Colchester - South Hero Causeway Improvement Project

Project Definition Report
PL 01(1)-19 CCMPO

Revised
June 16, 2005

Prepared for: Chittenden County Metropolitan Planning Organization

Town of Colchester

Town of South Hero

Local Motion

In Cooperation with: VTrans - LTF Bicycle & Pedestrian Program

VT Department of Fish & Wildlife

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1.0 Executive Summary

Dufresne-Henry (D-H) was retained by the Chittenden County Metropolitan Planning Organization (CCMPO), the Town of Colchester and the Town of South Hero to develop alternatives for potential improvements to the old railroad causeway within the limits of the Colchester shoreline to the South Hero shoreline. This historic corridor serves as a visually stunning, recreational haven for bicyclists, runners, pedestrians, anglers and hunters.

Project needs were realized through site visits and Local Concerns Meetings held in both Colchester and South Hero, and are summarized below:

- The extraordinary natural scenery and historic character of the causeway needs to be maintained per the requests of citizens and community leaders.
- Accessibility to and along the causeway needs to be improved to meet the goals of town and regional plans. These plans include provisions for alternative modes of transportation and enhancing recreational value.
- A sufficient path width and expedient emergency access is needed to provide a safe environment for recreational users, emergency responders and maintenance activities.

Potential capital improvements to address the project needs include:

- **Emergency/Maintenance Turnarounds** – Bulb-out areas located on each side of the "Cut" will provide a safe turnaround location for emergency vehicles in the event of an accident on the facility. The design minimizes fill into the lake, and maintains the aesthetic historic and natural character of the causeway by using materials similar to those already out there. Ancillary benefits of the turnarounds include:
    - *Maintenance* - Turnarounds will provide room for larger maintenance vehicles to turnaround.
    - *Recreation* - Turnarounds will serve as fishing, viewing & resting areas for the users.

- **Fishing Platforms** - The 200' wide opening in the causeway, known as the "Cut," is a destination in itself, and the existing abutments provide an opportunity to place a concrete viewing/fishing platform on each side. Since the gap is so wide, conflicts with boaters passing through are not expected. The platforms will include railings and provide a location for all to enjoy.

- **Path Improvements** - Inconsistent width defines the existing path. Washouts along the rock slopes are scattered throughout and need attention. A consistent width and more uniform crushed gravel surface is recommended. Out of the five alternatives developed, Alternative #4 (summarized below) is recommended for final design.
    - *Travelway* – A crushed gravel surface with dimensions of 8' width by 4" depth, adhering to VTrans guidelines, is recommended. The surface shall be firm, stable, slip resistant, and adhere to ADA firmness guidelines.

- *Shoulders* – A grassed area with a minimum 3' width on each side of the travelway is recommended to provide minimum recovery area widths along the entire length of the causeway.

- *Recovery Areas* – 5' recovery areas are recommended to provide pull-off areas for slower traffic, therefore reducing the potential for user collisions. Recovery areas should be constructed where existing width is available and where the path can be widened without impacting Lake Champlain below ordinary high water.

- *Barriers* – The causeway slopes consist of waste marble rip-rap material, are steeper than 2:1 in some locations, and have a vertical drop greater than 4' in the summer months. The causeway also provides stunning views of the Lake Champlain landscape, is visually pleasing in itself for those on Lake Champlain, and is recognized as a historic property type. For these reasons, 24" vegetative barriers are recommended to provide protection from falls onto these steep, unforgiving slopes, without adversely affecting the scenic and historic values of the landscape. Small shrubs and groundcovers are recommended as barriers in areas where slopes are greater than 2:1 and/or shoulder width is less than 5'. These vegetative barriers shall be established intermittently with spacing of no more than 6'. Examples of shrubs and groundcovers that will survive the harsh conditions of the lake environment include Prostrate Juniper (Juniperus Communis Depressa) and Dwarf Grey Willow (Salix Trista).

- *Signage* – Limited signage located prior to both the South Hero and Colchester entrances is recommended to educate and warn users of the inherent hazards that may be encountered on this unique recreation path. To avoid detracting from the visual appeal of the landscape, signage placed along the Causeway, if any, should have a similar look to that used on hiking trails throughout Vermont. Signs developed for this project should conform to specifications outlined in the Manual for Uniform Traffic Control Devices (MUTCD).

2.0 Introduction

The Colchester/South Hero Causeway Project involves improvements to 3 miles of an abandoned railroad corridor currently used for recreation purposes. Safety and maintenance concerns and reestablishment of an alternative transportation link between Colchester and South Hero were the main reasons for initiating this project improvement study. An alternative on-road alignment was considered, but no further evaluation was performed because this alternative does not meet the purpose and need of the project, and will impact numerous environmental resources and over 20 miles of roads.

This report summarizes existing conditions/deficiencies, cultural and natural resources, and public input, and provides recommendations for alternative improvements that will best satisfy the project purpose and need while addressing design and resource constraints. Conceptual cost estimates, resource review documentation, evaluation matrices, meeting minutes, and letters of support are included in the appendices.

3.0 Purpose and Need Statement

Purpose

Improve the safety of and accessibility to the causeway for bicyclists, pedestrians, sportspeople, and emergency responders while maintaining aesthetic qualities of the region, preserving historical significance and reestablishing the alternative transportation link between Colchester and South Hero.

Need

Community Character:

The causeway serves as a scenic recreational haven for its users. Plans for a summer ferry to transport users from the Colchester side to the South Hero side are moving forward. The addition of this ferry may lead to a significant increase in path usage, which will increase maintenance requirements. Currently, many areas along the causeway have experienced significant loss of materials over time, which has resulted in diminished path width and surface quality. Without improvements designed to facilitate maintenance activities, the causeway structure will continue to degrade. Users will feel unsafe, and may no longer choose to travel along the causeway for recreational purposes.

Accessibility:

Narrow path width and lack of turnaround areas cause maintenance difficulties. Without proper maintenance of the path, handicapped users will have difficulty utilizing the path.

Safety:

Insufficient path width creates an unsafe and uncomfortable environment for users. Lack of sufficient turnaround areas creates difficult and unsafe maneuvers for emergency vehicles.

4.0 Background Information

4.1 Project Description and Location

The Colchester/South Hero Railroad Causeway is a stretch of abandoned railroad corridor, built in 1900, crossing Lake Champlain. The Causeway separates Mallets Bay on the east from the broad lake on the west. The project limits extend approximately three miles from the Colchester shoreline near Mills Point to the South Hero shoreline at Allen Point, and are shown in Figure 4-1. The Causeway currently serves as a recreational area for bicyclists, runners, pedestrians, anglers and hunters. The Causeway is a component of the Causeway Park Path that extends from the Winooski River to the Colchester side of the "Cut." The Causeway Park Path connects to the Burlington Waterfront Bikeway via a bike ferry across the Winooski River to form a beautiful 13 mile recreational trail.

For ease of discussion, the Causeway structure, within the project limits, is divided into 3 regions. Region 1 extends approximately ¾ mile from the Colchester shoreline to the Bridge. Region 2 extends approximately 1 ¾ miles from the Bridge to the Colchester side of the "Cut," and Region 3 extends approximately ½ mile from the South Hero side of the "Cut" to the South Hero shoreline, as shown in Figure 4-1.

The Town of Colchester owns the portion of the Causeway from the Colchester shoreline to the "Cut." The State of Vermont Department of Fish and Wildlife owns the portion of the Causeway from the "Cut" to the South Hero shoreline.

