
47,139	98		Unconnected roofs, HSG A
52,252	98		Unconnected pavement, HSG A
8,871	98		Water Surface, HSG A
379,332	53	44	Weighted Average, UI Adjusted
271,070			71.46% Pervious Area
108,262			28.54% Impervious Area
99,391			91.81% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
1.2	83	0.0570	1.19		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
6.9	354	0.0150	0.86		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.9	122	0.2280	2.39		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
0.1	22	0.3300	4.02		**Shallow Concentrated Flow, E-F** Short Grass Pasture Kv= 7.0 fps
21.6	631	Total			

Subcatchment P-8B: SubCatchment P-8B



Summary for Subcatchment P-9: SubCatchment P-9

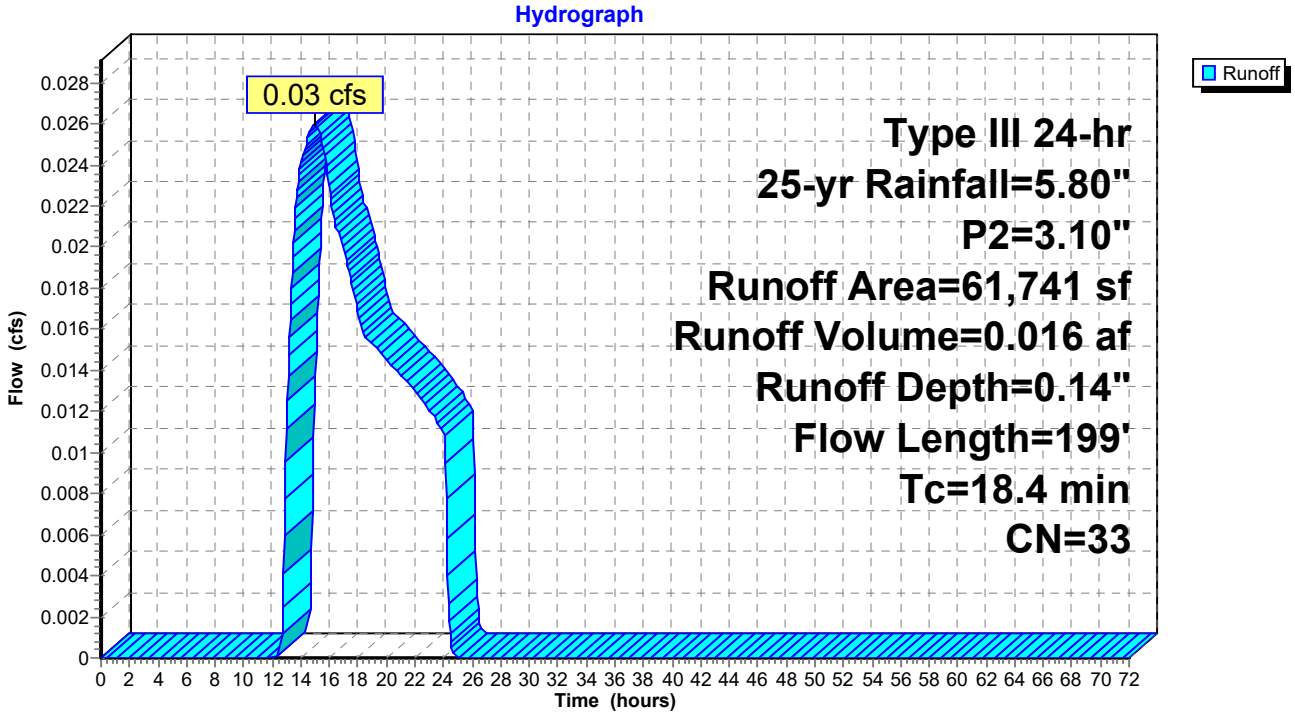
Runoff = 0.03 cfs @ 14.95 hrs, Volume= 0.016 af, Depth= 0.14"
Routed to Pond 5P : DP7 - Existing Depression 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.80", P2=3.10"

Area (sf)	CN	Description
46,123	30	Woods, Good, HSG A
14,817	39	>75% Grass cover, Good, HSG A
801	98	Water Surface, HSG A
61,741	33	Weighted Average
60,940		98.70% Pervious Area
801		1.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	50	0.0125	0.06		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
3.3	149	0.0226	0.75		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
18.4	199	Total			

Subcatchment P-9: SubCatchment P-9



Summary for Pond 1P: SubSurface Sys

Inflow Area = 10.912 ac, 56.27% Impervious, Inflow Depth = 2.74" for 25-yr event
Inflow = 22.28 cfs @ 12.32 hrs, Volume= 2.490 af
Outflow = 5.71 cfs @ 12.97 hrs, Volume= 2.490 af, Atten= 74%, Lag= 39.2 min
Discarded = 5.71 cfs @ 12.97 hrs, Volume= 2.490 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 173.55' @ 12.97 hrs Surf.Area= 29,809 sf Storage= 30,782 cf

Plug-Flow detention time= 38.6 min calculated for 2.489 af (100% of inflow)
Center-of-Mass det. time= 38.6 min (891.5 - 852.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	172.00'	5,168 cf	**44.25'W x 131.78'L x 3.50'H Field A** 20,409 cf Overall - 7,490 cf Embedded = 12,919 cf x 40.0% Voids
#2A	172.50'	7,490 cf	**ADS_StormTech SC-740 b +Cap** x 162 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 162 Chambers in 9 Rows Cap Storage= 2.7 cf x 2 x 9 rows = 47.8 cf
#3	172.50'	43,645 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
#4D	172.00'	3,915 cf	**30.00'W x 146.02'L x 3.50'H Field B** 15,332 cf Overall - 5,545 cf Embedded = 9,787 cf x 40.0% Voids
#5D	172.50'	5,545 cf	**ADS_StormTech SC-740 b +Cap** x 120 Inside #4 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 120 Chambers in 6 Rows Cap Storage= 2.7 cf x 2 x 6 rows = 31.9 cf
#6B	172.00'	4,492 cf	**49.00'W x 103.30'L x 3.50'H Field C** 17,715 cf Overall - 6,485 cf Embedded = 11,231 cf x 40.0% Voids
#7B	172.50'	6,485 cf	**ADS_StormTech SC-740 b +Cap** x 140 Inside #6 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 140 Chambers in 10 Rows Cap Storage= 2.7 cf x 2 x 10 rows = 53.1 cf
#8C	172.00'	4,292 cf	**30.00'W x 160.26'L x 3.50'H Field D** 16,827 cf Overall - 6,096 cf Embedded = 10,731 cf x 40.0% Voids
#9C	172.50'	6,096 cf	**ADS_StormTech SC-740 b +Cap** x 132 Inside #8 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 132 Chambers in 6 Rows Cap Storage= 2.7 cf x 2 x 6 rows = 31.9 cf
#10E	172.00'	2,974 cf	**20.50'W x 160.26'L x 3.50'H Field E** 11,498 cf Overall - 4,064 cf Embedded = 7,434 cf x 40.0% Voids
#11E	172.50'	4,064 cf	**ADS_StormTech SC-740 b +Cap** x 88 Inside #10 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 88 Chambers in 4 Rows Cap Storage= 2.7 cf x 2 x 4 rows = 21.2 cf
		94,165 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group D created with Chamber Wizard
Storage Group B created with Chamber Wizard
Storage Group C created with Chamber Wizard
Storage Group E created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
172.50	5,320	0	0
173.00	5,843	2,791	2,791
174.00	6,931	6,387	9,178
175.00	8,075	7,503	16,681
176.00	9,276	8,676	25,356
177.00	10,534	9,905	35,261
177.76	11,528	8,384	43,645

Device	Routing	Invert	Outlet Devices
#1	Discarded	172.00'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=5.71 cfs @ 12.97 hrs HW=173.55' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 5.71 cfs)

Pond 1P: SubSurface Sys - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 b +Cap (ADS StormTech® SC-740 with cap storage)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 9 rows = 47.8 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

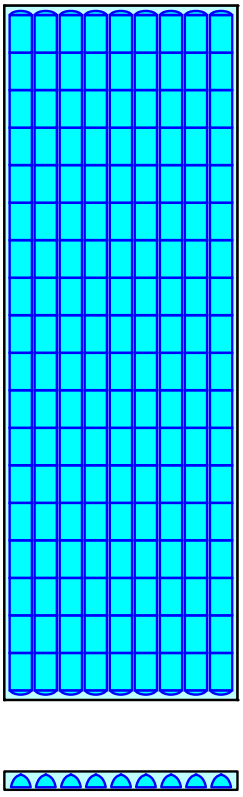
18 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 129.78' Row Length +12.0" End Stone x 2 = 131.78' Base Length
9 Rows x 51.0" Wide + 6.0" Spacing x 8 + 12.0" Side Stone x 2 = 44.25' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

162 Chambers x 45.9 cf + 2.7 cf Cap Volume x 2 x 9 Rows = 7,490.1 cf Chamber Storage

20,408.9 cf Field - 7,490.1 cf Chambers = 12,918.8 cf Stone x 40.0% Voids = 5,167.5 cf Stone Storage

Chamber Storage + Stone Storage = 12,657.6 cf = 0.291 af
Overall Storage Efficiency = 62.0%
Overall System Size = 131.78' x 44.25' x 3.50'

162 Chambers
755.9 cy Field
478.5 cy Stone



Pond 1P: SubSurface Sys - Chamber Wizard Field B

Chamber Model = ADS_StormTech SC-740 b +Cap (ADS StormTech® SC-740 with cap storage)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 6 rows = 31.9 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

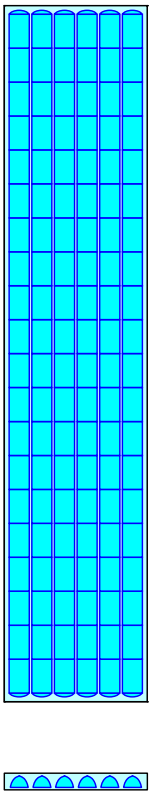
20 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 144.02' Row Length +12.0" End Stone x 2 = 146.02' Base Length
6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.00' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

120 Chambers x 45.9 cf + 2.7 cf Cap Volume x 2 x 6 Rows = 5,544.7 cf Chamber Storage

15,331.8 cf Field - 5,544.7 cf Chambers = 9,787.1 cf Stone x 40.0% Voids = 3,914.8 cf Stone Storage

Chamber Storage + Stone Storage = 9,459.5 cf = 0.217 af
Overall Storage Efficiency = 61.7%
Overall System Size = 146.02' x 30.00' x 3.50'

120 Chambers
567.8 cy Field
362.5 cy Stone



Pond 1P: SubSurface Sys - Chamber Wizard Field C

Chamber Model = ADS_StormTech SC-740 b +Cap (ADS StormTech® SC-740 with cap storage)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 10 rows = 53.1 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

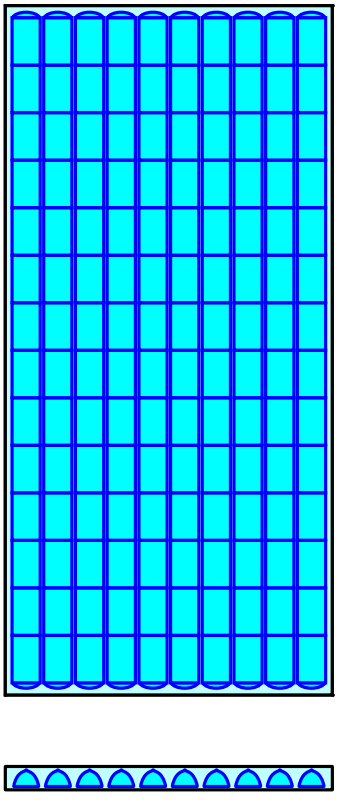
14 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 101.30' Row Length +12.0" End Stone x 2 = 103.30' Base Length
10 Rows x 51.0" Wide + 6.0" Spacing x 9 + 12.0" Side Stone x 2 = 49.00' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

140 Chambers x 45.9 cf + 2.7 cf Cap Volume x 2 x 10 Rows = 6,484.7 cf Chamber Storage

17,715.4 cf Field - 6,484.7 cf Chambers = 11,230.7 cf Stone x 40.0% Voids = 4,492.3 cf Stone Storage

Chamber Storage + Stone Storage = 10,977.0 cf = 0.252 af
Overall Storage Efficiency = 62.0%
Overall System Size = 103.30' x 49.00' x 3.50'

140 Chambers
656.1 cy Field
416.0 cy Stone



Pond 1P: SubSurface Sys - Chamber Wizard Field D

Chamber Model = ADS_StormTech SC-740 b +Cap (ADS StormTech® SC-740 with cap storage)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 6 rows = 31.9 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

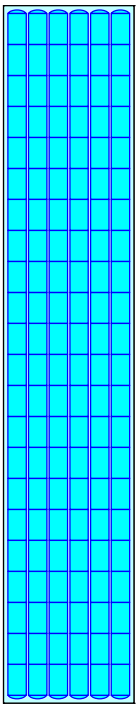
22 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 158.26' Row Length +12.0" End Stone x 2 = 160.26' Base Length
6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.00' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

132 Chambers x 45.9 cf + 2.7 cf Cap Volume x 2 x 6 Rows = 6,095.9 cf Chamber Storage

16,827.0 cf Field - 6,095.9 cf Chambers = 10,731.0 cf Stone x 40.0% Voids = 4,292.4 cf Stone Storage

Chamber Storage + Stone Storage = 10,388.3 cf = 0.238 af
Overall Storage Efficiency = 61.7%
Overall System Size = 160.26' x 30.00' x 3.50'

132 Chambers
623.2 cy Field
397.4 cy Stone





Pond 1P: SubSurface Sys - Chamber Wizard Field E

Chamber Model = ADS_StormTech SC-740 b +Cap (ADS StormTech® SC-740 with cap storage)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 4 rows = 21.2 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

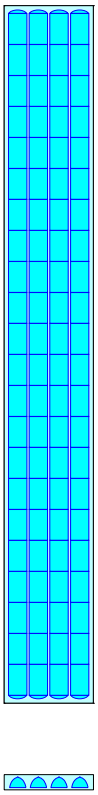
22 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 158.26' Row Length +12.0" End Stone x 2 = 160.26' Base Length
4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

88 Chambers x 45.9 cf + 2.7 cf Cap Volume x 2 x 4 Rows = 4,064.0 cf Chamber Storage

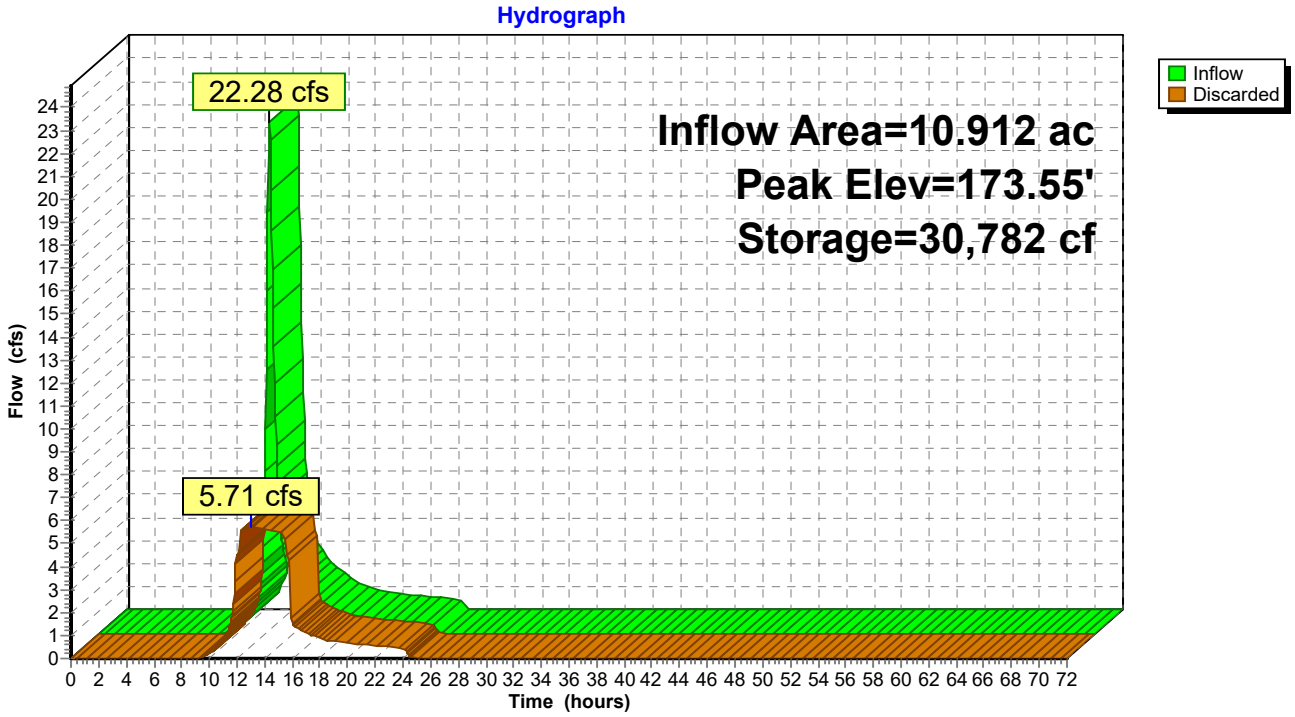
11,498.4 cf Field - 4,064.0 cf Chambers = 7,434.5 cf Stone x 40.0% Voids = 2,973.8 cf Stone Storage

Chamber Storage + Stone Storage = 7,037.7 cf = 0.162 af
Overall Storage Efficiency = 61.2%
Overall System Size = 160.26' x 20.50' x 3.50'

88 Chambers
425.9 cy Field
275.4 cy Stone



Pond 1P: SubSurface Sys



Summary for Pond 4P: Drainage Basin/Easement

Inflow Area = 8.571 ac, 41.42% Impervious, Inflow Depth = 2.07" for 25-yr event
Inflow = 15.16 cfs @ 12.20 hrs, Volume= 1.479 af
Outflow = 0.62 cfs @ 17.24 hrs, Volume= 1.479 af, Atten= 96%, Lag= 302.4 min
Discarded = 0.62 cfs @ 17.24 hrs, Volume= 1.479 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to nonexistent node SP6

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 180.57' @ 17.24 hrs Surf.Area= 11,186 sf Storage= 42,208 cf

Plug-Flow detention time= 834.1 min calculated for 1.477 af (100% of inflow)
Center-of-Mass det. time= 834.8 min (1,681.0 - 846.2)

Volume	Invert	Avail.Storage	Storage Description
#1	174.00'	345,939 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

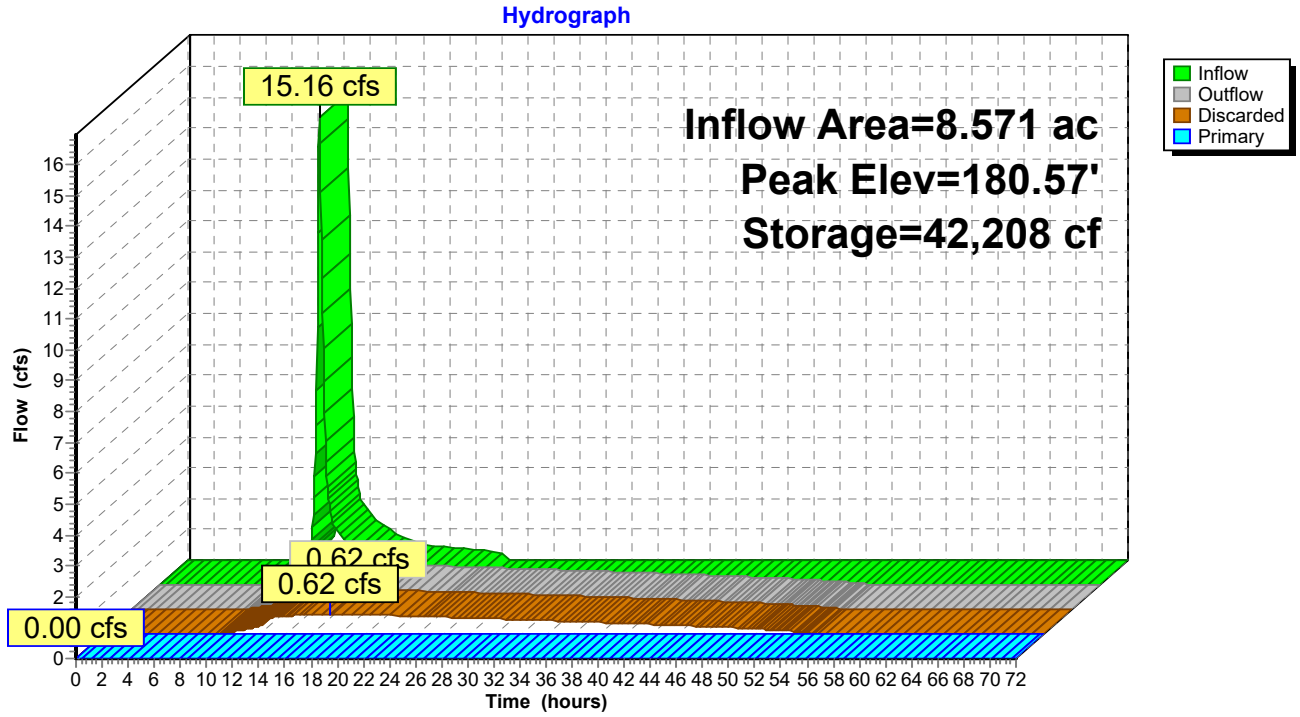
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
174.00	491	0	0
175.00	3,251	1,871	1,871
176.00	4,753	4,002	5,873
177.00	6,309	5,531	11,404
178.00	7,641	6,975	18,379
179.00	8,869	8,255	26,634
180.00	10,188	9,529	36,163
181.00	11,953	11,071	47,233
182.00	14,143	13,048	60,281
183.00	16,525	15,334	75,615
184.00	19,118	17,822	93,437
185.00	21,426	20,272	113,709
186.00	23,221	22,324	136,032
187.00	24,868	24,045	160,077
188.00	26,530	25,699	185,776
189.00	28,209	27,370	213,145
190.00	30,172	29,191	242,336
191.00	32,732	31,452	273,788
192.00	36,071	34,402	308,189
193.00	39,428	37,750	345,939

Device	Routing	Invert	Outlet Devices
#1	Primary	192.90'	**10.0' long x 50.0' 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
#2	Discarded	174.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.62 cfs @ 17.24 hrs HW=180.57' (Free Discharge)
↑**2=Exfiltration** (Exfiltration Controls 0.62 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=174.00' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 4P: Drainage Basin/Easement



Summary for Pond 5P: DP7 - Existing Depression 2

Inflow Area = 1.417 ac, 1.30% Impervious, Inflow Depth = 0.14" for 25-yr event
Inflow = 0.03 cfs @ 14.95 hrs, Volume= 0.016 af
Outflow = 0.03 cfs @ 15.20 hrs, Volume= 0.016 af, Atten= 1%, Lag= 14.7 min
Discarded = 0.03 cfs @ 15.20 hrs, Volume= 0.016 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 172.10' @ 15.20 hrs Surf.Area= 135 sf Storage= 10 cf

Plug-Flow detention time= 3.9 min calculated for 0.016 af (100% of inflow)
Center-of-Mass det. time= 3.9 min (1,072.7 - 1,068.8)

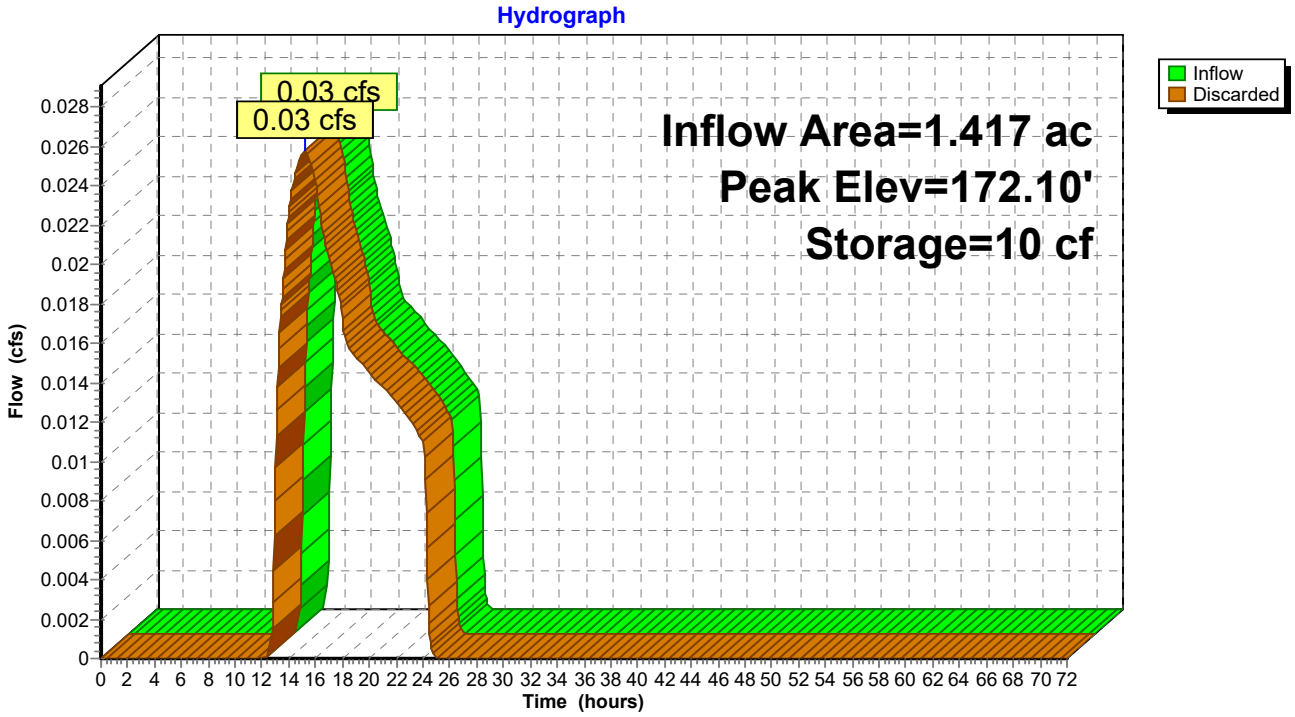
Volume	Invert	Avail.Storage	Storage Description
#1	172.00'	6,418 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
172.00	67	0	0
174.00	1,456	1,523	1,523
175.50	5,070	4,895	6,418

Device	Routing	Invert	Outlet Devices
#1	Discarded	172.00'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.03 cfs @ 15.20 hrs HW=172.10' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Pond 5P: DP7 - Existing Depression 2



Summary for Pond 6P: Depression-Chambers

Inflow Area = 1.485 ac, 19.02% Impervious, Inflow Depth = 0.78" for 25-yr event
Inflow = 0.71 cfs @ 12.21 hrs, Volume= 0.097 af
Outflow = 0.29 cfs @ 12.15 hrs, Volume= 0.097 af, Atten= 59%, Lag= 0.0 min
Discarded = 0.29 cfs @ 12.15 hrs, Volume= 0.097 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 177.19' @ 12.66 hrs Surf.Area= 1,534 sf Storage= 542 cf

Plug-Flow detention time= 9.7 min calculated for 0.097 af (100% of inflow)
Center-of-Mass det. time= 9.7 min (930.0 - 920.3)

Volume	Invert	Avail.Storage	Storage Description
#1	179.50'	1,835 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
#2A	176.50'	1,404 cf	**20.50'W x 74.82'L x 3.50'H Field A** 5,368 cf Overall - 1,859 cf Embedded = 3,509 cf x 40.0% Voids
#3A	177.00'	1,859 cf	**ADS_StormTech SC-740 b +Cap** x 40 Inside #2 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 40 Chambers in 4 Rows Cap Storage= 2.7 cf x 2 x 4 rows = 21.2 cf
		5,098 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
179.50	59	0	0
180.00	195	64	64
181.00	803	499	563
182.00	1,742	1,273	1,835

Device	Routing	Invert	Outlet Devices
#1	Discarded	176.50'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.29 cfs @ 12.15 hrs HW=176.63' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.29 cfs)

Pond 6P: Depression-Chambers - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 b +Cap (ADS StormTech® SC-740 with cap storage)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 4 rows = 21.2 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

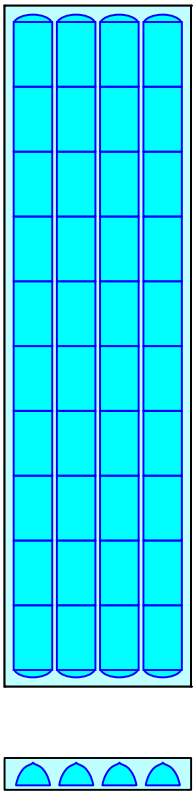
10 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 72.82' Row Length +12.0" End Stone x 2 = 74.82' Base Length
4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

40 Chambers x 45.9 cf + 2.7 cf Cap Volume x 2 x 4 Rows = 1,858.8 cf Chamber Storage

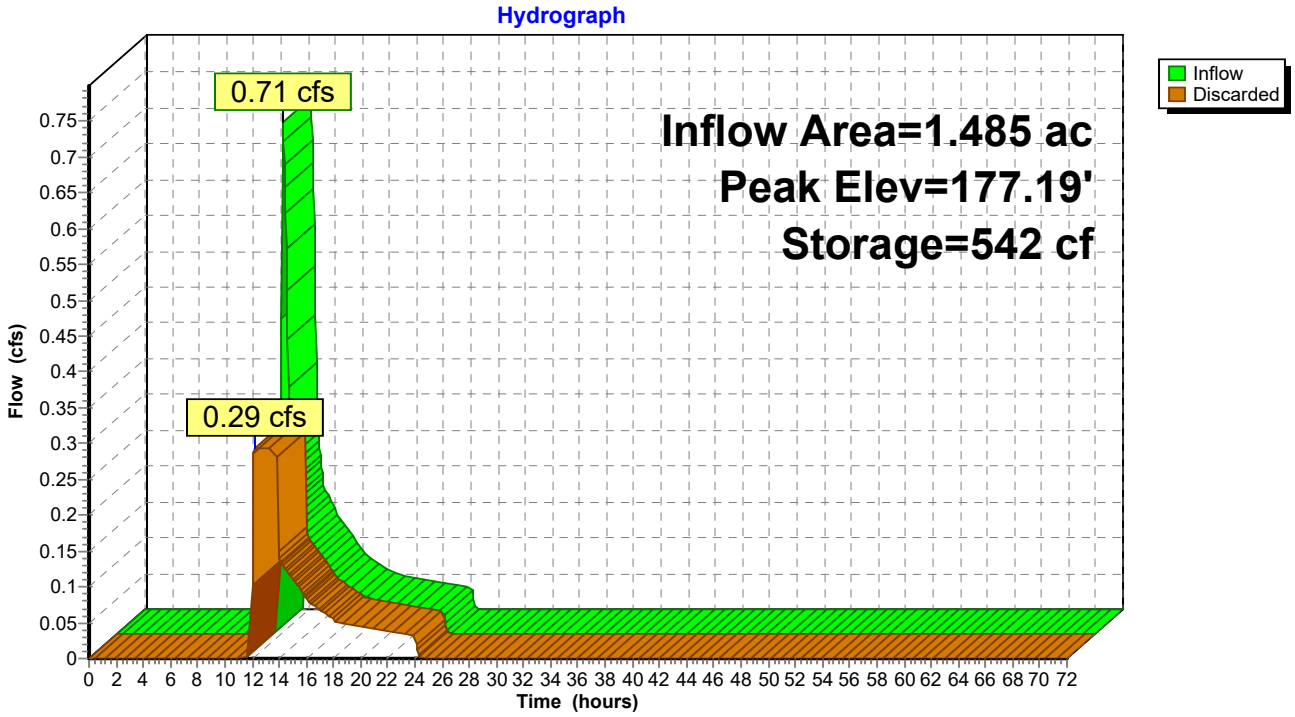
5,368.1 cf Field - 1,858.8 cf Chambers = 3,509.3 cf Stone x 40.0% Voids = 1,403.7 cf Stone Storage

Chamber Storage + Stone Storage = 3,262.5 cf = 0.075 af
Overall Storage Efficiency = 60.8%
Overall System Size = 74.82' x 20.50' x 3.50'

40 Chambers
198.8 cy Field
130.0 cy Stone



Pond 6P: Depression-Chambers



Summary for Pond 8P: DP6 - New Inf Basin Club

Inflow Area = 8.708 ac, 28.54% Impervious, Inflow Depth = 0.66" for 25-yr event
Inflow = 2.58 cfs @ 12.48 hrs, Volume= 0.481 af
Outflow = 0.98 cfs @ 13.24 hrs, Volume= 0.481 af, Atten= 62%, Lag= 45.6 min
Discarded = 0.98 cfs @ 13.24 hrs, Volume= 0.481 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 167.69' @ 13.24 hrs Surf.Area= 5,103 sf Storage= 3,219 cf

Plug-Flow detention time= 25.3 min calculated for 0.481 af (100% of inflow)
Center-of-Mass det. time= 25.3 min (967.7 - 942.4)

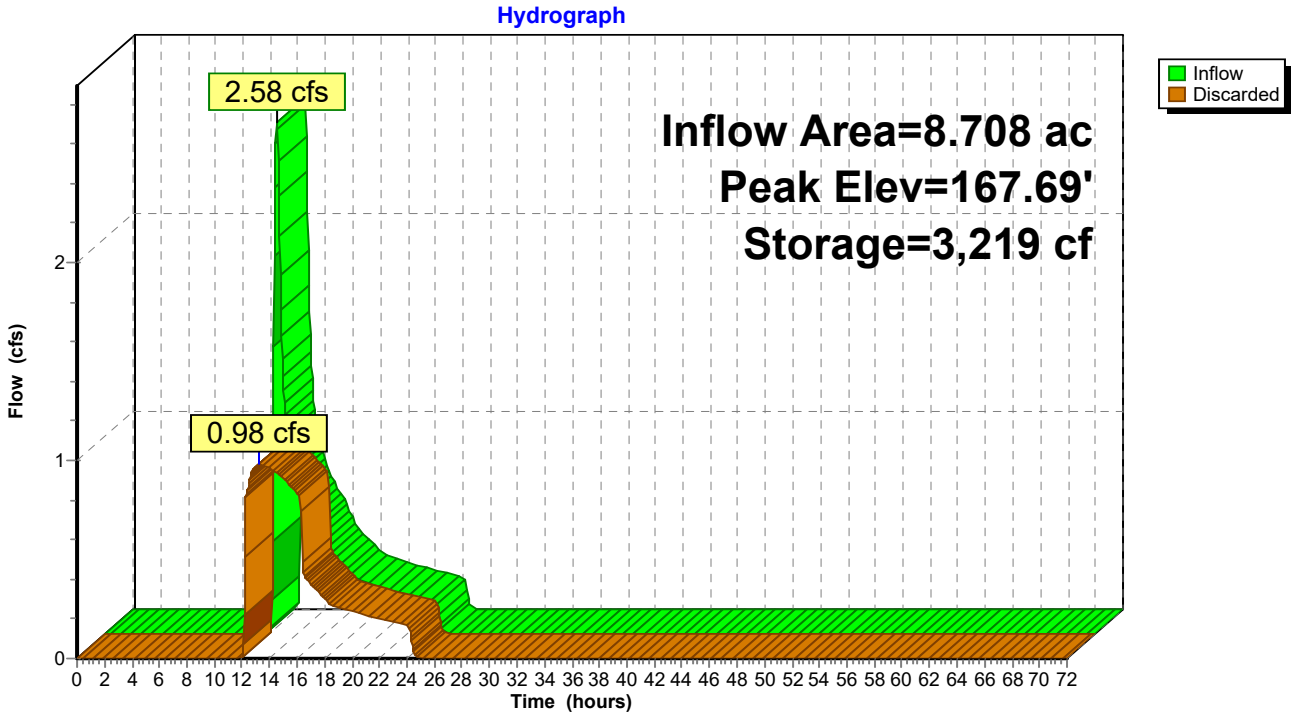
Volume	Invert	Avail.Storage	Storage Description
#1	167.00'	28,802 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
167.00	4,169	0	0
168.00	5,514	4,842	4,842
169.00	7,024	6,269	11,111
170.00	8,871	7,948	19,058
171.00	10,617	9,744	28,802

Device	Routing	Invert	Outlet Devices
#1	Discarded	167.00'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.98 cfs @ 13.24 hrs HW=167.69' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.98 cfs)

Pond 8P: DP6 - New Inf Basin Club

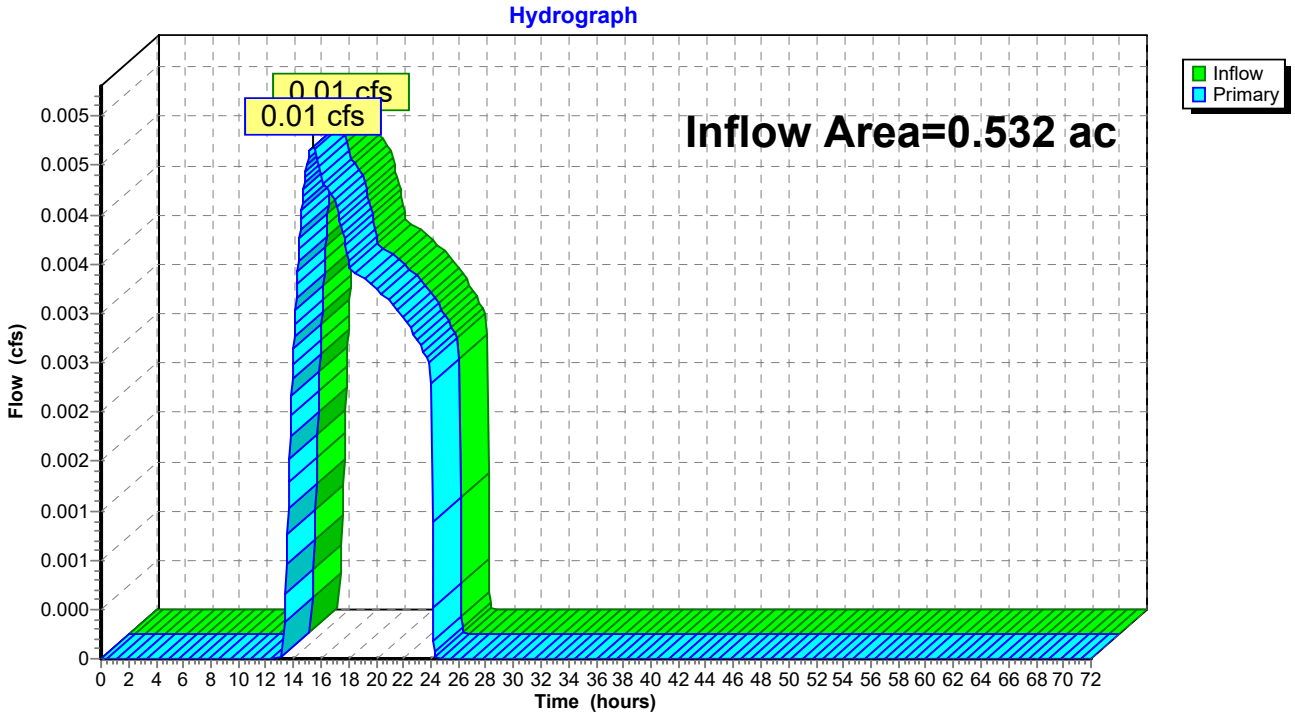


Summary for Link DP1: N'ly Property Line

Inflow Area = 0.532 ac, 0.00% Impervious, Inflow Depth = 0.08" for 25-yr event
Inflow = 0.01 cfs @ 15.40 hrs, Volume= 0.003 af
Primary = 0.01 cfs @ 15.40 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP1: N'ly Property Line

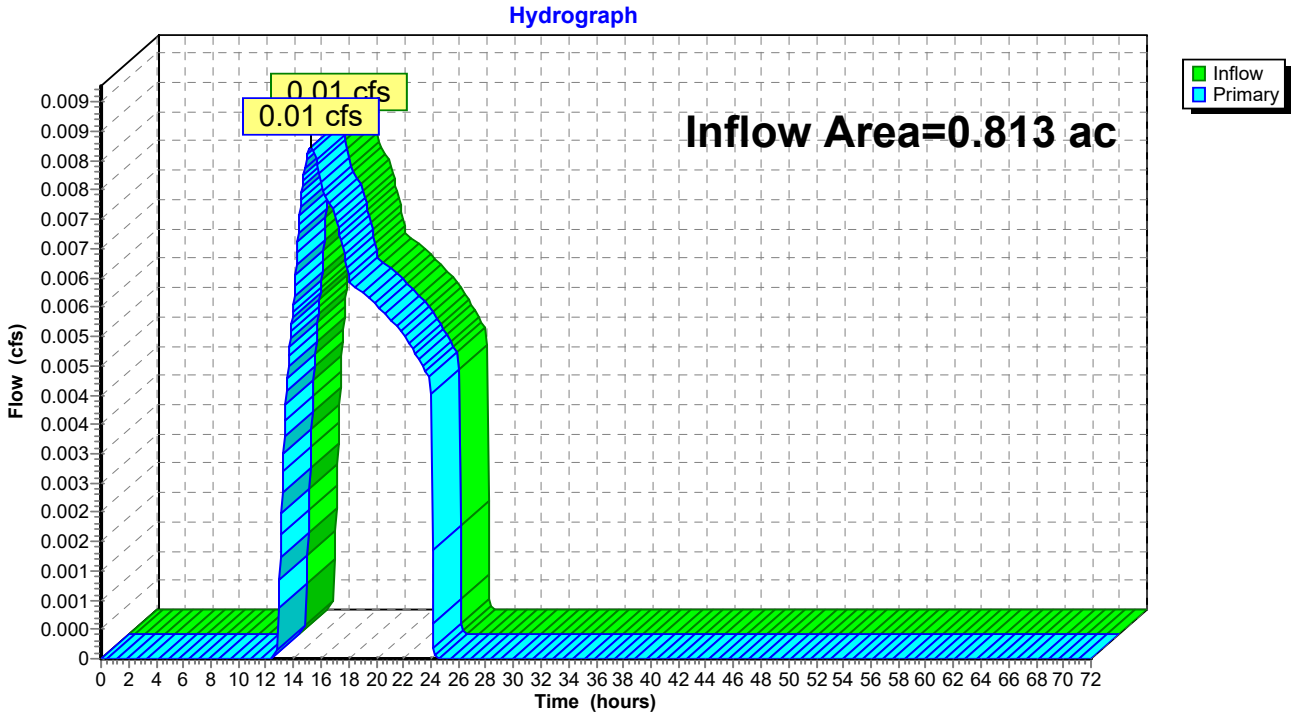


Summary for Link DP2: E'ly Property Line

Inflow Area = 0.813 ac, 0.00% Impervious, Inflow Depth = 0.09" for 25-yr event
Inflow = 0.01 cfs @ 15.30 hrs, Volume= 0.006 af
Primary = 0.01 cfs @ 15.30 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP2: E'ly Property Line

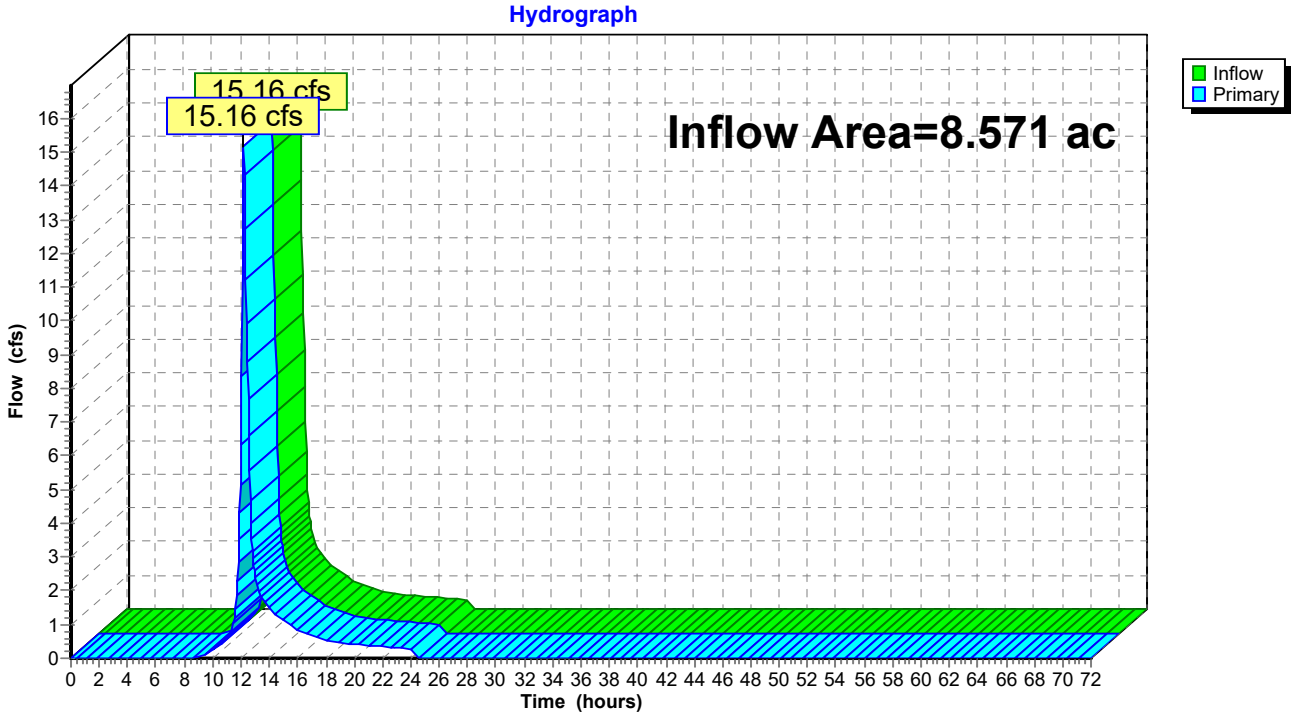


Summary for Link DP5: To Existing Basin

Inflow Area = 8.571 ac, 41.42% Impervious, Inflow Depth = 2.07" for 25-yr event
Inflow = 15.16 cfs @ 12.20 hrs, Volume= 1.479 af
Primary = 15.16 cfs @ 12.20 hrs, Volume= 1.479 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 4P : Drainage Basin/Easement

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP5: To Existing Basin



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: SubCatchment P-1 Runoff Area=8,787 sf 0.00% Impervious Runoff Depth=0.54"
Flow Length=114' Tc=5.6 min CN=31 Runoff=0.04 cfs 0.009 af

Subcatchment P-10: SubCatchment P-10 Runoff Area=475,346 sf 56.27% Impervious Runoff Depth=4.75"
Flow Length=740' Tc=22.5 min CN=71 Runoff=38.96 cfs 4.323 af

Subcatchment P-2A: SubCatchment P-2A Runoff Area=14,405 sf 0.00% Impervious Runoff Depth=0.54"
Flow Length=81' Tc=7.6 min CN=31 Runoff=0.06 cfs 0.015 af

Subcatchment P-2B: SubCatchment P-2B Runoff Area=13,129 sf 0.00% Impervious Runoff Depth=0.46"
Flow Length=68' Tc=7.2 min CN=30 Runoff=0.04 cfs 0.012 af

Subcatchment P-3: SubCatchment P-3 Runoff Area=22,271 sf 0.00% Impervious Runoff Depth=0.62"
Flow Length=181' Tc=5.8 min CN=32 Runoff=0.13 cfs 0.026 af

Subcatchment P-4: No Change E-4 Runoff Area=39,239 sf 0.00% Impervious Runoff Depth=0.62"
Flow Length=214' Tc=15.8 min CN=32 Runoff=0.20 cfs 0.046 af

Subcatchment P-5: No Change E-5 Runoff Area=198,882 sf 26.41% Impervious Runoff Depth=2.37"
Flow Length=270' Tc=18.4 min UI Adjusted CN=50 Runoff=8.07 cfs 0.903 af

Subcatchment P-6: SubCatchment P-6 Runoff Area=241,179 sf 60.39% Impervious Runoff Depth=5.10"
Flow Length=332' Tc=14.1 min CN=74 Runoff=25.46 cfs 2.355 af

Subcatchment P-7: SubCatchment P-7 Runoff Area=132,158 sf 6.78% Impervious Runoff Depth=1.15"
Flow Length=248' Tc=8.0 min CN=38 Runoff=2.37 cfs 0.290 af

Subcatchment P-8A: SubCatchment P-8A Runoff Area=64,700 sf 19.02% Impervious Runoff Depth=1.95"
Flow Length=227' Tc=10.1 min CN=46 Runoff=2.53 cfs 0.241 af

Subcatchment P-8B: SubCatchment P-8B Runoff Area=379,332 sf 28.54% Impervious Runoff Depth=1.74"
Flow Length=631' Tc=21.6 min UI Adjusted CN=44 Runoff=9.58 cfs 1.262 af

Subcatchment P-9: SubCatchment P-9 Runoff Area=61,741 sf 1.30% Impervious Runoff Depth=0.70"
Flow Length=199' Tc=18.4 min CN=33 Runoff=0.38 cfs 0.083 af

Pond 1P: SubSurface Sys Peak Elev=175.44' Storage=70,286 cf Inflow=38.96 cfs 4.323 af
Outflow=6.12 cfs 4.323 af

Pond 4P: Drainage Basin/Easement Peak Elev=183.25' Storage=79,828 cf Inflow=27.70 cfs 2.645 af
Discarded=0.96 cfs 2.645 af Primary=0.00 cfs 0.000 af Outflow=0.96 cfs 2.645 af

Pond 5P: DP7 - Existing Depression 2 Peak Elev=173.11' Storage=498 cf Inflow=0.38 cfs 0.083 af
Outflow=0.16 cfs 0.083 af

Pond 6P: Depression-Chambers Peak Elev=180.40' Storage=3,453 cf Inflow=2.53 cfs 0.241 af
Outflow=0.38 cfs 0.241 af

Pond 8P: DP6 - New Inf Basin Club Peak Elev=169.99' Storage=18,928 cf Inflow=9.58 cfs 1.262 af
Outflow=1.69 cfs 1.262 af

Link DP1: N'ly Property Line Inflow=0.10 cfs 0.024 af
Primary=0.10 cfs 0.024 af

Link DP2: E'ly Property Line Inflow=0.17 cfs 0.038 af
Primary=0.17 cfs 0.038 af

Link DP5: To Existing Basin Inflow=27.70 cfs 2.645 af
Primary=27.70 cfs 2.645 af

Total Runoff Area = 37.906 ac Runoff Volume = 9.565 af Average Runoff Depth = 3.03"
63.90% Pervious = 24.223 ac 36.10% Impervious = 13.682 ac

Summary for Subcatchment P-1: SubCatchment P-1

[49] Hint: Tc<2dt may require smaller dt

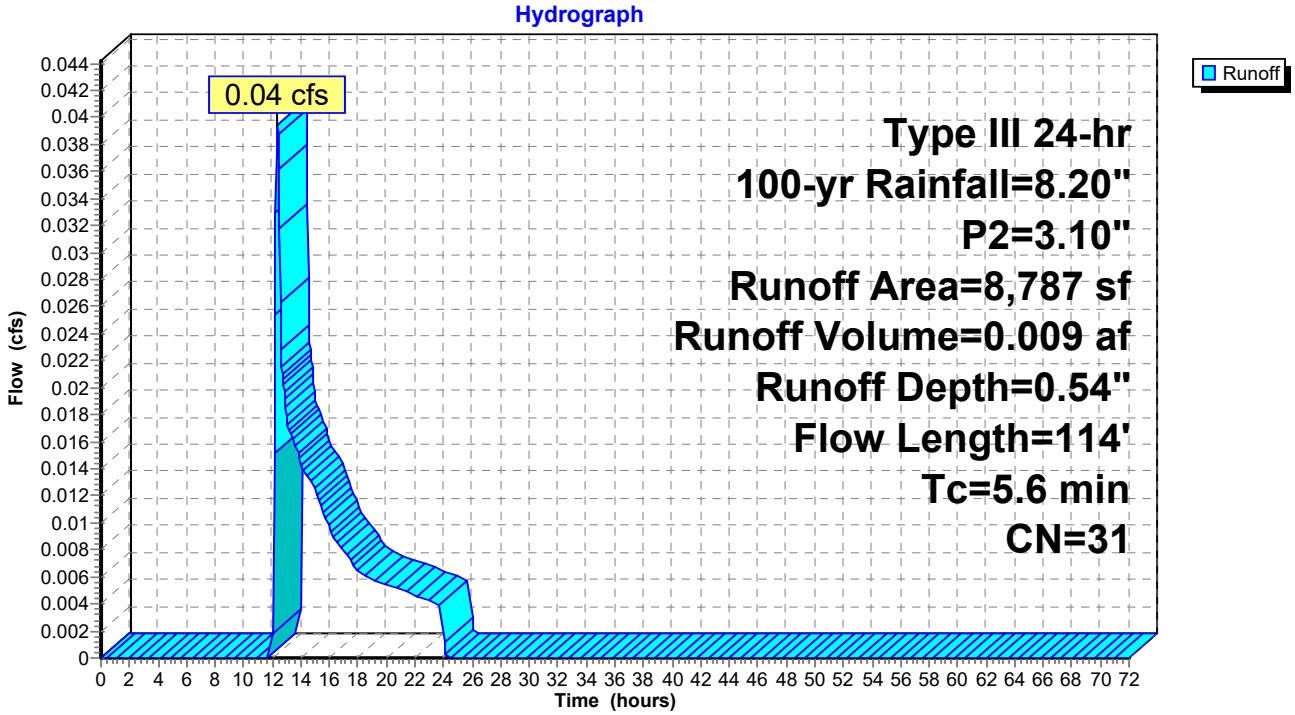
Runoff = 0.04 cfs @ 12.36 hrs, Volume= 0.009 af, Depth= 0.54"
Routed to Link DP1 : N'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.20", P2=3.10"

Area (sf)	CN	Description
7,342	30	Woods, Good, HSG A
1,445	39	>75% Grass cover, Good, HSG A
8,787	31	Weighted Average
8,787		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.1900	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	64	0.2100	2.29		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
5.6	114	Total			

Subcatchment P-1: SubCatchment P-1



Summary for Subcatchment P-10: SubCatchment P-10

[47] Hint: Peak is 1009% of capacity of segment #6
[47] Hint: Peak is 719% of capacity of segment #7
[47] Hint: Peak is 643% of capacity of segment #8
[47] Hint: Peak is 442% of capacity of segment #9

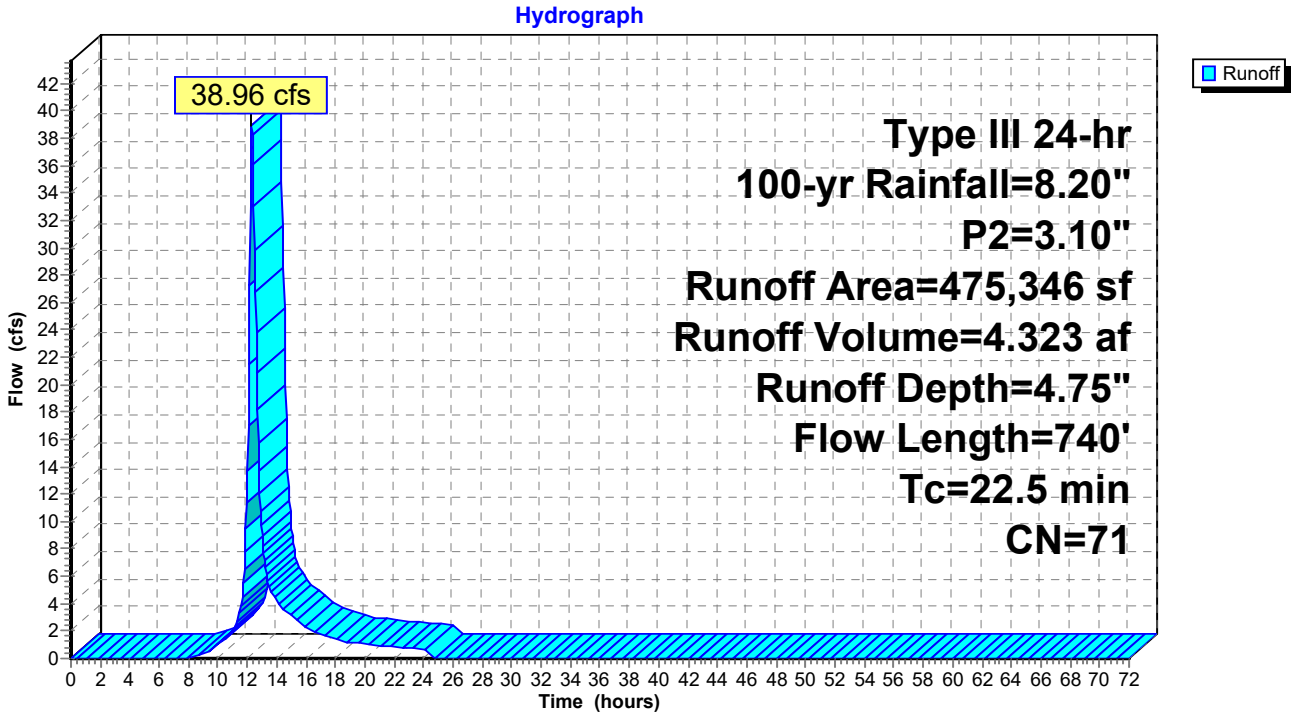
Runoff = 38.96 cfs @ 12.31 hrs, Volume= 4.323 af, Depth= 4.75"
Routed to Pond 1P : SubSurface Sys

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.20", P2=3.10"

Area (sf)	CN	Description
66,746	30	Woods, Good, HSG A
125,013	39	>75% Grass cover, Good, HSG A
76,512	98	Roofs, HSG A
173,050	98	Paved parking, HSG A
8,075	98	Water Surface, HSG A
25,950	61	1/4 acre lots, 38% imp, HSG A
475,346	71	Weighted Average
207,848		43.73% Pervious Area
267,498		56.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	50	0.0125	0.06		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
4.7	156	0.0125	0.56		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.1	131	0.1500	1.94		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
0.2	9	0.0200	0.99		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
0.3	60	0.0300	3.52		**Shallow Concentrated Flow, E-F** Paved Kv= 20.3 fps
0.4	111	0.0100	4.91	3.86	**Pipe Channel, F-G** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.3	81	0.0060	4.42	5.42	**Pipe Channel, G-H** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012
0.2	72	0.0075	4.94	6.06	**Pipe Channel, H-I** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012
0.2	70	0.0060	4.99	8.81	**Pipe Channel, I-J** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.012
22.5	740	Total			

Subcatchment P-10: SubCatchment P-10



Summary for Subcatchment P-2A: SubCatchment P-2A

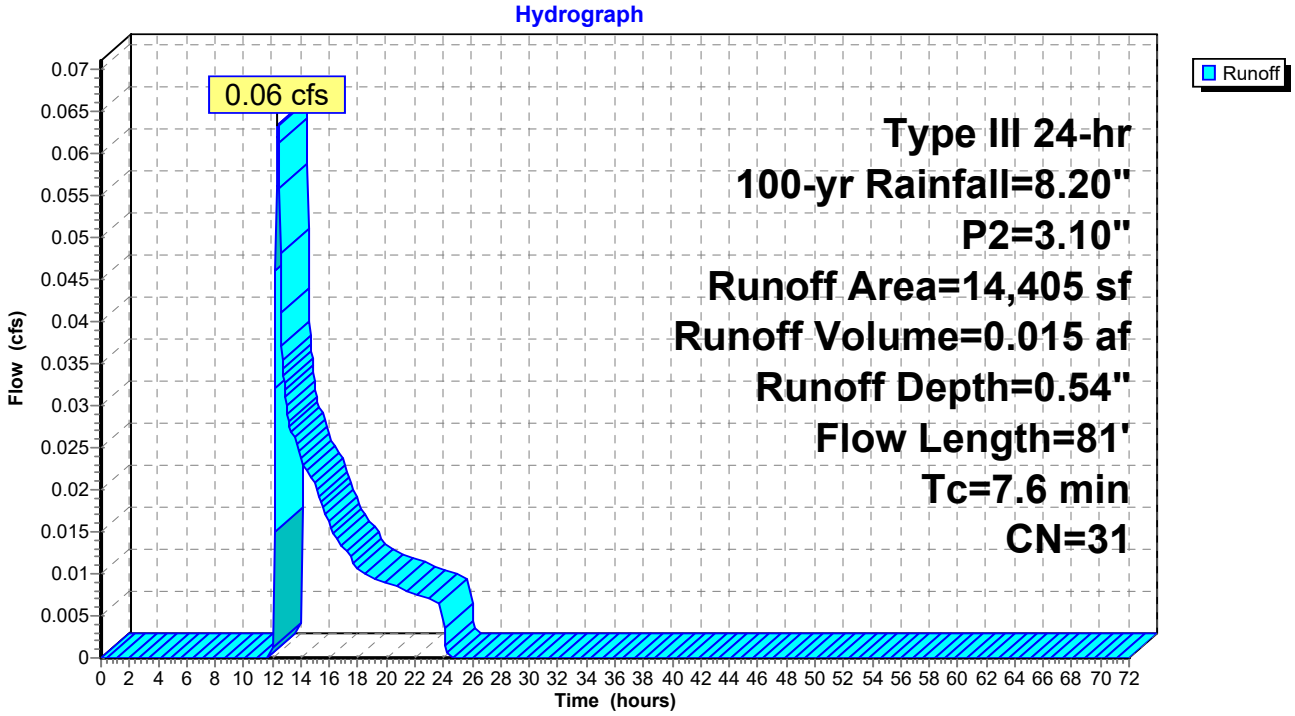
Runoff = 0.06 cfs @ 12.40 hrs, Volume= 0.015 af, Depth= 0.54"
Routed to Link DP1 : N'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.20", P2=3.10"

Area (sf)	CN	Description
13,193	30	Woods, Good, HSG A
1,212	39	>75% Grass cover, Good, HSG A
14,405	31	Weighted Average
14,405		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0800	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.4	31	0.0680	1.30		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
7.6	81	Total			

Subcatchment P-2A: SubCatchment P-2A



Summary for Subcatchment P-2B: SubCatchment P-2B

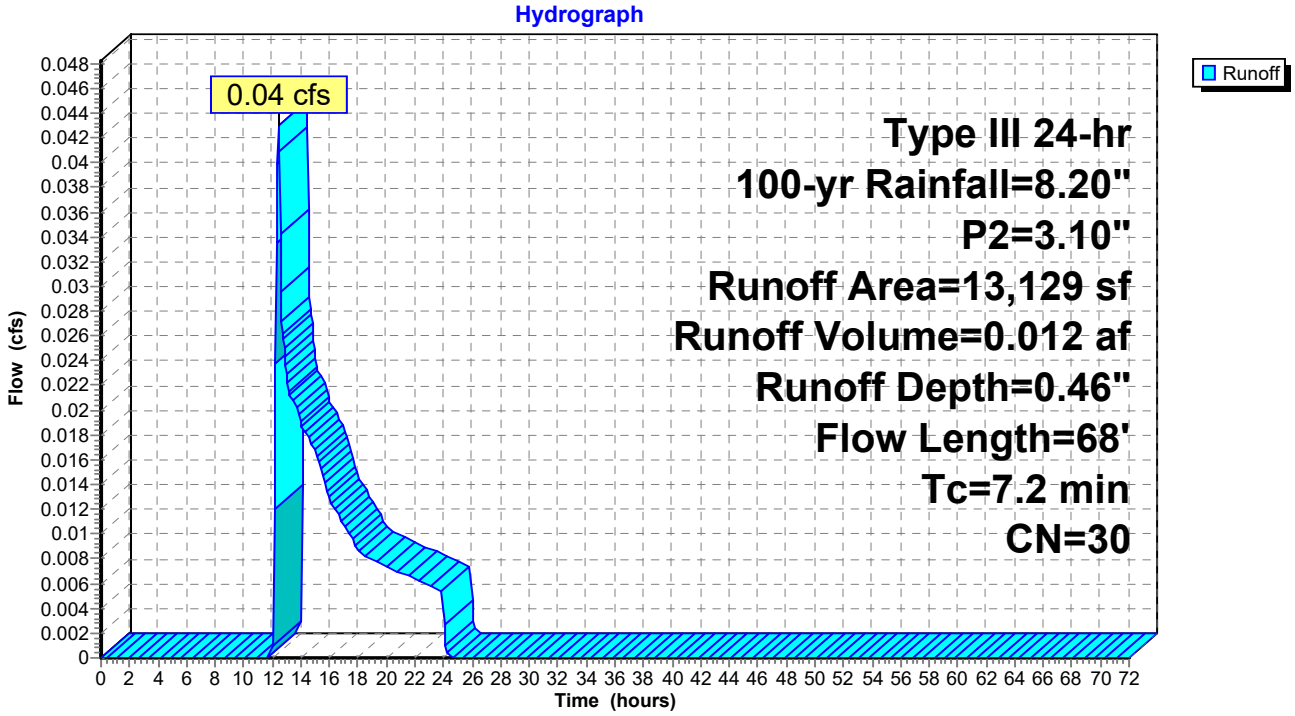
Runoff = 0.04 cfs @ 12.42 hrs, Volume= 0.012 af, Depth= 0.46"
Routed to Link DP2 : E'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.20", P2=3.10"

Area (sf)	CN	Description
12,906	30	Woods, Good, HSG A
223	39	>75% Grass cover, Good, HSG A
13,129	30	Weighted Average
13,129		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0860	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.2	18	0.0770	1.39		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
7.2	68	Total			

