STATE OF NEW HAMPSHIRE
INTER-DEPARTMENT COMMUNICATION

DATE: April 12, 2024

FROM: Andrew O'Sullivan
Wetlands Program Manager

AT (OFFICE): Department of Transportation
Bureau of Environment

SUBJECT Dredge & Fill Application
Acworth, 43566C

TO Karl Benedict, Public Works Permitting Officer
New Hampshire Wetlands Bureau
29 Hazen Drive, P.O. Box 95
Concord, NH 03302-0095

Forwarded herewith is the application package prepared by NH DOT Bureau of Highway Design for the subject major impact project. The project is proposing the replacement of a culvert under NH Route 123A in Acworth, NH, that conveys an unnamed stream. This activity will repair the NH Route 123A roadway and culvert that was damaged during the July 2021 storm event. The project will consist of replacing the existing structurally deficient and undersized culvert that is comprised of a single 4 foot-high by 2.8-foot-wide cast-in-place concrete culvert featuring an additional half cut 36" diameter corrugated metal pipe as the culvert ceiling with a 6' span by 6' rise (1.37' buried) concrete box culvert.

This project was reviewed at the Natural Resource Agency Coordination Meeting on December 20, 2023. A copy of the minutes has been included with this application package. A copy of this application and plans can be accessed on the Departments website via the following link: https://www.dot.nh.gov/projects-plans-and-programs/programs/environmental-management-system/project-management-section-0.

NHDOT anticipates and request that this project be reviewed and permitted by the Army Corp of Engineers through the State Programmatic General Permit process. A copy of the application has been sent to the Army Corp of Engineers.

Mitigation was determined to not be required for the proposed work.

The lead people to contact for this project are Jason Ayotte, Bureau of Highway Design (603-271-2230 or Jason.M.Ayotte@dot.nh.gov) or Andrew O'Sullivan, Wetlands Program Manager, Bureau of Environment (271-3226 or Andrew.O'Sullivan@dot.nh.gov).

A payment voucher has been processed for this application (Voucher #753036) in the amount of $432.80.

If and when this application meets with the approval of the Bureau, please send the permit directly to Andrew O'Sullivan, Wetlands Program Manager, Bureau of Environment.

JRB;
cc:
BOE Original
Town of Acworth (4 copies via certified mail)
Mike Dionne & Kevin Newton, NH Fish & Game (via electronic notification)
Maria Tur, US Fish & Wildlife (via electronic notification)
Jeanie Brochi, US Environmental Protection Agency (via electronic notification)
Michael Hicks & Rick Kristoff, US Army Corp of Engineers (via electronic notification)
Kevin Nyhan, BOE (via electronic notification)

\\dot.state.nh.us\data\Environment\PROJECTS\ACWORTH\43566C\Wetlands\Final Wetlands Application\Application Submission Documents\Acworth-WETAPP - Coverletter.doc

Replacement of the NH Route 123A Culvert Conveying an Unnamed Stream Acworth, NH

NH Department of Transportation (NHDOT)
FEMA Project Number: 670946
NHDOT Project Number: 43556C

New Hampshire Department of Environmental Services

Wetlands Bureau Permit Application

Hoyle, Tanner Project Number: 22.092501.03

Prepared By:

HOYLE TANNER

April 2024

HOYLE TANNER

Trusted Experts | Innovative Results

April 3, 2024

D.E.S. Wetlands Bureau
P.O. Box 95
Concord, NH 03302-0095

Re: Wetlands Permit Application
NHDOT Acworth #43556C
NH Route 124A Culvert Conveying an Unnamed Stream
Acworth, NH
Hoyle, Tanner Project No. 22.02501.03

Dear Sir/Madam:

The NHDOT is proposing replacement of a culvert under NH Route 123A in Acworth, NH, that conveys an unnamed stream The Purpose and Need of the project is to repair the NH Route 123A roadway and culvert damaged during the July 29-30, 2021, storm event that resulted in overtopping and damage to the roadway, culvert, headwall and wingwalls.

The project will consist of replacing the existing structurally deficient and undersized culvert that is comprised of a single 4-foot-high by 2.8-foot-wide cast-in-place concrete culvert featuring an additional half cut 36" diameter corrugated metal pipe as the culvert ceiling with a 6' span by 6' rise (1.37' buried) concrete box culvert.

There will be permanent and temporary resource impacts as a result of the project. All areas of temporary disturbance will be stabilized using mulch, tackifiers and loam upon work completion. A filing fee of $432.80 is included with the package. The current schedule is to commence and complete construction in the summer of 2025.

If you require any additional information, please feel free to contact me at your convenience.

Very truly yours,
HOYLE, TANNER & ASSOCIATES, INC.

Kimberly R. Peace
Senior Environmental Coordinator

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STANDARD DREDGE AND FILL WETLANDS PERMIT APPLICATION

Water Division/Land Resources Management
Wetlands Bureau

Check the Status of your Application

RSA/Rule: RSA 482-A/Env-Wt 100-900

APPLICANT'S NAME: NH Department of Transportation / Jason M. Ayotte, PE **TOWN NAME:** Acworth

Administrative Use Only	Administrative Use Only	Administrative Use Only	File No.:
			Check No.:
			Amount:
			Initials:

A person may request a waiver of the requirements in Rules Env-Wt 100-900 to accommodate situations where strict adherence to the requirements would not be in the best interest of the public or the environment but is still in compliance with RSA 482-A. A person may also request a waiver of the standards for existing dwellings over water pursuant to RSA 482-A:26, III(b). For more information, please consult the Waiver Request Form.

SECTION 1 - REQUIRED PLANNING FOR ALL PROJECTS (Env-Wt 306.05; RSA 482-A:3, I(d)(2))

Please use the Wetland Permit Planning Tool (WPPT), the Natural Heritage Bureau (NHB) DataCheck Tool, the Aquatic Restoration Mapper, or other sources to assist in identifying key features such as: priority resource areas (PRAs), protected species or habitats, coastal areas, designated rivers, or designated prime wetlands.

Has the required planning been completed?	☒ Yes ☐ No
Does the property contain a PRA? If yes, provide the following information:	☐ Yes ☒ No
• Does the project qualify for an Impact Classification Adjustment (e.g. NH Fish and Game Department (NHF&G) and NHB agreement for a classification downgrade) or a Project-Type Exception (e.g. Maintenance or Statutory Permit-by-Notification (SPN) project)? See Env-Wt 407.02 and Env-Wt 407.04.	☐ Yes ☒ No

• Protected species or habitat?
  ○ If yes, species or habitat name(s):
  ○ NHB Project ID #: NHB23-2379
	☐ Yes ☒ No

• Bog?	☐ Yes ☒ No
• Floodplain wetland contiguous to a tier 3 or higher watercourse?	☐ Yes ☒ No
• Designated prime wetland or duly-established 100-foot buffer?	☐ Yes ☒ No
• Sand dune, tidal wetland, tidal water, or undeveloped tidal buffer zone?	☐ Yes ☒ No
Is the property within a Designated River corridor? If yes, provide the following information: • Name of Local River Management Advisory Committee (LAC): Cold River Local Advisory Committee • A copy of the application was sent to the LAC on Month: Day: Year:	☒ Yes ☐ No

For dredging projects, is the subject property contaminated? • If yes, list contaminant:	☐ Yes ☒ No
Is there potential to impact impaired waters, class A waters, or outstanding resource waters?	☒ Yes ☐ No
For stream crossing projects, provide watershed size (see WPPT or Stream Stats): 0.19 Sq Mile / 122 Acres	

SECTION 2 - PROJECT DESCRIPTION (Env-Wt 311.04(i))

Provide a **brief** description of the project and the purpose of the project, outlining the scope of work to be performed and whether impacts are temporary or permanent. DO NOT reply "See attached"; please use the space provided below.

The NHDOT is proposing replacement of a culvert that conveys an unnamed stream and roadway repairs to a segment of NH Route 123A. The road runs parallel and is immediately adjacent to the Cold River. The project will consist of replacing the existing structurally deficient and undersized culvert that is comprised of a single 4-foot-high by 2.8-foot-wide cast-in-place concrete culvert featuring an additional half cut 36" diameter corrugated metal pipe as the culvert ceiling with a 6' span by 6' rise (1.37' buried) concrete box culvert.

A simulated natural stream bottom is proposed to be constructed with riprap stone through the crossing. Riprap voids will be filled with bank run gravel material and hydraulically washed in to replicate the natural stream and to also reduce flood velocities. This culvert type and opening size decreases flood velocities, provides a span that better accommodates existing brook flows, reduces flooding of the roadway at major flood events, lowers the flood profile of the unnamed stream and meets the NHDOT Manual on Drainage Design for Highways design standards.

The proposed project would result in a total of 642 square feet and 92 linear feet of temporary wetland impact and 440 square feet and 16 linear feet of permanent wetland impact. Temporary impacts are associated with space for the installation of water diversion structures and other erosion control best management practices. Temporary bank impact areas will be stabilized using mulch, tackifiers and loam.

SECTION 3 - PROJECT LOCATION

Separate wetland permit applications must be submitted for each municipality within which wetland impacts occur.

ADDRESS: NH Route 123A

TOWN/CITY: Acworth

TAX MAP/BLOCK/LOT/UNIT: Acworth Tax Map 248

US GEOLOGICAL SURVEY (USGS) TOPO MAP WATERBODY NAME: Unnamed Stream
☐ N/A

(Optional) LATITUDE/LONGITUDE in decimal degrees (to five decimal places): 43.18531° North / -72.25740° West

SECTION 4 - APPLICANT (DESIRED PERMIT HOLDER) INFORMATION (Env-Wt 311.04(a))

If the applicant is a trust or a company, then complete with the trust or company information.

NAME: NH Department of Transportation /Jason M. Ayotte, PE

MAILING ADDRESS: P.O. Box 483, 7 Hazen Drive

TOWN/CITY: Concord	STATE: NH	ZIP CODE: 03302

EMAIL ADDRESS: Jason.M.Ayotte@dot.nh.gov

FAX: (603) 271-2759	PHONE: (603) 271-2731

ELECTRONIC COMMUNICATION: By initialing here:- JMA, I hereby authorize NHDES to communicate all matters relative to this application electronically.

SECTION 5 - AUTHORIZED AGENT INFORMATION (Env-Wt 311.04(c))

☐ N/A

LAST NAME, FIRST NAME, M.I.: Peace, Kimberly R.		
COMPANY NAME: Hoyle, Tanner & Associates, Inc.		
MAILING ADDRESS: 150 Dow Street		
TOWN/CITY: Manchester	STATE: NH	ZIP CODE: 03101
EMAIL ADDRESS: kpeace@hoyletanner.com		
FAX: 603-669-4168	PHONE: (603) 460-5205	

ELECTRONIC COMMUNICATION: By initialing here KRP, I hereby authorize NHDES to communicate all matters relative to this application electronically.

SECTION 6 - PROPERTY OWNER INFORMATION (IF DIFFERENT THAN APPLICANT) (Env-Wt 311.04(b))

If the owner is a trust or a company, then complete with the trust or company information.

☒ Same as applicant

NAME:		
MAILING ADDRESS:		
TOWN/CITY:	STATE:	ZIP CODE:
EMAIL ADDRESS:		
FAX:	PHONE:	

ELECTRONIC COMMUNICATION: By initialing here , I hereby authorize NHDES to communicate all matters relative to this application electronically.

SECTION 7 - RESOURCE-SPECIFIC CRITERIA ESTABLISHED IN Env-Wt 400, Env-Wt 500, Env-Wt 600, Env-Wt 700, OR Env-Wt 900 HAVE BEEN MET (Env-Wt 313.01(a)(3))

In accordance with Env-Wt 400 the jurisdictional areas within the project limits have been delineated by Joanne Theriault, NH Certified Wetland Scientist #305. A copy of the Wetland Delineation Report is included with this application. The jurisdictional areas are referenced on the included wetland impact plan.

The project has been designed in accordance with, Env-Wt 904.01, Env-Wt 904.05, and Env-Wt 904.09. Project-specific information is contained within this permit application.

SECTION 8 - AVOIDANCE AND MINIMIZATION

The Avoidance and Minimization Checklist is attached to this permit application.

SECTION 9 - MITIGATION REQUIREMENT (Env-Wt 311.02)

If unavoidable jurisdictional impacts require mitigation, a mitigation pre-application meeting must occur at least 30 days but not more than 90 days prior to submitting this Standard Dredge and Fill Permit Application.

Mitigation Pre-Application Meeting Date: Month: Day: Year:
(☒ N/A - Mitigation is not required)

SECTION 10 - THE PROJECT MEETS COMPENSATORY MITIGATION REQUIREMENTS (Env-Wt 313.01(a)(1)c)

Confirm that you have submitted a compensatory mitigation proposal that meets the requirements of Env-Wt 800 for all permanent unavoidable impacts that will remain after avoidance and minimization techniques have been exercised to the maximum extent practicable: ☐ I confirm submittal.

(☒ N/A - Compensatory mitigation is not required) Mitigation is not required for the proposed project because: the permanent impacts proposed are necessary to stabilize the bank, protect the infrastructure and to improve roadway safety and drainage; Per Env-Wt 904.05 (f)(2), the proposed replacement stream crossing will meet the requirements of Env-Wt 904.09, will meet the general design criteria in Env-Wt 904.01 and the tier specific design criteria in Env-Wt 904.07 to the extent feasible; the project meets the definition of self-mitigating by improving the hydraulic capacity of an under-sized crossing; and will improve aquatic organism passage, connectivity and hydraulics by replacing an undersized culvert which is comprised of a single 4-foot-high by 2.8-foot-wide cast-in-place concrete culvert featuring an additional half cut 36" diameter corrugated metal pipe as the culvert ceiling with a 6' span by 6' rise (1.37' buried) concrete box culvert.

SECTION 11 - IMPACT AREA (Env-Wt 311.04(g))

For each jurisdictional area that will be/has been impacted, provide square feet (SF) and, if applicable, linear feet (LF) of impact, and note whether the impact is after-the-fact (ATF; i.e., work was started or completed without a permit).

For intermittent and ephemeral streams, the linear footage of impact is measured along the thread of the channel. *Please note, installation of a stream crossing in an ephemeral stream may be undertaken without a permit per Rule Env-Wt 309.02(d), however other dredge or fill impacts should be included below.*

For perennial streams/rivers, the linear footage of impact is calculated by summing the lengths of disturbances to the channel and banks.

Permanent impacts are impacts that will remain after the project is complete (e.g., changes in grade or surface materials).

Temporary impacts are impacts not intended to remain (and will be restored to pre-construction conditions) after the project is completed.

JURISDICTIONAL AREA		PERMANENT			TEMPORARY		
		SF	LF	ATF	SF	LF	ATF
Wetlands	Forested Wetland			☐			☐
	Scrub-shrub Wetland			☐			☐
	Emergent Wetland	353		☐			☐
	Wet Meadow			☐			☐
	Vernal Pool			☐			☐
	Designated Prime Wetland			☐			☐
	Duly-established 100-foot Prime Wetland Buffer			☐			☐
Surface Water	Intermittent / Ephemeral Stream			☐			☐
	Perennial Stream or River	107	16	☐	309	35	☐
	Lake / Pond			☐			☐
	Docking - Lake / Pond			☐			☐
	Docking - River			☐			☐
Banks	Bank - Intermittent Stream			☐			☐
	Bank - Perennial Stream / River	7	6	☐	306	51	☐
	Bank / Shoreline - Lake / Pond			☐			☐
Tidal	Tidal Waters			☐			☐
	Tidal Marsh			☐			☐
	Sand Dune			☐			☐
	Undeveloped Tidal Buffer Zone (TBZ)			☐			☐
	Previously-developed TBZ			☐			☐
	Docking - Tidal Water			☐			☐
TOTAL		**467**	**22**		**615**	**86**	

SECTION 12 - APPLICATION FEE (RSA 482-A:3, I)			
☐ **MINIMUM IMPACT FEE**: Flat fee of $400.			
☐ **NON-ENFORCEMENT RELATED, PUBLICLY-FUNDED AND SUPERVISED RESTORATION PROJECTS, REGARDLESS OF IMPACT CLASSIFICATION:** Flat fee of $400 (refer to RSA 482-A:3, 1(c) for restrictions).			
☒ **MINOR OR MAJOR IMPACT FEE:** Calculate using the table below:			
Permanent and temporary (non-docking):	1,082 SF	× $0.40 =	$432.80
Seasonal docking structure:	SF	× $2.00 =	$
Permanent docking structure:	SF	× $4.00 =	$
Projects proposing shoreline structures (including docks) add $400 =			$
Total =			$432.80
The application fee for minor or major impact is the above calculated total or $400, whichever is greater =			$432.80

SECTION 13 - PROJECT CLASSIFICATION (Env-Wt 306.05) Indicate the project classification.		
☐ Minimum Impact Project	☐ Minor Project	☒ Major Project

SECTION 14 - REQUIRED CERTIFICATIONS (Env-Wt 311.11)	
Initial each box below to certify:	
Initials: JKH	To the best of the signer's knowledge and belief, all required notifications have been provided.
Initials: JKH	The information submitted on or with the application is true, complete, and not misleading to the best of the signer's knowledge and belief.
Initials: JKH	The signer understands that: • The submission of false, incomplete, or misleading information constitutes grounds for NHDES to: 1. Deny the application. 2. Revoke any approval that is granted based on the information. 3. If the signer is a certified wetland scientist, licensed surveyor, or professional engineer licensed to practice in New Hampshire, refer the matter to the joint board of licensure and certification established by RSA 310-A:1.
Initials: N/A	If the applicant is not the owner of the property, each property owner signature shall constitute certification by the signer that he or she is aware of the application being filed and does not object to the filing.

SECTION 15 - REQUIRED SIGNATURES (Env-Wt 311.04(d); Env-Wt 311.11)		
SIGNATURE (OWNER):	PRINT NAME LEGIBLY: Jason Ayotte	DATE: 4/10/2024
SIGNATURE (APPLICANT, IF DIFFERENT FROM OWNER):	PRINT NAME LEGIBLY:	DATE:
SIGNATURE (AGENT, IF APPLICABLE):	PRINT NAME LEGIBLY: Kimberly Peace	DATE: 4/3/2024

SECTION 16 - TOWN / CITY CLERK SIGNATURE (Env-Wt 311.04(f))	
As required by RSA 482-A:3, I(a)(1), I hereby certify that the applicant has filed four application forms, four detailed plans, and four USGS location maps with the town/city indicated below.	
TOWN/CITY CLERK SIGNATURE: _____	PRINT NAME LEGIBLY: **Please refer to Env-Wt 311.05(a)(14) & RSA 482-A:3I(a)(I). The four town copies have sent via certified mail and filed directly with the Town of Acworth in accordance with the above rule and regulation.**
TOWN/CITY:	DATE:

DIRECTIONS FOR TOWN/CITY CLERK:
Per RSA 482-A:3, I(a)(1)

1. IMMEDIATELY sign the original application form and four copies in the signature space provided above.
2. Return the signed original application form and attachments to the applicant so that the applicant may submit the application form and attachments to NHDES by mail or hand delivery.
3. IMMEDIATELY distribute a copy of the application with one complete set of attachments to each of the following bodies: the municipal Conservation Commission, the local governing body (Board of Selectmen or Town/City Council), and the Planning Board.
4. Retain one copy of the application form and one complete set of attachments and make them reasonably accessible for public review.

DIRECTIONS FOR APPLICANT:
Submit the original permit application form bearing the signature of the Town/City Clerk, additional materials, and the application fee to NHDES by mail or hand delivery at the address at the bottom of this page. Make check or money order payable to “Treasurer – State of NH”.

HOYLE TANNER

150 Dow Street
Manchester, NH 03101
http://www.hoyletanner.com

Acworth #43566C
NH Route 123A Culvert
Conveying an Unnamed Stream

Project Location Map

Last updated on *Monday, August 21, 2023* by *dcoon*

N

SCALE
1 inch = 833 feet

STANDARD DREDGE AND FILL
WETLANDS PERMIT APPLICATION
ATTACHMENT A: MINOR AND MAJOR PROJECTS

Water Division/Land Resources Management

Wetlands Bureau

Check the Status of your Application

RSA/ Rule: RSA 482-A/ Env-Wt 311.10; Env-Wt 313.01(a)(1); Env-Wt 313.03

APPLICANT'S NAME: NH Department of Transportation / Jason M. Ayotte, PE **TOWN NAME:** Acworth

Attachment A is required for *all minor and major projects*, and must be completed *in addition* to the Avoidance and Minimization Narrative or Checklist that is required by Env-Wt 307.11.

For projects involving construction or modification of non-tidal shoreline structures over areas of surface waters having an absence of wetland vegetation, only Sections I.X through I.XV are required to be completed.

PART I: AVOIDANCE AND MINIMIZATION
In accordance with Env-Wt 313.03(a), the Department shall not approve any alteration of any jurisdictional area unless the applicant demonstrates that the potential impacts to jurisdictional areas have been avoided to the maximum extent practicable and that any unavoidable impacts have been minimized, as described in the Wetlands Best Management Practice Techniques For Avoidance and Minimization.
SECTION I.I - ALTERNATIVES (Env-Wt 313.03(b)(1)) Describe how there is no practicable alternative that would have a less adverse impact on the area and environments under the Department's jurisdiction.
There is no practicable alternative that would have a less adverse impact on the area and environments under the Department's jurisdiction. The primary purpose of this project is to allow for safe transport of pedestrians and traffic across an unnamed stream. The proposed alternative provides a replacement structure that meets the current statutory load requirements, provides a larger hydraulic opening with a simulated stream through the crossing that will mimic existing upstream and downstream streambed as well as create new streambed where none currently exists and minimizes the environmental impacts and construction costs.
SECTION I.II - MARSHES (Env-Wt 313.03(b)(2)) Describe how the project avoids and minimizes impacts to tidal marshes and non-tidal marshes where documented to provide sources of nutrients for finfish, crustacean, shellfish, and wildlife of significant value.
N/A – this project is not located within tidal waters or marshes.
SECTION I.III - HYDROLOGIC CONNECTION (Env-Wt 313.03(b)(3)) Describe how the project maintains hydrologic connections between adjacent wetland or stream systems.
The project is intended to replace a structurally deficient and undersized stream crossing and will improve hydrologic connectivity by replacement with a new structure that will have a larger hydraulic opening than what exists in the current condition.

SECTION I.IV - JURISDICTIONAL IMPACTS (Env-Wt 313.03(b)(4))

Describe how the project avoids and minimizes impacts to wetlands and other areas of jurisdiction under RSA 482-A, especially those in which there are exemplary natural communities, vernal pools, protected species and habitat, documented fisheries, and habitat and reproduction areas for species of concern, or any combination thereof.

Impacts to the jurisdictional bank and bed of the unnamed stream are necessary replace the culvert at this crossing, however these impacts have been minimized to the extent practicable. There are no exemplary natural communities, vernal pools, protected species or protected habitat, or documented fisheries. The NHDES Wetlands Permit Planning Tool shows the proposed project area is not predicted or cold-water fisheries habitat. Temporary bank impact areas that include soil disturbance and vegetation removal will be restored to the pre-existing conditions.

SECTION I.V - PUBLIC COMMERCE, NAVIGATION, OR RECREATION (Env-Wt 313.03(b)(5))

Describe how the project avoids and minimizes impacts that eliminate, depreciate or obstruct public commerce, navigation, or recreation.

The project will have a positive effect on public commerce and navigation by replacing a deteriorating crossing with a new, relatively maintenance-free structure designed for a minimum service life of 75 years. The project will have no impact on recreation.

SECTION I.VI - FLOODPLAIN WETLANDS (Env-Wt 313.03(b)(6))

Describe how the project avoids and minimizes impacts to floodplain wetlands that provide flood storage.

The wetland delineation report (attached) prepared for the project indicates there are floodplain wetlands present within the project area on the north side of the road, adjacent to the Cold River. The proposed project will have no impact on these floodplain wetlands. Wetlands delineated on the south side of the road do not offer flood storage due to their position higher on the slope and on the opposite side of the road.

SECTION I.VII - RIVERINE FORESTED WETLAND SYSTEMS AND SCRUB-SHRUB – MARSH COMPLEXES (Env-Wt 313.03(b)(7))

Describe how the project avoids and minimizes impacts to natural riverine forested wetland systems and scrub-shrub – marsh complexes of high ecological integrity.

N/A

SECTION I.VIII - DRINKING WATER SUPPLY AND GROUNDWATER AQUIFER LEVELS (Env-Wt 313.03(b)(8))

Describe how the project avoids and minimizes impacts to wetlands that would be detrimental to adjacent drinking water supply and groundwater aquifer levels.

N/A

SECTION I.IX - STREAM CHANNELS (Env-Wt 313.03(b)(9))

Describe how the project avoids and minimizes adverse impacts to stream channels and the ability of such channels to handle runoff of waters.

Upon completion of the project the hydraulic opening will be increased. The culvert at the crossing creates a constriction of the flow of the stream in this location due to being undersized. The new crossing eliminates the constriction and will have minor permanent and mostly temporary impacts on the streambed. The proposed wider opening will allow for creation of new streambed where none exists. It is anticipated there will be no permanent adverse impact to the stream channel nor the ability of the channel to handle runoff of waters. All impacts have been minimized to the extent practicable.

SECTION I.X - SHORELINE STRUCTURES - CONSTRUCTION SURFACE AREA (Env-Wt 313.03(c)(1))

Describe how the project has been designed to use the minimum construction surface area over surface waters necessary to meet the stated purpose of the structures.

N/A – No shoreline structures are proposed

SECTION I.XI - SHORELINE STRUCTURES - LEAST INTRUSIVE UPON PUBLIC TRUST (Env-Wt 313.03(c)(2))

Describe how the type of construction proposed is the least intrusive upon the public trust that will ensure safe docking on the frontage.

N/A – No shoreline structures are proposed

SECTION I.XII - SHORELINE STRUCTURES – ABUTTING PROPERTIES (Env-Wt 313.03(c)(3))

Describe how the structures have been designed to avoid and minimize impacts on ability of abutting owners to use and enjoy their properties.

N/A – No shoreline structures are proposed

SECTION I.XIII - SHORELINE STRUCTURES – COMMERCE AND RECREATION (Env-Wt 313.03(c)(4))

Describe how the structures have been designed to avoid and minimize impacts to the public's right to navigation, passage, and use of the resource for commerce and recreation.

N/A – No shoreline structures are proposed

SECTION I.XIV - SHORELINE STRUCTURES – WATER QUALITY, AQUATIC VEGETATION, WILDLIFE AND FINFISH HABITAT (Env-Wt 313.03(c)(5))

Describe how the structures have been designed, located, and configured to avoid impacts to water quality, aquatic vegetation, and wildlife and finfish habitat.

N/A – No shoreline structures are proposed

SECTION I.XV - SHORELINE STRUCTURES – VEGETATION REMOVAL, ACCESS POINTS, AND SHORELINE STABILITY (Env-Wt 313.03(c)(6))

Describe how the structures have been designed to avoid and minimize the removal of vegetation, the number of access points through wetlands or over the bank, and activities that may have an adverse effect on shoreline stability.

N/A – No shoreline structures are proposed

PART II: FUNCTIONAL ASSESSMENT
REQUIREMENTS Ensure that project meets the requirements of Env-Wt 311.10 regarding functional assessment (Env-Wt 311.04(j); Env-Wt 311.10).
FUNCTIONAL ASSESSMENT METHOD USED: Hoyle, Tanner & Associates, Inc. has prepared a functional assessment using the NHDES Functional Assessment Worksheet (NHDES-W-06-049). A summary narrative of the assessment results is part of the Wetland Delineation Report included with this application.
NAME OF CERTIFIED WETLAND SCIENTIST (FOR NON-TIDAL PROJECTS) OR QUALIFIED COASTAL PROFESSIONAL (FOR TIDAL PROJECTS) WHO COMPLETED THE ASSESSMENT: Joanne Theriault, CWS #305
DATE OF ASSESSMENT: August 14, 2023
Check this box to confirm that the application includes a NARRATIVE ON FUNCTIONAL ASSESSMENT: ☒
For minor or major projects requiring a standard permit without mitigation, the applicant shall submit a wetland evaluation report that includes completed checklists and information demonstrating the RELATIVE FUNCTIONS AND VALUES OF EACH WETLAND EVALUATED. Check this box to confirm that the application includes this information, if applicable: ☒ Note: The Wetlands Functional Assessment worksheet can be used to compile the information needed to meet functional assessment requirements.

NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES
WETLAND PERMIT APPLICATION
for
NH Route 123A Culvert Conveying an Unnamed Stream, Acworth, NH

Supplemental Narrative

The following information is offered as a supplement to the information provided in the Wetland Permit Application and Plans.

Purpose and Need:
The purpose of the project is to address the deficient condition of NH Route 123A in this location. The need for the project is due to a storm event that occurred July 29-30, 2021, that resulted in damage of the culvert and the currently unstable condition it created.

Resources:
Hoyle, Tanner & Associates, Inc. (Hoyle Tanner) completed the wetland and streams delineation as well as functions and values assessment for the NH Route 123A culvert that conveys an unnamed stream. Wetlands were delineated in accordance with Env-Wt 406.01; Hoyle Tanner's methodology is described in the included Wetland Delineation Report. Hoyle Tanner describes the unnamed stream as R3RB2F (Riverine, Upper Perennial, Rock Bottom, Rubble, Semipermanently Flooded). Two other streams were noted and delineated that are in proximity of the unnamed stream, including the Cold River. The classifications of these streams are R3UB1H (Riverine, Upper Perennial Flow Regime, Unconsolidated Bottom, Gravel/Cobble Substrate, Permanently Flooded) and R4SB3J (Riverine, Intermittent, Stream Channel, Cobble-Gravel, Intermittently Flooded). Two wetlands were identified and delineated in and around the project location.

A summary narrative of the Functions and Values Assessment is part of the Wetland Delineation Report included with this application.

Explanation as to methods, timing, and manner as to how the project will meet applicable standard permit conditions required in Env-Wt 307 (Env-Wt 311.03(b)(7))

Env-Wt 307.02 (US Army Corps of Engineers (USACE) Conditions). Appendix B is attached to this permit application. NHDOT seeks and requests to receive review and approval by the Army Corps of Engineers through their General Permit and via submittal of this State wetlands permit application to NHDES.

Env-Wt 307.03 (Protection of Water Quality Required). The contractor shall be responsible for implementing Erosion and Sediment control measures in accordance with the "New Hampshire Stormwater Manual, Volume 3 Erosion and Sediment Controls during Construction" by NHDES. Erosion and siltation control measures will be installed by the Contractor prior to the start of any work and will be maintained during the duration of the construction activities. It is the Contractor's responsibility to not cause violations of surface water quality standards. Upon completion of the project, the project will cause no adverse effects on the quality or quantity of surface or groundwater entering or exiting the project site.

Env-Wt 307.04 (Protection of Fisheries and Breeding Areas Required). There are no predicted or identified cold water fisheries associated with the unnamed stream. The Cold River is a predicted cold water fishery, however the river will not be affected.

Env-Wt 307.05 (Protection Against Invasive Species Required) Hoyle Tanner performed an invasive species review of the project area as a part of the wetland delineation. Small populations of Glossy buckthorn (*Frangula alnus*) and Japanese knotweed (*Reynoutria japonica*) were identified within the project area. The project contractor will be aware of and conform with the requirements in Env-Wt 307.05 and will be required to address the Best Management Practices For the Control of Invasive and Noxious Plant Species (2018) issued by NHDOT, including preparation of an Invasive Species Control and Management Plan to be submitted to the Contract Engineer for review and approval.

Env-Wt 307.06 (Protection of Rare, Threatened or Endangered Species and Critical Habitat) The NH Natural Heritage Bureau was contacted regarding the proposed project (see attached letter NHB23-2379, dated 8/8/2023). The database check determined that there are no recorded occurrences for sensitive species near the project area. A copy of the DataCheck Report is included with this application.

An official Federally-listed species list was obtained from the US Fish and Wildlife Service (USFWS) using the Information for Planning and Conservation (IPAC) online tool. The list includes the Federally-endangered Northern Long Eared Bat (*Myotis septentrionalis*; NLEB), Federally-endangered Northeastern Bulrush (*Scirpus ancistrochaetus*) and the Monarch Butterfly (*Danaus plexippus*) as a candidate species. A copy of the species list is included with this permit application.

The project has been reviewed within the IPaC system utilizing the Northern Long-eared Bat Rangewide Determination Key. A Consistency Letter was received that the Proposed Action will have no effect on the endangered northern long-eared bat (*Myotis septentrionalis*). If there are no updates on listed species, no further consultation/ coordination for this project is required with respect to the northern long-eared bat. However, the Service recommends that project proponents re-evaluate the Project in IPaC if: 1) the scope, timing, duration, or location of the Project changes (includes any project changes or amendments); 2) new information reveals the Project may impact (positively or negatively) federally listed species or designated critical habitat; or 3) a new species is listed, or critical habitat designated. If any of the above conditions occurs, additional coordination with the Service should take place to ensure compliance with the Act. A copy of this letter is included with this application.

The project has been reviewed within the IPaC system utilizing the Northeast Endangered Species Determination Key. A consistency letter was received that the Proposed Action will have no effect on the endangered Northeastern Bulrush (*Scirpus ancistrochaetus*). If there are no updates on listed species, no further consultation/coordination for this project is required for the species identified above. However, the Service recommends that project proponents re-evaluate the Project in IPaC if: 1) the scope, timing, duration, or location of the Project changes (includes any project changes or amendments); 2) new information reveals the Project may impact (positively or negatively) federally listed species or designated critical habitat; or 3) a new species is listed, or critical habitat designated. If any of the above conditions occurs, additional consultation with the Service should take place before project implements any changes which are final or commits additional resources.

Env-Wt 307.07 (Consistency Required with Shoreland Water Quality Protection Act). The project is located within the ¼ mile buffer of the Cold River, a NHDES Designated River and is subject to the Shoreland Water Quality Protection Act (SWQPA) (NH RSA 483-B). A Shoreland Permit will be applied for the project.

Env-Wt 307.11 (Filling Activity Conditions). All fill material shall conform to the requirements listed in 307.11.

Env-Wt 307.12 (Restoring Temporary Impacts: Site Stabilization) Upon completion of the project all temporary impact areas will be restored per the requirements listed in Env-Wt 307.12. Per Env-Wt 307.12, temporary impact areas that are disturbed will be stabilized using mulch, tackifiers and loam. Native

excavate will be re-used as feasible to increase potential for re-colonization of native vegetation.

Env-Wt 307.13 (Property Line Setbacks): A temporary construction easement and a permanent drainage easement will be required to construct the project. The NHDOT ROW Bureau is currently working on obtaining these easements and requests that submitting the easements to NHDES be made a condition of the permit.

Env-Wt 307.15 (Use of Heavy Equipment in Wetlands) There will be no heavy equipment in the wetlands for construction of this project. All heavy equipment will be located on the road or sideslopes adjacent to the crossing.

Env-Wt 307.16 (Adherence to Approved Plans Required) All work shall be in accordance with the plans prepared by Hoyle Tanner and approved by NHDES.

Env-Wt 307.18 (Reports) The contractor will be responsible for preparing a Storm Water Pollution Prevention Plan. This plan will be submitted to NHDES for approval prior to the contractor working within jurisdictional resources.

Statement of whether the applicant has received comments from the local conservation commission and, if so, how the applicant has addressed the comments (Env-Wt 311.06(h))

A copy of this wetland permit application was submitted by the NHDOT to the Town of Acworth and for distribution to the Conservation Commission concurrent with submittal of the application to NHDES.

Stream Crossings (Env-Wt 900)

Since the proposed culvert replacement project is located on a watercourse that is hydraulically connected to a Designated River and is partially located within a 100-yr floodplain, the stream crossing is categorized as a Tier 3 stream crossing. The stream crossing standards as outlined in New Hampshire Administrative Rule Env-Wt 900 have been addressed below.

Env-Wt 904.01: General Design Considerations

(a) All stream crossings, whether over tidal or non-tidal waters, shall be designed and constructed so as to:

(1) Not be a barrier to sediment transport;

The proposed crossing replacement has been designed to improve sediment transport in this location.

(2) Not restrict high flows and maintain existing low flows;

The proposed new crossing will not restrict high flows and will maintain existing low flows. The proposed replacement will improve the hydraulic capacity of the crossing due to the proposed larger hydraulic opening of the replacement structure.

(3) Not obstruct or otherwise substantially disrupt the movement of aquatic organisms indigenous to the waterbody beyond the actual duration of construction;

Aside from temporary obstructions or disruptions resulting from the construction activities (i.e., instream

erosion control measures), the replacement structure will maintain or enhance the existing movement of aquatic life as the hydraulic opening will be larger.

(4) Not cause an increase in the frequency of flooding or overtopping of banks;

The hydraulic opening of the replacement is larger than that of the existing culvert, which will decrease the flow velocity and lower the base flood elevations through the crossing during peak discharge events. This will result in a decrease in the potential of flooding or overtopping of banks.

(5) Maintain or enhance geomorphic compatibility by:
a. Minimizing the potential for inlet obstruction by sediment, wood, or debris; and
b. Preserving the natural alignment of the stream channel;

The increased hydraulic opening will reduce the potential for inlet obstruction caused by sediment, wood or debris. The existing channel alignment of unnamed stream will be preserved, as no realignment is included in the project design.

(6) Preserve watercourse connectivity where it currently exists;

The new structure is being installed in the existing stream alignment, and proposed larger hydraulic opening will preserve and improve watercourse connectivity by eliminating the constriction to the stream as a result of the undersized culvert.

(7) Restore watercourse connectivity where:
a. Connectivity previously was disrupted as a result of human activity(ies); and
b. Restoration of connectivity will benefit aquatic organisms upstream or downstream of the crossing, or both;

Not Applicable

(8) Not cause erosion, aggradation, or scouring upstream or downstream of the crossing; and

The proposed project includes riprap installation that is necessary for the protection of the new infrastructure, slope stability, and prevention of erosion, aggradation or scouring of the banks.

(9) Not cause water quality degradation.

The replacement structure will not cause water quality degradation.

(b) For stream crossings over tidal waters, the stream crossing shall be designed to:

(1) Match the velocity, depth, cross-sectional area, and substrate of the natural stream; and
(2) Be of sufficient size to not restrict bi-directional tidal flow over the natural tide range above, below, and through the crossing.

Not applicable, since the unnamed stream is not a tidal waterway.

Env-Wt 904.05: Tier 3 Stream Crossings

(a) Subject to (b), below, a tier 3 stream crossing shall be a crossing located:

(1) On a watercourse where the contributing watershed is 640 acres or greater;
(2) Within a designated river corridor, unless:
a. *The crossing would be a tier 1 stream based on the contributing watershed size; or*
b. *The structure does not create a direct surface water connection to the designated river as depicted on the national hydrography dataset as found on GRANIT;*
(3) Within a 100-year flood plain;
(4) In a jurisdictional area having any protected species or habitat; or
(5) In a prime wetlands or within a duly-established 100-foot buffer, unless a waiver has been granted pursuant to RSA 482-A:11, IV(b) and Env-Wt 706.

The watershed of the unnamed stream that crosses under NH Route 123A is approximately 122 acres in size (or 0.19 square miles). Refer to the Watershed Map included in this application. However, the proposed culvert replacement project is located on a watercourse that is hydraulically connected to a Designated River and is partially located within a 100-yr floodplain of the designated river. Therefore, this stream crossing is classified as a Tier 3 stream.

(b) The applicant for a project in which a stream crossing is categorized as tier 3 based solely on being in a 100-year floodplain may request that the crossing be categorized as a tier 1 or tier 2 stream crossing, as applicable based on watershed size, if the impacts to the floodplain are specifically mitigated in accordance with Env-Wt 800.

Not applicable.

(c) If an applicant for a project in which a stream crossing is categorized as tier 3 based solely in a jurisdictional area having any protected species or habitat may request that the crossing be categorized as tier 1 or tier 2 based on watershed size, provided:
(1) The applicant consults with NHB to determine whether any protected plant species or habitat would be impacted;
(2) The applicant consults with NHF&G to determine whether any protected species or habitat is impacted; and
(3) The NHB, NHF&G, or both, as applicable, recommend(s) such a downgrade to the department in writing.

Not applicable.

(d) A tier 3 stream crossing shall be a span structure or an open-bottomed culvert with stream simulation, not a closed-bottom culvert or pipe arch.

The replacement structure will be a closed-bottomed structure buried to allow for a stream simulation within it.

(e) The applicant shall use an alternative design by submitting a request as specified in Env-Wt 904.10.

Not applicable. Am alternative design is not required for culvert replacement projects under Env-Wt 904.09.

(f) Compensatory mitigation shall not be required for:
(1) Any new tier 3 stream crossing that:
a. Meets the general design criteria in Env-Wt 904.01 and the tier-specific criteria of Env-Wt 904.07;

b. Is self-mitigating; and

c. Improves aquatic organism passage, connectivity, and hydraulics; or

(2) Any replacement of a crossing that met all applicable requirements when originally installed but is in a location that results in the crossing being classified as tier 3 under these rules, provided the proposed stream crossing meets the requirements of Env-Wt 904.09.

The proposed replacement stream crossing will meet the requirements of Env-Wt 904.09, will meet the general design criteria in Env-Wt 904.01 and the tier specific design criteria in Env-Wt 904.07 to the extent feasible; the project meets the definition of self-mitigating by improving the hydraulic capacity of an under-sized crossing; and will improve aquatic organism passage, connectivity and hydraulics by replacing an undersized culvert which is comprised of a single 4-foot-high by 2.8-foot-wide cast-in-place concrete culvert featuring an additional half cut 36" diameter corrugated metal pipe as the culvert ceiling with a 6' span by 6' rise (1.37' buried) concrete box culvert.

(g) Plans for a tier 3 stream crossing shall be dated and bear the signature of the professional engineer who prepared or had responsibility for and approved them, as required by RSA 310-A:18.

Refer to the attached Wetland Impact Plans and the Erosion Control Plan which have been dated and signed by a licensed NH professional engineer.

Env-Wt 904.09: Repair, Rehabilitation, or Replacement of Tier 3 and Tier 4 Existing Legal Crossings

(a) The repair, rehabilitation, or replacement of tier 3 stream crossings shall be limited to existing legal crossings where the tier classification is based only on the size of the contributing watershed.

The stream crossing is classified as tier 3 due to its hydraulic connection to a designated river and is located partially within the 100-yr floodplain of the Cold River.

(b) Rehabilitation of a culvert or other closed-bottom stream crossing structure pursuant to this section may be accomplished by concrete repair, slip lining, cured-in place lining, or concrete invert lining, or any combination thereof, except that slip lining shall not occur more than once.

Not applicable.

(c) A project shall qualify under this section only if a professional engineer certifies, and provides supporting analyses to show, that:

(1) The existing crossing does not have a history of causing or contributing to flooding that damages the crossing or other human infrastructure or protected species habitat; and

The existing crossing does not have a history of causing or contributing to damaging flooding events. Flood damage that occurred happened due to flooding of the Cold River that is adjacent to the crossing.

(2) The proposed stream crossing will:

a. Meet the general criteria specified in Env-Wt 904.01;

Refer to the previous description for additional information regarding the proposed project's compliance with the general criteria specified in Env-Wt 904.01.

b. Maintain or enhance the hydraulic capacity of the stream crossing;

The project will improve the hydraulic capacity of the stream crossing. As previously discussed, the replacement structure will have a larger hydraulic opening.

> *c. Maintain or enhance the capacity of the crossing to accommodate aquatic organism passage;*

The capacity of the stream crossing to accommodate aquatic organism passage will be maintained. The structure opening will not be narrowed.

> *d. Maintain or enhance the connectivity of the stream reaches upstream or downstream of the crossing; and*

The connectivity of the stream reaches upstream and downstream of the crossing will be maintained. The scope of work proposed within jurisdictional areas will not negatively impact stream connectivity.

> *e. Not cause or contribute to the increase in the frequency of flooding or overtopping of the banks upstream or downstream of the crossing.*

The proposed replacement structure will not cause or contribute to the increase in the frequency of flooding or overtopping of the banks upstream or downstream of the crossing. The hydraulic capacity of the replacement structure will be an improvement as the existing structure is undersized.

(d) Repair, rehabilitation, or replacement of a tier 4 stream crossing shall comply with Env-Wt 904.07(d).

Not applicable. The proposed work involves a tier 3 stream crossing.

Pre-application coordination with NHDES included attendance at the NHDOT Natural Resource Agency Meeting on December 20, 2023. A Copy of meeting minutes are included with this permit application.

Mitigation

Per Env-Wt 904.05 (f)(2), the proposed replacement stream crossing will meet the requirements of Env-Wt 904.09, will meet the general design criteria in Env-Wt 904.01 and the tier specific design criteria in Env-Wt 904.07 to the extent feasible; the project meets the definition of self-mitigating by improving the hydraulic capacity of an under-sized crossing; and will improve aquatic organism passage, connectivity and hydraulics by replacing an undersized culvert which is comprised of a single 4-foot-high by 2.8-foot-wide cast-in-place concrete culvert featuring an additional half cut 36” diameter corrugated metal pipe as the culvert ceiling with a 6’ span by 6’ rise (1.37’ buried) concrete box culvert.

AVOIDANCE AND MINIMIZATION CHECKLIST

Water Division/Land Resources Management

Wetlands Bureau

Check the Status of your Application

RSA/Rule: RSA 482-A/ Env-Wt 311.07(c)

This checklist can be used in lieu of the written narrative required by Env-Wt 311.07(a) to demonstrate compliance with requirements for Avoidance and Minimization (A/M), pursuant to RSA 482-A:1 and Env-Wt 311.07(c).

For the construction or modification of non-tidal shoreline structures over areas of surface waters without wetland vegetation, complete only Sections 1, 2, and 4 (or the applicable sections in Attachment A: Minor and Major Projects (NHDES-W-06-013).

The following definitions and abbreviations apply to this worksheet:

- "A/M BMPs" stands for Wetlands Best Management Practice Techniques for Avoidance and Minimization dated 2019, published by the New England Interstate Water Pollution Control Commission (Env-Wt 102.18).
- "Practicable" means available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes (Env-Wt 103.62).

SECTION 1 - CONTACT/LOCATION INFORMATION		
APPLICANT LAST NAME, FIRST NAME, M.I.: NH Department of Transportation / Jason M. Ayotte. PE		
PROJECT STREET ADDRESS: NH Route 1243A		PROJECT TOWN: Acworth
TAX MAP/LOT NUMBER: Acworth Tax Map 248 / NHDOT ROW		
SECTION 2 - PRIMARY PURPOSE OF THE PROJECT		
Env-Wt 311.07(b)(1)	Indicate whether the primary purpose of the project is to construct a water-access structure or requires access through wetlands to reach a buildable lot or the buildable portion thereof.	☐ Yes ☒ No
If you answered "no" to this question, describe the purpose of the "non-access" project type you have proposed: The purpose of the project is to maintain safety and protect the traveling public by addressing the deficient condition of NH Route 123A culvert due to a storm event that occurred July 29-30, 2021, that resulted in damage of the culvert and the currently unstable condition it created.		
SECTION 3 - A/M PROJECT DESIGN TECHNIQUES Check the appropriate boxes below in order to demonstrate that these items have been considered in the planning of the project. Use N/A (not applicable) for each technique that is not applicable to your project.		
Env-Wt 311.07(b)(2)	For any project that proposes new permanent impacts of more than one acre or that proposes new permanent impacts to a Priority Resource Area (PRA), or both, whether any other properties reasonably available to the applicant, whether already owned or controlled by the applicant or not, could be used to achieve the project's purpose without altering the functions and values of any jurisdictional area, in particular wetlands, streams, and PRAs.	☐ Check ☒ N/A
Env-Wt 311.07(b)(3)	Whether alternative designs or techniques, such as different layouts, construction sequencing, or alternative technologies could be used to avoid impacts to jurisdictional areas or their functions and values.	☐ Check ☒ N/A

Env-Wt 311.07(b)(4) Env-Wt 311.10(c)(1) Env-Wt 311.10(c)(2)	The results of the functional assessment required by Env-Wt 311.03(b)(10) were used to select the location and design for the proposed project that has the least impact to wetland functions.	☐ Check ☒ N/A
Env-Wt 311.07(b)(4) Env-Wt 311.10(c)(3)	Where impacts to wetland functions are unavoidable, the proposed impacts are limited to the wetlands with the least valuable functions on the site while avoiding and minimizing impacts to the wetlands with the highest and most valuable functions.	☒ Check ☐ N/A
Env-Wt 313.01(c)(1) Env-Wt 313.01(c)(2) Env-Wt 313.03(b)(1)	No practicable alternative would reduce adverse impact on the area and environments under the department's jurisdiction and the project will not cause random or unnecessary destruction of wetlands.	☒ Check ☐ N/A
Env-Wt 313.01(c)(3)	The project would not cause or contribute to the significant degradation of waters of the state or the loss of any PRAs.	☒ Check ☐ N/A
Env-Wt 313.03(b)(3) Env-Wt 904.07(c)(8)	The project maintains hydrologic connectivity between adjacent wetlands or stream systems.	☒ Check ☐ N/A
Env-Wt 311.10 A/M BMPs	Buildings and/or access are positioned away from high function wetlands or surface waters to avoid impact.	☒ Check ☐ N/A
Env-Wt 311.10 A/M BMPs	The project clusters structures to avoid wetland impacts.	☐ Check ☒ N/A
Env-Wt 311.10 A/M BMPs	The placement of roads and utility corridors avoids wetlands and their associated streams.	☐ Check ☒ N/A
A/M BMPs	The width of access roads or driveways is reduced to avoid and minimize impacts. Pullouts are incorporated in the design as needed.	☒ Check ☐ N/A
A/M BMPs	The project proposes bridges or spans instead of roads/driveways/trails with culverts.	☐ Check ☒ N/A
A/M BMPs	The project is designed to minimize the number and size of crossings, and crossings cross wetlands and/or streams at the narrowest point.	☐ Check ☒ N/A
Env-Wt 500 Env-Wt 600 Env-Wt 900	Wetland and stream crossings include features that accommodate aquatic organism and wildlife passage.	☒ Check ☐ N/A

Env-Wt 900	Stream crossings are sized to address hydraulic capacity and geomorphic compatibility.	☒ Check ☐ N/A
A/M BMPs	Disturbed areas are used for crossings wherever practicable, including existing roadways, paths, or trails upgraded with new culverts or bridges.	☐ Check ☒ N/A
SECTION 4 - NON-TIDAL SHORELINE STRUCTURES		
Env-Wt 313.03(c)(1)	The non-tidal shoreline structure has been designed to use the minimum construction surface area over surfaces waters necessary to meet the stated purpose of the structure.	☐ Check ☒ N/A
Env-Wt 313.03(c)(2)	The type of construction proposed for the non-tidal shoreline structure is the least intrusive upon the public trust that will ensure safe navigation and docking on the frontage.	☐ Check ☒ N/A
Env-Wt 313.03(c)(3)	The non-tidal shoreline structure has been designed to avoid and minimize impacts on the ability of abutting owners to use and enjoy their properties.	☐ Check ☒ N/A
Env-Wt 313.03(c)(4)	The non-tidal shoreline structure has been designed to avoid and minimize impacts to the public's right to navigation, passage, and use of the resource for commerce and recreation.	☐ Check ☒ N/A
Env-Wt 313.03(c)(5)	The non-tidal shoreline structure has been designed, located, and configured to avoid impacts to water quality, aquatic vegetation, and wildlife and finfish habitat.	☐ Check ☒ N/A
Env-Wt 313.03(c)(6)	The non-tidal shoreline structure has been designed to avoid and minimize the removal of vegetation, the number of access points through wetlands or over the bank, and activities that may have an adverse effect on shoreline stability.	☐ Check ☒ N/A

Natural Resources Agency Coordination Meeting Minutes

Note: The meeting minutes have been modified to only include the applicable project

BUREAU OF ENVIRONMENT
CONFERENCE REPORT

SUBJECT: NHDOT Monthly Natural Resource Agency Coordination Meeting
DATE OF CONFERENCE: December 20, 2023
LOCATION OF CONFERENCE: Virtual meeting held via Zoom

ATTENDED BY:

NHDOT
Andrew O'Sullivan
Joshua Brown
Jon Evans
Mark Hemmerlein
Rebecca Martin
Tim Mallette
Dave Smith
Dillan Schmidt
Marc Laurin
Dan Prehemo
Tony King
Jason Ayotte
Wendy Johnson
Mike Mozer
David Scott
Meli Dube
Paul Lovely
Kathleen Corliss
Curtis Morrill
Kerry Ryan
Arin Mills
Rhona Thomson

ACOE
Mike Hicks

USCG
Gary Croot

EPA
Absent

NHDES
Karl Benedict
Seta Detzel
Emily Nichols
Mary Ann Tilton

NHB
Absent

NH Fish & Game
Mike Dionne
Kevin Newton

Federal Highway
Jamie Sikora

US Fish & Wildlife
Absent

The Nature Conservancy
Absent

NH Transportation & Wildlife Workgroup
Absent

Consultants/ Public Participants
Kyle Higgins
Mike Dugas
Mark Debowski
Christine Perron
John Parelli
Steve Hoffman
Brian Colburn
Carol Foss
Peter Steckler
Jennifer Riordan
Seth Hill
Kimberly Peace
Deb Coon
Chris Fournier
Josif Bicja
Tucker Gordon
Katy Lewis
Linda Hutchins
Madelyn Glavin
Trevor Ricker

PRESENTATIONS/ PROJECTS REVIEWED THIS MONTH: *(minutes on subsequent pages)*

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hydraulic analysis conducted for the project supports installing riprap on the banks for the causeway and as restoration, as the banks are currently. Chris Fournier (CF) (HEB Engineers, Inc) noted the riprap installed for causeway access is meant to be removed once the repair is done. KB stated that is what DES wants.

Emily Nichols (EM) (NHDES) stated she cannot speak to mitigation until the impacts are confirmed with KB.

Mike Dionne (MD) (NHF&G) stated with the water diversion there may be a time of year restriction for trout. He will follow up on this. Jonathan Evans (JE) (NHDOT) asked if he knew what that restriction would be and MD stated possibly no in water work October/November. MD stated he would talk to fisheries.

Kevin Newton (KN) (NHF&G) stated he doesn't have many concerns however he would like to see vegetation on the banks for wildlife.

Jamie Sikora (JS) (FHWA) asked if there has been coordination with the Town of Littleton. There is a trail that is in the area and while ATVs are not allowed on the trail, he believes there is an agreement with Town allowing ATVs on Industrial Park Road that could be impacted by the project. JS also noted that the trail may be a section 4(f) recreational resource. JE stated that the Department is aware of this 4(f) resource and coordination with the Town as well as the NH Department of Natural and Cultural Resources (DNCR) who operates the trail is ongoing to ensure any impacts or concerns associated with this resource have been adequately addressed.

Seta Detzel (SD) (NHDES) asked if there are any PRAs. KP stated there are pockets of floodplain wetlands that we are trying to avoid. Should there be impacts to these wetlands they will be minimal and temporary. SD stated that temporary impacts to PRAs would not require mitigation and that the permit application should include documentation that shows there is no loss to the functions and values of the wetlands.

David Scott (DS) (NHDOT) stated that the advertisement date for the project shown as January 2024 will likely shift to a date later in 2024 which has yet to be determined.

Acworth, 43566C (FEMA 670946):

Jason Ayotte (JA) (NHDOT Project Manager) provided an overview of the project, which will address a deteriorated and damaged culvert carrying an unnamed stream under NH Route 123A adjacent to the Cold River in the Town of Acworth. The original damage to the culvert and roadway occurred in 2021 during a high rainfall event which caused extensive flooding in the area. The Department is coordinating with the Federal Emergency Management Administration (FEMA) to receive funding for project, and is working to meet the resulting permitting, scheduling, and design requirements. Linda Hutchins (LH), representing FEMA, is also in attendance. JA explained that the NH Department of Transportation (the Department) has met with Town officials who agreed to allow the road to be closed during construction in order minimize construction timeframe and impacts to resources in the area, especially the Cold River. The Town also requested to schedule construction during the Summer of 2025 to avoid impacting the school bus routes in the area. The current advertisement date is July 16, 2024. The

purpose of this meeting is the review the proposed mitigation prior to submission of the permit application to the NH Department of Environmental Services (NHDES) Wetlands Bureau.

Kimberly Peace (KP) (Hoyle, Tanner and Associates) provided an overview of the existing conditions, alternatives, and the natural resources in the project area. The work will address an existing 4' high x 2.8' wide x 28' long concrete box culvert with a top consisting of a corrugated metal pipe (CMP) arch that conveys an unnamed stream under NH Route 123A to the Cold River in the Town of Acworth, NH approximately 0.5 miles west of Gates Mountain Road. The Department has investigated three alternatives including repair, replacement with a 14' span and replacement with a 6' span. Repair was deemed infeasible due to the poor condition of the concrete culvert, corrosion of the corrugated metal topper, and undermining of the existing wingwalls. Due to the shallow placement of the culvert under the roadway and the resulting high chloride content in the soil, leaving the existing structure in place would result in rapid and continual deterioration causing a safety concern for this alternative. Replacement with an NHDES Stream Crossing Compliant 14' span structure was also considered but was deemed infeasible due to the substantially higher costs and impacts to resources including the Cold River, which were not justifiable compared to the potential improvements. The Department's preferred alternative would replace the existing structure with a 6' span which provides safety improvements, meets the 50-year and 100-year storm requirements, improves connectivity, and minimizes costs, construction timeframe and impacts to the Cold River and other jurisdictional areas. The work would involve installation of a 6' wide x 6' high x 34' long precast concrete box culvert with headwalls and wingwalls, along with permanent repairs to NH 123A roadway pavement, base materials, and embankment. The culvert would be embedded to allow for natural stream simulation through the crossing.

KP described the existing conditions in the area. The unnamed brook is a Tier 1 Stream according to the 0.19 square mile watershed size; however, it is considered Tier 3 due to proximity to the Cold River, which is designated and subject to Shoreland Water Quality Protection Act (SWQPA). The NH Natural Heritage Bureau reviewed the project area and determined that there are no known records of protected species in the project area. The project is located in the ranges of the federally protected northern long-eared bat (NLEB) and northern bulrush. A plant survey was performed and determined that there is no suitable habitat for northern bulrush, and the appropriate consultation with the US Fish and Wildlife Service regarding impacts to NLEB has been completed. The Cold River is a predicted cold-water fishery, however, the work as proposed would not permanently impact the channel of the river. KP described that the unnamed stream exists at the culvert outlet as a surface water but then diffuses and is connected to the Cold River subsurface, as there is a large berm created by debris deposited by the Cold River in this area and there is no surface water connection. In addition to the unnamed stream and the Cold River, there is another intermittent stream flowing parallel to the Unnamed stream & perpendicular to Cold River, and two delineated wetlands adjacent to the roadway.

Karl Benedict (KB) (NHDES) asked if there is a history of flooding at this location. JA stated the damage that occurred was a result of debris blocking the culvert and not the culvert flooding. KB stated the crossing is a Tier 3 crossing per Env-Wt 904.05 (a)(2) and (a)(3) and would require a major impact permit. KB confirmed that even though there is a pile of debris that prevents direct surface water connection to the Cold River it is still hydraulically connected, and it is located

within a 100-yr floodplain. In addition, the use of a closed bottom structure does not meet Env-Wt 904.07 for a Tier 3 stream crossing and should be permitted as an alternative design.

The Cold River is a designated river and Meli Dube (MD) (NHDOT Environmental Manager) initiated coordination with the Cold River Local Advisory Committee (CRLAC), who are not active at this time. MD spoke with Tracie Sales, NHDES Rivers Program Administrator, who reviewed the project details and agreed that a waiver from a Tier 3 to a Tier 1 for this crossing would be acceptable. KB recognized this could address Env-Wt 904.05 (a)(2), but because the outlet is in the 100-year floodplain, it would need a second waiver for Env-Wt 904.05(a)(3) and that NHDES is unlikely to approve two waivers and an alternative design. Andy O'Sullivan (AO) (NHDOT Wetlands Program) agreed with KB's conclusion and the project could proceed as a Standard Dredge and Fill Application Major Impact Project with an alternative design request.

KB inquired about potentially restoring a surface water connection between the unnamed stream and the Cold River. AO and JA discussed that some connectivity will be restored due to nature of the work and the grading which will be necessary to install the larger structure and stabilize the unnamed stream and the banks of the Cold River. The Department typically seeks to minimize impacts to wetlands and surface waters to the maximum extent practicable but will investigate potentially expanding the grading work further to provide additional stream restoration and connectivity in this case.

Seta Detzel (SD) (NHDES) concurred that the work would be classified as a Major Impact Project and that the unnamed Stream should be classified as a Tier 3 stream. Because the delineated wetlands are contiguous to a Tier 3 stream, the wetlands impacted near the inlet area will become a Priority Resource Area (PRA) and impacts to these areas would require compensatory mitigation. SD further discussed what may qualify a project to be considered self-mitigating. The Department proposes that the anticipated impacts to the banks and channel of surface waters would be self-mitigating according to Env-Wt 904.05(f)(1)(b) as there will be hydraulic, connectivity and AOP improvements compared to the existing condition. KB recommended consulting with NH Fish and Game Department (NHF&G) to assess the impacts and improvements discussed above.

Mike Dionne (M. Dionne) (NHF&G) stated there is no fish data for the unnamed stream, but the Cold River is known trout habitat. He also stated the rock/debris pile most likely excludes trout from entering the unnamed stream and would like to see connectivity restored in this area if possible. AO stated the channel of the unnamed stream upstream of the crossing is very steep and unlikely to be naturally accessible to trout. It was agreed that a site visit would be best to efficiently assess the likelihood of fish using the stream and what benefits the proposed aquatic organism passage improvements may provide. An on-site meeting was subsequently scheduled for January 11, 2024.

Kevin Newton (KN) (NHF&G) stated while there are no wildlife records, the cold river could support wood turtles and requested that this be considered during the design and construction of the project. The Department will include standard commitments previously developed in coordination with NHF&G to ensure that best practices are used to protect turtles during construction.

Mike Hicks (MH) (USACE) stated that because the culvert was permitted in the past and is being repaired or replaced in-kind, a United States Army Corps of Engineers Individual Permit would not be required.

LH concluded by thanking the Department for inviting her to the meeting and stated that she is working closely with MD to meet permitting and schedule milestones but has no further comments on the NDHES permitting process.

Plymouth, #41583 (X-A004(680)):

Andrew O'Sullivan (NHDOT) introduced Tucker Gordon, Josh McAllister, and Katy Lewis (HEB Engineers, Inc.). Tucker stated Josh and Katy are unable to attend but that Maddie Glavin (HEB Engineers, Inc.) would be recording minutes.

Tucker Gordon (HEB Engineers, Inc.) introduced the Highland Street Improvements Project. The proposed project would consist of the reconstruction of approximately 2,000 linear feet of Highland Street in Plymouth, NH between the Broadway Street intersection and Old Ward Bridge Road intersection. The proposed reconstruction would include roadway upgrades, pedestrian access improvements, and drainage system improvements.

This is a federally funded TAP Project which will follow the LPA process. The project is anticipated to be classified as a Categorical Exclusion for NEPA documentation.

The Project Area is a two-lane roadway, with substandard pedestrian infrastructure. The project area is a densely developed residential neighborhood. T. Gordon noted that a portion of the project corridor narrows and creates snow removal issues for the Town of Plymouth. Additionally, T. Gordon noted that improvements to the intersection with Old Ward Bridge Road are being considered as part of the proposed project. The primary purpose of the proposed project is to improve pedestrian safety and access and to improve the overall condition of the corridor.

T. Gordon presented photos of the project area to show the existing condition of the roadway corridor and the pedestrian infrastructure. T. Gordon noted that there would be no significant utility changes as part of the proposed project. The goal of the project is to provide continuity between the sections of Highland Street to the east and west of the project area, which have sufficient sidewalks and curbing.

T. Gordon reviewed environmental considerations related to the proposed project. The project area is a densely developed residential area. The NHDHR Request for Project Review (RPR) has recently been completed and will be submitted to NHDOT this week for review. T. Gordon noted that he anticipates the need for coordination related to Section 106 and Section 4(f) due the age of some nearby properties, but hopes to avoid impacts and achieve a No Adverse Effects determination. The NHB DataCheck returned no known records in the project vicinity. The USFWS IPaC tool noted that the project is within the ranges of the Northern Long-eared Bat and the Monarch Butterfly.

