Tanglewood Drive Stormwater / Pedestrian Improvements Study

Tanglewood Drive, Cindy Lane to Woodlawn
Essex, Vermont

Scoping Report

May 20, 2021

Prepared for:

Town of Essex, Vermont

Chittenden County RPC

Prepared by:

Stantec

TANGLEWOOD DRIVE STORMWATER / PEDESTRIAN IMPROVEMENTS STUDY

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Under the direction of:

Chittenden County Regional Planning Commission

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1.0 EXECUTIVE SUMMARY

1.1 INTRODUCTION

Tanglewood Drive, between Cindy Lane and Woodlawn Drive, is a relatively low-volume car-oriented street with no accommodations for bicycles and pedestrians. There is also recurring problems with the outlet to the closed drainage system that has resulted in significant erosion near the outlet adjacent to Fern Hollow Road. Given the high residential density and proximity to schools, parks, and other public amenities, this study area is an important transportation link that is lacking safe and convenient facilities for bicycles and pedestrians.

This study builds on previous studies within the area and the region. These include the UVM capstone project “Design of Roadway Layout and Stormwater Infrastructure for Tanglewood Drive, Essex VT” dated May 12, 2012 and the Essex Bicycle and Pedestrian Plan dated January 2015. In the former report, the need for pedestrian facilities along Tanglewood Drive was identified. While the 2015 study helped identify the need for on-road facilities, it focused on the entire communities of Essex and Essex Junction, and lacked sufficient detail for this specific section. The purpose of this study is to provide the additional detail needed to evaluate the viability of a potential improvement.

Tanglewood Drive was constructed in the 1970’s as part of a housing development project. It is a 40’ wide paved roadway with curb on both sides and closed drainage. All utilities in the area are underground with municipal water service but private soil-based sewage disposal systems. This section of roadway has had pavement overlays but no major redevelopment since the original construction. Tanglewood Drive west of the study area was lengthened after the original construction and has a width of 24’ with an 8’ green strip and shared use path on the south side.

The speed limit along Tanglewood Drive is 25 mph. Tanglewood Drive is a Class III town highway with a 60’ right-of-way width. The roadway ends west of the study area in a cul-de-sac. There are four intersections in the study area including: Cindy Lane, Rosewood Trail, Fern Hollow Road, and Woodlawn Drive. All are dead-end roads with T-type intersection geometry onto Tanglewood Drive.

The closed drainage system consists of grated inlets with corrugated metal pipe connections. The system outlets to Fern Hollow north of Tanglewood Drive. The outlet area has been adjusted since original construction to include additional drop structures to reduce the energy at the outlet to reduce erosive forces. Although measures have been taken to reduce erosion, significant erosion near the outlet is still occurring.

1.2 PURPOSE AND NEED

***Purpose**:* The purpose of this project is to improve the drainage system along Tanglewood Drive and to provide safe, comfortable pedestrian and bicycle facilities for users of all ages and abilities while maintaining safe and efficient vehicular conditions.

Need:

1. Address drainage problems resulting in erosion at the closed drainage system outlet.
2. Provide an inviting pedestrian travel route for residents that reinforces the Town's and Region's goals for pedestrian and bicycle mobility.
3. Facilitate use by all age groups, experience levels, and trip purposes.

1.3 ALTERNATIVES

Alternative 1: No Action. Tanglewood Drive is scheduled for milling and overlay as part of regular pavement maintenance. As part of this work, there is an option to add a designated and painted bike/pedestrian lane to one or both sides.

- Met Purpose and Need: No
- Cost Estimate: $60,000

Alternative 2: This alternative narrows the roadway to 30' with 11' Lanes and 4' shoulders. A 5'-6" green strip and 5' wide paved path would be added to the north side of Tanglewood Drive. The green strip would be used for stormwater treatment to reduce the flows at the outlet. The existing storm sewer pipes would be lined to increase lifespan. One goal of this alternative was to maintain the existing roadway footprint to salvage the existing drainage system and reduce impacts.

- Met Purpose and Need: Yes
- Cost Estimate: $410,000

Alternative 3: This alternative is to mill (if needed) and overlay the existing pavement at the existing 40' width and reline the storm sewer pipes. Additionally, fill would be brought into Fern Hollow to stabilize eroded areas and the closed drainage system would be extended to relocate the outlet further north to a location with less potential for erosion due to reduced slopes. No dedicated pedestrian facilities constructed. An optional designated and painted bike/pedestrian lane could be added to one or both sides.

- Met Purpose and Need: Part
- Cost Estimate: $330,000

Alternative 4: This alternative is to mill (if needed) and overlay the existing pavement at the existing 40' width. The storm sewer pipes would be relined to extend life. A series of underground storage chambers will be added along Fern Hollow Road to detain stormwater to reduce peak flows. No pedestrian facilities constructed. An optional designated and painted bike/pedestrian lane could be added to one or both sides.

- Met Purpose and Need: Part
- Cost Estimate: $310,000

Alternative 5: Like alternative 3, this alternative is to mill (if needed) and overlay the existing pavement at the existing 40' width and reline the storm sewer pipes. Additionally, fill would be brought into Fern

Hollow to stabilize eroded areas and the closed drainage system would be extended to relocate the outlet further north to a location with less potential for erosion due to reduced slopes. This alternative also includes a sub-surface stormwater filter for water quality treatment. No dedicated pedestrian facilities constructed. An optional designated and painted bike/pedestrian lane could be added to one or both sides. Edge of road markings will be painted with a single white strip on both sides of road. A speed table will be installed east or west of the intersection.

- Met Purpose and Need: Part
- Cost Estimate: $440,000

1.4 PREFERRED ALTERNATIVE

With input received at the public meetings and survey of residents considered, Town Engineering and Planning Staffs worked cooperatively to produce a series of recommendations relative to the project. The Staff recommendations that were ultimately endorsed by the Town of Essex Selectboard are:

[Placeholder for SB preferred alternative.]

2.0 INTRODUCTION

The Chittenden County Regional Planning Commission (CCRPC), working with the Town of Essex and Stantec Consulting Services Inc. (Stantec), completed a scoping study for drainage and pedestrian improvements to Tanglewood Drive. The scoping process involves quantifying existing bicycle and pedestrian, roadway, and drainage conditions and then defining a purpose and need for the project. Alternative improvement strategies are then identified and evaluated leading to the selection of a preferred alternative.

The scoping process includes working closely with a project advisory committee made up of leaders, Town staff, and CCRPC staff. Advisory committee members for this project are listed below.

Essex Town Staff	Dennis Lutz PE, Ann Costandi PE
CCRPC	Bryan Davis, Chris Dubin
Stantec	Israel Maynard PE

The advisory committee is charged with recommending a preferred improvement alternative to the Town Selectboard.

3.0 PROJECT BACKGROUND

The Tanglewood Drive neighborhood has been identified as a location that is experiencing problems with the existing drainage system and that lacks sufficient pedestrian and bicycle facilities. Progress has been made in recent years to address the drainage problem. At the outlet near Fern Hollow Road, drop structures have been added and the outlet location was changed to reduce outlet velocities to reduce erosion potential. The newly constructed section of Tanglewood Drive west of the study area was constructed with an 8' green strip and an 8' shared use path.

This study focuses on the Tanglewood Drive section from Cindy Lane to Woodlawn Drive. The goal is for the alternative selected in this study to be replicated along the remaining length of Tanglewood Drive in the future. This scoping study builds upon previous studies to further evaluate alternatives for addressing the drainage problems as well as bicycle and pedestrian needs in this area.

Figure 1 Project Study Area

3.1 EXISTING PLAN AND STUDY REVIEW

Two previous studies for this area considered drainage and/or pedestrian concerns. The most recent studies were reviewed in the preparation of this scoping study and are listed below.

- Essex Bicycle and Pedestrian Plan Dated January 2015
- UVM Capstone Design of Roadway Layout and Drainage Infrastructure for Tanglewood Drive Report Dated May 12, 2012

3.1.1 Essex Bicycle and Pedestrian Plan

This plan includes the following objectives that pertain to this project.

1. Tanglewood Drive is identified as a link in a future network of shared use paths that would include path along the existing VT Route 289 right-of-way.

2. Tanglewood Drive identified as a location that could be retrofitted to improve bicycle access via buffered bike lanes.

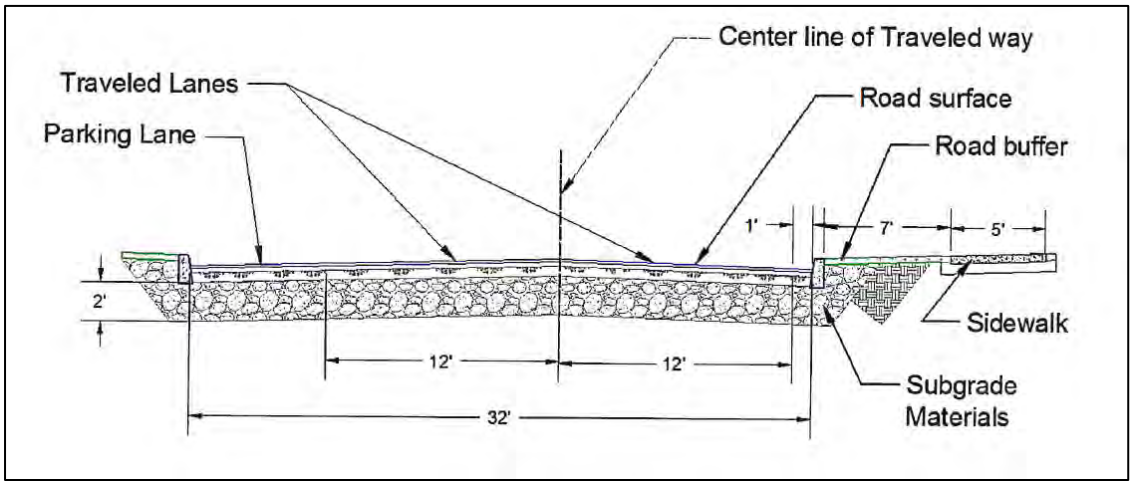
3.1.2 UVM Capstone Design of Roadway Layout and Drainage Infrastructure

The *UVM report* was completed in 2012 and included the entire project area. Below are the pertinent recommendations from the plan.

1. Reduce peak flow from Tanglewood Drive to prevent sediment laden runoff to Alder Brook.

2. Reduce existing roadway width to provide accommodation for bicycles and pedestrians.

Figure 2 Typical Section UVM Capstone Design Report

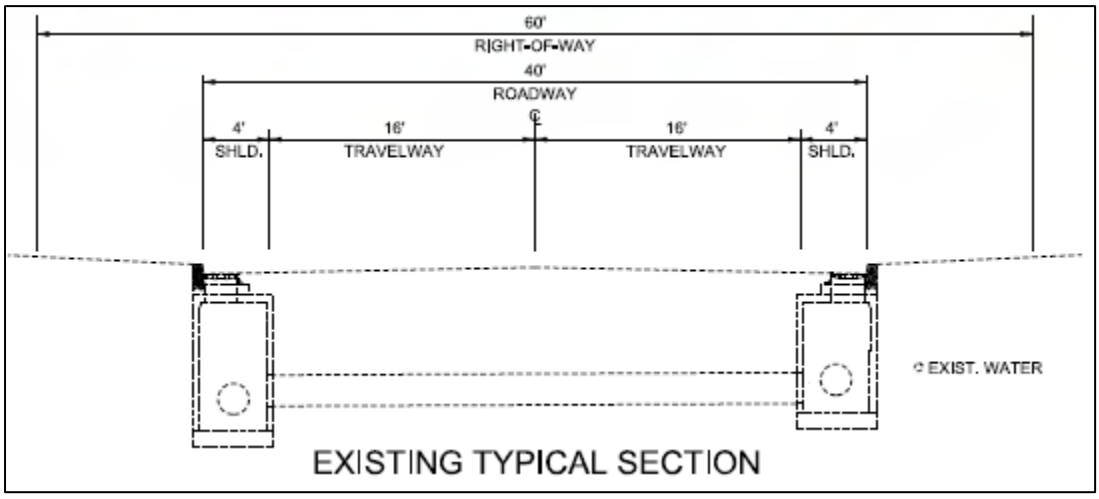


4.0 EXISTING CONDITIONS

4.1 ROADWAY CHARACTERISTICS

Tanglewood Drive was constructed in 1970's as part of the housing development project with a full depth of new subbase and pavement, new drainage system, and water utilities. It was constructed as a curbed two-lane roadway (one 16-foot lane and 4-foot shoulder in each direction). Underground electric is present on the north side of the roadway. A typical section of the existing condition is shown below. Given the excessively wide lanes, the roadway is used for informal parking and is used by bicyclists and pedestrians.

Figure 3 Existing Typical Section



The roadway is a dead-end street that connects a series of dead-end streets to Sand Hill Road. Four roads intersect Tanglewood Drive in the study area. They are Cindy Lane, Rosewood Trail, Fern Hollow Road, and Woodlawn Drive. All intersections are T-type stop-controlled intersections.

The current posted speed is 25 mph. Residents have indicated that the speeds on the roadway are typically significantly higher than the posted speed. No speed study has been conducted to support or deny the claim. The land use in this area is residential with primarily single-family homes.

4.2 TRAFFIC VOLUMES

Traffic volume data, including Annual Average Daily Traffic (AADT) values and Peak Hourly Volumes for the study area, were collected from the Vermont Agency of Transportation (VTrans) Transportation Data Management System. The 2019 AADT for the study area is 283 vehicles/day.

Intersection traffic data for the area are unavailable, but based on Tanglewood Drive's AADT, would not likely be approaching capacity.

4.3 PEDESTRIAN AND BICYCLE FACILITIES

A network of sidewalks and a shared use path are provided or planned adjacent to the project area. There is an existing 5-foot wide concrete sidewalk along Sand Hill Road at the intersection of Tanglewood Drive. This connects to sidewalks along VT Route 15 north of the project. The Sand Hill Road sidewalk connects to the Foster Road Sidewalk to the south of the project which leads to the school and athletic fields. Tanglewood Drive west of the project area was recently extended and includes an 8' paved path. (See Figure 4)

There are no dedicated bike or pedestrian facilities along Tanglewood Drive in the project area. Bicycles and pedestrians currently share a lane with traffic. The existing lanes are 16 feet wide with 4' shoulders.

The Essex/Essex Junction Bicycle Pedestrian Plan, dated January 15, 2015, identified Tanglewood Drive as a connection between Sand Hill Road and a future planned shared use path along the I-289 right-of-way.

Figure 4 Existing Pedestrian Facilities

4.4 STORMWATER INFRASTRUCTURE

The drainage infrastructure information for the study area was obtained from GIS data provided by the CCRPC and field verification. The project area contains the portion of one closed drainage system and the entirety of another. The first system on the west end of the project has three drop inlets in the study area at the intersection of Cindy Lane and Tanglewood Drive. This system flows to the west outside the study are. The second system contains 7 drop inlets on Tanglewood Drive that flow to Fern Hollow Drive. These inlets are connected by corrugated metal pipes. Pipes were video inspected in May 2021. Pipes in the study area are mainly CMP in poor condition. Video assessment indicates that the area would be a good candidate for slip lining. Along Fern Hollow Drive, there are three drop structures to dissipate energy down the steep grade. There is an additional inlet structure at the end of Fern Hollow Road that collects additional runoff and turns the piping towards the outlet in Fern Hollow. The outlet has a stone outlet pad and is in good condition (Figure 5).

Figure 5 Stone Outlet Pad

The channel upstream and downstream of the outlet is incised and unstable. The slope continues to slide as evidenced by the trees tilting into the gulley (Figures 6 and 7).

Figure 7 Downstream Channel

Figure 6 Upstream Channel

4.5 TRANSIT SERVICE

Green Mountain Transit (GMT) has a local bus route, the silver route, with a stop at the intersection of Tanglewood Drive and Sand Hill Road. This route loops through Essex and the Essex Junction Amtrak Station using VT Route 15, Sand Hill Road, and River Road.

4.6 CRASH HISTORY

The crash history for the study area was investigated using the VTrans crash database. VTrans keeps records of reported crashes by milepost along all public highways. General Yearly Summaries can be obtained through the Vermont Public Crash Data Query Tool for given roadway segments. Crash data for 2015 through 2019 were reviewed for Tanglewood Drive. No crashes were reported in the project area during this five-year period (2015-2019).

4.7 NATURAL RESOURCES

Stantec conducted a preliminary review of the natural resources present within the project area. Specifically, as part of this investigation, Stantec identified and characterized wetlands, streams, rare, threatened, or endangered (RTE) species, wildlife habitat, agricultural land, 4(f) and 6(f) public lands, and hazardous waste sites. Hartgen Archeological Associates worked as a subconsultant to determine potential archeological resources in the area. Following is a summary of the findings.

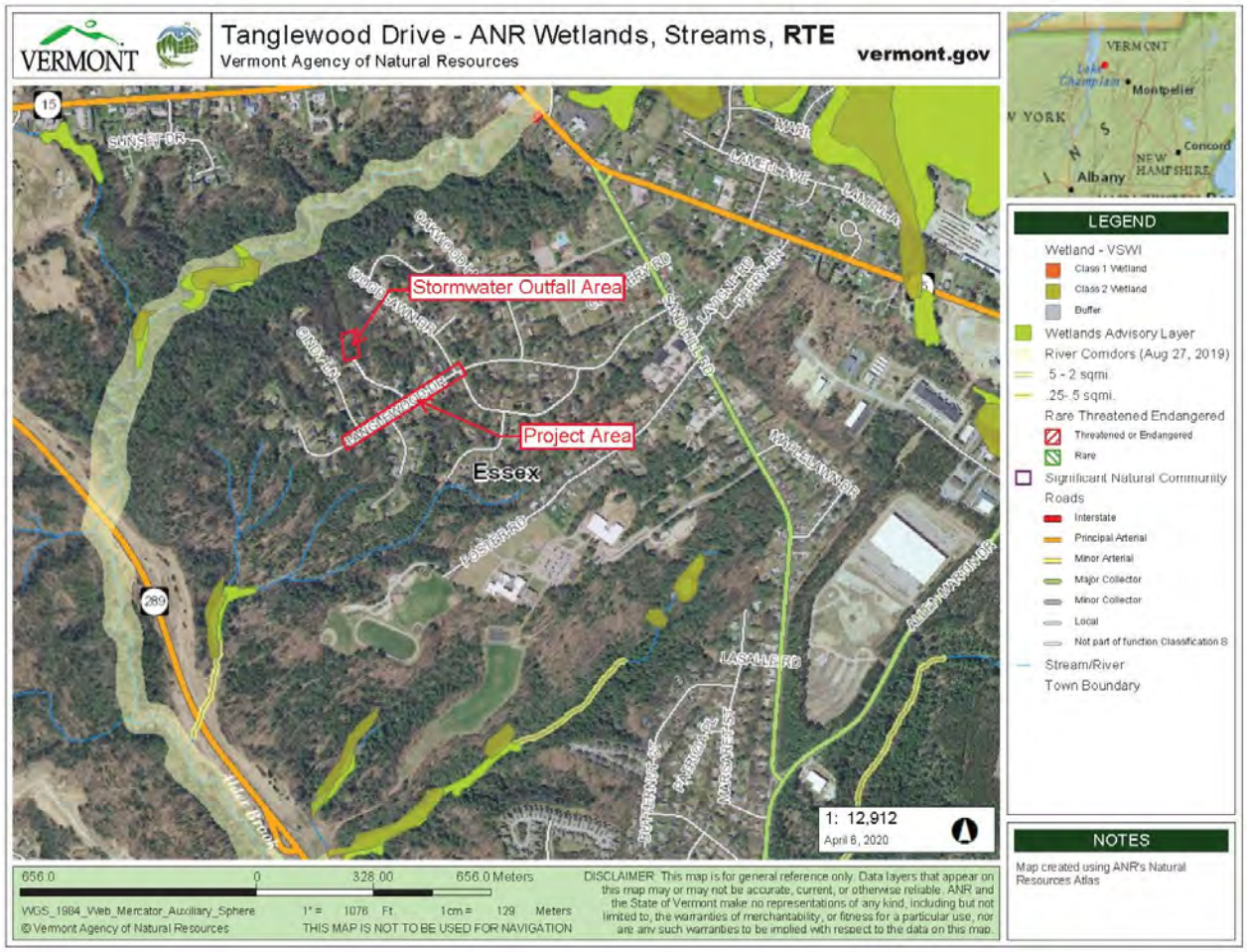
4.7.1 Review of Existing Resources

Stantec used the Vermont Agency of Natural Resources (ANR) Natural Resources Atlas mapping program to evaluate known natural resources within the Project Area.

Wetlands and Streams. According to the Atlas, there are no mapped Vermont Significant Wetland Inventory or Advisory Layer wetlands in the Project Area. There are no mapped streams within the Project Area.

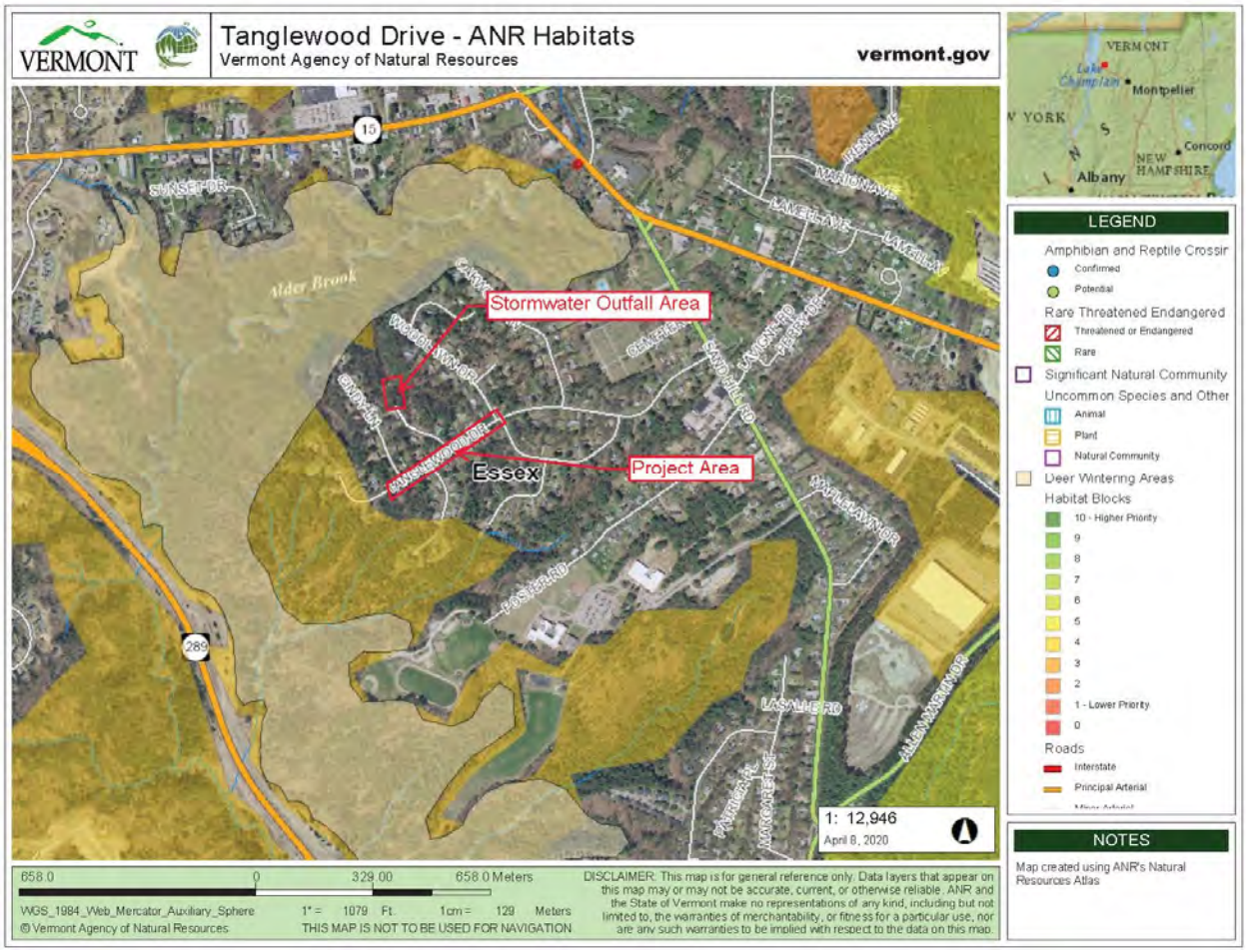
RTE Review. No RTE species are mapped within the Project Area, but all of Vermont is considered critical habitat for the state- and federal listed northern long-eared bat (Myotis septentrionalis). Trees and bridges provide potential habitat for this species. Work proposed for this project may include minimal tree cutting. The project will comply with the Federal Highway Administration (FHWA) Range-wide Programmatic Informal Consultation for Indiana Bat and Northern Long-eared Bats. Suitable Habitat includes trees (dead or alive) and/or bridges.

Figure 8 Streams, Wetlands, RTE



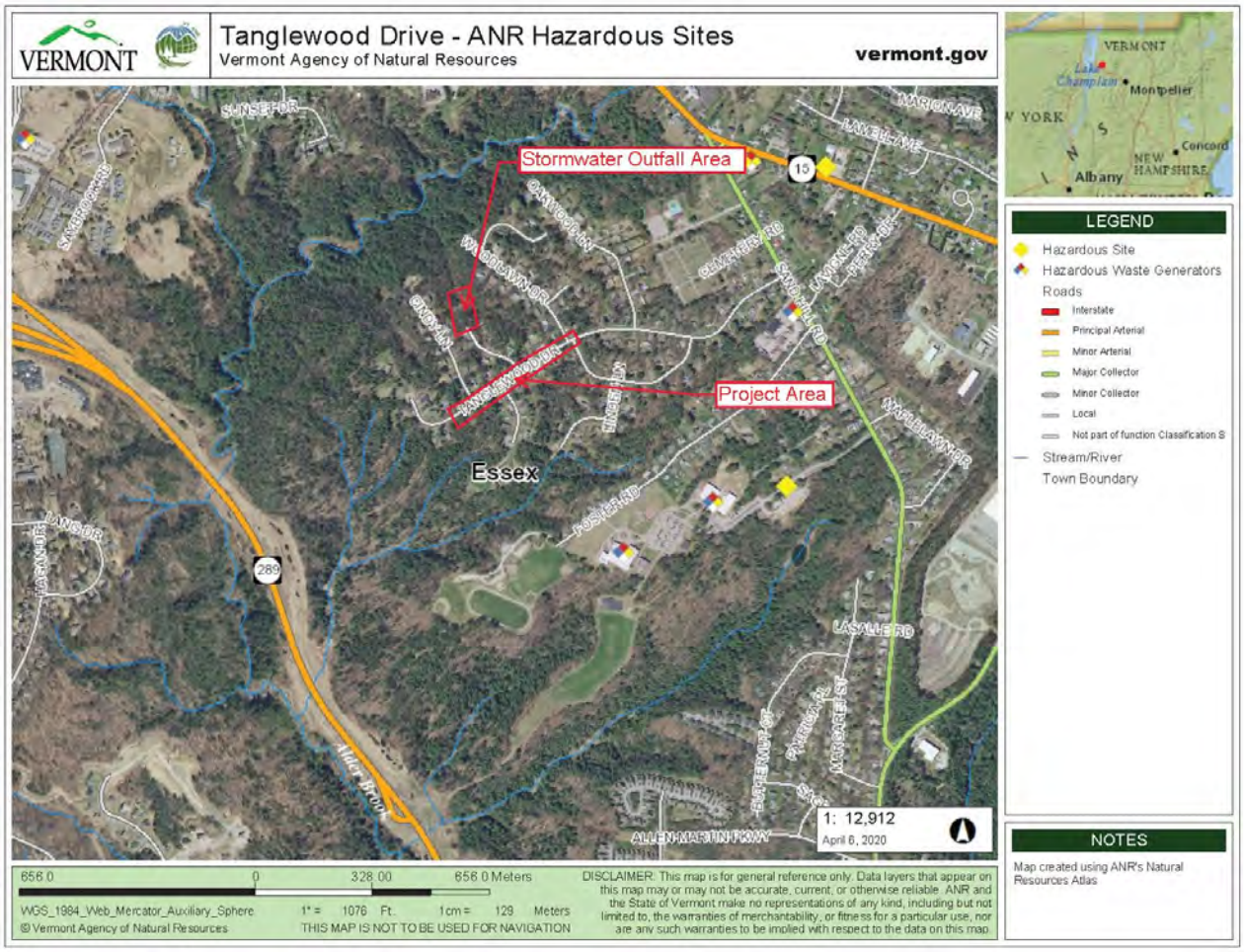
Flora/Fauna and Forest Land. No priority habitat areas are mapped within the Project Area, but low priority wildlife habitat blocks and deer wintering areas are mapped to the west and north of the Project Area. The undeveloped portions of the Project Area provide general habitat for various suburban species but are not considered critical habitat areas.

Figure 9 Habitats



Hazardous Waste Sites. There are no Hazardous Sites mapped within the Project Area.

Figure 10 Hazardous Waste Sites



4.7.2 Site Investigation

Stantec conducted a site visit on May 13, 2020, to evaluate natural resources present within the project area.

Wetlands/Streams. Palustrine emergent wetlands were identified within the Project Area. These wetlands are associated with the stormwater discharge system north of Fern Hollow Road. Stormwater is discharged into the ravine, and small areas of wetland are located adjacent to the discharge channel downstream of the outfall where the channel slope flattens. These wetland areas were determined using the technical criteria described in the U.S. Army Corps of Engineers (Corps) guidance document: *Corps of Engineers Wetlands Delineation Manual* and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Regional Supplement*. Wetland communities

were classified according to the *Classification of Wetlands and Deepwater Habitats of the United States*. Hydric soil determinations were made in accordance with the Corps manual and the *Field Indicators for Identifying Hydric Soils in New England, Version 4*. Dominant species present include jewelweed *(Impatiens capensis*) and sedges *(Carex spp.).* Soils had a thin (2-3") dark surface horizon of mucky loam over sand and were saturated to the surface during the field investigation on May 13, 2020.

No jurisdictional streams were identified in the project area.

RTE Species. No RTE species were observed within the Project Area during the field visit. Forested habitat is present within the stormwater discharge area north of Fern Hollow Road, and this may be considered habitat for the state- and federal listed northern long-eared bat.

Wildlife Habitat. The undeveloped portions of the Project Area provide general habitat for various suburban species but are not considered critical habitat areas. Eastern chipmunk (*Tamias striatus*) were observed and white-tailed deer (*Odocoileus virginianus*) prints and scat were present in the area north of Fern Hollow Road.

5.0 PURPOSE AND NEED STATEMENT

The following statement was developed based on the existing conditions assessment, public input, and project advisory committee discussions.

Purpose: The purpose of this project is to improve the drainage system along Tanglewood Drive and to provide safe, comfortable pedestrian and bicycle facilities for users of all ages and abilities while maintaining safe and efficient vehicular conditions.

Need:

- Address drainage problems resulting in erosion at the closed drainage system outlet.
- Provide an inviting pedestrian travel route for residents that reinforces the Town's and Region's goals for pedestrian and bicycle mobility.
- Facilitate use by all age groups, experience levels, and trip purposes.

6.0 ALTERNATIVES

The project advisory committee (PAC) considered a wide range of improvements to address the project's purpose and need. Constructing a 10-foot wide shared use path was considered. This improvement was discarded as it would require construction outside the existing roadway footprint, and there were viable alternatives to accommodate higher speed on-road cyclists. The PAC also discussed on-road facilities delineated by markers or other barriers. This was discarded due to the change in aesthetic and restriction to on street parking, as confirmed by comments from public meetings. Stormwater infiltration chambers were considered at the end of Fern Hollow Road. This option was discarded due to concern of a restrictive clay layer resulting in poor performance.

The resulting alternatives developed and evaluated include the following:

- Alternative 1: No Action (Scheduled mill and overlay only)
- Alternative 2: Narrowing Roadway to 30'; Constructing 5' path and green strip.
- Alternative 3: Mill and Overlay Existing Roadway; pedestrians continue to use roadway; Line existing pipes; Drainage outlet relocation; Gulley stabilized.
- Alternative 4: Mill and Overlay Existing Roadway: Pedestrians continue to use roadway; Line existing CMP's; Subsurface Storage adjacent to existing drop structures.
- Alternative 5: Is like Alternative 3 with a subsurface filtration system added for Water Quality.

6.1 ALTERNATIVE 1: NO ACTION

For the No Action alternative, the existing transportation and stormwater facilities in the project area remain as they exist today, although the roadway will be milled and repaved due to scheduled maintenance. This alternative retains the curb locations on both sides of Tanglewood Drive. The roadway is coarse milled and then overlaid with new pavement to improve the pavement condition. This alternative would include construction costs for milling and repaving only, and there would be no impacts to right-of-way, resources, or traffic. As part of repaving, there would be an option to add a designated and painted bike lane to one or both sides of the roadway. The No Action Alternative would not fully address the project's purpose and need. The estimated project cost of the mill and overlay for this area is $60,000.

6.2 ALTERNATIVE 2: 30' ROADWAY, GREENSTRIP AND 5' PATH

This alternative retains the curb on the south side of Tanglewood Drive and moves the edge of roadway in 10' on the north side of the roadway. A 5'-6" Green Strip and 5' Paved Path are added to the north side of Tanglewood Drive so that the back of the proposed path aligns with the existing back of curb location. The green strip is used for stormwater treatment and detention to reduce peak flows to the existing outfall in Fern Hollow. A typical section and plan of this alternative is shown in Figure 11. As shown on the plan, this alternative includes the following features:

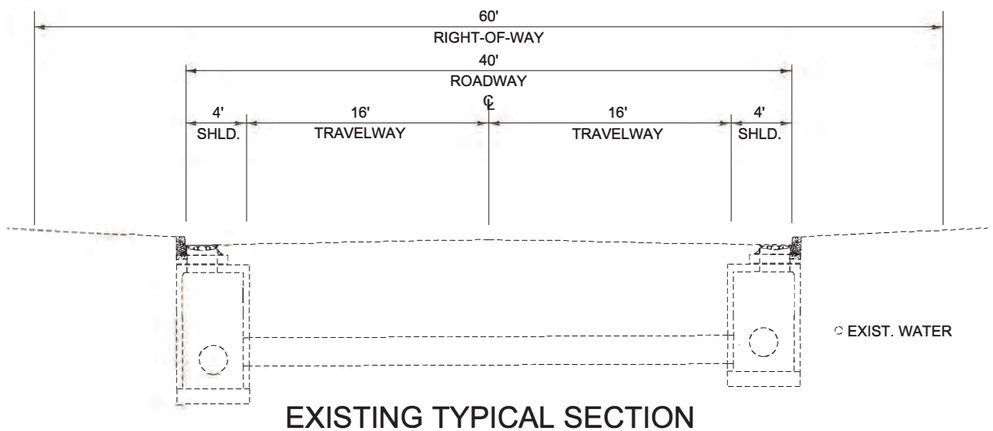
- 5' Paved Path on the north side of Tanglewood Drive
- Connection to the existing shared use path to the west of the project area via crosswalk
- Crosswalks and signage for crossing Cindy Lane and Fern Hollow Road
- Stormwater Detention / Treatment Areas in the newly constructed green strip
- Rehabilitation of the existing closed drainage system via pipe lining
- Estimated project cost is $410,000

These improvements do not impact right-of-way or utilities, or require permits, allowing this alternative to be readily implemented, subject to available funding.

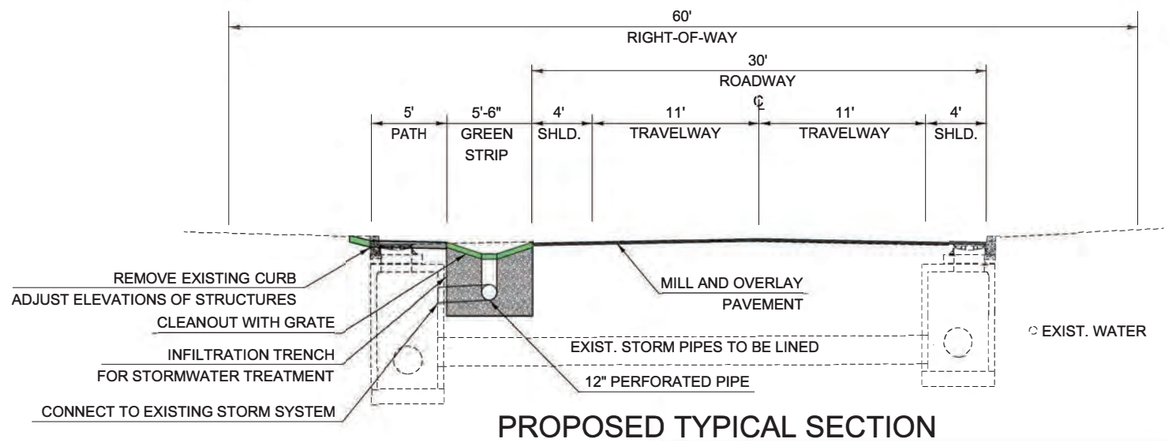
Based on the available 60’ right-of-way, the green strip could be widened in areas to increase potential for stormwater treatment. This will be restricted by underground electric vaults across from Rosewood Trail and near the drive between Fern Hollow Road and Woodlawn Drive.

Operational Impacts

Given the low traffic volumes on the roadway, there will not be a significant impact to traffic operations in the project area. It is assumed that the reduction in roadway will not impact the ability to park on the roadside. The parking condition would result in a further narrowed roadway which will reduce operating speed in this section. Stormwater runoff was analyzed and the available storage in green strip would result in a peak flow reduction of 15% at the outlet. In the future if the typical is applied along Tanglewood Drive between Woodlawn drive and Glenwood Drive the total flow reduction will be 34%. Further reductions could be achieved through infiltration in the green strip areas. Prior to design, soil investigations would need to be completed to determine the feasibility and capacity of infiltration in this area. HydroCAD analysis of the existing and proposed and potential future condition can be found in Appendix A.



EXISTING TYPICAL SECTION



PROPOSED TYPICAL SECTION

FIGURE 10

Stantec

PROJECT NAME:	TANGLEWOOD SCOPING
PROJECT NUMBER:	
FILE NAME: Concept 1- color.dgn	PLOT DATE: 4/14/2020
PROJECT LEADER: I. MAYNARD	DRAWN BY: J. LAPERLE
DESIGNED BY: I. MAYNARD	CHECKED BY: G. GOYETTE
ALTERNATIVE 2	SHEET | OF |

6.3 ALTERNATIVE 3: 40’ ROADWAY WIDTH; RELOCATE OUTFALL

This alternative retains the curb locations on both sides of Tanglewood Drive. The roadway is coarse milled and then overlaid with new pavement to improve the pavement condition. The existing CMP pipes along Tanglewood Drive receive liners to extend their useful life. The outfall location is relocated downstream, away from the unstable channel banks of Fern Hollow. The unstable banks are backfilled to reduce the potential for further collapse. A plan of this alternative is shown in Figure 12. As shown on the plan, this alternative includes the following features:

- Mill (if needed) and overlay of existing roadway
- Lining of existing CMP’s
- Extension of closed drainage system to relocate outfall
- Fill in existing outfall location to improve channel stability
- An optional designated and painted bike/pedestrian lane could be added to one or both sides.
- Estimated project cost is $330,000

These improvements do not impact right-of-way or utilities, a wetland permit may be required depending on area of wetland impacts at the relocated outfall.

Operational Impacts

Since this alternative does not change the conditions for vehicles or pedestrians, there will be no impacts to operations. The extension of the drainage system to a location with less slope will result in a more stable outfall condition that is less likely to erode in the future. Stabilization of the existing channel damage in the gulley will reduce further deterioration of the side slopes. A proper designed channel protection will ensure that the restored area remains stable through future storm events.

PROJECT NAME:	TANGLEWOOD SCOPING
PROJECT NUMBER:	
FILE NAME: Concept 2 - color.dgn	PLOT DATE: 10/19/2020
PROJECT LEADER: I. MAYNARD	DRAWN BY: J. LAPERLE
DESIGNED BY: I. MAYNARD	CHECKED BY: G. GOYETTE
ALTERNATIVE 2	SHEET 1 OF 1

Stantec

6.4 ALTERNATIVE 4: 40' ROADWAY WIDTH, STORMWATER STORAGE STRUCTURES

This alternative retains the curb locations on both sides of Tanglewood Drive. The roadway is coarse milled and then overlaid with new pavement to improve the pavement condition. The existing CMP pipes along Tanglewood Drive receive liners to extend their useful life. Stormwater storage chambers are added adjacent to the existing drop structures along Fern Hollow Road. A plan of this alternative is shown in Figure 13. As shown on the plan, this alternative includes the following features:

- Mill (if needed) and overlay of existing roadway
- Lining of existing CMP's
- Addition of Storage Structures along Fern Hollow Road
- Optional Treatment Filter at the end of Fern Hollow Road.
- An optional designated and painted bike/pedestrian lane could be added to one or both sides.
- Estimated project cost is $310,000

These improvements do not impact right-of-way or utilities, or require permits, allowing this alternative to be readily implemented, subject to available funding.

Operational Impacts

Since this alternative does not change the conditions for vehicles or pedestrians, there will be no impacts to traffic operations. Based on input from the Town, the desired storage configuration will be independent storage structures adjacent the existing basin drop structures along fern hollow road. To achieve maximum detention with structures in series down a slope the outlet to each structure will have to be variable to ensure that all structures fill simultaneously. A hydroCAD analysis was conducted to determine the peak flow reduction from a 1-year storm. Using the storage configuration described with outlets ranging from 7.25" at the lowest structure to 8.25" at the highest structure the peak flow would be reduced from 6.83 cfs to 4.83 cfs (approximately 30%). Optionally, a stormwater treatment practice could be added to the system to reduce nutrient load at the outfall. HydroCAD analysis of the existing and proposed condition can be found in Appendix A.

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PROJECT NAME: TANGLEWOOD SCOPING	
PROJECT NUMBER:	
FILE NAME: Concept 3 - color.dgn	PLOT DATE: 10/19/2020
PROJECT LEADER: I. MAYNARD	DRAWN BY: J. LAPERLE
DESIGNED BY: I. MAYNARD	CHECKED BY: G. GOYETTE
ALTERNATIVE 3	SHEET 1 OF 1

6.5 ALTERNATIVE 5: 40’ ROADWAY WIDTH; RELOCATE OUTFALL; SUBSURFACE FILTER

This alternative was added based on public comments from at the alternative presentation meeting. Like alternative 3, this alternative retains the curb locations on both sides of Tanglewood Drive. The roadway is coarse milled and then overlaid with new pavement to improve the pavement condition. The existing CMP pipes along Tanglewood Drive receive liners to extend their useful life. The outfall location is relocated downstream, away from the unstable channel banks of Fern Hollow. The unstable banks are backfilled to reduce the potential for further collapse. A plan of this alternative is shown in Figure 14. As shown on the plan, this alternative includes the following features:

- Mill (if needed) and overlay of existing roadway
- Lining of existing CMP’s
- Offline Subsurface filter for Water Quality Treatment
- Extension of closed drainage system to relocate outfall
- Fill in existing outfall location to improve channel stability
- speed table east or west of the intersection
- Paint the edge of road markings with a single white stripe on both sides of the road
- An optional designated and painted bike/pedestrian lane could be added to one or both sides.
- Estimated project cost is $440,000

These improvements do not impact right-of-way or utilities, a wetland permit may be required depending on area of wetland impacts at the relocated outfall.

Operational Impacts

Since this alternative does not change the conditions for vehicles or pedestrians, there will be no impacts to operations. The extension of the drainage system to a location with less slope will result in a more stable outfall condition that is less likely to erode in the future. Stabilization of the existing channel damage in the gulley will reduce further deterioration of the side slopes. A proper designed channel protection will ensure that the restored area remains stable through future storm events. The subsurface filter will treat water quality volume from the impervious surfaces upstream.

0 30 60

SCALE IN FEET

Stantec

PROJECT NAME:	TANGLEWOOD SCOPING
PROJECT NUMBER:	
FILE NAME: Concept 4 - color.dgn	PLOT DATE: 5/4/2021
PROJECT LEADER: I. MAYNARD	DRAWN BY: J. LAPERLE
DESIGNED BY: I. MAYNARD	CHECKED BY: G. GOYETTE
ALTERNATIVE 4	SHEET 1 OF 1

6.6 COMPARISON OF ALTERNATIVES

6.6.1 Alternative Impacts

Traffic Operations

Traffic operations do not significantly vary between alternatives. Alternative 2 introduces a crosswalk across Tanglewood Drive at the western limit of the study area. This crosswalk connects the proposed path to the existing path. Given the low volumes in the area, the crosswalk is not expected to impact traffic operations.

Safety Impacts

Safety for pedestrians and bicyclists is improved in Alternative 2. Intermediate and advanced cyclists can use the 4’ shoulder and beginner cyclists can use the 5-foot separated path. Alternatives 3 and 4 do not improve pedestrian and bicycle safety over the existing condition.

Right-of-Way (ROW) Impacts

Based on the available parcel data, the right-of-way width along Tanglewood Drive is 60’, centered on the existing roadway. Alternatives 2 and 4 do not have impacts outside existing right-of-way. Alternative 3 may require easements for stabilization of the existing channel near the outlet.

Environmental Resource Impacts

Based on the desktop research and site visit, there are no known impacts to natural resources, such as wetlands, streams, wildlife, or rare and endangered species, for any alternatives.

Cultural Resource Impacts

An archeological resource assessment (ARA) was conducted by Hartgen Archeological Associates. The assessment determined that there are no historic archeological sites, State Register or National Register sites located within or adjacent to the project areas and the project area is not considered to be archeologically sensitive for either historic or precontact resources. The full ARA report can be found in Appendix B.

Utility Impacts

Existing underground utilities in the project area include water, gas, electric and communications. The limited construction of the alternatives does not impact utilities and does not require their wholesale relocation. Alternative 2, which relocates the northside curb, does require new drainage inlets and may require utility relocations or adjustments.

Stormwater Impacts

Alternative 2 reduces the amount of impervious surface over the existing condition and will therefore reduce overall runoff volume. Storage will provide flow mitigation, resulting in an overall decrease in

volume and peak flow to the outfall. Alternative 3 does not reduce volume or peak flow. The outfall is relocated to a more stable location and existing channel banks are stabilized, which will reduce sediment load. Alternative 4 will reduce peak flows through detention provided in subsurface storage. Water quality can be improved in this alternative if the optional treatment practice is constructed. All three alternatives maintain or decrease impervious area over the existing condition so there will not be a need for an operational stormwater permit.

6.6.2 Project Costs

The following table is a summary of the estimated project costs for alternatives. It is assumed that there will be no right-of-way cost for any alternative. See Appendix C for a detailed breakdown of estimated construction costs.

Table 1 Summary of Project Costs

Item	Alternative 1 No Action*	Alternative 2 (30' Roadway, Green strip, Path)	Alternative 3 (40' Roadway, Relocated Outfall)	Alternative 4 (40' Roadway, Stormwater Storage)	Alternative 5 ** (40' Roadway, Stormwater Filtration)
Construction Costs	$60,000	$320,000	$250,000	$230,000	$360,000
Right-of-Way Costs	$0	$0	$0	$0	$0
Design Engineering	$0	$60,000	$50,000	$50,000	$50,000
Construction Engineering	$0	$30,000	$30,000	$30,000	$30,000
TOTAL PROJECT COSTS	$60,000	**$410,000**	**$330,000**	**$310,000**	**$440,000**

* No action alternative construction cost is for regularly scheduled mill and overlay work.
** Alternative added after alternatives presentation

6.6.3 Evaluation Matrix

The table below provides an evaluation matrix summarizing the above information for traffic operations, safety, right-of-way, environmental, cultural resources, utilities, and project costs.

Table 2 Evaluation Matrix

CRITERIA	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5*
	No Action (Overlay Only)	30' Roadway, Green strip, Path	40' Roadway, Relocated Outfall	40' Roadway, Stormwater Storage	40' Roadway, Stormwater Filtration
Project Costs	$60,000	$410,000	$330,000	$310,000	$440,000
PURPOSE AND NEED					
Address Drainage Problems resulting in unstable channel slopes in Fern Hollow	No	Yes	Yes	Yes	Yes
Support goals for active mobility	No	Yes	No	No	No
Facilitate use by all ages and experience	No	Yes	No	No	No
IMPACTS					
Traffic Operations	None	None	None	None	None
Safety	No Improvement	Improved	No Improvement	No Improvement	No Improvement
Right-of-way	None	None	None	None	None
Environmental	None	None	Wetland	None	Wetland
Cultural Resources	None	None	None	None	None
Utilities	None	None	None	None	None

CRITERIA	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5*
	No Action (Overlay Only)	**30' Roadway, Green strip, Path**	**40' Roadway, Relocated Outfall**	**40' Roadway, Stormwater Storage**	**40' Roadway, Stormwater Filtration**
Stormwater	No Change	Reduce Peak Flow and Volume	No change; Stabilized Outfall	Reduce Peak Flow	Water Quality Treatment and Stabilized Outfall
* Alternative added after alternatives presentation meeting					

7.0 STAKEHOLDER INPUT AND RECOMMENDATIONS

A local concerns meeting was held on October 23, 2019 at the Essex Fire station. At this meeting the existing information was presented along with the project's goals. The public provided input on their concerns which include speeding and stormwater runoff into residences. The presentation along with the meeting notes are attached in Appendix D.

After the local concerns meeting the project team sent an online survey to residents in the neighborhood to help guide the alternatives development process and gain more information about properties in the project area.

The survey questions and responses were as follows:

1. Does your property front on Tanglewood Drive between Woodlawn Drive and Cindy Lane?
    a. YES: 4
    b. NO: 15
2. If your property fronts on Tanglewood Drive between Woodlawn Drive and Cindy Lane, do you have a foundation drain that connects to the Town's storm water pipe in the roadway?
    a. YES: 2
    b. NO: 9
    c. DON'T KNOW: 5
3. If your property fronts on Tanglewood Drive between Woodlawn Drive and Cindy Lane, is your septic tank in the front or back lawn?
    a. FRONT: 0

   b. BACK: 4

   c. DON'T KNOW: 8

4. Do you prefer keeping the road width at 40 feet without any pedestrian or bicycle facilities?

   a. YES: 10

   b. NO: 6

   c. NO PREFERENCE: 3

5. Would you accept a narrower road width of 30 feet in this section of Tanglewood (per the Town's current road standards) with the 10 feet of removed roadway width used for a 5-foot wide pedestrian walkway separated from the travelled way by a 5 foot wide green strip?

   a. YES: 10

   b. NO: 8

   c. NO PREFERENCE: 1

6. If the roadway width was reduced to 30 feet, would you prefer parking on one side of the street or both?

   a. ONE SIDE: 8

   b. BOTH SIDES: 6

   c. NO PREFERENCE: 4

7. Would you prefer a 30-foot-wide road width with a separate 7-10-foot-wide multi-purpose path?

   a. YES: 6

   b. NO: 11

   c. NO PREFERENCE: 1

8. Would you prefer a vegetative green belt between any sidewalk/multi-purpose path or only protective delineators such as white flexible posts?

   a. VEGETATIVE GREEN BELT: 13

   b. FLEXIBLE WHITE POSTS: 1

   c. NO PREFERENCE: 4

Comments received as part of the online survey are attached in Appendix E.

An alternatives presentation meeting was noticed and then conducted on March 16, 2021 virtually via Microsoft Teams. Notes and chat log from this meeting can be found in Appendix F.

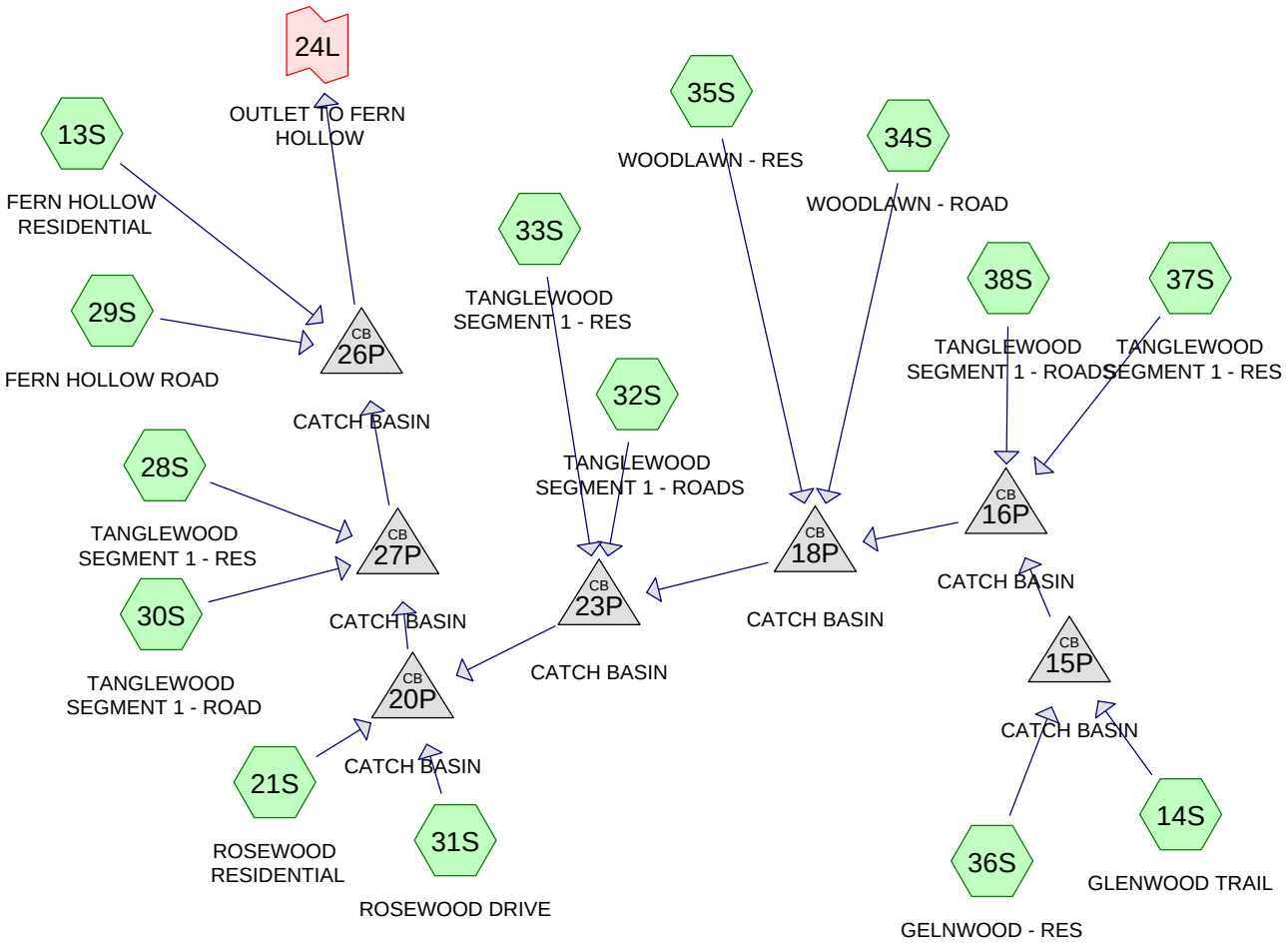
At this meeting alternatives 1 through 4 were presented and discussed. Attendees expressed a desire to keep the entirety of Tanglewood Drive uniform by maintaining the existing roadway width while also repairing damage to Fern Hollow and incorporating stormwater treatment. This resulted in an additional alternative that is very similar to alternative 3 but includes a sub-filter for stormwater treatment. Alternative 5 has been added to this report based on the results of this meeting.

8.0 MUNICIPAL PREFERRED ALTERNATIVE

With input received at the public meetings considered, Town Engineering and Planning Staffs worked cooperatively to produce recommendations relative to the project. The Staff recommendations is Alternative 5.