Subcatchment P-2B: SubCatchment P-2B



Summary for Subcatchment P-3: SubCatchment P-3

[49] Hint: Tc<2dt may require smaller dt

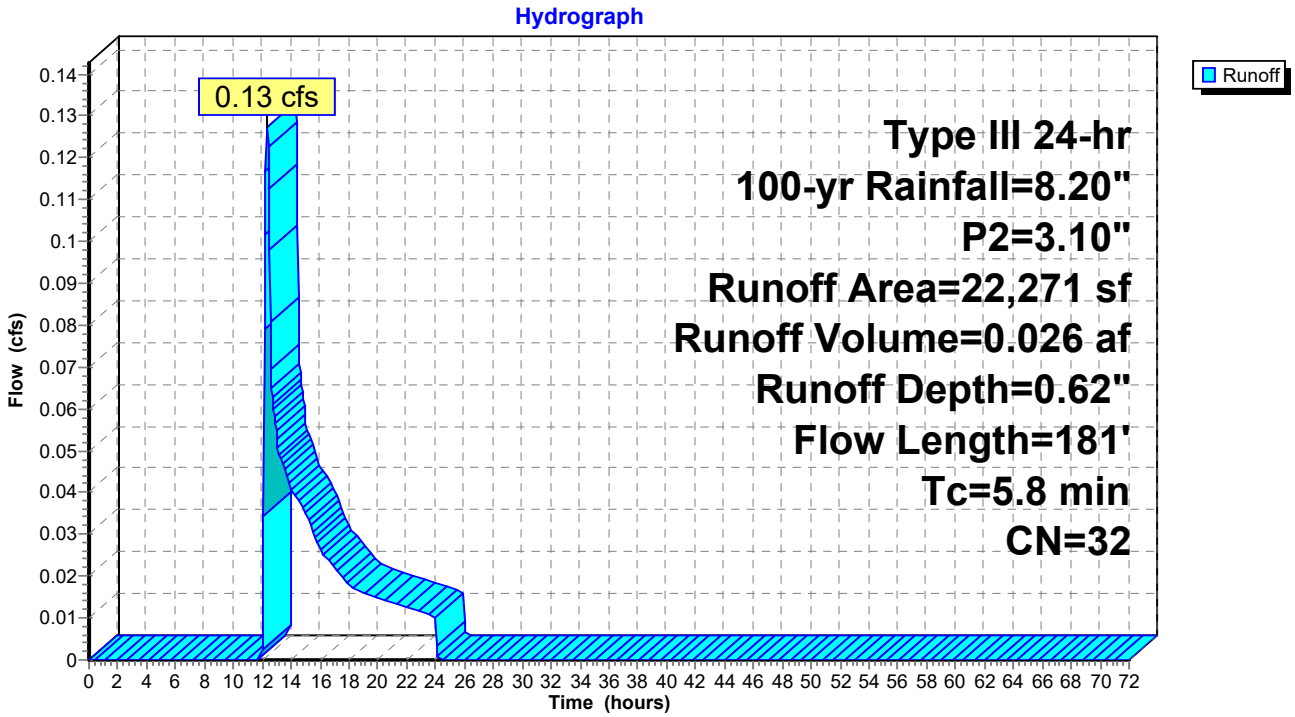
Runoff = 0.13 cfs @ 12.34 hrs, Volume= 0.026 af, Depth= 0.62"
Routed to Link DP2 : E'ly Property Line

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.20", P2=3.10"

Area (sf)	CN	Description
16,687	30	Woods, Good, HSG A
5,584	39	>75% Grass cover, Good, HSG A
22,271	32	Weighted Average
22,271		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.2200	0.17		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
1.0	131	0.2000	2.24		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
5.8	181	Total			

Subcatchment P-3: SubCatchment P-3



Summary for Subcatchment P-4: No Change E-4

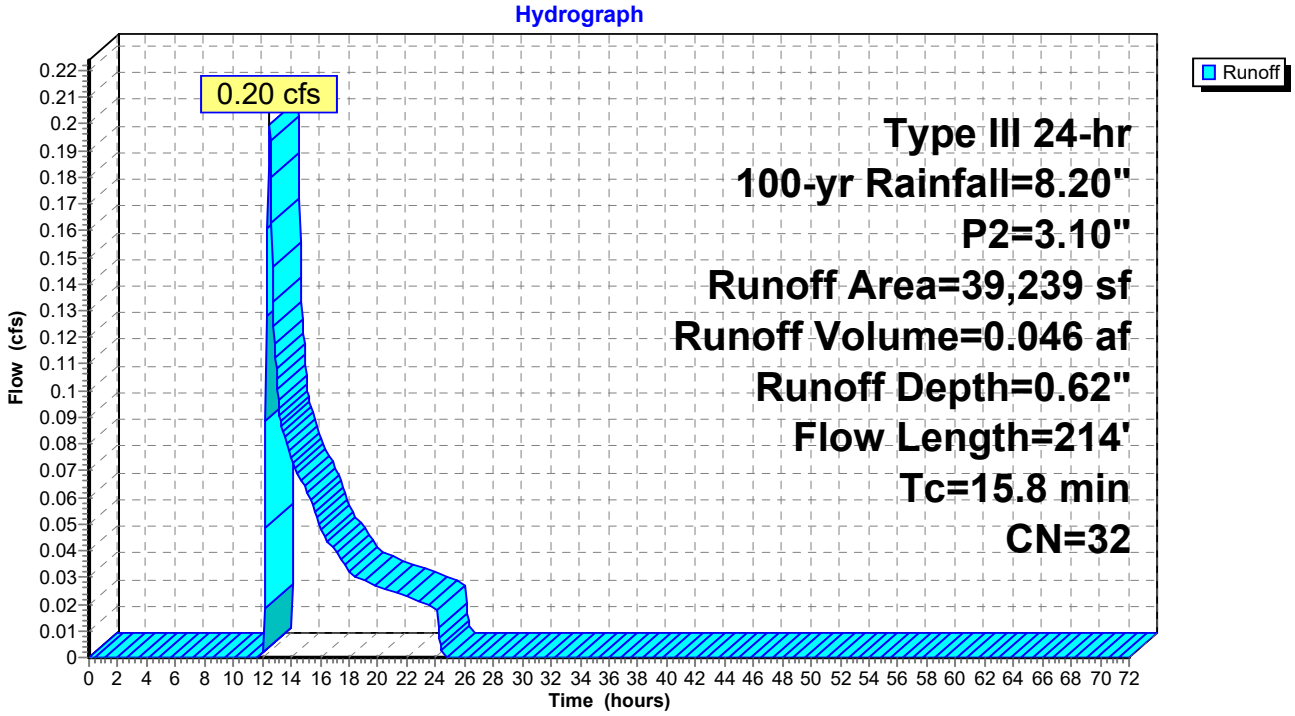
Runoff = 0.20 cfs @ 12.49 hrs, Volume= 0.046 af, Depth= 0.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.20", P2=3.10"

Area (sf)	CN	Description
37,500	30	Woods, Good, HSG A
1,739	72	Dirt roads, HSG A
39,239	32	Weighted Average
39,239		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.7	50	0.0300	0.08		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.7	29	0.0200	0.71		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.2	10	0.0100	1.00		**Shallow Concentrated Flow, C-D** Nearly Bare & Untilled Kv= 10.0 fps
4.2	125	0.0100	0.50		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
15.8	214	Total			

Subcatchment P-4: No Change E-4



Summary for Subcatchment P-5: No Change E-5

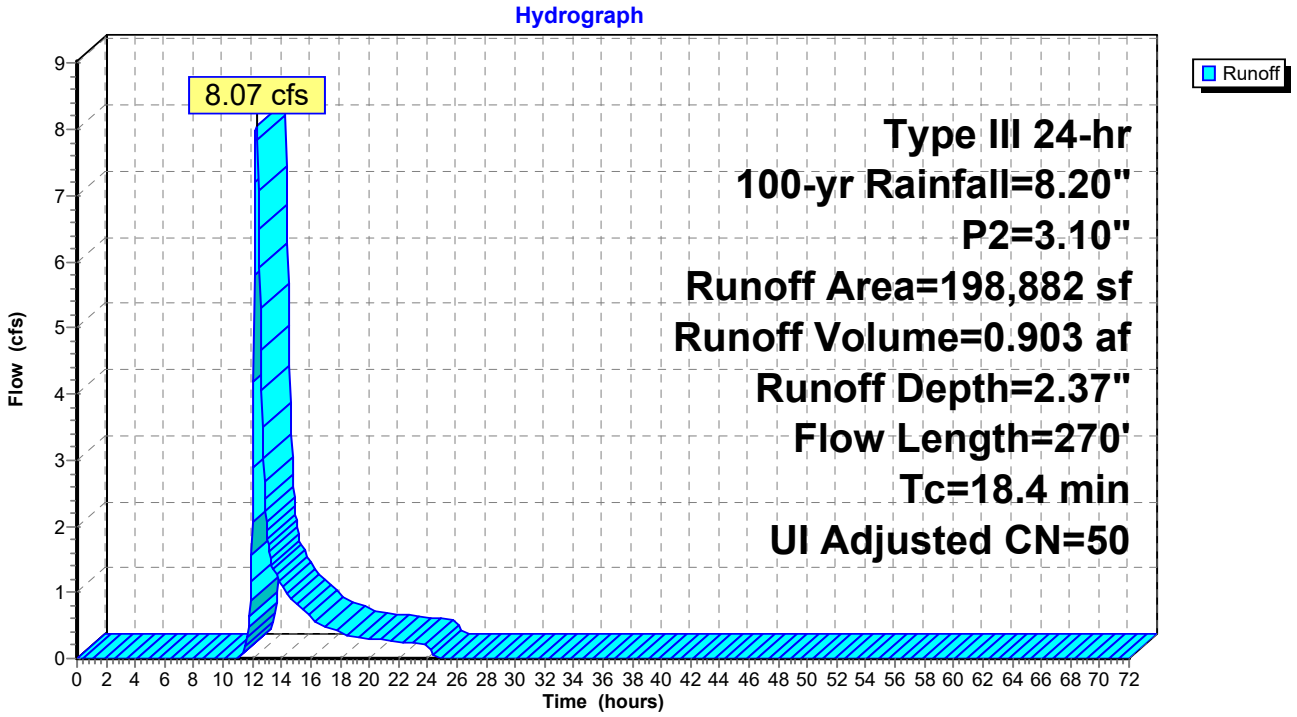
Runoff = 8.07 cfs @ 12.28 hrs, Volume= 0.903 af, Depth= 2.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.20", P2=3.10"

Area (sf)	CN	Adj	Description
99,401	30		Woods, Good, HSG A
33,545	39		>75% Grass cover, Good, HSG A
13,415	72		Dirt roads, HSG A
14,517	98		Unconnected pavement, HSG A
16,302	98		Paved parking, HSG A
21,702	98		Roofs, HSG A
198,882	52	50	Weighted Average, UI Adjusted
146,361			73.59% Pervious Area
52,521			26.41% Impervious Area
14,517			27.64% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		**Sheet Flow, A_B** Woods: Light underbrush n= 0.400 P2= 3.10"
5.6	184	0.0120	0.55		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.3	36	0.0500	2.24		**Shallow Concentrated Flow, C-D** Nearly Bare & Untilled Kv= 10.0 fps
18.4	270	Total			

Subcatchment P-5: No Change E-5



Summary for Subcatchment P-6: SubCatchment P-6

[47] Hint: Peak is 539% of capacity of segment #5
[47] Hint: Peak is 339% of capacity of segment #6

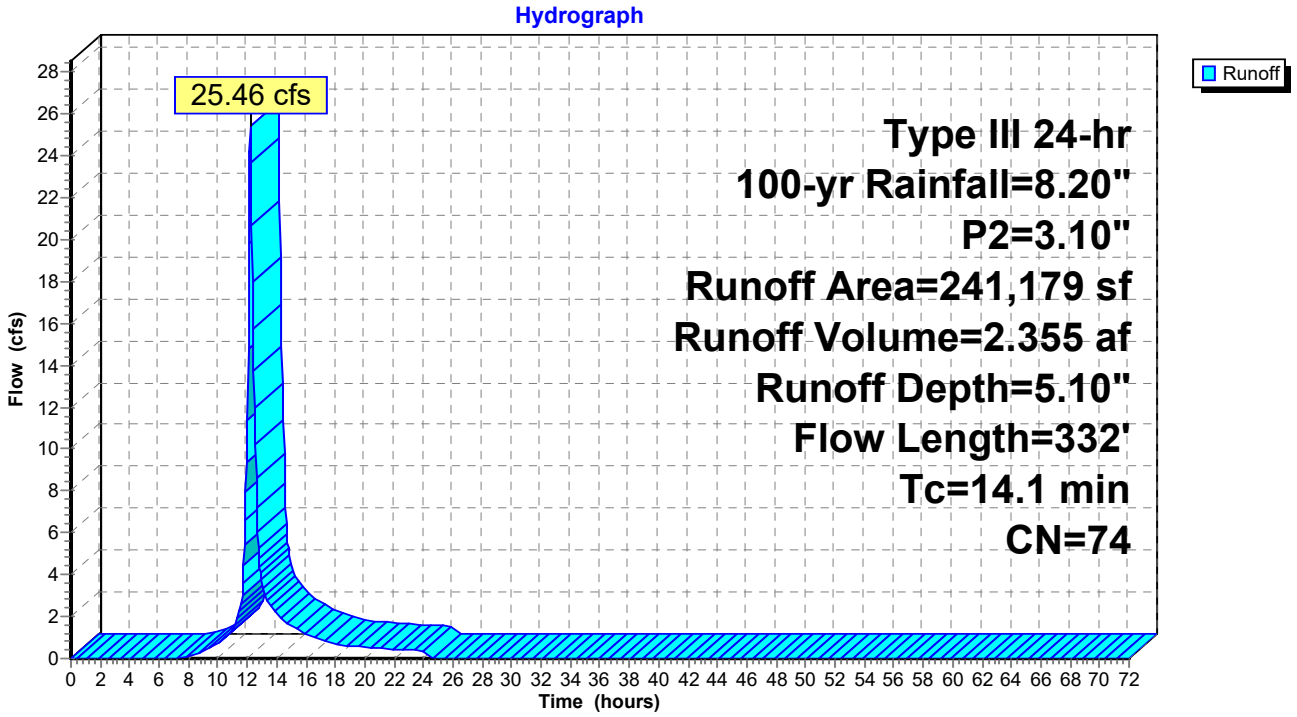
Runoff = 25.46 cfs @ 12.20 hrs, Volume= 2.355 af, Depth= 5.10"
Routed to Link DP5 : To Existing Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.20", P2=3.10"

Area (sf)	CN	Description
19,085	30	Woods, Good, HSG A
49,824	39	>75% Grass cover, Good, HSG A
136,787	98	Paved parking, HSG A
35,483	54	1/2 acre lots, 25% imp, HSG A
241,179	74	Weighted Average
95,521		39.61% Pervious Area
145,658		60.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	32	0.0100	0.05		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
1.6	18	0.1700	0.19		**Sheet Flow, B-C** Grass: Dense n= 0.240 P2= 3.10"
0.1	5	0.0200	0.99		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.2	39	0.0300	3.52		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
0.3	123	0.0150	6.02	4.73	**Pipe Channel, E-F** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.3	115	0.0500	6.12	7.51	**Pipe Channel, F-G** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.025 Corrugated metal
14.1	332	Total			

Subcatchment P-6: SubCatchment P-6



Summary for Subcatchment P-7: SubCatchment P-7

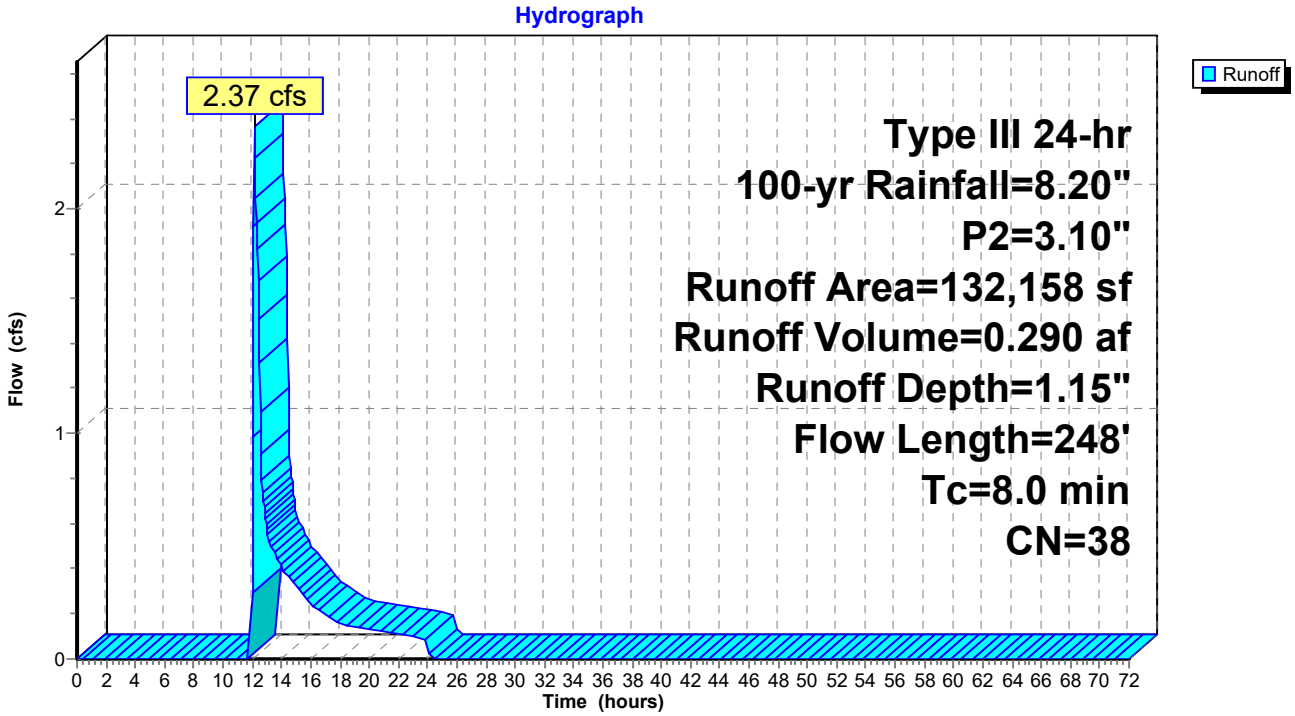
Runoff = 2.37 cfs @ 12.16 hrs, Volume= 0.290 af, Depth= 1.15"
Routed to Link DP5 : To Existing Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.20", P2=3.10"

Area (sf)	CN	Description
73,049	30	Woods, Good, HSG A
50,149	39	>75% Grass cover, Good, HSG A
8,960	98	Paved parking, HSG A
132,158	38	Weighted Average
123,198		93.22% Pervious Area
8,960		6.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
0.9	72	0.0400	1.40		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.8	126	0.2500	2.50		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
8.0	248	Total			

Subcatchment P-7: SubCatchment P-7



Summary for Subcatchment P-8A: SubCatchment P-8A

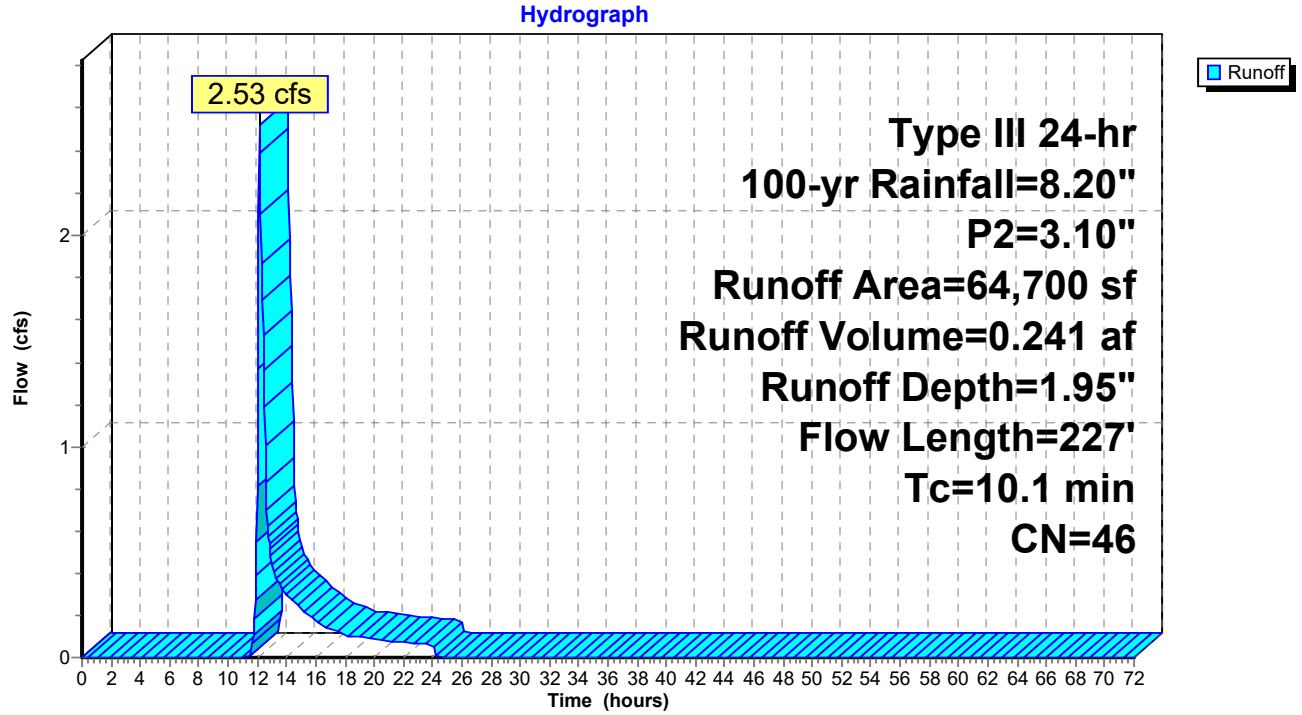
Runoff = 2.53 cfs @ 12.16 hrs, Volume= 0.241 af, Depth= 1.95"
Routed to Pond 6P : Depression-Chambers

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.20", P2=3.10"

Area (sf)	CN	Description
26,938	61	1/4 acre lots, 38% imp, HSG A
31,395	30	Woods, Good, HSG A
4,300	39	>75% Grass cover, Good, HSG A
2,067	98	Water Surface, HSG A
64,700	46	Weighted Average
52,397		80.98% Pervious Area
12,303		19.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	50	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.10"
1.0	57	0.0200	0.99		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.8	120	0.2400	2.45		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
10.1	227	Total			

Subcatchment P-8A: SubCatchment P-8A



Summary for Subcatchment P-8B: SubCatchment P-8B

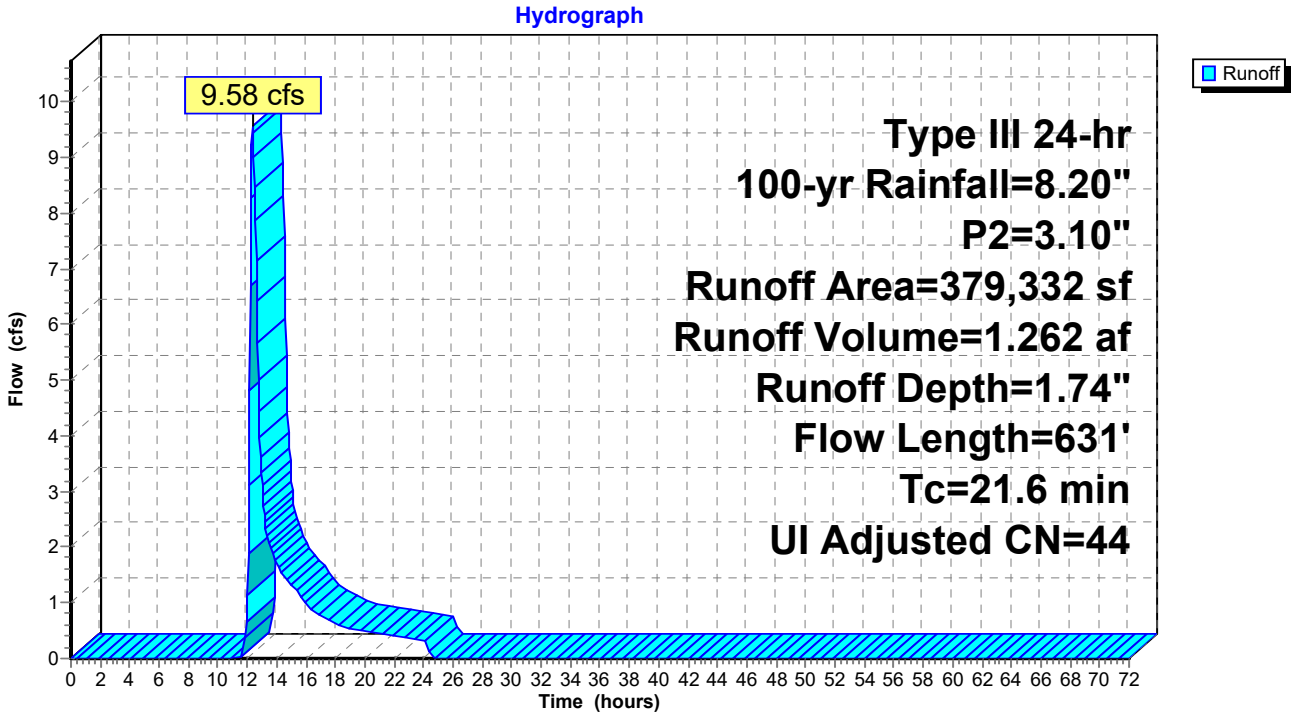
Runoff = 9.58 cfs @ 12.36 hrs, Volume= 1.262 af, Depth= 1.74"
Routed to Pond 8P : DP6 - New Inf Basin Club

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.20", P2=3.10"

Area (sf)	CN	Adj	Description
137,313	30		Woods, Good, HSG A
133,757	39		>75% Grass cover, Good, HSG A
47,139	98		Unconnected roofs, HSG A
52,252	98		Unconnected pavement, HSG A
8,871	98		Water Surface, HSG A
379,332	53	44	Weighted Average, UI Adjusted
271,070			71.46% Pervious Area
108,262			28.54% Impervious Area
99,391			91.81% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.5	50	0.0200	0.07		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
1.2	83	0.0570	1.19		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
6.9	354	0.0150	0.86		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.9	122	0.2280	2.39		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
0.1	22	0.3300	4.02		**Shallow Concentrated Flow, E-F** Short Grass Pasture Kv= 7.0 fps
21.6	631	Total			

Subcatchment P-8B: SubCatchment P-8B



Summary for Subcatchment P-9: SubCatchment P-9

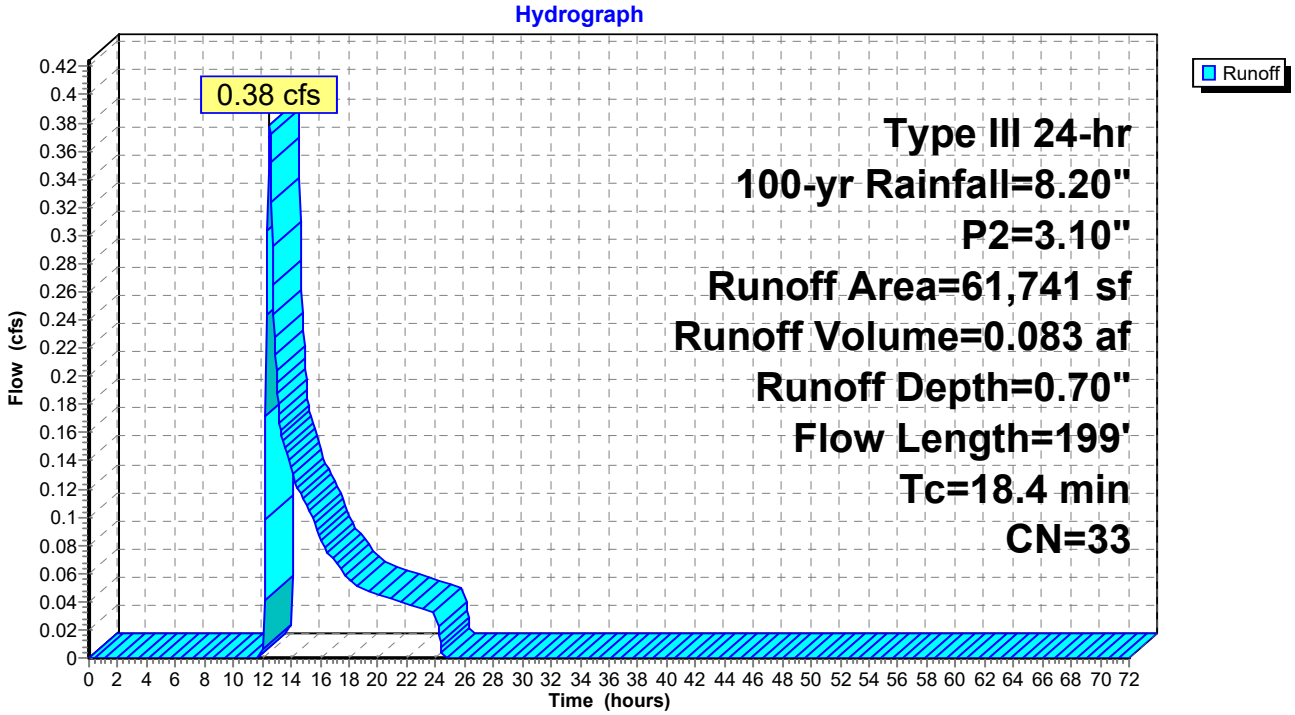
Runoff = 0.38 cfs @ 12.50 hrs, Volume= 0.083 af, Depth= 0.70"
Routed to Pond 5P : DP7 - Existing Depression 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.20", P2=3.10"

Area (sf)	CN	Description
46,123	30	Woods, Good, HSG A
14,817	39	>75% Grass cover, Good, HSG A
801	98	Water Surface, HSG A
61,741	33	Weighted Average
60,940		98.70% Pervious Area
801		1.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.1	50	0.0125	0.06		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.10"
3.3	149	0.0226	0.75		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
18.4	199	Total			

Subcatchment P-9: SubCatchment P-9



Summary for Pond 1P: SubSurface Sys

Inflow Area = 10.912 ac, 56.27% Impervious, Inflow Depth = 4.75" for 100-yr event
Inflow = 38.96 cfs @ 12.31 hrs, Volume= 4.323 af
Outflow = 6.12 cfs @ 13.28 hrs, Volume= 4.323 af, Atten= 84%, Lag= 58.1 min
Discarded = 6.12 cfs @ 13.28 hrs, Volume= 4.323 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 175.44' @ 13.28 hrs Surf.Area= 31,968 sf Storage= 70,286 cf

Plug-Flow detention time= 98.4 min calculated for 4.320 af (100% of inflow)
Center-of-Mass det. time= 98.4 min (935.3 - 836.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	172.00'	5,168 cf	**44.25'W x 131.78'L x 3.50'H Field A** 20,409 cf Overall - 7,490 cf Embedded = 12,919 cf x 40.0% Voids
#2A	172.50'	7,490 cf	**ADS_StormTech SC-740 b +Cap** x 162 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 162 Chambers in 9 Rows Cap Storage= 2.7 cf x 2 x 9 rows = 47.8 cf
#3	172.50'	43,645 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)
#4D	172.00'	3,915 cf	**30.00'W x 146.02'L x 3.50'H Field B** 15,332 cf Overall - 5,545 cf Embedded = 9,787 cf x 40.0% Voids
#5D	172.50'	5,545 cf	**ADS_StormTech SC-740 b +Cap** x 120 Inside #4 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 120 Chambers in 6 Rows Cap Storage= 2.7 cf x 2 x 6 rows = 31.9 cf
#6B	172.00'	4,492 cf	**49.00'W x 103.30'L x 3.50'H Field C** 17,715 cf Overall - 6,485 cf Embedded = 11,231 cf x 40.0% Voids
#7B	172.50'	6,485 cf	**ADS_StormTech SC-740 b +Cap** x 140 Inside #6 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 140 Chambers in 10 Rows Cap Storage= 2.7 cf x 2 x 10 rows = 53.1 cf
#8C	172.00'	4,292 cf	**30.00'W x 160.26'L x 3.50'H Field D** 16,827 cf Overall - 6,096 cf Embedded = 10,731 cf x 40.0% Voids
#9C	172.50'	6,096 cf	**ADS_StormTech SC-740 b +Cap** x 132 Inside #8 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 132 Chambers in 6 Rows Cap Storage= 2.7 cf x 2 x 6 rows = 31.9 cf
#10E	172.00'	2,974 cf	**20.50'W x 160.26'L x 3.50'H Field E** 11,498 cf Overall - 4,064 cf Embedded = 7,434 cf x 40.0% Voids
#11E	172.50'	4,064 cf	**ADS_StormTech SC-740 b +Cap** x 88 Inside #10 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 88 Chambers in 4 Rows Cap Storage= 2.7 cf x 2 x 4 rows = 21.2 cf
		94,165 cf	Total Available Storage

Storage Group A created with Chamber Wizard
Storage Group D created with Chamber Wizard
Storage Group B created with Chamber Wizard
Storage Group C created with Chamber Wizard
Storage Group E created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
172.50	5,320	0	0
173.00	5,843	2,791	2,791
174.00	6,931	6,387	9,178
175.00	8,075	7,503	16,681
176.00	9,276	8,676	25,356
177.00	10,534	9,905	35,261
177.76	11,528	8,384	43,645

Device	Routing	Invert	Outlet Devices
#1	Discarded	172.00'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=6.12 cfs @ 13.28 hrs HW=175.44' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 6.12 cfs)

Pond 1P: SubSurface Sys - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 b +Cap (ADS StormTech® SC-740 with cap storage)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 9 rows = 47.8 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

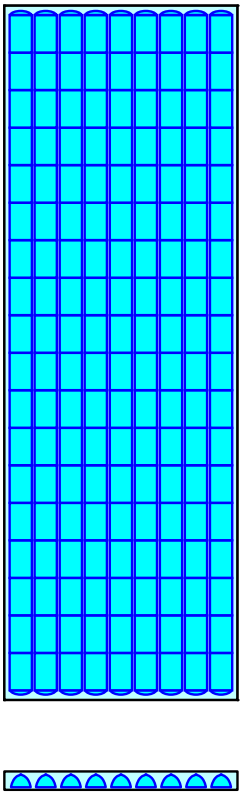
18 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 129.78' Row Length +12.0" End Stone x 2 = 131.78' Base Length
9 Rows x 51.0" Wide + 6.0" Spacing x 8 + 12.0" Side Stone x 2 = 44.25' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

162 Chambers x 45.9 cf + 2.7 cf Cap Volume x 2 x 9 Rows = 7,490.1 cf Chamber Storage

20,408.9 cf Field - 7,490.1 cf Chambers = 12,918.8 cf Stone x 40.0% Voids = 5,167.5 cf Stone Storage

Chamber Storage + Stone Storage = 12,657.6 cf = 0.291 af
Overall Storage Efficiency = 62.0%
Overall System Size = 131.78' x 44.25' x 3.50'

162 Chambers
755.9 cy Field
478.5 cy Stone



Pond 1P: SubSurface Sys - Chamber Wizard Field B

Chamber Model = ADS_StormTech SC-740 b +Cap (ADS StormTech® SC-740 with cap storage)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 6 rows = 31.9 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

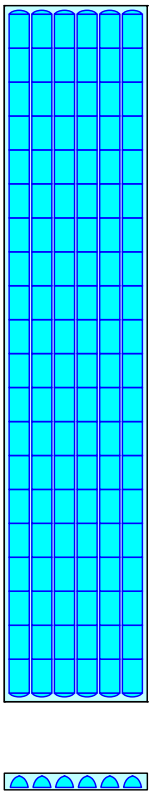
20 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 144.02' Row Length +12.0" End Stone x 2 = 146.02' Base Length
6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.00' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

120 Chambers x 45.9 cf + 2.7 cf Cap Volume x 2 x 6 Rows = 5,544.7 cf Chamber Storage

15,331.8 cf Field - 5,544.7 cf Chambers = 9,787.1 cf Stone x 40.0% Voids = 3,914.8 cf Stone Storage

Chamber Storage + Stone Storage = 9,459.5 cf = 0.217 af
Overall Storage Efficiency = 61.7%
Overall System Size = 146.02' x 30.00' x 3.50'

120 Chambers
567.8 cy Field
362.5 cy Stone



Pond 1P: SubSurface Sys - Chamber Wizard Field C

Chamber Model = ADS_StormTech SC-740 b +Cap (ADS StormTech® SC-740 with cap storage)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 10 rows = 53.1 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

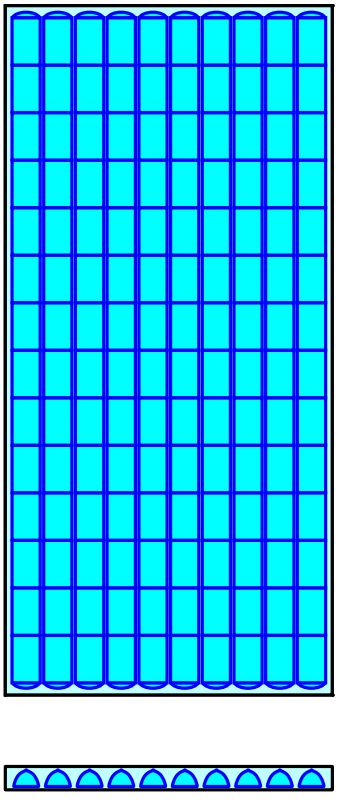
14 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 101.30' Row Length +12.0" End Stone x 2 = 103.30' Base Length
10 Rows x 51.0" Wide + 6.0" Spacing x 9 + 12.0" Side Stone x 2 = 49.00' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

140 Chambers x 45.9 cf + 2.7 cf Cap Volume x 2 x 10 Rows = 6,484.7 cf Chamber Storage

17,715.4 cf Field - 6,484.7 cf Chambers = 11,230.7 cf Stone x 40.0% Voids = 4,492.3 cf Stone Storage

Chamber Storage + Stone Storage = 10,977.0 cf = 0.252 af
Overall Storage Efficiency = 62.0%
Overall System Size = 103.30' x 49.00' x 3.50'

140 Chambers
656.1 cy Field
416.0 cy Stone



Pond 1P: SubSurface Sys - Chamber Wizard Field D

Chamber Model = ADS_StormTech SC-740 b +Cap (ADS StormTech® SC-740 with cap storage)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 6 rows = 31.9 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

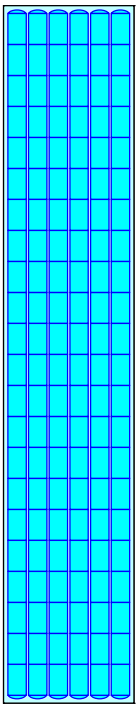
22 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 158.26' Row Length +12.0" End Stone x 2 = 160.26' Base Length
6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.00' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

132 Chambers x 45.9 cf + 2.7 cf Cap Volume x 2 x 6 Rows = 6,095.9 cf Chamber Storage

16,827.0 cf Field - 6,095.9 cf Chambers = 10,731.0 cf Stone x 40.0% Voids = 4,292.4 cf Stone Storage

Chamber Storage + Stone Storage = 10,388.3 cf = 0.238 af
Overall Storage Efficiency = 61.7%
Overall System Size = 160.26' x 30.00' x 3.50'

132 Chambers
623.2 cy Field
397.4 cy Stone





Pond 1P: SubSurface Sys - Chamber Wizard Field E

Chamber Model = ADS_StormTech SC-740 b +Cap (ADS StormTech® SC-740 with cap storage)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 4 rows = 21.2 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

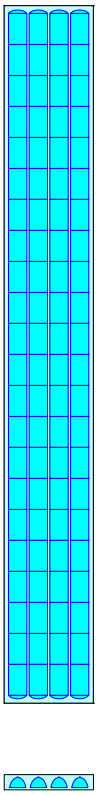
22 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 158.26' Row Length +12.0" End Stone x 2 = 160.26' Base Length
4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

88 Chambers x 45.9 cf + 2.7 cf Cap Volume x 2 x 4 Rows = 4,064.0 cf Chamber Storage

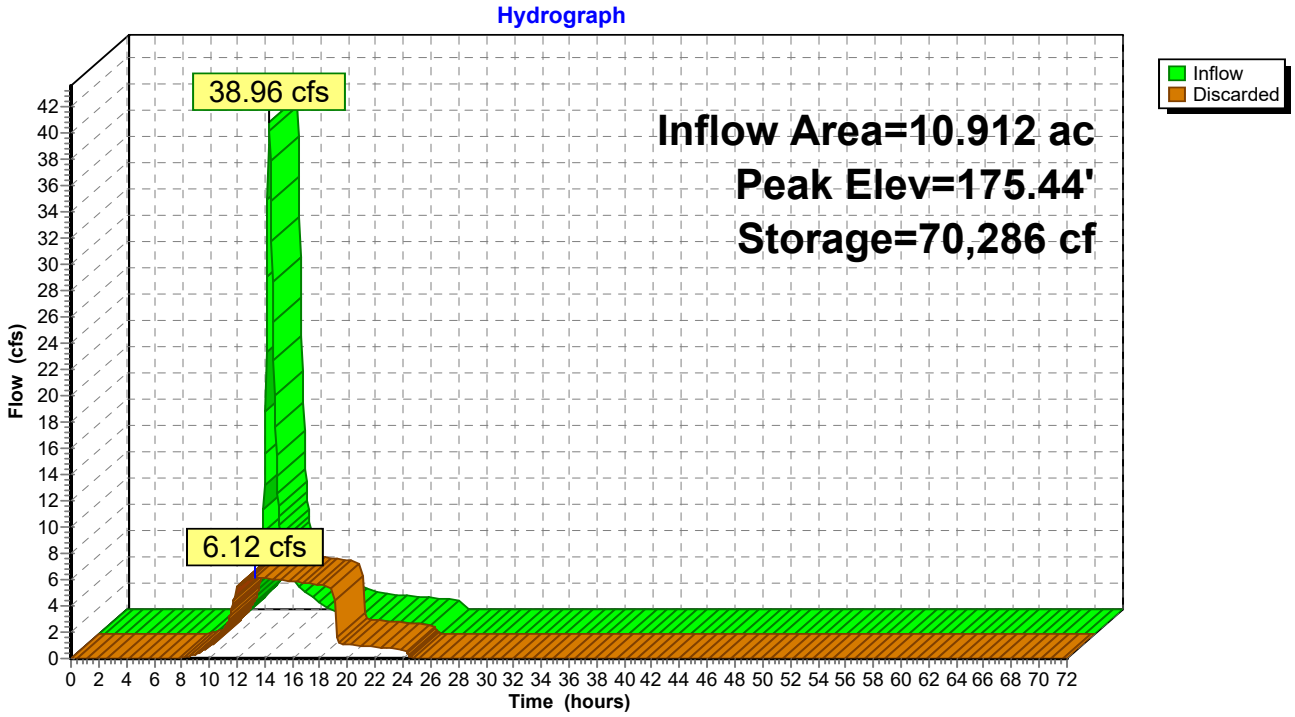
11,498.4 cf Field - 4,064.0 cf Chambers = 7,434.5 cf Stone x 40.0% Voids = 2,973.8 cf Stone Storage

Chamber Storage + Stone Storage = 7,037.7 cf = 0.162 af
Overall Storage Efficiency = 61.2%
Overall System Size = 160.26' x 20.50' x 3.50'

88 Chambers
425.9 cy Field
275.4 cy Stone



Pond 1P: SubSurface Sys



Summary for Pond 4P: Drainage Basin/Easement

Inflow Area = 8.571 ac, 41.42% Impervious, Inflow Depth = 3.70" for 100-yr event
Inflow = 27.70 cfs @ 12.19 hrs, Volume= 2.645 af
Outflow = 0.96 cfs @ 17.55 hrs, Volume= 2.645 af, Atten= 97%, Lag= 321.5 min
Discarded = 0.96 cfs @ 17.55 hrs, Volume= 2.645 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to nonexistent node SP6

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 183.25' @ 17.55 hrs Surf.Area= 17,173 sf Storage= 79,828 cf

Plug-Flow detention time= 1,074.3 min calculated for 2.643 af (100% of inflow)
Center-of-Mass det. time= 1,075.4 min (1,908.4 - 833.0)

Volume	Invert	Avail.Storage	Storage Description
#1	174.00'	345,939 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

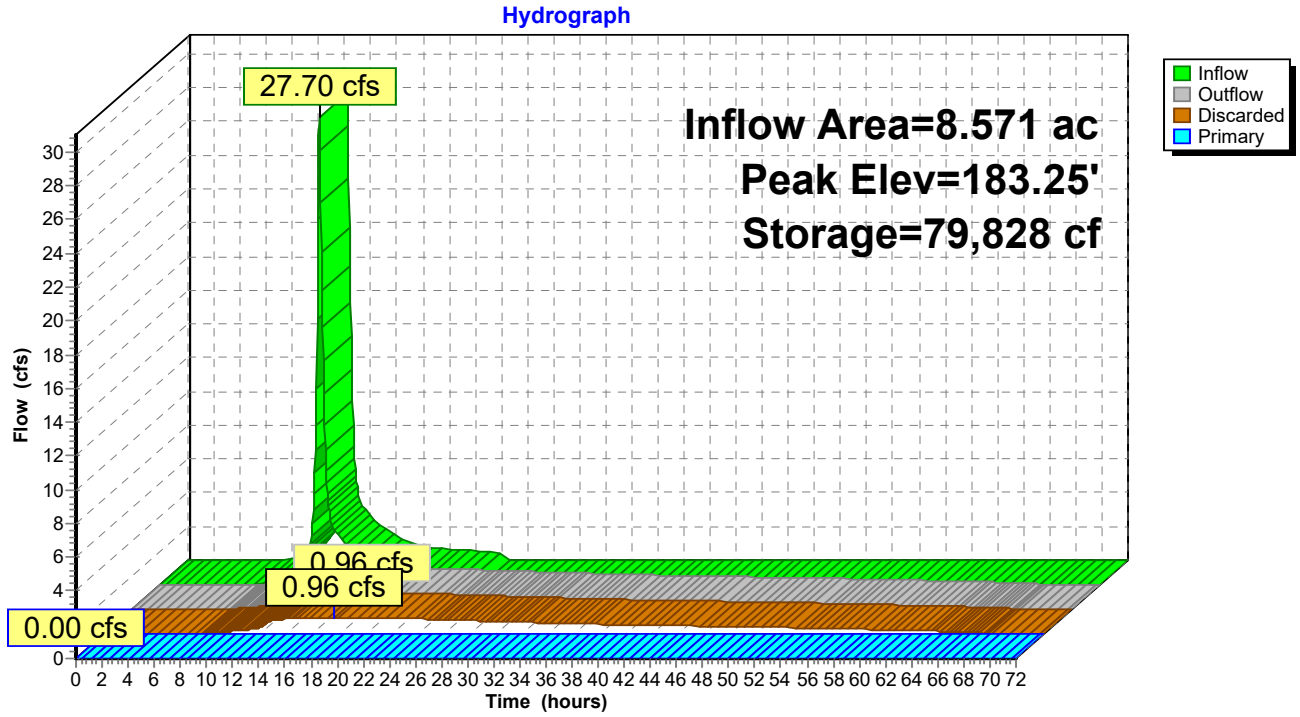
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
174.00	491	0	0
175.00	3,251	1,871	1,871
176.00	4,753	4,002	5,873
177.00	6,309	5,531	11,404
178.00	7,641	6,975	18,379
179.00	8,869	8,255	26,634
180.00	10,188	9,529	36,163
181.00	11,953	11,071	47,233
182.00	14,143	13,048	60,281
183.00	16,525	15,334	75,615
184.00	19,118	17,822	93,437
185.00	21,426	20,272	113,709
186.00	23,221	22,324	136,032
187.00	24,868	24,045	160,077
188.00	26,530	25,699	185,776
189.00	28,209	27,370	213,145
190.00	30,172	29,191	242,336
191.00	32,732	31,452	273,788
192.00	36,071	34,402	308,189
193.00	39,428	37,750	345,939

Device	Routing	Invert	Outlet Devices
#1	Primary	192.90'	**10.0' long x 50.0' 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
#2	Discarded	174.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.96 cfs @ 17.55 hrs HW=183.25' (Free Discharge)
↑**2=Exfiltration** (Exfiltration Controls 0.96 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=174.00' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 4P: Drainage Basin/Easement



Summary for Pond 5P: DP7 - Existing Depression 2

Inflow Area = 1.417 ac, 1.30% Impervious, Inflow Depth = 0.70" for 100-yr event
Inflow = 0.38 cfs @ 12.50 hrs, Volume= 0.083 af
Outflow = 0.16 cfs @ 13.28 hrs, Volume= 0.083 af, Atten= 58%, Lag= 46.3 min
Discarded = 0.16 cfs @ 13.28 hrs, Volume= 0.083 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 173.11' @ 13.28 hrs Surf.Area= 835 sf Storage= 498 cf

Plug-Flow detention time= 34.0 min calculated for 0.083 af (100% of inflow)
Center-of-Mass det. time= 34.0 min (994.4 - 960.4)

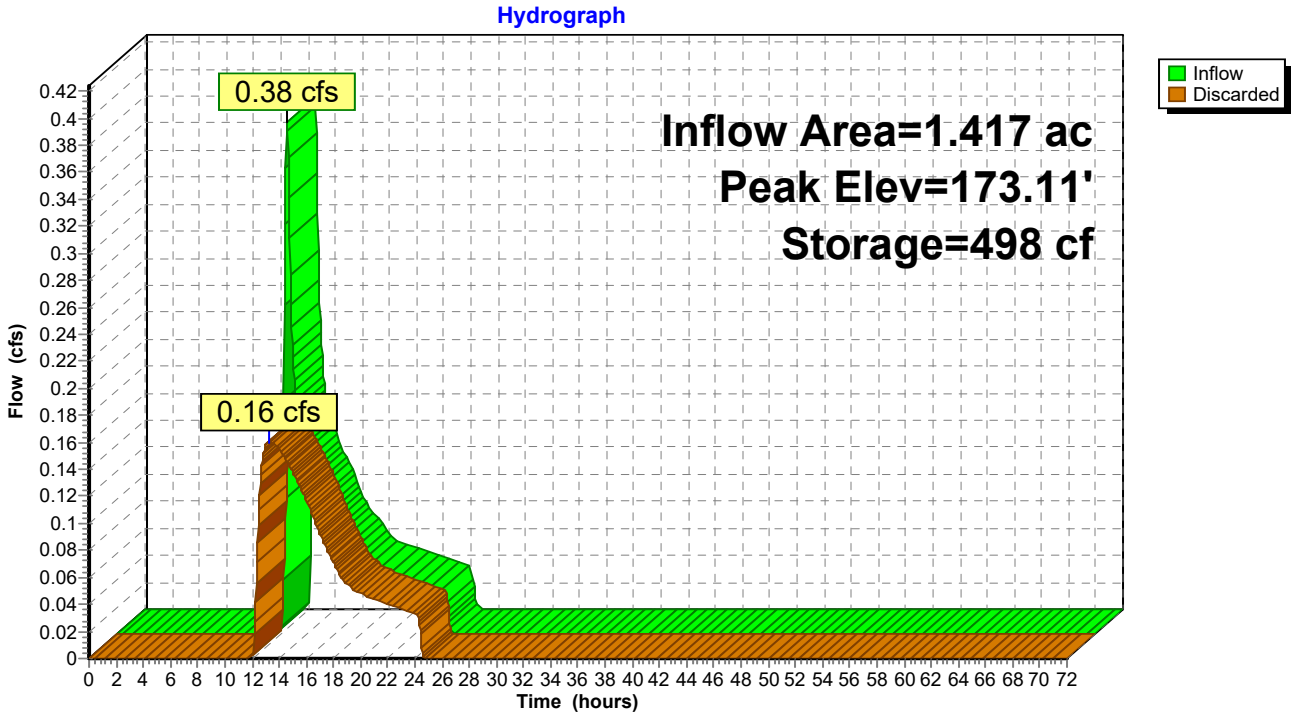
Volume	Invert	Avail.Storage	Storage Description
#1	172.00'	6,418 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
172.00	67	0	0
174.00	1,456	1,523	1,523
175.50	5,070	4,895	6,418

Device	Routing	Invert	Outlet Devices
#1	Discarded	172.00'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.16 cfs @ 13.28 hrs HW=173.11' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.16 cfs)

Pond 5P: DP7 - Existing Depression 2



Summary for Pond 6P: Depression-Chambers

Inflow Area = 1.485 ac, 19.02% Impervious, Inflow Depth = 1.95" for 100-yr event
Inflow = 2.53 cfs @ 12.16 hrs, Volume= 0.241 af
Outflow = 0.38 cfs @ 13.26 hrs, Volume= 0.241 af, Atten= 85%, Lag= 66.0 min
Discarded = 0.38 cfs @ 13.26 hrs, Volume= 0.241 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 180.40' @ 13.26 hrs Surf.Area= 1,972 sf Storage= 3,453 cf

Plug-Flow detention time= 105.8 min calculated for 0.241 af (100% of inflow)
Center-of-Mass det. time= 105.7 min (990.4 - 884.7)

Volume	Invert	Avail.Storage	Storage Description
#1	179.50'	1,835 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2A	176.50'	1,404 cf	**20.50'W x 74.82'L x 3.50'H Field A** 5,368 cf Overall - 1,859 cf Embedded = 3,509 cf x 40.0% Voids
#3A	177.00'	1,859 cf	**ADS_StormTech SC-740 b +Cap** x 40 Inside #2 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 40 Chambers in 4 Rows Cap Storage= 2.7 cf x 2 x 4 rows = 21.2 cf
		5,098 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
179.50	59	0	0
180.00	195	64	64
181.00	803	499	563
182.00	1,742	1,273	1,835

Device	Routing	Invert	Outlet Devices
#1	Discarded	176.50'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.38 cfs @ 13.26 hrs HW=180.40' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.38 cfs)

Pond 6P: Depression-Chambers - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 b +Cap (ADS StormTech® SC-740 with cap storage)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
Cap Storage= 2.7 cf x 2 x 4 rows = 21.2 cf

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

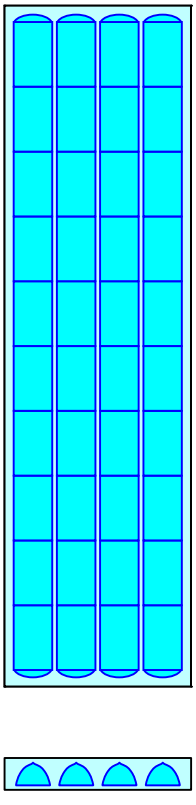
10 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 72.82' Row Length +12.0" End Stone x 2 = 74.82' Base Length
4 Rows x 51.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.50' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

40 Chambers x 45.9 cf + 2.7 cf Cap Volume x 2 x 4 Rows = 1,858.8 cf Chamber Storage

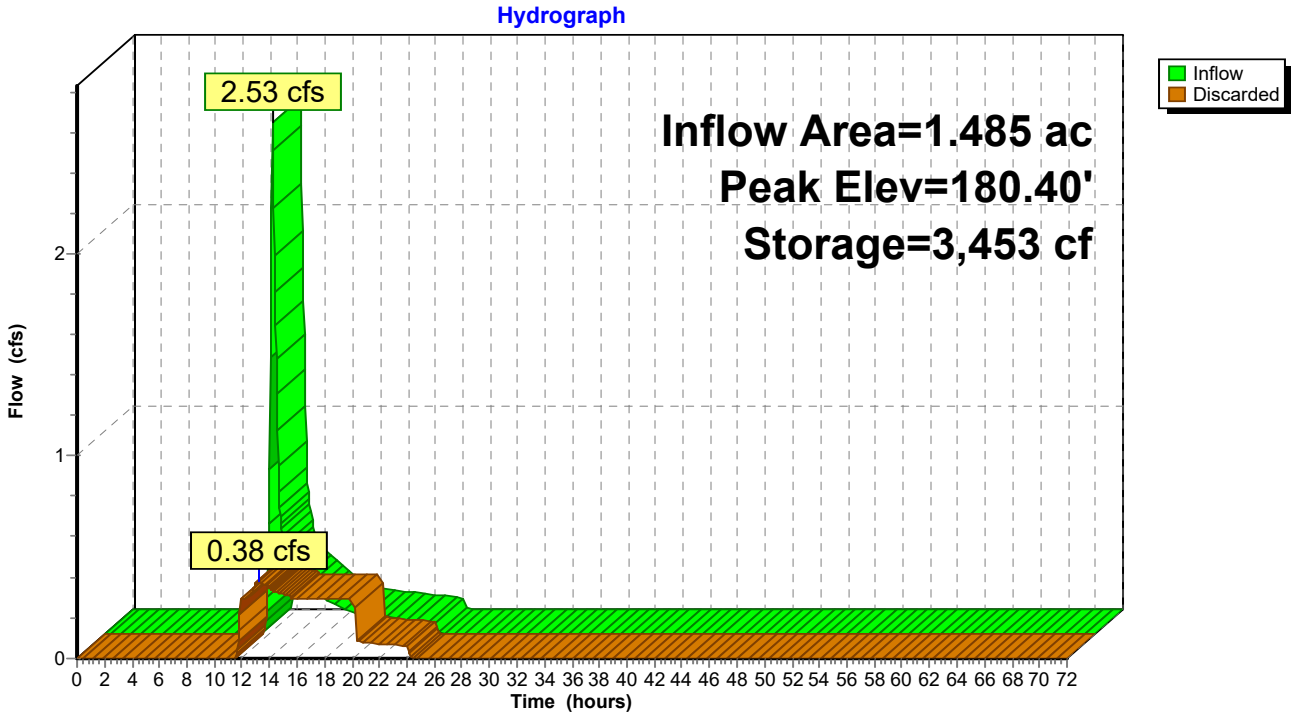
5,368.1 cf Field - 1,858.8 cf Chambers = 3,509.3 cf Stone x 40.0% Voids = 1,403.7 cf Stone Storage

Chamber Storage + Stone Storage = 3,262.5 cf = 0.075 af
Overall Storage Efficiency = 60.8%
Overall System Size = 74.82' x 20.50' x 3.50'

40 Chambers
198.8 cy Field
130.0 cy Stone



Pond 6P: Depression-Chambers



Summary for Pond 8P: DP6 - New Inf Basin Club

Inflow Area = 8.708 ac, 28.54% Impervious, Inflow Depth = 1.74" for 100-yr event
Inflow = 9.58 cfs @ 12.36 hrs, Volume= 1.262 af
Outflow = 1.69 cfs @ 14.04 hrs, Volume= 1.262 af, Atten= 82%, Lag= 100.6 min
Discarded = 1.69 cfs @ 14.04 hrs, Volume= 1.262 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 169.99' @ 14.04 hrs Surf.Area= 8,844 sf Storage= 18,928 cf

Plug-Flow detention time= 130.6 min calculated for 1.262 af (100% of inflow)
Center-of-Mass det. time= 130.5 min (1,032.8 - 902.2)

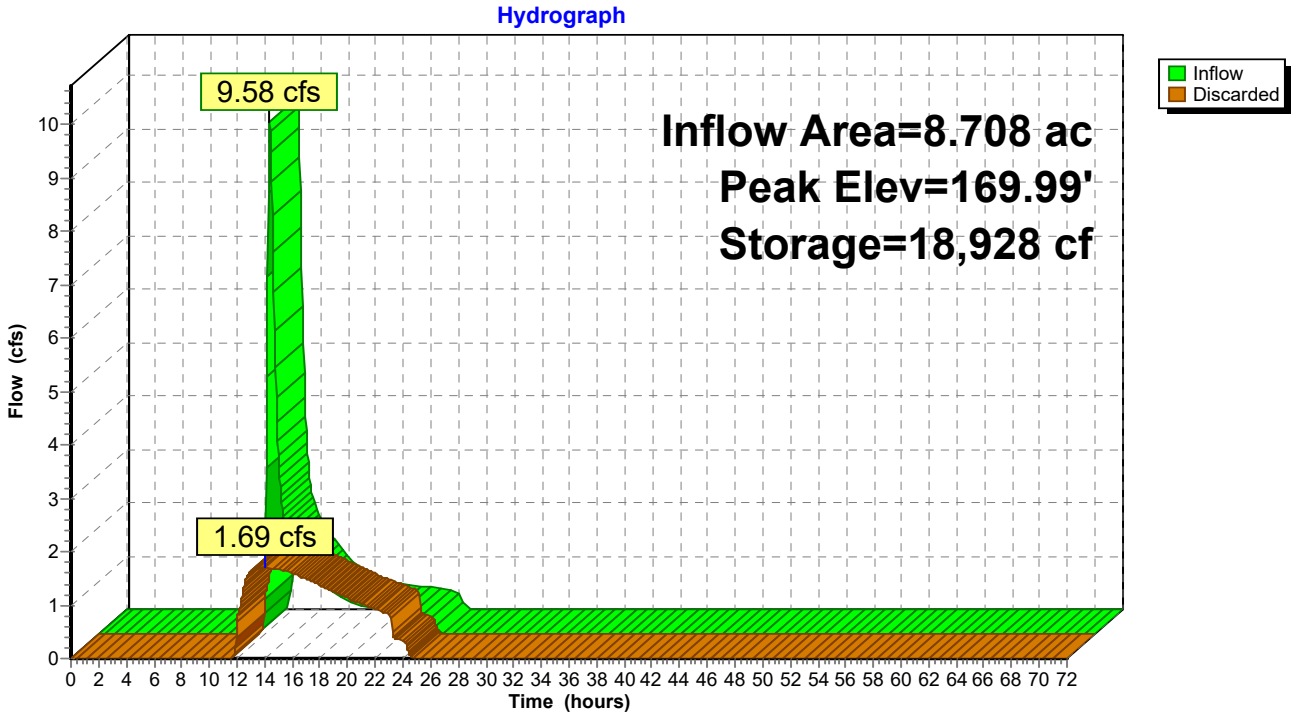
Volume	Invert	Avail.Storage	Storage Description
#1	167.00'	28,802 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
167.00	4,169	0	0
168.00	5,514	4,842	4,842
169.00	7,024	6,269	11,111
170.00	8,871	7,948	19,058
171.00	10,617	9,744	28,802

Device	Routing	Invert	Outlet Devices
#1	Discarded	167.00'	**8.270 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.69 cfs @ 14.04 hrs HW=169.99' (Free Discharge)
1=Exfiltration (Exfiltration Controls 1.69 cfs)

Pond 8P: DP6 - New Inf Basin Club

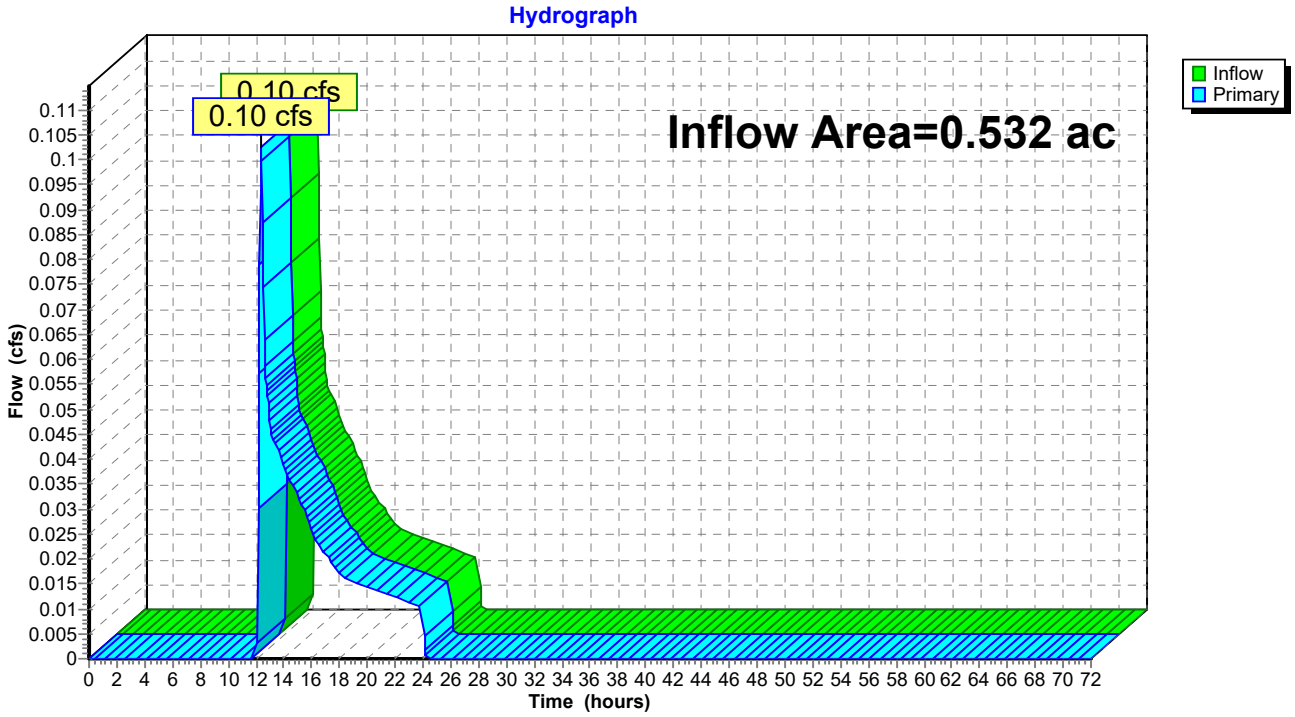


Summary for Link DP1: N'ly Property Line

Inflow Area = 0.532 ac, 0.00% Impervious, Inflow Depth = 0.54" for 100-yr event
Inflow = 0.10 cfs @ 12.38 hrs, Volume= 0.024 af
Primary = 0.10 cfs @ 12.38 hrs, Volume= 0.024 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP1: N'ly Property Line

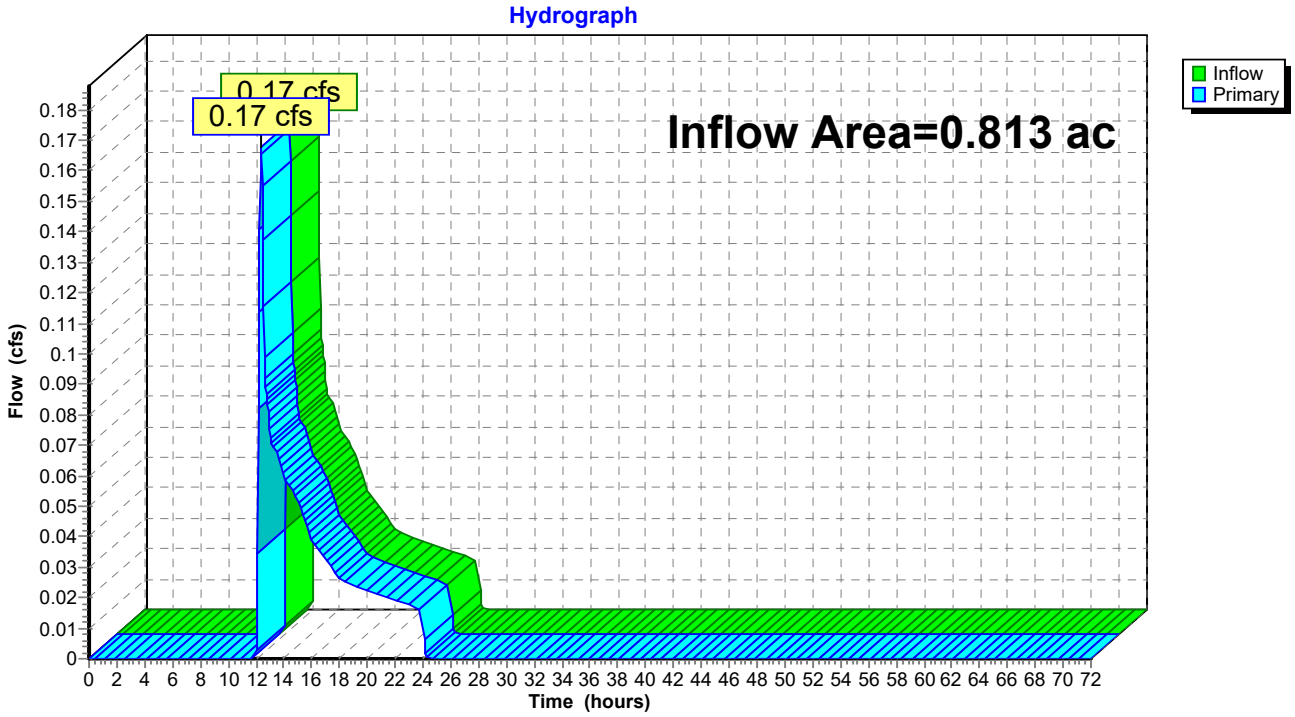


Summary for Link DP2: E'ly Property Line

Inflow Area = 0.813 ac, 0.00% Impervious, Inflow Depth = 0.56" for 100-yr event
Inflow = 0.17 cfs @ 12.37 hrs, Volume= 0.038 af
Primary = 0.17 cfs @ 12.37 hrs, Volume= 0.038 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP2: E'ly Property Line

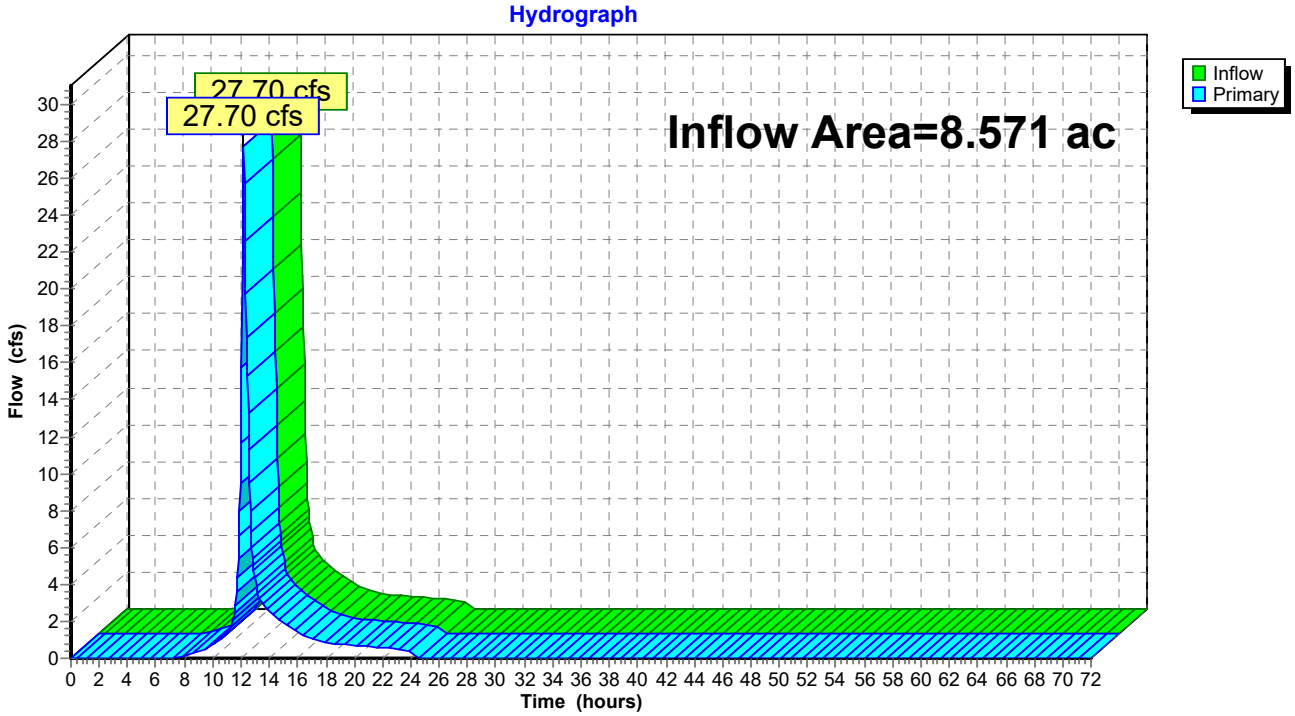


Summary for Link DP5: To Existing Basin

Inflow Area = 8.571 ac, 41.42% Impervious, Inflow Depth = 3.70" for 100-yr event
Inflow = 27.70 cfs @ 12.19 hrs, Volume= 2.645 af
Primary = 27.70 cfs @ 12.19 hrs, Volume= 2.645 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 4P : Drainage Basin/Easement

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Link DP5: To Existing Basin



APPENDIX B
SUPPORTING INFORMATION

ILLICIT DISCHARGE STATEMENT

Project: Multi-Family Development
Off Forest Ridge Road
Concord, MA 01742

Date: October 4, 2024

The stormwater management system proposed shall not be connected to the wastewater management system and shall not be contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease per Massachusetts DEP stormwater standard 10.