Wetland Delineation Report, Functional Assessment & Site Photos

Wetland Delineation Report

NH Department of Environmental Services, Wetlands Bureau

Acworth 43566C – NH Route 123A Culvert Replacement Project
Acworth, NH

Prepared for:
NH Department of Transportation
7 Hazen Drive
Concord, NH 03301

HOYLE TANNER

STATE OF NEW HAMPSHIRE
JOANNE E. THERIAULT
No. 305
CERTIFIED WETLAND SCIENTIST

1/29/2023

September 2023

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WETLAND DELINEATION REPORT
NH Route 123A Culvert Replacement Project
NHDOT Project No. 43566C

Hoyle Tanner Project Number: 22.092501.03

September 2023

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1. Introduction

This report has been prepared by Hoyle, Tanner & Associates, Inc. (Hoyle Tanner) to document field conditions at a culvert on NH Route 123A in Acworth, NH. The field investigation was performed on August 14, 2023 by Joanne Theriault, NH Certified Wetland Scientist #305. Hoyle Tanner was contracted by the NH Department of Transportation to perform this investigation in addition to engineering and permitting services for a culvert replacement project.

The report documents delineations of wetland resources under the jurisdiction of the NH Department of Environmental Services (NHDES) Wetland Bureau and the US Army Corps of Engineers (USACE) including wetland boundaries, stream ordinary high water/shoreland reference line (OHW), and stream top-of-bank (TOB). The site was also evaluated for the presence of potential vernal pool habitat and invasive plant populations within the project boundary. Stream crossing data was collected to enable preparation of an NHDES Stream Crossing Worksheet.

2. Site Overview

The project site is located on NH Route 123A in South Acworth. An unnamed stream crosses under the road approximately 2,700' south of the intersection with Gates Mountain Road, and the Cold River flows parallel to NH Route 123A on the north/downstream side of the unnamed stream crossing. The local land use is forested with sparse residential development and a small downtown district approximately 2 miles to the west. (Appendix A).

Review of existing available information resulted in the following regarding this site:

- The stream crossing is not a Priority Resource Area (PRA) defined by the NHDES Wetland Rules Env-Wt 100-900. There are nearby wetlands that are associated with the Cold River and mapped as Floodplain Wetlands Adjacent to a Tier 3 Stream (Appendix B). The results section of this report describes an additional nearby PRA.
- The Cold River is a Designated River, as determined by the NHDES Rivers Management and Protection Program (RMPP). Impacts within ¼ mile of the river will require consultation with the Cold River Local Advisory Committee (Appendix B).
- The stream crossing and NH Route 123 A are located within the 250-ft protected Shoreland of the Cold River as defined by the Shoreland Water Quality Protection Act (RSA 483-B) and its associated rules, Env-Wq 1400 (Appendix B).
- The project area includes no Prime Wetlands as determined by the Town of Acworth (Appendix B).
- The stream crossing is located within areas identified on the NH Wildlife Action Plan (WAP) as Highest Ranked Habitat in New Hampshire (Appendix C).

3. Methods

Hoyle Tanner performed the wetland delineation of the project area according to the criteria described in the US Army Corps of Engineers Wetlands Delineation Manual (USACE 1987) and Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northeast and Northcentral Region (USACE 2012). Stream top-of-bank (TOB) delineations were determined based on observation of a break

in slope at the upper limit of the stream's adjacent transitional slope per NH Wetland Rules Env-Wt 102.5. Delineations of the stream's Ordinary High Water (OHW) mark was based on the observation of physical shoreline characteristics as described in NH RSA 483-B:4, XI-e. Wetlands and surface waters on the site were classified using Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979).

Stream crossing assessment/classification data was collected at the site using the NHDOT Stream Crossing Assessment Worksheet (revised April 2022). The data collected is sufficient to complete the NHDES Stream Crossing Worksheet (NHDES-W-06-071) for existing crossings.

4. Results

The August 2023 site investigation included delineation of wetland and stream resources at the site and collection of stream assessment/classification data. Field conditions during this survey included temperatures ranging from 70-85˚ F, partly cloudy skies, and 5-10 mph winds. No major precipitation events occurred in the two weeks preceding the survey, but water was atypically high for New England in late summer.

4.1 Wetlands and Streams

The following resources were delineated within the project area as shown in Appendix D:

Stream 1 – Unnamed Stream

Stream 1 is a high-gradient perennial stream with an average width of approximately 12'. The stream originates south of the project area, flows northward, perpendicular to NH Route 123A, and crosses under the road. The stream channel upstream of the road has steep banks and severe undercutting. The streambed elevation changes rapidly in the project area with two >8' steps. Substrate on the upstream side is predominantly large boulder and cobble with some gravel interspersed.

The downstream side of the Stream 1 crossing under NH Route 123A has no permanent surface water connection to the Cold River, despite their proximity. A cobble berm lies between the two streams, and the low/moderate flow out of the culvert was redirecting below the undermined culvert headwall footings. Establishment of a surface water connection to the Cold River by topping the berm would require extremely high flow.

Dominant vegetation within and adjacent to Stream 1 includes sugar maple (*Acer saccharum*), striped maple (*A. pensylvanicum*), green ash (*Fraxinus pennsylvanica*), Eastern hemlock (*Tsuga canadensis*), hobblebush (*Viburnum lantanoides*), Canada mayflower (*Maianthemum canadense*), maystar (*Trientalis borealis*), wood ferns (*Dryopteris* sp.), and Christmas fern (*Polystichum acrostichoides*). The classification of Stream 1 is R3RB2F (Riverine, Upper Perennial, Rock Bottom, Rubble, Semipermanently Flooded).

Cold River (Stream 2)

Defined banks contain the Cold River throughout the project area. The banks typically correspond with the immediately adjacent roadbed but pull back closer to the OHW downstream of the subject culvert crossing. OHW was identified by observing accumulated leaf debris and directional growth of

herbaceous vegetation indicating exposure to stream flow; the OHW line generally lies low along the steep bank.
Dominant vegetation in the vicinity of the Cold River delineated boundaries includes meadowsweet (*Spiraea alba*), Eastern hemlock, white pine (saplings; *Pinus strobus*), red oak (*Quercus rubra*), green ash (saplings), and NY fern (*Thelypteris noveboracensis*). The streambed substrate is dominated by cobble with interspersed sand, gravel, and boulders. The classification of the Cold River within the project boundary is R3UB1H (Riverine, Upper Perennial Flow Regime, Unconsolidated Bottom, Gravel/Cobble Substrate, Permanently Flooded).

Stream 3 – Unnamed Stream

Stream 3 is a high-gradient intermittent stream flowing parallel to Stream 1 to the northeast. It crosses under NH Route 123A through a 15" high-density polyethylene (HDPE) pipe that outlets on the bank of the Cold River. The stream channel upstream of the road has defined banks with moderate undercutting. Substrate on the upstream side is predominantly cobble, gravel and sand. Dominant vegetation within and adjacent to Stream 2 is nearly identical to vegetation near Stream 1. The classification of Stream 2 is R4SB3J (Riverine, Intermittent, Stream Channel, Cobble-Gravel, Intermittently Flooded).

Wetland 1

Wetland 1 is located in the riparian area of the Cold River's south bank just west of the Stream 1 culvert outlet. It is configured as a semi-flat shelf sitting just above the Cold River's OHW and is likely flooded during periods of high flow. Wetland 1 was partially saturated at the time of the survey. Dominant vegetation in and adjacent to Wetland 1 includes green ash saplings, NY fern, Eastern hemlock, sedges, and mixed grasses. This wetland should be considered a Floodplain Wetland on a Tier 3 Watercourse and therefore a Priority Resource Areas per Env-Wt 103.66c. The classification of Wetland 1 is PEM1E (Palustrine, Emergent, Persistent Vegetation, Seasonally Flooded/Saturated).

Wetland 2

Wetland 2 is a linear roadside wetland on the south side of NH Route 123A with hydrologic connections to Streams 1 and 3. The wetland was saturated at the time of the survey but had no surface water flow. It ends abruptly on the west side and tapers out gradually on the east side as the road elevation rises. Wetland 2 on the western end has sparse vegetation with sand and stone, likely originating from road runoff. The vegetation on the edges is dominated by sensitive fern (*Onoclea sensibilis*), sedges, and NY fern. The eastern end seems to accumulate less sediment and therefore can support a ground cover of the species listed above. The classification of Wetland 2 is PEM1E (Palustrine, Emergent, Persistent Vegetation, Seasonally Flooded/Saturated).

4.2 Wetland Functions and Values

All delineated resources have been assessed for their functions and values (Appendix D). The Cold River (Stream 2) is a significant resource in the state of NH, providing economic value, wildlife habitat, and serving vast watershed areas from its headwaters at Crescent Lake in Acworth and Unity to its mouth at the Connecticut River in Walpole. Near the project area, the river flows through an area of minor disturbance with some altered banks and a roadbed overhead. The Cold River in its entirety is suitable for numerous functions and values but primarily serves the following in the vicinity of the NH Route 123A culvert crossing: floodflow alteration, fish & wildlife habitat, recreation, and aesthetic quality.

Streams 1 and 3 transport precipitation and other surface water from their steeply sloping but small watersheds. Both streams have defined and deep channels providing capacity for storage and transport of significant floodwaters. Their banks are supported and held intact by large boulders and tree roots, but notable erosion is present. The crossings at NH Route 123A create barriers for aquatic organism passage in both streams, and the flow is not sufficient in either stream to provide significant fish habitat.

Wetland 1, in its riparian shelf position along the bank of the Cold River, is positioned to provide shoreline stabilization and extra flood storage for the river; this is supported by evidence of both saturation and occasional flow in the wetland. Wetland 2 is located directly adjacent to NH Route 123A and collects precipitation and other surface water from the road. The linear wetland becomes saturated and occasionally floods and develops directional flow, transporting water to Stream 1, Stream 3, and ultimately the Cold River.

4.3 Vernal Pool Habitat

No vernal pool habitat was observed at the site.

4.4 Invasive Species

Invasive species are uncommon within the project area. Small populations of glossy buckthorn (*Frangula alnus*) and Japanese knotweed (*Reynoutria japonica*) were observed directly adjacent to NH Route 123A near the culvert. Individual stems of the invasive species were flagged in the field and located with a GPS Unit.

4.5 Northeastern Bulrush

An official species list was obtained for the project area from the US Fish and Wildlife Service (USFWS) using the Information for Planning and Conservation (IPAC) online tool (Project Code 2023-0115257). The list included the Federally endangered northeastern bulrush (*Scirpus ancistrochaetus*). The species' habitat consists of wetlands with acidic to neutral soil pH with full to partial sun including wet depressions, vernal pools, beaver flowages, and riparian areas (USFWS 2019).

The project area was assessed for potential northeastern bulrush habitat. Some potential riparian habitat was noted on the northern bank of the Cold River, opposite and outside the project area. The riparian Wetland 1 was also assessed and found to be unlikely habitat, because it is shaded by hemlock trees and appears to flood and sustain flow only during times of high surface water. Wetland 1 was searched, and no plants of the genus *Scirpus* were observed.

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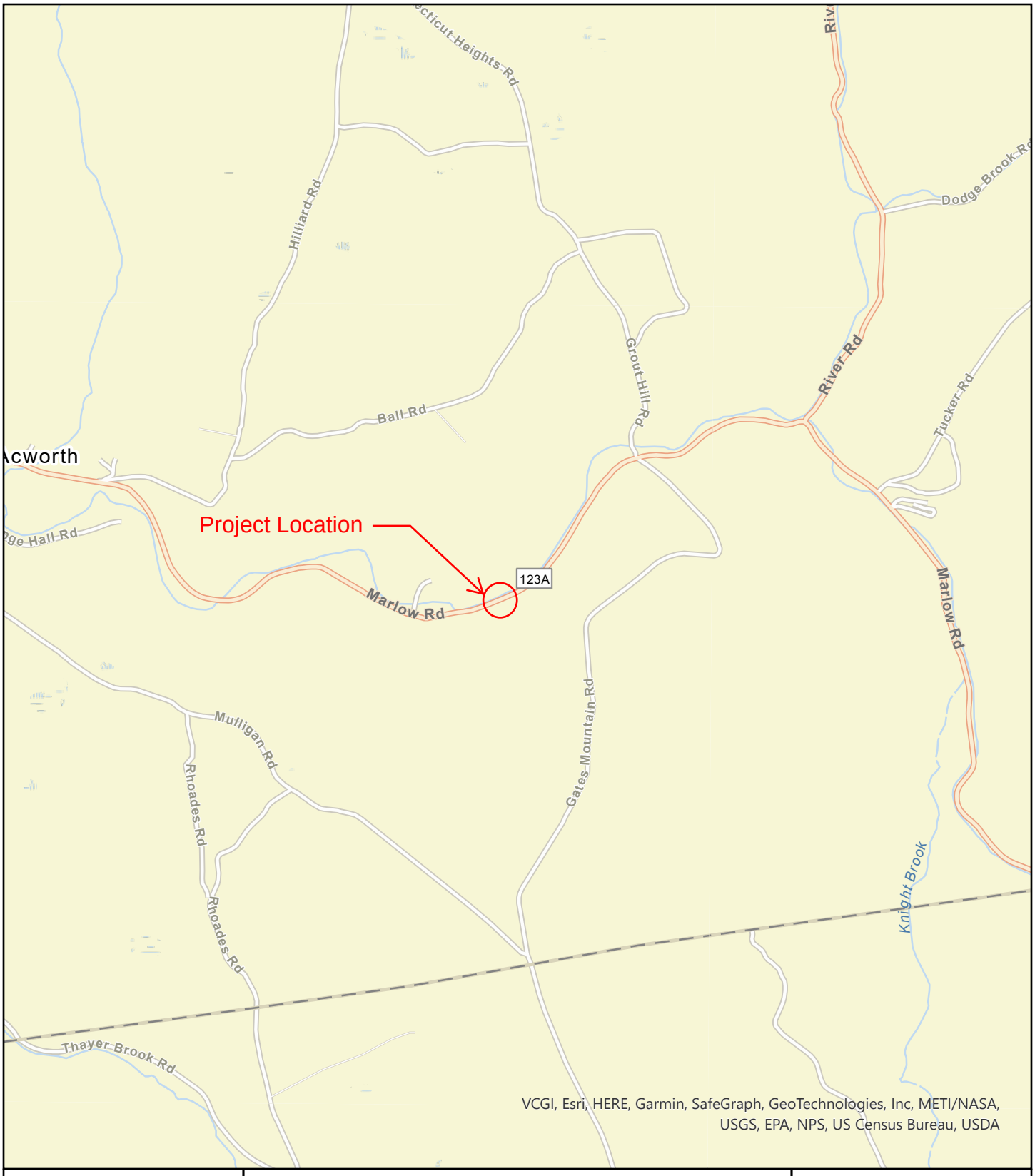
6. U.S. Fish and Wildlife Service. 2019. Species Status Assessment Report for the Northeastern Bulrush (*Scirpus ancistrochaetus*). Version 4. August 2019. Hadley, MA.

Appendix A: Project Location Map



HOYLE TANNER

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NHDOT 43566C Acworth
NH Route 123A Culvert Repairs
Acworth, NH

Project Location Map

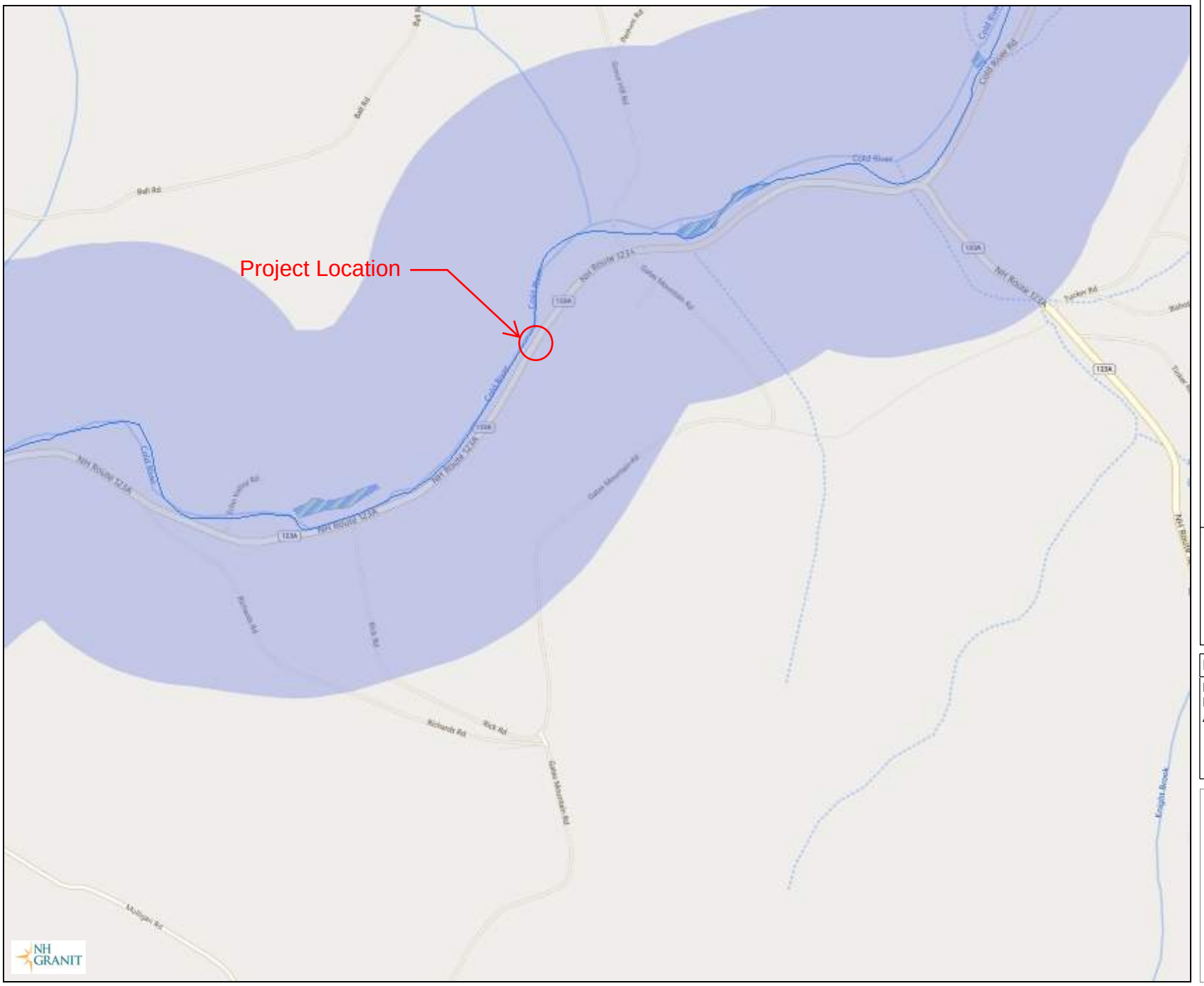
Last updated on *Monday, September 11, 2023* by *jtheriault*

N

SCALE
1 inch = 2,000 feet

Appendix B: NH Wetland Permit Planning Tool Map

Acworth 43566C Wetland Permit Planning Tool Map



Legend

- Additional Lines
- Designated Rivers with a
- Prime Wetlands
- Prime Wetlands with 100
- Peatland
- Flood Plain Wetlands Adj
- Marsh-Scrub / Shrub Wet
- Dunes
  - backdune
  - foredune
  - interdune
  - other
- Urban Exemptions
- Streams and Rivers
  - 4
  - 5
  - 6
  - 7

Map Scale

1: 12,988

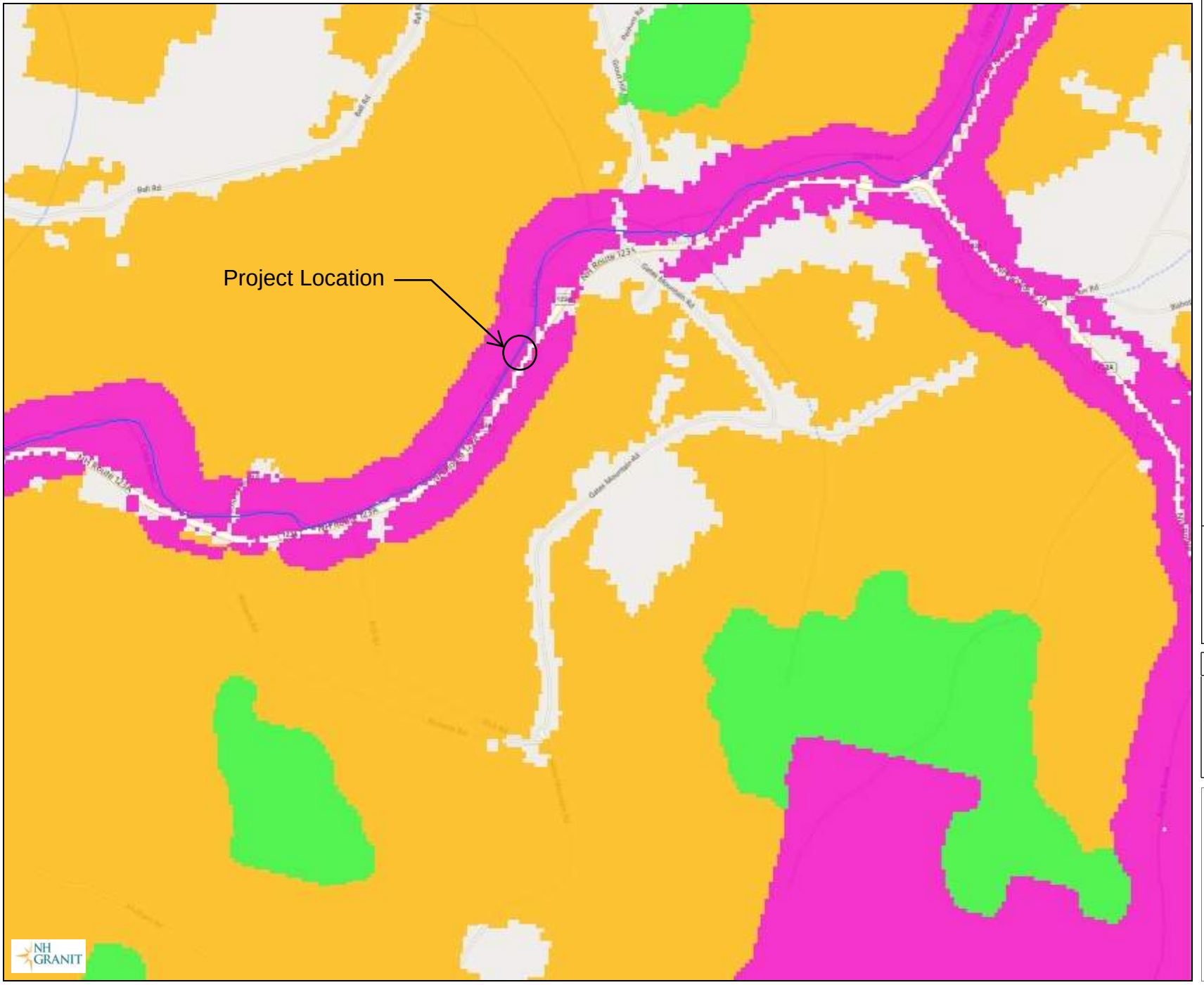
Map Generated: 9/11/2023

Notes

NHDOT 43566C Acworth
NH Route 123A Culvert Repairs
Acworth, NH

Appendix C: NH Wildlife Action Plan Map

Acworth 43566C Wetland Permit Planning Tool Map



Legend

- Additional Lines
- Urban Exemptions
- Streams and Rivers
  - 4
  - 5
  - 6
  - 7
- Highest Ranked Wildlife H
  - 0
  - 1 Highest Ranked Habitat in
  - 2 Highest Ranked Habitat in
  - 3 Supporting Landscape

Map Scale

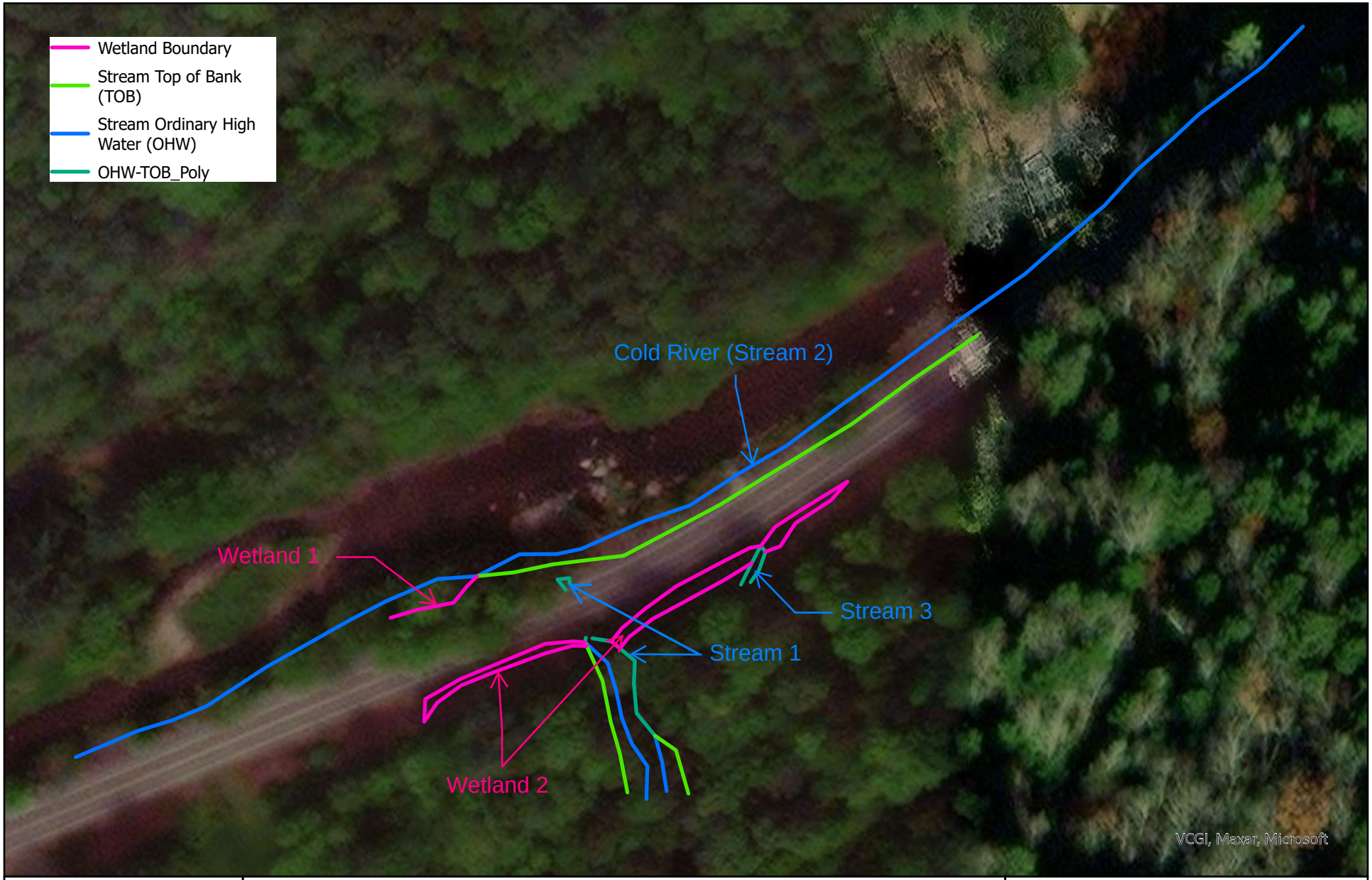
1: 12,988

Map Generated: 9/11/2023

Notes

NHDOT 43566C Acworth
NH Route 123A Culvert Repairs
Acworth, NH

Appendix D: Aerial Wetland/Stream Delineation Map



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NHDOT Acworth 43566C
NH Route 123A Culvert Repairs
Acworth, NH

N

SCALE
1 inch = 80 feet

Wetland/Stream Delineation Map

Last updated on *Monday, September 11, 2023* by *jtheriault*

Appendix E: Project Photographs

Photo 1 – View of Route 123A and Cold River from West Edge of Project Facing East – 8/14/2023

Photo 2 – Stream 1 at Culvert Inlet From Above Facing Upstream – 8/14/2023

Photo 3 – Stream 1 Inlet Facing Downstream – 8/14/2023

Photo 4 – Stream 1 View of Culvert Outlet Facing Southeast – 8/14/2023

Photo 5 – Cold River (Stream 2) Facing Upstream – 8/14/2023

Photo 6 – Cold River (Stream 2) Facing Downstream – 8/14/2023

Photo 7 – Stream 3 View from Culvert Inlet Facing Upstream – 8/14/2023

Photo 8 – Stream 3 View of Culvert Inlet – 8/14/2023

Photo 9 – Wetland 1 View From Roadbed Above Facing West – 8/14/2023

Photo 10– Wetland 1 View From Roadbed Above Facing Northwest – 8/14/2023

Photo 11 – Wetland 2 Facing West – 8/14/2023

Photo 12– Wetland 2 Facing East – 8/14/2023

Appendix E: Wetland Functions and Values

Wetland Function-Value Evaluation Form

Total area of wetland SF Human made? No Is wetland part of a wildlife corridor? Yes or a "habitat island"? No

Adjacent land use Forested, Very Sparse Residential Development Distance to nearest roadway or other development 25 ft.

Dominant wetland systems present Perennial Streams, Roadside Ditches Contiguous undeveloped buffer zone present No

Is the wetland a separate hydraulic system? No If not, where does the wetland lie in the drainage basin? Cold River Floodplain

How many tributaries contribute to the wetland? 1 Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. Stream 1

Latitude 43.185722 Longitude -72.256601

Prepared by: JET Date 09/20/2023

Wetland Impact:

TBD - See Permitting Plans

Evaluation based on:

Office ____ Field ✔

Corps manual wetland delineation completed? Y ✔ N ____

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	✔		5,7,15		Stream 1 is likely present due to a perennial connection to groundwater in addition to precipitation and run-off
Floodflow Alteration	✔		3,7,8,9,10,11,12,13	✔	Stream 1 has the opportunity, size, and capacity to provide this function principally.
Fish and Shellfish Habitat		✔	1,2,10,17		Stream 1 does not contain enough water to support fish populations independently.
Sediment/Toxicant Retention		✔	1,5,9,10		Adjacent land use may result in excess sediment , but the water regime of Stream 1 does not indicate that this is a principal function.
Nutrient Removal	✔		4,5,8,9		Adjacent land use may result in excess nutrients, but the water regime of Stream 1 does not indicate that this is a principal function.
Production Export		✔	1,2		The size and lack of vegetative diversity of Stream 1 indicate that this function is not served principally.
Sediment/Shoreline Stabilization	✔		1,2,3,4,6,8,9,14	✔	Stream 1 serves this function principally.
Wildlife Habitat	✔		5,6,7		Stream 1 contains some food sources but lacks open water elements and is situated just next to Route 123A
Recreation		✔	12		Stream 1 has little recreational potential due to its size and location.
Educational/Scientific Value		✔	9,10,11		Stream 1 is unsuitable for this function.
Uniqueness/Heritage	✔		8,16,22		Stream 1 lacks unique features required to have this value.
Visual Quality/Aesthetics		✔	11,12		Stream 1 lacks the aesthetic quality to have this value.
ES Endangered Species Habitat		✔			N/A
Other					

Notes: NH Route 123A is immediately adjacent to the Cold River in the project area. Two streams flow downslope and cross under the road, and the road has a ditch that is hydrologically connected to the streams.

* Refer to backup list of numbered considerations.

Wetland Function-Value Evaluation Form

Total area of wetland SF Human made? No Is wetland part of a wildlife corridor? Yes or a "habitat island"? No

Adjacent land use Forested, Very Sparse Residential Development Distance to nearest roadway or other development 25 ft.

Dominant wetland systems present Perennial Streams, Roadside Ditches Contiguous undeveloped buffer zone present No

Is the wetland a separate hydraulic system? No If not, where does the wetland lie in the drainage basin? Cold River Floodplain

How many tributaries contribute to the wetland? 1 Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. Stream 2

Latitude 43.185722 Longitude -72.256601

Prepared by: JET Date 09/20/2023

Wetland Impact:

TBD - See Permitting Plans

Evaluation based on:

Office ____ Field ✔

Corps manual wetland delineation completed? Y ✔ N ____

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	✔		1,4,5,7,15		Stream 2 is present due to a perennial connection to groundwater in addition to precipitation and run-off
Floodflow Alteration	✔		1,7,8,9,10,11,12,13	✔	Stream 2 has the opportunity, size, and capacity to provide this function principally.
Fish and Shellfish Habitat	✔		1,3,4,5,6,7,8,9,10,11,12,14,16,17	✔	Stream 2 provides this function principally
Sediment/Toxicant Retention	✔		1,2,5,6,8,9,10		Stream 2 serves this function regionally but lacks the conditions to serve it locally
Nutrient Removal	✔		2,3,4,5		Stream 2 serves this function regionally but lacks the conditions to serve it locally
Production Export	✔		1,3,4,6,10		Stream 2 produces some aquatic life for export by humans/wildlife but does not appear to be providing this function principally.
Sediment/Shoreline Stabilization	✔		1,2,3,4,6,8,9,10,11,14	✔	Stream 2 serves this function principally.
Wildlife Habitat	✔		3,5,6,7,8,9,10,12,18,19,20,21	✔	The Cold River (Stream 2) serves this function principally
Recreation	✔		2,5,7,9,12	✔	The Cold River lacks water access in the vicinity of the project but is used regionally for recreation.
Educational/Scientific Value	✔		5,9,10,11		Stream 2 is suitable for this function but lacks direct access and parking.
Uniqueness/Heritage	✔		3,8,11,13,14,16,17,19,22,27		Stream 2 contains many of the aesthetic characteristics for this value but lacks many of the unique features required to serve the value principally.
Visual Quality/Aesthetics	✔		1,2,3,7,8,9,10,11,12	✔	Stream 2 has this value principally.
ES Endangered Species Habitat	✔				N/A
Other					

Notes: NH Route 123A is immediately adjacent to the Cold River in the project area. Two streams flow downslope and cross under the road, and the road has a ditch that is hydrologically connected to the streams.

* Refer to backup list of numbered considerations.

Wetland Function-Value Evaluation Form

Total area of wetland SF Human made? No Is wetland part of a wildlife corridor? Yes or a "habitat island"? No

Adjacent land use Forested, Very Sparse Residential Development Distance to nearest roadway or other development 25 ft.

Dominant wetland systems present Perennial Streams, Roadside Ditches Contiguous undeveloped buffer zone present No

Is the wetland a separate hydraulic system? No If not, where does the wetland lie in the drainage basin? Cold River Floodplain

How many tributaries contribute to the wetland? 1 Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. Stream 3

Latitude 43.185722 Longitude -72.256601

Prepared by: JET Date 09/20/2023

Wetland Impact:

TBD - See Permitting Plans

Evaluation based on:

Office ____ Field ✔

Corps manual wetland delineation completed? Y ✔ N ____

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	✔		4,5,7,15		Stream 3 is likely present due to an intermittent connection to groundwater in addition to precipitation and run-off
Floodflow Alteration	✔		3,7,8,9,10,11,12,13	✔	Stream 3 has the opportunity, size, and capacity to provide this function principally.
Fish and Shellfish Habitat		✔	1,2,10,17		Stream 3 does not contain enough water to support fish populations independently.
Sediment/Toxicant Retention		✔	1,10		Adjacent land use may result in excess sediment , but the water regime of Stream 3 does not indicate that this is a principal function.
Nutrient Removal	✔		4,8,9		Adjacent land use likely results in excess nutrients, but the water regime of Stream 3 does not indicate that this is a principal function.
Production Export		✔	1,2,10		The size and lack of vegetative diversity of Stream 3 indicate that this function is not served principally.
Sediment/Shoreline Stabilization	✔		1,2,3,4,6,8,9,14	✔	Stream 3 serves this function principally.
Wildlife Habitat	✔		5,6,7		Stream 3 contains some food sources but lacks open water elements and is situated just next to Route 123A
Recreation		✔	12		Stream 3 has little recreational potential due to its size and location.
Educational/Scientific Value		✔	9,10,11		Stream 3 is unsuitable for this function.
Uniqueness/Heritage	✔		8,22		Stream 3 lacks unique features required to have this value.
Visual Quality/Aesthetics		✔	11,12		Stream 3 lacks the aesthetic quality to have this value.
ES Endangered Species Habitat		✔			N/A
Other					

Notes: NH Route 123A is immediately adjacent to the Cold River in the project area. Two streams flow downslope and cross under the road, and the road has a ditch that is hydrologically connected to the streams.

* Refer to backup list of numbered considerations.

Wetland Function-Value Evaluation Form

Total area of wetland SF Human made? No Is wetland part of a wildlife corridor? Yes or a "habitat island"? No

Adjacent land use Forested, Very Sparse Residential Development Distance to nearest roadway or other development 25 ft.

Dominant wetland systems present Perennial Streams, Roadside Ditches Contiguous undeveloped buffer zone present No

Is the wetland a separate hydraulic system? No If not, where does the wetland lie in the drainage basin? Cold River Floodplain

How many tributaries contribute to the wetland? 1 Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. Wetland 1

Latitude 43.185722 Longitude -72.256601

Prepared by: JET Date 09/20/2023

Wetland Impact:

TBD - See Permitting Plans

Evaluation based on:

Office ____ Field ✔

Corps manual wetland delineation completed? Y ✔ N ____

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	✔		1,4,5,7,15		Wetland 1 is suitable for this function but likely obtains most of its hydrology from floodwaters
Floodflow Alteration	✔		4,5,6,8,9,10,11,12,13	✔	Wetland 1 has the opportunity, size, and capacity to provide this function principally.
Fish and Shellfish Habitat	✔		1,4,6,7,8,9,11,14,17		Wetland 1 provides fish habitat during times of high flow for the Cold River, but this is not a principal function
Sediment/Toxicant Retention	✔		1,6,7,9,10		Adjacent land use may result in excess sediment , but the water regime of Wetland 1 does not indicate that this is a principal function.
Nutrient Removal	✔		2,3,4,9,10		Adjacent land use may result in excess nutrients, but the water regime of Wetland 1 does not indicate that this is a principal function.
Production Export		✔	1,2,10,12		The size and lack of vegetative diversity of Wetland 1 indicate that this function is not served principally.
Sediment/Shoreline Stabilization	✔		1,3,4,6,7,9,11,14	✔	Wetland 1 serves this function principally in the riparian zone of the Cold River.
Wildlife Habitat	✔		3,5,6,7,8,12,20,21		Wetland 1 is located in the riparian zone of Cold River, which serves this function principally.
Recreation	✔		2,7,9,12		Wetland 1 is associated with the Cold River but has little recreational potential on its own.
Educational/Scientific Value		✔	9,10,11		Wetland 1 is unsuitable for this function.
Uniqueness/Heritage		✔	8,11,12,13,14,22		Wetland 1 lacks unique features required to have this value.
Visual Quality/Aesthetics		✔	2,9,11,12		Wetland 1 lacks the aesthetic quality to have this value.
ES Endangered Species Habitat		✔			N/A
Other					

Notes: NH Route 123A is immediately adjacent to the Cold River in the project area. Two streams flow downslope and cross under the road, and the road has a ditch that is hydrologically connected to the streams.

* Refer to backup list of numbered considerations.

Wetland Function-Value Evaluation Form

Total area of wetland SF Human made? No Is wetland part of a wildlife corridor? Yes or a "habitat island"? No

Adjacent land use Forested, Very Sparse Residential Development Distance to nearest roadway or other development 25 ft.

Dominant wetland systems present Perennial Streams, Roadside Ditches Contiguous undeveloped buffer zone present No

Is the wetland a separate hydraulic system? No If not, where does the wetland lie in the drainage basin? Cold River Floodplain

How many tributaries contribute to the wetland? 1 Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. Wetland 2

Latitude 43.185722 Longitude -72.256601

Prepared by: JET Date 09/20/2023

Wetland Impact:

TBD - See Permitting Plans

Evaluation based on:

Office ____ Field ✔

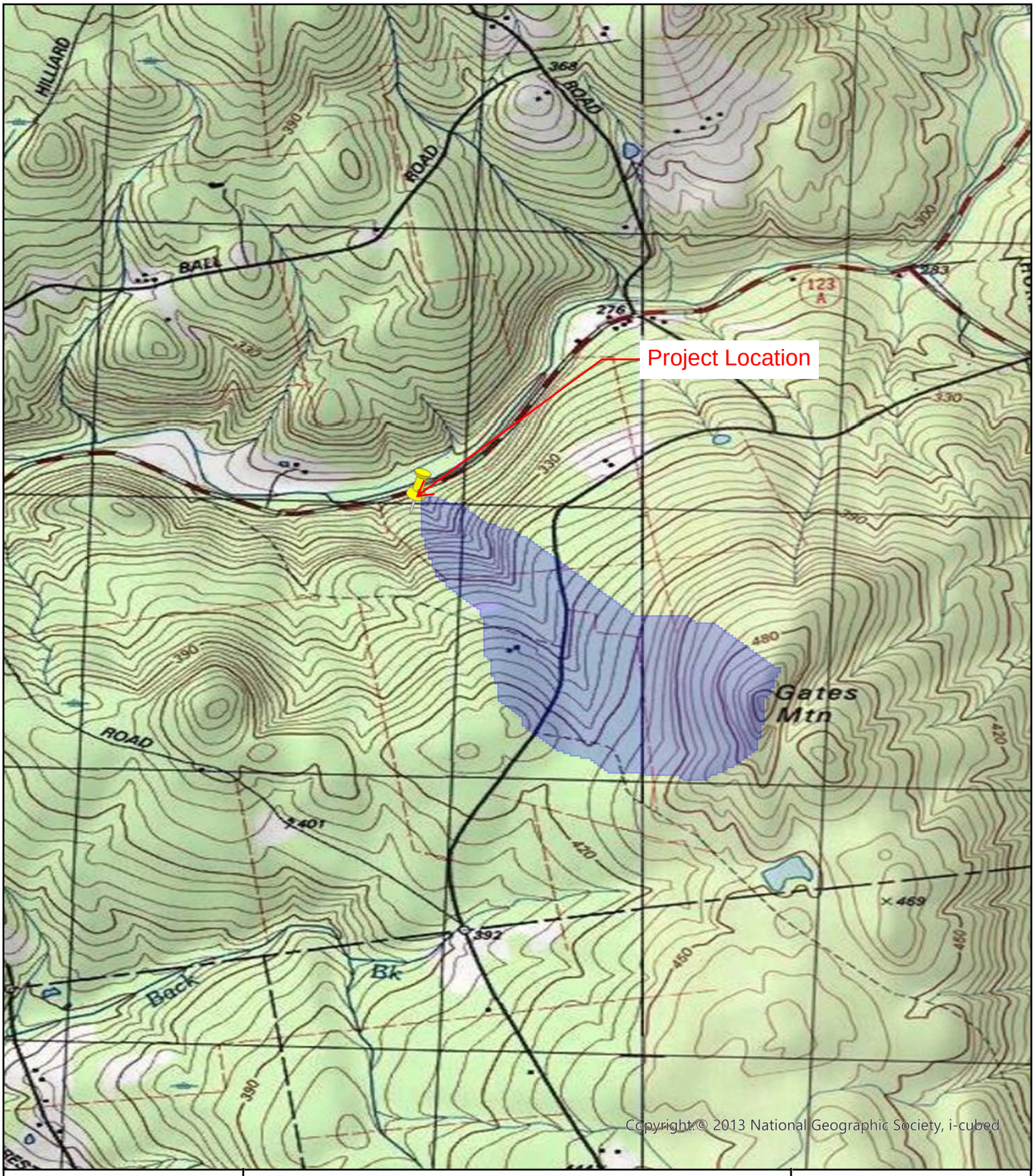
Corps manual wetland delineation completed? Y ✔ N ____

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	✔		4,5,7,9,10,15		Wetland 2 is suitable for this function but likely obtains most of its hydrology from precipitation and run-off
Floodflow Alteration	✔		3,4,5,6,7,8,9,10,11,12,13,15	✔	Wetland 2 has the opportunity, size, and capacity to provide this function principally.
Fish and Shellfish Habitat		✔	1		Wetland 2 does not contain enough water to support fish populations independently.
Sediment/Toxicant Retention	✔		1,4,10		Adjacent land use may result in excess sediment , but the water regime of Wetland 2 does not indicate that this is a principal function.
Nutrient Removal	✔		3,4,10		Adjacent land use may result in excess nutrients, but the water regime of Wetland 2 does not indicate that this is a principal function.
Production Export		✔	1,2,10,12		The size and lack of vegetative diversity of Wetland 2 indicate that this function is not served principally.
Sediment/Shoreline Stabilization	✔		1,3,4,15		Wetland 2 lacks opportunity to serve this function due to its configuration adjacent to the road and perpendicular to Stream 1
Wildlife Habitat	✔		3,6,7,8		Wetland 2 may provide some food sources but is highly disturbed due to its location adjacent to Route 123A.
Recreation		✔	12		Wetland 2 has little recreational potential due to its hydrology, size, and location.
Educational/Scientific Value		✔	9,10,11		Wetland 2 is unsuitable for this function.
Uniqueness/Heritage		✔	8,11,13,22		Wetland 2 lacks unique features required to have this value.
Visual Quality/Aesthetics		✔	9,11,12		Wetland 2 lacks the aesthetic quality to have this value.
ES Endangered Species Habitat		✔			N/A
Other					

Notes: NH Route 123A is immediately adjacent to the Cold River in the project area. Two streams flow downslope and cross under the road, and the road has a ditch that is hydrologically connected to the streams.

* Refer to backup list of numbered considerations.

USGS Watershed Boundary Map



HOYLE TANNER

150 Dow Street
Manchester, NH 03101
http://www.hoyletanner.com

Acworth #43566C
NH Route 123A Culvert
Conveying an Unnamed Stream

Unnamed Stream Watershed Area
0.19 Sq. Mile (122 AC) / Tier 1

Shape File Obtained from USGS StreamStats

Last updated on *Wednesday, August 23, 2023* by *dcoon*

N

SCALE
1 inch = 1,652 feet

Stream Crossing Worksheet

WETLANDS PERMIT APPLICATION
STREAM CROSSING WORKSHEET
Water Division/Land Resources Management
Wetlands Bureau

RSA/Rule RSA 482-A/ Env-Wt-900

This worksheet can be used to accompany Wetlands Permit Applications when proposing stream crossings.

SECTION 1 - TIER CLASSIFICATIONS

Determine the contributing watershed size at USGS StreamStats.

Note: Plans for tier 2 and 3 crossings shall be designed and stamped by a professional engineer who is licensed under RSA 310-A to practice in New Hampshire.

Size of contributing watershed at the crossing location: 121.6 acres

☐ **Tier 1**: A tier 1 stream crossing is a crossing located on a watercourse where the contributing watershed size is less than or equal to 200 acres.

☐ **Tier 2**: A tier 2 stream crossing is a crossing located on a watercourse where the contributing watershed size is greater than 200 acres and less than 640 acres.

☒ **Tier 3**: A tier 3 stream crossing is a crossing that meets **any** of the following criteria:

- ☐ On a watercourse where the contributing watershed is more than 640 acres.
- ☐ Within a designated river corridor unless:
  a. The crossing would be a tier 1 stream based on contributing watershed size, or
  b. The structure does not create a direct surface water connection to the designated river as depicted on the national hydrography dataset as found on GRANIT.
- ☒ Within a 100-year floodplain (see Section 2 below).
- ☐ In a jurisdictional area having any protected species or habitat (NHB DataCheck).
- ☐ In a prime wetland or within a duly-established 100-foot buffer, unless a waiver has been granted pursuant to RSA 482-A:11, IV(b) and Env-Wt 706. Review the Wetlands Permit Planning Tool (WPPT) for town prime wetland and prime wetland buffer maps to determine if your project is within these areas.

☐ **Tier 4**: A tier 4 stream crossing is a crossing located on a tidal watercourse.

SECTION 2 - 100-YEAR FLOODPLAIN

Use the FEMA Map Service Center to determine if the crossing is located within a 100-year floodplain. Please answer the questions below:

☐ **No**: The proposed stream crossing *is not* within the FEMA 100-year floodplain.

☒ **Yes**: The proposed project *is* within the FEMA 100-year floodplain. Zone = A

Elevation of the 100-year floodplain at the inlet: 878.2 feet (modeled elevation)

SECTION 3 - CALCULATING PEAK DISCHARGE	
Existing 100-year peak discharge (Q) calculated in cubic feet per second (CFS): 118 CFS	Calculation method: Average of FHWA 5-Parameter and TR-55 methods
Estimated bankfull discharge at the crossing location: 1 CFS	Calculation method: Q1.2 Average of FHWA 5-Parameter and TR-55 methods

Note: If tier 1, then skip to Section 10

SECTION 4 - PREDICTED CHANNEL GEOMETRY BASED ON REGIONAL HYDRAULIC CURVES *For **tier 2**, **tier 3** and **tier 4** crossings only.*	
Bankfull Width: 5.5 feet	Mean Bankfull Depth: 0.83 feet
Bankfull Cross Sectional Area: 4.6 square feet (SF)	

SECTION 5 - CROSS SECTIONAL CHANNEL GEOMETRY: MEASUREMENTS OF THE EXISTING STREAM WITHIN A REFERENCE REACH

*For **tier 2**, **tier 3** and **tier 4** crossings only.*

Describe the reference reach location: 3'-77' upstream from crossing (cannot go downstream from crossing, as the culvert discharges into the Cold River)

Reference reach watershed size: 121.6 acres

Parameter	Cross Section 1 Describe bed form Riffle (*e.g. pool, riffle, glide*)	Cross Section 2 Describe bed form Riffle (*e.g. pool, riffle, glide*)	Cross Section 3 Describe bed form Riffle (*e.g. pool, riffle, glide*)	Range
Bankfull Width	6.8 feet	11 feet	12.6 feet	5.8 feet
Bankfull Cross Sectional Area	15.64 SF	17.2 SF	28.6 SF	12.96 SF
Mean Bankfull Depth	2.6 feet	1.56 feet	2.38 feet	1.04 feet
Width to Depth Ratio	2.3	7	5	4.7
Max Bankfull Depth	3.3	2.73 feet	3.1 feet	0.57 feet
Flood Prone Width	63.86 feet	38.27 feet	36.71 feet	27.15 feet
Entrenchment Ratio	10.6	3.48	3.06	7.54

*Use **Figure 1** below to determine the measurements of the Reference Reach Attributes*

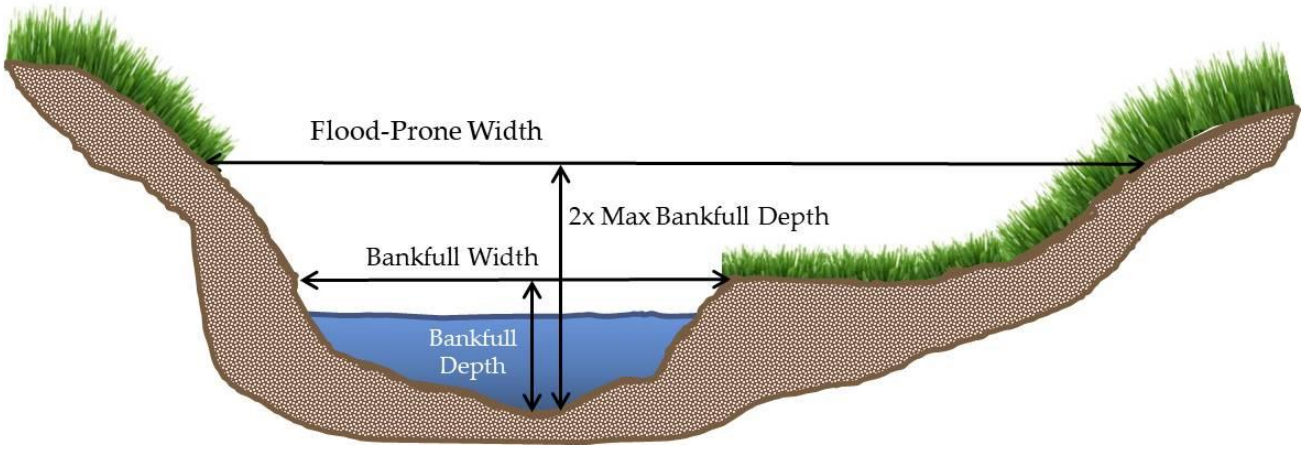


Figure 1: Determining the Reference Reach Attributes.

SECTION 6 - LONGITUDINAL PARAMETERS OF THE REFERENCE REACH AND CROSSING LOCATION *For **tier 2**, **tier 3** and **tier 4** crossings only.*	
Average Channel Slope of the Reference Reach: 12%	
Average Channel Slope at the Crossing Location: 1%	
SECTION 7 - PLAN VIEW GEOMETRY Note: Sinuosity is measured a distance of at least 20 times bankfull width, or 2 meander belt widths. *For **tier 2**, **tier 3** and **tier 4** crossings only.*	
Sinuosity of the Reference Reach: 1.12	
Sinuosity of the Crossing Location: 1.0	
SECTION 8 - SUBSTRATE CLASSIFICATION BASED ON FIELD OBSERVATIONS *For **tier 2**, **tier 3** and **tier 4** crossings only.*	
% of reach that is bedrock:	**0** %
% of reach that is boulder:	**26.7** %
% of reach that is cobble:	**41.7** %
% of reach that is gravel:	**16.7** %
% of reach that is sand:	**15** %
% of reach that is silt:	**0** %
SECTION 9 - STREAM TYPE OF REFERENCE REACH *For **tier 2**, **tier 3** and **tier 4** crossings only.*	
Stream Type of Reference Reach:	A3a+

*Refer to Rosgen Classification Chart (**Figure 2**) below:*

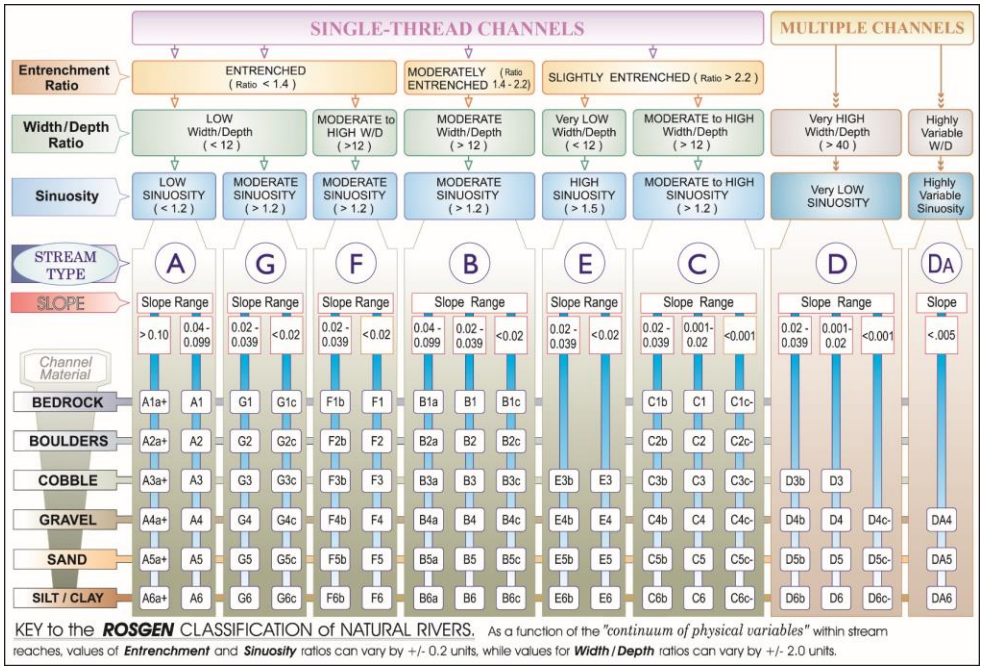


Figure 2: Reference from Applied River Morphology, Rosgen, 1996.

SECTION 10 - CROSSING STRUCTURE METRICS						
Existing Conditions	**Existing Structure Type:**	☐ Bridge span ☐ Pipe arch ☒ Open-bottom culvert ☐ Closed-bottom culvert ☐ Closed-bottom culvert with stream simulation ☐ Other:				
	Existing Crossing Span: *(perpendicular to flow)* 2.8 feet	**Culvert Height:** N/A feet **Inlet Elevation:** 872.24 feet				
	Existing Crossing Length: *(parallel to flow)* 28 feet	**Outlet Elevation:** N/A feet **Culvert Slope:** 0.019286				
Proposed Conditions	**Proposed Structure Type:**	**Tier 1**	**Tier 2**	**Tier 3**	**Alternative Design**	
	Bridge Span	☐	☐	☐	☐	
	Pipe Arch	☐	☐		☐	
	Closed-bottom Culvert	☐	☐		☐	
	Open-bottom Culvert	☐	☐	☐	☐	
	Closed-bottom Culvert with stream simulation	☐	☐	☒	☐	
	Proposed Structure Span: 6 feet *(perpendicular to flow)*	**Culvert Diameter:** N/A feet **Inlet Elevation:** 872.3 feet				
	Proposed Structure Length: 34 feet *(parallel to flow)*	**Outlet Elevation:** 871.5 feet **Culvert Slope:** 0.024				
	Proposed Entrenchment Ratio:* 1.4 *For **Tier 2**, **Tier 3** and **Tier 4** Crossings Only. To accommodate the entrenchment ratio, floodplain drainage structures may be utilized.*					

** Note: Proposed Entrenchment Ratio must meet the minimum ratio for each stream type listed in **Figure 3**, otherwise the applicant must address the Alternative Design criteria listed in Env-Wt 904.10.*

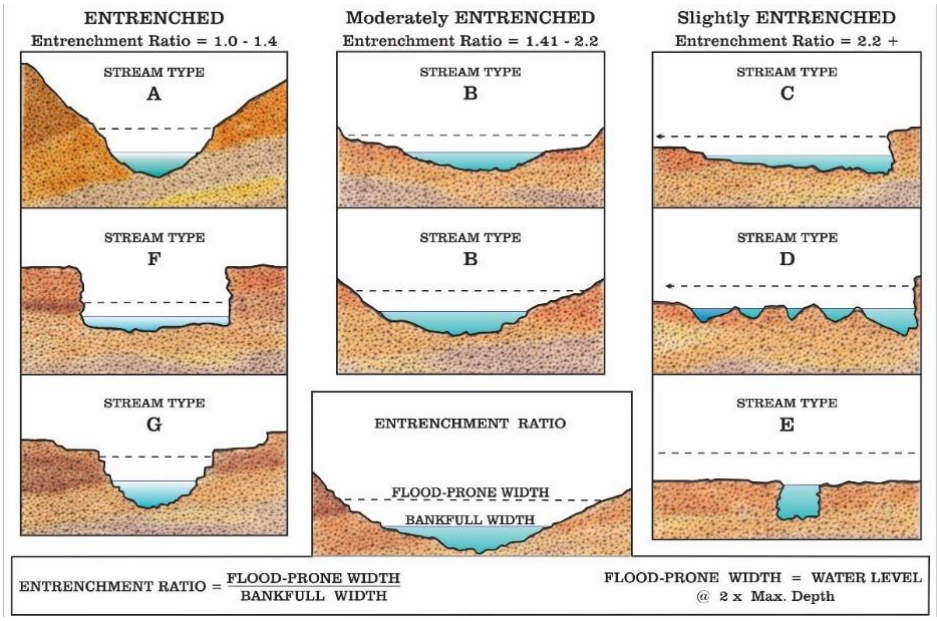


Figure 3: Reference from Applied River Morphology, Rosgen, 1996.

SECTION 11 - CROSSING STRUCTURE HYDRAULICS		
	Existing	**Proposed**
100 year flood stage elevation at inlet:	878.3	875.8
Flow velocity at outlet in feet per second (FPS):	11	9.6
Calculated 100 year peak discharge (Q) for the *proposed* structure in CFS:		118
Calculated 50 year peak discharge (Q) for the *proposed* structure in CFS:		92

SECTION 12 - CROSSING STRUCTURE OPENNESS RATIO

*For **tier 2**, **tier 3** and **tier 4** crossings only.*

Crossing Structure Openness Ratio* = 0.794

* Openness box culvert = (height x width)/length
Openness round culvert = (3.14 x radius^2)/length

SECTION 13 - GENERAL DESIGN CONSIDERATIONS

Env-Wt 904.01 requires all stream crossings to be designed and constructed according to the following requirements. Check each box if the project meets these general design considerations.

All stream crossings shall be designed and constructed so as to:

☒ Not be a barrier to sediment transport.

☒ Prevent the restriction of high flows and maintain existing low flows.

☒ Not obstruct or otherwise substantially disrupt the movement of aquatic life indigenous to the waterbody beyond the actual duration of construction.

☒ Not cause an increase in the frequency of flooding or overtopping of banks.

☒ Maintain or enhance geomorphic compatibility by:

a. Minimizing the potential for inlet obstruction by sediment, wood, or debris, and

b. Preserving the natural alignment of the stream channel.

☒ Preserve watercourse connectivity where it currently exists.

☒ Restore watercourse connectivity where:

a. Connectivity previously was disrupted as a result of human activity(ies), and

b. Restoration of connectivity will benefit aquatic life upstream or downstream of the crossing, or both.

☒ Not cause erosion, aggradation, or scouring upstream or downstream of the crossing.

☒ Not cause water quality degradation.

SECTION 14 - TIER-SPECIFIC DESIGN CRITERIA

Stream crossings must be designed in accordance with the tier specific design criteria listed in Part Env-Wt 904.

☒ The proposed project meets the tier specific design criteria listed in Part Env-Wt 904 and each requirement has been addressed in the plans and as part of the wetland application.

SECTION 15 - ALTERNATIVE DESIGN

NOTE: If the proposed crossing does not meet all of the general design considerations, the tier specific design criteria, or the minimum entrenchment ratio for each given stream type listed in **Figure 3**, then an alternative design plan and associated requirements must be addressed pursuant to Env-Wt 904.10.

☐ An alternative design will be submitted and address each requirement listed in Env-Wt 904.10.

Hydrologic and Hydraulic Analysis

October 9, 2023
Revised November 29, 2023

Mr. Jason M. Ayotte, P.E.
Project Manager
NHDOT Bureau of Highway Design
7 Hazen Drive
Concord, NH 03302

RE: Acworth 43566C – NH Route 123A Culvert
Hydrologic and Hydraulic Analysis Letter Report
Hoyle Tanner Project No. 22.092501.03

Dear Jason,

Hoyle, Tanner & Associates, Inc. (Hoyle Tanner) herein submits this Hydrologic and Hydraulic Analysis Letter Report detailing our findings and recommendations for the aforementioned project. This letter report has been prepared in accordance with the agreement between NHDOT and Hoyle Tanner.

PROJECT DESCRIPTION

Hoyle Tanner has been retained by the New Hampshire Department of Transportation (NHDOT) to perform a Hydrologic and Hydraulic Analysis for the NH Route 123A culvert over an Unnamed Tributary to Cold River (Unnamed Tributary). The culvert is considered to be in poor condition, with insufficient hydraulic connectivity and hydraulic capacity. This letter report was compiled from the existing conditions field measurements, hydrologic and hydraulic analyses, data collected, and photographs taken during a site visit. The goal of this letter report is to evaluate the existing opening of the culvert and to determine the hydraulic opening for a new culvert to meet current NHDOT design standards.

EXECUTIVE SUMMARY

Based on our hydrologic and hydraulic analysis, the existing hydraulic capacity of the NH Route 123A culvert was found to be insufficient to accommodate the NHDOT design flood event. The culvert is located within FEMA Zone A as shown on Flood Insurance Rate Map for Sullivan County, dated May 23, 2006. The 50-year flood analysis we completed indicates that flow overtops the culvert crown by approximately 1.4' and the 100-year flood overtops the culvert by approximately 1.7' and the roadway is submerged. Due to the lack of hydraulic capacity, as well as the deteriorated poor condition of the existing culvert, the NHDOT is investigating replacement options. A precast concrete box culvert with 6' span and 6' rise (1.37' buried to provide natural stream bottom and reduce design flood velocities) is proposed as a potential replacement structure that satisfies the hydraulic and structural needs. This option was dimensioned based on hydrologic and hydraulic analyses.

HYDROLOGY

The hydrologic analysis performed calculated flood flow values using methods shown in the scope of work and as found in Section 3 of the NHDOT Manual on Drainage Design for Highways. Per the NHDOT Manual on Drainage Design for Highways Table 1.0.a, the design flood for major State Aid Highways such as NH

Route 123A is the 50-year flood event. The 100-year flood event is used to ensure the roadway can sustain high flows without damage.

Hydrologic characteristics and the 2-, 10-, 50-, and 100-year instantaneous peak flood discharges were calculated using three methods. The first being the state regression equations utilized in the USGS StreamStats program. StreamStats is a web-based program that uses geographic information systems (GIS) terrain data, raster imaging, and other data and software to determine the variables needed for the 2008 USGS regression equations.

The 2008 USGS regression equations use drainage area, mean April precipitation, percentage of wetland area, and main channel slope to predict peak flows for the 2-year, 5-year, 10-year, 25-year, 50-year, 100-year and 500-year return periods for ungaged, unregulated, rural streams in New Hampshire.