APPENDIX A

HydroCAD Analysis



Subcat Reach Pond Link

Routing Diagram for Tanglewood_Existing
Prepared by Stantec Consulting Ltd., Printed 10/19/2020

Summary for Subcatchment 13S: FERN HOLLOW RESIDENTIAL

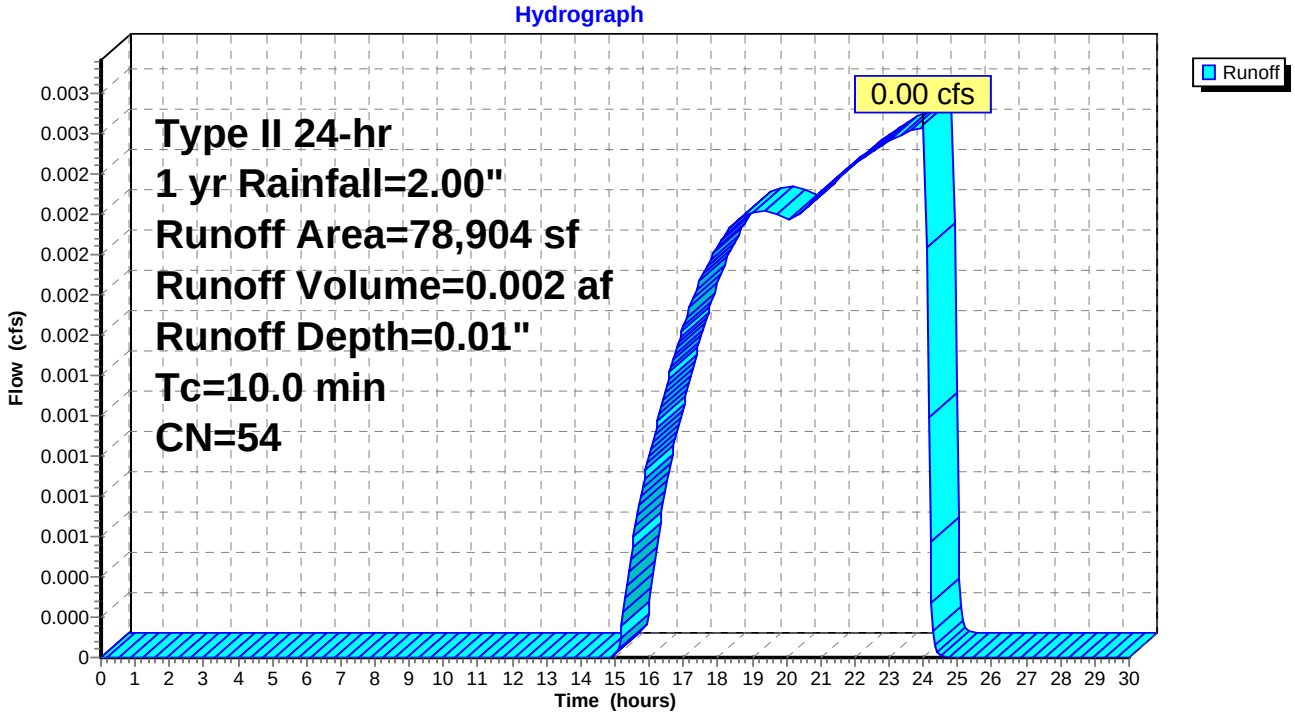
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.002 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
78,904	54	1/2 acre lots, 25% imp, HSG A
59,178		75.00% Pervious Area
19,726		25.00% Impervious Area

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

Subcatchment 13S: FERN HOLLOW RESIDENTIAL



Summary for Subcatchment 14S: GLENWOOD TRAIL

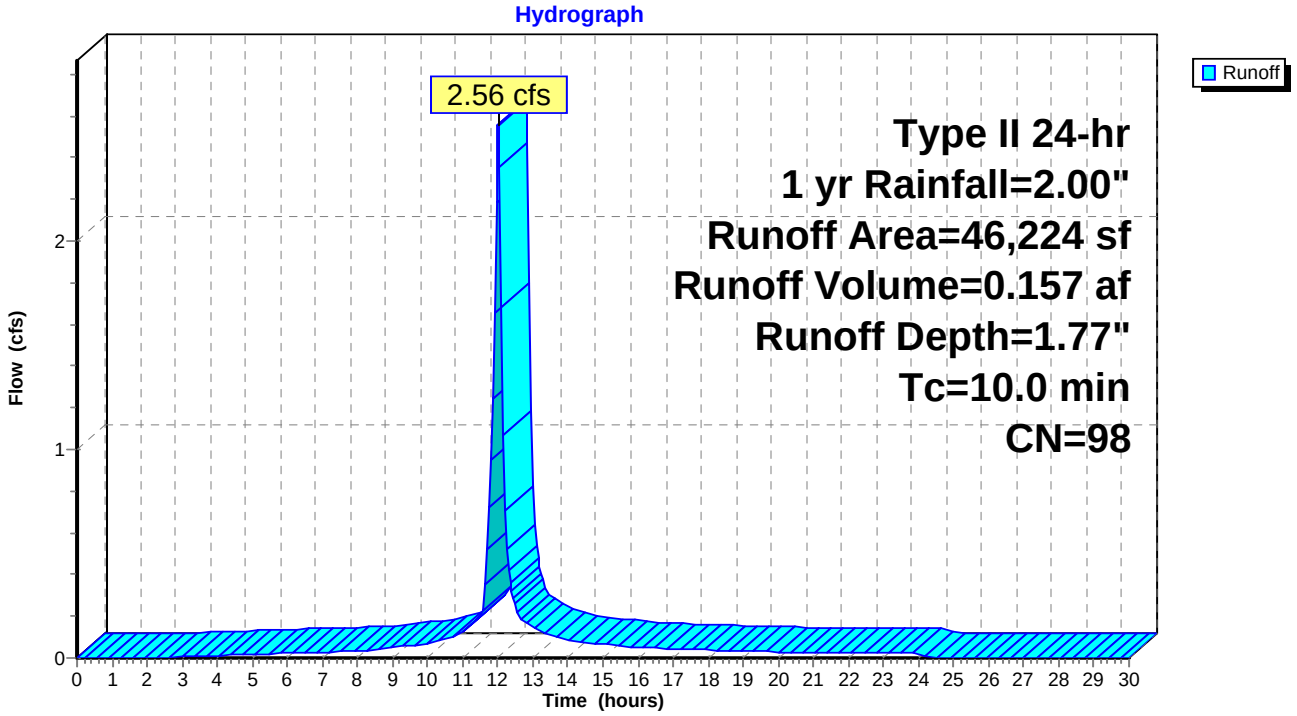
Runoff = 2.56 cfs @ 12.01 hrs, Volume= 0.157 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
46,224	98	Paved roads w/curbs & sewers, HSG A
46,224		100.00% Impervious Area

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

Subcatchment 14S: GLENWOOD TRAIL



Summary for Subcatchment 21S: ROSEWOOD RESIDENTIAL

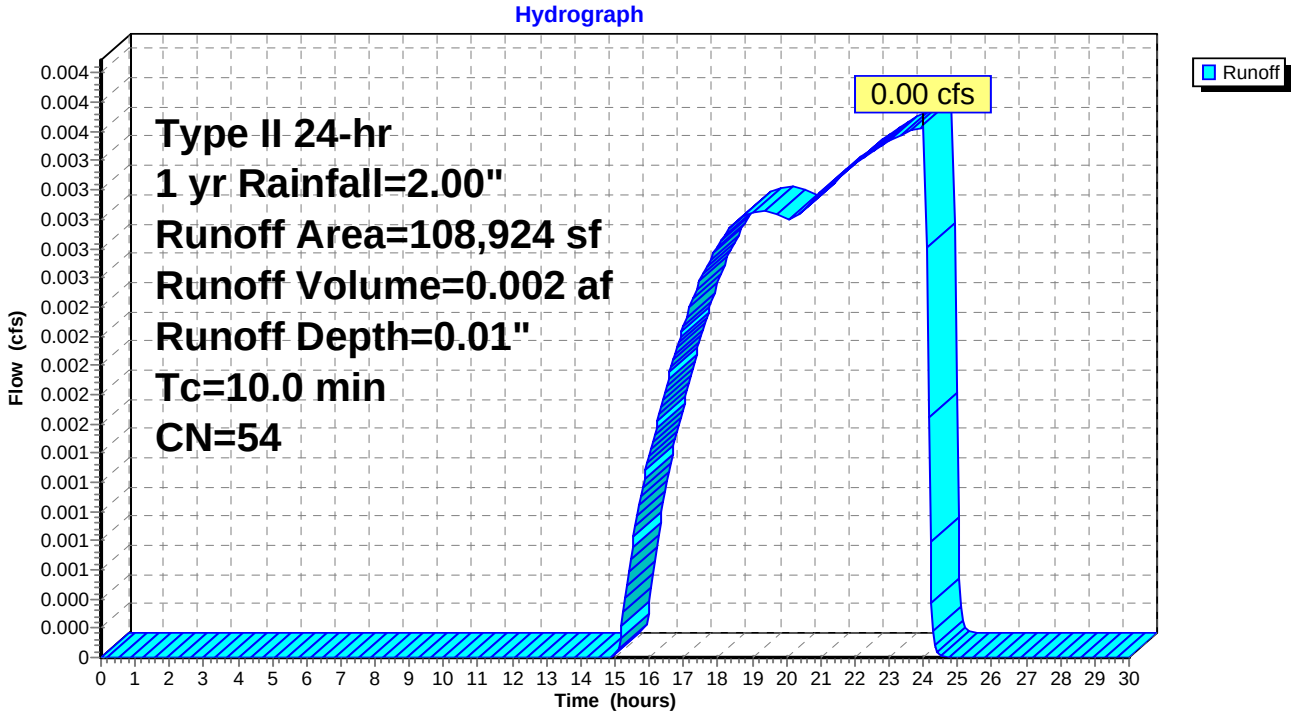
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.002 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
108,924	54	1/2 acre lots, 25% imp, HSG A
81,693		75.00% Pervious Area
27,231		25.00% Impervious Area

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

Subcatchment 21S: ROSEWOOD RESIDENTIAL



Summary for Subcatchment 28S: TANGLEWOOD SEGMENT 1 - RES

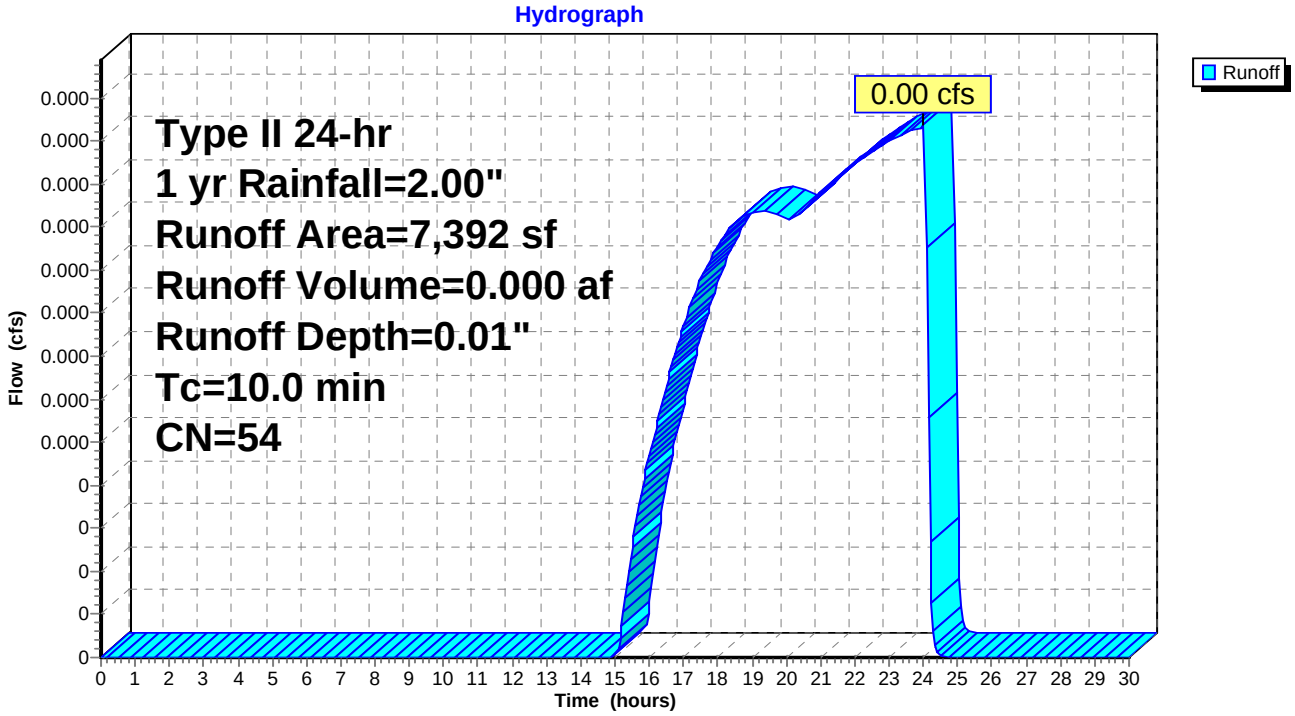
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
7,392	54	1/2 acre lots, 25% imp, HSG A
5,544		75.00% Pervious Area
1,848		25.00% Impervious Area

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

Subcatchment 28S: TANGLEWOOD SEGMENT 1 - RES



Summary for Subcatchment 29S: FERN HOLLOW ROAD

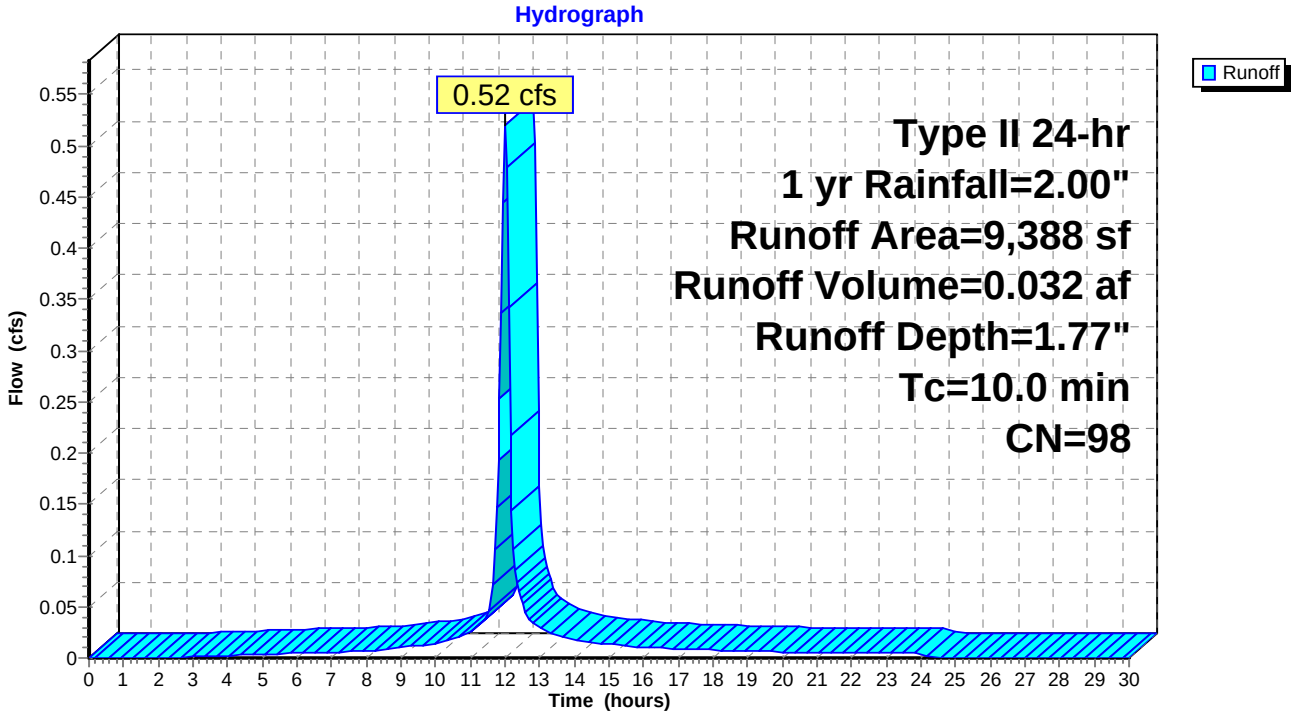
Runoff = 0.52 cfs @ 12.01 hrs, Volume= 0.032 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
9,388	98	Paved roads w/curbs & sewers, HSG A
9,388		100.00% Impervious Area

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

Subcatchment 29S: FERN HOLLOW ROAD



Summary for Subcatchment 30S: TANGLEWOOD SEGMENT 1 - ROAD

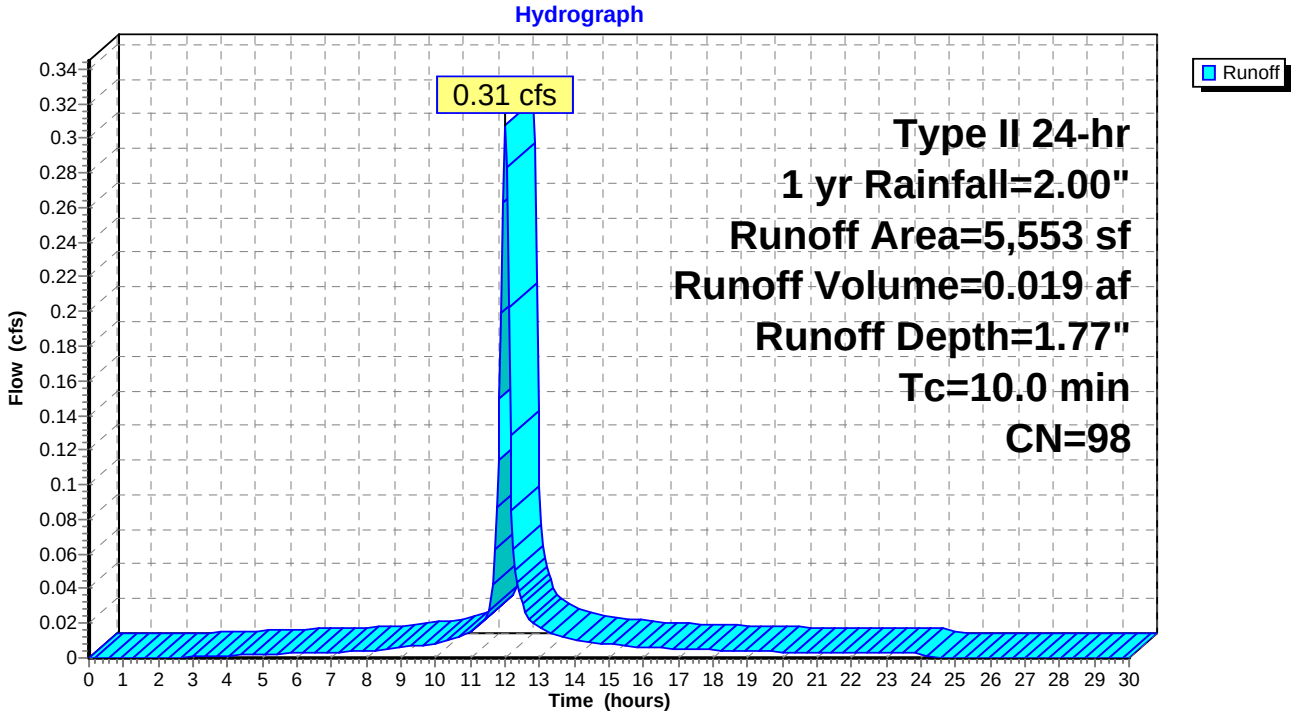
Runoff = 0.31 cfs @ 12.01 hrs, Volume= 0.019 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
5,553	98	Paved roads w/curbs & sewers, HSG A
5,553		100.00% Impervious Area

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

Subcatchment 30S: TANGLEWOOD SEGMENT 1 - ROAD



Summary for Subcatchment 31S: ROSEWOOD DRIVE

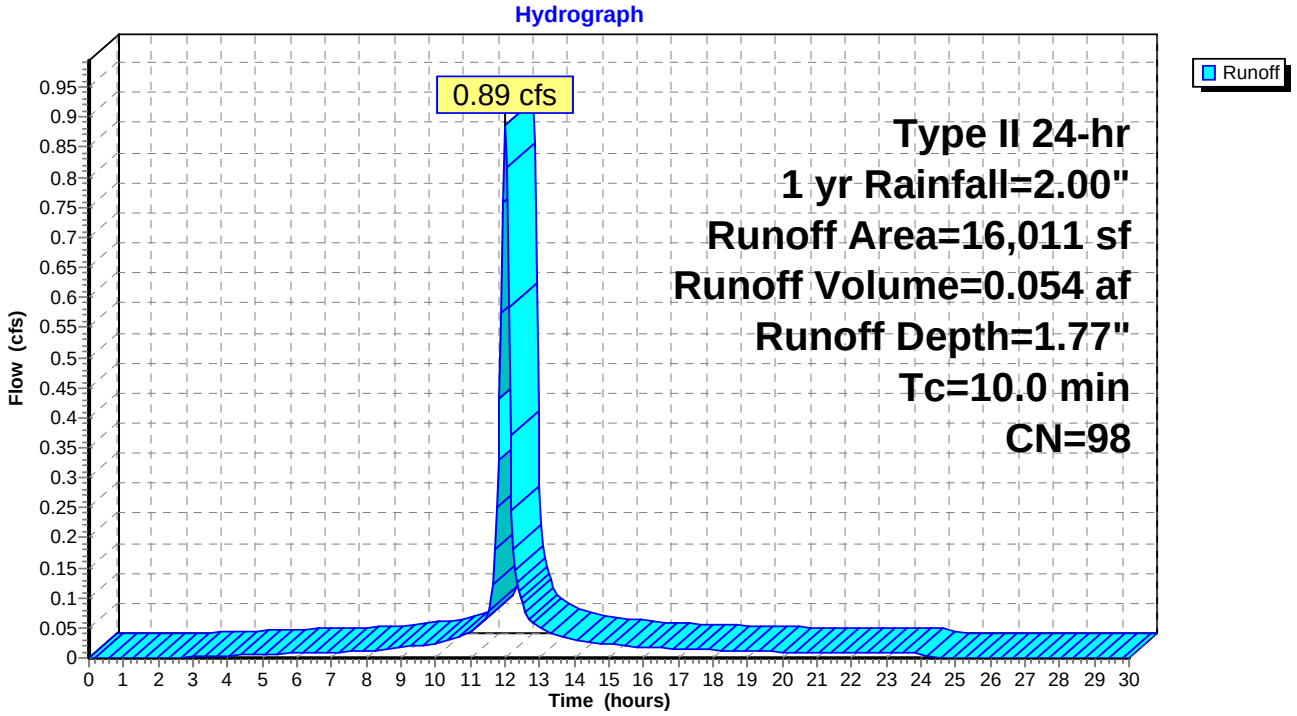
Runoff = 0.89 cfs @ 12.01 hrs, Volume= 0.054 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
16,011	98	Paved roads w/curbs & sewers, HSG A
16,011		100.00% Impervious Area

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

Subcatchment 31S: ROSEWOOD DRIVE



Summary for Subcatchment 32S: TANGLEWOOD SEGMENT 1 - ROADS

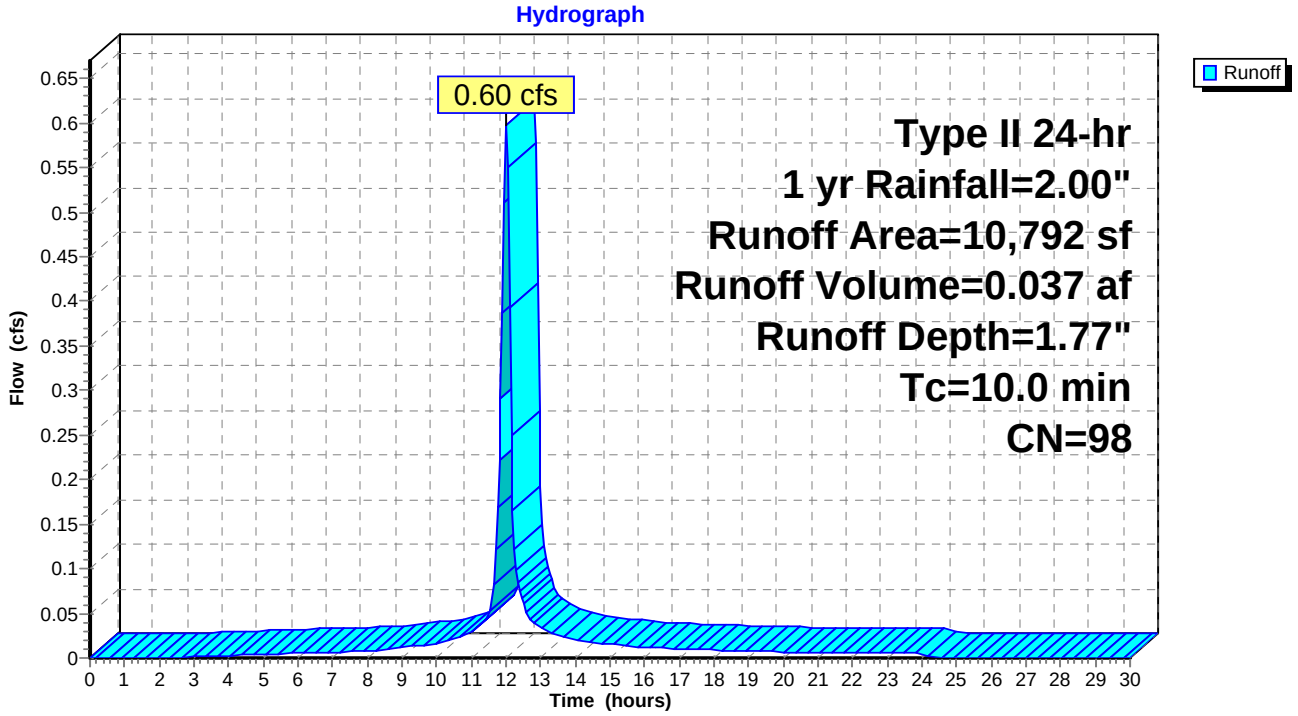
Runoff = 0.60 cfs @ 12.01 hrs, Volume= 0.037 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
10,792	98	Paved roads w/curbs & sewers, HSG A
10,792		100.00% Impervious Area

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

Subcatchment 32S: TANGLEWOOD SEGMENT 1 - ROADS



Summary for Subcatchment 33S: TANGLEWOOD SEGMENT 1 - RES

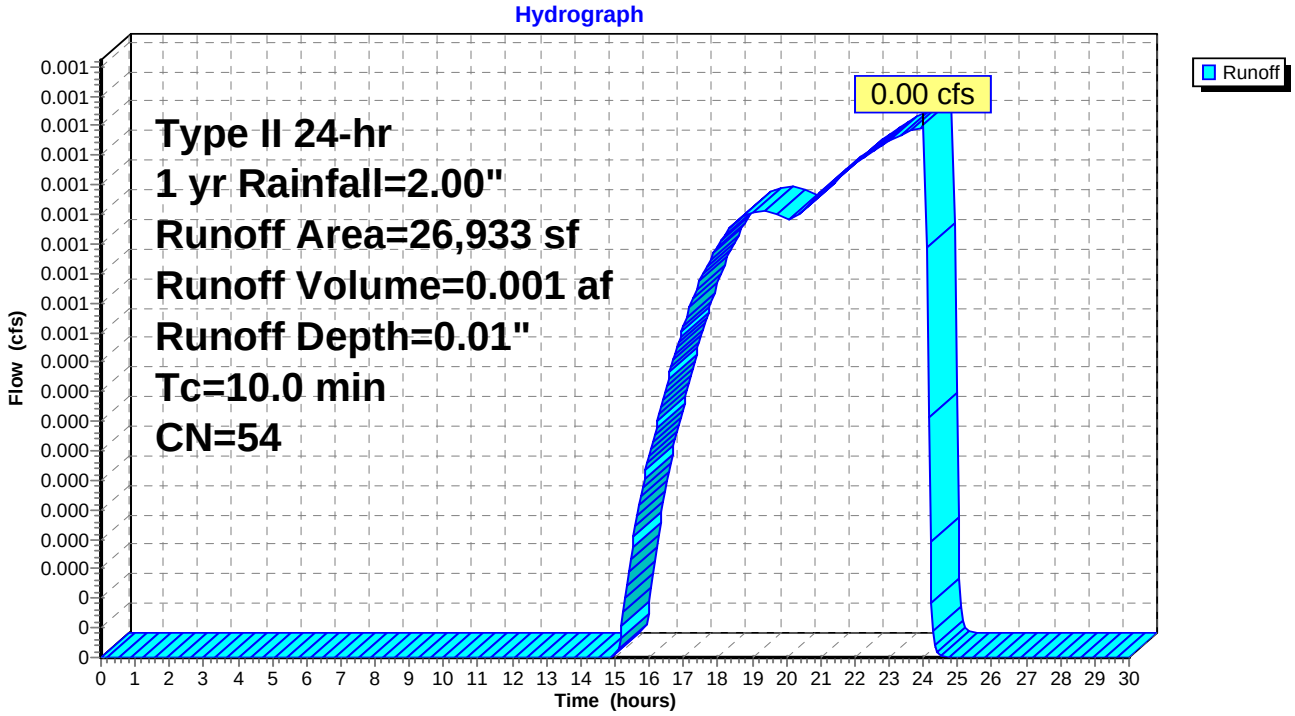
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.001 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
26,933	54	1/2 acre lots, 25% imp, HSG A
20,200		75.00% Pervious Area
6,733		25.00% Impervious Area

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

Subcatchment 33S: TANGLEWOOD SEGMENT 1 - RES



Summary for Subcatchment 34S: WOODLAWN - ROAD

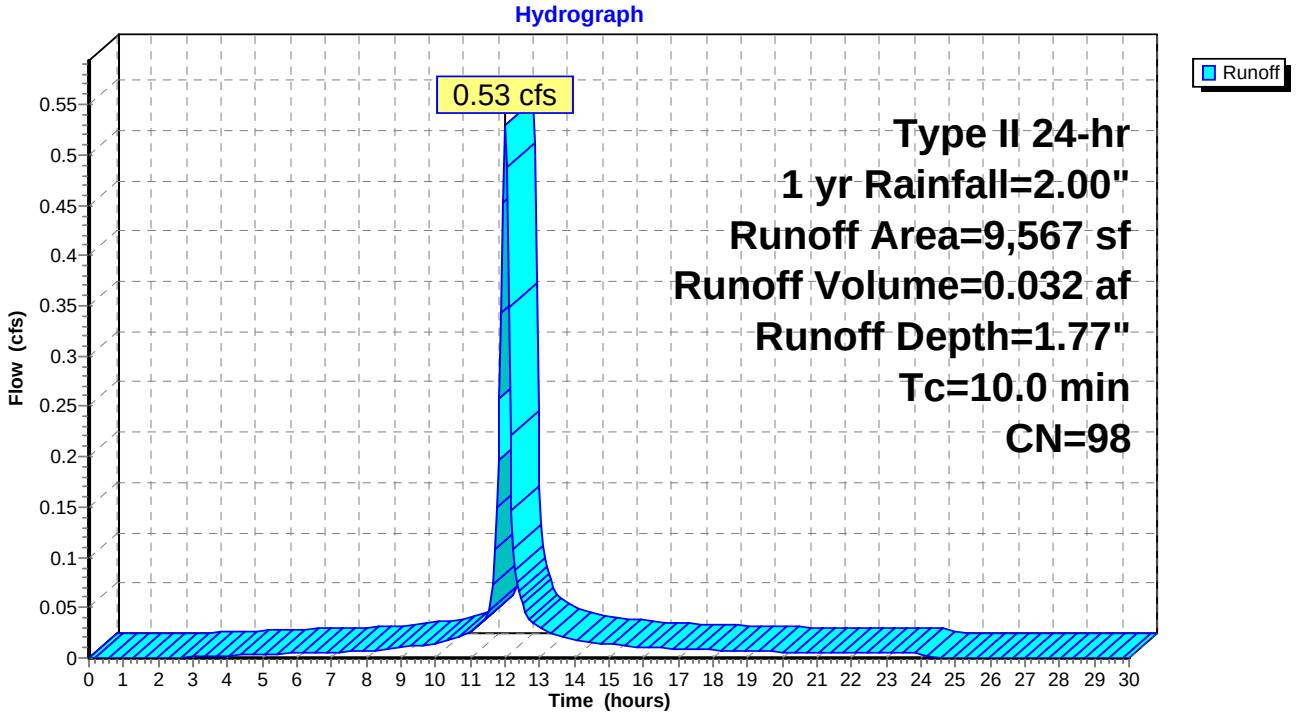
Runoff = 0.53 cfs @ 12.01 hrs, Volume= 0.032 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
9,567	98	Paved roads w/curbs & sewers, HSG A
9,567		100.00% Impervious Area

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

Subcatchment 34S: WOODLAWN - ROAD



Summary for Subcatchment 35S: WOODLAWN - RES

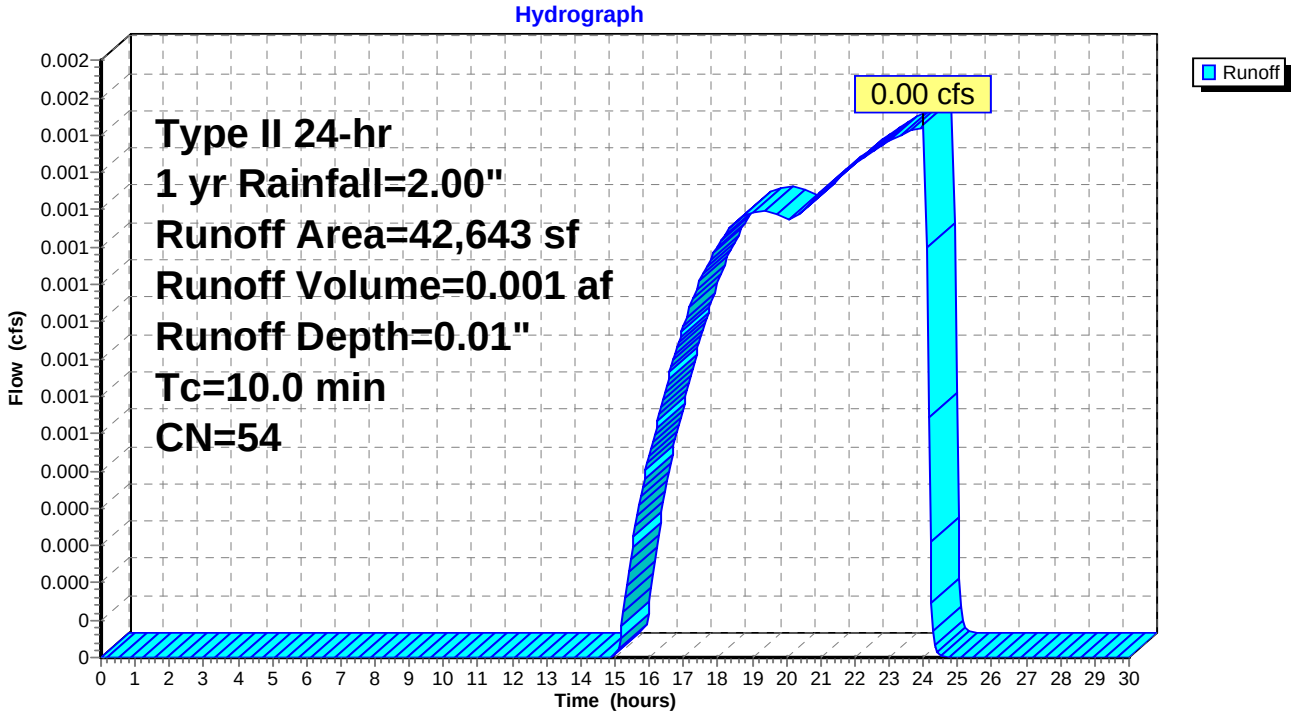
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.001 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
42,643	54	1/2 acre lots, 25% imp, HSG A
31,982		75.00% Pervious Area
10,661		25.00% Impervious Area

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

Subcatchment 35S: WOODLAWN - RES



Summary for Subcatchment 36S: GELNWOOD - RES

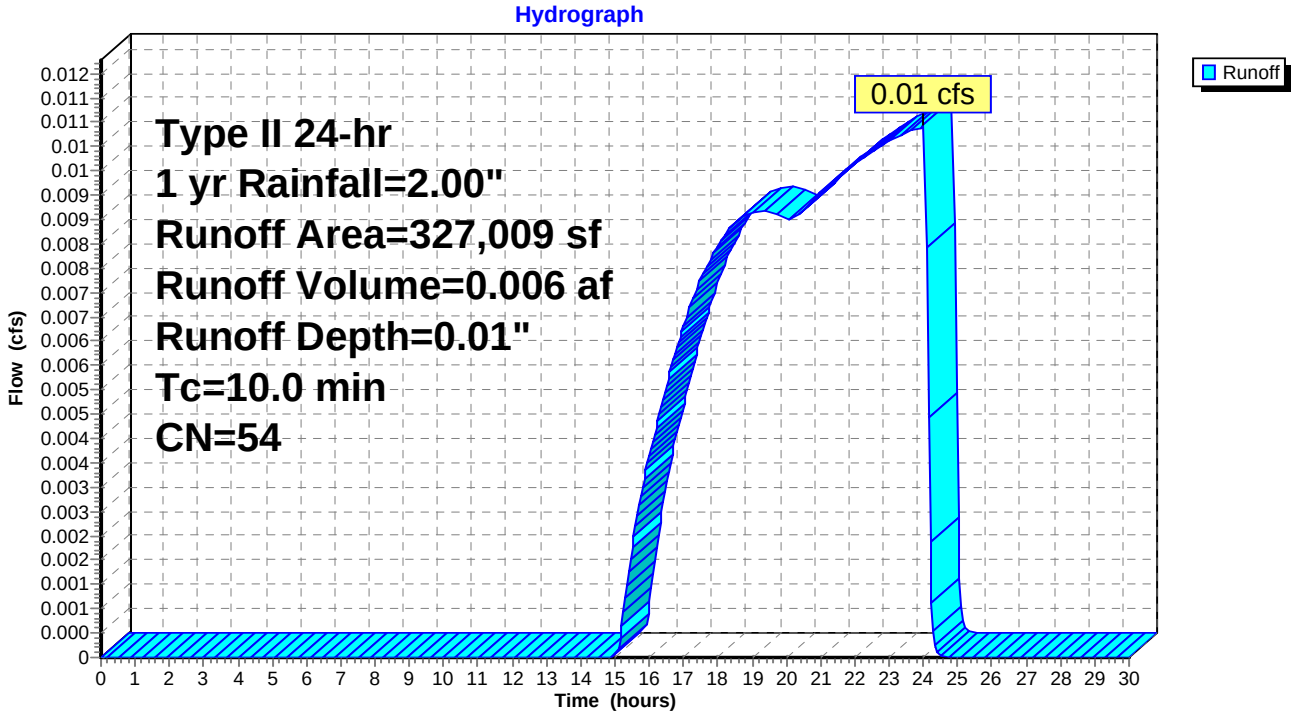
Runoff = 0.01 cfs @ 24.00 hrs, Volume= 0.006 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
327,009	54	1/2 acre lots, 25% imp, HSG A
245,257		75.00% Pervious Area
81,752		25.00% Impervious Area

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

Subcatchment 36S: GELNWOOD - RES



Summary for Subcatchment 37S: TANGLEWOOD SEGMENT 1 - RES

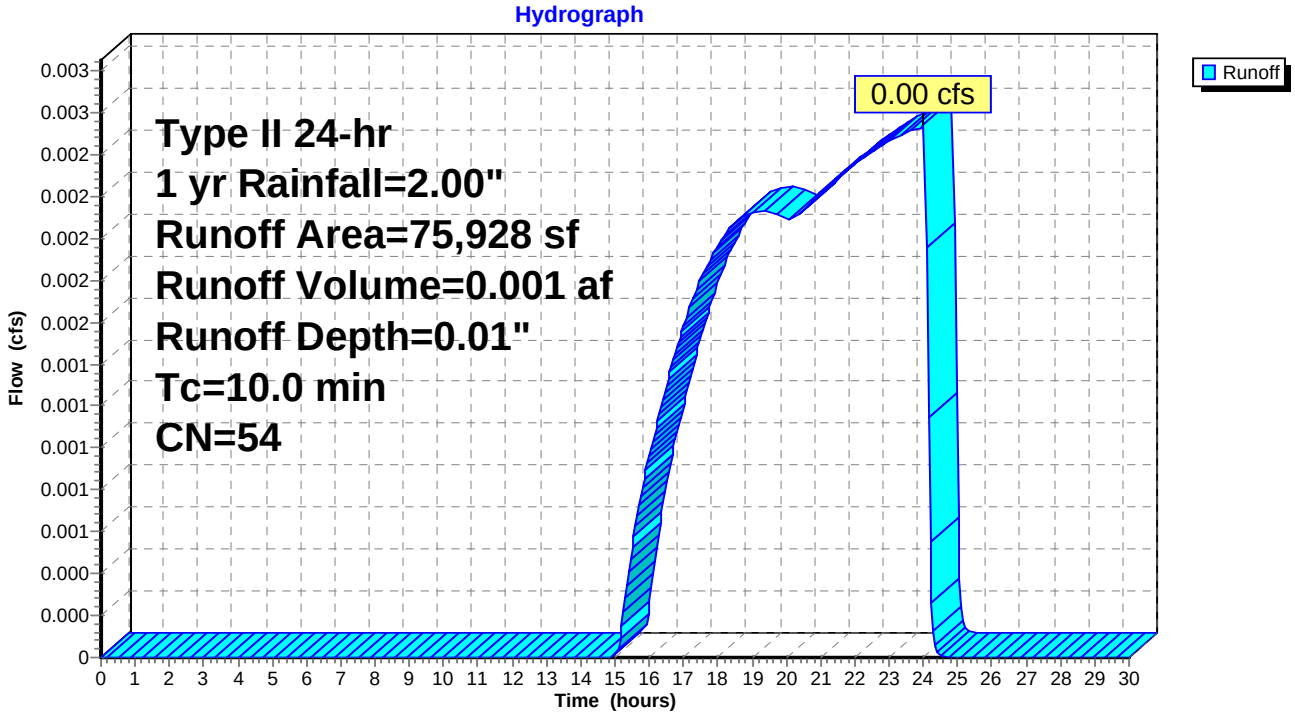
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.001 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
75,928	54	1/2 acre lots, 25% imp, HSG A
56,946		75.00% Pervious Area
18,982		25.00% Impervious Area

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

Subcatchment 37S: TANGLEWOOD SEGMENT 1 - RES



Summary for Subcatchment 38S: TANGLEWOOD SEGMENT 1 - ROADS

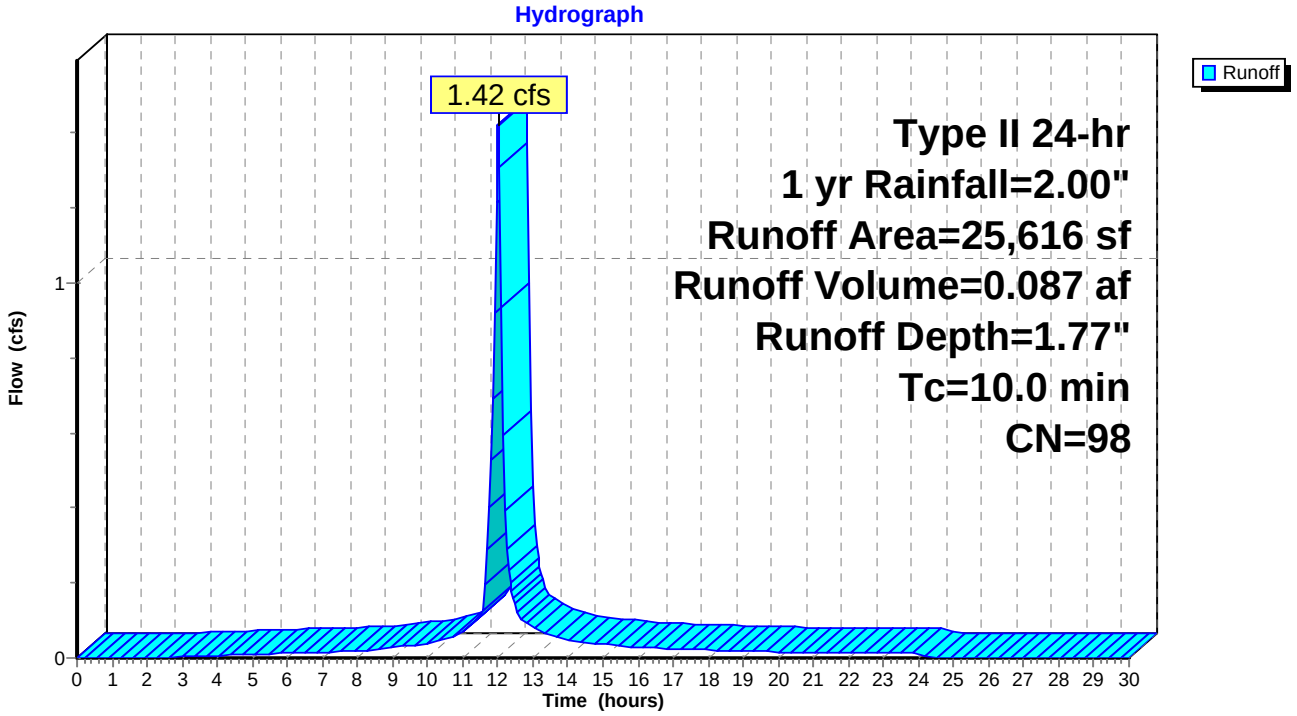
Runoff = 1.42 cfs @ 12.01 hrs, Volume= 0.087 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
25,616	98	Paved roads w/curbs & sewers, HSG A
25,616		100.00% Impervious Area

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

Subcatchment 38S: TANGLEWOOD SEGMENT 1 - ROADS



Summary for Pond 15P: CATCH BASIN

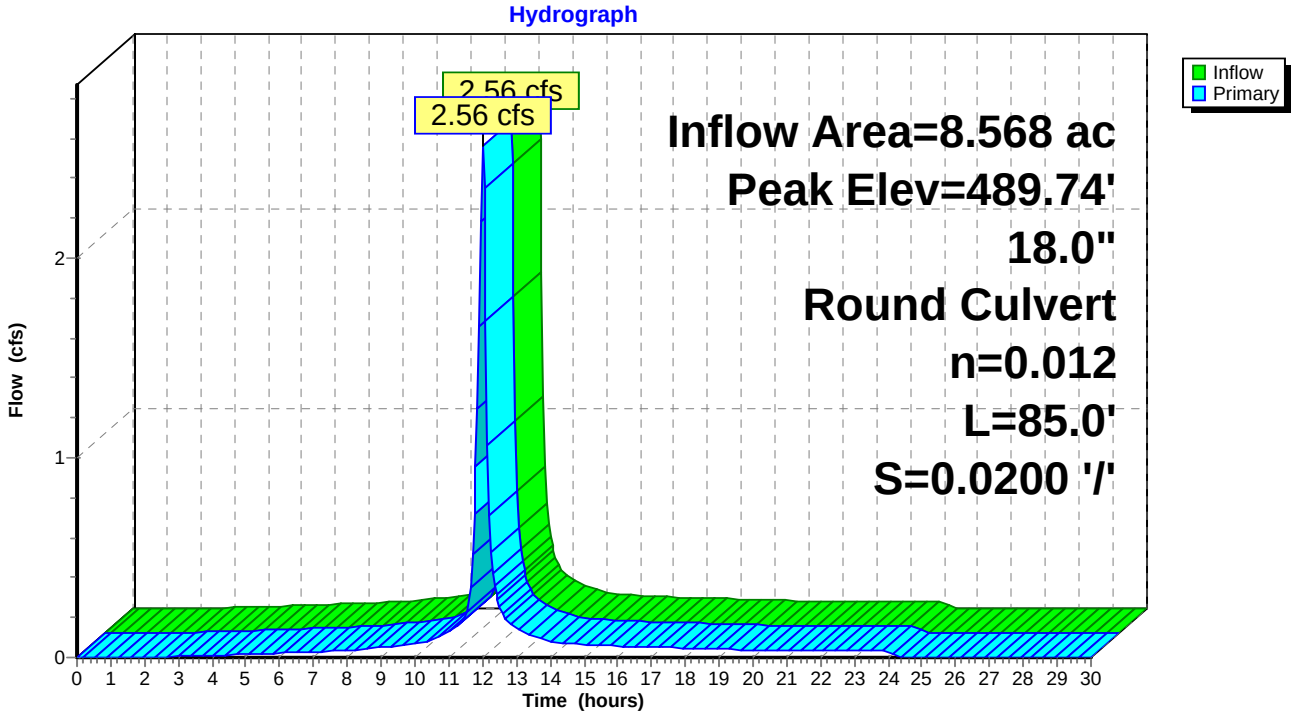
Inflow Area = 8.568 ac, 34.29% Impervious, Inflow Depth = 0.23" for 1 yr event
Inflow = 2.56 cfs @ 12.01 hrs, Volume= 0.163 af
Outflow = 2.56 cfs @ 12.01 hrs, Volume= 0.163 af, Atten= 0%, Lag= 0.0 min
Primary = 2.56 cfs @ 12.01 hrs, Volume= 0.163 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 489.74' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 85.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=2.53 cfs @ 12.01 hrs HW=489.74' (Free Discharge)
└**1=Culvert** (Inlet Controls 2.53 cfs @ 2.92 fps)

Pond 15P: CATCH BASIN



Summary for Pond 16P: CATCH BASIN

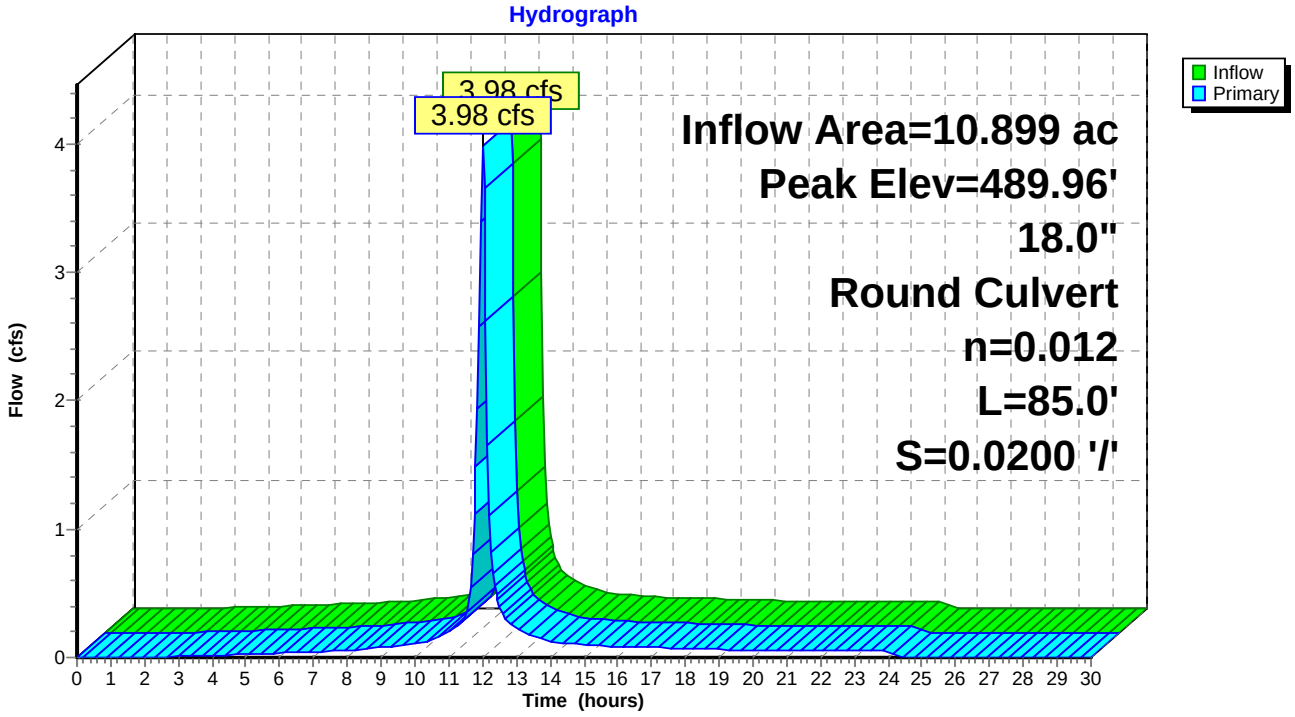
Inflow Area = 10.899 ac, 36.35% Impervious, Inflow Depth = 0.28" for 1 yr event
Inflow = 3.98 cfs @ 12.01 hrs, Volume= 0.252 af
Outflow = 3.98 cfs @ 12.01 hrs, Volume= 0.252 af, Atten= 0%, Lag= 0.0 min
Primary = 3.98 cfs @ 12.01 hrs, Volume= 0.252 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 489.96' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 85.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=3.93 cfs @ 12.01 hrs HW=489.95' (Free Discharge)
└**1=Culvert** (Inlet Controls 3.93 cfs @ 3.32 fps)

Pond 16P: CATCH BASIN



Summary for Pond 18P: CATCH BASIN

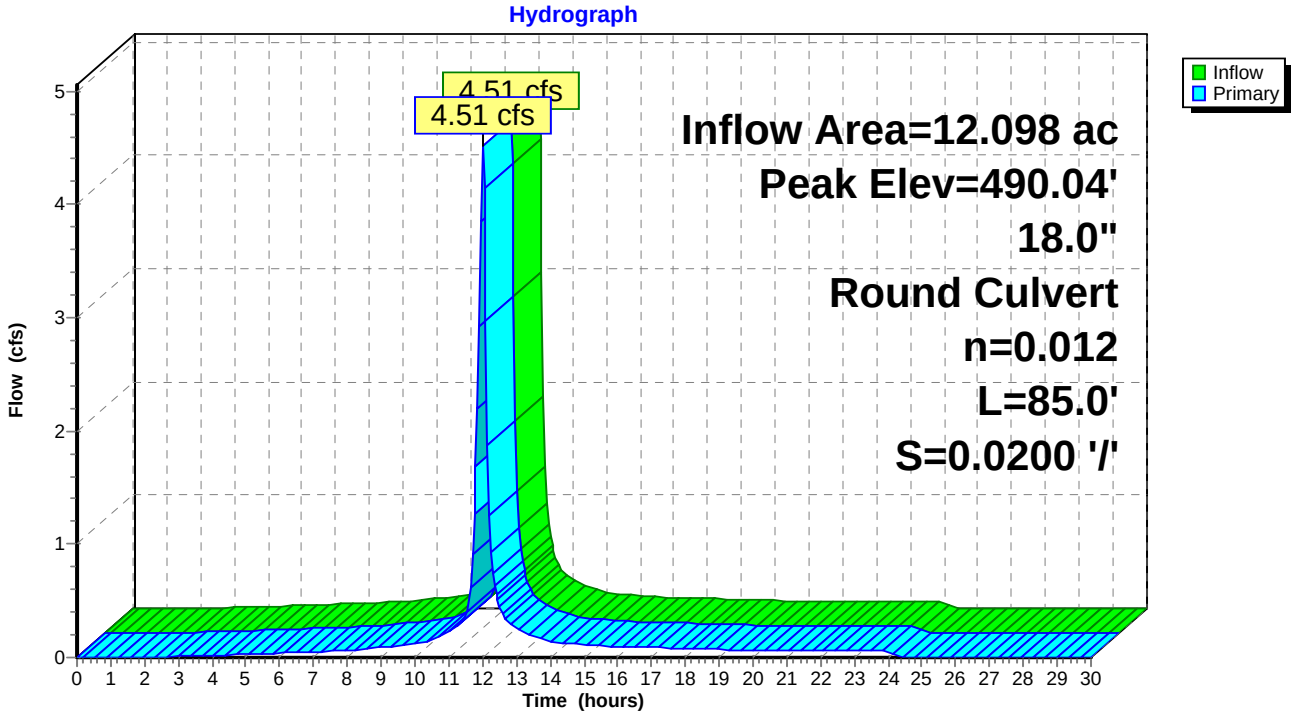
Inflow Area = 12.098 ac, 36.59% Impervious, Inflow Depth = 0.28" for 1 yr event
Inflow = 4.51 cfs @ 12.01 hrs, Volume= 0.285 af
Outflow = 4.51 cfs @ 12.01 hrs, Volume= 0.285 af, Atten= 0%, Lag= 0.0 min
Primary = 4.51 cfs @ 12.01 hrs, Volume= 0.285 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 490.04' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 85.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=4.45 cfs @ 12.01 hrs HW=490.03' (Free Discharge)
└**1=Culvert** (Inlet Controls 4.45 cfs @ 3.45 fps)

Pond 18P: CATCH BASIN



Summary for Pond 20P: CATCH BASIN

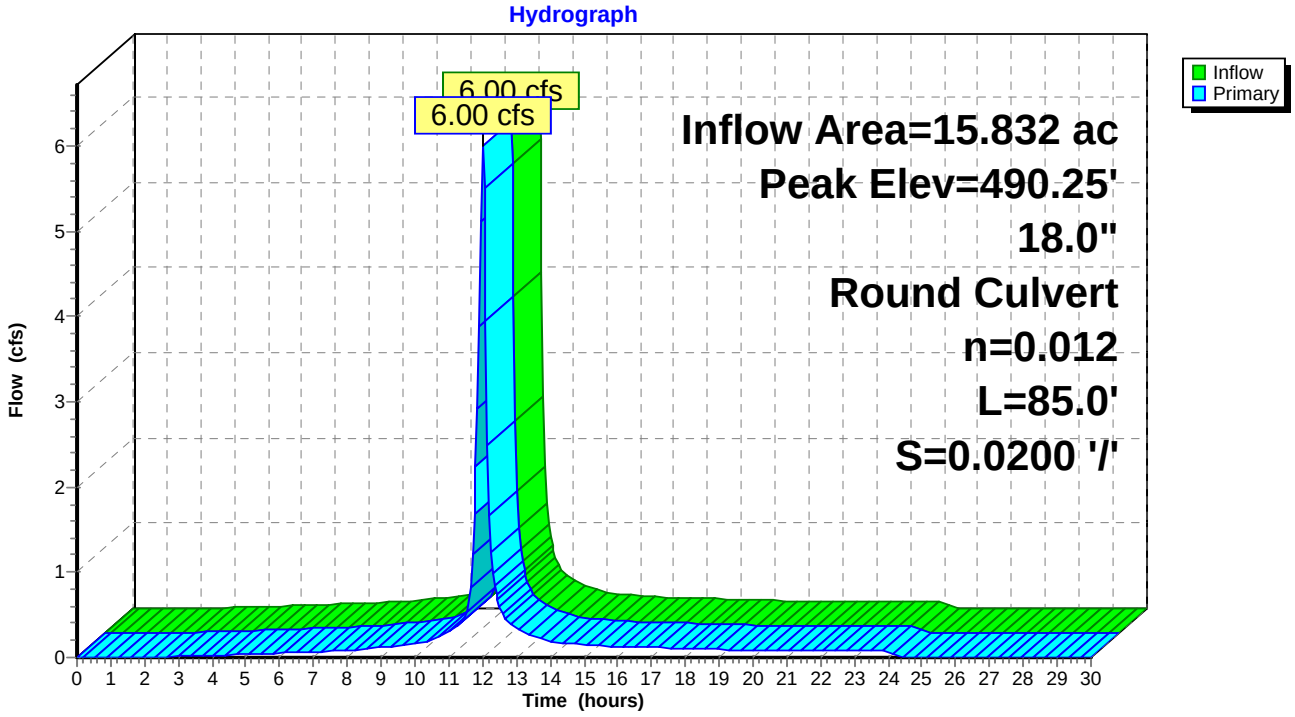
Inflow Area = 15.832 ac, 36.77% Impervious, Inflow Depth = 0.29" for 1 yr event
Inflow = 6.00 cfs @ 12.01 hrs, Volume= 0.378 af
Outflow = 6.00 cfs @ 12.01 hrs, Volume= 0.378 af, Atten= 0%, Lag= 0.0 min
Primary = 6.00 cfs @ 12.01 hrs, Volume= 0.378 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 490.25' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 85.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=5.92 cfs @ 12.01 hrs HW=490.24' (Free Discharge)
└**1=Culvert** (Inlet Controls 5.92 cfs @ 3.79 fps)

Pond 20P: CATCH BASIN



Summary for Pond 23P: CATCH BASIN

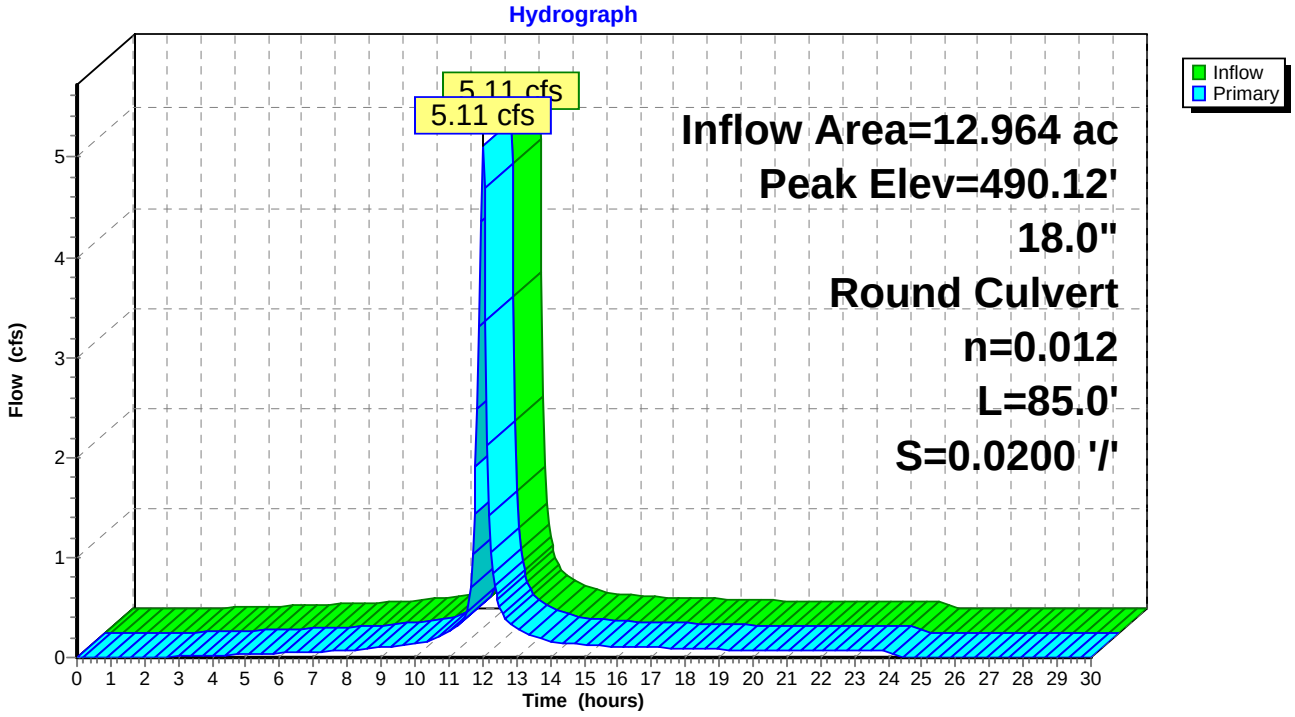
Inflow Area = 12.964 ac, 37.25% Impervious, Inflow Depth = 0.30" for 1 yr event
Inflow = 5.11 cfs @ 12.01 hrs, Volume= 0.322 af
Outflow = 5.11 cfs @ 12.01 hrs, Volume= 0.322 af, Atten= 0%, Lag= 0.0 min
Primary = 5.11 cfs @ 12.01 hrs, Volume= 0.322 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 490.12' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 85.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=5.04 cfs @ 12.01 hrs HW=490.11' (Free Discharge)
└**1=Culvert** (Inlet Controls 5.04 cfs @ 3.59 fps)

Pond 23P: CATCH BASIN



Summary for Pond 26P: CATCH BASIN

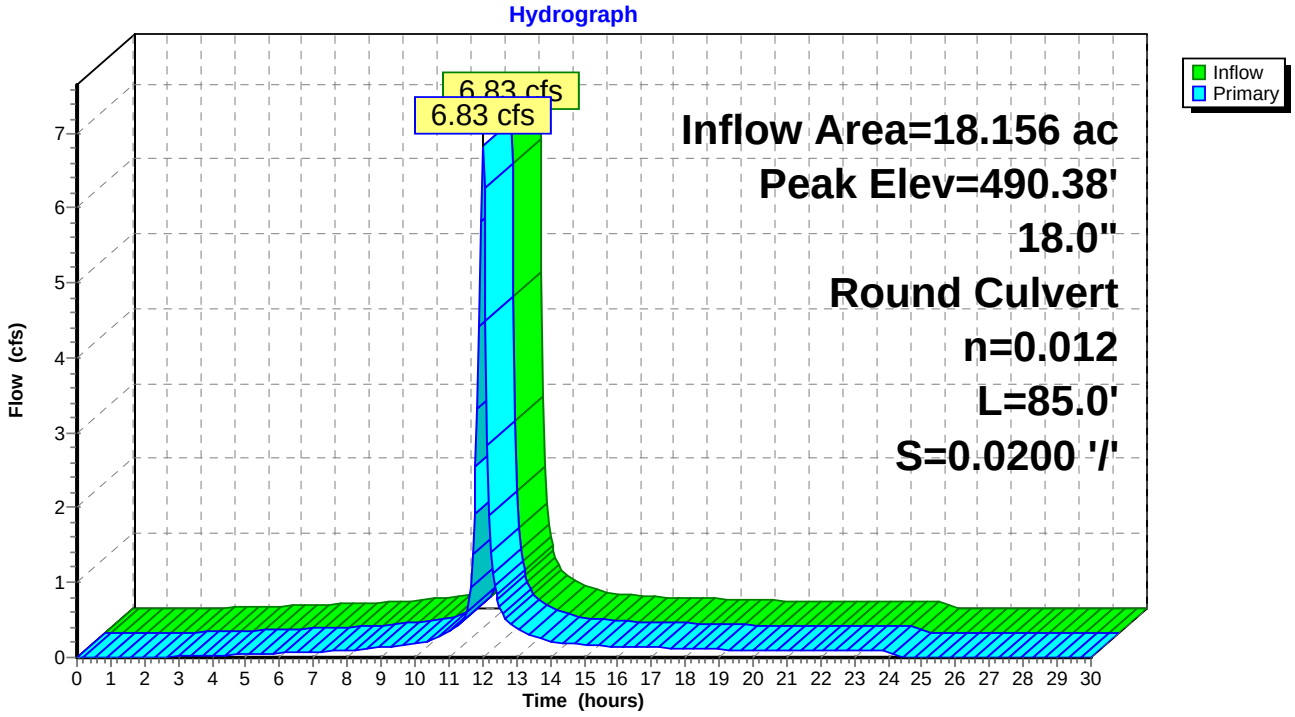
Inflow Area = 18.156 ac, 36.68% Impervious, Inflow Depth = 0.28" for 1 yr event
Inflow = 6.83 cfs @ 12.01 hrs, Volume= 0.431 af
Outflow = 6.83 cfs @ 12.01 hrs, Volume= 0.431 af, Atten= 0%, Lag= 0.0 min
Primary = 6.83 cfs @ 12.01 hrs, Volume= 0.431 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 490.38' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 85.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=6.74 cfs @ 12.01 hrs HW=490.37' (Free Discharge)
└**1=Culvert** (Inlet Controls 6.74 cfs @ 3.98 fps)