Engineer:
Allen & Major Associates, Inc.
10 Main Street
Lakeville, MA 02347

_____ _____
Philip Cordeiro, P.E. Signature

Owner:
Thoreau Residences, LLC
275 Forest Ridge Road
Concord, MA 01742

_____ _____
Owner Signature

SOIL INFORMATION

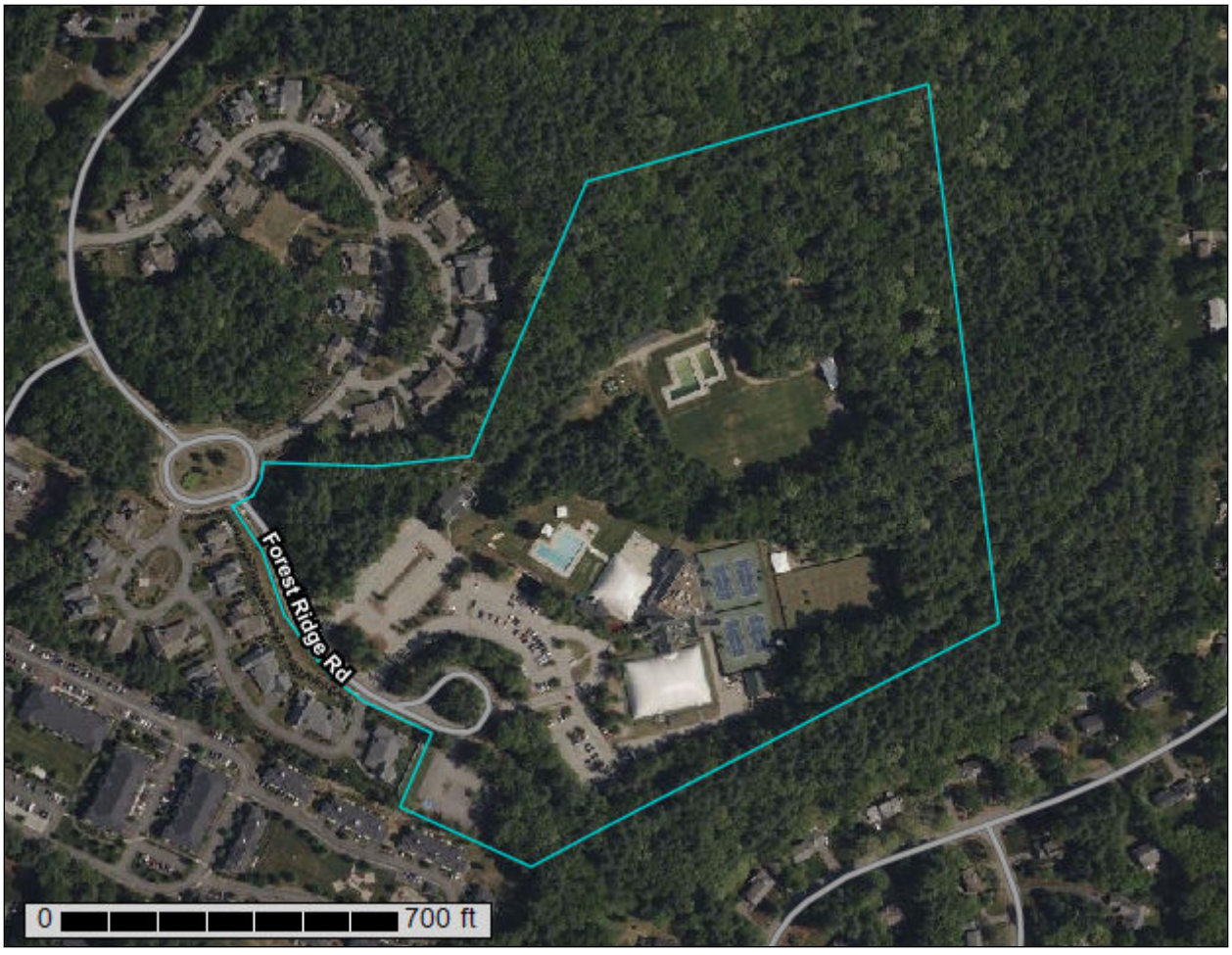
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Middlesex County, Massachusetts



June 7, 2024

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:3,770 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 23, Sep 12, 2023

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
253C	Hinckley loamy sand, 8 to 15 percent slopes	4.4	12.9%
253D	Hinckley loamy sand, 15 to 25 percent slopes	17.8	52.0%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	3.9	11.3%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	7.8	22.8%
255B	Windsor loamy sand, 3 to 8 percent slopes	0.2	0.4%
654	Udorthents, loamy	0.2	0.5%
Totals for Area of Interest		**34.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it

was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Middlesex County, Massachusetts

253C—Hinckley loamy sand, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2svm9
Elevation: 0 to 1,480 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Hinckley and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Outwash deltas, outwash terraces, moraines, eskers, kames, outwash plains, kame terraces
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 8 inches: loamy sand
Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A

Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Sudbury
Percent of map unit: 5 percent
Landform: Outwash deltas, moraines, outwash plains, kame terraces, outwash terraces
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: No

Merrimac
Percent of map unit: 5 percent
Landform: Kames, outwash plains, outwash terraces, moraines, eskers
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Windsor
Percent of map unit: 5 percent
Landform: Moraines, eskers, kames, outwash deltas, outwash terraces, outwash plains, kame terraces
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

253D—Hinckley loamy sand, 15 to 25 percent slopes

Map Unit Setting
National map unit symbol: 2svmc
Elevation: 0 to 1,460 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition
Hinckley and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Kames, kame terraces, outwash deltas, outwash terraces, moraines, eskers, outwash plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 8 inches: loamy sand
Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 8 percent
Landform: Eskers, outwash terraces, kames, outwash plains, moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Windsor

Percent of map unit: 5 percent

Landform: Kames, kame terraces, moraines, eskers, outwash deltas, outwash terraces, outwash plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Head slope, nose slope, side slope, crest, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Sudbury

Percent of map unit: 2 percent
Landform: Eskers, kame terraces, outwash deltas, moraines, outwash plains, outwash terraces
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Convex, concave, linear
Across-slope shape: Convex, concave, linear
Hydric soil rating: No

254A—Merrimac fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2tyqr
Elevation: 0 to 1,100 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Merrimac and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Outwash plains, outwash terraces, moraines, eskers, kames
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Crest, side slope, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand

2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Minor Components

Sudbury

Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Deltas, kames, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, crest, side slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Agawam

Percent of map unit: 3 percent
Landform: Stream terraces, outwash terraces, outwash plains, moraines, eskers, kames
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Windsor

Percent of map unit: 2 percent
Landform: Dunes, deltas, outwash terraces, outwash plains

Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread, riser
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Hydric soil rating: No

254B—Merrimac fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyqs
Elevation: 0 to 1,290 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Merrimac and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Outwash plains, outwash terraces, moraines, eskers, kames
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Crest, side slope, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent

Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Minor Components

Sudbury

Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Deltas, kames, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, crest, side slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Windsor

Percent of map unit: 3 percent
Landform: Outwash terraces, dunes, deltas, outwash plains
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Agawam

Percent of map unit: 2 percent
Landform: Outwash terraces, moraines, stream terraces, eskers, kames, outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

255B—Windsor loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2svkf
Elevation: 0 to 1,210 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Windsor and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Windsor

Setting

Landform: Outwash terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loose sandy glaciofluvial deposits derived from granite and/or schist and/or gneiss

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: loamy sand
Bw - 3 to 25 inches: loamy sand
C - 25 to 65 inches: sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Minor Components

Hinckley

Percent of map unit: 10 percent
Landform: Eskers
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Deerfield, loamy sand

Percent of map unit: 5 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F144AY027MA - Moist Sandy Outwash
Hydric soil rating: No

654—Udorthents, loamy

Map Unit Setting

National map unit symbol: vr1l
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents, loamy, and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Loamy

Setting

Parent material: Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till

Properties and qualities

Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Minor Components

Udorthents, sandy
Percent of map unit: 10 percent
Hydric soil rating: No

Udorthents, wet substratum
Percent of map unit: 5 percent
Hydric soil rating: Yes

Urban land
Percent of map unit: 5 percent
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

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TRAFFIC IMPACT REPORT

TRAFFIC IMPACT AND ACCESS STUDY

PROPOSED RESIDENTIAL DEVELOPMENT

275 Forest Ridge Road
Concord, Massachusetts

Prepared for:
WP East Aquisitions, LLC &
Pinebrook Group, LLC

October 2024

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

MDM.

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TRAFFIC IMPACT AND ACCESS STUDY

PROPOSED RESIDENTIAL DEVELOPMENT

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October 2024

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EXECUTIVE SUMMARY

MDM Transportation Consultants, Inc. (MDM) has prepared this Traffic Impact and Access Study (TIAS) for a proposed residential development to be located at 275 Forest Ridge Road in Concord, Massachusetts. The proximity of the Site in relation to the regional transportation system is shown in **Figure 1**. This report documents existing operational and safety-related characteristics of roadways serving the development Site, estimates future year operating characteristics of these roadways independent of the development, estimates development-related trip generation, and identifies incremental impacts of Site-related traffic.

This TIAS has been prepared in accordance with requirements and standards for the preparation of traffic studies as jointly issued by the Commonwealth of Massachusetts Executive Office of Energy & Environmental Affairs/ Massachusetts Department of Transportation (EEA/MassDOT).

E.1 PROJECT DESCRIPTION

The Site comprises approximately 13.1± acres located at 275 Forest Ridge Road in Concord, Massachusetts. The Site includes Camp Thoreau which includes, buildings, pools, cabins and recreational areas that are adjacent to the Thoreau Club which comprises recreational facilities that include but are not limited to a pool, athletic fields and courts and small ancillary buildings. Site access is currently provided via two driveways along the Thoreau Club driveway.

Under proposed conditions, 237 units of multifamily housing will be constructed across two buildings. Parking supply will comprise of 354± surface spaces and 40± garage bays. The project will include onsite amenities and a dog park. Access/egress to the Site will be consolidated to a single boulevard style full access driveway located along the existing Camp Thoreau and Thoreau Club driveways. As part of the project the Camp Thoreau buildings and uses will all be removed.

E.2 STUDY AREA

This TIAS evaluates transportation characteristics of Main Street and Forest Ridge Road and the primary study intersection of Main Street at Forest Ridge Road that provide a primary means of access to the Site as well as the secondary study intersections of the Forest Ridge Road cul-de-sac and Camp Thoreau/ Thoreau Club Driveways to quantifying area traffic patterns. The study area includes the following study intersections:

Primary Study Intersection:

- Main Street at Forest Ridge Road (Unsignalized)
- Forest Ridge Road at Black Birch Lane/Sweet Birch Lane (Traffic Circle)

Secondary Study Intersections:

- Thoreau Club Driveway at Camp Thoreau Driveway
- Thoreau Club Driveway Internal Intersections

E.3 SUMMARY OF ANALYSIS AND FINDINGS

Capacity analyses were conducted for the primary gateway study area intersection to quantify baseline and future year traffic operations with and without the development for the weekday morning and weekday evening peak hours. These time periods represent the highest activity periods of the proposed project and the adjacent roadway system.

The analyses presented in this TIAS are based on industry-standard trip rates and methodology published by the Institute of Transportation Engineers (ITE). Based on industry-standard trip rates the proposed residential development generates approximately 88 vehicle trips during the weekday morning peak hour (20 entering and 68 exiting) and 92 vehicle trips during the weekday evening peak hour (56 entering and 36 exiting). On a daily basis, the development would generate approximately 1,076 vehicle trips on a weekday. Journey to work data for the Town of Concord served as the primary basis for distribution for the residential trips to/from the Site.

Capacity analyses indicate that project will not result in any consequential changes in intersection operations compared to No-Build conditions. Under Build conditions, capacity analyses indicate that the unsignalized Forest Ridge Road approach to Route 62 will continue to operate below capacity at LOS D or better during the weekday morning and weekday evening peak hours. Mainline vehicular movements along Route 62 will continue to operate with minimal delay. Based on a review of Warrants 2 and 3, a traffic signal will continue to *not be warranted* at the Main Street intersection with Forest Ridge Road under conditions with the proposed residential development in place. Likewise, under Build conditions with the proposed residential project in place, the critical northbound and southbound approaches to the traffic circle will operate at 16% capacity during the peak hours. Accordingly, no off-site roadway improvements are warranted to accommodate the project.

E.4 PARKING DEMANDS

Industry standard peak parking rates published by ITE indicate a peak parking demand rate range of 1.23 to 1.45 spaces per unit for a multi-family housing complex. Empirical peak parking rates observed at area multi-family complexes range between 1.29 and 1.44 spaces per unit which is highly consistent with the ITE data. Based on the parking data reviewed, the projected peak parking demand is estimated at between 292 and 344 vehicles at full build-out and occupancy (237 units). As shown, the peak parking demand will be adequately accommodated by the proposed parking supply of 394± marked spaces. The data outlined in this memorandum supports the requested parking relief with respect to the requirements set forth by local zoning.

E.5 RECOMMENDATIONS

MDM finds Main Street and Forest Ridge Road roadways within the site vicinity can accommodate modest traffic increases of the project. Relative traffic increases for the proposed project represent an inconsequential change in operations compared to No-Build conditions and are immaterial to traffic operations along Main Street (Route 62). However, several mitigation actions are identified to support the project to ensure that site access meets applicable safety criteria, to enhance neighborhood walking/bicycling and to reduce dependency on single-occupant auto use. These include (a) access-related improvements, (b) pedestrian and bicycle accommodations and (c) TDM actions as summarized below.

Access/Egress Improvements

- *Driveway Design*. The final driveway alignment, widths and curb radii have been designed to accommodate the Town's largest fire apparatus (ladder truck) and single unit delivery trucks. The final driveway layout achieves a perpendicular alignment to the exiting Thoreau Club driveway. Signs and pavement markings that are compliant with the Manual on Uniform Traffic Control Devices (MUTCD) should be installed on the approach to the Thoreau Club driveway including a "STOP" sign (R2-1) and "STOP" line pavement markings.

- *Sight Line Triangles.* The available sight lines at the Thoreau Club driveway intersection with the proposed site driveway will satisfy the recommended sight line requirements from AASHTO. New plantings (shrubs, bushes) and structures (walls, fences, etc.) shall be designed, installed and maintained so as not to exceed 2.5-feet in height. Snow accumulation (windrows) located within sight triangle areas that exceed 3.5-feet in height or that would otherwise inhibit sight lines shall be promptly removed.

Pedestrian and Bicycle Accommodations

- *Pedestrian Connections*. The Site Plan incorporates sidewalks that connect the proposed buildings, on-site surface parking areas, amenity space, and the expansive existing sidewalk network that is already in place along Forest Ridge Road, Main Street, the existing Thoreau Club, and internal neighborhood roadways. As part of the project, ADA compliant crosswalks and markings should be provided at all internal crosswalks, and a crosswalk with ADA compliant ramps should be provided on the exiting Thoreau Club driveway to the north of the proposed site driveway.

- *Bicycle Amenities*. The Proponent should incorporate secure weather-protected bicycle racks to encourage and facilitate this mode of transportation to/from the Site by residents. Additional bike racks near the entranceways should also be provided to accommodate visitors.

Transportation Demand Management (TDM) Program

The Proponent is committed to reduce auto dependency by residents by implementing a TDM program. A preliminary list of potential TDM program elements may include the following, subject to refinement of the development program and further evaluation by the Proponent:

- *Vehicle Charging Stations.* Electric vehicle charging stations/outlets should be provided for resident use. The proponent should place additional conduit within the parking area to facilitate additional charging stations to meet actual demand over time.

- *Bicycle Facilities*. Provide bicycle parking, including secure weather protected racks for residents and conveniently located racks for visitors proximate to the building entrances.

- *On-Site Amenities.* The Proponent should provide on-site amenities that may include a fitness center for residents, mailroom, a club room, and other features for residents.

- *Pedestrian Infrastructure*. Sidewalk connections will be provided along primary pedestrian desire lines that connect building entrances with the surface parking areas, on-site amenities, and the existing sidewalk network in the area.

E.6 CONCLUSIONS

In summary, the proposed residential development will be accommodated well within capacity of Main Street, Forest Ridge Road and the primary intersection of Main Street at Forester Ridge Road with no discernable impact to traffic flow and at operating levels compared to No-Build conditions. The Forest Ridge Road will continue to operate well below capacity at LOS D or better during the peak hours. Accordingly, no off-site roadway improvements are warranted to accommodate the project. The available sight lines at the proposed site driveway intersection with the existing Thoreau Club driveway will exceed the recommended sight line requirements from AASHTO. The proposed parking supply while less than the zoning requirement will be adequate to accommodate the peak parking demands for the Site based on industry standard and empirical parking rates. Proposed access/egress improvements, pedestrian and bicycle accommodations, and TDM program as outlined in the *Conclusions and Recommendations* will establish a framework of minimizing Site traffic impacts by encouraging non-motorized travel modes and pedestrian accommodation that is compatible with other projects in the area.

1.0 INTRODUCTION

MDM Transportation Consultants, Inc. (MDM) has prepared this Traffic Impact and Access Study (TIAS) for a proposed residential development to be located at 275 Forest Ridge Road in Concord, Massachusetts. The proximity of the Site in relation to the regional transportation system is shown in **Figure 1**. This report documents existing operational and safety-related characteristics of roadways serving the development Site, estimates future year operating characteristics of these roadways independent of the development, estimates development-related trip generation, and identifies incremental impacts of Site-related traffic.

This TIAS has been prepared in accordance with requirements and standards for the preparation of traffic studies as jointly issued by the Commonwealth of Massachusetts Executive Office of Energy & Environmental Affairs/ Massachusetts Department of Transportation (EEA/MassDOT).

1.1 PROPOSED DEVELOPMENT

The Site comprises approximately 13.1± acres located at 275 Forest Ridge Road in Concord, Massachusetts. The Site includes Camp Thoreau which includes, buildings, pools, cabins and recreational areas that are adjacent to the Thoreau Club which comprises recreational facilities that include but are not limited to a pool, athletic fields and courts and small ancillary buildings. Site access is currently provided via two driveways along the Thoreau Club driveway.

Under proposed conditions, 237 units of multifamily housing will be constructed across two buildings. Parking supply will comprise of 354± surface spaces and 40± garage bays. The project will include onsite amenities and a dog park. Access/egress to the Site will be consolidated to a single boulevard style full access driveway located along the existing Thoreau Club driveway. As part of the project the Camp Thoreau buildings and uses will all be removed. A preliminary site plan from Allen & Major Associates, Inc. is shown in **Figure 2**.

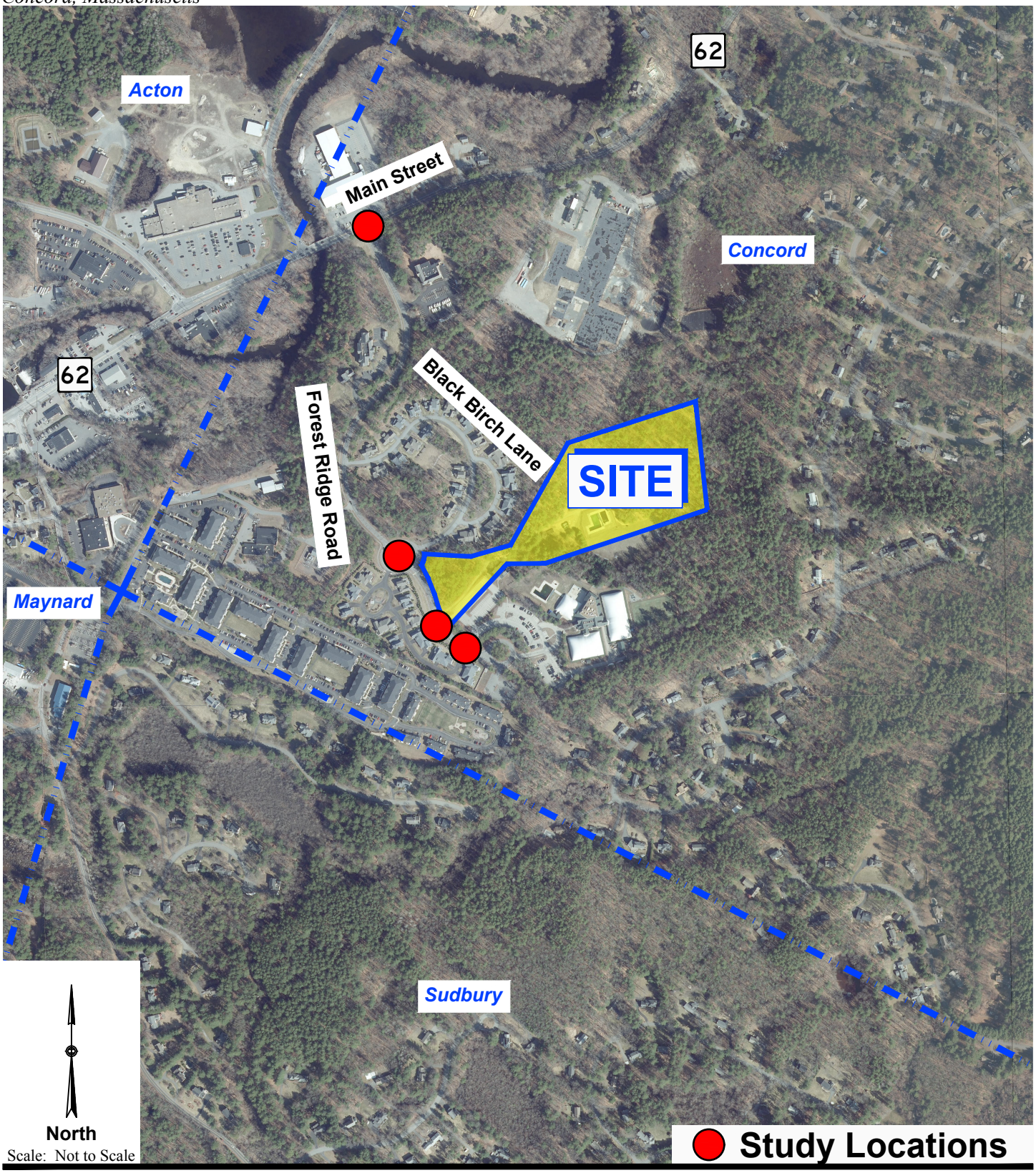
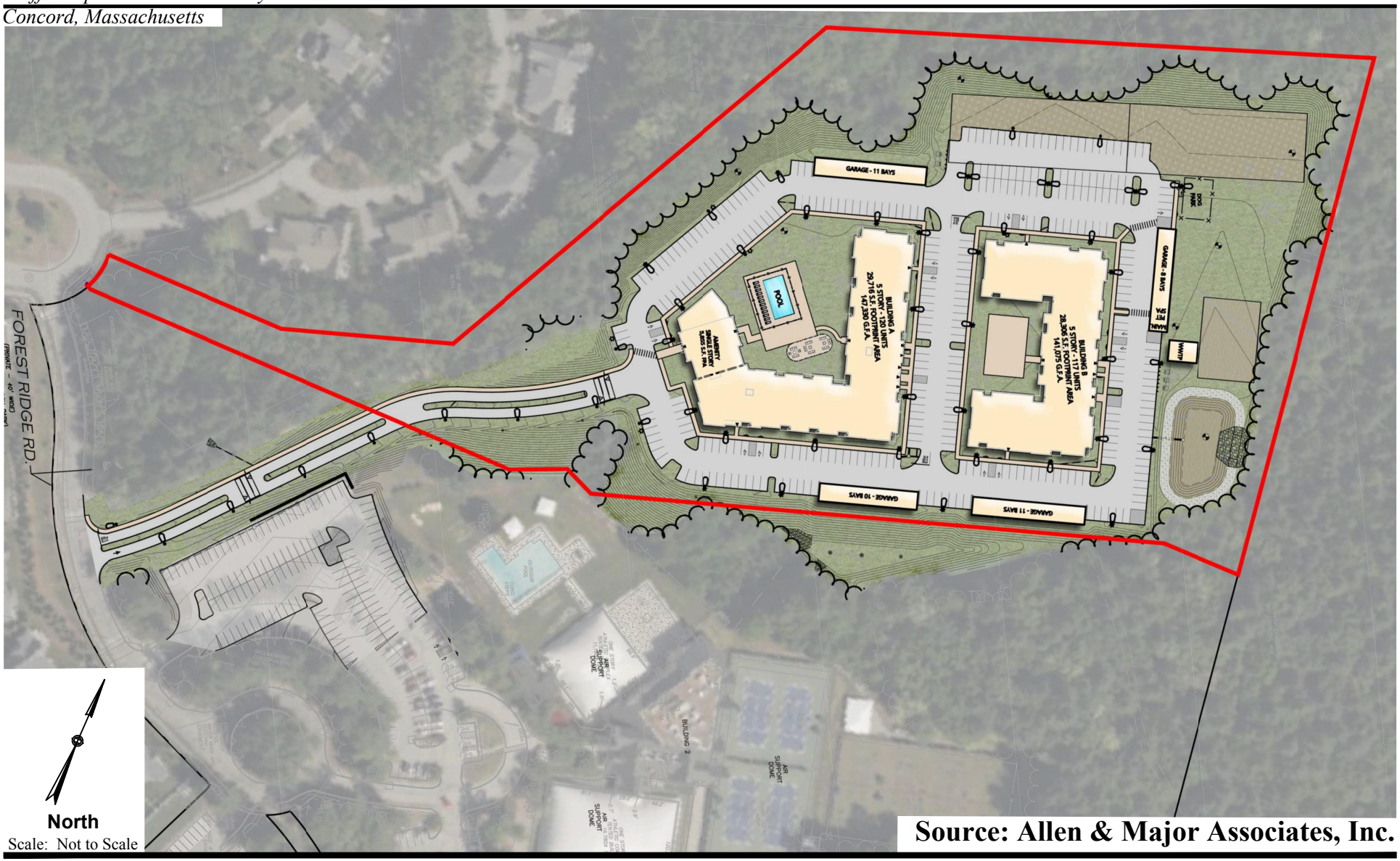


Figure 1

Site Location

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

Date: October 2024
Dwg No. 1391 TIAS.dwg
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Source: Allen & Major Associates, Inc.

Figure 2

Preliminary Site Layout

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

Date: October 2024
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1.2 STUDY METHODOLOGY

This transportation impact and access evaluation is conducted in accordance with EEA/MassDOT guidelines and consists of several steps. The first step documents existing conditions in the transportation study area including an inventory of roadway geometry, observed traffic volumes, and safety characteristics. Next, future year traffic conditions are forecasted, taking into account other planned area developments, normal area growth, and development-related traffic increases. The third step quantifies operating characteristics of the study intersections. Specific attention is given to the incremental impacts of the proposed development. Finally, improvements are identified to address specific development-related requirements as needed.

1.3 STUDY AREA

This TIAS evaluates transportation characteristics of Main Street and Forest Ridge Road and the primary study intersection of Main Street at Forest Ridge Road that provide a primary means of access to the Site as well as the secondary study intersections of Forest Ridge Road cul-de-sac and Camp Thoreau/ Thoreau Club Driveways to quantifying area traffic patterns. The study area includes the following study intersections:

Primary Study Intersection:

- Main Street at Forest Ridge Road (Unsignalized)
- Forest Ridge Road at Black Birch Lane/Sweet Birch Lane (Traffic Circle)

Secondary Study Intersections:

- Thoreau Club Driveway at Camp Thoreau Driveway
- Thoreau Club Driveway Internal Intersections

2.0 EXISTING CONDITIONS

In order to provide a basis for quantifying the transportation impacts of the development, the existing roadway system and the existing traffic operations of study area roadways were reviewed. This section describes the existing traffic characteristics and operations of roadways and intersections within the study area. Specifically, this section presents an overview of the traffic data collection program, existing traffic volumes, and safety issues.

2.1 STUDY AREA ROADWAY NETWORK

The study area roadways and intersection are described briefly in this section. A general description of the physical roadway and intersection features is provided. The study area includes roadways under local jurisdiction. The study area and intersections are depicted in **Figure 1**.

2.1.1 Roadways

Main Street (Route 62)

Main Street (Route 62) is classified by MassDOT as an Urban Principal Arterial roadway under local (town) jurisdiction. This roadway generally runs in a northeast-southwest direction with the study area and provides a connection between route 2 and the center of Concord to the east and the center of Maynard to the west. The roadway provides one lane of travel in the southwest and northeast directions, separated by a double yellow centerline, with additional turn lanes at its major intersections. The regulatory speed limit along Route 62 in the study area is 35 mph. Land use along Route 62 include residential homes as well as commercial properties including Stop and Shop, Valley Sports Aena and industrial land uses.

Forest Ridge Road

Forest Ridge Road is classified as a local roadway under private jurisdiction according to MassDOT. Forest Ridge Road generally runs in a north-south direction connecting to Route 62 to the north and ends in a traffic circle at the northern end of the Thoreau Club driveway. Land use along Forest Ridge Road includes a variety of residential land uses, the Thoreau Club, and Camp Thoreau properties.

2.1.2 Intersections

Main Street (Route 62) at Forest Ridge Road

Main Street (Route 62) meets Forest Ridge Road to form a three-legged, unsignalized intersection under local jurisdiction. The Route 62 eastbound approach to the intersection includes one shared through/right turn lane. The Route 62 westbound approach is marked as a wide single lane approach to allow through movements to by-pass left turn movements. The Forest Ridge Road northbound approach to Route 62 includes a right-turn lane and one left-turn lane under "STOP" control. Two driveways for the Valley Sports Arena are located approximately 100± ft immediately adjacent to the east and west of the intersection along Main Street. Land uses at the intersection include undeveloped land and the Valley Sports Areana.

Forest Ridge Road at Sweet Birch Lane/ Black Birch Lane/ The Thoreau Club Driveway

Forest Ridge Road meets Sweet Birch Lane/ Black Birch Lane/ The Thoreau Club Driveway to form a four-legged, unsignalized traffic circle intersection under private jurisdiction. The Forest Ridge Road/ The Thoreau Club Driveway approaches include single travel lanes under "Yield" control. The Sweet Birch Lane and Black Birch Lane include single travel lane approaches to the traffic circle under "Stop" sign control. The traffic circle includes a single counterclockwise circulating lane. Land uses near the intersection include residential homes and undeveloped land.

2.2 BASELINE TRAFFIC VOLUMES

Traffic-volume data used in this study were obtained by mechanical and manual methods in October 2023 and October 2024. Automatic traffic recorder counts (ATRs) were conducted along Main Street and Forest Ridge Road, while manual turning movement counts (TMCs) were conducted at the existing study intersections. Traffic data were collected during the weekday morning (7:00 to 9:00 AM) and weekday evening (4:00 to 6:00 PM) peak periods. These hours represent the combination of busiest activity periods of the Site and adjacent roadway network.

2.2.1 Daily Traffic

Daily traffic volumes along Main Street to the west of Forest Ridge Road was collected in October 2024 and along Forest Ridge Road to the south of Main Street was collected in October 2023 and are summarized in **Table 1**. Detailed traffic count data is included in the **Appendix**.

TABLE 1
BASELINE TRAFFIC VOLUME SUMMARY

Time Period	Daily Volume (vpd)[1]	Percent Daily Traffic[2]	Peak Hour Volume (vph)[3]	Peak Flow Direction[4]	Peak Hour Directional Volume (vph)
Main Street (Route 62) west of Forest Ridge Road					
Weekday Morning Peak Hour	12,860	8%	1,026	70% EB	715
Weekday Evening Peak Hour	12,860	8%	1,007	56% WB	567
Forest Ridge Road					
Weekday Morning Peak Hour	1,990	9%	184	65% SB	120
Weekday Evening Peak Hour	1,990	8%	152	53% SB	80

[1]Two-way daily traffic expressed in vehicles per day without seasonal adjustment.
[2]The percent of daily traffic that occurs during the peak hour.
[3]Two-way peak-hour volume expressed in vehicles per hour.
[4]NB = Northbound, SB = Southbound, EB = Eastbound, WB = Westbound

As summarized in **Table 1**,

- *Main Street (Route 62.* The daily traffic volume on Main Street to the west of Forest Ridge Road was approximately 12,860 vehicles per day (vpd) during a typical weekday. Peak hour traffic flow on Main Street ranges from approximately 1,007 to 1,026 vehicles per hour (vph) which represents 8 percent of daily traffic flow. The traffic flow is skewed in the eastbound direction during the weekday morning peak hour and westbound during the weekday evening peak hour which is consistent with commuter traffic in the area.

- *Forest Ridge Road.* The daily traffic volume on Forest Ridge Road to the south of Main Street was approximately 1,990 vehicles per day (vpd) during a typical weekday. Peak hour traffic flow on Forest Ridge Road ranges from approximately 152 to 184 vehicles per hour (vph) which represents 8 to 9 percent of daily traffic flow on Forest Ridge Road.

2.2.2 Peak-Hour Traffic Volumes

Peak-hour traffic volumes at the study area intersections were collected in October 2023 and October 2024. Comparison of the traffic count data maintained by MassDOT for nearby permanent count stations indicates that October is representative of above-average volume conditions (approximately 5 percent above average month conditions). As a conservative measure, no adjustment (decrease) was made to the traffic counts to represent average conditions. To present 2024 Baseline conditions the 2023 turning movement counts were adjusted by 0.5 percent for one-year and then additional trips to/from Main Street were added through project area for additional activity at the Thoreau Club. The 2024 Baseline weekday morning and weekday evening peak hour traffic volume networks for study intersections are depicted in **Figure 3** and **Figure 4**. Permanent count station data, seasonal adjustment data, and expanded traffic volume networks are provided in the **Appendix**.

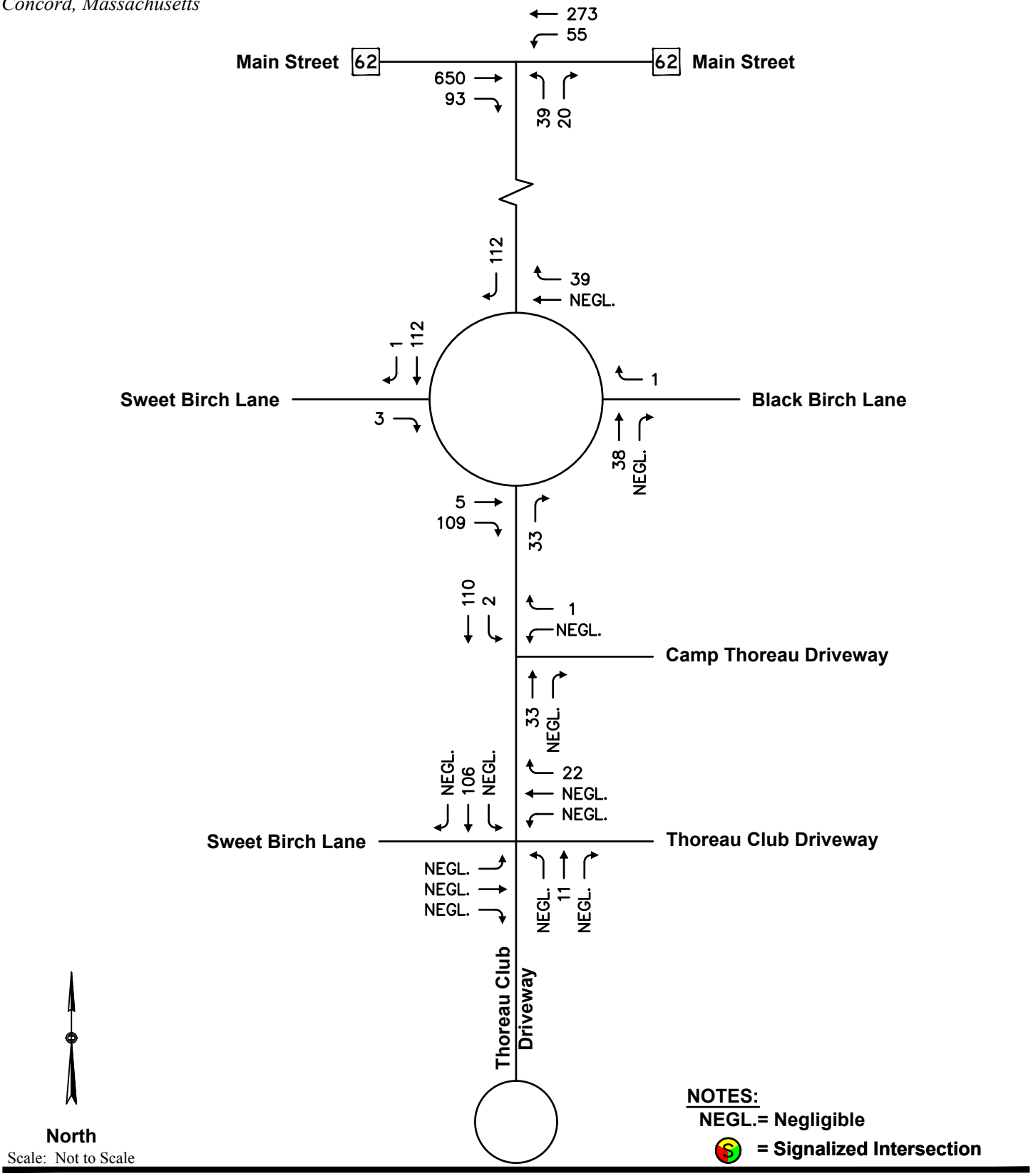


Figure 3

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

2024 Baseline Conditions
Weekday Morning Peak Hour Volumes

Date: October 2024
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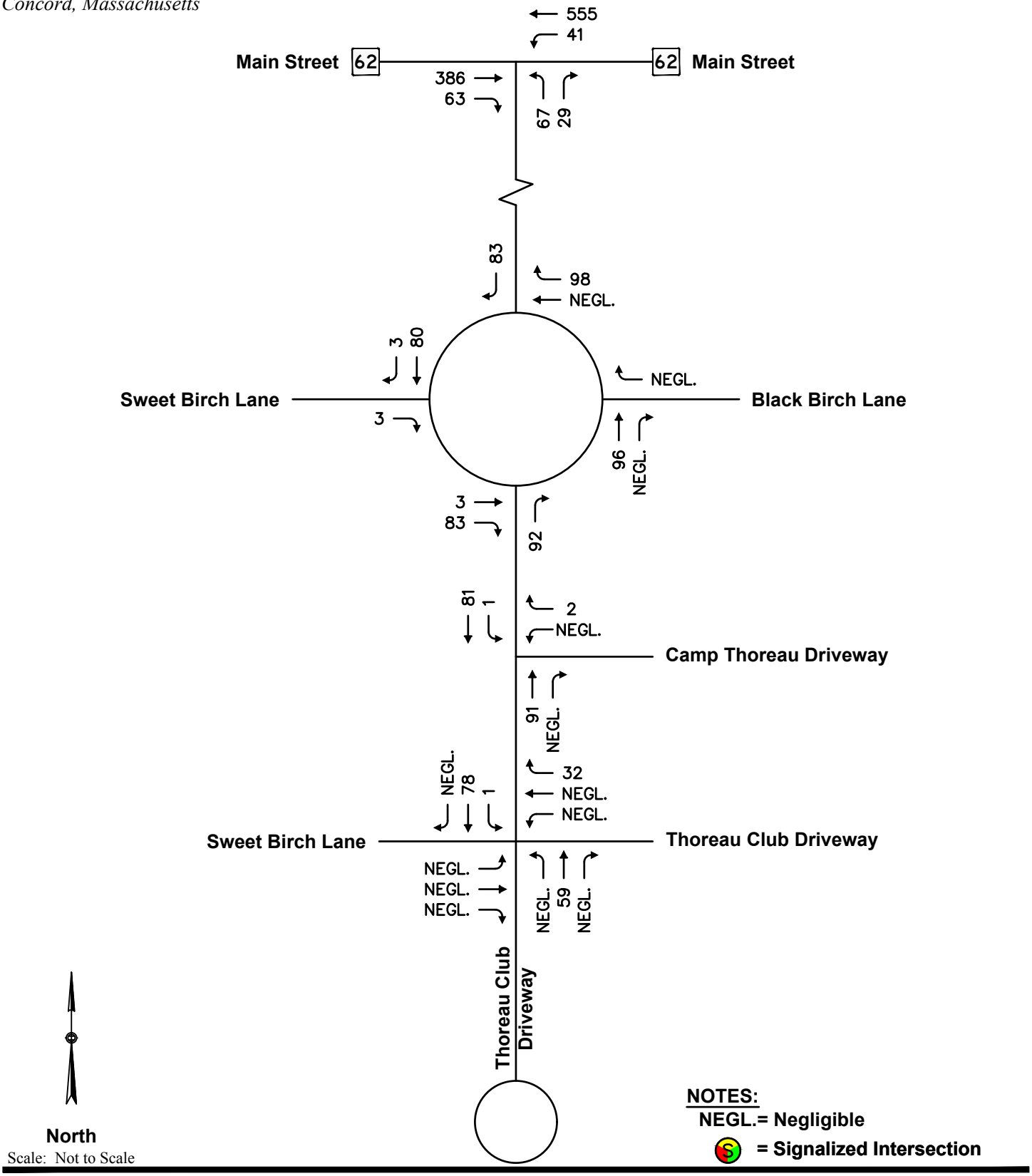


Figure 4

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

2024 Baseline Conditions
Weekday Evening Peak Hour Volumes

Date: October 2024
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2.4 SAFETY

In order to identify crash trends and safety characteristics for the study intersections, crash data were obtained from MassDOT for the Town of Concord for the five-year period of 2019 through 2023. Crash data for the study intersections is summarized in **Table 2** with detailed data provided in the **Appendix.**

Crash rates were calculated for the study area intersections as reported in **Table 2**. This rate quantifies the number of crashes per million entering vehicles. MassDOT has determined the official District 4 (which includes the Town of Concord) crash rate to be 0.57 for unsignalized intersections. This rate represents MassDOT's "average" crash experience for District 4 communities and serves as a basis for comparing reported crash rates for the study intersections. Where calculated crash rates notably exceed the district average, some form of safety countermeasures may be warranted. A review of Highway Safety Improvement Project (HSIP) locations was also conducted.

TABLE 2
INTERSECTION CRASH SUMMARY
2019 THROUGH 2023[1]

Data Category	STUDY LOCATION Main Street (Route 62) at Forest Ridge Road
Traffic Control	Unsignalized
Crash Rate[2]	**0.24**
MassDOT Avg. Rate[3]	0.57
Year:	
2019	2
2020	0
2021	1
2022	1
2023	2
Total	6
Type:	
Angle	1
Rear-End	2
Head-On	1
Sideswipe	0
Single Vehicle	2
Other/Unknown	0
Severity:	
P. Damage Only	6
Personal Injury	0
Fatality	0
Other/Unknown	0
Conditions:	
Dry	4
Wet	1
Snow/Ice	1
Other/Unknown	0
Time:	
7:00 to 9:00 AM	0
4:00 to 6:00 PM	3
Rest of Day	3

[1] Source: MassDOT Crash Database
[2] Crashes per million entering vehicles
[3] District 4 Average Crash Rate

As summarized in **Table 2**,

- *Main Street at Forest Ridge Road.* Six (6) crashes were reported for the Main Street unsignalized intersection with Forest Ridge Road. The resulting crash rate of 0.24 is lower than the District 4 average of 0.57. The reported crashes included one (1) angle/sideswipe type collision, two (2) rear-end type collisions, one (1) head-on type collision and two (2) single vehicle collisions. All (100%) of the crashes resulted in property damage only, generally indicative of low-speed crashes. No fatalities or pedestrian-related incidents were reported during the study period. A review of the data indicates that there were also no crashes at the adjacent Valley Sport Area driveways during the study period.

- *Forest Ridge Road – Traffic Circle.* No crashes were reported at the Forest Ridge Road traffic circle intersections with Sweet Birch Lane and Black Birch Lane during the study period.

- *Thoreau Camp/ The Thoreau Club internal intersections.* No crashes were reported at the internal intersections with the Thoreau Camp or The Thoreau Club driveways during the study period.

In summary, based on extensive review of MassDOT crash data, the study intersections, experienced crash rates below the District 4 averages and none of the intersection are listed as high crash (HSIP) locations; therefore, no immediate safety countermeasures are warranted based on the crash history at the study intersections.

2.5 SIGHT LINE ANALYSIS

An evaluation of sight lines was conducted at the Site driveway location to ensure that minimum recommended sight lines are available at the proposed Site driveway intersection with the existing Thoreau Club driveway. The evaluation documents existing sight lines for vehicles as they relate to the Thoreau Club driveway comparison to recommended guidelines.

The American Association of State Highway and Transportation Officials' (AASHTO) standards[1] reference two types of sight distance which are relevant at the Site driveway intersection: stopping sight distance (SSD) and intersection sight distance (ISD). Sight lines for critical vehicle movements at the Site driveway intersection were compared to minimum SSD and ISD recommendations for the travel speeds in the Site vicinity.

[1] *A policy on Geometric Design of Highways and Streets*, American Association of State Highway and Transportation Officials (AASHTO), 2018.

Stopping Sight Distance

Sight distance is the length of roadway visible to the motorist to a fixed object. The minimum sight distance available on a roadway should be sufficiently long enough to enable a below-average operator, traveling at or near a regulatory speed limit, to stop safely before reaching a stationary object in its path, in this case, a vehicle exiting onto the existing Thoreau Club driveway. The SSD criteria are defined by AASHTO based on design and operating speeds, anticipated driver behavior and vehicle performance, as well as physical roadway conditions. SSD includes the length of roadway traveled during the perception and reaction time of a driver to an object, and the distance traveled during brake application on wet level pavement. Adjustment factors are applied to account for roadway grades when applicable.

SSD was estimated in the field using AASHTO standards for driver's eye (3.5 feet) and object height equivalent to the taillight height of a passenger car (2.0 feet) for the northbound and southbound Thoreau Club driveway approaches to the Site driveway. **Table 3** presents a summary of the available SSD as they relate to Main Street and AASHTO's recommended SSD.

TABLE 3
STOPPING SIGHT DISTANCE SUMMARY
THOREAU CLUB DRIVEWAY APPROACHES TO PROPOSED SITE DRIVEWAY

Approach/ Travel Direction	Available SSD	AASHTO Recommended[1]	
		Regulatory Speed Limit[2]	Criteria Satisfied
Northbound	275± Feet	80 Feet	Yes
Southbound	350± Feet	80 Feet	Yes

[1]Recommended sight distance based on AASHTO, A Policy on Geometric Design of Highways and Streets. Based on driver height of eye of 3.5 feet to object height of 2.0 feet with adjustments for average grade within the sight line area.
[2]Based on 15 mph turning speed from cul-de-sac.

As summarized in **Table 3** analysis results indicate that the available sight lines on the site driveway approach to the Thoreau Club driveway exceed AASHTO's recommended SSD criteria for both travel directions along the Thoreau Club driveway based on a 15-mph turning speed from the adjacent cul-de-sac and Traffic Circle.

Intersection Sight Distance

Clear sight lines provide sufficient sight distance for a stopped driver on a minor-road approach to depart from the intersection and enter or cross the major road. As stated under AASHTO's Intersection Sight Distance (ISD) considerations, "*…If the available sight distance for an entering …vehicle is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient sight distance to avoid collisions…To enhance traffic operations, intersection sight distances that exceed stopping sight distances are desirable along the major road*." AASHTO's ISD criteria are defined into several "cases". For the unsignalized Site driveway location, which will operate under STOP sign control, the ISD in question relates to the ability to turn left or turn right from the proposed driveway at the Thoreau Club driveway.

Available ISD was estimated in the field using AASHTO standards for driver's eye (3.5 feet), object height (3.5 feet) and decision point (8 to 10 feet from the edge of the travel way) for the northbound and southbound directions along the existing Thoreau Club driveway. **Table 4** presents a summary of the available ISD for the departure from the Site driveway and AASHTO's minimum recommended ISD.

TABLE 4
INTERSECTION SIGHT DISTANCE SUMMARY
SITE DRIVEWAY DEPARTURES TO THE THOREAU CLUB DRIVEWAY

		AASHTO Minimum[1]	AASHTO Ideal[1]
View Direction	Available ISD	Regulatory Speed Limit[2]	Regulatory Speed Limit[2]
Looking North	350± Feet	80 Feet	170 Feet
Looking South	275± Feet	80 Feet	145 Feet

[1]Recommended sight distance based on AASHTO, A Policy on Geometric Design of Highways and Streets. Based on driver height of eye of 3.5 feet and an object height of 3.5 feet. Minimum value as noted represents SSD per AASHTO guidance.
[2]Based on 15 mph turning speed from cul-de-sac.

The results of the ISD analysis presented in **Table 4** indicate that the available sight lines looking north and south from the proposed site driveway onto the existing Thoreau Club driveway exceed the recommended minimum and ideal sight line requirements from AASHTO for the regulatory speeds along the Thoreau Club driveway. MDM recommends new plantings (shrubs, bushes) and structures (walls, fences, etc.) should be designed, installed and maintained so as not to exceed 2.5-feet in height. Snow accumulation (windrows) located within sight triangle areas that exceed 3.5-feet in height or that would otherwise inhibit sight lines shall be promptly removed.

3.0 FUTURE CONDITIONS

Evaluation of the proposed development impacts requires the establishment of a future baseline analysis condition. This section estimates future roadway and traffic conditions with and without the proposed development. To be consistent with EEA/MassDOT guidelines, a seven-year planning horizon was selected.

To determine the impact of Site-generated traffic volumes on the roadway network under future conditions, baseline traffic volumes in the study area were projected to a future year condition. Traffic volumes on the roadway network at that time, in the absence of the development (that is, the No-Build condition), would include existing traffic, new traffic due to general background traffic growth, and traffic related to specific development by others that is currently under review at the local and/or state level. Consideration of these factors resulted in the development of No-Build traffic volumes. Anticipated Site-generated traffic volumes were then superimposed upon these No-Build traffic-flow networks to develop the future Build condition.

The following sections provide an overview of future No-Build traffic volumes and projected Build traffic volumes.

3.1 BACKGROUND TRAFFIC GROWTH

Background traffic includes demand generated by other planned developments in the area as well as demand increases caused by external factors. External factors are general increases in traffic not attributable to a specific development and are determined using historical data.

3.1.1 Historical Area Growth

Nearby permanent count station data published by MassDOT indicates a 0.3 percent per year growth rate. For purposes of this evaluation, a 0.5 percent compounded annual growth rate was used (3.6 percent increase over a 7-year horizon). This growth rate is slightly higher than historic rates and is also expected to account for any small fluctuation in hourly traffic as may occur from time to time in the study area and traffic associated with other potential small developments or vacancies in the area. MassDOT permanent count station data and background growth calculations are provided in the **Appendix.**

3.1.2 Background Development-Related Growth

Development of future No-Build traffic volumes also considers traffic generated from specific area developments. Based on review of available project databases in the Town of Concord, Town of Maynard, Town of Acton and review of Massachusetts Environmental Policy Act (MEPA) files there *is one* project in the immediate area that *may increase* traffic volumes in the project study vicinity. This evaluation included consideration of traffic for the NOVO Riverside Commons residential project at 292 & 294 Baker Avenue; however, review of the traffic study for this project indicates that trip increases in the study location (Main Street at Forest Ridge Road) are accounted for under general background growth assumptions. Additionally, the Site-specific development project in the area that may increase baseline traffic at the study intersections as follows:

- *Apartments at Powder Mill.* This project consists of the development of a 230 units residential apartment building to be located along Route 62 in Acton, MA. Trips were estimated based on ITE data and distributed onto the roadway network based on Journey to Work data. Site-specific trip tracings for the project provided in the **Appendix**.

3.2 NO-BUILD TRAFFIC VOLUMES

To account for future traffic growth along the corridor, the 0.5 percent annual growth rate was applied to Baseline traffic volumes over a seven-year period and estimated traffic from the development background project listed above. Future 2031 No-Build traffic volumes are displayed in **Figure 5** and **Figure 6**.

3.3 SITE-GENERATED TRAFFIC

The methodology utilized to estimate the future trip-generation characteristics of the proposed development are summarized below. In accordance with EEA/MassDOT guidelines, the traffic generated by the proposed development was estimated using trip rates published in ITE's *Trip Generation* for the Land Use Code (LUC) based on trip rates for Multifamily House (Mid-Rise) (LUC 221).

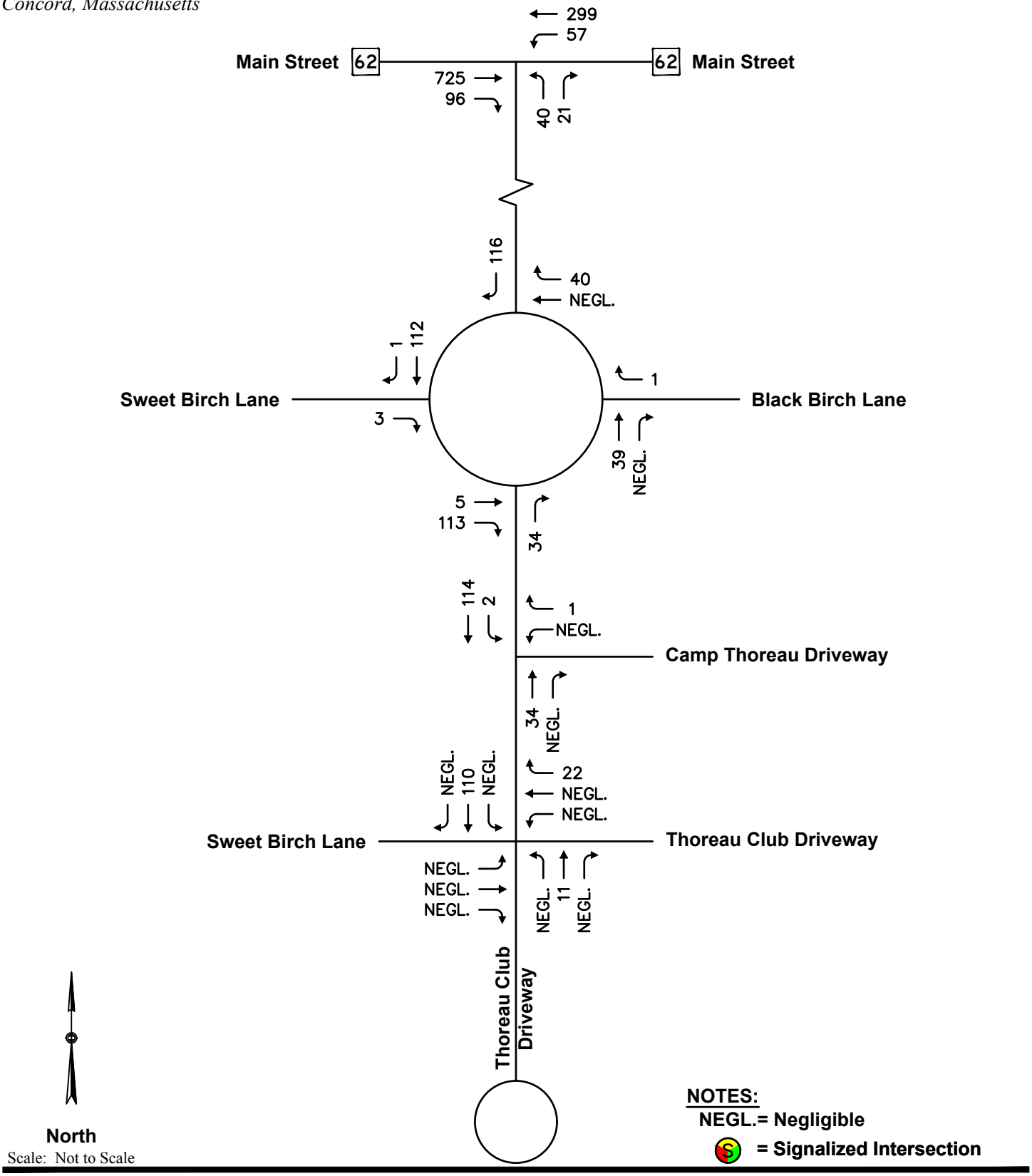


Figure 5

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

2031 No-Build Conditions
Weekday Morning Peak Hour Volumes

Date: October 2024
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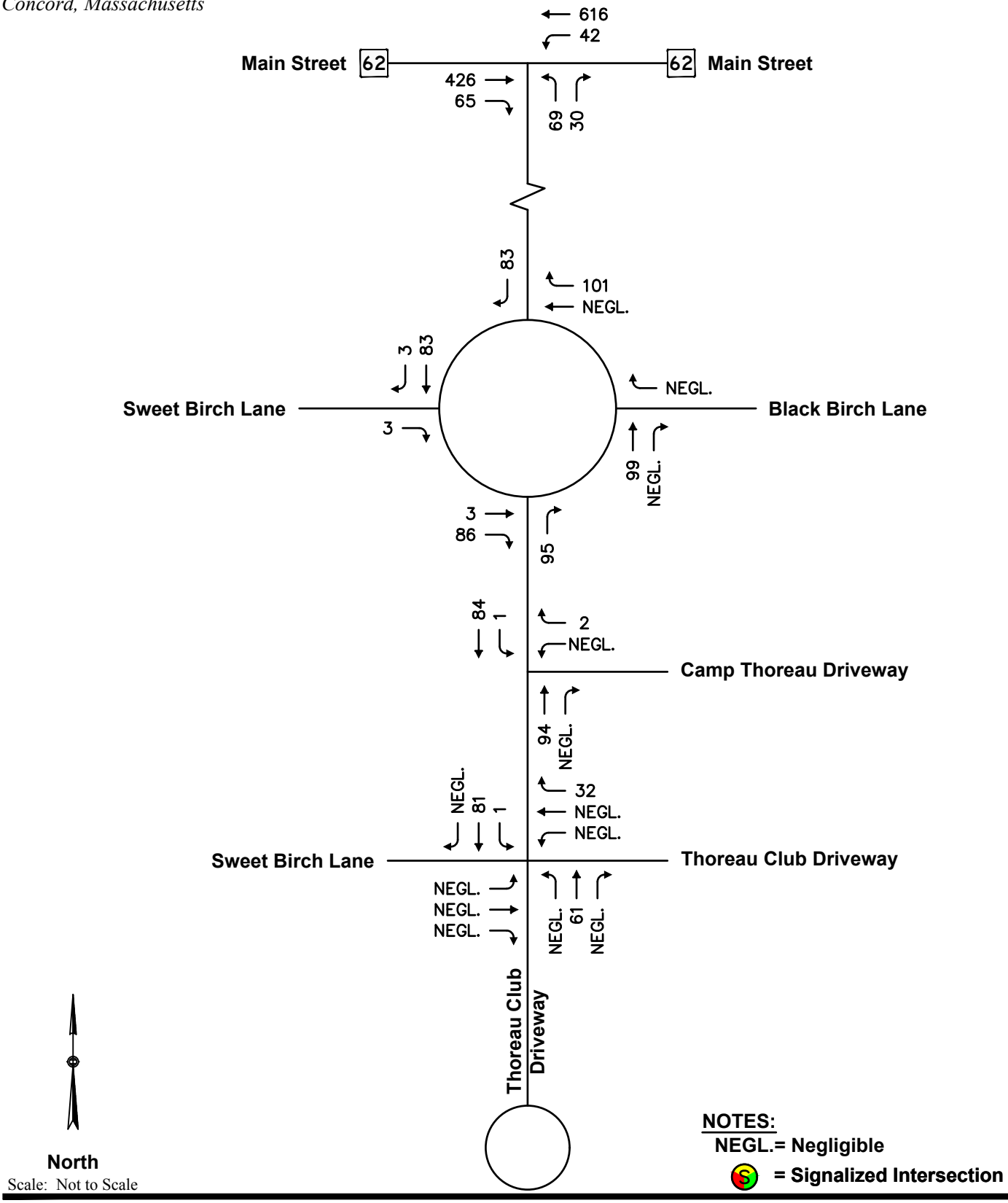


Figure 6

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2031 No-Build Conditions
Weekday Evening Peak Hour Volumes

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Table 5 presents the trip-generation estimates for the proposed development based on ITE methodology and EEA/MassDOT guidelines without no adjustments for alternative transportation modes.