Based on the StreamStats analysis, the Unnamed Tributary at NH Route 123A watershed does not contain any ponds or wetland areas and has an approximate drainage area of 0.19 square miles (121.6 acres), which is outside the range (0.70-1290 sq mi) of parameters for the USGS regression equations used by StreamStats. Due to the small drainage area of the watershed, additional methods were used to calculate the peak discharge of the Unnamed Tributary. The second method used is the Federal Highway Administration (FHWA)'s 5-Parameter Method and the third method is HydroCAD Stormwater Modeling software, which utilizes a combination of the TR-20 and TR-55 Methods. HydroCAD model was developed in accordance with the software manual and the NHDOT Manual on Drainage Design for Highways. To calculate the TR-55 method, first the time to concentration (Tc) is calculated, which begins with sheet flow (limited to 100'), after which flow changes to shallow concentrated and where applicable channel flow. The Tc is based on the flow path through the watershed which is most hydraulically distant from the outlet. The Table shown below summarizes the peak discharges and Annual Exceedance Probability (AEP) or the likelihood that the corresponding storm event will occur within a given year. Using engineering judgment and the review of all results provided below, it appears that USGS StreamStats Method is an outlier and underestimates the flows due to watershed size being outside the range of parameters for the USGS regression equations. The average of the FHWA's 5-Paramenter Method and HydroCAD discharge flows were used for the purpose of analyzing the existing culvert and sizing the new stream crossing replacement structure.

Table 1 – AEP, Storm Event and Peak Discharge Comparison

Annual Exceedance Probability	Storm Event/Return Interval	Peak Discharge, USGS StreamStats (Cubic Feet per Second - CFS)	Peak Discharge, FHWA-5 (Cubic Feet per Second – CFS)	Peak Discharge, TR-55 (Cubic Feet per Second – CFS)	Peak Discharge, Average of TR-55 and FHWA-5 (Cubic Feet per Second – CFS)
50%	2-year	13	28	7	18
10%	10-year	34	60	32	46
2%	50-year	60	96	88	92
1%	100-year	74	111	125	118

EXISTING CONDITIONS

The existing crossing is comprised of a single 4-foot-high by 2.8-foot-wide cast-in-place concrete culvert featuring an additional half cut 36" diameter corrugated metal pipe as the culvert ceiling. Personnel from Hoyle Tanner visited the site on August 14, 2023 to gather measurements and information for the preparation of this letter report. Our observations found the current condition of the culvert to be in poor condition with the following deficiencies noted:

Upstream (South) Elevation

- The northeast wingwall has failed and exhibits spalled concrete with large round river aggregate.
- All other wingwalls and portions of wall within the culvert have been undermined.
- Water flows through the soil surrounding the culvert to an undetermined extent.
- The concrete is comprised of river stone and has no evidence of reinforcing steel.

For additional information, see the Condition Assessment Letter Report prepared by Hoyle Tanner, dated October 9, 2023.

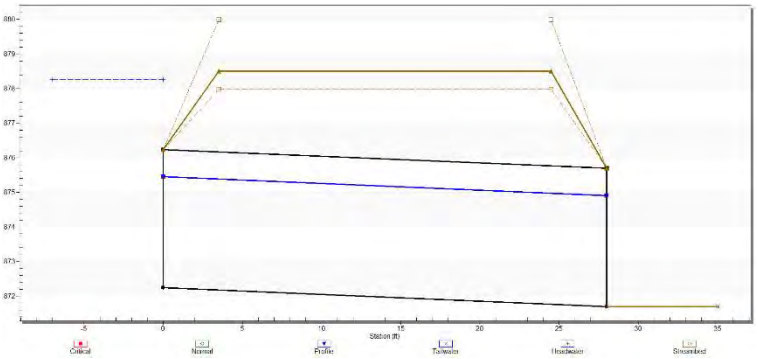
HYDRAULICS

Hydraulic Modeling

Hydrologic and hydraulic analyses were performed for the Unnamed Tributary at the NH Route 123A culvert. The hydrologic analysis calculated flood flow values using approved methods in the NHDOT Manual on Drainage Design for Highways. The hydrologic and hydraulic analyses were performed using the Federal Highway Administration (FHWA) HY-8 Version 7.5 hydraulic analysis program. Elevations used for this analysis came from the survey completed by NHDOT, dated June 2023. The analysis results are summarized herein. Refer to the enclosed exhibits for the full hydraulic report.

Flood History and Model Verification

Based on discussions between NHDOT officials and Hoyle Tanner personnel, the NH Route 123A culvert has a history of flooding. The 50-year flood profile computed by the HY-8 hydraulic analysis program resulted in the headwater elevation reaching the roadway elevation of 878' and the 100-year flood resulted in approximately 4" of roadway overtopping – consistent with past observations.



Existing Culvert HY-8 Model

Existing Culvert Hydraulic Conditions

Tailwater elevation from Cold River is not known for the major flood events and it was beyond the scope of work for this project to determine flood elevations for the Cold River. A sensitivity analysis was performed to vary the tailwater height and observe the flood elevations and velocities, assuming no tailwater and tailwater above the existing outlet crown. For design purposes, the range of tailwater elevations used was 866.5' (no tailwater) and 876.2' (6" above the top of culvert at the outlet side) and it was determined that flood velocities and upstream elevations did not change substantially when compared to no tailwater condition.

There is an existing 15" culvert approximately 110' east of the main culvert. Due to the small size of this additional culvert, it was decided to not include it in the hydraulic analysis as this culvert could easily be clogged up by debris during high flood events.

The existing hydraulic capacity of the NH Route 123A culvert was found to be insufficient to accommodate the 50-year design flood event. The design flood event overtops the existing culvert, and the headwater reaches the same elevation as the roadway surface (878'). The 100-year event, which is the check flow, overtops the roadway by approximately 4". Table 2 below depicts a summary of the existing hydraulic data for the 50-year and 100-year flood events.

Table 2 – Existing Culvert Hydraulic Data

	50-year Flood Event	100-year Flood Event
Drainage Area (sq. mi.)	0.19	0.19
Flow (cfs)	92	118
Roadway Surface Elevation (ft.)	878.0	878.0
Culvert Upstream Crown Elevation (ft.)	876.6	876.6
Water Surface Elevation (ft.)	878	878.3
Overtopping Above Top of Road (ft.)	n/a	0.30
Outlet Velocity (fps)	10.8	11.0
Waterway Area (sq. ft)	10.1	10.1
Flow Area Through Culvert during Flood Event (sq. ft)	10.1	10.1
% Opening Full During Flood Event	100%	100%

Proposed Culvert Hydraulic Conditions

As shown in Table 2 above, the 50-year design flood overtops the culvert, but does not overtop the road at the crossing. The design flood does reach the same elevation as the roadway surface. The 100-year check flood event overtops the existing culvert and roadway. Several culvert sizes shown in Table 3 below were evaluated to assist with determining the preferred culvert size to pass the 50-year flood event and reduce design flood velocities to acceptable levels with reasonably sized and constructible riprap stone sizes. If velocities are above 10fps, stones with larger D_{50} values are required for channel protection, which become difficult to place around concrete structures.

Table 3 – Replacement Culvert Alternatives

Hydraulic Opening		Headwater Elevation (ft)	Hw -Headwater Depth (ft)	Hw/D	Freeboard (ft)	Outlet Velocity (fps)
4' span x 4.63' rise	50-year Flood	876.19	3.89	0.84	0.64	9.94
	100-year Flood	876.96	4.66	0.99	-0.13	10.79
5' span x 4.63' rise	50-year Flood	875.63	3.33	0.72	1.2	9.31
	100-year Flood	876.26	3.96	0.86	0.57	10.15
6' span x 4.63' rise	50-year Flood	875.25	2.95	0.64	1.58	8.79
	100-year Flood	875.79	3.49	0.75	1.04	9.61
7' span x 4.63' rise	50-year Flood	874.95	2.65	0.57	1.89	8.34
	100-year Flood	875.44	3.14	0.68	1.39	9.16

The existing culvert is a three-sided structure with a gravel bottom. Due to the proximity of the Cold River and natural culvert channel bottom, it will be required to maintain a gravel channel through the culvert. The hydraulic openings listed above were selected to match the existing culvert height and assumes a natural bottom.

Based on our review of hydraulic analyses completed we recommend replacing the existing culvert with a new concrete box culvert with a span of 6' and rise of 6'. The proposed structure would be buried 1.37' to provide a natural stream bottom while maintaining the rise of the existing structure. The natural stream bottom is proposed to be constructed with riprap stone. Riprap voids are proposed to be filled with bank run gravel material and hydraulically washed in to replicate the natural stream and to also reduce flood velocities. The proposed 6' wide culvert reduces the 100-year flood event velocity to below 10 fps, which allows for smaller riprap stone sizes to be used, and therefore greater ease of constructability.

Our analysis indicates that 50-year and 100-year flood events pass through the proposed 6' wide culvert without overtopping. A 50-year tailwater sensitivity analysis was performed to consider a range of downstream conditions. Flood velocity decreases by 16% and 11% for the 50-year and 100-year flood events, respectively. Riprap stone armoring will be designed for the 100-year flood event to adequately protect the new culvert.

Table 4 – Proposed 6' Wide Culvert Hydraulic Data

	50-year Flood Event	100-year Flood Event
Drainage Area (sq. mi.)	0.19	0.19
Flow (cfs)	92	118
Roadway Surface Elevation (ft.)	878.0	878.0
Culvert Crown Elevation (ft.)	876.8	876.8
Water Surface Elevation (ft.)	875.3	875.8

Freeboard (ft.)	1.5	1.0
Outlet Velocity (fps)	8.8	9.6
Waterway Area (sq. ft)	27	27
Flow Area Through Bridge during Flood Event (sq. ft)	18	21
% Opening Full During Flood Event	66.7%	77.8%

Floodplain Development Ordinances and Regulations

The NH Route 123A culvert crossing is in FEMA Zone A, which is within a FEMA Special Flood Hazard Area (SFHA). The Town of Alstead requires that any development within the floodway not result in any increase in flood levels within the community, as stated in the Town of Acworth Zoning Ordinance, Section VIII, Item 3:

"The Board of Selectmen shall obtain, review, and reasonably utilize any floodway data available from Federal, State, or other sources as criteria for requiring that all development located in Zone A meet the following floodway requirement: 'No encroachments, including fill, new construction, substantial improvements, and other development are allowed within the floodway that would result in any increase in flood levels within the community during the base flood discharge.'"

Therefore, since the NH Route 123A culvert is in Zone A, the base flood elevation will not be impacted at any point. Similarly, the federal floodplain management regulations, specifically 44 CFR §60.3(d)(4) respectively, states:

"…a community may permit encroachments within the adopted regulatory floodway that would result in an increase in base flood elevations, provided that the community first applies for a conditional FIRM and floodway revision, fulfills the requirements for such revisions as established under the provisions of §65.12, and receives the approval of the Federal Insurance Administrator."
The hydraulic analysis for the proposed conditions demonstrates that there will not be an increase in flood levels upstream or downstream of the crossing due to the proposed culvert size (6' concrete box culvert). Therefore, a Conditional Letter of Map Revision (CLOMR) application is not anticipated to be required by FEMA for this project. Additionally, a Letter of Map Revision (LOMR) application is not anticipated to be required since the Effective Flood Insurance Rate Map's floodplain and flood way boundaries are not being affected by the proposed culvert.

RECOMMENDATIONS

Hoyle Tanner recommends replacing the existing structurally deficient and undersized culvert with a 6' span by 6' rise (1.37' buried) concrete box culvert. The natural stream bottom is proposed to be constructed with riprap stone. Riprap voids are proposed to be filled with bank run gravel material and hydraulically washed in to replicate the natural stream and to also reduce flood velocities. This culvert type and opening size decreases flood velocities, provides a span that better accommodates existing brook flows, reduces flooding of the roadway at major flood events, lowers Unnamed Tributary flood profiles and meets the NHDOT Manual on Drainage Design for Highways design standards.

Please feel free to contact me at (603) 867-0733 or jbicja@hoyletanner.com if you have any questions regarding the contents of this letter, or should you need additional information.

Sincerely,
Hoyle, Tanner & Associates, Inc.

Josif Bicja, PE
Senior Structural Engineer

Enclosures
Hydrology Calculations
HY-8 Report: Existing Conditions
HY-8 Report: Proposed Conditions

Hydrology Calculations

NOTES AND ASSUMPTIONS

References:

1. NHDOT Drainage Design Manual, 1998.
2. Runoff Estimate for Small Rural Watersheds Development of a Sound Method. Volume II, Recommendations for Preparing Design Manuals and Appendices B, C, D, E, F, G, & H. FHWA Report No. FHWA-RD-77-159, 1977.
3. U.S. Geological Survey, 2019, The StreamStats program, online at https:// streamstats.usgs.gov/ss/, accessed July 2023.
4. NHDES Env-Wt 900: Stream Crossings; Certified Culvert Maintainer Program
5. State of New Hampshire Department of Transportation Construction Plans FEMA \ Betterment Project NH Project No. 43566C NH Route 123A Preliminary Contour Plan dated June 5, 2023.

- Discharges for the 2.33, 50, and 100-year floods are determined based on the following methods:

- USGS StreamStats
- FHWA 5- Parameter Method
- TR-55 Method

- The watershed area at the Route 123A culvert is 0.19 sq mi, which is outside the suggested range of drainage areas for the USGS StreamStats application. Therefore, the FHWA 5-Parameter method and the TR-55 method will also be used to calculate discharges. TR-55 is calculated using HydroCAD.
- The NEHL-AWM method would likely overestimate the discharge, as the NHDOT Drainage Design Manual states the range of catchment sizes for that method is between 1 and 1,000 sq mi. The catchment area at Route 123A is 0.19 sq mi.
- A replacement structure will be designed to accommodate the 50-year storm per the New Hampshire Environmental Rules Env-Wt 904.03.

METHOD NO. 1 - USGS STREAMSTATS

- StreamStats Report is shown below, which consists of peak flows for the 2, 5, 10, 25, 50, 100, and 500-year flood events. For the purpose of this report, only the 2-, 10-, 50-, and 100-year flood events will be used.

2-Year Design Flood: $Q_{2.USGS} := 13.3\ cfs$

10-Year Design Flood: $Q_{10.USGS} := 33.7\ cfs$

50-Year Design Flood: $Q_{50.USGS} := 59.5\ cfs$

100-Year Design Flood: $Q_{100.USGS} := 73.8\ cfs$

Peak-Flow Statistics Flow Report [Peak Flow Statewide SIR2008 5206]

Statistic	Value	Unit
50-percent AEP flood	13.3	ft^3/s
20-percent AEP flood	24	ft^3/s
10-percent AEP flood	33.7	ft^3/s
4-percent AEP flood	47.6	ft^3/s
2-percent AEP flood	59.5	ft^3/s
1-percent AEP flood	73.8	ft^3/s
0.2-percent AEP flood	111	ft^3/s

Peak-Flow Statistics Citations

Olson, S.A.,2009, Estimation of flood discharges at selected recurrence intervals for streams in New Hampshire: U.S.Geological Survey Scientific Investigations Report 2008-5206, 57 p. (http://pubs.usgs.gov/sir/2008/5206/)

METHOD NO. 2 - FHWA 5-PARAMETER METHOD

- FHWA 5-Parameter Method is taken from the Runoff Estimate for Small Rural Watersheds Development of a Sound Method; FHWA Report No. FHWA-RD-77-159, 1977. Refer to Volume II Recommendations for Preparing Design Manuals and Appendices B, C, D, E, F, G, and H (Report VII), Section Design Procedure - Federal Highway Administration Method.
- Additional information is found in the NHDOT Drainage Design Manual.

STEP 1 - DELINEATE WATERSHED:

Area of Watershed: $A := 0.19\ mi^2$ — USGS StreamStats Report

STEP 2 - DETERMINE THE PROBABLE MAXIMUM RUNOFF PEAK, Qp (MAX):

Maximum Runoff Peak: $Q_{p.max} := 10^{\left(3.92 + 0.812 \cdot \log\left(\frac{A}{mi^2}, 10\right) - 0.0325 \cdot \left(\log\left(\frac{A}{mi^2}, 10\right)\right)^2\right)} \cdot cfs$

$Q_{p.max} = 2077\ cfs$ — Report VII Equation 1

STEP 3 - DETERMINE THE REQUIRED HYDROPHYSIOGRAPHIC PARAMETERS:

Iso-erodent factor: $R := 93.4$ — Report VII Appendix C-33; See Sheet EPD-5

Elevation Difference:

Start of Brook: $EL_{start} := 1345\ ft$ — USGS StreamStats Exploration Tool; See Sheet EPD-6

At Culvert: $EL_{culvert} := 872.24\ ft$ — NHDOT Contour Plan, 2023

Elevation Difference: $DH := EL_{start} - EL_{culvert} = 472.760\ ft$

% Surface Water Storage Area: $S := 0\%$ — USGS StreamStats Report; See Sheet EPD-6

Hydrophysiographic Zone:

- Per Appendix B-33 of Report VII, all of NH is in Zone 9; this zone is used when determining the 10-year runoff peak equation to use.

Principal Drainage Channel Length: $L := 0.58\ mi$ — USGS StreamStats Exploration Tool; See Sheet EPD-6

10-Year, 60-Minute Rainfall: $P_{60} := 1.71$ — Report VII Appendix D-33; See Sheet EPD-7

METHOD NO. 2 - FHWA 5-PARAMETER METHOD (CONT.)

STEP 4 - DETERMINE THE ESTIMATED 10-YEAR FUNOFF PEAK, Q10:

Estimated 10-Year Peak: $q_{10} := 7.7165 \cdot cfs \cdot \left(\frac{A}{mi^2}\right)^{0.5814} \cdot R^{0.0547} \cdot \left(\frac{DH}{ft}\right)^{0.3865} \cdot \left(\frac{L}{mi}\right)^{0.0990} \cdot P_{60}{}^{0.8217}$

$q_{10} = 59.93 \ \frac{ft^3}{s}$ Report VII, Table 1-C

Storage Correction Factor: $SFC := 1$ Report VII, Figure 5; See Sheet EPD-8

Corrected 10-Year Peak: $\hat{q}_{10} := SFC \cdot q_{10} = 59.930 \ cfs$

STEP 5 - DETERMINE RETURN PERIOD TD:

Design Flood Event: $T_D := 50$ Env-Wt 904.03

STEP 6 - PREPARE THE EXTRAPOLATION CURVE FOR DETERMINATION QTD:

2.33-Year Design Flood: $Q_{2.33.FHWA} := 0.46921 \cdot \left(\frac{\hat{q}_{10}}{cfs}\right)^{1.00243} \cdot cfs = 28 \ cfs$

Report VII, Equation 8

10-Year Design Flood: $Q_{10.FHWA} := \hat{q}_{10} = 59.93 \ cfs$

50-Year Design Flood: $Q_{50.FHWA} := 1.45962 \cdot \left(\frac{\hat{q}_{10}}{cfs}\right)^{1.02342} \cdot cfs = 96 \ cfs$

Report VII, Equation 9

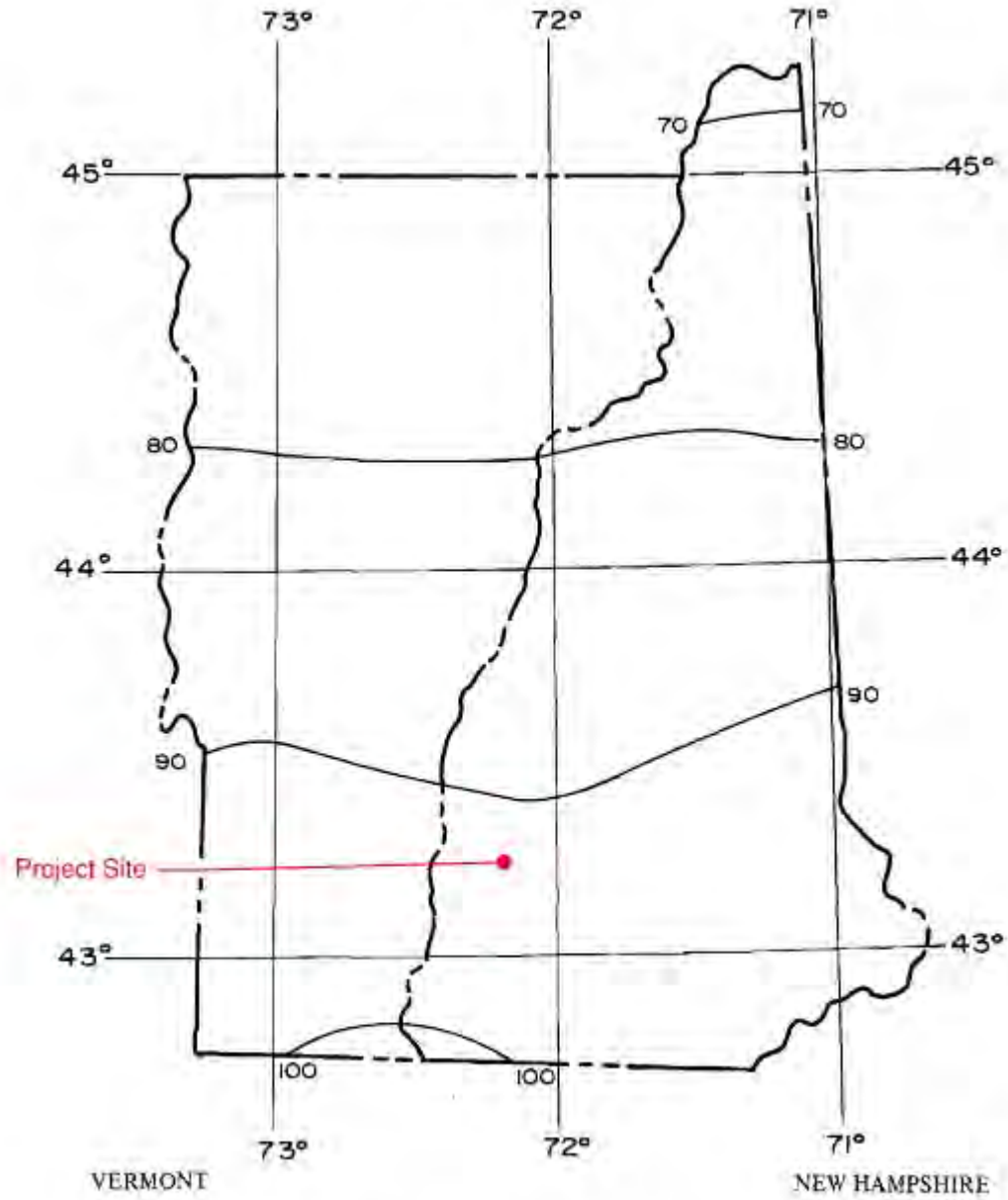
100-Year Design Flood: $Q_{100.FHWA} := 1.64380 \cdot \left(\frac{\hat{q}_{10}}{cfs}\right)^{1.02918} \cdot cfs = 111 \ cfs$

Report VII, Equation 10

METHOD NO. 2 - FHWA 5-PARAMETER METHOD (CONT.)

HYDROPHYSIOGRAPHIC PARAMETERS

Iso-erodent factor:



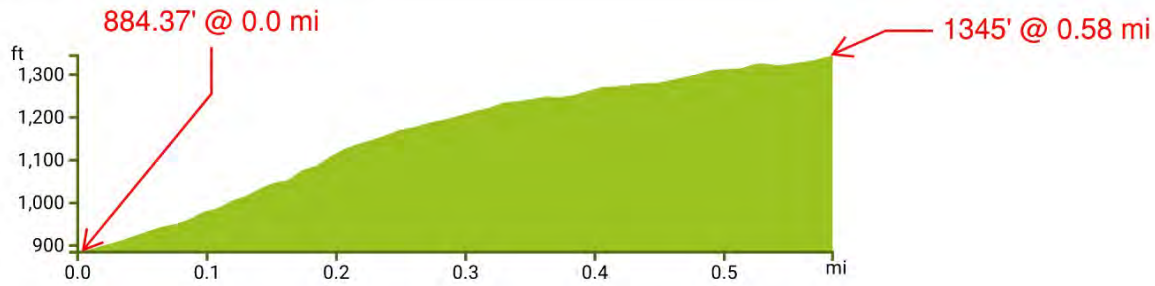
Appendix C-33. Isoerodent, R, map of New Hampshire.
Appendix C-50. Isoerodent, R, map of Vermont.

METHOD NO. 2 - FHWA 5-PARAMETER METHOD (CONT.)

HYDROPHYSIOGRAPHIC PARAMETERS

Elevation Difference:

Elevation profile



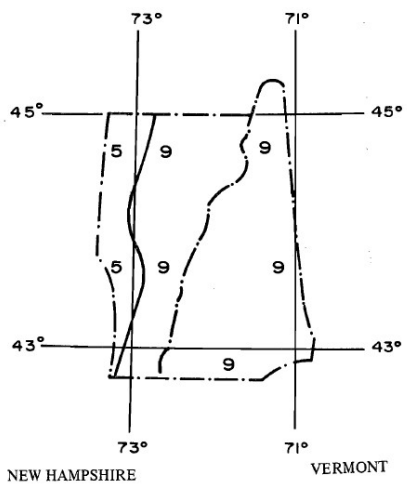
USGS StreamStats Exploration Tools

Percent Water Storage Area:

WETLAND	Percent Wetlands	0	percent

USGS StreamStats Report

Hydrophysiographic Zone:

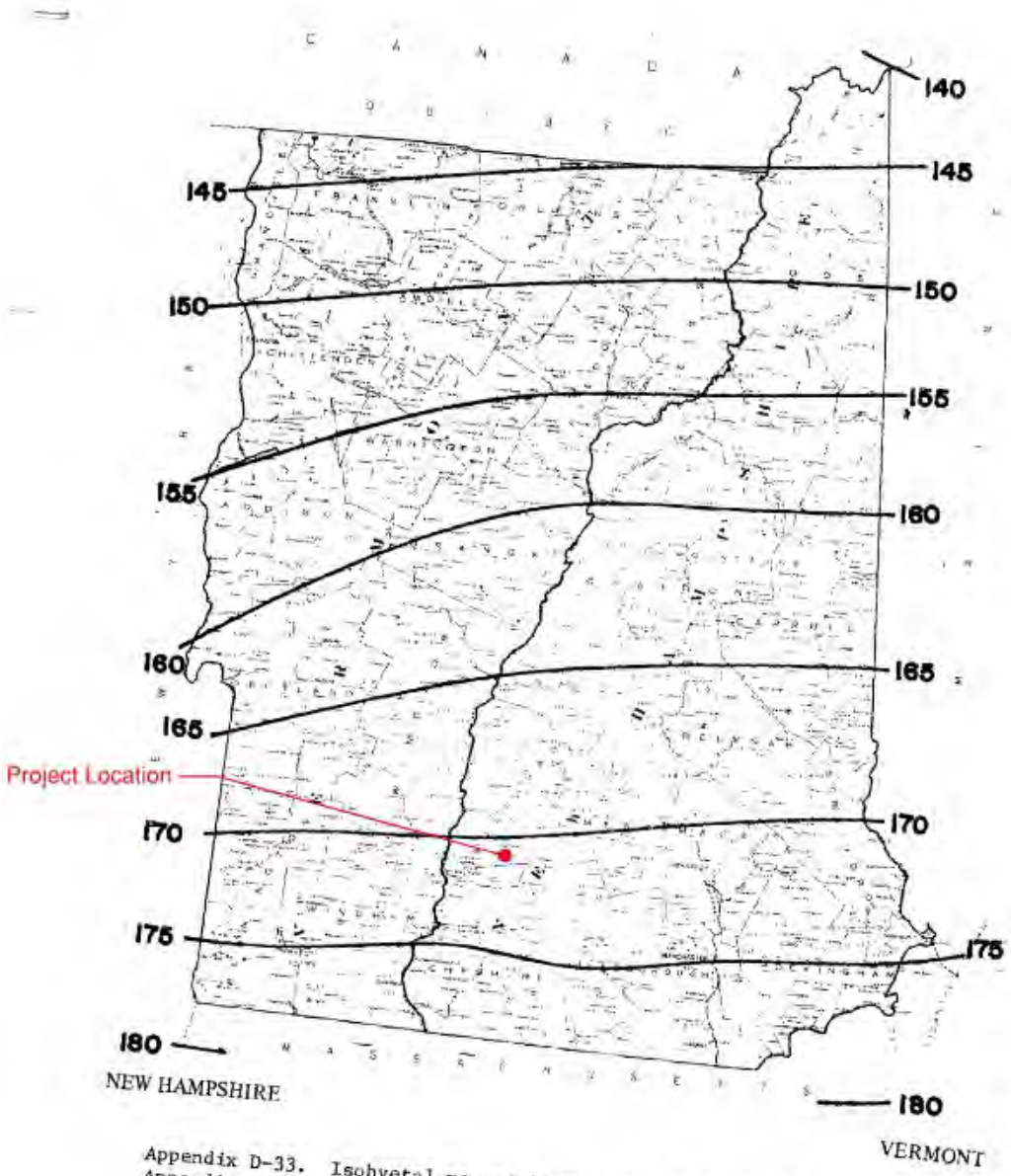


Appendix B-33. Hydrophysiographic zones of New Hampshire.
Appendix B-50. Hydrophysiographic zones of Vermont.

METHOD NO. 2 - FHWA 5-PARAMETER METHOD (CONT.)

HYDROPHYSIOGRAPHIC PARAMETERS

Rainfall Intensity:



Appendix D-33. Isohyetal map of 10-year 1-hour rainfall for New Hampshire.
Appendix D-50. Isohyetal map of 10-year 1-hour rainfall for Vermont.

METHOD NO. 2 - FHWA 5-PARAMETER METHOD (CONT.)

HYDROPHYSIOGRAPHIC PARAMETERS

Storage Correction Factor:

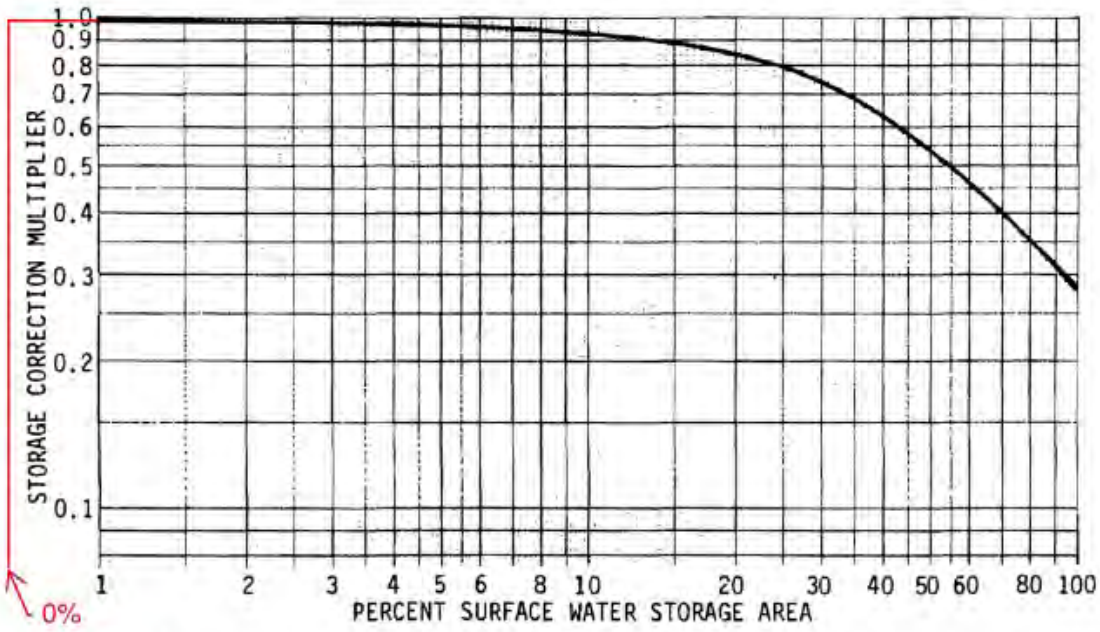


Figure 5. Storage correction curve. (Defines the relationship between the percentage of watershed area covered by lakes, ponds, swamps, playas, etc. and the multiplication factor required to correct a peak runoff estimate for storage.)

Assume storage correction multiplier of 1, based on 0% wetland area.

COMPARISON OF FLOWS

	STREAMSTATS	FHWA	TR-55
2/2.33-Year Design Flood:	$Q_{2.USGS} = 13$ *cfs*	$Q_{2.33.FHWA} = 28$ *cfs*	$Q_{2.TR55} := 6.94$ *cfs*
10-Year Design Flood:	$Q_{10.USGS} = 33.7$ *cfs*	$Q_{10.FHWA} = 59.9$ *cfs*	$Q_{10.TR55} := 31.81$ *cfs*
50-Year Design Flood:	$Q_{50.USGS} = 59.5$ *cfs*	$Q_{50.FHWA} = 96$ *cfs*	$Q_{50.TR55} := 87.6$ *cfs*
100-Year Design Flood:	$Q_{100.USGS} = 74$ *cfs*	$Q_{100.FHWA} = 111$ *cfs*	$Q_{100.TR55} := 124.93$ *cfs*

- For the 2-, 10-, 50-, and 100-year design flows, StreamStats produces flows lower than the FHWA 5-Parameter method.
- For the 2- and 10-year design flows, StreamStats produces flows higher than the TR-55 method. For the 50- and 100-year design flows, StreamStats produces flows lower than the TR-55 method.

FINAL FLOWS USED

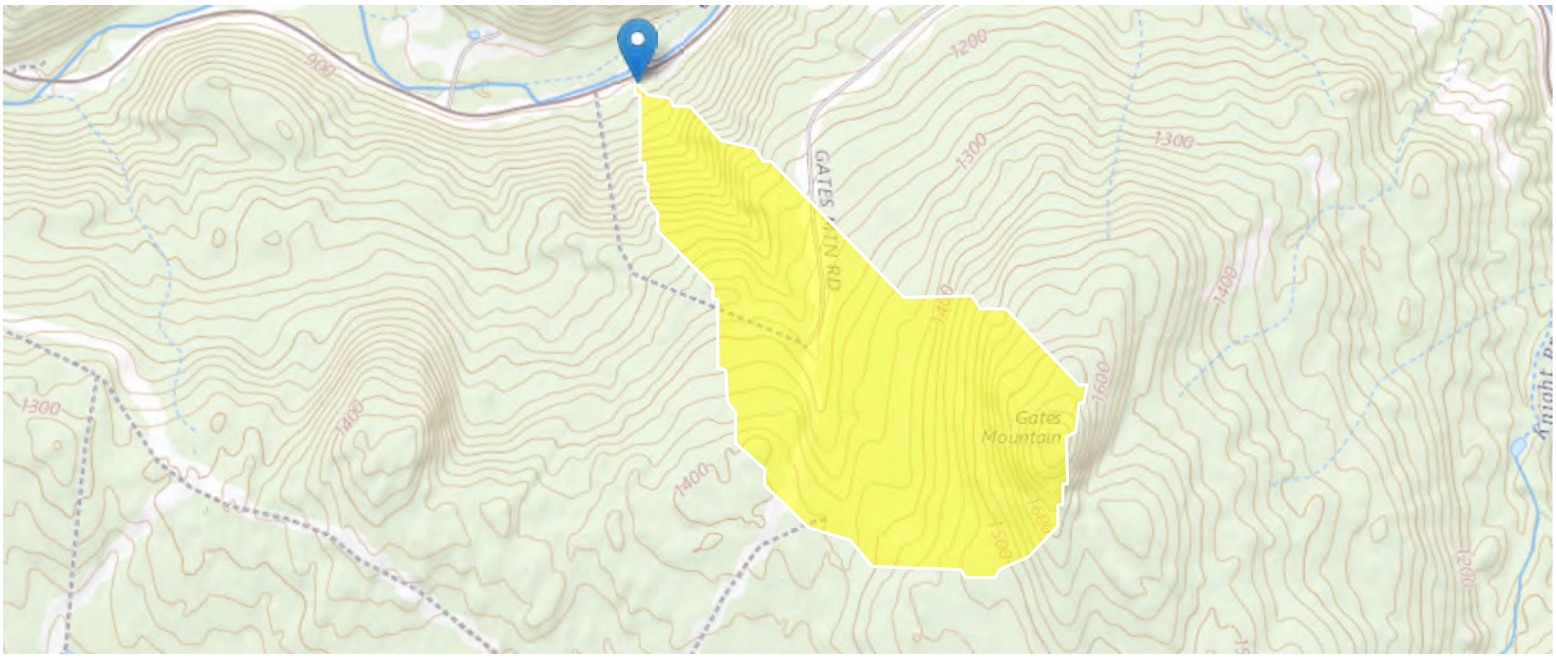
- Because StreamStats is likely underestimating the 50- and 100-year design floods, use the average of the FHWA and TR-55 flows.

	Average of FHWA-5 and TR-55
2/2.33-Year Design Flood:	$Q_{2.AVG} := \text{mean}\left(Q_{2.33.FHWA}, Q_{2.TR55}\right) = 18$ *cfs*
10-Year Design Flood:	$Q_{10.AVG} := \text{mean}\left(Q_{10.FHWA}, Q_{10.TR55}\right) = 45.87$ *cfs*
50-Year Design Flood:	$Q_{50.AVG} := \text{mean}\left(Q_{50.FHWA}, Q_{50.TR55}\right) = 91.94$ *cfs*
100-Year Design Flood:	$Q_{100.AVG} := \text{mean}\left(Q_{100.FHWA}, Q_{100.TR55}\right) = 118$ *cfs*

USGS StreamStats Report

Acworth StreamStats Report

Region ID: NH
Workspace ID: NH20230719122420083000
Clicked Point (Latitude, Longitude): 43.18531, -72.25740
Time: 2023-07-19 08:24:41 -0400



Collapse All

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
APRAVPRE	Mean April Precipitation	3.492	inches
CSL10_85	Change in elevation divided by length between points 10 and 85 percent of distance along main channel to basin divide - main channel method not known	716	feet per mi
DRNAREA	Area that drains to a point on a stream	0.19	square miles
WETLAND	Percentage of Wetlands	0	percent

Peak-Flow Statistics

Peak-Flow Statistics Parameters [Peak Flow Statewide SIR2008 5206]

Parameter Code	Parameter Name		Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	121.6 acres =	0.19	square miles	0.7	1290
APRAVPRE	Mean April Precipitation		3.492	inches	2.79	6.23
WETLAND	Percent Wetlands		0	percent	0	21.8
CSL10_85	Stream Slope 10 and 85 Method		716	feet per mi	5.43	543

Peak-Flow Statistics Disclaimers [Peak Flow Statewide SIR2008 5206]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Peak-Flow Statistics Flow Report [Peak Flow Statewide SIR2008 5206]

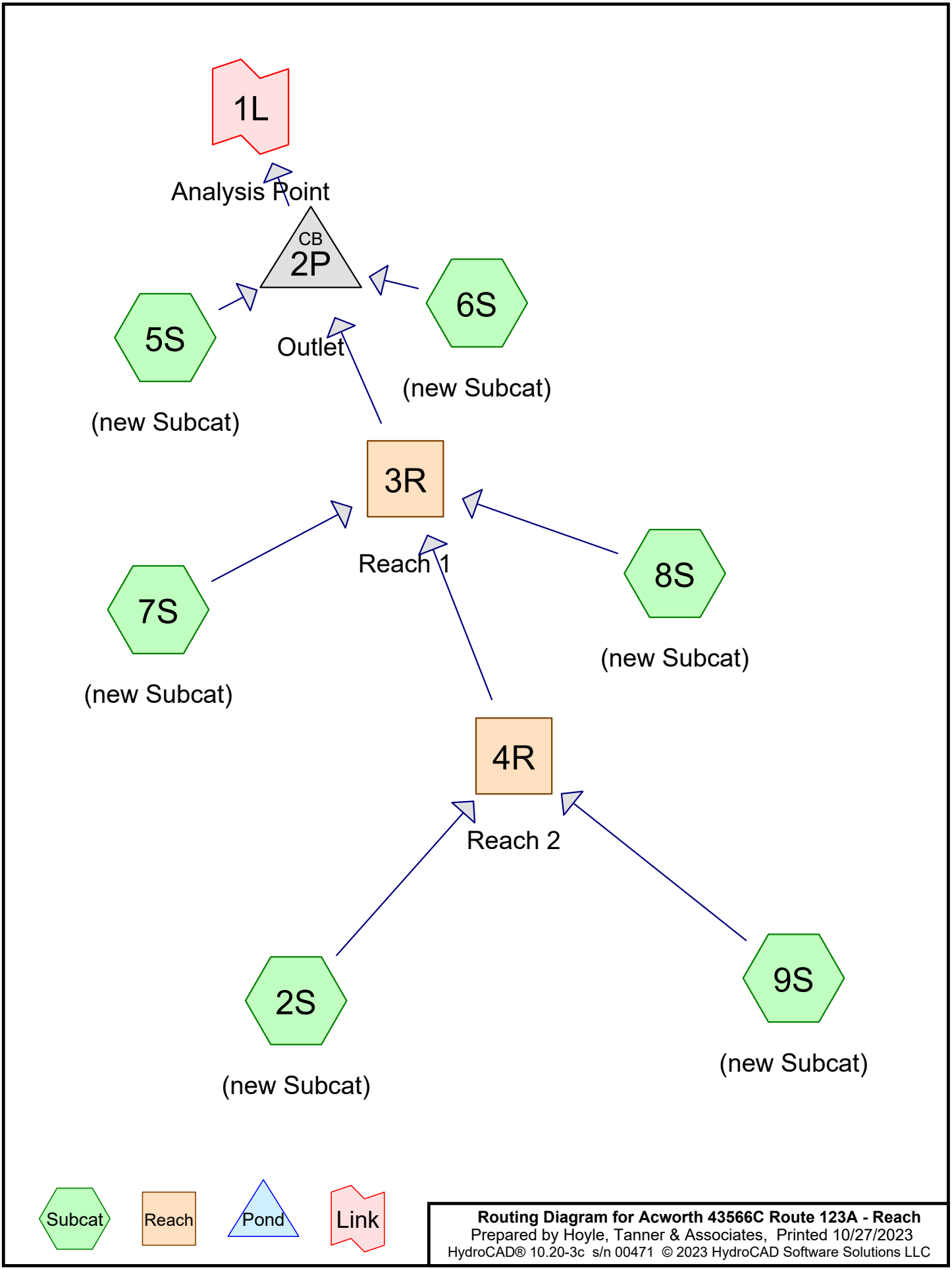
Statistic	Return Year	Value	Unit
50-percent AEP flood	Q2	13.3	ft^3/s
20-percent AEP flood	Q5	24	ft^3/s
10-percent AEP flood	Q10	33.7	ft^3/s
4-percent AEP flood	Q25	47.6	ft^3/s
2-percent AEP flood	Q50	59.5	ft^3/s
1-percent AEP flood	Q100	73.8	ft^3/s
0.2-percent AEP flood	Q500	111	ft^3/s

Peak-Flow Statistics Citations

Olson, S.A.,2009, Estimation of flood discharges at selected recurrence intervals for streams in New Hampshire: U.S.Geological Survey Scientific Investigations Report 2008-5206, 57 p. (http://pubs.usgs.gov/sir/2008/5206/)

Application Version: 4.16.0
StreamStats Services Version: 1.2.22
NSS Services Version: 2.2.1

HydroCAD Report



Routing Diagram for Acworth 43566C Route 123A - Reach
Prepared by Hoyle, Tanner & Associates, Printed 10/27/2023

Project Notes

Designer: LMS
Checker: TMC

Rainfall Events Listing

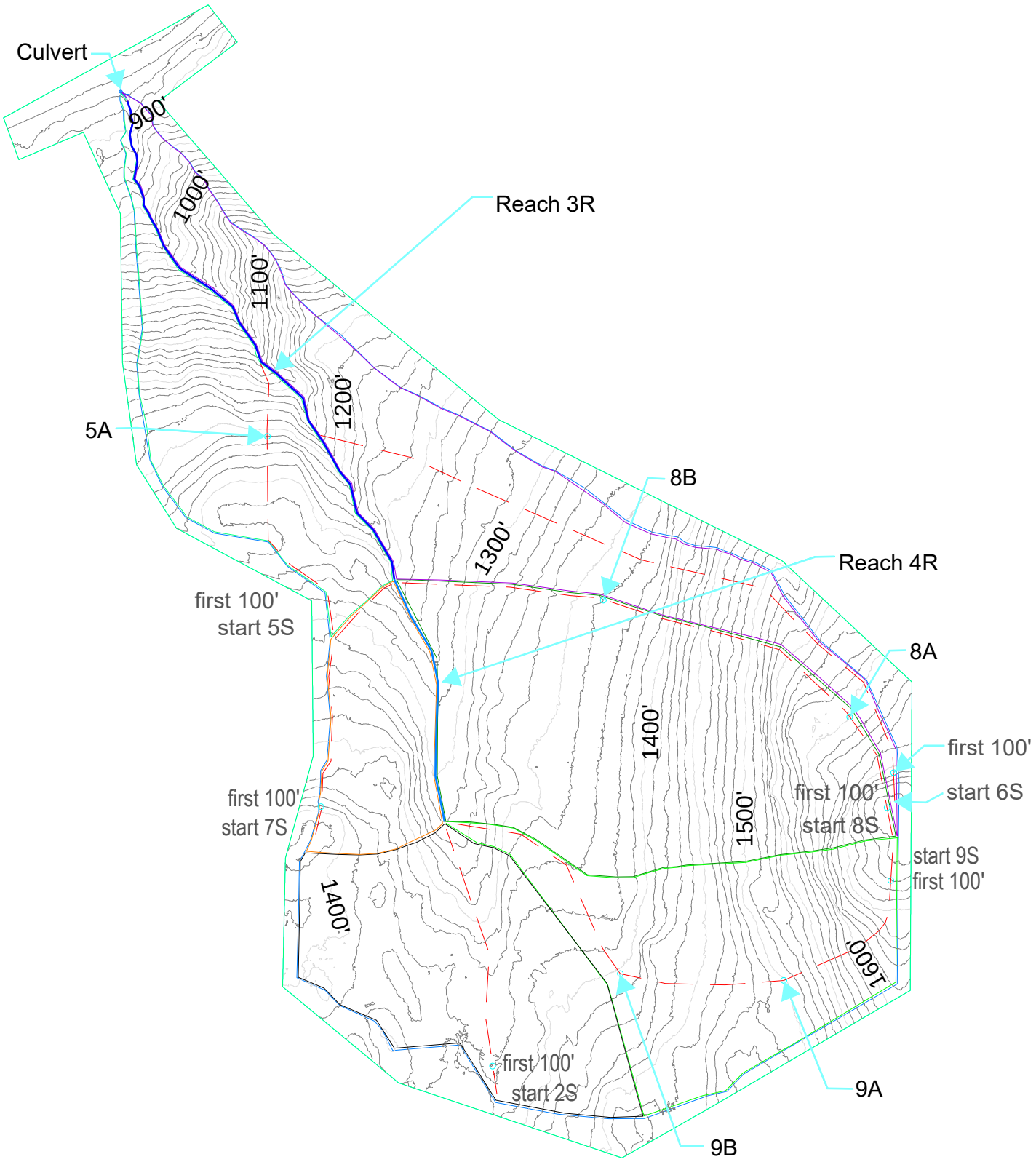
Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2 yr	Type III 24-hr		Default	24.00	1	2.71	2
2	10 yr	Type III 24-hr		Default	24.00	1	3.95	2
3	50 yr	Type III 24-hr		Default	24.00	1	5.76	2
4	100 yr	Type III 24-hr		Default	24.00	1	6.79	2

Note: Rainfall data collected from Extreme Precipitation Tables from the Northeast Regional Climate Center. See attached pdf.

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.020	91	Gravel roads, HSG D (5S, 6S)
64.550	55	Woods, Good, HSG B (2S, 5S, 6S, 7S, 8S, 9S)
17.430	70	Woods, Good, HSG C (5S, 6S, 7S, 8S)
7.850	75	Woods, Good, HSG D (2S)
13.680	77	Woods, Good, HSG D (5S, 6S, 7S, 8S, 9S)
103.530	**62**	**TOTAL AREA**

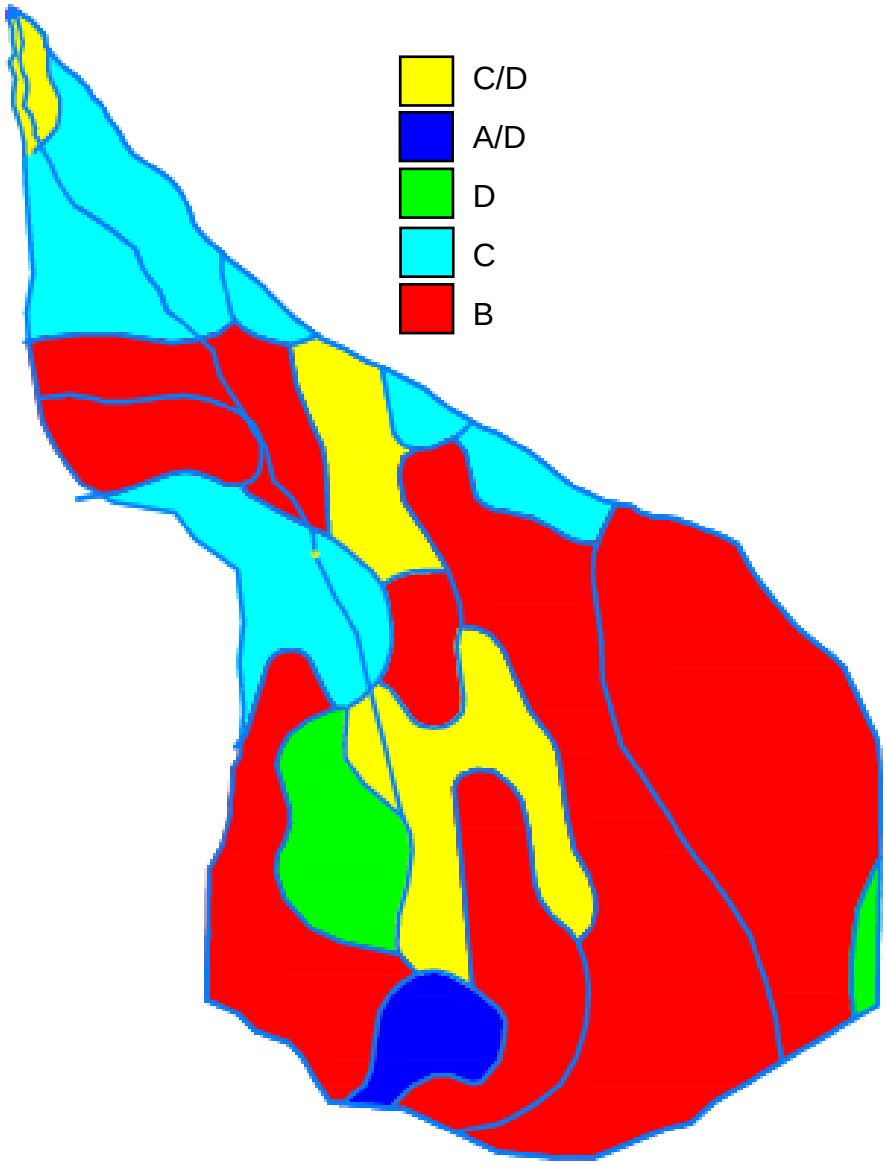
Note: Gravel roads land use type used for small right-of-way area at culvert inlet.



Subcatchments, reaches, and Tc paths diagram.

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
64.550	HSG B	2S, 5S, 6S, 7S, 8S, 9S
17.430	HSG C	5S, 6S, 7S, 8S
21.550	HSG D	2S, 5S, 6S, 7S, 8S, 9S
0.000	Other	
103.530		**TOTAL AREA**



Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.020	0.000	0.020	Gravel roads	5S, 6S
0.000	64.550	17.430	21.530	0.000	103.510	Woods, Good	2S, 5S, 6S, 7S, 8S, 9S
0.000	**64.550**	**17.430**	**21.550**	**0.000**	**103.530**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	2P	872.24	871.70	28.0	0.0193	0.017	33.6	52.2	0.0	Outlet

Time span=5.00-31.00 hrs, dt=0.05 hrs, 521 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2S: (new Subcat) Runoff Area=16.950 ac 0.00% Impervious Runoff Depth=0.35"
Flow Length=986' Tc=61.7 min CN=64 Runoff=1.76 cfs 0.492 af

Subcatchment5S: (new Subcat) Runoff Area=12.670 ac 0.00% Impervious Runoff Depth=0.29"
Flow Length=1,067' Tc=30.8 min CN=62 Runoff=1.38 cfs 0.305 af

Subcatchment6S: (new Subcat) Runoff Area=21.450 ac 0.00% Impervious Runoff Depth=0.38"
Flow Length=2,600' Tc=50.6 min CN=65 Runoff=2.85 cfs 0.679 af

Subcatchment7S: (new Subcat) Runoff Area=7.000 ac 0.00% Impervious Runoff Depth=0.45"
Flow Length=999' Tc=30.6 min CN=67 Runoff=1.54 cfs 0.261 af

Subcatchment8S: (new Subcat) Runoff Area=25.460 ac 0.00% Impervious Runoff Depth=0.24"
Flow Length=2,098' Tc=39.0 min CN=60 Runoff=1.75 cfs 0.500 af

Subcatchment9S: (new Subcat) Runoff Area=20.000 ac 0.00% Impervious Runoff Depth=0.17"
Flow Length=2,230' Tc=55.2 min CN=57 Runoff=0.61 cfs 0.275 af

Reach 3R: Reach 1 Avg. Flow Depth=0.12' Max Vel=2.93 fps Inflow=4.23 cfs 1.528 af
n=0.050 L=2,055.4' S=0.1708 '/' Capacity=406.60 cfs Outflow=4.16 cfs 1.528 af

Reach 4R: Reach 2 Avg. Flow Depth=0.12' Max Vel=1.96 fps Inflow=2.35 cfs 0.767 af
n=0.050 L=892.0' S=0.0774 '/' Capacity=142.85 cfs Outflow=2.31 cfs 0.767 af

Pond 2P: Outlet Peak Elev=873.04' Inflow=6.94 cfs 2.513 af
33.6" x 52.2", R=17.0" Arch Culvert n=0.017 L=28.0' S=0.0193 '/' Outflow=6.94 cfs 2.513 af

Link 1L: Analysis Point Inflow=6.94 cfs 2.513 af
Primary=6.94 cfs 2.513 af

Total Runoff Area = 103.530 ac Runoff Volume = 2.513 af Average Runoff Depth = 0.29"
100.00% Pervious = 103.530 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 2S: (new Subcat)

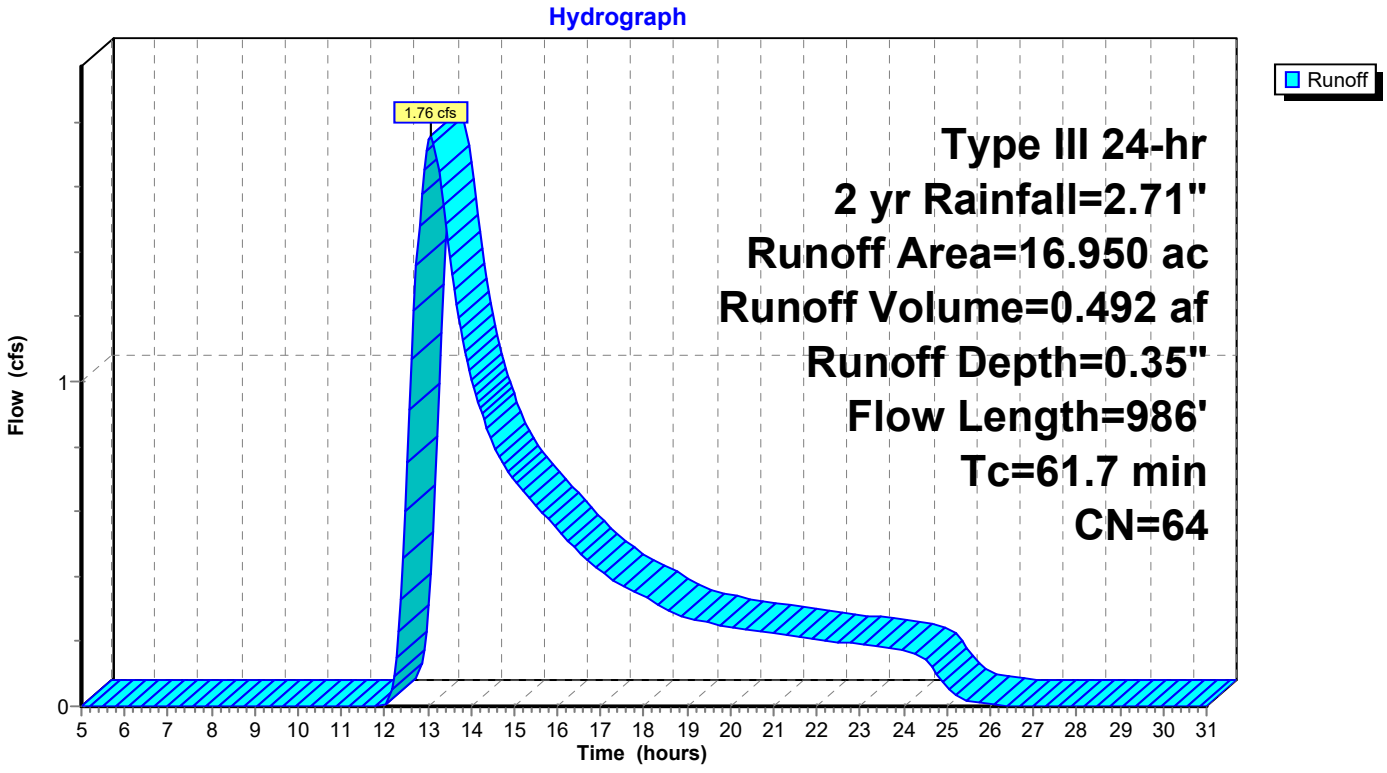
Runoff = 1.76 cfs @ 13.07 hrs, Volume= 0.492 af, Depth= 0.35"
Routed to Reach 4R : Reach 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 yr Rainfall=2.71"

	Area (ac)	CN	Description
	9.100	55	Woods, Good, HSG B
*	7.850	75	Woods, Good, HSG D
	16.950	64	Weighted Average
	16.950		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.6	100	0.0200	0.04		**Sheet Flow, First 100'** Woods: Dense underbrush n= 0.800 P2= 2.71"
21.1	886	0.0785	0.70		**Shallow Concentrated Flow, 100' to End** Forest w/Heavy Litter Kv= 2.5 fps
61.7	986	Total			

Subcatchment 2S: (new Subcat)



Summary for Subcatchment 5S: (new Subcat)

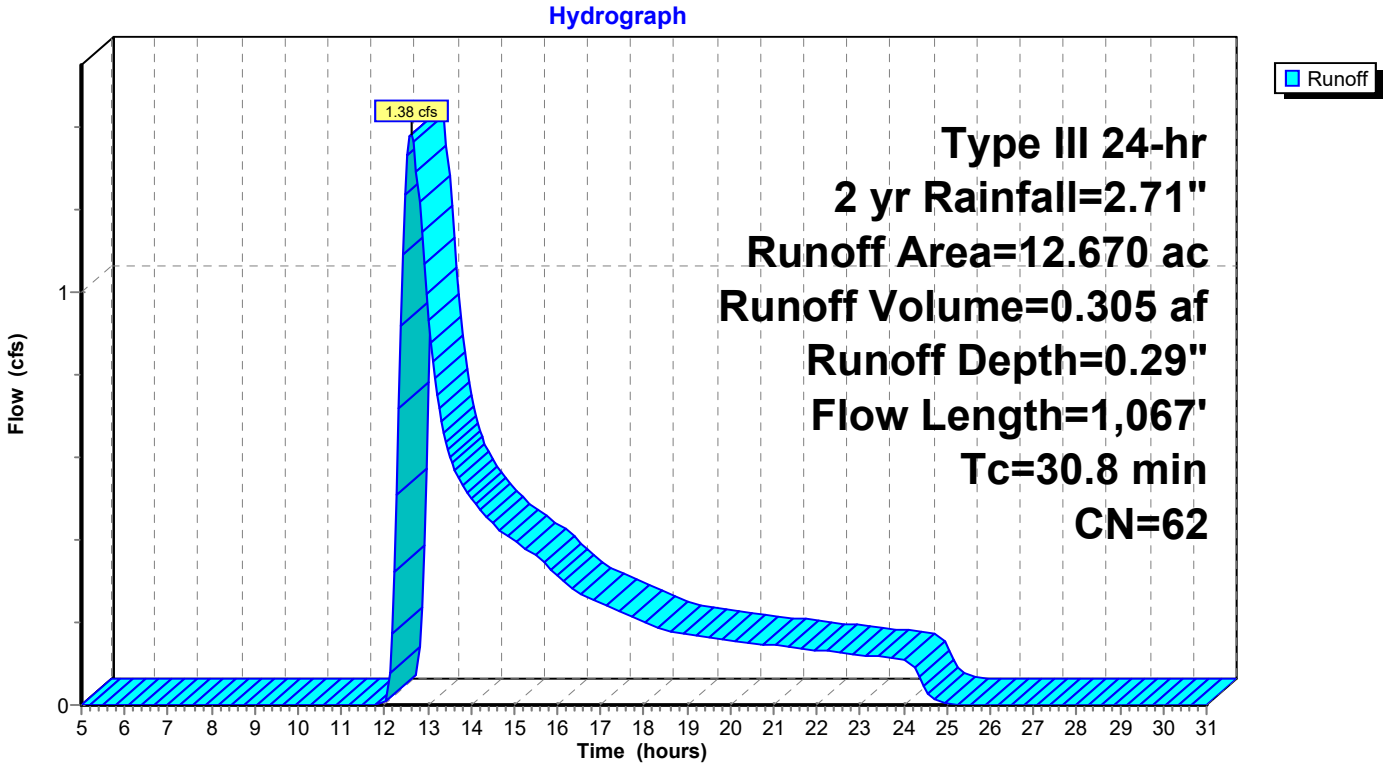
Runoff = 1.38 cfs @ 12.63 hrs, Volume= 0.305 af, Depth= 0.29"
Routed to Pond 2P : Outlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 yr Rainfall=2.71"

Area (ac)	CN	Description
0.010	91	Gravel roads, HSG D
0.400	77	Woods, Good, HSG D
6.560	55	Woods, Good, HSG B
5.700	70	Woods, Good, HSG C
12.670	62	Weighted Average
12.670		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.1	100	0.1750	0.10		**Sheet Flow, First 100'** Woods: Dense underbrush n= 0.800 P2= 2.71"
13.6	693	0.1150	0.85		**Shallow Concentrated Flow, 100' to Pt 5A** Forest w/Heavy Litter Kv= 2.5 fps
0.1	274	0.3500	74.73	24,360.52	**Channel Flow, Pt 5A to End** Area= 326.0 sf Perim= 52.0' r= 6.27' n= 0.040
30.8	1,067	Total			

Subcatchment 5S: (new Subcat)



Summary for Subcatchment 6S: (new Subcat)

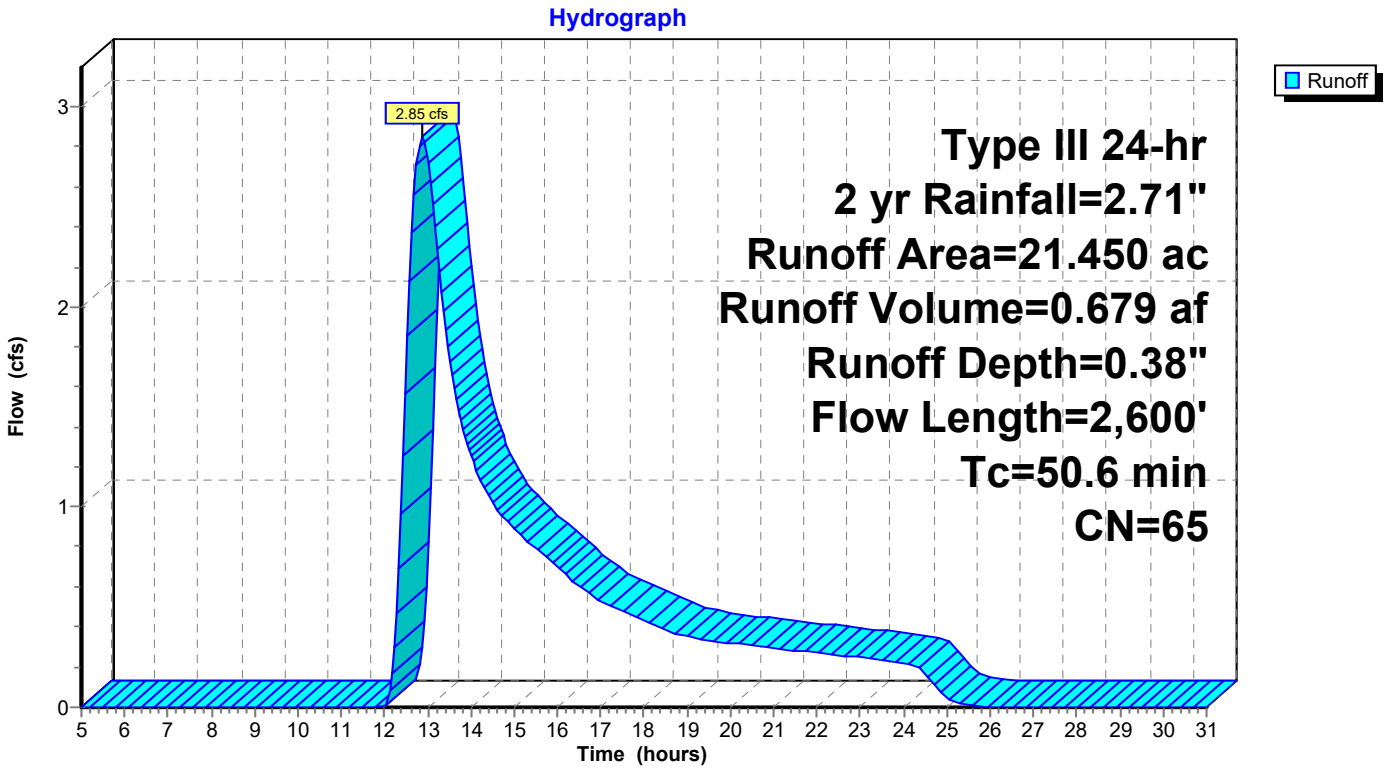
Runoff = 2.85 cfs @ 12.87 hrs, Volume= 0.679 af, Depth= 0.38"
Routed to Pond 2P : Outlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 yr Rainfall=2.71"