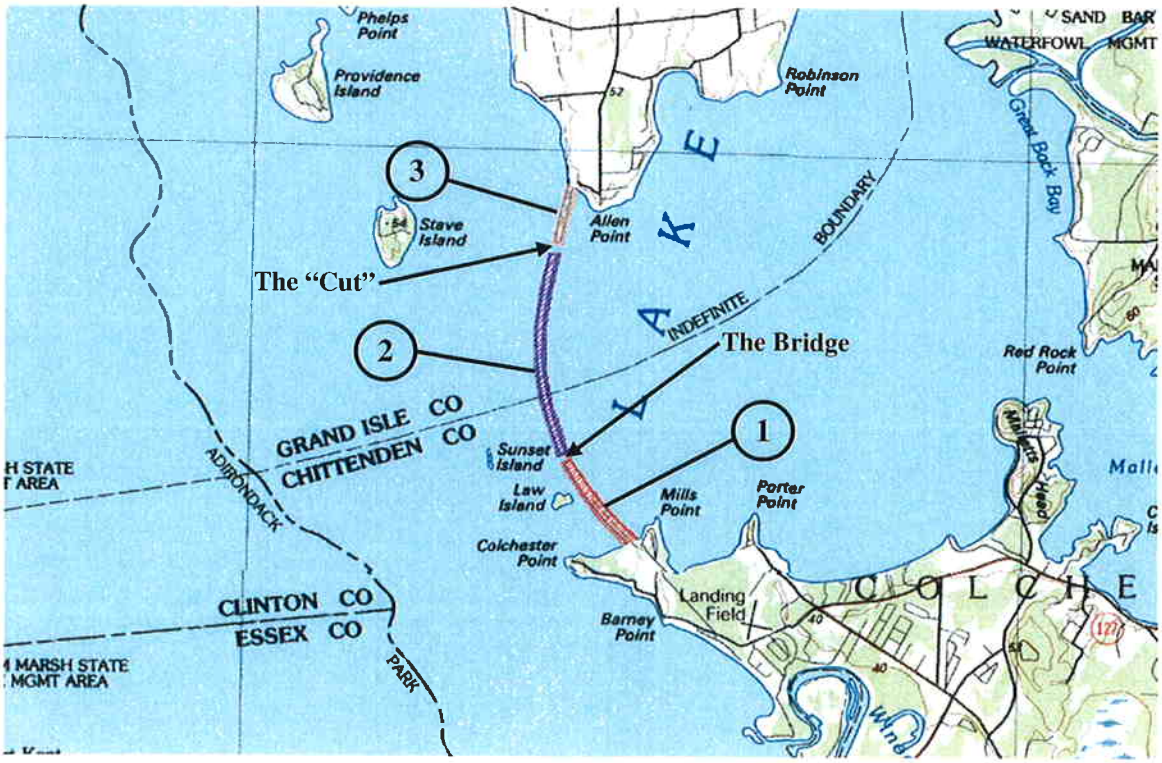

Figure 4-1: Map of the Causeway defining regions 1, 2, & 3 for ease of discussion

4.2 Existing Project Conditions

4.2.1 Access

On the Colchester side of the project, the Causeway is accessible from Mills Point Road, as shown in Figure 4-2. Users may park their cars at Airport Park on Colchester Point Road, and bike or walk along the recreation path, in a northwesterly direction, to the Mills Point Road Access. Restroom facilities are found at Airport Park. A small parking area near Broadlake Road and a small parking area a few hundred feet south of the Mills Point Road access also serve this area. The Town of Colchester is currently constructing a multi-use path along Colchester Point Road that will connect the Porters Point area to the Causeway Path.

According to the Colchester Park Ordinance, motorized vehicles are prohibited from using the Mills Point Road access without written consent from the Colchester Parks and Recreation Department. The Colchester shoreline lies about ½ mile north of the Mills Point Road access.

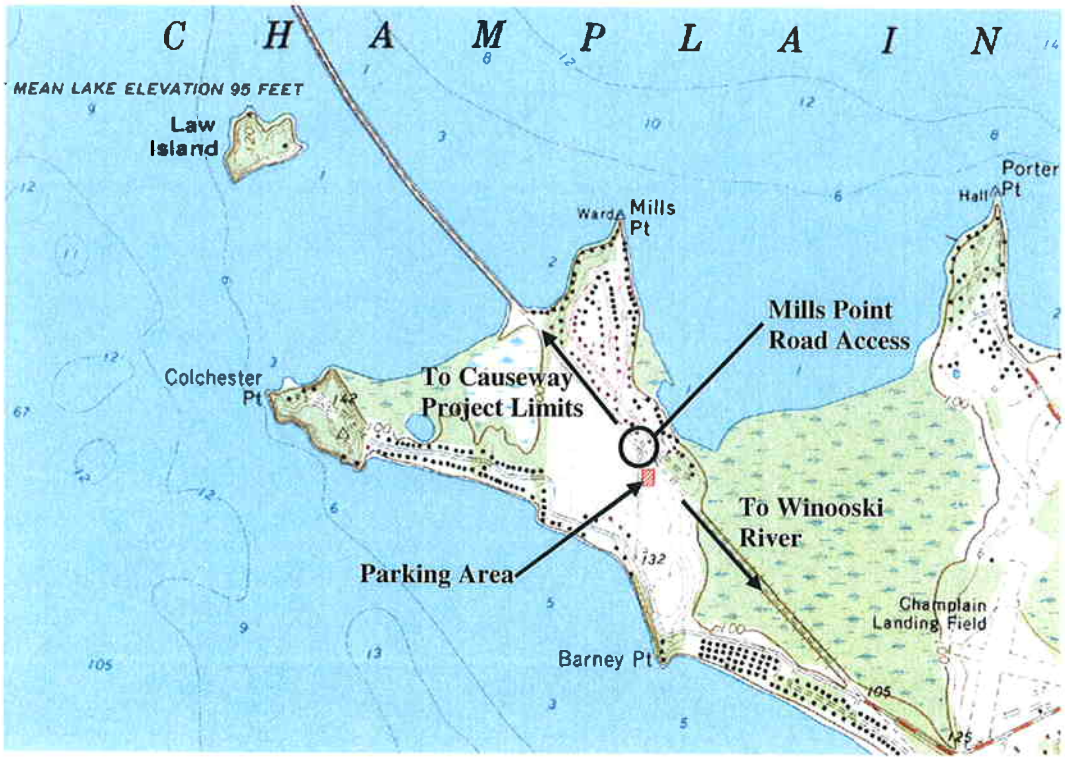

Figure 4-2: Mills Point Road Access and Parking Area

On the South Hero side of the project, the Causeway is accessible from Martin Road, as shown in Figure 4-3. Users currently park on Martin Road and access the causeway directly from Martin Road via an existing unpaved path. Motor vehicles are permitted to use this path to access the Causeway. The South Hero shoreline lies about ½ mile south of the Martin Road access.

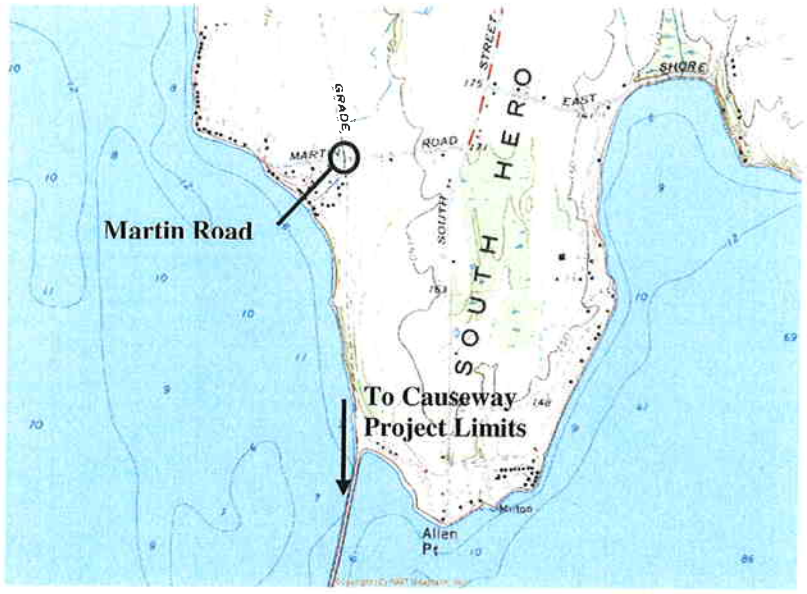

Figure 4-3: Martin Road Access

4.2.2 The Bridge

A steel railroad bridge with timber decking exists approximately ¾ mile north of the Colchester shoreline, as shown in Figure 4-4. Fishing, swimming and viewing are common activities at this location. When lake surface water elevations are low enough to provide vertical clearance, the Bridge underpass serves as secondary access for small boats between the broad lake and Mallet's Bay. The timber decking of the Bridge has been recently replaced. Currently, the structural integrity of the Bridge decking is adequate for the common users, but may not be adequate for maintenance or construction operations. The steel structure, once used for rail traffic, does not show signs of deterioration, and its structural integrity appears to be satisfactory.