TABLE 5
TRIP-GENERATION SUMMARY[1]

Peak Hour/Direction	Site Trips[1]
Weekday Morning Peak Hour:	
Entering	20
Exiting	68
Total	88
Weekday Evening Peak Hour:	
Entering	56
Exiting	36
Total	92
Weekday Daily (24 hours)	1,076

Source: ITE *Trip Generation*, 11th Edition; 2021.
[1]ITE LUC 237 – Multifamily Housing (Mid-Rise) to 237 units.

As summarized in **Table 5**, based on industry-standard trip rates, the proposed residential development generates approximately 88 vehicle trips during the weekday morning peak hour (20 entering and 68 exiting) and 92 vehicle trips during the weekday evening peak hour (56 entering and 36 exiting). On a daily basis, the development would generate approximately 1,076 vehicle trips on a weekday.

3.4 TRIP DISTRIBUTION & ASSIGNMENT

The directional distribution of development-generated trips on the roadway network is a function of a number of variables including area population centers and the efficiency of these roadways leading to the Site. Journey to work census data serve as the primary basis for determining the trip distribution pattern for the proposed residential development, which is presented in **Figure 7**. Trip distribution calculations for the Site are provided in the **Appendix**.

Development-related trips for the Site were assigned to the roadway network using the ITE trip-generation estimates shown in **Table 5** and the distribution patterns presented in **Figure 7**. New development-related trips at each intersection for the weekday morning and weekday evening peak hours are quantified in **Figure 8** and **Figure 9**, respectively.

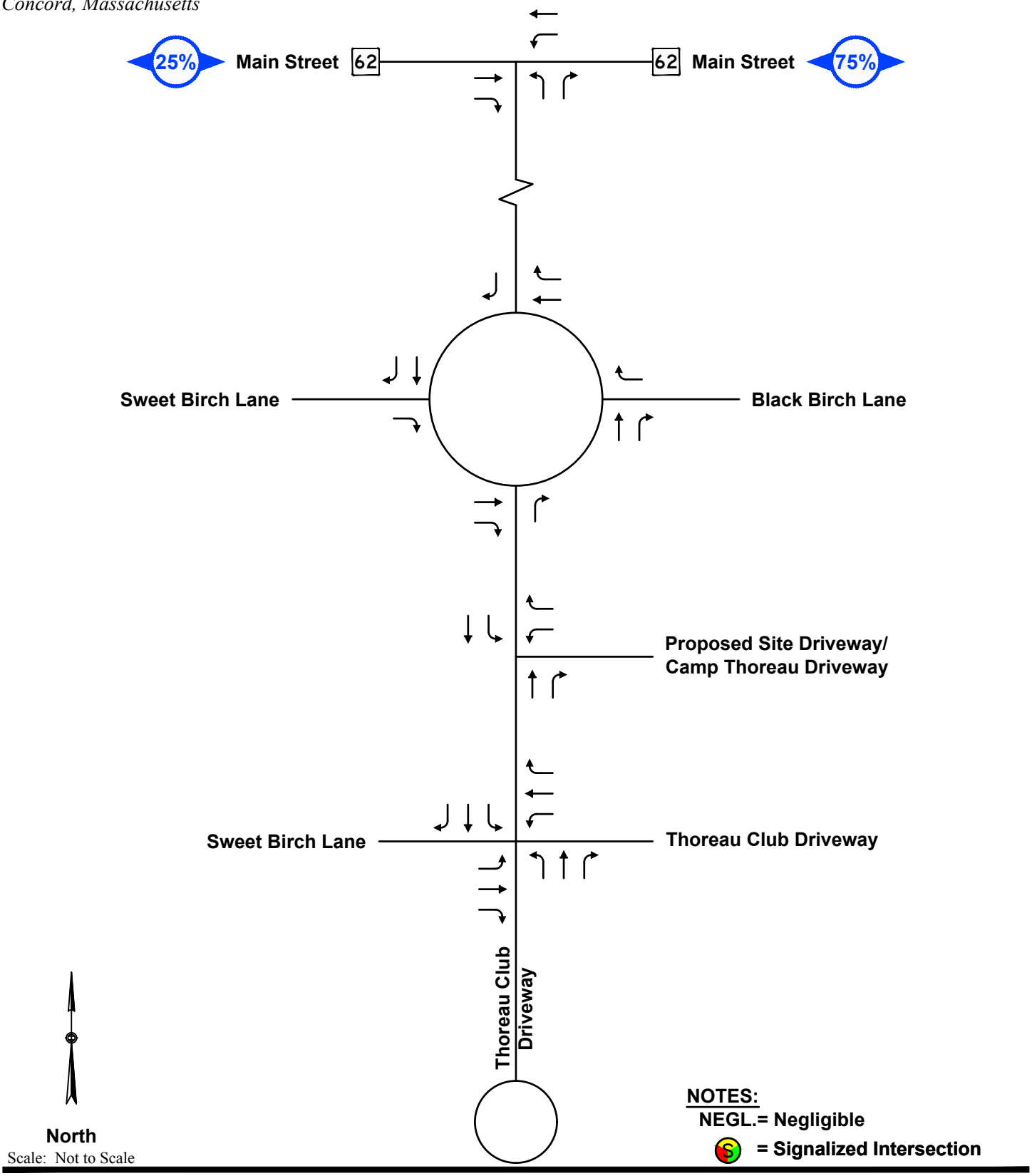


Figure 7

Trip Distribution

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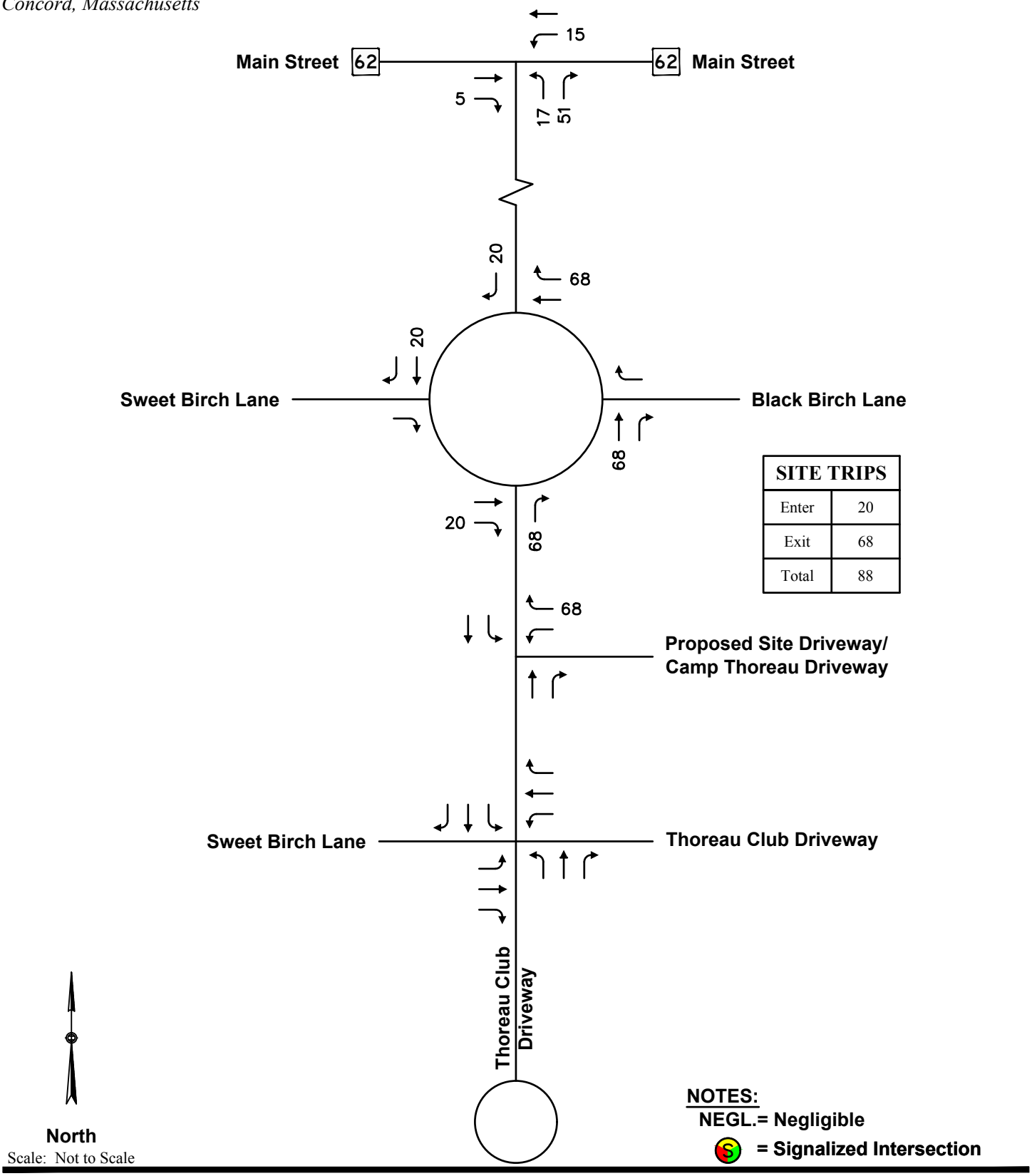


Figure 8

Site Generated Trips
Weekday Morning Peak Hour Volumes

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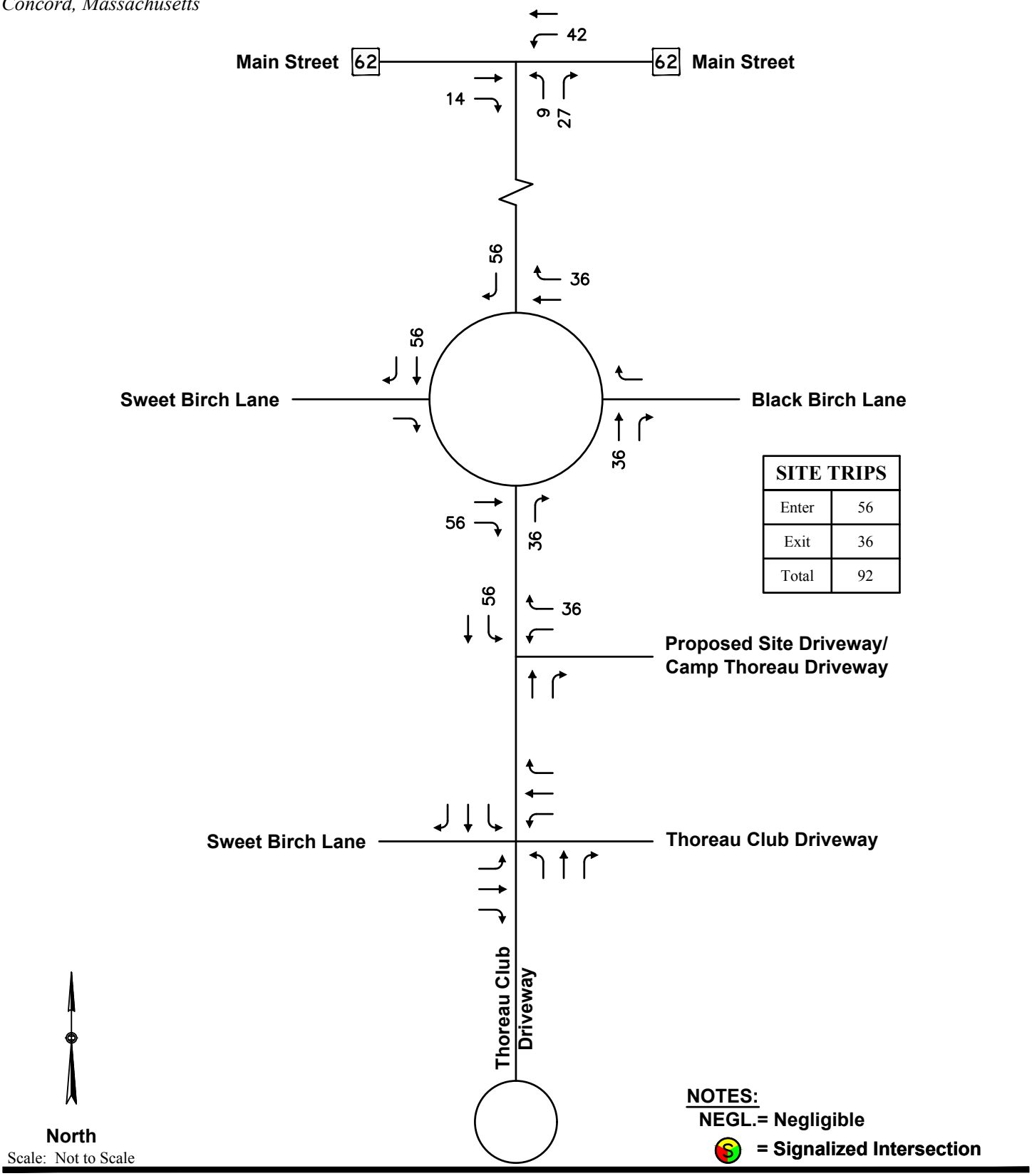


Figure 9

Site Generated Trips
Weekday Evening Peak Hour Volumes

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3.5 BUILD TRAFFIC VOLUMES

Future Build traffic volumes were arrived at by adding development-specific traffic volumes for the project to the 2031 No-Build conditions. The 2031 Build condition traffic-volume networks for the weekday morning and weekday evening peak hours are displayed in **Figure 10** and **Figure 11**, respectively.

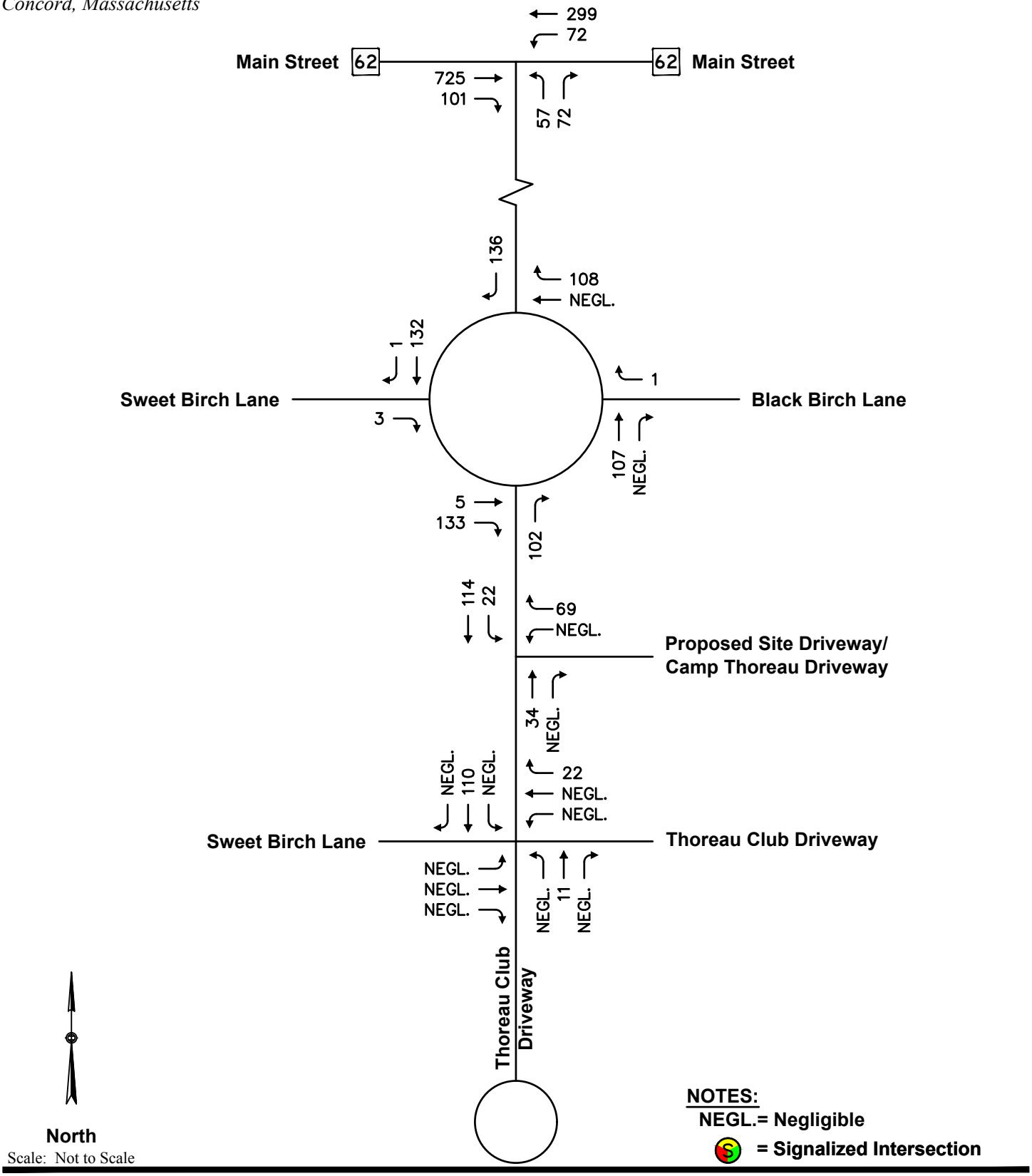


Figure 10

MDM TRANSPORTATION CONSULTANTS, INC.
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2031 Build Conditions
Weekday Morning Peak Hour Volumes

Date: October 2024
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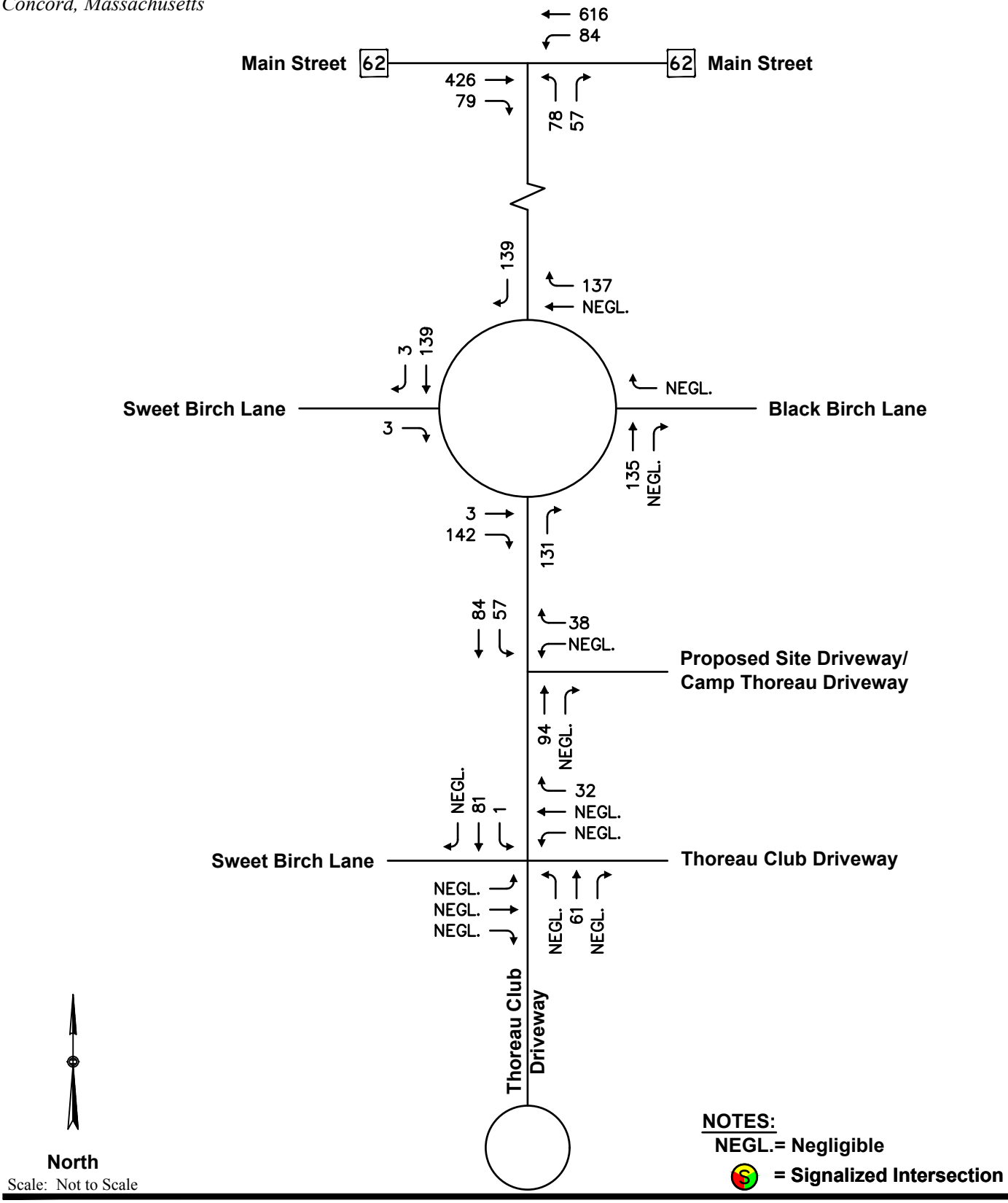


Figure 11

MDM TRANSPORTATION CONSULTANTS, INC.
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2031 Build Conditions
Weekday Evening Peak Hour Volumes

Date: October 2024
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4.0 TRAFFIC OPERATIONS ANALYSIS

Intersection capacity analyses for the primary study intersections are presented in this section for the Baseline, No-Build, and Build traffic-volume conditions. Capacity analyses, conducted in accordance with EEA/MassDOT guidelines, provide an index of how well the roadway facilities serve the traffic demands placed upon them. The operational results provide the basis for recommended access and roadway improvements in the following section.

4.1 CAPACITY ANALYSIS PROCEDURES

Capacity analysis of intersections is developed using the Synchro® computer software, which implements the methods of the Highway Capacity Manual 6th edition (HCM6). The resulting analysis presents a level-of-service (LOS) designation for individual intersection movements. The LOS is a letter designation that provides a qualitative measure of operating conditions based on several factors including roadway geometry, speeds, ambient traffic volumes, traffic controls, and driver characteristics. Since the LOS of a traffic facility is a function of the traffic flows placed upon it, such a facility may operate at a wide range of LOS, depending on the time of day, day of week, or period of year. A range of six levels of service are defined on the basis of average delay, ranging from LOS A (the least delay) to LOS F (delays greater than 50 seconds for unsignalized movements. The specific control delays and associated LOS designations are presented in the **Appendix.**

4.2 INTERSECTION CAPACITY ANALYSIS RESULTS

Capacity analysis results for the weekday morning and weekday evening peak hour capacity analysis results for the study intersections are described below, with detailed analysis results presented in the **Appendix**.

4.2.1 Level of Service Analysis

The capacity analysis results for the primary study intersections is summarized in **Table 6** for the weekday morning and weekday evening peak hours, respectively. Detailed analysis results are presented in the **Appendix**.

TABLE 6
INTERSECTION CAPACITY ANALYSIS RESULTS

		2024 Baseline			2031 No-Build			2031 Build		
Time Period	Approach	v/c[1]	Delay[2]	LOS[3]	v/c	Delay	LOS	v/c	Delay	LOS
Weekday Morning Peak Hour										
	Eastbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
Main Street (Route 62)	Westbound	0.07	<5	A	0.08	<5	A	0.10	<5	A
at Forest Ridge Road	NB Left[5]	0.17	23	C	0.20	26	D	0.31	32	D
	NB Right[5]	0.03	10	A	0.03	10	A	0.11	11	B
Forest Ridge Road at	Eastbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
Sweet Birch Lane/	Westbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
Black Birch Lane/	Northbound	0.03	<5	A	0.03	<5	A	0.08	<5	A
Thoreau Club Dwy	Southbound	0.09	<5	A	0.09	<5	A	0.11	<5	A
Weekday Evening Peak Hour										
	Eastbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
Main Street (Route 62)	Westbound	0.04	<5	A	0.04	<5	A	0.08	<5	A
at Forest Ridge Road	NB Left[5]	0.25	22	C	0.29	26	D	0.40	34	D
	NB Right[5]	0.03	9	A	0.04	9	A	0.07	9	A
Forest Ridge Road at	Eastbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
Sweet Birch Lane/	Westbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
Black Birch Lane/	Northbound	0.10	<5	A	0.11	<5	A	0.15	<5	A
Thoreau Club Dwy	Southbound	0.10	<5	A	0.10	<5	A	0.16	<5	A

[1] Volume-to-capacity ratio
[2] Average control delay per vehicle (in seconds)
[3] Level of service
[4] n/a = not applicable
[5]Calibrated based on delay study during the critical weekday evening peak hour.

Under future Build conditions capacity analyses indicate the following key findings as summarized in **Table 6**:

- *Main Street at Forest Ridge Road.* Under future Build conditions, the proposed development does not result in any significant change in operations at the primary interaction of Main Street at Forest Ridge Road intersection compared to No-Build conditions. The unsignalized Forest Ridge Road approach to Route 62 will continue to operate below capacity at LOS D or better during the weekday morning and weekday evening peak hours. Mainline vehicular movements along Route 62 will continue to operate with minimal delay. Additionally, field observations indicate the Valley Sports Center was in operation during both the weekday morning and evening peak hours; however, the driveways resulted in little to no interactions with minimal influence on operations at the Main Street at Forester Ridge Road operations (entering and exiting movements) during the peak hours. A traffic signal warrant evaluation is provided for this location under *Section 5.0* below.

- *Forest Ridge Road at Sweet Birch Lane, Black Birch Lane and The Thoreau Club Driveway.* Under Build conditions, capacity analyses indicate that the unsignalized roundabout intersection will continue to operate well below capacity at LOS A or better during the weekday morning and weekday evening peak hours. Under Build conditions with the proposed residential project in place, the critical northbound and southbound approaches will operate at 16% capacity during the peak hours.

5.0 TRAFFIC SIGNAL EVALUATION

A review of the traffic volumes at the intersection indicates that the majority of the turns from Forest Ridge Road are right turns which generally don't warrant a traffic signal and the capacity analysis provided under *Section 4.2*, indicates that the critical left turn movements from Forest Ridge Road onto Main Street will continue to operate well below capacity (70% reserve capacity) at LOS D or better during the peak hours.

Despite adequate capacity and operations, the need for traffic signal installation at the Main Street (Route 62) intersection with Forest Ridge Road was evaluated using procedures found in the Manual on Uniform Traffic Control Devices (MUTCD) 11th Edition[2] in order to justify installation of traffic signals at the intersection, one or more of the following nine signal warrants should be met.

- Warrant 1 – Eight-Hour Vehicular Volume
- Warrant 2 – Four-Hour Vehicular Volume
- Warrant 3 – Peak Hour
- Warrant 4 – Pedestrian Volume
- Warrant 5 – School Crossing
- Warrant 6 – Coordinated Signal System
- Warrant 7 – Crash Experience
- Warrant 8 – Roadway Network
- Warrant 9 – Intersection Near a Grade Crossing

The warrants reviewed for this report is based on the Manual on Uniform Traffic Control Devices (MUTCD) 11th Edition and include *Warrant 2: Four-Hour Vehicular Volume* and *Warrant 3: Peak Hour Vehicular Volume*. The traffic signal warrant was reviewed based on the following conditions: 2024 Baseline traffic volumes plus site generated traffic with a regulatory speed limit along Main Street (Route 62) of 35 mph. Based on a review of Warrants 2 and 3, a traffic signal will continue to *not be warranted* at the intersection of Main Stret and Forest Ridge Road under conditions with the proposed residential development in place. Detailed calculation sheets are included in the **Appendix**.

[2] *Manual on Uniform Traffic Control Devices, 11th Edition* US Department of Transportation, Washington, DC, December 2023.

6.0 PARKING ANALYSIS

6.1 PROJECTED PARKING DEMAND

Projected peak parking demands at the site are evaluated based on parking rates and methodology published by the Institute of Transportation Engineers (ITE) and empirical parking data from suburban multi-family housing projects in the Commonwealth. The project proposes to have parking supply levels that are less than the local zoning requirements.

Local Zoning Requirements

Given the project is proposed as a 40B development local zoning requirements generally do not apply. That said, a review of the local zoning requirements indicates that 2.0 spaces per dwelling unit are required for multi-family developments in this area. Based on 237 units the project would require 474 parking spaces to satisfy the local zoning requirement. At 394 spaces the proposed parking supply as proposed is 1.66 spaces per unit.

6.1.1 Peak Parking Rates – ITE

Peak parking generation rates for residential land uses, including apartment complexes, are published by the Institute of Transportation Engineers (ITE) in *Parking Generation*[3] which provides a basis for identifying parking demand characteristics for residential developments. These parking rates represent peak characteristics for each land use type as "stand-alone" uses that have differing peak parking periods. **Table 7** provides a summary of standard peak parking demands for the multifamily residential (mid-rise) uses.

[3] *Parking Generation, 6th Edition*, Institute of Transportation Engineers, Washington D.C. October 2023.

TABLE 7
PEAK PARKING DEMAND – ITE

Source	Peak Parking Rate	Peak Parking Demand
ITE Average Peak[1]	1.23 (per Unit)	292
ITE 95% Confidence[2]	1.31 (per Unit)	311
ITE 85th Percentile[3]	1.45 (per Unit)	344

[1]Average peak period demand per LUC 221 (Mid-Rise Apartment) for a General Urban/Suburban location applied to 237 Units.
[2] 95% Confidence Interval for ITE LUC 221 peak parking generation rate applied to 237 Units.
[3]85th Percentile Parking Demand for ITE LUC 221 peak parking generation rate. applied to 237 Units.

As summarized in **Table 7**, standard residential peak parking demand for the 237-unit project ranges from 292 to 344 vehicles based on *ITE parking generation* rates with peak demands occurring during the overnight hours. Daytime hour demand (8 AM to 6 PM) will be 35 to 50 percent lower than overnight peak demands based on ITE time-of-day demand statistics. The onsite parking supply of 394 onsite parking spaces will accommodate the peak residential parking demands at the Site with a 13% surplus during peak periods.

6.1.2 Peak Parking Rates – Empirical

Parking observations at six (6) multi-family housing complexes were conducted during the overnight peak period. It is noted that access to garage spaces was restricted for the West Village development at the time of the observations; however, as a conservative measure all garage units were assumed to be fully occupied at the time of the count. Parking activity, residential unit count and associated peak parking rate for each of the multi-family residential complexes are presented in **Table 8** for comparison to the ITE parking rates.

TABLE 8
PEAK PARKING DEMAND – Empirical Data from Area Multi-Family Complexes

Development	City/Town	# Units	Peak Parking Usage	Peak Parking Rate (spaces per unit)
West Village[1]	Mansfield	204	283	1.39
Concord Mews	Concord	350	504	1.44
Cloverleaf	Natick	183	236	1.29
Chapel Hill West	Framingham	168	220	1.31
Chapel Hill East	Framingham	174	225	1.29
Martins Landing	North Reading	97	129	1.33
AVERAGE		208	294	1.34

[1]Access to garage spaces was restricted; as a conservative measure, all garage units were assumed to be occupied at the time of the count. Peak demand includes observed surface parking activity plus all garage units as each garage is assumed to be occupied.

As presented in **Table 8**, peak parking demand rate of 1.34 spaces per unit exhibited by area multi-family housing complexes is highly consistent with ITE peak parking demand data described above. When applied to the proposed 237-unit project the peak parking demand for the proposed residential use is estimated to be approximately 318 spaces which is below the proposed parking supply of 394 marked spaces with an excess parking of approximately 19% (76± surplus spaces).

6.1.3 Parking Summary

In summary, industry standard peak parking rates published by ITE indicate a peak parking demand rate range of 1.23 to 1.45 spaces per unit for a multi-family housing complex. Empirical peak parking rates observed at area multi-family complexes range between 1.29 and 1.44 spaces per unit which is highly consistent with the ITE data. Based on the parking data reviewed, the projected peak parking demand is estimated at between 292 and 344 vehicles at full build-out and occupancy (237 units). As shown, the peak parking demand will be adequately accommodated by the proposed parking supply of 394± marked spaces. The data outlined in this memorandum supports the requested parking relief with respect to the requirements set forth by local zoning.

7.0 RECOMMENDATIONS AND CONCLUSIONS

7.1 RECOMMENDATIONS

MDM finds Main Street and Forest Ridge Road roadways within the site vicinity can accommodate modest traffic increases of the project. Relative traffic increases for the proposed project represent an inconsequential change in operations compared to No-Build conditions and are immaterial to traffic operations along Main Street (Route 62). However, several mitigation actions are identified to support the project to ensure that site access meets applicable safety criteria, to enhance neighborhood walking/bicycling and to reduce dependency on single-occupant auto use. These include (a) access-related improvements, (b) pedestrian and bicycle accommodations and (c) TDM actions as summarized below.

Access/Egress Improvements

- *Driveway Design*. The final driveway alignment, widths and curb radii have been designed to accommodate the Town's largest fire apparatus (ladder truck) and single unit delivery trucks. The final driveway layout achieves a perpendicular alignment to the exiting Thoreau Club driveway. Signs and pavement markings that are compliant with the Manual on Uniform Traffic Control Devices (MUTCD) should be installed on the approach to the Thoreau Club driveway including a "STOP" sign (R2-1) and "STOP" line pavement markings.

- *Sight Line Triangles.* The available sight lines at the Thoreau Club driveway intersection with the proposed site driveway will satisfy the recommended sight line requirements from AASHTO. New plantings (shrubs, bushes) and structures (walls, fences, etc.) shall be designed, installed and maintained so as not to exceed 2.5-feet in height. Snow accumulation (windrows) located within sight triangle areas that exceed 3.5-feet in height or that would otherwise inhibit sight lines shall be promptly removed.

Pedestrian and Bicycle Accommodations

- *Pedestrian Connections*. The Site Plan incorporates sidewalks that connect the proposed buildings, on-site surface parking areas, amenity space, and the expansive existing sidewalk network that is already in place along Forest Ridge Road, Main Street, the existing Thoreau Club, and internal neighborhood roadways. As part of the project, ADA compliant crosswalks and markings should be provided at all internal crosswalks, and a crosswalk with ADA compliant ramps should be provided on the exiting Thoreau Club driveway to the north of the proposed site driveway.

- *Bicycle Amenities*. The Proponent should incorporate secure weather-protected bicycle racks to encourage and facilitate this mode of transportation to/from the Site by residents. Additional bike racks near the entranceways should also be provided to accommodate visitors.

Transportation Demand Management (TDM) Program

The Proponent is committed to reduce auto dependency by residents by implementing a TDM program. A preliminary list of potential TDM program elements may include the following, subject to refinement of the development program and further evaluation by the Proponent:

- *Vehicle Charging Stations.* Electric vehicle charging stations/outlets should be provided for resident use. The proponent should place additional conduit within the parking area to facilitate additional charging stations to meet actual demand over time.

- *Bicycle Facilities*. Provide bicycle parking, including secure weather protected racks for residents and conveniently located racks for visitors proximate to the building entrances.

- *On-Site Amenities.* The Proponent should provide on-site amenities that may include a fitness center for residents, mailroom, a club room, and other features for residents.

- *Pedestrian Infrastructure*. Sidewalk connections will be provided along primary pedestrian desire lines that connect building entrances with the surface parking areas, on-site amenities, and the existing sidewalk network in the area.

7.2 CONCLUSIONS

In summary, the proposed residential development will be accommodated well within capacity of Main Street, Forest Ridge Road and the primary intersection of Main Street at Forester Ridge Road with no discernable impact to traffic flow and at operating levels compared to No-Build conditions. The Forest Ridge Road will continue to operate well below capacity at LOS D or better during the peak hours. Accordingly, no off-site roadway improvements are warranted to accommodate the project. The available sight lines at the proposed site driveway intersection with the existing Thoreau Club driveway will exceed the recommended sight line requirements from AASHTO. The proposed parking supply while less than the zoning requirement will be adequate to accommodate the peak parking demands for the Site based on industry standard and empirical parking rates. Proposed access/egress improvements, pedestrian and bicycle accommodations, and TDM program as outlined in the *Conclusions and Recommendations* will establish a framework of minimizing Site traffic impacts by encouraging non-motorized travel modes and pedestrian accommodation that is compatible with other projects in the area.

APPENDIX

- Traffic Volume Data
- Seasonal/Yearly Growth Data
- Crash Data
- Sight Distance Calculations
- Background Projects
- Trip Generation
- Trip Distribution Calculations
- Delay Study
- Capacity Analysis
- Signal Warrant Analysis

- Traffic Volume Data

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Marlborough, MA 01752

N/S: Forest Ridge Road
E/W: Main Street
Concord, MA

File Name : 1319_Forest_at_Main_2024_TMC_1236148_10-10-2024
Site Code : 1319
Start Date : 10/10/2024

Groups Printed- Lights - Mediums - Articulated Trucks

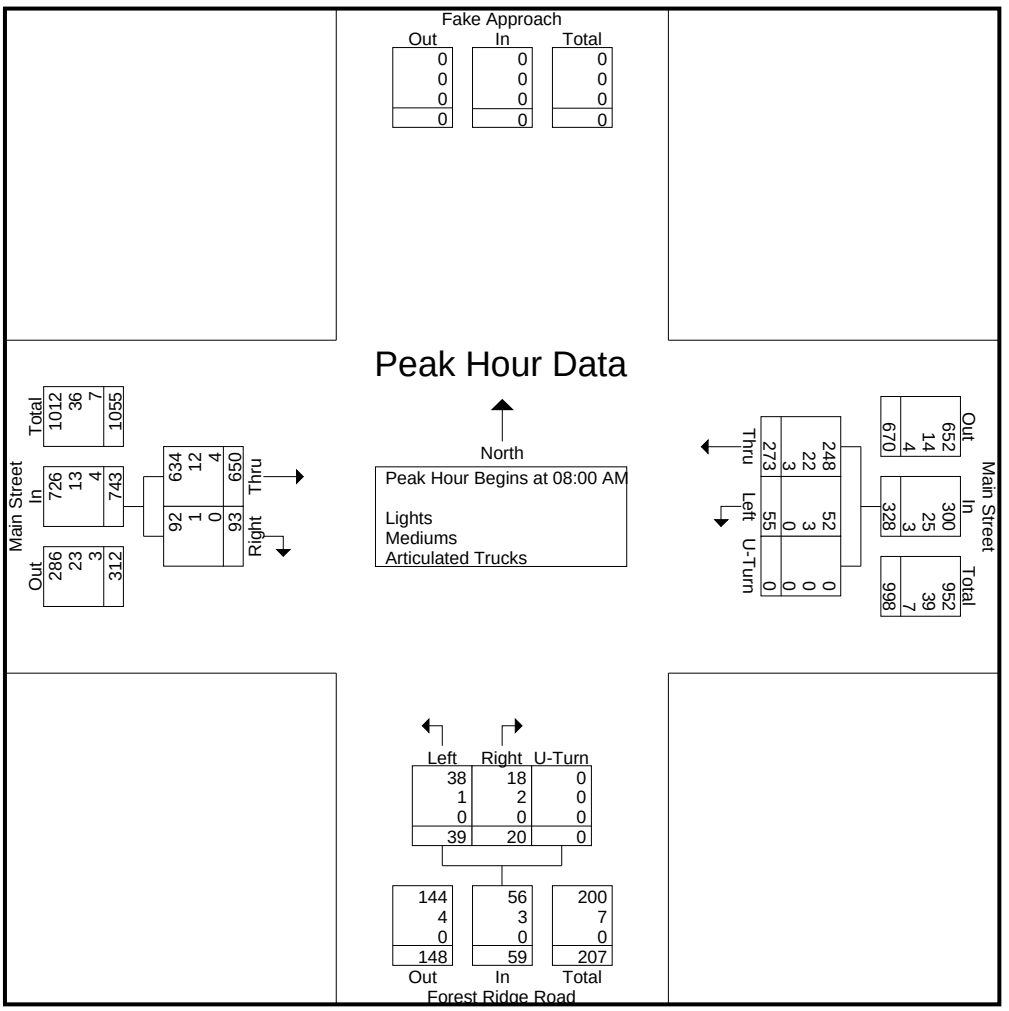
	Main Street From East				Forest Ridge Road From South				Main Street From West			
Start Time	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Right	Thru	App. Total	Int. Total
07:00 AM	40	4	0	44	6	9	0	15	7	152	159	218
07:15 AM	50	7	0	57	5	7	0	12	19	130	149	218
07:30 AM	40	4	0	44	0	8	0	8	6	155	161	213
07:45 AM	82	4	0	86	2	4	0	6	12	180	192	284
Total	212	19	0	231	13	28	0	41	44	617	661	933
08:00 AM	52	10	0	62	3	8	0	11	16	173	189	262
08:15 AM	67	19	0	86	2	8	0	10	33	172	205	301
08:30 AM	64	13	0	77	7	9	0	16	20	166	186	279
08:45 AM	90	13	0	103	8	14	0	22	24	139	163	288
Total	273	55	0	328	20	39	0	59	93	650	743	1130
04:00 PM	136	12	0	148	7	22	0	29	18	97	115	292
04:15 PM	129	12	0	141	12	10	0	22	29	77	106	269
04:30 PM	147	9	0	156	5	21	0	26	7	99	106	288
04:45 PM	143	8	0	151	5	14	0	19	9	113	122	292
Total	555	41	0	596	29	67	0	96	63	386	449	1141
05:00 PM	118	11	0	129	7	9	0	16	9	90	99	244
05:15 PM	153	9	0	162	8	15	0	23	4	87	91	276
05:30 PM	130	6	0	136	15	13	0	28	5	119	124	288
05:45 PM	139	7	0	146	7	10	0	17	14	105	119	282
Total	540	33	0	573	37	47	0	84	32	401	433	1090
Grand Total	1580	148	0	1728	99	181	0	280	232	2054	2286	4294
Apprch %	91.4	8.6	0		35.4	64.6	0		10.1	89.9		
Total %	36.8	3.4	0	40.2	2.3	4.2	0	6.5	5.4	47.8	53.2	
Lights	1515	144	0	1659	97	178	0	275	230	2002	2232	4166
% Lights	95.9	97.3	0	96	98	98.3	0	98.2	99.1	97.5	97.6	97
Mediums	60	4	0	64	2	2	0	4	2	44	46	114
% Mediums	3.8	2.7	0	3.7	2	1.1	0	1.4	0.9	2.1	2	2.7
Articulated Trucks	5	0	0	5	0	1	0	1	0	8	8	14
% Articulated Trucks	0.3	0	0	0.3	0	0.6	0	0.4	0	0.4	0.3	0.3

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N/S: Forest Ridge Road
E/W: Main Street
Concord, MA

File Name : 1319_Forest_at_Main_2024_TMC_1236148_10-10-2024
Site Code : 1319
Start Date : 10/10/2024

	Main Street From East				Forest Ridge Road From South				Main Street From West			
Start Time	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Right	Thru	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1												
Peak Hour for Entire Intersection Begins at 08:00 AM												
08:00 AM	52	10	0	62	3	8	0	11	16	**173**	**189**	**262**
08:15 AM	**67**	**19**	0	86	2	8	0	10	**33**	172	**205**	**301**
08:30 AM	64	13	0	77	7	9	0	16	20	166	186	279
08:45 AM	**90**	13	0	**103**	**8**	**14**	0	**22**	24	139	163	288
Total Volume	273	55	0	328	20	39	0	59	93	650	743	1130
% App. Total	83.2	16.8	0		33.9	66.1	0		12.5	87.5		
PHF	.758	.724	.000	.796	.625	.696	.000	.670	.705	.939	.906	.939
Lights	248	52	0	300	18	38	0	56	92	634	726	1082
% Lights	90.8	94.5	0	91.5	90.0	97.4	0	94.9	98.9	97.5	97.7	95.8
Mediums	22	3	0	25	2	1	0	3	1	12	13	41
% Mediums	8.1	5.5	0	7.6	10.0	2.6	0	5.1	1.1	1.8	1.7	3.6
Articulated Trucks	3	0	0	3	0	0	0	0	0	4	4	7
% Articulated Trucks	1.1	0	0	0.9	0	0	0	0	0	0.6	0.5	0.6

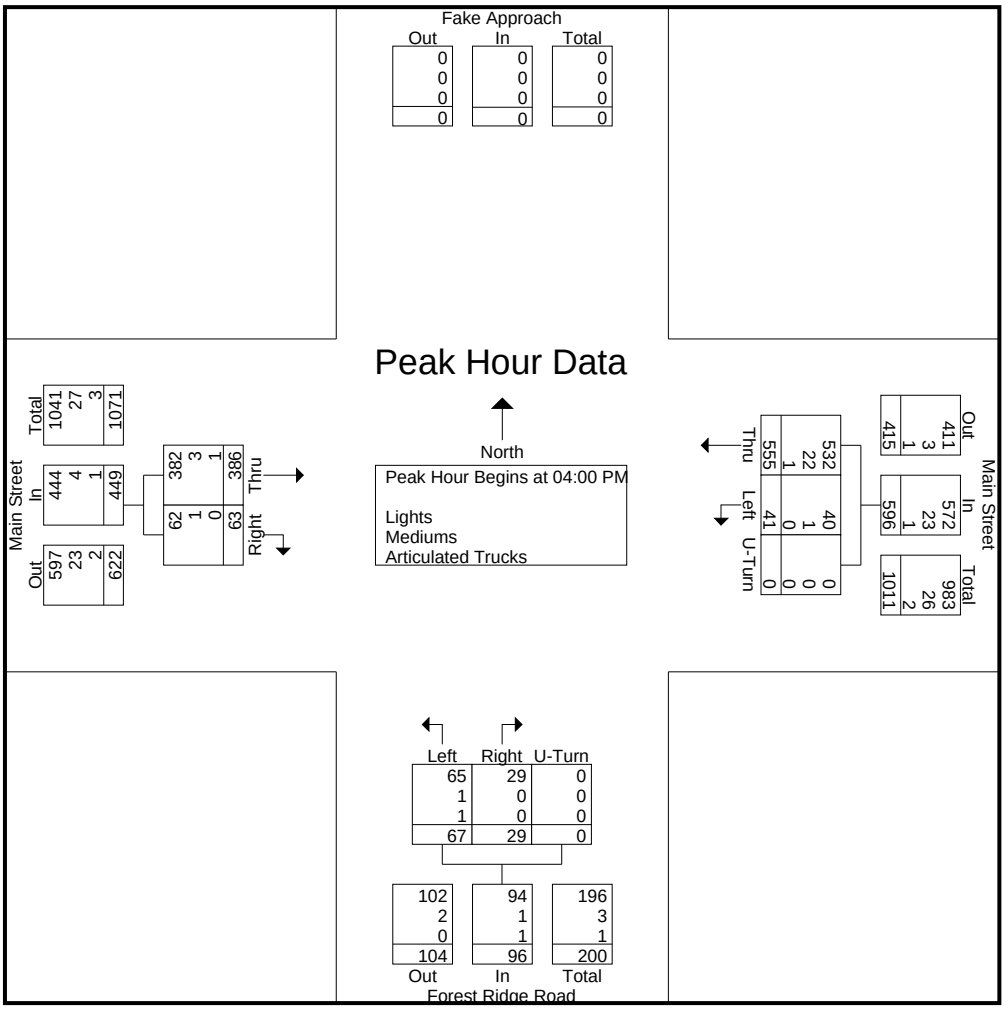


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E/W: Main Street
Concord, MA

File Name : 1319_Forest_at_Main_2024_TMC_1236148_10-10-2024
Site Code : 1319
Start Date : 10/10/2024

	Main Street From East				Forest Ridge Road From South				Main Street From West			
Start Time	Thru	Left	U-Turn	App. Total	Right	Left	U-Turn	App. Total	Right	Thru	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1												
Peak Hour for Entire Intersection Begins at 04:00 PM												
04:00 PM	136	**12**	0	148	7	**22**	0	**29**	18	97	115	**292**
04:15 PM	129	12	0	141	**12**	10	0	22	**29**	77	106	269
04:30 PM	**147**	9	0	**156**	5	21	0	26	7	99	106	288
04:45 PM	143	8	0	151	5	14	0	19	9	**113**	**122**	292
Total Volume	555	41	0	596	29	67	0	96	63	386	449	1141
% App. Total	93.1	6.9	0		30.2	69.8	0		14	86		
PHF	.944	.854	.000	.955	.604	.761	.000	.828	.543	.854	.920	.977
Lights	532	40	0	572	29	65	0	94	62	382	444	1110
% Lights	95.9	97.6	0	96.0	100	97.0	0	97.9	98.4	99.0	98.9	97.3
Mediums	22	1	0	23	0	1	0	1	1	3	4	28
% Mediums	4.0	2.4	0	3.9	0	1.5	0	1.0	1.6	0.8	0.9	2.5
Articulated Trucks	1	0	0	1	0	1	0	1	0	1	1	3
% Articulated Trucks	0.2	0	0	0.2	0	1.5	0	1.0	0	0.3	0.2	0.3



MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA, 01752

SB: Forest Ridge Road
E/W: Loop Road
Concord, MA

File Name : 1319_Forest_Ridge_at_Loop_NW_10-26-2023
Site Code : 1319
Start Date : 10/26/2023
Page No : 1

Groups Printed- Lights - Mediums - Articulated Trucks - Bicycles on Road

	Forest Ridge Road From North				Loop Road From East				Loop Road From West				
Start Time	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	7	0	0	7	2	1	0	3	0	0	0	0	10
07:15 AM	15	0	0	15	3	0	0	3	0	0	0	0	18
07:30 AM	9	0	0	9	3	0	0	3	0	0	0	0	12
07:45 AM	11	0	0	11	8	0	0	8	0	0	0	0	19
Total	42	0	0	42	16	1	0	17	0	0	0	0	59
08:00 AM	23	0	0	23	7	0	0	7	0	0	0	0	30
08:15 AM	27	0	0	27	9	0	0	9	0	0	0	0	36
08:30 AM	19	0	1	20	16	0	0	16	0	0	0	0	36
08:45 AM	24	0	0	24	6	0	0	6	0	0	0	0	30
Total	93	0	1	94	38	0	0	38	0	0	0	0	132
04:00 PM	17	0	0	17	10	8	0	18	0	0	0	0	35
04:15 PM	18	0	0	18	8	1	0	9	0	0	0	0	27
04:30 PM	14	0	0	14	8	0	0	8	0	0	0	0	22
04:45 PM	21	0	0	21	8	0	0	8	0	0	0	0	29
Total	70	0	0	70	34	9	0	43	0	0	0	0	113
05:00 PM	10	0	0	10	25	0	1	26	0	0	0	0	36
05:15 PM	13	0	0	13	16	0	0	16	0	0	0	0	29
05:30 PM	10	0	0	10	11	0	0	11	0	0	0	0	21
05:45 PM	33	0	0	33	16	0	0	16	0	0	0	0	49
Total	66	0	0	66	68	0	1	69	0	0	0	0	135
Grand Total	271	0	1	272	156	10	1	167	0	0	0	0	439
Apprch %	99.6	0	0.4		93.4	6	0.6		0	0	0		
Total %	61.7	0	0.2	62	35.5	2.3	0.2	38	0	0	0	0	
Lights	269	0	1	270	154	2	1	157	0	0	0	0	427
% Lights	99.3	0	100	99.3	98.7	20	100	94	0	0	0	0	97.3
Mediums	2	0	0	2	2	0	0	2	0	0	0	0	4
% Mediums	0.7	0	0	0.7	1.3	0	0	1.2	0	0	0	0	0.9
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	0	0	0	0	8	0	8	0	0	0	0	8
% Bicycles on Road	0	0	0	0	0	80	0	4.8	0	0	0	0	1.8

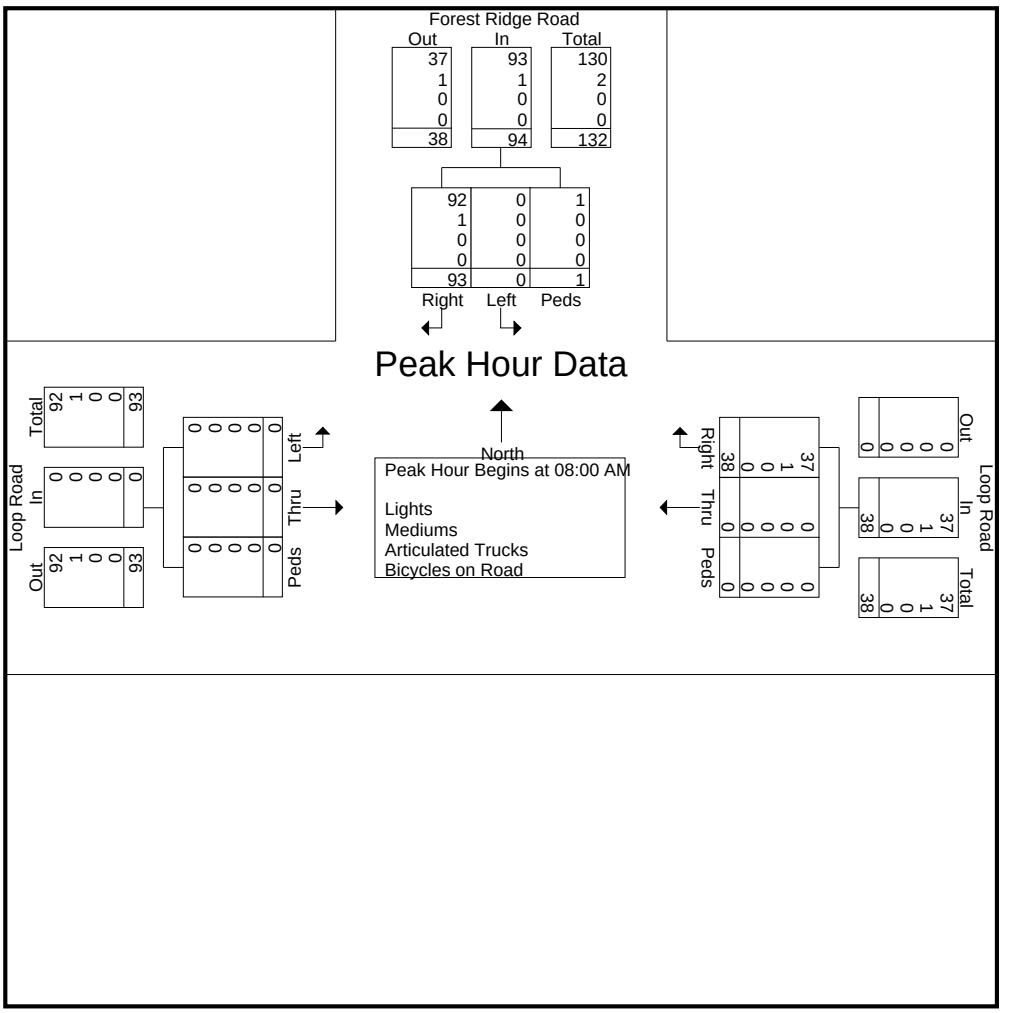
MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA, 01752

SB: Forest Ridge Road
E/W: Loop Road
Concord, MA

File Name : 1319_Forest_Ridge_at_Loop_NW_10-26-2023
Site Code : 1319
Start Date : 10/26/2023
Page No : 2

	Forest Ridge Road From North				Loop Road From East				Loop Road From West				
Start Time	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 08:00 AM													
08:00 AM	23	0	0	23	7	0	0	7	0	0	0	0	30
08:15 AM	**27**	0	0	**27**	9	0	0	9	0	0	0	0	**36**
08:30 AM	19	0	**1**	20	**16**	0	0	**16**	0	0	0	0	36
08:45 AM	24	0	0	24	6	0	0	6	0	0	0	0	30
Total Volume	93	0	1	94	38	0	0	38	0	0	0	0	132
% App. Total	98.9	0	1.1		100	0	0		0	0	0		
PHF	.861	.000	.250	.870	.594	.000	.000	.594	.000	.000	.000	.000	.917
Lights	92	0	1	93	37	0	0	37	0	0	0	0	130
% Lights	98.9	0	100	98.9	97.4	0	0	97.4	0	0	0	0	98.5
Mediums	1	0	0	1	1	0	0	1	0	0	0	0	2
% Mediums	1.1	0	0	1.1	2.6	0	0	2.6	0	0	0	0	1.5
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0



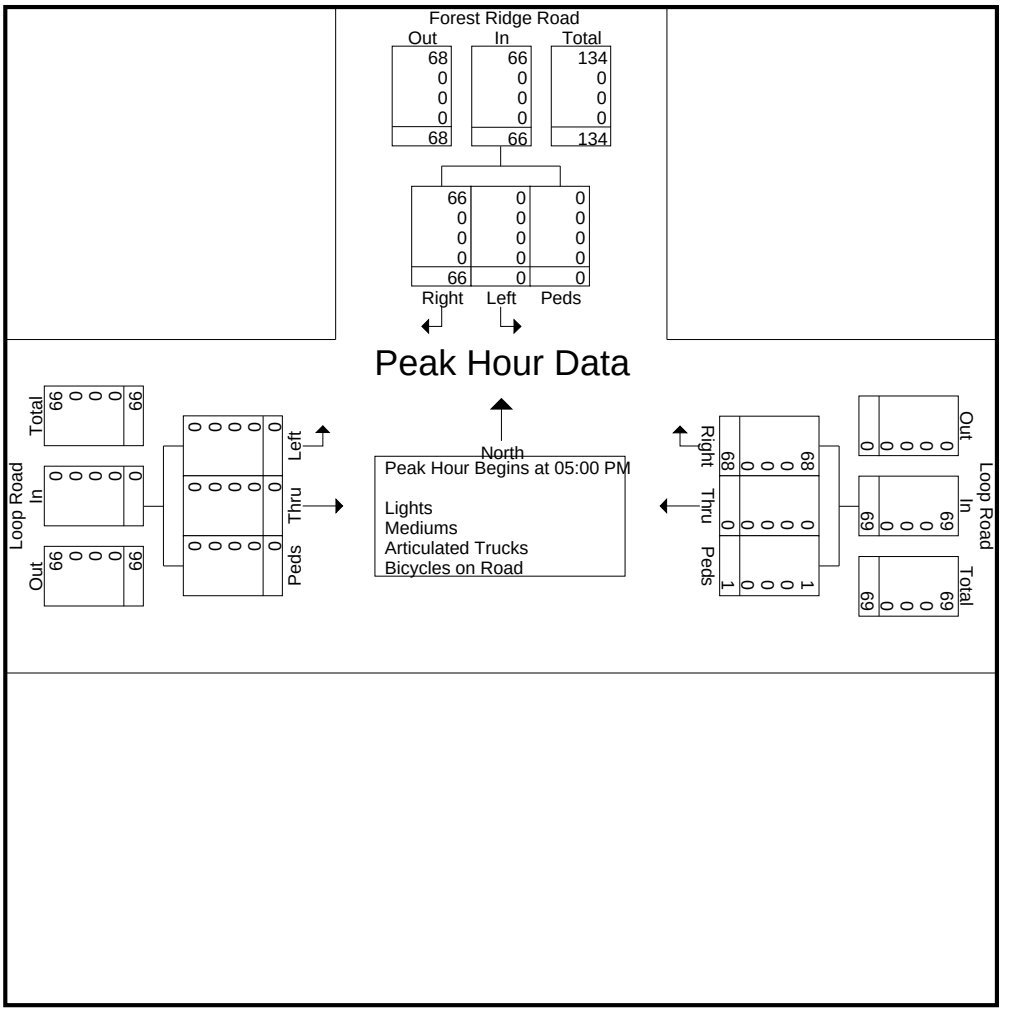
MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA, 01752

SB: Forest Ridge Road
E/W: Loop Road
Concord, MA

File Name : 1319_Forest_Ridge_at_Loop_NW_10-26-2023
Site Code : 1319
Start Date : 10/26/2023
Page No : 3

	Forest Ridge Road From North				Loop Road From East				Loop Road From West				
Start Time	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 05:00 PM													
05:00 PM	10	0	0	10	**25**	0	**1**	**26**	0	0	0	0	36
05:15 PM	13	0	0	13	16	0	0	16	0	0	0	0	29
05:30 PM	10	0	0	10	11	0	0	11	0	0	0	0	21
05:45 PM	**33**	0	0	**33**	16	0	0	16	0	0	0	0	**49**
Total Volume	66	0	0	66	68	0	1	69	0	0	0	0	135
% App. Total	100	0	0		98.6	0	1.4		0	0	0		
PHF	.500	.000	.000	.500	.680	.000	.250	.663	.000	.000	.000	.000	.689
Lights	66	0	0	66	68	0	1	69	0	0	0	0	135
% Lights	100	0	0	100	100	0	100	100	0	0	0	0	100
Mediums	0	0	0	0	0	0	0	0	0	0	0	0	0
% Mediums	0	0	0	0	0	0	0	0	0	0	0	0	0
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0



MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA, 01752

N/S: Loop Road
WB: Black Birch Lane
Concord, MA

File Name : 1319_Black_Birch_at_Loop_NE_10-26-2023
Site Code : 1319
Start Date : 10/26/2023
Page No : 1

Groups Printed- Lights - Mediums - Articulated Trucks - Bicycles on Road

	Loop Road From North				Black Birch Lane From East				Loop Road From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	1	0	1	2	1	2	0	3	5
07:15 AM	0	0	0	0	0	0	0	0	0	3	0	3	3
07:30 AM	0	0	0	0	0	0	0	0	0	3	0	3	3
07:45 AM	0	0	0	0	1	0	0	1	0	7	0	7	8
Total	0	0	0	0	2	0	1	3	1	15	0	16	19
08:00 AM	0	0	0	0	0	0	2	2	0	7	0	7	9
08:15 AM	0	0	0	0	0	0	0	0	0	9	0	9	9
08:30 AM	0	0	0	0	1	0	1	2	0	15	0	15	17
08:45 AM	0	0	0	0	0	0	0	0	0	6	0	6	6
Total	0	0	0	0	1	0	3	4	0	37	0	37	41
04:00 PM	0	0	0	0	1	0	0	1	0	18	0	18	19
04:15 PM	0	0	0	0	1	0	0	1	2	8	0	10	11
04:30 PM	0	0	0	0	0	0	0	0	2	8	0	10	10
04:45 PM	0	0	0	0	2	0	0	2	0	6	0	6	8
Total	0	0	0	0	4	0	0	4	4	40	0	44	48
05:00 PM	0	0	0	0	0	0	0	0	0	25	0	25	25
05:15 PM	0	0	0	0	0	0	1	1	0	14	0	14	15
05:30 PM	0	0	0	0	0	0	0	0	0	11	0	11	11
05:45 PM	0	0	0	0	0	0	0	0	0	16	0	16	16
Total	0	0	0	0	0	0	1	1	0	66	0	66	67
Grand Total	0	0	0	0	7	0	5	12	5	158	0	163	175
Apprch %	0	0	0		58.3	0	41.7		3.1	96.9	0		
Total %	0	0	0	0	4	0	2.9	6.9	2.9	90.3	0	93.1	
Lights	0	0	0	0	6	0	5	11	5	149	0	154	165
% Lights	0	0	0	0	85.7	0	100	91.7	100	94.3	0	94.5	94.3
Mediums	0	0	0	0	0	0	0	0	0	2	0	2	2
% Mediums	0	0	0	0	0	0	0	0	0	1.3	0	1.2	1.1
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	0	0	0	1	0	0	1	0	7	0	7	8
% Bicycles on Road	0	0	0	0	14.3	0	0	8.3	0	4.4	0	4.3	4.6

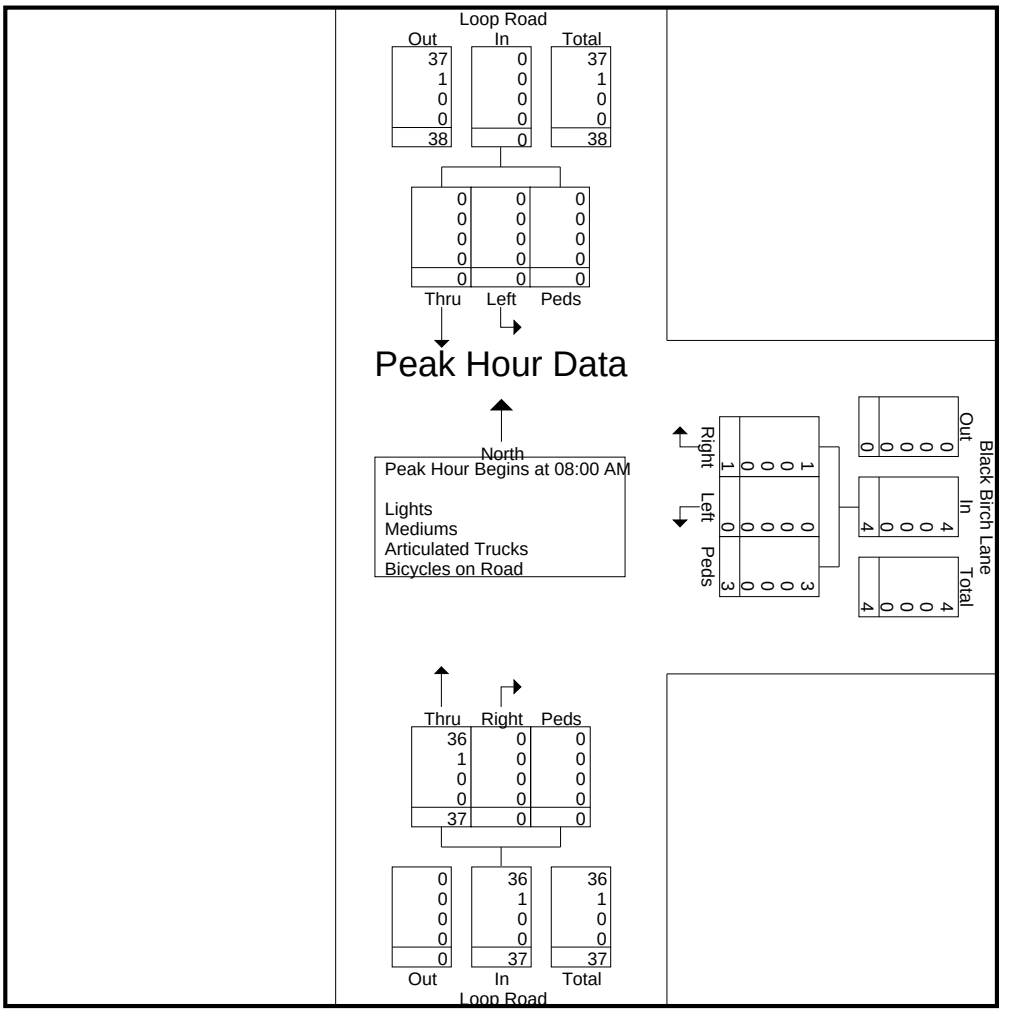
MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA, 01752