Area (ac)	CN	Description
0.010	91	Gravel roads, HSG D
4.300	77	Woods, Good, HSG D
9.070	55	Woods, Good, HSG B
8.070	70	Woods, Good, HSG C
21.450	65	Weighted Average
21.450		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4	100	0.3900	0.13		**Sheet Flow, First 100'** Woods: Dense underbrush n= 0.800 P2= 2.71"
38.2	2,500	0.1904	1.09		**Shallow Concentrated Flow, 100' to End** Forest w/Heavy Litter Kv= 2.5 fps
50.6	2,600	Total			

Subcatchment 6S: (new Subcat)



Summary for Subcatchment 7S: (new Subcat)

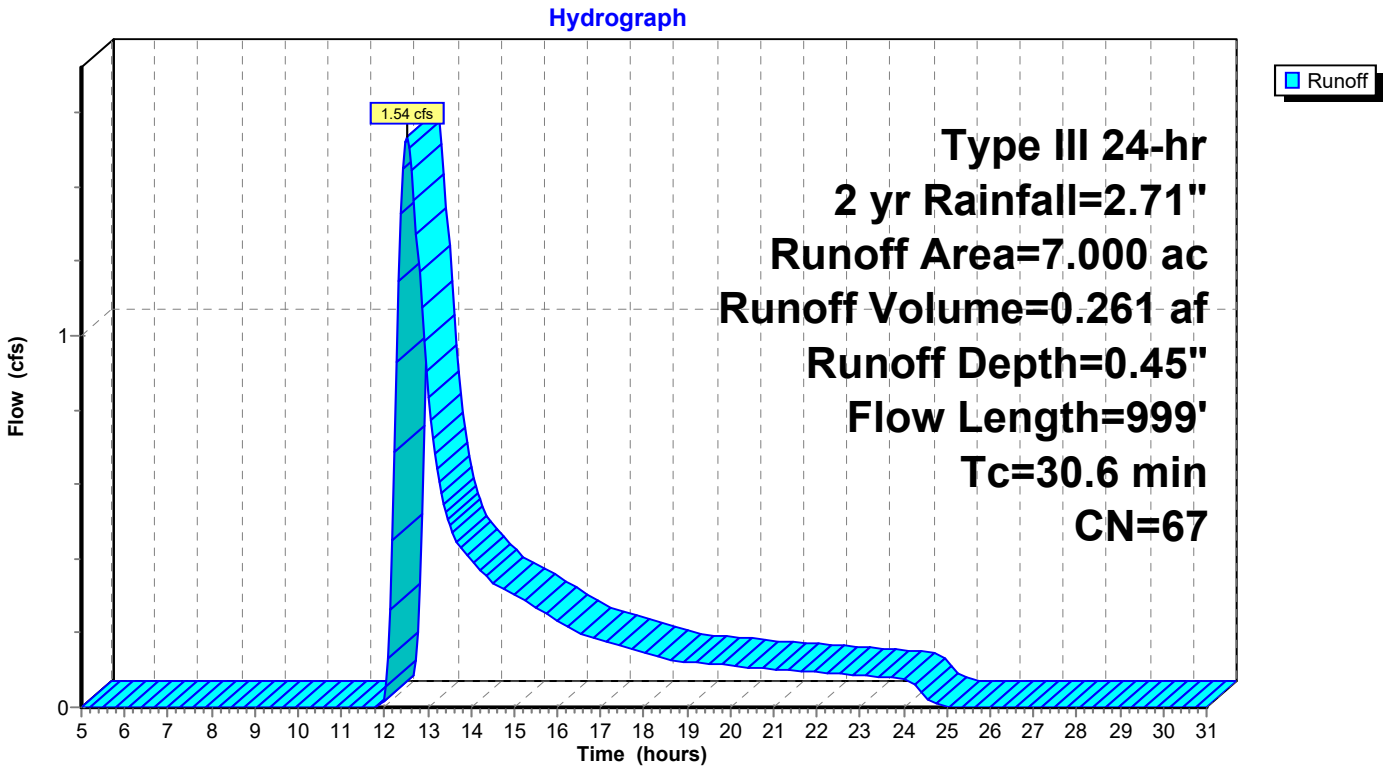
Runoff = 1.54 cfs @ 12.54 hrs, Volume= 0.261 af, Depth= 0.45"
Routed to Reach 3R : Reach 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 yr Rainfall=2.71"

Area (ac)	CN	Description
2.800	70	Woods, Good, HSG C
2.180	55	Woods, Good, HSG B
2.020	77	Woods, Good, HSG D
7.000	67	Weighted Average
7.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.2	100	0.2350	0.11		**Sheet Flow, First 100'** Woods: Dense underbrush n= 0.800 P2= 2.71"
15.4	899	0.1510	0.97		**Shallow Concentrated Flow, 100' to Pt A7** Forest w/Heavy Litter Kv= 2.5 fps
30.6	999	Total			

Subcatchment 7S: (new Subcat)



Summary for Subcatchment 8S: (new Subcat)

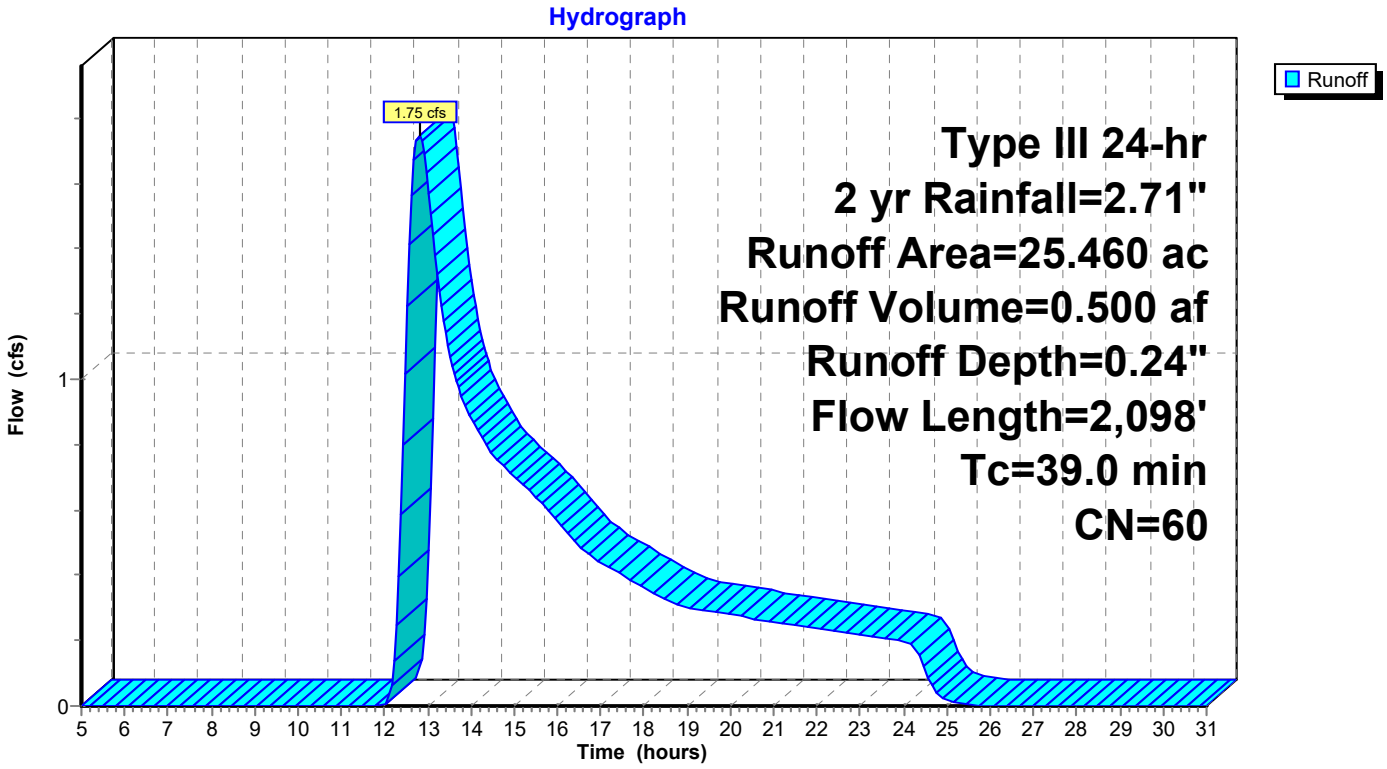
Runoff = 1.75 cfs @ 12.80 hrs, Volume= 0.500 af, Depth= 0.24"
Routed to Reach 3R : Reach 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 yr Rainfall=2.71"

Area (ac)	CN	Description
0.860	70	Woods, Good, HSG C
19.190	55	Woods, Good, HSG B
5.410	77	Woods, Good, HSG D
25.460	60	Weighted Average
25.460		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.8	100	0.0950	0.08		**Sheet Flow, first 100'** Woods: Dense underbrush n= 0.800 P2= 2.71"
3.6	293	0.2920	1.35		**Shallow Concentrated Flow, 100' to Pt 8A** Forest w/Heavy Litter Kv= 2.5 fps
13.3	982	0.2440	1.23		**Shallow Concentrated Flow, Pt 8A to Pt 8B** Forest w/Heavy Litter Kv= 2.5 fps
0.3	723	0.1410	47.43	15,461.87	**Channel Flow, Pt 8B to End** Area= 326.0 sf Perim= 52.0' r= 6.27' n= 0.040
39.0	2,098	Total			

Subcatchment 8S: (new Subcat)



Summary for Subcatchment 9S: (new Subcat)

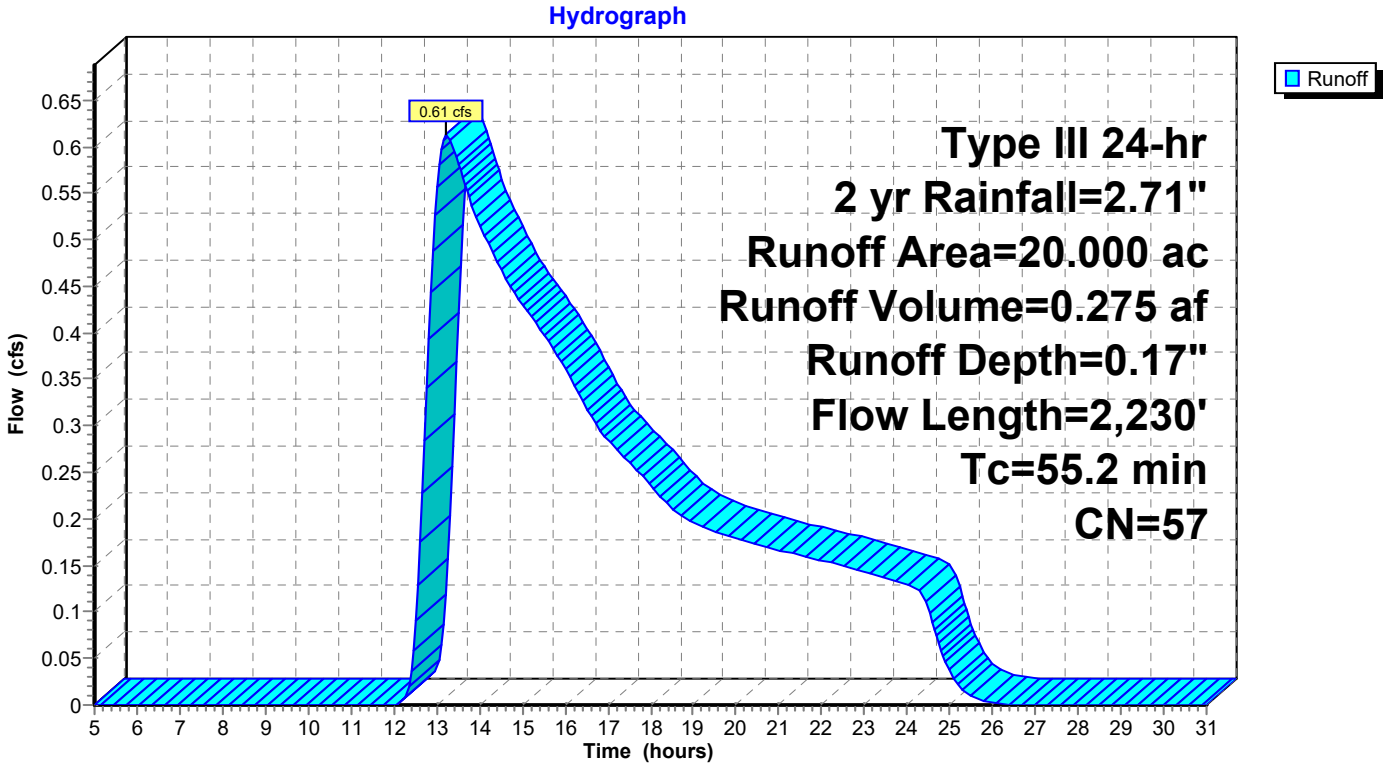
Runoff = 0.61 cfs @ 13.22 hrs, Volume= 0.275 af, Depth= 0.17"
Routed to Reach 4R : Reach 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 yr Rainfall=2.71"

Area (ac)	CN	Description
18.450	55	Woods, Good, HSG B
1.550	77	Woods, Good, HSG D
20.000	57	Weighted Average
20.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.2	100	0.1300	0.09		**Sheet Flow, first 100'** Woods: Dense underbrush n= 0.800 P2= 2.71"
8.0	677	0.3200	1.41		**Shallow Concentrated Flow, 100' to Pt 9A** Forest w/Heavy Litter Kv= 2.5 fps
9.8	589	0.1600	1.00		**Shallow Concentrated Flow, Pt 9A to Pt 9B** Forest w/Heavy Litter Kv= 2.5 fps
18.2	864	0.1000	0.79		**Shallow Concentrated Flow, Pt 9B to End** Forest w/Heavy Litter Kv= 2.5 fps
55.2	2,230	Total			

Subcatchment 9S: (new Subcat)



Summary for Reach 3R: Reach 1

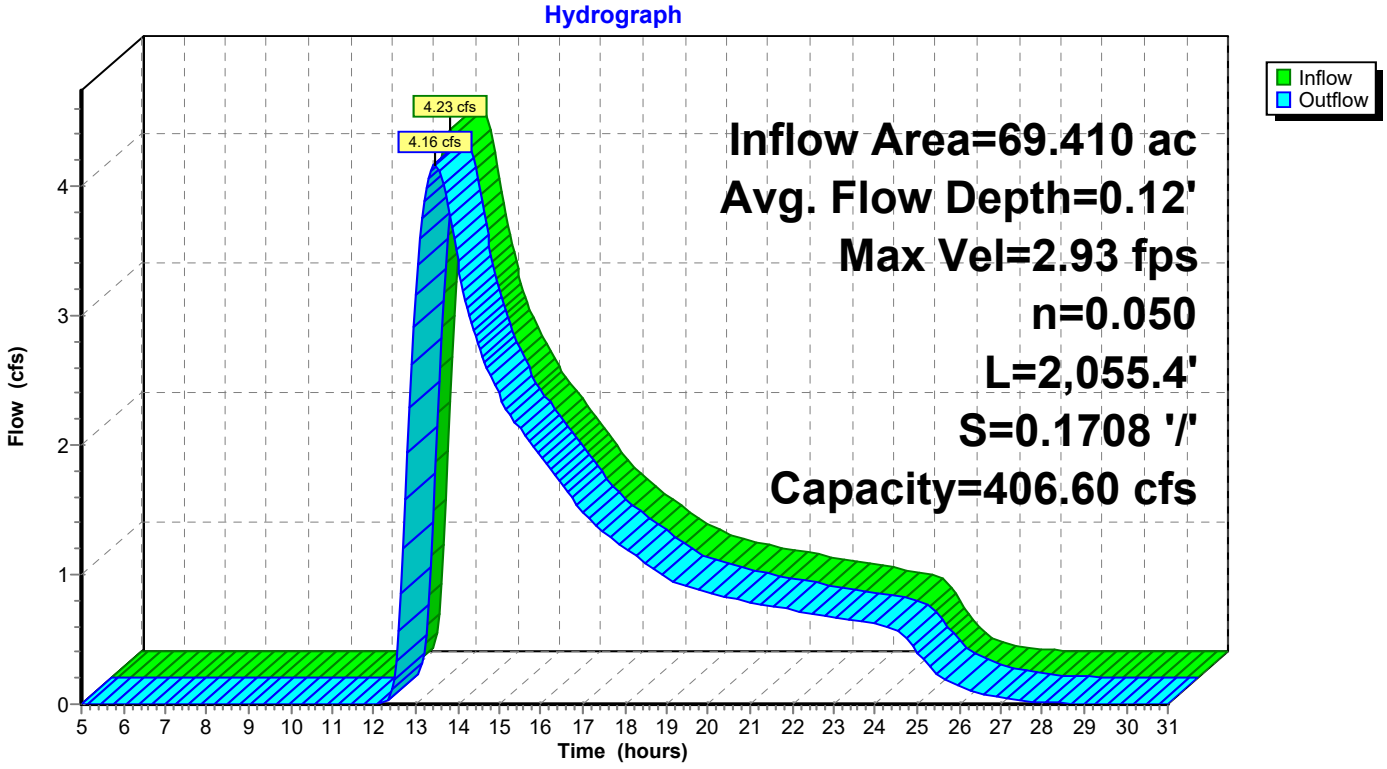
[62] Hint: Exceeded Reach 4R OUTLET depth by 0.03' @ 12.55 hrs

Inflow Area = 69.410 ac, 0.00% Impervious, Inflow Depth = 0.26" for 2 yr event
Inflow = 4.23 cfs @ 13.13 hrs, Volume= 1.528 af
Outflow = 4.16 cfs @ 13.45 hrs, Volume= 1.528 af, Atten= 2%, Lag= 19.3 min
Routed to Pond 2P : Outlet

Routing by Stor-Ind+Trans method, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.93 fps, Min. Travel Time= 11.7 min
Avg. Velocity = 1.52 fps, Avg. Travel Time= 22.5 min

Peak Storage= 2,923 cf @ 13.25 hrs
Average Depth at Peak Storage= 0.12' , Surface Width= 12.05'
Bank-Full Depth= 2.00' Flow Area= 24.8 sf, Capacity= 406.60 cfs

12.00' x 2.00' deep channel, n= 0.050 Mountain streams w/large boulders
Side Slope Z-value= 0.2 '/' Top Width= 12.80'
Length= 2,055.4' Slope= 0.1708 '/'
Inlet Invert= 1,231.00', Outlet Invert= 880.00'



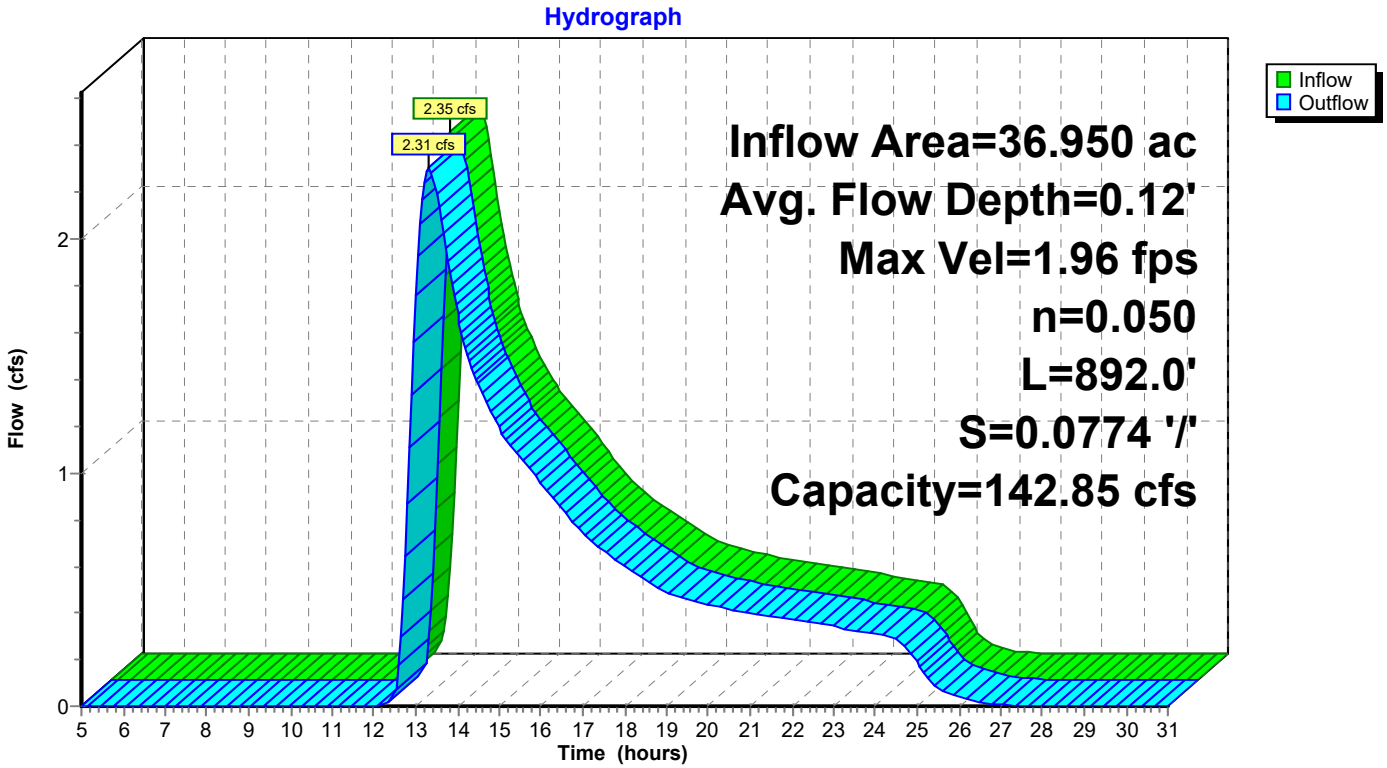
Summary for Reach 4R: Reach 2

Inflow Area = 36.950 ac, 0.00% Impervious, Inflow Depth = 0.25" for 2 yr event
Inflow = 2.35 cfs @ 13.10 hrs, Volume= 0.767 af
Outflow = 2.31 cfs @ 13.31 hrs, Volume= 0.767 af, Atten= 2%, Lag= 13.0 min
Routed to Reach 3R : Reach 1

Routing by Stor-Ind+Trans method, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.96 fps, Min. Travel Time= 7.6 min
Avg. Velocity = 1.00 fps, Avg. Travel Time= 14.9 min

Peak Storage= 1,053 cf @ 13.18 hrs
Average Depth at Peak Storage= 0.12' , Surface Width= 10.05'
Bank-Full Depth= 1.50' Flow Area= 15.4 sf, Capacity= 142.85 cfs

10.00' x 1.50' deep channel, n= 0.050 Mountain streams w/large boulders
Side Slope Z-value= 0.2 '/' Top Width= 10.60'
Length= 892.0' Slope= 0.0774 '/'
Inlet Invert= 1,300.00', Outlet Invert= 1,231.00'



Summary for Pond 2P: Outlet

[57] Hint: Peaked at 873.04' (Flood elevation advised)

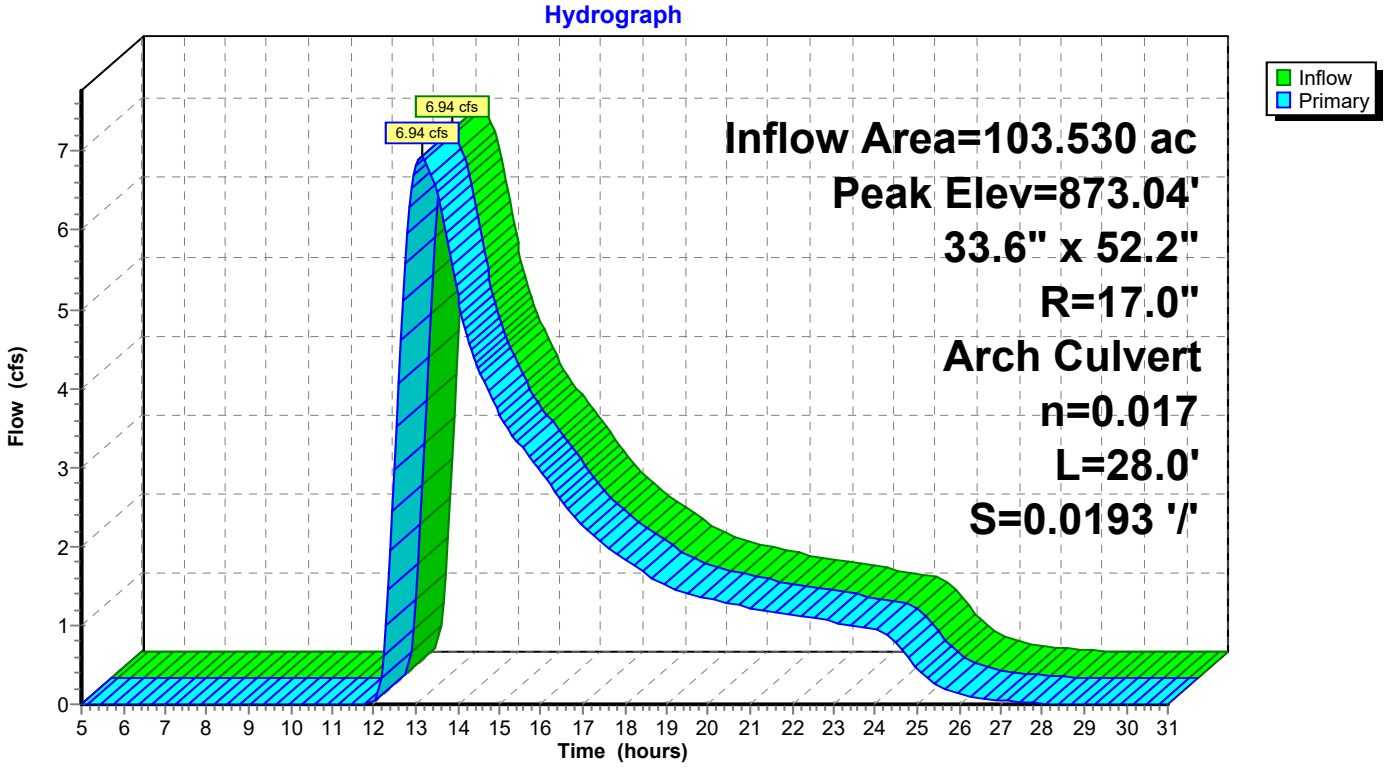
Inflow Area = 103.530 ac, 0.00% Impervious, Inflow Depth = 0.29" for 2 yr event
Inflow = 6.94 cfs @ 13.13 hrs, Volume= 2.513 af
Outflow = 6.94 cfs @ 13.13 hrs, Volume= 2.513 af, Atten= 0%, Lag= 0.0 min
Primary = 6.94 cfs @ 13.13 hrs, Volume= 2.513 af
Routed to Link 1L : Analysis Point

Routing by Stor-Ind method, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Peak Elev= 873.04' @ 13.13 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	872.24'	**33.6" W x 52.2" H, R=17.0" Arch Culvert** L= 28.0' Box, 30-75° wingwalls, square crown, Ke= 0.400 Inlet / Outlet Invert= 872.24' / 871.70' S= 0.0193 '/' Cc= 0.900 n= 0.017, Flow Area= 11.36 sf

Primary OutFlow Max=6.93 cfs @ 13.13 hrs HW=873.04' TW=866.60' (Fixed TW Elev= 866.60')
1=Culvert (Inlet Controls 6.93 cfs @ 3.08 fps)

Pond 2P: Outlet

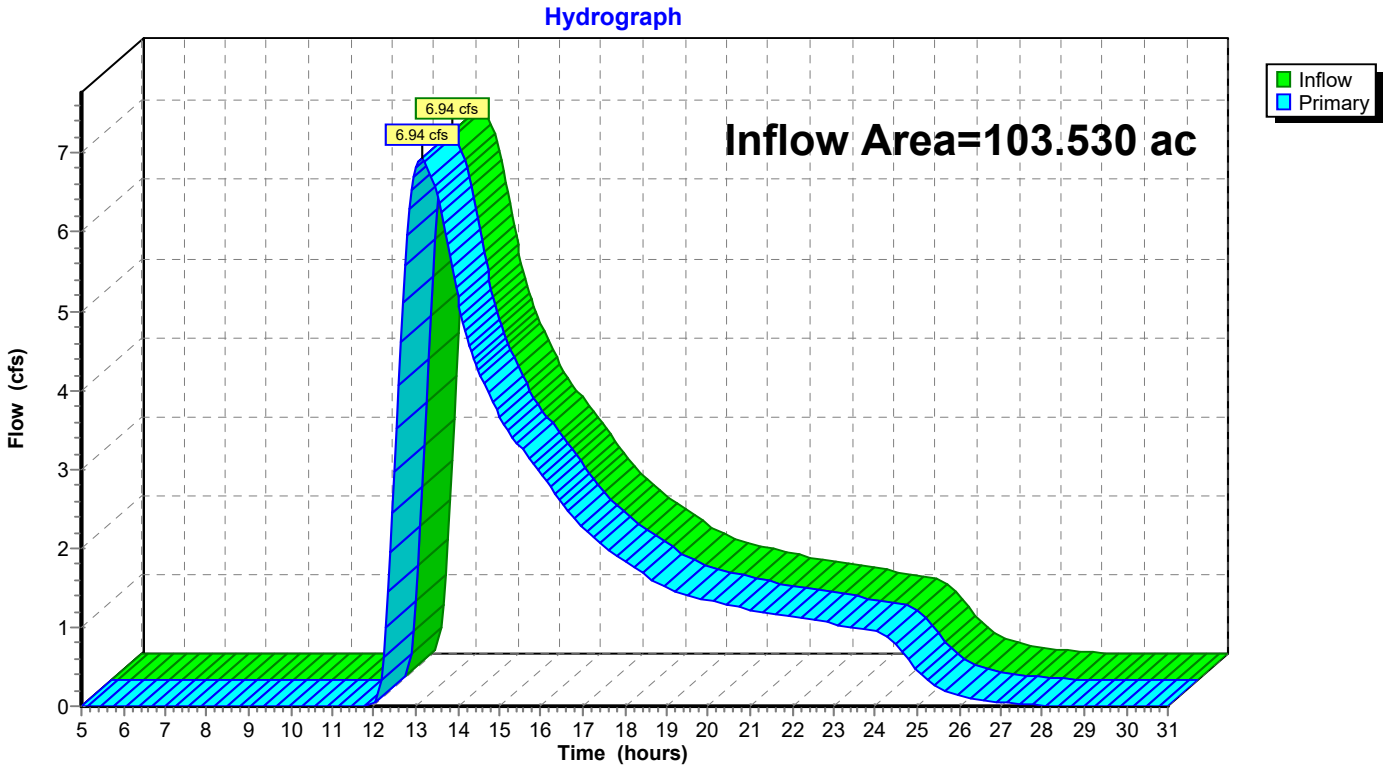


Summary for Link 1L: Analysis Point

Inflow Area = 103.530 ac, 0.00% Impervious, Inflow Depth = 0.29" for 2 yr event
Inflow = 6.94 cfs @ 13.13 hrs, Volume= 2.513 af
Primary = 6.94 cfs @ 13.13 hrs, Volume= 2.513 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs

Link 1L: Analysis Point



Time span=5.00-31.00 hrs, dt=0.05 hrs, 521 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2S: (new Subcat) Runoff Area=16.950 ac 0.00% Impervious Runoff Depth=0.94"
Flow Length=986' Tc=61.7 min CN=64 Runoff=6.28 cfs 1.334 af

Subcatchment5S: (new Subcat) Runoff Area=12.670 ac 0.00% Impervious Runoff Depth=0.84"
Flow Length=1,067' Tc=30.8 min CN=62 Runoff=5.82 cfs 0.885 af

Subcatchment6S: (new Subcat) Runoff Area=21.450 ac 0.00% Impervious Runoff Depth=1.00"
Flow Length=2,600' Tc=50.6 min CN=65 Runoff=9.65 cfs 1.787 af

Subcatchment7S: (new Subcat) Runoff Area=7.000 ac 0.00% Impervious Runoff Depth=1.11"
Flow Length=999' Tc=30.6 min CN=67 Runoff=4.69 cfs 0.650 af

Subcatchment8S: (new Subcat) Runoff Area=25.460 ac 0.00% Impervious Runoff Depth=0.74"
Flow Length=2,098' Tc=39.0 min CN=60 Runoff=8.73 cfs 1.565 af

Subcatchment9S: (new Subcat) Runoff Area=20.000 ac 0.00% Impervious Runoff Depth=0.60"
Flow Length=2,230' Tc=55.2 min CN=57 Runoff=4.13 cfs 0.995 af

Reach 3R: Reach 1 Avg. Flow Depth=0.30' Max Vel=5.34 fps Inflow=19.54 cfs 4.544 af
n=0.050 L=2,055.4' S=0.1708 '/' Capacity=406.60 cfs Outflow=19.33 cfs 4.544 af

Reach 4R: Reach 2 Avg. Flow Depth=0.29' Max Vel=3.52 fps Inflow=10.41 cfs 2.329 af
n=0.050 L=892.0' S=0.0774 '/' Capacity=142.85 cfs Outflow=10.34 cfs 2.329 af

Pond 2P: Outlet Peak Elev=874.58' Inflow=31.81 cfs 7.215 af
33.6" x 52.2", R=17.0" Arch Culvert n=0.017 L=28.0' S=0.0193 '/' Outflow=31.81 cfs 7.215 af

Link 1L: Analysis Point Inflow=31.81 cfs 7.215 af
Primary=31.81 cfs 7.215 af

Total Runoff Area = 103.530 ac Runoff Volume = 7.215 af Average Runoff Depth = 0.84"
100.00% Pervious = 103.530 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 2S: (new Subcat)

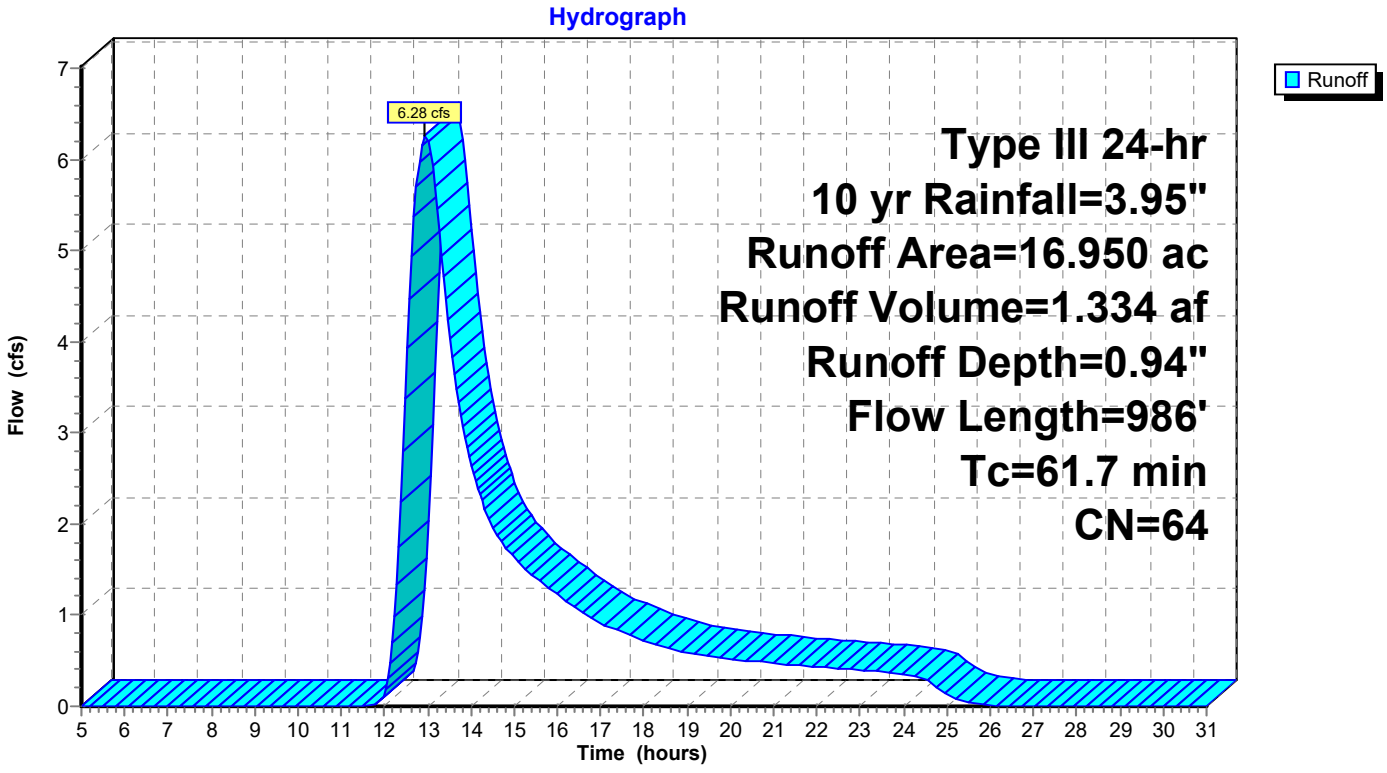
Runoff = 6.28 cfs @ 12.94 hrs, Volume= 1.334 af, Depth= 0.94"
Routed to Reach 4R : Reach 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.95"

	Area (ac)	CN	Description
	9.100	55	Woods, Good, HSG B
*	7.850	75	Woods, Good, HSG D
	16.950	64	Weighted Average
	16.950		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.6	100	0.0200	0.04		**Sheet Flow, First 100'** Woods: Dense underbrush n= 0.800 P2= 2.71"
21.1	886	0.0785	0.70		**Shallow Concentrated Flow, 100' to End** Forest w/Heavy Litter Kv= 2.5 fps
61.7	986	Total			

Subcatchment 2S: (new Subcat)



Summary for Subcatchment 5S: (new Subcat)

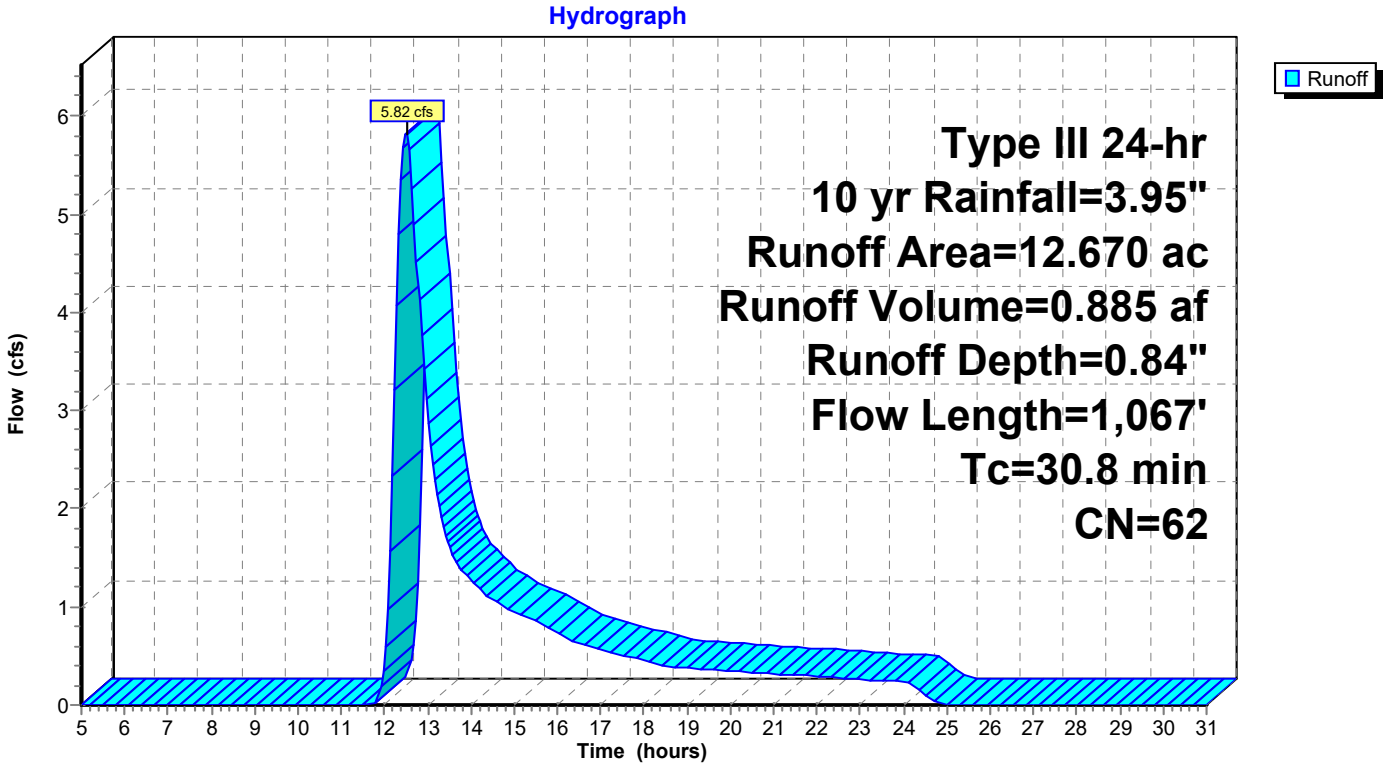
Runoff = 5.82 cfs @ 12.51 hrs, Volume= 0.885 af, Depth= 0.84"
Routed to Pond 2P : Outlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.95"

Area (ac)	CN	Description
0.010	91	Gravel roads, HSG D
0.400	77	Woods, Good, HSG D
6.560	55	Woods, Good, HSG B
5.700	70	Woods, Good, HSG C
12.670	62	Weighted Average
12.670		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.1	100	0.1750	0.10		**Sheet Flow, First 100'** Woods: Dense underbrush n= 0.800 P2= 2.71"
13.6	693	0.1150	0.85		**Shallow Concentrated Flow, 100' to Pt 5A** Forest w/Heavy Litter Kv= 2.5 fps
0.1	274	0.3500	74.73	24,360.52	**Channel Flow, Pt 5A to End** Area= 326.0 sf Perim= 52.0' r= 6.27' n= 0.040
30.8	1,067	Total			

Subcatchment 5S: (new Subcat)



Summary for Subcatchment 6S: (new Subcat)

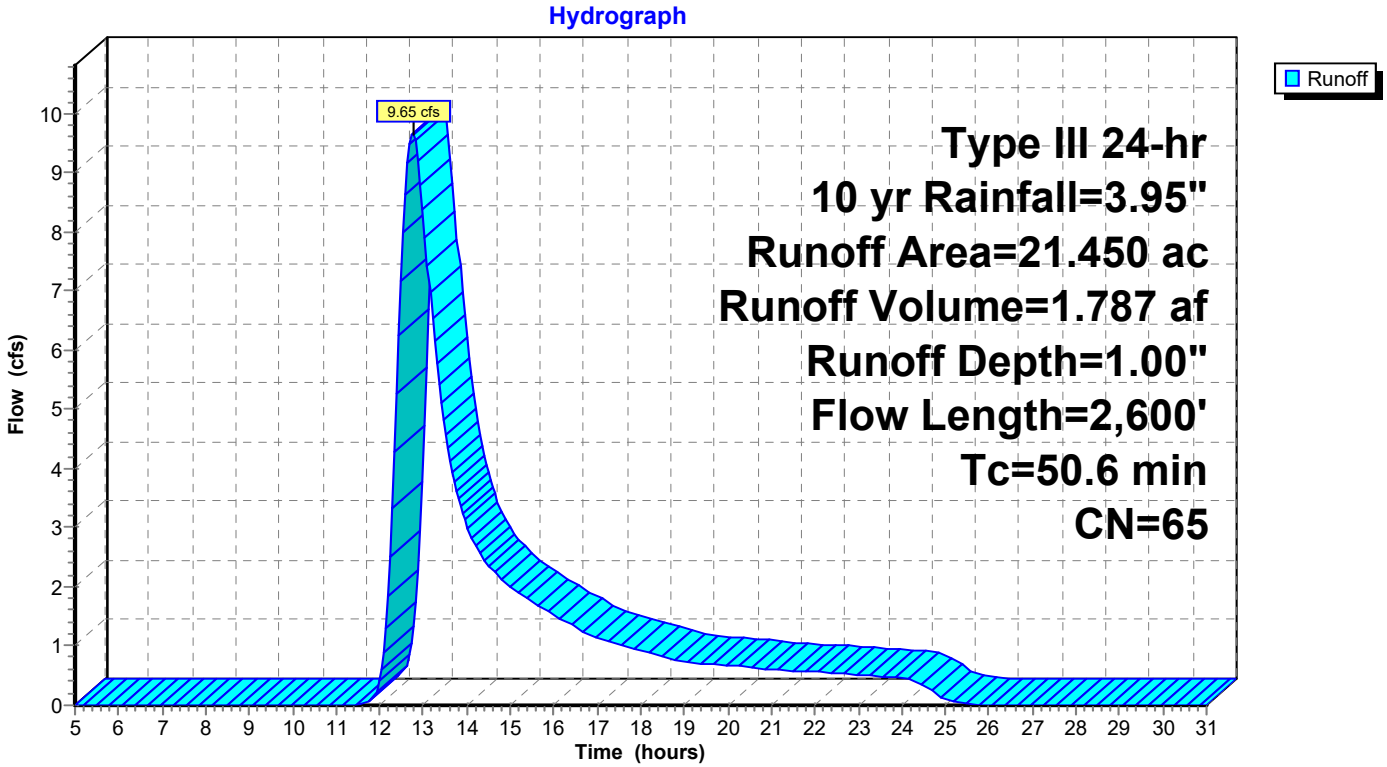
Runoff = 9.65 cfs @ 12.77 hrs, Volume= 1.787 af, Depth= 1.00"
Routed to Pond 2P : Outlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.95"

Area (ac)	CN	Description
0.010	91	Gravel roads, HSG D
4.300	77	Woods, Good, HSG D
9.070	55	Woods, Good, HSG B
8.070	70	Woods, Good, HSG C
21.450	65	Weighted Average
21.450		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4	100	0.3900	0.13		**Sheet Flow, First 100'** Woods: Dense underbrush n= 0.800 P2= 2.71"
38.2	2,500	0.1904	1.09		**Shallow Concentrated Flow, 100' to End** Forest w/Heavy Litter Kv= 2.5 fps
50.6	2,600	Total			

Subcatchment 6S: (new Subcat)



Summary for Subcatchment 7S: (new Subcat)

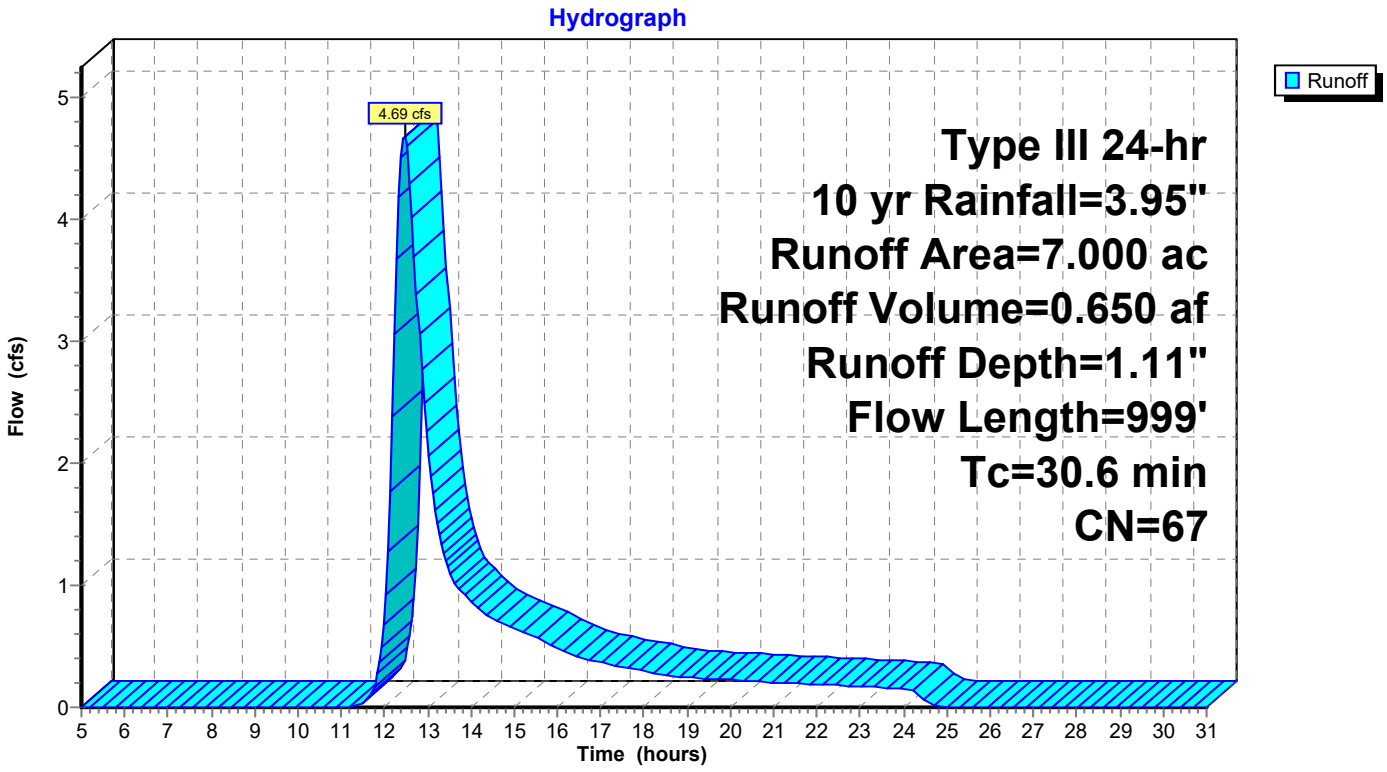
Runoff = 4.69 cfs @ 12.48 hrs, Volume= 0.650 af, Depth= 1.11"
Routed to Reach 3R : Reach 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.95"

Area (ac)	CN	Description
2.800	70	Woods, Good, HSG C
2.180	55	Woods, Good, HSG B
2.020	77	Woods, Good, HSG D
7.000	67	Weighted Average
7.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.2	100	0.2350	0.11		**Sheet Flow, First 100'** Woods: Dense underbrush n= 0.800 P2= 2.71"
15.4	899	0.1510	0.97		**Shallow Concentrated Flow, 100' to Pt A7** Forest w/Heavy Litter Kv= 2.5 fps
30.6	999	Total			

Subcatchment 7S: (new Subcat)



Summary for Subcatchment 8S: (new Subcat)

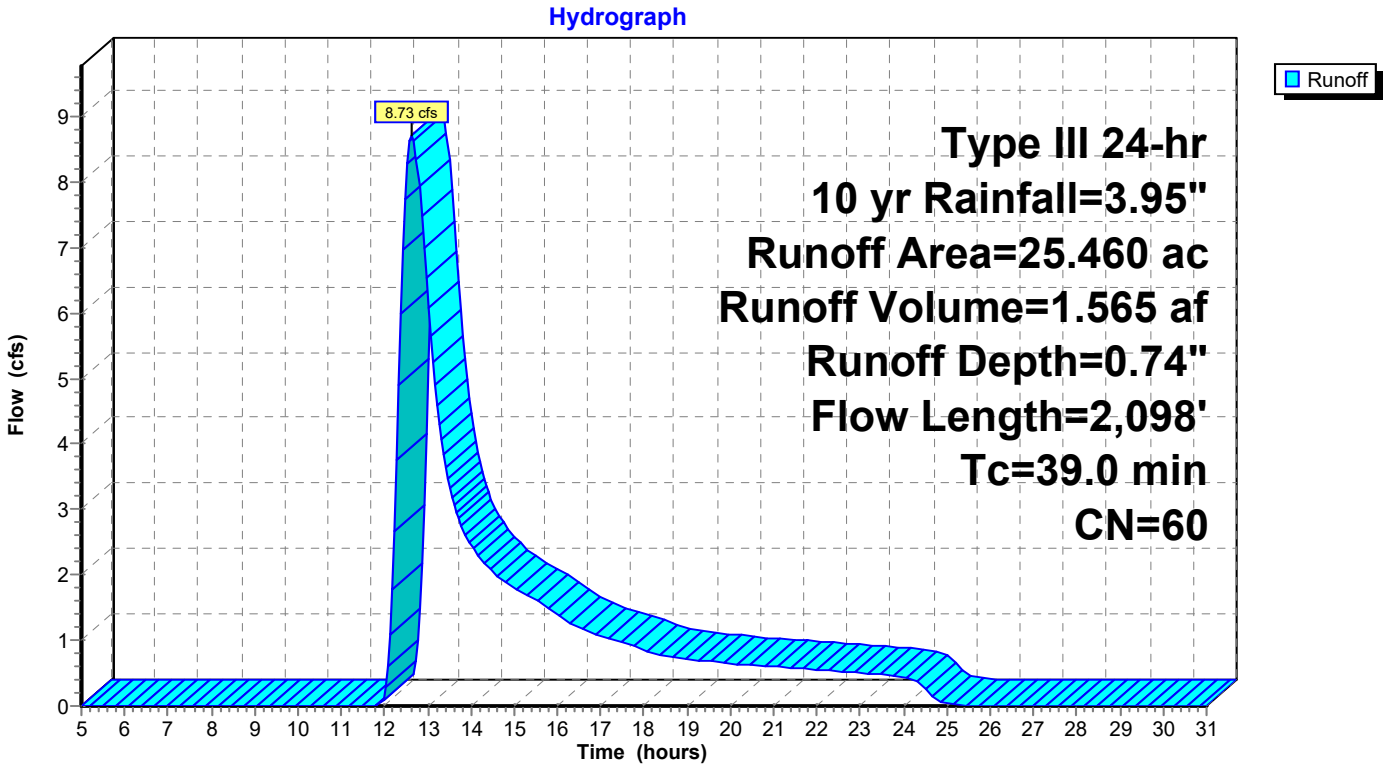
Runoff = 8.73 cfs @ 12.65 hrs, Volume= 1.565 af, Depth= 0.74"
Routed to Reach 3R : Reach 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.95"

Area (ac)	CN	Description
0.860	70	Woods, Good, HSG C
19.190	55	Woods, Good, HSG B
5.410	77	Woods, Good, HSG D
25.460	60	Weighted Average
25.460		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.8	100	0.0950	0.08		**Sheet Flow, first 100'** Woods: Dense underbrush n= 0.800 P2= 2.71"
3.6	293	0.2920	1.35		**Shallow Concentrated Flow, 100' to Pt 8A** Forest w/Heavy Litter Kv= 2.5 fps
13.3	982	0.2440	1.23		**Shallow Concentrated Flow, Pt 8A to Pt 8B** Forest w/Heavy Litter Kv= 2.5 fps
0.3	723	0.1410	47.43	15,461.87	**Channel Flow, Pt 8B to End** Area= 326.0 sf Perim= 52.0' r= 6.27' n= 0.040
39.0	2,098	Total			

Subcatchment 8S: (new Subcat)



Summary for Subcatchment 9S: (new Subcat)

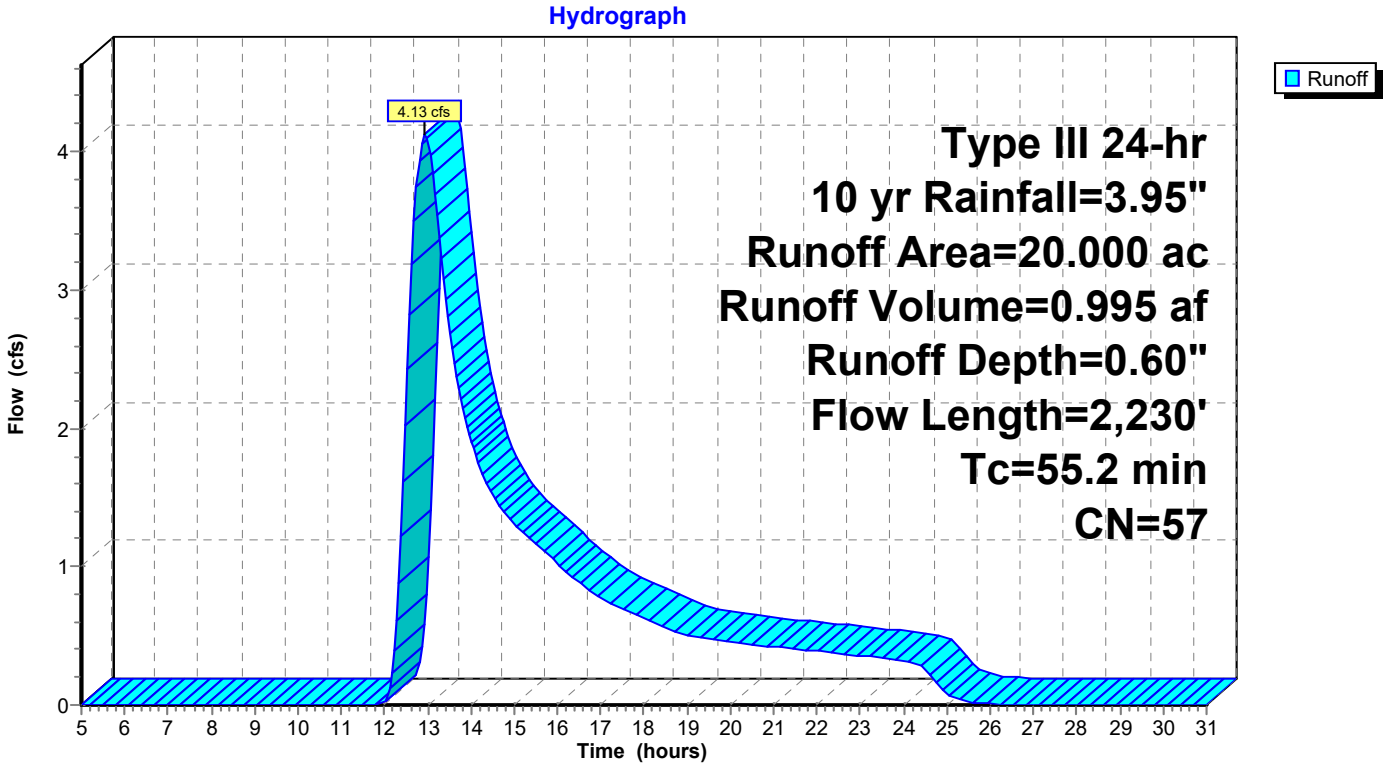
Runoff = 4.13 cfs @ 12.93 hrs, Volume= 0.995 af, Depth= 0.60"
Routed to Reach 4R : Reach 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 yr Rainfall=3.95"

Area (ac)	CN	Description
18.450	55	Woods, Good, HSG B
1.550	77	Woods, Good, HSG D
20.000	57	Weighted Average
20.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.2	100	0.1300	0.09		**Sheet Flow, first 100'** Woods: Dense underbrush n= 0.800 P2= 2.71"
8.0	677	0.3200	1.41		**Shallow Concentrated Flow, 100' to Pt 9A** Forest w/Heavy Litter Kv= 2.5 fps
9.8	589	0.1600	1.00		**Shallow Concentrated Flow, Pt 9A to Pt 9B** Forest w/Heavy Litter Kv= 2.5 fps
18.2	864	0.1000	0.79		**Shallow Concentrated Flow, Pt 9B to End** Forest w/Heavy Litter Kv= 2.5 fps
55.2	2,230	Total			

Subcatchment 9S: (new Subcat)



Summary for Reach 3R: Reach 1

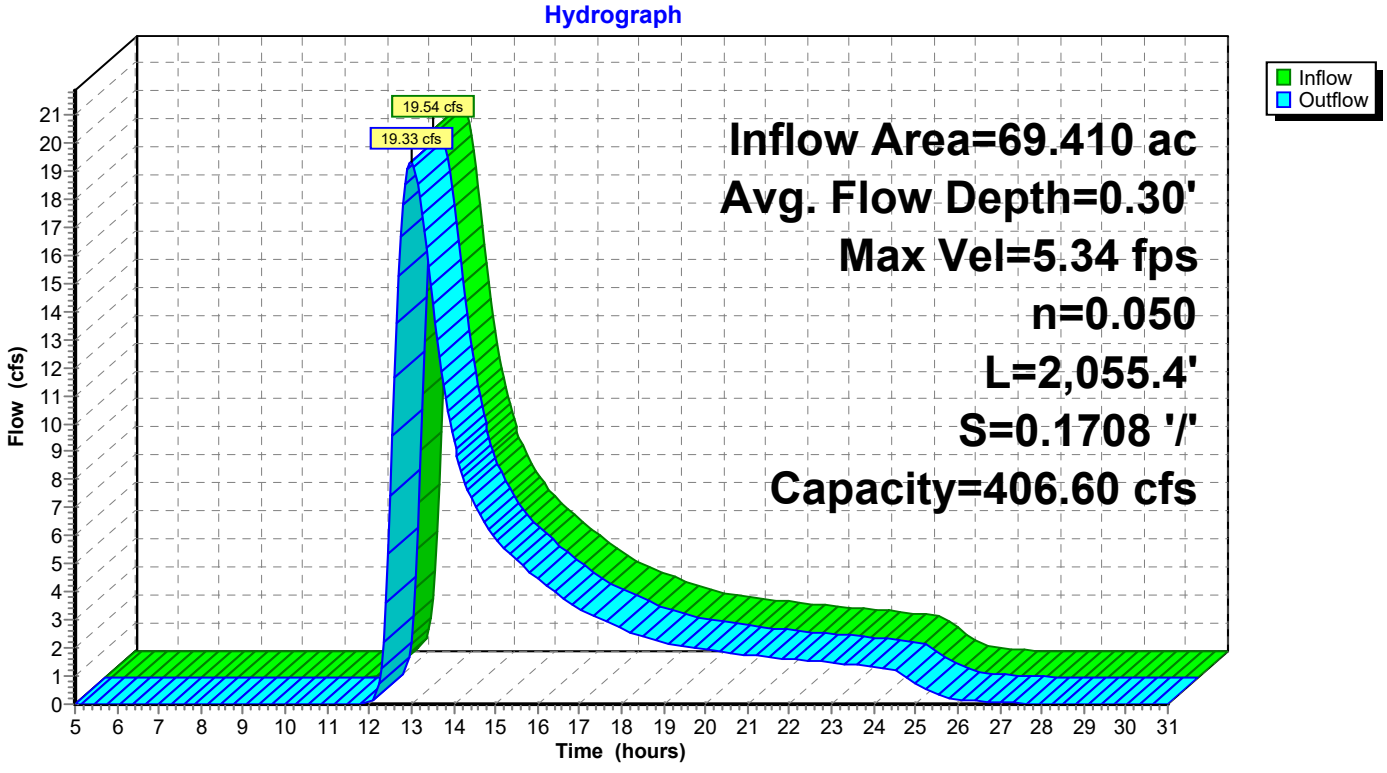
[62] Hint: Exceeded Reach 4R OUTLET depth by 0.06' @ 12.45 hrs

Inflow Area = 69.410 ac, 0.00% Impervious, Inflow Depth = 0.79" for 10 yr event
Inflow = 19.54 cfs @ 12.80 hrs, Volume= 4.544 af
Outflow = 19.33 cfs @ 12.98 hrs, Volume= 4.544 af, Atten= 1%, Lag= 11.1 min
Routed to Pond 2P : Outlet