Figure 4-4: The Bridge

4.2.3 The "Cut"

A 200-foot gap, called the "Cut," exists near the north end of the Causeway, as shown in Figure 4-5. A turn-style bridge crossed the "Cut" for rail crossing, and was removed after abandonment of the rail corridor in the 1950's. The abutments for the bridge still remain on both sides of the "Cut." Fishing, swimming and viewing are common activities at this location. When lake surface elevation is high, the "Cut" serves as the sole access for all boats between the broad lake and Mallet's Bay, and serves as the primary access when lake surface elevation is low. Water depths range from 10'-20' through the "Cut."

Figure 4-5: The "Cut" (looking north at South Hero)

4.2.4 Causeway Structure

The travelway width varies from 5'-9' and consists of a loose, crushed stone surface. The shoulder width varies from 0'-6' and consists of grassy areas intermingled with native shrubs and trees. The slopes are lined with heavy, marble armor stone. Slope washouts are scattered along the length of the Causeway.

Region 1 - The existing surface elevation varies from 105' to 103.5'. The path typically consists of 8'-9' travelway width and 4'-5' shoulder widths. The combined travelway and shoulder width near the Bridge narrows to 13.5'. From the shoreline to about halfway to the bridge, native shrubs and trees line the edge of the shoulders. From this point to the Bridge, native vegetation becomes more sparse. A few minor slope washout areas exist in this region.

Region 2 - The existing surface elevation varies from 105' to 103.5'. This region of the Causeway experiences maximum exposure to the harsh lake environment. Numerous slope washout areas exist in this region. The crushed stone surface has suffered from significant wave and ice erosion as evidenced by loss of crushed stone and severe rutting. The path typically consists of 6'-7' travelway width and 3'-4' shoulder widths. Path widths diminish to approximately 5' in washout areas. Shrubs and trees exist sporadically through this region.

Region 3 - The existing surface elevation varies from 105' to 103.5'. The path typically consists of 8'-10' travelway width, 0'-2' shoulder widths on the east bank, and 4' densely vegetated ledge on the west bank. All substantial vegetation on the east bank was removed during improvements made in the summer of 2001. The crushed stone surface has been recently replaced, but is still prone to erosion. A few minor slope washout areas exist in this region.

4.2.5 Turnaround Areas

A small turnaround area exists about 100 feet before the Bridge in Region 1. The turnaround is approximately 33' wide, at the widest point, by about 60' long. These dimensions are not adequate for efficient movement of emergency and maintenance vehicles.

Another small turnaround area exists where the old bridge tender's station was located, adjacent to the South Hero side of the "Cut". The turnaround area is not adequate for efficient movement of emergency and maintenance vehicles. This location may serve as an appropriate spot for a proposed emergency turnaround (see Section 7.1), due to the larger amount of existing materials in the area.

4.2.6 Right-of-Way

The Town of Colchester owns the portion of the Causeway from the Colchester shoreline to the "Cut." The portion of the Causeway from the "Cut" to the South Hero shoreline is owned by the State of Vermont and managed by the Department of Fish and Wildlife.

4.2.7 Utilities

Active utilities do not exist on the Causeway within the project limits. A few abandoned utility poles remain from the time of railroad use.

5.0 Environmental Resources

Impacts to natural, land use, and historical resources dictated design of various improvements and influenced project recommendations.

5.1 Natural Resources

A subconsultant, William D. Countryman – Environmental Assessment and Planning, performed an assessment of the natural resources within the project limits (see Appendix A). The following comments are based on the natural resource assessment and a meeting with the Army Corps of Engineers and Lakes and Ponds (see Section 6.3).

5.1.1 Wetlands

Although no wetlands lie within the project limits, the Causeway crosses through a forest/shrub wetland between the Mills Point Road access and the Colchester shoreline. Normally, this area would be subject to Vermont Wetland Rules if heavy equipment crosses through this point during construction. However, the project may not require a permit since the proposed improvements to the Causeway may be considered as reconstruction, routine repair, or minor additions/modifications.

5.1.2 U.S. Army Corps of Engineers Permit

A permit from the U.S. Army Corps of Engineers is required for any project that involves encroachment beyond the ordinary high water level of 98'. Considering the amount of fill required for the proposed improvements, an Individual Permit will likely be required for this project. Requirements for this permit include a completed application form, vicinity map, site plan showing proposed impact, and cross sections showing proposed impact. The application fee will range from $0-$100, depending on the type of permit.

5.1.3 Lakes & Ponds

A Shoreland Encroachment Permit will be required from the Vermont Agency of Natural Resources - Department of Environmental Conservation, if any materials are dredged or discharged into Lake Champlain below the mean water level of 95.5'. Any ordinary repairs or maintenance, without filling or dredging activities below 95.5', will not require this permit. Requirements for this permit are similar to those for the Corps of Engineers permit and include a completed application form, location map, site plan showing impact areas, cross-sections showing impact areas, construction drawings, and specifications. Municipalities are exempt from the permit fee.

5.1.4 Floodplains

No floodplains are located within the project limits according to Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps.

5.1.5 Rare, Threatened, and Endangered Species

On the federal level, the only species likely to dwell within the project limits is the bald eagle (Haliaeetus Leucocephalus). A sign-off letter needs to be obtained from the U.S. Fish and Wildlife Service.

On the state level, two animal species that may be found on the Causeway are protected under the Vermont Endangered Species Law (10 V.S.A., Chapter 123). The Spiny Soft Shell Turtle (Abalone Spiffer) and Rough Necked Tiger Beetle (Cicindela Hirticollis) potentially dwell within the project limits. Coordination with Vermont Department of Fish and Wildlife Non-game & Natural Heritage Program will be necessary to ensure that the project does not have impacts on these species. A number of other protected species found in Lake Champlain, such as fish and mollusks, are unlikely to be affected by the project.

5.1.6 Stormwater

A stormwater discharge permit will not be required for this project. However, a Construction General Permit will be required from the Vermont Agency of Natural Resources.

5.2 Land Use Resources

5.2.1 Land & Water Conservation Fund (L&WCF) Sites

The Vermont Agency of Natural Resources (VANR) maintains a list of L&WCF sites. The list can be found at:

http://www.state.vt.us/anr/fpr/recreation/projectlist.htm

As of June 2002, none of the sites included on this list are located within the project limits.

5.2.2 Hazardous Materials Sites

The Vermont Agency of Natural Resources (VANR) maintains a list of active hazardous sites. The list can be found at:

http://www.anr.vt.us/dec/wastediv/rcra/hazsites.htm

As of June 2002, none of the sites included on this list were located within the project limits.

5.2.3 Agricultural Lands

No agricultural lands lie within the project limits.

5.3 Historic Resources

5.3.1 Historic Sites & Structures

Based on a letter concerning historic resources in the project area by DALY & Associates dated January 13, 2002, the Causeway is identified as a historic property type in the Vermont Historic Preservation Plan (July 1989). Any proposed changes to the structure of the Causeway will have to be carefully reviewed for adverse affects, both structural and visual, to the historic resource. See Appendix A for the DALY & Associates letter.

5.3.2 Archaeological Sites

The University of Vermont Consulting Archaeology Program conducted an Archaeological Resources Assessment (ARA). The ARA, dated May 10, 2002, suggests that the Causeway, within the project limits, is considered sensitive for underwater historical resources. A Phase I site identification survey is recommended prior to construction to determine the presence/absence of historic maritime resources. This study should be coordinated directly with the Lake Champlain Maritime Museum. An underwater investigation will be required to ensure there are no shipwrecks in the exact project fill locations. See Appendix A for the Archaeological Resources Assessment.