N/S: Loop Road
WB: Black Birch Lane
Concord, MA

File Name : 1319_Black_Birch_at_Loop_NE_10-26-2023
Site Code : 1319
Start Date : 10/26/2023
Page No : 2

	Loop Road From North				Black Birch Lane From East				Loop Road From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 08:00 AM to 11:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 08:00 AM													
08:00 AM	0	0	0	0	0	0	**2**	**2**	0	7	0	7	9
08:15 AM	0	0	0	0	0	0	0	0	0	9	0	9	9
08:30 AM	0	0	0	0	**1**	0	1	2	0	**15**	0	**15**	**17**
08:45 AM	0	0	0	0	0	0	0	0	0	6	0	6	6
Total Volume	0	0	0	0	1	0	3	4	0	37	0	37	41
% App. Total	0	0	0		25	0	75		0	100	0		
PHF	.000	.000	.000	.000	.250	.000	.375	.500	.000	.617	.000	.617	.603
Lights	0	0	0	0	1	0	3	4	0	36	0	36	40
% Lights	0	0	0	0	100	0	100	100	0	97.3	0	97.3	97.6
Mediums	0	0	0	0	0	0	0	0	0	1	0	1	1
% Mediums	0	0	0	0	0	0	0	0	0	2.7	0	2.7	2.4
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0



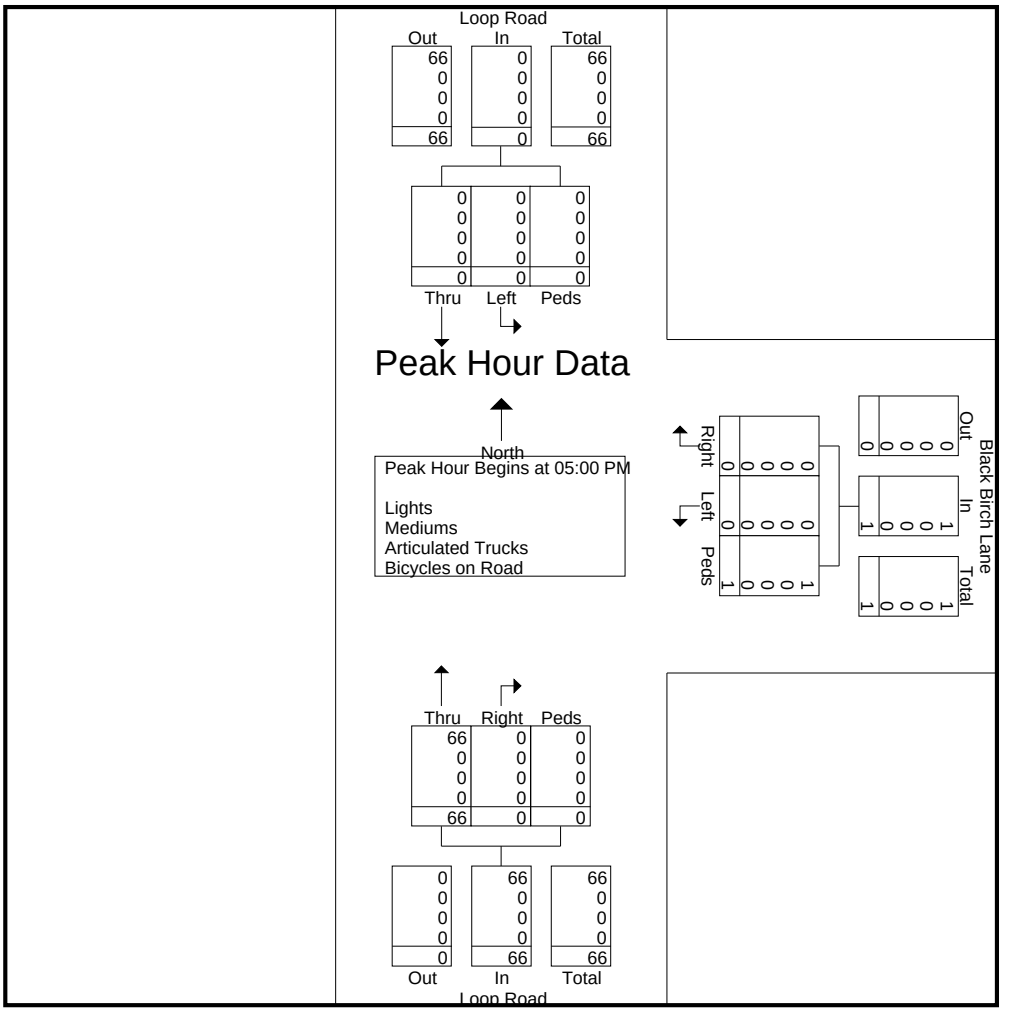
MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA, 01752

N/S: Loop Road
WB: Black Birch Lane
Concord, MA

File Name : 1319_Black_Birch_at_Loop_NE_10-26-2023
Site Code : 1319
Start Date : 10/26/2023
Page No : 3

	Loop Road From North				Black Birch Lane From East				Loop Road From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 05:00 PM													
05:00 PM	0	0	0	0	0	0	0	0	0	**25**	0	**25**	**25**
05:15 PM	0	0	0	0	0	0	**1**	**1**	0	14	0	14	15
05:30 PM	0	0	0	0	0	0	0	0	0	11	0	11	11
05:45 PM	0	0	0	0	0	0	0	0	0	16	0	16	16
Total Volume	0	0	0	0	0	0	1	1	0	66	0	66	67
% App. Total	0	0	0		0	0	100		0	100	0		
PHF	.000	.000	.000	.000	.000	.000	.250	.250	.000	.660	.000	.660	.670
Lights	0	0	0	0	0	0	1	1	0	66	0	66	67
% Lights	0	0	0	0	0	0	100	100	0	100	0	100	100
Mediums	0	0	0	0	0	0	0	0	0	0	0	0	0
% Mediums	0	0	0	0	0	0	0	0	0	0	0	0	0
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0



MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA, 01752

E/W: Loop Road
NB: Forest Ridge Road
Concord, MA

File Name : 1319_Forest_Ridge_at_Loop_SE_10-26-2023
Site Code : 1319
Start Date : 10/26/2023

Groups Printed- Lights - Mediums - Articulated Trucks - Bicycles on Road

	Loop Road From East				Forest Ridge Road From South				Loop Road From West				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	1	0	1	2	7	1	0	8	10
07:15 AM	0	0	0	0	3	0	0	3	14	0	0	14	17
07:30 AM	0	0	0	0	2	0	0	2	10	1	0	11	13
07:45 AM	0	0	0	0	6	0	0	6	10	1	0	11	17
Total	0	0	0	0	12	0	1	13	41	3	0	44	57
08:00 AM	0	0	0	0	6	0	3	9	21	0	0	21	30
08:15 AM	0	0	0	0	8	0	0	8	29	1	0	30	38
08:30 AM	0	0	0	0	13	0	0	13	16	3	0	19	32
08:45 AM	0	0	0	0	5	0	0	5	24	1	0	25	30
Total	0	0	0	0	32	0	3	35	90	5	0	95	130
04:00 PM	0	0	0	0	9	0	1	10	17	9	0	26	36
04:15 PM	0	0	0	0	7	0	0	7	15	3	0	18	25
04:30 PM	0	0	0	0	8	0	2	10	11	1	0	12	22
04:45 PM	0	0	0	0	6	0	2	8	20	0	0	20	28
Total	0	0	0	0	30	0	5	35	63	13	0	76	111
05:00 PM	0	0	0	0	24	0	0	24	13	1	1	15	39
05:15 PM	0	0	0	0	12	0	1	13	11	1	0	12	25
05:30 PM	0	0	0	0	11	0	0	11	10	1	0	11	22
05:45 PM	0	0	0	0	15	0	0	15	32	0	0	32	47
Total	0	0	0	0	62	0	1	63	66	3	1	70	133
Grand Total	0	0	0	0	136	0	10	146	260	24	1	285	431
Apprch %	0	0	0		93.2	0	6.8		91.2	8.4	0.4		
Total %	0	0	0	0	31.6	0	2.3	33.9	60.3	5.6	0.2	66.1	
Lights	0	0	0	0	136	0	10	146	258	15	1	274	420
% Lights	0	0	0	0	100	0	100	100	99.2	62.5	100	96.1	97.4
Mediums	0	0	0	0	0	0	0	0	0	2	0	2	2
% Mediums	0	0	0	0	0	0	0	0	0	8.3	0	0.7	0.5
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	0	0	0	0	0	0	0	2	7	0	9	9
% Bicycles on Road	0	0	0	0	0	0	0	0	0.8	29.2	0	3.2	2.1

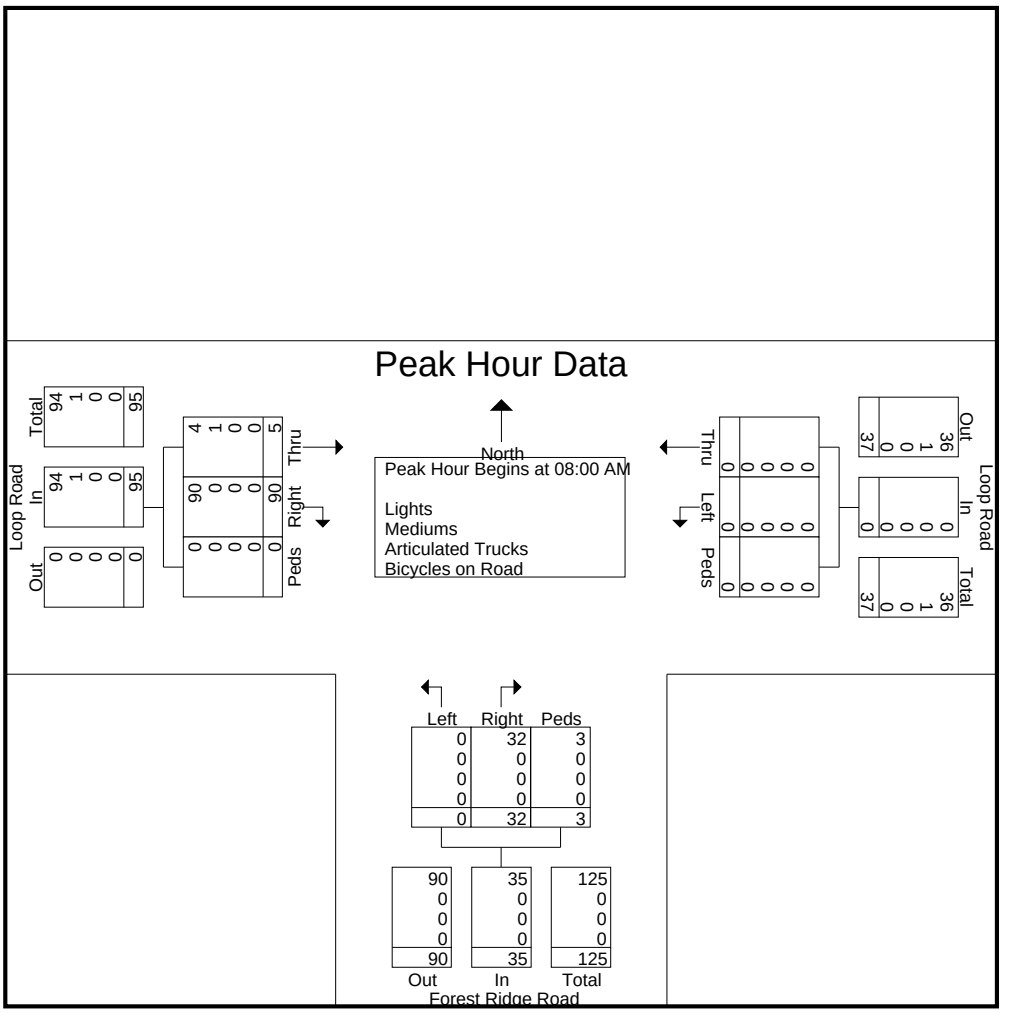
MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA, 01752

E/W: Loop Road
NB: Forest Ridge Road
Concord, MA

File Name : 1319_Forest_Ridge_at_Loop_SE_10-26-2023
Site Code : 1319
Start Date : 10/26/2023
Page No : 2

	Loop Road From East				Forest Ridge Road From South				Loop Road From West				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 08:00 AM													
08:00 AM	0	0	0	0	6	0	**3**	9	21	0	0	21	30
08:15 AM	0	0	0	0	8	0	0	8	**29**	1	0	**30**	**38**
08:30 AM	0	0	0	0	**13**	0	0	**13**	16	**3**	0	19	32
08:45 AM	0	0	0	0	5	0	0	5	24	1	0	25	30
Total Volume	0	0	0	0	32	0	3	35	90	5	0	95	130
% App. Total	0	0	0		91.4	0	8.6		94.7	5.3	0		
PHF	.000	.000	.000	.000	.615	.000	.250	.673	.776	.417	.000	.792	.855
Lights	0	0	0	0	32	0	3	35	90	4	0	94	129
% Lights	0	0	0	0	100	0	100	100	100	80.0	0	98.9	99.2
Mediums	0	0	0	0	0	0	0	0	0	1	0	1	1
% Mediums	0	0	0	0	0	0	0	0	0	20.0	0	1.1	0.8
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0



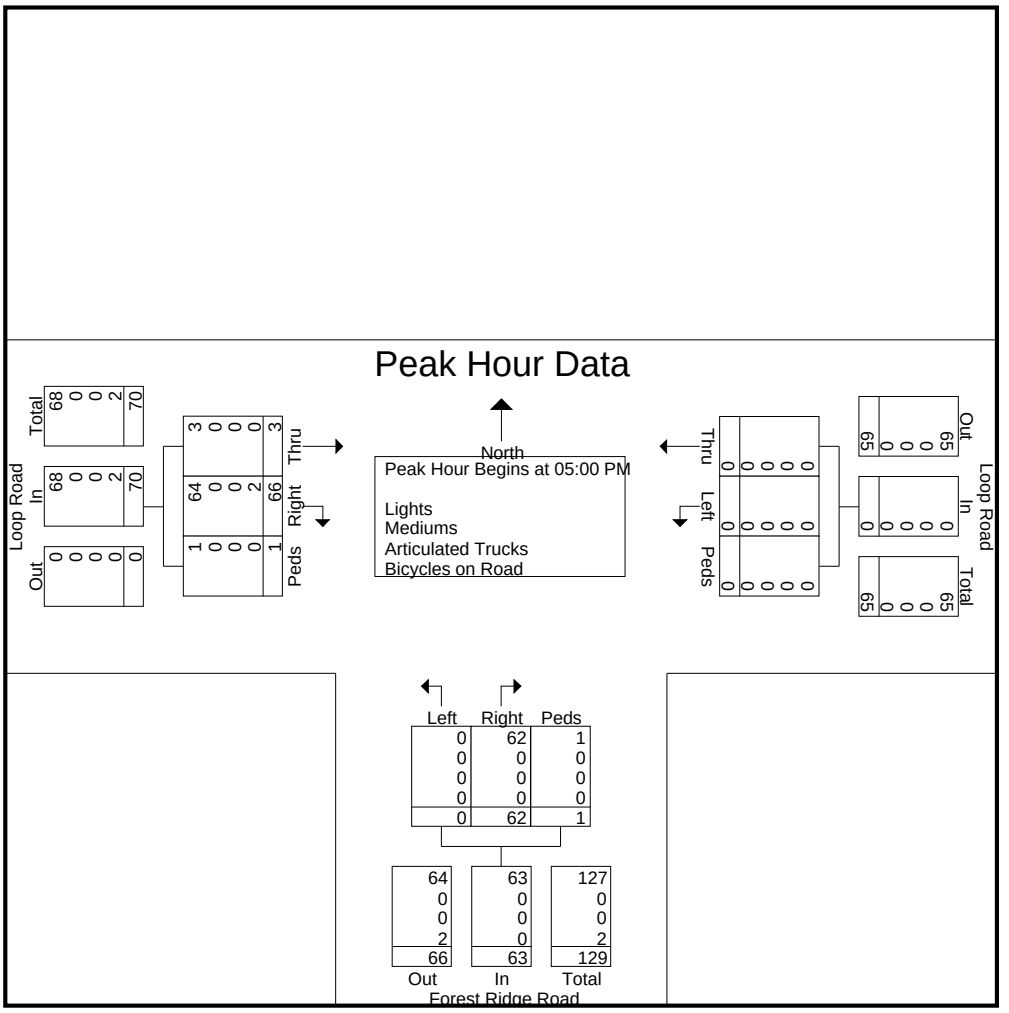
MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA, 01752

E/W: Loop Road
NB: Forest Ridge Road
Concord, MA

File Name : 1319_Forest_Ridge_at_Loop_SE_10-26-2023
Site Code : 1319
Start Date : 10/26/2023
Page No : 3

	Loop Road From East				Forest Ridge Road From South				Loop Road From West				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 05:00 PM													
05:00 PM	0	0	0	0	**24**	0	0	**24**	13	**1**	**1**	15	39
05:15 PM	0	0	0	0	12	0	**1**	13	11	1	0	12	25
05:30 PM	0	0	0	0	11	0	0	11	10	1	0	11	22
05:45 PM	0	0	0	0	15	0	0	15	**32**	0	0	**32**	**47**
Total Volume	0	0	0	0	62	0	1	63	66	3	1	70	133
% App. Total	0	0	0		98.4	0	1.6		94.3	4.3	1.4		
PHF	.000	.000	.000	.000	.646	.000	.250	.656	.516	.750	.250	.547	.707
Lights	0	0	0	0	62	0	1	63	64	3	1	68	131
% Lights	0	0	0	0	100	0	100	100	97.0	100	100	97.1	98.5
Mediums	0	0	0	0	0	0	0	0	0	0	0	0	0
% Mediums	0	0	0	0	0	0	0	0	0	0	0	0	0
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	0	0	0	0	0	0	0	2	0	0	2	2
% Bicycles on Road	0	0	0	0	0	0	0	0	3.0	0	0	2.9	1.5



MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA, 01752

E/W: Loop Road
NB: Sweet Birch Lane
Concord, MA

File Name : 1319_Sweet_Birch_at_Loop_SW_10-26-2023
Site Code : 1319
Start Date : 10/26/2023
Page No : 1

Groups Printed- Lights - Mediums - Articulated Trucks - Bicycles on Road

	Loop Road From East				Sweet Birch Lane From South				Loop Road From West				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	8	0	8	8
07:15 AM	0	0	0	0	0	0	0	0	0	14	0	14	14
07:30 AM	0	0	0	0	1	0	1	2	0	10	0	10	12
07:45 AM	0	0	0	0	1	0	5	6	0	9	0	9	15
Total	0	0	0	0	2	0	6	8	0	41	0	41	49
08:00 AM	0	0	0	0	0	0	0	0	1	23	0	24	24
08:15 AM	0	0	0	0	1	0	0	1	0	29	0	29	30
08:30 AM	0	0	0	0	2	0	0	2	0	18	0	18	20
08:45 AM	0	0	0	0	0	0	0	0	0	23	0	23	23
Total	0	0	0	0	3	0	0	3	1	93	0	94	97
04:00 PM	0	0	0	0	0	0	0	0	1	27	0	28	28
04:15 PM	0	0	0	0	0	0	2	2	0	18	0	18	20
04:30 PM	0	0	0	0	0	0	0	0	1	13	0	14	14
04:45 PM	0	0	1	1	0	0	1	1	0	20	0	20	22
Total	0	0	1	1	0	0	3	3	2	78	0	80	84
05:00 PM	0	0	0	0	1	0	0	1	0	11	0	11	12
05:15 PM	0	0	0	0	1	0	2	3	1	9	0	10	13
05:30 PM	0	0	0	0	1	0	2	3	1	12	0	13	16
05:45 PM	0	0	0	0	0	0	1	1	1	31	0	32	33
Total	0	0	0	0	3	0	5	8	3	63	0	66	74
Grand Total	0	0	1	1	8	0	14	22	6	275	0	281	304
Apprch %	0	0	100		36.4	0	63.6		2.1	97.9	0		
Total %	0	0	0.3	0.3	2.6	0	4.6	7.2	2	90.5	0	92.4	
Lights	0	0	1	1	8	0	14	22	5	266	0	271	294
% Lights	0	0	100	100	100	0	100	100	83.3	96.7	0	96.4	96.7
Mediums	0	0	0	0	0	0	0	0	0	2	0	2	2
% Mediums	0	0	0	0	0	0	0	0	0	0.7	0	0.7	0.7
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	0	0	0	0	0	0	0	1	7	0	8	8
% Bicycles on Road	0	0	0	0	0	0	0	0	16.7	2.5	0	2.8	2.6

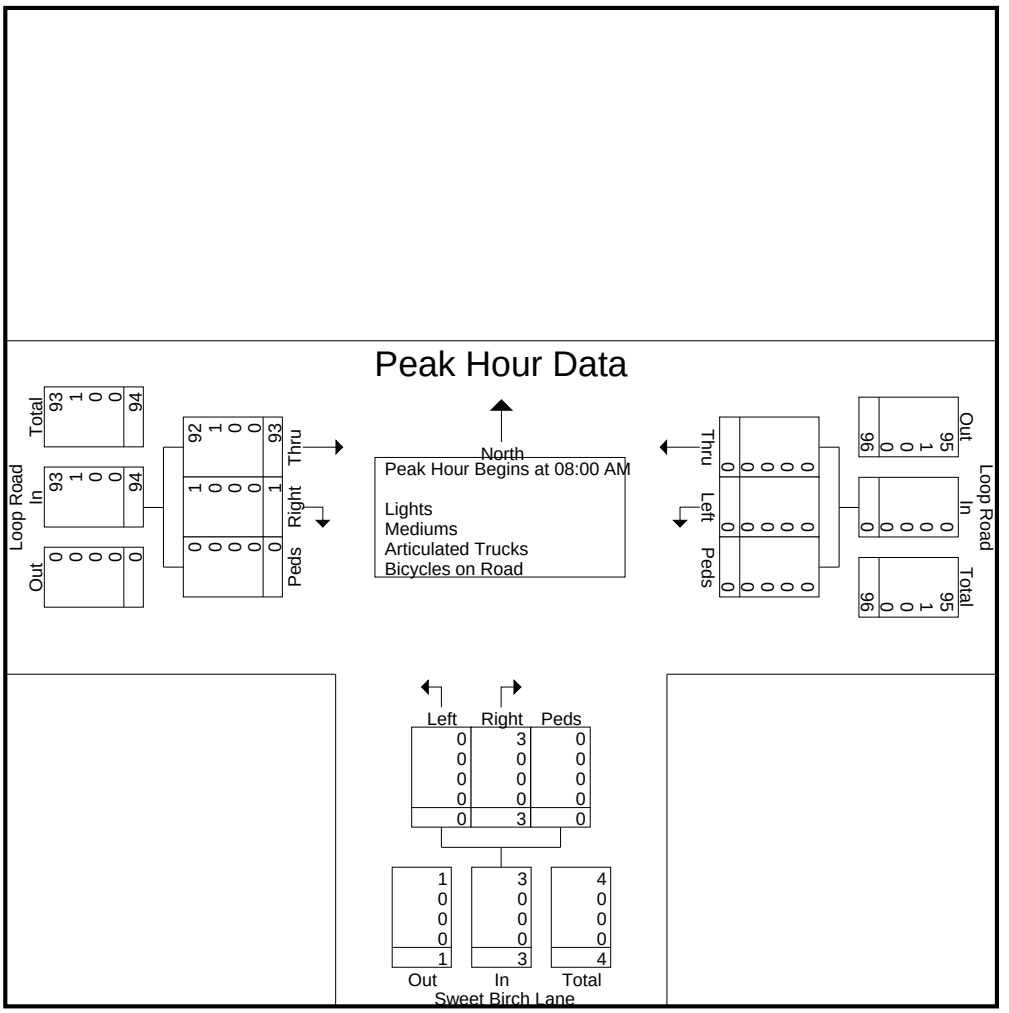
MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA, 01752

E/W: Loop Road
NB: Sweet Birch Lane
Concord, MA

File Name : 1319_Sweet_Birch_at_Loop_SW_10-26-2023
Site Code : 1319
Start Date : 10/26/2023
Page No : 2

	Loop Road From East				Sweet Birch Lane From South				Loop Road From West				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 08:00 AM													
08:00 AM	0	0	0	0	0	0	0	0	**1**	23	0	24	24
08:15 AM	0	0	0	0	1	0	0	1	0	**29**	0	**29**	**30**
08:30 AM	0	0	0	0	**2**	0	0	**2**	0	18	0	18	20
08:45 AM	0	0	0	0	0	0	0	0	0	23	0	23	23
Total Volume	0	0	0	0	3	0	0	3	1	93	0	94	97
% App. Total	0	0	0		100	0	0		1.1	98.9	0		
PHF	.000	.000	.000	.000	.375	.000	.000	.375	.250	.802	.000	.810	.808
Lights	0	0	0	0	3	0	0	3	1	92	0	93	96
% Lights	0	0	0	0	100	0	0	100	100	98.9	0	98.9	99.0
Mediums	0	0	0	0	0	0	0	0	0	1	0	1	1
% Mediums	0	0	0	0	0	0	0	0	0	1.1	0	1.1	1.0
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0



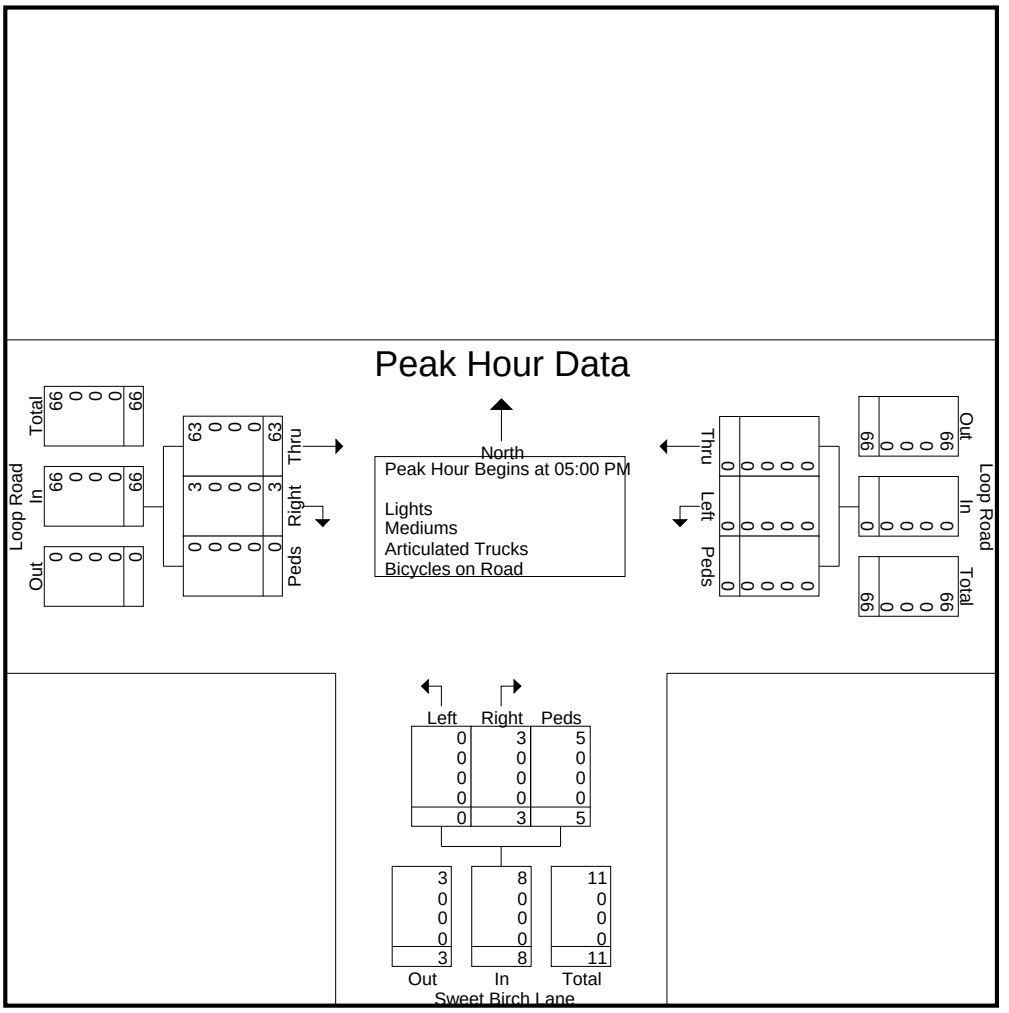
MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA, 01752

E/W: Loop Road
NB: Sweet Birch Lane
Concord, MA

File Name : 1319_Sweet_Birch_at_Loop_SW_10-26-2023
Site Code : 1319
Start Date : 10/26/2023
Page No : 3

	Loop Road From East				Sweet Birch Lane From South				Loop Road From West				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 05:00 PM to 05:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 05:00 PM													
05:00 PM	0	0	0	0	**1**	0	0	1	0	11	0	11	12
05:15 PM	0	0	0	0	1	0	**2**	**3**	**1**	9	0	10	13
05:30 PM	0	0	0	0	1	0	2	3	1	12	0	13	16
05:45 PM	0	0	0	0	0	0	1	1	1	**31**	0	**32**	**33**
Total Volume	0	0	0	0	3	0	5	8	3	63	0	66	74
% App. Total	0	0	0		37.5	0	62.5		4.5	95.5	0		
PHF	.000	.000	.000	.000	.750	.000	.625	.667	.750	.508	.000	.516	.561
Lights	0	0	0	0	3	0	5	8	3	63	0	66	74
% Lights	0	0	0	0	100	0	100	100	100	100	0	100	100
Mediums	0	0	0	0	0	0	0	0	0	0	0	0	0
% Mediums	0	0	0	0	0	0	0	0	0	0	0	0	0
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0



MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA, 01752

N/S: Forest Ridge Road
WB: Camp Thoreau North Dwy
Concord, MA

File Name : 1319_Forest_Ridge_at_Camp_Thoreau_First_10-26-2023
Site Code : 1319
Start Date : 10/26/2023
Page No : 1

Groups Printed- Lights - Mediums - Articulated Trucks - Bicycles on Road

	Forest Ridge Road From North				Camp Thoreau Dwy 1 From East				Forest Ridge Road From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
07:00 AM	7	0	0	7	0	0	0	0	0	2	0	2	9
07:15 AM	14	1	0	15	0	0	0	0	0	3	0	3	18
07:30 AM	6	2	0	8	0	0	0	0	0	2	1	3	11
07:45 AM	10	0	1	11	0	0	0	0	0	5	0	5	16
Total	37	3	1	41	0	0	0	0	0	12	1	13	54
08:00 AM	20	1	0	21	1	0	0	1	0	5	0	5	27
08:15 AM	30	0	0	30	0	0	0	0	0	9	0	9	39
08:30 AM	19	0	0	19	0	0	0	0	0	12	0	12	31
08:45 AM	22	1	0	23	0	0	0	0	0	6	0	6	29
Total	91	2	0	93	1	0	0	1	0	32	0	32	126
04:00 PM	14	1	0	15	0	1	0	1	0	7	0	7	23
04:15 PM	15	0	0	15	0	0	0	0	0	7	0	7	22
04:30 PM	12	0	0	12	0	0	0	0	0	9	0	9	21
04:45 PM	21	0	0	21	0	0	0	0	0	6	0	6	27
Total	62	1	0	63	0	1	0	1	0	29	0	29	93
05:00 PM	10	1	0	11	2	0	0	2	0	22	0	22	35
05:15 PM	12	0	0	12	0	0	0	0	0	12	1	13	25
05:30 PM	9	0	0	9	0	0	0	0	0	11	0	11	20
05:45 PM	33	0	0	33	0	0	0	0	0	16	2	18	51
Total	64	1	0	65	2	0	0	2	0	61	3	64	131
Grand Total	254	7	1	262	3	1	0	4	0	134	4	138	404
Apprch %	96.9	2.7	0.4		75	25	0		0	97.1	2.9		
Total %	62.9	1.7	0.2	64.9	0.7	0.2	0	1	0	33.2	1	34.2	
Lights	253	7	1	261	3	1	0	4	0	134	4	138	403
% Lights	99.6	100	100	99.6	100	100	0	100	0	100	100	100	99.8
Mediums	0	0	0	0	0	0	0	0	0	0	0	0	0
% Mediums	0	0	0	0	0	0	0	0	0	0	0	0	0
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	1	0	0	1	0	0	0	0	0	0	0	0	1
% Bicycles on Road	0.4	0	0	0.4	0	0	0	0	0	0	0	0	0.2

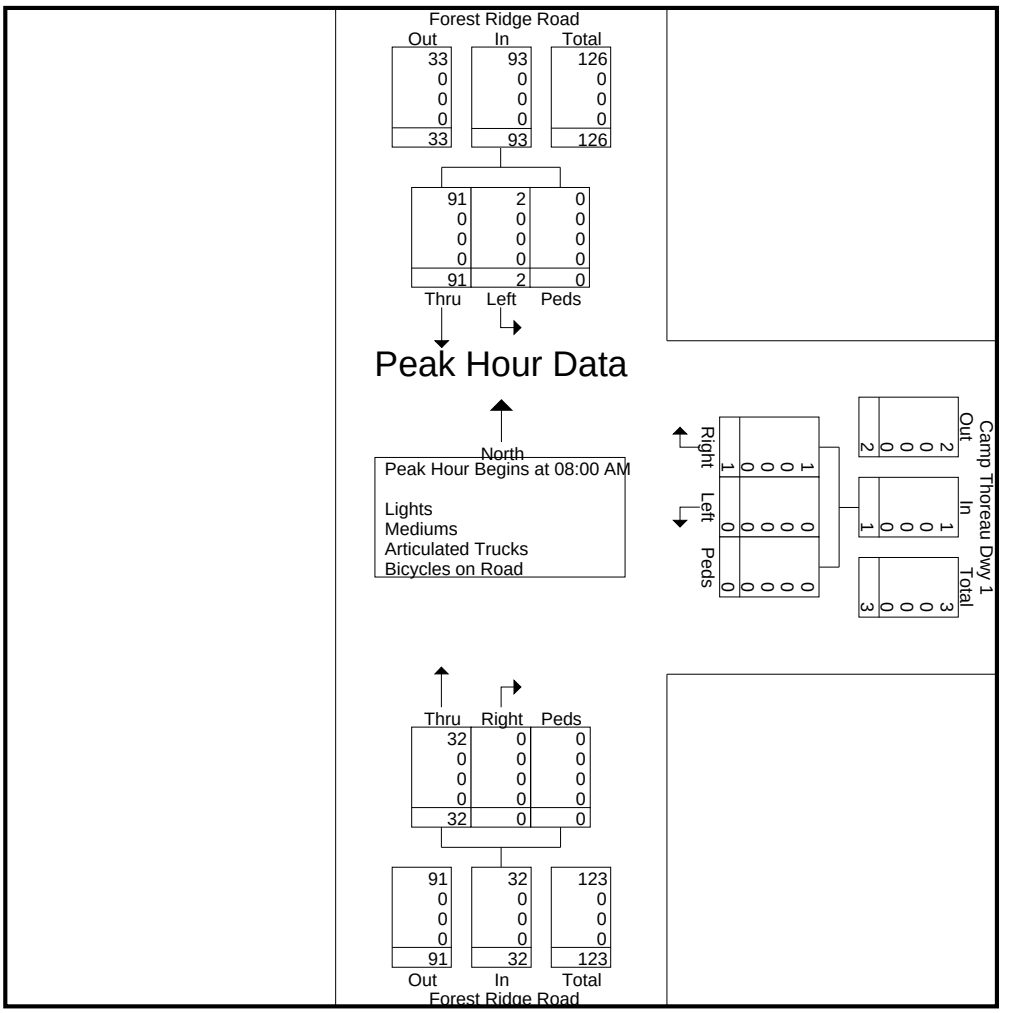
MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA, 01752

N/S: Forest Ridge Road
WB: Camp Thoreau North Dwy
Concord, MA

File Name : 1319_Forest_Ridge_at_Camp_Thoreau_First_10-26-2023
Site Code : 1319
Start Date : 10/26/2023

	Forest Ridge Road From North				Camp Thoreau Dwy 1 From East				Forest Ridge Road From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 08:00 AM													
08:00 AM	20	**1**	0	21	**1**	0	0	**1**	0	5	0	5	27
08:15 AM	**30**	0	0	**30**	0	0	0	0	0	9	0	9	**39**
08:30 AM	19	0	0	19	0	0	0	0	0	**12**	0	**12**	31
08:45 AM	22	1	0	23	0	0	0	0	0	6	0	6	29
Total Volume	91	2	0	93	1	0	0	1	0	32	0	32	126
% App. Total	97.8	2.2	0		100	0	0		0	100	0		
PHF	.758	.500	.000	.775	.250	.000	.000	.250	.000	.667	.000	.667	.808
Lights	91	2	0	93	1	0	0	1	0	32	0	32	126
% Lights	100	100	0	100	100	0	0	100	0	100	0	100	100
Mediums	0	0	0	0	0	0	0	0	0	0	0	0	0
% Mediums	0	0	0	0	0	0	0	0	0	0	0	0	0
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0



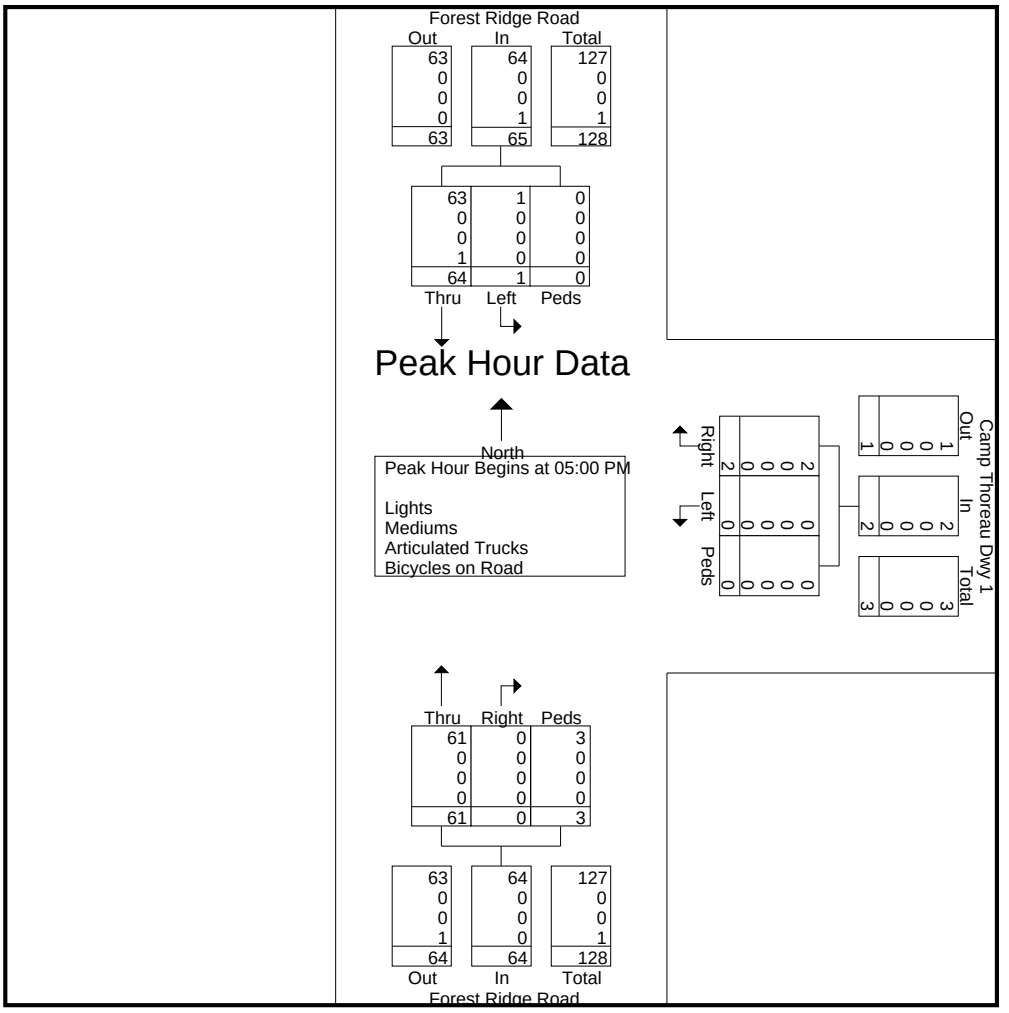
MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA, 01752

N/S: Forest Ridge Road
WB: Camp Thoreau North Dwy
Concord, MA

File Name : 1319_Forest_Ridge_at_Camp_Thoreau_First_10-26-2023
Site Code : 1319
Start Date : 10/26/2023
Page No : 3

	Forest Ridge Road From North				Camp Thoreau Dwy 1 From East				Forest Ridge Road From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 05:00 PM													
05:00 PM	10	**1**	0	11	**2**	0	0	**2**	0	**22**	0	**22**	35
05:15 PM	12	0	0	12	0	0	0	0	0	12	1	13	25
05:30 PM	9	0	0	9	0	0	0	0	0	11	0	11	20
05:45 PM	**33**	0	0	**33**	0	0	0	0	0	16	**2**	18	**51**
Total Volume	64	1	0	65	2	0	0	2	0	61	3	64	131
% App. Total	98.5	1.5	0		100	0	0		0	95.3	4.7		
PHF	.485	.250	.000	.492	.250	.000	.000	.250	.000	.693	.375	.727	.642
Lights	63	1	0	64	2	0	0	2	0	61	3	64	130
% Lights	98.4	100	0	98.5	100	0	0	100	0	100	100	100	99.2
Mediums	0	0	0	0	0	0	0	0	0	0	0	0	0
% Mediums	0	0	0	0	0	0	0	0	0	0	0	0	0
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	1	0	0	1	0	0	0	0	0	0	0	0	1
% Bicycles on Road	1.6	0	0	1.5	0	0	0	0	0	0	0	0	0.8



MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA, 01752

N/S: Forest Ridge Road
WB: Camp Thoreau South Dwy
EB: Sweet Birch Lane
Concord, MA

File Name : 1319_Forest_Ridge_at_Thoreau_+_Sweet_Birch_10-26-2023
Site Code : 1319
Start Date : 10/26/2023
Page No : 1

Groups Printed- Lights - Mediums - Articulated Trucks - Bicycles on Road

	Forest Ridge Road From North				Camp Thoreau Dwy 2 From East					Forest Ridge Road From South					Sweet Birch Lane From West					
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	5	0	5	2	0	0	0	2	0	0	0	0	0	0	0	0	1	1	8
07:15 AM	0	17	0	17	4	0	0	0	4	0	0	0	0	0	0	0	0	0	0	21
07:30 AM	0	6	0	6	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	8
07:45 AM	0	7	0	7	2	0	0	0	2	0	2	0	0	2	0	0	0	0	0	11
Total	0	35	0	35	10	0	0	0	10	0	2	0	0	2	0	0	0	1	1	48
08:00 AM	0	19	0	19	5	0	0	0	5	0	2	0	0	2	0	0	0	0	0	26
08:15 AM	0	31	0	31	6	0	0	0	6	0	2	0	0	2	0	0	0	0	0	39
08:30 AM	0	15	0	15	6	0	0	0	6	0	5	0	0	5	0	0	0	0	0	26
08:45 AM	0	22	0	22	5	0	0	0	5	0	1	0	0	1	0	0	0	0	0	28
Total	0	87	0	87	22	0	0	0	22	0	10	0	0	10	0	0	0	0	0	119
04:00 PM	0	18	1	19	5	0	0	0	5	0	4	0	0	4	0	0	0	2	2	30
04:15 PM	0	14	0	14	2	0	0	0	2	0	4	0	0	4	0	0	0	2	2	22
04:30 PM	0	12	0	12	4	0	0	0	4	0	6	0	0	6	0	0	0	2	2	24
04:45 PM	0	19	0	19	5	0	0	0	5	0	1	0	0	1	0	0	0	0	0	25
Total	0	63	1	64	16	0	0	0	16	0	15	0	0	15	0	0	0	6	6	101
05:00 PM	0	12	1	13	7	0	0	0	7	0	12	0	0	12	0	0	0	0	0	32
05:15 PM	0	9	0	9	7	0	0	0	7	0	10	0	0	10	0	0	0	1	1	27
05:30 PM	0	11	0	11	8	0	0	0	8	0	3	0	0	3	0	0	0	2	2	24
05:45 PM	0	29	0	29	10	0	0	0	10	0	4	0	0	4	0	0	0	0	0	43
Total	0	61	1	62	32	0	0	0	32	0	29	0	0	29	0	0	0	3	3	126
Grand Total	0	246	2	248	80	0	0	0	80	0	56	0	0	56	0	0	0	10	10	394
Apprch %	0	99.2	0.8		100	0	0	0		0	100	0	0		0	0	0	100		
Total %	0	62.4	0.5	62.9	20.3	0	0	0	20.3	0	14.2	0	0	14.2	0	0	0	2.5	2.5	
Lights	0	245	2	247	80	0	0	0	80	0	56	0	0	56	0	0	0	10	10	393
% Lights	0	99.6	100	99.6	100	0	0	0	100	0	100	0	0	100	0	0	0	100	100	99.7
Mediums	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Mediums	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
% Bicycles on Road	0	0.4	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3

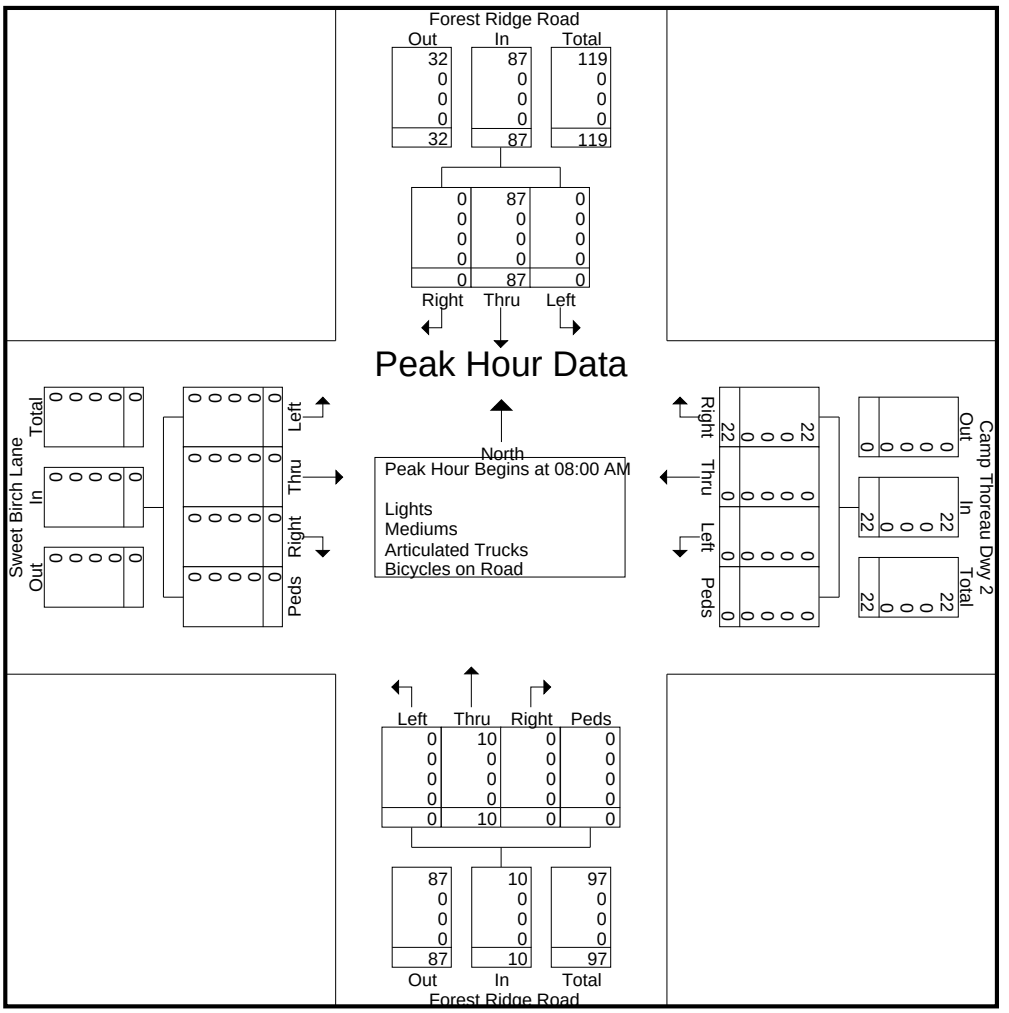
MDM Transportation Consultants, Inc.

28 Lord Road, Suite 280
Marlborough, MA, 01752

N/S: Forest Ridge Road
WB: Camp Thoreau South Dwy
EB: Sweet Birch Lane
Concord, MA

File Name : 1319_Forest_Ridge_at_Thoreau_+_Sweet_Birch_10-26-2023
Site Code : 1319
Start Date : 10/26/2023
Page No : 2

	Forest Ridge Road From North				Camp Thoreau Dwy 2 From East					Forest Ridge Road From South					Sweet Birch Lane From West					
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																				
Peak Hour for Entire Intersection Begins at 08:00 AM																				
08:00 AM	0	19	0	19	5	0	0	0	5	0	2	0	0	2	0	0	0	0	0	26
08:15 AM	0	**31**	0	**31**	**6**	0	0	0	**6**	0	2	0	0	2	0	0	0	0	0	**39**
08:30 AM	0	15	0	15	6	0	0	0	6	0	**5**	0	0	**5**	0	0	0	0	0	26
08:45 AM	0	22	0	22	5	0	0	0	5	0	1	0	0	1	0	0	0	0	0	28
Total Volume	0	87	0	87	22	0	0	0	22	0	10	0	0	10	0	0	0	0	0	119
% App. Total	0	100	0		100	0	0	0		0	100	0	0		0	0	0	0		
PHF	.000	.702	.000	.702	.917	.000	.000	.000	.917	.000	.500	.000	.000	.500	.000	.000	.000	.000	.000	.763
Lights	0	87	0	87	22	0	0	0	22	0	10	0	0	10	0	0	0	0	0	119
% Lights	0	100	0	100	100	0	0	0	100	0	100	0	0	100	0	0	0	0	0	100
Mediums	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Mediums	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



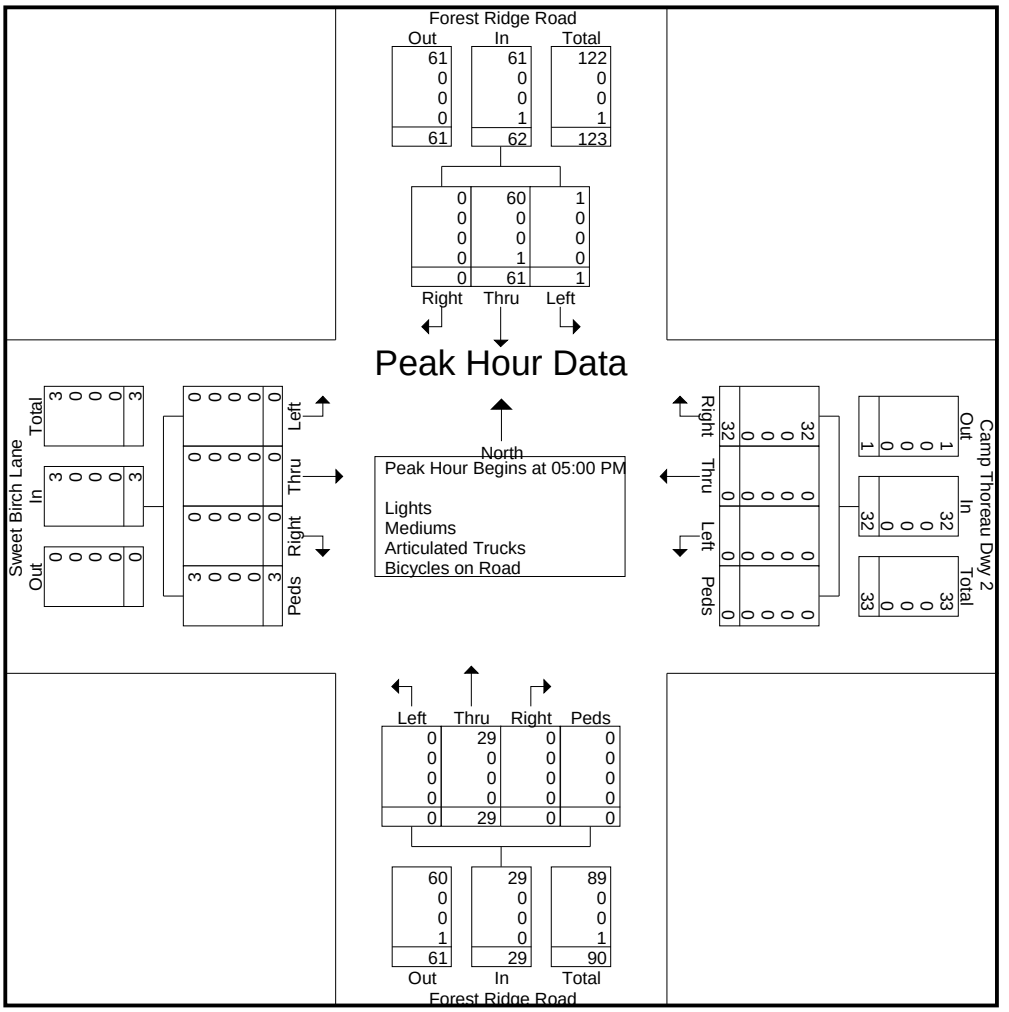
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File Name : 1319_Forest_Ridge_at_Thoreau_+_Sweet_Birch_10-26-2023
Site Code : 1319
Start Date : 10/26/2023
Page No : 3

	Forest Ridge Road From North				Camp Thoreau Dwy 2 From East					Forest Ridge Road From South					Sweet Birch Lane From West					
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																				
Peak Hour for Entire Intersection Begins at 05:00 PM																				
05:00 PM	0	12	**1**	13	7	0	0	0	7	0	**12**	0	0	**12**	0	0	0	0	0	32
05:15 PM	0	9	0	9	7	0	0	0	7	0	10	0	0	10	0	0	0	1	1	27
05:30 PM	0	11	0	11	8	0	0	0	8	0	3	0	0	3	0	0	0	**2**	**2**	24
05:45 PM	0	**29**	0	**29**	**10**	0	0	0	**10**	0	4	0	0	4	0	0	0	0	0	**43**
Total Volume	0	61	1	62	32	0	0	0	32	0	29	0	0	29	0	0	0	3	3	126
% App. Total	0	98.4	1.6		100	0	0	0		0	100	0	0		0	0	0	100		
PHF	.000	.526	.250	.534	.800	.000	.000	.000	.800	.000	.604	.000	.000	.604	.000	.000	.000	.375	.375	.733
Lights	0	60	1	61	32	0	0	0	32	0	29	0	0	29	0	0	0	3	3	125
% Lights	0	98.4	100	98.4	100	0	0	0	100	0	100	0	0	100	0	0	0	100	100	99.2
Mediums	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Mediums	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
% Bicycles on Road	0	1.6	0	1.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.8



□ Seasonal/Yearly Growth Data

SECTION I - CONTINUOUS COUNTING STATION MONTHLY AVERAGE DAILY TRAFFIC

STATION 403 - CONCORD - RTE.2 - 0.2 km EAST OF CONCORD ROTARY

YR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
10	41,546	41,883	46,472	50,492	45,910	46,524	43,534	39,595	40,709	46,285	43,576	44,350	44,240
	-6%	-4%	-6%	-12%	0%	-1%	0%	9%	10%	-2%	-1%	-5%	-2%
11	39,037	40,138	43,732	44,191	45,777	46,145	43,496	43,117	44,740	45,508	43,282	42,043	43,434
	6%	5%	-2%	0%	0%	-1%	-7%	4%	0%	-1%	-1%	-1%	0%
12	41,311	42,111	43,069	44,294	45,759	45,640	40,408	44,775	44,720	44,904	42,980	41,701	43,473
	1%	-7%	-2%	-3%	-3%	-1%	4%	-3%	-1%	0%	-1%	3%	-1%
13	41,792	39,095	42,007	42,993	44,222	44,984	41,995	43,310	44,422	45,062	42,684	42,773	42,945
	-6%	-6%	2%	2%	3%	2%	4%	1%	-1%	2%	2%	12%	1%
15	39,457	36,908	42,703	44,051	45,401	45,790	43,572	43,700	43,992	46,043	43,701	47,747	43,589
	6%	15%	4%	1%	3%	4%	3%	6%	3%	2%	4%	-9%	3%
16	41,896	42,396	44,580	44,670	46,737	47,669	45,004	46,441	45,499	47,080	45,357	43,312	45,053
	3%	1%	1%	1%	2%	2%	2%	1%	4%	4%	3%	-1%	2%
17	43,250	43,008	45,196	45,139	47,491	48,619	45,789	46,860	47,255	48,955	46,715	42,828	45,855
	0%	3%	0%	4%	1%	1%	-3%	-2%	-5%	-1%	-9%	5%	0%
18	43,289	44,164	45,201	46,965	48,147	49,054	44,492	45,928	44,882	48,454	42,446	45,171	45,683
Seasonal Adjustment Factor (to average month)	1.07	1.08	1.00	0.98	0.96	0.95	1.02	1.00	1.00	0.95	1.01	1.01	
												Growth	**0.33%**

MADT

ITALICS = ESTIMATED DATA

- Crash Data

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Concord, MA COUNT DATE : Oct-23

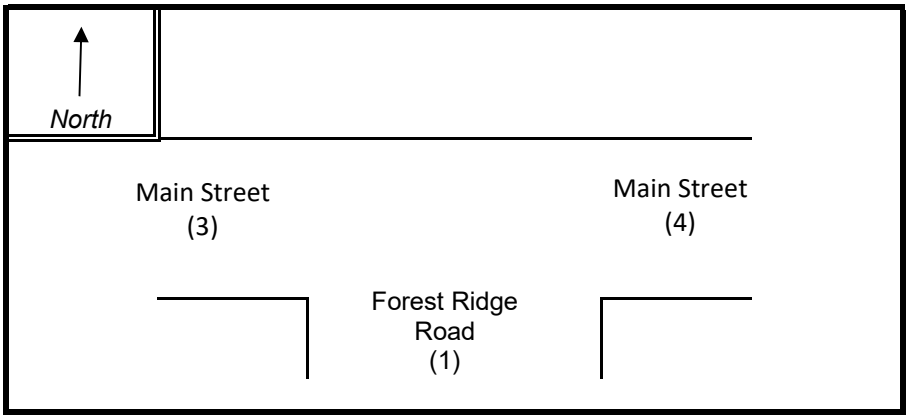
DISTRICT : 4 UNSIGNALIZED : X SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Main Street (Route 62)

MINOR STREET(S) : Forest Ridge Road

INTERSECTION DIAGRAM
(Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES (PM) :	66		406	636		1,108

" K " FACTOR : **0.082**

INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **13,512**

TOTAL # OF CRASHES : 6

OF YEARS : 5

AVERAGE # OF CRASHES PER YEAR (**A**) : **1.20**

CRASH RATE CALCULATION : **0.24**

RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : MassDOT District 4 Avg: Signalized = 0.73; Unsignalized = 0.57

Project Title & Date: 1319 - Concord

Crash Date	Crash Severity	Crash Time	Number of Vehicles	Light Conditions	Manner of Collision	Road Surface Condition	Total Fatalities	Total Non-Fatal Injuries	Vehicle Actions Prior to Crash (All Vehicles)	Vehicle Configuration (All Vehicles)	Vehicle Travel Directions (All Vehicles)	Weather Conditions	Most Harmful Event (All Vehicles)	X	Y	Roadway
08/14/2019	Property damage only (none injured)	11:36 AM	2	Daylight	Angle	Dry	0	0	V1: Travelling straight ahead / V2: Turning left	V1:(Passenger car) / V2:(Passenger car)	V1: E / V2: S	Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	206125.0313	910204.5629	MAIN ST / FOREST RIDGE RD
08/13/2019	Property damage only (none injured)	3:23 PM	2	Daylight	Rear-end	Dry	0	0	V1: Travelling straight ahead / V2: Slowing or stopped in traffic	V1:(Passenger car) / V2:(Passenger car)	V1: E / V2: E	Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	206134.2292	910208.7996	MAIN ST
03/22/2021	Property damage only (none injured)	2:03 PM	1	Daylight	Single vehicle crash	Dry	0	0	V1: Travelling straight ahead	V1:(Passenger car)	V1: W	Clear	V1:(Collision with other movable object)	206111.5228	910198.3668	MAIN ST
10/27/2022	Property damage only (none injured)	4:55 PM	2	Daylight	Rear-end	Wet	0	0	V1: Travelling straight ahead / V2: Turning left	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Passenger car)	V1: N / V2: N	Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	206111.5228	910198.3668	MAIN ST
01/23/2023	Property damage only (none injured)	3:10 PM	1	Daylight	Single vehicle crash	Snow	0	0	V1: Travelling straight ahead	V1:(Passenger car)	V1: W	Snow	V1:(Other)	206111.5228	910198.3668	MAIN ST Rte
07/20/2023	Property damage only (none injured)	3:24 PM	2	Daylight	Front to Front	Dry	0	0	V1: Turning left / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: N / V2: E	Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	206125.0313	910204.5629	MAIN ST Rte / FOREST RIDGE RD Rte

□ Sight Distance Calculations

Stopping Sight Distance - Regulatory

Existing Thoreau Club Driveway

		SPEED (MPH)	BRAKE REACTION DISTANCE (FT)	BRAKING DISTANCE (FT)	CALCULATED STOPPING SIGHT DISTANCE (FT)
Direction 1	NB	15	55.125	21.6	76.7
Direction 2	SB	15	55.125	21.6	76.7

INPUTS	Direction 1	Direction 2
Travel Direction	NB	SB
Speed	15	15
Grade	0	0
t	2.5	2.5
a	11.2	11.2

Stopping Sight Distance (SSD) - Source: AASHTO

SSD = Reaction Distance + Brake Distance

Reaction Distance = 1.47 x t x V

Brake Distance = V^2 / (30 x ((a/32.2)+G))

Where:
t = reaction time (sec)
V = travel speed (mph)
G= roadway grade
a - deceleration rate (ft/sec^2)

Intersection Sight Distance Calculations

Source: *A Policy on Geometric Design of Highways and Street, 7th Edition;* AASHTO; 2018.