Routing by Stor-Ind+Trans method, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.34 fps, Min. Travel Time= 6.4 min
Avg. Velocity = 2.07 fps, Avg. Travel Time= 16.5 min

Peak Storage= 7,440 cf @ 12.88 hrs
Average Depth at Peak Storage= 0.30' , Surface Width= 12.12'
Bank-Full Depth= 2.00' Flow Area= 24.8 sf, Capacity= 406.60 cfs

12.00' x 2.00' deep channel, n= 0.050 Mountain streams w/large boulders
Side Slope Z-value= 0.2 '/' Top Width= 12.80'
Length= 2,055.4' Slope= 0.1708 '/'
Inlet Invert= 1,231.00', Outlet Invert= 880.00'



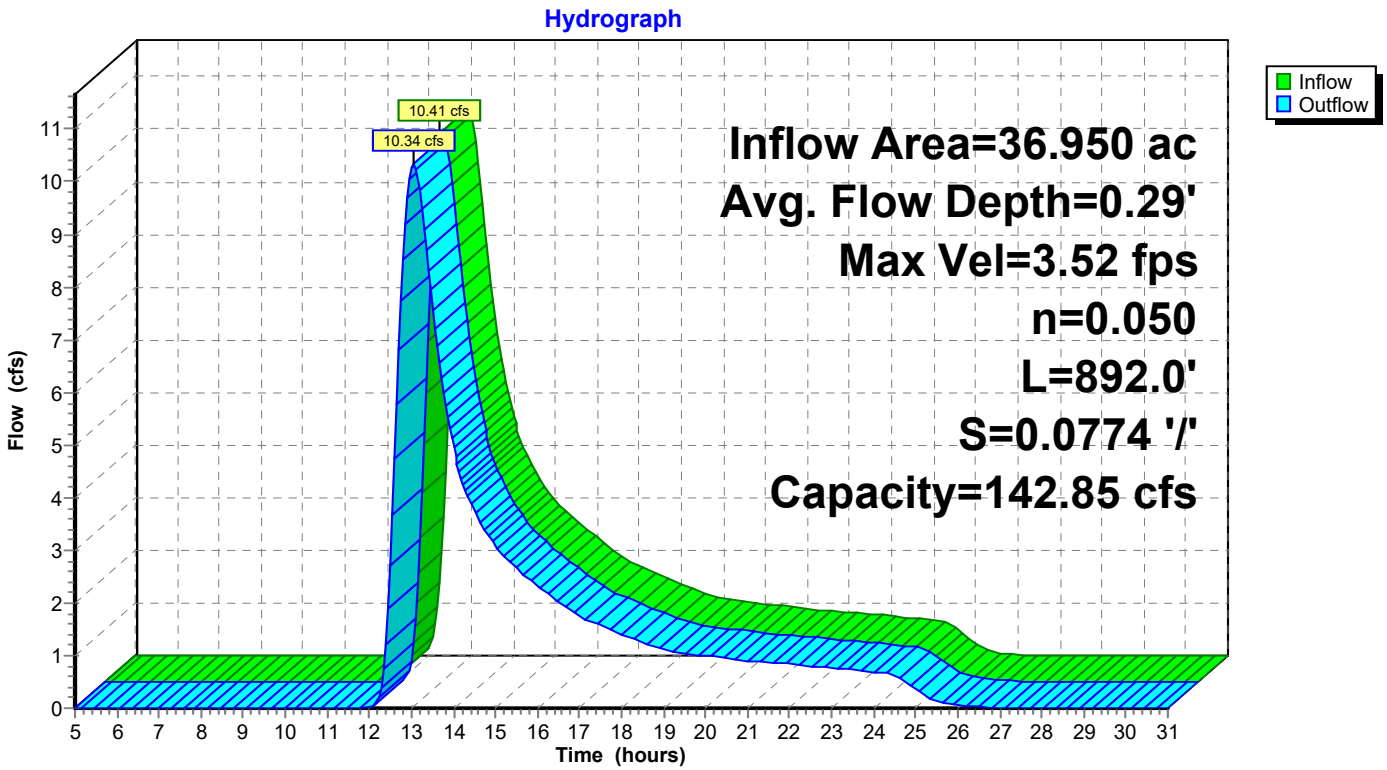
Summary for Reach 4R: Reach 2

Inflow Area = 36.950 ac, 0.00% Impervious, Inflow Depth = 0.76" for 10 yr event
Inflow = 10.41 cfs @ 12.94 hrs, Volume= 2.329 af
Outflow = 10.34 cfs @ 13.05 hrs, Volume= 2.329 af, Atten= 1%, Lag= 6.8 min
Routed to Reach 3R : Reach 1

Routing by Stor-Ind+Trans method, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.52 fps, Min. Travel Time= 4.2 min
Avg. Velocity = 1.40 fps, Avg. Travel Time= 10.6 min

Peak Storage= 2,624 cf @ 12.98 hrs
Average Depth at Peak Storage= 0.29' , Surface Width= 10.12'
Bank-Full Depth= 1.50' Flow Area= 15.4 sf, Capacity= 142.85 cfs

10.00' x 1.50' deep channel, n= 0.050 Mountain streams w/large boulders
Side Slope Z-value= 0.2 '/' Top Width= 10.60'
Length= 892.0' Slope= 0.0774 '/'
Inlet Invert= 1,300.00', Outlet Invert= 1,231.00'



Summary for Pond 2P: Outlet

[57] Hint: Peaked at 874.58' (Flood elevation advised)

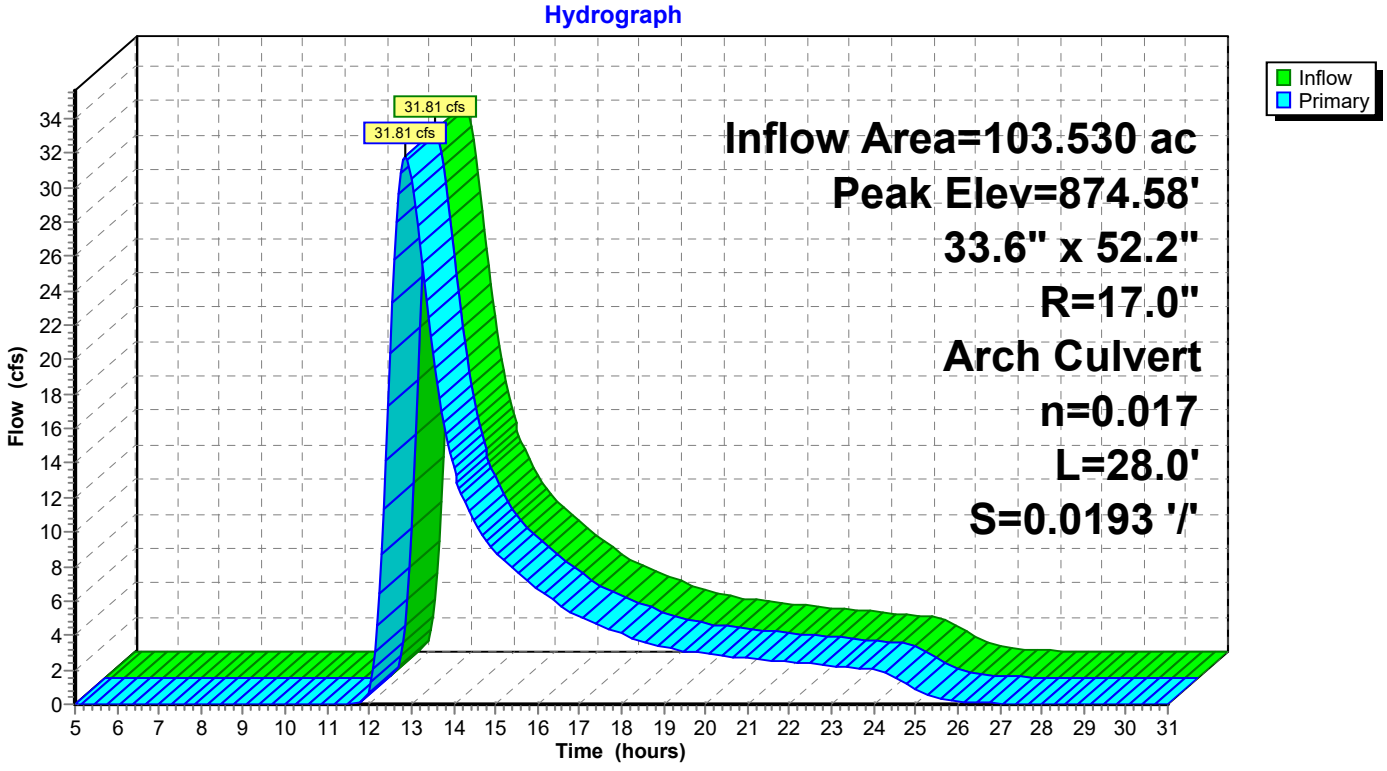
Inflow Area = 103.530 ac, 0.00% Impervious, Inflow Depth = 0.84" for 10 yr event
Inflow = 31.81 cfs @ 12.86 hrs, Volume= 7.215 af
Outflow = 31.81 cfs @ 12.86 hrs, Volume= 7.215 af, Atten= 0%, Lag= 0.0 min
Primary = 31.81 cfs @ 12.86 hrs, Volume= 7.215 af
Routed to Link 1L : Analysis Point

Routing by Stor-Ind method, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Peak Elev= 874.58' @ 12.86 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	872.24'	**33.6" W x 52.2" H, R=17.0" Arch Culvert** L= 28.0' Box, 30-75° wingwalls, square crown, Ke= 0.400 Inlet / Outlet Invert= 872.24' / 871.70' S= 0.0193 '/' Cc= 0.900 n= 0.017, Flow Area= 11.36 sf

Primary OutFlow Max=31.78 cfs @ 12.86 hrs HW=874.58' TW=866.60' (Fixed TW Elev= 866.60')
1=Culvert (Barrel Controls 31.78 cfs @ 6.47 fps)

Pond 2P: Outlet

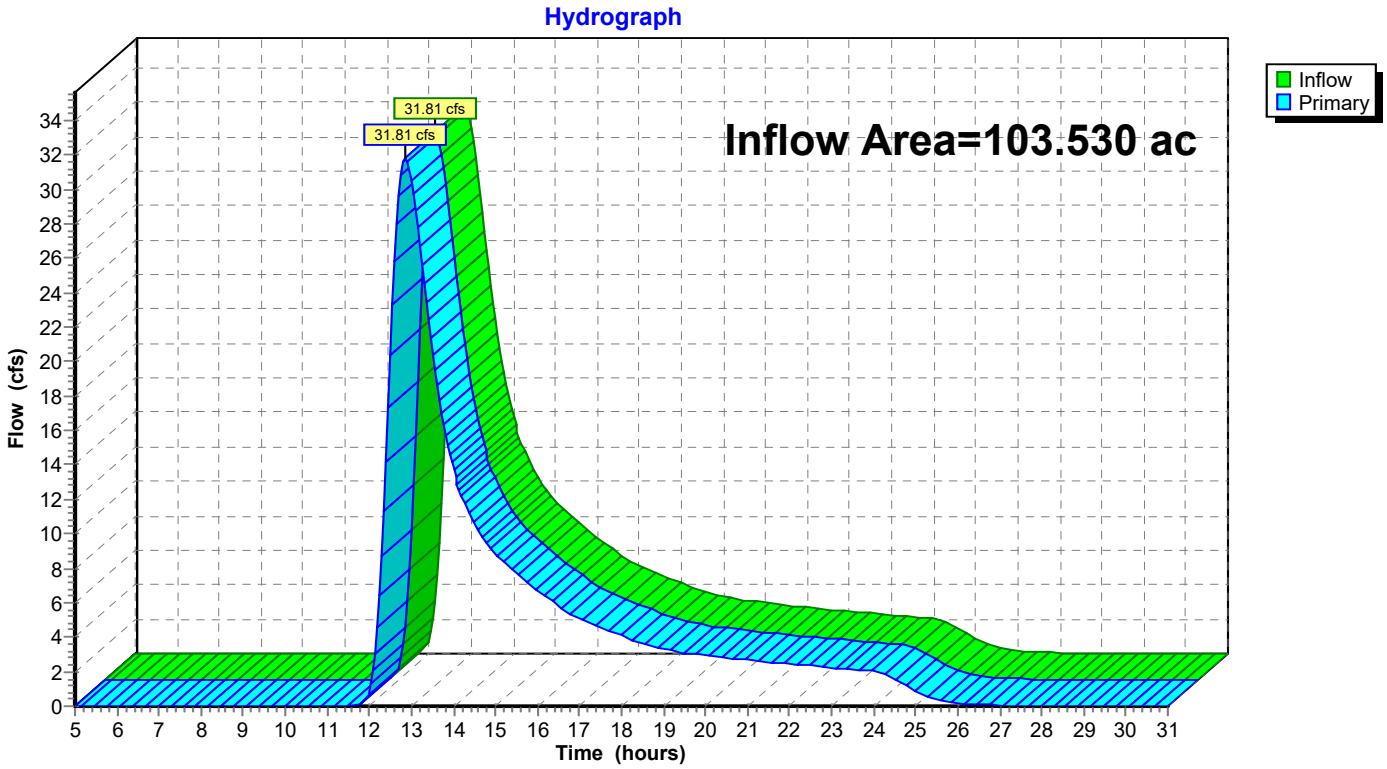


Summary for Link 1L: Analysis Point

Inflow Area = 103.530 ac, 0.00% Impervious, Inflow Depth = 0.84" for 10 yr event
Inflow = 31.81 cfs @ 12.86 hrs, Volume= 7.215 af
Primary = 31.81 cfs @ 12.86 hrs, Volume= 7.215 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs

Link 1L: Analysis Point



Time span=5.00-31.00 hrs, dt=0.05 hrs, 521 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2S: (new Subcat) Runoff Area=16.950 ac 0.00% Impervious Runoff Depth=2.09"
Flow Length=986' Tc=61.7 min CN=64 Runoff=15.41 cfs 2.958 af

Subcatchment5S: (new Subcat) Runoff Area=12.670 ac 0.00% Impervious Runoff Depth=1.93"
Flow Length=1,067' Tc=30.8 min CN=62 Runoff=15.19 cfs 2.036 af

Subcatchment6S: (new Subcat) Runoff Area=21.450 ac 0.00% Impervious Runoff Depth=2.18"
Flow Length=2,600' Tc=50.6 min CN=65 Runoff=22.99 cfs 3.894 af

Subcatchment7S: (new Subcat) Runoff Area=7.000 ac 0.00% Impervious Runoff Depth=2.35"
Flow Length=999' Tc=30.6 min CN=67 Runoff=10.57 cfs 1.371 af

Subcatchment8S: (new Subcat) Runoff Area=25.460 ac 0.00% Impervious Runoff Depth=1.77"
Flow Length=2,098' Tc=39.0 min CN=60 Runoff=24.54 cfs 3.748 af

Subcatchment9S: (new Subcat) Runoff Area=20.000 ac 0.00% Impervious Runoff Depth=1.53"
Flow Length=2,230' Tc=55.2 min CN=57 Runoff=13.28 cfs 2.554 af

Reach 3R: Reach 1 Avg. Flow Depth=0.57' Max Vel=7.98 fps Inflow=55.27 cfs 10.630 af
n=0.050 L=2,055.4' S=0.1708 '/' Capacity=406.60 cfs Outflow=54.85 cfs 10.630 af

Reach 4R: Reach 2 Avg. Flow Depth=0.55' Max Vel=5.18 fps Inflow=28.66 cfs 5.511 af
n=0.050 L=892.0' S=0.0774 '/' Capacity=142.85 cfs Outflow=28.58 cfs 5.511 af

Pond 2P: Outlet Peak Elev=877.26' Inflow=87.60 cfs 16.560 af
33.6" x 52.2", R=17.0" Arch Culvert n=0.017 L=28.0' S=0.0193 '/' Outflow=87.60 cfs 16.560 af

Link 1L: Analysis Point Inflow=87.60 cfs 16.560 af
Primary=87.60 cfs 16.560 af

Total Runoff Area = 103.530 ac Runoff Volume = 16.560 af Average Runoff Depth = 1.92"
100.00% Pervious = 103.530 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 2S: (new Subcat)

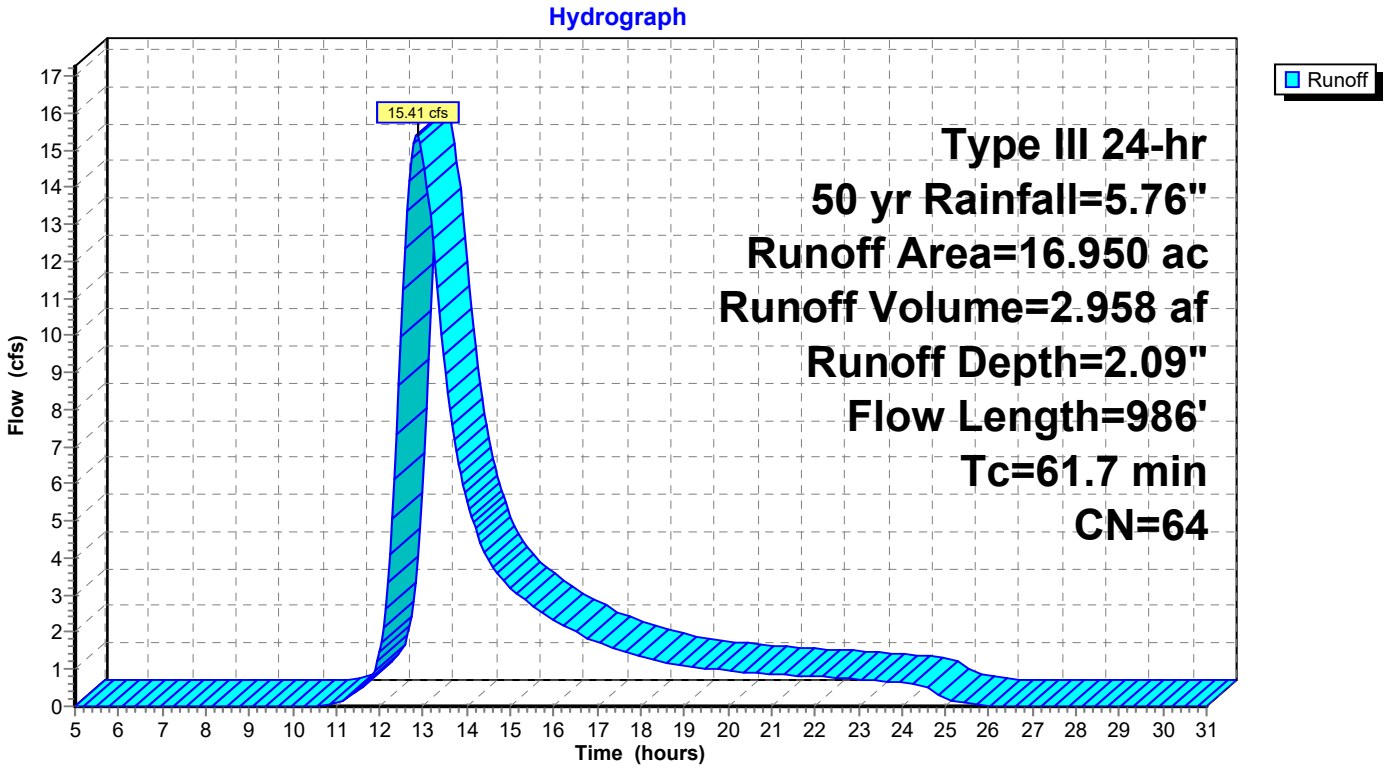
Runoff = 15.41 cfs @ 12.88 hrs, Volume= 2.958 af, Depth= 2.09"
Routed to Reach 4R : Reach 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 yr Rainfall=5.76"

	Area (ac)	CN	Description
	9.100	55	Woods, Good, HSG B
*	7.850	75	Woods, Good, HSG D
	16.950	64	Weighted Average
	16.950		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.6	100	0.0200	0.04		**Sheet Flow, First 100'** Woods: Dense underbrush n= 0.800 P2= 2.71"
21.1	886	0.0785	0.70		**Shallow Concentrated Flow, 100' to End** Forest w/Heavy Litter Kv= 2.5 fps
61.7	986	Total			

Subcatchment 2S: (new Subcat)



Summary for Subcatchment 5S: (new Subcat)

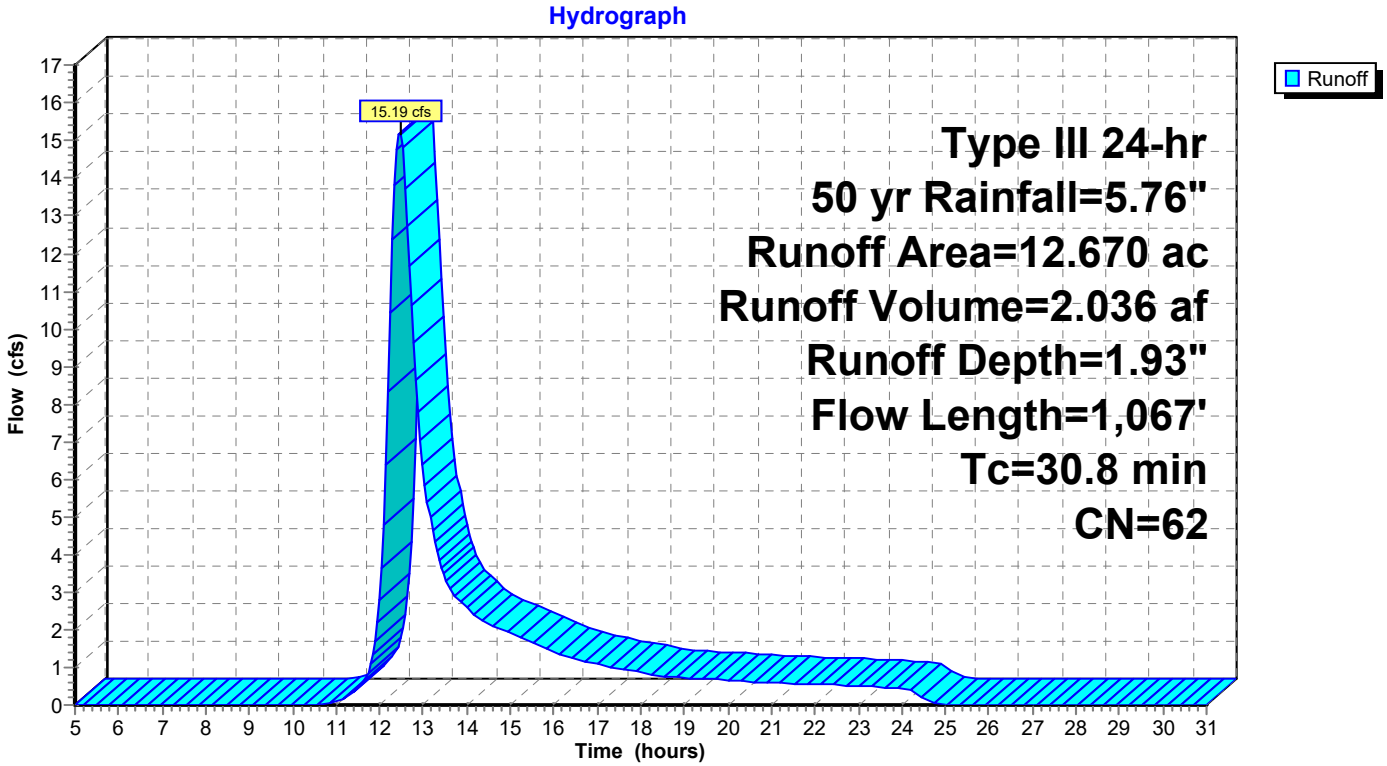
Runoff = 15.19 cfs @ 12.47 hrs, Volume= 2.036 af, Depth= 1.93"
Routed to Pond 2P : Outlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 yr Rainfall=5.76"

Area (ac)	CN	Description
0.010	91	Gravel roads, HSG D
0.400	77	Woods, Good, HSG D
6.560	55	Woods, Good, HSG B
5.700	70	Woods, Good, HSG C
12.670	62	Weighted Average
12.670		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.1	100	0.1750	0.10		**Sheet Flow, First 100'** Woods: Dense underbrush n= 0.800 P2= 2.71"
13.6	693	0.1150	0.85		**Shallow Concentrated Flow, 100' to Pt 5A** Forest w/Heavy Litter Kv= 2.5 fps
0.1	274	0.3500	74.73	24,360.52	**Channel Flow, Pt 5A to End** Area= 326.0 sf Perim= 52.0' r= 6.27' n= 0.040
30.8	1,067	Total			

Subcatchment 5S: (new Subcat)



Summary for Subcatchment 6S: (new Subcat)

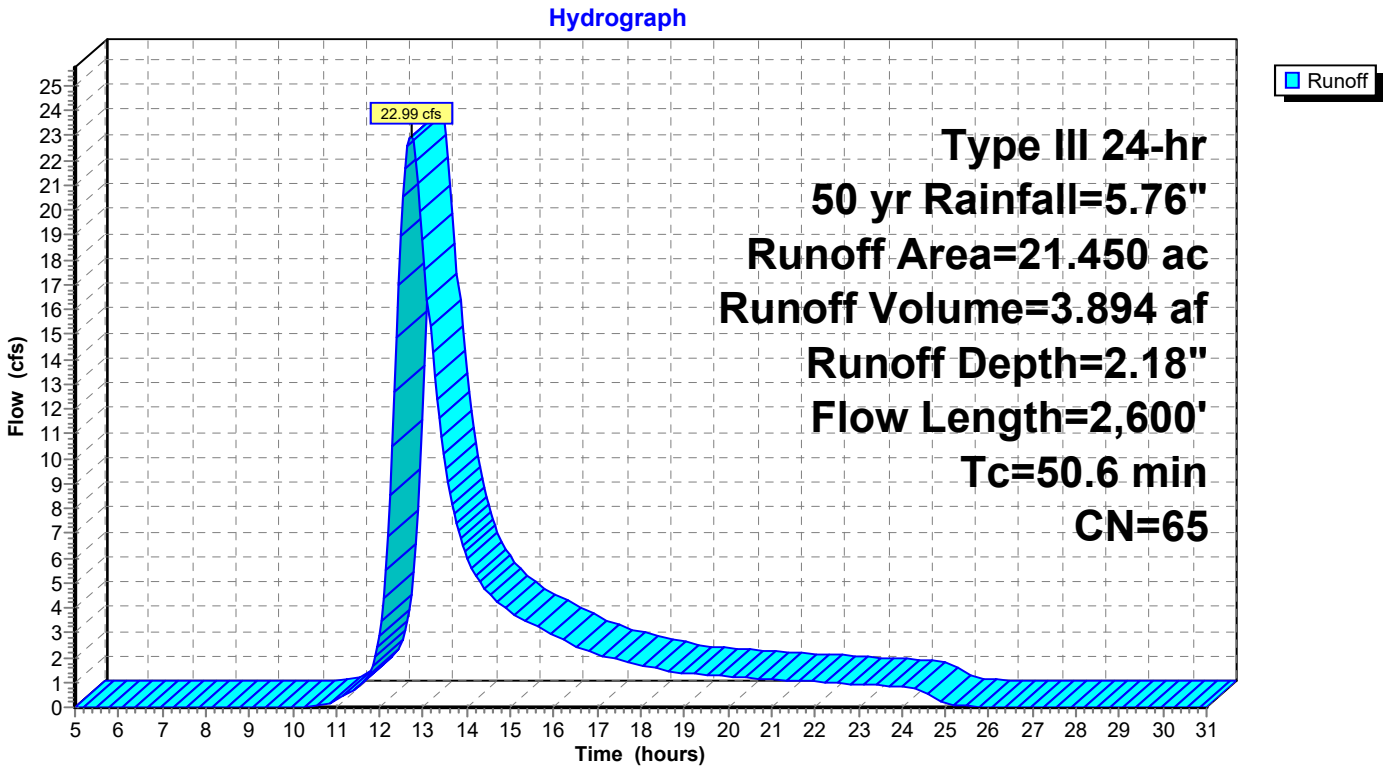
Runoff = 22.99 cfs @ 12.73 hrs, Volume= 3.894 af, Depth= 2.18"
Routed to Pond 2P : Outlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 yr Rainfall=5.76"

Area (ac)	CN	Description
0.010	91	Gravel roads, HSG D
4.300	77	Woods, Good, HSG D
9.070	55	Woods, Good, HSG B
8.070	70	Woods, Good, HSG C
21.450	65	Weighted Average
21.450		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4	100	0.3900	0.13		**Sheet Flow, First 100'** Woods: Dense underbrush n= 0.800 P2= 2.71"
38.2	2,500	0.1904	1.09		**Shallow Concentrated Flow, 100' to End** Forest w/Heavy Litter Kv= 2.5 fps
50.6	2,600	Total			

Subcatchment 6S: (new Subcat)



Summary for Subcatchment 7S: (new Subcat)

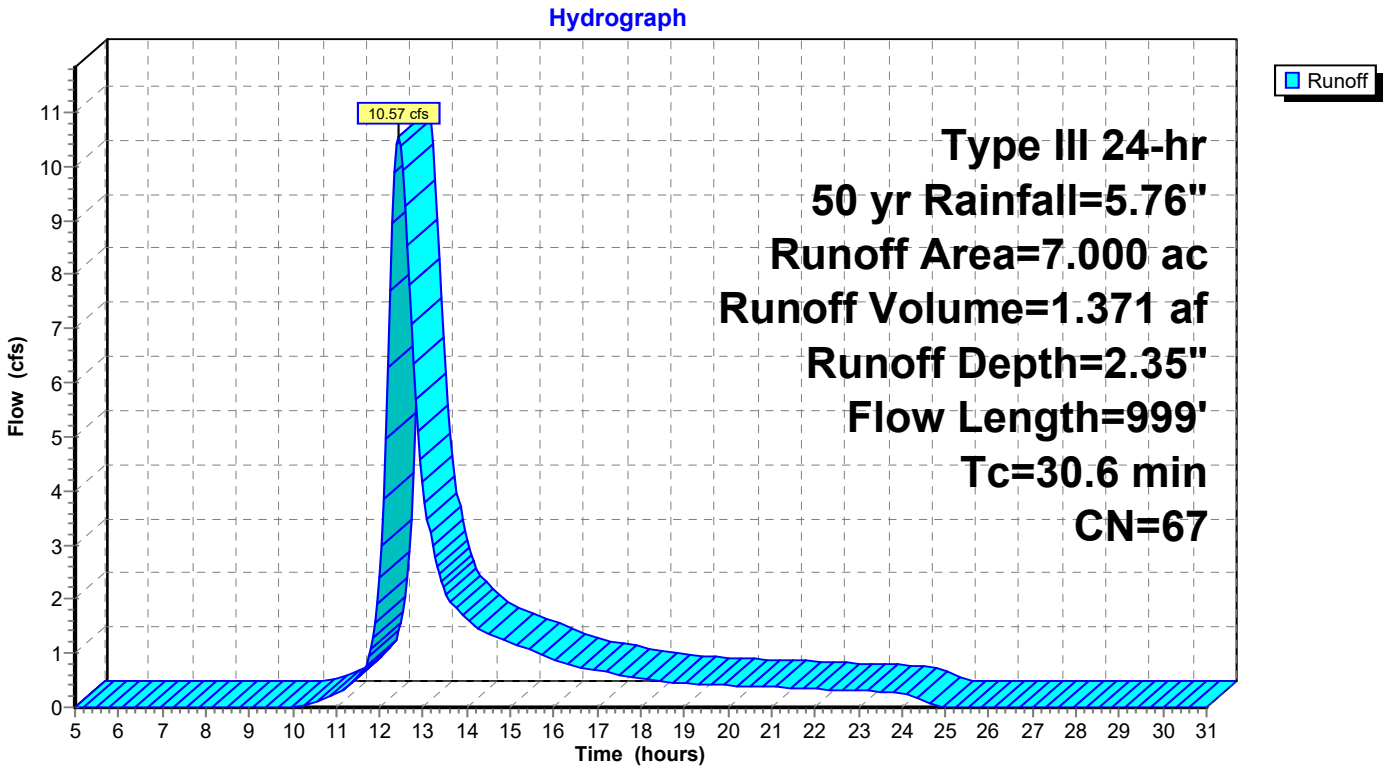
Runoff = 10.57 cfs @ 12.45 hrs, Volume= 1.371 af, Depth= 2.35"
Routed to Reach 3R : Reach 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 yr Rainfall=5.76"

Area (ac)	CN	Description
2.800	70	Woods, Good, HSG C
2.180	55	Woods, Good, HSG B
2.020	77	Woods, Good, HSG D
7.000	67	Weighted Average
7.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.2	100	0.2350	0.11		**Sheet Flow, First 100'** Woods: Dense underbrush n= 0.800 P2= 2.71"
15.4	899	0.1510	0.97		**Shallow Concentrated Flow, 100' to Pt A7** Forest w/Heavy Litter Kv= 2.5 fps
30.6	999	Total			

Subcatchment 7S: (new Subcat)



Summary for Subcatchment 8S: (new Subcat)

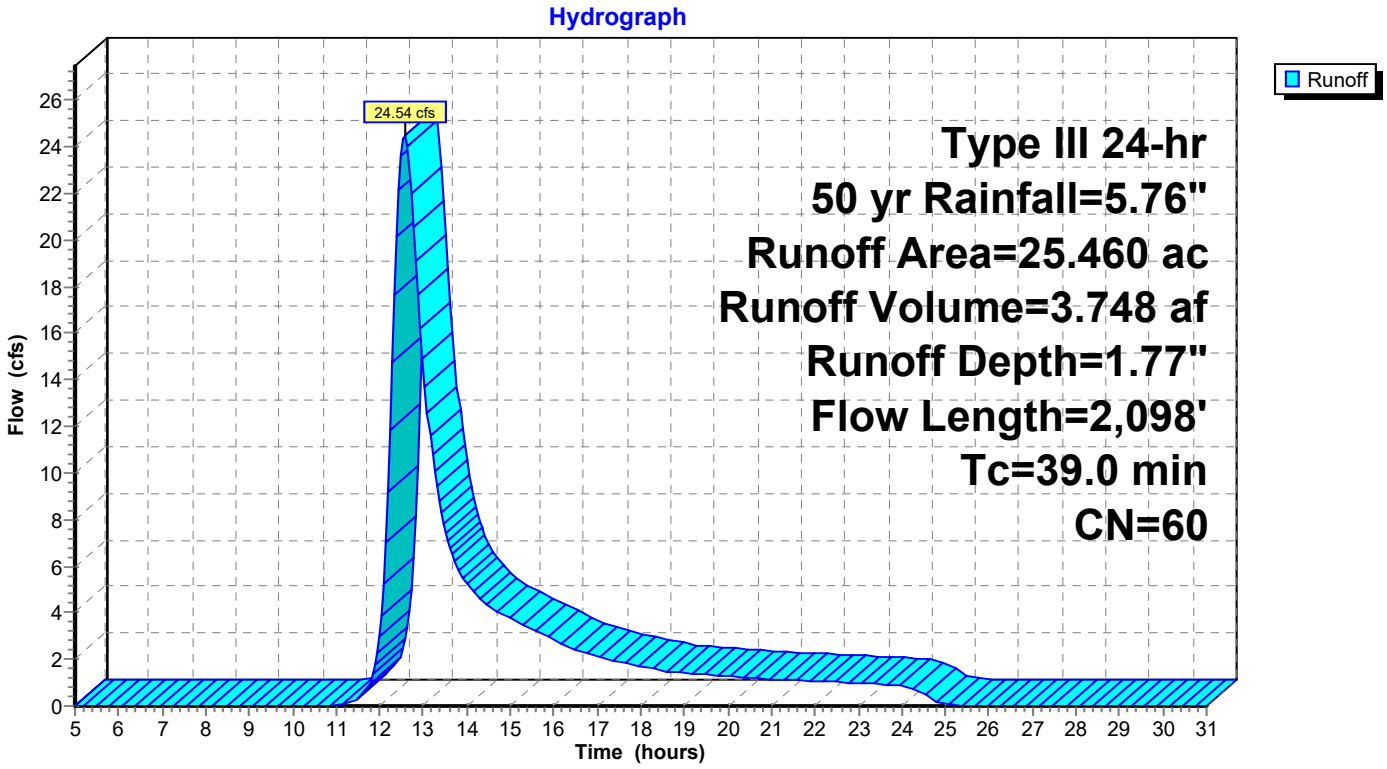
Runoff = 24.54 cfs @ 12.59 hrs, Volume= 3.748 af, Depth= 1.77"
Routed to Reach 3R : Reach 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 yr Rainfall=5.76"

Area (ac)	CN	Description
0.860	70	Woods, Good, HSG C
19.190	55	Woods, Good, HSG B
5.410	77	Woods, Good, HSG D
25.460	60	Weighted Average
25.460		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.8	100	0.0950	0.08		**Sheet Flow, first 100'** Woods: Dense underbrush n= 0.800 P2= 2.71"
3.6	293	0.2920	1.35		**Shallow Concentrated Flow, 100' to Pt 8A** Forest w/Heavy Litter Kv= 2.5 fps
13.3	982	0.2440	1.23		**Shallow Concentrated Flow, Pt 8A to Pt 8B** Forest w/Heavy Litter Kv= 2.5 fps
0.3	723	0.1410	47.43	15,461.87	**Channel Flow, Pt 8B to End** Area= 326.0 sf Perim= 52.0' r= 6.27' n= 0.040
39.0	2,098	Total			

Subcatchment 8S: (new Subcat)



Summary for Subcatchment 9S: (new Subcat)

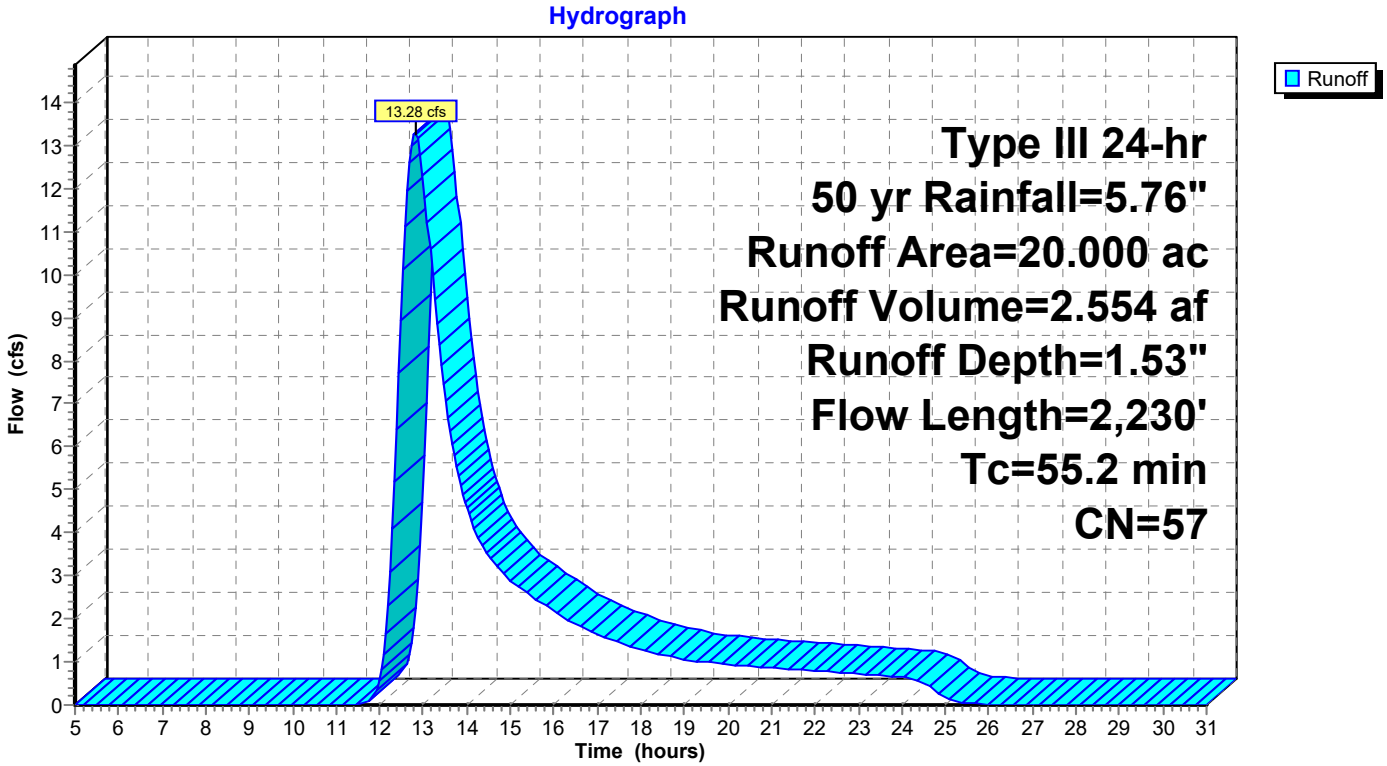
Runoff = 13.28 cfs @ 12.83 hrs, Volume= 2.554 af, Depth= 1.53"
Routed to Reach 4R : Reach 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Type III 24-hr 50 yr Rainfall=5.76"

Area (ac)	CN	Description
18.450	55	Woods, Good, HSG B
1.550	77	Woods, Good, HSG D
20.000	57	Weighted Average
20.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.2	100	0.1300	0.09		**Sheet Flow, first 100'** Woods: Dense underbrush n= 0.800 P2= 2.71"
8.0	677	0.3200	1.41		**Shallow Concentrated Flow, 100' to Pt 9A** Forest w/Heavy Litter Kv= 2.5 fps
9.8	589	0.1600	1.00		**Shallow Concentrated Flow, Pt 9A to Pt 9B** Forest w/Heavy Litter Kv= 2.5 fps
18.2	864	0.1000	0.79		**Shallow Concentrated Flow, Pt 9B to End** Forest w/Heavy Litter Kv= 2.5 fps
55.2	2,230	Total			

Subcatchment 9S: (new Subcat)



Summary for Reach 3R: Reach 1

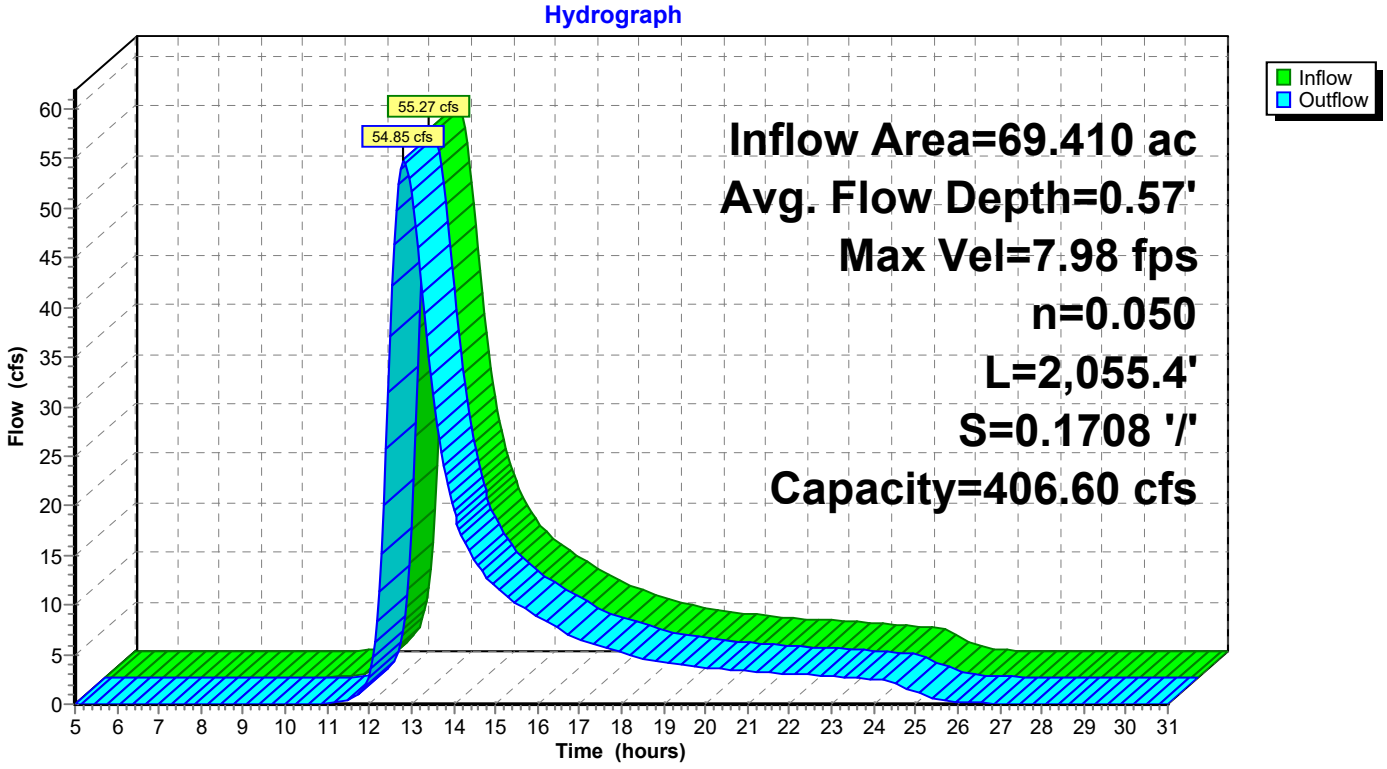
[62] Hint: Exceeded Reach 4R OUTLET depth by 0.11' @ 12.40 hrs

Inflow Area = 69.410 ac, 0.00% Impervious, Inflow Depth = 1.84" for 50 yr event
Inflow = 55.27 cfs @ 12.71 hrs, Volume= 10.630 af
Outflow = 54.85 cfs @ 12.83 hrs, Volume= 10.630 af, Atten= 1%, Lag= 7.2 min
Routed to Pond 2P : Outlet

Routing by Stor-Ind+Trans method, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.98 fps, Min. Travel Time= 4.3 min
Avg. Velocity = 2.62 fps, Avg. Travel Time= 13.1 min

Peak Storage= 14,157 cf @ 12.75 hrs
Average Depth at Peak Storage= 0.57' , Surface Width= 12.23'
Bank-Full Depth= 2.00' Flow Area= 24.8 sf, Capacity= 406.60 cfs

12.00' x 2.00' deep channel, n= 0.050 Mountain streams w/large boulders
Side Slope Z-value= 0.2 '/' Top Width= 12.80'
Length= 2,055.4' Slope= 0.1708 '/'
Inlet Invert= 1,231.00', Outlet Invert= 880.00'



Summary for Reach 4R: Reach 2

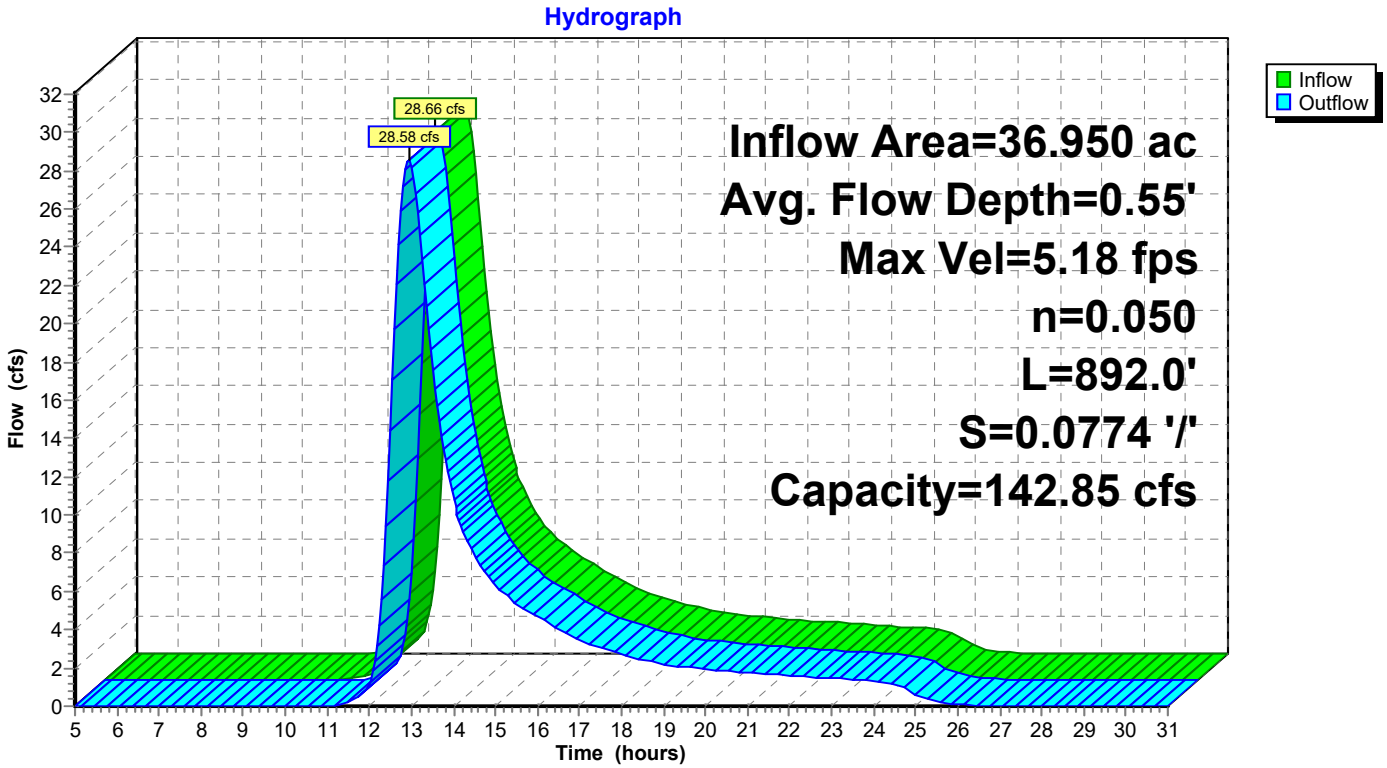
Inflow Area = 36.950 ac, 0.00% Impervious, Inflow Depth = 1.79" for 50 yr event
Inflow = 28.66 cfs @ 12.85 hrs, Volume= 5.511 af
Outflow = 28.58 cfs @ 12.93 hrs, Volume= 5.511 af, Atten= 0%, Lag= 4.8 min
Routed to Reach 3R : Reach 1

Routing by Stor-Ind+Trans method, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.18 fps, Min. Travel Time= 2.9 min
Avg. Velocity = 1.78 fps, Avg. Travel Time= 8.4 min

Peak Storage= 4,920 cf @ 12.89 hrs
Average Depth at Peak Storage= 0.55' , Surface Width= 10.22'
Bank-Full Depth= 1.50' Flow Area= 15.4 sf, Capacity= 142.85 cfs

10.00' x 1.50' deep channel, n= 0.050 Mountain streams w/large boulders
Side Slope Z-value= 0.2 '/' Top Width= 10.60'
Length= 892.0' Slope= 0.0774 '/'
Inlet Invert= 1,300.00', Outlet Invert= 1,231.00'

Reach 4R: Reach 2



Summary for Pond 2P: Outlet

[57] Hint: Peaked at 877.26' (Flood elevation advised)

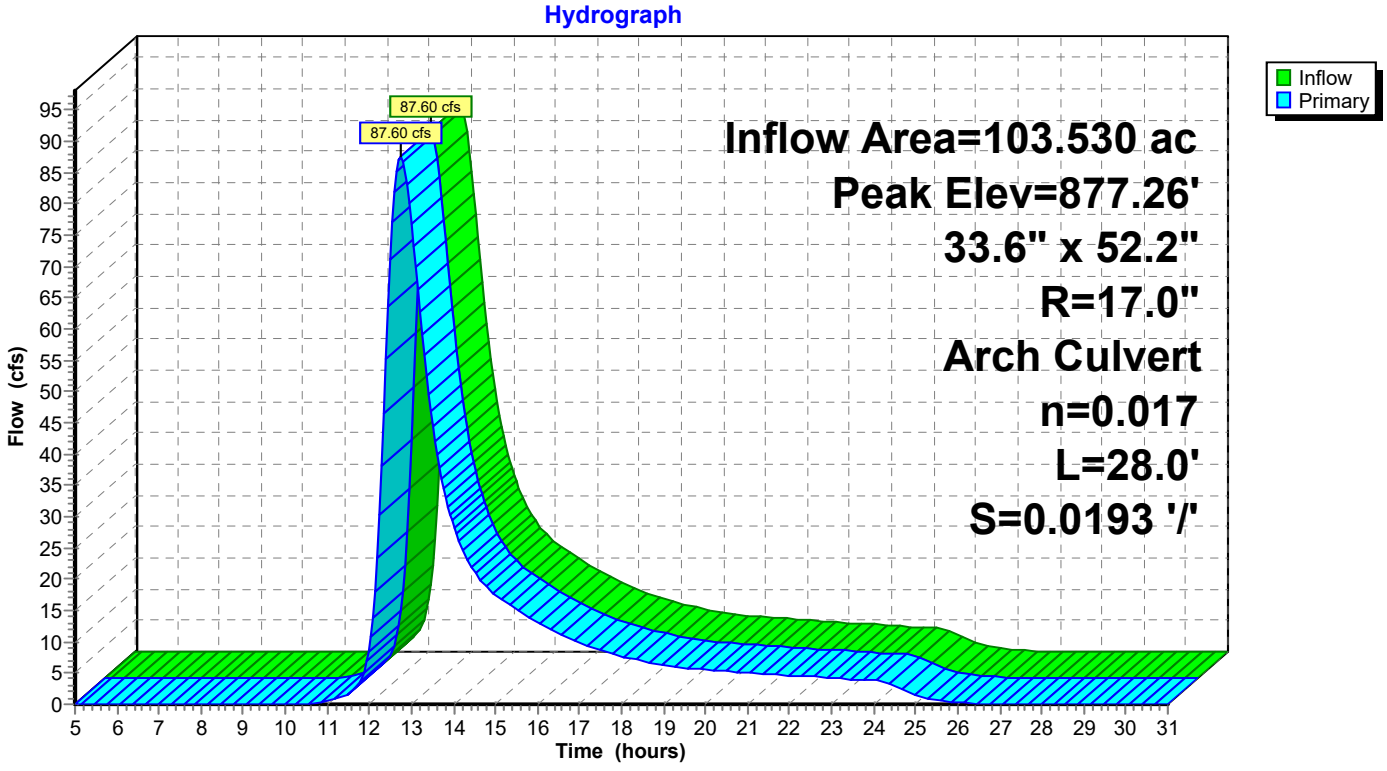
Inflow Area = 103.530 ac, 0.00% Impervious, Inflow Depth = 1.92" for 50 yr event
Inflow = 87.60 cfs @ 12.75 hrs, Volume= 16.560 af
Outflow = 87.60 cfs @ 12.75 hrs, Volume= 16.560 af, Atten= 0%, Lag= 0.0 min
Primary = 87.60 cfs @ 12.75 hrs, Volume= 16.560 af
Routed to Link 1L : Analysis Point

Routing by Stor-Ind method, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Peak Elev= 877.26' @ 12.75 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	872.24'	**33.6" W x 52.2" H, R=17.0" Arch Culvert** L= 28.0' Box, 30-75° wingwalls, square crown, Ke= 0.400 Inlet / Outlet Invert= 872.24' / 871.70' S= 0.0193 '/' Cc= 0.900 n= 0.017, Flow Area= 11.36 sf

Primary OutFlow Max=87.59 cfs @ 12.75 hrs HW=877.26' TW=866.60' (Fixed TW Elev= 866.60')
1=Culvert (Barrel Controls 87.59 cfs @ 8.40 fps)

Pond 2P: Outlet

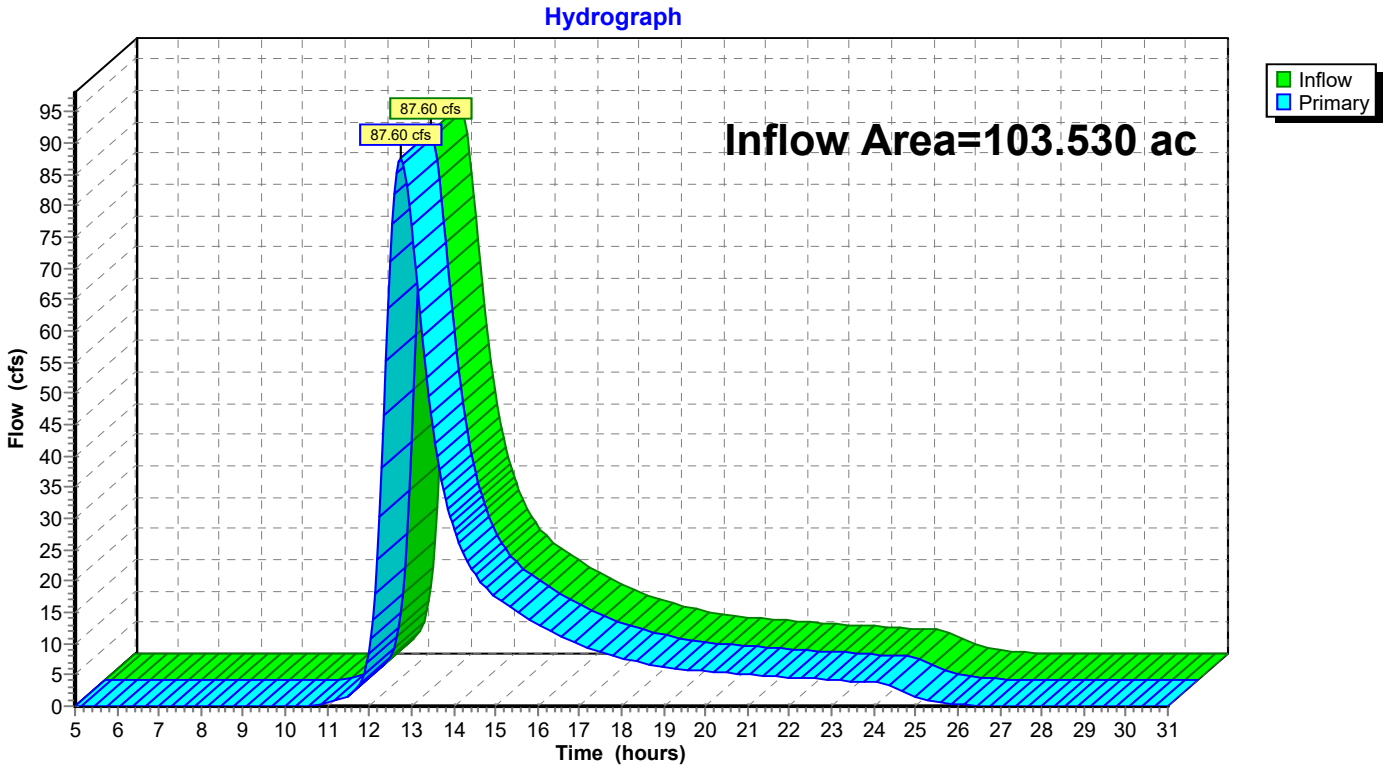


Summary for Link 1L: Analysis Point

Inflow Area = 103.530 ac, 0.00% Impervious, Inflow Depth = 1.92" for 50 yr event
Inflow = 87.60 cfs @ 12.75 hrs, Volume= 16.560 af
Primary = 87.60 cfs @ 12.75 hrs, Volume= 16.560 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs

Link 1L: Analysis Point



Time span=5.00-31.00 hrs, dt=0.05 hrs, 521 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment2S: (new Subcat) Runoff Area=16.950 ac 0.00% Impervious Runoff Depth=2.84"
Flow Length=986' Tc=61.7 min CN=64 Runoff=21.37 cfs 4.015 af

Subcatchment5S: (new Subcat) Runoff Area=12.670 ac 0.00% Impervious Runoff Depth=2.65"
Flow Length=1,067' Tc=30.8 min CN=62 Runoff=21.37 cfs 2.796 af

Subcatchment6S: (new Subcat) Runoff Area=21.450 ac 0.00% Impervious Runoff Depth=2.94"
Flow Length=2,600' Tc=50.6 min CN=65 Runoff=31.55 cfs 5.257 af

Subcatchment7S: (new Subcat) Runoff Area=7.000 ac 0.00% Impervious Runoff Depth=3.14"
Flow Length=999' Tc=30.6 min CN=67 Runoff=14.29 cfs 1.832 af

Subcatchment8S: (new Subcat) Runoff Area=25.460 ac 0.00% Impervious Runoff Depth=2.46"
Flow Length=2,098' Tc=39.0 min CN=60 Runoff=35.18 cfs 5.211 af

Subcatchment9S: (new Subcat) Runoff Area=20.000 ac 0.00% Impervious Runoff Depth=2.17"
Flow Length=2,230' Tc=55.2 min CN=57 Runoff=19.73 cfs 3.625 af

Reach 3R: Reach 1 Avg. Flow Depth=0.71' Max Vel=9.14 fps Inflow=79.44 cfs 14.682 af
n=0.050 L=2,055.4' S=0.1708 '/' Capacity=406.60 cfs Outflow=78.98 cfs 14.682 af

Reach 4R: Reach 2 Avg. Flow Depth=0.68' Max Vel=5.92 fps Inflow=41.02 cfs 7.640 af
n=0.050 L=892.0' S=0.0774 '/' Capacity=142.85 cfs Outflow=40.92 cfs 7.640 af

Pond 2P: Outlet Peak Elev=879.22' Inflow=124.93 cfs 22.735 af
33.6" x 52.2", R=17.0" Arch Culvert n=0.017 L=28.0' S=0.0193 '/' Outflow=124.93 cfs 22.735 af

Link 1L: Analysis Point Inflow=124.93 cfs 22.735 af
Primary=124.93 cfs 22.735 af

Total Runoff Area = 103.530 ac Runoff Volume = 22.735 af Average Runoff Depth = 2.64"
100.00% Pervious = 103.530 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 2S: (new Subcat)

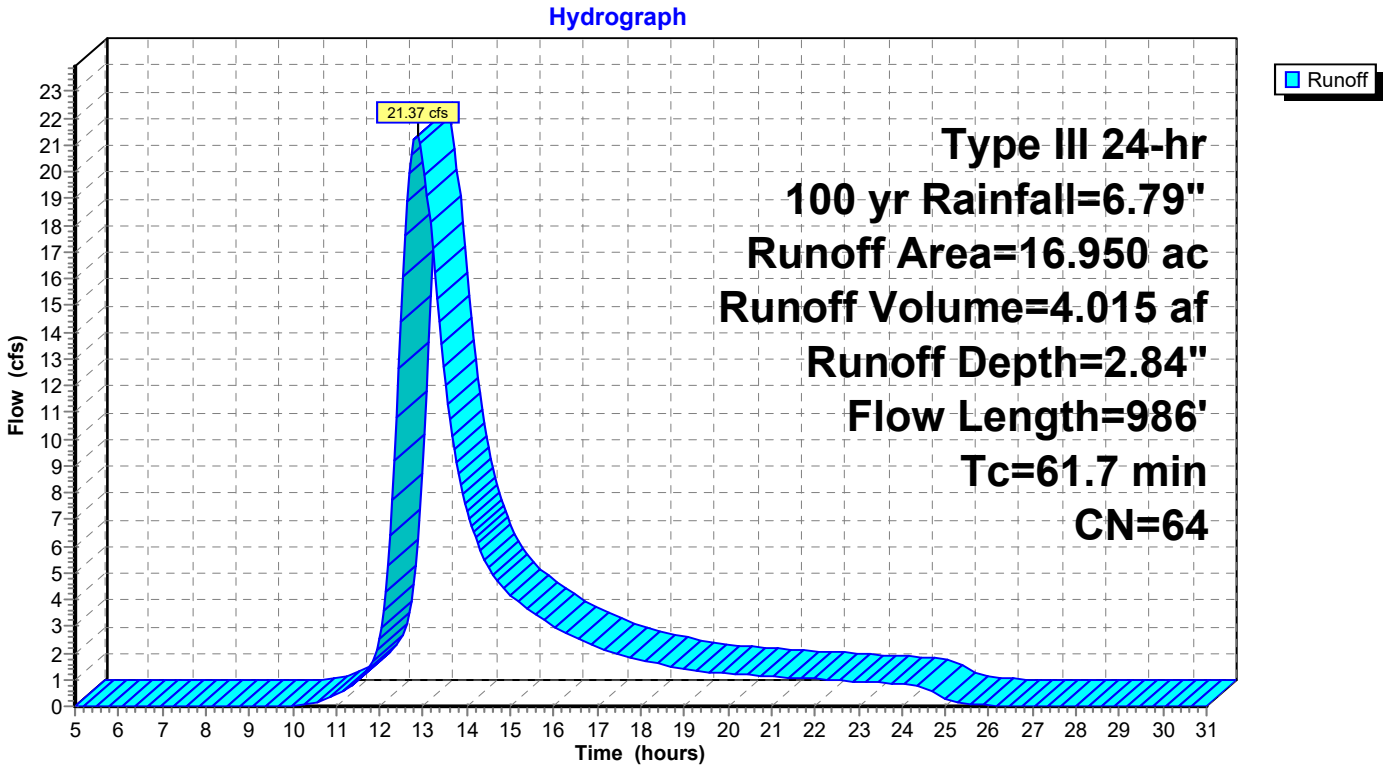
Runoff = 21.37 cfs @ 12.86 hrs, Volume= 4.015 af, Depth= 2.84"
Routed to Reach 4R : Reach 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=6.79"