6.0 Meetings/Public Involvement

Many meetings were conducted to solicit input from various stakeholders and permitting agencies. Stakeholders include the users, Local Motion, Vermont State Department of Fish & Wildlife, the Town of Colchester, the Town of South Hero, Chittenden County Metropolitan Planning Organization (CCMPO), and Northwest Regional Planning Commission (NWRPC). Permitting agencies include the State of Vermont Agency of Natural Resources and the U.S. Army Corps of Engineers. Table 6-1 briefly summarizes these meetings.

Meeting/Organization	Location	Contact	Date
Local Concerns #1	South Hero Town Meeting Hall, South Hero	Don Smallwood, 372-5552	10/22/01
Local Concerns #2	Colchester Village Meeting House, Colchester	Al Voegele, 654-0709	10/23/01
Steering Committee #1	Colchester Town Offices, Colchester	Chris Pecor, 864-0223	1/14/02
Army Corps of Engineers	ACOE Office, Essex	Mike Adams, 872-2893	3/13/02
VT Dept. of Fish & Wildlife	ACOE Office, Essex	Steve Hanna, 241-3777	3/13/02
Engineers Construction, Inc.	ECI Offices, South Burlington	Gene Trombley, 862-9703	3/21/02
Act 250	Act 250 Office, Essex	Peter Keibel, 879-5614	3/26/02
Steering Committee #2	Colchester Town Offices, Colchester	Chris Pecor, 864-0223	4/4/02
South Hero Selectboard	South Hero Town Meeting Hall, South Hero	Don Smallwood, 372-5552	4/8/02
Colchester Selectboard	Colchester Village Meeting House, Colchester	Al Voegele, 654-0709	4/9/02
NWRPC	Dufresne-Henry, Inc., South Burlington	Bonnie Wanninger, 524-5958	4/25/02
Fish & Wildlife	Agency of Natural Resources, Waterbury	John Guilmette, 241-3737	5/2/02
Alternatives Presentation #1	Folsom School, South Hero	Don Smallwood, 372-5552	5/7/02
Alternatives Presentation #2	Colchester Village Meeting House, Colchester	Al Voegele, 654-0709	5/14/02

Table 6-1: Meetings Summary

6.1 Local Concerns Meetings

Local Concerns Meetings were held in both the Town of South Hero and the Town of Colchester on October 22, 2001 and October 23, 2001, respectively. The public was informed of the current status and future steps of the project. The public expressed concerns with the existing conditions of the Causeway. The meetings were publicly advertised and open to everyone. See Appendix B for the meeting minutes. Concerns expressed at these meetings included:

- Aesthetics - public wants to maintain extraordinary scenic nature of the Causeway
- Safety of existing path surface - public wants tighter, more uniform surface
- Path width - public does not want to see man-made barriers
- Erosion of the structure – some surface and slope rip-rap locations are in need of repair
- Paved surface vs. unpaved surface - public does not want paved surface
- Crossing the "Cut" - ferry vs. tunnel vs. bridge
- Access for emergency vehicles - public wants larger turnaround areas

The draft purpose and need statement for this project was developed based on the comments received at this meeting.

6.2 Steering Committee Meeting #1

This meeting was held on January 14, 2002 at the Colchester Town Offices. The Steering Committee revised the draft purpose and need statement and discussed the latest developments of the proposed improvements.

A Steering Committee was formed with representatives from the Town of South Hero, the Town of Colchester, D-H, CCMPO, Local Motion, and Moorings. The State of Vermont Fish and Wildlife organization was invited to join the committee, but was unable to attend. The Steering Committee was formed to balance numerous design, permit, and construction issues while trying to ensure that the project receives funding.

6.3 Army Corps of Engineers Meeting

This meeting was held on March 13, 2002 with Mike Adams, Army Corps of Engineers, and Steve Hanna, Department of Lakes and Ponds, to discuss natural resource impacts related to the proposed Causeway improvements (see Section 5.1.2 & 5.1.3). Refer to Appendix B for a copy of the meeting summary.

6.4 Contractor Meeting

Dufresne-Henry met with Gene Trombley, Engineers Construction Inc., on March 21, 2002 to discuss construction of the proposed improvements. Mr. Trombley informed D-H of techniques that may be used to construct the proposed improvements. With this information, more reliable cost estimates of the proposed improvements were determined.

6.5 Act 250 Jurisdictional Opinion Meeting

Dufresne-Henry met with Peter Keibel, District 4 Coordinator for Act 250, on March 26, 2002. The purpose of the meeting was to determine if an Act 250 permit would be required for the proposed improvements. Peter Keibel issued a jurisdictional opinion stating that an Act 250 permit would not be required for the proposed improvements. See Appendix A for a copy of the jurisdictional opinion.

6.6 Steering Committee #2

This meeting was held on April 4, 2002 at the Colchester Town Offices. The Steering Committee made final revisions to the draft purpose and need statement (see Section 3) and made a final review of the proposed improvements before being presented to the Town Selectboards and citizens. See Section 7 for discussion of the proposed improvements.

6.7 Town Selectboard Meetings

Dufresne-Henry met with the Town Selectboards of South Hero and Colchester on April 8, 2002 and April 9, 2002, respectively. The Selectboards were updated on the project

status, and informed of the proposed improvements to be presented at the Alternatives Presentation Meetings.

6.8 Northwest Regional Planning Commission Meeting

Dufresne-Henry met with Bonnie Wanninger of the Northwest Regional Planning Commission on April 25, 2002. Ms. Wanninger was updated on the project status and she informed D-H that the NWRPC would like to see improved fishing access.

6.9 Vermont State Department of Fish & Wildlife Meeting

Dufresne-Henry met with John Guilmette of the Department of Fish & Wildlife on May 2, 2002, to discuss the inclusion of fishing platforms at the "Cut." Mr. Guilmette provided plans of a sample fishing platform constructed on a previous project.

6.10 Alternatives Presentation Meetings

Alternatives Presentation Meetings were held in both the Town of South Hero and the Town of Colchester on May 7, 2002 and May 14, 2002, respectively. The public was informed of the current status and future steps of the project, and alternative improvements were presented. The public made comments on each of the improvements. Questionnaires were distributed to better gauge public sentiment on the alternatives. Appendix D contains a copy of the questionnaire and a summary of the questionnaire responses. The meetings were publicly advertised and open to anyone. See Appendix B for a copy of the meeting minutes.

7.0 Conceptual Improvements/Cost Estimates

Conceptual improvements were developed to address the purpose and need of the project. Cost estimates were developed for each improvement, and can be found in Appendix E. Matrices were developed to qualitatively evaluate the alternatives for each improvement. Factors that were considered in the matrices include cost, resource impacts and engineering requirements. The evaluation matrices are located at the end of each section.

7.1 Emergency/Maintenance Turnarounds

Turnarounds will improve access for both emergency response and maintenance operations. The turnarounds will provide a potential rest area for the users. The turnarounds will be located on the eastside of the Causeway to minimize damage due to wave & ice action. Figures 7-1 & 7-2 show a conceptual plan and elevation view for an emergency turnaround.