Pond 26P: CATCH BASIN



Summary for Pond 27P: CATCH BASIN

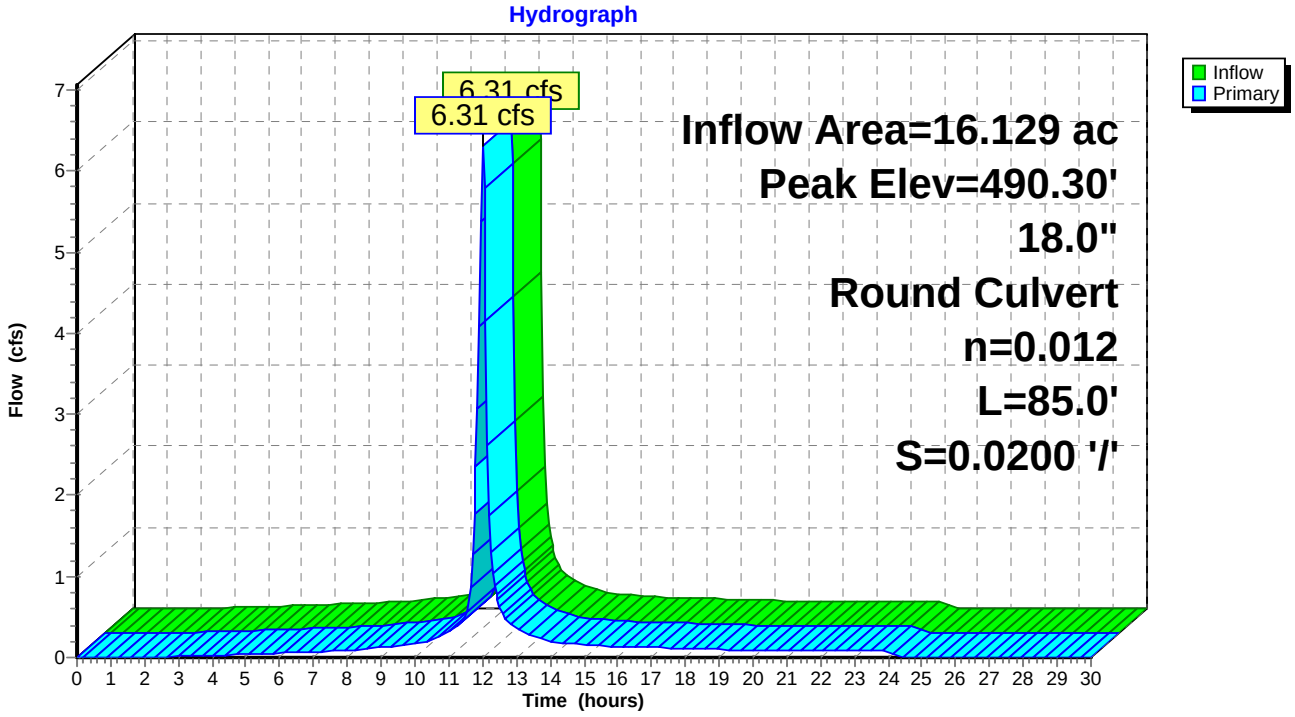
Inflow Area = 16.129 ac, 37.14% Impervious, Inflow Depth = 0.30" for 1 yr event
Inflow = 6.31 cfs @ 12.01 hrs, Volume= 0.397 af
Outflow = 6.31 cfs @ 12.01 hrs, Volume= 0.397 af, Atten= 0%, Lag= 0.0 min
Primary = 6.31 cfs @ 12.01 hrs, Volume= 0.397 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 490.30' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 85.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=6.22 cfs @ 12.01 hrs HW=490.29' (Free Discharge)
└**1=Culvert** (Inlet Controls 6.22 cfs @ 3.86 fps)

Pond 27P: CATCH BASIN

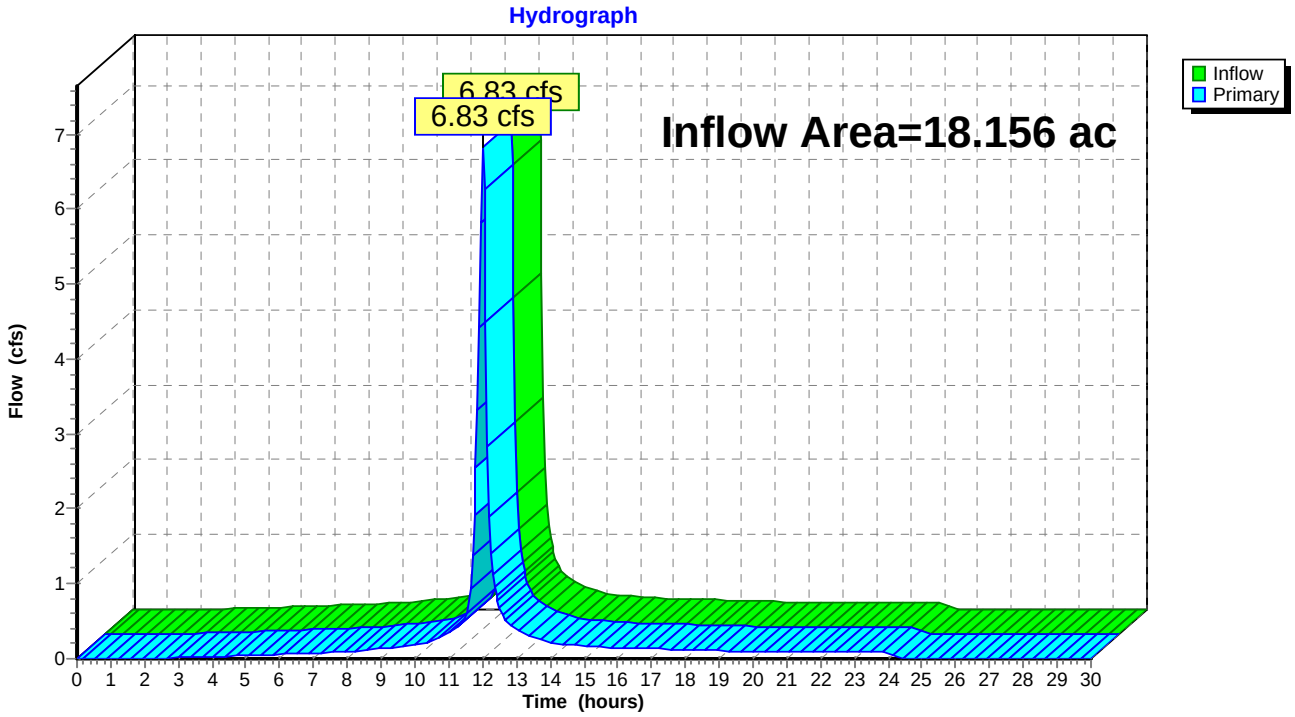


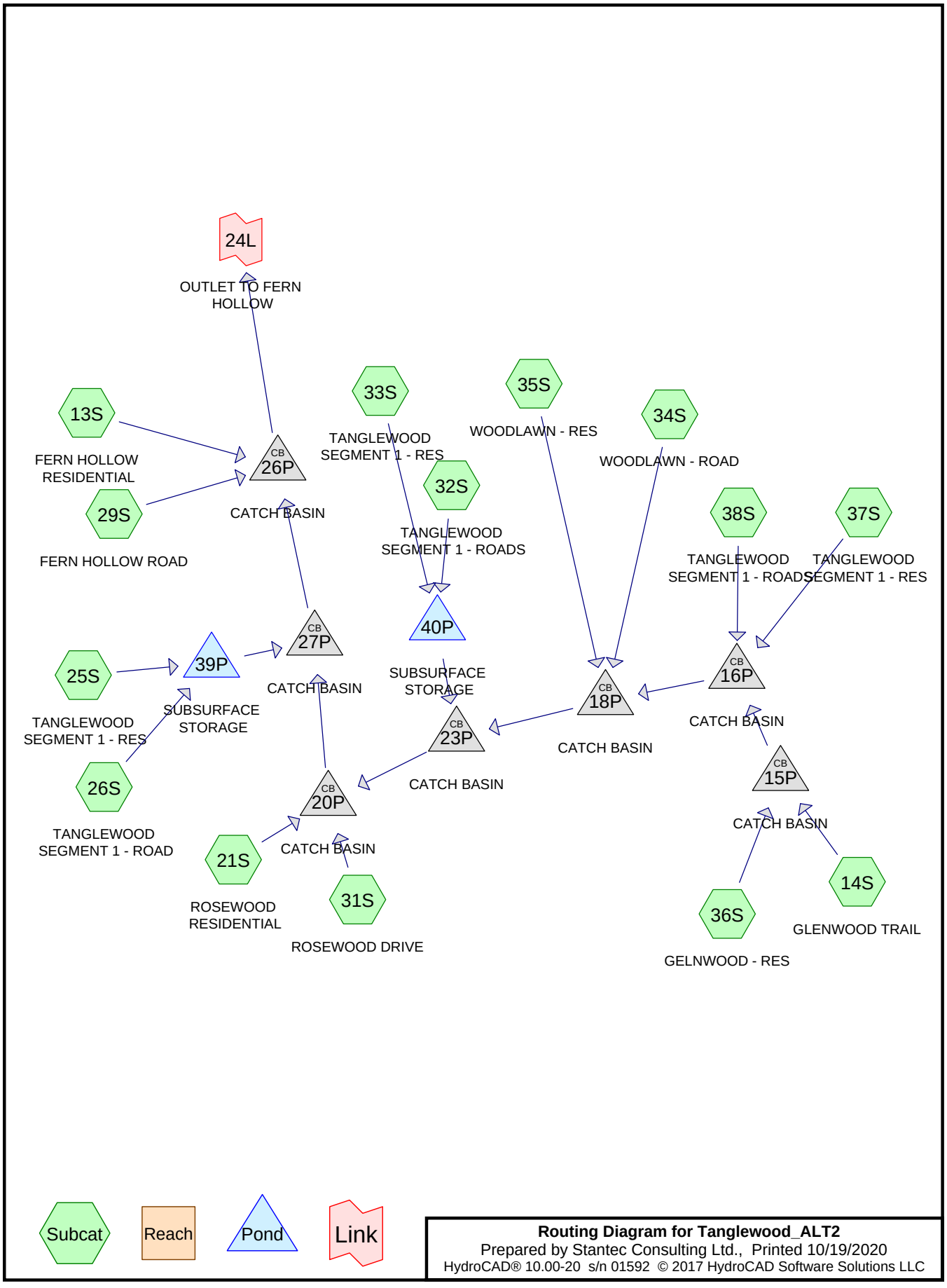
Summary for Link 24L: OUTLET TO FERN HOLLOW

Inflow Area = 18.156 ac, 36.68% Impervious, Inflow Depth = 0.28" for 1 yr event
Inflow = 6.83 cfs @ 12.01 hrs, Volume= 0.431 af
Primary = 6.83 cfs @ 12.01 hrs, Volume= 0.431 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link 24L: OUTLET TO FERN HOLLOW





Routing Diagram for Tanglewood_ALT2
Prepared by Stantec Consulting Ltd., Printed 10/19/2020

Summary for Subcatchment 13S: FERN HOLLOW RESIDENTIAL

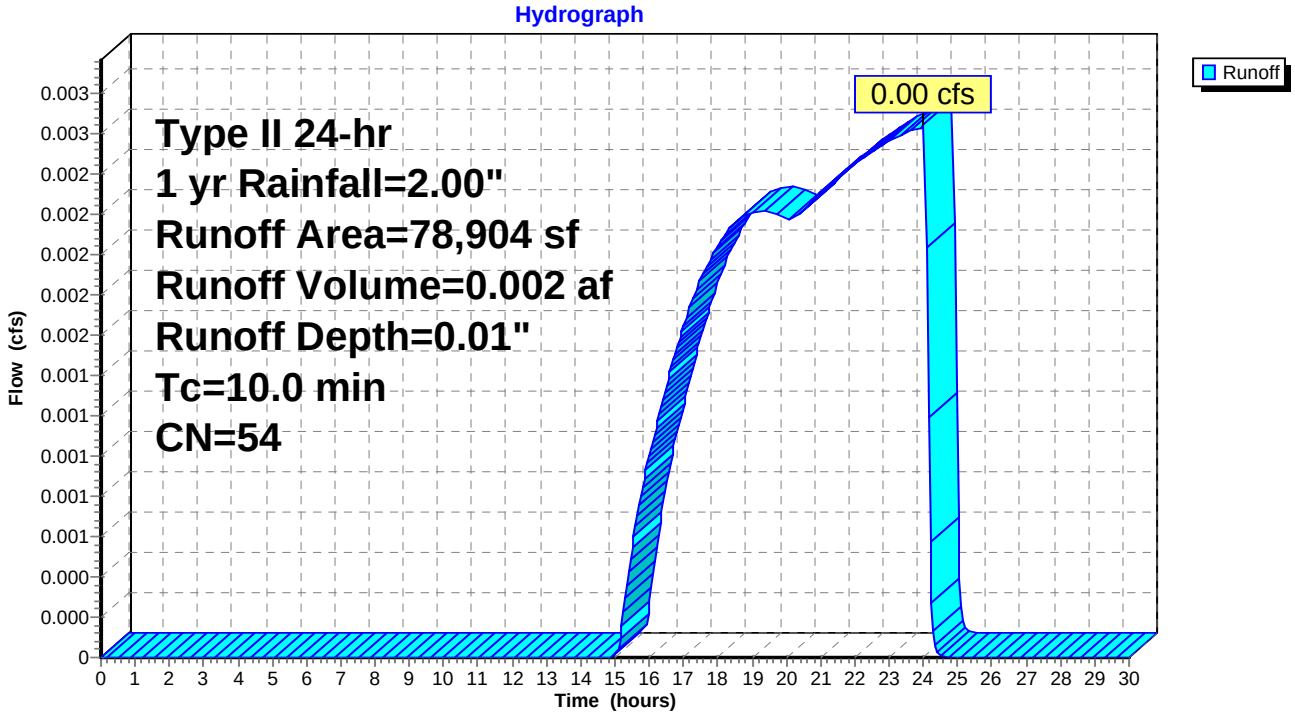
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.002 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
78,904	54	1/2 acre lots, 25% imp, HSG A
59,178		75.00% Pervious Area
19,726		25.00% Impervious Area

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

Subcatchment 13S: FERN HOLLOW RESIDENTIAL



Summary for Subcatchment 14S: GLENWOOD TRAIL

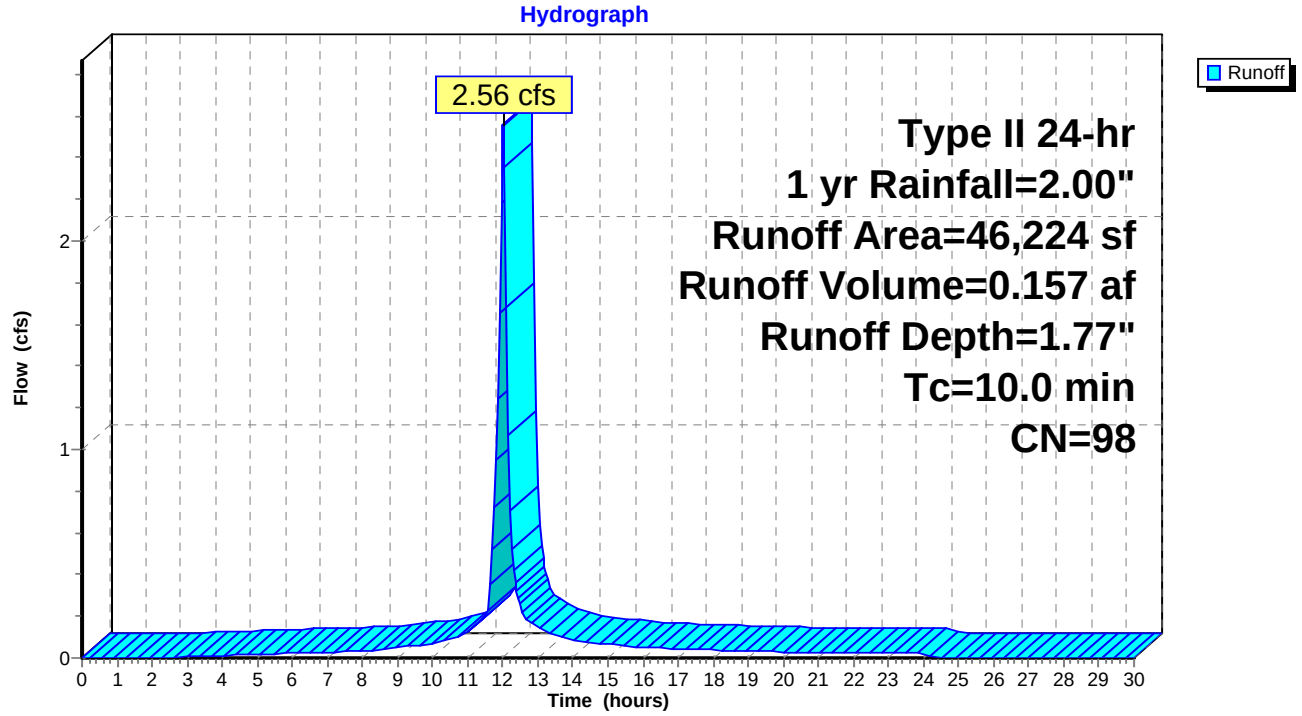
Runoff = 2.56 cfs @ 12.01 hrs, Volume= 0.157 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
46,224	98	Paved roads w/curbs & sewers, HSG A
46,224		100.00% Impervious Area

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

Subcatchment 14S: GLENWOOD TRAIL



Summary for Subcatchment 21S: ROSEWOOD RESIDENTIAL

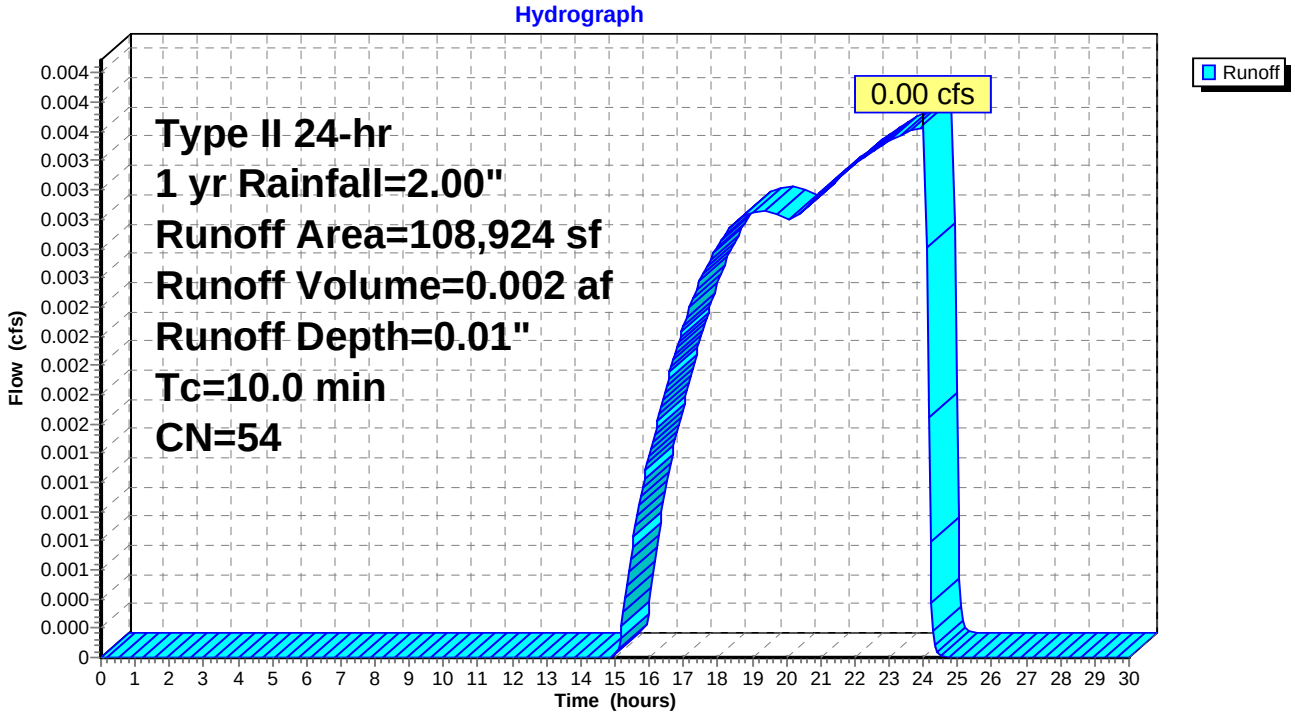
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.002 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
108,924	54	1/2 acre lots, 25% imp, HSG A
81,693		75.00% Pervious Area
27,231		25.00% Impervious Area

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

Subcatchment 21S: ROSEWOOD RESIDENTIAL



Summary for Subcatchment 25S: TANGLEWOOD SEGMENT 1 - RES

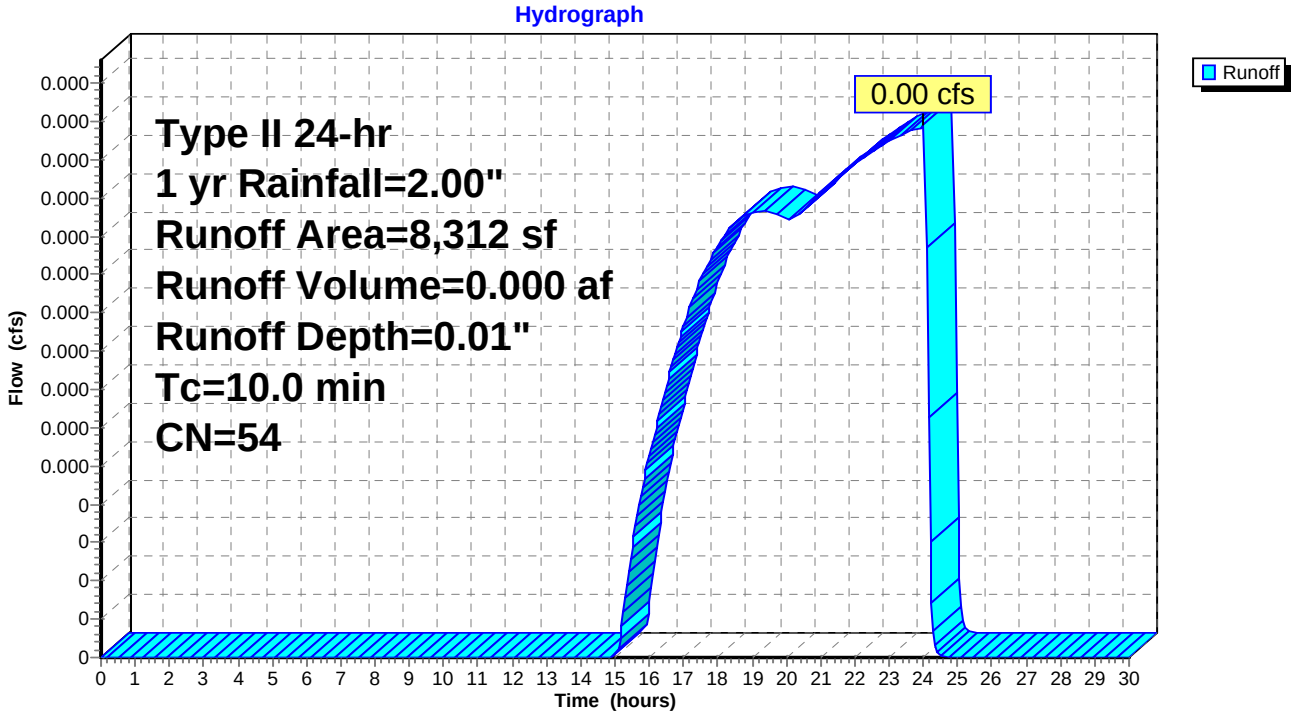
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
8,312	54	1/2 acre lots, 25% imp, HSG A
6,234		75.00% Pervious Area
2,078		25.00% Impervious Area

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

Subcatchment 25S: TANGLEWOOD SEGMENT 1 - RES



Summary for Subcatchment 26S: TANGLEWOOD SEGMENT 1 - ROAD

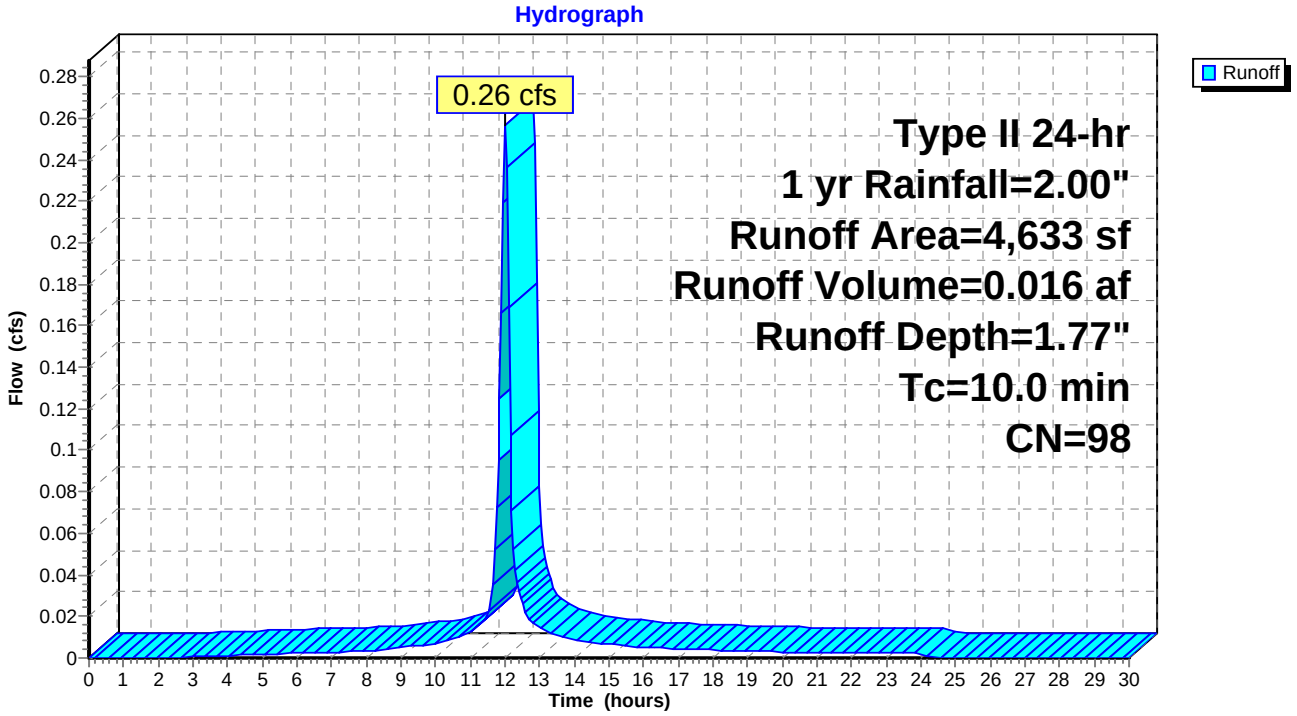
Runoff = 0.26 cfs @ 12.01 hrs, Volume= 0.016 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
4,633	98	Paved roads w/curbs & sewers, HSG A
4,633		100.00% Impervious Area

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

Subcatchment 26S: TANGLEWOOD SEGMENT 1 - ROAD



Summary for Subcatchment 29S: FERN HOLLOW ROAD

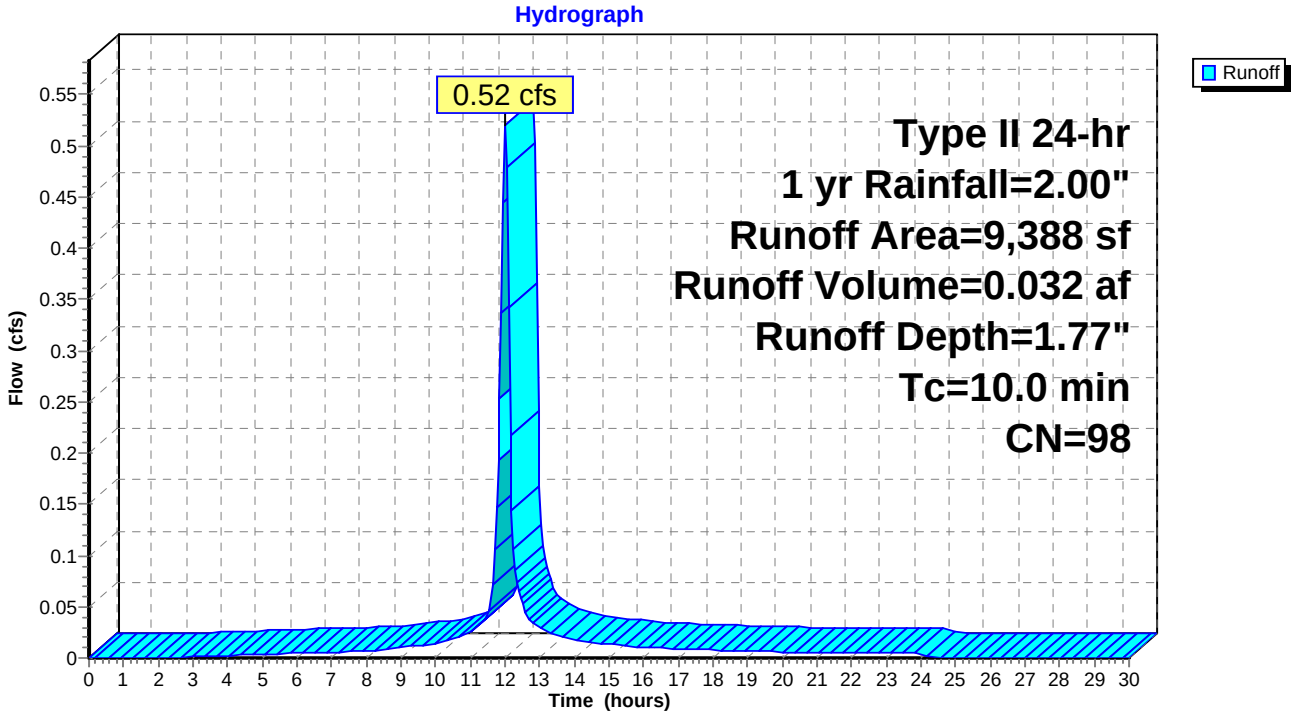
Runoff = 0.52 cfs @ 12.01 hrs, Volume= 0.032 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
9,388	98	Paved roads w/curbs & sewers, HSG A
9,388		100.00% Impervious Area

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

Subcatchment 29S: FERN HOLLOW ROAD



Summary for Subcatchment 31S: ROSEWOOD DRIVE

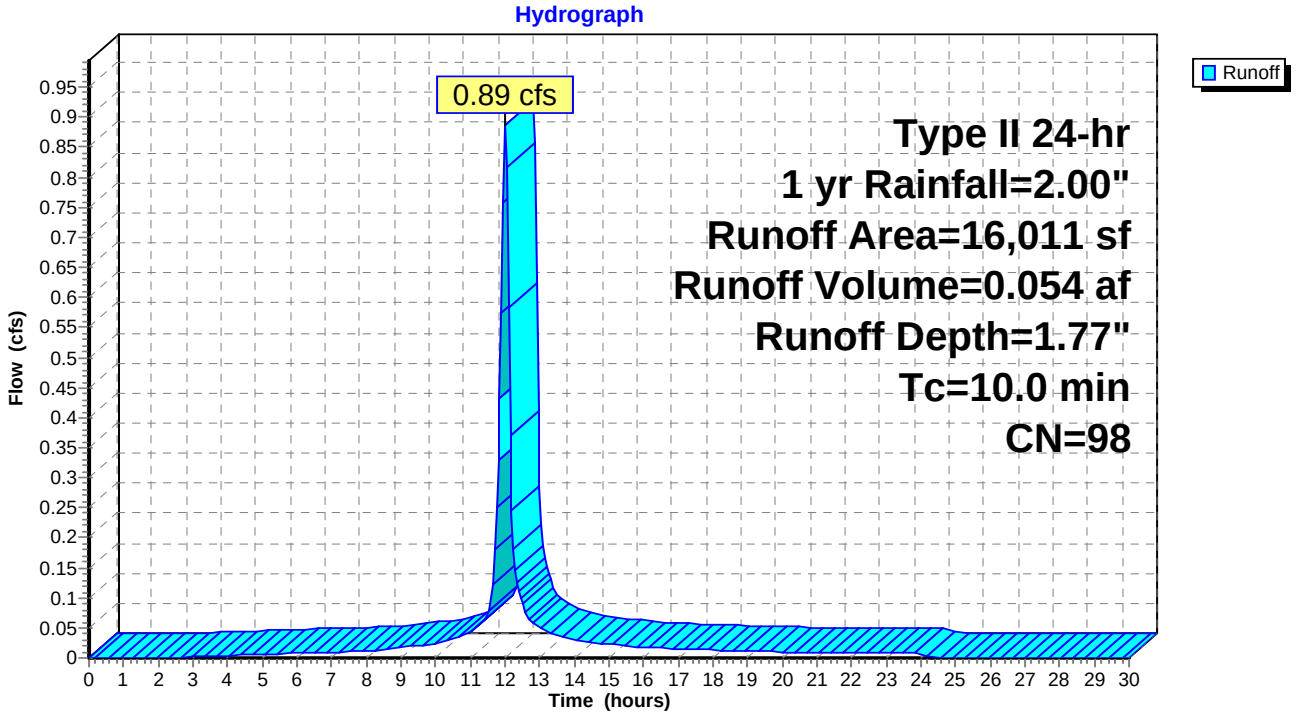
Runoff = 0.89 cfs @ 12.01 hrs, Volume= 0.054 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
16,011	98	Paved roads w/curbs & sewers, HSG A
16,011		100.00% Impervious Area

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

Subcatchment 31S: ROSEWOOD DRIVE



Summary for Subcatchment 32S: TANGLEWOOD SEGMENT 1 - ROADS

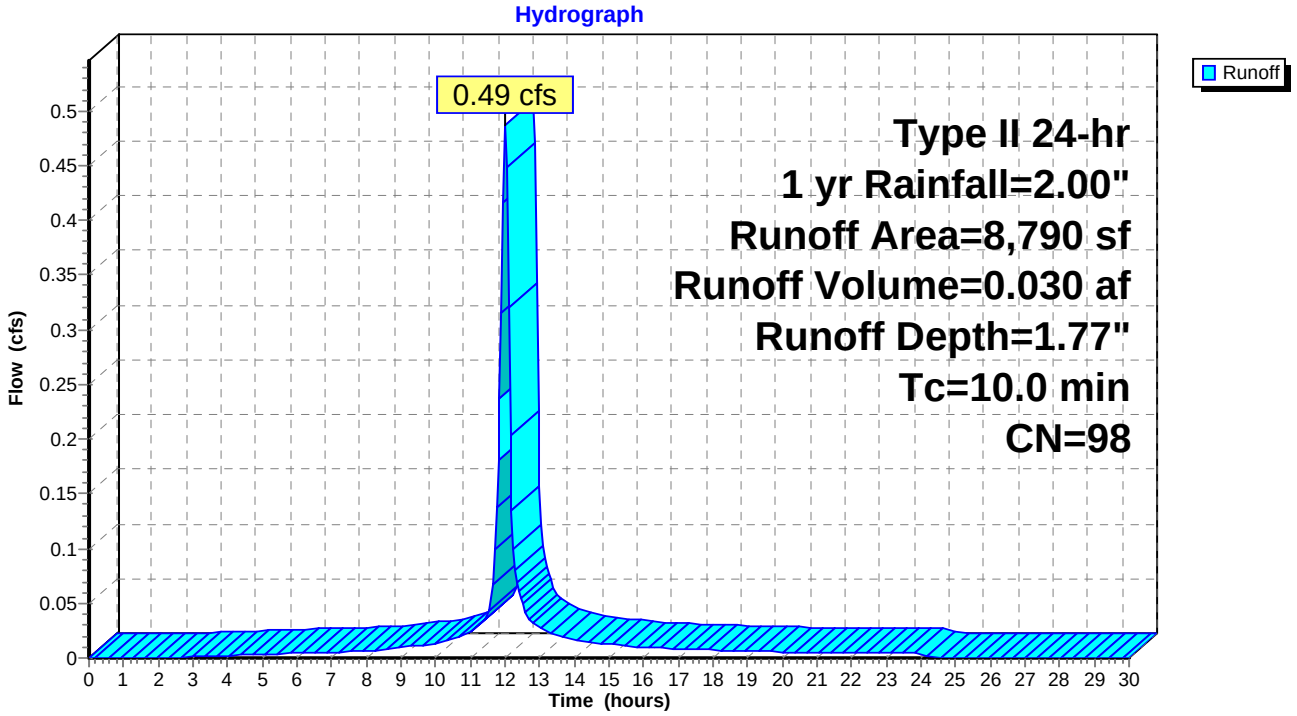
Runoff = 0.49 cfs @ 12.01 hrs, Volume= 0.030 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
8,790	98	Paved roads w/curbs & sewers, HSG A
8,790		100.00% Impervious Area

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

Subcatchment 32S: TANGLEWOOD SEGMENT 1 - ROADS



Summary for Subcatchment 33S: TANGLEWOOD SEGMENT 1 - RES

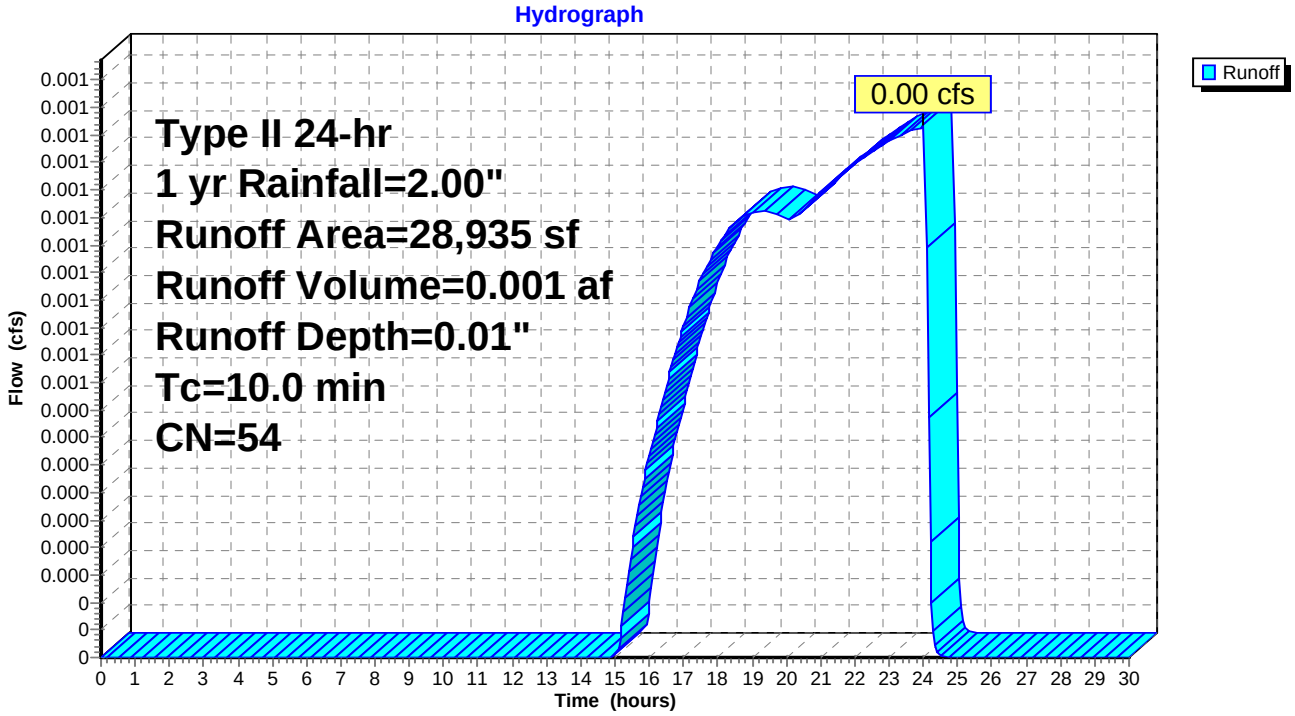
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.001 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
28,935	54	1/2 acre lots, 25% imp, HSG A
21,701		75.00% Pervious Area
7,234		25.00% Impervious Area

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

Subcatchment 33S: TANGLEWOOD SEGMENT 1 - RES



Summary for Subcatchment 34S: WOODLAWN - ROAD

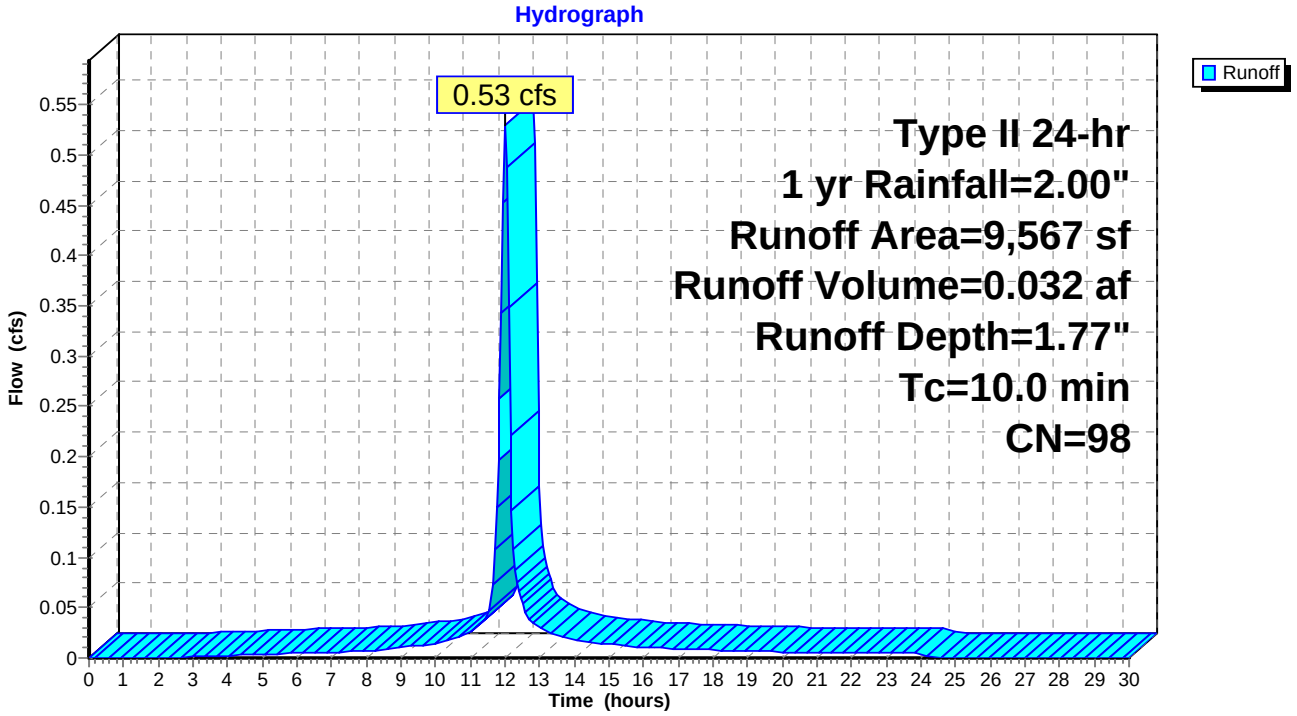
Runoff = 0.53 cfs @ 12.01 hrs, Volume= 0.032 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
9,567	98	Paved roads w/curbs & sewers, HSG A
9,567		100.00% Impervious Area

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

Subcatchment 34S: WOODLAWN - ROAD



Summary for Subcatchment 35S: WOODLAWN - RES

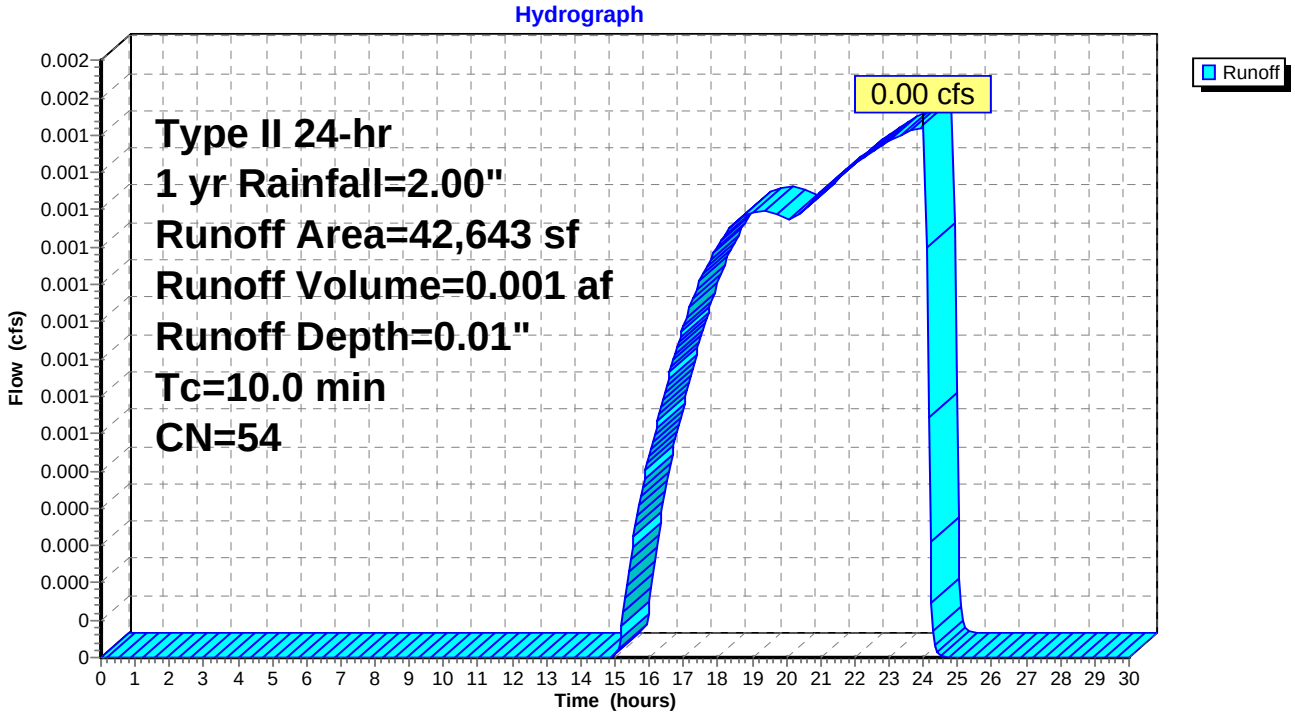
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.001 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
42,643	54	1/2 acre lots, 25% imp, HSG A
31,982		75.00% Pervious Area
10,661		25.00% Impervious Area

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

Subcatchment 35S: WOODLAWN - RES



Summary for Subcatchment 36S: GELNWOOD - RES

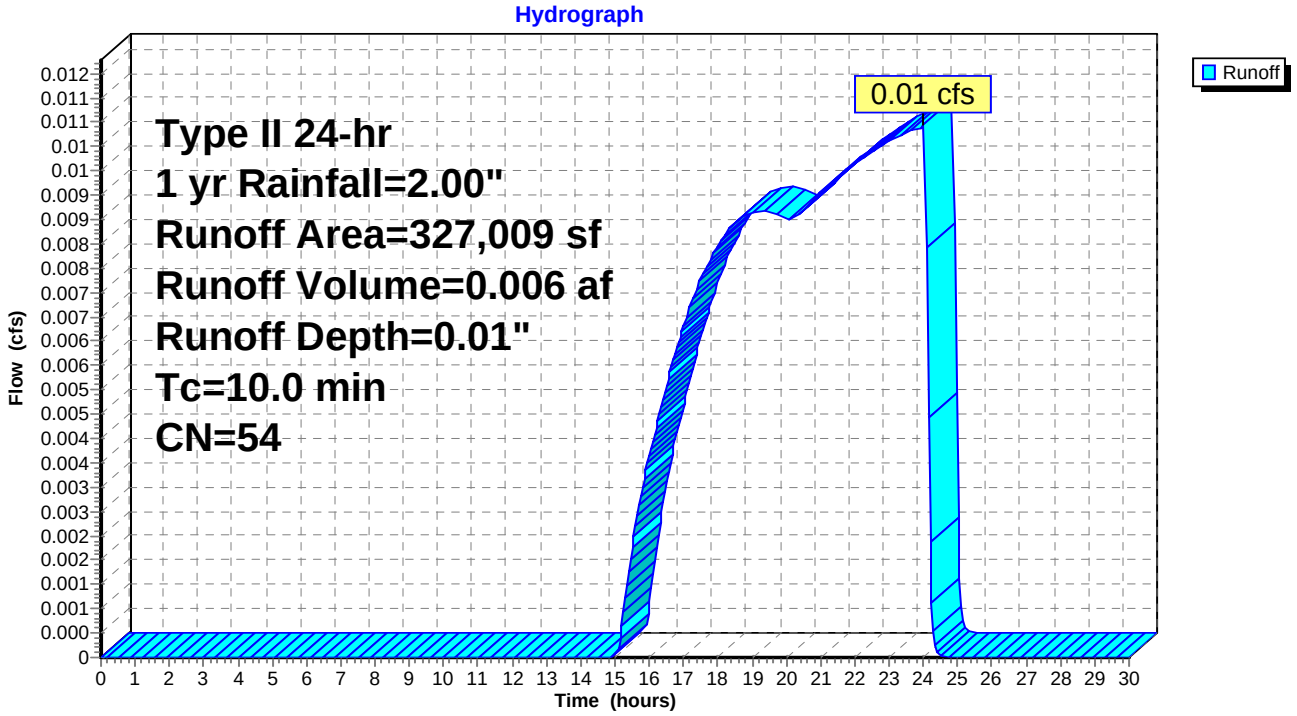
Runoff = 0.01 cfs @ 24.00 hrs, Volume= 0.006 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
327,009	54	1/2 acre lots, 25% imp, HSG A
245,257		75.00% Pervious Area
81,752		25.00% Impervious Area

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

Subcatchment 36S: GELNWOOD - RES



Summary for Subcatchment 37S: TANGLEWOOD SEGMENT 1 - RES

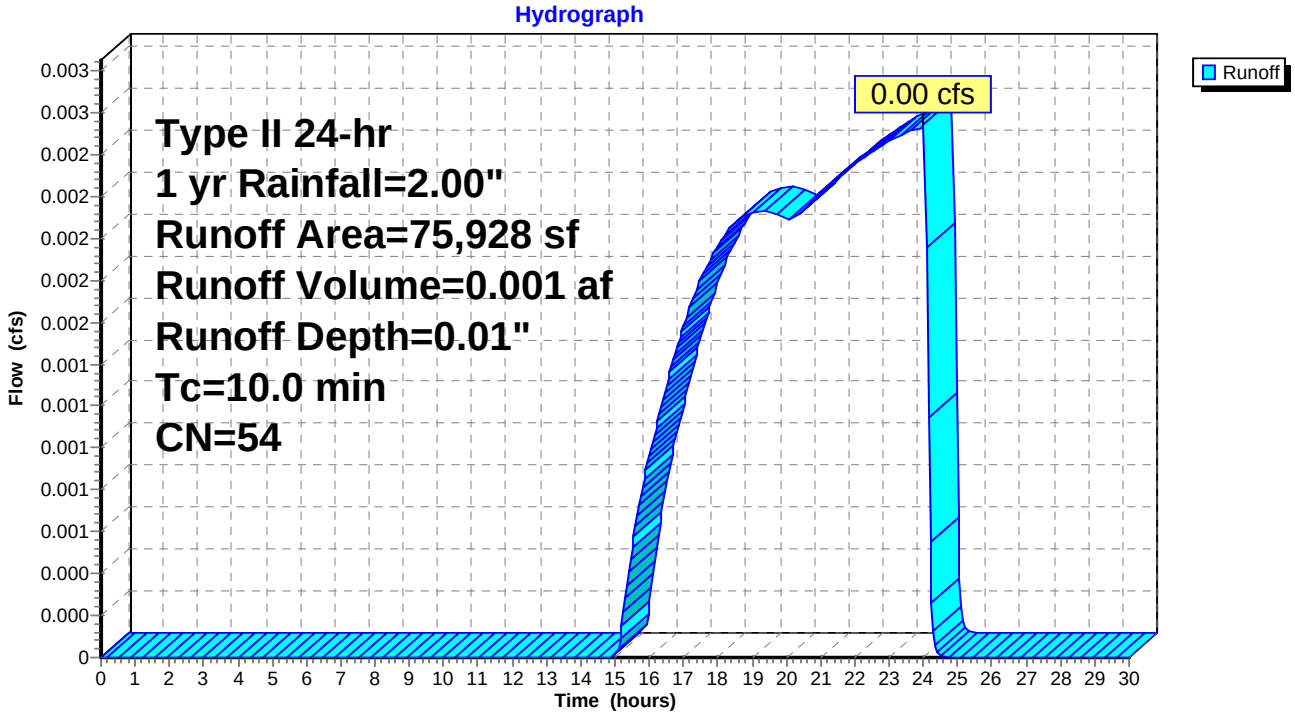
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.001 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
75,928	54	1/2 acre lots, 25% imp, HSG A
56,946		75.00% Pervious Area
18,982		25.00% Impervious Area

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

Subcatchment 37S: TANGLEWOOD SEGMENT 1 - RES



Summary for Subcatchment 38S: TANGLEWOOD SEGMENT 1 - ROADS

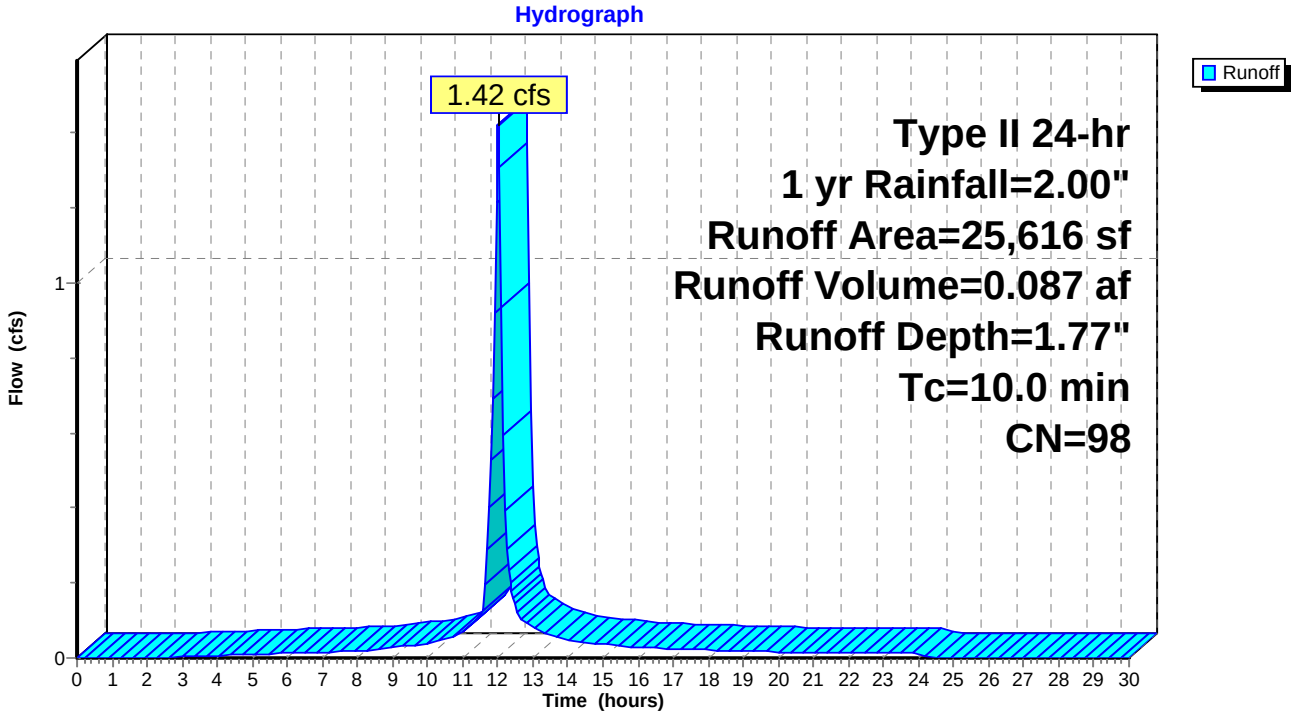
Runoff = 1.42 cfs @ 12.01 hrs, Volume= 0.087 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
25,616	98	Paved roads w/curbs & sewers, HSG A
25,616		100.00% Impervious Area

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

Subcatchment 38S: TANGLEWOOD SEGMENT 1 - ROADS



Summary for Pond 15P: CATCH BASIN

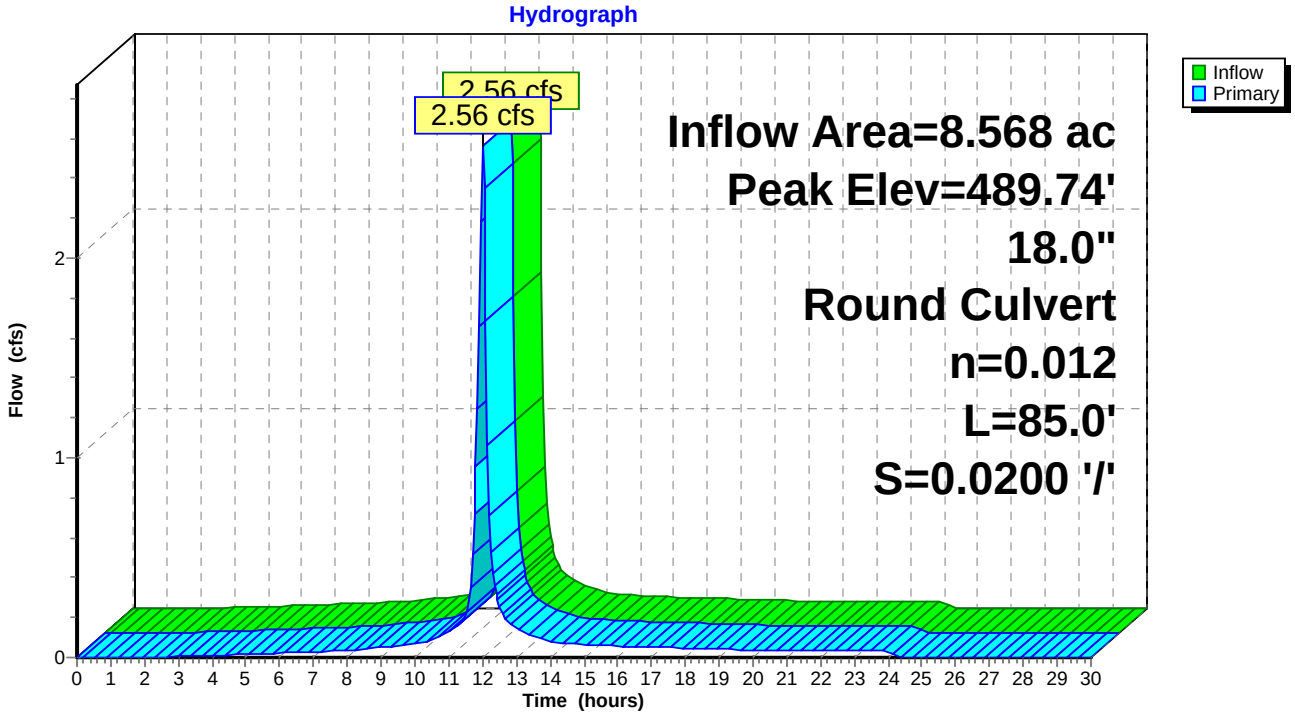
Inflow Area = 8.568 ac, 34.29% Impervious, Inflow Depth = 0.23" for 1 yr event
Inflow = 2.56 cfs @ 12.01 hrs, Volume= 0.163 af
Outflow = 2.56 cfs @ 12.01 hrs, Volume= 0.163 af, Atten= 0%, Lag= 0.0 min
Primary = 2.56 cfs @ 12.01 hrs, Volume= 0.163 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 489.74' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 85.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=2.53 cfs @ 12.01 hrs HW=489.74' (Free Discharge)
└**1=Culvert** (Inlet Controls 2.53 cfs @ 2.92 fps)