Passenger Car
ISD = 1.47 * V * t

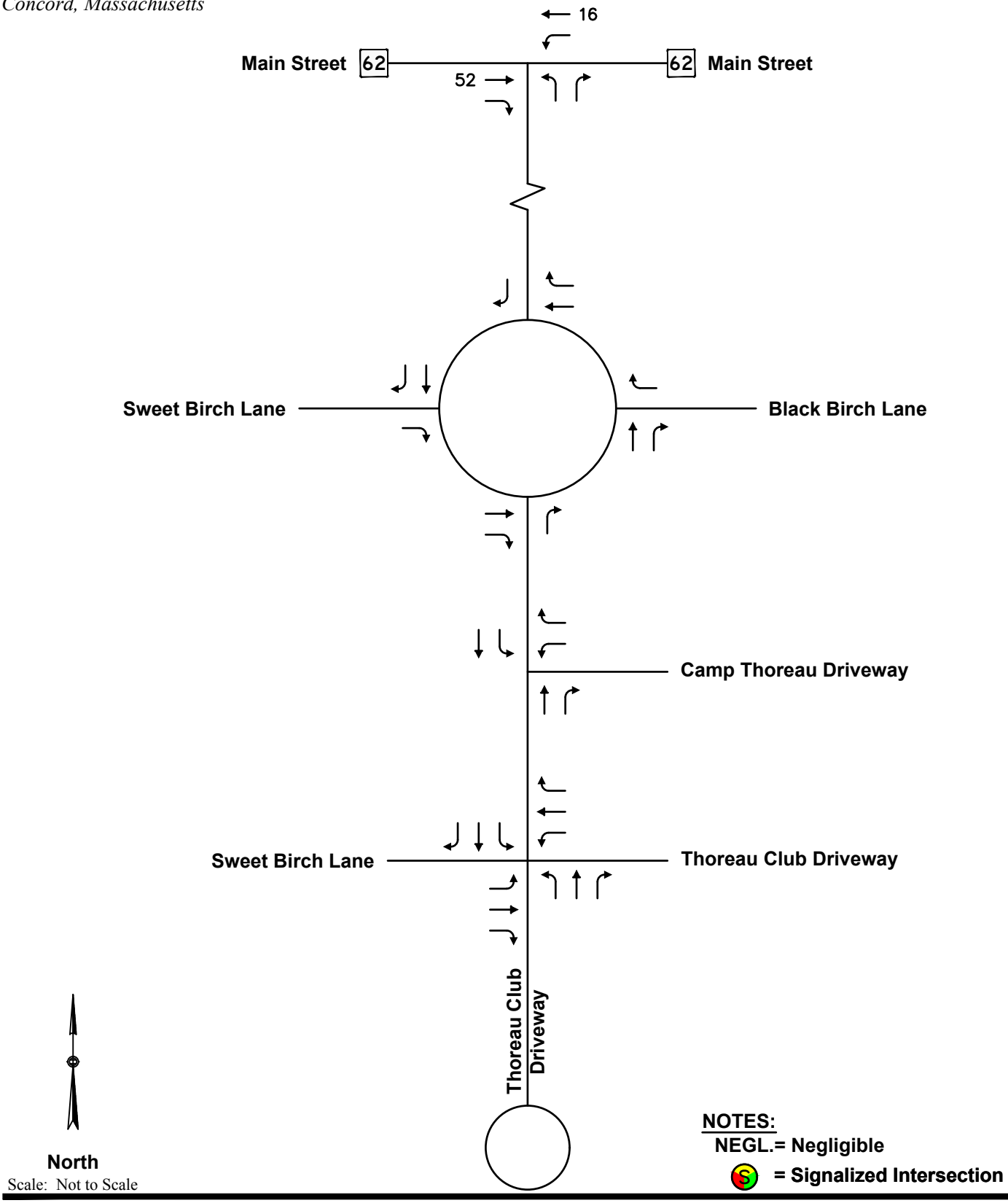
V = speed
t = time gap

t = 7.5 s for a passenger car for Left Turn from a Stop
t = 6.5 s for a passenger car for Right Turn from a Stop

Thoreau Club Driveway

		Average Speed		Ideal ISD	SAY
Looking North (left-turn from a stop)	ISD = 1.47*	25	* 7.5 =	275.625	**280 feet**
Looking South (right-turn from a stop)	ISD = 1.47*	25	* 6.5 =	238.875	**240 feet**

- [ ] Background Projects

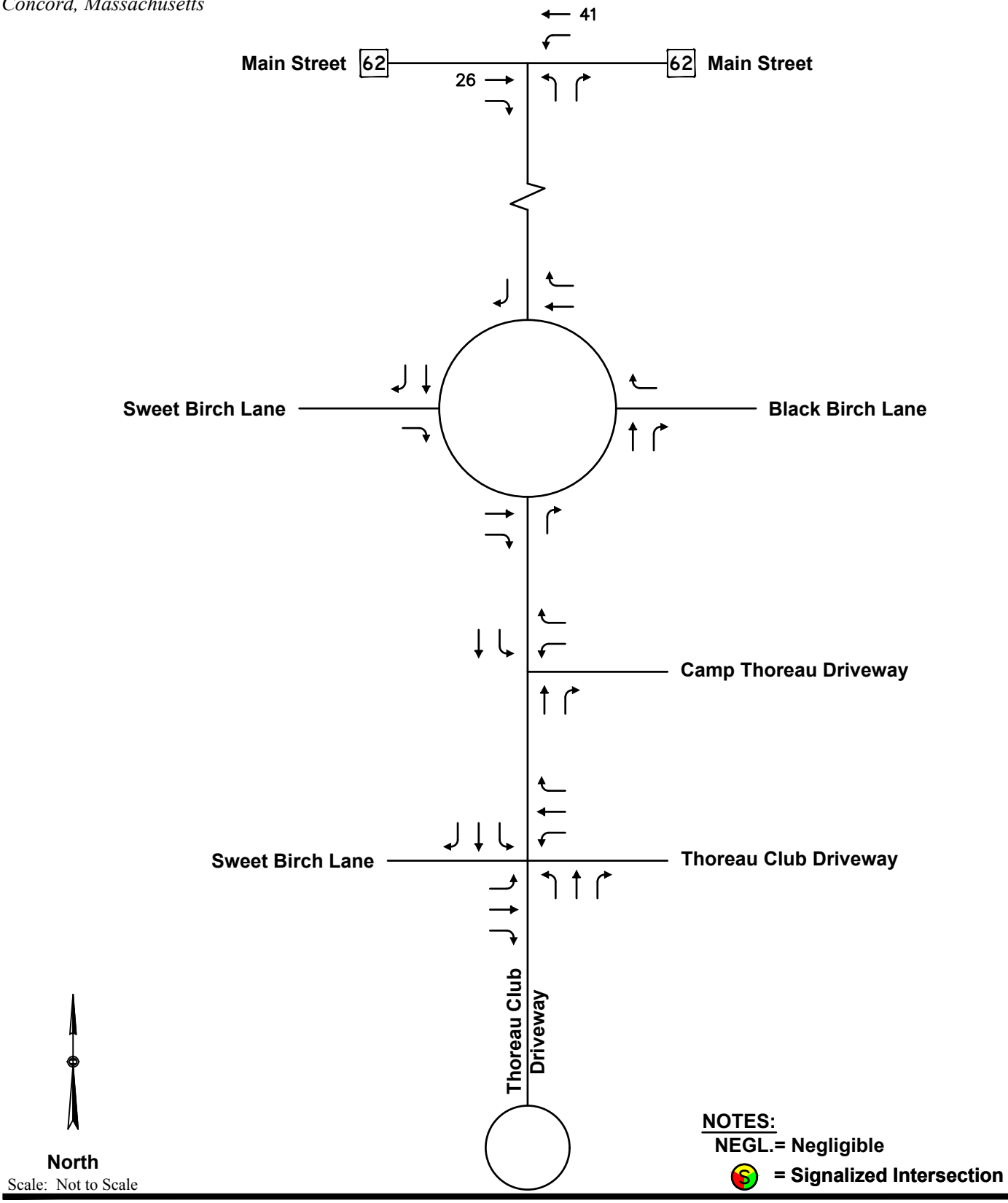


Attachment

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

The Apartments at Powder Mill
Weekday Morning Peak Hour Volumes

Date: October 2024
Dwg No. 1391 TIAS.dwg
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Attachment

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

The Apartments at Powder Mill
Weekday Evening Peak Hour Volumes

Date: October 2024
Dwg No. 1391 TIAS.dwg
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- Trip Generation

Institute of Transportation Engineers (ITE) 11th Edition
Land Use Code (LUC) 221 - Multifamily Housing (Mid-Rise)

Average Vehicle Trips Ends vs: Dwelling Units
Independent Variable (X): 237

AVERAGE WEEKDAY DAILY

T = 4.54 * X
T = 4.54 * 237
T = 1075.98
T = 1,076 vehicle trips
with 50% (**538** vpd) entering and 50% (**538** vpd) exiting.

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

T = 0.37 * X
T = 0.37 * 237
T = 87.69
T = 88 vehicle trips
with 23% (**20** vph) entering and 77% (**68** vph) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

T = 0.39 * X
T = 0.39 * 237
T = 92.43
T = 92 vehicle trips
with 61% (**56** vph) entering and 39% (**36** vph) exiting.

SATURDAY DAILY

T = 4.57 * X
T = 4.57 * 237
T = 1083.09
T = 1,084 vehicle trips
with 50% (**542** vpd) entering and 50% (**542** vpd) exiting.

SATURDAY MIDDAY PEAK HOUR OF GENERATOR

T = 0.39 * X
T = 0.39 * 237
T = 92.43
T = 92 vehicle trips
with 49% (**45** vph) entering and 51% (**47** vph) exiting.

□ Trip Distribution Calculations

Journey-to-Work Distribution

US Census Journey-to-Work Data

Residence Town Name	Workplace Town Name	All Workers	% of Total Rounded
Concord town	Concord town	2,595	34.9%
Concord town	Boston city	1,049	14.1%
Concord town	Cambridge city	606	8.2%
Concord town	Waltham city	263	3.5%
Concord town	Lexington town	251	3.4%
Concord town	Burlington town	216	2.9%
Concord town	Acton town	174	2.3%
Concord town	Framingham town	162	2.2%
Concord town	Woburn city	92	1.2%
Concord town	Chelmsford town	90	1.2%
Concord town	Bedford town	86	1.2%
Concord town	Westford town	84	1.1%
Concord town	Lowell city	81	1.1%
Concord town	Weston town	80	1.1%
Concord town	Billerica town	73	1.0%
Concord town	Natick town	72	1.0%
Concord town	Lincoln town	71	1.0%
Concord town	Newton city	64	0.9%
Concord town	Sudbury town	61	0.8%
Concord town	Medford city	60	0.8%
Concord town	Littleton town	57	0.8%
Concord town	Groton town	56	0.8%
Concord town	Danvers town	55	0.7%
Concord town	Marlborough city	55	0.7%
Concord town	Wellesley town	54	0.7%
Concord town	Watertown Town city	51	0.7%
Concord town	Andover town	50	0.7%
Concord town	Worcester city	42	0.6%
Concord town	Wilmington town	38	0.5%
Concord town	Belmont town	37	0.5%
Concord town	Brookline town	36	0.5%
	Sub-Total	**6,762**	**91%**
	Other	668	9%
	Total	**7,430**	**100%**

	To/From Routes				
	Route 62		Route 62		
Workplace	(To/From West)		(To/From East)		Total
Concord town		0.0%	100%	34.9%	34.9%
Boston city	50%	7.1%	50%	7.1%	14.1%
Cambridge city		0.0%	100%	8.2%	8.2%
Waltham city	50%	1.8%	50%	1.8%	3.5%
Lexington town		0.0%	100%	3.4%	3.4%
Burlington town		0.0%	100%	2.9%	2.9%
Acton town	50%	1.2%	50%	1.2%	2.3%
Framingham town	100%	2.2%		0.0%	2.2%
Woburn city		0.0%	100%	1.2%	1.2%
Chelmsford town	50%	0.6%	50%	0.6%	1.2%
Bedford town		0.0%	100%	1.2%	1.2%
Westford town	50%	0.6%	50%	0.6%	1.1%
Lowell city	50%	0.5%	50%	0.5%	1.1%
Weston town	100%	1.1%		0.0%	1.1%
Billerica town		0.0%	100%	1.0%	1.0%
Natick town	100%	1.0%		0.0%	1.0%
Lincoln town	50%	0.5%	50%	0.5%	1.0%
Newton city	50%	0.4%	50%	0.4%	0.9%
Sudbury town	100%	0.8%		0.0%	0.8%
Medford city		0.0%	100%	0.8%	0.8%
Littleton town	100%	0.8%		0.0%	0.8%
Groton town	100%	0.8%		0.0%	0.8%
Danvers town		0.0%	100%	0.7%	0.7%
Marlborough city	100%	0.7%		0.0%	0.7%
Wellesley town	50%	0.4%	50%	0.4%	0.7%
Watertown Town city		0.0%	100%	0.7%	0.7%
Andover town	50%	0.3%	50%	0.3%	0.7%
Worcester city	100%	0.6%		0.0%	0.6%
Wilmington town		0.0%	100%	0.5%	0.5%
Belmont town		0.0%	100%	0.5%	0.5%
Brookline town	50%	0.2%	50%	0.2%	0.5%
Sub-Total		21.4%		69.6%	91.0%
Other		2.1%		6.9%	9.0%
Total		23.6%		76.4%	100.0%
SAY		25%		75%	100%

□ Delay Study

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers
28 Lord Road, Suite 280
Marlborough, MA 01752

Forest Ridge Road
at Main Street
Concord, MA

File Name : 1391 Delay Study
Site Code : 00001391
Start Date : 10/30/2024

Summary Information:

4:00:00 PM - 5:00:00 PM	Left Turn	Right Turn
Total Vehicle Count:	67	29
Delayed Vehicle Count:	67	29
Through Vehicle Count:	0	0
Average Stopped Time:	22.46	4.241
Maximum Stopped Time:	85	13
Min. Secs. for Delay:	0	0
Average Queue:	0.44	0.038
Queue Density:	1.50	1.017
Maximum Queue:	7	2
Delay in Vehicle Hour:	0.45	0.04
Total Delay:	1505	123

- [ ] Capacity Analysis

Intersection	
Int Delay, s/veh	1.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	650	93	55	273	39	20
Future Vol, veh/h	650	93	55	273	39	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	97
Heavy Vehicles, %	2	1	9	6	3	10
Mvmt Flow	691	99	59	290	41	21

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	790	0	1149	741
Stage 1	-	-	-	-	741	-
Stage 2	-	-	-	-	408	-
Critical Hdwy	-	-	4.19	-	5.8	3.4
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.281	-	3.527	3.39
Pot Cap-1 Maneuver	-	-	800	-	267	733
Stage 1	-	-	-	-	470	-
Stage 2	-	-	-	-	669	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	800	-	244	733
Mov Cap-2 Maneuver	-	-	-	-	244	-
Stage 1	-	-	-	-	470	-
Stage 2	-	-	-	-	610	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.7	18.6
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	244	733	-	-	800	-
HCM Lane V/C Ratio	0.17	0.028	-	-	0.073	-
HCM Control Delay (s)	22.8	10.1	-	-	9.9	0
HCM Lane LOS	C	B	-	-	A	A
HCM 95th %tile Q(veh)	0.6	0.1	-	-	0.2	-

Intersection	
Intersection Delay, s/veh	3.2
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	3	1	36	123
Demand Flow Rate, veh/h	3	1	36	124
Vehicles Circulating, veh/h	123	39	3	0
Vehicles Exiting, veh/h	1	0	123	40
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	3.0	2.7	2.8	3.3
Approach LOS	A	A	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	3	1	36	124
Cap Entry Lane, veh/h	1217	1326	1376	1380
Entry HV Adj Factor	1.000	1.000	1.000	0.990
Flow Entry, veh/h	3	1	36	123
Cap Entry, veh/h	1217	1326	1376	1366
V/C Ratio	0.002	0.001	0.026	0.090
Control Delay, s/veh	3.0	2.7	2.8	3.3
LOS	A	A	A	A
95th %tile Queue, veh	0	0	0	0

Intersection	
Int Delay, s/veh	1.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	386	63	41	555	67	29
Future Vol, veh/h	386	63	41	555	67	29
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	1	2	2	4	3	0
Mvmt Flow	394	64	42	566	68	30

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	458	0	1076	426
Stage 1	-	-	-	-	426	-
Stage 2	-	-	-	-	650	-
Critical Hdwy	-	-	4.12	-	5.8	3.3
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.218	-	3.527	3.3
Pot Cap-1 Maneuver	-	-	1103	-	292	892
Stage 1	-	-	-	-	657	-
Stage 2	-	-	-	-	518	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1103	-	276	892
Mov Cap-2 Maneuver	-	-	-	-	276	-
Stage 1	-	-	-	-	657	-
Stage 2	-	-	-	-	489	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	18.3
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	276	892	-	-	1103	-
HCM Lane V/C Ratio	0.248	0.033	-	-	0.038	-
HCM Control Delay (s)	22.3	9.2	-	-	8.4	0
HCM Lane LOS	C	A	-	-	A	A
HCM 95th %tile Q(veh)	1	0.1	-	-	0.1	-

Intersection	
Intersection Delay, s/veh	3.4
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	5	0	142	133
Demand Flow Rate, veh/h	5	0	142	133
Vehicles Circulating, veh/h	128	147	5	0
Vehicles Exiting, veh/h	5	0	128	147
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	3.0	0.0	3.4	3.4
Approach LOS	A	-	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	5	0	142	133
Cap Entry Lane, veh/h	1211	1188	1373	1380
Entry HV Adj Factor	1.000	1.000	1.000	1.000
Flow Entry, veh/h	5	0	142	133
Cap Entry, veh/h	1211	1188	1373	1380
V/C Ratio	0.004	0.000	0.103	0.096
Control Delay, s/veh	3.0	3.0	3.4	3.4
LOS	A	A	A	A
95th %tile Queue, veh	0	0	0	0

Intersection	
Int Delay, s/veh	1.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	725	96	57	299	40	21
Future Vol, veh/h	725	96	57	299	40	21
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	97
Heavy Vehicles, %	2	1	9	6	3	10
Mvmt Flow	771	102	61	318	43	22

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	873	0	1262	822
Stage 1	-	-	-	-	822	-
Stage 2	-	-	-	-	440	-
Critical Hdwy	-	-	4.19	-	5.8	3.4
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.281	-	3.527	3.39
Pot Cap-1 Maneuver	-	-	744	-	233	702
Stage 1	-	-	-	-	430	-
Stage 2	-	-	-	-	647	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	744	-	210	702
Mov Cap-2 Maneuver	-	-	-	-	210	-
Stage 1	-	-	-	-	430	-
Stage 2	-	-	-	-	582	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.6	21
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	210	702	-	-	744	-
HCM Lane V/C Ratio	0.203	0.031	-	-	0.082	-
HCM Control Delay (s)	26.4	10.3	-	-	10.3	0
HCM Lane LOS	D	B	-	-	B	A
HCM 95th %tile Q(veh)	0.7	0.1	-	-	0.3	-

Intersection	
Intersection Delay, s/veh	3.2
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	3	1	37	127
Demand Flow Rate, veh/h	3	1	37	128
Vehicles Circulating, veh/h	127	40	3	0
Vehicles Exiting, veh/h	1	0	127	41
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	3.0	2.7	2.8	3.4
Approach LOS	A	A	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	3	1	37	128
Cap Entry Lane, veh/h	1212	1325	1376	1380
Entry HV Adj Factor	1.000	1.000	1.000	0.990
Flow Entry, veh/h	3	1	37	127
Cap Entry, veh/h	1212	1325	1376	1366
V/C Ratio	0.002	0.001	0.027	0.093
Control Delay, s/veh	3.0	2.7	2.8	3.4
LOS	A	A	A	A
95th %tile Queue, veh	0	0	0	0

Intersection	
Int Delay, s/veh	1.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	426	65	42	616	69	30
Future Vol, veh/h	426	65	42	616	69	30
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	1	2	2	4	3	0
Mvmt Flow	435	66	43	629	70	31

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	501	0	1183	468
Stage 1	-	-	-	-	468	-
Stage 2	-	-	-	-	715	-
Critical Hdwy	-	-	4.12	-	5.8	3.3
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.218	-	3.527	3.3
Pot Cap-1 Maneuver	-	-	1063	-	256	874
Stage 1	-	-	-	-	628	-
Stage 2	-	-	-	-	483	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1063	-	240	874
Mov Cap-2 Maneuver	-	-	-	-	240	-
Stage 1	-	-	-	-	628	-
Stage 2	-	-	-	-	453	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.5	21
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	240	874	-	-	1063	-
HCM Lane V/C Ratio	0.293	0.035	-	-	0.04	-
HCM Control Delay (s)	26.1	9.3	-	-	8.5	0
HCM Lane LOS	D	A	-	-	A	A
HCM 95th %tile Q(veh)	1.2	0.1	-	-	0.1	-

Intersection	
Intersection Delay, s/veh	3.4
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	5	0	146	133
Demand Flow Rate, veh/h	5	0	146	133
Vehicles Circulating, veh/h	128	151	5	0
Vehicles Exiting, veh/h	5	0	128	151
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	3.0	0.0	3.5	3.4
Approach LOS	A	-	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	5	0	146	133
Cap Entry Lane, veh/h	1211	1183	1373	1380
Entry HV Adj Factor	1.000	1.000	1.000	1.000
Flow Entry, veh/h	5	0	146	133
Cap Entry, veh/h	1211	1183	1373	1380
V/C Ratio	0.004	0.000	0.106	0.096
Control Delay, s/veh	3.0	3.0	3.5	3.4
LOS	A	A	A	A
95th %tile Queue, veh	0	0	0	0

Intersection	
Int Delay, s/veh	2.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	725	101	72	299	57	72
Future Vol, veh/h	725	101	72	299	57	72
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	97
Heavy Vehicles, %	2	1	9	6	3	10
Mvmt Flow	771	107	77	318	61	74

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	878	0	1297	825
Stage 1	-	-	-	-	825	-
Stage 2	-	-	-	-	472	-
Critical Hdwy	-	-	4.19	-	5.8	3.4
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.281	-	3.527	3.39
Pot Cap-1 Maneuver	-	-	741	-	223	701
Stage 1	-	-	-	-	429	-
Stage 2	-	-	-	-	626	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	741	-	195	701
Mov Cap-2 Maneuver	-	-	-	-	195	-
Stage 1	-	-	-	-	429	-
Stage 2	-	-	-	-	547	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2	20.1
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	195	701	-	-	741	-
HCM Lane V/C Ratio	0.311	0.106	-	-	0.103	-
HCM Control Delay (s)	31.6	10.7	-	-	10.4	0
HCM Lane LOS	D	B	-	-	B	A
HCM 95th %tile Q(veh)	1.3	0.4	-	-	0.3	-

Intersection	
Intersection Delay, s/veh	3.4
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	3	1	111	144
Demand Flow Rate, veh/h	3	1	111	145
Vehicles Circulating, veh/h	144	114	3	0
Vehicles Exiting, veh/h	1	0	144	115
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	3.0	2.9	3.3	3.5
Approach LOS	A	A	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	3	1	111	145
Cap Entry Lane, veh/h	1191	1228	1376	1380
Entry HV Adj Factor	1.000	1.000	1.000	0.990
Flow Entry, veh/h	3	1	111	144
Cap Entry, veh/h	1191	1228	1376	1366
V/C Ratio	0.003	0.001	0.081	0.105
Control Delay, s/veh	3.0	2.9	3.3	3.5
LOS	A	A	A	A
95th %tile Queue, veh	0	0	0	0

Intersection	
Int Delay, s/veh	2.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	426	79	84	616	78	57
Future Vol, veh/h	426	79	84	616	78	57
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	98	98	98	98	98	98
Heavy Vehicles, %	1	2	2	4	3	0
Mvmt Flow	435	81	86	629	80	58

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	516	0	1277	476
Stage 1	-	-	-	-	476	-
Stage 2	-	-	-	-	801	-
Critical Hdwy	-	-	4.12	-	5.8	3.3
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	-	-	2.218	-	3.527	3.3
Pot Cap-1 Maneuver	-	-	1050	-	229	870
Stage 1	-	-	-	-	623	-
Stage 2	-	-	-	-	440	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1050	-	200	870
Mov Cap-2 Maneuver	-	-	-	-	200	-
Stage 1	-	-	-	-	623	-
Stage 2	-	-	-	-	385	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1	23.8
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	200	870	-	-	1050	-
HCM Lane V/C Ratio	0.398	0.067	-	-	0.082	-
HCM Control Delay (s)	34.4	9.4	-	-	8.7	0
HCM Lane LOS	D	A	-	-	A	A
HCM 95th %tile Q(veh)	1.8	0.2	-	-	0.3	-

Intersection	
Intersection Delay, s/veh	3.8
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	1	1	1	1
Conflicting Circle Lanes	1	1	1	1
Adj Approach Flow, veh/h	5	0	202	219
Demand Flow Rate, veh/h	5	0	202	219
Vehicles Circulating, veh/h	214	207	5	0
Vehicles Exiting, veh/h	5	0	214	207
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	3.3	0.0	3.8	3.9
Approach LOS	A	-	A	A

Lane	Left	Left	Left	Left
Designated Moves	LTR	LTR	LTR	LTR
Assumed Moves	LTR	LTR	LTR	LTR
RT Channelized				
Lane Util	1.000	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976	4.976
Entry Flow, veh/h	5	0	202	219
Cap Entry Lane, veh/h	1109	1117	1373	1380
Entry HV Adj Factor	1.000	1.000	1.000	1.000
Flow Entry, veh/h	5	0	202	219
Cap Entry, veh/h	1109	1117	1373	1380
V/C Ratio	0.005	0.000	0.147	0.159
Control Delay, s/veh	3.3	3.2	3.8	3.9
LOS	A	A	A	A
95th %tile Queue, veh	0	0	1	1

□ Signal Warrant Analysis

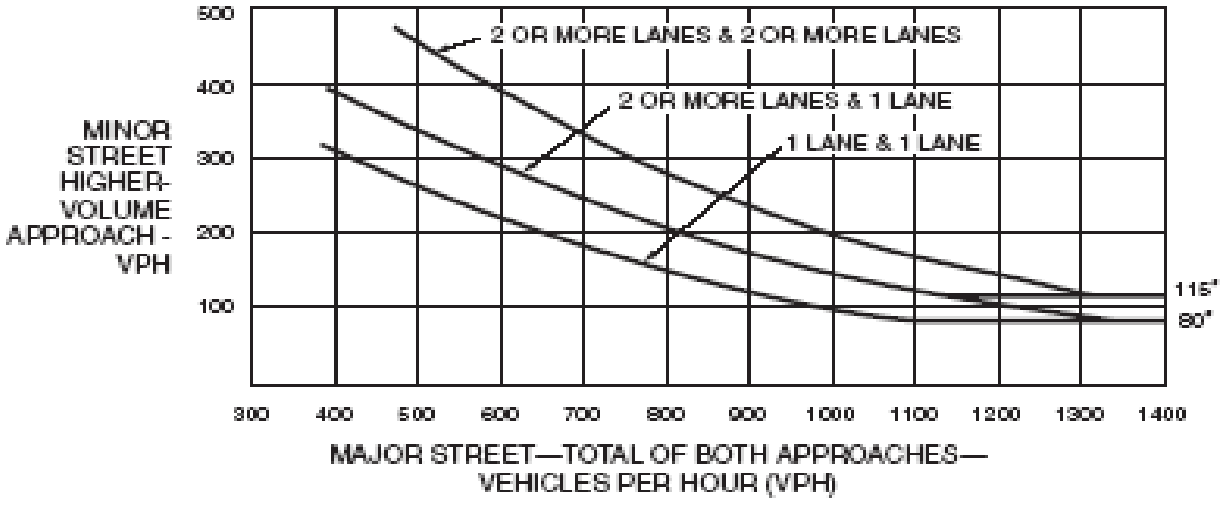
MUTCD Traffic Signal Warrant #2 Analysis

Project Name 1391 Concord
Date Baseline 2024 + Site Trips

	Street Name	Direction
Major 1	Main Street	EB
Major 2	Main Street	WB
Minor 1	Forest Rideg Road	NB
Minor 2	n/a	0

		Main Street	Main Street		Forest Rideg Road	n/a		
Node	Time Period	Major St. 1 Approach Volume	Major St. 2 Approach Volume	Total Major St. Volume	Minor St. 1 Approach Volume	Minor St. 2 Approach Volume	Higher Minor St. Volume	Warrant 2 Threshold Met
1	6:00-7:00 AM	374	133	507	30	0	30	NO
2	7:00-8:00 AM	664	243	907	48	0	48	NO
3	8:00-9:00 AM	717	342	1059	85	0	85	NO
4	9:00-10:00 AM	538	391	929	98	0	98	NO
5	10:00-11:00 AM	446	369	815	122	0	122	NO
6	11:00 AM-12:00 PM	436	393	829	123	0	123	NO
7	12:00-1:00 PM	454	433	887	132	0	132	NO
8	1:00 PM - 2:00 PM	435	439	874	93	0	93	NO
9	2:00 PM - 3:00 PM	455	446	901	98	0	98	NO
10	3:00 PM - 4:00 PM	419	541	960	126	0	126	NO
11	4:00 PM - 5:00 PM	439	595	1034	115	0	115	NO
12	5:00 PM - 6:00 PM	465	575	1040	132	0	132	YES
							Hours Met	1

Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume



*Note: 115 vph applies as the lower threshold volume for a minor-street

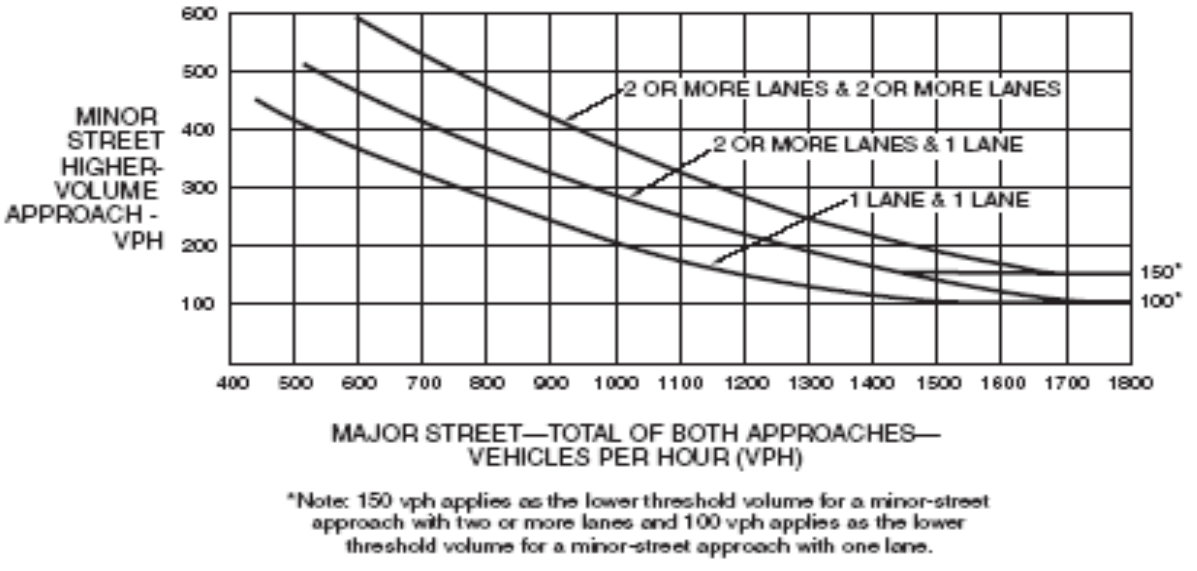
MUTCD Traffic Signal Warrant #3 Analysis

Project Name 1391 Concord
Date Baseline 2024 + Site Trips

	Street Name	Direction
Major 1	Main Street	EB
Major 2	Main Street	WB
Minor 1	Forest Rideg Road	NB
Minor 2	n/a	

Node	Time Period	Main Street Major St. 1 Approach Volume	Main Street Major St. 2 Approach Volume	Total Major St. Volume	Forest Rideg Road Minor St. 1 Approach Volume	n/a Minor St. 2 Approach Volume	Higher Minor St. Volume	Warrant 3 Threshold Met
1	6:00-7:00 AM	374	133	507	30	0	30	NO
2	7:00-8:00 AM	664	243	907	48	0	48	NO
3	8:00-9:00 AM	717	342	1059	85	0	85	NO
4	9:00-10:00 AM	538	391	929	98	0	98	NO
5	10:00-11:00 AM	446	369	815	122	0	122	NO
6	11:00 AM-12:00 PM	436	393	829	123	0	123	NO
7	12:00-1:00 PM	454	433	887	132	0	132	NO
8	1:00 PM - 2:00 PM	435	439	874	93	0	93	NO
9	2:00 PM - 3:00 PM	455	446	901	98	0	98	NO
10	3:00 PM - 4:00 PM	419	541	960	126	0	126	NO
11	4:00 PM - 5:00 PM	439	595	1034	115	0	115	NO
12	5:00 PM - 6:00 PM	465	575	1040	132	0	132	NO
							Hours Met	0

Figure 4C-3. Warrant 3, Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

CLOSED DRAINAGE PIPE CALCULATIONS

ALLEN & MAJOR ASSOCIATES, INC.

DESIGN YEAR: 100.00

K= 290.00 B= 31

Title ***Stormwater Conveyance Sizing (100 YEAR STORM)***

Project ***Multi-Family Residential - Concord, MA***

Date 10-04-2024 Rev 02-28-2025

A&M Project Number: 1670-24

Minimum Slope:	0.005	
Minimum Size:	12.000	inch
Rainfall Intensity (in/hr):	7.838	(100 year storm)
Manning's n:	0.012	HDPE
Manning's n:	0.013	RCP
Min. Velocity:	2.000	fps
Max. Velocity:	12.000	fps

From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (inches)	Manning's Roughness	Peak Flow (cfs)	Time of Peak Flow (days hh:mm)	Max Flow Velocity (ft/sec)	Travel Time (min)	Design Flow Capacity (cfs)	Max Flow / Design Flow Ratio	Max Flow Depth (ft)	Reported Condition
To Existing Drainage Easement																
PDCB A	PDMH C	121.84	199.50	197.67	1.5000	CIRCULAR	12.000	0.0120	3.13	0 00:06	8.54	0.24	4.73	0.66	0.59	OK
PDCB B	PDMH C	56.29	200.00	198.87	2.0000	CIRCULAR	12.000	0.0120	4.01	0 00:06	7.63	0.12	5.46	0.73	0.64	OK
ECB B	PDMH C	13.19	197.89	197.23	5.0000	CIRCULAR	15.000	0.0120	0.00	0 00:00	0.00		15.65	0.00	0.00	OK
PDMH C	ECB A	60.57	197.13	194.00	5.1700	CIRCULAR	15.000	0.0120	7.10	0 00:06	12.61	0.08	15.91	0.45	0.59	OK
ECB A	EHW	55.01	193.50	190.03	6.3100	CIRCULAR	15.000	0.0120	7.10	0 00:06	13.57	0.07	17.58	0.40	0.55	OK
PCB 1A	PDMH 1	24.81	193.65	193.40	1.0000	CIRCULAR	12.000	0.0120	0.96	0 00:06	4.08	0.10	3.85	0.25	0.34	OK
PCB 1B	PDMH 1	8.25	193.57	193.40	2.0000	CIRCULAR	12.000	0.0120	0.82	0 00:06	5.01	0.03	5.46	0.15	0.26	OK
PDMH 1	PFES 1	64.54	193.30	192.66	1.0000	CIRCULAR	12.000	0.0120	1.76	0 00:06	4.83	0.22	3.86	0.46	0.47	OK
To Sub-Surface System 1																
PCB 2A	PDMH 2	32.55	185.65	185.00	2.0000	CIRCULAR	12.000	0.0120	0.76	0 00:06	4.94	0.11	5.46	0.14	0.25	OK
PCB 2B	PDMH 2	23.73	185.48	185.00	2.0000	CIRCULAR	12.000	0.0120	0.75	0 00:06	4.89	0.08	5.46	0.14	0.25	OK
PDMH 2	PDMH 3	98.41	183.44	180.00	3.5000	CIRCULAR	12.000	0.0120	1.50	0 00:06	7.30	0.22	7.22	0.21	0.31	OK
PDMH 3	PDMH 4	124.39	179.82	176.71	2.5000	CIRCULAR	12.000	0.0120	1.49	0 00:06	6.47	0.32	6.10	0.24	0.34	OK
PCB 4A	PDMH 4	14.41	177.00	176.71	2.0000	CIRCULAR	12.000	0.0120	0.67	0 00:06	4.72	0.05	5.46	0.12	0.24	OK
PCB 4B	PDMH 4	3.91	176.79	176.71	2.0000	CIRCULAR	12.000	0.0120	0.82	0 00:06	5.00	0.01	5.45	0.15	0.26	OK
PDMH 4	PDMH 5	35.34	176.61	175.90	2.0000	CIRCULAR	12.000	0.0120	2.91	0 00:06	7.06	0.08	5.46	0.53	0.52	OK
PDCB 5A	PDMH 5	157.37	175.76	174.50	0.8000	CIRCULAR	12.000	0.0120	3.15	0 00:06	7.60	0.35	3.45	0.91	0.75	OK
PCB 5B	PDMH 5	18.89	175.33	175.14	1.0000	CIRCULAR	12.000	0.0120	2.48	0 00:06	5.23	0.06	3.86	0.64	0.58	OK
PDMH 5	PDMH 6	8.38	174.00	173.94	0.7000	CIRCULAR	18.000	0.0120	8.45	0 00:06	6.10	0.02	9.55	0.88	1.10	OK
PDMH 6	PDMH 7	10.23	173.84	173.77	0.7000	CIRCULAR	18.000	0.0120	8.45	0 00:06	6.10	0.03	9.55	0.88	1.10	OK
PDMH 7	PINF A	2.30	172.52	172.51	0.5200	CIRCULAR	24.000	0.0120	8.45	0 00:06	5.57	0.01	17.69	0.48	0.97	OK
PDCB 9A	PDMH 9	110.74	175.83	175.00	0.7500	CIRCULAR	12.000	0.0120	2.96	0 00:06	6.81	0.27	3.34	0.89	0.73	OK
PCB 9B	PDMH 9	6.63	175.07	175.00	0.9900	CIRCULAR	12.000	0.0120	2.04	0 00:06	4.98	0.02	3.85	0.53	0.52	OK
PDMH 9	PDMH 10	81.27	174.75	174.26	0.6000	CIRCULAR	15.000	0.0120	4.92	0 00:06	5.06	0.27	5.42	0.91	0.93	OK
GAR A	PDMH 10	56.96	175.33	174.76	1.0000	CIRCULAR	12.000	0.0120	0.50	0 00:06	4.51	0.21	3.86	0.13	0.24	OK
PDMH 10	PDMH 11	72.71	174.16	173.65	0.7000	CIRCULAR	15.000	0.0120	5.38	0 00:06	5.46	0.22	5.86	0.92	0.94	OK
PDCB 11A	PDMH 11	4.09	173.99	173.90	2.0100	CIRCULAR	12.000	0.0120	2.89	0 00:06	7.06	0.01	5.47	0.53	0.52	OK
PDMH 11	PDMH 12	83.92	173.40	172.90	0.6000	CIRCULAR	18.000	0.0120	8.04	0 00:06	5.71	0.24	8.82	0.91	1.12	OK
PDMH 12	PINF H	3.44	172.53	172.51	0.4900	CIRCULAR	24.000	0.0120	8.04	0 00:06	5.39	0.01	17.23	0.47	0.96	OK

ALLEN & MAJOR ASSOCIATES, INC.

DESIGN YEAR: 100.00

K= 290.00 B= 31

Title ***Stormwater Conveyance Sizing (100 YEAR STORM)***

Project ***Multi-Family Residential - Concord, MA***

Date 10-04-2024 Rev 02-28-2025

A&M Project Number: 1670-24

Minimum Slope:	0.005	
Minimum Size:	12.000	inch
Rainfall Intensity (in/hr):	7.838	(100 year storm)
Manning's n:	0.012	HDPE
Manning's n:	0.013	RCP
Min. Velocity:	2.000	fps
Max. Velocity:	12.000	fps

From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (inches)	Manning's Roughness	Peak Flow (cfs)	Time of Peak Flow (days hh:mm)	Max Flow Velocity (ft/sec)	Travel Time (min)	Design Flow Capacity (cfs)	Max Flow / Design Flow Ratio	Max Flow Depth (ft)	Reported Condition
BLDG 1A	PDMH 13	15.7	176.83	176.20	4.00	CIRCULAR	12	0.012	5.76	0 00:06	10.78	0.02	7.72	0.75	0.64	OK
PCB 14A	PDMH 14	1.5	174.10	174.04	4.02	CIRCULAR	12	0.012	2.26	0 00:06	8.55	0	7.74	0.29	0.37	OK
PDMH 14	PINF J	4.8	172.54	172.51	0.56	CIRCULAR	24	0.012	2.26	0 00:06	3.97	0.02	18.31	0.12	0.47	OK
PCB 17A	PDMH 17	4.9	175.10	175.00	2.01	CIRCULAR	12	0.012	1.67	0 00:06	6.12	0.01	5.47	0.31	0.38	OK
PDMH 17	PINF C	5.1	172.54	172.51	0.51	CIRCULAR	24	0.012	1.67	0 00:06	3.52	0.02	17.47	0.10	0.42	OK
GAR B	PDMH 18	38.2	176.50	176.12	1.00	CIRCULAR	12	0.012	0.43	0 00:06	3.98	0.16	3.86	0.11	0.23	OK
PDMH 18	PINF L	2.7	172.53	172.51	0.64	CIRCULAR	24	0.012	0.43	0 00:06	2.48	0.02	19.57	0.02	0.21	OK
PCB 19A	PDMH 19	75.6	174.19	173.81	0.50	CIRCULAR	12	0.012	2.06	0 00:06	5.13	0.25	2.73	0.76	0.65	OK
PCB 19B	PDMH 19	40.3	174.21	173.81	1.00	CIRCULAR	12	0.012	1.65	0 00:06	4.82	0.14	3.86	0.43	0.45	OK
PDMH 19	PDMH 20	14.1	173.56	173.49	0.50	CIRCULAR	15	0.012	3.70	0 00:06	4.42	0.05	4.93	0.75	0.81	OK
PDMH 20	PDMH 21	22.4	173.39	173.28	0.50	CIRCULAR	15	0.012	3.69	0 00:06	4.43	0.08	4.95	0.75	0.80	OK
GAR C	PDMH 21	15.4	175.31	175.00	2.00	CIRCULAR	12	0.012	0.50	0 00:06	4.34	0.06	5.45	0.09	0.20	OK
PDMH 21	PINF N	3.0	172.53	172.51	0.50	CIRCULAR	24	0.012	4.18	0 00:06	4.54	0.01	17.33	0.24	0.67	OK
PCB 24A	PDMH 24	12.1	175.00	174.92	0.65	CIRCULAR	12	0.012	2.75	0 00:06	4.49	0.04	3.12	0.88	0.73	OK
PCB 24B	PDMH 24	4.3	174.94	174.92	0.49	CIRCULAR	12	0.012	1.99	0 00:06	3.76	0.02	2.70	0.74	0.64	OK
PDMH 24	PDMH 25	103.5	174.67	174.16	0.50	CIRCULAR	15	0.012	4.67	0 00:06	4.82	0.36	4.95	0.94	0.96	OK
PCB 25A	PDMH 25	32.4	175.14	174.81	1.00	CIRCULAR	12	0.012	1.04	0 00:06	4.28	0.13	3.86	0.27	0.35	OK
PDMH 25	PDMH 26	36.8	174.09	173.91	0.50	CIRCULAR	18	0.012	5.67	0 00:06	4.95	0.12	8.05	0.70	0.93	OK
PDCB 26A	PDMH 26	4.5	174.36	174.31	1.25	CIRCULAR	12	0.012	4.10	0 00:06	6.25	0.01	4.31	0.95	0.78	OK
PDMH 26	PDMH 27	103.8	173.81	173.03	0.75	CIRCULAR	18	0.012	9.56	0 00:06	6.44	0.27	9.86	0.97	1.19	OK
BLDG 2	PDMH 27	39.8	175.00	174.26	1.87	CIRCULAR	12	0.012	4.56	0 00:06	8.02	0.08	5.27	0.87	0.72	OK
PDMH 27	PINF T	3.4	172.53	172.51	0.49	CIRCULAR	24	0.012	13.89	0 00:06	6.10	0.01	17.23	0.81	1.36	
GAR D	PDMH 28	58.1	175.58	175.00	1.00	CIRCULAR	12	0.012	0.45	0 00:06	4.43	0.22	3.86	0.12	0.23	OK
PDMH 28	PINF S	3.4	172.53	172.51	0.49	CIRCULAR	24	0.012	0.46	0 00:06	2.39	0.02	17.23	0.03	0.23	OK

ALLEN & MAJOR ASSOCIATES, INC.

Title ***Stormwater Conveyance Sizing (100 YEAR STORM)***
Project ***Multi-Family Residential - Concord, MA***
Date 10-04-2024 Rev 2-28-2025
A&M Project Number: 1670-24

Watershed	Drainage Node ID	Area (acres)	Weighted Runoff Coefficient	Accumulated Precipitation (inches)	Total Runoff (inches)	Peak Runoff (cfs)	Rainfall Intensity (inches/hr)	Time of Concentration (days hh:mm:ss)
Sub-01	PCB 1A	0.22	0.5700	0.78	0.45	0.96	7.838	0 00:06:00
Sub-02	PCB 1B	0.13	0.8200	0.78	0.64	0.82	7.838	0 00:06:00
Sub-03	PCB 2A	0.15	0.6600	0.78	0.52	0.77	7.838	0 00:06:00
Sub-04	PCB 2B	0.16	0.6100	0.78	0.48	0.75	7.838	0 00:06:00
Sub-05	PCB 4A	0.12	0.7200	0.78	0.56	0.67	7.838	0 00:06:00
Sub-06	PCB 4B	0.13	0.8200	0.78	0.64	0.82	7.838	0 00:06:00
Sub-07	PCB 5B	0.46	0.6900	0.78	0.54	2.49	7.838	0 00:06:00
Sub-08	PDCB 5A	0.94	0.4400	0.78	0.35	3.22	7.838	0 00:06:00
Sub-09	PDCB 9A	1.33	0.2900	0.78	0.23	3.01	7.838	0 00:06:00
Sub-10	PCB 9B	0.47	0.5500	0.78	0.43	2.04	7.838	0 00:06:00
Sub-11	PDCB 11A	0.53	0.7000	0.78	0.55	2.90	7.838	0 00:06:00
Sub-12	PCB 14A	0.41	0.7000	0.78	0.55	2.27	7.838	0 00:06:00
Sub-13	PCB 17A	0.28	0.7700	0.78	0.60	1.67	7.838	0 00:06:00
Sub-14	PCB 19A	0.34	0.7800	0.78	0.61	2.09	7.838	0 00:06:00
Sub-15	PCB 19B	0.27	0.7900	0.78	0.62	1.66	7.838	0 00:06:00
Sub-16	PDCB 26A	0.85	0.6200	0.78	0.49	4.11	7.838	0 00:06:00
Sub-17	PCB 24B	0.36	0.7000	0.78	0.55	2.00	7.838	0 00:06:00
Sub-18	PCB 24A	0.49	0.7200	0.78	0.56	2.75	7.838	0 00:06:00
Sub-19	PDCB B	0.65	0.7900	0.78	0.62	4.03	7.838	0 00:06:00
Sub-20	PDCB A	0.54	0.7500	0.78	0.59	3.18	7.838	0 00:10:00
Sub-22	GAR B	0.06	0.9000	0.78	0.71	0.44	7.838	0 00:06:00
Sub-23	BLDG 1A	0.82	0.9000	0.78	0.71	5.76	7.838	0 00:10:00
Sub-24	GAR A	0.07	0.9000	0.78	0.71	0.50	7.838	0 00:06:00
Sub-25	GAR C	0.07	0.9000	0.78	0.71	0.50	7.838	0 00:06:00
Sub-26	BLDG 2	0.65	0.9000	0.78	0.71	4.59	7.838	0 00:06:00
Sub-27	GAR D	0.07	0.9000	0.78	0.71	0.46	7.838	0 00:06:00
Sub-29	PCB 25A	0.23	0.5700	0.78	0.45	1.05	7.838	0 00:06:00

WATER QUALITY STRUCTURES SIZING SHEETS

Project: The Residences at Thoreau
Location: Concord, MA
Prepared For: Allen & Major / Paul Matos

Purpose: To calculate the water quality flow rate (WQF) over a given site area. In this situation the WQF is derived from the first 1" of runoff from the contributing impervious surface.

Reference: Massachusetts Dept. of Environmental Protection Wetlands Program / United States Department of Agriculture Natural Resources Conservation Service TR-55 Manual

Procedure: Determine unit peak discharge using Figure 1 or 2. Figure 2 is in tabular form so is preferred. Using the tc, read the unit peak discharge (qu) from Figure 1 or Table in Figure 2. qu is expressed in the following units: cfs/mi^2/watershed inches (csm/in).

Compute Q Rate using the following equation:

$$Q = (qu)\ (A)\ (WQV)$$

where:

Q = flow rate associated with first 1" of runoff
qu = the unit peak discharge, in csm/in.
A = impervious surface drainage area (in square miles)
WQV = water quality volume in watershed inches (1" in this case)

Structure Name	Impv. (acres)	A (miles^2)	t_c (min)	t_c (hr)	WQV (in)	qu (csm/in.)	Q (cfs)
PDMH 1	0.18	0.0002813	6.0	0.100	1.00	774.00	0.22
PDMH 6	0.91	0.0014219	6.0	0.100	1.00	774.00	1.10
PDMH 9	0.39	0.0006078	6.0	0.100	1.00	774.00	0.47
PDMH 20	0.54	0.0008438	6.0	0.100	1.00	774.00	0.65
PDMH 25	0.86	0.0013438	6.0	0.100	1.00	774.00	1.04
PDCB 15A	0.34	0.0005313	6.0	0.100	1.00	774.00	0.41
PCB 16A	0.28	0.0004375	6.0	0.100	1.00	774.00	0.34
PCB 19A	0.22	0.0003438	6.0	0.100	1.00	774.00	0.27

The WQf sizing calculation selects the minimum size CDS/Cascade/StormCeptor model capable of operating at the computed WQf peak flowrate prior to bypassing. It assumes free discharge of the WQf through the unit and ignores the routing effect of any upstream storm drain piping. As with all hydrodynamic separators, there will be some impact to the Hydraulic Gradient of the corresponding drainage system, and evaluation of this impact should be considered in the design.

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD

THE RESIDENCES AT THOREAU
CONCORD, MA

Area	**0.28 ac**	Unit Site Designation	**PCB 16A**
Weighted C	**0.9**	Rainfall Station #	**68**
t_c	**6 min**		
CDS Model	**2015-4**	CDS Treatment Capacity	**1.4 cfs**

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	9.3%	9.3%	0.01	0.01	9.3
0.04	9.5%	18.8%	0.01	0.01	9.5
0.06	8.7%	27.5%	0.02	0.02	8.7
0.08	10.1%	37.6%	0.02	0.02	10.1
0.10	7.2%	44.8%	0.03	0.03	7.2
0.12	6.0%	50.8%	0.03	0.03	6.0
0.14	6.3%	57.1%	0.04	0.04	6.3
0.16	5.6%	62.7%	0.04	0.04	5.6
0.18	4.7%	67.4%	0.05	0.05	4.7
0.20	3.6%	71.0%	0.05	0.05	3.6
0.25	8.2%	79.1%	0.06	0.06	8.1
0.50	14.9%	94.0%	0.13	0.13	14.5
0.75	3.2%	97.3%	0.19	0.19	3.1
1.00	1.2%	98.5%	0.25	0.25	1.2
1.50	0.7%	99.2%	0.38	0.38	0.6
2.00	0.8%	100.0%	0.50	0.50	0.7
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
					99.0
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.5%
				Predicted Net Annual Load Removal Efficiency =	**92.6%**

1 - Based on 10 years of rainfall data from NCDC station 736, Blue Hill, Norfolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD

THE RESIDENCES AT THOREAU
CONCORD, MA

Area	**0.22 ac**	Unit Site Designation	**PCB 19A**
Weighted C	**0.9**	Rainfall Station #	**68**
t_c	**6 min**		
CDS Model	**2015-4**	CDS Treatment Capacity	**1.4 cfs**

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	9.3%	9.3%	0.00	0.00	9.3
0.04	9.5%	18.8%	0.01	0.01	9.5
0.06	8.7%	27.5%	0.01	0.01	8.7
0.08	10.1%	37.6%	0.02	0.02	10.1
0.10	7.2%	44.8%	0.02	0.02	7.2
0.12	6.0%	50.8%	0.02	0.02	6.0
0.14	6.3%	57.1%	0.03	0.03	6.3
0.16	5.6%	62.7%	0.03	0.03	5.6
0.18	4.7%	67.4%	0.04	0.04	4.7
0.20	3.6%	71.0%	0.04	0.04	3.6
0.25	8.2%	79.1%	0.05	0.05	8.1
0.50	14.9%	94.0%	0.10	0.10	14.6
0.75	3.2%	97.3%	0.15	0.15	3.1
1.00	1.2%	98.5%	0.20	0.20	1.2
1.50	0.7%	99.2%	0.30	0.30	0.7
2.00	0.8%	100.0%	0.40	0.40	0.7
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
					99.3
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.5%
				Predicted Net Annual Load Removal Efficiency =	**92.9%**

1 - Based on 10 years of rainfall data from NCDC station 736, Blue Hill, Norfolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD

THE RESIDENCES AT THOREAU
CONCORD, MA

Area	**0.34 ac**	Unit Site Designation	**PDCB 15A**
Weighted C	**0.9**	Rainfall Station #	**68**
t_c	**6 min**		
CDS Model	**2015-5**	CDS Treatment Capacity	**1.4 cfs**

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	9.3%	9.3%	0.01	0.01	9.3
0.04	9.5%	18.8%	0.01	0.01	9.5
0.06	8.7%	27.5%	0.02	0.02	8.7
0.08	10.1%	37.6%	0.02	0.02	10.1
0.10	7.2%	44.8%	0.03	0.03	7.2
0.12	6.0%	50.8%	0.04	0.04	6.0
0.14	6.3%	57.1%	0.04	0.04	6.3
0.16	5.6%	62.7%	0.05	0.05	5.6
0.18	4.7%	67.4%	0.06	0.06	4.7
0.20	3.6%	71.0%	0.06	0.06	3.6
0.25	8.2%	79.1%	0.08	0.08	8.1
0.50	14.9%	94.0%	0.15	0.15	14.3
0.75	3.2%	97.3%	0.23	0.23	3.0
1.00	1.2%	98.5%	0.31	0.31	1.1
1.50	0.7%	99.2%	0.46	0.46	0.6
2.00	0.8%	100.0%	0.61	0.61	0.6
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
					98.7
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.5%
				Predicted Net Annual Load Removal Efficiency =	**92.2%**

1 - Based on 10 years of rainfall data from NCDC station 736, Blue Hill, Norfolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD

THE RESIDENCES AT THOREAU
CONCORD, MA

Area	**0.18 ac**	Unit Site Designation	**PDMH 1**
Weighted C	**0.9**	Rainfall Station #	**68**
t_c	**6 min**		
CDS Model	**2015-4**	CDS Treatment Capacity	**1.4 cfs**

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	9.3%	9.3%	0.00	0.00	9.3
0.04	9.5%	18.8%	0.01	0.01	9.5
0.06	8.7%	27.5%	0.01	0.01	8.7
0.08	10.1%	37.6%	0.01	0.01	10.1
0.10	7.2%	44.8%	0.02	0.02	7.2
0.12	6.0%	50.8%	0.02	0.02	6.0
0.14	6.3%	57.1%	0.02	0.02	6.3
0.16	5.6%	62.7%	0.03	0.03	5.6
0.18	4.7%	67.4%	0.03	0.03	4.7
0.20	3.6%	71.0%	0.03	0.03	3.6
0.25	8.2%	79.1%	0.04	0.04	8.2
0.50	14.9%	94.0%	0.08	0.08	14.7
0.75	3.2%	97.3%	0.12	0.12	3.1
1.00	1.2%	98.5%	0.16	0.16	1.2
1.50	0.7%	99.2%	0.24	0.24	0.7
2.00	0.8%	100.0%	0.32	0.32	0.7
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
					99.5
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.5%
				Predicted Net Annual Load Removal Efficiency =	**93.1%**

1 - Based on 10 years of rainfall data from NCDC station 736, Blue Hill, Norfolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD

THE RESIDENCES AT THOREAU
CONCORD, MA

Area	**0.91 ac**	Unit Site Designation	**PDMH 6**
Weighted C	**0.9**	Rainfall Station #	**68**
t_c	**6 min**		
CDS Model	**2015-4**	CDS Treatment Capacity	**1.4 cfs**

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	9.3%	9.3%	0.02	0.02	9.3
0.04	9.5%	18.8%	0.03	0.03	9.5
0.06	8.7%	27.5%	0.05	0.05	8.7
0.08	10.1%	37.6%	0.07	0.07	10.0
0.10	7.2%	44.8%	0.08	0.08	7.1
0.12	6.0%	50.8%	0.10	0.10	5.9
0.14	6.3%	57.1%	0.11	0.11	6.1
0.16	5.6%	62.7%	0.13	0.13	5.4
0.18	4.7%	67.4%	0.15	0.15	4.5
0.20	3.6%	71.0%	0.16	0.16	3.5
0.25	8.2%	79.1%	0.20	0.20	7.7
0.50	14.9%	94.0%	0.41	0.41	13.0
0.75	3.2%	97.3%	0.61	0.61	2.6
1.00	1.2%	98.5%	0.82	0.82	0.9
1.50	0.7%	99.2%	1.23	1.23	0.4
2.00	0.8%	100.0%	1.64	1.40	0.4
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
					95.0
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.4%
				Predicted Net Annual Load Removal Efficiency =	**88.6%**

1 - Based on 10 years of rainfall data from NCDC station 736, Blue Hill, Norfolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD

THE RESIDENCES AT THOREAU
CONCORD, MA

Area	**0.39 ac**	Unit Site Designation	**PDMH 9**
Weighted C	**0.9**	Rainfall Station #	**68**
t_c	**6 min**		
CDS Model	**2015-4**	CDS Treatment Capacity	**1.4 cfs**

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	9.3%	9.3%	0.01	0.01	9.3
0.04	9.5%	18.8%	0.01	0.01	9.5
0.06	8.7%	27.5%	0.02	0.02	8.7
0.08	10.1%	37.6%	0.03	0.03	10.1
0.10	7.2%	44.8%	0.04	0.04	7.2
0.12	6.0%	50.8%	0.04	0.04	6.0
0.14	6.3%	57.1%	0.05	0.05	6.3
0.16	5.6%	62.7%	0.06	0.06	5.6
0.18	4.7%	67.4%	0.06	0.06	4.6
0.20	3.6%	71.0%	0.07	0.07	3.6
0.25	8.2%	79.1%	0.09	0.09	8.0
0.50	14.9%	94.0%	0.18	0.18	14.2
0.75	3.2%	97.3%	0.26	0.26	3.0
1.00	1.2%	98.5%	0.35	0.35	1.1
1.50	0.7%	99.2%	0.53	0.53	0.6
2.00	0.8%	100.0%	0.70	0.70	0.6
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
					98.4
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.5%
				Predicted Net Annual Load Removal Efficiency =	**91.9%**

1 - Based on 10 years of rainfall data from NCDC station 736, Blue Hill, Norfolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD

THE RESIDENCES AT THOREAU
CONCORD, MA

Area	**0.54 ac**	Unit Site Designation	**PDMH 20**
Weighted C	**0.9**	Rainfall Station #	**68**
t_c	**6 min**		
CDS Model	**2015-4**	CDS Treatment Capacity	**1.4 cfs**

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	9.3%	9.3%	0.01	0.01	9.3
0.04	9.5%	18.8%	0.02	0.02	9.5
0.06	8.7%	27.5%	0.03	0.03	8.7
0.08	10.1%	37.6%	0.04	0.04	10.1
0.10	7.2%	44.8%	0.05	0.05	7.1
0.12	6.0%	50.8%	0.06	0.06	6.0
0.14	6.3%	57.1%	0.07	0.07	6.2
0.16	5.6%	62.7%	0.08	0.08	5.5
0.18	4.7%	67.4%	0.09	0.09	4.6
0.20	3.6%	71.0%	0.10	0.10	3.5
0.25	8.2%	79.1%	0.12	0.12	7.9
0.50	14.9%	94.0%	0.24	0.24	13.9
0.75	3.2%	97.3%	0.36	0.36	2.9
1.00	1.2%	98.5%	0.49	0.49	1.1
1.50	0.7%	99.2%	0.73	0.73	0.5
2.00	0.8%	100.0%	0.97	0.97	0.5
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
					97.5
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.5%
				Predicted Net Annual Load Removal Efficiency =	**91.0%**

1 - Based on 10 years of rainfall data from NCDC station 736, Blue Hill, Norfolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD

THE RESIDENCES AT THOREAU
CONCORD, MA

Area	**0.86 ac**	Unit Site Designation	**PDMH 25**
Weighted C	**0.9**	Rainfall Station #	**68**
t_c	**6 min**		
CDS Model	**2015-4**	CDS Treatment Capacity	**1.4 cfs**

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	9.3%	9.3%	0.02	0.02	9.3
0.04	9.5%	18.8%	0.03	0.03	9.5
0.06	8.7%	27.5%	0.05	0.05	8.7
0.08	10.1%	37.6%	0.06	0.06	10.0
0.10	7.2%	44.8%	0.08	0.08	7.1
0.12	6.0%	50.8%	0.09	0.09	5.9
0.14	6.3%	57.1%	0.11	0.11	6.2
0.16	5.6%	62.7%	0.12	0.12	5.4
0.18	4.7%	67.4%	0.14	0.14	4.5
0.20	3.6%	71.0%	0.15	0.15	3.5
0.25	8.2%	79.1%	0.19	0.19	7.7
0.50	14.9%	94.0%	0.39	0.39	13.2
0.75	3.2%	97.3%	0.58	0.58	2.6
1.00	1.2%	98.5%	0.77	0.77	0.9
1.50	0.7%	99.2%	1.16	1.16	0.4
2.00	0.8%	100.0%	1.55	1.40	0.4
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
					95.4
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.5%
				Predicted Net Annual Load Removal Efficiency =	**88.9%**

1 - Based on 10 years of rainfall data from NCDC station 736, Blue Hill, Norfolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

RAINFALL DATA

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Metadata for Point	
Smoothing	Yes
State	
Location	
Latitude	42.437 degrees North
Longitude	71.421 degrees West
Elevation	60 feet
Date/Time	Fri Sep 20 2024 14:18:46 GMT-0400 (Eastern Daylight Time)

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.43	0.53	0.70	0.88	1.10	**1yr**	0.76	1.04	1.28	1.61	2.04	2.59	2.82	**1yr**	2.29	2.71	3.17	3.85	4.49	**1yr**
2yr	0.34	0.53	0.66	0.87	1.09	1.37	**2yr**	0.94	1.26	1.59	1.99	2.48	3.10	3.42	**2yr**	2.75	3.29	3.79	4.52	5.15	**2yr**
5yr	0.41	0.63	0.80	1.07	1.36	1.73	**5yr**	1.18	1.58	2.00	2.51	3.13	3.89	4.34	**5yr**	3.44	4.17	4.80	5.72	6.41	**5yr**
10yr	0.46	0.72	0.91	1.24	1.61	2.06	**10yr**	1.39	1.87	2.40	3.00	3.73	4.62	5.19	**10yr**	4.09	4.99	5.73	6.83	7.57	**10yr**
25yr	0.55	0.87	1.10	1.52	2.01	2.59	**25yr**	1.74	2.33	3.02	3.79	4.71	5.80	6.59	**25yr**	5.13	6.34	7.26	8.64	9.45	**25yr**
50yr	0.61	0.98	1.26	1.77	2.38	3.10	**50yr**	2.06	2.76	3.63	4.55	5.63	6.90	7.89	**50yr**	6.10	7.59	8.68	10.32	11.17	**50yr**
100yr	0.70	1.14	1.47	2.08	2.83	3.70	**100yr**	2.44	3.27	4.33	5.44	6.71	8.20	9.47	**100yr**	7.26	9.10	10.38	12.34	13.21	**100yr**
200yr	0.80	1.31	1.70	2.43	3.35	4.42	**200yr**	2.89	3.88	5.18	6.50	8.01	9.76	11.35	**200yr**	8.63	10.92	12.42	14.75	15.63	**200yr**
500yr	0.97	1.59	2.07	3.01	4.21	5.58	**500yr**	3.63	4.86	6.56	8.24	10.13	12.29	14.45	**500yr**	10.87	13.90	15.76	18.70	19.53	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.23	0.35	0.42	0.57	0.70	0.80	**1yr**	0.61	0.78	1.06	1.44	1.74	2.27	2.34	**1yr**	2.01	2.25	2.69	3.49	4.13	**1yr**
2yr	0.33	0.50	0.62	0.84	1.04	1.24	**2yr**	0.89	1.21	1.42	1.85	2.37	2.99	3.32	**2yr**	2.65	3.19	3.68	4.36	5.03	**2yr**
5yr	0.38	0.58	0.72	0.99	1.26	1.46	**5yr**	1.09	1.43	1.69	2.20	2.81	3.60	4.00	**5yr**	3.19	3.84	4.43	5.34	5.99	**5yr**
10yr	0.42	0.65	0.80	1.12	1.45	1.65	**10yr**	1.25	1.61	1.84	2.49	3.17	4.12	4.60	**10yr**	3.65	4.42	5.09	5.89	6.85	**10yr**
25yr	0.48	0.73	0.91	1.30	1.71	1.93	**25yr**	1.48	1.88	2.12	2.93	3.73	4.96	5.56	**25yr**	4.39	5.35	6.10	6.98	8.17	**25yr**
50yr	0.53	0.80	1.00	1.43	1.93	2.18	**50yr**	1.66	2.13	2.36	3.32	4.21	5.71	6.41	**50yr**	5.05	6.17	7.03	7.95	9.35	**50yr**
100yr	0.58	0.87	1.09	1.57	2.16	2.46	**100yr**	1.86	2.41	2.63	3.22	4.76	6.58	7.42	**100yr**	5.82	7.14	8.08	9.02	10.73	**100yr**
200yr	0.63	0.95	1.21	1.75	2.43	2.77	**200yr**	2.10	2.71	2.94	3.54	5.41	7.63	8.61	**200yr**	6.75	8.28	9.33	10.21	12.33	**200yr**
500yr	0.72	1.07	1.38	2.00	2.85	3.25	**500yr**	2.46	3.18	3.39	4.00	6.41	9.28	10.54	**500yr**	8.21	10.14	11.33	12.03	14.85	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.32	0.49	0.60	0.80	0.99	1.17	**1yr**	0.85	1.15	1.35	1.78	2.22	2.80	3.06	**1yr**	2.48	2.94	3.49	4.37	4.91	**1yr**
2yr	0.37	0.56	0.69	0.94	1.16	1.35	**2yr**	1.00	1.32	1.56	2.05	2.61	3.23	3.57	**2yr**	2.86	3.44	3.97	4.71	5.29	**2yr**
5yr	0.44	0.68	0.85	1.16	1.48	1.78	**5yr**	1.27	1.74	2.00	2.57	3.24	4.24	4.68	**5yr**	3.75	4.50	5.18	6.13	6.87	**5yr**
10yr	0.53	0.81	1.00	1.40	1.81	2.20	**10yr**	1.56	2.15	2.54	3.10	3.88	5.20	5.77	**10yr**	4.60	5.54	6.38	7.63	8.38	**10yr**
25yr	0.67	1.02	1.27	1.81	2.39	2.90	**25yr**	2.06	2.84	3.38	3.97	4.92	6.83	7.61	**25yr**	6.04	7.32	8.42	10.07	10.89	**25yr**
50yr	0.80	1.22	1.52	2.19	2.95	3.59	**50yr**	2.54	3.51	4.19	4.80	5.89	8.39	9.38	**50yr**	7.43	9.02	10.39	12.44	13.29	**50yr**
100yr	0.97	1.46	1.84	2.65	3.64	4.43	**100yr**	3.14	4.33	5.21	6.64	7.06	10.32	11.57	**100yr**	9.13	11.13	12.81	15.38	16.22	**100yr**
200yr	1.17	1.75	2.22	3.22	4.49	5.48	**200yr**	3.87	5.36	6.48	8.19	8.45	12.69	14.26	**200yr**	11.23	13.72	15.79	19.04	19.81	**200yr**
500yr	1.50	2.23	2.87	4.16	5.92	7.21	**500yr**	5.11	7.05	8.65	10.86	10.72	16.63	18.80	**500yr**	14.72	18.08	20.83	25.27	25.76	**500yr**

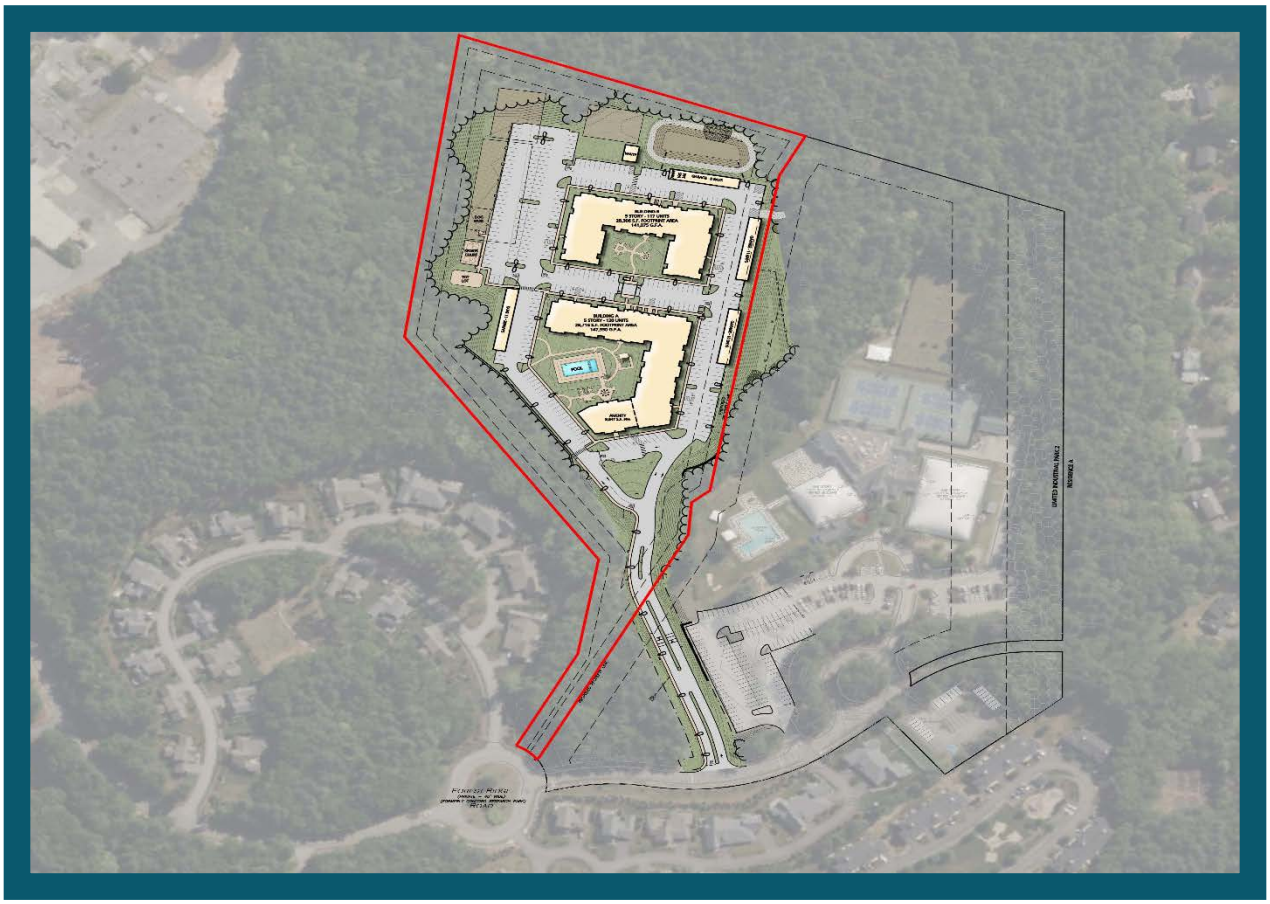
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APPENDIX C
OPERATION & MAINTENANCE PLAN

OPERATION & MAINTENANCE PLAN

ALLEN & MAJOR ASSOCIATES, INC.