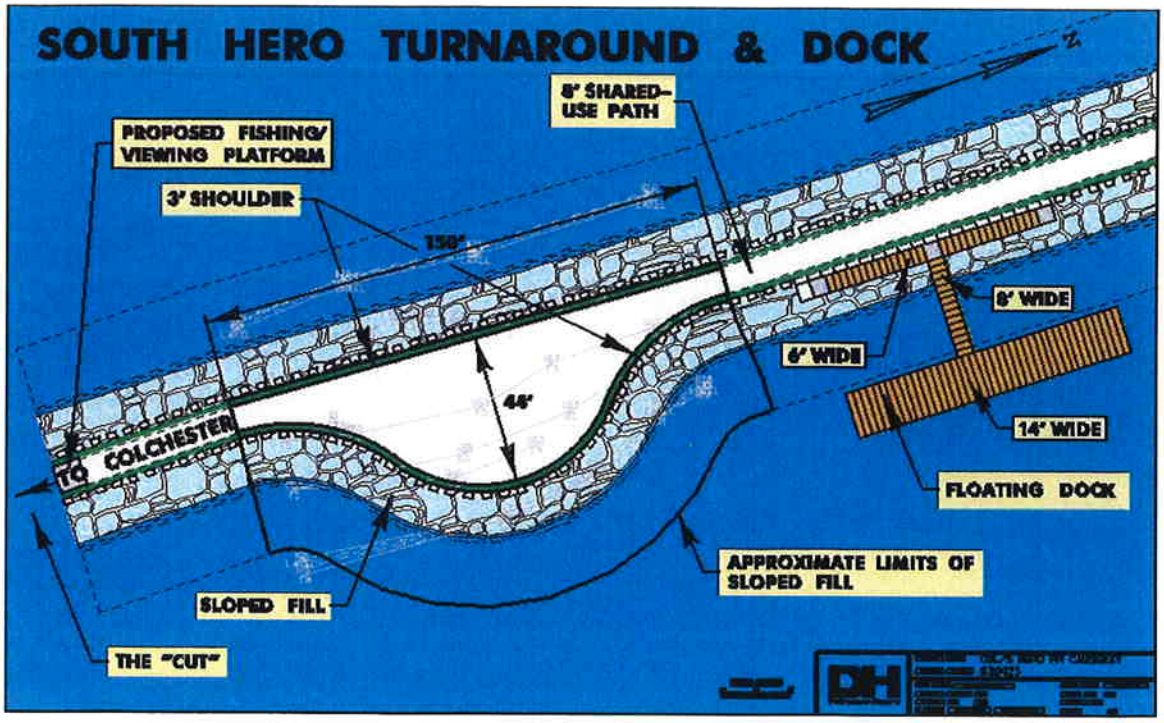

Figure 7-1: Conceptual Plan of Emergency Turnaround

Four emergency turnarounds were initially proposed. This number was reduced to two after speaking with permitting agencies and emergency responders. Applying for 2 emergency turnarounds allows a greater opportunity for obtaining funding and permits, and meets the needs of emergency responders and maintenance operations.

Vertical retaining walls to support these turnarounds are not feasible from an engineering and aesthetic standpoint (susceptible to ice damage, high cost, noticeable to those on the lake). A sloped fill using armor stone, similar to the existing materials, appears to be the most feasible alternative to minimize ice damage and visual impacts. The size of the

turnaround was designed so that an emergency response vehicle can easily and comfortably make a 3-point turn, and impacts to the lake will be minimized.

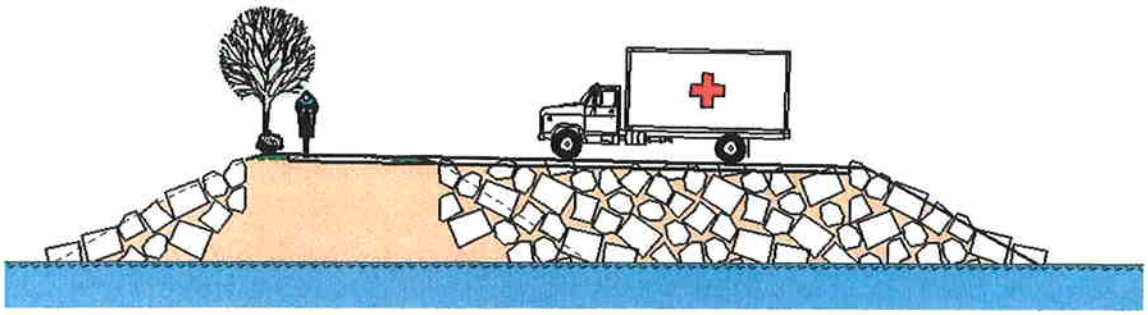

Figure 7-2: Elevation View of Emergency Turnaround

Potential impacts to archaeological resources and rare, threatened and endangered species may result from construction. A permit will be required from both the Agency of Natural Resources and the Army Corps of Engineers to construct the turnarounds. Cost to construct both turnarounds is estimated at $300,000.

CCMPO - Causeway Bike - DH# 6310023

Colchester - South Hero Causeway Project

Preliminary Evaluation Matrix - 4/8/02

Emergency Turnarounds

		Alternative 1 Do Nothing	Alternative 2 2 Turnarounds w/ Sloped Fill
Costs	**Total Estimated Cost***	**$0**	**$300,000**
	Properties Affected	0	0
Engineering	Meets AASHTO Guidelines	N/A	N/A
	Meets ADA Guidelines	Probably not	Yes
	Alignment Change	N/A	N/A
	Bicycle / Ped Access	No Change	Improved
	Drainage Change	No Change	2% sloped down from west to east bank
	Hydraulic	N/A	N/A
	Utility	N/A	N/A
Impacts	Agricultural	No	No
	Air Quality	No	No
	Archaeological	**No**	**Possible**
	Historic Structures, Sites and Districts	No	No
	Hazardous Materials	No	No
	Fish and Wildlife	**No**	**Possible**
	Rare, Threatened & Endangered Species	**No**	**Possible**
	Public Lands - Section 4(f)	No	No
	LWCF - Section 6(f)	No	No
	Noise	No	No
	Water Quality	No	Possible
	Wetlands	No	No
Local and Regional Issues	Conformance to Regional Transportation Plan	N/A	N/A
	Socio-Economic Impacts	N/A	N/A
	Satisfies Purpose and Needs Statement (Rankings: 1-Does not satisfy, 2-Marginal, 3-Satisfactory, 4-Good, 5-Best)		
	Maintains or Enhances Community Character	**5**	**5**
	Increases Safety	**1**	**5**
	Facilitates Maintenance	**1**	**5**
	Improves Access To Causeway and Links Regions	**1**	**5**
Permits	Act 250	No	No
	401 Water Quality	**No**	**Possible**
	404 COE Permit	**No**	**Yes, Individual Permit (> 5000 ft2)**
	Coast Guard	No	No
	Categorical Exclusion	**No**	**Yes**
	Stream Alteration	No	No
	Conditional Use Determination	No	No
	Stormwater Discharge	No	No
	Lakes and Ponds	**No**	**Yes**
	Threatened and Endangered Species	**No**	**Possible**
	SHPO	**No**	**Yes**

*Estimated Construction Cost Only

Figure 7-3: Evaluation Matrix for Emergency Turnarounds

7.2 Fishing Platforms

Improvements to the causeway will enhance fishing opportunities. Emergency turnarounds will provide opportunities to move away from the path to fish, rest, or view the surroundings. Two fishing platforms at the old bridge abutments on each side of the "Cut" will further enhance fishing, as suggested by the Department of Fish & Wildlife. Figure 7-4 shows a conceptual plan of the "Cut" with fishing platforms, and a sample cross-section of a fishing platform. In order to minimize conflicts, signage to make anglers aware of boaters crossing the "Cut" is recommended. Construction cost for two fishing platforms is estimated at $200,000.