	Area (ac)	CN	Description
	9.100	55	Woods, Good, HSG B
*	7.850	75	Woods, Good, HSG D
	16.950	64	Weighted Average
	16.950		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.6	100	0.0200	0.04		**Sheet Flow, First 100'** Woods: Dense underbrush n= 0.800 P2= 2.71"
21.1	886	0.0785	0.70		**Shallow Concentrated Flow, 100' to End** Forest w/Heavy Litter Kv= 2.5 fps
61.7	986	Total			

Subcatchment 2S: (new Subcat)



Summary for Subcatchment 5S: (new Subcat)

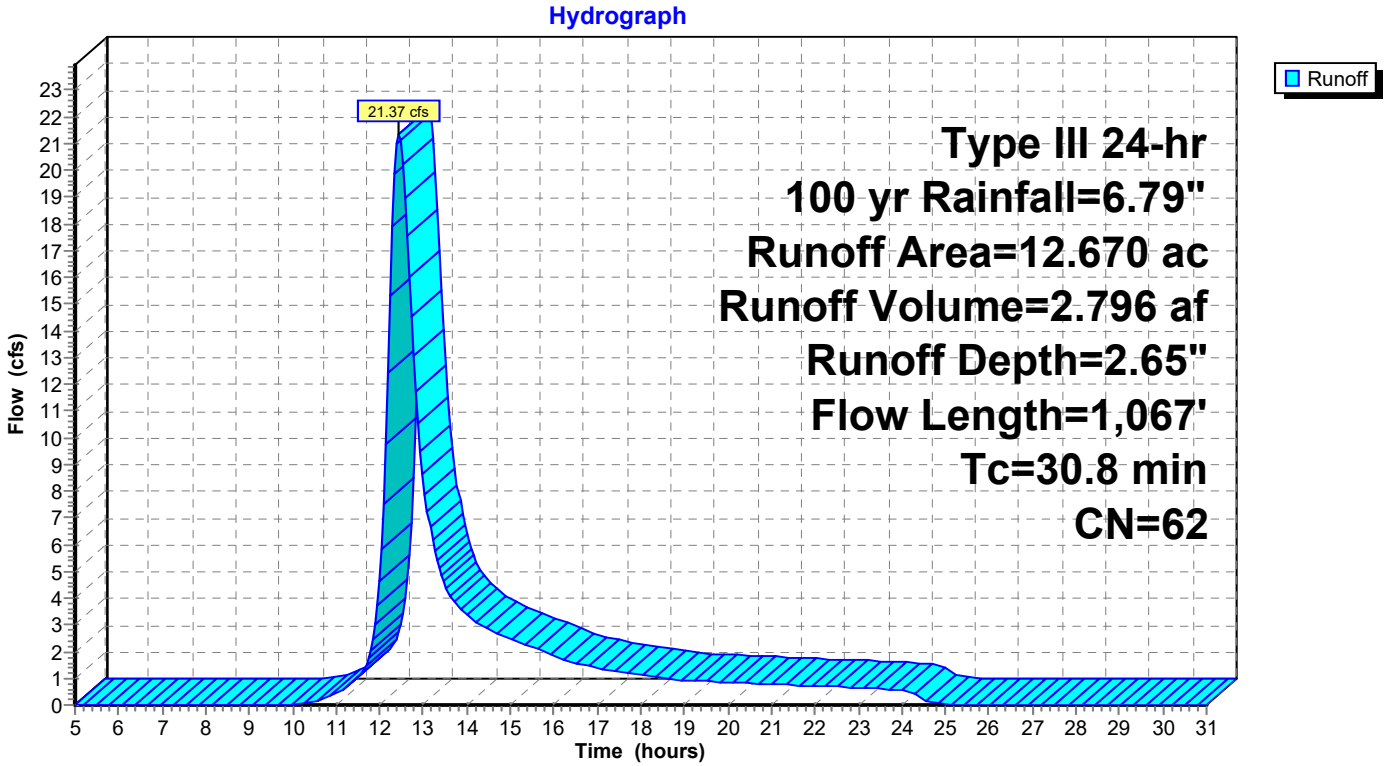
Runoff = 21.37 cfs @ 12.45 hrs, Volume= 2.796 af, Depth= 2.65"
Routed to Pond 2P : Outlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=6.79"

Area (ac)	CN	Description
0.010	91	Gravel roads, HSG D
0.400	77	Woods, Good, HSG D
6.560	55	Woods, Good, HSG B
5.700	70	Woods, Good, HSG C
12.670	62	Weighted Average
12.670		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.1	100	0.1750	0.10		**Sheet Flow, First 100'** Woods: Dense underbrush n= 0.800 P2= 2.71"
13.6	693	0.1150	0.85		**Shallow Concentrated Flow, 100' to Pt 5A** Forest w/Heavy Litter Kv= 2.5 fps
0.1	274	0.3500	74.73	24,360.52	**Channel Flow, Pt 5A to End** Area= 326.0 sf Perim= 52.0' r= 6.27' n= 0.040
30.8	1,067	Total			

Subcatchment 5S: (new Subcat)



Summary for Subcatchment 6S: (new Subcat)

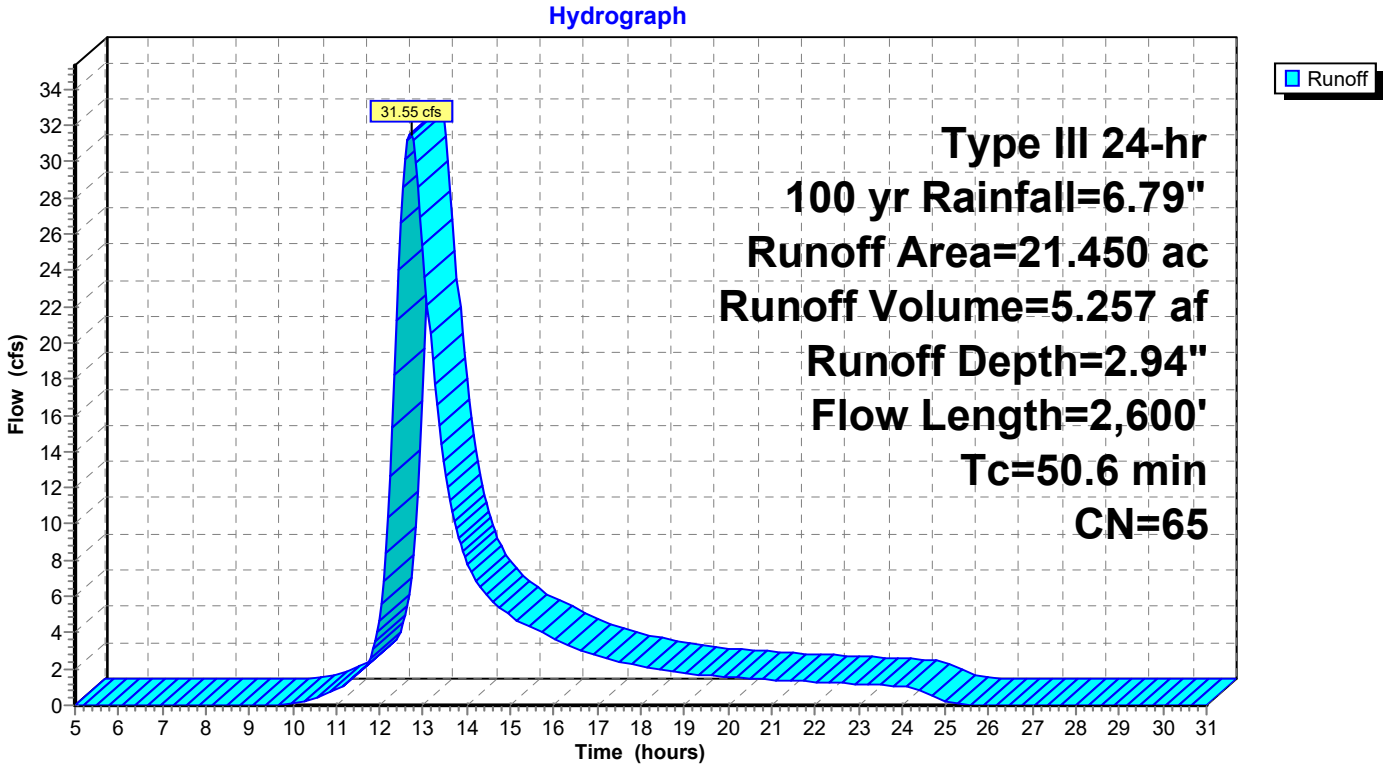
Runoff = 31.55 cfs @ 12.72 hrs, Volume= 5.257 af, Depth= 2.94"
Routed to Pond 2P : Outlet

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=6.79"

Area (ac)	CN	Description
0.010	91	Gravel roads, HSG D
4.300	77	Woods, Good, HSG D
9.070	55	Woods, Good, HSG B
8.070	70	Woods, Good, HSG C
21.450	65	Weighted Average
21.450		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4	100	0.3900	0.13		**Sheet Flow, First 100'** Woods: Dense underbrush n= 0.800 P2= 2.71"
38.2	2,500	0.1904	1.09		**Shallow Concentrated Flow, 100' to End** Forest w/Heavy Litter Kv= 2.5 fps
50.6	2,600	Total			

Subcatchment 6S: (new Subcat)



Summary for Subcatchment 7S: (new Subcat)

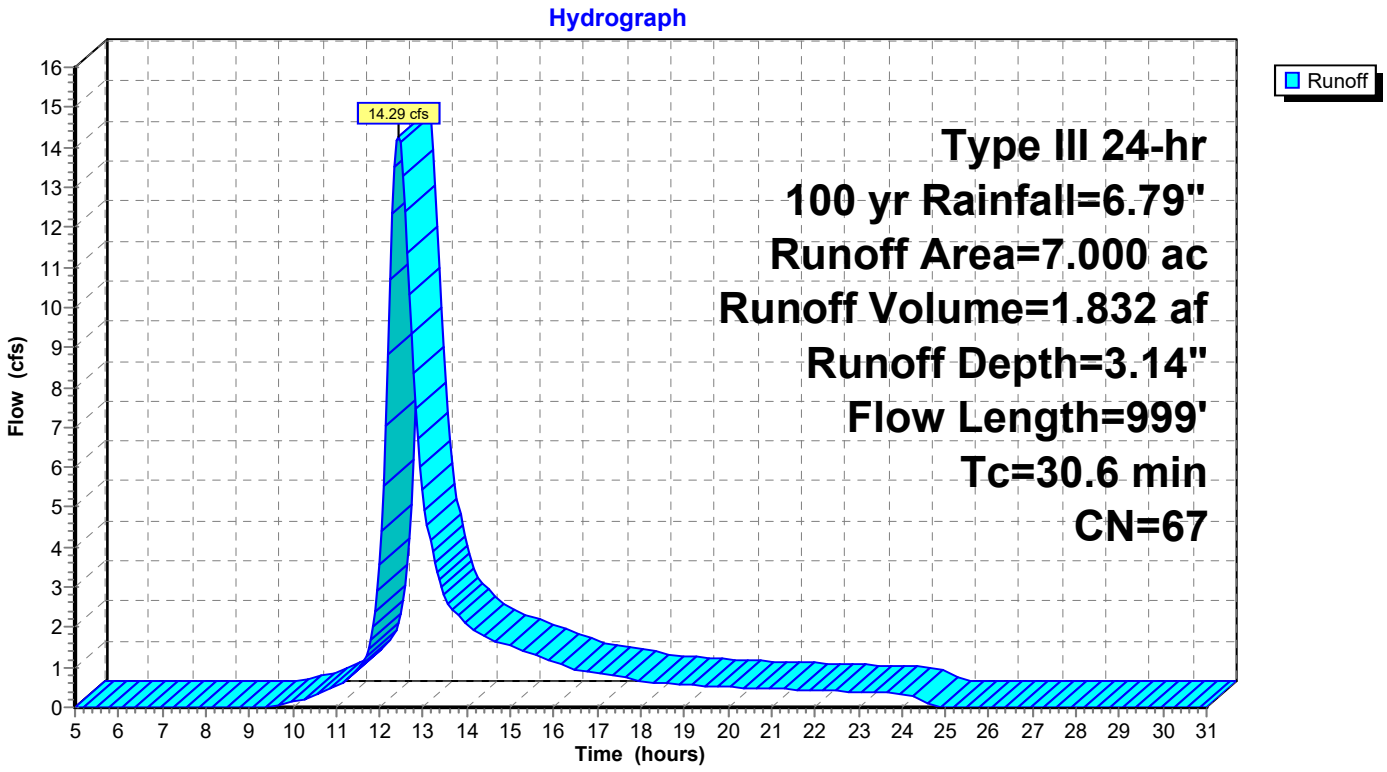
Runoff = 14.29 cfs @ 12.44 hrs, Volume= 1.832 af, Depth= 3.14"
Routed to Reach 3R : Reach 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=6.79"

Area (ac)	CN	Description
2.800	70	Woods, Good, HSG C
2.180	55	Woods, Good, HSG B
2.020	77	Woods, Good, HSG D
7.000	67	Weighted Average
7.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.2	100	0.2350	0.11		**Sheet Flow, First 100'** Woods: Dense underbrush n= 0.800 P2= 2.71"
15.4	899	0.1510	0.97		**Shallow Concentrated Flow, 100' to Pt A7** Forest w/Heavy Litter Kv= 2.5 fps
30.6	999	Total			

Subcatchment 7S: (new Subcat)



Summary for Subcatchment 8S: (new Subcat)

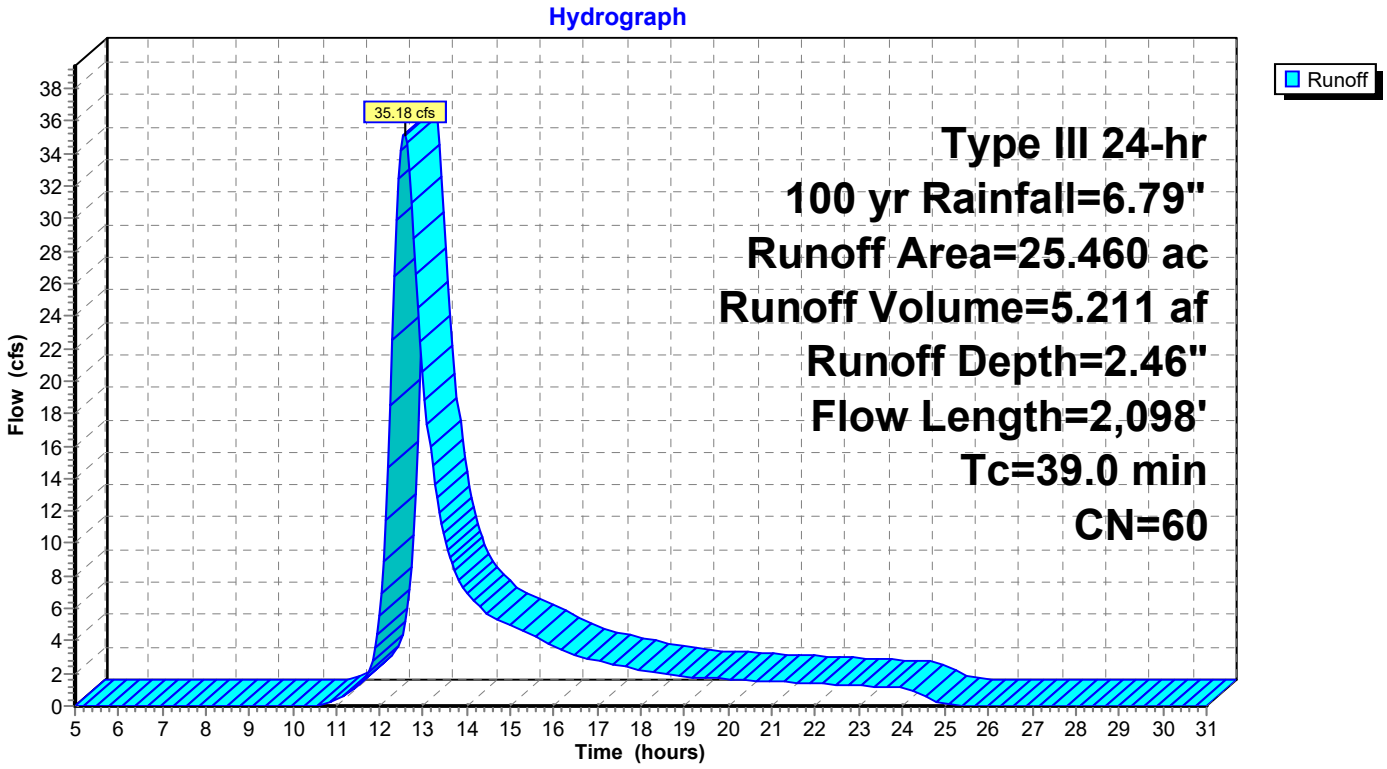
Runoff = 35.18 cfs @ 12.58 hrs, Volume= 5.211 af, Depth= 2.46"
Routed to Reach 3R : Reach 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=6.79"

Area (ac)	CN	Description
0.860	70	Woods, Good, HSG C
19.190	55	Woods, Good, HSG B
5.410	77	Woods, Good, HSG D
25.460	60	Weighted Average
25.460		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.8	100	0.0950	0.08		**Sheet Flow, first 100'** Woods: Dense underbrush n= 0.800 P2= 2.71"
3.6	293	0.2920	1.35		**Shallow Concentrated Flow, 100' to Pt 8A** Forest w/Heavy Litter Kv= 2.5 fps
13.3	982	0.2440	1.23		**Shallow Concentrated Flow, Pt 8A to Pt 8B** Forest w/Heavy Litter Kv= 2.5 fps
0.3	723	0.1410	47.43	15,461.87	**Channel Flow, Pt 8B to End** Area= 326.0 sf Perim= 52.0' r= 6.27' n= 0.040
39.0	2,098	Total			

Subcatchment 8S: (new Subcat)



Summary for Subcatchment 9S: (new Subcat)

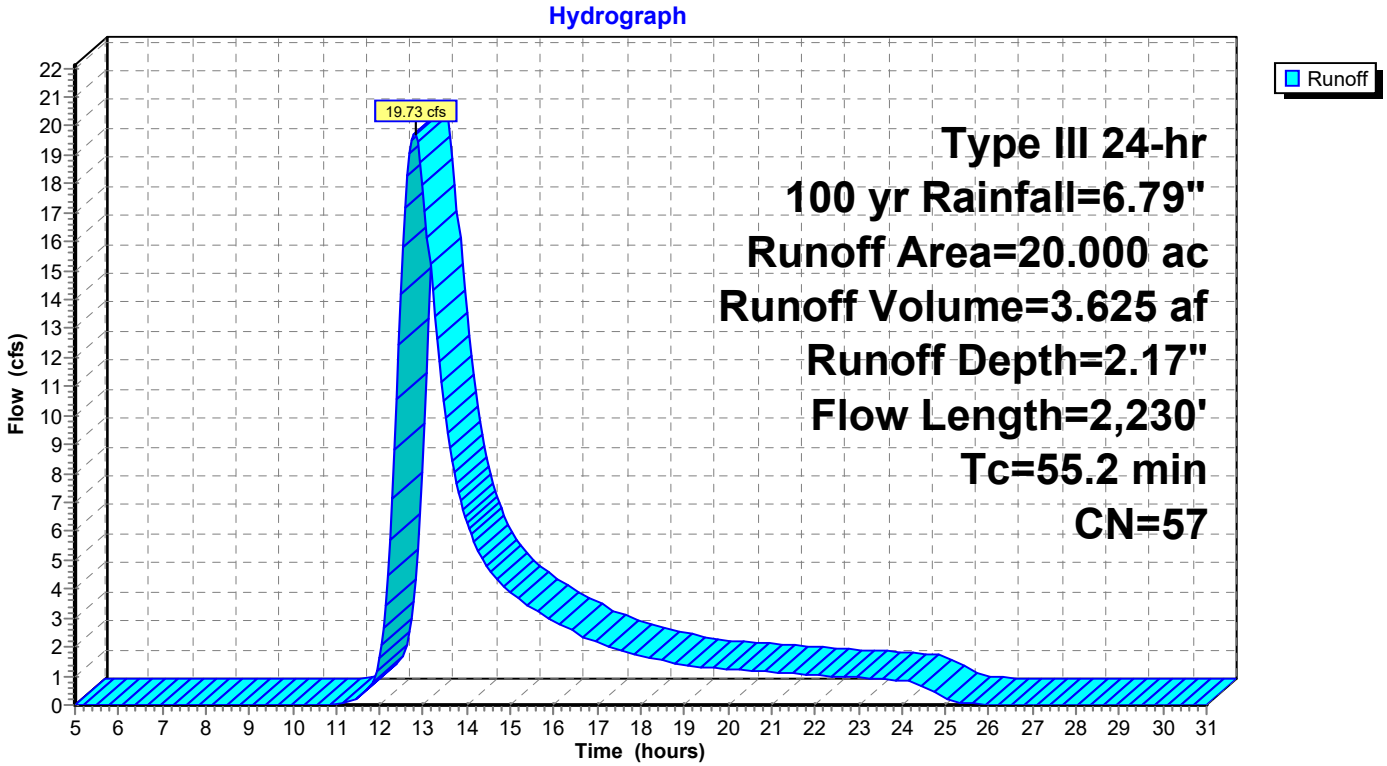
Runoff = 19.73 cfs @ 12.81 hrs, Volume= 3.625 af, Depth= 2.17"
Routed to Reach 4R : Reach 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 yr Rainfall=6.79"

Area (ac)	CN	Description
18.450	55	Woods, Good, HSG B
1.550	77	Woods, Good, HSG D
20.000	57	Weighted Average
20.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.2	100	0.1300	0.09		**Sheet Flow, first 100'** Woods: Dense underbrush n= 0.800 P2= 2.71"
8.0	677	0.3200	1.41		**Shallow Concentrated Flow, 100' to Pt 9A** Forest w/Heavy Litter Kv= 2.5 fps
9.8	589	0.1600	1.00		**Shallow Concentrated Flow, Pt 9A to Pt 9B** Forest w/Heavy Litter Kv= 2.5 fps
18.2	864	0.1000	0.79		**Shallow Concentrated Flow, Pt 9B to End** Forest w/Heavy Litter Kv= 2.5 fps
55.2	2,230	Total			

Subcatchment 9S: (new Subcat)



Summary for Reach 3R: Reach 1

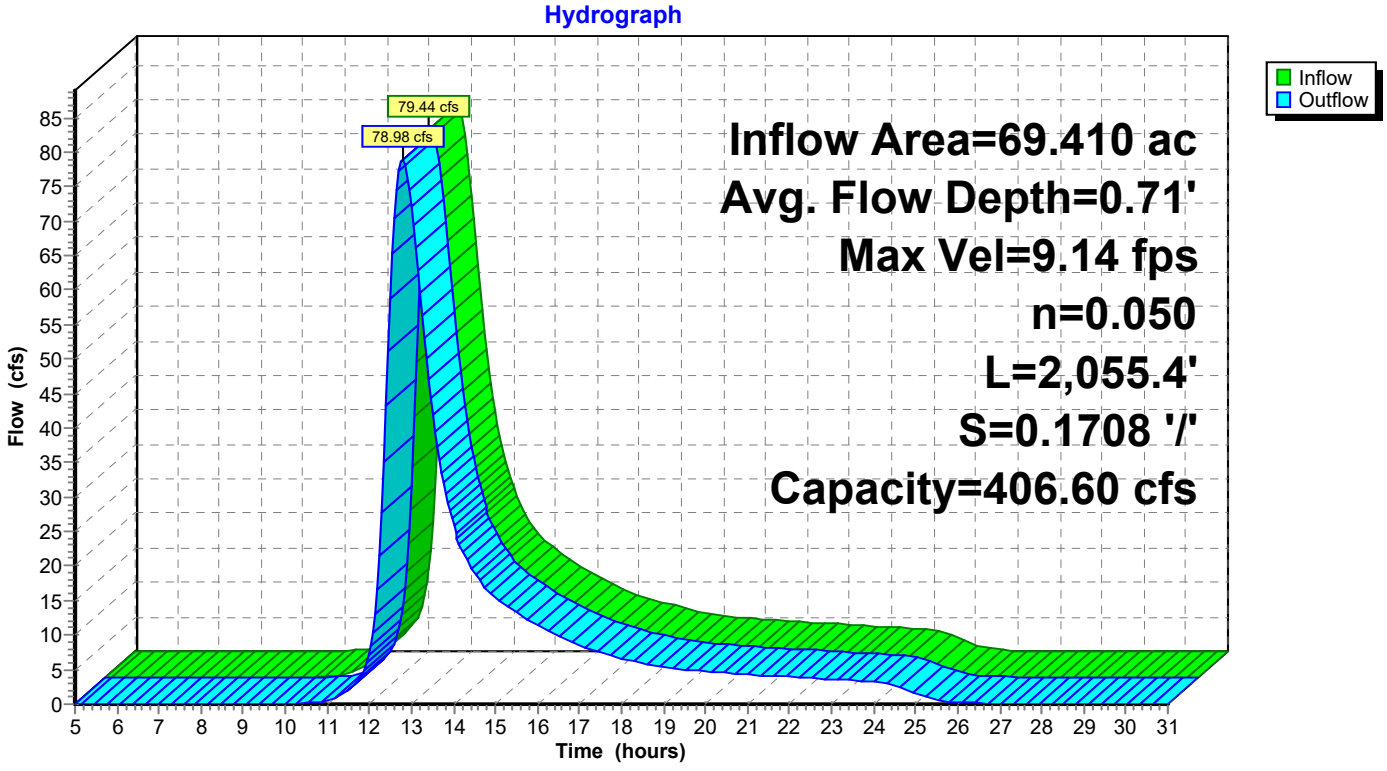
[62] Hint: Exceeded Reach 4R OUTLET depth by 0.13' @ 12.40 hrs

Inflow Area = 69.410 ac, 0.00% Impervious, Inflow Depth = 2.54" for 100 yr event
Inflow = 79.44 cfs @ 12.68 hrs, Volume= 14.682 af
Outflow = 78.98 cfs @ 12.79 hrs, Volume= 14.682 af, Atten= 1%, Lag= 6.3 min
Routed to Pond 2P : Outlet

Routing by Stor-Ind+Trans method, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Max. Velocity= 9.14 fps, Min. Travel Time= 3.7 min
Avg. Velocity = 2.87 fps, Avg. Travel Time= 11.9 min

Peak Storage= 17,772 cf @ 12.72 hrs
Average Depth at Peak Storage= 0.71' , Surface Width= 12.28'
Bank-Full Depth= 2.00' Flow Area= 24.8 sf, Capacity= 406.60 cfs

12.00' x 2.00' deep channel, n= 0.050 Mountain streams w/large boulders
Side Slope Z-value= 0.2 '/' Top Width= 12.80'
Length= 2,055.4' Slope= 0.1708 '/'
Inlet Invert= 1,231.00', Outlet Invert= 880.00'



Summary for Reach 4R: Reach 2

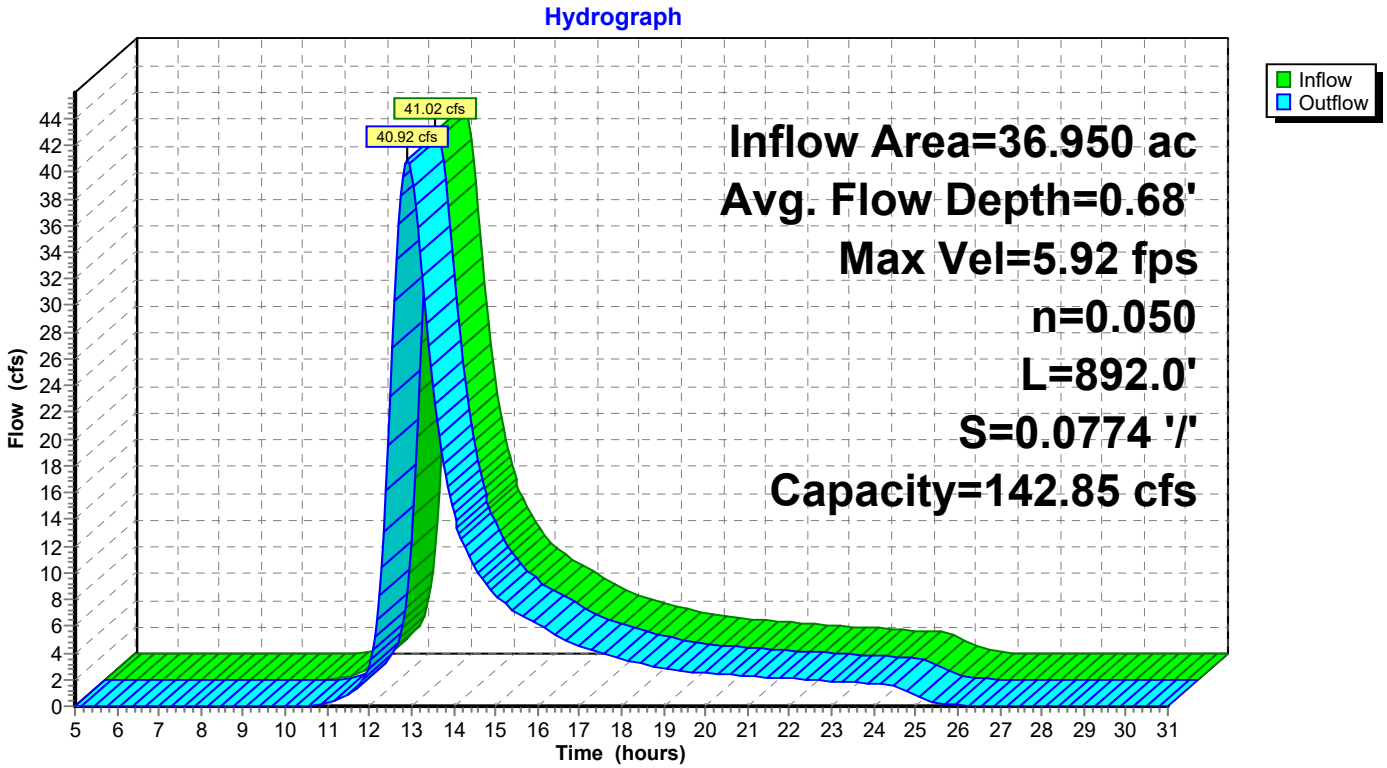
Inflow Area = 36.950 ac, 0.00% Impervious, Inflow Depth = 2.48" for 100 yr event
Inflow = 41.02 cfs @ 12.83 hrs, Volume= 7.640 af
Outflow = 40.92 cfs @ 12.90 hrs, Volume= 7.640 af, Atten= 0%, Lag= 4.3 min
Routed to Reach 3R : Reach 1

Routing by Stor-Ind+Trans method, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.92 fps, Min. Travel Time= 2.5 min
Avg. Velocity = 1.95 fps, Avg. Travel Time= 7.6 min

Peak Storage= 6,166 cf @ 12.86 hrs
Average Depth at Peak Storage= 0.68' , Surface Width= 10.27'
Bank-Full Depth= 1.50' Flow Area= 15.4 sf, Capacity= 142.85 cfs

10.00' x 1.50' deep channel, n= 0.050 Mountain streams w/large boulders
Side Slope Z-value= 0.2 '/' Top Width= 10.60'
Length= 892.0' Slope= 0.0774 '/'
Inlet Invert= 1,300.00', Outlet Invert= 1,231.00'

Reach 4R: Reach 2



Summary for Pond 2P: Outlet

[57] Hint: Peaked at 879.22' (Flood elevation advised)

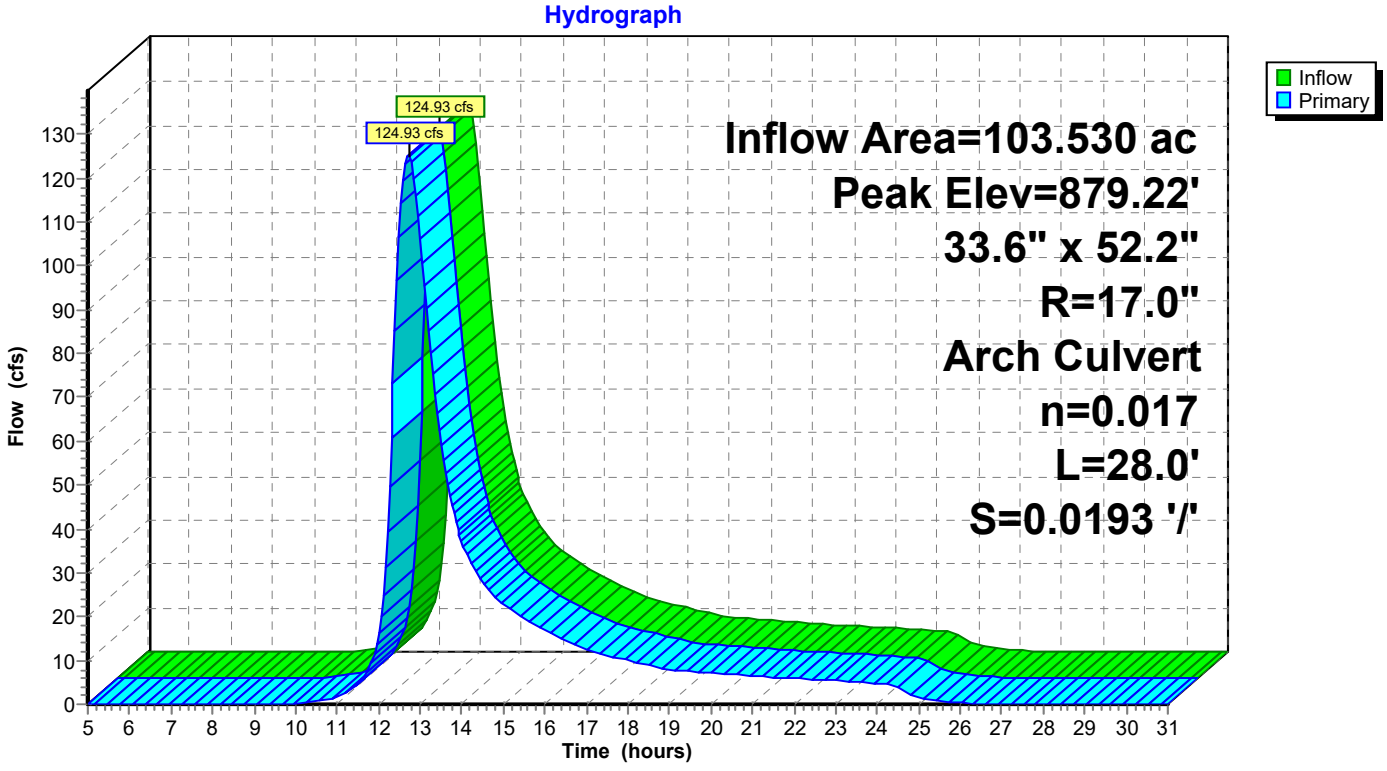
Inflow Area = 103.530 ac, 0.00% Impervious, Inflow Depth = 2.64" for 100 yr event
Inflow = 124.93 cfs @ 12.72 hrs, Volume= 22.735 af
Outflow = 124.93 cfs @ 12.72 hrs, Volume= 22.735 af, Atten= 0%, Lag= 0.0 min
Primary = 124.93 cfs @ 12.72 hrs, Volume= 22.735 af
Routed to Link 1L : Analysis Point

Routing by Stor-Ind method, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs
Peak Elev= 879.22' @ 12.72 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	872.24'	**33.6" W x 52.2" H, R=17.0" Arch Culvert** L= 28.0' Box, 30-75° wingwalls, square crown, Ke= 0.400 Inlet / Outlet Invert= 872.24' / 871.70' S= 0.0193 '/' Cc= 0.900 n= 0.017, Flow Area= 11.36 sf

Primary OutFlow Max=124.73 cfs @ 12.72 hrs HW=879.21' TW=866.60' (Fixed TW Elev= 866.60')
1=Culvert (Barrel Controls 124.73 cfs @ 10.98 fps)

Pond 2P: Outlet

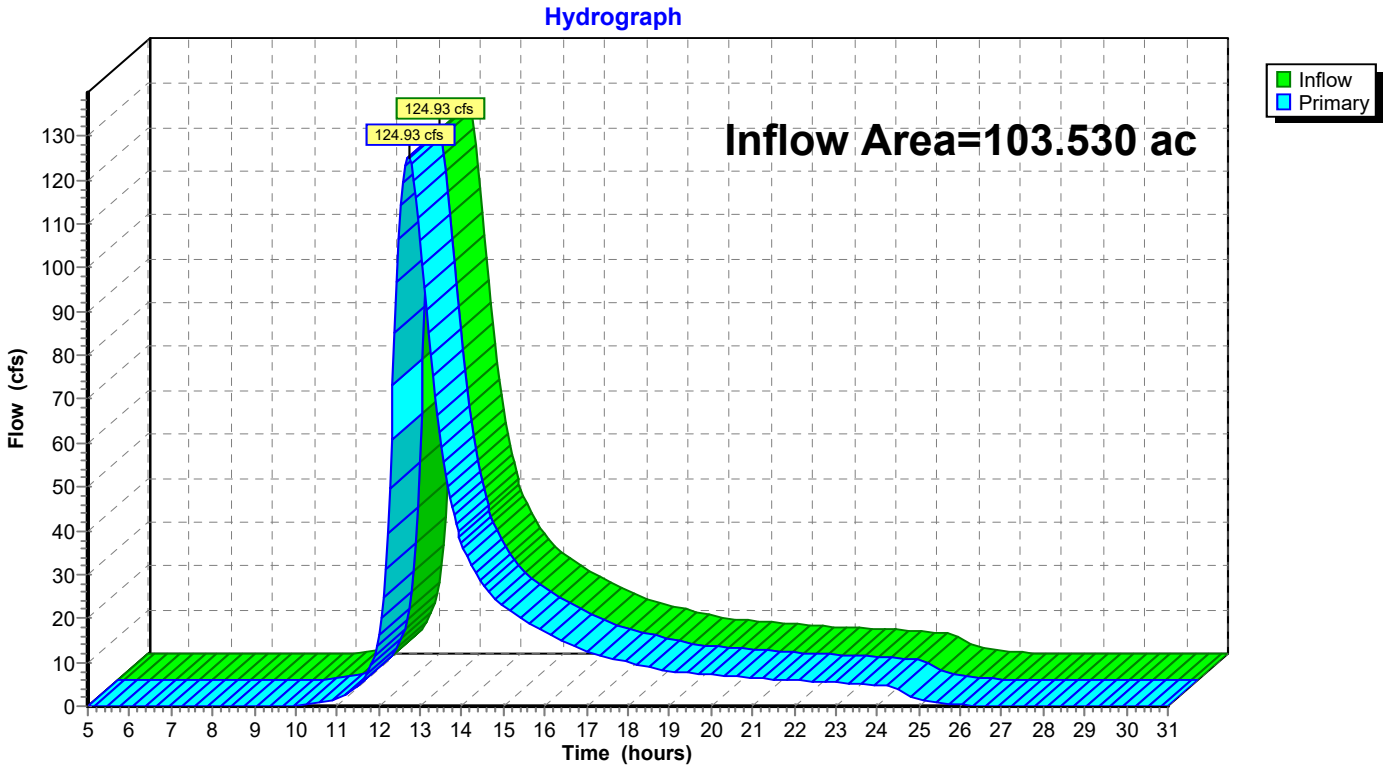


Summary for Link 1L: Analysis Point

Inflow Area = 103.530 ac, 0.00% Impervious, Inflow Depth = 2.64" for 100 yr event
Inflow = 124.93 cfs @ 12.72 hrs, Volume= 22.735 af
Primary = 124.93 cfs @ 12.72 hrs, Volume= 22.735 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-31.00 hrs, dt= 0.05 hrs

Link 1L: Analysis Point



Rainfall Data

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Metadata for Point

Smoothing	Yes
State	New Hampshire
Location	New Hampshire, United States
Latitude	43.186 degrees North
Longitude	72.257 degrees West
Elevation	260 feet
Date/Time	Thu Aug 10 2023 14:51:35 GMT-0400 (Eastern Daylight Time)

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.27	0.41	0.51	0.67	0.83	1.04	**1yr**	0.72	0.97	1.20	1.49	1.84	2.28	2.59	**1yr**	2.02	2.49	2.89	3.54	4.08	**1yr**
2yr	0.32	0.49	0.61	0.81	1.01	1.27	**2yr**	0.88	1.15	1.46	1.80	2.21	2.71	3.08	**2yr**	2.40	2.96	3.46	4.12	4.70	**2yr**
5yr	0.38	0.59	0.74	0.99	1.27	1.60	**5yr**	1.09	1.44	1.84	2.26	2.76	3.36	3.86	**5yr**	2.97	3.71	4.31	5.06	5.74	**5yr**
10yr	0.43	0.67	0.85	1.16	1.50	1.91	**10yr**	1.30	1.71	2.20	2.70	3.28	3.95	4.57	**10yr**	3.49	4.40	5.09	5.91	6.67	**10yr**
25yr	0.51	0.81	1.03	1.42	1.88	2.40	**25yr**	1.62	2.15	2.77	3.39	4.10	4.89	5.74	**25yr**	4.33	5.52	6.35	7.26	8.14	**25yr**
50yr	0.57	0.92	1.18	1.65	2.23	2.87	**50yr**	1.93	2.56	3.32	4.06	4.87	5.76	6.82	**50yr**	5.10	6.56	7.51	8.49	9.47	**50yr**
100yr	0.66	1.06	1.37	1.94	2.65	3.42	**100yr**	2.29	3.04	3.95	4.82	5.76	6.79	8.10	**100yr**	6.01	7.79	8.89	9.94	11.01	**100yr**
200yr	0.75	1.22	1.59	2.28	3.15	4.08	**200yr**	2.72	3.62	4.72	5.75	6.84	8.00	9.64	**200yr**	7.08	9.27	10.53	11.63	12.82	**200yr**
500yr	0.91	1.50	1.95	2.83	3.96	5.14	**500yr**	3.41	4.57	5.95	7.22	8.55	9.95	12.13	**500yr**	8.80	11.67	13.17	14.34	15.68	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.20	0.30	0.37	0.50	0.61	0.83	**1yr**	0.53	0.81	0.92	1.22	1.61	1.92	2.40	**1yr**	1.70	2.31	2.66	3.28	3.70	**1yr**
2yr	0.31	0.47	0.58	0.79	0.98	1.14	**2yr**	0.84	1.11	1.30	1.68	2.15	2.65	2.98	**2yr**	2.34	2.86	3.37	4.04	4.60	**2yr**
5yr	0.35	0.54	0.67	0.92	1.18	1.35	**5yr**	1.01	1.32	1.54	1.97	2.48	3.14	3.61	**5yr**	2.78	3.47	4.07	4.78	5.42	**5yr**
10yr	0.39	0.60	0.74	1.04	1.34	1.52	**10yr**	1.16	1.49	1.73	2.21	2.74	3.55	4.06	**10yr**	3.14	3.90	4.68	5.23	6.11	**10yr**
25yr	0.44	0.67	0.83	1.19	1.57	1.76	**25yr**	1.35	1.72	2.04	2.55	3.14	4.15	4.85	**25yr**	3.68	4.66	5.64	6.41	7.17	**25yr**
50yr	0.48	0.72	0.90	1.30	1.74	1.96	**50yr**	1.51	1.92	2.29	2.85	3.46	4.69	5.56	**50yr**	4.15	5.35	6.50	7.29	8.10	**50yr**
100yr	0.51	0.77	0.96	1.39	1.91	2.18	**100yr**	1.65	2.13	2.59	3.18	3.83	5.27	6.38	**100yr**	4.67	6.14	7.51	8.30	9.16	**100yr**
200yr	0.54	0.82	1.04	1.50	2.10	2.42	**200yr**	1.81	2.37	2.92	3.54	4.23	5.94	7.35	**200yr**	5.25	7.07	8.68	9.46	10.37	**200yr**
500yr	0.60	0.89	1.15	1.67	2.38	2.76	**500yr**	2.05	2.70	3.41	4.08	4.83	6.90	8.88	**500yr**	6.11	8.54	10.54	11.28	12.22	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.29	0.46	0.56	0.75	0.92	1.09	**1yr**	0.79	1.07	1.22	1.60	1.99	2.43	2.76	**1yr**	2.15	2.65	3.10	3.77	4.34	**1yr**
2yr	0.34	0.53	0.66	0.89	1.09	1.24	**2yr**	0.94	1.22	1.40	1.80	2.28	2.81	3.21	**2yr**	2.49	3.09	3.55	4.25	4.84	**2yr**
5yr	0.41	0.63	0.79	1.08	1.37	1.60	**5yr**	1.18	1.57	1.82	2.29	2.88	3.59	4.13	**5yr**	3.18	3.97	4.58	5.35	6.08	**5yr**
10yr	0.49	0.75	0.93	1.30	1.68	1.97	**10yr**	1.45	1.93	2.23	2.76	3.44	4.34	5.21	**10yr**	3.85	5.01	5.55	6.64	7.24	**10yr**
25yr	0.62	0.94	1.16	1.66	2.19	2.62	**25yr**	1.89	2.56	2.93	3.56	4.37	5.62	6.85	**25yr**	4.98	6.59	7.17	8.06	9.13	**25yr**
50yr	0.73	1.12	1.39	2.00	2.69	3.24	**50yr**	2.32	3.17	3.61	4.31	5.23	6.85	8.44	**50yr**	6.06	8.12	8.70	9.63	10.88	**50yr**
100yr	0.89	1.34	1.68	2.43	3.33	4.02	**100yr**	2.87	3.93	4.45	5.23	6.29	8.34	10.39	**100yr**	7.38	9.99	10.53	11.49	12.97	**100yr**
200yr	1.07	1.61	2.04	2.95	4.11	5.00	**200yr**	3.55	4.89	5.49	6.35	7.54	10.17	12.80	**200yr**	9.00	12.31	12.77	13.73	15.47	**200yr**
500yr	1.38	2.05	2.63	3.82	5.44	6.68	**500yr**	4.69	6.53	7.27	8.23	9.63	13.23	16.85	**500yr**	11.71	16.20	16.45	17.37	19.52	**500yr**

HY-8 Report: Existing Conditions

HY-8 Culvert Analysis Report

Project Data

Project Title: Route 123A Over Unnamed Tributary to the Cold River

Designer: LMS, Checker: SAB

Project Date: Wednesday, August 9, 2023

Project Notes: Existing Conditions Hydraulic Analysis with Average of FHWA and TR-55 Flows

Project Units: U.S. Customary Units

Outlet Control Option: Profiles

Exit Loss Option: Standard Method

Crossing Data: Acworth Rt123A

Crossing Notes: Station numbers, road elevations, culvert length, and culvert inlet/outlet invert elevations are all taken from the survey performed by NHDOT (Located here: "K:\1_PROJECTS\NHDOT\22_092501_03-NHDOT-Acworth-Culvert-Design-Statewide-43870\2-CADD\Wrk\LMS\Working File.dgn" and here: "K:\1_PROJECTS\NHDOT\22_092501_03-NHDOT-Acworth-Culvert-Design-Statewide-43870\2-CADD\PlanPDFs\2023-08-04_SurveyProfile.pdf")

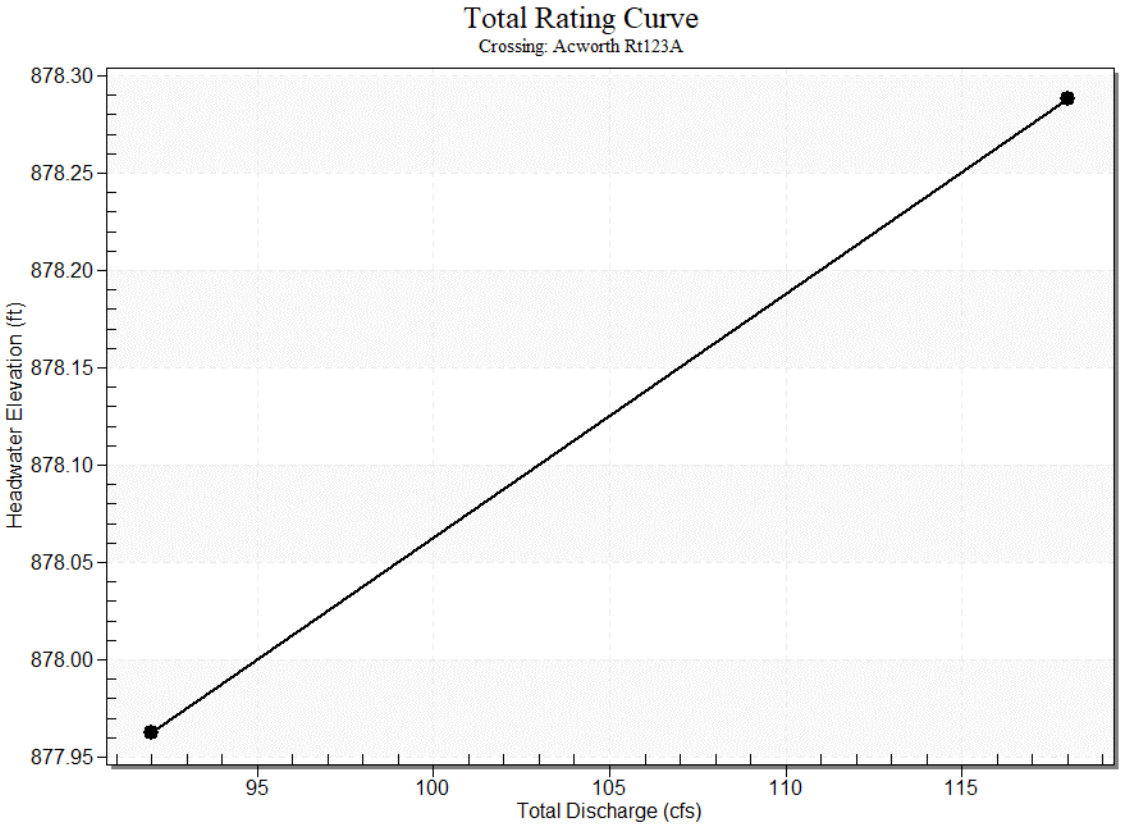
Crossing Discharge Data

Discharge Selection Method: User Defined

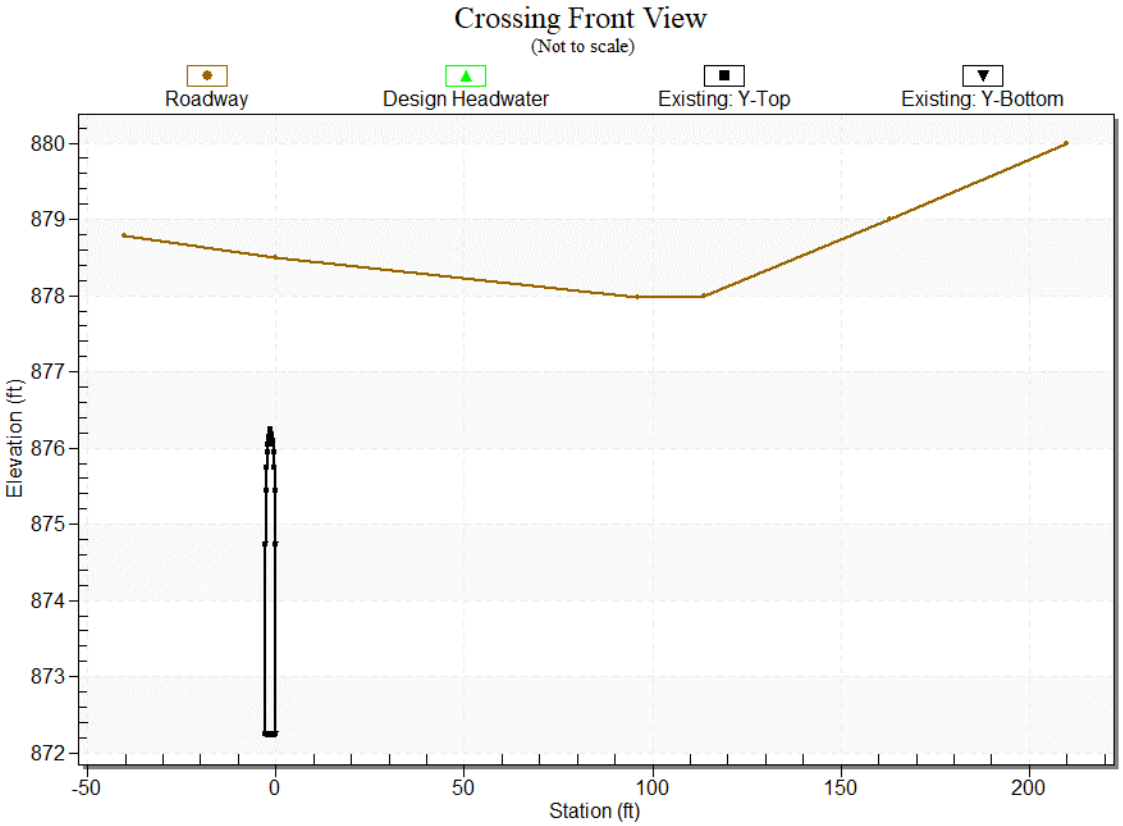
Table 1 - Summary of Culvert Flows at Crossing: Acworth Rt123A

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Existing Discharge (cfs)	Roadway Discharge (cfs)	Iterations
877.96	Q50	92.00	92.00	0.00	1
878.29	Q100	118.00	96.99	20.95	10
877.98	Overtopping	92.26	92.26	0.00	Overtopping

Rating Curve Plot for Crossing: Acworth Rt123A



Crossing Front View (Roadway Profile): Acworth Rt123A



Culvert Data: Existing

Culvert Notes:

Table 1 - Culvert Summary Table: Existing

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
Q50	92.00 cfs	92.00 cfs	877.96	5.72	5.409	5-S2n	3.09	3.12	3.09	0.00	10.77	0.00
Q100	118.00 cfs	96.99 cfs	878.29	6.05	6.006	7-M2c	3.22	3.22	3.22	0.00	10.95	0.00

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

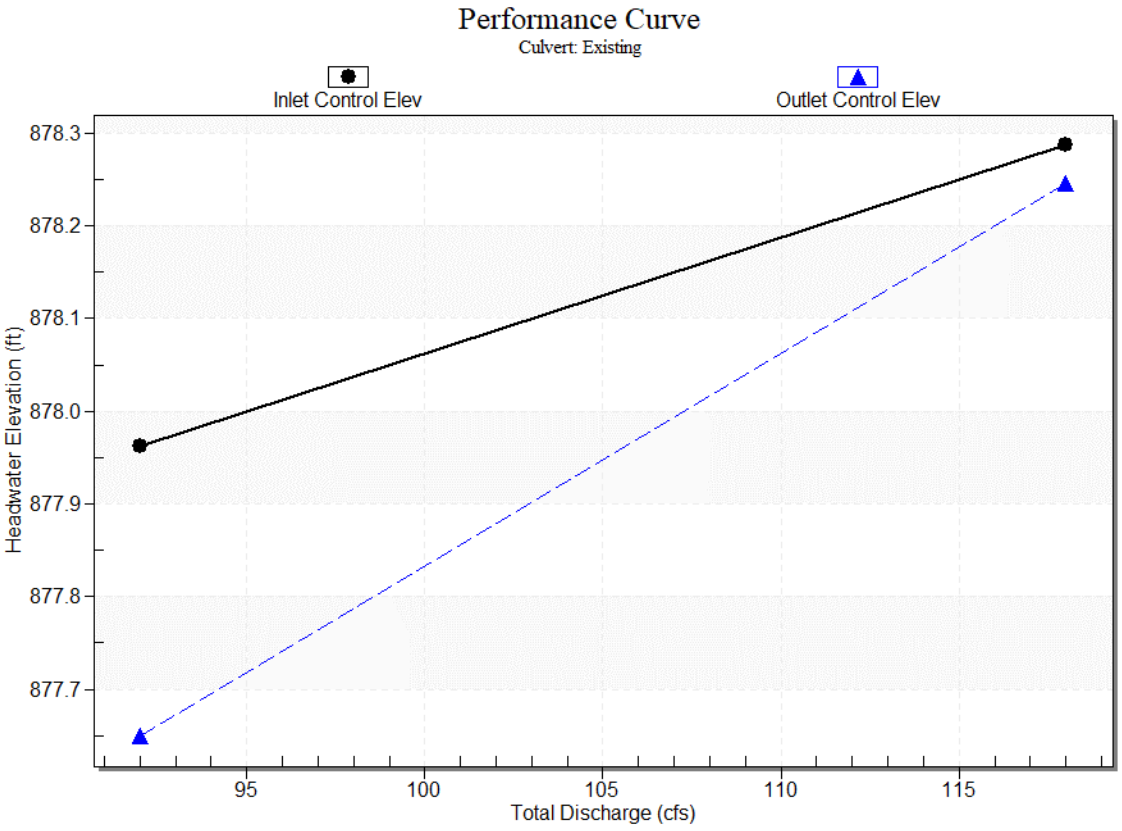
Inlet Elevation (invert): 872.24 ft,

Outlet Elevation (invert): 871.70 ft

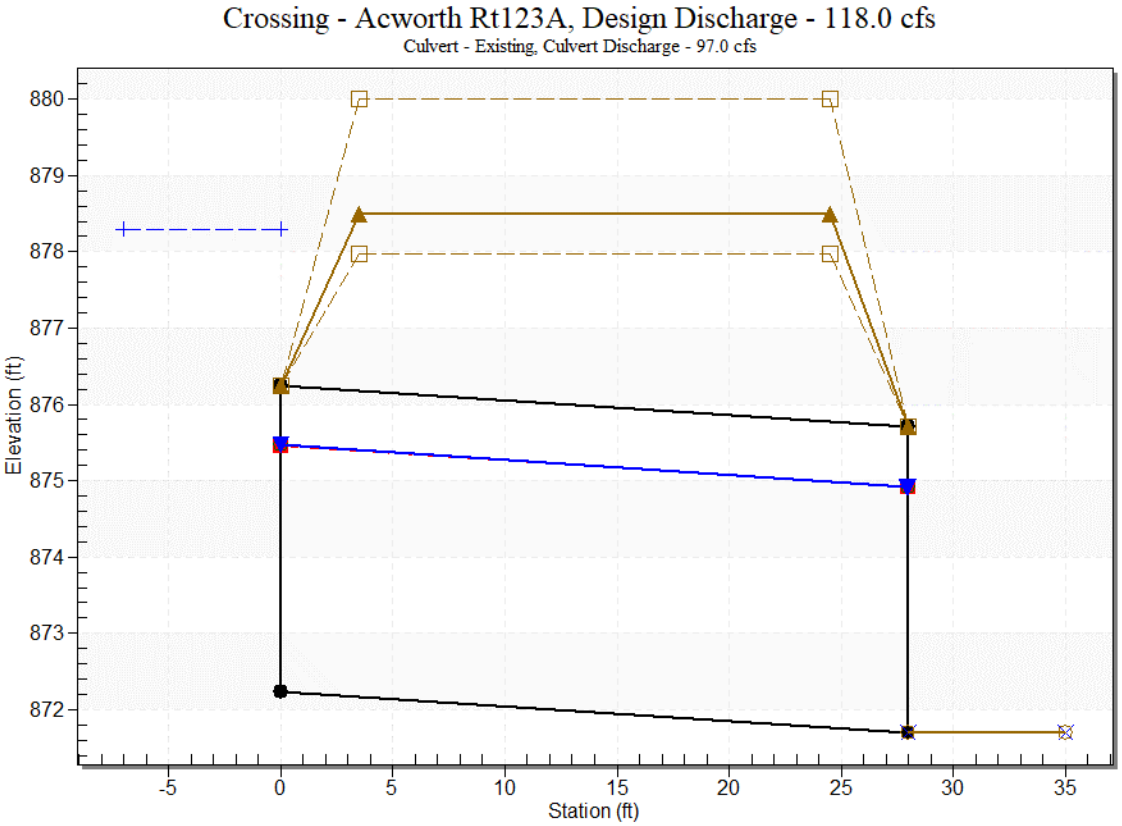
Culvert Length: 28.01 ft,

Culvert Slope: 0.0193

Culvert Performance Curve Plot: Existing



Water Surface Profile Plot for Culvert: Existing



Site Data - Existing

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 872.24 ft

Outlet Station: 28.00 ft

Outlet Elevation: 871.70 ft

Number of Barrels: 1

Culvert Data Summary - Existing

Barrel Shape: User Defined

Barrel Span: 2.80 ft

Barrel Rise: 4.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120 (top and sides)

Manning's n: 0.0300 (bottom)

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: Acworth Rt123A

Table 2 - Downstream Channel Rating Curve (Crossing: Acworth Rt123A)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
92.00	871.70	0.00
118.00	871.70	0.00

Tailwater Channel Data - Acworth Rt123A

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 871.70 ft

Roadway Data for Crossing: Acworth Rt123A

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section

Coord No.	Station (ft)	Elevation (ft)
0	-40.10	878.78
1	0.00	878.50
2	96.20	877.98
3	113.60	878.00
4	163.00	879.00
5	209.80	880.00

Roadway Surface: Paved

Roadway Top Width: 21.00 ft

HY-8 Report: Proposed Conditions

HY-8 Culvert Analysis Report

Project Data

Project Title: Acworth 43566C – Route 123A over Unnamed Tributary

Designer: LMS, Checked by: SAB

Project Date: Wednesday, September 6, 2023

Project Notes: Proposed Culvert 6ft span. Used existing roadway alignment profile as roadway elevation points. See backup Mathcad for culvert elevation calculations. Skew matches existing as 5 degrees.

