



Windham Vermont


Windham Route 121 Culvert Replacement Project STP MM20(2)

Alternatives Presentation



OTTER CREEK
ENGINEERING

Progress Check-In

- ✓ Project Kick-off Meeting
This is a meeting of the municipality, MPM, Design Consultant, and VTrans Project Supervisor to discuss the goals and objectives of the project and define the project development process. Project scope, schedule, and budget are some of the areas of discussion at this meeting.
- ✓ Local Concerns Meeting
This is the first of three public meetings. This gives local citizens and stakeholders with interest in the project a chance to comment on the potential details and impacts of the project.
- ✓ Purpose & Need
Develop a Purpose and Need Statement so that the needs and goals of the project are clearly defined.
-  Alternatives Presentation
This is the second of three public meetings. This is when the design consultant presents the alternatives of the project to the public. The purpose of this presentation is to ultimately select a preferred alternative for further development.
- Conceptual Plans
This is the first step in plan development of the preferred alternative. These plans are approximately 25% of plans development and shall include a construction cost estimate.
- Public Informational Meeting
This is the third public meeting. Conceptual plans are presented for public input, including potential impacts of the project on environmental resources.
- Environmental Document
This document details the impacts of the project on resources such as wetlands, historic, archaeological, etc. as mandated by the National Environmental Policy Act (NEPA).

Alternatives

1. Option #1: No Build
2. Option #2: Build New
 - Design Alternative A: Corrugated Metal Pipe Culvert
 - Design Alternative B: Precast Concrete Box Culvert
 - Design Alternative C: Open Bottom Arch Culvert

Option #1: No Build

- Headwater to depth ratios of existing structure exceed allowable values established in the current VTrans Hydraulics Manual
- Existing structure does not meet the state stream equilibrium standards for bankfull width which constricts the channel, increases the potential for ice and debris blockage, and limits aquatic organism passage
- Existing structure is deteriorating

Existing culvert below Route 121 in Windham, VT



Upstream end of culvert



Downstream end of culvert

Option #2: Build New

Design Alternative A

Consists of:

- Corrugated metal squash pipe culvert structure
- Retention sills (baffles) along the bottom
- Buried invert
- Metal headwalls/wingwalls

Design Example



Option #2: Build New

Design Alternative B

Consists of:

- Precast concrete box culvert structure
- Bed retention sills (baffles) along the bottom
- Buried invert
- Precast concrete headwalls/wingwalls

Design Example



Option #2: Build New

Design Alternative C

Consists of:

- Corrugated metal arch structure
- No bottom
- Wingwalls
- Cast in place or precast footings

Design Examples:



Considerations

1. Purpose & Need
2. Impacts
3. Permitting
4. Engineering Materials
5. Construction
6. Cost

Purpose & Need

Purpose: Provide a culvert that allows a smooth transition of flow through the structure and limits scour and to provide a structure material that has proven long term durability.

Need: The existing corrugated metal pipe culvert with no headwalls has failed and a new culvert needs to be implemented.

Option #1: No Build

Does not meet the purpose or need.

Option #2: Build New

Design Alternatives A, B, and C meet the purpose and need.

Impacts

Option #1: No Build

- Wetlands
 - No new impacts
- Floodplain
 - Current culvert restricts waterway and may lead to debris blockage, increased stream velocities, accelerated erosion, etc.
- Noise
 - No anticipated impacts

Option #2: Build New

- Wetlands
 - Construction will involve temporary wetland impacts
- Floodplain
 - An appropriately sized culvert will minimize negative impacts, help the waterway flow more naturally, and allow for aquatic organism passage
- Noise
 - Construction related noise only for short duration during work

Permitting

	No Build	Design Alternative A	Design Alternative B	Design Alternative C
VT Wetlands Permit		X	X	X
Stream Alteration Permit		X	X	X

Engineering: Materials

No Build

- Deteriorated pipe

Design Alternative A

(Corrugated Metal Pipe Culvert)

- Corrugated metal is less durable than concrete
- Susceptible to corrosion
- Corrugated metal is significantly cheaper than concrete

Design Alternative B

(Precast Concrete Box Culvert)

- Concrete is a more durable material
- Concrete is a more expensive material

Design Alternative C

(Open Bottom Culvert)

