

Addendum

Town of Brookfield

Request for Design Engineering Qualifications

June 28, 2024

1. Q. Can you please provide a location map?  
R. The VTrans H&H reports contain the coordinates for the structures, however as noted in the RFQ, two of the reports are still pending, therefore a location map is herein provided.
2. Q. Are the Federal Funds administered by VTrans?  
R. Yes, all FEMA funds are process through the State.
3. Q. Can you confirm that permits can be obtained after the fact?  
S. Permits required for construction must be obtained during the design process and included as a part of the Bid/Construction Documents.
4. Q. Does VTrans ROW process apply?  
R. The three roads involved all have a three rod Right-of-Way. The Town will assist in obtaining any additional permanent or temporary easements if required
5. The Town has received one of the two requested H&H studies for the structures on Northfield Road which is attached.

**State of Vermont**  
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*Agency of Transportation*

**TO:** Michelle Redmond, District 6 Project Manager  
 MaCaden Lyford, District 6 Technician

**CC:** Jaron Borg, ANR River Management Engineer

**FROM:** Keith Friedland, Hydraulics Technician

**DATE:** June 17, 2024

**SUBJECT:** Brookfield, TH-1, Northfield Road, over unnamed tributary to Sunny Brook  
 Site location: 0.2 miles NE of VT-12  
 Coordinates: [44.07315, -72.63308](#)

We have completed our hydraulic study for the above referenced site and offer the following for your use.

**Hydrology**

The following physical characteristics are descriptive of this drainage basin:

Drainage Area	2.2 square miles
Land Cover	Forest, fields and rural residences
Water Bodies and Wetlands (NLCD 2006)	0.51 %
Mean Annual Precipitation	44.3 inches

Using the USGS hydrologic method, the following design flow rates were selected:

Annual Exceedance Probability (AEP)	Flow Rate in Cubic Feet per Second (cfs)
50 % (Q2)	100
10 % (Q10)	210
4 % (Q25)	280
2 % (Q50)	350 Design Flow – Minor Collector
1 % (Q100)	420 Check Flow

**Channel Morphology**

The channel for this perennial stream is straight to sinuous with an estimated local channel slope of 1.8%. Field measurements of bankfull width varied from 17 to 19 feet upstream and downstream of the structure. Bedrock was observed in the channel approximately 500 feet upstream of the existing structure inlet.

**Existing Conditions**

The existing structure is a corrugated metal pipe arch with a span of 8 feet and a height of 5.5 feet, providing an approximate waterway opening of 37 square feet. Our calculations, field observations and measurements indicate the existing structure does not meet current standards of the VTrans Hydraulic Manual nor does the existing structure meet state stream equilibrium standards for bankfull width (span length). The existing structure

constricts the channel width, resulting in an increased potential for debris blockage. This complication is known to cause ponding at the inlet, increase stream velocity and scour at the outlet, and may lead to erosion and failure of channel banks.

The existing structure results in a headwater depth of approximately 8.6 feet at 4% AEP and 10.7 feet at 1% AEP. *Water overtops the roadway just after the 1% AEP (Q100).*

### **Replacement Recommendations**

In sizing a new structure, we attempt to select structures that meet both the current VTrans hydraulic standards, state environmental standards with regard to span length and opening height, and consider roadway grade and other site constraints.

**Prior to the selection of the replacement structure additional engineering and subsurface evaluation should be performed. If bedrock is encountered, a buried structure may be difficult to install, and an open bottom structure may be desirable for constructability.** Based on the above considerations and the information available, we recommend any of the following structures as a replacement at this site:

- An open bottom rigid frame or bridge with a clear span of 18 feet and clear height of 6 feet, providing 108 square feet of waterway area. This structure results in a headwater depth of 3.9 feet at the 2% AEP and 4.4 feet at the 1% AEP.
- A concrete box with an inside opening span of 18 feet and minimum height of 8 feet. The box invert should be buried 2 feet. This will result in a clear height of 6 feet above streambed, providing 108 square feet of waterway area. Bed retention sills should be added in the bottom of the structure. Sills should be 12 inches high at the edges of the box and 6 inches high in the center, creating a V-shape across the full width of the box. Sills should be spaced no more than 8 feet apart throughout the structure with one sill placed at both the inlet and the outlet. The structure should be filled level to the streambed with E-Stone, Type II, allowing flow to be kept above the surface, providing the conditions necessary for aquatic organism passage. This structure results in a headwater depth of 3.9 feet at the 2% AEP and 4.4 feet at the 1% AEP.
- Any similar structure that fits the site conditions could be considered.

Any structure with a closed bottom should have bed retention sills and a buried invert as described above. If an open bottom structure is installed, the VTrans Hydraulics Manual requires a minimum of 1-foot of freeboard at the design AEP. For sites with heavy woody debris loads, 2-feet of freeboard is recommended at the design AEP.

To match the approximate local stream slope, the structures recommended above have been modeled with a culvert slope of 1.8%. The local stream slope should be verified prior to installation of the new structure.

Stone Fill, Type II should be used to protect any disturbed channel banks or roadway slopes at the structure's inlet and outlet, up to a height of at least one-foot above the top of the opening. The stone fill should not constrict the channel or structure opening.