Pond 15P: CATCH BASIN



Summary for Pond 16P: CATCH BASIN

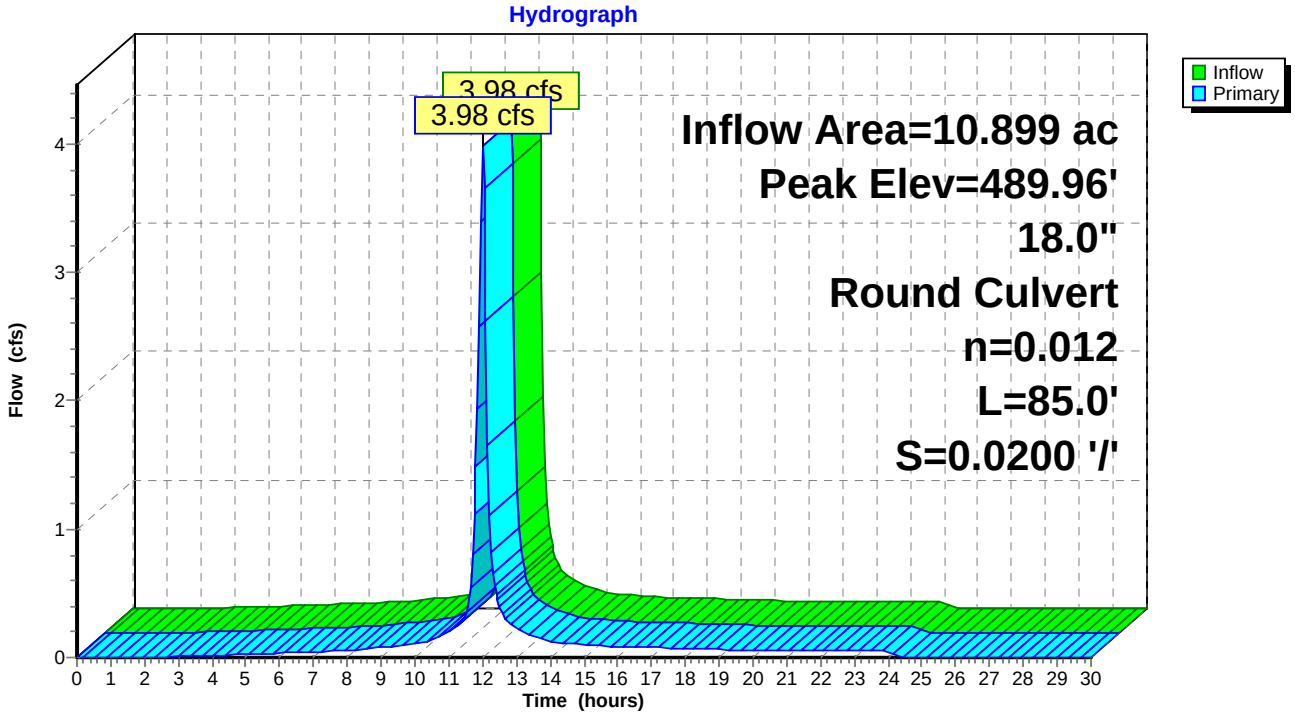
Inflow Area = 10.899 ac, 36.35% Impervious, Inflow Depth = 0.28" for 1 yr event
Inflow = 3.98 cfs @ 12.01 hrs, Volume= 0.252 af
Outflow = 3.98 cfs @ 12.01 hrs, Volume= 0.252 af, Atten= 0%, Lag= 0.0 min
Primary = 3.98 cfs @ 12.01 hrs, Volume= 0.252 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 489.96' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 85.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=3.93 cfs @ 12.01 hrs HW=489.95' (Free Discharge)
└**1=Culvert** (Inlet Controls 3.93 cfs @ 3.32 fps)

Pond 16P: CATCH BASIN



Summary for Pond 18P: CATCH BASIN

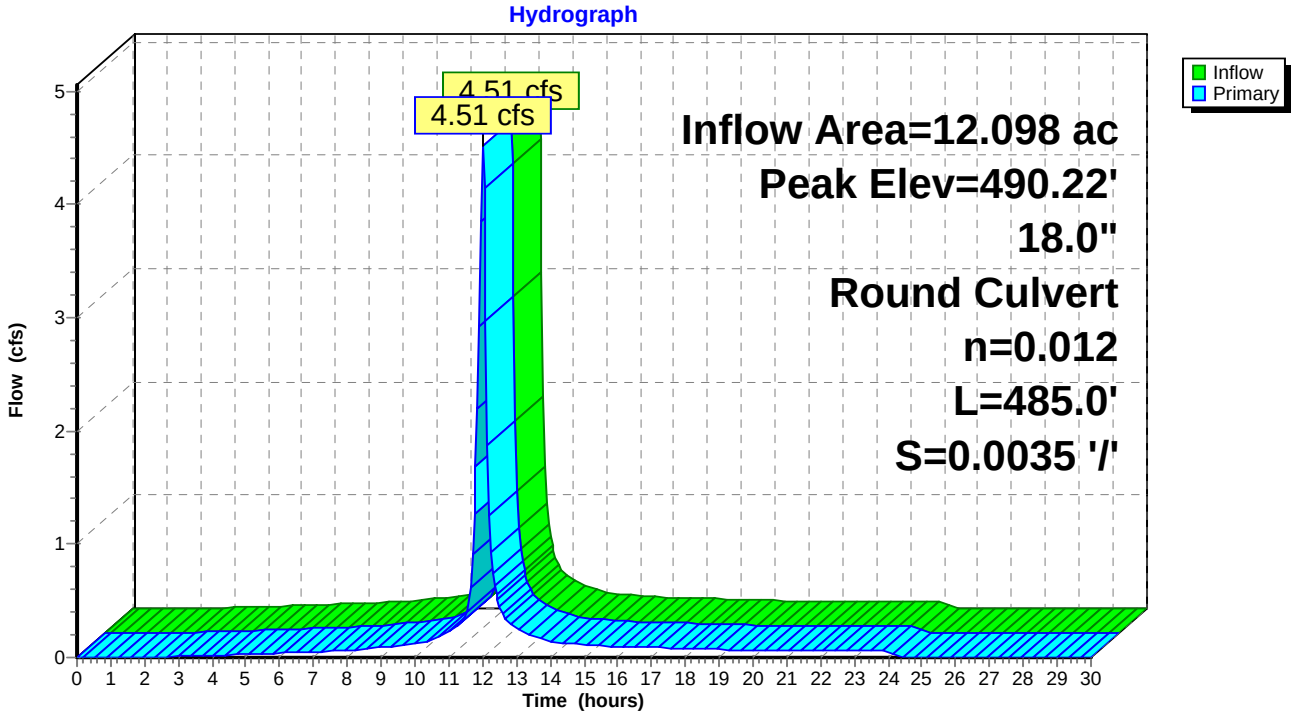
Inflow Area = 12.098 ac, 36.59% Impervious, Inflow Depth = 0.28" for 1 yr event
Inflow = 4.51 cfs @ 12.01 hrs, Volume= 0.285 af
Outflow = 4.51 cfs @ 12.01 hrs, Volume= 0.285 af, Atten= 0%, Lag= 0.0 min
Primary = 4.51 cfs @ 12.01 hrs, Volume= 0.285 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 490.22' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 485.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0035 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=4.45 cfs @ 12.01 hrs HW=490.21' (Free Discharge)
└**1=Culvert** (Barrel Controls 4.45 cfs @ 4.00 fps)

Pond 18P: CATCH BASIN



Summary for Pond 20P: CATCH BASIN

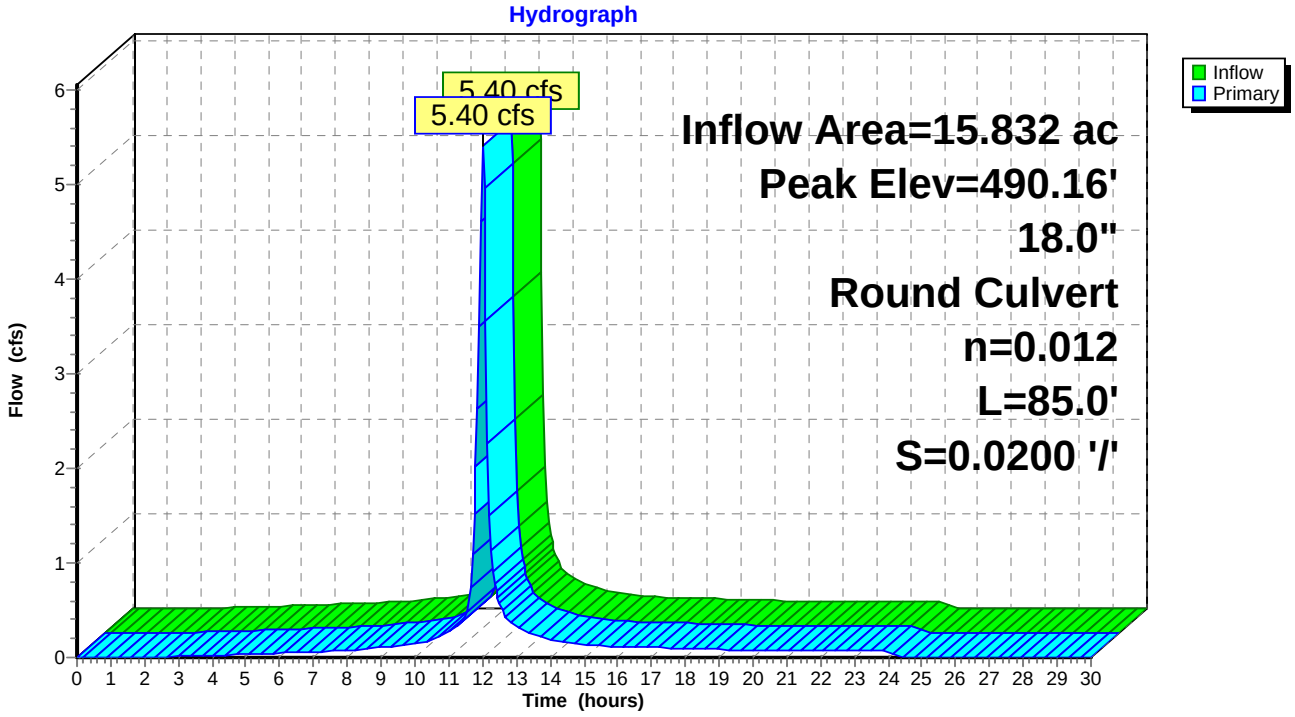
Inflow Area = 15.832 ac, 36.55% Impervious, Inflow Depth = 0.26" for 1 yr event
Inflow = 5.40 cfs @ 12.01 hrs, Volume= 0.344 af
Outflow = 5.40 cfs @ 12.01 hrs, Volume= 0.344 af, Atten= 0%, Lag= 0.0 min
Primary = 5.40 cfs @ 12.01 hrs, Volume= 0.344 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 490.16' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 85.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=5.33 cfs @ 12.01 hrs HW=490.15' (Free Discharge)
└**1=Culvert** (Inlet Controls 5.33 cfs @ 3.66 fps)

Pond 20P: CATCH BASIN



Summary for Pond 23P: CATCH BASIN

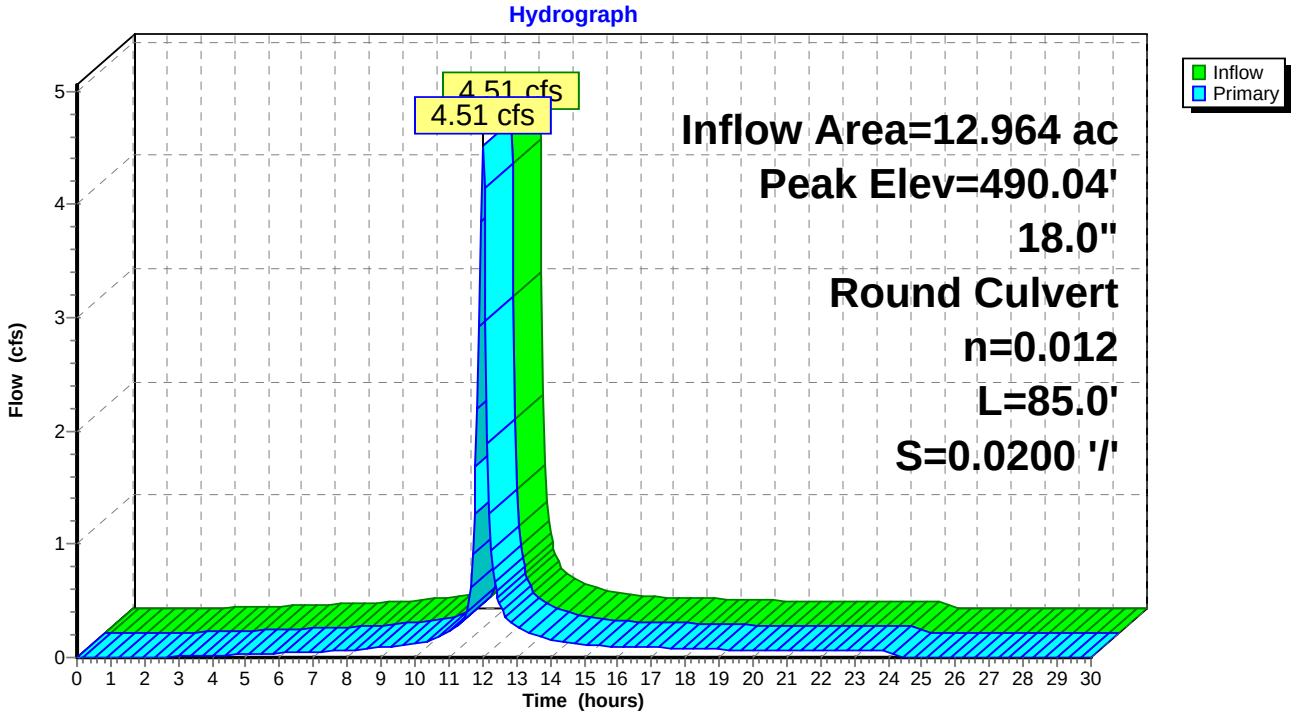
Inflow Area = 12.964 ac, 36.98% Impervious, Inflow Depth = 0.27" for 1 yr event
Inflow = 4.51 cfs @ 12.01 hrs, Volume= 0.287 af
Outflow = 4.51 cfs @ 12.01 hrs, Volume= 0.287 af, Atten= 0%, Lag= 0.0 min
Primary = 4.51 cfs @ 12.01 hrs, Volume= 0.287 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 490.04' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 85.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=4.45 cfs @ 12.01 hrs HW=490.03' (Free Discharge)
└**1=Culvert** (Inlet Controls 4.45 cfs @ 3.45 fps)

Pond 23P: CATCH BASIN



Summary for Pond 26P: CATCH BASIN

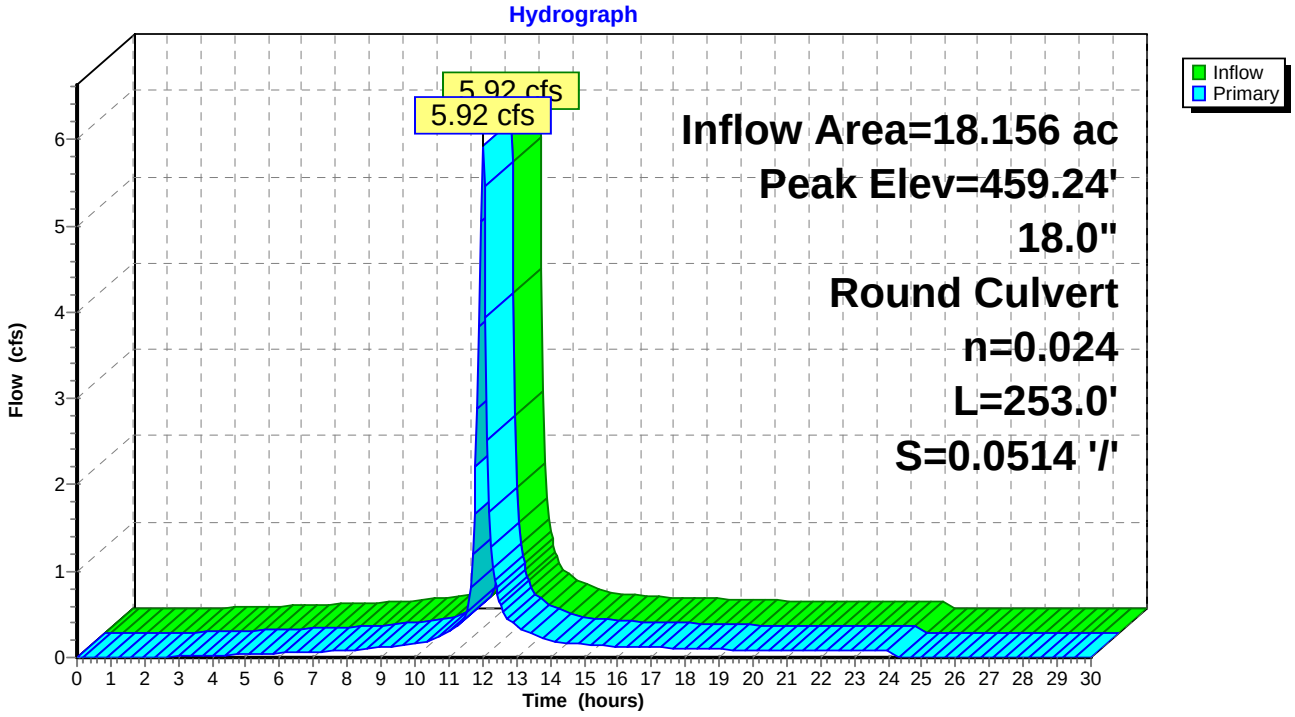
Inflow Area = 18.156 ac, 36.40% Impervious, Inflow Depth = 0.25" for 1 yr event
Inflow = 5.92 cfs @ 12.01 hrs, Volume= 0.381 af
Outflow = 5.92 cfs @ 12.01 hrs, Volume= 0.381 af, Atten= 0%, Lag= 0.0 min
Primary = 5.92 cfs @ 12.01 hrs, Volume= 0.381 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 459.24' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	458.00'	**18.0" Round Culvert** L= 253.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 458.00' / 445.00' S= 0.0514 '/' Cc= 0.900 n= 0.024, Flow Area= 1.77 sf

Primary OutFlow Max=5.84 cfs @ 12.01 hrs HW=459.23' (Free Discharge)
└**1=Culvert** (Inlet Controls 5.84 cfs @ 3.77 fps)

Pond 26P: CATCH BASIN



Summary for Pond 27P: CATCH BASIN

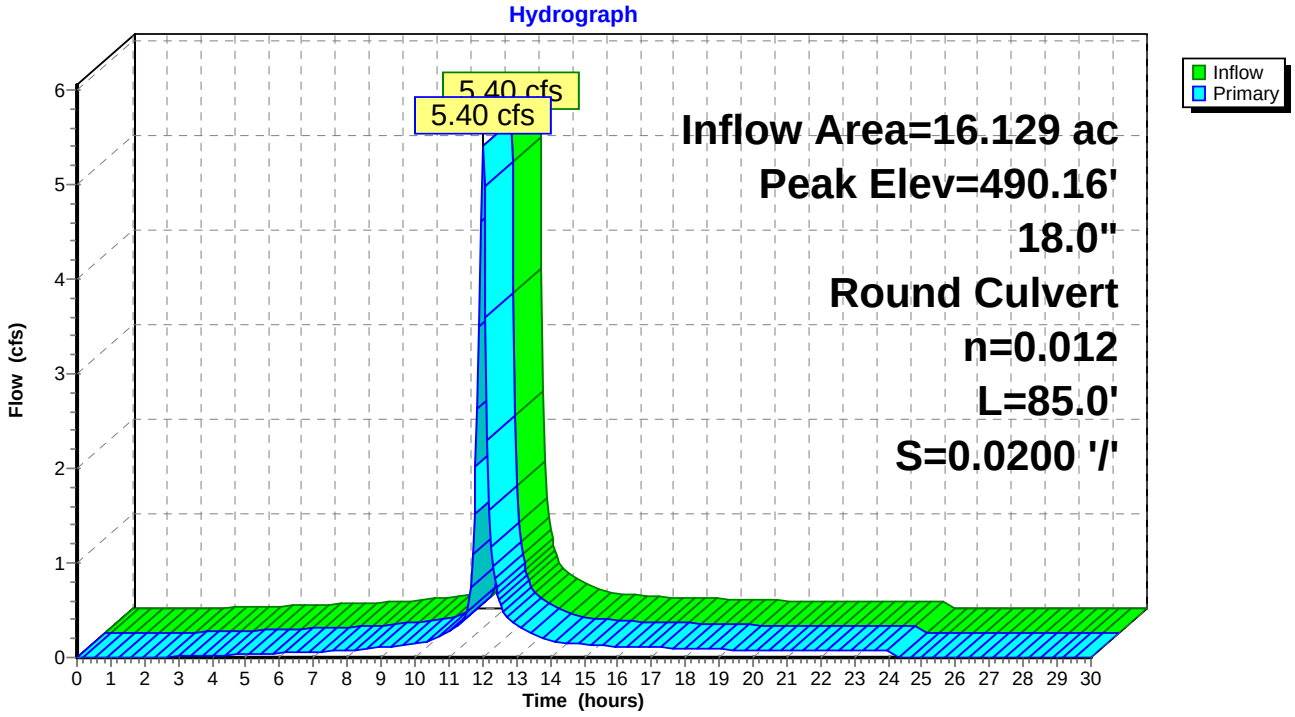
Inflow Area = 16.129 ac, 36.83% Impervious, Inflow Depth = 0.26" for 1 yr event
Inflow = 5.40 cfs @ 12.01 hrs, Volume= 0.347 af
Outflow = 5.40 cfs @ 12.01 hrs, Volume= 0.347 af, Atten= 0%, Lag= 0.0 min
Primary = 5.40 cfs @ 12.01 hrs, Volume= 0.347 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 490.16' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 85.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=5.33 cfs @ 12.01 hrs HW=490.15' (Free Discharge)
└**1=Culvert** (Inlet Controls 5.33 cfs @ 3.66 fps)

Pond 27P: CATCH BASIN



Summary for Pond 39P: SUBSURFACE STORAGE

Inflow Area = 0.297 ac, 51.84% Impervious, Inflow Depth = 0.64" for 1 yr event
Inflow = 0.26 cfs @ 12.01 hrs, Volume= 0.016 af
Outflow = 0.05 cfs @ 12.25 hrs, Volume= 0.016 af, Atten= 79%, Lag= 14.8 min
Discarded = 0.01 cfs @ 12.25 hrs, Volume= 0.012 af
Primary = 0.04 cfs @ 12.25 hrs, Volume= 0.003 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 450.76' @ 12.25 hrs Surf.Area= 0.021 ac Storage= 0.006 af

Plug-Flow detention time= 127.5 min calculated for 0.016 af (100% of inflow)
Center-of-Mass det. time= 127.4 min (899.4 - 772.0)

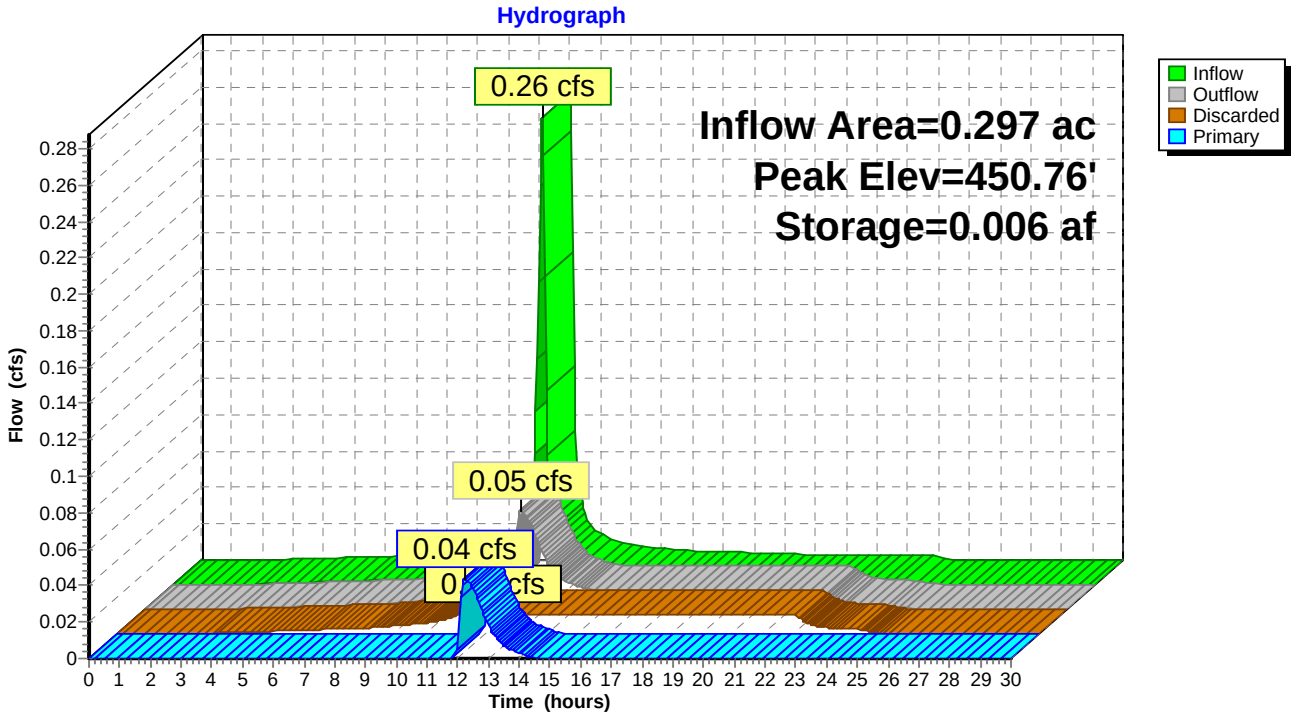
Volume	Invert	Avail.Storage	Storage Description
#1	450.00'	0.033 af	**5.00'W x 180.00'L x 4.00'H Prismatoid** 0.083 af Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	450.50'	**2.0" Vert. Orifice/Grate** C= 0.600
#2	Discarded	450.00'	**0.500 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 10.00'

Discarded OutFlow Max=0.01 cfs @ 12.25 hrs HW=450.76' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=0.04 cfs @ 12.25 hrs HW=450.76' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 0.04 cfs @ 2.00 fps)

Pond 39P: SUBSURFACE STORAGE



Summary for Pond 40P: SUBSURFACE STORAGE

Inflow Area = 0.866 ac, 42.48% Impervious, Inflow Depth = 0.42" for 1 yr event
Inflow = 0.49 cfs @ 12.01 hrs, Volume= 0.030 af
Outflow = 0.05 cfs @ 12.50 hrs, Volume= 0.030 af, Atten= 90%, Lag= 29.5 min
Discarded = 0.03 cfs @ 12.50 hrs, Volume= 0.028 af
Primary = 0.02 cfs @ 12.50 hrs, Volume= 0.002 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 450.64' @ 12.50 hrs Surf.Area= 0.051 ac Storage= 0.013 af

Plug-Flow detention time= 148.4 min calculated for 0.030 af (100% of inflow)
Center-of-Mass det. time= 148.2 min (923.9 - 775.7)

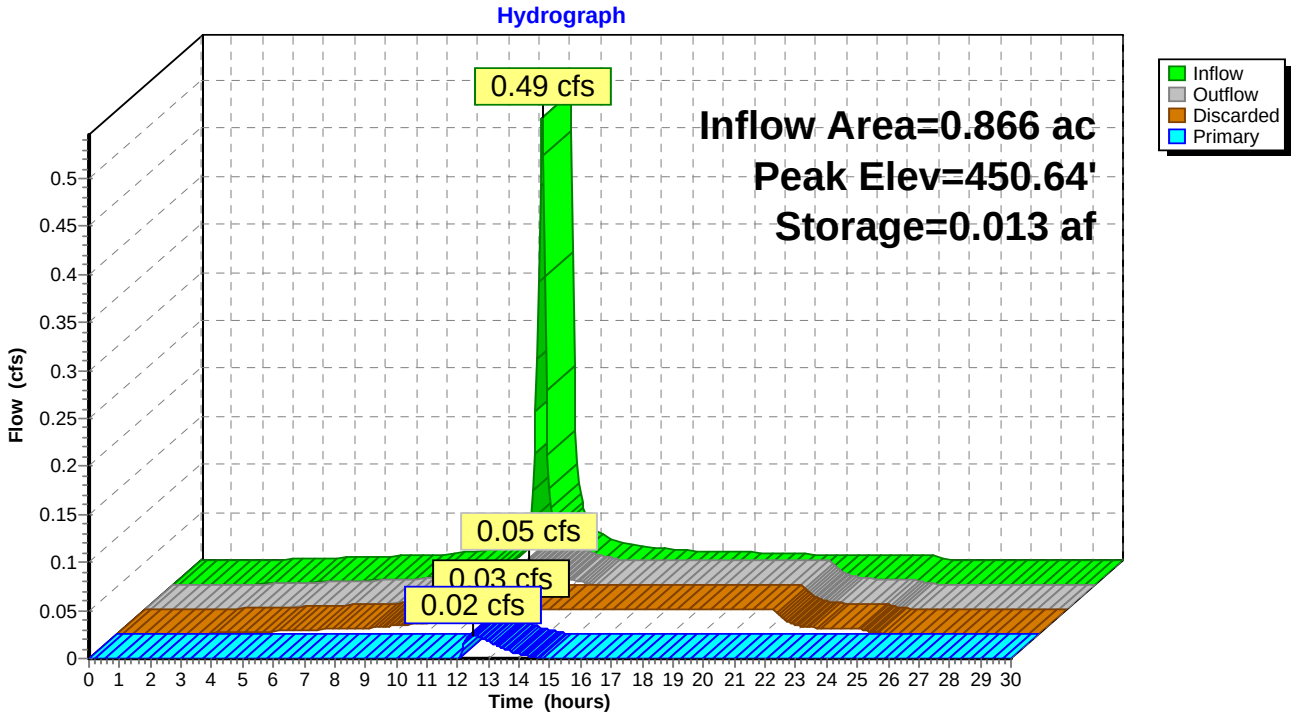
Volume	Invert	Avail.Storage	Storage Description
#1	450.00'	0.081 af	**5.00'W x 440.00'L x 4.00'H Prismatoid** 0.202 af Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	450.50'	**2.0" Vert. Orifice/Grate** C= 0.600
#2	Discarded	450.00'	**0.500 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 10.00'

Discarded OutFlow Max=0.03 cfs @ 12.50 hrs HW=450.64' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.02 cfs @ 12.50 hrs HW=450.64' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 0.02 cfs @ 1.26 fps)

Pond 40P: SUBSURFACE STORAGE

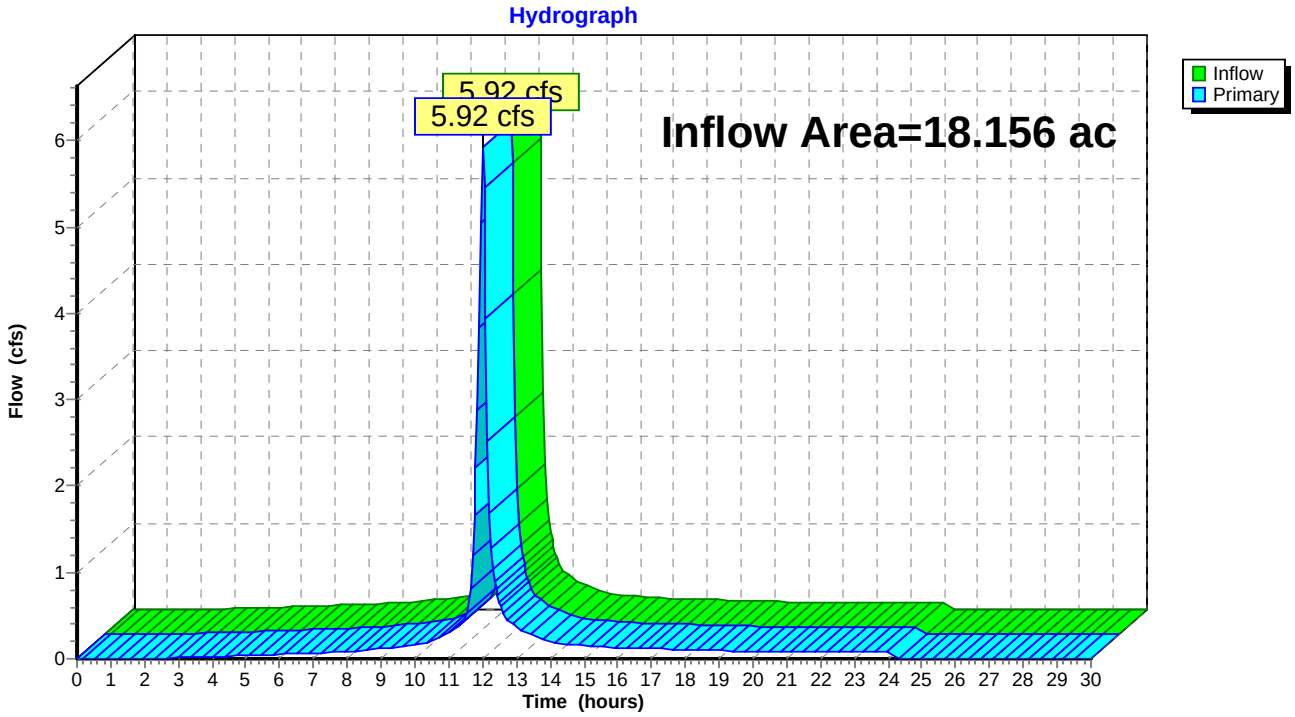


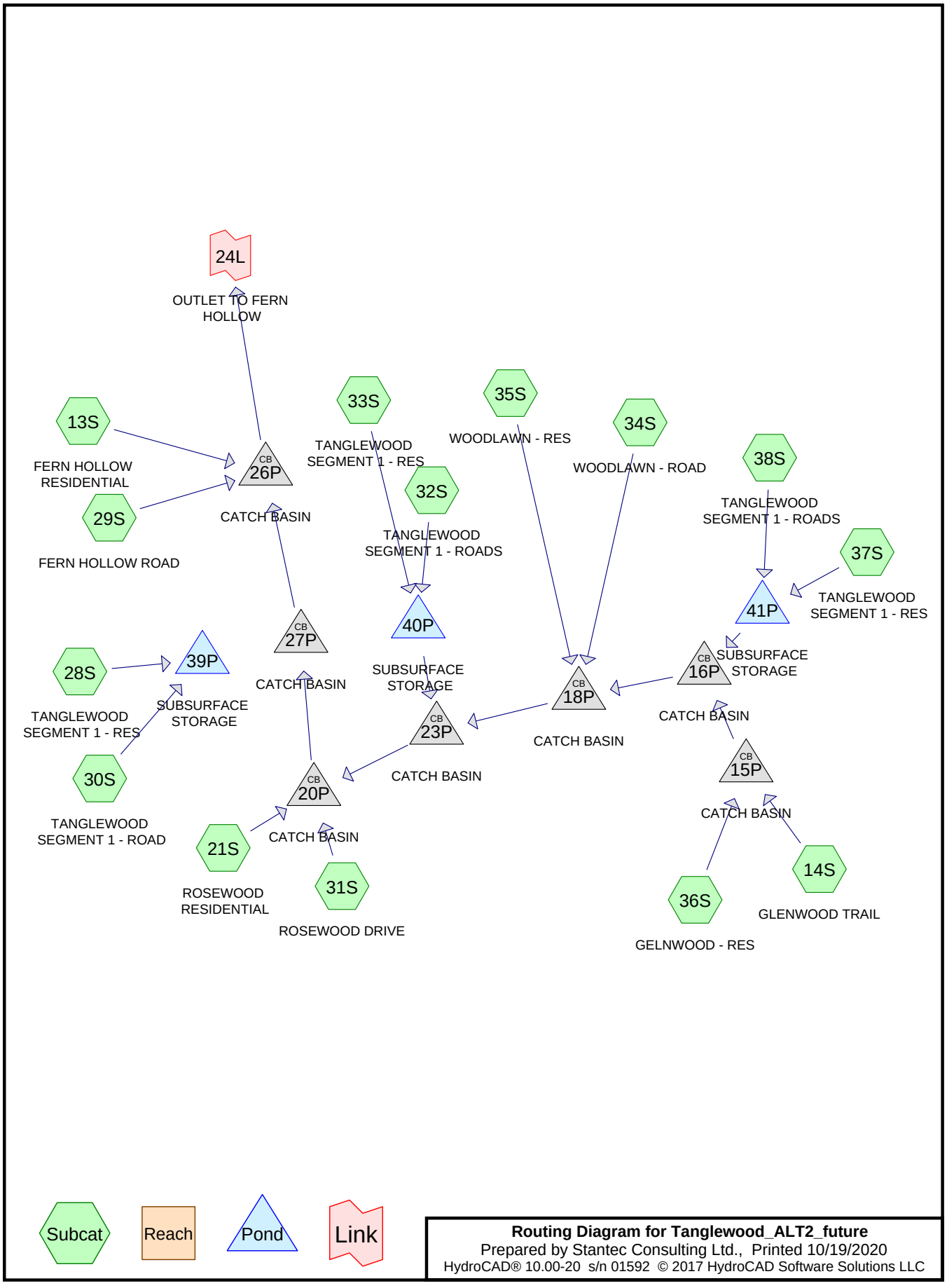
Summary for Link 24L: OUTLET TO FERN HOLLOW

Inflow Area = 18.156 ac, 36.40% Impervious, Inflow Depth = 0.25" for 1 yr event
Inflow = 5.92 cfs @ 12.01 hrs, Volume= 0.381 af
Primary = 5.92 cfs @ 12.01 hrs, Volume= 0.381 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link 24L: OUTLET TO FERN HOLLOW





Routing Diagram for Tanglewood_ALT2_future
Prepared by Stantec Consulting Ltd., Printed 10/19/2020

Summary for Subcatchment 13S: FERN HOLLOW RESIDENTIAL

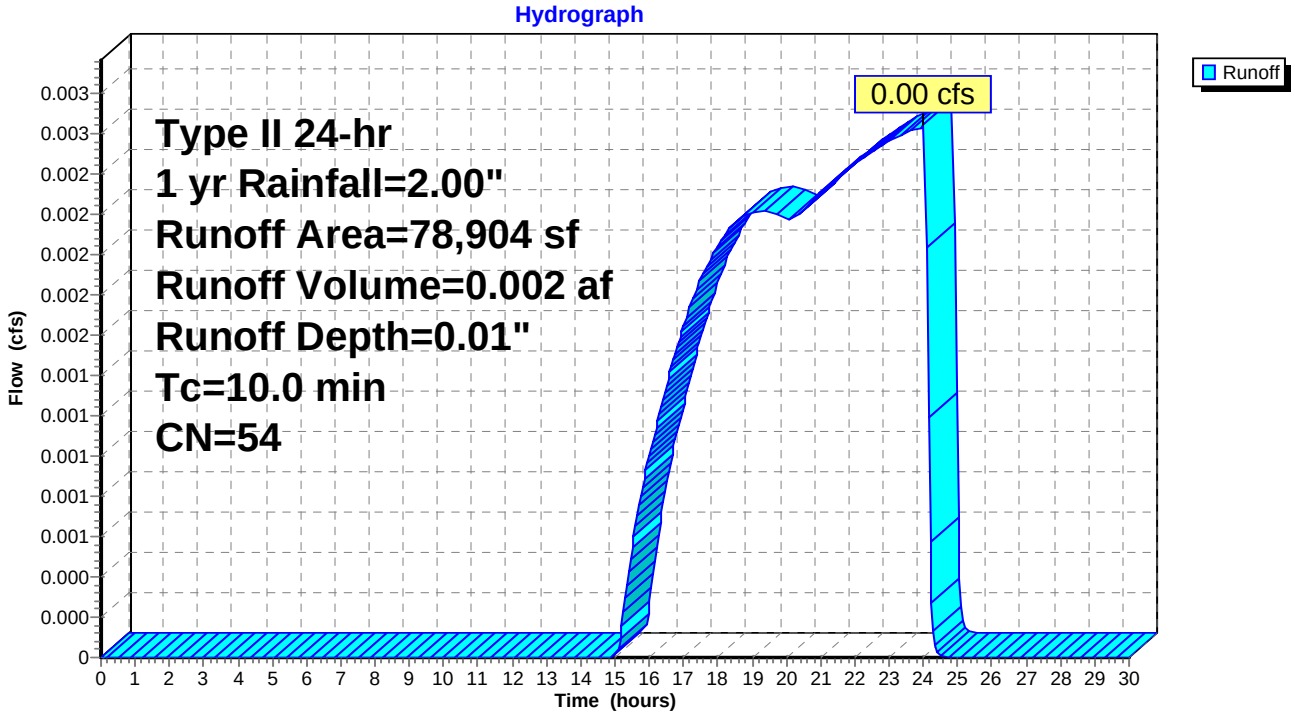
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.002 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
78,904	54	1/2 acre lots, 25% imp, HSG A
59,178		75.00% Pervious Area
19,726		25.00% Impervious Area

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

Subcatchment 13S: FERN HOLLOW RESIDENTIAL



Summary for Subcatchment 14S: GLENWOOD TRAIL

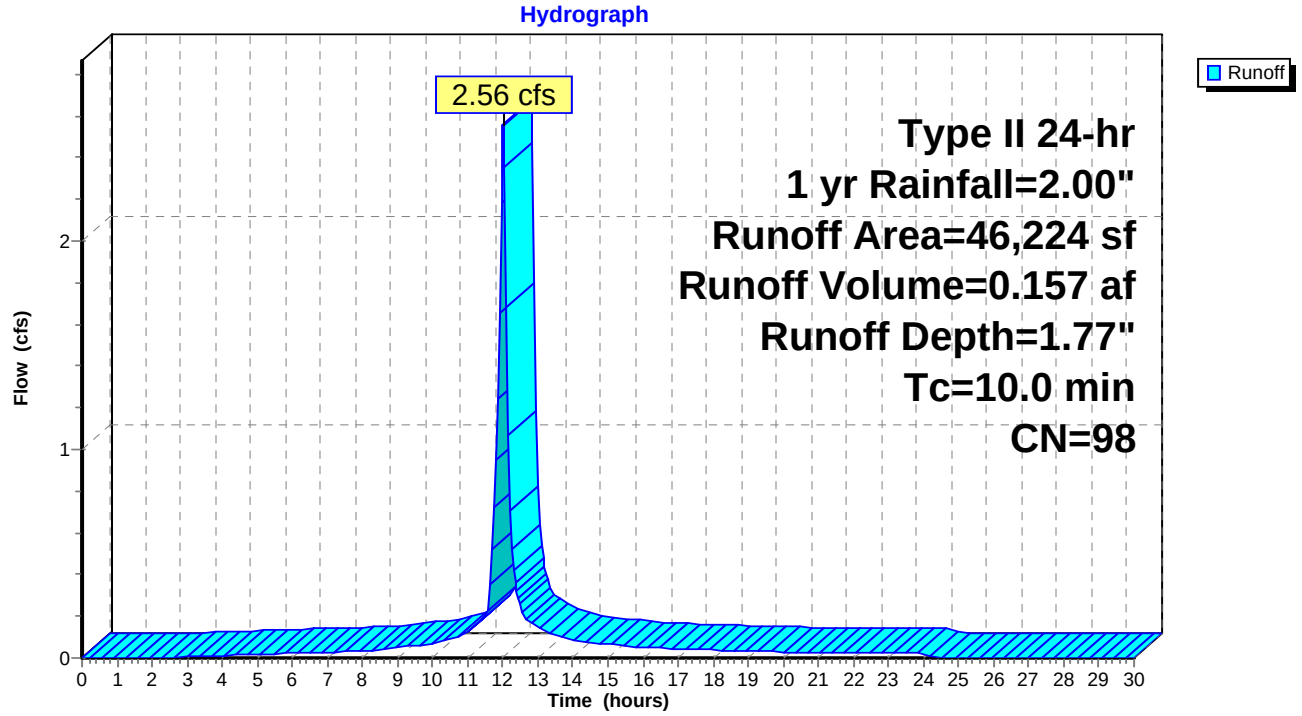
Runoff = 2.56 cfs @ 12.01 hrs, Volume= 0.157 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
46,224	98	Paved roads w/curbs & sewers, HSG A
46,224		100.00% Impervious Area

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

Subcatchment 14S: GLENWOOD TRAIL



Summary for Subcatchment 21S: ROSEWOOD RESIDENTIAL

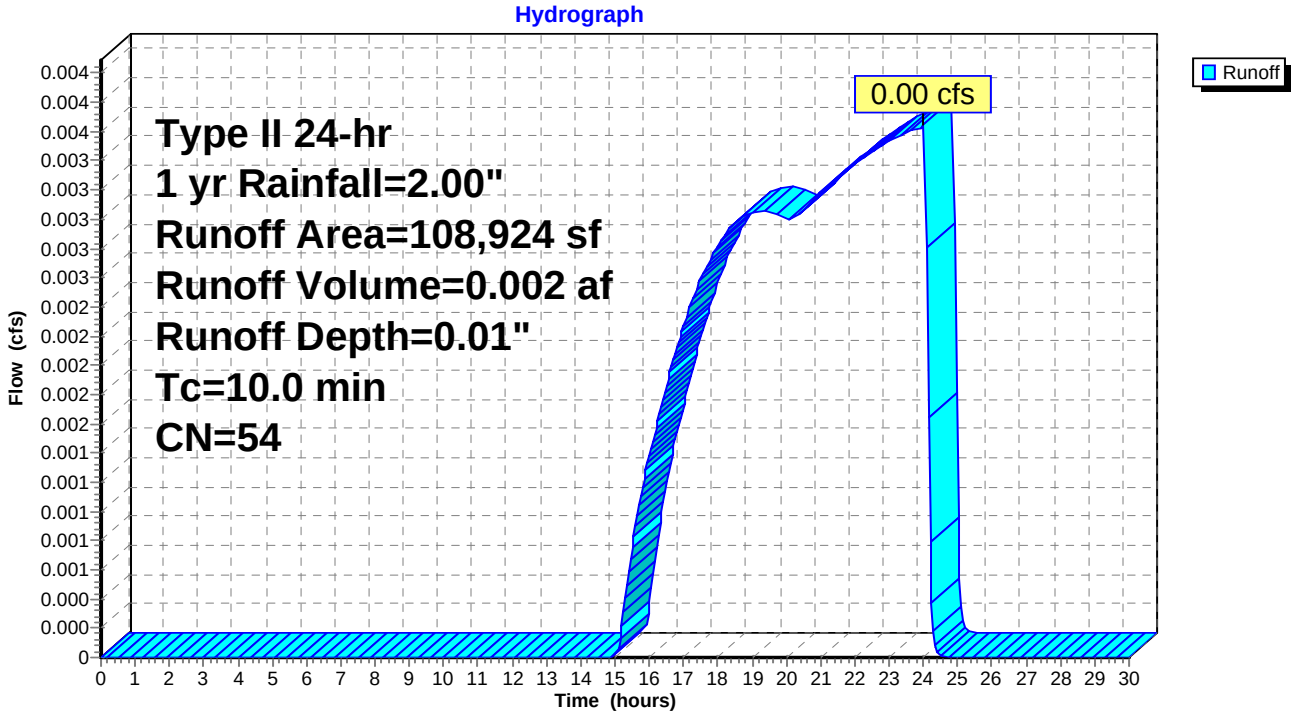
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.002 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
108,924	54	1/2 acre lots, 25% imp, HSG A
81,693		75.00% Pervious Area
27,231		25.00% Impervious Area

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

Subcatchment 21S: ROSEWOOD RESIDENTIAL



Summary for Subcatchment 28S: TANGLEWOOD SEGMENT 1 - RES

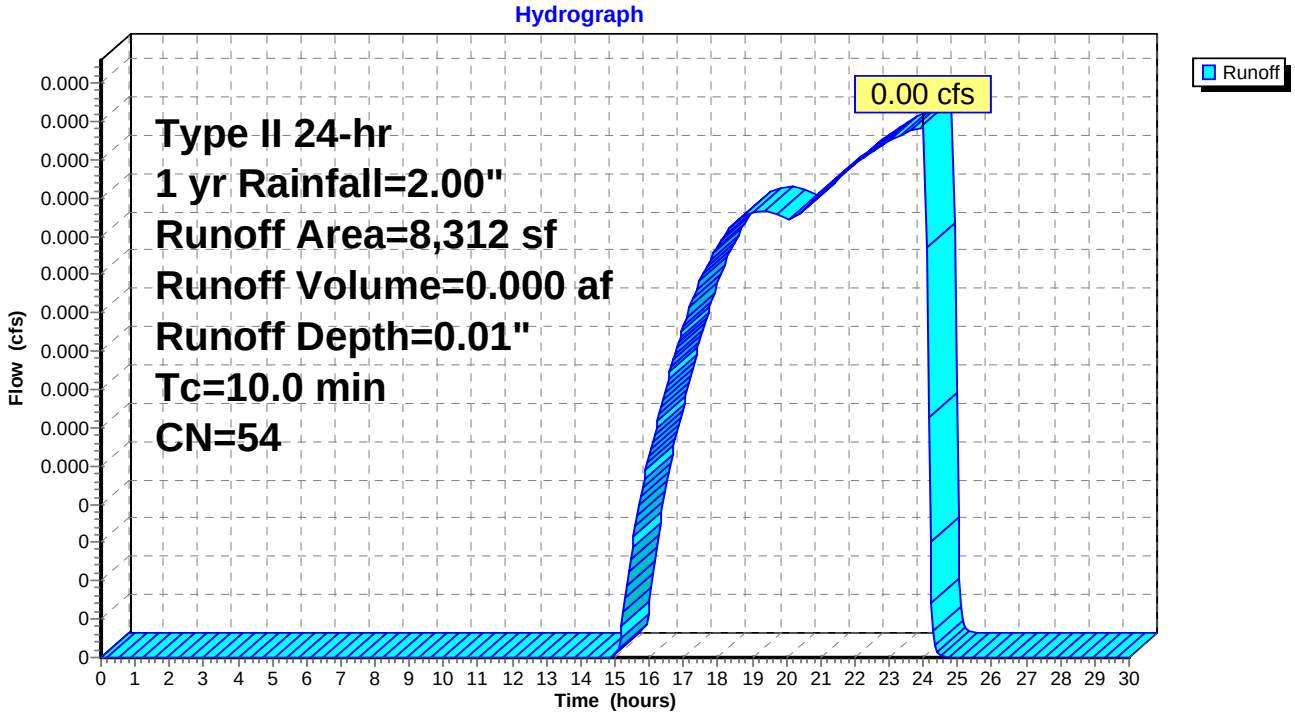
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
8,312	54	1/2 acre lots, 25% imp, HSG A
6,234		75.00% Pervious Area
2,078		25.00% Impervious Area

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

Subcatchment 28S: TANGLEWOOD SEGMENT 1 - RES



Summary for Subcatchment 29S: FERN HOLLOW ROAD

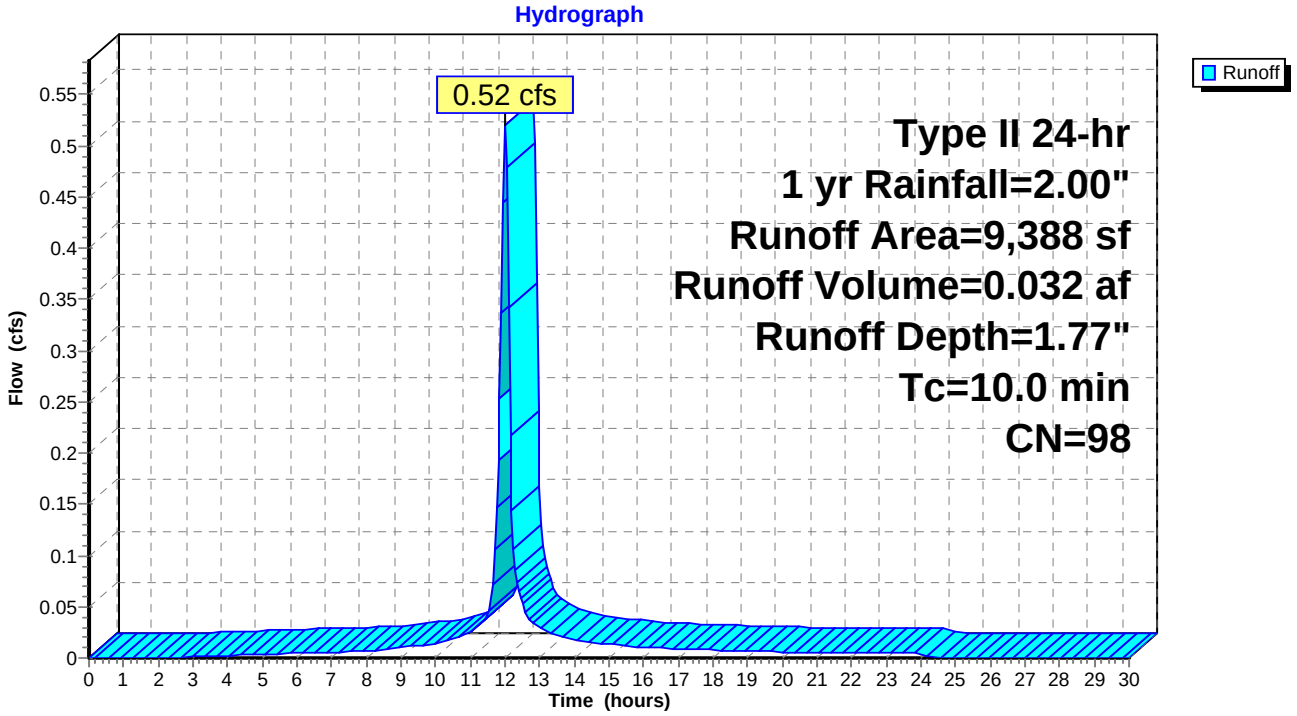
Runoff = 0.52 cfs @ 12.01 hrs, Volume= 0.032 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
9,388	98	Paved roads w/curbs & sewers, HSG A
9,388		100.00% Impervious Area

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

Subcatchment 29S: FERN HOLLOW ROAD



Summary for Subcatchment 30S: TANGLEWOOD SEGMENT 1 - ROAD

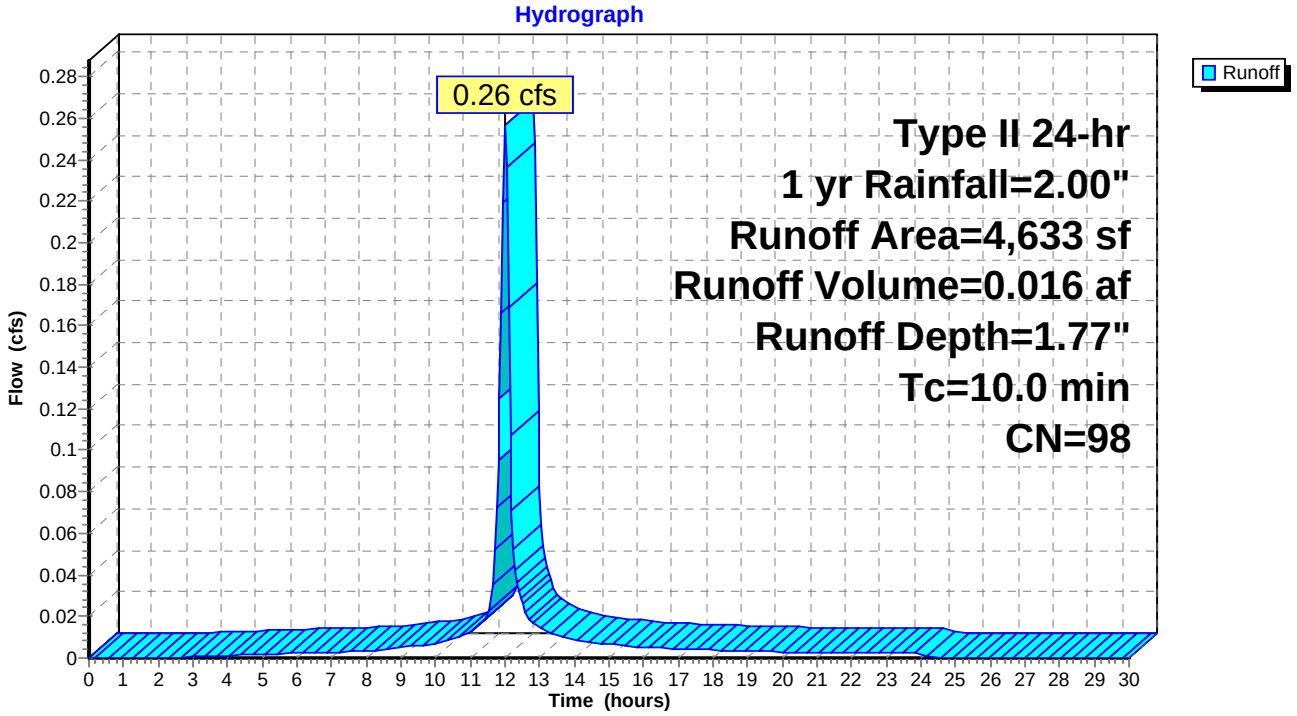
Runoff = 0.26 cfs @ 12.01 hrs, Volume= 0.016 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
4,633	98	Paved roads w/curbs & sewers, HSG A
4,633		100.00% Impervious Area

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

Subcatchment 30S: TANGLEWOOD SEGMENT 1 - ROAD



Summary for Subcatchment 31S: ROSEWOOD DRIVE

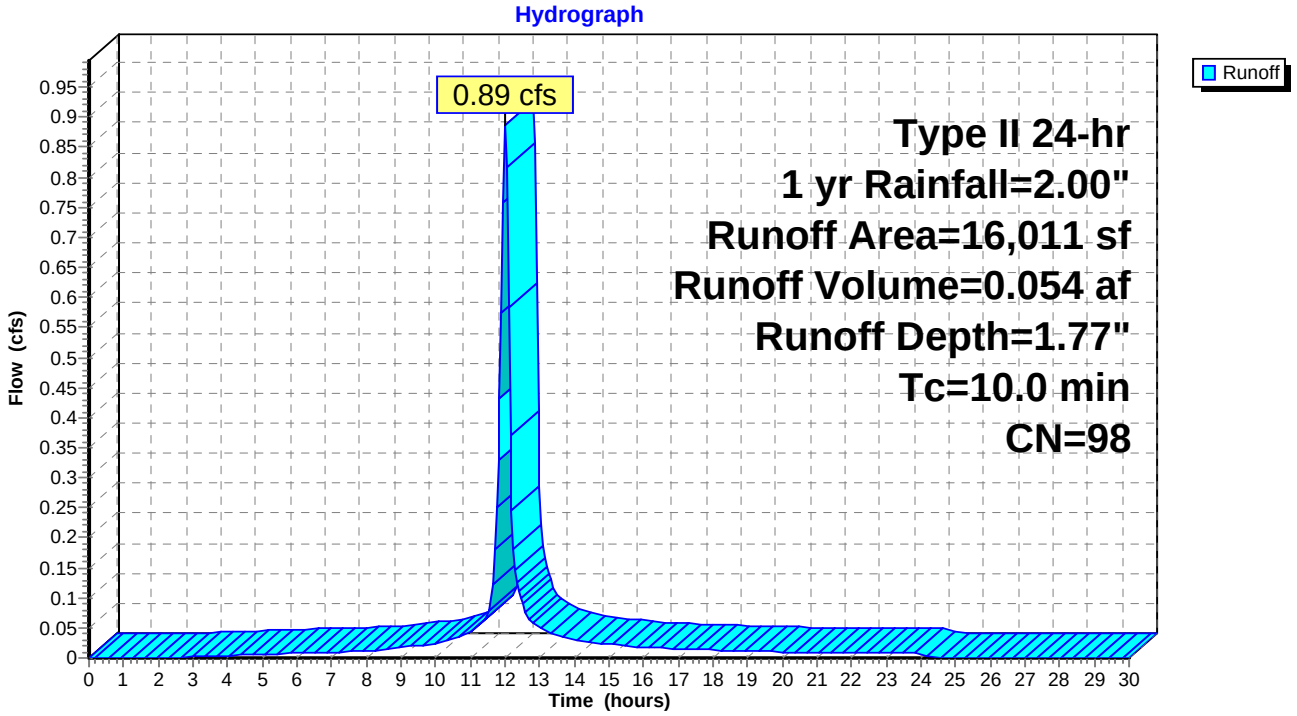
Runoff = 0.89 cfs @ 12.01 hrs, Volume= 0.054 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
16,011	98	Paved roads w/curbs & sewers, HSG A
16,011		100.00% Impervious Area