- Corrugated metal is less durable than concrete
- Susceptible to corrosion
- Corrugated metal is significantly cheaper than concrete

Engineering: Construction

	No Build	Design Alternative 2A (Corrugated Metal Pipe Culvert)	Design Alternative 2B (Precast Concrete Box Culvert)	Design Alternative 2C (Open Bottom Culvert)
Schedule	N/A	Moderate timeline	Moderate timeline	Slightly longer than other options
Complexity	N/A	Medium	Low	Higher

Costs

(16' span, 50' length, and min. 80 sq-ft waterway area structure)

Design Alternative 2A (Corrugated Metal Squash Pipe Culvert)
Construction Cost: \$ 317,000.00

Design Alternative 2B (Precast Concrete Box Culvert)
Construction Cost: \$ 416,500.00

Design Alternative 2C (Open Bottom Metal Arch Culvert)
Construction Cost: \$ 312,100.00

**Note: Pricing includes 20% contingency at this early concept stage

Evaluation Matrix

Category		Option #1: No Build	Option #2: Build New		
			Design Alternative 2A (Metal Pipe)	Design Alternative 2B (Concrete Box)	Design Alternative 2C (Open Bottom)
Cost	Roadway				
	Structure				
	Detour				
	Traffic & Safety				
	Total	\$0	\$317,000	\$416,500	\$312,100
Engineering	Material	Deteriorating	Less durable	Durable	Less durable
	Construction	N/A	Moderate Construction Time	Short Construction Time	Longer Construction Time
	Bicycle Access	N/A	N/A	N/A	N/A
	Hydraulic Performance	Insufficient	Sufficient	Sufficient	Sufficient
	Permitting	N/A	Permits prior to construction	Permits prior to construction	Permits prior to construction
	Utilities	N/A	N/A	N/A	N/A
Impacts	Ag. Lands	None	None	None	None
	Archaeological	None	None	None	None
	Historic	None	None	None	None
	Hazardous Materials	None	None	None	None
	Floodplains	Culvert constricts waterway and may increase severity of flooding	Appropriately sized culvert will minimize the impact of the culvert on flooding	Appropriately sized culvert will minimize the impact of the culvert on flooding	Appropriately sized culvert will minimize the impact of the culvert on flooding
	Fish & Wildlife	None	None	None	None
	Rare, Threatened & Endangered Species	None	None	None	None
	Public Lands – Sect. 4(f)	None	None	None	None
	LWCP – Sect. 6(f)	None	None	None	None
	Noise	None	None	None	None
	Wetlands	None	Temporary	Temporary	Temporary
Local & Regional Issues	Concerns	Debris blockage, corrosion of current pipe culvert, etc.	None	None	None
	Aesthetics	Unchanged	Positive Change	Positive Change	Positive Change
	Community Character	Unchanged	Positive Change	Positive Change	Positive Change
	Economic Impacts	None	None	None	None
	Conformance to Reg. Transportation Plan	N/A	N/A	N/A	N/A
	Satisfies Purpose & Need	No	Yes	Yes	Yes
Permits	ACT 250	No	No	No	No
	401 Water Quality	No	No	No	No
	404 COE Permits	No	No	No	No
	Stream Alteration	No	Yes	Yes	Yes
	State Wetland Permit	No	Yes	Yes	Yes
	Storm Water Discharge	No	No	No	No
	Lakes & Ponds	No	No	No	No
	T & E Species	No	No	No	No
	SHPO	No	No	No	No

Other Considerations

Design Alternative 2A (Corrugated Metal Pipe Culvert)

- In the long run, a corrugated metal pipe culvert will need to be replaced more frequently than a concrete culvert due to the metal's susceptibility to corrosion.

Design Alternative 2B (Precast Concrete Box Culvert)

- Areas with a shallow bedrock profile can prove difficult locations to install embedded structures (such as closed bottom culverts) and the necessary solid rock removal can be a costly and time-consuming process.

Design Alternative 2C (Metal Arch w/Open Bottom Culvert)

- Open bottom structures use spread footings which are useful in areas of shallow bedrock as the subfooting may be poured directly to ledge, reducing scour susceptibility, minimizing excavation, and eliminating solid rock removal.



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Questions?

Thank you for your time



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