Project Units: U.S. Customary Units

Outlet Control Option: Profiles

Exit Loss Option: Standard Method

Crossing Data: Proposed 6'

Crossing Notes:

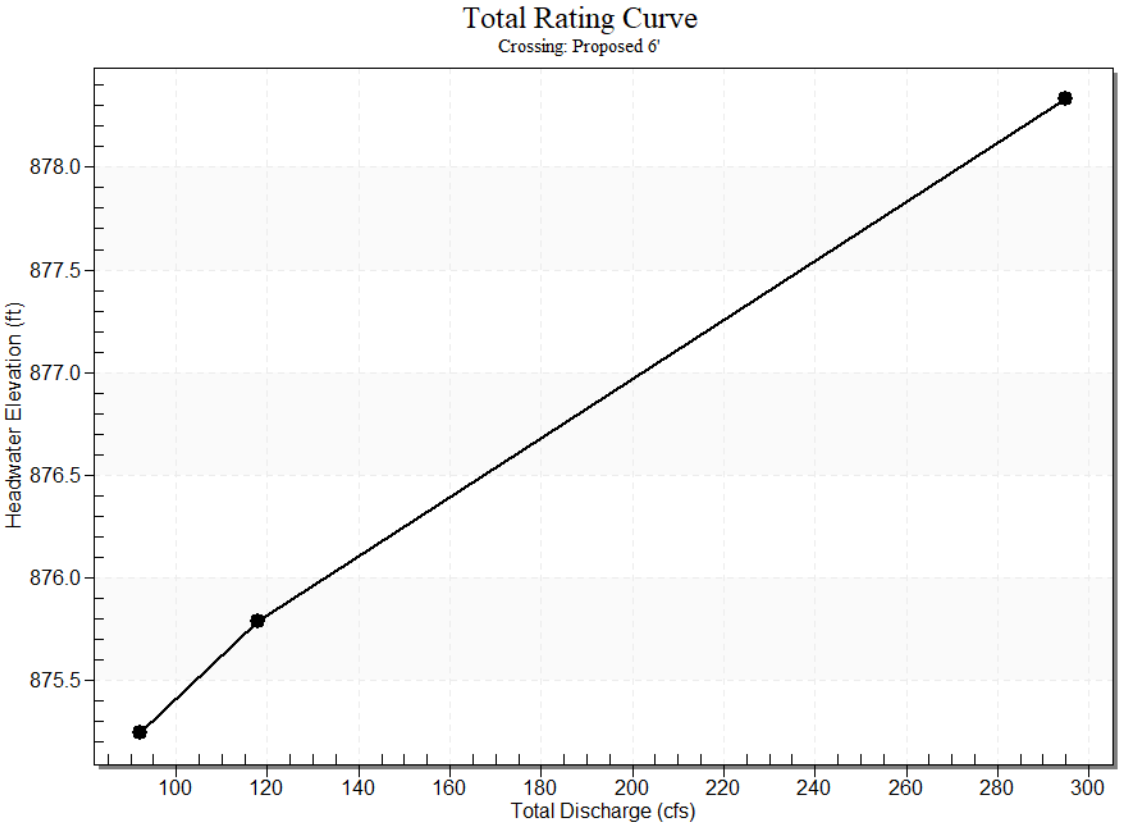
Crossing Discharge Data

Discharge Selection Method: User Defined

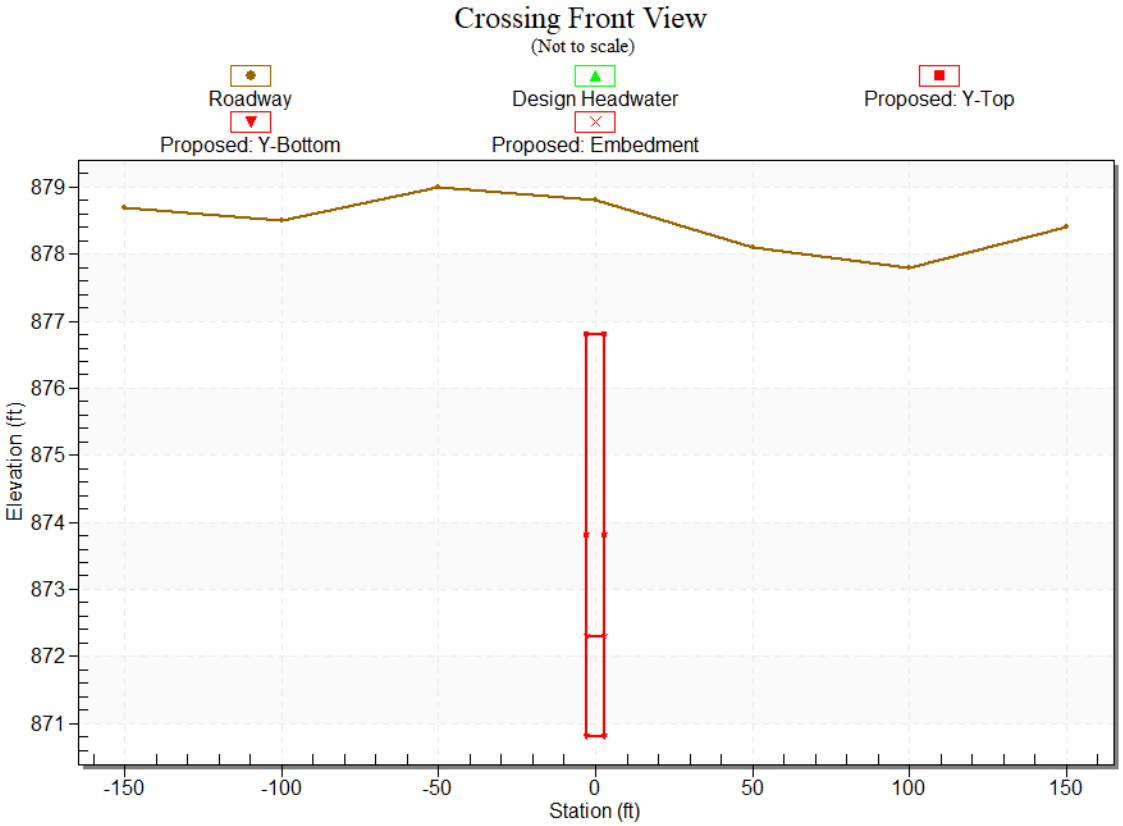
Table 1 - Summary of Culvert Flows at Crossing: Proposed 6'

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Proposed Discharge (cfs)	Roadway Discharge (cfs)	Iterations
875.25	Q50	92.00	92.00	0.00	1
875.79	Q100	118.00	118.00	0.00	1
877.80	Overtopping	216.65	216.65	0.00	Overtopping

Rating Curve Plot for Crossing: Proposed 6'



Crossing Front View (Roadway Profile): Proposed 6'



Culvert Data: Proposed

Culvert Notes:

Table 1 - Culvert Summary Table: Proposed

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
Q50	92.00 cfs	92.00 cfs	875.25	2.95	1.491	1-S2n	1.74	1.94	1.74	1.57	8.79	6.41
Q100	118.00 cfs	118.00 cfs	875.79	3.49	2.060	1-S2n	2.04	2.29	2.05	1.79	9.61	6.87

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

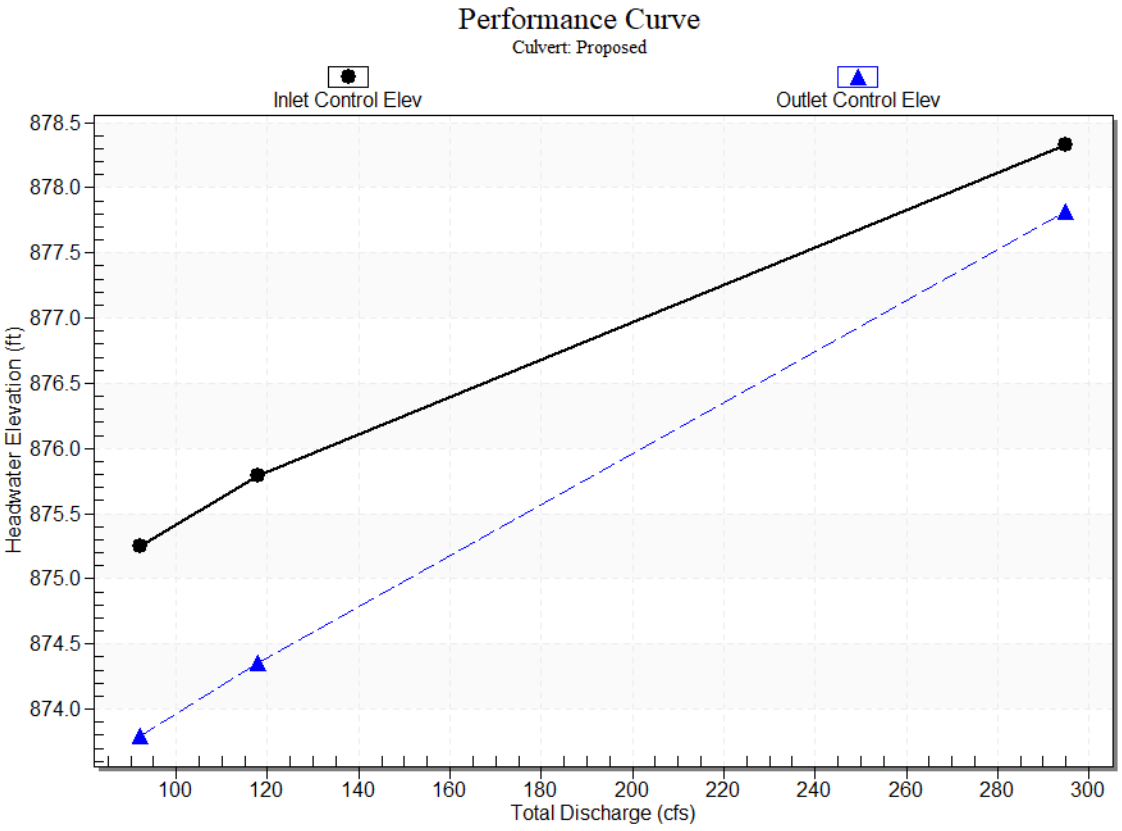
Inlet Elevation (invert): 872.30 ft,

Outlet Elevation (invert): 871.50 ft

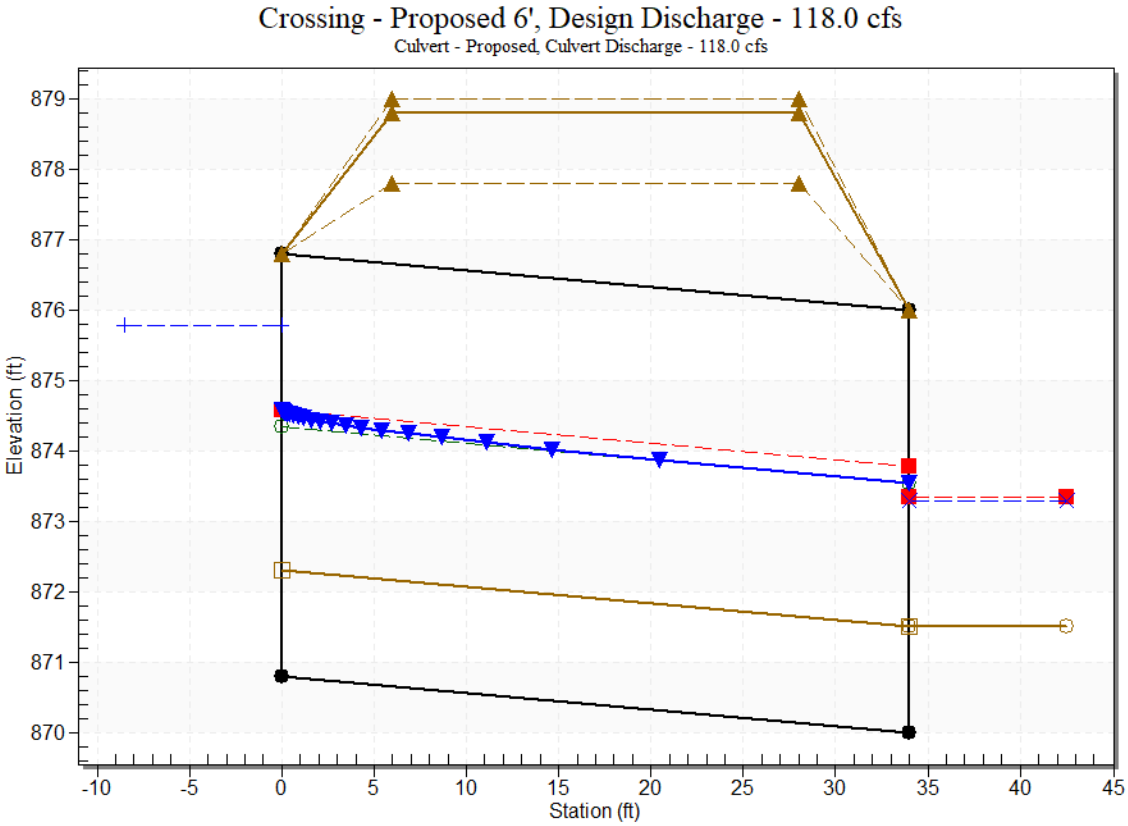
Culvert Length: 34.01 ft,

Culvert Slope: 0.0235

Culvert Performance Curve Plot: Proposed



Water Surface Profile Plot for Culvert: Proposed



Site Data - Proposed

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 870.80 ft

Outlet Station: 34.00 ft

Outlet Elevation: 870.00 ft

Number of Barrels: 1

Culvert Data Summary - Proposed

Barrel Shape: Concrete Box

Barrel Span: 6.00 ft

Barrel Rise: 6.00 ft

Barrel Material: Concrete

Embedment: 18.00 in

Barrel Manning's n: 0.0120 (top and sides)

Manning's n: 0.0350 (bottom)

Culvert Type: Straight

Inlet Configuration: Square Edge (30-75º flare) Wingwall (Ke=0.4)

Inlet Depression: None

Tailwater Data for Crossing: Proposed 6'

Table 2 - Downstream Channel Rating Curve (Crossing: Proposed 6')

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
92.00	873.07	1.57	6.41	1.96	1.04
118.00	873.29	1.79	6.87	2.24	1.06

Tailwater Channel Data - Proposed 6'

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 6.00 ft

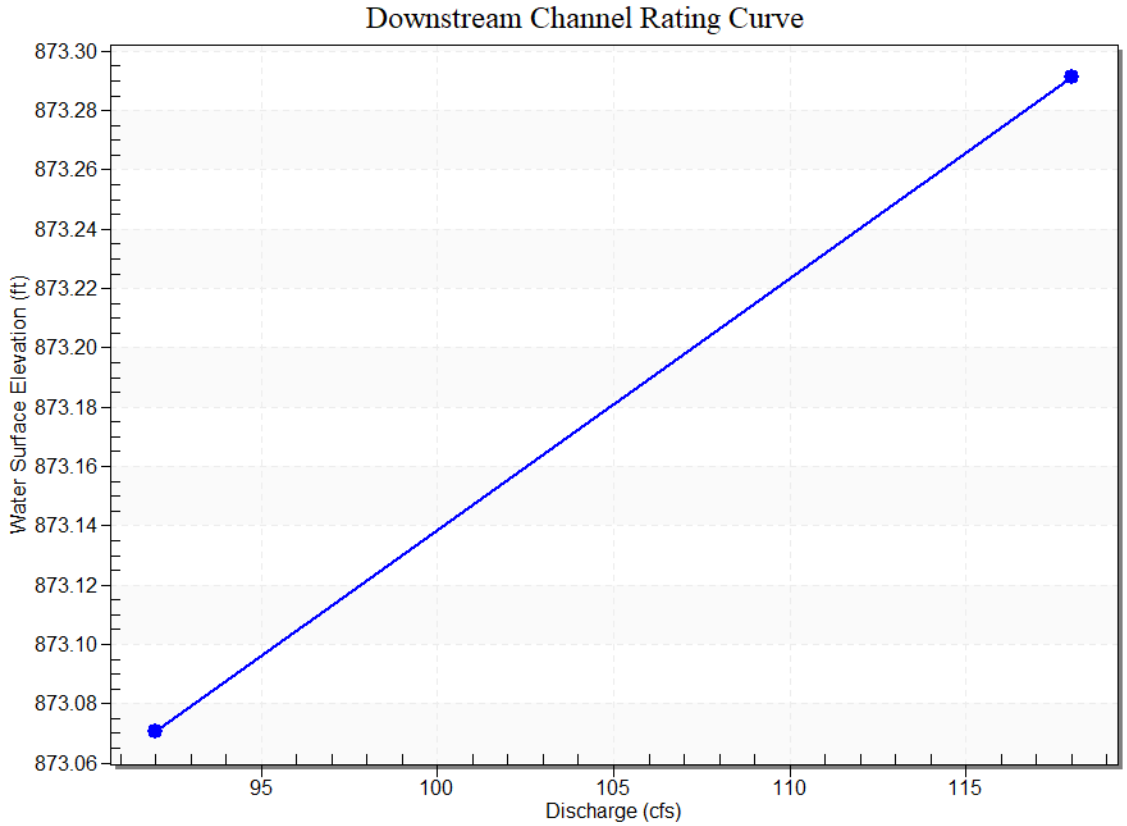
Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0350

Channel Invert Elevation: 871.50 ft

Tailwater Rating Curve Plot for Crossing: Proposed 6'



Roadway Data for Crossing: Proposed 6'

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section

Coord No.	Station (ft)	Elevation (ft)
0	-150.00	878.70
1	-100.00	878.50
2	-50.00	879.00
3	0.00	878.80
4	50.00	878.10
5	100.00	877.80
6	150.00	878.40

Roadway Surface: Paved

Roadway Top Width: 22.00 ft

HY-8 Report: Proposed Conditions
Sensitivity Analyses

HY-8 Culvert Analysis Report

Project Data

Project Title: Acworth 43566C – Route 123A over Unnamed Tributary

Designer: LMS, Checked by: SAB

Project Date: Wednesday, September 6, 2023

Project Notes: Proposed Culvert 6ft span. Used existing roadway alignment profile as roadway elevation points. See backup Mathcad for culvert elevation calculations. Skew matches existing as 5 degrees.

Project Units: U.S. Customary Units

Outlet Control Option: Profiles

Exit Loss Option: Standard Method

Crossing Data: Proposed 6'

Crossing Notes: Tailwater sensitivity analysis – constant tailwater set at 876’

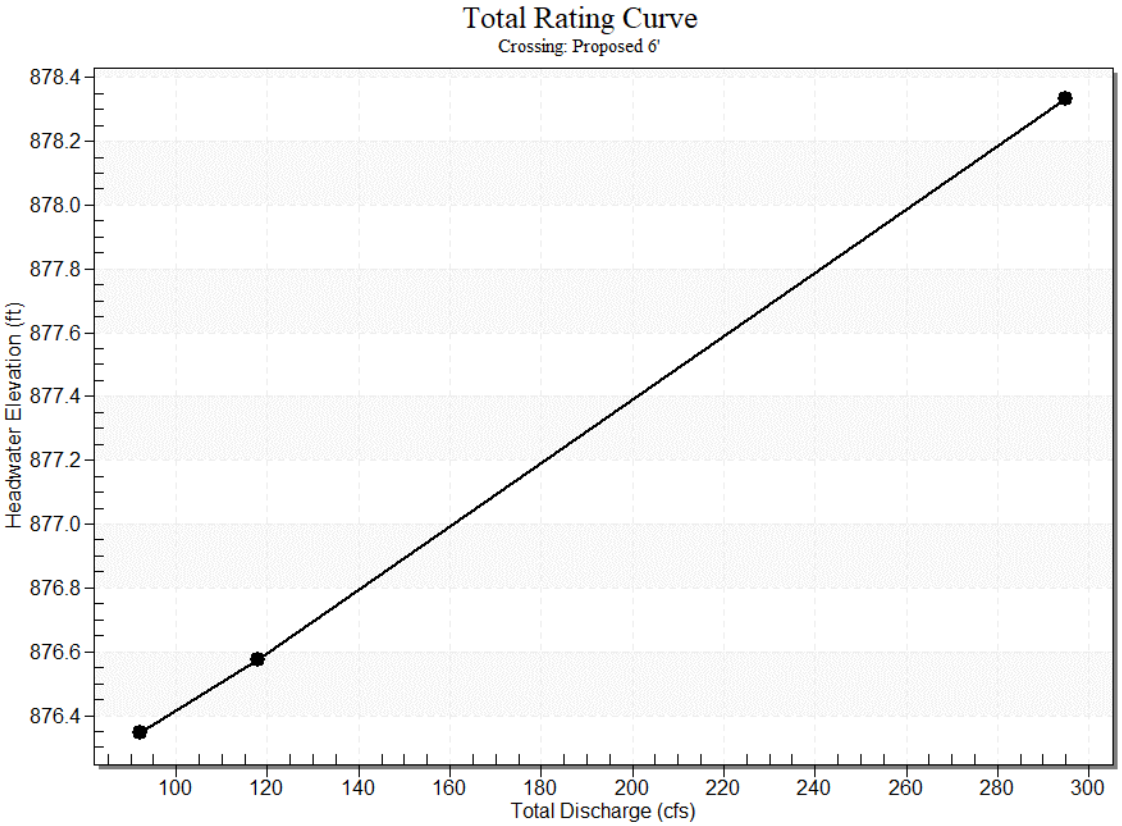
Crossing Discharge Data

Discharge Selection Method: User Defined

Table 1 - Summary of Culvert Flows at Crossing: Proposed 6'

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Proposed Discharge (cfs)	Roadway Discharge (cfs)	Iterations
876.35	Q50	92.00	92.00	0.00	1
876.57	Q100	118.00	118.00	0.00	1
877.80	Overtopping	216.65	216.65	0.00	Overtopping

Rating Curve Plot for Crossing: Proposed 6'



Culvert Data: Proposed

Culvert Notes:

Table 1 - Culvert Summary Table: Proposed

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
Q50	92.00 cfs	92.00 cfs	876.35	2.95	4.047	1-S1f	1.74	1.94	4.50	4.50	3.41	0.00
Q100	118.00 cfs	118.00 cfs	876.57	3.49	4.274	1-S1f	2.04	2.29	4.50	4.50	4.37	0.00

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

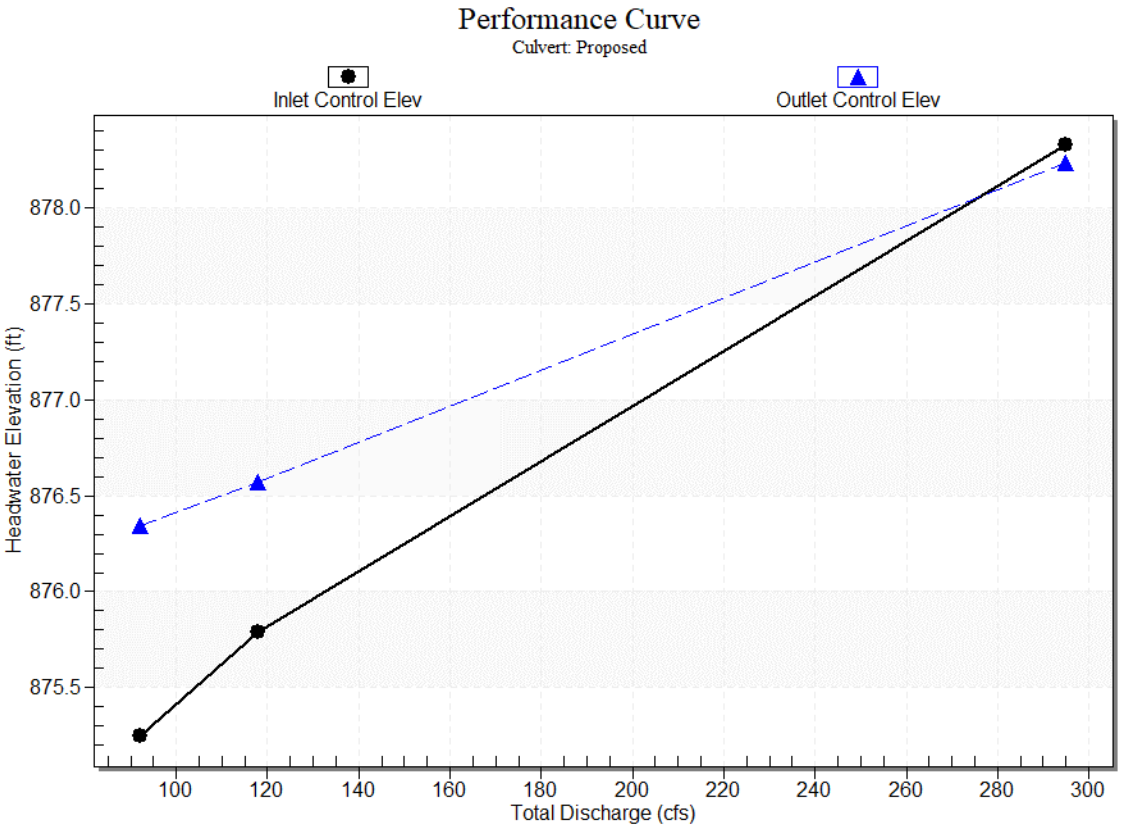
Inlet Elevation (invert): 872.30 ft,

Outlet Elevation (invert): 871.50 ft

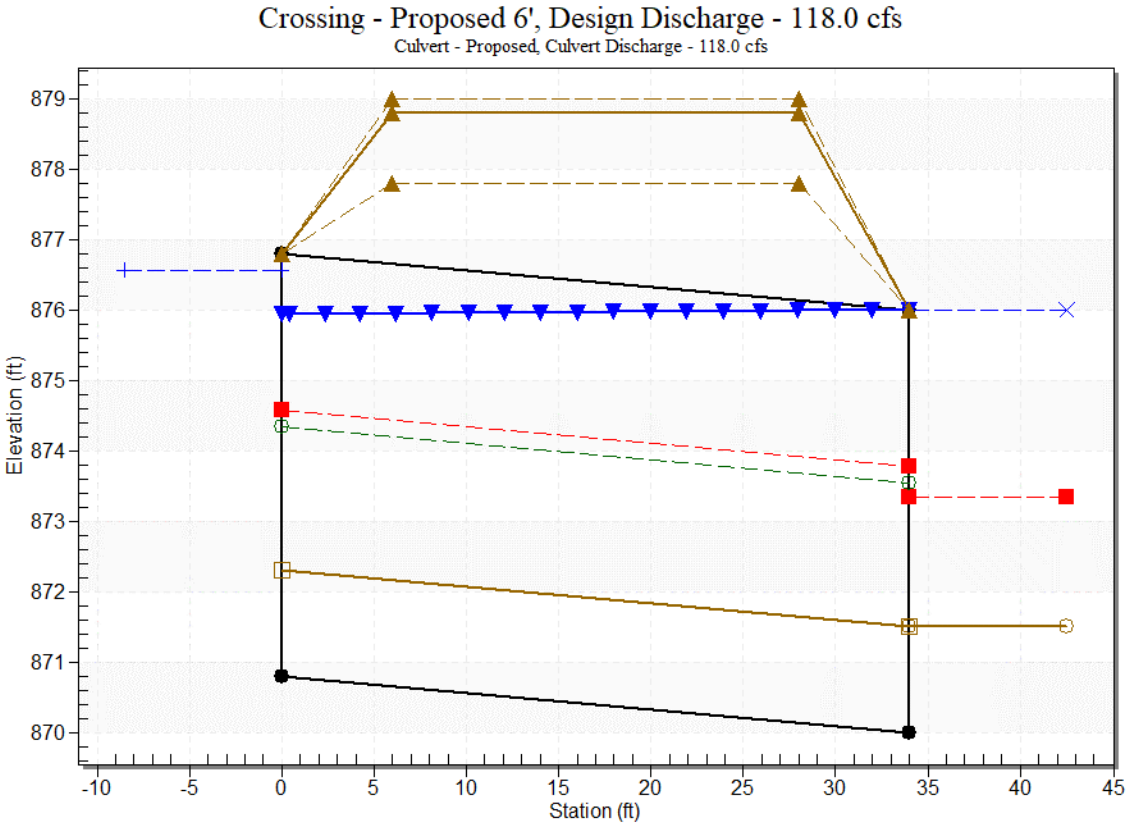
Culvert Length: 34.01 ft,

Culvert Slope: 0.0235

Culvert Performance Curve Plot: Proposed



Water Surface Profile Plot for Culvert: Proposed



Site Data - Proposed

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 870.80 ft

Outlet Station: 34.00 ft

Outlet Elevation: 870.00 ft

Number of Barrels: 1

Culvert Data Summary - Proposed

Barrel Shape: Concrete Box

Barrel Span: 6.00 ft

Barrel Rise: 6.00 ft

Barrel Material: Concrete

Embedment: 18.00 in

Barrel Manning's n: 0.0120 (top and sides)

Manning's n: 0.0350 (bottom)

Culvert Type: Straight

Inlet Configuration: Square Edge (30-75º flare) Wingwall (Ke=0.4)

Inlet Depression: None

Tailwater Data for Crossing: Proposed 6'

Table 2 - Downstream Channel Rating Curve (Crossing: Proposed 6')

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
92.00	876.00	4.50
118.00	876.00	4.50

Tailwater Channel Data - Proposed 6'

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 876.00 ft

Roadway Data for Crossing: Proposed 6'

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section

Coord No.	Station (ft)	Elevation (ft)
0	-150.00	878.70
1	-100.00	878.50
2	-50.00	879.00
3	0.00	878.80
4	50.00	878.10
5	100.00	877.80
6	150.00	878.40

Roadway Surface: Paved

Roadway Top Width: 22.00 ft

HY-8 Culvert Analysis Report

Project Data

Project Title: Acworth 43566C – Route 123A over Unnamed Tributary

Designer: LMS, Checked by: SAB

Project Date: Wednesday, September 6, 2023

Project Notes: Proposed Culvert 6ft span. Used existing roadway alignment profile as roadway elevation points. See backup Mathcad for culvert elevation calculations. Skew matches existing as 5 degrees.

Project Units: U.S. Customary Units

Outlet Control Option: Profiles

Exit Loss Option: Standard Method

Crossing Data: Proposed 6'

Crossing Notes: Tailwater sensitivity analysis – constant tailwater set at 877'

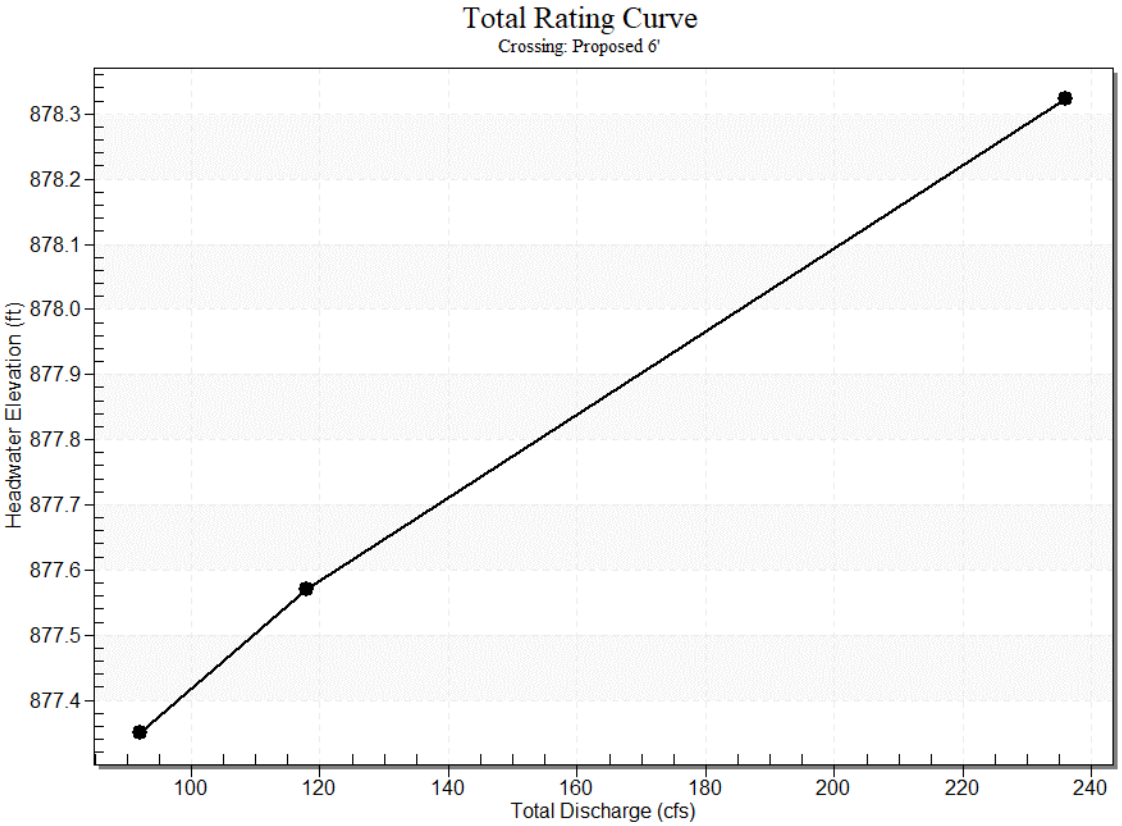
Crossing Discharge Data

Discharge Selection Method: User Defined

Table 1 - Summary of Culvert Flows at Crossing: Proposed 6'

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Proposed Discharge (cfs)	Roadway Discharge (cfs)	Iterations
877.35	Q50	92.00	92.00	0.00	1
877.57	Q100	118.00	118.00	0.00	1
877.80	Overtopping	140.57	140.57	0.00	Overtopping

Rating Curve Plot for Crossing: Proposed 6'



Culvert Data: Proposed

Culvert Notes:

Table 1 - Culvert Summary Table: Proposed

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
Q50	92.00 cfs	92.00 cfs	877.35	2.95	5.050	4-FFf	1.74	1.94	4.50	5.50	3.41	0.00
Q100	118.00 cfs	118.00 cfs	877.57	3.49	5.269	4-FFf	2.04	2.29	4.50	5.50	4.37	0.00

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

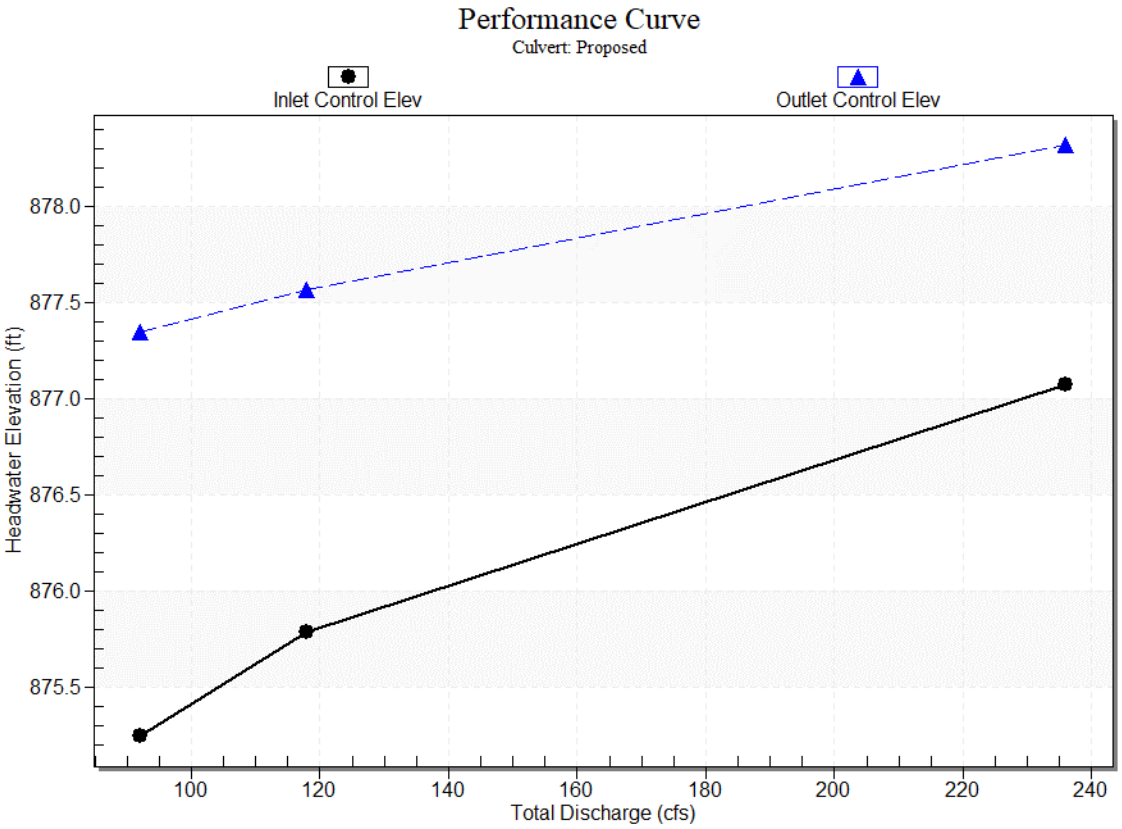
Inlet Elevation (invert): 872.30 ft,

Outlet Elevation (invert): 871.50 ft

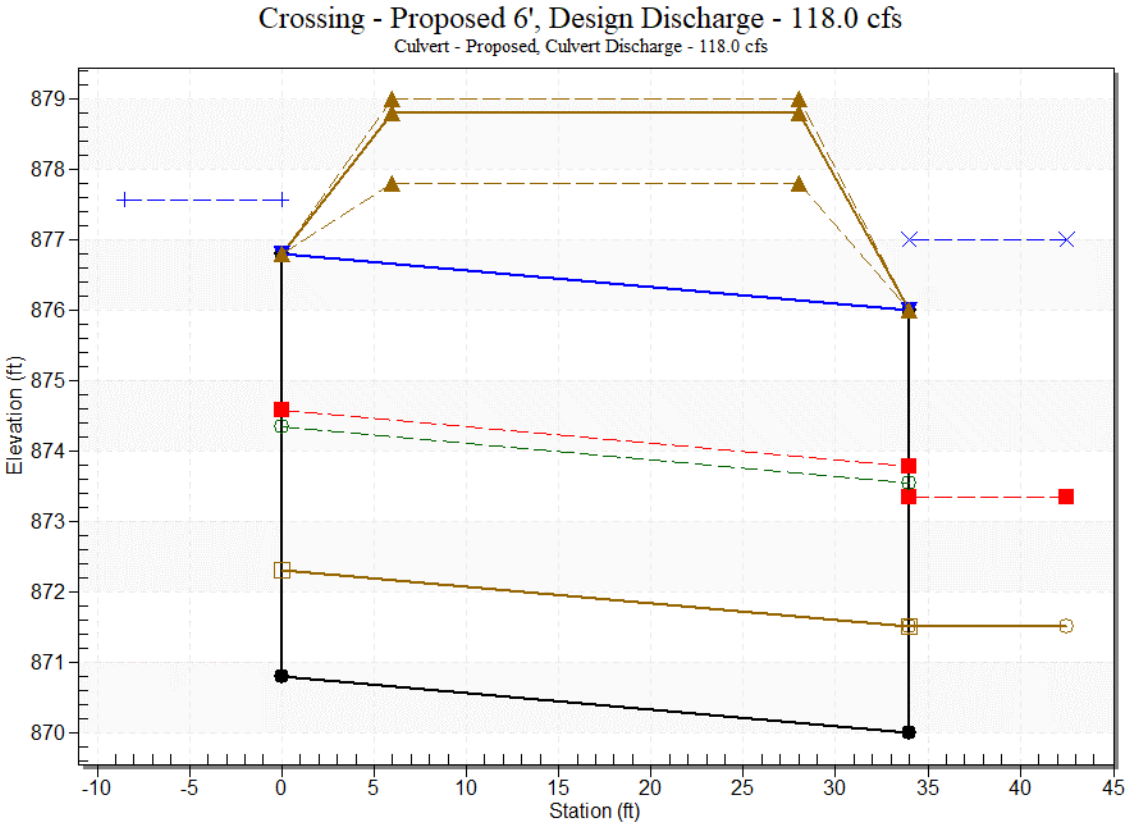
Culvert Length: 34.01 ft,

Culvert Slope: 0.0235

Culvert Performance Curve Plot: Proposed



Water Surface Profile Plot for Culvert: Proposed



Site Data - Proposed

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 870.80 ft

Outlet Station: 34.00 ft

Outlet Elevation: 870.00 ft

Number of Barrels: 1

Culvert Data Summary - Proposed

Barrel Shape: Concrete Box

Barrel Span: 6.00 ft

Barrel Rise: 6.00 ft

Barrel Material: Concrete

Embedment: 18.00 in

Barrel Manning's n: 0.0120 (top and sides)

Manning's n: 0.0350 (bottom)

Culvert Type: Straight

Inlet Configuration: Square Edge (30-75º flare) Wingwall (Ke=0.4)

Inlet Depression: None

Tailwater Data for Crossing: Proposed 6'

Table 2 - Downstream Channel Rating Curve (Crossing: Proposed 6')

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
92.00	877.00	5.50
118.00	877.00	5.50

Tailwater Channel Data - Proposed 6'

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 877.00 ft

Roadway Data for Crossing: Proposed 6'

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section

Coord No.	Station (ft)	Elevation (ft)
0	-150.00	878.70
1	-100.00	878.50
2	-50.00	879.00
3	0.00	878.80
4	50.00	878.10
5	100.00	877.80
6	150.00	878.40

Roadway Surface: Paved

Roadway Top Width: 22.00 ft

Natural Heritage Bureau (NHB) Review

New Hampshire Natural Heritage Bureau
NHB DataCheck Results Letter

To: Joanne Theriault
Hoyle, Tanner & Associates, Inc.
150 Dow Street
Manchester, NH 03101

From: NH Natural Heritage Bureau

Date: 8/8/2023 (This letter is valid through 8/8/2024)

Re: Review by NH Natural Heritage Bureau of request dated 8/8/2023

Permit Types: General Permit
Wetland Standard Dredge & Fill - Major
Federal: NEPA Review

NHB ID: NHB23-2379

Applicant: Joanne Theriault

Location: Acworth
Tax Map: 248, Tax Lot: 25
Address: NH Route 123A

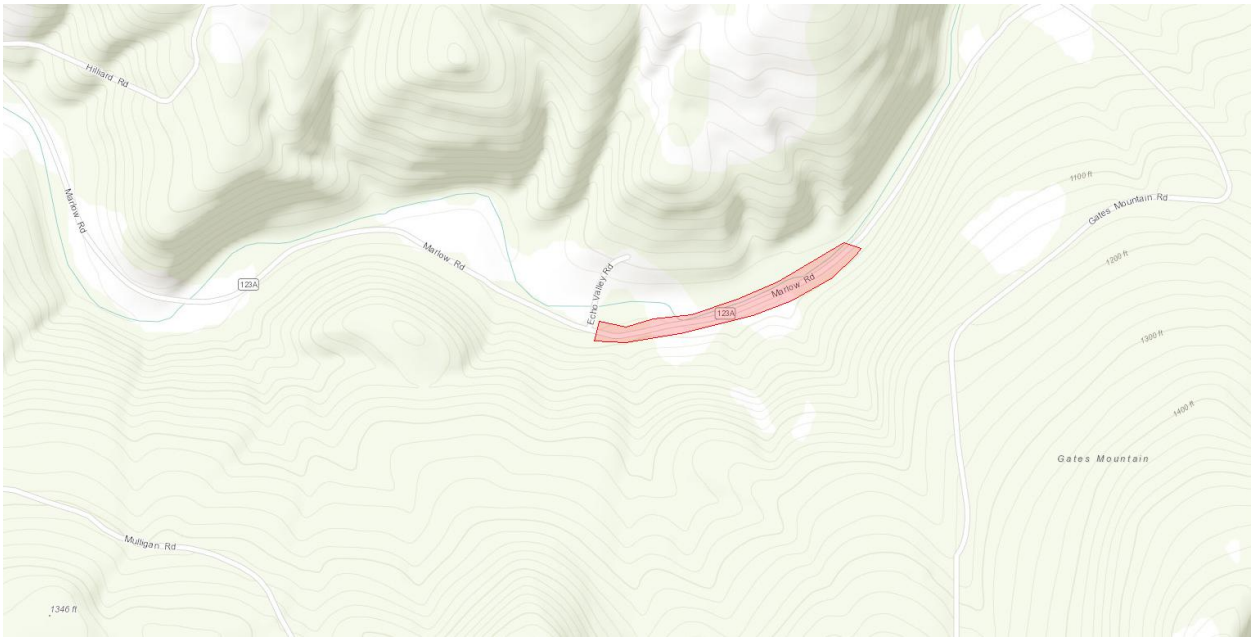
Proj. Description: The NHDOT is proposing headwall and culvert replacement and roadway repairs to a segment of NH Route 123A. The road runs parallel and is immediately adjacent to the Cold River. The crossing to be replaced conveys Brooks Gorge under NH Route 123A just upstream of its convergence with the Cold River.

The NH Natural Heritage database has been checked for records of rare species and exemplary natural communities near the area mapped below. The species considered include those listed as Threatened or Endangered by either the state of New Hampshire or the federal government. We currently have no recorded occurrences for sensitive species near this project area.

A negative result (no record in our database) does not mean that a sensitive species is not present. Our data can only tell you of known occurrences, based on information gathered by qualified biologists and reported to our office. However, many areas have never been surveyed, or have only been surveyed for certain species. An on-site survey would provide better information on what species and communities are indeed present.

Based on the information submitted, no further consultation with the NH Fish and Game Department pursuant to Fis 1004 is required.

MAP OF PROJECT BOUNDARIES FOR: NHB23-2379



Department of Natural and Cultural Resources
Division of Forests and Lands
(603) 271-2214 fax: 271-6488

DNCR/NHB
172 Pembroke Rd.
Concord NH 03301

US Fish and Wildlife (USF&W) IPaC Results & Correspondence

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
Phone: (603) 223-2541 Fax: (603) 223-0104

In Reply Refer To: 03/29/2024 17:29:17 UTC
Project Code: 2023-0115257
Project Name: NHDOT Acworth 43566C - NH Route 123A over Unnamed Tributary to Cold River

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed, and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through IPaC by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)

(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at: https://www.fws.gov/sites/default/files/documents/endangered-species-consultation-handbook.pdf

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts, see Migratory Bird Permit | What We Do | U.S. Fish & Wildlife Service (fws.gov).

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures, see https://www.fws.gov/library/collections/threats-birds.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/partner/council-conservation-migratory-birds.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
(603) 223-2541

PROJECT SUMMARY

Project Code: 2023-0115257

Project Name: NHDOT Acworth 43566C - NH Route 123A over Unnamed Tributary to Cold River

Project Type: Bridge - Replacement

Project Description: The NHDOT is proposing headwall and culvert replacement and roadway repairs to a segment of NH Route 123A. The road runs parallel and immediately adjacent to the Cold River.

Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@43.18585015,-72.25637094785819,14z

Counties: Sullivan County, New Hampshire

ENDANGERED SPECIES ACT SPECIES

There is a total of 4 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 1 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Endangered
Tricolored Bat *Perimyotis subflavus* No critical habitat has been designated for this species. This species only needs to be considered under the following conditions: ▪ This species only needs to be considered if the project includes wind turbine operations. Species profile: https://ecos.fws.gov/ecp/species/10515	Proposed Endangered

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

FLOWERING PLANTS

NAME	STATUS
Northeastern Bulrush *Scirpus ancistrochaetus* Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6715	Endangered

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

IPAC USER CONTACT INFORMATION

Agency: New Hampshire Department of Transportation
Name: Deb Coon
Address: 150 Dow Street
City: Manchester
State: NH
Zip: 03101
Email dcoon@hoyletanner.com
Phone: 6034605154

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Federal Emergency Management Agency

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
Phone: (603) 223-2541 Fax: (603) 223-0104

In Reply Refer To: October 23, 2023
Project code: 2023-0115257
Project Name: NHDOT Acworth 43566C - NH Route 123A over Unnamed Tributary to Cold River

Federal Nexus: yes
Federal Action Agency (if applicable): Federal Emergency Management Agency

Subject: Record of project representative's no effect determination for 'NHDOT Acworth 43566C - NH Route 123A over Unnamed Tributary to Cold River'

Dear Deb Coon:

This letter records your determination using the Information for Planning and Consultation (IPaC) system provided to the U.S. Fish and Wildlife Service (Service) on October 23, 2023, for 'NHDOT Acworth 43566C - NH Route 123A over Unnamed Tributary to Cold River' (here forward, Project). This project has been assigned Project Code 2023-0115257 and all future correspondence should clearly reference this number. **Please carefully review this letter.**

Ensuring Accurate Determinations When Using IPaC

The Service developed the IPaC system and associated species' determination keys in accordance with the Endangered Species Act of 1973 (ESA; 87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) and based on a standing analysis. All information submitted by the Project proponent into IPaC must accurately represent the full scope and details of the Project.

Failure to accurately represent or implement the Project as detailed in IPaC or the Northern Long-eared Bat Rangewide Determination Key (Dkey), invalidates this letter. ***Answers to certain questions in the DKey commit the project proponent to implementation of conservation measures that must be followed for the ESA determination to remain valid.***

Determination for the Northern Long-Eared Bat

Based upon your IPaC submission and a standing analysis, your project has reached the determination of "No Effect" on the northern long-eared bat. To make a no effect determination, the full scope of the proposed project implementation (action) should not have any effects (either positive or negative), to a federally listed species or designated critical habitat. Effects of the

action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action. (See § 402.17).

Under Section 7 of the ESA, if a federal action agency makes a no effect determination, no consultation with the Service is required (ESA §7). If a proposed Federal action may affect a listed species or designated critical habitat, formal consultation is required except when the Service concurs, in writing, that a proposed action "is not likely to adversely affect" listed species or designated critical habitat [50 CFR §402.02, 50 CFR§402.13].

Other Species and Critical Habitat that May be Present in the Action Area

The IPaC-assisted determination for the northern long-eared bat does not apply to the following ESA-protected species and/or critical habitat that also may occur in your Action area:

- Monarch Butterfly *Danaus plexippus* Candidate
- Northeastern Bulrush *Scirpus ancistrochaetus* Endangered

You may coordinate with our Office to determine whether the Action may affect the animal species listed above and, if so, how they may be affected.

Next Steps

Based upon your IPaC submission, your project has reached the determination of “No Effect” on the northern long-eared bat. If there are no updates on listed species, no further consultation/ coordination for this project is required with respect to the northern long-eared bat. However, the Service recommends that project proponents re-evaluate the Project in IPaC if: 1) the scope, timing, duration, or location of the Project changes (includes any project changes or amendments); 2) new information reveals the Project may impact (positively or negatively) federally listed species or designated critical habitat; or 3) a new species is listed, or critical habitat designated. If any of the above conditions occurs, additional coordination with the Service should take place to ensure compliance with the Act.

If you have any questions regarding this letter or need further assistance, please contact the New England Ecological Services Field Office and reference Project Code 2023-0115257 associated with this Project.

Action Description
You provided to IPaC the following name and description for the subject Action.

1. Name

NHDOT Acworth 43566C - NH Route 123A over Unnamed Tributary to Cold River

2. Description

The following description was provided for the project 'NHDOT Acworth 43566C - NH Route 123A over Unnamed Tributary to Cold River':

> The NHDOT is proposing headwall and culvert replacement and roadway repairs to a segment of NH Route 123A. The road runs parallel and immediately adjacent to the Cold River.

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@43.185823049999996,-72.25642923939864,14z

DETERMINATION KEY RESULT

Based on the information you provided, you have determined that the Proposed Action will have no effect on the Endangered northern long-eared bat (Myotis septentrionalis). Therefore, no consultation with the U.S. Fish and Wildlife Service pursuant to Section 7(a)(2) of the Endangered Species Act of 1973 (87 Stat. 884, as amended 16 U.S.C. 1531 *et seq.*) is required for those species.

QUALIFICATION INTERVIEW

1. Does the proposed project include, or is it reasonably certain to cause, intentional take of the northern long-eared bat or any other listed species?

   Note: Intentional take is defined as take that is the intended result of a project. Intentional take could refer to research, direct species management, surveys, and/or studies that include intentional handling/encountering, harassment, collection, or capturing of any individual of a federally listed threatened, endangered or proposed species?

   No

2. Does any component of the action involve construction or operation of wind turbines?

   Note: For federal actions, answer ‘yes’ if the construction or operation of wind power facilities is either (1) part of the federal action or (2) would not occur but for a federal agency action (federal permit, funding, etc.).

   No

3. Is the proposed action authorized, permitted, licensed, funded, or being carried out by a Federal agency in whole or in part?

   Yes

4. Is the Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), or Federal Transit Administration (FTA) funding or authorizing the proposed action, in whole or in part?

   No

5. Are you an employee of the federal action agency or have you been officially designated in writing by the agency as its designated non-federal representative for the purposes of Endangered Species Act Section 7 informal consultation per 50 CFR § 402.08?

   Note: This key may be used for federal actions and for non-federal actions to facilitate section 7 consultation and to help determine whether an incidental take permit may be needed, respectively. This question is for information purposes only.

   No

6. Is the lead federal action agency the Environmental Protection Agency (EPA) or Federal Communications Commission (FCC)? Is the Environmental Protection Agency (EPA) or Federal Communications Commission (FCC) funding or authorizing the proposed action, in whole or in part?

   No

7. Is the lead federal action agency the Federal Energy Regulatory Commission (FERC)?

   No

8. Have you determined that your proposed action will have no effect on the northern long-eared bat? Remember to consider the effects of any activities that would not occur but for the proposed action.

   If you think that the northern long-eared bat may be affected by your project or if you would like assistance in deciding, answer “No” below and continue through the key. If you have determined that the northern long-eared bat does not occur in your project’s action area and/or that your project will have no effects whatsoever on the species despite the potential for it to occur in the action area, you may make a “no effect” determination for the northern long-eared bat.

   Note: Federal agencies (or their designated non-federal representatives) must consult with USFWS on federal agency actions that may affect listed species [50 CFR 402.14(a)]. Consultation is not required for actions that will not affect listed species or critical habitat. Therefore, this determination key will not provide a consistency or verification letter for actions that will not affect listed species. If you believe that the northern long-eared bat may be affected by your project or if you would like assistance in deciding, please answer “No” and continue through the key. Remember that this key addresses only effects to the northern long-eared bat. Consultation with USFWS would be required if your action may affect another listed species or critical habitat. The definition of Effects of the Action can be found here: https://www.fws.gov/media/northern-long-eared-bat-assisted-determination-key-selected-definitions

   Yes

PROJECT QUESTIONNAIRE

Will all project activities by completed by April 1, 2024?

No

IPAC USER CONTACT INFORMATION

Agency: New Hampshire Department of Transportation
Name: Deb Coon
Address: 150 Dow Street
City: Manchester
State: NH
Zip: 03101
Email dcoon@hoyletanner.com
Phone: 6034605154

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Federal Emergency Management Agency

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
Phone: (603) 223-2541 Fax: (603) 223-0104

In Reply Refer To: October 19, 2023
Project code: 2023-0115257
Project Name: NHDOT Acworth 43566C - NH Route 123A over Unnamed Tributary to Cold River

Federal Nexus: yes
Federal Action Agency (if applicable): Federal Emergency Management Agency

Subject: Federal agency coordination under the Endangered Species Act, Section 7 for 'NHDOT Acworth 43566C - NH Route 123A over Unnamed Tributary to Cold River'

Dear Deb Coon:

This letter records your determination using the Information for Planning and Consultation (IPaC) system provided to the U.S. Fish and Wildlife Service (Service) on October 19, 2023, for "NHDOT Acworth 43566C - NH Route 123A over Unnamed Tributary to Cold River" (here forward, Project). This project has been assigned Project Code 2023-0115257 and all future correspondence should clearly reference this number.

The Service developed the IPaC system and associated species' determination keys in accordance with the Endangered Species Act of 1973 (ESA; 87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) and based on a standing analysis. All information submitted by the Project proponent into the IPaC must accurately represent the full scope and details of the Project. Failure to accurately represent or implement the Project as detailed in IPaC or the Northeast Determination Key (DKey), invalidates this letter. ***Answers to certain questions in the DKey commit the project proponent to implementation of conservation measures that must be followed for the ESA determination to remain valid.***

To make a no effect determination, the full scope of the proposed project implementation (action) should not have any effects (either positive or negative effect(s)), to a federally listed species or designated critical habitat. Effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action. (See § 402.17). Under Section 7 of the ESA, if a federal action agency

makes a no effect determination, no further consultation with, or concurrence from, the Service is required (ESA §7). If a proposed Federal action may affect a listed species or designated critical habitat, formal consultation is required (except when the Service concurs, in writing, that a proposed action "is not likely to adversely affect" listed species or designated critical habitat [50 CFR §402.02, 50 CFR§402.13]).

The IPaC results indicated the following species is (are) potentially present in your project area and, based on your responses to the Service's Northeast DKey, you determined the proposed Project will have the following effect determinations:

Species	**Listing Status**	**Determination**
Northeastern Bulrush (*Scirpus ancistrochaetus*)	Endangered	No effect

Conclusion If there are no updates on listed species, no further consultation/coordination for this project is required for the species identified above. However, the Service recommends that project proponents re-evaluate the Project in IPaC if: 1) the scope, timing, duration, or location of the Project changes (includes any project changes or amendments); 2) new information reveals the Project may impact (positively or negatively) federally listed species or designated critical habitat; or 3) a new species is listed, or critical habitat designated. If any of the above conditions occurs, additional consultation with the Service should take place before project implements any changes which are final or commits additional resources.

In addition to the species listed above, the following species and/or critical habitats may also occur in your project area and are not covered by this conclusion:

- Monarch Butterfly *Danaus plexippus* Candidate
- Northern Long-eared Bat *Myotis septentrionalis* Endangered

To complete consultation for species that have reached a "May Affect" determination and/or species may occur in your project area and are not covered by this conclusion, please visit the "New England Field Office Endangered Species Project Review and Consultation" website for step-by-step instructions on how to consider effects on these listed species and/or critical habitats, avoid and minimize potential adverse effects, and prepare and submit a project review package if necessary: https://www.fws.gov/office/new-england-ecological-services/endangered-species-project-review

Please Note: If the Action may impact bald or golden eagles, additional coordination with the Service under the Bald and Golden Eagle Protection Act (BGEPA) (54 Stat. 250, as amended, 16 U.S.C. 668a-d) by the prospective permittee may be required. Please contact the Migratory Birds Permit Office, (413) 253-8643, or PermitsR5MB@fws.gov, with any questions regarding potential impacts to Eagles.

If you have any questions regarding this letter or need further assistance, please contact the New England Ecological Services Field Office and reference the Project Code associated with this Project.

Action Description
You provided to IPaC the following name and description for the subject Action.

1. Name

NHDOT Acworth 43566C - NH Route 123A over Unnamed Tributary to Cold River

2. Description

The following description was provided for the project 'NHDOT Acworth 43566C - NH Route 123A over Unnamed Tributary to Cold River':

> The NHDOT is proposing headwall and culvert replacement and roadway repairs to a segment of NH Route 123A. The road runs parallel and immediately adjacent to the Cold River.

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@43.185823049999996,-72.25642923939864,14z

QUALIFICATION INTERVIEW

1. As a representative of this project, do you agree that all items submitted represent the complete scope of the project details and you will answer questions truthfully?

   Yes

2. Does the proposed project include, or is it reasonably certain to cause, intentional take of listed species?

   Note: This question could refer to research, direct species management, surveys, and/or studies that include intentional handling/encountering, harassment, collection, or capturing of any individual of a federally listed threatened, endangered, or proposed species.

   No

3. Is the action authorized, permitted, licensed, funded, or being carried out by a Federal agency in whole or in part?

   Yes

4. Is the Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), or Federal Transit Administration (FTA) the lead agency for this project?

   No

5. Are you including in this analysis all impacts to federally listed species that may result from the entirety of the project (not just the activities under federal jurisdiction)?

   Note: If there are project activities that will impact listed species that are considered to be outside of the jurisdiction of the federal action agency submitting this key, contact your local Ecological Services Field Office to determine whether it is appropriate to use this key. If your Ecological Services Field Office agrees that impacts to listed species that are outside the federal action agency's jurisdiction will be addressed through a separate process, you can answer yes to this question and continue through the key.

   Yes

6. Are you the lead federal action agency or designated non-federal representative requesting concurrence on behalf of the lead Federal Action Agency?

   No

7. Is the lead federal action agency the Environmental Protection Agency (EPA) or Federal Communications Commission (FCC)?

   No

8. Is the lead federal action agency the Federal Energy Regulatory Commission (FERC)?

   No

9. Will the proposed project involve the use of herbicide where listed species are present?

   No

10. Are there any caves or anthropogenic features suitable for hibernating or roosting bats within the area expected to be impacted by the project?

    No

11. Does any component of the project associated with this action include structures that may pose a collision risk to **birds** (e.g., land-based or offshore wind turbines, communication towers, high voltage transmission lines, any type of towers with or without guy wires)?

    Note: For federal actions, answer ‘yes’ if the construction or operation of wind power facilities is either (1) part of the federal action or (2) would not occur but for a federal agency action (federal permit, funding, etc.).

    No

12. Does any component of the project associated with this action include structures that may pose a collision risk to **bats** (e.g., land-based wind turbines)?

    Note: For federal actions, answer ‘yes’ if the construction or operation of wind power facilities is either (1) part of the federal action or (2) would not occur but for a federal agency action (federal permit, funding, etc.).

    No

13. Will the proposed project result in permanent changes to water quantity in a stream or temporary changes that would be sufficient to result in impacts to listed species?

    For example, will the proposed project include any activities that would alter stream flow, such as water withdrawal, hydropower energy production, impoundments, intake structures, diversion structures, and/or turbines? Projects that include temporary and limited water reductions that will not displace listed species or appreciably change water availability for listed species (e.g. listed species will experience no changes to feeding, breeding or sheltering) can answer "No". Note: This question refers only to the amount of water present in a stream, other water quality factors, including sedimentation and turbidity, will be addressed in following questions.

    Yes

14. Will the proposed project affect wetlands where listed species are present?

    This includes, for example, project activities within wetlands, project activities within 300 feet of wetlands that may have impacts on wetlands, water withdrawals and/or discharge of contaminants (even with a NPDES).

    No

15. Will the proposed project activities (including upland project activities) occur within 0.5 miles of the water's edge of a stream or tributary of a stream where listed species may be present?

    Yes

16. Will the proposed project directly affect a streambed (below ordinary high water mark (OHWM)) of the stream or tributary where listed species may be present?

    No

17. Will the proposed project bore underneath (directional bore or horizontal directional drill) a stream where listed species may be present?

    No

18. Will the proposed project involve a new point source discharge into a stream or change an existing point source discharge (e.g., outfalls; leachate ponds) where listed species may be present?

    No

19. Will the proposed project involve the removal of excess sediment or debris, dredging or in-stream gravel mining where listed species may be present?

    No

20. Will the proposed project involve the creation of a new water-borne contaminant source where listed species may be present?

    Note New water-borne contaminant sources occur through improper storage, usage, or creation of chemicals. For example: leachate ponds and pits containing chemicals that are not NSF/ANSI 60 compliant have contaminated waterways. Sedimentation will be addressed in a separate question.

    No

21. Will the proposed project involve perennial stream loss, in a stream of tributary of a stream where listed species may be present, that would require an individual permit under 404 of the Clean Water Act?

    No

22. Will the proposed project involve blasting where listed species may be present?

    No

23. Will the proposed project include activities that could negatively affect fish movement temporarily or permanently (including fish stocking, harvesting, or creation of barriers to fish passage).

    Yes

24. Will the proposed project involve earth moving that could cause erosion and sedimentation, and/or contamination along a stream or tributary of a stream where listed species may be present?

    Note: Answer "Yes" to this question if erosion and sediment control measures will be used to protect the stream.

    Yes

25. Will earth moving activities result in sediment being introduced to streams or tributaries of streams where listed species may be present through activities such as, but not limited to, valley fills, large-scale vegetation removal, and/or change in site topography?

    No

26. Will the proposed project involve vegetation removal within 200 feet of a perennial stream bank where aquatic listed species may be present?

    Yes

27. Will erosion and sedimentation control Best Management Practices (BMPs) associated with applicable state and/or Federal permits, be applied to the project? If BMPs have been provided by and/or coordinated with and approved by the appropriate Ecological Services Field Office, answer "Yes" to this question.

    Yes

28. Is the project being funded, lead, or managed in whole or in part by U.S Fish and Wildlife Restoration and Recovery Program (e.g., Partners, Coastal, Fisheries, Wildlife and Sport Fish Restoration, Refuges)?

    No

29. [Semantic] Does the project intersect the Virginia big-eared bat critical habitat?

    Automatically answered
    No

30. [Semantic] Does the project intersect the Indiana bat critical habitat?

    Automatically answered
    No

31. [Semantic] Does the project intersect the candy darter critical habitat?

    Automatically answered
    No

32. [Semantic] Does the project intersect the diamond darter critical habitat?

    Automatically answered
    No

33. [Semantic] Does the project intersect the Big Sandy crayfish critical habitat?

    Automatically answered
    No

34. [Hidden Semantic] Does the project intersect the Guyandotte River crayfish critical habitat?

    Automatically answered
    No

35. [Hidden Semantic] Does the project intersect the northeastern bulrush AOI?

    Automatically answered
    Yes

36. Do you have any other documents that you want to include with this submission?

    No

PROJECT QUESTIONNAIRE

1. Approximately how many acres of trees would the proposed project remove?

   .05

2. Approximately how many total acres of disturbance are within the disturbance/ construction limits of the proposed project?

   .69

3. Briefly describe the habitat within the construction/disturbance limits of the project site.

   The project proposes a culvert replacement and associated roadway work. The area of disturbance includes pavement, both the upstream and downstream sides of the culvert are predominantly large boulder and cobble with some gravel interspersed.

IPAC USER CONTACT INFORMATION

Agency: New Hampshire Department of Transportation
Name: Deb Coon
Address: 150 Dow Street
City: Manchester
State: NH
Zip: 03101
Email dcoon@hoyletanner.com
Phone: 6034605154

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Federal Emergency Management Agency

Section 106 No Adverse Effect Memo

15284

Section 106 Cultural Resources Effect Memo
(Project NOT directly managed by NHDOT)

RECEIVED SEP 29 2023

Project Town: **Acworth**

Date: **9/21/2023**

State No.: **43556C**

Federal No. (as applicable): **TBD**

Lead Federal Agency: **Other: FEMA**

Submitted by: **Todd Clark, PE**
(Project Manager/Sponsor)

Email address: **tclark@hoyletanner.com**

Pursuant to meetings on and/or the Request for Project Review signed on 9/7/2023, and for the purpose of compliance with the regulations of National Historic Preservation Act and the Advisory Council on Historic Preservation's *procedures for the Protection of Historic Properties* (36 CFR 800), and NH RSA 227-C the NH Division of Historical Resources and, when applicable, the NH Division of the Federal Highway Administration or the US Army Corps of Engineers have coordinated the identification and evaluation of cultural resources relative to:

The New Hampshire Department of Transportation is investigating alternatives for repair or replacement of a culvert under NH Route 123A in Acworth, NH, that conveys an unnamed stream. The site is approximately 1.5 miles east of South Acworth Village and is 7 miles northeast of the 123/123A intersection. Additional elements of the project could include reconstruction of the roadway, pavement and shoulder repairs, slope stabilization, and replacement of guardrail and drainage.

The purpose of the project is to reconstruct, repair and stabilize NH Route 123A in this location. The need for the project is due to a storm event that occurred July 29-30, 2021, that resulted in the unstable condition of the culvert and roadway.

The existing culvert is a 4' high x 3' wide x 28' long concrete box with a top consisting of a corrugated metal pipe (CMP) arch. The construction date is unknown. Should the project be deemed to be a replacement, and not a repair, the proposed replacement structure would consist of a precast concrete box culvert that would be embedded below the stream bottom for a natural stream bed.