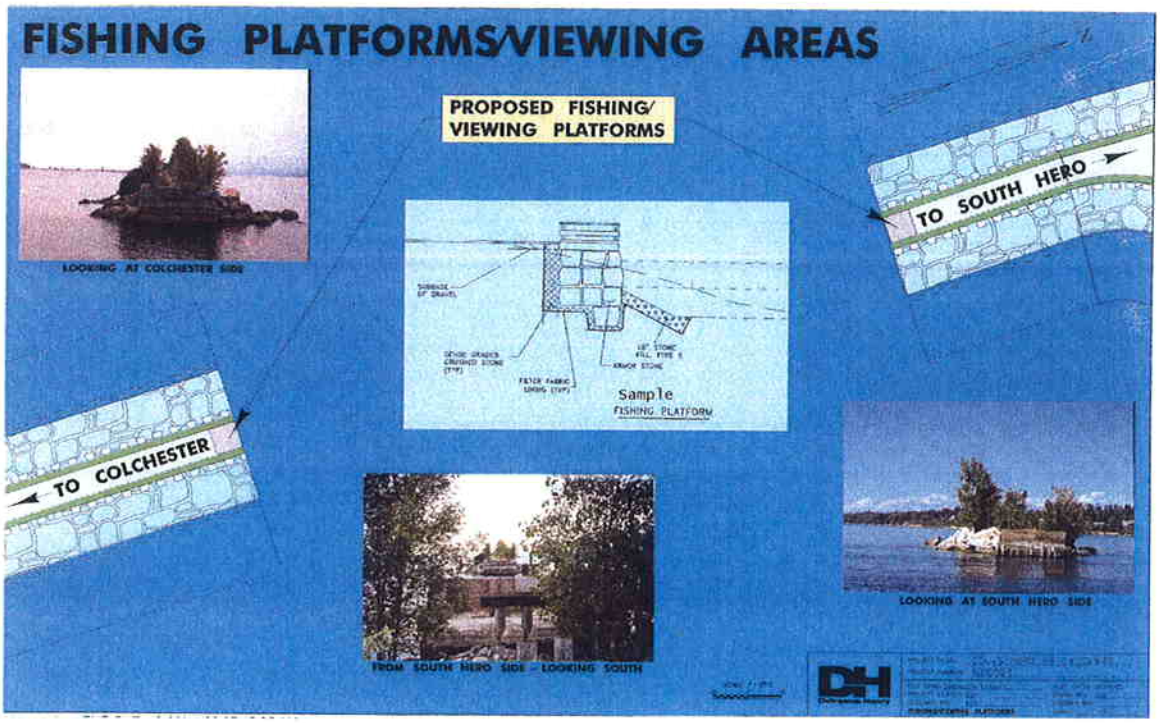

Figure 7-4: Conceptual Plan of the "Cut" with Fishing Platforms

Improvement: Fishing Platform

		Do Nothing	Alternative 1
Costs	**Total Estimated Cost***	**$0**	**$200,000**
	Properties Affected	0	0
Engineering	Meets AASHTO Guidelines	N/A	N/A
	Meets ADA Guidelines	N/A	Yes
	Alignment Change	N/A	N/A
	Bicycle / Ped Access	No Change	Improved
	Drainage Change	N/A	N/A
	Hydraulic	N/A	N/A
	Utility	N/A	N/A
Impacts	Agricultural	No	No
	Air Quality	No	No
	Archaeological	**No**	**Possible**
	Historic Structures, Sites and Districts	**No**	**Possible**
	Hazardous Materials	No	No
	Fish and Wildlife	**No**	**Possible**
	Rare, Threatened & Endangered Species	**No**	**Possible**
	Public Lands - Section 4(f)	No	No
	LWCF - Section 6(f)	No	No
	Noise	No	No
	Water Quality	No	No
	Wetlands	No	No
Local and Regional Issues	Conformance to Regional Transportation Plan	N/A	N/A
	Socio-Economic Impacts	N/A	N/A
	Satisfies Purpose and Needs Statement (Rankings: 1-Does not satisfy, 2-Marginal, 3-Satisfactory, 4-Good, 5-Best)		
	Maintains or Enhances Community Character	**1**	**3**
	Increases Safety	**1**	**5**
	Facilitates Maintenance	N/A	N/A
	Improves Access To Causeway and Links Regions	**1**	**4**
Permits	Act 250	No	No
	401 Water Quality	No	No
	404 COE Permit	No	No
	Coast Guard	No	No
	Categorical Exclusion	**No**	**Yes**
	Stream Alteration	No	No
	Conditional Use Determination	No	No
	Stormwater Discharge	No	No
	Lakes and Ponds	No	No
	Threatened and Endangered Species	**No**	**Possible**
	SHPO	**No**	**Yes**

*Estimated Construction Cost Only

Figure 7-5: Evaluation Matrix for Fishing Platforms

7.3 Path Improvements

State and federal guidelines suggest a minimum width of 8' for the path travelway and a preferred width of 5' for shoulders on trails adjacent to 2:1 slopes. Where the shoulder widths cannot be maintained adjacent to steep slopes, the shoulder width may be reduced to 3', if barriers are considered. Five alternatives were developed based on these guidelines and a site survey conducted in April 2003. Appendix F contains cross-sections and cut/fill volume calculations for each alternative.

7.3.1 Alternative 1 – Do nothing

No repairs or enhancements will be made to the Causeway. This alternative will cost $0. The Causeway will not experience any detrimental visual or historical impacts. This alternative does not satisfy the purpose and need of the project.

7.3.2 Alternative 2 – Widen Path

Alternative 2 proposes an 8' travelway width and 5' shoulders for the entire length of the structure. Large amounts of rip-rap will be required. Estimated construction costs will be $4 million. To construct this alternative, an estimated 6,500-7,500 cubic yards of material will need to be placed below ordinary high water (see Appendix F). Obtaining an Army Corps of Engineers permit for this alternative is unlikely.

7.3.3 Alternative 3 – Minimal Path Improvements w/ 42" Barriers

The path will be improved to a minimum 8' travelway width and minimum 2' shoulder widths (14' total path width). New surface material will be applied over the existing surface material, and will be firm, stable, slip resistant, and meet ADA firmness guidelines. The path will not be paved. Washout areas will be repaired. Region 1 of the Causeway from the Colchester shore to the bridge will require surface material replacement and washout repairs only. Barriers are not recommended in this region due to the existing 5' shoulder widths.

Region 2 from the bridge to the "Cut" will require the most work. A small section of the path will need to be widened to meet the minimum 2' shoulder width in this region, and surface materials will be replaced. 42" barriers are recommended on both sides of the path, as shown in Figure 7-5.

New 42" barriers would be required only on the east side of the causeway in Region 3 from the cut to South Hero. The existing vegetation provides a natural barrier on the west side of this region.

Combinations of three different barrier types can be used: vegetative barrier, marble block barrier, or wooden fence barrier. All barrier types will be difficult to establish or maintain on the causeway. Vegetative barriers will be difficult to

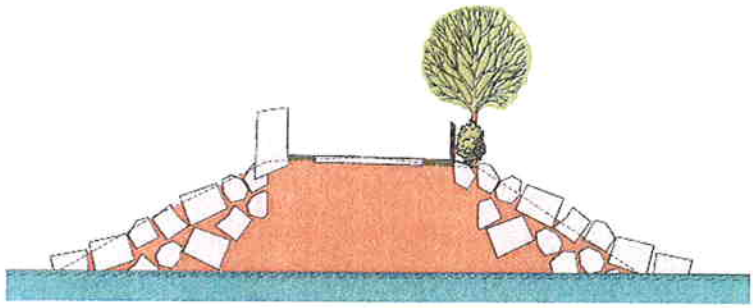

Figure 7-5: Cross-section showing 8' travelway, 2' shoulders (minimum), and various 42" high barriers types (marble block, wooden fence, and vegetation)

plant and cultivate. Extremely large marble block barriers will be very costly to install, and may be considered more of a hazard than a protective structure. A wooden fence barrier will be difficult to construct along the causeway structure, and may sustain significant damage during periods of high water and wave action. Vegetative barriers are recommended because they will provide a safety cushion for those who stray off the path and onto the slopes, are less of a hazard than marble blocks, have a better chance of surviving the winter than the wooden fence, and are less of a visual obstruction than marble blocks or wood fencing.

Construction costs for Alternative 3 are estimated at $450,000.

7.3.4 Alternative 4 – 3'-8'-3' Typical Section with 24" Vegetative Barrier and Intermittent 5' Recovery Areas

Alternative 4 incorporates the same path improvements as Alternative 3 with the following exceptions:

1. 24" barriers are proposed instead of 42" high barriers, as shown in Figure 7-6.
2. A minimum 3' shoulder will be constructed.
3. 5' recovery areas will be provided on both sides of the path where existing width is available and where the path can be widened without placing material below ordinary high water.

The 24" high barriers will be more visually appealing and will provide a measure of traffic calming. Reasons for using 24" barriers as opposed to 42" barriers include:

- The gravel surface inherently reduces the speeds of bicyclists.
- 42" high barriers may detract from the scenery enjoyed by those on the lake and on the Causeway.
- There will be fewer types of users with a gravel surface. Users, such as roller bladers, skaters, and skiers, are unlikely to use the path, therefore reducing user conflicts.

- The proposed intermittent barriers, recovery areas, and appropriate signage will improve safety while preserving the aesthetic nature of this "one-of-a-kind" resource for all to enjoy.

Barriers are not recommended in sections where a 5' recovery area width can be provided. Table 7-1 summarizes the locations at which either 3' recovery areas with barriers or 5' recovery areas without barriers are recommended.