Prior to any action toward the implementation of any recommendations received from VTrans, structure size must be confirmed by the VT ANR River Management Engineer to ensure compliance with state environmental standards for stream crossing structures.

### **General Comments**

It is recommended that a full height concrete headwall with flared wingwalls be constructed at the inlet, matched into the channel banks to smoothly transition flow and protect the structure and roadway approaches from erosion.

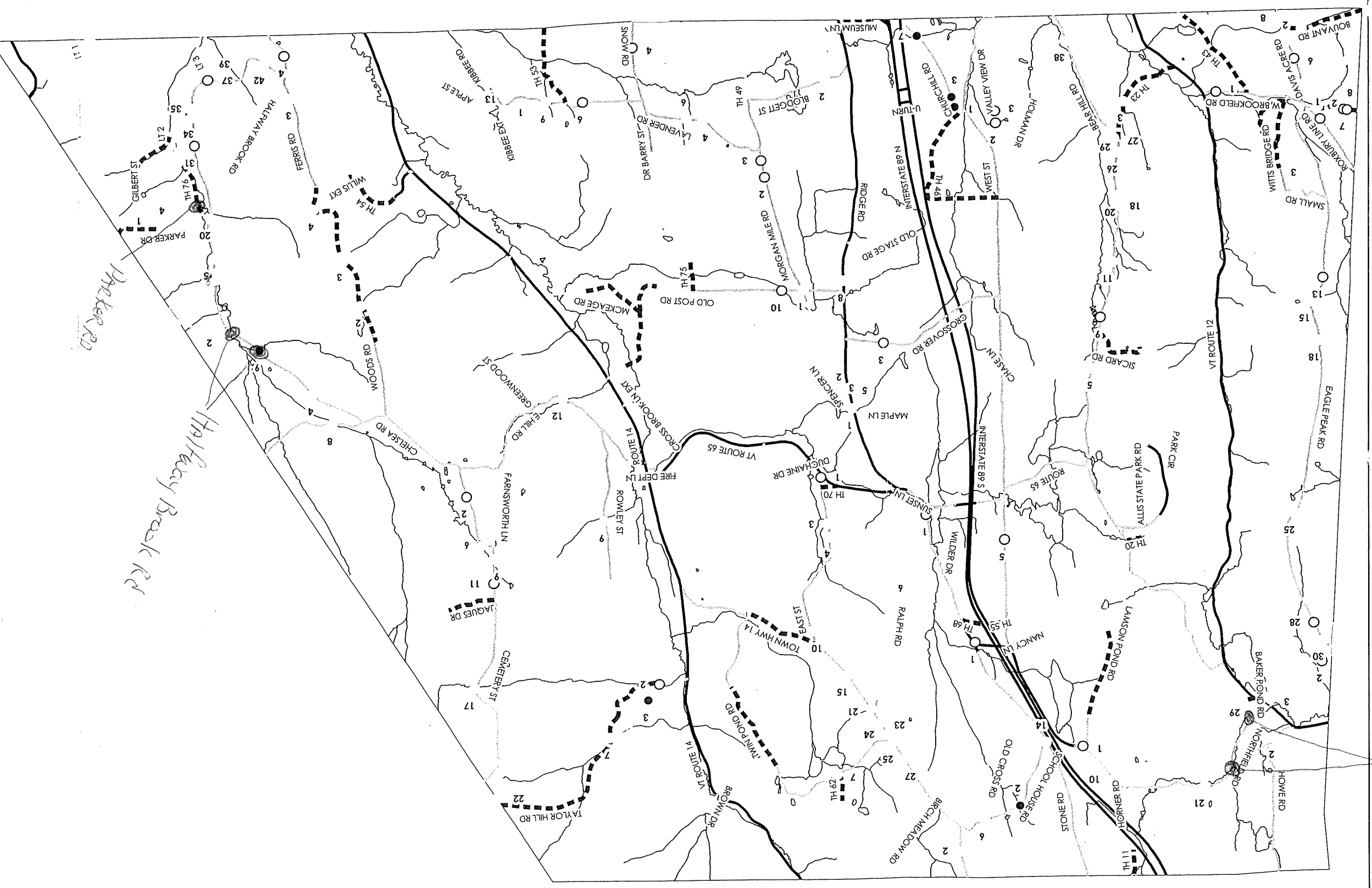
If a closed bottom structure is installed, it should be equipped with cutoff walls, extending to a depth equal to the culvert rise, up to 4 feet, or to ledge, to serve as undermining prevention. E-Stone thickness plus the bottom of structure thickness should be included when determining the total cutoff wall depth.

If an open bottom structure is installed, the bottom of abutment footings shall be at least 6 feet below the channel bottom, **or pinned to bedrock**, to prevent undermining. Abutments on piles should be designed to be free standing for a scour depth at least 6 feet below channel bottom.

Any new structure should be properly aligned with the channel, span the natural channel width, and be constructed on a grade that matches the channel.

**Please note that while a site visit was made, these recommendations were made without the benefit of a survey and are based on limited information.** The final decision regarding replacement of this structure must comply with state regulatory standards, and should take into consideration matching natural channel conditions, roadway grade, environmental concerns, safety, and other requirements.

Please contact us if you have any questions or if we may be of further assistance.



*Handwritten notes:*  
Ducker Rd  
Hoffmeyer Brook Rd

*Handwritten note:*  
Northfield Rd