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

Subcatchment 31S: ROSEWOOD DRIVE



Summary for Subcatchment 32S: TANGLEWOOD SEGMENT 1 - ROADS

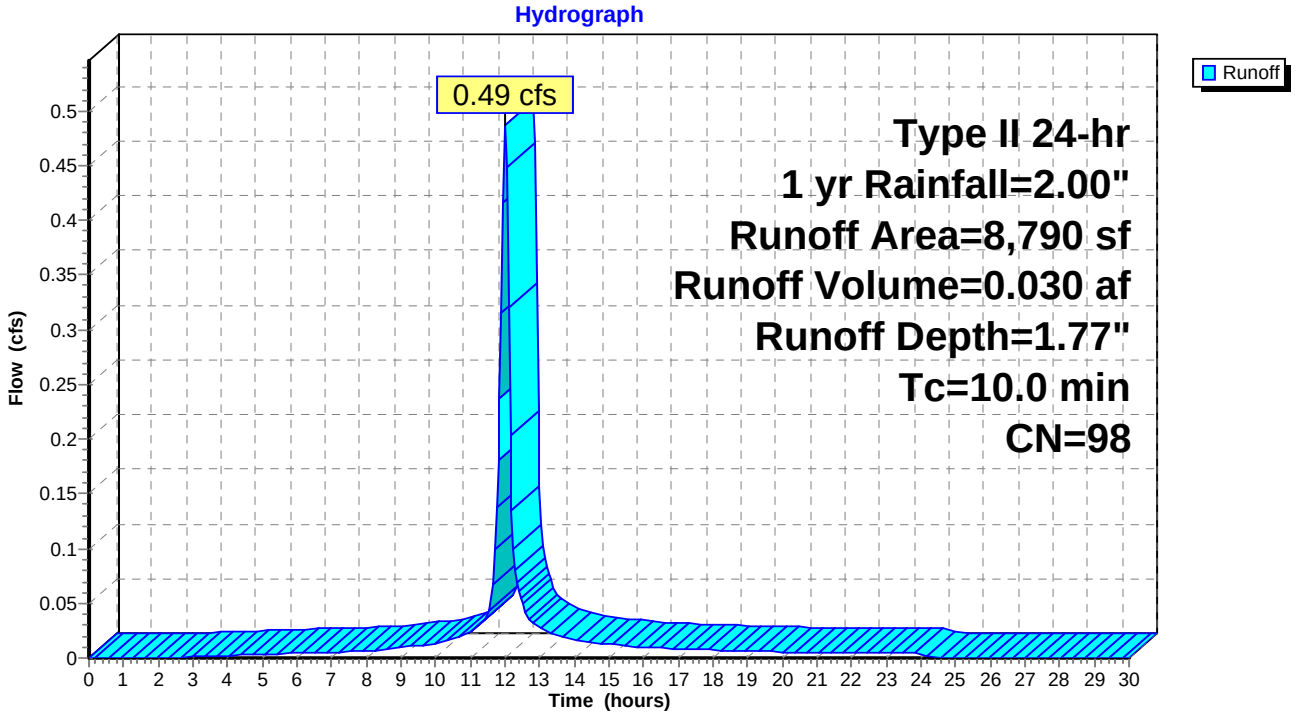
Runoff = 0.49 cfs @ 12.01 hrs, Volume= 0.030 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
8,790	98	Paved roads w/curbs & sewers, HSG A
8,790		100.00% Impervious Area

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

Subcatchment 32S: TANGLEWOOD SEGMENT 1 - ROADS



Summary for Subcatchment 33S: TANGLEWOOD SEGMENT 1 - RES

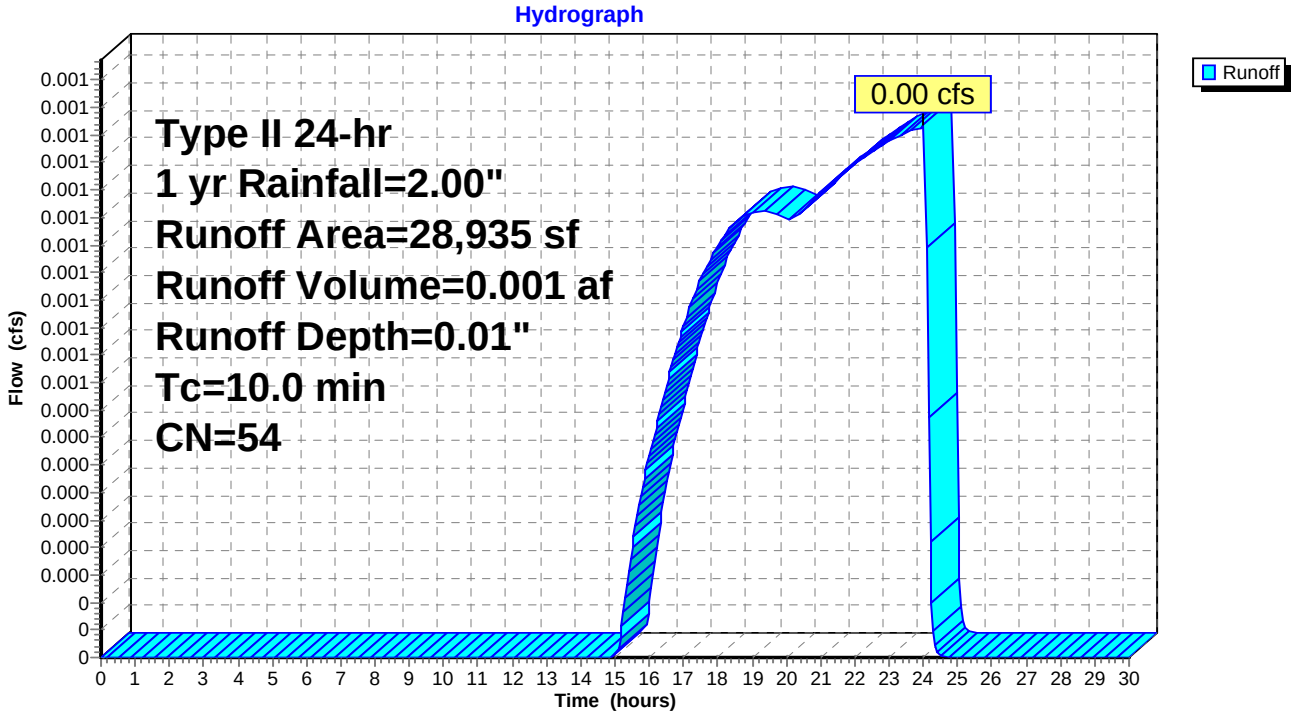
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.001 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
28,935	54	1/2 acre lots, 25% imp, HSG A
21,701		75.00% Pervious Area
7,234		25.00% Impervious Area

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

Subcatchment 33S: TANGLEWOOD SEGMENT 1 - RES



Summary for Subcatchment 34S: WOODLAWN - ROAD

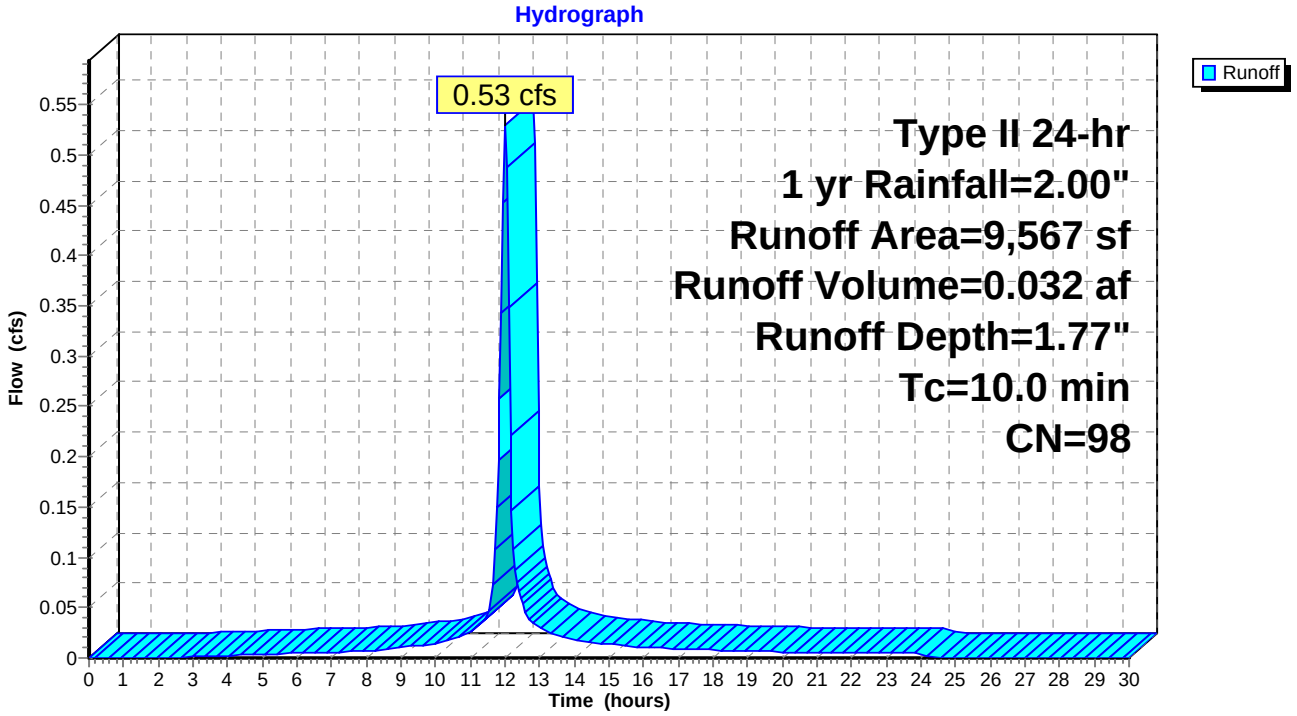
Runoff = 0.53 cfs @ 12.01 hrs, Volume= 0.032 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
9,567	98	Paved roads w/curbs & sewers, HSG A
9,567		100.00% Impervious Area

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

Subcatchment 34S: WOODLAWN - ROAD



Summary for Subcatchment 35S: WOODLAWN - RES

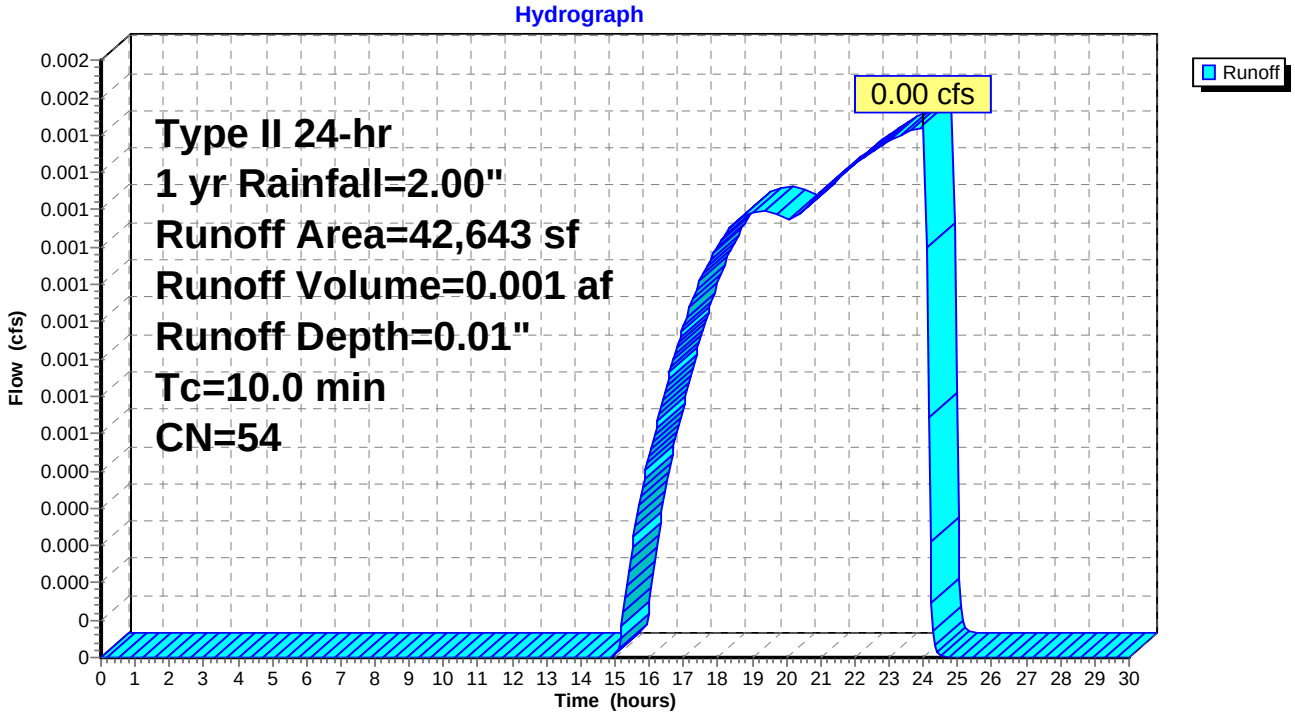
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.001 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
42,643	54	1/2 acre lots, 25% imp, HSG A
31,982		75.00% Pervious Area
10,661		25.00% Impervious Area

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

Subcatchment 35S: WOODLAWN - RES



Summary for Subcatchment 36S: GELNWOOD - RES

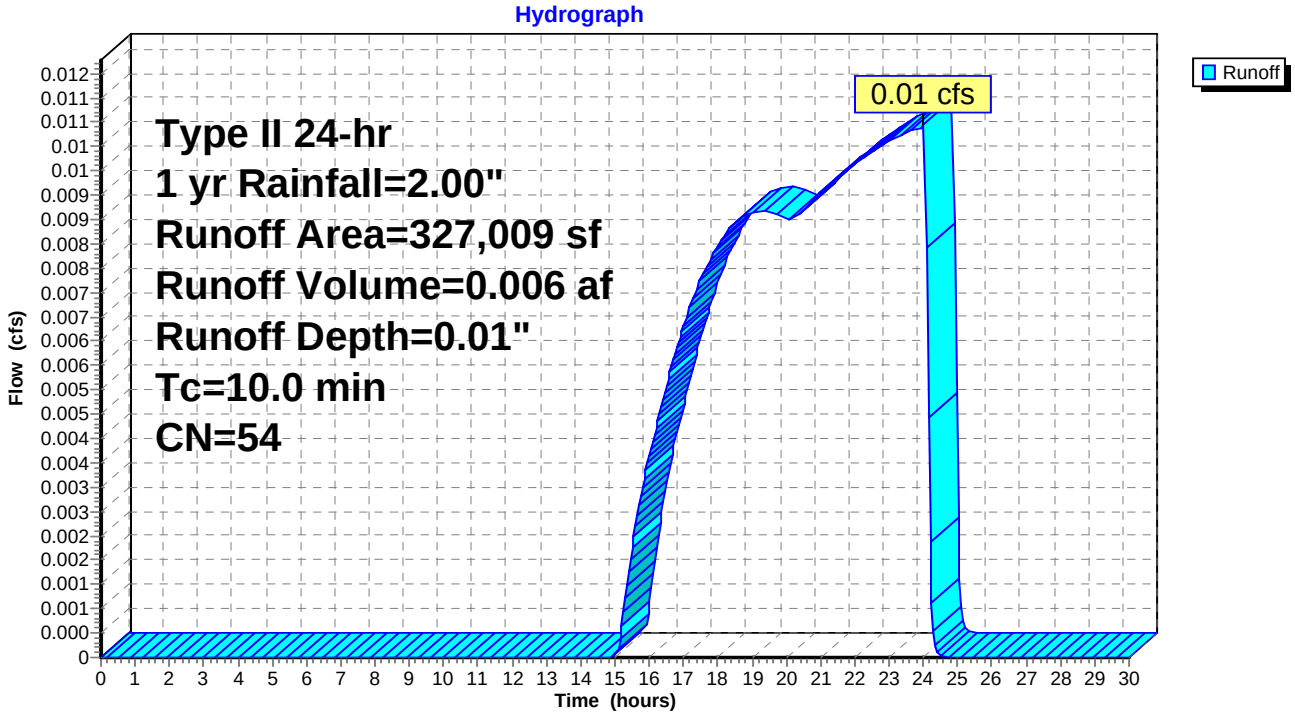
Runoff = 0.01 cfs @ 24.00 hrs, Volume= 0.006 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
327,009	54	1/2 acre lots, 25% imp, HSG A
245,257		75.00% Pervious Area
81,752		25.00% Impervious Area

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

Subcatchment 36S: GELNWOOD - RES



Summary for Subcatchment 37S: TANGLEWOOD SEGMENT 1 - RES

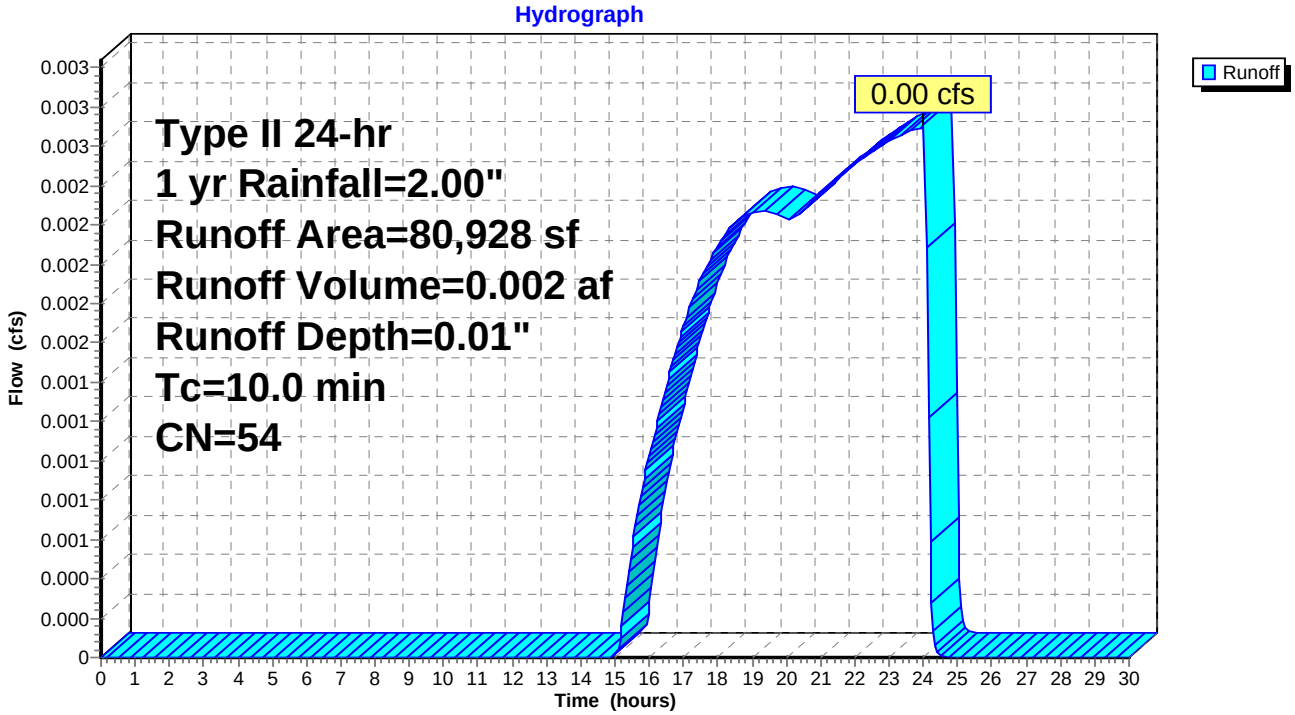
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.002 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
80,928	54	1/2 acre lots, 25% imp, HSG A
60,696		75.00% Pervious Area
20,232		25.00% Impervious Area

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

Subcatchment 37S: TANGLEWOOD SEGMENT 1 - RES



Summary for Subcatchment 38S: TANGLEWOOD SEGMENT 1 - ROADS

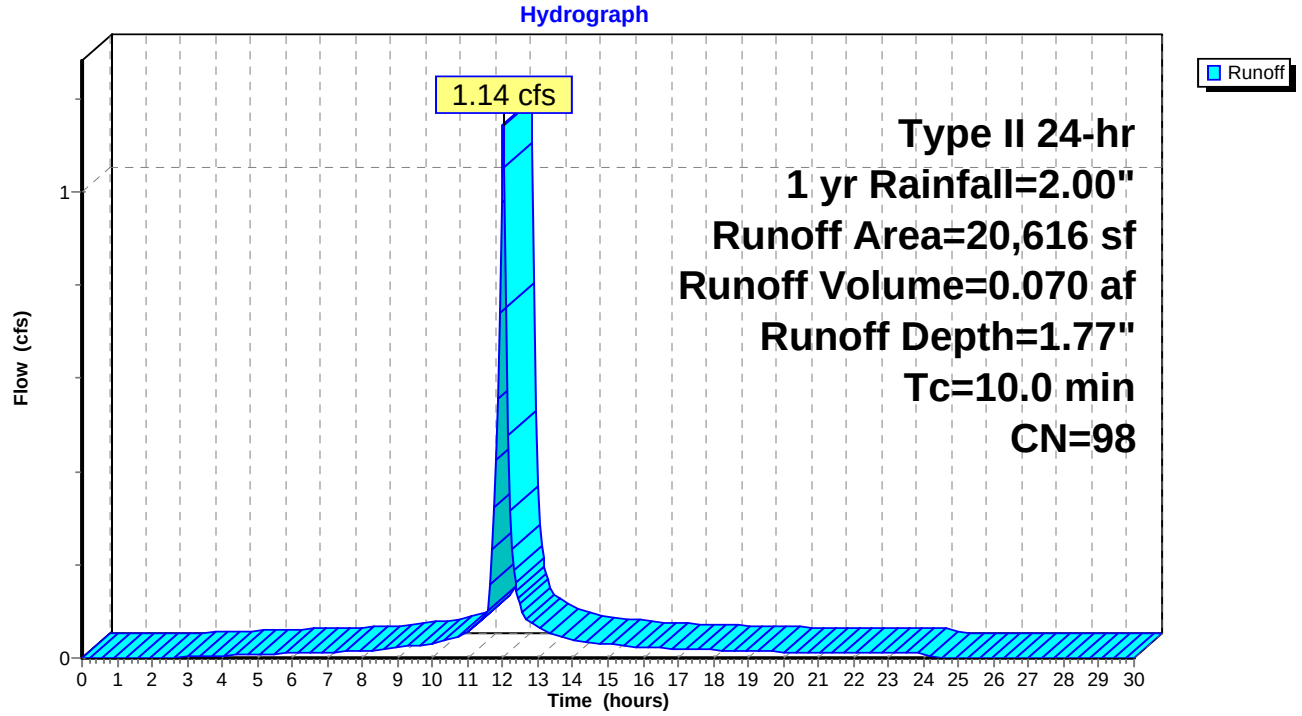
Runoff = 1.14 cfs @ 12.01 hrs, Volume= 0.070 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
20,616	98	Paved roads w/curbs & sewers, HSG A
20,616		100.00% Impervious Area

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

Subcatchment 38S: TANGLEWOOD SEGMENT 1 - ROADS



Summary for Pond 15P: CATCH BASIN

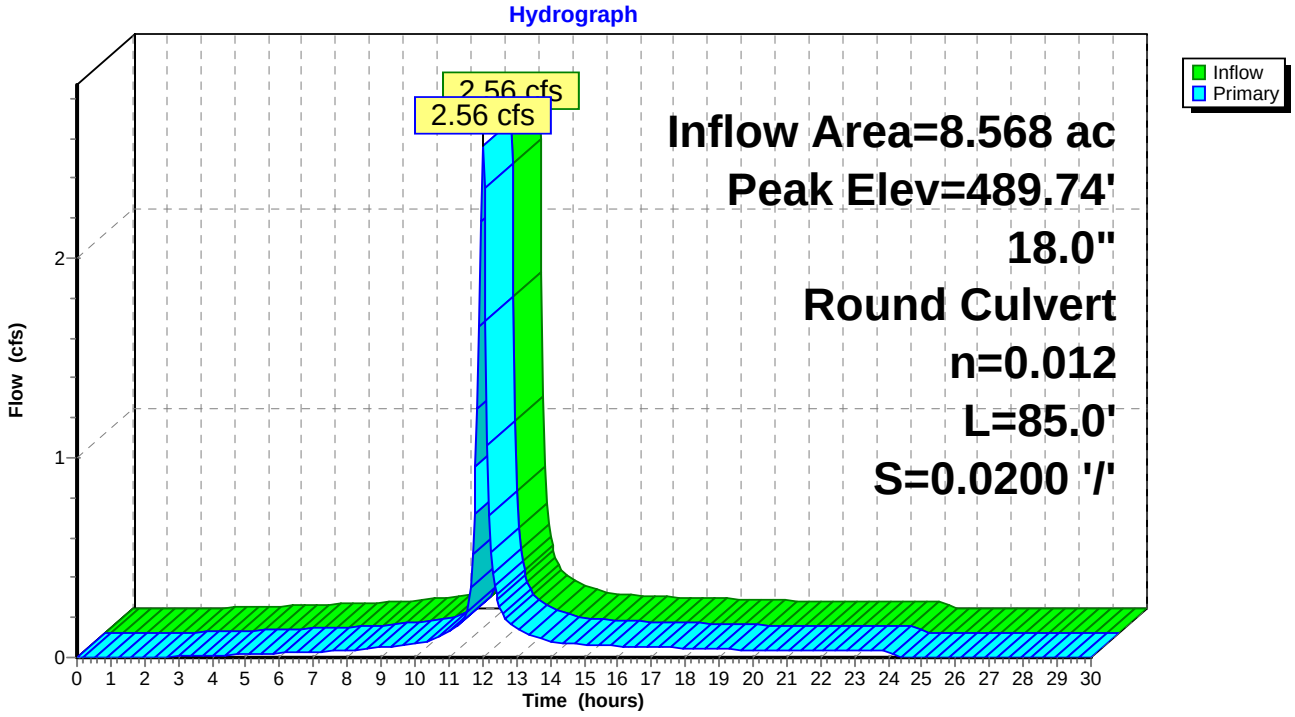
Inflow Area = 8.568 ac, 34.29% Impervious, Inflow Depth = 0.23" for 1 yr event
Inflow = 2.56 cfs @ 12.01 hrs, Volume= 0.163 af
Outflow = 2.56 cfs @ 12.01 hrs, Volume= 0.163 af, Atten= 0%, Lag= 0.0 min
Primary = 2.56 cfs @ 12.01 hrs, Volume= 0.163 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 489.74' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 85.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=2.53 cfs @ 12.01 hrs HW=489.74' (Free Discharge)
└**1=Culvert** (Inlet Controls 2.53 cfs @ 2.92 fps)

Pond 15P: CATCH BASIN



Summary for Pond 16P: CATCH BASIN

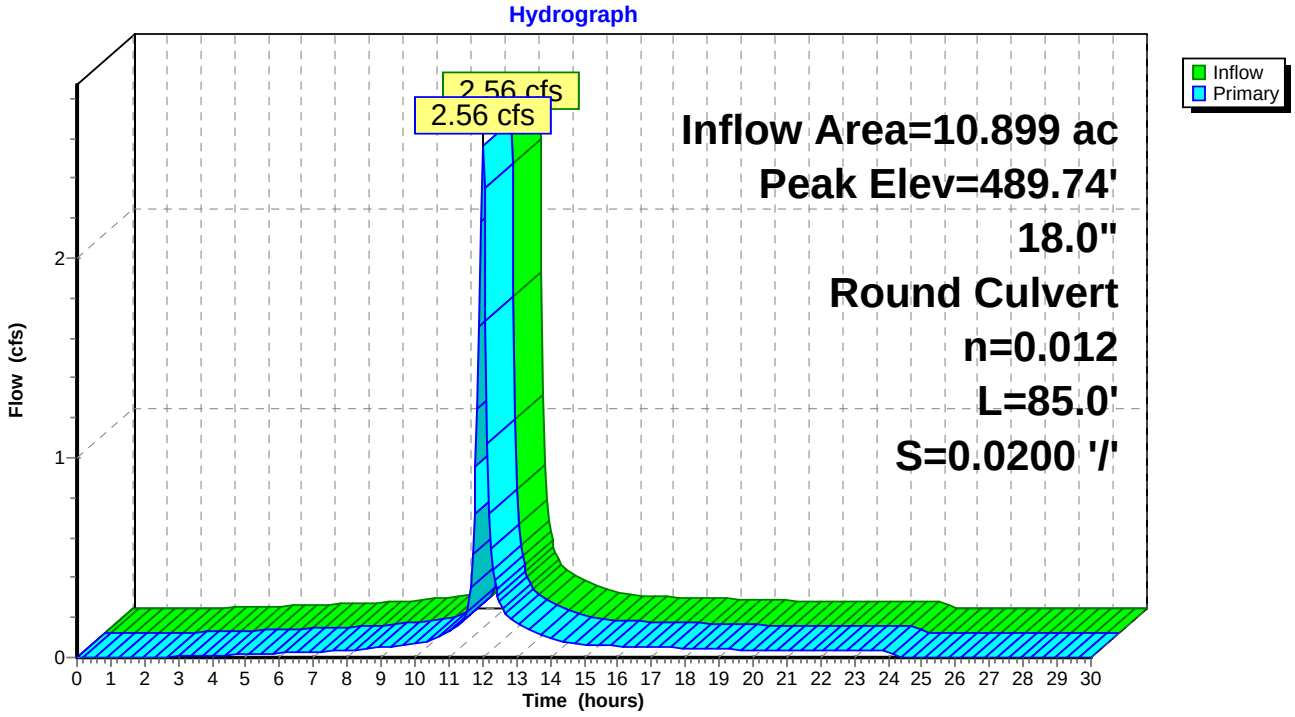
Inflow Area = 10.899 ac, 35.56% Impervious, Inflow Depth = 0.18" for 1 yr event
Inflow = 2.56 cfs @ 12.01 hrs, Volume= 0.167 af
Outflow = 2.56 cfs @ 12.01 hrs, Volume= 0.167 af, Atten= 0%, Lag= 0.0 min
Primary = 2.56 cfs @ 12.01 hrs, Volume= 0.167 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 489.74' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 85.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=2.53 cfs @ 12.01 hrs HW=489.74' (Free Discharge)
└**1=Culvert** (Inlet Controls 2.53 cfs @ 2.92 fps)

Pond 16P: CATCH BASIN



Summary for Pond 18P: CATCH BASIN

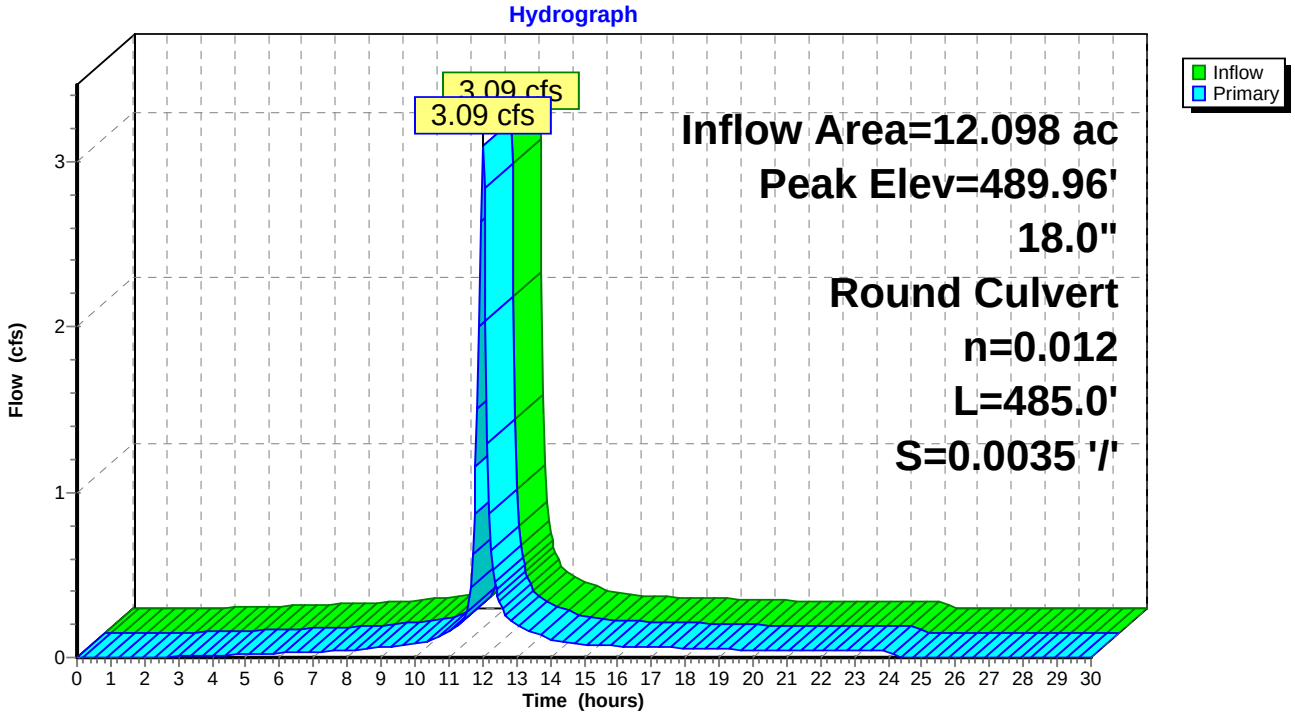
Inflow Area = 12.098 ac, 35.87% Impervious, Inflow Depth = 0.20" for 1 yr event
Inflow = 3.09 cfs @ 12.01 hrs, Volume= 0.200 af
Outflow = 3.09 cfs @ 12.01 hrs, Volume= 0.200 af, Atten= 0%, Lag= 0.0 min
Primary = 3.09 cfs @ 12.01 hrs, Volume= 0.200 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 489.96' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 485.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0035 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=3.05 cfs @ 12.01 hrs HW=489.96' (Free Discharge)
└**1=Culvert** (Barrel Controls 3.05 cfs @ 3.65 fps)

Pond 18P: CATCH BASIN



Summary for Pond 20P: CATCH BASIN

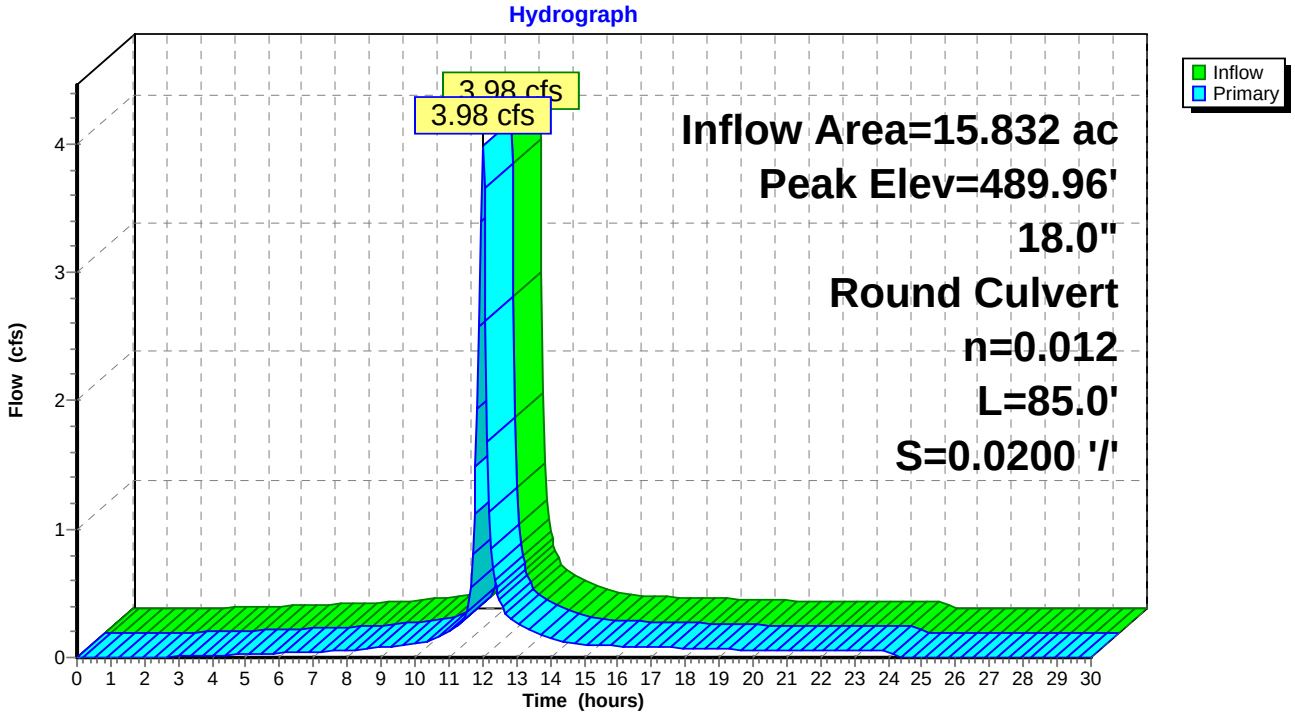
Inflow Area = 15.832 ac, 36.01% Impervious, Inflow Depth = 0.20" for 1 yr event
Inflow = 3.98 cfs @ 12.01 hrs, Volume= 0.259 af
Outflow = 3.98 cfs @ 12.01 hrs, Volume= 0.259 af, Atten= 0%, Lag= 0.0 min
Primary = 3.98 cfs @ 12.01 hrs, Volume= 0.259 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 489.96' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 85.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=3.93 cfs @ 12.01 hrs HW=489.95' (Free Discharge)
└**1=Culvert** (Inlet Controls 3.93 cfs @ 3.32 fps)

Pond 20P: CATCH BASIN



Summary for Pond 23P: CATCH BASIN

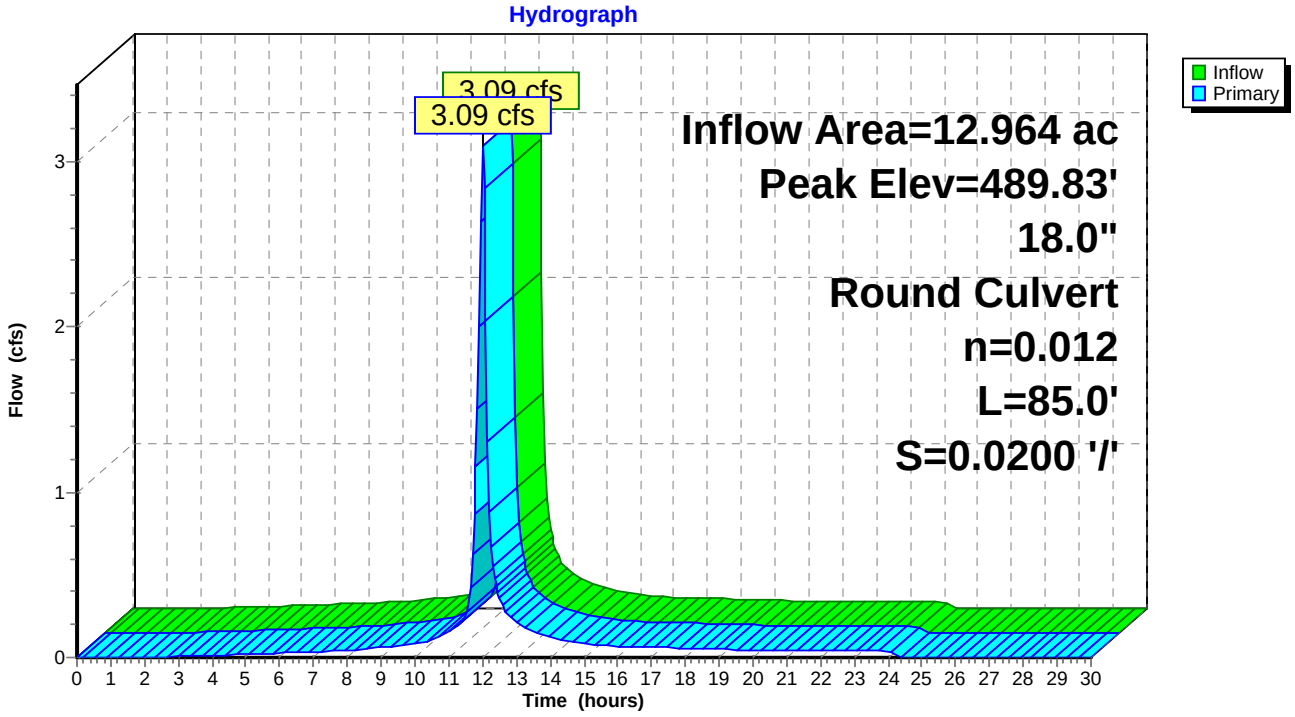
Inflow Area = 12.964 ac, 36.32% Impervious, Inflow Depth = 0.19" for 1 yr event
Inflow = 3.09 cfs @ 12.01 hrs, Volume= 0.203 af
Outflow = 3.09 cfs @ 12.01 hrs, Volume= 0.203 af, Atten= 0%, Lag= 0.0 min
Primary = 3.09 cfs @ 12.01 hrs, Volume= 0.203 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 489.83' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 85.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=3.05 cfs @ 12.01 hrs HW=489.82' (Free Discharge)
└**1=Culvert** (Inlet Controls 3.05 cfs @ 3.08 fps)

Pond 23P: CATCH BASIN



Summary for Pond 26P: CATCH BASIN

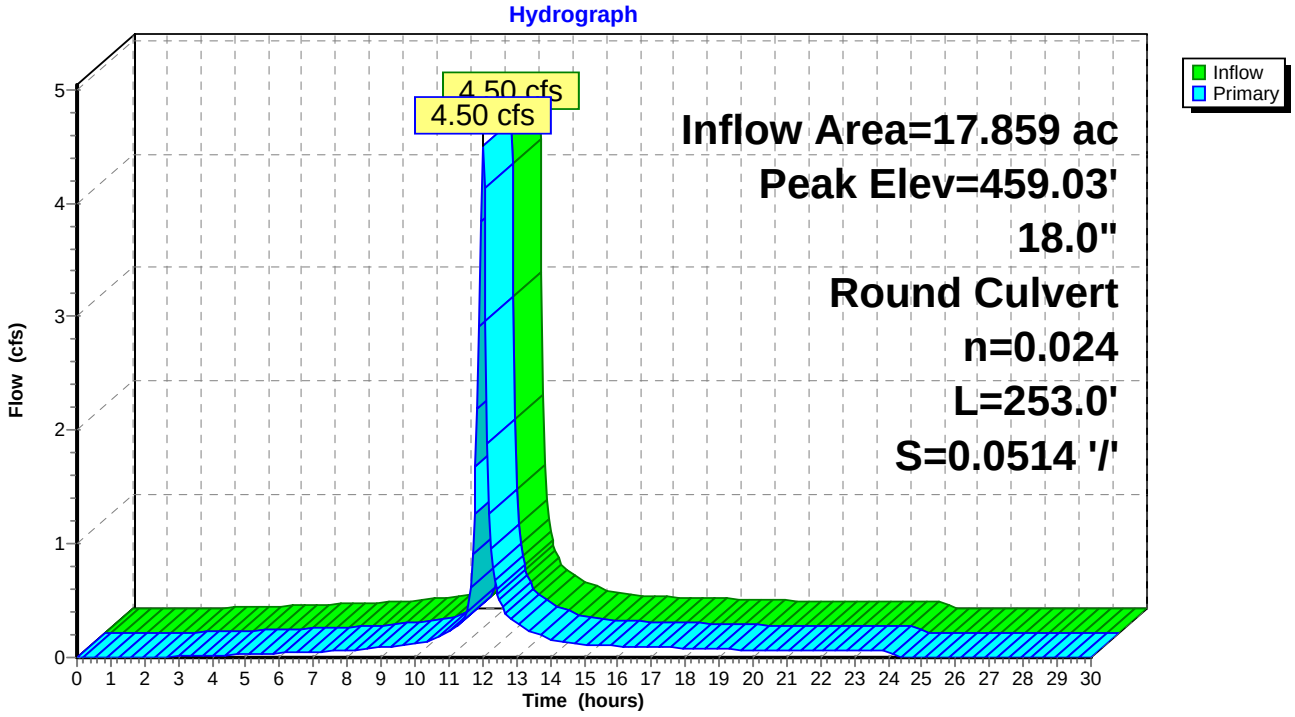
Inflow Area = 17.859 ac, 35.66% Impervious, Inflow Depth = 0.20" for 1 yr event
Inflow = 4.50 cfs @ 12.01 hrs, Volume= 0.292 af
Outflow = 4.50 cfs @ 12.01 hrs, Volume= 0.292 af, Atten= 0%, Lag= 0.0 min
Primary = 4.50 cfs @ 12.01 hrs, Volume= 0.292 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 459.03' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	458.00'	**18.0" Round Culvert** L= 253.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 458.00' / 445.00' S= 0.0514 '/' Cc= 0.900 n= 0.024, Flow Area= 1.77 sf

Primary OutFlow Max=4.44 cfs @ 12.01 hrs HW=459.03' (Free Discharge)
└**1=Culvert** (Inlet Controls 4.44 cfs @ 3.45 fps)

Pond 26P: CATCH BASIN



Summary for Pond 27P: CATCH BASIN

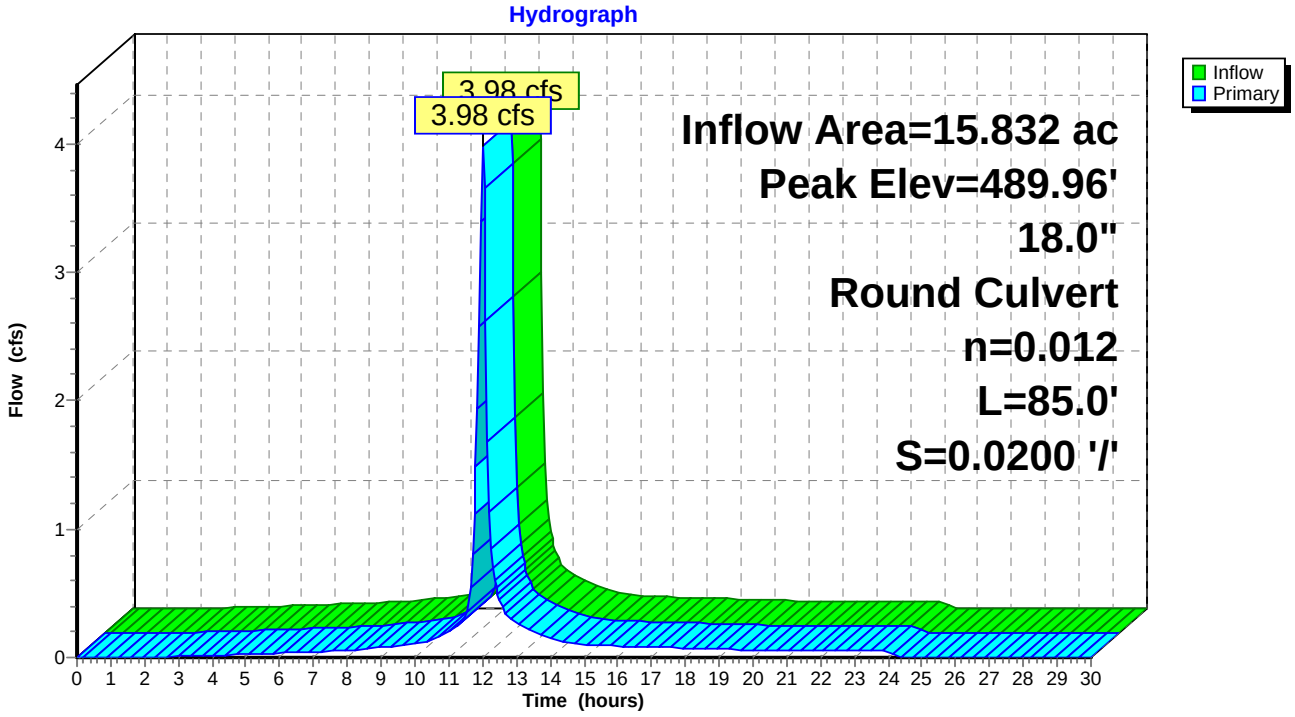
Inflow Area = 15.832 ac, 36.01% Impervious, Inflow Depth = 0.20" for 1 yr event
Inflow = 3.98 cfs @ 12.01 hrs, Volume= 0.259 af
Outflow = 3.98 cfs @ 12.01 hrs, Volume= 0.259 af, Atten= 0%, Lag= 0.0 min
Primary = 3.98 cfs @ 12.01 hrs, Volume= 0.259 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 489.96' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 85.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=3.93 cfs @ 12.01 hrs HW=489.95' (Free Discharge)
└**1=Culvert** (Inlet Controls 3.93 cfs @ 3.32 fps)

Pond 27P: CATCH BASIN



Summary for Pond 39P: SUBSURFACE STORAGE

Inflow Area = 0.297 ac, 51.84% Impervious, Inflow Depth = 0.64" for 1 yr event
Inflow = 0.26 cfs @ 12.01 hrs, Volume= 0.016 af
Outflow = 0.05 cfs @ 12.25 hrs, Volume= 0.016 af, Atten= 79%, Lag= 14.8 min
Discarded = 0.01 cfs @ 12.25 hrs, Volume= 0.012 af
Primary = 0.04 cfs @ 12.25 hrs, Volume= 0.003 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 450.76' @ 12.25 hrs Surf.Area= 0.021 ac Storage= 0.006 af

Plug-Flow detention time= 127.5 min calculated for 0.016 af (100% of inflow)
Center-of-Mass det. time= 127.4 min (899.4 - 772.0)

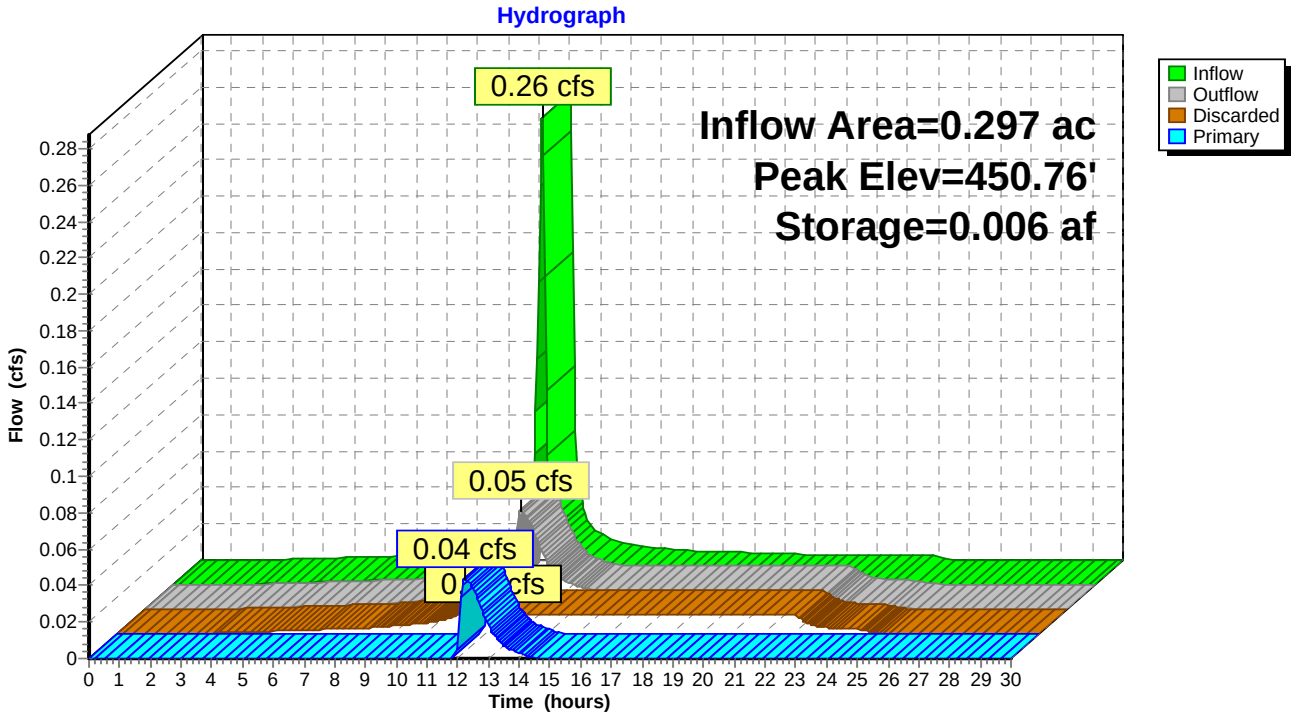
Volume	Invert	Avail.Storage	Storage Description
#1	450.00'	0.033 af	**5.00'W x 180.00'L x 4.00'H Prismatoid** 0.083 af Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	450.50'	**2.0" Vert. Orifice/Grate** C= 0.600
#2	Discarded	450.00'	**0.500 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 10.00'

Discarded OutFlow Max=0.01 cfs @ 12.25 hrs HW=450.76' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=0.04 cfs @ 12.25 hrs HW=450.76' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 0.04 cfs @ 2.00 fps)

Pond 39P: SUBSURFACE STORAGE



Summary for Pond 40P: SUBSURFACE STORAGE

Inflow Area = 0.866 ac, 42.48% Impervious, Inflow Depth = 0.42" for 1 yr event
Inflow = 0.49 cfs @ 12.01 hrs, Volume= 0.030 af
Outflow = 0.05 cfs @ 12.50 hrs, Volume= 0.030 af, Atten= 90%, Lag= 29.5 min
Discarded = 0.03 cfs @ 12.50 hrs, Volume= 0.028 af
Primary = 0.02 cfs @ 12.50 hrs, Volume= 0.002 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 450.64' @ 12.50 hrs Surf.Area= 0.051 ac Storage= 0.013 af

Plug-Flow detention time= 148.4 min calculated for 0.030 af (100% of inflow)
Center-of-Mass det. time= 148.2 min (923.9 - 775.7)

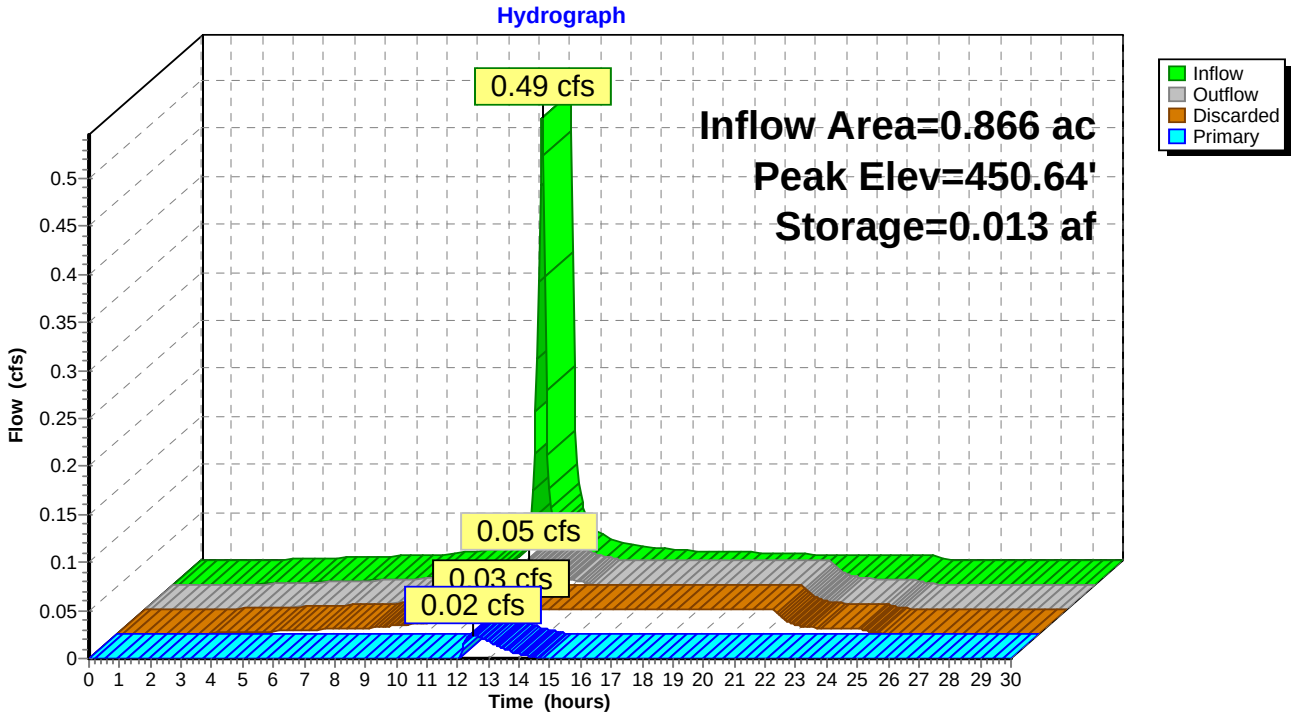
Volume	Invert	Avail.Storage	Storage Description
#1	450.00'	0.081 af	**5.00'W x 440.00'L x 4.00'H Prismatoid** 0.202 af Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	450.50'	**2.0" Vert. Orifice/Grate** C= 0.600
#2	Discarded	450.00'	**0.500 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 10.00'

Discarded OutFlow Max=0.03 cfs @ 12.50 hrs HW=450.64' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.02 cfs @ 12.50 hrs HW=450.64' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 0.02 cfs @ 1.26 fps)

Pond 40P: SUBSURFACE STORAGE



Summary for Pond 41P: SUBSURFACE STORAGE

Inflow Area = 2.331 ac, 40.23% Impervious, Inflow Depth = 0.37" for 1 yr event
Inflow = 1.14 cfs @ 12.01 hrs, Volume= 0.072 af
Outflow = 0.09 cfs @ 12.66 hrs, Volume= 0.072 af, Atten= 92%, Lag= 39.1 min
Discarded = 0.06 cfs @ 12.66 hrs, Volume= 0.068 af
Primary = 0.03 cfs @ 12.66 hrs, Volume= 0.004 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 450.64' @ 12.66 hrs Surf.Area= 0.121 ac Storage= 0.031 af

Plug-Flow detention time= 161.7 min calculated for 0.071 af (100% of inflow)
Center-of-Mass det. time= 161.5 min (938.7 - 777.2)

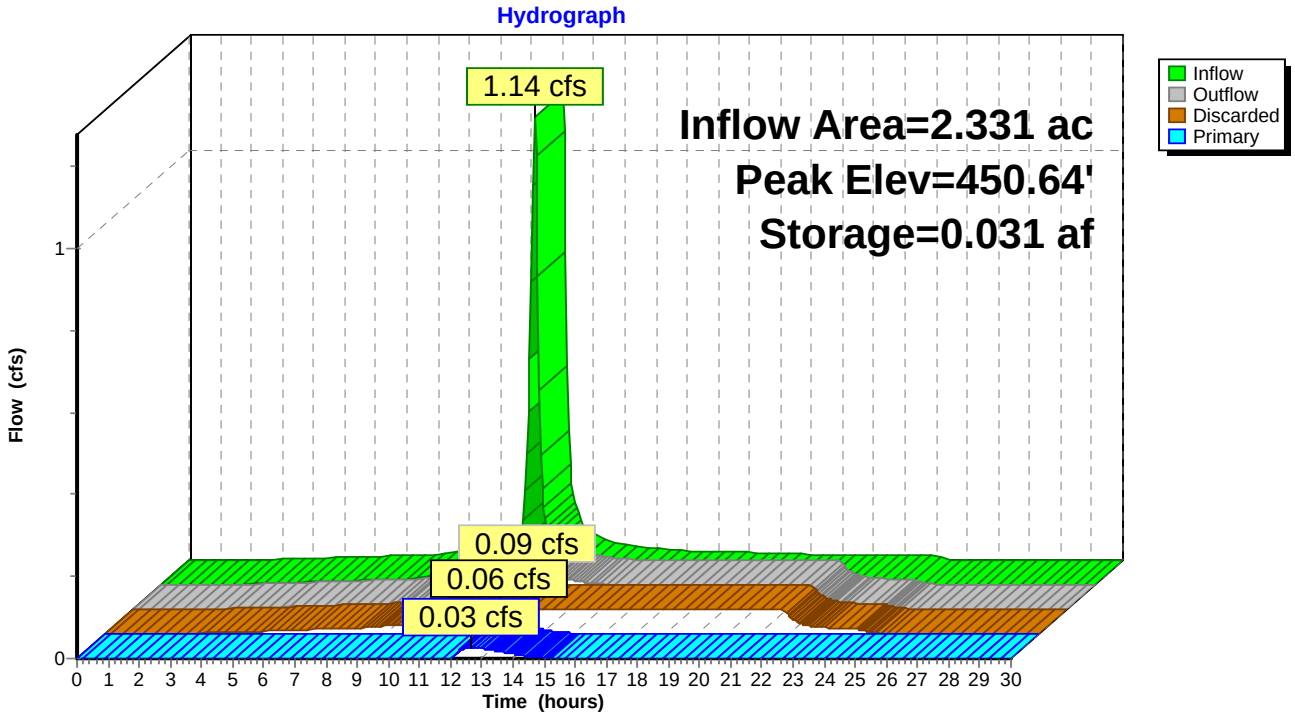
Volume	Invert	Avail.Storage	Storage Description
#1	450.00'	0.193 af	**5.00'W x 1,050.00'L x 4.00'H Prismatoid** 0.482 af Overall x 40.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	450.50'	**2.0" Vert. Orifice/Grate** C= 0.600
#2	Discarded	450.00'	**0.500 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 10.00'

Discarded OutFlow Max=0.06 cfs @ 12.66 hrs HW=450.64' (Free Discharge)
└**2=Exfiltration** (Controls 0.06 cfs)