STATION BEGIN	STATION END	DISTANCE LF	TYPICAL SECTION	24" BARRIER RECOMMENDED	
0+00.00	25+00.00	2500	5'-8'-5'	No	
25+00.00	35+00.00	1000	3'-8'-3'	Yes	
35+00.00	41+04.59	605	5'-8'-5'	No	Begin Bridge
42+34.67	75+00.00	3265	3'-8'-3'	Yes	End Bridge
75+00.00	95+00.00	2000	5'-8'-5'	No	
95+00.00	105+00.00	1000	3'-8'-3'	Yes	
110+00.00	115+00.00	500	5'-8'-5'	No	
115+00.00	120+00.00	500	3'-8'-3'	Yes	
120+00.00	125+00.00	500	5'-8'-5'	No	
125+00.00	135+00.00	1000	3'-8'-3'	Yes	
135+00.00	139+63.23	463	5'-8'-5'	No	Begin Cut
142+18.52	160+00.00	1781	3'-8'-3'	Yes, east side only	End Cut
160+00.00	164+30.00	430	5'-8'-5'	No	

Table 7-1: Summary of Recovery Area & Barrier Locations

Figures 7-6 and 7-7 show typical sections of the 8' travelway with 3' shoulders and 5' shoulders, respectively.

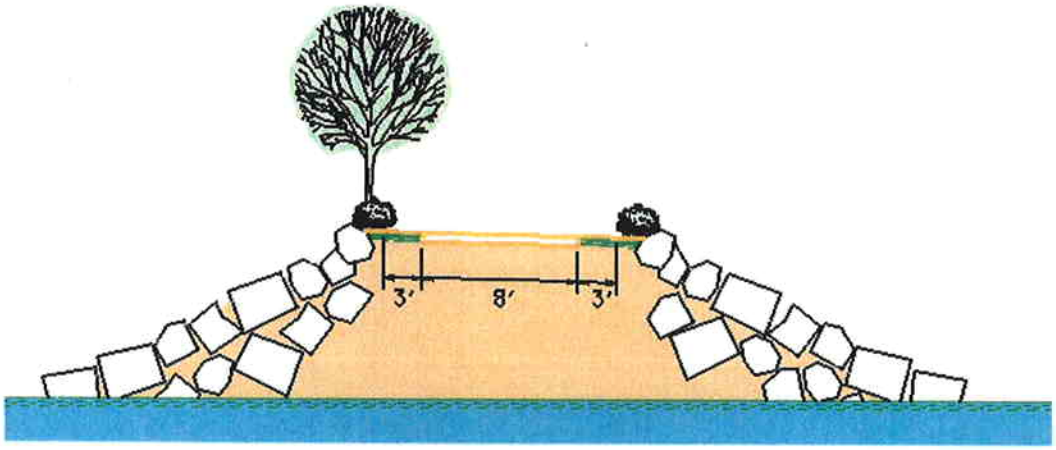

Figure 7-6: Cross-section showing 8' travelway, 3' shoulders, and 24" vegetative barriers

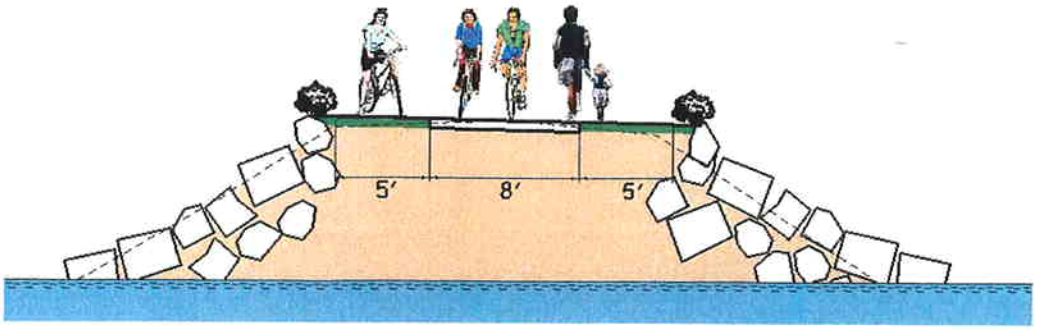

Figure 7-7: Cross-section showing 8' travelway and 5' recovery areas

Figures 7-8 and 7-9 show typical plan views of the causeway with 3' shoulders and 5' shoulders, respectively. Dark grey areas indicate the extent of the proposed fill, while the light grey areas represent the existing slopes. The ordinary high water mark of 98' has been shown as a bold, dashed/dotted line on Figures 7-8 and 7-9. If the improvements are constructed according to the recommendations shown in Table 7-1 and as shown on the plan views, no impacts are expected below the ordinary high water mark.

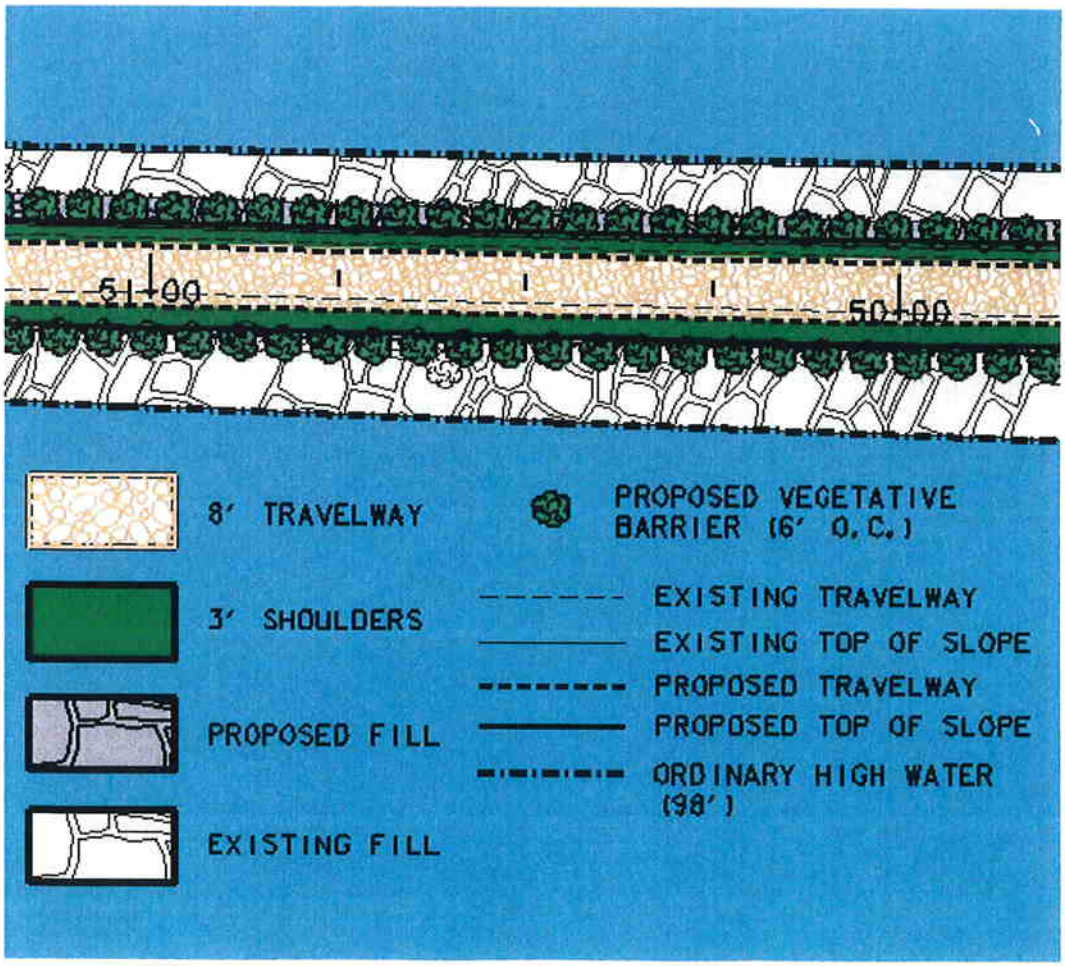

Figure 7-8: Layout plan showing 8' travelway and 3' shoulders (no impacts below ordinary high water)

