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Vermont Emergency Management  
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## **STATE OF VERMONT: HYDROLOGIC AND HYDRAULIC (H&H) STUDY GUIDE**

### **DEFINITION**

A Hydrologic and Hydraulic (H&H) Study is the study of movement of water, including the volume and rate of flow as it moves through a watershed, basin, channel, or man-made structure.

### **PURPOSE**

This Study Guide outlines State of Vermont and FEMA guidance regarding the contents of a Hydrologic and Hydraulic (H&H) Study and when it is necessary for FEMA PA Projects within Disaster DR4720. It is a summary of salient points related to H&H Studies from State of Vermont and FEMA policies. It *does not* supersede any official guidance from the State of Vermont or FEMA PAPPG v. 4.

### **WHEN AN H&H STUDY IS REQUIRED**

- An H&H Study is required when a ***town highway structure*** conveys a perennial stream. While recommended, an H&H Study is not required for crossings that are not part of the transportation network.
  - Bridge and culvert work on perennial stream crossings must conform with the Vermont statewide DEC Stream Alteration Standard.<sup>1</sup>
- In the State of Vermont, H&H studies must be conducted by VTrans ***or consultants for H&H Studies, adhering to VTrans hydraulics standards*** outlined in the 2015 VTrans Hydraulics Manual.<sup>2</sup>

### **WHEN AN H&H STUDY IS NOT REQUIRED**

- An H&H study is *not* required if the structure carries an intermittent stream.
  - Culvert sizing for crossings on intermittent streams are determined based on the Active Channel Width by field measurements. ***The culvert size must meet or exceed the Active Channel Width***, as required by the Vermont Department of Environmental Conservation (DEC) Municipal Roads General Permit (MRGP).<sup>3</sup>
  - The Vermont Stream Alteration Rule *does not apply* to intermittent streams.<sup>4</sup>

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<sup>1</sup> *Environmental Protection Rule* (Chapter 27), "Vermont Stream Alteration Rule," Agency of Natural Resources, Department of Environmental Conservation, Watershed Management Division, River Management Program, March 10, 2017.

<sup>2</sup> *Hydraulics Manual*, Vermont Agency of Transportation, May 28, 2015.

<sup>3</sup> *General Permit 3-9040*, "For Stormwater Discharges from Municipal Roads," Appendix C, Agency of Natural Resources, Department of Environmental Conservation, January 26, 2023.

<sup>4</sup> *Environmental Protection Rule* (Chapter 27), "Vermont Stream Alteration Rule."

- An H&H study is *not* required for Stream Alteration Permits.
  - State of Vermont culvert sizing criteria include geomorphic sizing standards and a hydraulic check by engineers.
- A post-disaster H&H study is *not* required when a structure has simply been repaired to pre-disaster condition.

#### CONTENTS OF AN H&H STUDY<sup>5</sup>

- Identification of upstream and downstream impacts (e.g. stage, velocity, duration) of alterations to the floodplain, including change to the extent or depth of the Special Flood Hazard Area (SFHA) or changes to the Base Flood Elevation (BFE).
- General site description, including location, latitude and longitude, drainage basin, FIRM, regulatory mapped flood zone (if applicable).
- Existing condition: pipe shape, material, length, inlet and outlet conditions, performance level.
- Proposed condition: pipe shape, size, material, length, inlet and outlet conditions, performance level.
- Will the proposed condition satisfy the local floodplain ordinance and local and state storm water management requirements?
- Review by a professional engineer in the State of Vermont to ensure compliance with 44 CFR 60.3.

#### H&H STUDY RESULTS

The analysis resulting from an H&H Study will determine sizing and fish passage *requirements* for the structure. In addition, analysis *may recommend* a structure type based on site constraints, provided it meets Vermont Codes and Standards for width, depth, embedment, fish passage and hydraulic capacity.