Primary OutFlow Max=0.03 cfs @ 12.66 hrs HW=450.64' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.03 cfs @ 1.29 fps)

Pond 41P: SUBSURFACE STORAGE

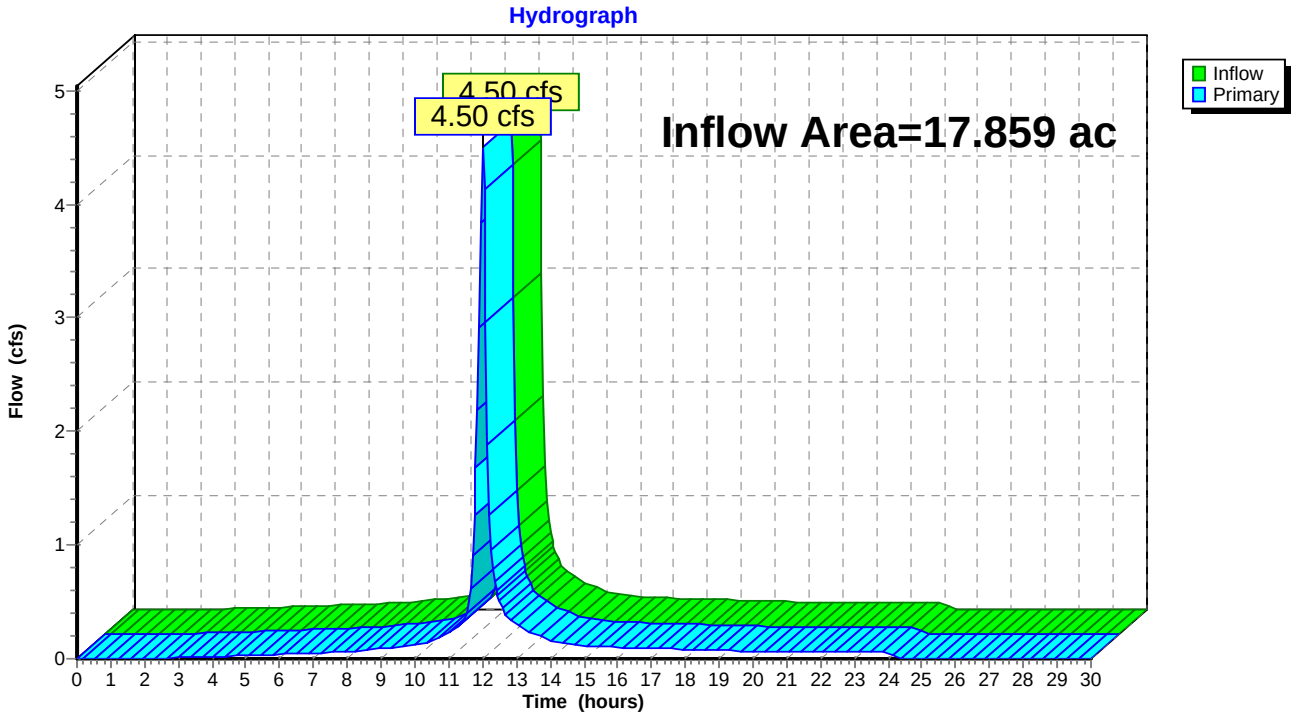


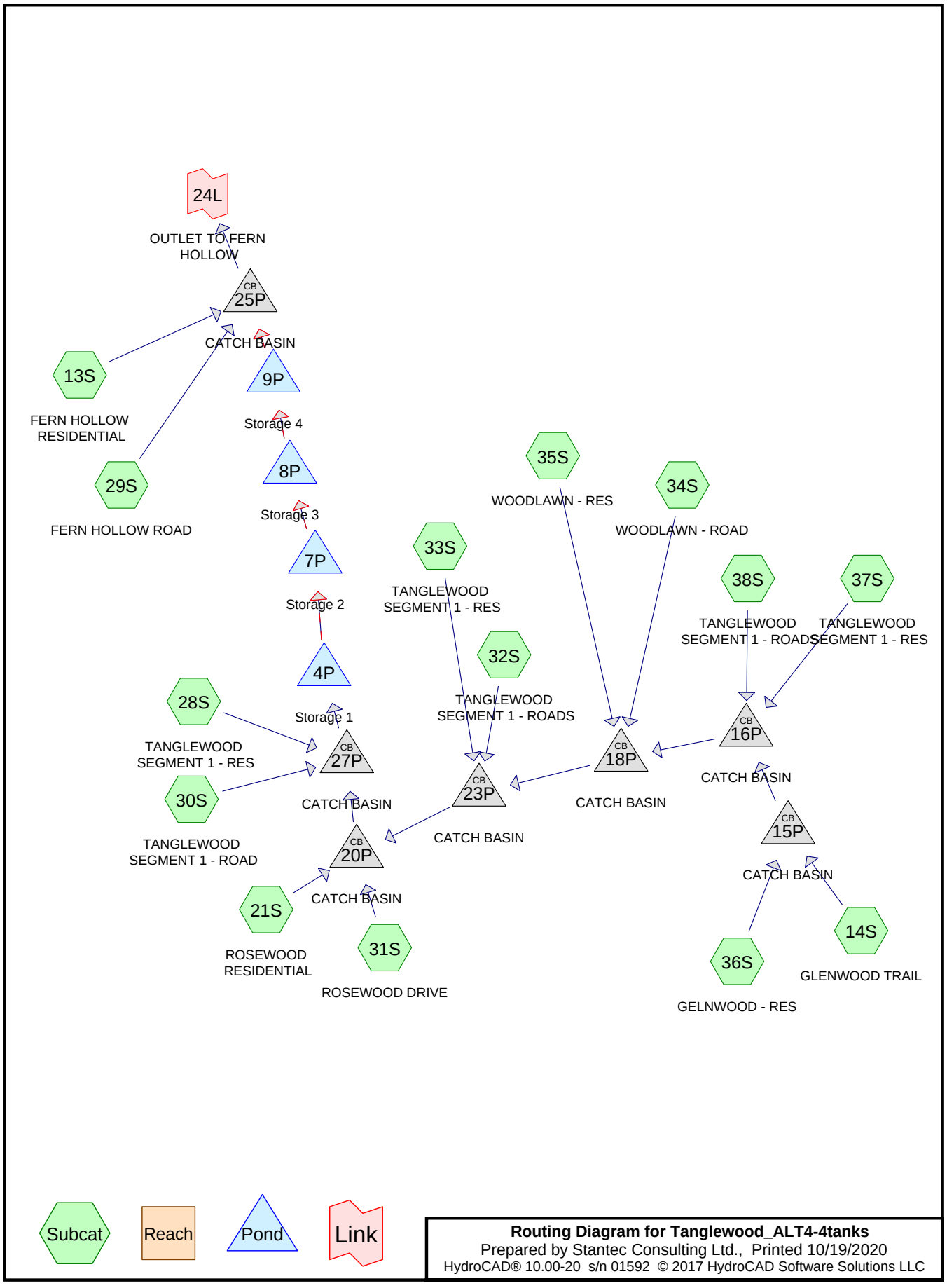
Summary for Link 24L: OUTLET TO FERN HOLLOW

Inflow Area = 17.859 ac, 35.66% Impervious, Inflow Depth = 0.20" for 1 yr event
Inflow = 4.50 cfs @ 12.01 hrs, Volume= 0.292 af
Primary = 4.50 cfs @ 12.01 hrs, Volume= 0.292 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link 24L: OUTLET TO FERN HOLLOW





Routing Diagram for Tanglewood_ALT4-4tanks
Prepared by Stantec Consulting Ltd., Printed 10/19/2020

Summary for Subcatchment 13S: FERN HOLLOW RESIDENTIAL

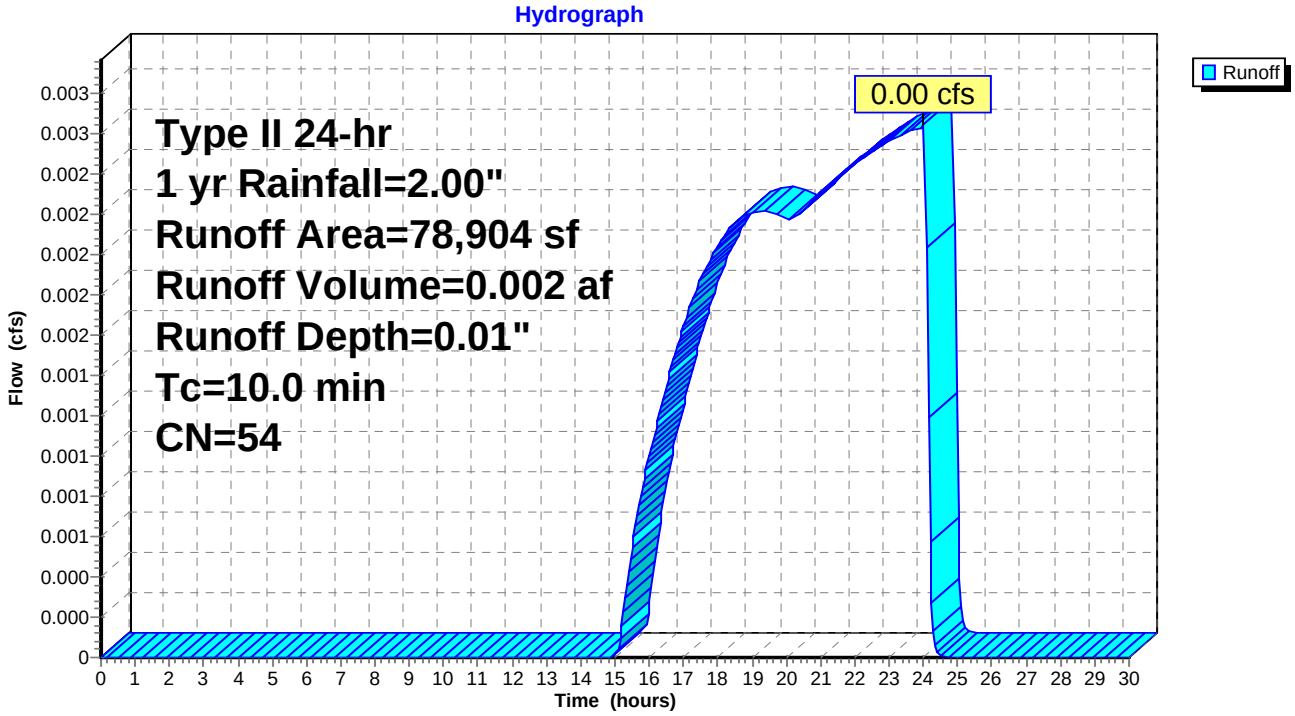
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.002 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
78,904	54	1/2 acre lots, 25% imp, HSG A
59,178		75.00% Pervious Area
19,726		25.00% Impervious Area

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

Subcatchment 13S: FERN HOLLOW RESIDENTIAL



Summary for Subcatchment 14S: GLENWOOD TRAIL

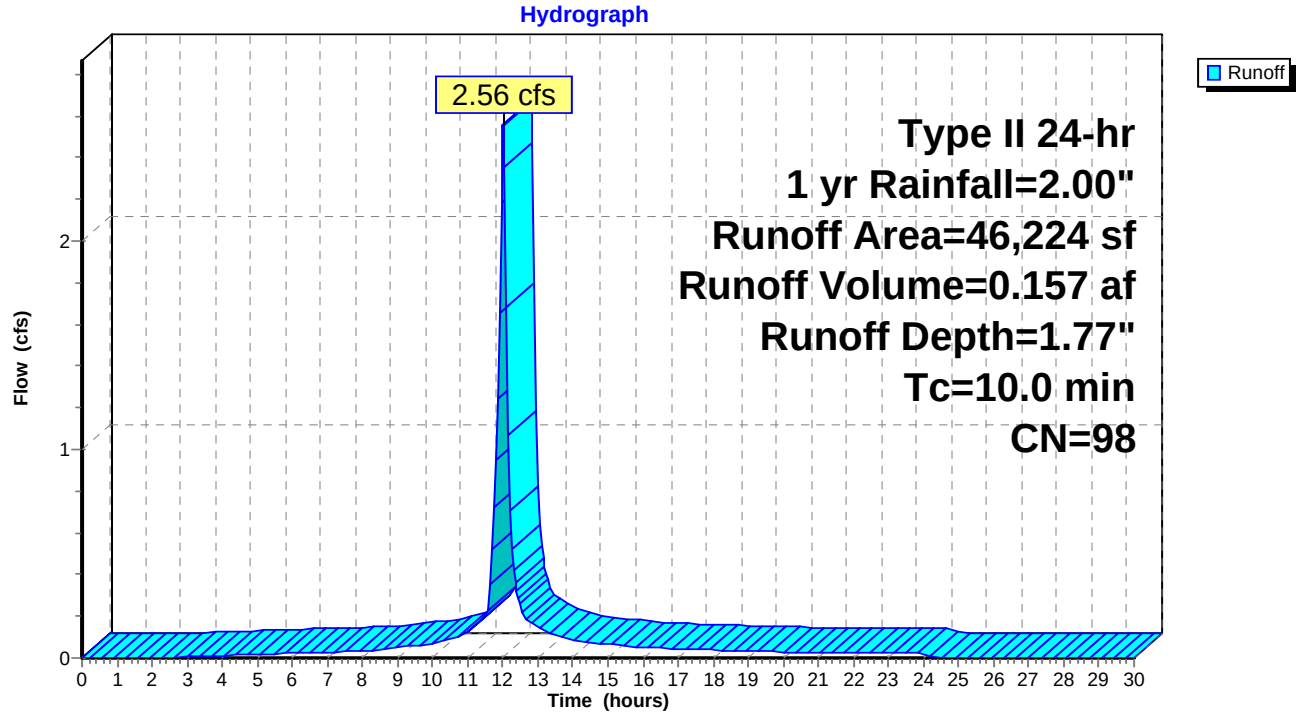
Runoff = 2.56 cfs @ 12.01 hrs, Volume= 0.157 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
46,224	98	Paved roads w/curbs & sewers, HSG A
46,224		100.00% Impervious Area

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

Subcatchment 14S: GLENWOOD TRAIL



Summary for Subcatchment 21S: ROSEWOOD RESIDENTIAL

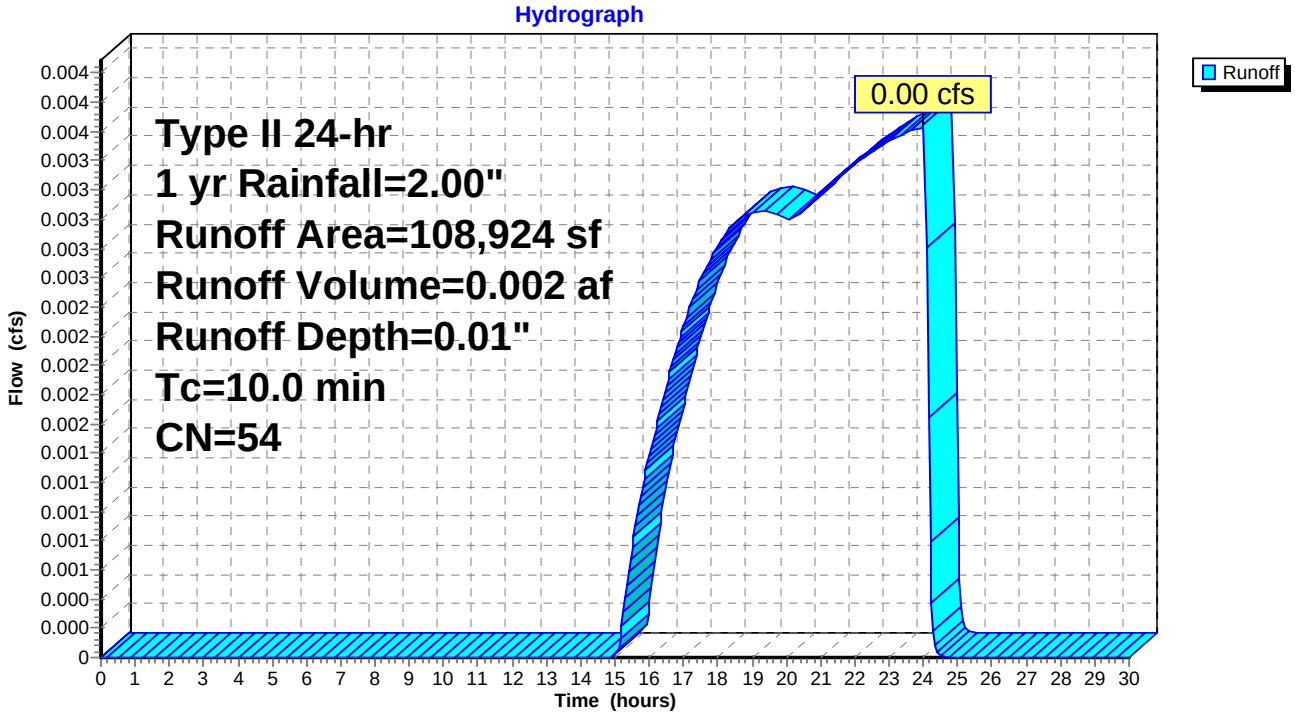
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.002 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
108,924	54	1/2 acre lots, 25% imp, HSG A
81,693		75.00% Pervious Area
27,231		25.00% Impervious Area

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

Subcatchment 21S: ROSEWOOD RESIDENTIAL



Summary for Subcatchment 28S: TANGLEWOOD SEGMENT 1 - RES

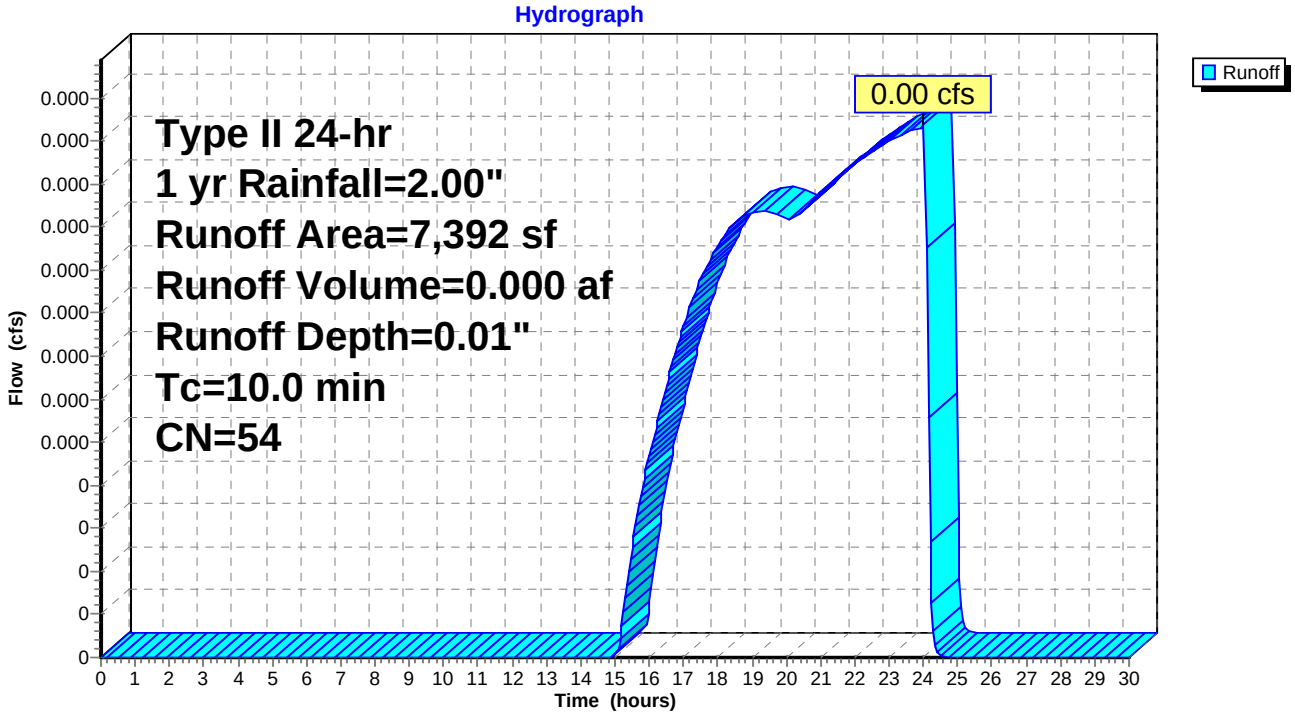
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
7,392	54	1/2 acre lots, 25% imp, HSG A
5,544		75.00% Pervious Area
1,848		25.00% Impervious Area

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

Subcatchment 28S: TANGLEWOOD SEGMENT 1 - RES



Summary for Subcatchment 29S: FERN HOLLOW ROAD

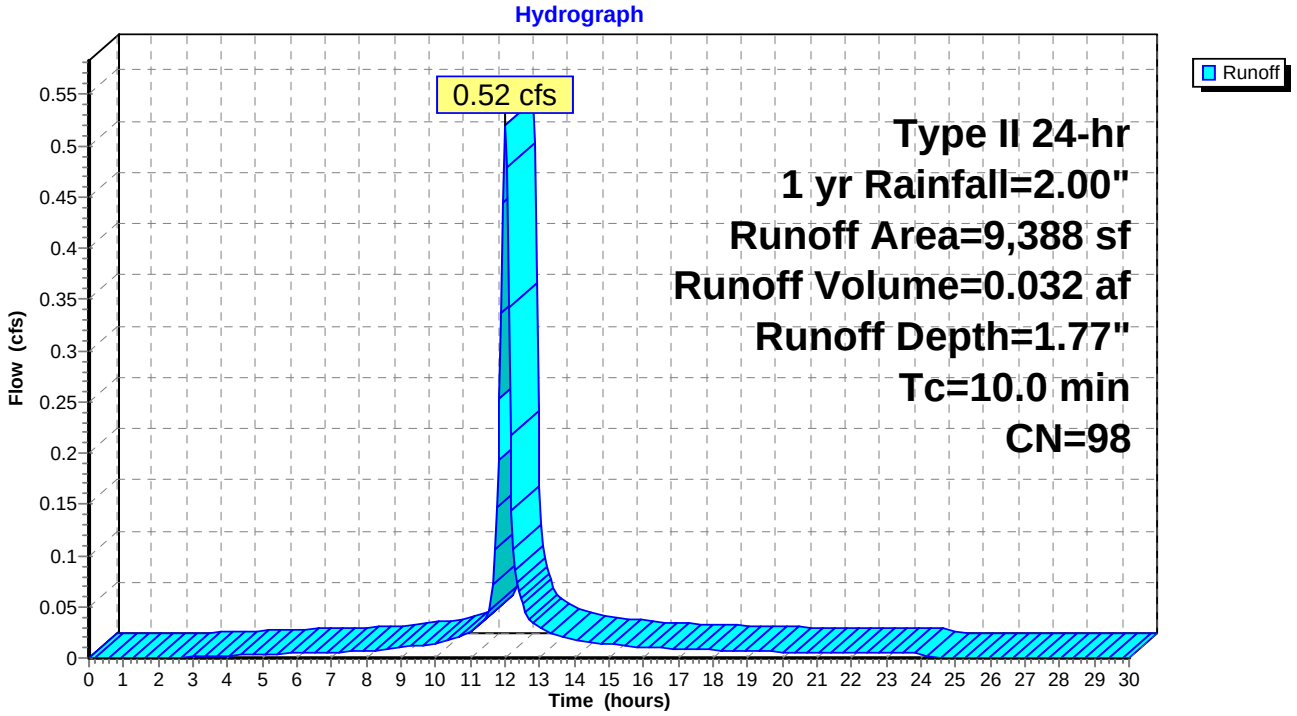
Runoff = 0.52 cfs @ 12.01 hrs, Volume= 0.032 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
9,388	98	Paved roads w/curbs & sewers, HSG A
9,388		100.00% Impervious Area

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

Subcatchment 29S: FERN HOLLOW ROAD



Summary for Subcatchment 30S: TANGLEWOOD SEGMENT 1 - ROAD

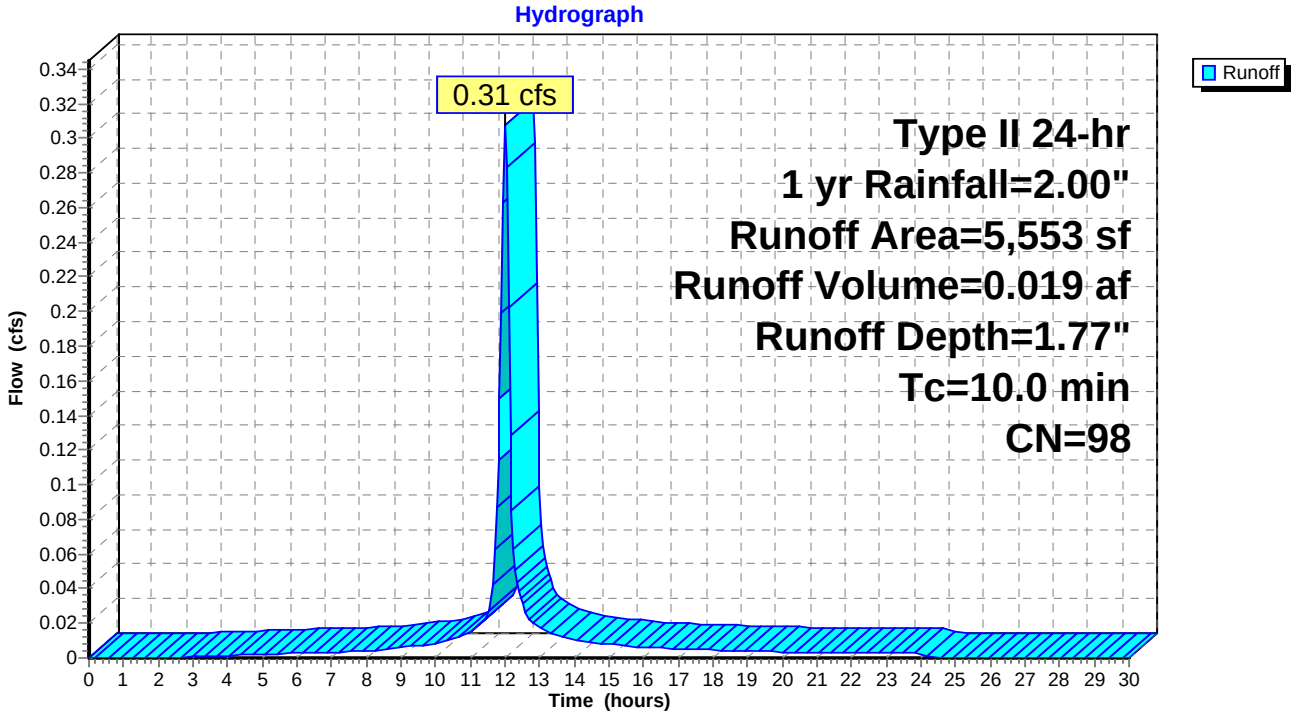
Runoff = 0.31 cfs @ 12.01 hrs, Volume= 0.019 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
5,553	98	Paved roads w/curbs & sewers, HSG A
5,553		100.00% Impervious Area

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

Subcatchment 30S: TANGLEWOOD SEGMENT 1 - ROAD



Summary for Subcatchment 31S: ROSEWOOD DRIVE

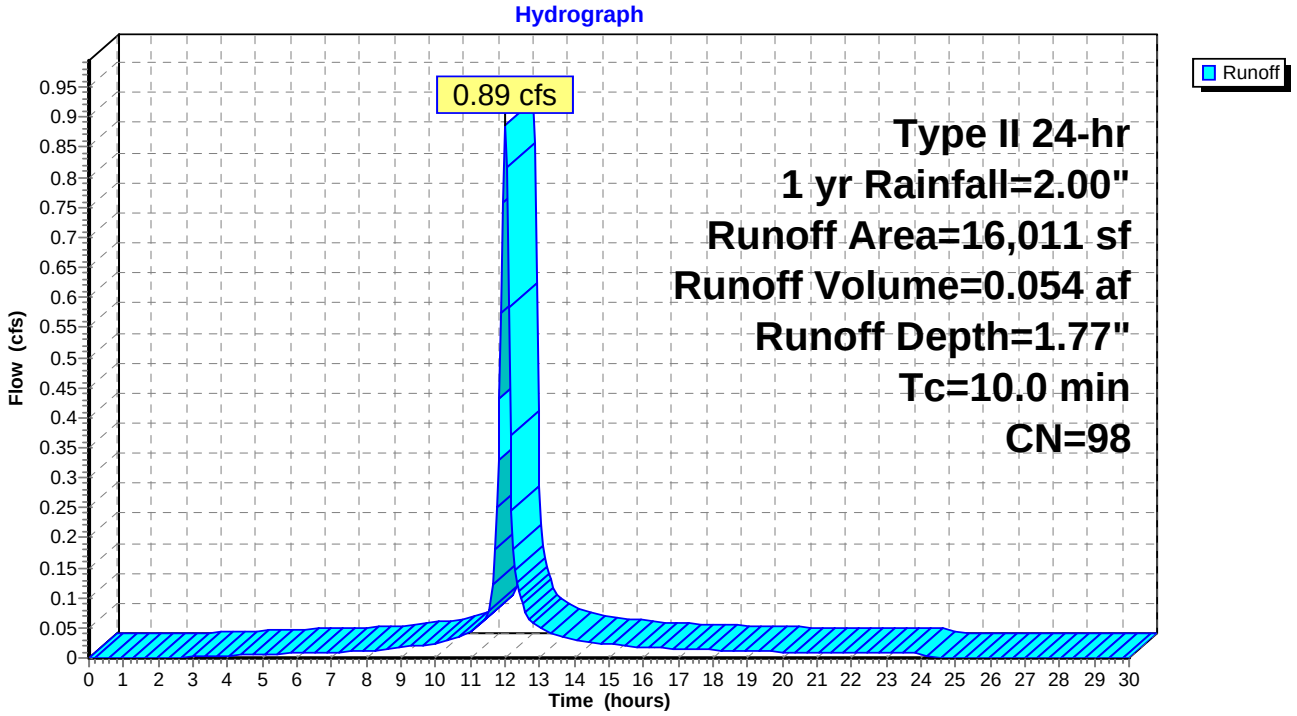
Runoff = 0.89 cfs @ 12.01 hrs, Volume= 0.054 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
16,011	98	Paved roads w/curbs & sewers, HSG A
16,011		100.00% Impervious Area

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

Subcatchment 31S: ROSEWOOD DRIVE



Summary for Subcatchment 32S: TANGLEWOOD SEGMENT 1 - ROADS

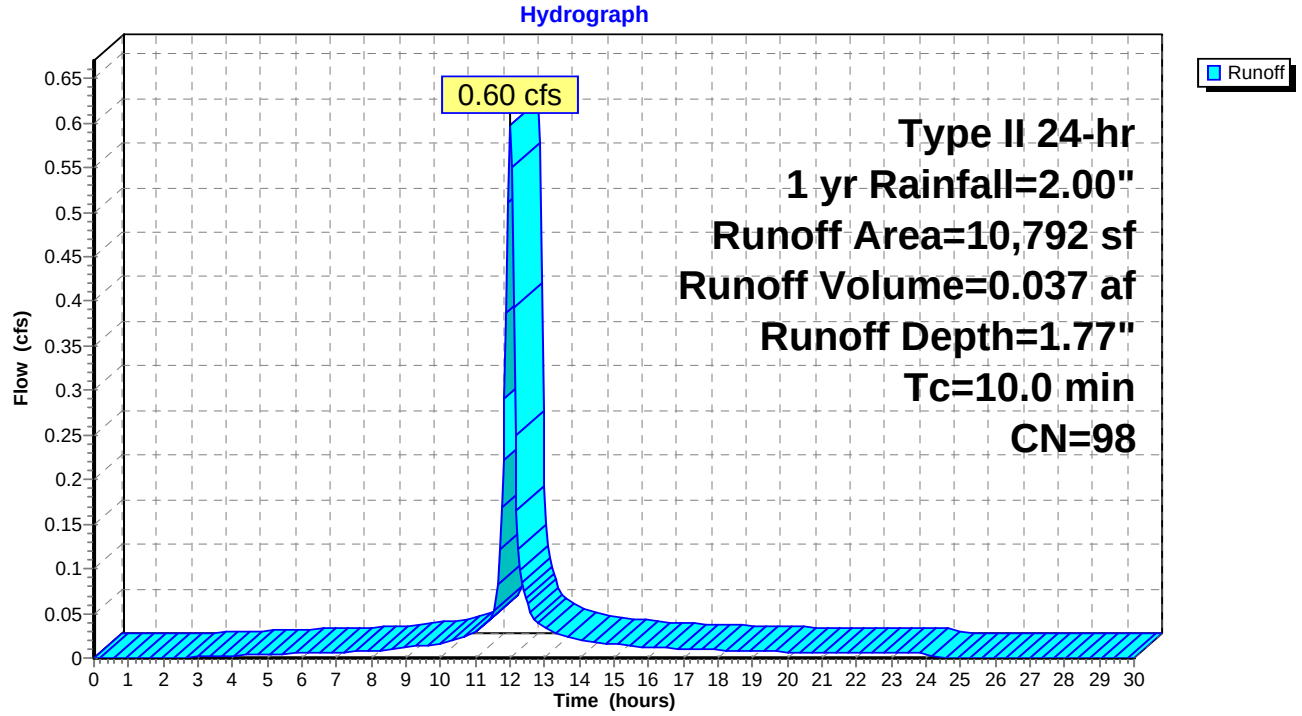
Runoff = 0.60 cfs @ 12.01 hrs, Volume= 0.037 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
10,792	98	Paved roads w/curbs & sewers, HSG A
10,792		100.00% Impervious Area

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

Subcatchment 32S: TANGLEWOOD SEGMENT 1 - ROADS



Summary for Subcatchment 33S: TANGLEWOOD SEGMENT 1 - RES

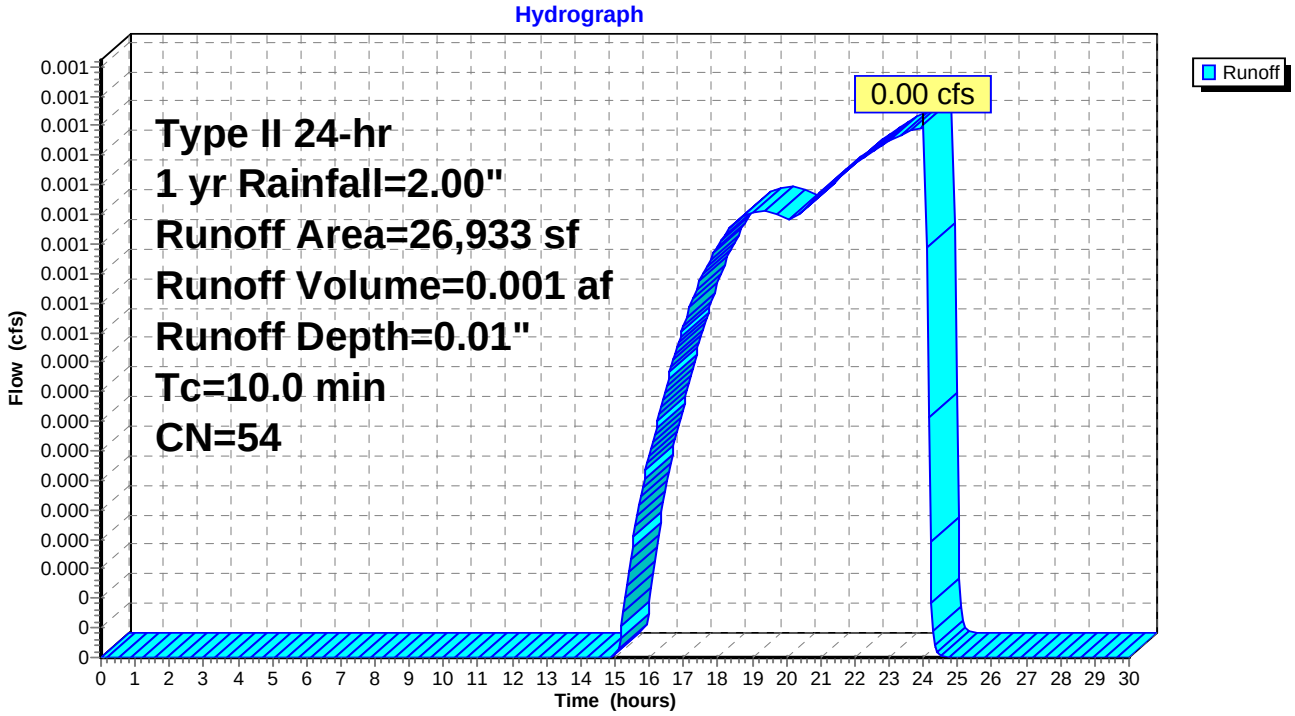
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.001 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
26,933	54	1/2 acre lots, 25% imp, HSG A
20,200		75.00% Pervious Area
6,733		25.00% Impervious Area

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

Subcatchment 33S: TANGLEWOOD SEGMENT 1 - RES



Summary for Subcatchment 34S: WOODLAWN - ROAD

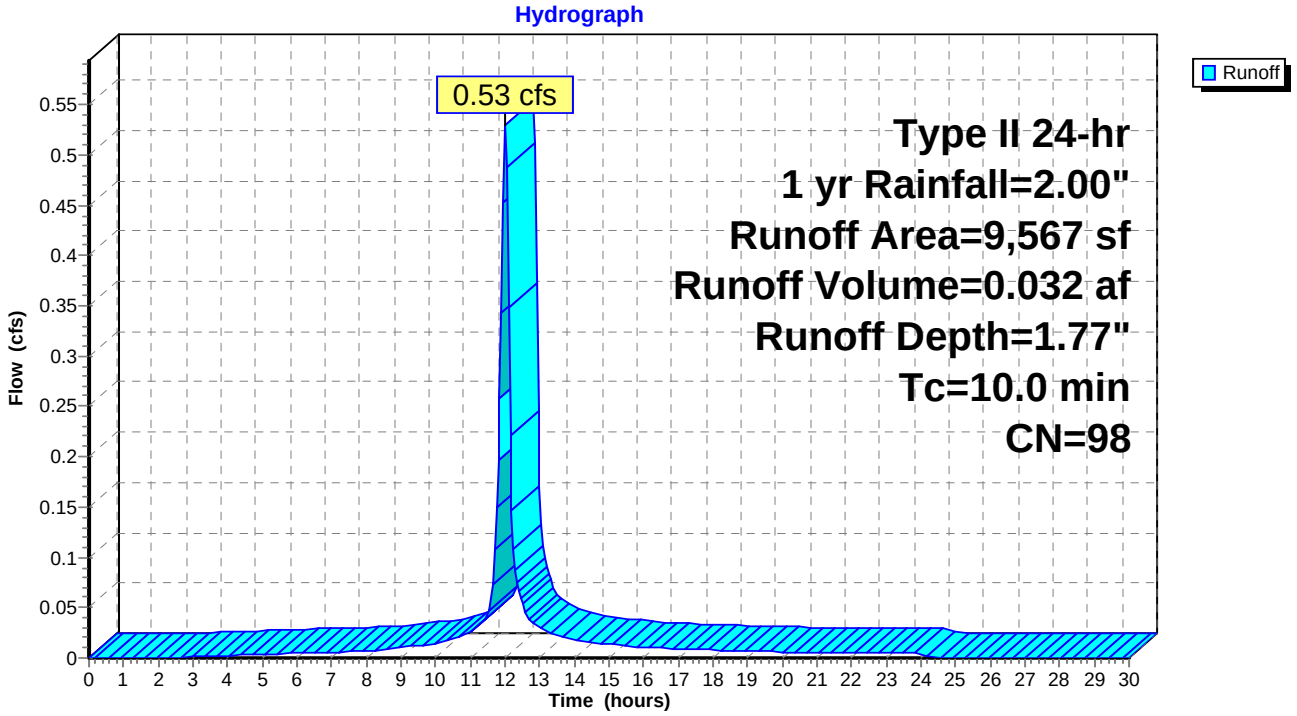
Runoff = 0.53 cfs @ 12.01 hrs, Volume= 0.032 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
9,567	98	Paved roads w/curbs & sewers, HSG A
9,567		100.00% Impervious Area

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

Subcatchment 34S: WOODLAWN - ROAD



Summary for Subcatchment 35S: WOODLAWN - RES

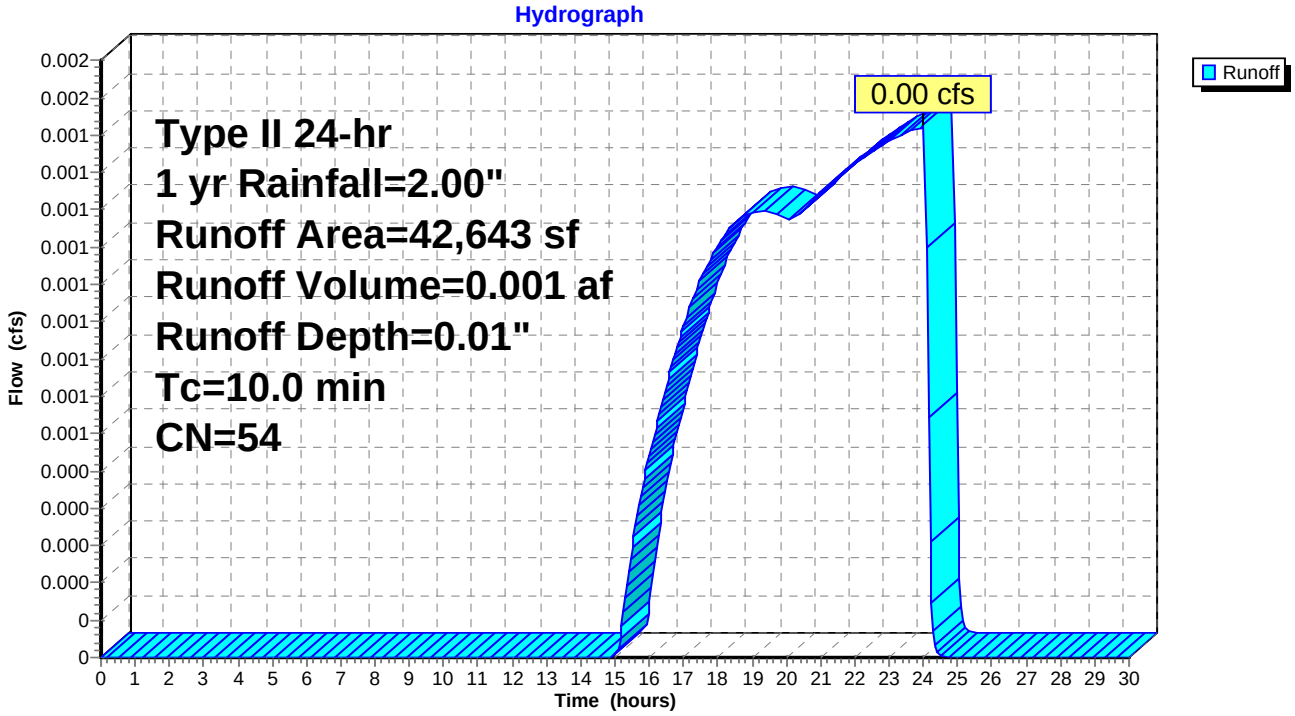
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.001 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
42,643	54	1/2 acre lots, 25% imp, HSG A
31,982		75.00% Pervious Area
10,661		25.00% Impervious Area

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

Subcatchment 35S: WOODLAWN - RES



Summary for Subcatchment 36S: GELNWOOD - RES

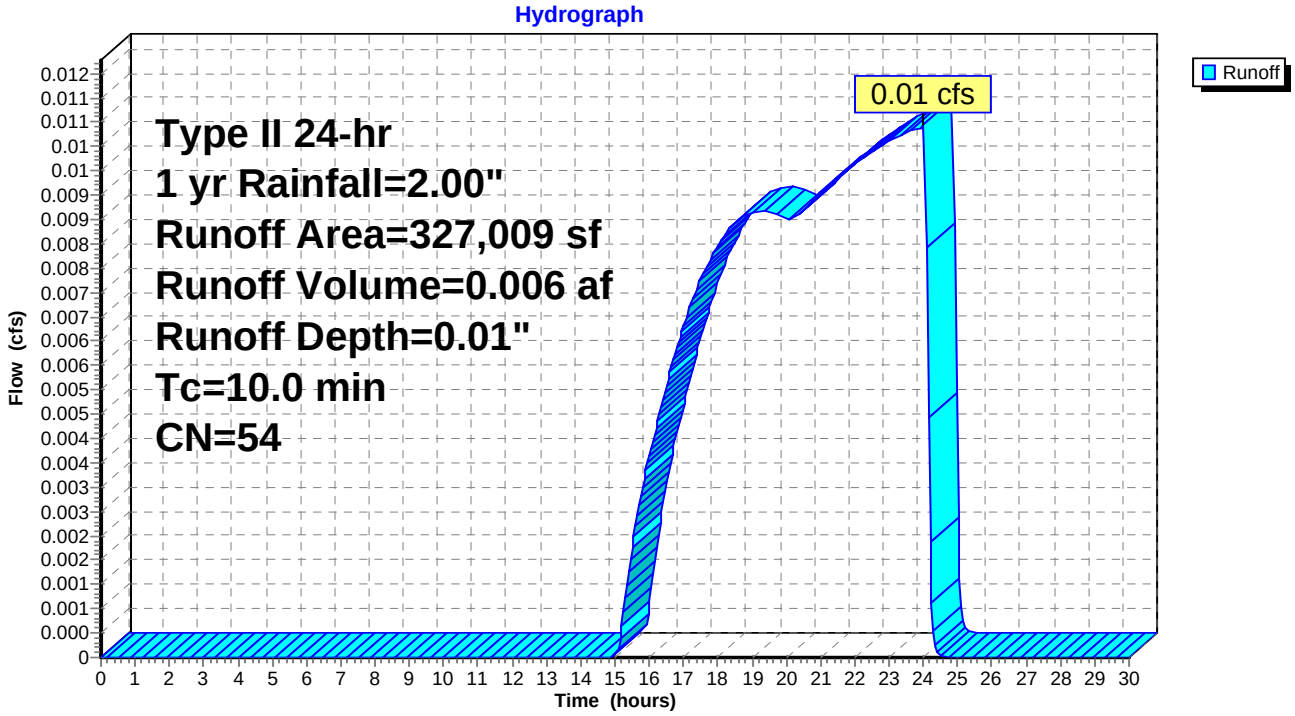
Runoff = 0.01 cfs @ 24.00 hrs, Volume= 0.006 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
327,009	54	1/2 acre lots, 25% imp, HSG A
245,257		75.00% Pervious Area
81,752		25.00% Impervious Area

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

Subcatchment 36S: GELNWOOD - RES



Summary for Subcatchment 37S: TANGLEWOOD SEGMENT 1 - RES

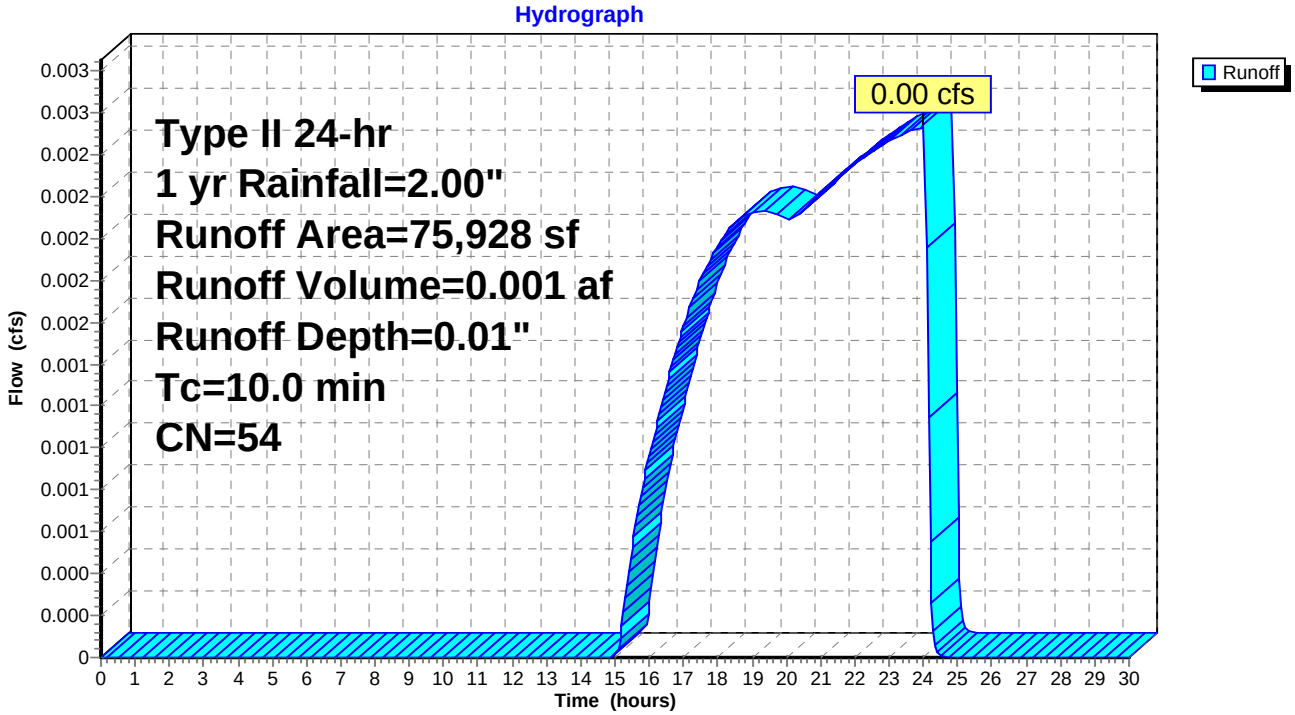
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.001 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
75,928	54	1/2 acre lots, 25% imp, HSG A
56,946		75.00% Pervious Area
18,982		25.00% Impervious Area

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

Subcatchment 37S: TANGLEWOOD SEGMENT 1 - RES



Summary for Subcatchment 38S: TANGLEWOOD SEGMENT 1 - ROADS

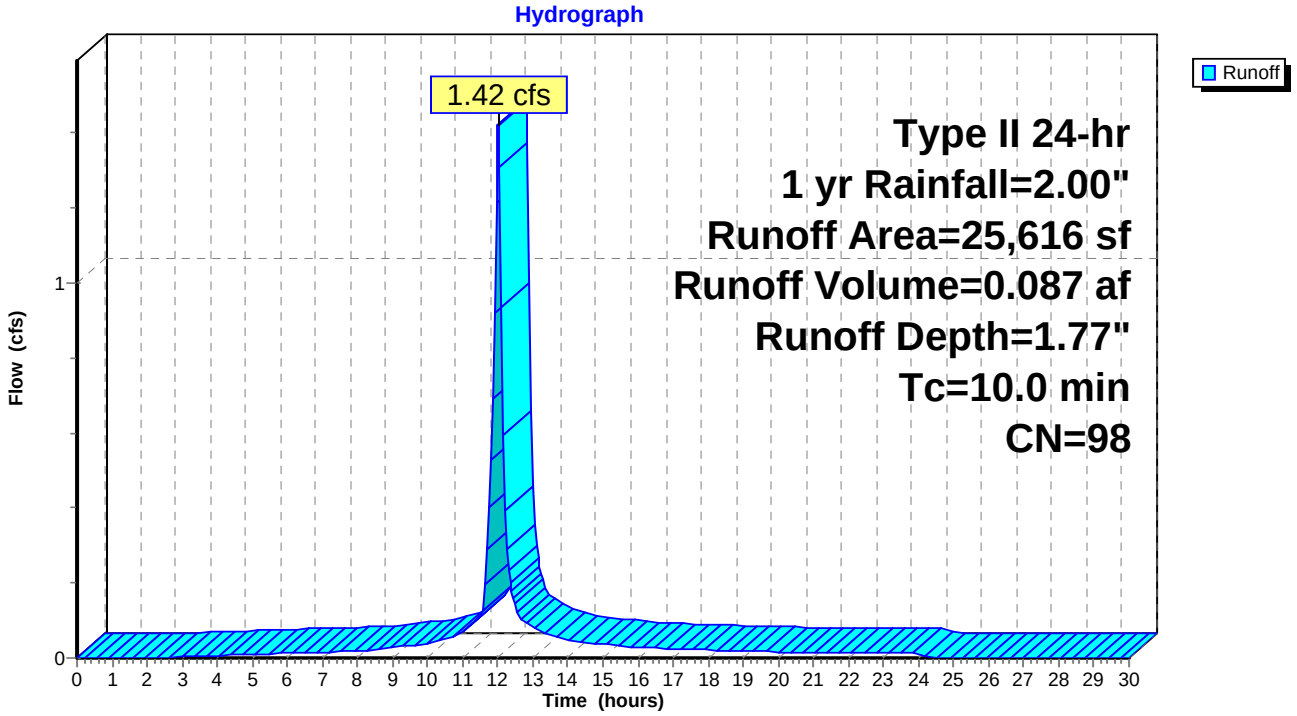
Runoff = 1.42 cfs @ 12.01 hrs, Volume= 0.087 af, Depth= 1.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 1 yr Rainfall=2.00"

Area (sf)	CN	Description
25,616	98	Paved roads w/curbs & sewers, HSG A
25,616		100.00% Impervious Area

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

Subcatchment 38S: TANGLEWOOD SEGMENT 1 - ROADS



Summary for Pond 4P: Storage 1

Inflow Area = 16.129 ac, 37.14% Impervious, Inflow Depth = 0.30" for 1 yr event
Inflow = 6.31 cfs @ 12.01 hrs, Volume= 0.397 af
Outflow = 6.00 cfs @ 12.04 hrs, Volume= 0.397 af, Atten= 5%, Lag= 2.2 min
Primary = 5.79 cfs @ 12.04 hrs, Volume= 0.397 af
Secondary = 0.21 cfs @ 12.05 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 486.09' @ 12.04 hrs Surf.Area= 0.001 ac Storage= 0.013 af

Plug-Flow detention time= 1.1 min calculated for 0.397 af (100% of inflow)
Center-of-Mass det. time= 1.1 min (781.4 - 780.3)

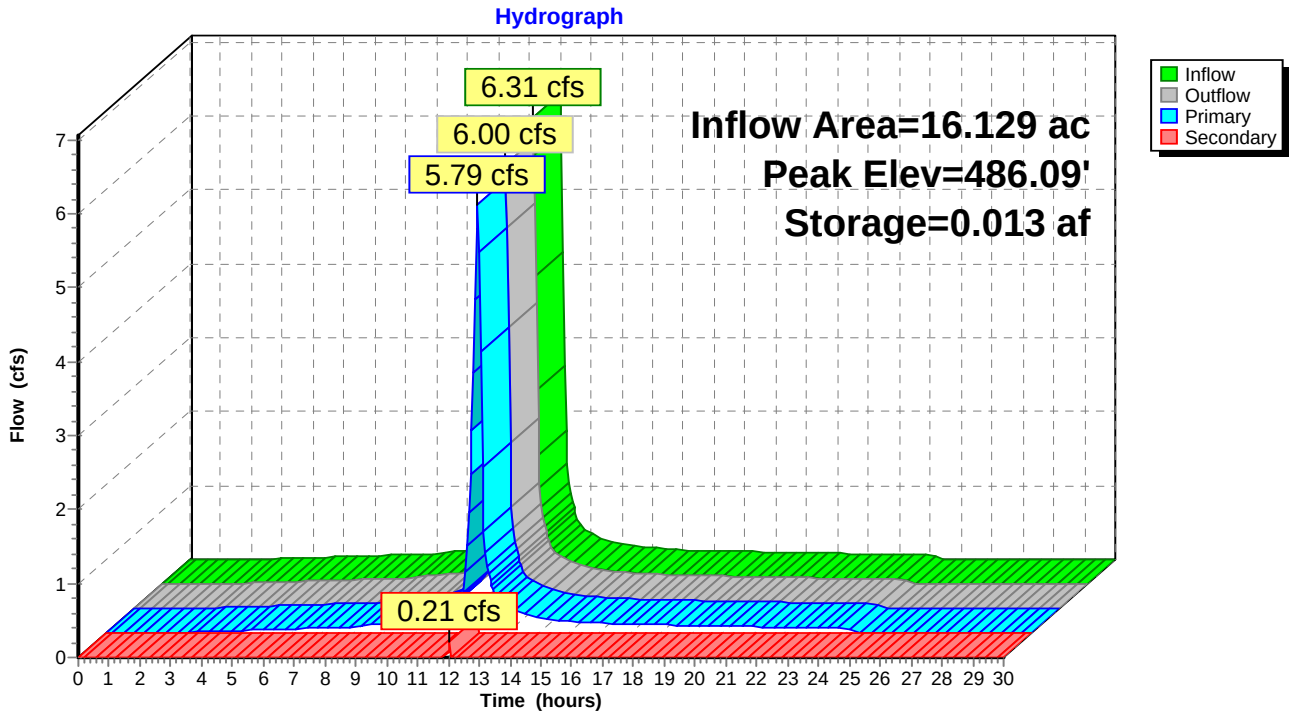
Volume	Invert	Avail.Storage	Storage Description
#1	475.00'	0.014 af	**8.00'D x 12.00'H Vertical Cone/Cylinder**

Device	Routing	Invert	Outlet Devices
#1	Primary	475.00'	**8.2" Vert. Orifice/Grate (8.25")** C= 0.600
#2	Secondary	486.00'	**18.0" Horiz. Orifice/Grate (18")** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=5.73 cfs @ 12.04 hrs HW=485.87' (Free Discharge)
└**1=Orifice/Grate (8.25")** (Orifice Controls 5.73 cfs @ 15.62 fps)

Secondary OutFlow Max=0.18 cfs @ 12.05 hrs HW=486.05' (Free Discharge)
└**2=Orifice/Grate (18")** (Weir Controls 0.18 cfs @ 0.75 fps)

Pond 4P: Storage 1



Summary for Pond 7P: Storage 2

Inflow Area = 16.129 ac, 37.14% Impervious, Inflow Depth = 0.30" for 1 yr event
Inflow = 6.00 cfs @ 12.04 hrs, Volume= 0.397 af
Outflow = 5.51 cfs @ 12.09 hrs, Volume= 0.397 af, Atten= 8%, Lag= 2.5 min
Primary = 5.51 cfs @ 12.09 hrs, Volume= 0.397 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 481.05' @ 12.09 hrs Surf.Area= 0.001 ac Storage= 0.016 af

Plug-Flow detention time= 1.3 min calculated for 0.397 af (100% of inflow)
Center-of-Mass det. time= 1.3 min (782.7 - 781.4)

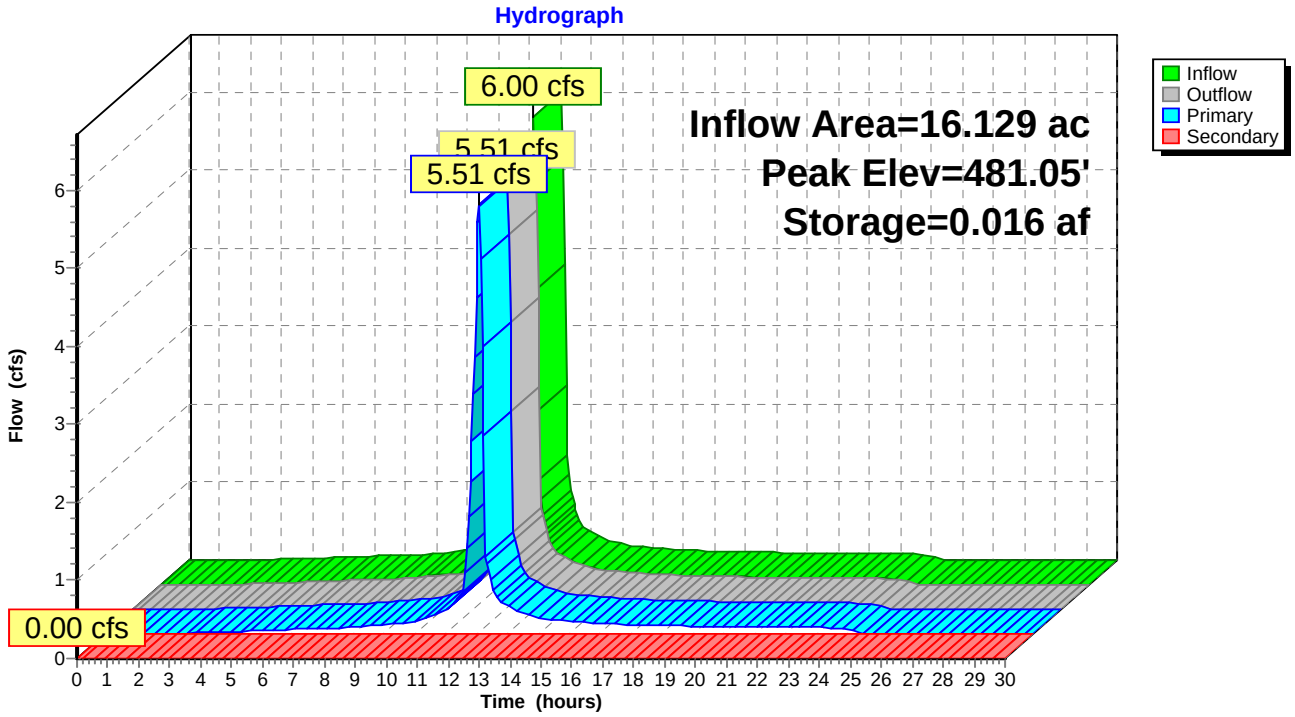
Volume	Invert	Avail.Storage	Storage Description
#1	470.00'	0.014 af	**8.00'D x 12.00'H Vertical Cone/Cylinder**
#2	473.20'	0.004 af	**18.0" Round Pipe Storage** L= 90.0' S= 0.0200 '/'
		0.017 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	470.00'	**8.0" Vert. Orifice/Grate (8.0")** C= 0.600
#2	Secondary	481.00'	**18.0" Horiz. Orifice/Grate (18")** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=5.42 cfs @ 12.09 hrs HW=480.74' (Free Discharge)
↑—**1=Orifice/Grate (8.0")** (Orifice Controls 5.42 cfs @ 15.53 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=470.00' (Free Discharge)
↑—**2=Orifice/Grate (18")** (Controls 0.00 cfs)