Please describe all public outreach efforts (see 36 CFR800.2-3) that have been done to-date. Identify Consulting Parties and include any public feedback (if applicable, attached pages if necessary):

Letters were sent to the local officials in the Town of Acworth on August 24, 2023. Responses received did not include any comments or concerns with historic resources. Invitations to be a Consulting Party were sent to the Acworth Conservation Commission and the Acworth Historical Society on August 24, 2023. To date, no response has been received. A Public Informational Meeting is being planned and is tentatively scheduled for the end of October. The project is not controversial, and it is not expected that there will be significant concerns from the public.

Based on a review of the project, as presented to date, it has been determined that:

Section 106 Effect Determination	
	☒ **No Historic or Archaeological Properties will be Affected**
	☐ **There will be No Adverse Effect on Historic or Archaeological Properties**
	☐ **There will be an Adverse Effect on Historic or Archaeological Properties or Resources**
	Additional comments, please explain *why* the undertaking has resulted in the above effect: A review of NHDHR's online mapping system EMMIT revealed that there are no historic properties or districts identified within the project location. A Request for Review (RPR) was sent to the NHDOT Bureau of Environment (BOE) and NHDHR. A response to the RPR was received noting there are no archaeological concerns. Additional comment included on the response was that no above-ground survey appears necessary unless there is potential for the culvert y contribute to a larger historic 20th century road system. No historic road system was identified within the project area.

In accordance with the Advisory Council's regulations, we will continue to consult, as appropriate, as this project proceeds.

Section 4(f) *(to be completed by FHWA)*	*There Will Be:*	☒ **No 4(f);**	☐ **Programmatic 4(f);**	☐ **Full 4 (f);** or
	☐ **A finding of *de minimis* 4(f) impact as stated:** In addition, with NHDHR concurrence of no adverse effect for the above undertaking, and in accordance with 23 CFR 774.3, FHWA intends to, and by signature below, does make a finding of *de minimis* impact. NHDHR's signature represents concurrence with both the no adverse effect determination and the *de minimis* findings. Parties to the Section 106 process have been consulted and their concerns have been taken into account. Therefore, the requirements of Section 4(f) have been satisfied.			

Lead Federal Agency (date)
(if applicable)

Jill Edelen 9/29/23
NHDOT Cultural Resources Program

The NH State Historic Preservation Officer concurs with these findings: Nadine Miller 10/9/23
NH Division of Historical Resources

cc: FHWA NHDHR ACOE (⇐ as applicable ⇑)

US Army Corps of Engineers ®
New England District

Appendix B
New Hampshire General Permits
Required Information and USACE Section 404Checklist

USACE Section 404 Checklist

1. Attach any explanations to this checklist. Lack of information could delay a USACE permit determination.
2. All references to "work" include all work associated with the project construction and operation. Work includes filling, clearing, flooding, draining, excavation, dozing, stumping, etc.
3. See GC 3 for information on single and complete projects.
4. Contact USACE at (978) 318-8832 with any questions.
5. The information requested below is generally required in the NHDES Wetland Application. See page 61 for NHDES references and Admin Rules as they relate to the information below.

1. Impaired Waters	Yes	No
1.1 Will any work occur within 1 mile upstream in the watershed of an impaired water? See the following to determine if there is an impaired water in the vicinity of your work area. * https://nhdes-surface-water-quality-assessment-site-nhdes.hub.arcgis.com/ https://www.des.nh.gov/water/rivers-and-lakes/water-quality-assessment https://www4.des.state.nh.us/onestopdatamapper/onestopmapper.aspx	X	
2. Wetlands	Yes	No
2.1 Are there are streams, brooks, rivers, ponds, or lakes within 200 feet of any proposed work?	X	
2.2 Are there proposed impacts to tidal SAS, prime wetlands, or priority resource areas? Applicants may obtain information from the NH Department of Resources and Economic Development Natural Heritage Bureau (NHB) DataCheck Tool for information about resources located on the property at https://www4.des.state.nh.us/NHB-DataCheck/.		X
2.3 If wetland crossings are proposed, are they adequately designed to maintain hydrology, sediment transport & wildlife passage?	X	
2.4 Would the project remove part or all of a riparian buffer? (Riparian buffers are lands adjacent to streams where vegetation is strongly influenced by the presence of water. They are often thin lines of vegetation containing native grasses, flowers, shrubs and/or trees that line the stream banks. They are also called vegetated buffer zones.)	X	
2.5 The overall project site is more than 40 acres?		X
2.6 What is the area of the previously filled wetlands?	N/A	
2.7 What is the area of the proposed fill in wetlands?	433 SF	
2.8 What % of the overall project site will be previously and proposed filled wetlands?	N/A	
3. Wildlife	Yes	No
3.1 Has the NHB & USFWS determined that there are known occurrences of rare species, exemplary natural communities, Federal and State threatened and endangered species and habitat, in the vicinity of the proposed project? (All projects require an NHB ID number & a USFWS IPAC determination.) NHB DataCheck Tool: https://www4.des.state.nh.us/NHB- DataCheck/. USFWS IPAC website: https://ipac.ecosphere.fws.gov/	X	

3.2 Would work occur in any area identified as either "Highest Ranked Habitat in N.H." or "Highest Ranked Habitat in Ecological Region"? (These areas are colored magenta and green, respectively, on NH Fish and Game's map, "2010 Highest Ranked Wildlife Habitat by Ecological Condition.") Map information can be found at: • PDF: https://wildlife.state.nh.us/wildlife/wap-high-rank.html. • Data Mapper: www.granit.unh.edu. • GIS: www.granit.unh.edu/data/downloadfreedata/category/databycategory.html.	X	
3.3 Would the project impact more than 20 acres of an undeveloped land block (upland, wetland/waterway) on the entire project site and/or on an adjoining property(s)?		X
3.4 Does the project propose more than a 10-lot residential subdivision, or a commercial or industrial development?		X
3.5 Are stream crossings designed in accordance with the GC 31?	X	
4. Flooding/Floodplain Values	Yes	No
4.1 Is the proposed project within the 100-year floodplain of an adjacent river or stream?	X	
4.2 If 4.1 is yes, will compensatory flood storage be provided if the project results in a loss of flood storage?		X
5. Historic/Archaeological Resources		
For a minimum, minor or major impact project - a copy of the RPR Form (www.nh.gov/nhdhr/review) with your DES file number shall be sent to the NH Division of Historical Resources as required on Page 37 GC 14(d) of the GP document**	X	
6. Minimal Impact Determination (for projects that exceed 1 acre of permanent impact)	Yes	No
Projects with greater than 1 acre of permanent impact must include the following: • Functional assessment for aquatic resources in the project area. • On and off-site alternative analysis. • Provide additional information and description for how the below criteria are met.		
6.1 Will there be complete loss of aquatic resources on site?		
6.2 Have the impacts to the aquatic resources been avoided and minimized to the greatest extent practicable?		
6.3 Will all aquatic resource function be lost?		
6.4 Does the aquatic resource (s) have regional significance (watershed or ecoregion)?		
6.5 Is there an on-site alternative with less impact?		
6.6 Is there an off-site alternative with less impact?		
6.7 Will there be a loss to a resource dependent species?		
6.8 Are indirect impacts greater than 1 acre within and adjacent to the project area?		
6.9 Does the proposed mitigation replace aquatic resource function for direct, indirect, and cumulative impacts?		

*Although this checklist utilizes state information, its submittal to USACE is a federal requirement.

** If your project is not within Federal jurisdiction, coordination with NH DHR is not required under Federal law.

U.S. Army Corps of Engineers
New Hampshire Programmatic General Permit (PGP)
Required Information and USACE Section 404 Checklist
NH Route 123A Culvert Conveying an Unnamed Stream, Acworth, NH

Explanations for Checklist Answers

1.1 The project will occur within 1 mile upstream of the Cold River. The Cold River is marginally impaired for aquatic life & fish consumption due to mercury according to the 2020 303(d) list. The proposed project will not add to these impairments.

2.1 The project is proposed to replace a failing existing stream crossing. The stream and some associated wetlands will be affected by the project.

2.4 Riparian buffers will be affected by the project as required to replace the culvert; however, these impacts have been minimized to the extent practicable.

3.1 The NH Natural Heritage Bureau was contacted regarding the proposed project (see attached letter NHB23-2379, dated 8/8/2023). The database check determined that there are no recorded occurrences for sensitive species near the project area. A copy of the DataCheck Report is included with this application.

An official Federally-listed species list was obtained from the US Fish and Wildlife Service (USFWS) using the Information for Planning and Conservation (IPAC) online tool. The list includes the Federally-endangered Northern Long Eared Bat (*Myotis septentrionalis*; NLEB), Federally-endangered Northeastern Bulrush (*Scirpus ancistrochaetus*) and the Monarch Butterfly (*Danaus plexippus*) as a candidate species. A copy of the species list is included with this permit application.

The project has been reviewed within the IPaC system utilizing the Northern Long-eared Bat Rangewide Determination Key. A Consistency Letter was received that the Proposed Action will have no effect on the endangered northern long-eared bat (*Myotis septentrionalis*). If there are no updates on listed species, no further consultation/ coordination for this project is required with respect to the northern long-eared bat. However, the Service recommends that project proponents re-evaluate the Project in IPaC if: 1) the scope, timing, duration, or location of the Project changes (includes any project changes or amendments); 2) new information reveals the Project may impact (positively or negatively) federally listed species or designated critical habitat; or 3) a new species is listed, or critical habitat designated. If any of the above conditions occurs, additional coordination with the Service should take place to ensure compliance with the Act. A copy of this letter is included with this application.

The project has been reviewed within the IPaC system utilizing the Northeast Endangered Species Determination Key. A consistency letter was received that the Proposed Action will have no effect on the endangered Northeastern Bulrush (*Scirpus ancistrochaetus*). If there are no updates on listed species, no further consultation/coordination for this project is required for the species identified above. However, the Service recommends that project proponents re-evaluate the Project in IPaC if: 1) the scope, timing, duration, or location of the Project changes (includes any project changes or amendments); 2) new information reveals the Project may impact (positively or negatively) federally listed species or designated critical habitat; or 3) a new species is listed, or critical habitat designated. If any of the above conditions occurs, additional consultation with the Service should take place before project implements any changes which are final or commits additional resources.

4.1 The culvert replacement project is located within the 100-year floodplain of the Cold River but will not result in a loss of flood storage.

5. A Request for Project Review was submitted to the New Hampshire Division of Historic Resources (NHDHR) as part of the NEPA Review for the project. An Effect Memo was issued for the project with a determination of "No Historic or Archaeological Properties will be Affected". A copy of the Effect Memo is included with this application.

Construction Sequence

NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES
WETLAND PERMIT APPLICATION
for
NH Route 123A Culvert Conveying an Unnamed Stream, Acworth, NH

Proposed Construction Sequence

The construction sequence for the project is as follows:

1. Coordinate traffic operations per the Traffic Control Plan document to install temporary roadway signage and implement the 4 week road closure traffic detour. Project must be completed to enable reopening to traffic after 4 weeks as stipulated in the contract documents.
2. Install temporary sediment control measures, dewatering measures and turbidity barriers as detailed on the Erosion Control Plan. Remove trees and vegetation within the proposed slope limits. Contractor shall take care to minimize removal of vegetation within the temporary easement limits as shown in these plans. Contractor shall not remove stumps below the Top of Bank (TOB) as noted on the plan.
3. Construct stream diversion and install temporary slope support structures (trench box, block walls, temporary back slopes stabilization or contractors pre-approved option) to divert the existing stream, construct proposed culvert under dry conditions and maintain stabilized site conditions.
4. Remove existing earthen materials, culvert and wingwalls structure to the depth required to place, compact and grade proposed bedding materials absent of wet conditions.
5. Place the precast concrete culvert cutoff wall, barrel and wingwall segments. Advance construction of the culvert, wingwalls and streambed. Remove temporary support structures as the permanent stabilized condition is advanced.
6. Install native channel material or Simulated Streambed Material conforming to Item 585.3401 within the proposed culvert and limits of channel disturbance as shown on the plan.
7. Backfill the culvert and advance stream bed and stream side slopes construction using conforming materials and to the limits shown on the plans.
8. Prior to removal of stream diversion, contractor shall apply water to the new stream bed and stream side slopes to bed materials. The application of water to the new stream shall be controlled to not introduce turbidity beyond the erosion controls in place.
9. Remove temporary stream diversion.
10. Complete roadway reconstruction. Install erosion control turf establishment with mulch, tackifiers, and loam and install temporary slope matting type D (wildlife friendly). Remove temporary sediment control measures.
11. Remove temporary roadway signage to reopen NH 123A to traffic.

Work is anticipated to begin in the summer of 2025 and will be substantially complete in four weeks.

NHDOT Specification Item 585.3401
Simulated Streambed Material

ACWORTH
43566C

XXXX, 2024

S P E C I A L P R O V I S I O N

AMENDMENT TO SECTION 585 – STONE FILL

Item 585.3401 – Simulated Streambed Material

Add to Description:

1.2 This work shall consist of furnishing and placing Simulated Streambed Material at the following location on this project:

STA 104+08.0, RT 24.6' to 103+98.9, LT 24.3 (Item 585.3401)

1.2.1 The Simulated Streambed Material shall be placed in locations as shown on the contract plans. The intent is to protect and replicate the natural streambed environments of the reference reach listed above. The percentage of specific stream bed material was determined in the field utilizing the Wolman Pebble Count methodology. The gradation of substrate particle sizes are based on the Wentworth scale as referenced in the Guidelines for Naturalized River Channel Design and Bank Stabilization.

Add to 2.1:

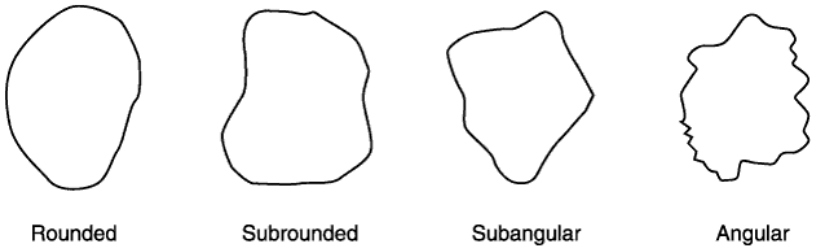
2.1.6 Simulated Streambed Material shall consist the following gradation:

	% by Weight	Sieve Sizes (in)		
Item 585	.3401			
Sand	15%	0.003 to 0.08		(smaller than head of a match)
Gravel	20%	0.08 to 2.5		(between head of match and tennis ball)
Cobble	40%	2.5 to 10.00		(between tennis ball and volleyball)
Boulder	25%	10.0 to >		(Larger than volleyball)
Depth	12"	n/a		
Shape	Sub-R	n/a		

2.1.6.1 Streambed Material depth shall be as shown in the table except as noted in the contract plans.

2.1.6.2 Particle shape shall general conformity to:

R = Rounded, Sub-R = Subrounded, Sub-A = Subangular, A = Angular



Add to 3.1:

3.1.3 In accordance with the *Guidelines for Naturalized River Channel Design and Bank Stabilization (*https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/2020-01/r-wd-06-37.pdf*)*, specifically 2.2.1.2 Semi-Natural Form Design, the Streambed Material shall be placed directly on the existing channel floor as shown in the contract plans. In cases where scour protection or streambed anchorage material is required the scour/anchorage material shall be placed first. Then the Streambed Material shall be worked into the top 1'-0" filling voids, followed by the depth of Streambed Material specified.

Add to Method of Measurement:

4.2 Simulated Streambed Material will be measured by the cubic yard.

Add to 5.1:

5.1.1 The accepted quantity of Simulated Streambed Material will be paid for at the Contract unit price per cubic yard complete in place.

Add to Pay Items and Units:

585.3401	Simulated Streambed Material	Cubic Yard

NHDOT Specification
Item 585.14 Weir Boulders

S P E C I A L P R O V I S I O N

AMENDMENT TO SECTION 585 – STONE FILL

Item 585.14 – Weir Boulders

Add to Description:

1.2 This work shall consist of furnishing and placing two weir boulders at the following locations on this project:

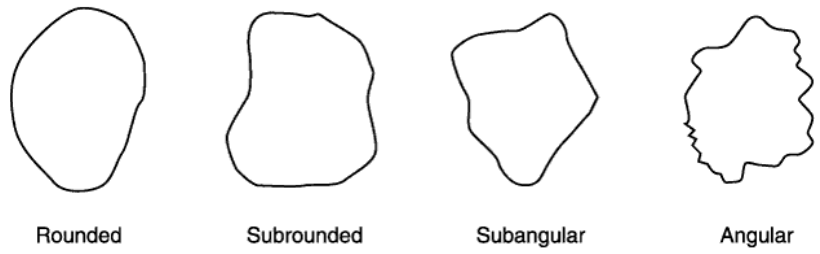
- Downstream of the proposed culvert at STA 104+02 under NH Route 123A. Place one bolder just upstream of each of the two trees with stumps to remain in-place.

Add to Materials:

2.1.6.1 Weir Boulders shall be composed of individual stones with volumes between 10ft^3 and 15 ft^3.

2.1.6.2 Particle shape shall generally conform to R and Sub-R.

R = Rounded, Sub-R = Subrounded, Sub-A = Subangular, A = Angular



Add to Construction Requirements:

3.5 Weir Boulders shall be placed in locations and arranged as shown on the contract plans. The intent is to create interlocking and sturdy structures that will retain stream flow at the heights specified on the contract plans.

Add to Method of Measurement:

4.2 Weir Boulders will be measured by the cubic yard.

Add to Basis of Payment:

5.1.1 The accepted quantity of Weir Boulders will be paid for at the Contract unit price per cubic yard complete in place.

Add to Pay Items and Units:

585.14	Weir Boulders	Cubic Yard

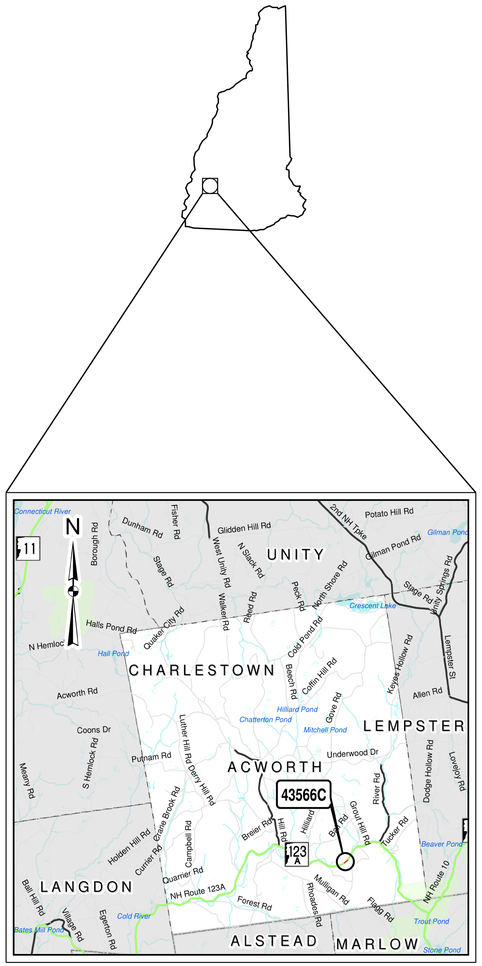
Project Plans

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION

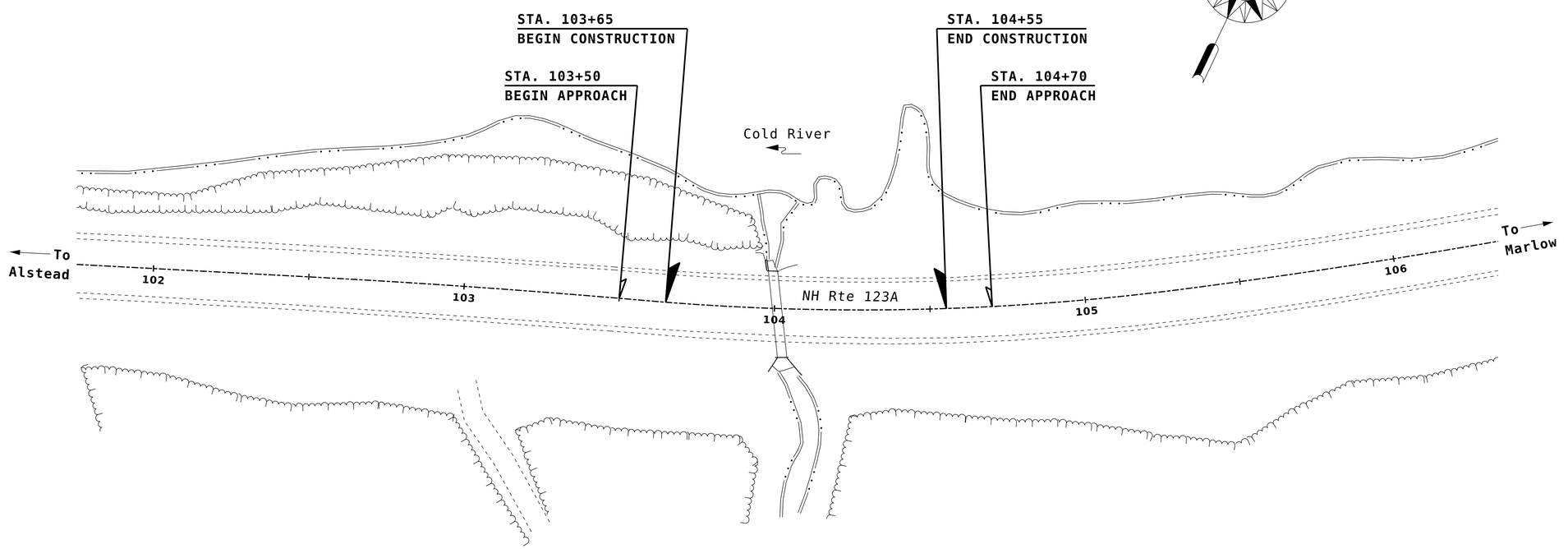
WETLANDS PLANS
FEDERAL AID PROJECT

N.H. PROJECT NO. 43566C
NH ROUTE 123A

DESIGN DATA		
AVERAGE DAILY TRAFFIC 20	22	411
AVERAGE DAILY TRAFFIC 20	24	411
PERCENT OF TRUCKS		UNKOWN
DESIGN SPEED		35 MPH
LENGTH OF PROJECT		90 FEET



LOCATION MAP



INDEX OF SHEETS

1	FRONT SHEET
2-3	STANDARD SYMBOLS SHEETS
4	WETLAND IMPACT PLANS
5	EROSION CONTROL STRATEGIES
6	EROSION CONTROL PLANS
7	EROSION CONTROL DETAILS

DRAWN BY	KDP	DATE	1/2024
CHECKED BY	TMC	DATE	1/2024

TOWN OF ACWORTH
COUNTY OF SULLIVAN
SCALE: 1" = 20'

FOR CONSTRUCTION AND ALIGNMENT DETAILS - SEE CONSTRUCTION PLANS

STATE OF NEW HAMPSHIRE - PROFESSIONAL ENGINEER - TODD M. CLARK No. 10256 LICENSED
4/3/2024

NHDOT THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

RECOMMENDED FOR APPROVAL:

DIRECTOR OF PROJECT DEVELOPMENT — DATE

MUNICIPAL HIGHWAYS ENGINEER
BUREAU OF PLANNING AND COMMUNITY ASSISTANCE — DATE

APPROVED:

ASSISTANT COMMISSIONER AND CHIEF ENGINEER — DATE

DRAWING NAME	FEDERAL PROJECT NO.	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
43566Cfsw		43566C	1	7

GENERAL

EDGE OF PAVEMENT — PROPOSED ROADWAY

TRAVELED WAY — existing roadway

(pavement removed outside slope lines)

DRIVEWAYS

(label surface type)

BUILDINGS

(building to be removed)

(label house or type of building)

FOUNDATION

(label type)

LEACH FIELD

leach field

BRIDGE CROSSINGS

STREAM

OVERPASS

STEPS AND WALK

(label type)

DITCH LINE

INTERMITTENT WATER COURSE/STREAM

SHORE LINE

river/stream

pond

(label name of water body)

POTENTIAL WET AREA SYMBOL

BRUSH OR WOODS LINE

TREES (PLANS)

(deciduous) (coniferous) (stump)

TREE OR STUMP (CROSS-SECTIONS)

(show station, circumference in feet & type)

HEDGE

(label type)

MONITORING WELL

mon W

WELL

W

FLAG POLE

fp

ORIGINAL GROUND (TYPICALS)

ROCK OUTCROP

ROCK LINE (TYPICALS & SECTIONS ONLY)

GUARDRAIL (label type)

existing PROPOSED

bgr

cgr

JERSEY BARRIER

CURB (LABEL TYPE)

STONE WALL

RETAINING WALL (LABEL TYPE)

(points toward retained ground)

FENCE (LABEL TYPE)

SIGNS

(single post)

(double post)

GAS PUMP

gp

FUEL TANK (ABOVE GROUND)

ft

(label size & type)

STORAGE TANK FILLER CAP

fc

SEPTIC TANK

S

GRAVE

gr

MAILBOX

mb

VENT PIPE

vp

SATELLITE DISH ANTENNA

da

PHONE

ph

GROUND LIGHT/LAMP POST

gl lp

BORING LOCATION

TEST PIT

INTERSTATE NUMBERED HIGHWAY

93

UNITED STATES NUMBERED HIGHWAY

3

STATE NUMBERED HIGHWAY

102

SHORELAND - WETLAND

WETLAND DESIGNATION AND TYPE — 2 PUB2E

DELINEATED WETLAND — DW

ORDINARY HIGH WATER — OHW

TOP OF BANK — TOB

TOP OF BANK & ORDINARY HIGH WATER — TOBOHW

NORMAL HIGH WATER — NHW

WIDTH AT BANK FULL — WBF

PRIME WETLAND — PWET

PRIME WETLAND 100' BUFFER — PWET100

NON-JURISDICTIONAL DRAINAGE AREA — DA — NJDA

COWARDIN DISTINCTION LINE — CDL

TIDAL BUFFER ZONE — TBZ

DEVELOPED TIDAL BUFFER ZONE — DTBZ

HIGHEST OBSERVABLE TIDE LINE — HOTL

MEAN HIGH WATER — MHW

MEAN LOW WATER — MLW

VERNAL POOL — VP

SPECIAL AQUATIC SITE — SAS

REFERENCE LINE — REF

WATER FRONT BUFFER — 0 — WB50

NATURAL WOODLAND BUFFER — NWB150

PROTECTED SHORELAND — PS250

INVASIVE SPECIES LABEL — I.S. I I.S. II

INVASIVE SPECIES — INV

FLOODPLAIN / FLOODWAY

500 YEAR FLOODPLAIN BOUNDARY — FP500

100 YEAR FLOODPLAIN BOUNDARY — FP100

FLOODWAY — FW

ENGINEERING

CONSTRUCTION BASELINE — 30 31 32

PC, PT, POT (ON CONST BASELINE)

PI (IN CONSTRUCTION BASELINES)

INTERSECTION OR EQUATION OF TWO LINES

ORIGINAL GROUND LINE (PROFILES AND CROSS-SECTIONS)

PROFILE GRADE LINE (PROFILES AND CROSS-SECTIONS)

SLOPE LINE — CLEARING LINE

CLEARING LINE

SLOPE LINE

SLOPE LINE (FILL)

SLOPE LINE (CUT)

PROFILES AND CROSS SECTIONS:

ORIGINAL GROUND ELEVATION (LEFT) — 72.5

FINISHED GRADE ELEVATION (RIGHT) — 79.14

72.5 79.14

STATE OF NEW HAMPSHIRE
ACWORTH
DEPARTMENT OF TRANSPORTATION ○ BUREAU OF HIGHWAY DESIGN

STANDARD SYMBOLS

REVISION DATE	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
07-31-2023	43566Csymb	43566C	2	7

STD SYMB SHT 1 OF 2

DRAINAGE

MANHOLE

CATCH BASIN — cb

DROP INLET — di

(existing) / (PROPOSED)

DRAINAGE PIPE (existing) — DP — DP — (label size & type)

DRAINAGE PIPE (PROPOSED) — PDP — PDP

UNDERDRAIN (existing) W/ FLUSHING BASIN — DP — fb — DP — (label size & type)

UNDERDRAIN (PROPOSED) W/ FLUSHING BASIN — PDP — PDP

show direction of flow

HEADER (existing & PROPOSED) — DP — PDP — (with stone outlet protection)

END SECTION (existing & PROPOSED) — METAL or PLASTIC; RCP

OPEN DITCH (PROPOSED)

EROSION CONTROL/ STONE SLOPE PROTECTION

BOUNDARIES / RIGHT-OF-WAY

RIGHT-OF-WAY LINE — (label type)

RR RIGHT-OF-WAY LINE

PROPERTY LINE

PROPERTY LINE (COMMON OWNER) — Z — Z

TOWN LINE — BOW / CONCORD

COUNTY LINE — COOS / GRAFTON

STATE LINE — MAINE / NEW HAMPSHIRE

NATIONAL FOREST

CONSERVATION LAND — LC — LC

BENCH MARK / SURVEY DISK

BOUND — bnd — (PROPOSED)

STATE LINE/ TOWN LINE MONUMENT — S/L — T/L

NHDOT PROJECT MARKER

IRON PIPE OR PIN — ip

DRILL HOLE IN ROCK — dh

TAX MAP AND LOT NUMBER — 156 / 14 — 1642/341 — 6.80 Ac.±

PROPERTY PARCEL NUMBER — 12

HISTORIC PROPERTY — H

UTILITIES

TELEPHONE POLE

POWER POLE

JOINT OCCUPANCY

MISCELLANEOUS/UNKNOWN POLE

GUY POLE OR PUSH BRACE

LIGHT POLE

LIGHT ON POWER POLE

LIGHT ON JOINT POLE

existing / PROPOSED

(plot point at face not center of symbol)

POLE STATUS:
REMOVE, LEAVE, PROPOSED, OR TEMPORARY
AS APPLICABLE e.g.:

R — L — P+04 25.0' — T+04 25.0'

RAILROAD — (label ownership)

RAILROAD SIGN

RAILROAD SIGNAL

UTILITY JUNCTION BOX — jb — JB

OVERHEAD WIRE — OW — OW — (label type)

UNDERGROUND UTILITIES

WATER (on existing lines label size, type and note if abandoned) — W — W — PW — PW

SEWER — S — S — PS — PS

TELEPHONE — T — T — PT — PT

ELECTRIC — E — E — PE — PE

GAS — G — G — PG — PG

LIGHTING — L — L — PL — PL

INTELLIGENT TRANSPORTATION SYSTEM — ITS — ITS — PITS — PITS

FIBER OPTIC — FO — FO — PFO — PFO

WATER SHUT OFF — WSO

GAS SHUT OFF — GSO

HYDRANT — HYD

MANHOLES

SEWER — MHS

TELEPHONE — MHT

ELECTRICAL — MHE

GAS — MHG

UNKNOWN

WATER — MHW

TRAFFIC SIGNALS / ITS

existing / PROPOSED

MAST ARM — 30' MA (NOTE ANGLE FROM ℄)

OPTICOM RECEIVER

OPTICOM STROBE

TRAFFIC SIGNAL

PEDESTAL WITH PEDESTRIAN SIGNAL HEADS AND PUSH BUTTON UNIT

SIGNAL CONDUIT — C — C — C — PC — PC — PC

CONTROLLER CABINET — cc — CC

METER PEDESTAL — mp — MP

PULL BOX — pb — PB

LOOP DETECTOR (QUADRUPOLE) — (label size)

LOOP DETECTOR (RECTANGULAR) — (label size)

CAMERA POLE (CCTV)

FIBER OPTIC DELINEATOR — fod — FOD

FIBER OPTIC SPLICE VAULT — SVF

ITS EQUIPMENT CABINET — its — ITS

MOTOR VEHICLE DETECTION SYSTEM (MVDS)

VARIABLE SPEED LIMIT SIGN

DYNAMIC MESSAGE SIGN

ROAD AND WEATHER INFO SYSTEM

CONSTRUCTION NOTES

CURB MARK NUMBER - BITUMINOUS	B-1
CURB MARK NUMBER - GRANITE	G-1
CLEARING AND GRUBBING AREA	A
DRAINAGE NOTE	1
EROSION CONTROL NOTE	A
FENCING NOTE	A
GUARDRAIL NOTE	1
ITS NOTE	1
LIGHTING NOTE	A
TRAFFIC SIGNAL NOTE	1

STATE OF NEW HAMPSHIRE
ACWORTH
DEPARTMENT OF TRANSPORTATION ○ BUREAU OF HIGHWAY DESIGN

STANDARD SYMBOLS

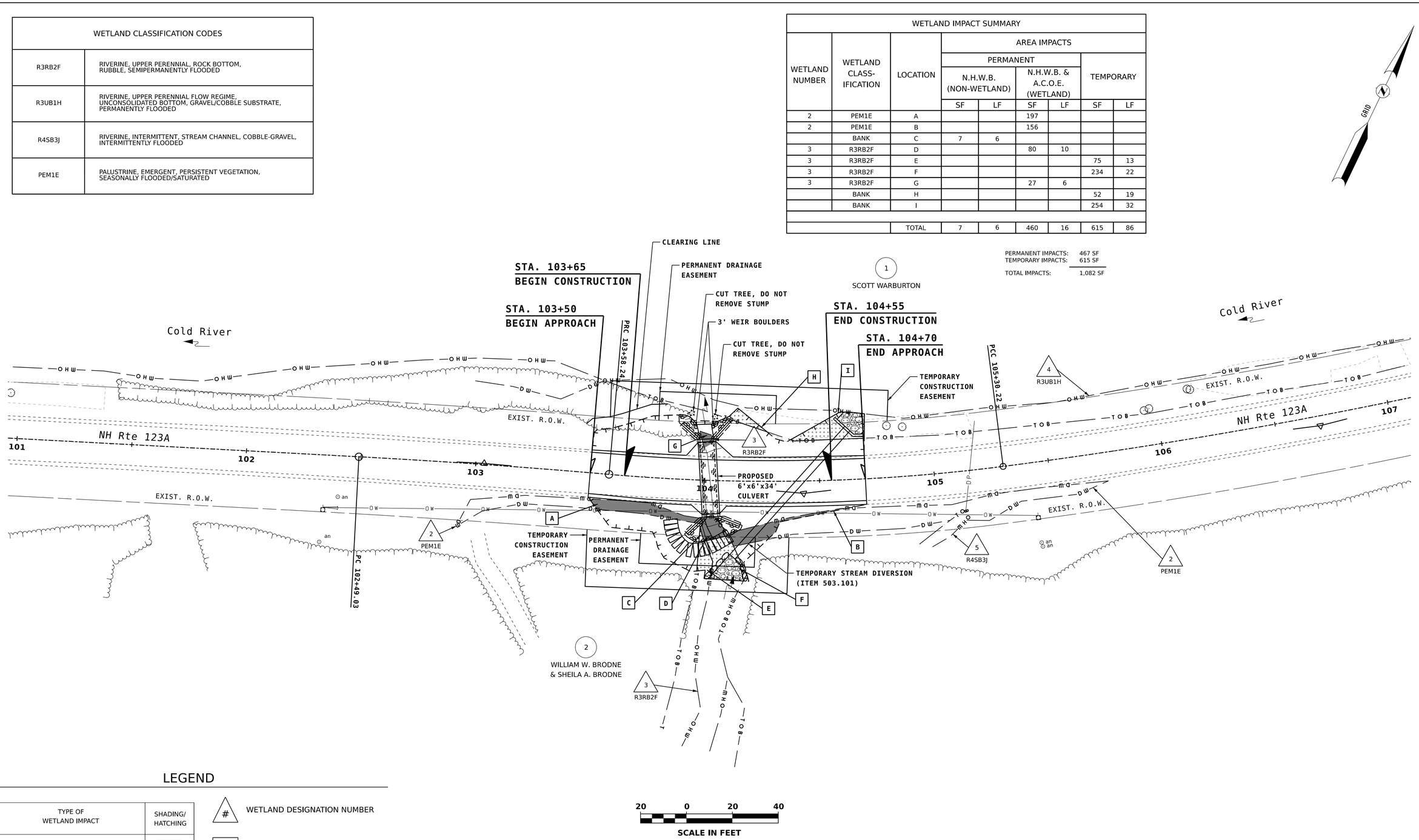
REVISION DATE	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
07-31-2023	43566Csymb	43566C	3	7

STD SYMB SHT 2 OF 2

WETLAND CLASSIFICATION CODES	
R3RB2F	RIVERINE, UPPER PERENNIAL, ROCK BOTTOM, RUBBLE, SEMIPERMANENTLY FLOODED
R3UB1H	RIVERINE, UPPER PERENNIAL FLOW REGIME, UNCONSOLIDATED BOTTOM, GRAVEL/COBBLE SUBSTRATE, PERMANENTLY FLOODED
R4SB3J	RIVERINE, INTERMITTENT, STREAM CHANNEL, COBBLE-GRAVEL, INTERMITTENTLY FLOODED
PEM1E	PALUSTRINE, EMERGENT, PERSISTENT VEGETATION, SEASONALLY FLOODED/SATURATED

WETLAND IMPACT SUMMARY

WETLAND NUMBER	WETLAND CLASS-IFICATION	LOCATION	AREA IMPACTS					
			PERMANENT				TEMPORARY	
			N.H.W.B. (NON-WETLAND)		N.H.W.B. & A.C.O.E. (WETLAND)			
			SF	LF	SF	LF	SF	LF
2	PEM1E	A			197			
2	PEM1E	B			156			
	BANK	C	7	6				
3	R3RB2F	D			80	10		
3	R3RB2F	E					75	13
3	R3RB2F	F					234	22
3	R3RB2F	G			27	6		
	BANK	H					52	19
	BANK	I					254	32
		TOTAL	7	6	460	16	615	86



LEGEND

TYPE OF WETLAND IMPACT	SHADING/ HATCHING
NEW HAMPSHIRE WETLANDS BUREAU (PERMANENT NON-WETLAND)	
NEW HAMPSHIRE WETLANDS BUREAU & ARMY CORP OF ENGINEERS (PERMANENT WETLAND)	
TEMPORARY IMPACTS	

- # — WETLAND DESIGNATION NUMBER
- # — WETLAND IMPACT LOCATION
- # — WETLAND MITIGATION AREA
- MITIGATION

REVISIONS AFTER PROPOSAL

NUMBER	DESCRIPTION	STATION	DATE

SDR PROCESSED NHDOT DATE 12/2022
NEW DESIGN HOYLE, TANNER DESIGN TEAM DATE 4/2024
SHEET CHECKED TMC DATE 4/2024
AS BUILT DETAILS DATE

HOYLE TANNER

STATE OF NEW HAMPSHIRE
ACWORTH
DEPARTMENT OF TRANSPORTATION ○ BUREAU OF ENVIRONMENT

WETLAND IMPACT PLANS

HT PROJECT NO.	MODEL	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
22.092501.03	WET1	43566Cwetplans	43566C	4	7

EROSION CONTROL NOTES AND STRATEGIES

1. Erosion Control/Stormwater Control Selection, Sequencing and Maintenance
   - 1.1. Comply with RSA 485-A:17 Terrain Alteration.
   - 1.2. Install and maintain all erosion control/stormwater controls in accordance with the New Hampshire Stormwater Management Manual, Volume 3, Erosion and Sediment Controls During Construction, December 2008 (BMP Manual), available from the NH Department of Environmental Services (NHDES).
   - 1.3. Install erosion control/stormwater control measures prior to the start of work and in accordance with the manufacturer's recommendations.
   - 1.4. Select erosion control/stormwater control measures based on the size and nature of the project and physical characteristics of the site, including slope, soil type, vegetative cover, and proximity to jurisdictional areas.
   - 1.5. Install perimeter controls prior to earth disturbing activities.
   - 1.6. Install stormwater treatment ponds and drainage swales before rough grading the site.
   - 1.7. Clean, replace, and augment stormwater control measures and infiltration basins as necessary to prevent sedimentation beyond project limits throughout the project duration.
   - 1.8. Inspect erosion and sediment control measures in accordance with Section 645 of the specifications, weekly, and within 24 hours (during normal work hours), of any storm event greater than 0.25 inches of rain in a 24-hour period.
   - 1.9. Contain stockpiles with temporary perimeter controls. Protect inactive soil stockpiles with soil stabilization measures (temporary erosion control seed mix and mulch, soil binder) or cover them with anchored tarps. If the stockpile is to remain undisturbed for more than 14 days, mulch the stockpile.
   - 1.10. Maintain temporary erosion and stormwater control measures in place until the area has been permanently stabilized.
   - 1.11. An area is considered stable if one of the following has occurred:
     - Base course gravels have been installed in areas to be paved;
     - A minimum of 85% vegetative growth has been established;
     - A minimum of 3”of non-erosive material such as stone or rip-rap has been installed;
     - Temporary slope stabilization has been properly installed (see Table 1).
   - 1.12. Direct runoff to temporary practices until permanent stormwater infrastructure is constructed and stabilized.
   - 1.13. Use temporary mulching, permanent mulching, temporary vegetative cover, and permanent vegetative cover to reduce the need for dust control. Use mechanical sweepers on paved surfaces where necessary to prevent dust buildup. Apply water, or other dust inhibiting agents or tackifiers.
   - 1.14. Plan activities to account for sensitive site conditions
     - Sequence construction to limit the duration and area of exposed soils.
     - Clearly flag areas to be protected in the field and provide construction barrier to prevent trafficking outside of work areas.
     - Protect and maximize existing native vegetation and natural forest buffers between construction activities and sensitive areas.
     - When work is undertaken in a flowing watercourse, implement stream flow diversion methods prior to any excavation or filling activity.
   - 1.15. Utilize storm drain inlet protection to prevent sediment from entering a storm drainage system prior to the permanent stabilization of the contributing disturbed area.
   - 1.16. Use care to ensure that sediments do not enter any existing catch basins during construction. Place temporary inlet protection at inlets in areas of soil disturbance that are subject to sedimentation.
   - 1.17. Construct, stabilize, and maintain temporary and permanent ditches in a manner that will minimize scour. Direct temporary and permanent ditches to drain to sediment basins or stormwater collection areas.
   - 1.18. Supplement channel protection measures with perimeter control measures when ditch lines occur at the bottom of long fill slopes. Install the perimeter controls on the fill slope to minimize the potential for fill slope sediment deposits in the ditch line.
   - 1.19. Divert sediment laden water away from drainage inlet structures to the extent possible.
   - 1.20. Install sediment barriers and sediment traps at drainage inlets to prevent sediment from entering the drainage system.
   - 1.21. Clean catch basins, drainage pipes, and culverts if significant sediment is deposited.
   - 1.22. Construct and stabilize dewatering infiltration basins prior to any excavation that may require dewatering.
   - 1.23. Place and stabilize temporary sediment basins or traps at locations where concentrated flow (channels and pipes) discharge to the surrounding environment from areas of unstabilized earth disturbing activities.
   - 1.24. Stabilize, to appropriate anticipated velocities, conveyance channels or pumping systems needed to convey construction stormwater to basins and discharge locations prior to use.
   - 1.25. Size temporary sediment basins to contain the 2-year, 24 hour storm event.
   - 1.26. Size temporary sediment traps to contain 3,600 cubic feet of storage for each acre of drainage area.
   - 1.27. Construct detention basins to accommodate the 2-year, 24-hour storm event.

2. Construction Planning
   - 2.1. Divert off site runoff or clean water away from the construction activities to reduce the volume that needs to be treated on site.
   - 2.2. Divert storm runoff from upslope drainage areas away from disturbed areas, slopes and around active work areas to a stabilized outlet location.
   - 2.3. Construct impermeable barriers, as necessary, to collect or divert concentrated flows from work or disturbed areas.
   - 2.4. Locate staging areas and stockpiles outside of wetlands jurisdiction.
   - 2.5. Do not store, maintain, or repair mobile heavy equipment in wetlands, unless equipment cannot be practicably removed and secondary containment is provided.
   - 2.6. Provide a water truck to control excessive dust, at the discretion of the Contract Administrator.

3. Site Stabilization
   - 3.1. Stabilize all areas of unstabilized soil as soon as practicable, but no later than 45 days after initial disturbance.
   - 3.2. Limit unstabilized soil to a maximum of 5 acres unless documentation is provided that demonstrates that cuts and fills are such that 5 acres is unreasonable.
   - 3.3. Use erosion control seed mix in all inactive construction areas that will not be permanently seeded within two weeks of disturbance and prior to September 15" of any given year in order to achieve vegetative stabilization prior to the end of the growing season.
   - 3.4. Apply, and reapply as necessary, soil tackifiers in accordance with the manufacturer’s specifications to minimize soil and mulch loss until permanent vegetation is established.
   - 3.5. Stabilize basins, ditches and swales prior to directing runoff to them.
   - 3.6. Stabilize roadway and parking areas within 72 hours of achieving finished grade.
   - 3.7. Stabilize cut and fill slopes within 72 hours of achieving finished grade.
   - 3.8. When temporarily stabilizing soils and slopes, utilize the techniques outlined in Table 1.
   - 3.9. Stabilize all areas that can be stabilized prior to opening up new areas to construction activities.
   - 3.10. Utilize Table 1 when selecting temporary soil stabilization measures.
   - 3.11. Divert off-site water through the project in an appropriate manner so as not to disturb the upstream or downstream soils, vegetation or hydrology beyond the permitted area.
   - 3.12. Install and maintain construction exits anywhere traffic leaves a construction site onto a public right-of-way.
   - 3.13. Sweep all construction related debris and soil from the adjacent paved roadways, as necessary.

4. Slope Protection
   - 4.1. Intercept and divert storm runoff from upslope drainage areas away from unprotected and newly established areas and slopes to a stabilized outlet or conveyance.
   - 4.2. Consider how groundwater seepage on cut slopes may impact slope stability and incorporate appropriate measures to minimize erosion.
   - 4.3. Convey storm water down the slope in a stabilized channel or slope drain.
   - 4.4. The outer face of the fill slope should be in a loose, ruffled condition prior to turf establishment.

5. Winter Construction
   - 5.1. To minimize erosion and sedimentation impacts, limit the extent and duration of winter excavation and earthwork activities. The maximum amount of disturbed earth shall not exceed a total of 5 acres from May 1" through October 15", or exceed one acre during winter months, unless the contractor demonstrates to the Department that the additional area of disturbance is necessary to meet the contractor’s Critical Path Method (CPM) schedule, and the contractor has adequate resources available to ensure that environmental requirements will be met.
   - 5.2. Construction performed any time between October 15" and May 1" of any year is considered winter construction. During winter construction:
     - Stabilize all proposed vegetation areas which do not exhibit a minimum of 85% vegetative growth by October 15", or which are disturbed after October 15", in accordance with Table 1.
     - Stabilize all ditches or swales which do not exhibit a minimum of 85% vegetative growth by October 15", or which are disturbed after October 15", in accordance with Table 1.
     - Protect incomplete road surfaces, where base course gravels have not been installed, and where work has stopped for the season after October 15", in accordance with Table 1.
     - Unless a winter construction plan has been approved by NHDOT, conduct winter excavation and earthwork such that no more than 1 acre of the project is without stabilization an any one time.

6. Wildlife Protection Measures
   - 6.1. Report all observations of threatened and endangered species on the project site to the Department’s Bureau of Environment by phone at 603-271-3226 or by email at Bureau16@dot.nh.gov, indicating in the subject line the project name, number, and that a threatened/endangered species was found.
   - 6.2. Photograph the observed species and nearby elements of habitat or areas of land disturbance and provide them to the Department’s Bureau of Environment at the above email address.
   - 6.3. In the event that a threatened or endangered species is observed on the project during work, the species shall not be disturbed, handled, or harmed prior to receiving direction from the Bureau of Environment.
   - 6.4. Utilize wildlife friendly erosion control methods when:
     - Erosion control blankets are used,
     - A protected species or habitat is documented,
     - The proposed work is in or adjacent to a priority resource area, and/or when specifically requested by NHB or NHF&G

GUIDANCE ON SELECTING TEMPORARY SOIL STABILIZATION MEASURES
TABLE 1

APPLICATION AREAS	DRY MULCH METHODS				HYDRAULICALLY APPLIED MULCHES[2]				ROLLED EROSION CONTROL BLANKETS[3]			
	HMT	WC	SG	CB	HM	SMM	BFM	FRM	SNSB	DNSB	DNSCB	DNCB
SLOPES[1]												
STEEPER THAN 2:1	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	NO	YES
2:1 SLOPE	YES1	YES[1]	YES	YES	NO	NO	YES	YES	NO	YES	YES	YES
3:1 SLOPE	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES	YES	NO
4:1 SLOPE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	NO
WINTER STABILIZATION	4T/AC	YES	YES	YES	NO	NO	YES	YES	YES	YES	YES	YES
CHANNELS												
LOW FLOW CHANNELS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
HIGH FLOW CHANNELS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES

ABBREV.	STABILIZATION MEASURE	ABBREV.	STABILIZATION MEASURE	ABBREV.	STABILIZATION MEASURE
HMT	HAY MULCH & TACK	HM	HYDRAULIC MULCH	SNSB	SINGLE NET STRAW BLANKET
WC	WOOD CHIPS	SMM	STABILIZED MULCH MATRIX	DNSB	DOUBLE NET STRAW BLANKET
SG	STUMP GRINDINGS	BFM	BONDED FIBER MATRIX	DNSCB	2 NET STRAW-COCONUT BLANKET
CB	COMPOST BLANKET	FRM	FIBER REINFORCED MEDIUM	DNCB	2 NET COCONUT BLANKET

NOTES:
1. All slope stabilization options assume a slope length ≤ 10 times the horizontal distance component of the slope, in feet.
2. Do not apply products containing polyacrylamide (PAM) directly to, or within 100 feet of any surface water without NHDES approval.
3. Install all methods in Table 1 per the manufacturer’s recommendation for time of year and steepness of slope.

STATE OF NEW HAMPSHIRE
ACWORTH
DEPARTMENT OF TRANSPORTATION ○ BUREAU OF HIGHWAY DESIGN

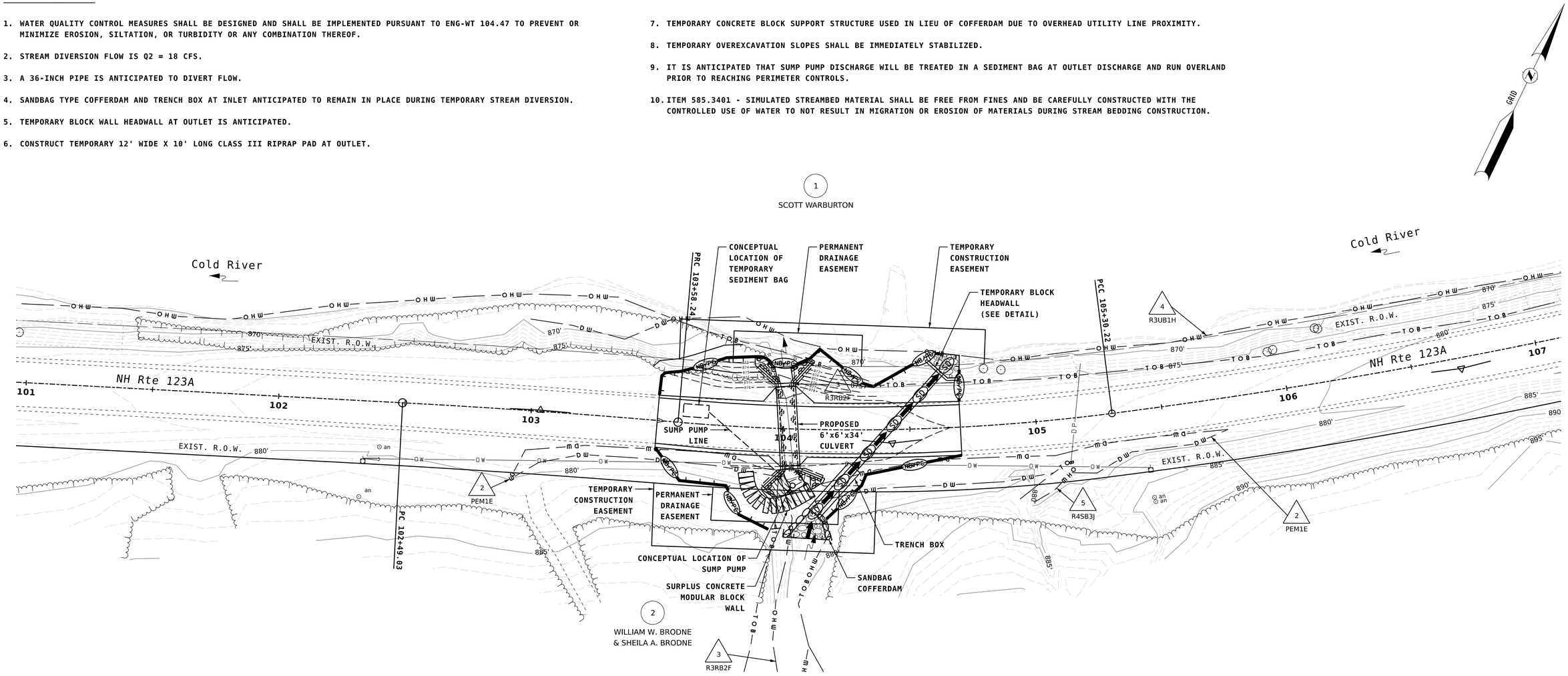
EROSION CONTROL PLANS

REVISION DATE
02-29-2024

HT PROJECT NO.	MODEL	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
22.092501.03	erosstrat-ce	43566Cerostrat	43566C	5	7

GENERAL NOTES

1. WATER QUALITY CONTROL MEASURES SHALL BE DESIGNED AND SHALL BE IMPLEMENTED PURSUANT TO ENG-WT 104.47 TO PREVENT OR MINIMIZE EROSION, SILTATION, OR TURBIDITY OR ANY COMBINATION THEREOF.
2. STREAM DIVERSION FLOW IS Q2 = 18 CFS.
3. A 36-INCH PIPE IS ANTICIPATED TO DIVERT FLOW.
4. SANDBAG TYPE COFFERDAM AND TRENCH BOX AT INLET ANTICIPATED TO REMAIN IN PLACE DURING TEMPORARY STREAM DIVERSION.
5. TEMPORARY BLOCK WALL HEADWALL AT OUTLET IS ANTICIPATED.
6. CONSTRUCT TEMPORARY 12' WIDE X 10' LONG CLASS III RIPRAP PAD AT OUTLET.
7. TEMPORARY CONCRETE BLOCK SUPPORT STRUCTURE USED IN LIEU OF COFFERDAM DUE TO OVERHEAD UTILITY LINE PROXIMITY.
8. TEMPORARY OVEREXCAVATION SLOPES SHALL BE IMMEDIATELY STABILIZED.
9. IT IS ANTICIPATED THAT SUMP PUMP DISCHARGE WILL BE TREATED IN A SEDIMENT BAG AT OUTLET DISCHARGE AND RUN OVERLAND PRIOR TO REACHING PERIMETER CONTROLS.
10. ITEM 585.3401 - SIMULATED STREAMBED MATERIAL SHALL BE FREE FROM FINES AND BE CAREFULLY CONSTRUCTED WITH THE CONTROLLED USE OF WATER TO NOT RESULT IN MIGRATION OR EROSION OF MATERIALS DURING STREAM BEDDING CONSTRUCTION.



EROSION CONTROL PLAN LEGEND

- PC — PERIMETER CONTROL
  - SILT FENCE
  - EROSION CONTROL MIX BERM
  - EROSION CONTROL MIX SOX
  - TURBIDITY CURTAIN
  - SHEET PILE
  - COFFER DAM
- NB/PC — NATURAL BUFFER/PERIMETER CONTROL
  - SILT FENCE
  - EROSION CONTROL MIX BERM
  - EROSION CONTROL MIX SOX
  - TURBIDITY CURTAIN
  - SHEET PILE
  - COFFER DAM
- CP — CHANNEL PROTECTION
  - STONE CHECK DAMS
  - STRAW WATTLES
  - CHANNEL MATTING
  - CLASS D EROSION STONE
  - CLASS C STONE
- SD — STREAM DIVERSION
  - SEE ATTACHED PLAN FOR DETAILS
- URS — UNIMPACTED RIVERINE SURFACE WATERS
  - NO WORK AND/OR IMPACT
- ROA — ROUTINE ROADWAY QUALIFYING ACTIVITY
  - USE SPECIFIED CONTROL MEASURE FROM MANUAL

CONSTRUCTION SEQUENCE AND TIMING NOTES

1. COORDINATE TRAFFIC OPERATIONS PER THE TRAFFIC CONTROL PLAN DOCUMENT TO INSTALL TEMPORARY ROADWAY SIGNAGE AND IMPLEMENT THE 4 WEEK ROAD CLOSURE TRAFFIC DETOUR. PROJECT MUST BE COMPLETED TO ENABLE REOPENING TO TRAFFIC AFTER 4 WEEKS AS STIPULATED IN THE CONTRACT DOCUMENTS.
2. INSTALL TEMPORARY SEDIMENT CONTROL MEASURES, DEWATERING MEASURES AND TURBIDITY BARRIERS AS DETAILED ON THE EROSION CONTROL PLAN. REMOVE TREES AND VEGETATION WITHIN THE PROPOSED SLOPE LIMITS. CONTRACTOR SHALL TAKE CARE TO MINIMIZE REMOVAL OF VEGETATION WITHIN THE TEMPORARY EASEMENT LIMITS AS SHOWN IN THESE PLANS. CONTRACTOR SHALL NOT REMOVE STUMPS BELOW THE TOP OF BANK (TOB) AS NOTED ON THE PLAN.
3. CONSTRUCT STREAM DIVERSION AND INSTALL TEMPORARY SLOPE SUPPORT STRUCTURES (TRENCH BOX, BLOCK WALLS, TEMPORARY BACK SLOPES STABILIZATION OR CONTRACTORS PRE-APPROVED OPTION) TO DIVERT THE EXISTING STREAM, CONSTRUCT PROPOSED CULVERT UNDER DRY CONDITIONS AND MAINTAIN STABILIZED SITE CONDITIONS.
4. REMOVE EXISTING EARTHEN MATERIALS, CULVERT AND WINGWALLS STRUCTURE TO THE DEPTH REQUIRED TO PLACE, COMPACT AND GRADE PROPOSED BEDDING MATERIALS ABSENT OF WET CONDITIONS.
5. PLACE THE PRECAST CONCRETE CULVERT CUTOFF WALL, BARREL AND WINGWALL SEGMENTS. ADVANCE CONSTRUCTION OF THE CULVERT, WINGWALLS AND STREAMBED. REMOVE TEMPORARY SUPPORT STRUCTURES AS THE PERMANENT STABILIZED CONDITION IS ADVANCED.
6. INSTALL NATIVE CHANNEL MATERIAL OR SIMULATED STREAMBED MATERIAL CONFORMING TO ITEM 585.3401 WITHIN THE PROPOSED CULVERT AND LIMITS OF CHANNEL DISTURBANCE AS SHOWN ON THE PLAN.
7. BACKFILL THE CULVERT AND ADVANCE STREAMBED AND STREAM SIDE SLOPES CONSTRUCTION USING CONFORMING MATERIALS AND TO THE LIMITS SHOWN ON THE PLANS.
8. PRIOR TO REMOVAL OF STREAM DIVERSION, CONTRACTOR SHALL APPLY WATER TO THE NEW STREAMBED AND STREAM SIDE SLOPES TO BED MATERIALS. THE APPLICATION OF WATER TO THE NEW STREAM SHALL BE CONTROLLED TO NOT INTRODUCE TURBIDITY BEYOND THE EROSION CONTROLS IN PLACE.
9. REMOVE TEMPORARY STREAM DIVERSION.
10. COMPLETE ROADWAY RECONSTRUCTION. INSTALL EROSION CONTROL TURF ESTABLISHMENT WITH MULCH, TACKIFIERS, AND LOAM AND INSTALL TEMPORARY SLOPE MATTING TYPE D (WILDLIFE FRIENDLY). REMOVE TEMPORARY SEDIMENT CONTROL MEASURES.
11. REMOVE TEMPORARY ROADWAY SIGNAGE TO REOPEN NH 123A TO TRAFFIC.

NUMBER	DESCRIPTION	STATION	STATION	DATE

REVISIONS AFTER PROPOSAL

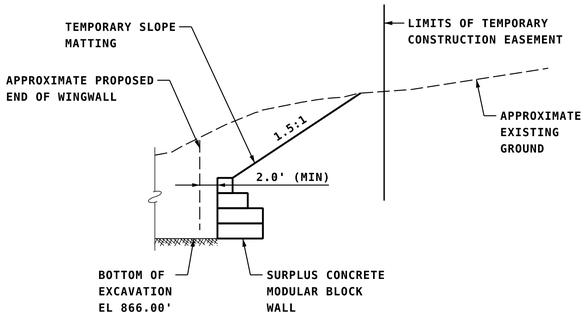
SDR PROCESSED	NHDOT	DATE	12/2022
NEW DESIGN	HOYLE, TANNER DESIGN TEAM	DATE	4/2024
SHEET CHECKED	TMC	DATE	4/2024
AS BUILT DETAILS		DATE	

HOYLE TANNER

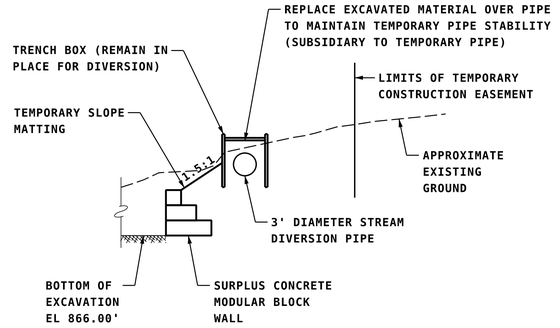
STATE OF NEW HAMPSHIRE
ACWORTH
DEPARTMENT OF TRANSPORTATION ○ BUREAU OF ENVIRONMENT

EROSION CONTROL PLANS

HT PROJECT NO.	MODEL	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
22.092501.03	ERO1	43566Ceroplans	43566C	6	7



SOUTHEAST WINGWALL TEMPORARY EXCAVATION DETAIL



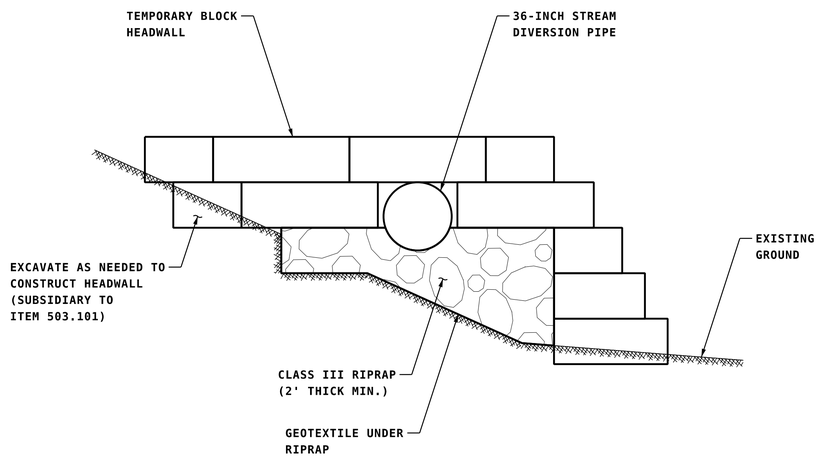
SOUTHEAST WINGWALL TEMPORARY EXCAVATION DETAIL

NOTES

USE NON-WOVEN GEOTEXTILE BEHIND BLOCKS AS NEEDED TO MINIMIZE TEMPROARY EROSION POTENTIAL (SUBSIDIARY TO ITEM 503.201).

SURPLUS CONCRETE MODULAR BLOCK OPTION DETAIL

NOT TO SCALE



NOTES

TEMPORARY SURPLUS CONCRETE MODULAR BLOCK OUTLET HEADWALL SUBSIDIARY TO ITEM 503.101.

TEMPORARY SURPLUS CONCRETE MODULAR BLOCK OUTLET HEADWALL DETAIL

NOT TO SCALE

REVISIONS AFTER PROPOSAL

NUMBER	DESCRIPTION	DATE	STATION

SDR PROCESSED	NHDOT	DATE 12/2022
NEW DESIGN	HOYLE, TANNER DESIGN TEAM	DATE 4/2024
SHEET CHECKED	TMC	DATE 4/2024
AS BUILT DETAILS		DATE

HOYLE TANNER

STATE OF NEW HAMPSHIRE
ACWORTH
DEPARTMENT OF TRANSPORTATION ○ BUREAU OF HIGHWAY DESIGN

EROSION CONTROL DETAILS

HT PROJECT NO.	MODEL	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
22.092501.03	ERO2	43566Ceroplans	43566C	7	7