Off Forest Ridge Road
Concord, Massachusetts



APPLICANT:
Thoreau Residences, LLC
275 Forest Ridge Road
Concord, Massachusetts 01742

PREPARED BY:
Allen & Major Associates, Inc.
Engineer of Record
10 Main Street
Lakeville, Massachusetts 02347

Issued: October 4, 2024
Revised: February 28, 2025

allenmajor.com

OPERATION & MAINTENANCE PLAN

Multi-Family Development
Off Forest Ridge Road
Concord, Massachusetts

PROPONENT:
Thoreau Residences, LLC
275 Forest Ridge Road
Concord, Massachusetts 01742

PREPARED BY:
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10 Main Street
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A&M PROJECT NO.:
1670-24

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SECTION 1.0
OPERATIONS & MAINTENANCE PLAN

1.1 INTRODUCTION

In accordance with the standards set forth by the Stormwater Management Policy issued by the Massachusetts Department of Environmental Protection (MassDEP), Allen & Major Associates, Inc. has prepared the following Operations & Maintenance (O&M) Plan for the proposed stormwater management system for the Multi-Family Development located off Forest Ridge Road in Concord, MA.

This plan focuses on post construction maintenance of the on-site drainage system. Operation and Maintenance (O&M) practices discussed below are recommendations made by the Design Engineer based on available reference material on Best Management Practices (BMP's) and experience. The property owner is responsible for implementation of the plan, and is encouraged to revise / supplement this plan accordingly based on actual site conditions.

The plan is broken down into two major sections. The first section describes the long-term pollution prevention measures (Long Term Pollution Prevention Plan). The second section is a post-construction operation and maintenance plan designed to address the long-term maintenance needs of the stormwater management system (Long Term Maintenance Plan).

1.2 NOTIFICATION PROCEDURES FOR CHANGE OF RESPONSIBILITY FOR O&M

The Stormwater Management System (SMS) for this project is owned by Thoreau Residences, LLC (owner). The owner shall be legally responsible for the long-term operation and maintenance of this SMS as outlined in this Operation and Maintenance Plan.

The owner shall submit an annual summary report and the completed Operation & Maintenance Schedule & Checklist to the Conservation Commission (via email or print copy), highlighting inspection and maintenance activities including performances of BMPs. Operations and Maintenance inspection reports shall be maintained for at least three (3) years and that copies of the report from the preceding year shall be submitted to the Concord Public Works Engineering Department annually. Should ownership of the SMS change, the owner will continue to be responsible until the succeeding owner shall notify the Commission and Concord Public Works Engineering Department the that the succeeding owner has assumed such responsibility.

1.3 CONTACT INFORMATION

Stormwater Management System Owner:	Thoreau Residences, LLC 275 Forest Ridge Road Concord, MA 01742 Phone: TBD

Emergency Contact Information:

Thoreau Residences LLC (Owner/Operator)	Phone: TBD
Concord Department of Public Works	Phone: 978-318-3206
Concord Fire Department (non-emergency line)	Phone: 978-318-3488
Concord Natural Resources Division	Phone: 978-318-3285
MassDEP Emergency Response	Phone: (888) 304-1133
Clean Harbors Inc (24-Hour Line)	Phone: (800) 645-8265

1.4 CONSTRUCTION PERIOD

1. Call Digsafe: 1-888-344-7233
2. Schedule a meeting with the various Town Departments, Design Engineer and Owner at least three (3) days prior to start of construction.
3. Install Erosion Control measures (construction entrance, wattles, straw bales, silt fence, silt sac, etc.) as shown on the Plans prepared by A&M. If required, by any special conditions, the Town shall review the installation of erosion control measures prior to the start of any site demolition work. Install Construction fencing if determined to be necessary at the commencement of construction.
4. All erosion and sedimentation controls shall be in accordance with MassDEP's Erosion and Sedimentation Control guidelines revised through May 2003 and the USDA SCS Erosion and Sedimentation Control in site development dated September 1983.
5. Site access shall be achieved only from the designated construction entrances.
6. Cut and clear trees in construction areas only (within the limit of work; see plans).
7. Stockpiles of materials subject to erosion shall be stabilized with erosion control matting or temporary seeding whenever practicable, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased.

8. Install silt sacks and straw bales around each drain inlet prior to any demolition and or construction activities.
9. All erosion control measures shall be inspected weekly and after every rainfall event. Records of these inspections shall be kept on-site for review.
10. All erosion control measures shall be maintained, repaired, or replaced as required or at the direction of the owner's engineer or the Town's representative.
11. Sediment accumulation up-gradient of the straw bales, silt fence, and stone check dams greater than 6" in depth shall be removed and disposed of in accordance with all applicable regulations.
12. If it appears that sediment is exiting the site, silt sacks shall be installed in all catch basins adjacent to the site. Sediment accumulation on all adjacent catch basin inlets shall be removed and the silt sack replaced if torn or damaged.
13. Install stone check dam on-site during construction as needed. Refer to the erosion control details. Temporary sediment basins combined with stone check damns shall be installed on-site during construction to control and collect runoff from upland areas of this site during demolition and construction activities.
14. The contractor shall comply with the Sedimentation and Erosion Control Notes as shown on the Site Development Plans and Specifications.
15. The stabilized construction entrances shall be inspected weekly and records of inspections kept. The entrances shall be maintained by adding additional clean, angular, durable stone to remove the soil from the construction vehicle's tires when exiting the site. If soil is still leaving the site via the construction vehicle tires, adjacent roadways shall be kept clean by street sweeping.
16. Dust pollution shall be controlled using on-site water trucks and/or an approved soil stabilization product.
17. During demolition and construction activities, Status Reports on compliance with this O&M Document shall be submitted weekly. The report shall document any deficiencies and corrective actions taken by the applicant.
18. No overuse, over-compaction, or storage of materials shall occur within any areas defined as stormwater infiltration to prevent the incidental compaction of soils. The areas are to be constructed as soon as possible and protected from construction traffic. NO CONSTRUCTION WATERS are to be emptied into an infiltration system. An allowance may be accommodated for a temporary excavation of soils within the infiltration basin for collection and handling of construction water, but the entirety of the debris is to be removed in order to achieve the grades as shown on the construction drawings.

19. The entire drainage system, including but not limited to catch basin, manholes, piping, water quality structures and sub-surface infiltration systems should be cleaned prior to turnover to the Owner.

1.5 LONG-TERM POLLUTION PREVENTION PLAN

Standard #4 from the MassDEP Stormwater Management Handbook requires that a Long-Term Pollution Prevention Plan (LTPPP) be prepared and incorporated as part of the Operation and Maintenance Plan of the Stormwater Management System. The purpose of the LTPPP is to identify potential sources of pollution that may affect the quality of stormwater discharges, and to describe the implementation of practices to reduce the pollutants in stormwater discharges. The following items describe the source control and proper procedures of the LTPPP.

- **Housekeeping**
  The existing development has been designed to maintain a high level of water quality treatment for all stormwater discharge to the wetland areas. An Operation and Maintenance (O&M) plan has been prepared and is included in this section of the report. The owner (or its designee) is responsible for adherence to the O&M plan in a strict and complete manner.

- **Storing of Materials & Water Products**
  The trash and waste program for the site includes exterior dumpsters. There is a trash contractor used to pick up the waste material in the dumpsters. The stormwater drainage system has water quality inlets designed to capture trash and debris.

- **Vehicle Washing**
  Outdoor vehicle washing has the potential to result in high loads of nutrients, metals, and hydrocarbons during dry weather conditions, as the detergent-rich water used to wash the grime off the vehicle enters the stormwater drainage system. The existing development does not include any designated vehicle washing areas, nor is it expected that any vehicle washing will take place on-site.

- **Spill Prevention & Response**
  Sources of potential spill hazards include vehicle fluids, liquid fuels, pesticides, paints, solvents, and liquid cleaning products. The majority of the spill hazards would likely occur within the buildings and would not enter the stormwater drainage system. However, there are spill hazards from vehicle fluids or liquid fuels located outside of the buildings. These exterior spill hazards have the potential to enter the stormwater drainage system and are to be addressed as follows:

1. Spill hazards of pesticides, paints, and solvents shall be remediated using the Manufacturers' recommended spill cleanup protocol.
2. Vehicle fluids and liquid fuel spill shall be remediated according to the local and state regulations governing fuel spills.
3. The owner shall have the following equipment and materials on hand to address a spill clean-up: brooms, dust pans, mops, rags, gloves, absorptive material, sand, sawdust, plastic and metal trash containers.
4. All spills shall be cleaned up immediately after discovery.
5. Spills of toxic or hazardous material shall be reported, regardless of size, to the Massachusetts Department of Environmental Protection at (888) 304-1333.
6. Should a spill occur, the pollution prevention plan will be adjusted to include measures to prevent another spill of a similar nature. A description of the spill, along with the causes and cleanup measures will be included in the updated pollution prevention plan.

- **Maintenance of Lawns, Gardens, and Other Landscaped Areas**
  It should be recognized that this is a general guideline towards achieving high quality and well-groomed landscaped areas. The grounds staff/landscape contractor must recognize the shortcomings of a general maintenance plan such as this, and modify and/or augment it based on weekly, monthly, and yearly observations. In order to assure the highest quality conditions, the staff must also recognize and appreciate the need to be aware of the constantly changing conditions of the landscaping and be able to respond to them on a proactive basis. No trees shall be planted over the drain lines or recharge area, and that only shallow rooted plants and shrubs will be allowed.
    - **Fertilizer**

      Maintenance practices should be aimed at reducing environmental, mechanical and pest stresses to promote healthy and vigorous growth. When necessary, pest outbreaks should be treated with the most sensitive control measure available. Synthetic chemical controls should be used only as a last resort to organic and biological control methods. Fertilizer, synthetic chemical controls and pest management applications (when necessary) shall be performed only by licensed applicators in accordance with the manufacturer's label instructions when environmental conditions are conducive to controlled product application.

Only slow-release organic fertilizers should be used in the planting and mulch areas to limit the amount of nutrients that could enter downstream resource areas. Fertilization of the planting and mulch areas will be performed within manufacturers labeling instructions and shall not exceed an NPK ration of 1:1:1 (i.e. Triple 10 fertilizer mix), considered a low nitrogen mixture. Fertilizers approved for the use under this O&M Plan are as follows:

Type: LESCO® 28-0-12 (Lawn Fertilizer)
MERIT® 0.2 Plus Turf Fertilizer
MOMENTUM™ Force Weed & Feed

- **Suggested Aeration Program**

  In-season aeration of lawn areas is good cultural practice, and is recommended whenever feasible. It should be accomplished with a solid thin tine aeration method to reduce disruption to the use of the area. The depth of solid tine aeration is similar to core type, but should be performed when the soil is somewhat drier for a greater overall effect.

  Depending on the intensity of use, it can be expected that all landscaped lawn areas will need aeration to reduce compaction at least once per year. The first operation should occur in late May following the spring season. Methods of reducing compaction will vary based on the nature of the compaction. Compaction on newly established landscaped areas is generally limited to the top 2-3" and can be alleviated using hollow core or thin tine aeration methods.

  The spring aeration should consist of two passes at opposite directions with 1/4" hollow core tines penetrating 3-5" into the soil profile. Aeration should occur when the soil is moist but not saturated. The soil cores should be shattered in place and dragged or swept back into the turf to control thatch. If desired the cores may also be removed and the area top-dressed with sand or sandy loam. If the area drains on average too slowly, the topdressing should contain a higher percentage of sand. If it is draining on average too quickly, the top dressing should contain a higher percentage of soil and organic matter.

- **Landscape Maintenance Program Practices**:

  - **Lawn**

    1. Mow a minimum of once a week in spring, to a height of 2” to 2 1/2” high. Mowing should be frequent enough so that no more than 1/3 of grass blade is removed at each mowing. The top growth supports the roots; the shorter the grass is cute, the less

the roots will grow. Short cutting also dries out the soil and encourages weeds to germinate.

2. Mow approximately once every two weeks from July 1st to August 15th depending on lawn growth.
3. Mow on a ten-day cycle in fall, when growth is stimulated by cooler nights and increased moisture.
4. Do not remove grass clippings after mowing.
5. Keep mower blades sharp to prevent ragged cuts on grass leaves, which cause a brownish appearance and increase the chance for disease to enter a leaf.

- **Shrubs**

1. Mulch not more than 3" depth with shredded pine or fir bark.
2. Hand prune annually, immediately after blooming, to remove 1/3 of the above-ground biomass (older stems). Stem removals are to occur within 6" of the ground to open up shrub and maintain two-year wood (the blooming wood).
3. Hand-prune evergreen shrubs only as needed to remove dead and damaged wood and to maintain the naturalistic form of the shrub. Never mechanically shear evergreen shrubs.

- **Trees**

1. Provide aftercare of new tree plantings for the first three years.
2. Do not fertilize trees, it artificially stimulates them (unless tree health warrants).
3. Water once a week for the first year; twice a month for the second; once a month for the third year.
4. Prune trees on a four-year cycle.

- **Invasive Species**

1. Inform the Conservation Commission Agent prior to the removal of invasive species proposed either through hand work or through chemical removal.

- **Storage and Use of Herbicides and Pesticides**

Integrated Pest Management is the combination of all methods (of pest control) which may prevent, reduce, suppress, eliminate, or repel an insect population. The main requirements necessary to support any pest population are food, shelter and

water, and any upset of the balance of these will assist in controlling a pest population. Scientific pest management is the knowledgeable use of all pest control methods (sanitation, mechanical, chemical) to benefit mankind's health, welfare, comfort, property and food. A Pest Management Professional (PMP) should be retained who is licensed with the Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs, Department of Agricultural Resources.

The site manager will be provided with approved bulletin before entering into or renewing an agreement to apply pesticides for the control of indoor household or structural pests, refer to 333 CMR 13.08.

Before beginning each application, the applicator must post a Department approved notice on all of the entrances to the treated room or area. The applicator must leave such notices posted after the application. The notice will be posted at conspicuous point(s) of access to the area treated. The location and number of signs will be determined by the configuration of the area to be treated based on the applicator's best judgment. It is intended to give sufficient notice so that no one comes into an area being treated unaware that the applicator is working and pesticides are being applied. However, if the contracting entity does not want the signs posted, he/she may sign a Department approved waiver indicating this.

The applicator or employer will provide to any person upon their request the following information on previously conducted applications:

1. Name and phone number of pest control company;
2. Date and time of the application;
3. Name and license number of the applicator;
4. Target pests; and
5. Name and EPA Registration Number of pesticide products applied.

- **Pet Waste Management**
  The owner's landscape crew (or designee) shall remove any obvious pet waste that has been left behind by pet owners within the development. The pet waste shall be disposed of in accordance with local and state regulations.

- **Management of Deicing Chemicals and Snow**
  Snow will be stockpiled on site until the accumulated snow becomes a hazard to the daily operations of the site. It will be the responsibility of the snow removal contractor to properly dispose of transported snow according to MassDEP, Bureau of Resource Protection – Snow Disposal Guideline #BRPG01-01, governing the proper disposal of snow. It will be the responsibility of the snow removal contractor to follow these guidelines and all applicable laws and regulations

The owner's maintenance staff (or its designee) will be responsible for the clearing of the sidewalk and building entrances. The owner may be required to use a de-icing agent such as potassium chloride to maintain a safe walking surface. If used, the de-icing agent for the walkways and building entrances will be kept within the storage rooms located within the building. If used, de-icing agents will not be stored outside. The owner's maintenance staff will limit the application of sand.

1.6 LONG-TERM MAINTENANCE PLAN – FACILITIES DESCRIPTION

A maintenance log will be kept (i.e. report) summarizing inspections, maintenance, and any corrective actions taken. The log will include the date on which each inspection or maintenance task was performed, a description of the inspection findings or maintenance completed, and the name of the inspector or maintenance personnel performing the task. If a maintenance task requires the clean-out of any sediments or debris, the location where the sediment and debris was disposed after removal will be indicated. The log will be made accessible to department staff and a copy provided to the department upon request.

The following is a description of the Stormwater Management System for the project site.

- **Stormwater Collection System – On-Site**: The stormwater collection system is comprised of deep sump hooded catch basins, water quality structures, subsurface infiltration system, a closed gravity pipe network and several outlet control structures.
  The stormwater runoff from the building rooftops are collected using roof drains. The stormwater is conveyed to the discharge locations using internal building plumbing and external roof leaders. The building rooftop runoff discharges to the sub-surface infiltration system.

1.7 INSPECTION AND MAINTENANCE FREQUENCY AND CORRECTIVE MEASURES

In accordance with MA DEP Stormwater Handbook: Volume 2, Chapter 2; the following areas, facilities, and measures will be inspected and the identified deficiencies will be corrected. Clean-out must include the removal and legal disposal of any accumulated sediments, trash, and debris. In any and all cases, operations, inspections, and maintenance activities shall utilize best practical measures to avoid and minimize impacts to wetland resource areas outside the footprint of the SMS.

Attached is an Operation and Maintenance Plan (OM-1) illustrating the location of the following SMS components that will require continuing inspection as outlined in the document:

- *Street Sweeping*
- *Deep Sump Hooded Catch Basin*
- *Water Quality Structures*

- *Grass Swale*
- *Stormtech Isolator Row*
- *Sub-Surface Infiltration System (Stormtech Chambers)*
- *Pipe Ends*
- *Snow Storage (as outlined on plan)*

1.8 STRUCTURAL PRETREATMENT BMPS

Regular maintenance of these BMPs is especially critical because they typically receive the highest concentration of suspended solids during the first flush of a storm event.

Deep Sump Catch Basins:

Deep sump catch basins, also known as oil and grease or hooded catch basins, are underground retention systems designed to remove trash, debris, and coarse sediment from stormwater runoff, and serve as temporary spill containment devices for floatables such as oils and greases.

Regular maintenance is essential. Deep sump catch basins remain effective by removing pollutants only if they are cleaned out frequently. One study found that once 50% of the sump volume is filled, the catch basin is not able to retain additional sediments.

Inspect or clean deep sump catch basins at least four times per year and at the end of the foliage and snow-removal seasons. Sediments must also be removed four times per year or whenever the depths of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin.

Clamshell buckets are typically used to remove sediment in Massachusetts. However, vacuum trucks are preferable, because they remove more trapped sediment and supernatant than clamshells. Vacuuming is also a speedier process and is less likely to snap the cast iron hood within the deep sump catch basin.

Always consider the safety of the staff cleaning deep sump catch basins. Cleaning a deep sump catch basin within a road with active traffic or even within a parking lot is dangerous, and a police detail may be necessary to safeguard workers.

Although catch basin debris often contains concentrations of oil and hazardous materials, such as petroleum hydrocarbons and metals, MassDEP classifies them as solid waste. Unless there is evidence that they have been contaminated by a spill or other means, MassDEP does not routinely require catch basin cleanings to be tested before disposal. Contaminated catch basin cleanings must be evaluated in accordance with the Hazardous Waste Regulations, 310 CMR 30.000, and handled as hazardous waste.

In the absence of evidence of contamination, catch basin cleanings may be taken to a landfill or other facility permitted by MassDEP to accept solid waste, without any prior approval by MassDEP. However, some landfills require catch basin cleanings to be tested before they are accepted.

With prior MassDEP approval, catch basin cleanings may be used as grading and shaping materials at landfills undergoing closure (see Revised Guidelines for Determining Closure Activities at Inactive Unlined Landfill Sites) or as daily cover at active landfills. MassDEP also encourages the beneficial reuse of catch basin cleanings whenever possible. A Beneficial Reuse Determination is required for such use.

MassDEP regulations prohibit landfills from accepting materials that contain free-draining liquids. One way to remove liquids is to use a hydraulic lift truck during cleaning operations so that the material can be decanted at the site. After loading material from several catch basins into a truck, elevate the truck so that any free-draining liquid can flow back into the structure. If there is no free water in the truck, the material may be deemed to be sufficiently dry. Otherwise catch basin cleanings must undergo a Paint Filter Liquids Test. Go to www.Mass.gov/dep/recycle/laws/cafacts.doc for information on all of the MassDEP requirements pertaining to the disposal of catch basin cleanings

Water Quality Structure:

Regular maintenance is essential. Inspect or clean water quality structure at least twice per year (e.g. spring & fall) and snow-removal seasons. Sediments must also be removed whenever the depths of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin. Please refer to the Contech CDS and Stormceptor Operation and Maintenance Guide attached hereafter.

Vacuum trucks are preferable, because they remove more trapped sediment and supernatant than clamshells. Vacuuming is also a speedier process and is less likely to snap the cast iron hood within the deep sump catch basin.

Always consider the safety of the staff cleaning the structure. Cleaning structures within a road with active traffic or even within a parking lot is dangerous, and a police detail may be necessary to safeguard workers.

Although debris often contains concentrations of oil and hazardous materials, such as petroleum hydrocarbons and metals, MassDEP classifies them as solid waste. Unless there is evidence that they have been contaminated by a spill or other means, MassDEP does not routinely require catch basin cleanings to be tested before disposal. Contaminated catch basin cleanings must be evaluated in

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1.9 CONVEYANCE BMPS

Grass Swale:

Grass Drainage Channels should be inspected within the first three months after construction to ensure proper vegetation is established; thereafter, Inspect 2 times per year (preferably in Spring and Fall) to ensure they are working in their intended fashion and that they are free of sediment and debris. Remove any obstructions to flow, including accumulated sediments and debris and vegetated growth. Repair any erosion of the ditch lining. Vegetated ditches will be mowed at least annually or otherwise maintained to control the growth of woody vegetation and maintain flow capacity. Any woody vegetation growing through riprap linings must also be removed. Repair any slumping side slopes as soon as practicable and correct any erosion of the channel's bottom or side slopes.

1.10 TREATMENT BMPS

Stormtech Isolator Row:

Stormtech Isolator Row is an isolated row of chambers wrapped in geotextile fabric which filters the stormwater, trapping pollutants in the row before entering the adjacent chambers. The Isolator Row inspection/maintenance should be done in accordance with the manufacturer's guidelines and documentation. A copy is attached hereafter.

1.11 INFILTRATION BMPS

Infiltration Basin

Infiltration basins are stormwater collection areas that are constructed over permeable soils.

Preventative maintenance, which includes but not limited to mowing, trash/debris removal, grass clipping removal, and removal of accumulated organic material should be conducted twice a year. Inspect pretreatment devices every other month or at least twice a year and after every major storm event. Remove any debris that might clog the system. Include mosquito controls in the Operation and Maintenance Plan.

Inspect outlet from infiltration basin to adjacent resource area for signs of scour and sediment accumulation at least twice annually. Remove sediment accumulation and add rip rap as necessary to prevent scour.

Subsurface Structures:

Subsurface structures are underground systems that capture runoff, and gradually infiltrate it into the groundwater through rock and gravel.

Because subsurface structures are installed underground, they are extremely difficult to maintain. Inspect inlets at least twice a year. Remove any debris that might clog the system. Include mosquito controls in the Operation and Maintenance Plan.

Inspect outlet from subsurface structures to adjacent resource area for signs of scour and sediment accumulation at least twice annually. Remove sediment accumulation and add rip rap as necessary to prevent scour.

1.12 OTHER BMPS AND ACCESSORIES:

Outlet Control Structures:

Outlets of BMPs are devices that control the flow of stormwater out of the BMP to the conveyance system.

Inspect outlet structures twice per year. Remove any accumulated sediment and debris that could prevent flow at the outlet structure.

Culverts:
Inspect culverts 2 times per year (preferably in Spring and Fall) to ensure that the culverts are working in their intended fashion and that they are free of debris. Remove any obstructions to flow; remove accumulated sediments and debris at the inlet, at the outlet, and within the conduit and repair any erosion damage at the culvert's inlet and outlet.

Rip Rap and Level Spreaders:

Inspect twice per year for erosion, debris accumulation, and unwanted vegetation. Erosion areas shall be stabilized and sediment, debris, and woody vegetation will be removed.

Vegetated Areas:

Inspect slopes and embankments early in the growing season to identify active or potential erosion problems. Replant bare areas or areas with sparse growth. Where rill erosion is evident, armor the area with an appropriate lining or divert the erosive flows to on-site areas able to withstand the concentrated flows.

Roadway and Parking Surfaces:

Clear accumulations of winter sand in parking lots and along roadways at least once a year, preferably in the spring. Accumulations on pavement may be removed by pavement sweeping. Accumulations of sand along road shoulders may be removed by grading excess sand to the pavement edge and removing it manually or by a front-end loader.

Mosquito Control Plan:

MA Stormwater Handbook; Volume 2, Chapter 5 (Attached)

Both above ground and underground stormwater BMPs have the potential to serve as mosquito breeding areas. Good design, proper operation and maintenance, and treatment with larvicides can minimize this potential.

1.13 SUPPLEMENTAL INFORMATION

PROPOSED OPERATIONS AND MAINTENANCE LOG FORM

Based on site specific stormwater management system asset list. At a minimum, fields should be provided for:

- Date of inspection

- Name of inspector
- Condition of each BMP, including components such as:
    - Pretreatment devices
    - Vegetation
    - Other safety devices
    - Control structures
    - Embankments, slopes, and safety benches
    - Inlet and outlet channels and structures
    - Underground drainage
    - Sediment and debris accumulation in storage and forebay areas (including catch basins)
    - Any nonstructural practices
    - Any other item that could affect the proper function of the stormwater management system
- Description of the need for maintenance
- Description of maintenance performed



APPENDIX A
SUPPLEMENT INFORMATION

SNOW DISPOSAL GUIDANCE

Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection
One Winter Street Boston, MA 02108 • 617-292-5500

Charles D. Baker
Governor

Karyn E. Polito
Lieutenant Governor

Kathleen A. Theoharides
Secretary

Martin Suuberg
Commissioner

Massachusetts Department of Environmental Protection
Bureau of Water Resources
Snow Disposal Guidance

Effective Date: December 23, 2019

Applicability: Applies to all federal, state, regional and local agencies, as well as to private businesses.

Supersedes: Bureau of Resource Protection (BRP) Snow Disposal Guideline No. BRPG97-1 issued December 12, 1997 and BRPG01-01 issued March 8, 2001; Bureau of Water Resources (BWR) snow disposal guidance issued December 21, 2015 and December 12, 2018.

Approved by: Kathleen Baskin, Assistant Commissioner, Bureau of Water Resources

PURPOSE: To provide guidelines to all government agencies and private businesses regarding snow disposal site selection, site preparation and maintenance, and emergency snow disposal options that are protective of wetlands, drinking water, and water bodies, and are acceptable to the Massachusetts Department of Environmental Protection (MassDEP), Bureau of Water Resources.

APPLICABILITY: These Guidelines are issued by MassDEP's Bureau of Water Resources on behalf of all Bureau Programs (including Drinking Water Supply, Wetlands and Waterways, Wastewater Management, and Watershed Planning and Permitting). They apply to all federal agencies, state agencies, state authorities, municipal agencies and private businesses disposing of snow in the Commonwealth of Massachusetts.

INTRODUCTION

Finding a place to dispose of collected snow poses a challenge to municipalities and businesses as they clear roads, parking lots, bridges, and sidewalks. While MassDEP is aware of the threats to public safety caused by snow, collected snow that is contaminated with road salt, sand, litter, and automotive pollutants such as oil also threatens public health and the environment.

As snow melts, road salt, sand, litter, and other pollutants are transported into surface water or through the soil where they may eventually reach the groundwater. Road salt and other pollutants can contaminate water supplies and are toxic to aquatic life at certain levels. Sand washed into

waterbodies can create sand bars or fill in wetlands and ponds, impacting aquatic life, causing flooding, and affecting our use of these resources.

There are several steps that communities can take to minimize the impacts of snow disposal on public health and the environment. These steps will help communities avoid the costs of a contaminated water supply, degraded waterbodies, and flooding. Everything that occurs on the land has the potential to impact the Commonwealth's water resources. Given the authority of local government over the use of the land, municipal officials and staff have a critically important role to play in protecting our water resources.

The purpose of these guidelines is to help federal agencies, state agencies, state authorities, municipalities and businesses select, prepare, and maintain appropriate snow disposal sites before the snow begins to accumulate through the winter. Following these guidelines and obtaining the necessary approvals may also help municipalities in cases when seeking reimbursement for snow disposal costs from the Federal Emergency Management Agency is possible.

RECOMMENDED GUIDELINES

These snow disposal guidelines address: (1) site selection; (2) site preparation and maintenance; and (3) emergency snow disposal.

1. SITE SELECTION

The key to selecting effective snow disposal sites is to locate them adjacent to or on pervious surfaces in upland areas or upland locations on impervious surfaces away from water resources and drinking water wells. At these locations, the snow meltwater can filter into the soil, leaving behind sand and debris which can be removed in the spring. The following conditions should be followed:

- Within water supply Zone A and Zone II, avoid storage or disposal of snow and ice containing deicing chemicals that has been collected from streets located outside these zones. Municipalities may have a water supply protection land use control that prohibits the disposal of snow and ice containing deicing chemicals from outside the Zone A and Zone II, subject to the Massachusetts Drinking Water Regulations at 310 CMR 22.20C and 310 CMR 22.21(2).
- Avoid storage or disposal of snow or ice in Interim Wellhead Protection Areas (IWPA) of public water supply wells, and within 75 feet of a private well, where road salt may contaminate water supplies.
- Avoid dumping snow into any waterbody, including rivers, the ocean, reservoirs, ponds, or wetlands. In addition to water quality impacts and flooding, snow disposed of in open water can cause navigational hazards when it freezes into ice blocks.
- Avoid dumping snow on MassDEP-designated high and medium-yield aquifers where it may contaminate groundwater.
- Avoid dumping snow in sanitary landfills and gravel pits. Snow meltwater will create more contaminated leachate in landfills posing a greater risk to groundwater, and in gravel pits, there is little opportunity for pollutants to be filtered out of the meltwater because groundwater is close to the land surface.

- Avoid disposing of snow on top of storm drain catch basins or in stormwater drainage systems including detention basins, swales or ditches. Snow combined with sand and debris may block a stormwater drainage system, causing localized flooding. A high volume of sand, sediment, and litter released from melting snow also may be quickly transported through the system into surface water.

Recommended Site Selection Procedures

It is important that the municipal Department of Public Works or Highway Department, Conservation Commission, and Board of Health work together to select appropriate snow disposal sites. The following steps should be taken:

- Estimate how much snow disposal capacity may be needed for the season so that an adequate number of disposal sites can be selected and prepared.
- Identify sites that could potentially be used for snow disposal, such as municipal open space (e.g., parking lots or parks).
- Select sites located in upland locations that are not likely to impact sensitive environmental resources first.
- If more storage space is still needed, prioritize the sites with the least environmental impact (using the site selection criteria, and local or MassGIS maps as a guide).

Snow Disposal Mapping Assistance

MassDEP has an online mapping tool to assist in identifying possible locations to potentially dispose of snow. MassDEP encourages municipalities to use this tool to identify possible snow disposal options. The tool identifies wetland resource areas, public drinking water supplies and other sensitive locations where snow should not be disposed. The tool may be accessed through the Internet at the following web address: **https://maps.env.state.ma.us/dep/arcgis/js/templates/PSF/**.

2. SITE PREPARATION AND MAINTENANCE

In addition to carefully selecting disposal sites before the winter begins, it is important to prepare and maintain these sites to maximize their effectiveness. The following maintenance measures should be undertaken for all snow disposal sites:

- A silt fence or equivalent barrier should be placed securely on the downgradient side of the snow disposal site.
- Wherever possible maintain a 50-foot vegetated buffer between the disposal site and adjacent waterbodies to filter pollutants from the meltwater.
- Clear debris from the site prior to using the site for snow disposal.
- Clear debris from the site and properly dispose of it at the end of the snow season, and no later than May 15.

3. SNOW DISPOSAL APPROVALS

Proper snow disposal may be undertaken through one of the following approval procedures:

- Routine snow disposal – Minimal, if any, administrative review is required in these cases when upland and pervious snow disposal locations or upland locations on impervious surfaces that have functioning and maintained stormwater management systems have been identified, mapped, and used for snow disposal following ordinary snowfalls. Use of upland and pervious snow disposal sites avoids wetland resource areas and allows snow meltwater to recharge groundwater and will help filter pollutants, sand, and other debris. This process will address the majority of snow removal efforts until an entity exhausts all available upland snow disposal sites. The location and mapping of snow disposal sites will help facilitate each entity's routine snow management efforts.
- Emergency Certifications – If an entity demonstrates that there is no remaining capacity at upland snow disposal locations, local conservation commissions may issue an Emergency Certification under the Massachusetts Wetlands Protection regulations to authorize snow disposal in buffer zones to wetlands, certain open water areas, and certain wetland resource areas (i.e. within flood plains). Emergency Certifications can only be issued at the request of a public agency or by order of a public agency for the protection of the health or safety of citizens, and are limited to those activities necessary to abate the emergency. See 310 CMR 10.06(1)-(4). Use the following guidelines in these emergency situations:
    - Dispose of snow in open water with adequate flow and mixing to prevent ice dams from forming.
    - Do not dispose of snow in salt marshes, vegetated wetlands, certified vernal pools, shellfish beds, mudflats, drinking water reservoirs and their tributaries, Zone IIs or IWPAs of public water supply wells, Outstanding Resource Waters, or Areas of Critical Environmental Concern.
    - Do not dispose of snow where trucks may cause shoreline damage or erosion.
    - Consult with the municipal Conservation Commission to ensure that snow disposal in open water complies with local ordinances and bylaws.

- Severe Weather Emergency Declarations – In the event of a large-scale severe weather event, MassDEP may issue a broader Emergency Declaration under the Wetlands Protection Act which allows federal agencies, state agencies, state authorities, municipalities, and businesses greater flexibility in snow disposal practices. Emergency Declarations typically authorize greater snow disposal options while protecting especially sensitive resources such as public drinking water supplies, vernal pools, land containing shellfish, FEMA designated floodways, coastal dunes, and salt marsh. In the event of severe winter storm emergencies, the snow disposal site maps created by municipalities will enable MassDEP and the Massachusetts Emergency Management Agency (MEMA) in helping communities identify appropriate snow disposal locations.

  If upland disposal sites have been exhausted, the Emergency Declaration issued by MassDEP allows for snow disposal near water bodies. In these situations, a buffer of at

least 50 feet, preferably vegetated, should still be maintained between the site and the waterbody. Furthermore, it is essential that the other guidelines for preparing and maintaining snow disposal sites be followed to minimize the threat to adjacent waterbodies.

Under extraordinary conditions, when all land-based snow disposal options are exhausted, the Emergency Declaration issued by MassDEP may allow disposal of snow in certain waterbodies under certain conditions. ***A federal agency, state agency, state authority, municipality or business seeking to dispose of snow in a waterbody should take the following steps***:

- Call the emergency contact phone number [(888) 304-1133)] and notify the MEMA of the municipality's intent.
- MEMA will ask for some information about where the requested disposal will take place.
- MEMA will confirm that the disposal is consistent with MassDEP's Severe Weather Emergency Declaration and these guidelines and is therefore approved.

During declared statewide snow emergency events, MassDEP's website will also highlight the emergency contact phone number [(888) 304-1133)] for authorizations and inquiries. For further non-emergency information about this Guidance you may contact your MassDEP Regional Office Service Center:

Northeast Regional Office, Wilmington, 978-694-3246
Southeast Regional Office, Lakeville, 508-946-2714
Central Regional Office, Worcester, 508-792-7650
Western Regional Office, Springfield, 413-755-2114

MOSQUITO CONTROL

Chapter 5
Miscellaneous Stormwater Topics

Mosquito Control in Stormwater Management Practices

Both aboveground and underground stormwater BMPs have the potential to serve as mosquito breeding areas. Good design, proper operation and maintenance and treatment with larvicides can minimize this potential.

EPA recommends that stormwater treatment practices dewater within 3 days (72 hours) to reduce the number of mosquitoes that mature to adults, since the aquatic stage of many mosquito species is 7 to 10 days. Massachusetts has had a 72-hour dewatering rule in its Stormwater Management Standards since 1996. The 2008 technical specifications for BMPs set forth in Volume 2, Chapter 2 of the Massachusetts Stormwater Handbook also concur with this practice by requiring that all stormwater practices designed to drain do so within 72 hours.

Some stormwater practices are designed to include permanent wet pools. These practices – if maintained properly – can limit mosquito breeding by providing habitat for mosquito predators. Additional measures that can be taken to reduce mosquito populations include increasing water circulation, attracting mosquito predators by adding suitable habitat, and applying larvicides.

The Massachusetts State Reclamation and Mosquito Control Board (SRMCB), through the Massachusetts Mosquito Control Districts, can undertake further mosquito control actions specifically for the purpose of mosquito control pursuant to Massachusetts General Law Chapter 252. The Mosquito Control Board, http://www.mass.gov/agr/mosquito/, describes mosquito control methods and is in the process of developing guidance documents that describe Best Management Practices for mosquito control projects.

The SRMCB and Mosquito Control Districts are not responsible for operating and maintaining stormwater BMPs to reduce mosquito populations. The owners of property that construct the stormwater BMPs or municipalities that "accept" them through local subdivision approval are responsible for their maintenance.[1] The SRMCB is composed of officials from MassDEP, Department of Agricultural Resources, and Department of Conservation and Recreation. The nine (9) Mosquito Control Districts overseen by the SRMCB are located throughout Massachusetts, covering 176 municipalities.

Construction Period Best Management Practices for Mosquito Control

To minimize mosquito breeding during construction, it is essential that the following actions be taken to minimize the creation of standing pools by taking the following actions:

- ***Minimize Land Disturbance:*** Minimizing land disturbance reduces the likelihood of mosquito breeding by reducing silt in runoff that will cause construction period controls to clog and retain standing pools of water for more than 72 hours.
- ***Catch Basin inlets:*** Inspect and refresh filter fabric, hay bales, filter socks or stone dams on a regular basis to ensure that any stormwater ponded at the inlet drains within 8 hours after precipitation stops. Shorter periods may be necessary to avoid hydroplaning in roads

[1] MassDEP and MassHighway understand that the numerous stormwater BMPs along state highways pose a unique challenge. To address this challenge, the 2004 MassHighway Stormwater Handbook will provide additional information on appropriate operation and maintenance practices for mosquito control when the Handbook is revised to reflect the 2008 changes to the Stormwater Management Standards..

caused by water ponded at the catch basin inlet. Treat catch basin sumps with larvicides such as *Bacillus sphaericus* (*Bs*) using a licensed pesticide applicator.

- ***Check Dams:*** If temporary check dams are used during the construction period to lag peak rate of runoff or pond runoff for exfiltration, inspect and repair the check dams on a regular basis to ensure that any stormwater ponded behind the check dam drains within 72 hours.
- ***Design construction period sediment traps*** to dewater within 72 hours after precipitation. Because these traps are subject to high silt loads and tend to clog, treat them with the larvicide *Bs* after it rains from June through October, until the first frost occurs.
- ***Construction period open conveyances:*** When temporary manmade ditches are used for channelizing construction period runoff, inspect them on a regular basis to remove any accumulated sediment to restore flow capacity to the temporary ditch.
- ***Revegetating Disturbed Surfaces:*** Revegetating disturbed surfaces reduces sediment in runoff that will cause construction period controls to clog and retain standing pools of water for greater than 72 hours.
- ***Sediment fences/hay bale barriers:*** When inspections find standing pools of water beyond the 24-hour period after a storm, take action to restore barrier to its normal function.

Post-Construction Stormwater Treatment Practices

- Mosquito control begins with the environmentally sensitive site design. Environmentally sensitive site design that minimizes impervious surfaces reduces the amount of stormwater runoff. Disconnecting runoff using the LID Site Design credits outlined in the Massachusetts Stormwater Handbook reduces the amount of stormwater that must be conveyed to a treatment practice. Utilizing green roofs minimizes runoff from smaller storms. Storage media must be designed to dewater within 72 hours after precipitation.
- Mosquito control continues with the selection of structural stormwater BMPs that are unlikely to become breeding grounds for mosquitoes, such as:
    - ***Bioretention Areas/Rain Gardens/Sand Filter:*** These practices tend not to result in mosquito breeding. If any level spreaders, weirs or sediment forebays are used as part of the design, inspect them and correct them as necessary to prevent standing pools of water for more than 72 hours.
    - ***Infiltration Trenches:*** This practice tends not to result in mosquito breeding. If any level spreaders, weirs, or sediment forebays are used as part of the design, inspect them and correct them as necessary to prevent standing pools of water for more than 72 hours.
- Another mosquito control strategy is to select BMPs that can become habitats for mosquito predators, such as:
    - ***Constructed Stormwater Wetlands:*** Habitat features can be incorporated in constructed stormwater wetlands to attract dragonflies, amphibians, turtles, birds, bats, and other natural predators of mosquitoes.
    - ***Wet Basins:*** Wet basins can be designed to incorporate fish habitat features, such as deep pools. Introduce fish in consultation with Massachusetts Division of Fisheries and Wildlife. Vegetation within wet basins designed as fish habitat must be properly managed to ensure that vegetation does not overtake the habitat. Proper design to ensure that no low circulation or "dead" zones are created may reduce the potential for mosquito breeding. Introducing bubblers may increase water circulation in the wet basin.

Effective mosquito controls require proponents to design structural BMPs to prevent ponding and facilitate maintenance and, if necessary, the application of larvicides. Examples of such design practices include the following:

- ***Basins:*** Provide perimeter access around wet basins, extended dry detention basins and dry detention basins for both larviciding and routine maintenance. Control vegetation to ensure that access pathways stay open.
- ***BMPs without a permanent pool of water:*** All structural BMPs that do not rely on a permanent pool of water must drain and completely dewater within 72 hours after precipitation. This includes dry detention basins, extended dry detention basins, infiltration basins, and dry water quality swales. Use underdrains at extended dry detention basins to drain the small pools that form due to accumulation of silts. Wallace indicates that extended dry extended detention basins may breed more mosquitoes than wet basins. It is, therefore, imperative to design outlets from extended dry detention basins to completely dewater within the 72-hour period.
- ***Energy Dissipators and Flow Spreaders:*** Currier and Moeller, 2000 indicate that shallow recesses in energy dissipators and flow spreaders trap water where mosquitoes breed. Set the riprap in grout to reduce the shallow recesses and minimize mosquito breeding.
- ***Outlet control structures:*** Debris trapped in small orifices or on trash racks of outlet control structures such as multiple stage outlet risers may clog the orifices or the trash rack, causing a standing pool of water. Optimize the orifice size or trash rack mesh size to provide required peak rate attenuation/water quality detention/retention time while minimizing clogging.
- ***Rain Barrels and Cisterns:*** Seal lids to reduce the likelihood of mosquitoes laying eggs in standing water. Install mosquito netting over inlets. The cistern system should be designed to ensure that all collected water is drained into it within 72 hours.
- ***Subsurface Structures, Deep Sump Catch Basins, Oil Grit Separators, and Leaching Catch Basins:*** Seal all manhole covers to reduce likelihood of mosquitoes laying eggs in standing water. Install mosquito netting over the outlet (CALTRANS 2004).

The Operation and Maintenance Plan should provide for mosquito prevention and control.

- ***Check dams:*** Inspect permanent check dams on the schedule set forth in the O&M Plan. Inspect check dams 72 hours after storms for standing water ponding behind the dam. Take corrective action if standing water is found.
- ***Cisterns:*** Apply *Bs* larvicide in the cistern if any evidence of mosquitoes is found. The Operation and Maintenance Plan shall specify how often larvicides should be applied to waters in the cistern.
- ***Water quality swales:*** Remove and properly dispose of any accumulated sediment as scheduled in the Operation and Maintenance Plan.
- ***Larvicide Treatment:*** The Operation and Maintenance Plan must include measures to minimize mosquito breeding, including larviciding.
- The party identified in the Operation and Maintenance Plan as responsible for maintenance shall see that larvicides are applied as necessary to the following stormwater treatment practices: catch basins, oil/grit separators, wet basins, wet water quality swales, dry extended detention basins, infiltration basins, and constructed stormwater wetlands. The Operation and Maintenance Plan must ensure that all larvicides are applied by a licensed pesticide applicator and in compliance with all pesticide label requirements.
- The Operation and Maintenance Plan should identify the appropriate larvicide and the time and method of application. For example, *Bacillus sphaericus (Bs*), the preferred

larvicide for stormwater BMPs, should be hand-broadcast.[2] Alternatively, Altosid, a Methopren product, may be used. Because some practices are designed to dewater between storms, such as dry extended detention and infiltration basins, the Operation and Maintenance Plan should provide that larviciding must be conducted during or immediately after wet weather, when the detention or infiltration basin has a standing pool of water, unless a product is used that can withstand extended dry periods.

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[2] *Bacillus thuringienis israelensis* or *Bti* is usually applied by helicopter to wetlands and floodplains

Roads and Stormwater BMPs

In general, the stormwater BMPs used for land development projects can also be used for new roadways and roadway improvement projects. However, for improvement of existing roads, there are often constraints that limit the choice of BMP. These constraints derive from the linear configuration of the road, the limited area within the existing right-of-way, the structural and safety requirements attendant to good roadway design, and the long-term maintainability of the roadway drainage systems. The MassHighway Handbook provides strategies for dealing with the constraints associated with providing stormwater BMPs for roadway redevelopment projects.

Roadway design can minimize impacts caused by stormwater. Reducing roadway width reduces the total and peak volume of runoff. Designing a road with country drainage (no road shoulders or curbs) disconnects roadway runoff. Disconnection of roadway runoff is eligible for the Low Impact Site Design Credit provided the drainage is disconnected in accordance with specifications outlined in Volume 3.

Like other parties, municipalities that work within wetlands jurisdictional areas and adjacent buffer zones must design and implement structural stormwater best management practices in accordance with the Stormwater Management Standards and the Stormwater Management Handbook. In addition, in municipalities and areas where state agencies operate stormwater systems, the DPWs (or other town or state agencies) must meet the "good housekeeping" requirement of the municipality's or agency's MS4 permit.

MassHighway has taken stormwater management one step further by working with MassDEP to develop the MassHighway Storm Water Handbook for Highways and Bridges. The purpose of the MassHighway Handbook is to provide guidance for persons involved in the design, permitting, review and implementation of state highway projects, especially those involving existing roadways where physical constraints often limit the stormwater management options available. These constraints, like those common to redevelopment sites, may make it difficult to comply precisely with the requirements of the Stormwater Management Standards and the Massachusetts Stormwater Handbook.[3] In response to these constraints, MassDEP and MHD developed specific design, permitting, review and implementation practices that meet the unique challenges of providing environmental protection for existing state roads. The information in the MassHighway Handbook may also aid in the planning and design of projects to build new highways and to add lanes to existing highways, since they may face similar difficulties in meeting the requirements of the Stormwater Management Standards.

Although it is very useful, the MassHighway Handbook does not allow MassHighway projects to proceed without individual review and approval by the issuing authority when subject to the Wetlands Protection Act Regulations, 310 CMR 10.00, or the 401 Water Quality Certification Regulations, 314 CMR 9.00. For example, MassHighway must provide a Conservation Commission with a project-specific Operation and Maintenance Plan in accordance with Standard 9 that documents how the project's post-construction BMPs will be operated and maintained.[4]

[3] The 2004 MassHighway Handbook outlines standardized methods for dealing with these constraints as they apply to highway redevelopment projects. MassDEP and MassHighway intend to work together to provide guidance for add a lane projects when the 2004 Handbook is revised to reflect the 2008 changes to the Stormwater Management Standards.

[4] The general permit for municipal separate storm sewer systems (the MS4 Permit) requires MassHighway to develop and implement procedures for the proper operation and maintenance of stormwater BMPs. To

Some municipalities have asked if the MassHighway Handbook governs municipal road projects. The answer is no.[5] The MassHighway Handbook was developed in response to the unique problems and challenges arising out of the management of the state highway system. Like other project proponents, cities and towns planning road or other projects in areas subject to jurisdiction under the Wetlands Protection Act must design and implement LID, non-structural and structural best management practices in accordance with the Stormwater Management Standards and the Massachusetts Stormwater Handbook.

avoid duplication of effort, MassHighway may be able rely on the same procedures to fulfill the operation and maintenance requirements of Standard 9 and the MS 4 Permit.

[5] Although the MassHighway Handbook does not govern municipal road projects, cities and towns may find some of the information presented in the Handbook useful.

OPERATION & MAINTENANCE SUMMARY TABLE

OPERATION AND MAINTENANCE PLAN SCHEDULE **Date:**

ALLEN & MAJOR ASSOCIATES, INC.

Project: Multi-Family Development
Project Address: Off Forest Ridge Road Concord, MA

Responsible for O&M Plan: Thoreau Residences, LLC
Address: 275 Forest Ridge Road Concord, MA 01742
Phone:

All information within table is derived from Massachussetts Stormwater Handbook: Volume 2, Chapter 2

BMP CATEGORY	BMP OR MAINTENANCE ACTIVITY	SCHEDULE/ FREQUENCY	NOTES	ESTIMATED ANNUAL MAINTENANCE COST	INSPECTION PERFORMED	
					DATE:	BY:
STRUCTURAL PRETREATMENT BMPs	**DEEP SUMP HOODED CATCH BASIN**	Twice per year.	Inspect and clean catch basin units whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin.	$5,000		
	PROPRIETARY SEPARATORS	In accordance with manufacturers requirements, but no less than twice a year following installation and once a year thereafter.	Remove sediment and other trapped pollutants at frequency or level specified by manufacturer.	$1,500		
CONVEYANCE BMPs	**GRASS SWALE**	Remove sediment annually. Mow once a month during growing season. Repair erosion no less than once per year.	Remove sediment from forebay and grass channel, mow, repair areas of erosion and revegetate.	$500		
INFILTRATION BMPs	**INFILTRATION BASIN**	Inspect basin and pretreatment devices at least twice a year and after every major storm event. Remove debris that may clog the system as needed.	Preventative maintenance, which includes but is not limited to mowing, trash and debris removal, grass clipping removal, and removal of accumulated organic material shall be conducted at least twice a year.	$1,000		
	SUBSURFACE STRUCTURES	Inspect structure inlets at least twice a year. Remove debris that may clog the system as needed.	Because subsurface structures are installed underground, they are extremely difficult to maintain. Remove any debris that might clog the system.	$1,500		
ESSORIES	**LEVEL SPREADERS**	Inspect regularly, especially after large rainfall events.	Inspect level spreaders regularly, especially after large rainfall events. Note and repair any erosion or low spots in the spreader.	$500		

BMP ACC	**OUTLET STRUCTURES**	Periodic cleaning of Outlet Control Structures as needed.	Clear trash and debris as necessary.	$500		
OTHER MAINTENANCE ACTIVITY	**MOSQUITO CONTROL**	Inspect BMPs as needed to ensure the system's drainage time is less than the maximum 72 hour period.	Massachusetts stormwater handbook requires all stormwater practices that are designed to drain do so within 72 hours to reduce the number of mosquitos that mature to adults since the aquatic stage of a mosquito is 7-10 days.	$300		
	SNOW STORAGE	Clear and remove snow to approved storage locations as necessary to ensure systems are working properly and are protected from meltwater pollutants.	Carefully select snow disposal sites before winter. Avoid dumping removed snow over catch basins, or in detention ponds, sediment forebays, rivers, wetlands, and flood plains. It is also prohibited to dump snow in the bioretention basins or gravel swales.	$500		
	STREET SWEEPING	Clear accumulations of winter sand in parking lots and along roadways at least once a year, preferably in the spring.	Sweep, power broom or vacuum paved areas. Submit information that confirms that all street sweepings have been completed in accordance with state and local requirements	$2,000		

STORMTECH ISOLATOR ROW OPERATION & MAINTENANCE

Isolator® Row Plus
O&M Manual



ADS StormTech™

The Isolator® Row Plus

Introduction

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row Plus is a technique to inexpensively enhance Total Suspended Solids (TSS), Total Phosphorus (TP), Total Petroluem Hydrocarbons (TPH) and Total Nitrogen (TN) removal with easy access for inspection and maintenance.

The Isolator Row Plus

The Isolator Row Plus is a row of StormTech chambers, either SC-160, SC-310, SC-310-3, SC-740, DC-780, SC-800, MC-3500, MC-4500 or MC-7200 models, are lined with filter fabric and connected to a closely located manhole for easy access. The fabric lined chambers provide for sediment settling and filtration as stormwater rises in the Isolator Row Plus and passes through the filter fabric. The open bottom chambers allow stormwater to flow vertically out of the chambers. Sediments are captured in the Isolator Row Plus protecting the adjacent stone and chambers storage areas from sediment accumulation.

ADS Isolator Row and Plus fabric are placed between the stone and the Isolator Row Plus chambers. The woven geotextile provides a media for stormwater filtration, a durable surface for maintenance, prevents scour of the underlying stone and remains intact during high pressure jetting.

The Isolator Row Plus is designed to capture the “first flush” runoff and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole provides access to the Isolator Row Plus and includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row Plus bypass through a manifold to the other chambers. This is achieved with an elevated bypass manifold or a high-flow weir. This creates a differential between the Isolator Row Plus row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row Plus. After Stormwater flows through the Isolator Row Plus and into the rest of the chamber system it is either exfiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

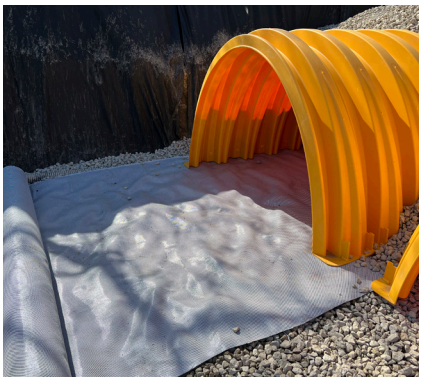
The Isolator Row Plus Flamp™ is a flared end ramp apparatus attached to the inlet pipe on the inside of the chamber end cap. The FLAMP provides a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance by enhancing outflow of solid debris that would otherwise collect at the chamber's end, or more difficult to remove and require confined space entry into the chamber area. It also serves to improve the fluid and solid flow into the access pipe during maintenance and cleaning and to guide cleaning and inspection equipment back into the inlet pipe when complete.

The Isolator Row Plus may be part of a treatment train system. The treatment train design and pretreatment device selection by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, StormTech recommend using the Isolator Row Plus to minimize maintenance requirements and maintenance costs.

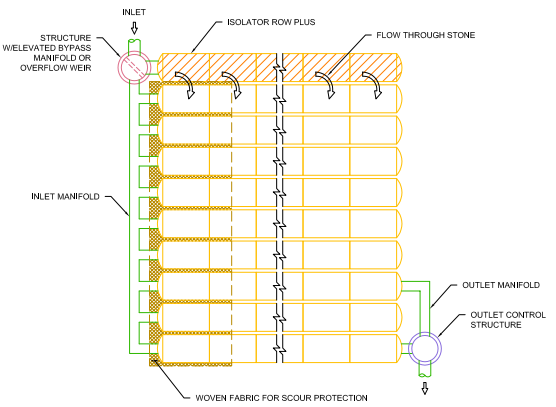
Note: *See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row Plus.*



Looking down the Isolator Row Plus from the manhole opening, ADS Plus Fabric is shown between the chamber and stone base.



StormTech Isolator Row Plus with Overflow Structure (not to scale)



Isolator Row Plus Inspection/Maintenance

Inspection

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row Plus should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

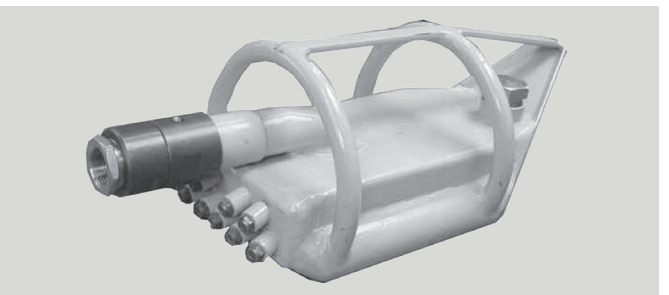
The Isolator Row Plus incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3" (75 mm) throughout the length of the Isolator Row Plus, clean-out should be performed.

Maintenance

The Isolator Row Plus was designed to reduce the cost of periodic maintenance. By “isolating” sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entry.

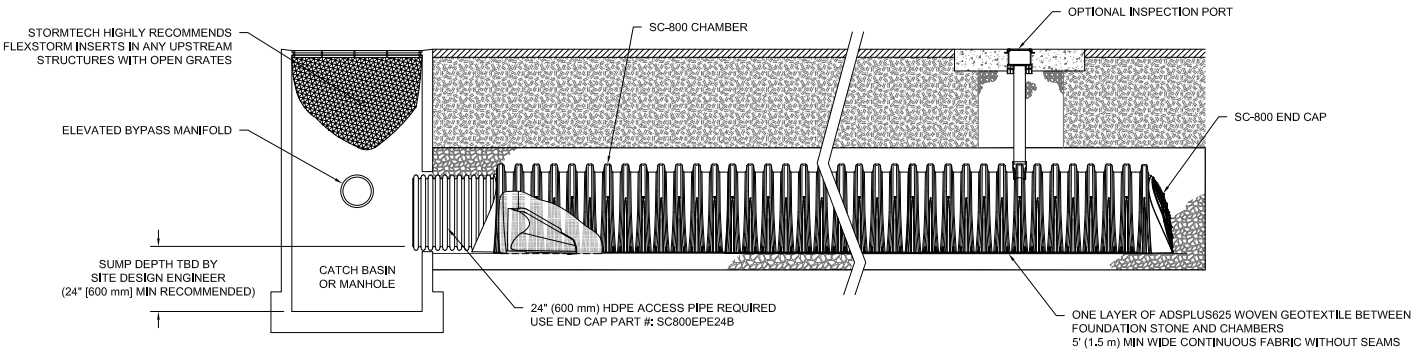
Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row Plus while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45” are best. StormTech recommends a maximum nozzle pressure of 2000 psi be utilized during cleaning. JetVac reels can vary in length. For ease of maintenance, ADS recommends Isolator Row Plus lengths up to 200' (61 m). **The JetVac process shall only be performed on StormTech Isolator Row Plus that have ADS Plus Fabric (as specified by StormTech) over their angular base stone.**







StormTech Isolator Row Plus (*not to scale*)



Isolator Row Plus Step By Step Maintenance Procedures

Step 1

Inspect Isolator Row Plus for sediment.

A) Inspection ports (if present)
   i. Remove lid from floor box frame
   ii. Remove cap from inspection riser
   iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
   iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.

B) All Isolator Row Plus
   i. Remove cover from manhole at upstream end of Isolator Row Plus
   ii. Using a flashlight, inspect down Isolator Row Plus through outlet pipe
      1. Mirrors on poles or cameras may be used to avoid a confined space entry
      2. Follow OSHA regulations for confined space entry if entering manhole
   iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2.
   If not, proceed to Step 3.

Step 2

Clean out Isolator Row Plus using the JetVac process.

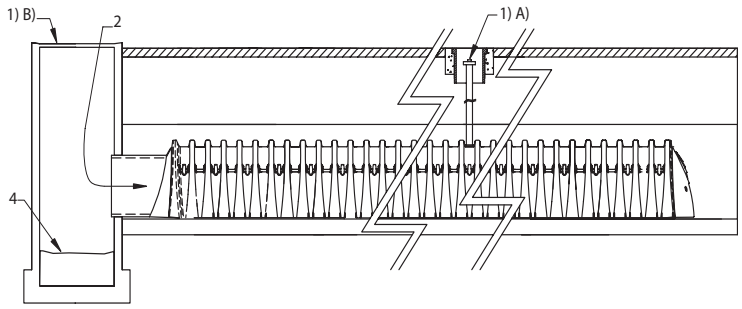
A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required

Step 3

Replace all caps, lids and covers, record observations and actions.

Step 4

Inspect & clean catch basins and manholes upstream of the StormTech system.



Sample Maintenance Log

Date	Stadia Rod Readings		Sediment Depth (1)–(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row Plus, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

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CONTECH CDS WQS OPERATION & MAINTENANCE

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CDS® Inspection and Maintenance Guide



CDS TECHNOLOGIES

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes.



CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y^3	m^3
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.3	3.0	0.9	1.3	1.0
CDS2020	5	1.3	3.5	1.1	1.3	1.0
CDS2025	5	1.3	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities



Support

- Drawings and specifications are available at www.contechstormwater.com.
- Site-specific design support is available from our engineers.