Pond 7P: Storage 2



Summary for Pond 8P: Storage 3

Inflow Area = 16.129 ac, 37.14% Impervious, Inflow Depth = 0.30" for 1 yr event
Inflow = 5.51 cfs @ 12.09 hrs, Volume= 0.397 af
Outflow = 5.15 cfs @ 12.13 hrs, Volume= 0.397 af, Atten= 6%, Lag= 2.8 min
Primary = 5.13 cfs @ 12.13 hrs, Volume= 0.397 af
Secondary = 0.02 cfs @ 12.15 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 477.18' @ 12.13 hrs Surf.Area= 0.001 ac Storage= 0.014 af

Plug-Flow detention time= 1.3 min calculated for 0.397 af (100% of inflow)
Center-of-Mass det. time= 1.3 min (784.0 - 782.7)

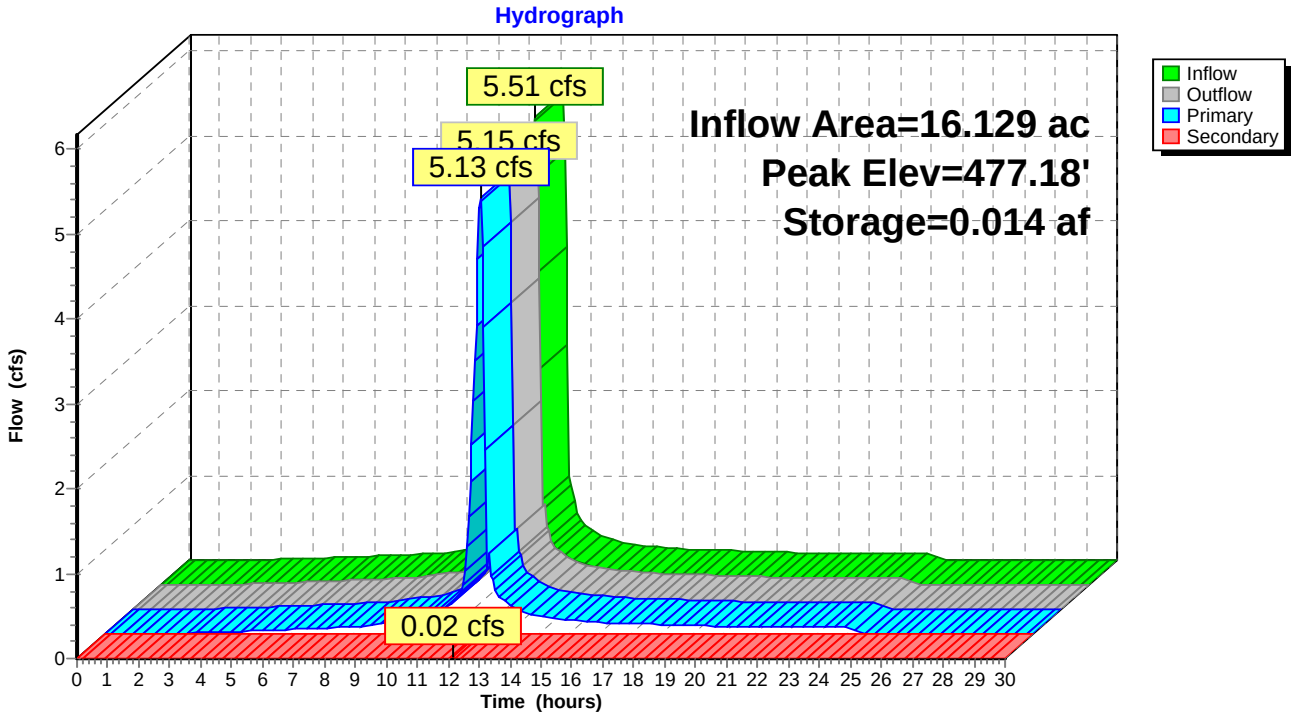
Volume	Invert	Avail.Storage	Storage Description
#1	466.00'	0.014 af	**8.00'D x 12.00'H Vertical Cone/Cylinder**
#2	470.50'	0.001 af	**18.0" Round Pipe Storage** L= 25.0' S= 0.0200 '/'
		0.015 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	466.00'	**7.7" Vert. Orifice/Grate (7.75")** C= 0.600
#2	Secondary	477.00'	**18.0" Horiz. Orifice/Grate (18")** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=5.06 cfs @ 12.13 hrs HW=476.90' (Free Discharge)
↑—**1=Orifice/Grate (7.75")** (Orifice Controls 5.06 cfs @ 15.66 fps)

Secondary OutFlow Max=0.01 cfs @ 12.15 hrs HW=477.01' (Free Discharge)
↑—**2=Orifice/Grate (18")** (Weir Controls 0.01 cfs @ 0.27 fps)

Pond 8P: Storage 3



Summary for Pond 9P: Storage 4

Inflow Area = 16.129 ac, 37.14% Impervious, Inflow Depth = 0.30" for 1 yr event
Inflow = 5.15 cfs @ 12.13 hrs, Volume= 0.397 af
Outflow = 4.68 cfs @ 12.20 hrs, Volume= 0.397 af, Atten= 9%, Lag= 3.8 min
Primary = 4.68 cfs @ 12.20 hrs, Volume= 0.397 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 468.35' @ 12.20 hrs Surf.Area= 0.001 ac Storage= 0.016 af

Plug-Flow detention time= 1.4 min calculated for 0.397 af (100% of inflow)
Center-of-Mass det. time= 1.4 min (785.4 - 784.0)

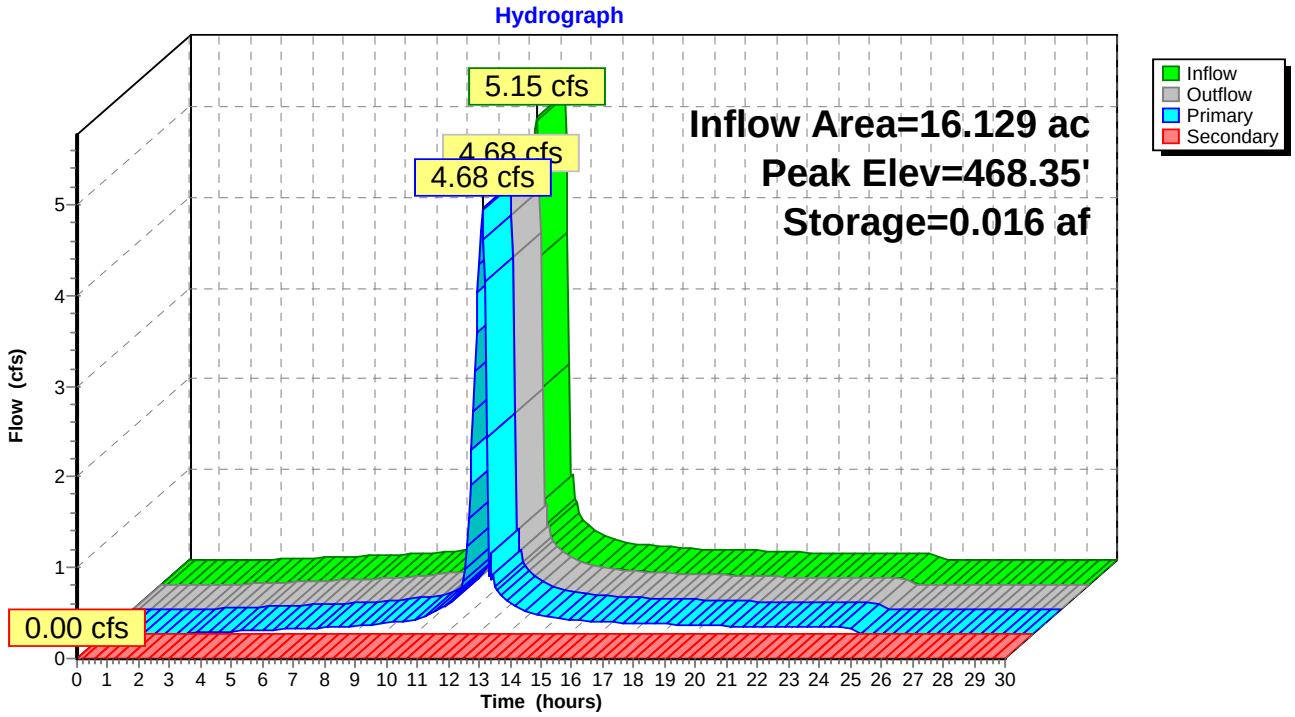
Volume	Invert	Avail.Storage	Storage Description
#1	458.00'	0.014 af	**8.00'D x 12.00'H Vertical Cone/Cylinder**
#2	464.00'	0.004 af	**18.0" Round Pipe Storage** L= 100.0' S= 0.0200 '/'
		0.018 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	458.00'	**7.5" Vert. Orifice/Grate (7.5")** C= 0.600
#2	Secondary	469.00'	**18.0" Horiz. Orifice/Grate (18")** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=4.66 cfs @ 12.20 hrs HW=468.26' (Free Discharge)
└**1=Orifice/Grate (7.5")** (Orifice Controls 4.66 cfs @ 15.18 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=458.00' (Free Discharge)
└**2=Orifice/Grate (18")** (Controls 0.00 cfs)

Pond 9P: Storage 4



Summary for Pond 15P: CATCH BASIN

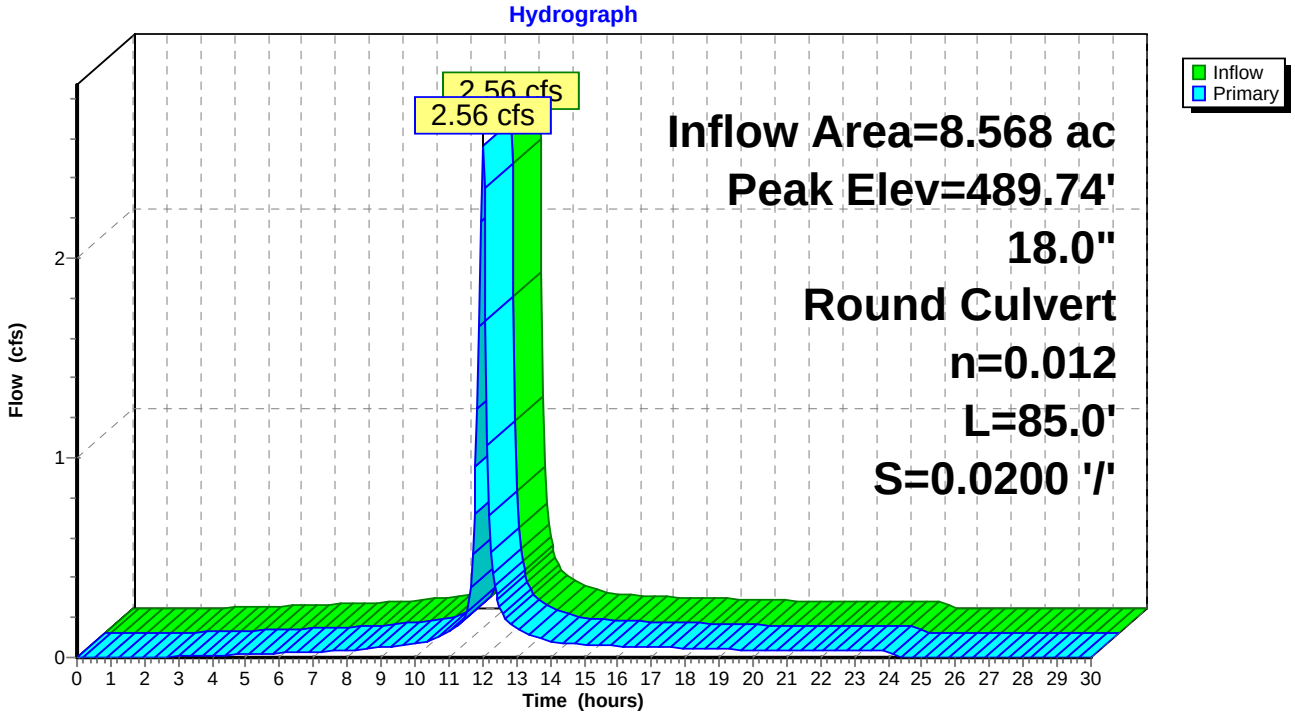
Inflow Area = 8.568 ac, 34.29% Impervious, Inflow Depth = 0.23" for 1 yr event
Inflow = 2.56 cfs @ 12.01 hrs, Volume= 0.163 af
Outflow = 2.56 cfs @ 12.01 hrs, Volume= 0.163 af, Atten= 0%, Lag= 0.0 min
Primary = 2.56 cfs @ 12.01 hrs, Volume= 0.163 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 489.74' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 85.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=2.53 cfs @ 12.01 hrs HW=489.74' (Free Discharge)
└**1=Culvert** (Inlet Controls 2.53 cfs @ 2.92 fps)

Pond 15P: CATCH BASIN



Summary for Pond 16P: CATCH BASIN

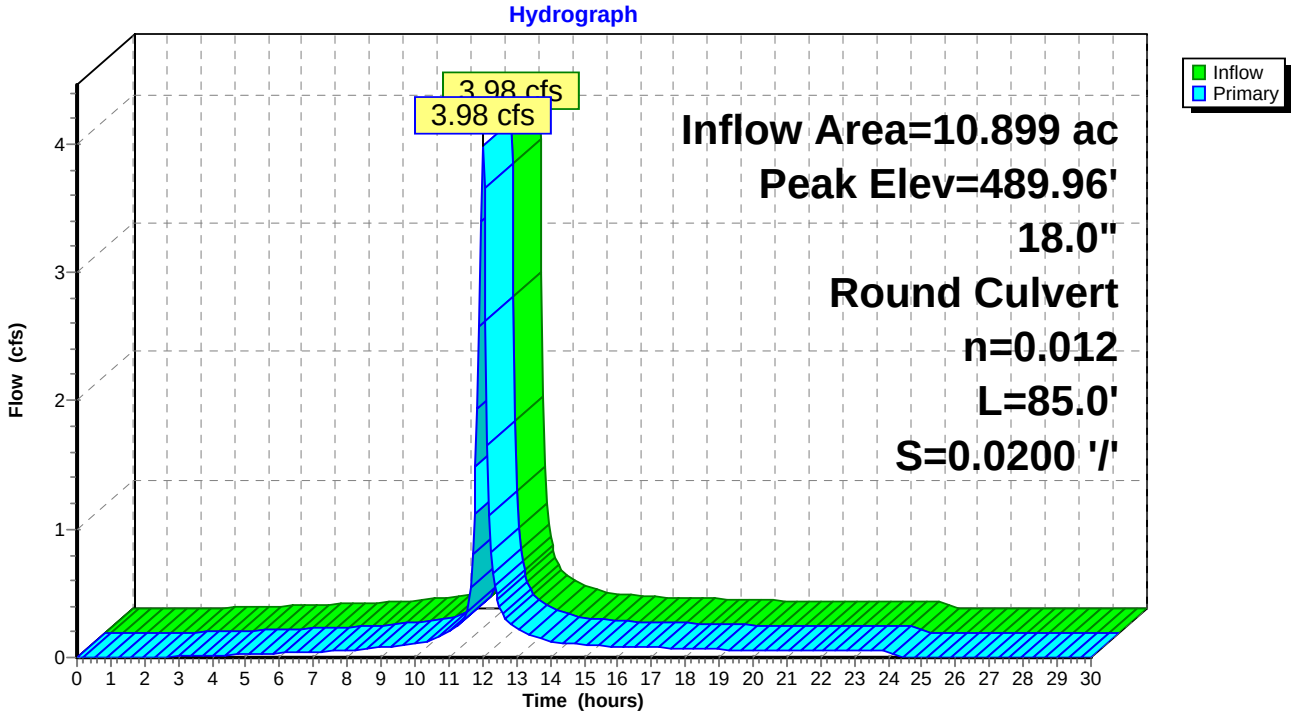
Inflow Area = 10.899 ac, 36.35% Impervious, Inflow Depth = 0.28" for 1 yr event
Inflow = 3.98 cfs @ 12.01 hrs, Volume= 0.252 af
Outflow = 3.98 cfs @ 12.01 hrs, Volume= 0.252 af, Atten= 0%, Lag= 0.0 min
Primary = 3.98 cfs @ 12.01 hrs, Volume= 0.252 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 489.96' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 85.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=3.93 cfs @ 12.01 hrs HW=489.95' (Free Discharge)
└**1=Culvert** (Inlet Controls 3.93 cfs @ 3.32 fps)

Pond 16P: CATCH BASIN



Summary for Pond 18P: CATCH BASIN

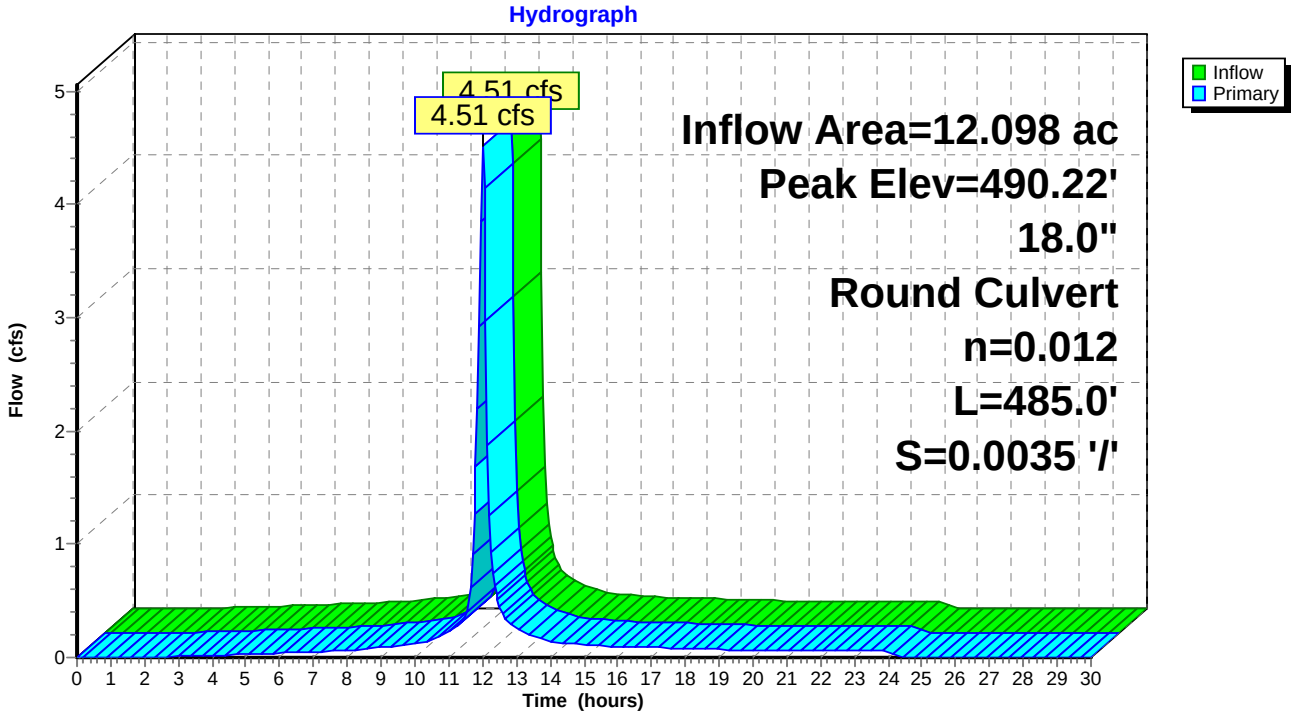
Inflow Area = 12.098 ac, 36.59% Impervious, Inflow Depth = 0.28" for 1 yr event
Inflow = 4.51 cfs @ 12.01 hrs, Volume= 0.285 af
Outflow = 4.51 cfs @ 12.01 hrs, Volume= 0.285 af, Atten= 0%, Lag= 0.0 min
Primary = 4.51 cfs @ 12.01 hrs, Volume= 0.285 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 490.22' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 485.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0035 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=4.45 cfs @ 12.01 hrs HW=490.21' (Free Discharge)
└**1=Culvert** (Barrel Controls 4.45 cfs @ 4.00 fps)

Pond 18P: CATCH BASIN



Summary for Pond 20P: CATCH BASIN

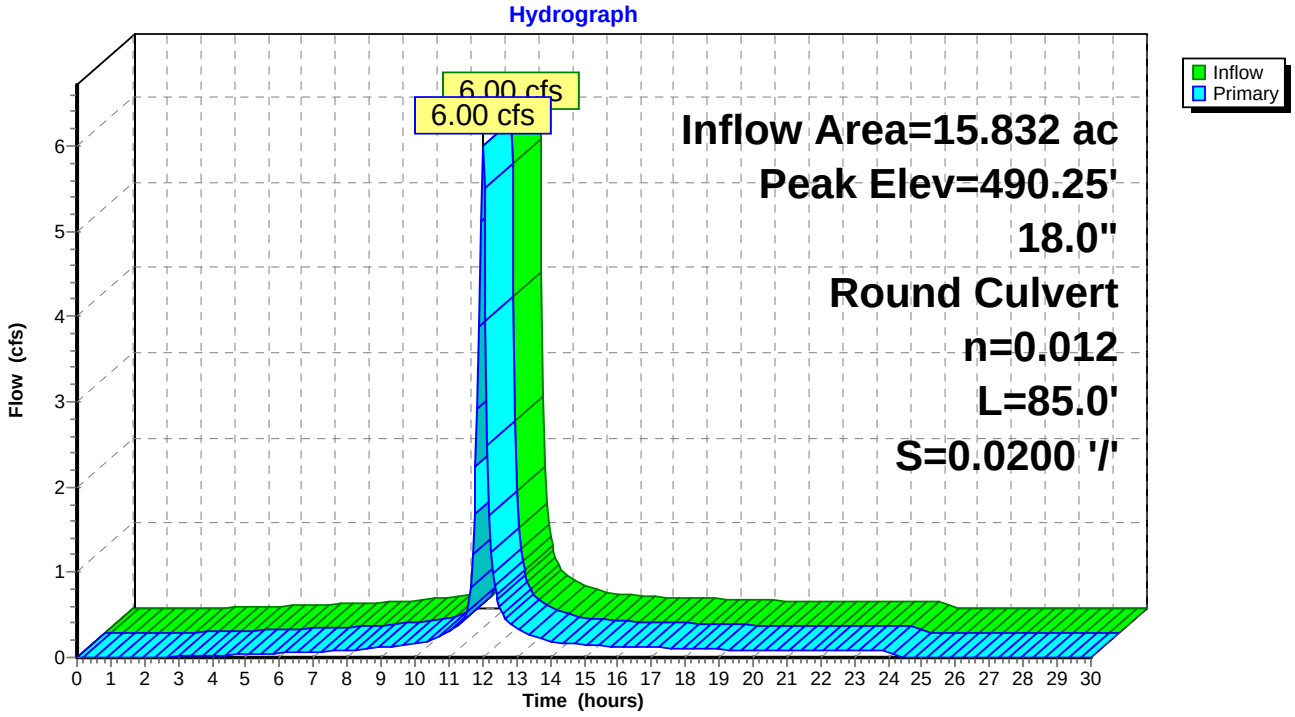
Inflow Area = 15.832 ac, 36.77% Impervious, Inflow Depth = 0.29" for 1 yr event
Inflow = 6.00 cfs @ 12.01 hrs, Volume= 0.378 af
Outflow = 6.00 cfs @ 12.01 hrs, Volume= 0.378 af, Atten= 0%, Lag= 0.0 min
Primary = 6.00 cfs @ 12.01 hrs, Volume= 0.378 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 490.25' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 85.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=5.92 cfs @ 12.01 hrs HW=490.24' (Free Discharge)
└**1=Culvert** (Inlet Controls 5.92 cfs @ 3.79 fps)

Pond 20P: CATCH BASIN



Summary for Pond 23P: CATCH BASIN

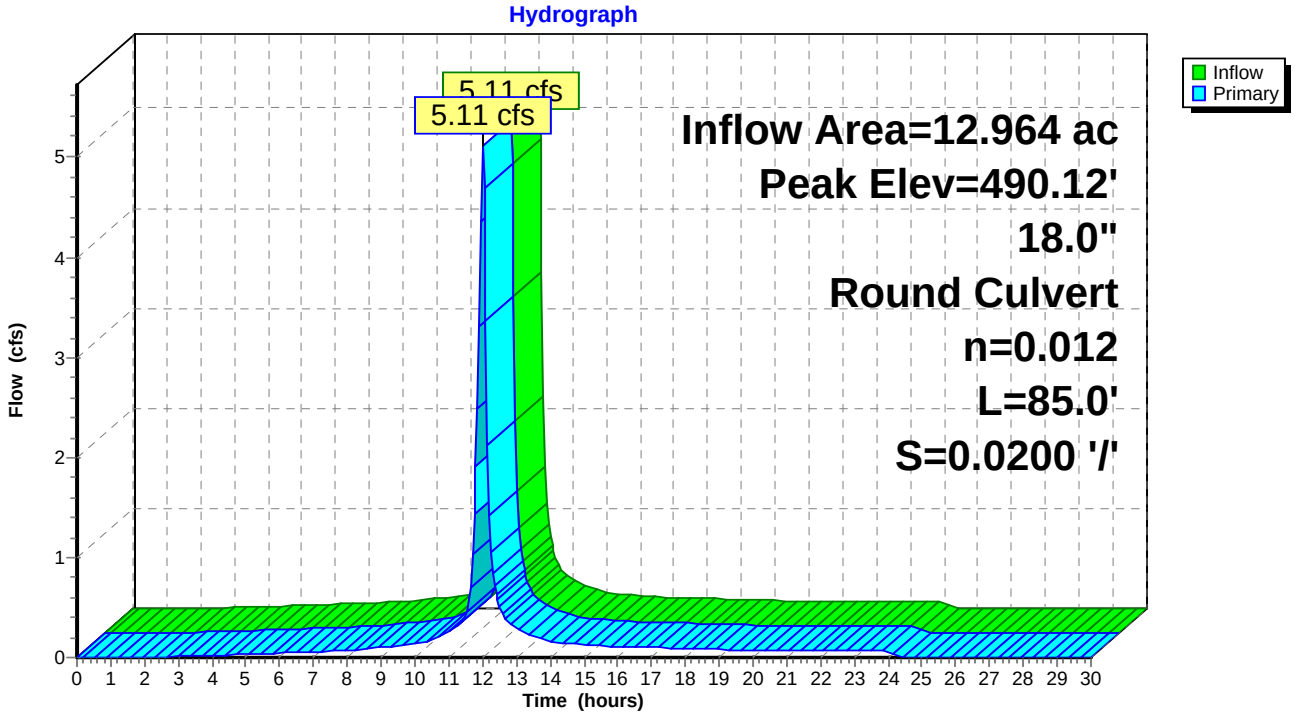
Inflow Area = 12.964 ac, 37.25% Impervious, Inflow Depth = 0.30" for 1 yr event
Inflow = 5.11 cfs @ 12.01 hrs, Volume= 0.322 af
Outflow = 5.11 cfs @ 12.01 hrs, Volume= 0.322 af, Atten= 0%, Lag= 0.0 min
Primary = 5.11 cfs @ 12.01 hrs, Volume= 0.322 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 490.12' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 85.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=5.04 cfs @ 12.01 hrs HW=490.11' (Free Discharge)
└**1=Culvert** (Inlet Controls 5.04 cfs @ 3.59 fps)

Pond 23P: CATCH BASIN



Summary for Pond 25P: CATCH BASIN

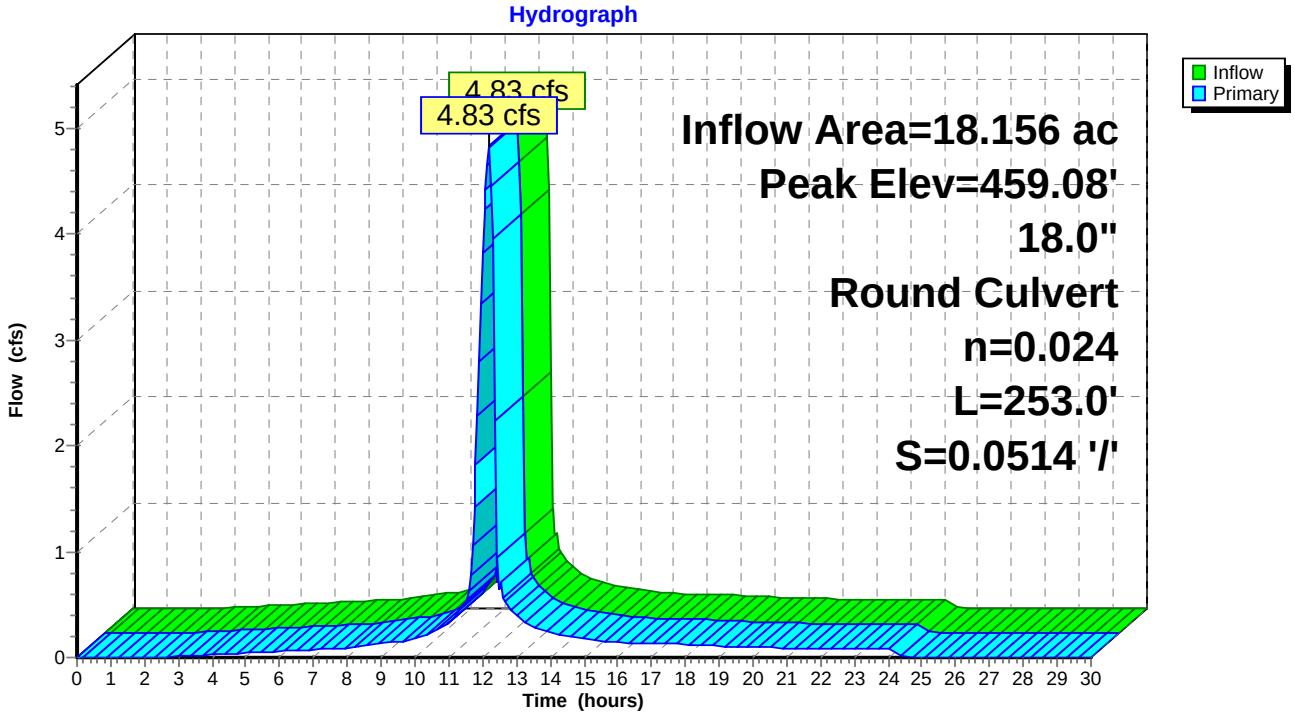
Inflow Area = 18.156 ac, 36.68% Impervious, Inflow Depth = 0.28" for 1 yr event
Inflow = 4.83 cfs @ 12.19 hrs, Volume= 0.431 af
Outflow = 4.83 cfs @ 12.19 hrs, Volume= 0.431 af, Atten= 0%, Lag= 0.0 min
Primary = 4.83 cfs @ 12.19 hrs, Volume= 0.431 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 459.08' @ 12.19 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	458.00'	**18.0" Round Culvert** L= 253.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 458.00' / 445.00' S= 0.0514 '/' Cc= 0.900 n= 0.024, Flow Area= 1.77 sf

Primary OutFlow Max=4.79 cfs @ 12.19 hrs HW=459.08' (Free Discharge)
└**1=Culvert** (Inlet Controls 4.79 cfs @ 3.53 fps)

Pond 25P: CATCH BASIN



Summary for Pond 27P: CATCH BASIN

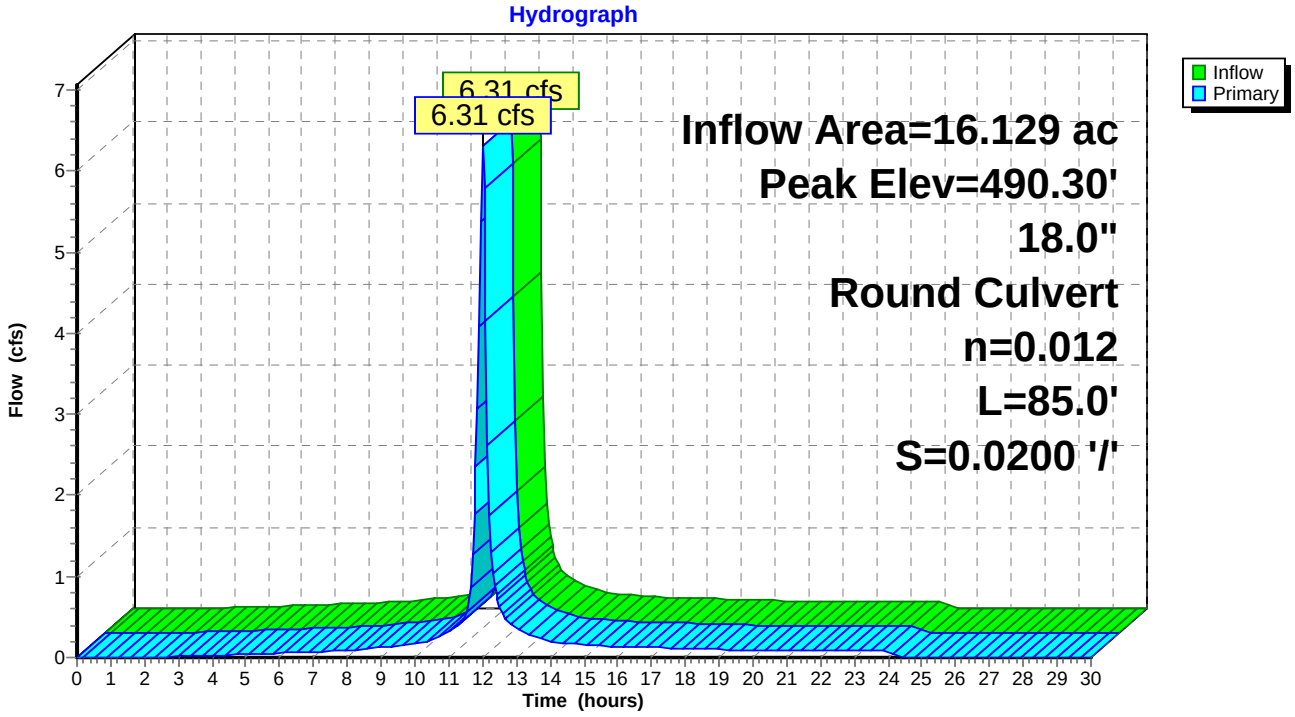
Inflow Area = 16.129 ac, 37.14% Impervious, Inflow Depth = 0.30" for 1 yr event
Inflow = 6.31 cfs @ 12.01 hrs, Volume= 0.397 af
Outflow = 6.31 cfs @ 12.01 hrs, Volume= 0.397 af, Atten= 0%, Lag= 0.0 min
Primary = 6.31 cfs @ 12.01 hrs, Volume= 0.397 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Peak Elev= 490.30' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	489.00'	**18.0" Round Culvert** L= 85.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 489.00' / 487.30' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf

Primary OutFlow Max=6.22 cfs @ 12.01 hrs HW=490.29' (Free Discharge)
└**1=Culvert** (Inlet Controls 6.22 cfs @ 3.86 fps)

Pond 27P: CATCH BASIN

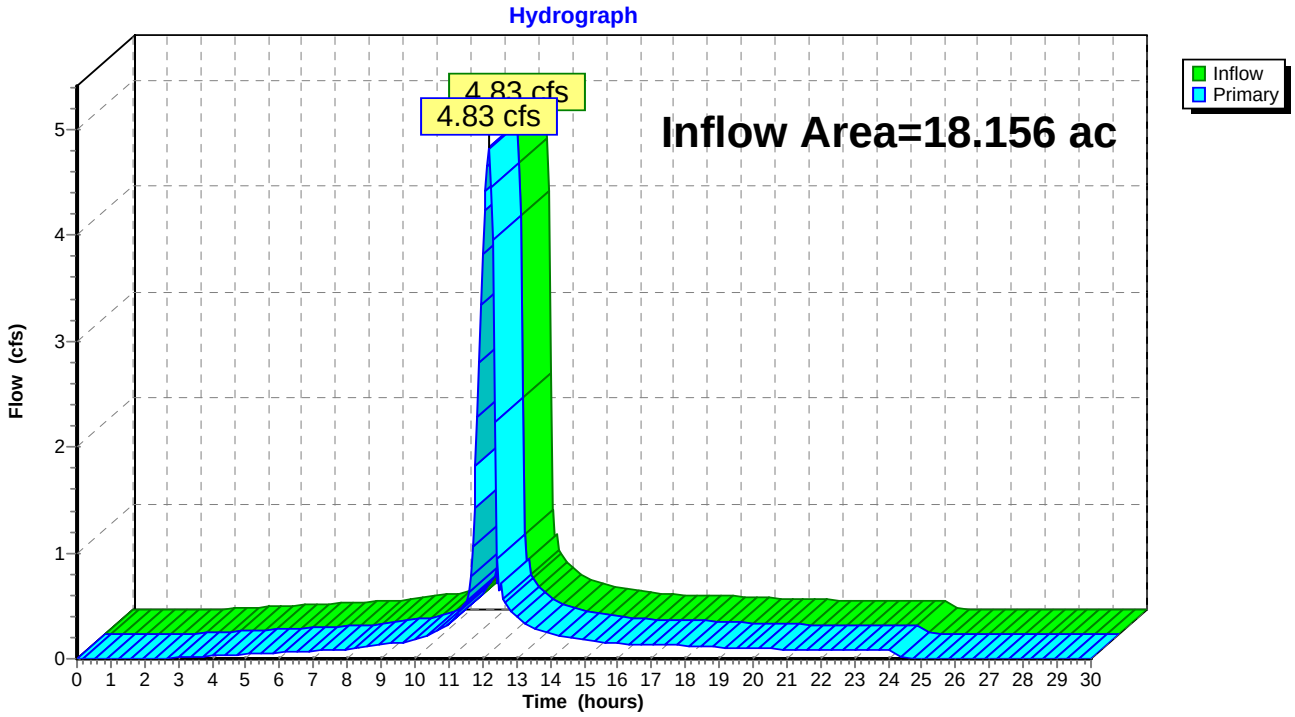


Summary for Link 24L: OUTLET TO FERN HOLLOW

Inflow Area = 18.156 ac, 36.68% Impervious, Inflow Depth = 0.28" for 1 yr event
Inflow = 4.83 cfs @ 12.19 hrs, Volume= 0.431 af
Primary = 4.83 cfs @ 12.19 hrs, Volume= 0.431 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Link 24L: OUTLET TO FERN HOLLOW



APPENDIX B

Archeological Resource Assessment

HARTGEN
archeological associates inc

ARCHEOLOGICAL RESOURCE ASSESSMENT

Tanglewood Drive Shared-Use Path and Stormwater Project

Town of Essex
Chittenden County, Vermont

HAA # 5500.11

Submitted to:

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An ACRA Member Firm
www.acra-crm.org

August 2020

MANAGEMENT SUMMARY

SHPO Project Review Number:
Involved State and Federal Agencies: *Vermont Agency of Transportation (VTrans)*
Phase of Survey: *Archeological Resource Assessment (ARA)*

LOCATION INFORMATION

Municipality: *Town of Essex*
County: *Chittenden County, Vermont*

SURVEY AREA

Tanglewood Drive: *The area of potential effects (APE) for the ARA includes the areas directly adjacent to Tanglewood Drive, along an alignment measuring approximately 1,000 feet in length and an approximate 300-foot alignment along Fern Hollow Road. In addition, stormwater improvements are proposed along an approximate 300-foot alignment within and adjacent to a seasonal waterway.*

RESULTS OF RESEARCH

Total number of Precontact Archeological sites within one mile of the project area: *Six*
Historic Archeological sites within one mile: *None*
NR/NRE districts in or adjacent: *None*
Precontact Sensitivity: *Low*
Historic Sensitivity: *Low*

RECOMMENDATIONS

Archeological potential is low due to previous disturbance from road construction, driveways, curbing, sidewalks and utilities. The portion of the project area located within and adjacent to a seasonal waterway has been previously disturbed by erosion and man-made alterations for stormwater features.

Report Authors: *Elise Manning-Sterling*

Date of Report: *August 2020*

ARCHEOLOGICAL RESOURCE ASSESSMENT

INTRODUCTION

Hartgen Archeological Associates, Inc. (HAA, Inc.) was retained by Stantec to conduct an Archaeological Resource Assessment (ARA) for the proposed Tanglewood Drive Shared-Use Path and Stormwater Project located in the Village of Essex Junction, Chittenden County, Vermont (Map 1). Tanglewood Drive in Essex is a dead-end residential street with a curb-to-curb pavement width of approximately 40 feet and no sidewalks or shared-use paths. The Town of Essex would like to study possible pedestrian bicycling and stormwater improvements along Tanglewood Drive from Cindy Lane to Woodlawn Drive and along Fern Hollow Road (Map 2, 2a, 2b, 2c). The project is being undertaken by the Town with funding from the Chittenden County Regional Planning Commission. The cultural resources investigations required according to Section 106 of the National Historic Preservation Act. The project requires approval by the Vermont Agency of Transportation (VTrans), and the cultural resource report will be reviewed by the VTrans archaeology officer.

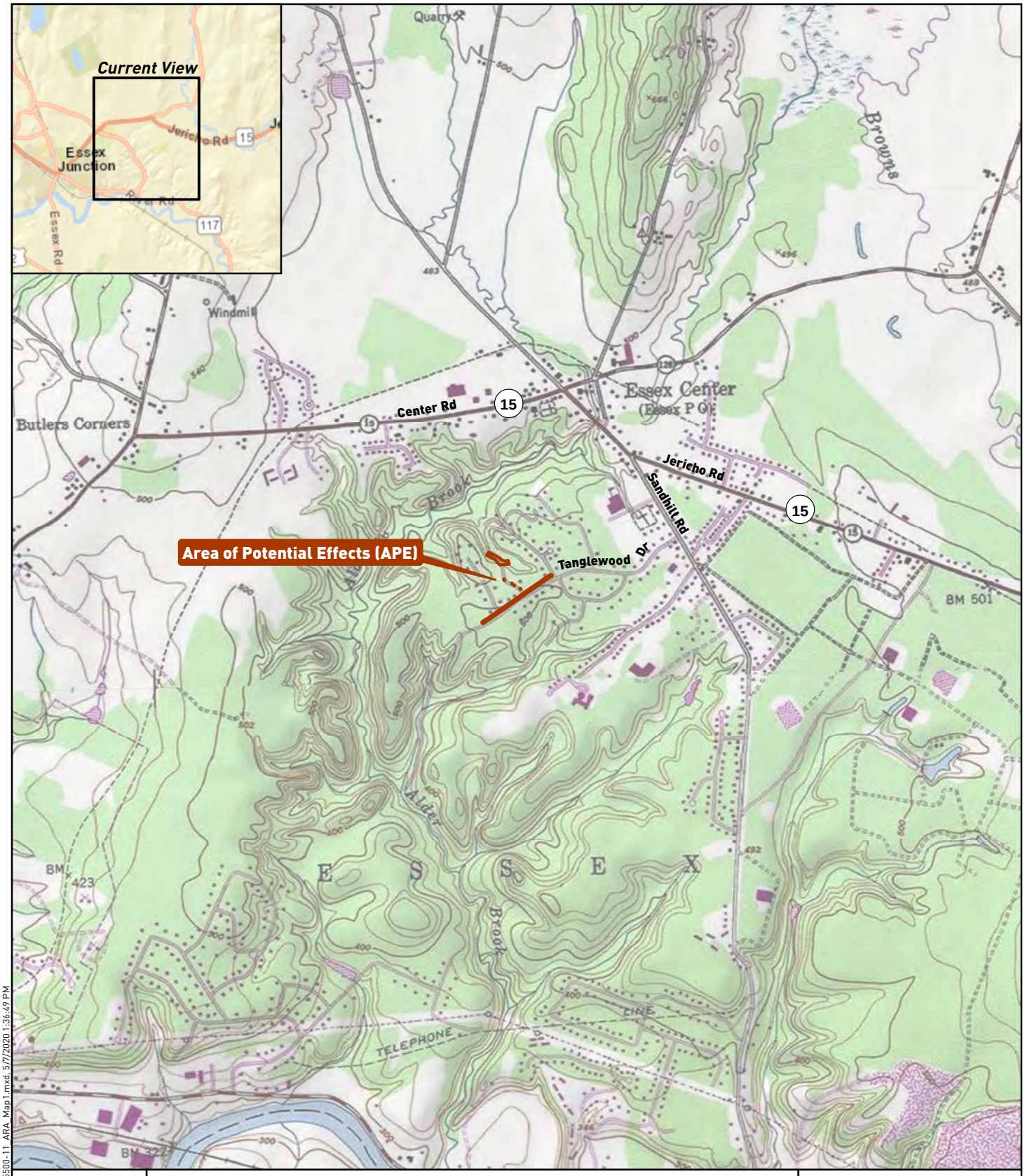
The primary objective of the ARA is to identify areas of archeological sensitivity based on environmental factors, known site information and historical information for the project Area of Potential Effects (APE). Reference to the general project vicinity is provided as appropriate to understanding the local cultural and historical context. Background research was conducted at the Vermont Division for Historic Preservation (VDHP) ORC (Online Resource Center) site where archeological site files, National Register (NR), State Register (SR) and town information were reviewed. A site visit was conducted by Elise Manning Sterling to observe and photograph existing conditions within the project area.

Current Conditions and Environmental Overview

The Tanglewood Drive project area is characterized as a late 20th-century housing development containing small to moderate sized well-kept residences set back a distance from the road, with grass lawns and gardens (Photos 1-4). The project plans also propose stormwater improvements along Fern Hollow which include the installation of several storage structures in the roadway and a filtering treatment structure at the end of the road (Photo 5). In the wooded area to the north of Fern Hollow where there is an existing drainage system, the proposed improvements include the importation of fill to stabilize existing channel and side slopes, and the extension of the closed drainage system further to the north where the existing channel is stable (Photos 6-9).

Environmental characteristics of an area are significant for determining the sensitivity for archeological resources. Precontact and historic groups often favored level, well-drained locations near wetlands and waterways. Therefore, topography, proximity to wetlands, and soils are examined to determine if there are landforms in the project area that are more likely to contain archeological resources. In addition, bedrock formations or other lithic sources may contain resources that may have been quarried by precontact groups. Other locations can also be special purpose sacred and traditional use sites. Soil conditions can provide a clue to past climatic conditions, as well as changes in local hydrology.

The Tanglewood and Fern Hollow project area is located on a broad terrace which slopes down to tributaries of Alder Brook to the north and south. The project area along Tanglewood Drive is relatively flat, with some small slopes leading up to houses and gardens. Fern Hollow Road is the closest area to a waterway, with a small seasonal tributary of Alder Brook located approximately 150 feet to the north. This is the area where stormwater improvements are proposed. The main channel of Alder Brook is located downslope, approximately 500 feet to the north of Fern Hollow Drive. A separate tributary of Alder Brook is located approximately 500 feet to the south of Tanglewood Drive. The confluence of Alder Brook with the Winooski River is located approximately one mile south of the project area.



N

1,000 0 1,000 2,000 Feet

300 0 300 600 Meters

Note: Contour interval is 20 feet.

Project Location

GIS Services Accessed 5/7/2020: Environmental Systems Research Institute, Inc., World Street Map; USGS The National Map

HARTGEN archeological associates inc

Map 1

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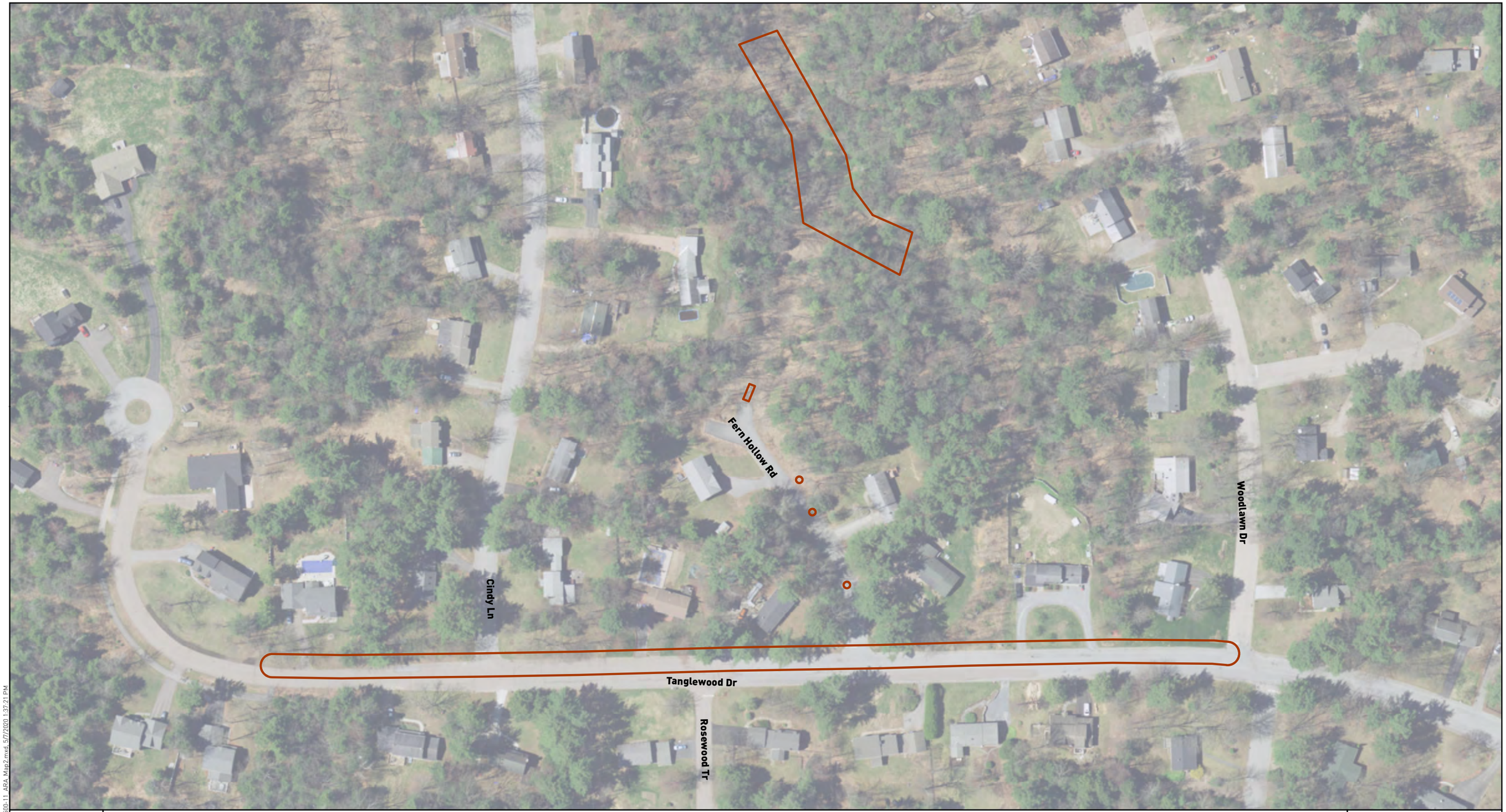

60 0 60 120 Feet
18 0 18 36 Meters

Legend

Area of Potential Effects (APE)

Project Map

Environmental Systems Research Institute, Inc.,
World Imagery Accessed 5/7/2020

HARTGEN archeological associates inc

Map 2

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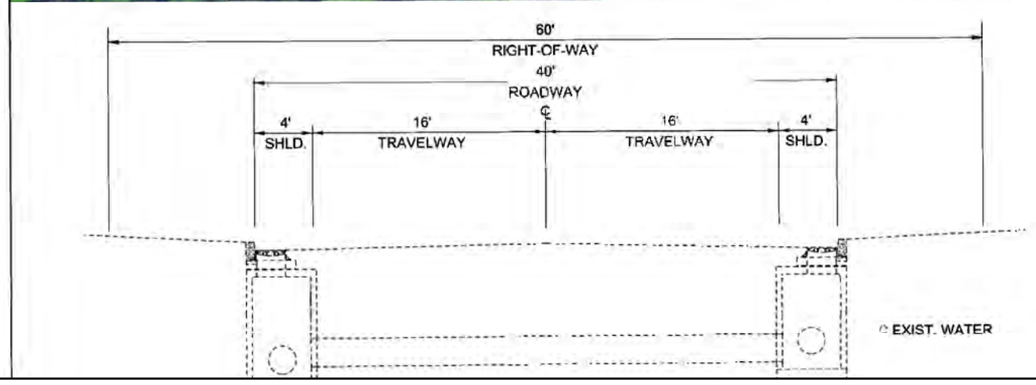

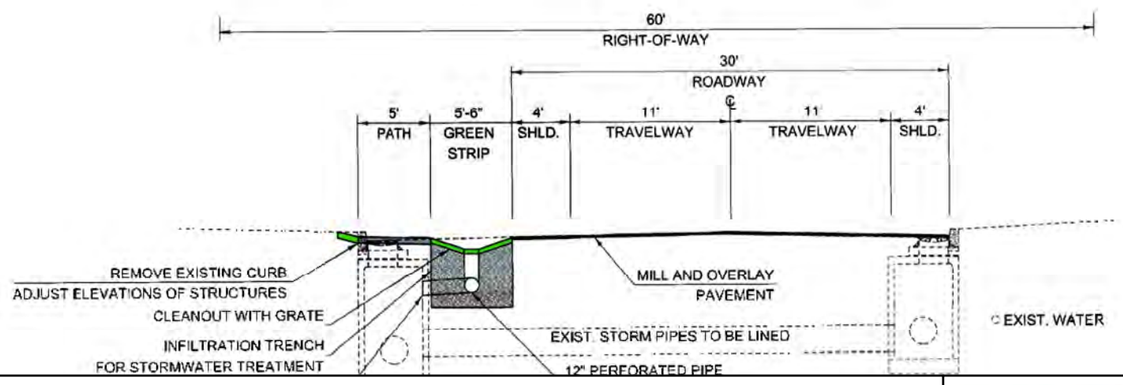

Tanglewood Scoping

Stantec 4/14/2020

HARTGEN archeological associates inc

Map 2a

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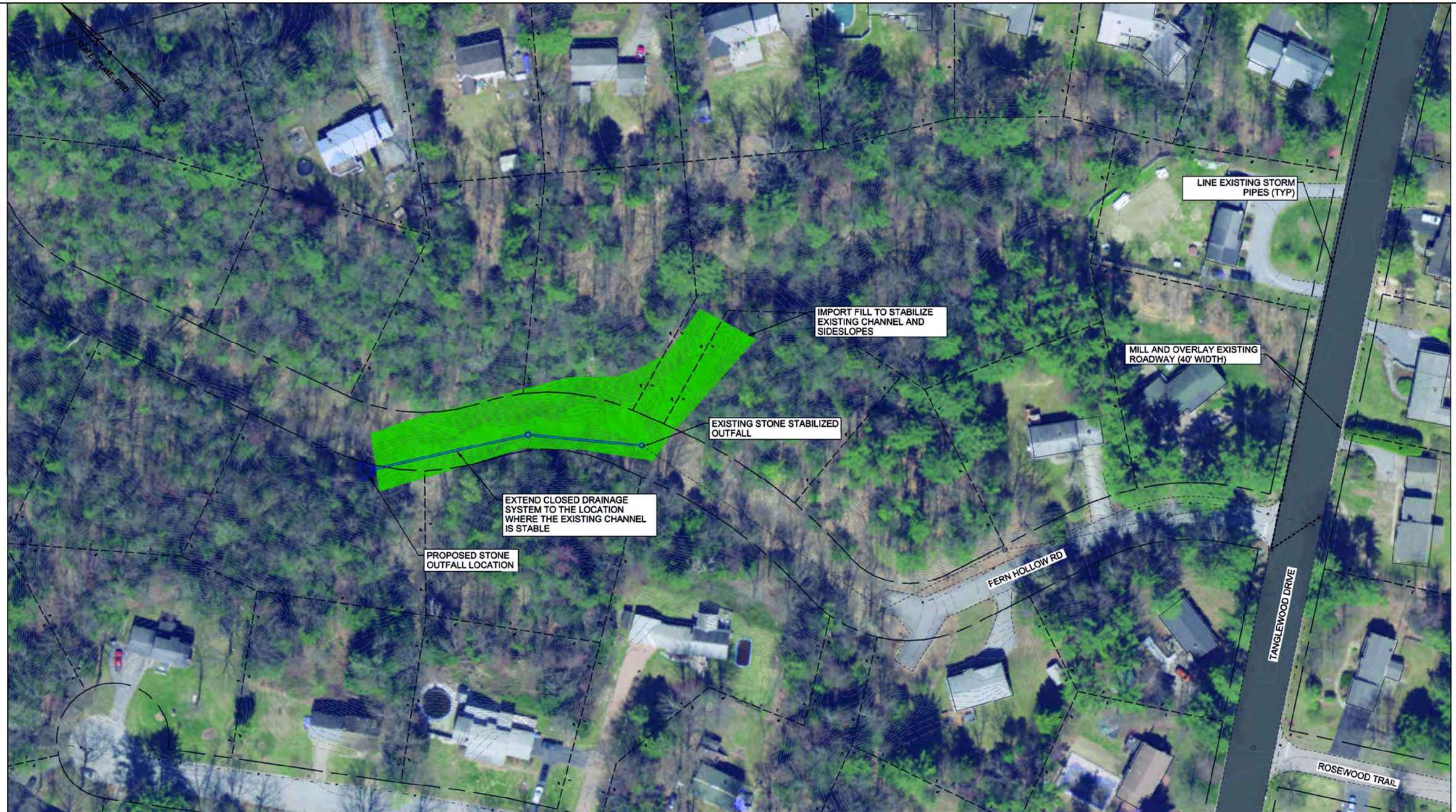

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Tanglewood Scoping

Stantec 4/14/2020

HARTGEN archeological associates inc

Map 2b

Tanglewood Scoping

Stantec 4/14/2020

HARTGEN archeological associates inc

Map 2c

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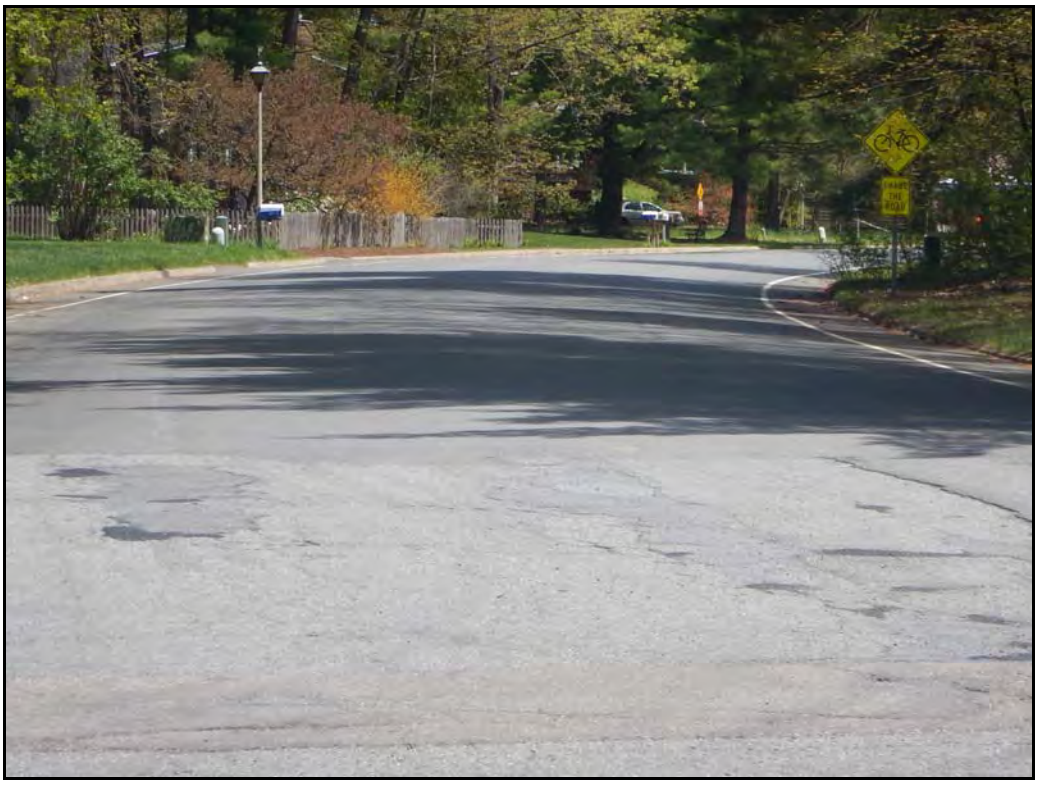


Photo 1. Photo shows the streetscape on Tanglewood Drive near its intersection with Woodlawn Drive. View is to the west.