#### STRUCTURE REPLACEMENT GUIDE (DISASTER RESPONSE)

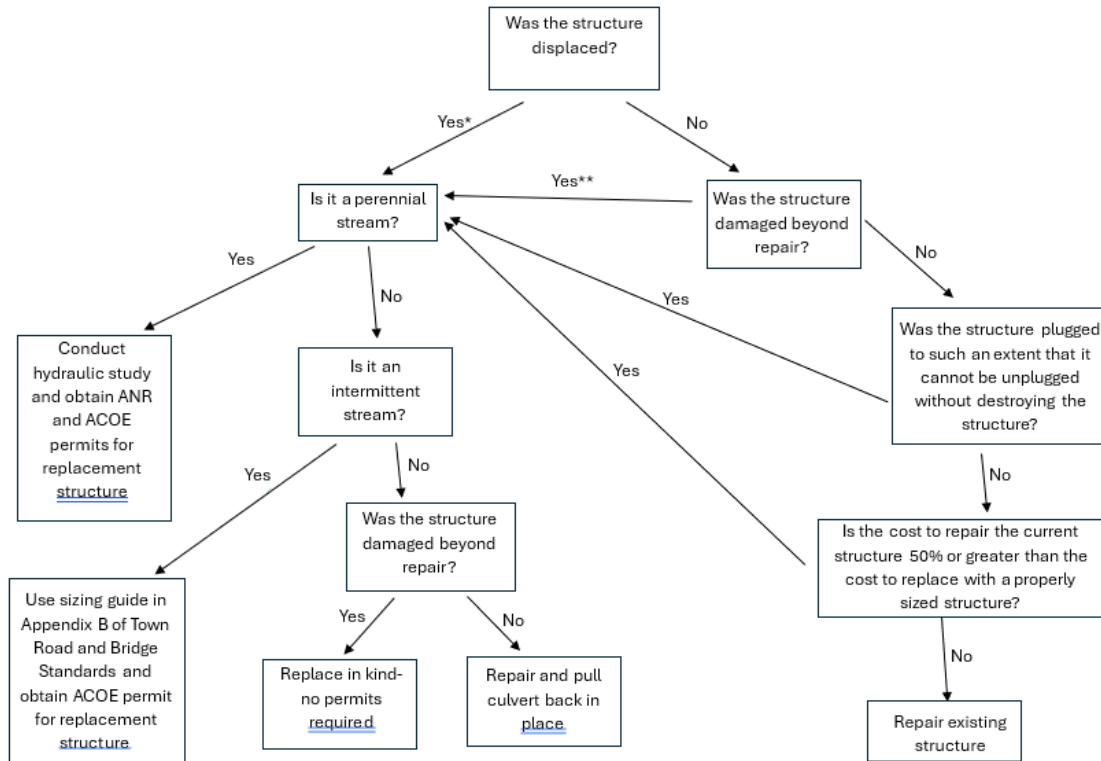
The following Structure Replacement Guide from the Vermont Agency of Transportation illustrates State of Vermont requirements for structures impacted during a storm event.

Note that “damaged beyond repair” means it is “not feasible to repair the existing damaged structure,” as noted in the Vermont Stream Alteration General Permit (G.11.b). This includes instances when a culvert, pipe, and/or supporting fill need to be newly assembled, including when a culvert pipe plugged with debris cannot be unplugged. ***A replacement culvert pipe must meet State of Vermont Codes and Standards for size.***

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<sup>5</sup> DHS FEMA Region 4 Policy Memo, “Hydrologic & Hydraulic (H&H) Study Quick Guide,” V3.0, October 2017.

## Structure Replacement Guide (Disaster Response)



\* In an emergency, the structure can be dragged back in place as a **temporary** repair

\*\*In an emergency, a structure that is at least as large as the damaged structure can be installed as a **temporary** repair

## ADDITIONAL RESOURCES

The following resources represent official policy guidance from the State of Vermont and FEMA.

Issuing Agency	Policy	H&H Study-Related Guidance
Agency of Natural Resources, DEC	<a href="#">Vermont Stream Alteration Rule</a> <i>Environmental Protection Rule, Chapter 27</i>	Subchapter 4 - Investigation; Standards for Issuance of Stream Alteration Permits (9)
Agency of Natural Resources, DEC	<a href="#">Municipal Roads General Permit Permit 3-9040</a> , <i>“For Stormwater Discharges from Municipal Roads”</i>	Intermittent Stream Crossing Specification (Appendix C, iii to iv)
Vermont Agency of Transportation	<a href="#">Hydraulics Manual</a>	Chapter 3; Data Collection, Resources and Tools (3-1 to 3-10) Chapter 4; Hydrology (4-1 to 4-36)
Vermont Agency of Transportation	<a href="#">Town Road and Bridge Standards</a> <i>The Orange Book, Part 7</i>	Town Road and Bridge Standards FAQ (7-3 to 7-4)
FEMA	<a href="#">Grant Programs Directorate Environmental Planning and Historic Preservation</a> <i>Poli #108-023-1, Revision 2</i>	EHP Review Process (1 to 3)