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CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

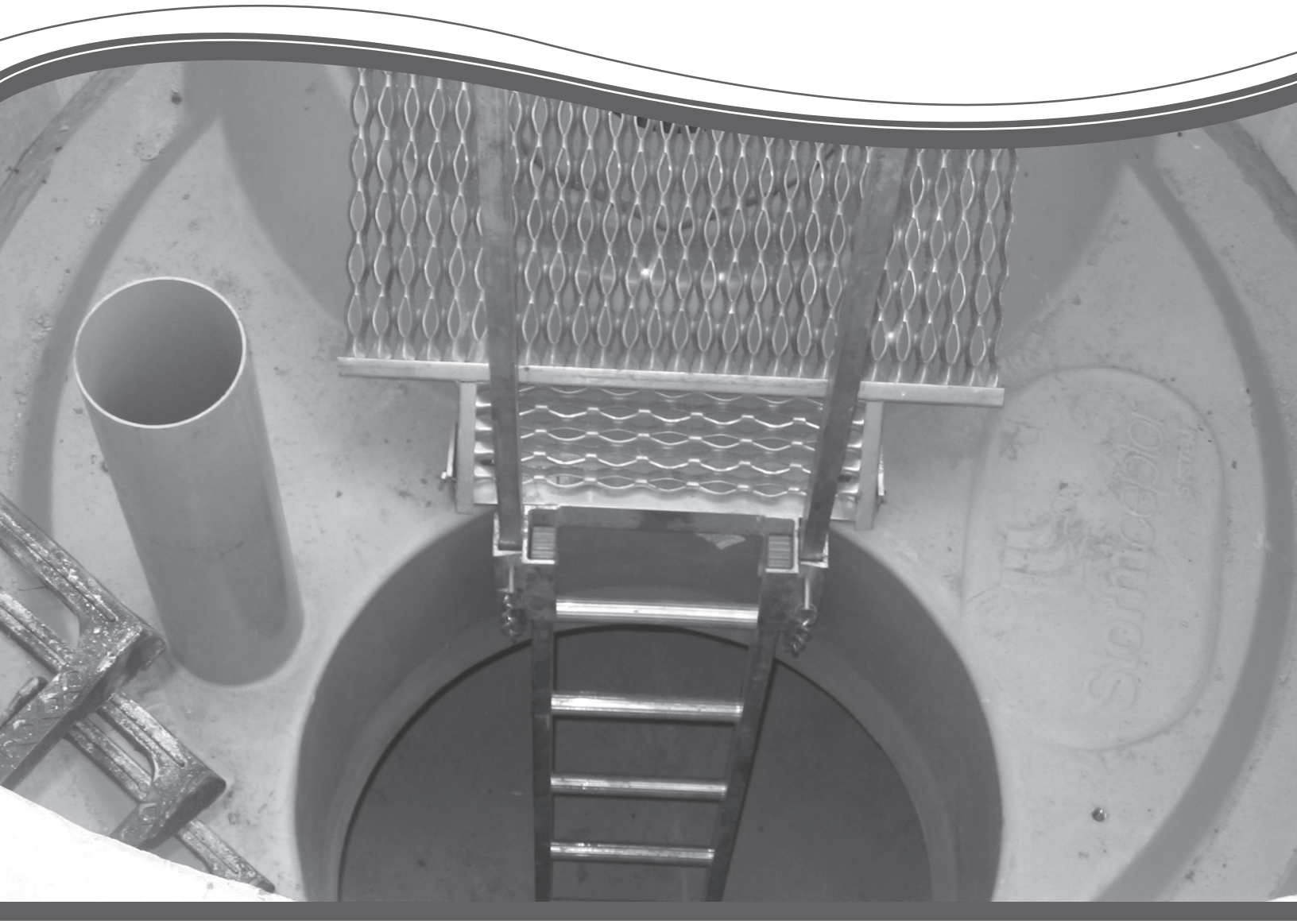
1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

CONTECH STORMCEPTOR WQS OPERATION & MAINTENANCE

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Stormceptor® STC
Operation and Maintenance Guide



Stormceptor® STC

Stormceptor Design Notes

- Only the STC 450i is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 450i to STC 7200 may accommodate multiple inlet pipes.

Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences			
Inlet Pipe Configuration	STC 450i	STC 900 to STC 7200	STC 11000 to STC 16000
Single inlet pipe	3 in. (75 mm)	1 in. (25 mm)	3 in. (75 mm)
Multiple inlet pipes	3 in. (75 mm)	3 in. (75 mm)	Only one inlet pipe.

Maximum inlet and outlet pipe diameters:

Inlet/Outlet Configuration	Inlet Unit STC 450i	In-Line Unit STC 900 to STC 7200	Series* STC 11000 to STC 16000
Straight Through	24 inch (600 mm)	42 inch (1050 mm)	60 inch (1500 mm)
Bend (90 degrees)	18 inch (450 mm)	33 inch (825 mm)	33 inch (825 mm)

- The inlet and in-line Stormceptor units can accommodate turns to a maximum of 90 degrees.
- Minimum distance from top of grade to crown is 2 feet (0.6 m)
- Submerged conditions. A unit is submerged when the standing water elevation at the proposed location of the Stormceptor unit is greater than the outlet invert elevation during zero flow conditions. In these cases, please contact your local Stormceptor representative and provide the following information:
- Top of grade elevation
- Stormceptor inlet and outlet pipe diameters and invert elevations
- Standing water elevation
- Stormceptor head loss, K = 1.3 (for submerged condition, K = 4)

Stormceptor® STC

OPERATION AND MAINTENANCE GUIDE
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1. About Stormceptor

The Stormceptor® STC (Standard Treatment Cell) was developed by Imbrium™ Systems to address the growing need to remove and isolate pollution from the storm drain system before it enters the environment. The Stormceptor STC targets hydrocarbons and total suspended solids (TSS) in stormwater runoff. It improves water quality by removing contaminants through the gravitational settling of fine sediments and floatation of hydrocarbons while preventing the re-suspension or scour of previously captured pollutants.

The development of the Stormceptor STC revolutionized stormwater treatment, and created an entirely new category of environmental technology. Protecting thousands of waterways around the world, the Stormceptor System has set the standard for effective stormwater treatment.

1.1. Patent Information

The Stormceptor technology is protected by the following patents:

- Australia Patent No. 693,164 • 693,164 • 707,133 • 729,096 • 779401
- Austrian Patent No. 289647
- Canadian Patent No 2,009,208 •2,137,942 • 2,175,277 • 2,180,305 • 2,180,383 • 2,206,338 • 2,327,768 (Pending)
- China Patent No 1168439
- Denmark DK 711879
- German DE 69534021
- Indonesian Patent No 16688
- Japan Patent No 9-11476 (Pending)
- Korea 10-2000-0026101 (Pending)
- Malaysia Patent No PI9701737 (Pending)
- New Zealand Patent No 314646
- United States Patent No 4,985,148 • 5,498,331 • 5,725,760 • 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690
- Stormceptor OSR Patent Pending • Stormceptor LCS Patent Pending

2. Stormceptor Design Overview

2.1. Design Philosophy

The patented Stormceptor System has been designed to focus on the environmental objective of providing long-term pollution control. The unique and innovative Stormceptor design allows for continuous positive treatment of runoff during all rainfall events, while ensuring that all captured pollutants are retained within the system, even during intense storm events.

An integral part of the Stormceptor design is PCSWMM for Stormceptor - sizing software developed in conjunction with Computational Hydraulics Inc. (CHI) and internationally acclaimed expert, Dr. Bill James. Using local historical rainfall data and continuous simulation modeling, this software allows a Stormceptor unit to be designed for each individual site and the corresponding water quality objectives.

By using PCSWMM for Stormceptor, the Stormceptor System can be designed to remove a wide range of particles (typically from 20 to 2,000 microns), and can also be customized to remove a specific particle size distribution (PSD). The specified PSD should accurately reflect what is in the stormwater runoff to ensure the device is achieving the desired water quality objective. Since stormwater runoff contains small particles (less than 75 microns), it is important to design a treatment system to remove smaller particles in addition to coarse particles.

2.2. Benefits

The Stormceptor System removes free oil and suspended solids from stormwater, preventing spills and non-point source pollution from entering downstream lakes and rivers. The key benefits, capabilities and applications of the Stormceptor System are as follows:

- Provides continuous positive treatment during all rainfall events
- Can be designed to remove over 80% of the annual sediment load
- Removes a wide range of particles
- Can be designed to remove a specific particle size distribution (PSD)
- Captures free oil from stormwater
- Prevents scouring or re-suspension of trapped pollutants
- Pre-treatment to reduce maintenance costs for downstream treatment measures (ponds, swales, detention basins, filters)
- Groundwater recharge protection
- Spills capture and mitigation
- Simple to design and specify
- Designed to your local watershed conditions
- Small footprint to allow for easy retrofit installations
- Easy to maintain (vacuum truck)
- Multiple inlets can connect to a single unit
- Suitable as a bend structure
- Pre-engineered for traffic loading (minimum AASHTO HS-20)
- Minimal elevation drop between inlet and outlet pipes
- Small head loss
- Additional protection provided by an 18" (457 mm) fiberglass skirt below the top of the insert, for the containment of hydrocarbons in the event of a spill.

2.3. Environmental Benefit

Freshwater resources are vital to the health and welfare of their surrounding communities. There is increasing public awareness, government regulations and corporate commitment to reducing the pollution entering our waterways. A major source of this pollution originates from stormwater runoff from urban areas. Rainfall runoff carries oils, sediment and other contaminants from roads and parking lots discharging directly into our streams, lakes and coastal waterways.

The Stormceptor System is designed to isolate contaminants from getting into the natural environment. The Stormceptor technology provides protection for the environment from spills that occur at service stations and vehicle accident sites, while also removing contaminated sediment in runoff that washes from roads and parking lots.

3. Key Operation Features

3.1. Scour Prevention

A key feature of the Stormceptor System is its patented scour prevention technology. This innovation ensures pollutants are captured and retained during all rainfall events, even extreme storms. The Stormceptor System provides continuous positive treatment for all rainfall events, including intense storms. Stormceptor slows incoming runoff, controlling and reducing velocities in the lower chamber to create a non-turbulent environment that promotes free oils and floatable debris to rise and sediment to settle.

The patented scour prevention technology, the fiberglass insert, regulates flows into the lower chamber through a combination of a weir and orifice while diverting high energy flows away through the upper chamber to prevent scouring. Laboratory testing demonstrated no scouring when tested up to 125% of the unit's operating rate, with the unit loaded to 100% sediment capacity (NJDEP, 2005). Second, the depth of the lower chamber ensures the sediment storage zone is adequately separated from the path of flow in the lower chamber to prevent scouring.

3.2. Operational Hydraulic Loading Rate

Designers and regulators need to evaluate the treatment capacity and performance of manufactured stormwater treatment systems. A commonly used parameter is the "operational hydraulic loading rate" which originated as a design methodology for wastewater treatment devices.

Operational hydraulic loading rate may be calculated by dividing the flow rate into a device by its settling area. This represents the critical settling velocity that is the prime determinant to quantify the influent particle size and density captured by the device. PCSWMM for Stormceptor uses a similar parameter that is calculated by dividing the hydraulic detention time in the device by the fall distance of the sediment.

$$v_{SC} = \frac{H}{6_H} = \frac{Q}{A_S}$$

Where:

v_{SC} = critical settling velocity, ft/s (m/s)

H = tank depth, ft (m)

$Ø_H$ = hydraulic detention time, ft/s (m/s)

Q = volumetric flow rate, ft3/s (m3/s)

A_S = surface area, ft^2 (m^2)

(Tchobanoglous, G. and Schroeder, E.D. 1987. Water Quality. Addison Wesley.)

Unlike designing typical wastewater devices, stormwater systems are designed for highly variable flow rates including intense peak flows. PCSWMM for Stormceptor incorporates all of the flows into its calculations, ensuring that the operational hydraulic loading rate is considered not only for one flow rate, but for all flows including extreme events.

3.3. Double Wall Containment

The Stormceptor System was conceived as a pollution identifier to assist with identifying illicit discharges. The fiberglass insert has a continuous skirt that lines the concrete barrel wall for a depth of 18 inches (457 mm) that provides double wall containment for hydrocarbons storage. This protective barrier ensures that toxic floatables do not migrate through the concrete wall into the surrounding soils.

4. Stormceptor Product Line

4.1. Stormceptor Models

A summary of Stormceptor models and capacities are listed in Table 1.

Table 1. Stormceptor Models

Stormceptor Model	Total Storage Volume U.S. Gal (L)	Hydrocarbon Storage Capacity U.S. Gal (L)	Maximum Sediment Capacity ft^3 (L)
STC 450i	470 (1,780)	86 (330)	46 (1,302)
STC 900	952 (3,600)	251 (950)	89 (2,520)
STC 1200	1,234 (4,670)	251 (950)	127 (3,596)
STC 1800	1,833 (6,940)	251 (950)	207 (5,861)
STC 2400	2,462 (9,320)	840 (3,180)	205 (5,805)
STC 3600	3,715 (1,406)	840 (3,180)	373 (10,562)
STC 4800	5,059 (1,950)	909 (3,440)	543 (15,376)
STC 6000	6,136 (23,230)	909 (3,440)	687 (19,453)
STC 7200	7,420 (28,090)	1,059 (4,010)	839 (23,757)
STC 11000	11,194 (42,370)	2,797 (10, 590)	1,086 (30,752)
STC 13000	13,348 (50,530)	2,797 (10, 590)	1,374 (38,907)
STC 16000	15,918 (60,260)	3,055 (11, 560)	1,677 (47,487)

NOTE: Storage volumes may vary slightly from region to region. For detailed information, contact your local Stormceptor representative.

4.2. Inline Stormceptor

The Inline Stormceptor, Figure 1, is the standard design for most stormwater treatment applications. The patented Stormceptor design allows the Inline unit to maintain continuous positive treatment of total suspended solids (TSS) year-round, regardless of flow rate. The Inline Stormceptor is composed of a precast concrete tank with a fiberglass insert situated at the invert of the storm sewer pipe, creating an upper chamber above the insert and a lower chamber below the insert.

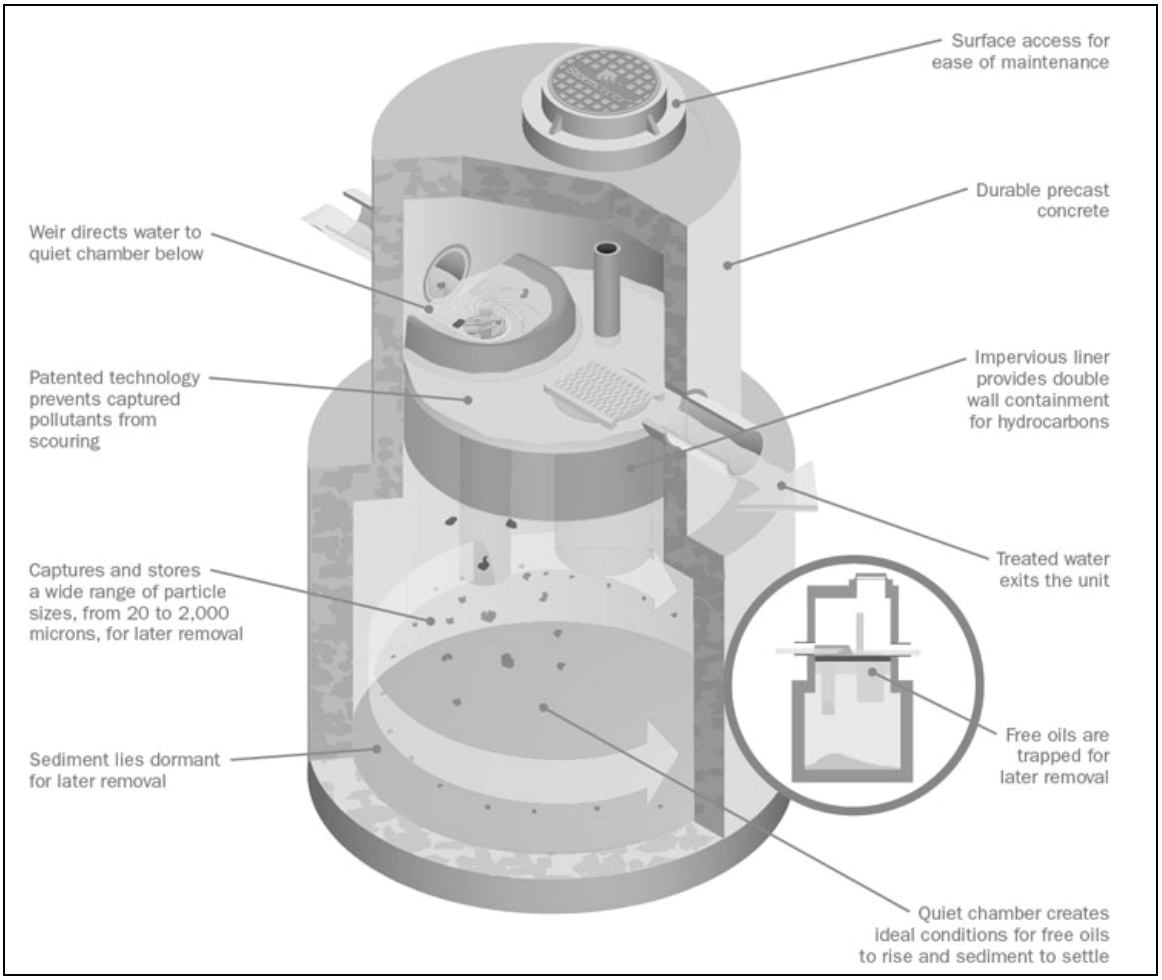


Figure 1. Inline Stormceptor

Operation

As water flows into the Stormceptor unit, it is slowed and directed to the lower chamber by a weir and drop tee. The stormwater enters the lower chamber, a non-turbulent environment, allowing free oils to rise and sediment to settle. The oil is captured underneath the fiberglass insert and shielded from exposure to the concrete walls by a fiberglass skirt. After the pollutants separate, treated water continues up a riser pipe, and exits the lower chamber on the downstream side of the weir before leaving the unit. During high flow events, the Stormceptor System's patented scour prevention technology ensures continuous pollutant removal and prevents re-suspension of previously captured pollutants.

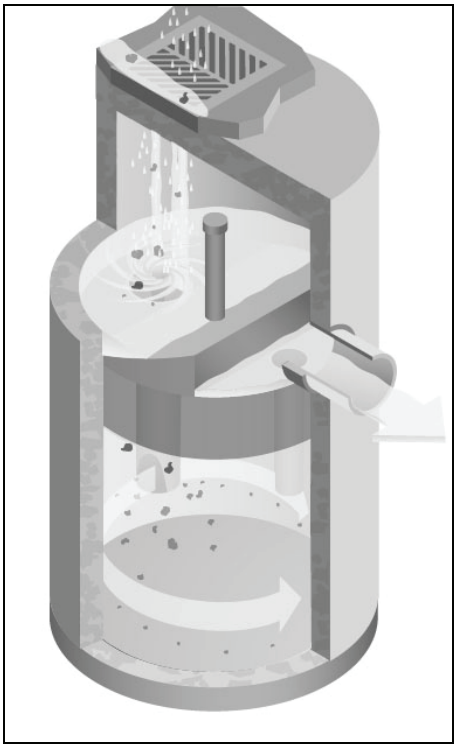


Figure 2. Inlet Stormceptor

4.3. Inlet Stormceptor

The Inlet Stormceptor System, Figure 2, was designed to provide protection for parking lots, loading bays, gas stations and other spill-prone areas. The Inlet Stormceptor is designed to remove sediment from stormwater introduced through a grated inlet, a storm sewer pipe, or both.

The Inlet Stormceptor design operates in the same manner as the Inline unit, providing continuous positive treatment, and ensuring that captured material is not re-suspended.

4.4. Series Stormceptor

Designed to treat larger drainage areas, the Series Stormceptor System, Figure 3, consists of two adjacent Stormceptor models that function in parallel. This design eliminates the need for additional structures and piping to reduce installation costs.

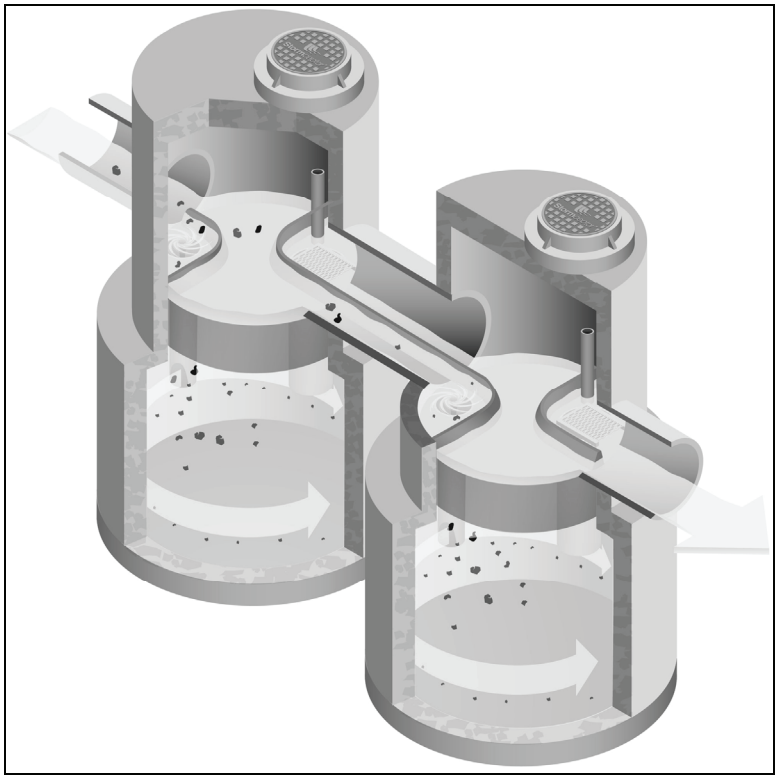


Figure 3. Series System

The Series Stormceptor design operates in the same manner as the Inline unit, providing continuous positive treatment, and ensuring that captured material is not re-suspended.

5. Sizing the Stormceptor System

The Stormceptor System is a versatile product that can be used for many different aspects of water quality improvement. While addressing these needs, there are conditions that the designer needs to be aware of in order to size the Stormceptor model to meet the demands of each individual site in an efficient and cost-effective manner.

PCSWMM for Stormceptor is the support tool used for identifying the appropriate Stormceptor model. In order to size a unit, it is recommended the user follow the seven design steps in the program. The steps are as follows:

STEP 1 – Project Details

The first step prior to sizing the Stormceptor System is to clearly identify the water quality objective for the development. It is recommended that a level of annual sediment (TSS) removal be identified and defined by a particle size distribution.

STEP 2 – Site Details

Identify the site development by the drainage area and the level of imperviousness. It is recommended that imperviousness be calculated based on the actual area of imperviousness based on paved surfaces, sidewalks and rooftops.

STEP 3 – Upstream Attenuation

The Stormceptor System is designed as a water quality device and is sometimes used in conjunction with onsite water quantity control devices such as ponds or underground detention systems. When possible, a greater benefit is typically achieved when installing a Stormceptor unit upstream of a detention facility. By placing the Stormceptor unit upstream of a detention structure, a benefit of less maintenance of the detention facility is realized.

STEP 4 – Particle Size Distribution

It is critical that the PSD be defined as part of the water quality objective. PSD is critical for the design of treatment system for a unit process of gravity settling and governs the size of a treatment system. A range of particle sizes has been provided and it is recommended that clays and silt-sized particles be considered in addition to sand and gravel-sized particles. Options and sample PSDs are provided in PCSWMM for Stormceptor. The default particle size distribution is the Fine Distribution, Table 2, option.

Table 2. Fine Distribution

Particle Size	Distribution	Specific Gravity
20	20%	1.3
60	20%	1.8
150	20%	2.2
400	20%	2.65
2000	20%	2.65

If the objective is the long-term removal of 80% of the total suspended solids on a given site, the PSD should be representative of the expected sediment on the site. For example, a system designed to remove 80% of coarse particles (greater than 75 microns) would provide relatively poor removal efficiency of finer particles that may be naturally prevalent in runoff from the site.

Since the small particle fraction contributes a disproportionately large amount of the total available particle surface area for pollutant adsorption, a system designed primarily for coarse particle capture will compromise water quality objectives.

STEP 5 – Rainfall Records

Local historical rainfall has been acquired from the U.S. National Oceanic and Atmospheric Administration, Environment Canada and regulatory agencies across North America. The rainfall data provided with PCSMM for Stormceptor provides an accurate estimation of small storm hydrology by modeling actual historical storm events including duration, intensities and peaks.

STEP 6 – Summary

At this point, the program may be executed to predict the level of TSS removal from the site. Once the simulation has completed, a table shall be generated identifying the TSS removal of each Stormceptor unit.

STEP 7 – Sizing Summary

Performance estimates of all Stormceptor units for the given site parameters will be displayed in a tabular format. The unit that meets the water quality objective, identified in Step 1, will be highlighted.

5.1. PCSWMM for Stormceptor

The Stormceptor System has been developed in conjunction with PCSWMM for Stormceptor as a technological solution to achieve water quality goals. Together, these two innovations model, simulate, predict and calculate the water quality objectives desired by a design engineer for TSS removal.

PCSWMM for Stormceptor is a proprietary sizing program which uses site specific inputs to a computer model to simulate sediment accumulation, hydrology and long-term total suspended solids removal. The model has been calibrated to field monitoring results from Stormceptor units that have been monitored in North America. The sizing methodology can be described by three processes:

1. Determination of real time hydrology
2. Buildup and wash off of TSS from impervious land areas
3. TSS transport through the Stormceptor (settling and discharge). The use of a calibrated model is the preferred method for sizing stormwater quality structures for the following reasons:
    - » The hydrology of the local area is properly and accurately incorporated in the sizing (distribution of flows, flow rate ranges and peaks, back-to-back storms, inter-event times)
    - » The distribution of TSS with the hydrology is properly and accurately considered in the sizing
    - » Particle size distribution is properly considered in the sizing
    - » The sizing can be optimized for TSS removal
    - » The cost benefit of alternate TSS removal criteria can be easily assessed
    - » The program assesses the performance of all Stormceptor models. Sizing may be selected based on a specific water quality outcome or based on the Maximum Extent Practicable

For more information regarding PCSWMM for Stormceptor, contact your local Stormceptor representative, or visit www.imbriumsystems.com to download a free copy of the program.

5.2. Sediment Loading Characteristics

The way in which sediment is transferred to stormwater can have a considerable effect on which type of system is implemented. On typical impervious surfaces (e.g. parking lots) sediment will build over time and wash off with the next rainfall. When rainfall patterns are examined, a short intense storm will have a higher concentration of sediment than a long slow drizzle. Together with rainfall data representing the site's typical rainfall patterns, sediment loading characteristics play a part in the correct sizing of a stormwater quality device.

Typical Sites

For standard site design of the Stormceptor System, PCSWMM for Stormceptor is utilized to accurately assess the unit's performance. As an integral part of the product's design, the program can be used to meet local requirements for total suspended solid removal. Typical installations of manufactured stormwater treatment devices would occur on areas such as paved parking lots or paved roads. These are considered "stable" surfaces which have non – erodible surfaces.

Unstable Sites

While standard sites consist of stable concrete or asphalt surfaces, sites such as gravel parking lots, or maintenance yards with stockpiles of sediment would be classified as "unstable". These types of sites do not exhibit first flush characteristics, are highly erodible and exhibit atypical sediment loading characteristics and must therefore be sized more carefully. Contact your local Stormceptor representative for assistance in selecting a proper unit sized for such unstable sites.

6. Spill Controls

When considering the removal of total petroleum hydrocarbons (TPH) from a storm sewer system there are two functions of the system: oil removal, and spill capture.

'Oil Removal' describes the capture of the minute volumes of free oil mobilized from impervious surfaces. In this instance relatively low concentrations, volumes and flow rates are considered. While the Stormceptor unit will still provide an appreciable oil removal function during higher flow events and/or with higher TPH concentrations, desired effluent limits may be exceeded under these conditions.

'Spill Capture' describes a manner of TPH removal more appropriate to recovery of a relatively high volume of a single phase deleterious liquid that is introduced to the storm sewer system over a relatively short duration. The two design criteria involved when considering this manner of introduction are overall volume and the specific gravity of the material. A standard Stormceptor unit will be able to capture and retain a maximum spill volume and a minimum specific gravity.

For spill characteristics that fall outside these limits, unit modifications are required. Contact your local Stormceptor Representative for more information.

One of the key features of the Stormceptor technology is its ability to capture and retain spills. While the standard Stormceptor System provides excellent protection for spill control, there are additional options to enhance spill protection if desired.

6.1. Oil Level Alarm

The oil level alarm is an electronic monitoring system designed to trigger a visual and audible alarm when a pre-set level of oil is reached within the lower chamber. As a standard, the oil

level alarm is designed to trigger at approximately 85% of the unit's available depth level for oil capture. The feature acts as a safeguard against spills caused by exceeding the oil storage capacity of the separator and eliminates the need for manual oil level inspection.

The oil level alarm installed on the Stormceptor insert is illustrated in Figure 4.

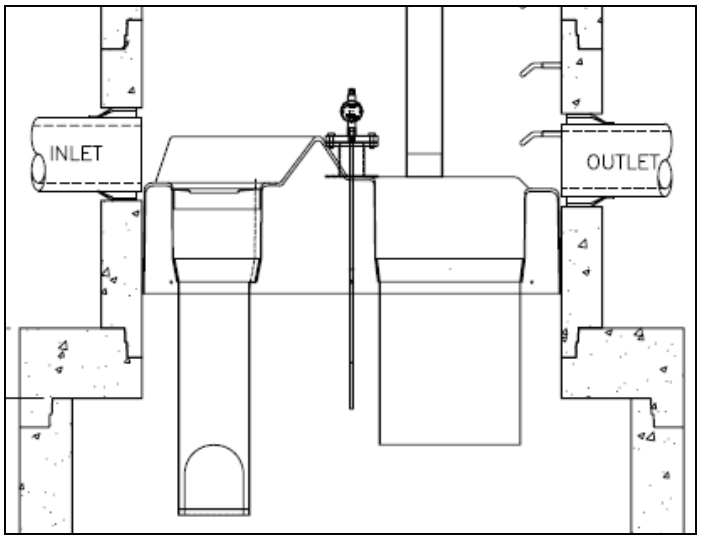


Figure 4. Oil level alarm

6.2. Increased Volume Storage Capacity

The Stormceptor unit may be modified to store a greater spill volume than is typically available. Under such a scenario, instead of installing a larger than required unit, modifications can be made to the recommended Stormceptor model to accommodate larger volumes. Contact your local Stormceptor representative for additional information and assistance for modifications.

7. Stormceptor Options

The Stormceptor System allows flexibility to incorporate to existing and new storm drainage infrastructure. The following section identifies considerations that should be reviewed when installing the system into a drainage network. For conditions that fall outside of the recommendations in this section, please contact your local Stormceptor representative for further guidance.

7.1. Installation Depth Minimum Cover

The minimum distance from the top of grade to the crown of the inlet pipe is 24 inches (600 mm). For situations that have a lower minimum distance, contact your local Stormceptor representative.

7.2. Maximum Inlet and Outlet Pipe Diameters

Maximum inlet and outlet pipe diameters are illustrated in Figure 5. Contact your local Stormceptor representative for larger pipe diameters

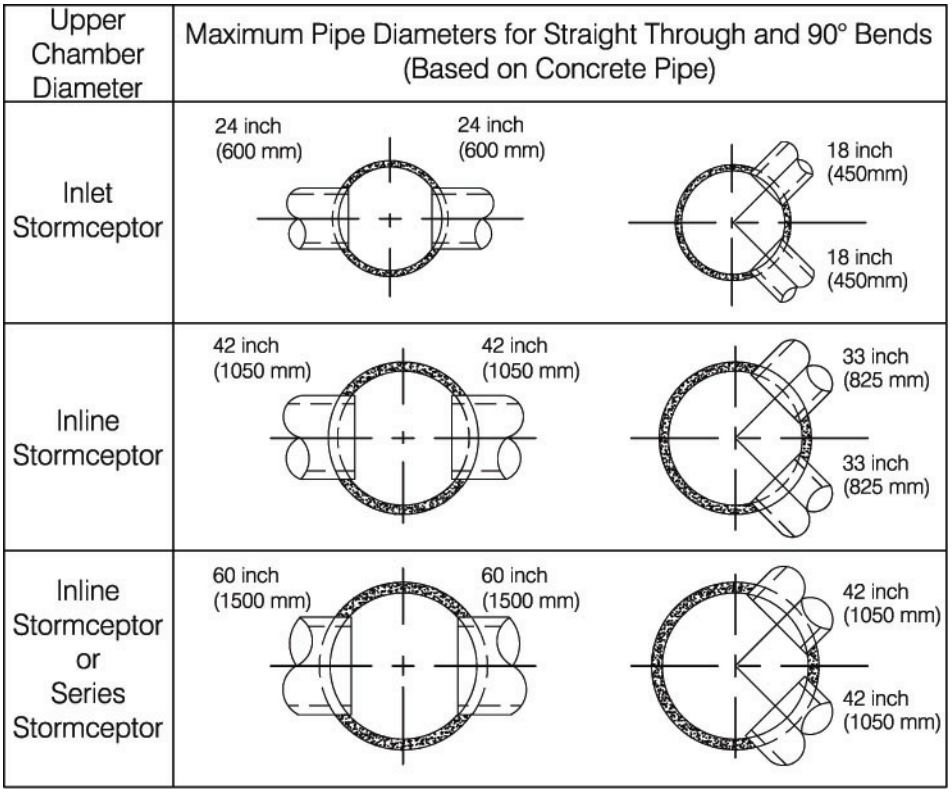


Figure 5. Maximum pipe diameters for straight through and bend applications

*The bend should only be incorporated into the second structure (downstream structure) of the Series Stormceptor System

7.3. Bends

The Stormceptor System can be used to change horizontal alignment in the storm drain network up to a maximum of 90 degrees. Figure 6 illustrates the typical bend situations of the Stormceptor System. Bends should only be applied to the second structure (downstream structure) of the Series Stormceptor System.

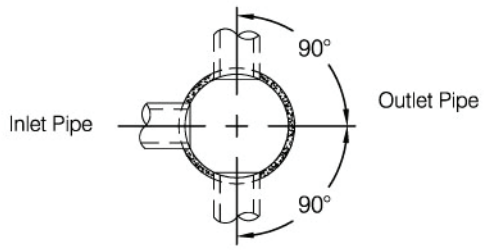
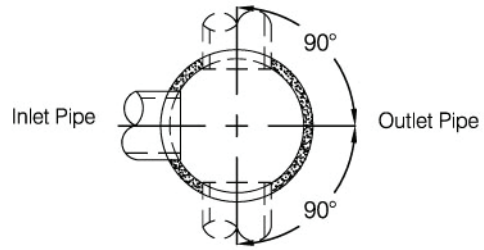
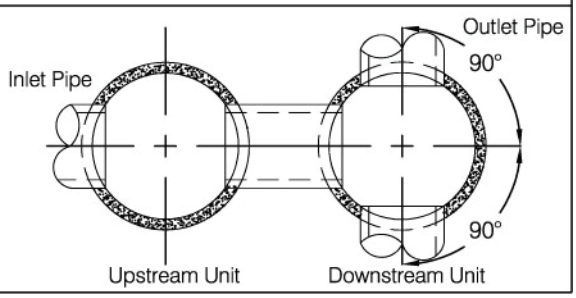
Stormceptor System	Maximum Bend Configurations
Inlet Stormceptor	
Inline Stormceptor	
Series Stormceptor	

Figure 6. Maximum bend angles

7.4. Multiple Inlet Pipes

The Inlet and Inline Stormceptor System can accommodate two or more inlet pipes. The maximum number of inlet pipes that can be accommodated into a Stormceptor unit is a function of the number, alignment and diameter of the pipes and its effects on the structural integrity of the precast concrete. When multiple inlet pipes are used for new developments, each inlet pipe shall have an invert elevation 3 inches (75 mm) higher than the outlet pipe invert elevation.

7.5. Inlet/Outlet Pipe Invert Elevations

Recommended inlet and outlet pipe invert differences are listed in Table 3.

Table 3. Recommended Drops Between Inlet and Outlet Pipe Inverts

Number of Inlet Pipes	Inlet System	In-Line System	Series System
1	3 inches (75 mm)	1 inch (25 mm)	3 inches (75 mm)
>1	3 inches (75 mm)	3 inches (75 mm)	Not Applicable

7.6. Shallow Stormceptor

In cases where there may be restrictions to the depth of burial of storm sewer systems. In this situation, for selected Stormceptor models, the lower chamber components may be increased in diameter to reduce the overall depth of excavation required.

7.7. Customized Live Load

The Stormceptor system is typically designed for local highway truck loading (AASHTO HS- 20). When the project requires live loads greater than HS-20, the Stormceptor System may be customized structurally for a pre-specified live load. Contact your local Stormceptor representative for customized loading conditions.

7.8. Pre-treatment

The Stormceptor System may be sized to remove sediment and for spills control in conjunction with other stormwater BMPs to meet the water quality objective. For pretreatment applications, the Stormceptor System should be the first unit in a treatment train. The benefits of pre-treatment include the extension of the operational life (extension of maintenance frequency) of large stormwater management facilities, prevention of spills and lower total life- cycle maintenance cost.

7.9. Head loss

The head loss through the Stormceptor System is similar to a 60 degree bend at a manhole. The K value for calculating minor losses is approximately 1.3 (minor loss = k*1.3v2/2g).

However, when a Submerged modification is applied to a Stormceptor unit, the corresponding K value is 4.

7.10. Submerged

The Submerged modification, Figure 7, allows the Stormceptor System to operate in submerged or partially submerged storm sewers. This configuration can be installed on all models of the Stormceptor System by modifying the fiberglass insert. A customized weir height and a secondary drop tee are added.

Submerged instances are defined as standing water in the storm drain system during zero flow conditions. In these instances, the following information is necessary for the proper design and application of submerged modifications:

- Stormceptor top of grade elevation
- Stormceptor outlet pipe invert elevation
- Standing water elevation

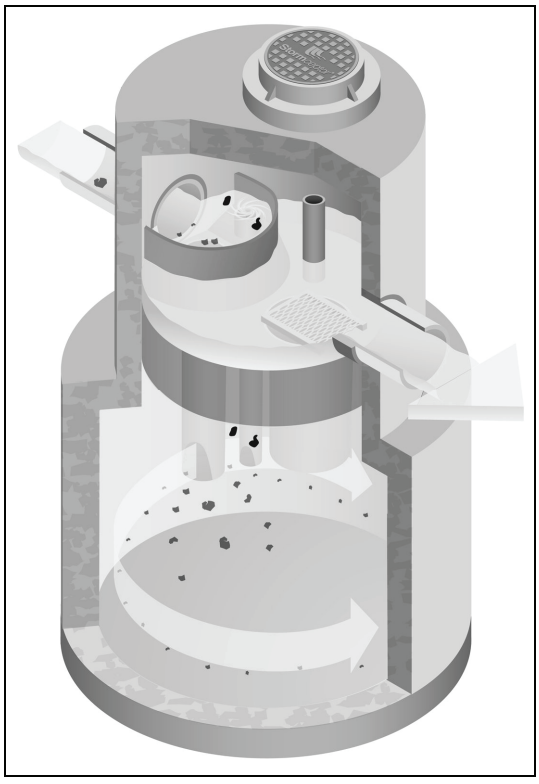


Figure 7. Submerged Stormceptor

8. Comparing Technologies

Designers have many choices available to achieve water quality goals in the treatment of stormwater runoff. Since many alternatives are available for use in stormwater quality treatment it is important to consider how to make an appropriate comparison between "approved alternatives". The following is a guide to assist with the accurate comparison of differing technologies and performance claims.

8.1. Particle Size Distribution (PSD)

The most sensitive parameter to the design of a stormwater quality device is the selection of the design particle size. While it is recommended that the actual particle size distribution (PSD) for sites be measured prior to sizing, alternative values for particle size should be selected to represent what is likely to occur naturally on the site. A reasonable estimate of a particle size distribution likely to be found on parking lots or other impervious surfaces should consist of a wide range of particles such as 20 microns to 2,000 microns (Ontario MOE, 1994).

There is no absolute right particle size distribution or specific gravity and the user is cautioned to review the site location, characteristics, material handling practices and regulatory requirements when selecting a particle size distribution. When comparing technologies, designs using different PSDs will result in incomparable TSS removal efficiencies. The PSD of the TSS removed needs to be standard between two products to allow for an accurate comparison.

8.2. Scour Prevention

In order to accurately predict the performance of a manufactured treatment device, there must be confidence that it will perform under all conditions. Since rainfall patterns cannot be predicted, stormwater quality devices placed in storm sewer systems must be able to withstand extreme events, and ensure that all pollutants previously captured are retained in the system.

In order to have confidence in a system's performance under extreme conditions, independent validation of scour prevention is essential when examining different technologies. Lack of independent verification of scour prevention should make a designer wary of accepting any product's performance claims.

8.3. Hydraulics

Full scale laboratory testing has been used to confirm the hydraulics of the Stormceptor System. Results of lab testing have been used to physically design the Stormceptor System and the sewer pipes entering and leaving the unit. Key benefits of Stormceptor are:

- Low head loss (typical k value of 1.3)
- Minimal inlet/outlet invert elevation drop across the structure
- Use as a bend structure
- Accommodates multiple inlets

The adaptability of the treatment device to the storm sewer design infrastructure can affect the overall performance and cost of the site.

8.4. Hydrology

Stormwater quality treatment technologies need to perform under varying climatic conditions. These can vary from long low intensity rainfall to short duration, high intensity storms. Since a treatment device is expected to perform under all these conditions, it makes sense that any system's design should accommodate those conditions as well.

Long-term continuous simulation evaluates the performance of a technology under the varying conditions expected in the climate of the subject site. Single, peak event design does not provide this information and is not equivalent to long-term simulation. Designers should request long-term simulation performance to ensure the technology can meet the long-term water quality objective.

9. Testing

The Stormceptor System has been the most widely monitored stormwater treatment technology in the world. Performance verification and monitoring programs are completed to the strictest standards and integrity. Since its introduction in 1990, numerous independent field tests and studies detailing the effectiveness of the Stormceptor System have been completed.

- Coventry University, UK – 97% removal of oil, 83% removal of sand and 73% removal of peat
- National Water Research Institute, Canada, - scaled testing for the development of the Stormceptor System identifying both TSS removal and scour prevention.
- New Jersey TARP Program – full scale testing of an STC 900 demonstrating 75% TSS removal of particles from 1 to 1000 microns. Scour testing completed demonstrated that the system does not scour. The New Jersey Department of Environmental Protection was followed.
- City of Indianapolis – full scale testing of an STC 900 demonstrating over 80% TSS removal of particles from 50 microns to 300 microns at 130% of the unit's operating rate. Scour testing completed demonstrated that the system does not scour.
- Westwood Massachusetts (1997), demonstrated >80% TSS removal
- Como Park (1997), demonstrated 76% TSS removal
- Ontario MOE SWAMP Program – 57% removal of 1 to 25 micron particles
- Laval Quebec – 50% removal of 1 to 25 micron particles

10. Installation

The installation of the concrete Stormceptor should conform in general to state highway, or local specifications for the installation of manholes. Selected sections of a general specification that are applicable are summarized in the following sections.

10.1. Excavation

Excavation for the installation of the Stormceptor should conform to state highway, or local specifications. Topsoil removed during the excavation for the Stormceptor should be stockpiled in designated areas and should not be mixed with subsoil or other materials.

Topsoil stockpiles and the general site preparation for the installation of the Stormceptor should conform to state highway or local specifications.

The Stormceptor should not be installed on frozen ground. Excavation should extend a minimum of 12 inches (300 mm) from the precast concrete surfaces plus an allowance for shoring and bracing where required. If the bottom of the excavation provides an unsuitable foundation additional excavation may be required.

In areas with a high water table, continuous dewatering may be required to ensure that the excavation is stable and free of water.

10.2. Backfilling

Backfill material should conform to state highway or local specifications. Backfill material should be placed in uniform layers not exceeding 12 inches (300mm) in depth and compacted to state highway or local specifications.

11. Stormceptor Construction Sequence

The concrete Stormceptor is installed in sections in the following sequence:

1. Aggregate base
2. Base slab
3. Lower chamber sections
4. Upper chamber section with fiberglass insert
5. Connect inlet and outlet pipes
6. Assembly of fiberglass insert components (drop tee, riser pipe, oil cleanout port and orifice plate
7. Remainder of upper chamber
8. Frame and access cover

The precast base should be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, should be installed in accordance with the precast concrete manufacturer's recommendations.

Adjustment of the Stormceptor can be performed by lifting the upper sections free of the excavated area, re-leveling the base and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary. Once the Stormceptor has been constructed, any lift holes must be plugged with mortar.

12. Maintenance

12.1. Health and Safety

The Stormceptor System has been designed considering safety first. It is recommended that confined space entry protocols be followed if entry to the unit is required. In addition, the fiberglass insert has the following health and safety features:

- Designed to withstand the weight of personnel
- A safety grate is located over the 24 inch (600 mm) riser pipe opening
- Ladder rungs can be provided for entry into the unit, if required

12.2. Maintenance Procedures

Maintenance of the Stormceptor system is performed using vacuum trucks. No entry into the unit is required for maintenance (in most cases). The vacuum service industry is a well- established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean a Stormceptor will vary based on the size of unit and transportation distances.

The need for maintenance can be determined easily by inspecting the unit from the surface. The depth of oil in the unit can be determined by inserting a dipstick in the oil inspection/cleanout port.

Similarly, the depth of sediment can be measured from the surface without entry into the Stormceptor via a dipstick tube equipped with a ball valve. This tube would be inserted through the riser pipe. Maintenance should be performed once the sediment depth exceeds the guideline values provided in the Table 4.

Table 4. Sediment Depths Indicating Required Servicing*

Particle Size	Specific Gravity
Model	Sediment Depth inches (mm)
450i	8 (200)
900	8 (200)
1200	10 (250)
1800	15 (381)
2400	12 (300)
3600	17 (430)
4800	15 (380)
6000	18 (460)
7200	15 (381)
11000	17 (380)
13000	20 (500)
16000	17 (380)
* based on 15% of the Stormceptor unit's total storage	

Although annual servicing is recommended, the frequency of maintenance may need to be increased or reduced based on local conditions (i.e. if the unit is filling up with sediment more quickly than projected, maintenance may be required semi-annually; conversely once the site has stabilized maintenance may only be required every two or three years).

Oil is removed through the oil inspection/cleanout port and sediment is removed through the riser pipe. Alternatively oil could be removed from the 24 inches (600 mm) opening if water is removed from the lower chamber to lower the oil level below the drop pipes.

The following procedures should be taken when cleaning out Stormceptor:

1. Check for oil through the oil cleanout port
2. Remove any oil separately using a small portable pump
3. Decant the water from the unit to the sanitary sewer, if permitted by the local regulating authority, or into a separate containment tank
4. Remove the sludge from the bottom of the unit using the vacuum truck
5. Re-fill Stormceptor with water where required by the local jurisdiction

12.3. Submerged Stormceptor

Careful attention should be paid to maintenance of the Submerged Stormceptor System. In cases where the storm drain system is submerged, there is a requirement to plug both the inlet and outlet pipes to economically clean out the unit.

12.4. Hydrocarbon Spills

The Stormceptor is often installed in areas where the potential for spills is great. The Stormceptor System should be cleaned immediately after a spill occurs by a licensed liquid waste hauler.

12.5. Disposal

Requirements for the disposal of material from the Stormceptor System are similar to that of any other stormwater Best Management Practice (BMP) where permitted. Disposal options for the sediment may range from disposal in a sanitary trunk sewer upstream of a sewage treatment plant, to disposal in a sanitary landfill site. Petroleum waste products collected in the Stormceptor (free oil/chemical/fuel spills) should be removed by a licensed waste management company.

12.6. Oil Sheens

With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a rainbow or sheen can be seen at very small oil concentrations (<10 mg/L). Stormceptor will remove over 98% of all free oil spills from storm sewer systems for dry weather or frequently occurring runoff events.

The appearance of a sheen at the outlet with high influent oil concentrations does not mean the unit is not working to this level of removal. In addition, if the influent oil is emulsified the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified conditions.



SUPPORT

Drawings and specifications are available at www.ContechES.com.

Site-specific design support is available from our engineers.

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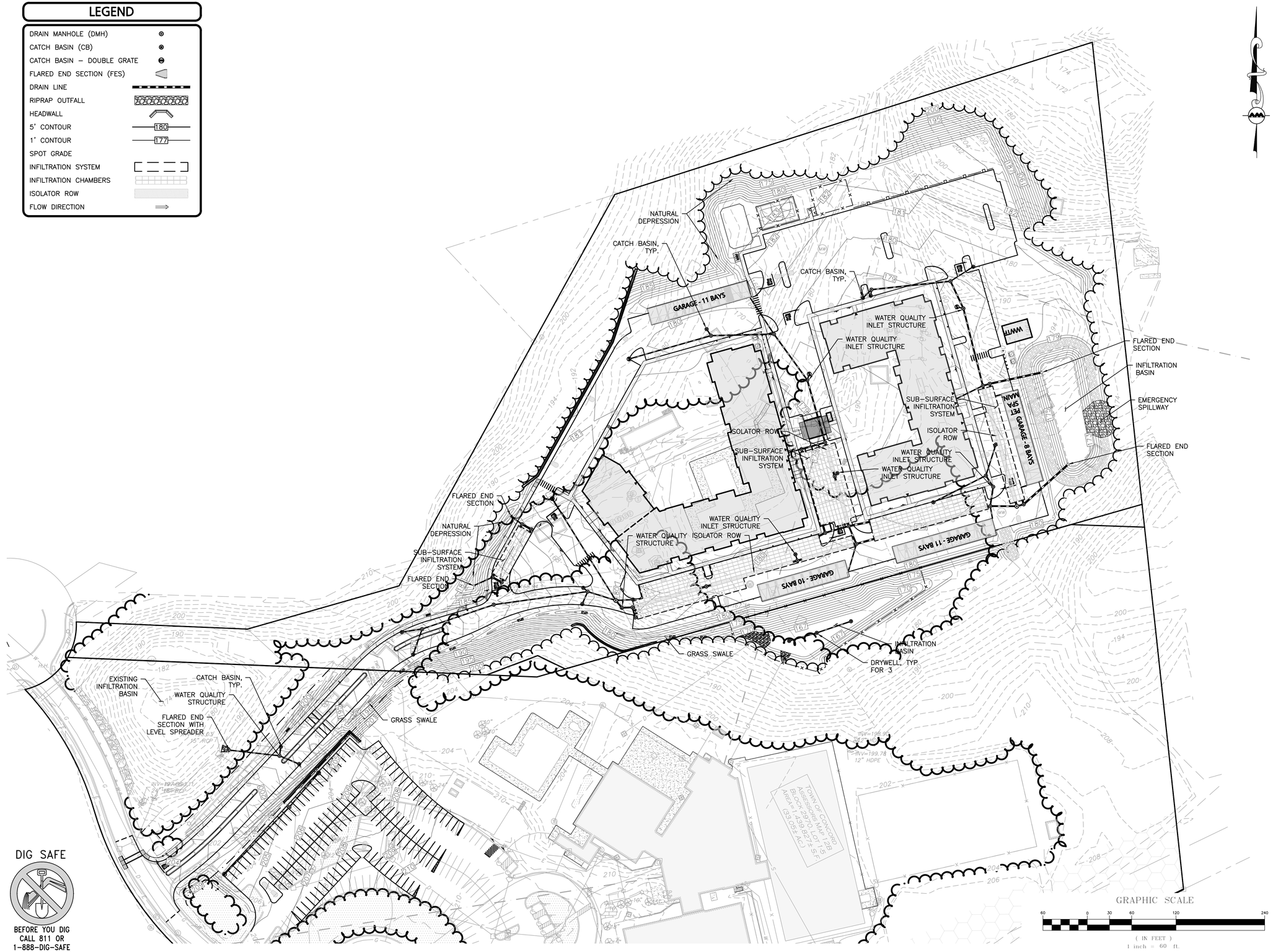
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APPENDIX B SITE PLANS

SITE PLAN

LEGEND

- DRAIN MANHOLE (DMH)
- CATCH BASIN (CB)
- CATCH BASIN – DOUBLE GRATE
- FLARED END SECTION (FES)
- DRAIN LINE
- RIPRAP OUTFALL
- HEADWALL
- 5' CONTOUR (180)
- 1' CONTOUR (177)
- SPOT GRADE
- INFILTRATION SYSTEM
- INFILTRATION CHAMBERS
- ISOLATOR ROW
- FLOW DIRECTION



GRAPHIC SCALE

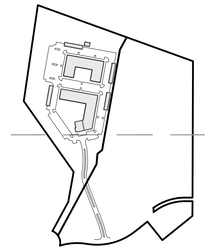
60 0 30 60 120 240

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1 inch = 60 ft.

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KEYSHEET

ISSUED FOR REVIEW
DEC. 20, 2023 REV FEB. 28,2025

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION
05	02/28/25	PER PEER REVIEW COMMENTS
04	02/13/25	LAYOUT REVISIONS PER WORKSHOP
03	01/23/25	LAYOUT REVISIONS PER WORKSHOP
02	10/18/24	ZBA RESUBMISSION
01	02/23/24	ZBA RESUBMISSION

APPLICANT\OWNER:

THOREAU RESIDENCES, LLC
275 FOREST RIDGE ROAD
CONCORD, MA 01742

PROJECT:

THE RESIDENCES AT THOREAU
275 FOREST RIDGE ROAD
CONCORD, MA 01742

PROJECT NO.	1670-24	DATE:	12/20/2023
SCALE:	1" = 60'	DWG. NAME:	C-1670-24
DESIGNED BY:	PGM	CHECKED BY:	PLC

PREPARED BY:

ALLEN & MAJOR ASSOCIATES, INC.
civil engineering ◆ land surveying
environmental consulting ◆ landscape architecture
www.allenmajor.com
10 MAIN STREET
LAKEVILLE, MA 02347
TEL: (508) 923-1010
FAX: (508) 923-6309
WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

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DRAWING TITLE:

OPERATION & MAINTENANCE PLAN

SHEET No.

O&M-1

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APPENDIX D PLANS

EXISTING WATERSHED PLANS

LEGEND

- EXISTING WATERSHED
- SCS SOILS BOUNDARY
- Tc FLOW PATH (A — B)
- SUBCATCHMENT LABEL (E-1)
- SUBCATCHMENT BOUNDARY
- FLOW DIRECTION

NOTES:

1. ALL EXISTING AND PROPOSED COVER TYPES SHALL BE CONSIDERED "GOOD" FOR MODELING PURPOSES UNLESS OTHERWISE NOTED.
2. TOTAL SITE WATERSHED AREA IS 1,647,074± SF.
3. MINIMUM TIME OF CONCENTRATION IS 6.0 MINUTES.
4. SEE HYDROCAD REPORT FOR SUBCATCHMENT AREAS, COVER TYPES, AND TIMES OF CONCENTRATION.



GRAPHIC SCALE

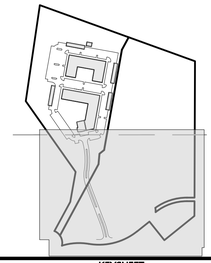
50 0 25 50 100 200

(IN FEET)
1 inch = 50 ft.

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1-888-344-7233

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KEYSHEET

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DEC. 20, 2023 REV FEB. 28,2025

COMMONWEALTH OF MASSACHUSETTS
PHILIP L. CORDEIRO
CIVIL
NO. 47083
REGISTERED PROFESSIONAL ENGINEER

Digitally signed by Philip Cordeiro
Date: 2025.03.05 10:48:31-05'00'

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

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DRAWING TITLE:

EXISTING WATERSHED PLAN

SHEET No.

EWS-1

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LEGEND

- EXISTING WATERSHED
- SCS SOILS BOUNDARY
- Tc FLOW PATH (A – B)
- SUBCATCHMENT LABEL (E-1)
- SUBCATCHMENT BOUNDARY
- FLOW DIRECTION

DESIGN POINT 1
N'LY PROPERTY LINE

STORM EVENT	PEAK RATE	VOL (AC–FT)
2YR STORM	0.00 CFS	0.000
10YR STORM	0.00 CFS	0.001
25YR STORM	0.01 CFS	0.009
100YR STORM	0.24 CFS	0.052

DESIGN POINT 2
E'LY PROPERTY LINE

STORM EVENT	PEAK RATE	VOL (AC–FT)
2YR STORM	0.00 CFS	0.000
10YR STORM	0.00 CFS	0.001
25YR STORM	0.03 CFS	0.018
100YR STORM	0.49 CFS	0.106

DESIGN POINT 3
EXISTING DEPRESSION 1

STORM EVENT	PEAK RATE	VOL (AC–FT)
2YR STORM	0.00 CFS	0.000
10YR STORM	0.00 CFS	0.000
25YR STORM	0.01 CFS	0.008
100YR STORM	0.20 CFS	0.046

STUDY POINT 7
EXISTING DEPRESSION 2

STORM EVENT	PEAK RATE	VOL (AC–FT)
2YR STORM	0.00 CFS	0.000
10YR STORM	0.03 CFS	0.017
25YR STORM	0.16 CFS	0.062
100YR STORM	1.31 CFS	0.223

STUDY POINT 6
EXISTING INFILTRATION BASIN

E-1 E-2 E-3 E-4 E-8 E-9

SCS - 254B
MERRIMAC FINE SANDY LOAM
3 TO 8% SLOPE
HSG(A)

SCS - 253C
HINCKLEY LOAMY SAND,
8 TO 15% SLOPES
HSG(A)

SCS - 253D
HINCKLEY LOAMY SAND,
15 TO 25% SLOPES
HSG(A)

PROPOSED PROPERTY LINE

EXISTING PROPERTY LINE

PROPOSED PROPERTY LINE

EXISTING PROPERTY LINE

SEE SHEET EWS–1B

SEE SHEET EWS–1A

GRAPHIC SCALE
50 0 25 50 100 200
(IN FEET)
1 inch = 50 ft.

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COMMONWEALTH OF MASSACHUSETTS
PHILIP L. CORDEIRO
CIVIL
NO. 47083
REGISTERED PROFESSIONAL ENGINEER

Digitally signed by Philip Cordeiro
Date: 2025.03.05 10:48:14-05'00'

PROFESSIONAL ENGINEER FOR
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DRAWING TITLE:
EXISTING WATERSHED PLAN

SHEET No.
EWS-2

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PROPOSED WATERSHED PLANS

SUBCATCHMENT AREA CALCULATIONS

Subcatchment	Inlet Structure	Imperv (SF)	Imperv (Ac)	Grass (SF)	Grass (Ac)	Woods (SF)	Woods (Ac)	Area	C	Q_{10}	Q_{25}	Q_{100}
1	PCB 1A	4169	0.096	5184	0.119			0.215	0.57	0.65	0.78	0.95
2	PCB 1B	4790	0.110	766	0.018			0.128	0.82	0.55	0.67	0.82
3	PCB 2A	3823	0.088	2613	0.060			0.148	0.66	0.51	0.62	0.76
4	PCB 2B	4644	0.107	2199	0.050			0.157	0.71	0.59	0.71	0.87
5	PCB 4A	3637	0.083	1561	0.036			0.119	0.72	0.46	0.55	0.67
6	PCB 4B	4786	0.110	805	0.018			0.128	0.81	0.55	0.67	0.82
7	PCB 6A	13155	0.302	6903	0.158			0.460	0.69	1.69	2.04	2.50
8	PDCB 5A	11867	0.272	16600	0.381	12266	0.282	0.935	0.44	2.20	2.66	3.26
9	PDCB 9A	5235	0.120	17297	0.397	35237	0.809	1.326	0.29	2.06	2.49	3.05
10	PCB 9B	9970	0.229	1989	0.046	8638	0.198	0.473	0.55	1.37	1.66	2.03
11	PDCB 11A	15278	0.351	7722	0.177			0.528	0.70	1.95	2.36	2.89
12	PCB 14A (WQS)	12070	0.277	5926	0.136			0.413	0.70	1.54	1.85	2.27
13	PCB 17A (WQS)	9458	0.217	2627	0.060			0.277	0.77	1.13	1.36	1.67
14	PCB 19A	11972	0.275	2935	0.067			0.342	0.78	1.42	1.71	2.10
15	PCB19B	9517	0.218	2167	0.050			0.268	0.79	1.12	1.35	1.66
16	PDCB 26A	19629	0.451	17234	0.396			0.846	0.62	2.78	3.35	4.11
17	PCB 24B	10461	0.240	5389	0.124			0.364	0.70	1.34	1.62	1.98
18	PCB 24A	14721	0.338	6548	0.150			0.488	0.72	1.85	2.23	2.74
20	PDCB A	17642	0.405	5914	0.136			0.541	0.75	2.15	2.59	3.18
21	PDCB B	23312	0.535	5043	0.116			0.651	0.79	2.74	3.30	4.05
22	Garage B	2712	0.062	0	0.000			0.062	0.90	0.30	0.36	0.44
23	BLDG 1	35571	0.817	0	0.000			0.817	0.90	3.90	4.70	5.76
24	Garage A	3088	0.071	0	0.000			0.071	0.90	0.34	0.41	0.50
25	Garage C	3097	0.071	0	0.000			0.071	0.90	0.34	0.41	0.50
26	BLDG 2	28306	0.650	0	0.000			0.650	0.90	3.10	3.74	4.58
27	Garage D	2827	0.065	0	0.000			0.065	0.90	0.31	0.37	0.46
28	WWTF	910	0.021	0	0.000			0.021	0.90	0.10	0.12	0.15
29	PCB 25A	4591	0.105	5583	0.128			0.234	0.57	0.71	0.85	1.04

LEGEND

- EXISTING WATERSHED
- PROPOSED WATERSHED
- SCS SOILS BOUNDARY
- Tc FLOW PATH (A → B)
- SUBCATCHMENT LABEL (P-1)
- SUBCATCHMENT BOUNDARY
- SUBCATCH LABEL CATCH BASIN (1)
- FLOW DIRECTION



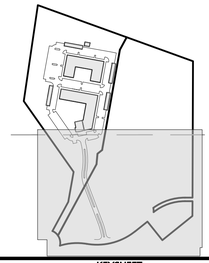
DESIGN POINT 5 DRAINAGE BASIN/EASEMENT		
STORM EVENT	PEAK RATE	VOL (AC–FT)
2YR STORM	4.55 CFS	0.449
10YR STORM	10.21 CFS	0.979
25YR STORM	15.16 CFS	1.479
100YR STORM	27.70 CFS	2.645

STUDY POINT 4 (NO CHANGE) S'LY PROPERTY LINE		
STORM EVENT	PEAK RATE	VOL (AC–FT)
2YR STORM	0.07 CFS	0.041
10YR STORM	1.18 CFS	0.207
25YR STORM	2.97 CFS	0.398
100YR STORM	8.07 CFS	0.903

GRAPHIC SCALE
50 0 25 50 100 200
(IN FEET)
1 inch = 50 ft.

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KEYSHEET

ISSUED FOR REVIEW
DEC. 20, 2023 REV FEB. 28,2025

COMMONWEALTH OF MASSACHUSETTS
PHILIP L. CORDEIRO
CIVIL
NO. 47085
REGISTERED PROFESSIONAL ENGINEER

Digitally signed by Philip Cordeiro
Date: 2025.03.05 10:47:56-05'00'

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

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PROPOSED WATERSHED PLAN

SHEET No.
PWS-1

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LEGEND

- EXISTING WATERSHED
- PROPOSED WATERSHED
- SCS SOILS BOUNDARY
- Tc FLOW PATH (A → B)
- SUBCATCHMENT LABEL (P-1)
- SUBCATCHMENT BOUNDARY
- SUBCATCH LABEL CATCH BASIN (1)
- FLOW DIRECTION

DESIGN POINT 1
N'LY PROPERTY LINE

STORM EVENT	PEAK RATE	VOL (AC–FT)
2YR STORM	0.00 CFS	0.000
10YR STORM	0.00 CFS	0.000
25YR STORM	0.01 CFS	0.003
100YR STORM	0.10 CFS	0.024

DESIGN POINT 2
E'LY PROPERTY LINE

STORM EVENT	PEAK RATE	VOL (AC–FT)
2YR STORM	0.00 CFS	0.000
10YR STORM	0.00 CFS	0.000
25YR STORM	0.01 CFS	0.006
100YR STORM	0.17 CFS	0.038

DESIGN POINT 3(NO CHANGE)
EXISTING DEPRESSION 1

STORM EVENT	PEAK RATE	VOL (AC–FT)
2YR STORM	0.00 CFS	0.000
10YR STORM	0.00 CFS	0.000
25YR STORM	0.01 CFS	0.008
100YR STORM	0.20 CFS	0.046

STUDY POINT 7
EXISTING DEPRESSION 2

STORM EVENT	PEAK RATE	VOL (AC–FT)
2YR STORM	0.00 CFS	0.000
10YR STORM	0.00 CFS	0.002
25YR STORM	0.03 CFS	0.016
100YR STORM	0.38 CFS	0.083

STUDY POINT 6
NEW INFILTRATION BASIN CLUB

STORM EVENT	PEAK RATE	VOL (AC–FT)
2YR STORM	0.02 CFS	0.017
10YR STORM	0.70 CFS	0.211
25YR STORM	2.58 CFS	0.481
100YR STORM	9.58 CFS	1.262

P-1 SCS - 254B MERRIMAC FINE SANDY LOAM 3 TO 8% SLOPE HSG(A)

P-2A SCS - 253D HINCKLEY LOAMY SAND 15 TO 25% SLOPES HSG(A)

P-2B SCS - 253C HINCKLEY LOAMY SAND 3 TO 15% SLOPES HSG(A)

P-3 SCS - 253B HINCKLEY LOAMY SAND 0 TO 3% SLOPES HSG(A)

P-4 NO CHANGE

P-8B SCS - 253C HINCKLEY LOAMY SAND 3 TO 15% SLOPES HSG(A)

P-9 SCS - 253D HINCKLEY LOAMY SAND 15 TO 25% SLOPES HSG(A)

P-10 SCS - 253C HINCKLEY LOAMY SAND 3 TO 15% SLOPES HSG(A)

BUILDING B
5 STORY - 117 UNITS
28,306 S.F. FOOTPRINT AREA
141,075 G.F.A.

BUILDING A
5 STORY - 120 UNITS
29,716 S.F. FOOTPRINT AREA
147,330 G.F.A.

GARAGE - 8 BAYS

GARAGE - 11 BAYS

GARAGE - 10 BAYS

WWTP

POOL

AMENITY
9,647 S.F. FPA

DOG PARK

SPORTS COURT

TOT LOT

PROPOSED PROPERTY LINE

TOWN OF CONCORD ASSESSORS MAP 12B BLOCK 2970, LOT 1-5 AREA=1,439,827± S.F. (33.05± Ac.)

GRAPHIC SCALE
50 0 25 50 100 200
(IN FEET)
1 inch = 50 ft.

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CIVIL
NO. 47085
REGISTERED PROFESSIONAL ENGINEER

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