Photo 2. Photo shows a typical streetscape along Tanglewood Drive. View is to the west.

Photo 3. Photo shows stone and garden features on Tanglewood Drive just east of the intersection with Cindy Lane. View is to the southwest.

Photo 4. Photo shows utility locations on Tanglewood Drive just west of the intersection with Cindy Lane. View is to the southwest.

Photo 5. Photo shows Fern Hollow Road. View is to the north.

Photo 6. Photo shows the sloping terrain within the project area. An eroded stream bank can be seen on the right, earthen and stone stormwater features in the center, and the earthen hiking path to the left. View is to the northwest.

Photo 7. Photo shows a close-up of the eroded stream channel where stormwater improvements are proposed. View is to the northwest.

Photo 8. Photo shows the stone stormwater features in the foreground and the eroded stream channel in the background. View is to the northwest.

Photo 9. Photo shows the stone stormwater features on the hillslope. View is to the southeast toward Fern Hollow Road.

The soil types present within the project area are typically located on terraces and are moderately to well-drained (USDA 2020). The soils consist of loam to fine sand loam derived from glaciofluvial or glaciolacustrine deposits. The soils on the eastern half of the Tanglewood Drive alignment are characterized as Adams and Windsor loam sand, 0-5% slope. The western portion of the project area, including Fern Hollow Drive, contains fine sand loam, 30-60% slope (USDA 2020).

DOCUMENTARY RESEARCH

Precontact Site File Research and Archeological Sensitivity

Examination of VDHP site files indicates that within several miles of the project area, there are several hundred precontact sites situated adjacent to Lake Champlain, the Winooski River, and their numerous tributaries, such as Alder Brook, Muddy Brook, Indian Brook, and their associated wetlands.

There are six precontact sites located approximately one mile distant from the project area VT-CH-207, VT-CH-840, VT-CH-841, VT-CH-842, VT-CH-964 and VT-CH-1043. Five of the sites were identified as small camps, based on the presence of lithics and fire-cracked rock. One isolated find site contained a chert core. All six precontact sites are situated in close proximity to a stream channel or other waterway. Four sites located northeast of the project area were situated adjacent to a pond or wetlands. A site located to the south was located on a high terrace overlooking the Winooski River. Located to the southwest, was a site situated adjacent to Alder Brook.

The VDHP Environmental Predictive Model (EPM) was completed for the three project areas which produced an overall rating of 20 (Appendix 1), with a rating of 32 or above indicating precontact sensitivity. The overall project areas received points based on its location in an area with a high density of recorded

precontact sites (32 points) situated on a valley edge landform (12 points), and located within close proximity to a small intermittent stream (8 points). This rating also reflects a large reduction (-32 points) for previous disturbance.

Precontact archeological potential is considered low due to previous disturbance from road construction, driveways, curbing, sidewalks and utilities. The portion of the project area located within and adjacent to a seasonal waterway has been previously disturbed by erosion and man-made alterations from installation and maintenance of stormwater features.

Historic Site File Search and Archeological Sensitivity

Historic Archaeological Sites, National and State Register, Cemeteries

There are no historic archeological sites, State Register or National Register sites located within or adjacent to the project Areas of Potential Effect (APE).

There are no known cemeteries located within or adjacent to the project area (Hyde and Hyde 1991).

Historic Maps

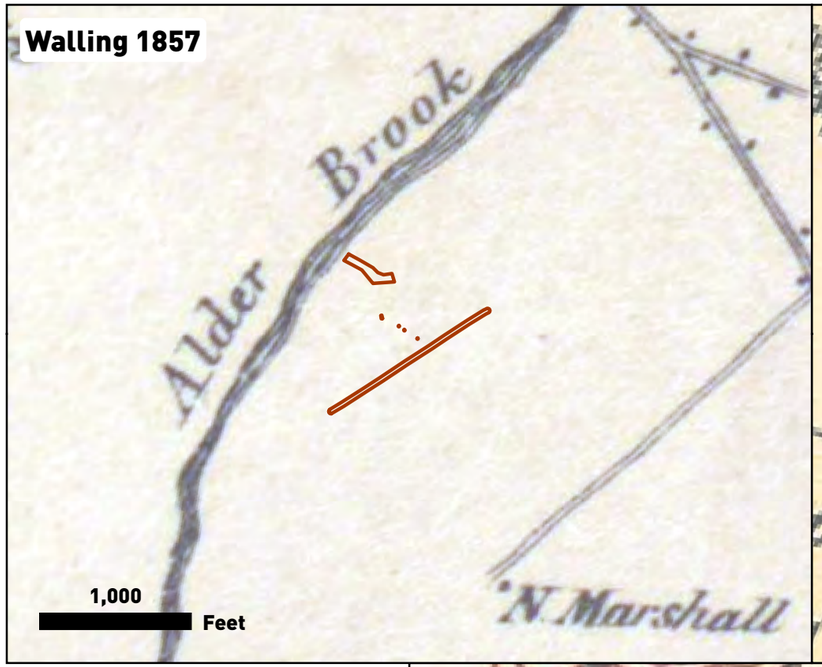
A review of historic maps of the project area was conducted to attain an overview of the changing historical and environmental landscape within the project area. This review includes the study of historic structures that may be or may no longer be extant, alterations to road and rail systems, and changes in stream and river courses. Two 19th-century maps, the 1857 Walling map and the 1869 Beers map, depict the roadways and river and stream courses in the project areas, as well as the names of the residents who lived there in those years (Map 3). These maps indicate that there was no historic development in the Tanglewood Drive area into the third quarter of the 19th century. Similarly, two 20th century USGS maps were studied, from 1913 and 1944, which showed no development, roads or structures represented through mid-century (Map 3). The Tanglewood Drive housing development was fully established by 1987, as shown on most recent USGS map (Map 3).

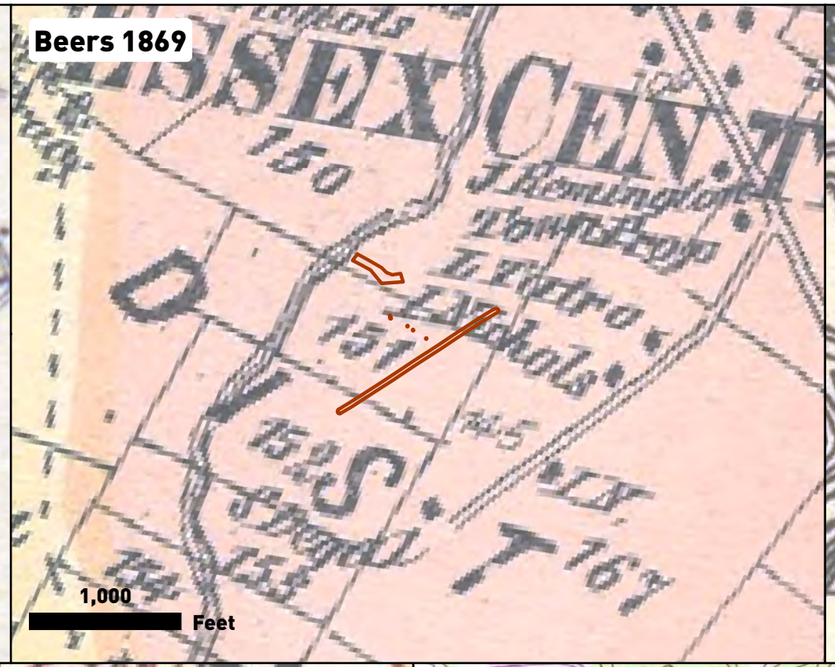
ARCHEOLOGICAL POTENTIAL AND RECOMMENDATIONS

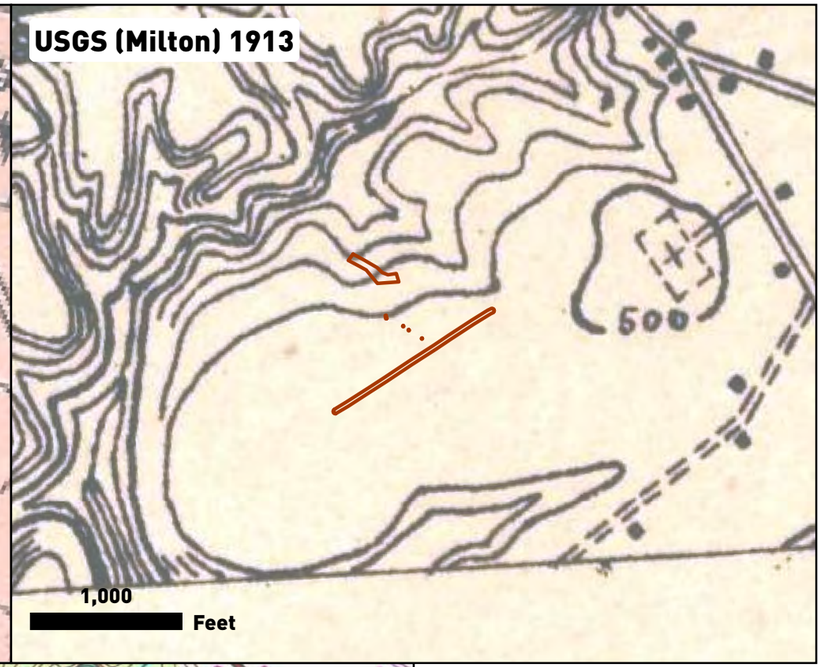
The areas directly adjacent to the Tanglewood Drive and Fern Hollow Road portions of the project alignment have been previously disturbed from the construction and installation of the roadway, driveways, curbing and utilities (Photos 1-5).

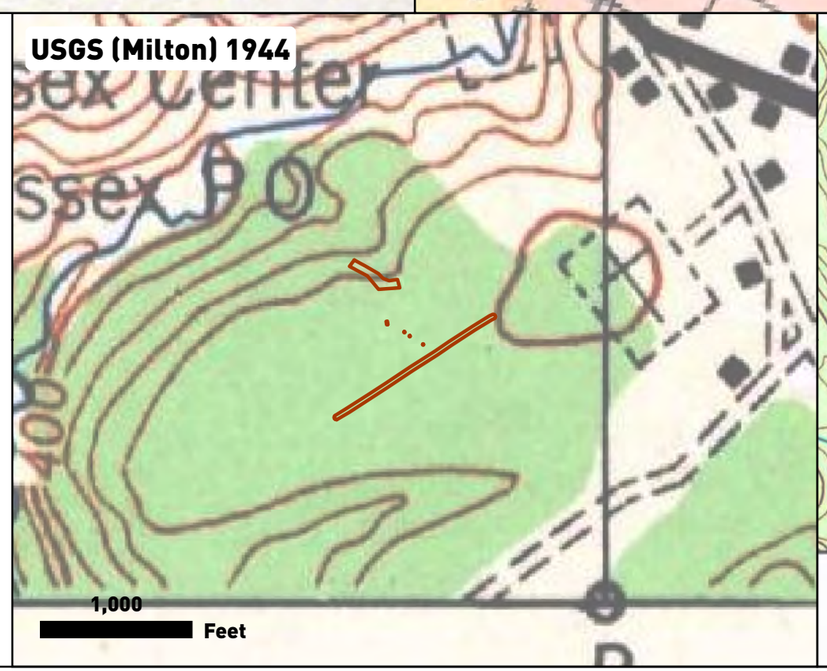
The portion of the project area located north of Fern Hollow road within and adjacent to a seasonal waterway is the proposed location of stormwater improvements. The area surrounding the seasonal stream is characterized as having moderate to steep slope and is bordered to the west by an earthen hiking path (Photo 6). The water channel exhibits exposed stream bank surfaces from erosion, and there are a number of modern stone stormwater features evident (Photos 7-9). The area of the proposed stormwater improvements has been previously disturbed by erosion and man-made alterations to stormwater features.

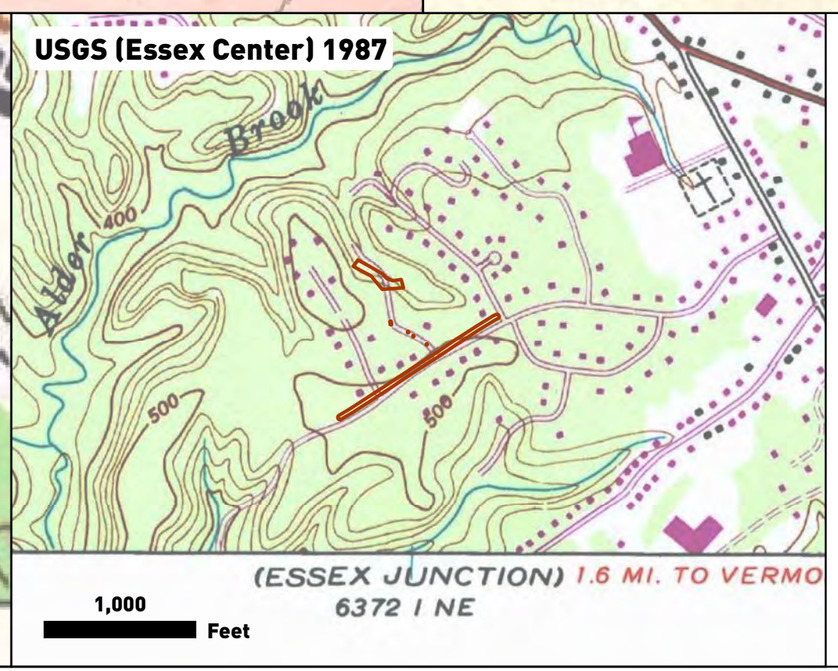
The project area is not considered to be archeologically sensitive for either historic or precontact resources. No further archeological investigation is recommended for the Tanglewood Drive Shared-Use Path and Stormwater Project. This ARA report should be submitted to VTrans archaeology officer for review and concurrence.











N

Legend

Area of Potential Effects (APE)

HARTGEN archeological associates inc

Historical Maps 1857-1987

Map 3

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APPENDIX 1: VDHP Archaeological Resources Assessment Form

VERMONT DIVISION FOR HISTORIC PRESERVATION

Environmental Predictive Model for Locating Pre-contact Archaeological Sites

Project Name St. Albans Shared Use Path **County** Franklin **Town** St. Albans
DHP No. **Map No.** **Staff Init.** **Date** 8/2020

Additional Information

Environmental Variable	Proximity	Value	Assigned Score
A. RIVERS and STREAMS (EXISTING or RELICT):			
1) Distance to River or Permanent Stream (measured from top of bank)	0- 90 m 90- 180 m	12 6	12
2) Distance to Intermittent Stream	0- 90 m 90-180 m	8 4	
3) Confluence of River/River or River/Stream	0-90 m 90 –180 m	12 6	
4) Confluence of Intermittent Streams	0 – 90 m 90 – 180 m	8 4	
5) Falls or Rapids	0 – 90 m 90 – 180 m	8 4	
6) Head of Draw	0 – 90 m 90 – 180 m	8 4	
7) Major Floodplain/Alluvial Terrace		32	
8) Knoll or swamp island		32	
9) Stable Riverine Island		32	
B. LAKES and PONDS (EXISTING or RELICT):			
10) Distance to Pond or Lake	0- 90 m 90 -180 m	12 6	
11) Confluence of River or Stream	0-90 m 90 –180 m	12 6	
12) Lake Cove/Peninsula/Head of Bay		12	
C. WETLANDS:			
13) Distance to Wetland (wetland > one acre in size)	0- 90 m 90 -180 m	12 6	12
14) Knoll or swamp island		32	
D. VALLEY EDGE and GLACIAL LAND FORMS:			
15) High elevated landform such as Knoll Top/Ridge Crest/ Promontory		12	
16) Valley edge features such as Kame/Outwash Terrace**		12	

17) Marine/Lake Delta Complex**		12	
18) Champlain Sea or Glacial Lake Shore Line**		32	
E. OTHER ENVIRONMENTAL FACTORS: 19) Caves /Rockshelters		32	
20) ☐ Natural Travel Corridor ☐ Sole or important access to another drainage ☐ Drainage divide		 12	
21) Existing or Relict Spring	0 – 90 m 90 – 180 m	8 4	
22) Potential or Apparent Prehistoric Quarry for stone procurement	0 – 180 m	32	
23)) Special Environmental or Natural Area, such as Milton acquifer, mountain top, etc. (these may be historic or prehistoric sacred or traditional site locations and prehistoric site types as well)		32	
F. OTHER HIGH SENSITIVITY FACTORS: 24) High Likelihood of Burials		32	
25) High Recorded Site Density		32	
26) High likelihood of containing significant site based on recorded or archival data or oral tradition		32	
G. NEGATIVE FACTORS: 27) Excessive Slope (>15%) or Steep Erosional Slope (>20)		- 32	
28) Previously disturbed land as evaluated by a qualified archeological professional or engineer based on coring, earlier as-built plans, or obvious surface evidence (such as a gravel pit)		- 32	
**** refer to 1970 Surficial Geological Map of Vermont** **Total Score**: 24			
Other Comments :			
0- 31 = Archeologically Non- Sensitive **32+ = Archeologically Sensitive**			

APPENDIX C

Construction Cost Estimate

Stantec

55 Green Mountain Drive
South Burlington, VT 05403
Tel: (802) 864-0223

Quantity Summary and Opinion of Probable Cost

Essex

Tanglewood Drive, Cindy Lane to Woodlawn Dr.

Stormwater and Pedestrian Mobility Scoping Study

Item No.	Item Name	Unit	Unit Price	Alternative 2		Alternative 3		Alternative 4		Alternative 5	
				Quantity	$	Quantity	$	Quantity	$	Quantity	$
201.10	CLEARING AND GRUBBING, INCLUDING INDIVIDUAL TREES AND STUMPS	LS	$5,000.00	-		1	$5,000.00	-		1	$5,000.00
204.20	TRENCH EXCAVATION OF EARTH	CY	$20.00	1050	$21,000.00	110	$2,200.00	170	$3,400.00	170	$3,400.00
203.32	GRANULAR BORROW	CY	$20.00	-		1000	$20,000.00			1000	$20,000.00
210.10	COARSE-MILLING, BITUMINOUS PAVEMENT	SY	$2.25	4200	$9,450.00	5400	$12,150.00	5400	$12,150.00	5400	$12,150.00
406.35	SUPERPAVE BITUMINOUS CONCRETE PAVEMENT	TON	$80.00	430	$34,400.00	465	$37,200.00	465	$37,200.00	465	$37,200.00
406.38	HAND-PLACED BITUMINOUS CONCRETE PAVEMENT, DRIVES	SY	$22.00	120	$2,640.00	55	$1,210.00	55	$1,210.00	55	$1,210.00
601.2610	15" CPEP(SL)	LF	$60.00	-		-		-		50	$3,000.00
601.0915	18" CPEP	LF	$65.00	-		240	$15,600.00	-		355	$23,075.00
601.7015	18" CPEPES	EACH	$300.00	-		1	$300.00	-		1	$300.00
605.13	UNDERDRAIN PIPE, 12 INCHES	LF	$70.00	1030	$72,100.00	1	$70.00	-		-	
604.20	PRECAST REINFORCED CONCRETE CATCH BASIN WITH CAST IRON GRATE	EACH	$4,000.00	-		2	$8,000.00	-		3	$12,000.00
613.10	STONE FILL, TYPE I	CY	$60.00	-		5	$300.00	-		5	$300.00
629.54	CRUSHED STONE BEDDING	TON	$35.00	-		65	$2,275.00	-		110	$3,850.00
635.11	MOBILIZATION/DEMOBILIZATION	LS	10%	1	$22,610.90	1	$17,852.10	1	$16,413.60	1	$26,070.10
641.10	TRAFFIC CONTROL	LS	5%	1	$11,305.45	1	$8,926.05	1	$8,206.80	1	$12,946.25
646.402	DURABLE 4 INCH WHITE LINE, THERMOPLASTIC	LF	$0.80	2220	$1,776.00	2220	$1,776.00	2220	$1,776.00	2220	$1,776.00
646.482	DURABLE 24 INCH STOP BAR, THERMOPLASTIC	LF	$12.00	24	$288.00	-		-		-	
646.502	DURABLE CROSSWALK MARKING, THERMOPLASTIC	LF	$35.00	85	$2,975.00	-		-		-	
675.20	TRAFFIC SIGN, TYPE A	LF	$15.00	18	$270.00	-		-		-	
675.341	SQUARE TUBE SIGN POST AND ANCHOR	LF	$9.00	90	$810.00	-		-		-	
649.31	GEOTEXTILE UNDER STONE FILL	SY	$2.50	-		16	$40.00	-		16	$40.00
900.620	SPECIAL PROVISION (STORAGE STRUCTURE)	EACH	$9,000.00	-		-		4	$36,000.00	-	
900.620	SPECIAL PROVISION (12" INLINE DRAIN HDPE)	EACH	$1,000.00	8	$8,000.00	-		-		-	
900.620	SPECIAL PROVION (HYDRODYNAMIC SEPARATOR)	EACH	$15,000.00			-				1	$15,000.00
900.620	SPECIAL PROVION (PRECAST CONCRETE SUBSURFACE FILTER)	EACH	$50,000.00			-				1	$50,000.00
900.640	SPECIAL PROVISION (LINE STORMWATER PIPE)	LF	$80.00	905	$72,400.00	905	$72,400.00	905	$72,400.00	905	$72,400.00
			Construction Cost		$260,025.35		$200,299.15		$188,756.40		$294,717.35
			Contingency (20%)		$52,005.07		$40,059.83		$37,751.28		$58,943.47
			Total		$312,030.42		$240,358.98		$226,507.68		$353,660.82
			Say		**$320,000.00**		**$250,000.00**		**$230,000.00**		**$360,000.00**

APPENDIX D

Local Concerns Meeting

Tanglewood Drive Scoping Study

Local Concerns Meeting

October 23, 2019

Essex, Vermont

CHITTENDEN COUNTY RPC

TOWN OF Essex, Vermont

Stantec

Tonight's Purpose

- Introduce Project Team and review project area
- Review project development process
- Review existing conditions research
- **Gather feedback on issues, concerns, ideas - open public discussion**
- Discuss next steps

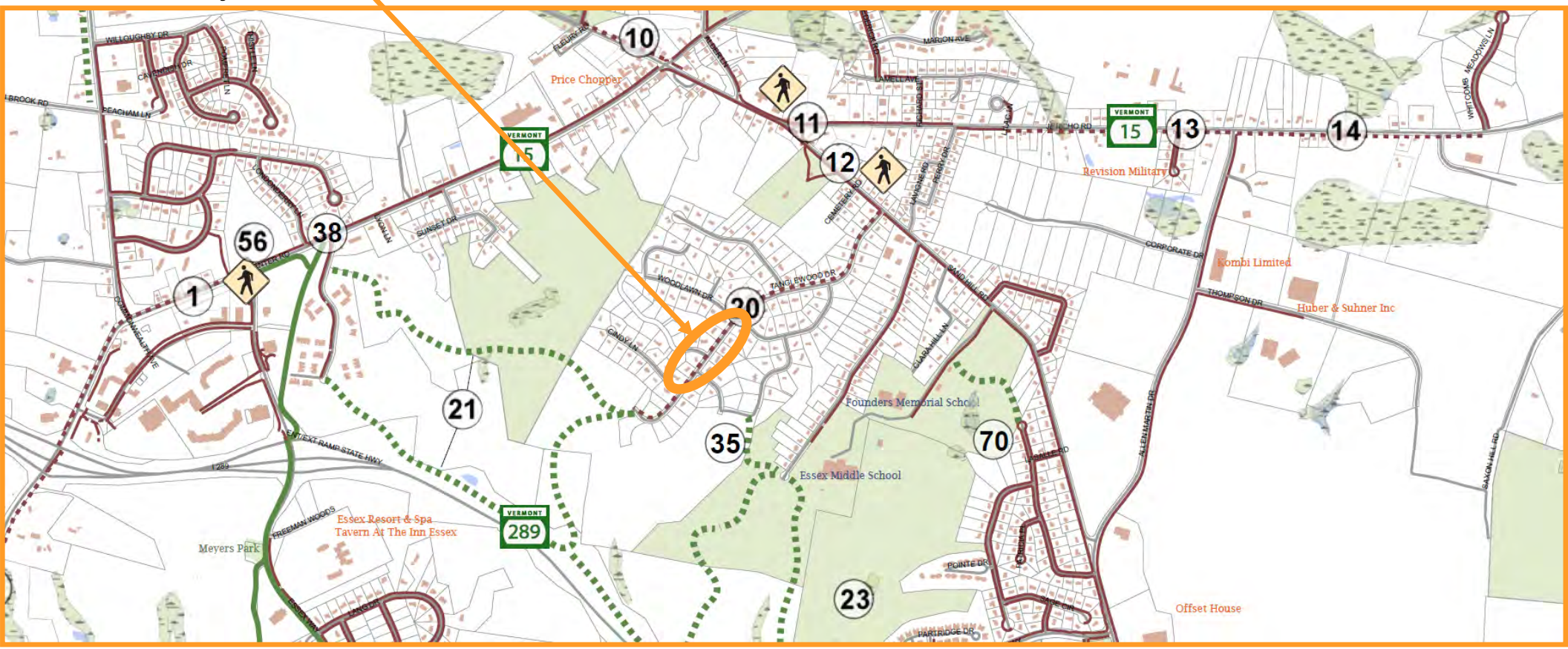
Stantec

Introductions : Project Team

- Essex Town Staff
  - Ann Costandi, Dennis Lutz
- CCRPC
  - Bryan Davis
  - Chris Dubin
- Stantec
  - Israel Maynard
  - Greg Goyette

Stantec

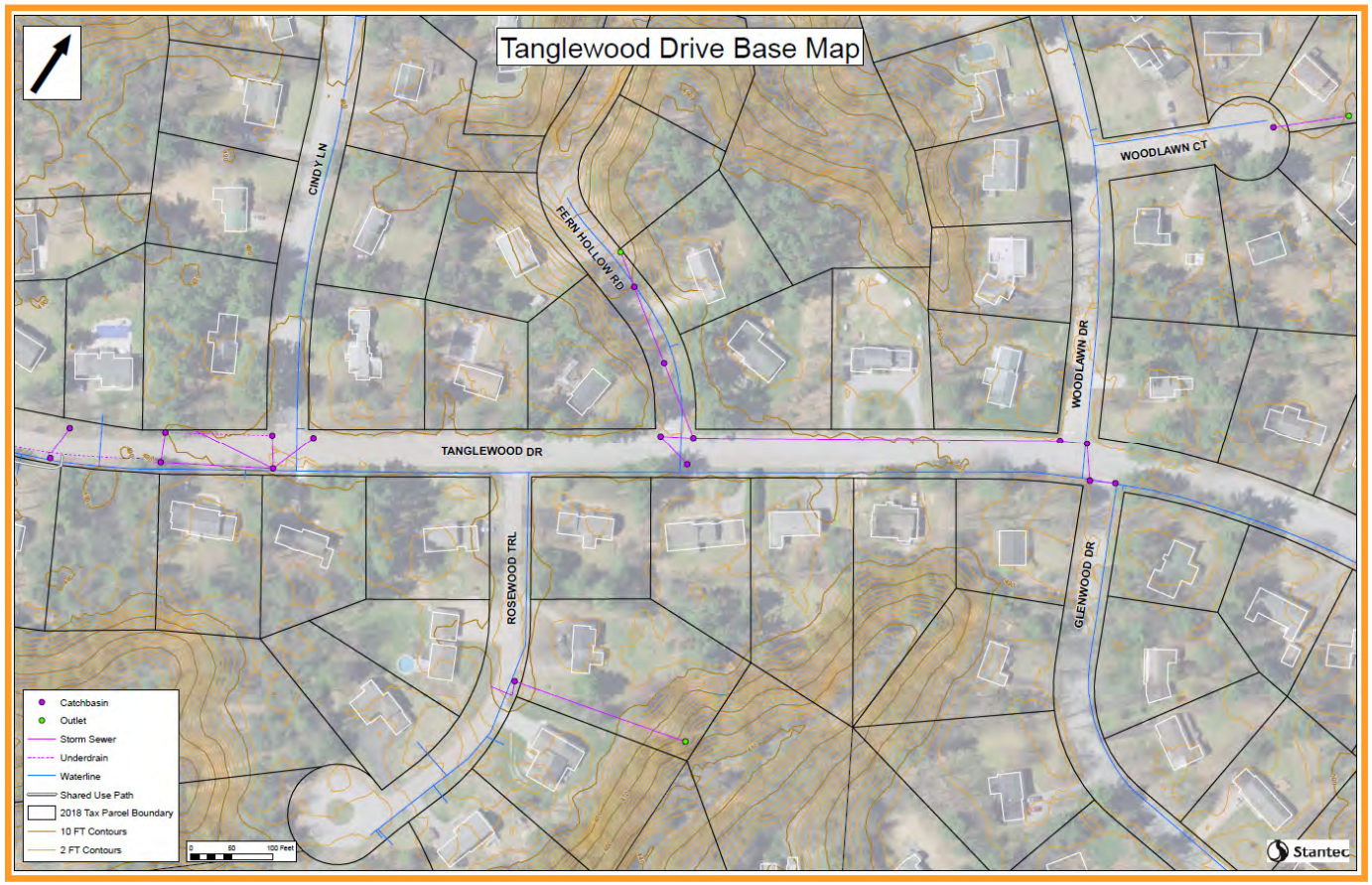
Project Background and Area



Map from Essex Bicycle and Pedestrian Plan

Stantec

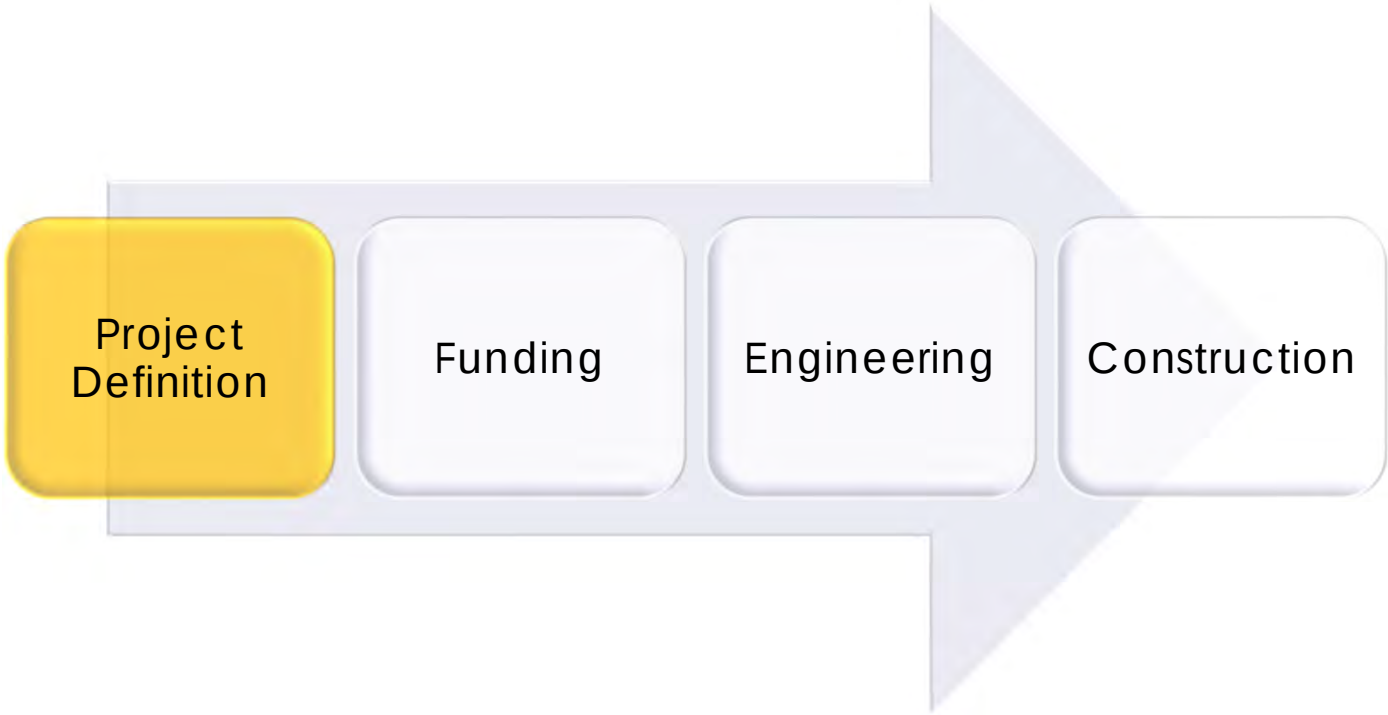
Project Background and Area



Study Focus: Bicycles, Pedestrians, Stormwater

Stantec

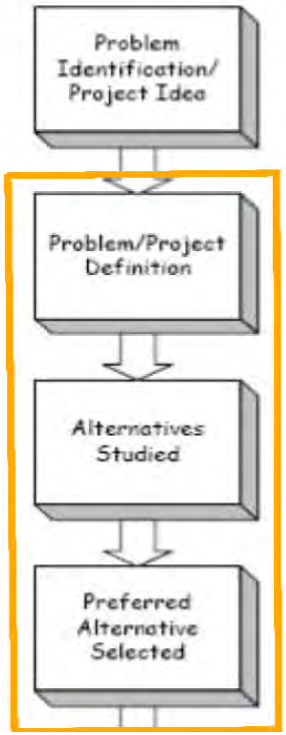
Typical Project Process



Stantec

Typical Project Process

Typical Stages in the Development and Funding of Transportation Projects



Problem Identification/Project Idea – The process starts when a particular transportation problem is identified or a new idea is put forward. This step can be initiated by members of the public, local elected officials, a private business, a community group, or a public agency. The CCMPO also often identifies problems and projects through its ongoing regional planning process.

Problem/Project Defined – The problem or project idea is brought to the CCMPO by local officials for definition and discussion (development of "purpose and need").

Alternatives Studied – As part of the Unified Planning Work Program (UPWP), the CCMPO studies the problem/project idea and examines alternatives through our Technical Assistance and/or Scoping and Project Definition process. In some cases, depending on the scale and complexity of the project, the CCMPO can develop a "quick fix" to resolve the problem quickly.

Preferred Alternative Selected – Working with affected community and the public, the CCMPO facilitates the selection of a preferred alternative, which flows from the study process, for implementation.

Stantec

Study Tasks and Timeline

- Task 1: Data gathering ,existing conditions analysis; **September - October**
- Task 2: Local concerns public meeting; **October**
- Task 3: Alternatives development; **November - December**
- Task 4: Alternative evaluation, draft scoping report; **January-February**
- Task 5: Alternative presentation, final report; **March-April**

Stantec

Tanglewood Existing Conditions

- Speed limit 25 mph
- ROW width – 60 ft.(typ.)
- Limited environmental resources
- Underground Water, Gas, Electric, Communications
- Private Septic Systems

Stantec

Tanglewood Existing Conditions

- 16 Foot Lanes,
- 4 Foot Shoulders
- Parking on the Street is occurring
- Entirely Residential
- Schools and Athletic Fields to the south
- Park and Town Pool to the North

Tanglewood Drainage Existing Conditions

- Collection System: Closed Drainage
- Outfall: 15” CPEP(SL) with Stabilized Outfall, Erosion Downstream
- Discharge Water: Alder Brook

Public Input and Solutions

What are the most important conditions, concerns, issues or solutions?

- Safety
- Pedestrian Accessibility
- Bicycle travel
- Drainage/Stormwater

Stantec

Next Steps and Public Meeting

- Develop ideas/solutions to address concerns
- Review with Team members
- Conduct public meeting to seek input on alternatives – **February/March**

Stantec

Thank you!

Contact information

Ann Costandi, Town of Essex:
acostandi@essex.org

Bryan Davis, CCPRC:
bdavis@ccprcvt.org

Israel Maynard, Stantec:
Israel.Maynard@stantec.com

Stantec

PROJECT: Essex Tanglewood Drive
MEETING: Local Concerns Meeting
LOCATION: Fire Station Community Room (190 Sand Hill Road)
DATE: 10/23/2019
TIME: 7:00 PM

	NAME	ADDRESS/REPRESENTING	E-MAIL
1	Israel Maynard	Stantec Consulting	israel.maynard@stantec.com
2	Ann Costandi	Essex Town	acostandi@essex,org
3	Bryan Davis	Chittenden County Regional Planning (CCRPC)	bdavis@ccrpcvt.org
4	TATRO	10 WOODLAWN	STATRO @ OMEGAVT.COM
5	Judy ERIKSEN	12 WOODLAWN DR	vtjudy43@comcast.net
6	Bill Silverstein	36 Tanglewood	bill.silverstein@gmail.com
7	Bruce & Mary POST	1 Cindy Lane	MARYPOST@GMAIL.COM
8	Dylan McNamara	51 Tanglewood Dr.	dnmcnama@gmail.com
9			
10			
11			

Essex Tanglewood public meeting notesA
October 23, 2019
Israel, Dennis, Annie, Chris, Bryan
9-10 members of the public

- Dennis gave an overview of the project, different issues being considered including stormwater, pedestrian safety with more kids walking to school since the district changed bus routes, on street parking, previous stormwater projects, TMDL issues generally, and a general overview of potential alternatives including lining the current stormwater pipe, reducing roadway width by 10 feet and add greenbelt/sidewalk, remove curb and add swales….
- Public comments:
    - People are speeding, how to slow them down?
    - Consider stop signs at intersections? Dennis notes that Town must follow MUTCD for stop warrants, which it won't meet. Residents need to work together with each other.
    - Could add bump outs at intersections to help slow people down.
    - Neighborhood needs a second access but it keeps getting waived and more houses are built.
    - Fire department access, impacts if road were to be narrowed.
    - Stormwater is an issue and need to do something about it.
    - Addition of sidewalk on Tanglewood doesn't solve connectivity issue (to other sidewalks). Also if it's not maintained in winter then would be unusable. Dennis notes that in the longer term a sidewalk could connect to new sections to be added later.
    - There is some parking on the street but not consistently.
        - Dennis asked about putting in flex posts on one side of the street as protected lane for walk/bike, could plow with sidewalk plow but not park in it. Some people don't like idea of white posts along street but could be OK without parking on one side of street.
        - Another option would be going through SB process to put up No Parking This Side of Street signs.
    - If Town removes the curb then could create swales to treat stormwater. Some peopled noted a preference to have consistency in curb/no curb. Dennis notes that over time the entire roadway could look the same.
    - Comment that stormwater issues are beyond Fern Hollow and include some of the side streets like Woodlawn. Annie notes that addressing Tanglewood stormwater may have positive effects on other streets. Another resident echoes concern/issues of flooding in first floor of raised ranch. Stormwater flow from street down driveway into house. Dennis notes that Town has 1800 catch basins, they sweep in spring and fall, do their best but can't keep up with everything.
    - Can't Town just take out the curb and be done with it? No, would have to do more work to add swales and get water after the road.
    - Cindy Lane and Tanglewood, known as Lake Tanglewood. What happened there? Catch basins failed and had to be replaced, some pipe replacement.
    - Need to address stormwater as part of larger environmental effort.

Suggestion to develop a short survey for residents to get input on issues, potential design options, etc. Residents could use Neighborhood Watch list and FPF to distribute.

Issues and ideas to include as part of survey:

- Introduction: ROW is 60 ft, roadway is 40 ft, summarize stormwater and safety issues, outline some potential ideas to consider:
    - Reduce roadway width to:
        - Add greenbelt/sidewalk
        - Remove curb and add swale
    - Keep roadway width and:
        - Break the curb at certain points to allow infiltration
        - No parking on one side (signs or flexposts) for walk/bike area
    - Remove pavement at 30-35 ft to create swale, leave remaining pavement at 35-40 ft as sidewalk/path

APPENDIX E

Online Survey Comments

Survey Additional Comments:

It seems odd to have just this section be different from the beginning of Tanglewood (intersection with Sandhill Road) to Woodlawn. If anything is done, I would like to have it be consistent on all of Tanglewood Drive.
1/3/2020 8:11 PM

Unless you can GUARANTEE the future funds will be in place to make the entire length of Tanglewood Drive look uniform (with a sidewalk or bike lane) then please just stick with dealing with the stormwater and leaving the road 'as is' (putting in the drains and re-pave that area quickly) or we will most likely get stuck with lengthy construction that eventually yield a 'hodge-podge' solution seeing as public works already struggles to afford the number of necessary projects within Essex in any given year. Having the solutions in the survey above for only 200-300 feet of the entire length of Tanglewood makes absolutely no sense whatsoever. My vote is to dig it up, fix the issue, and re-pave. I also have a rock garden at the edge of my road between Fernhollow and Cindy Lane that I have put significant money into and do not wish to move, without the curb it would fall towards the street.
12/27/2019 5:06 PM

You are trying to solve a problem that does not exist. Things are fine the way they are. Leave them alone. You are delinquent in your fiduciary duty to the taxpayers by proposing unnecessary expenditures. If anything, please have the plow crews keep the road at 40 feet during the Winter. In the past, they have failed to do so and the road narrows to the point it is a hazard to both pedestrians and their dogs in the morning. Also, please publish the results of this survey.
12/24/2019 8:33 AM

I like the idea of a multi purpose path over a sidewalk, as that's what is located at the end of Tangelwood. I am having a hard time with the fact that it is only for a small stretch of road. I would love for it to connect to the one at the end of Tangelwood and eventually extend towards Sandhill.
12/16/2019 9:16 PM

I live on Oakwood Lane
12/13/2019 1:19 PM

There is no second exit from The pinewood development. Severll years ago when a local development wish to extend the development at the end of Tanglewood where it intersects with Cindy Lan he was only allowed to do so after the town fire chief asserted that a second exit was not necessary because Tanglewood was 40 ft wide and that with would permit access and egress for emergency vehicles going or coming from the Cindy Lane Tanglewood extension area. I'm dictating a response here's to me Log Tanglewood is narrowed to 30 ft per your proposal the town of Essex will need to provide a second exit egress to ensure that emergency vehicles and residents could access and exit the area at the end of Tanglewood. This matter was resolved in State environmental Court in part because of the town's assertion that tanglewood's 40ft with provided for safe access and egress to the end of Tanglewood drive.
12/12/2019 7:52 PM

No
12/12/2019 6:53 PM

I live on Tanglewood immediately past Cindy Lane. I’m concerned that the integrity of the neighborhood will drastically change with some of the questions being asked. I honestly don’t feel as though many people would use a path or walkway and reducing the width of the road may create a safety hazard for those that bike regularly who would not use the path.
12/12/2019 6:40 PM

Our current roadway accommodates 12 month walking without risk of slipping on winter ice on sidewalks. Our FAMILY oriented roadway accommodates family reunions/graduations/birthdays with parking for the 8-20 cars of friends and family. FAMILY walks allow 3-4 people wide conversations while walking. Our

learning to ride a bike young children can be accompanied by an adult by their side as they gradually master skills. We love this neighborhood roadway for those reasons. Handicapped individuals have greater mobility for 12 months of the year. Aging seniors need dry surfaces for exercise and mobility. Large delivery vehicles have no issues.
12/12/2019 6:25 PM

Don't change anything, add anything and leave everything as is. Thank you
12/12/2019 5:32 PM

This is a very short section of Tanglewood and how this meshes with the rest of Tanglewood should be considered.
12/12/2019 5:28 PM

no
12/12/2019 5:26 PM

it would be nice to do the rest of the road. the white paint was a waste of money it would have been better to put a center strip
12/12/2019 5:24 PM

APPENDIX F

Alternatives Presentation Meeting Notes and Chat Log

Essex Tanglewood Public Meeting
March 16, 2021
Attendees (check chat log as well):
Dennis Lutz
Ann Costandi
Israel Maynard
Bryan Davis
Chris Dubin
Barbara Higgins
Essex Reporter
Mary Post
Bruce Post
Katherine McNamara
Rosina Cannizzaro
Sam Tatro
Laura Ennis
Erin Ennis
Dylan McNamara
Betsy Dunn
Irene Wrenner
Andy Elliston
Bill Silverstrum
Jacobs
Elizabeth Marvin
Patty
Bob Bates
Richard Divenere
Missie Thurston
Suzanne
David
Chris Yandell
Carolyn Lewis

1. Israel gave a presentation including a detailed review of the 2019 survey results
2. Public input about survey:
    - Dylan - Did survey go out by mail? Are we looking for more input tonight? Israel – survey responses helped guide alternatives development, which we'll share to night and accept more feedback
    - Bruce – survey asked about frontage, did rest of survey only ask them? Or open to all? Israel – open to all.
    - Bob – could Dennis respond to concern about reducing roadway width from 40 ft to 30 ft? Bob remembers previous (10-15 years ago) discussion about not having second exit from subdivision. Concern about safety of neighbors. Israel – path or sidewalk could have full roadbed underneath to support emergency vehicles.

- Betsy – worried about more impervious surfaces and stormwater impacts, would like to hear more about this plan.
- Jacobs – works for other public works. Is the bike/ped component a "feel good" part or can we just address the stormwater issue? Israel – one alternative has no bike/ped improvements, bike/ped could work in tandem with school busing (there was lack of busing) but if people don't want it, then we don't have to have it. Annie – town could consider other improvements besides white posts if people want something else.

3. Presentation of alternatives
   - Alt 1 no action but could add striped walk/bike lane on one side (this could be for all 40 ft alternatives)
   - Alt 2 – 30 ft with green strip buffer/drainage and sidewalk/path
   - Alt 3 – 40 ft roadway, relocated outfall
   - Alt 4 – 40 ft roadway, stormwater storage structures
4. Review of evaluation matrix

5. Questions from the public:
   - Bruce – what do you mean there's no bussing? Ann – there were bus staff shortages. Bruce – alt 2 does sidewalk/path get extended past Cindy Lane? Israel – existing shared use path is just off screen so this alt would connect by a crosswalk. Bruce – by observation very few people use sidewalk.
   - Patty – what are you going to do about phosphorous? Alt 3 talked about wetlands, we want to protect them. Also plowing isn't very good and leaves ice so people can't walk. Israel – phosphorous is a concern, Town has a plan. Dennis – agree 100%, working with the Village, got a grant to do a phosphorous plan, whatever alternative is chosen will have phosphorous removal component but might be as a separate effort. Israel – reducing flow and reducing impervious also reduces phosphorous load
   - Barbara – didn't get survey, prefer Alt 4 because we need four season ped access, don't see that with Alt 2 which could be preferred from engineering perspective. People walk in road not sidewalk because it's not plowed. Alt 4 doesn't change look of community.
   - Dylan – appreciate addressing phosphorous. Notes that roadway needs repaving. Like Alt 2 with sidewalk but if not maintained then can't use.
   - Dennis responded with info about TV through the pipes to check the condition, which will help Town understand what is needed.
   - Suzanne – prefer to keep flow out of stream to prevent erosion. Israel – Alt 3 guided by this thinking.
   - Jacobs – don't understand Town's policy on plowing, not curb to curb. Do you plow curb to curb? Dennis – with 40 ft wide road the plows don't reach the whole way with two passes. Town tries to get to this roadway sooner because it's in a school zone with walk/bike access. Even with 30 ft roads tough to get curb to curb. Even when you go back to get curb to curb you end up plowing people back in. Jacobs – Alt 2 with green strip – if road is already pitched why would you put that there, it will fill up. Why? Dennis – yes, plowing in winter will push snow into the swale and would have to melt for drainage to be effective. This could be curbed and would add 50,000-60,000 to project, but snow would still end up in green strip..

- Carolyn Lewis – what would be the maintenance of green strip in the summer? Israel – usually has grass and mowed. Carolyn – what are differences between Alts 3 and 4? Israel – for Alt 3 wouldn't change peak flow, only extend into stabilized area, about 300 ft downstream. Alt 4 benefit is that storage structures would reduce peak flow, could also filter out phosphorous. Carolyn – overly costly to do both alts? Israel we could take a look, might not be too expensive. Carolyn – inclined towards options without green strip, who could keep sidewalk plowed timely. Israel – how about the line striping for bikes/peds? Carolyn – seems pretty friendly, maybe put it on same side of road as existing sidewalk.
- Richard – issue is we like the wide road, striping side would be super, we see lots of people walking/biking. No complaints about the plow. My issue is concern about safety, Tanglewood has turned into a raceway, please do something to slow traffic down. Police clocked people doing 55 mph on straightaway.
- Chris Yandell – we don't really have a mobility issue with the road, we like the width, more people walking and biking on it than driving, I don't think people will use sidewalk with so many people out there. Main issue seems to be stormwater and erosion. Is there a ranking on what's most important or how you prioritize specific mitigations in the matrix? What's most important? Does more expensive alt do more/better? Would some alts be more likely to be funded? Israel – in purpose and need we don't weigh anything higher than something else, public comments are key. Annie – resident support is key to direction, there might be some things Town could do without grant funding (like striping or repaving) but grants could fund bigger/more expensive pieces. Dennis – we have to remove phosphorous within 20 years, and we need to figure out how we're going to pay for these projects, we're going to have to get grants. No guarantee on grant funding, Town puts away $150,000 each year and has been successful with grants in year's past, needs to be smart with investments. If alt 3 was chosen, for example, we'd still do something about flow, like what is in alt 4.
- Discussion about speed humps/bumps.
- Erin Ennis – long term maintenance costs? And hybrid of alt 2? Israel – what's proposed stays within existing impact even though ROW is 60 ft. Didn't look closely at long term maintenance costs.
- Bill Silverstrum – prefer alt 3 or 4. Another concern with narrowing road is that this is only for a portion of the roadway so there's still width on both ends. I also thought we were supposed to have a second access to neighborhood. Parking issue – can park on both sides right now, proposal would mean that people may have to park in front of neighbor. Storms knock down branches and roadway is only clear path. If I need to get to my yard I'll have to cross whatever it is you build, I have rock wall lined driveway. Grant money is hard to come by so we'd only have this one section done for years. Finally, if TV shows that pipes are good, then we don't need to dig anything? Israel – some catch basins may need to be cleaned out/replaced. Dennis – discussion of pipe materials.
- Barb H – are lining costs part of the project? Israel – cost would go up if pipes needed to be lined.
- Mary Post – feel like we're behind, if we had these problems then why did development continue? Couldn't developers pay to fix rather than taxpayers? Safety – we've asked for years for safety to be addressed, like put in stop signs but Dennis says have to follow federal guidelines but this isn't federal road. Like the wide road, it's safe for everyone to use. Painting

the sides – don't have a problem with it but sides are usually full of debris. Dennis – new development subject to planning commission approval, made up of residents, if project meets standards then it can be developed. Some standards being tightened up to control phosphorous, for example. Stop signs and other markings follow federal guidance, as do other towns. Water line issue – there's only one into the development and will continue to look at adding a second line for a reliable source.

- Bob – Bill brought up issue I raised about second entrance requirement. Also issue of safety, we feel safe but agree that speed is an issue, are there options besides stop signs, like speed bumps or (radar speed feedback sign)? Phosphorous also an issue to address immediately. Dennis – some of these are old issues so hard to address. This is one of a few 40 ft roadways, also pretty long. Bob B – regulations about second access…alt 2 is concerning because it reduces roadway width.
- David – proponent of sidewalks, advocate for white lines, speed is an issue, there is no perfect design, wouldn't want to miss an opportunity to take advantage of having most impact. Comment about upgrading electrical in addition to water. Israel – didn't look at electrical. David – like alt 2 but also like the bigger road that people use, is there a way to do a hybrid for other sections to have continuity. Use rumble strip to designate space? But have young children so safe space is desired. Understand why town doesn't like speed bumps in neighborhoods but I'm interested in safety. Dennis – speed bumps are problematic, installed a bunch years ago, took speed data before and after, found that 50% speeds went up 2 mph, 50% speed went down 2 mph. We took out some because residents were tired of hearing cars going over them at night. There are other things that can be done like bulb outs that narrow intersections and people tend to slow down. Rumble strip could be an idea. Project scope is somewhat limited through RPC funding. David – suggest doing something of scale that could be done for the rest of the road at some point, described modified version of alt 2.
- Dylan – helpful to hear the cons of speed bumps. Sounds like alt 3 or 4 is popular, as is modified alt 2. Next steps? Israel – project team to determine if we have enough info to make a decision, or maybe another survey. Dennis – next step, run TV, look at catch basins, have a good feel from tonight, could be combination of alt 3 and 4 with some other options. This is only scoping so only part of the process. Take preferred alternative, send out to everyone, bring to Selectboard,
- Dylan – agree with preference for alt 3 and 4 but with safety improvements
- Israel – pavement markings could help create some safety improvement
- Patty – I'm a runner and biker, what if snow was physically removed, wouldn't that mitigate everything at once? Town only has one bucket loader, in winter trucks have salt and sand in back so can't put snow in the back. Also, where would you put snow if removed? Would have to be safe space.
- Bob – thanks for describing the process. Good feelings about living here reinforced by this conversation. Hope that plan will incorporate what you've heard and maybe we'd have another hearing like this before it goes to Selectboard.
- Mary – 40 ft roadway is safe and everyone enjoys it, but speeding is an issue, so maybe take to the Selectboard.
- Betsy – we have bike lanes on Tanglewood, I called police chief who didn't know the rules about using them or where to park cars. Also debris in fall is seasonal, road cleaning isn't frequent. Reiterate waiving second access and safety issue. Israel – white lines are just painted shoulders

not bike lanes. Dennis – correct. If bike lanes then parking gets restricted, as they are now doesn't restrict parking.

Essex Tanglewood Public Meeting
MS Teams Chat Log
March 16, 2021

[7:00 PM] Essex ReTorter (Guest)
This meeting is being live streamed and recorded nd can be reviewed at the Essex ReTorter Face Book Page.

[7:00 PM] Unknown User "Irene Wrenner (Guest)" was invited to the meeting.

[7:00 PM] Unknown User Patty was invited to the meeting.

[7:00 PM] Unknown User Amy was invited to the meeting.

[7:01 PM] Unknown User Marvin, Elizabeth was invited to the meeting.

[7:02 PM] Unknown User "Bob BatesB (Guest)" was invited to the meeting.

[7:02 PM] Unknown User Chris yandell was invited to the meeting.

[7:05 PM] Dylan McNamara- EWSD (Guest)
I'm glad you are presenting this as I missed the survey and it'll be good to for folks to have a chance for additional input
(1 liked)

[7:06 PM] Unknown User richard divenere (Guest) was invited to the meeting.

[7:07 PM] Unknown User Missie Thurston (Guest) was invited to the meeting.

[7:21 PM] Dylan McNamara- EWSD (Guest)
It looks like only 6 people said they had frontage but more than that actually answered the questions even though the questions said "if your property fronts Tanglewood..."

[7:21 PM] Andy Elliston (Guest)
FYI, I live in that section and my residence is connected to town sewer.

[7:23 PM] Unknown User Chris Yandell (Guest) was invited to the meeting.

[7:23 PM] Unknown User Chris yandell no longer has access to the chat.

[7:23 PM] David (Guest)

I'd just like to comment on the white lines. I certainly don't think they were a waste. I have young kids who would love to feel safe traveling in the neighborhood, and having the lines in place of what we would really love, a sidewalk, was a small upgrade and a minimal expense.

[7:24 PM] Unknown User Knight, Stacey L was invited to the meeting.

[7:28 PM] Erin Ennis (Guest)
David, I agree. Our kids are in Middle School, but I don't feel particularly safe allowing them to walk to school on the road, especially in the winter. 25MPH is often a loose suggestion on Tanglewood. I'm curious if a 30' roadway + sidewalk would encourage adherence to the speed limit.

[7:31 PM] Sam Tatro (Guest)
Annie, what impact will these upgrades have regarding the existing flooding issues on Woodlawn Drive. (1 liked)

[7:34 PM] Unknown User Carolyn Lewis (Guest) was invited to the meeting.

[7:35 PM] Ann Costandi
Hi Sam. We did not look at the drainage on Woodlawn as part of this project, but drainage improvements on Tanglewood will reduce the amount of stormwater running down Woodlawn and we will take a closer look at the drainage on Woodlawn once we select an alternative and come up with a plan for this project.

[7:37 PM] Sam Tatro (Guest)
Thank you, Annie. We're very interested in this project and the solution to the flooding issue on Woodlawn.

[7:39 PM] Ann Costandi
We are planning to some televising work of the storm pipes in the spring so I'll make sure that Woodlawn is included. I have your contact info Sam and I will keep you updated when we start doing the additional work.

[7:39 PM] Erin Ennis (Guest)
Ann Costandi This may be beyond the scope of this project. There is a bridge in the Town Forest across the discharge gully about 100 yards downstream from Fern Hollow. This access point frequently washes out, rendering pedestrian access to the Town Forest trails from the end of Woodlawn Drive unsafe. 1) Is the proposed solution expected to address the cause of the washout. 2) Is the stabilization/repair of this access point/crossing of the gulley within the scope of any remediation of the drainage corridor between Tanglewood/Fern Hollow and Alder Brook?

[7:43 PM] Amy (Guest)
Annie, what were the markings for that were done all down Woodlawn before winter? My understanding was that was to make improvements for the drainage on Woodlawn. If not, what will be

the impact on drainage of these changes that come from the markings that town made that have been yet to be implemented?

[7:48 PM] Ann Costandi
Hi Erin - the Town Forest falls under the Parks and Rec jurisdiction. I do know that P&R have completed a study to look at all the crossings in the Town Forest and have come up with a plan to repair and fix some of these. It is one of their priorities projects. The work we want to do to improve the drainage will store a portion of the water that causes some of this erosion. Between this project and the work from P&R, the crossing will be addressed.
(1 liked)

[7:49 PM] Unknown User David (Guest) no longer has access to the chat.

[7:49 PM] Unknown User "David (Guest)" was invited to the meeting.

[7:50 PM] Ann Costandi
Hi Amy, The markings were for paving improvements not drainage improvements. I do not know the schedule for it, but I can find out for you.

[7:52 PM] Marvin, Elizabeth (Guest)
Q: If I understand correctly, this project is being funded by a grant. How much is the grant?

[7:52 PM] McNamara, Katherine (Guest)
will the pavement markings along the sides of the road prevent parking being allowed?

[8:10 PM] Dylan McNamara- EWSD (Guest)
Have you considered adding speed humps/bumps?

[8:12 PM] Marvin, Elizabeth (Guest)
I agree.

[8:12 PM] Unknown User richard divenere (Guest) no longer has access to the chat.

[8:15 PM] Knight, Stacey L (Guest)
We also enjoy having a wider road, but we are fine with having markings on both sides of the road like we have now.
(1 liked)

[8:16 PM] Carolyn Lewis (Guest)
I would like to hear if there is any reason not to add in speed bumps?

[8:17 PM] Ann Costandi
We discussed speed humps and bumps in the first public meeting and it was not a preferred method so we took it out when looking closer into the alternatives.

[8:18 PM] Dylan McNamara- EWSD (Guest)
Going with option 3 or 4 appears to address drainage. Adding lines and/or speed bumps would enhance safety and mobility and check those boxes.

[8:22 PM] Unknown User Sam Tatro (Guest) no longer has access to the chat.

[8:28 PM] McNamara, Katherine (Guest)
I'm in favor of options 3 or 4 or a hybrid of those to reduce storm flow and phosphorus, while maintaining the wide roadway. A sidewalk would not get used for all of the reasons mentioned by others. For added safety, add speed bumps.

[8:31 PM] "David (Guest)"
I've had my hand up for a while but havent had a chanmce yet, love to comment if possible

[8:48 PM] Unknown User Marvin, Elizabeth no longer has access to the chat.

[8:48 PM] Unknown User Chris Yandell (Guest) no longer has access to the chat.

[8:49 PM] Unknown User "Rosina Cannizzaro (Guest)" no longer has access to the chat.

[8:53 PM] sharon zukowski (Guest)
Its 50 homes that require a second access. Both of the two developments at the end of Tanglewood were approved by the PC AND in Court with Dennis and the Fire Chief's assurance that the second access could be waived based on the 40 foot width of Tanglewood. Birchwood has over 200 homes and no second access. This is not old news. It is a current safety issue, which Dennis is calling sour grapes.

[8:57 PM] "Irene Wrenner (Guest)"
Old Farm Road?

[8:57 PM] Ann Costandi
Old Farm Road is one and also Laurel Hill Drive in South Burlington

[9:01 PM] Unknown User McNamara, Katherine no longer has access to the chat.

[9:02 PM] Erin Ennis (Guest)
David said it clearer than I did, but replacing the sidewalk with the green strip for the 35' road was what I was trying to ask about earlier.

[9:06 PM] sharon zukowski (Guest)
Great ideas from Dylan McNamara.

[9:06 PM] Missie Thurston (Guest)

I agree that speed is a huge problem on Tanglewood impacting the safety of all, especially our small children. If speed bumps are not effective, are there flower planters or those pushouts or other things that periodically narrow the road to slow speed in the summer? Or environmental elements (like rumble strip or planters or other) that highlight the "pedestrian area" on the side of the street. Do these features create the sense of a narrowed road without narrowing the road, and has narrowing roads been shown to slow speed? These could add aesthetic beauty in the summer and slow traffic but leave the 40' roadway intact and have a 40' roadway in the winter that's completely open like it is now.