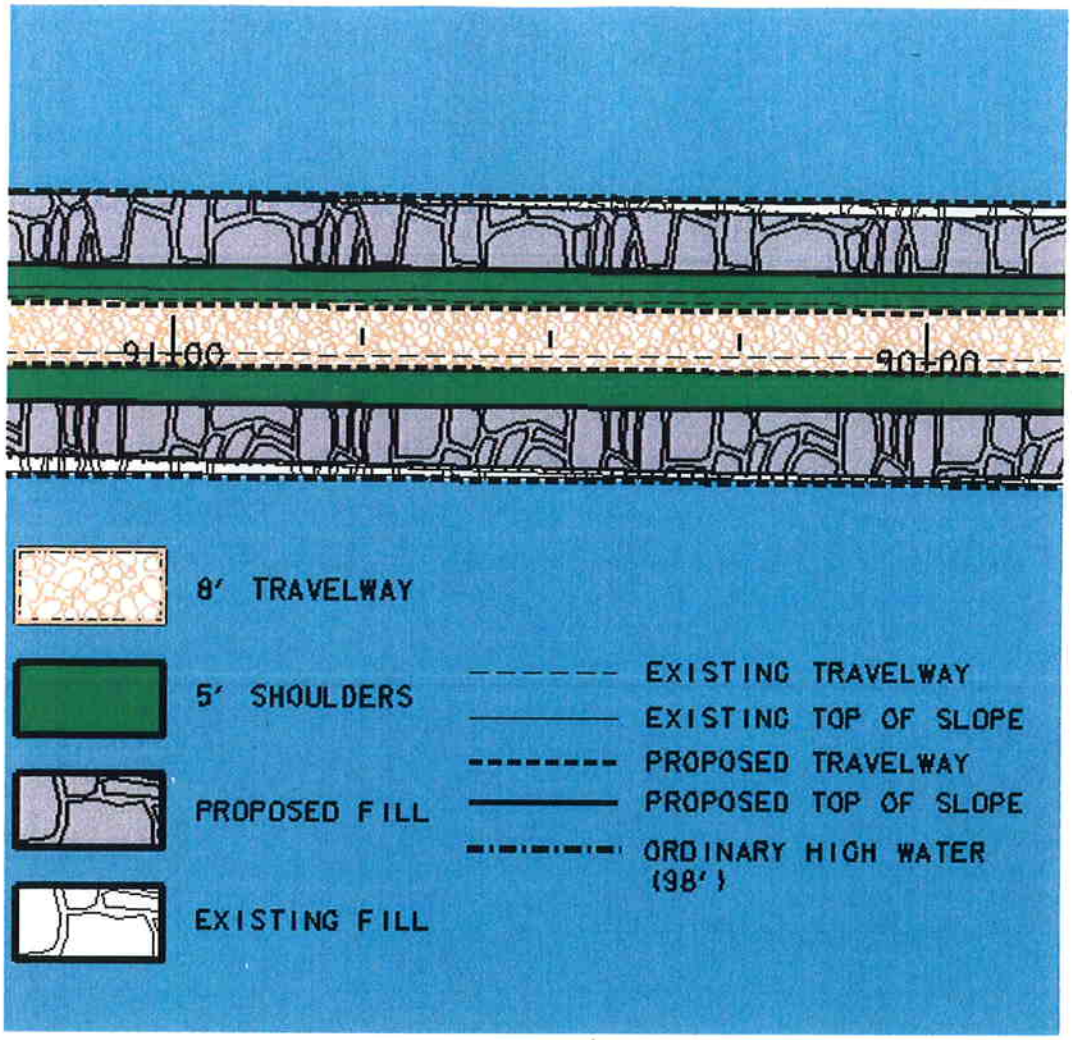

Figure 7-9: Layout plan showing 8' travelway and 5' recovery areas (no impacts below ordinary high water)

Construction costs for Alternative 4 are estimated at $1,300,000.

7.3.5 Alternative 5 – 3'-8'-3' Typical Section with No Barrier and Intermittent 5' Recovery Areas

Alternative 5 incorporates the same path improvements as Alternative 4, except that no new barriers are proposed, as shown in Figure 7-10. This will be the most visually appealing alternative, but will not provide protection against falls onto the marble rip-rap slopes. Reasons for eliminating barriers are similar to those outlined in Section 7.4.4.

Construction costs for Alternative 5 are estimated at $1,200,000.

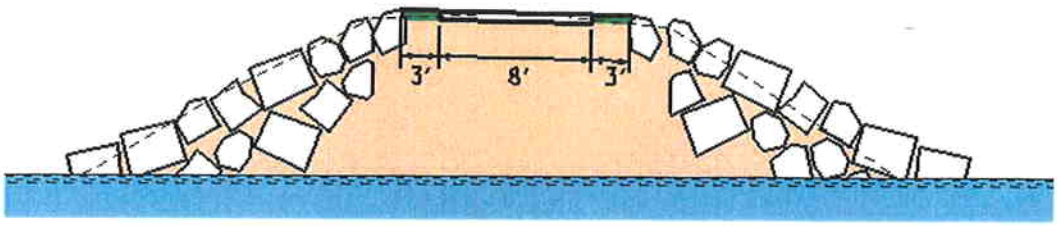

Figure 7-10: Cross-section showing 8' travelway, 3' shoulders, and no barriers

7.4 Survey

Survey information was used to obtain a cost estimate for each alternative. The survey was taken in April 2003. Slope information was provided only to the water surface elevation, approximately 98', at the time of the survey (see Figure 7-11). Therefore assumptions were made about the slopes below the water surface and the lake bottom elevation.

Based on visual inspection, the causeway slopes were assumed to be 1:1.5 below the surveyed water surface. A nautical map was used to determine that the lake bottom elevation is approximately 4' below a reference elevation of 93' in the causeway region. Therefore the lake bottom elevation was assumed to be 89'. The assumed causeway slopes start from the surveyed water surface and end at the assumed lake bottom. The slope of the lake bottom was assumed to slope away from the bottom of the causeway slope at a rate of 2%. Additional survey of the lake bottom may be required during the final design depending on the project scope.

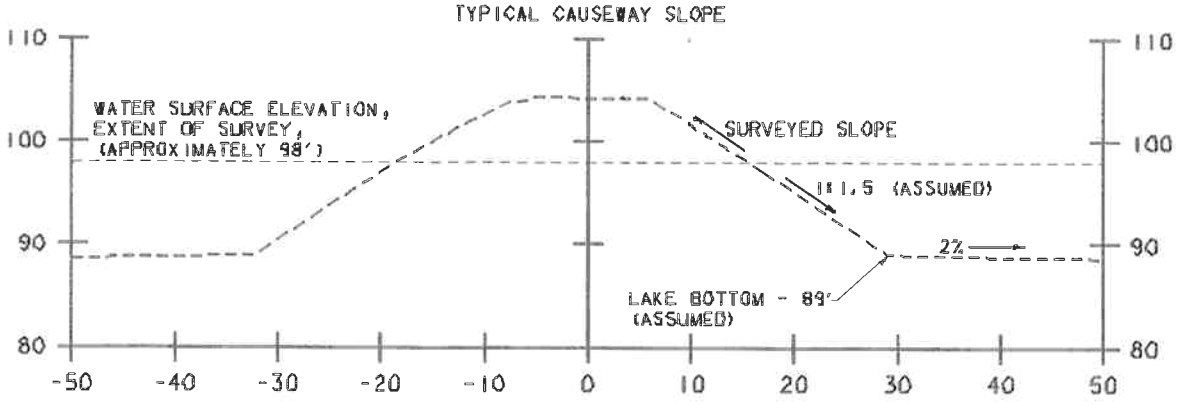

Figure 7-11: Typical Causeway Slope

These assumptions may have a significant impact on the construction costs of Alternative 2. If a slope steeper than 1:1.5 exists below 98' or if the lake bottom elevation is below 89', then the construction costs for Alternative 2 are expected to increase.

Colchester - South Hero Causeway Project
Preliminary Evaluation Matrix - 07/01/03
Improvement: Path Width and Repairs

		Alternative 1 Do Nothing	Alternative 2 5'-8'-5' Typical	Alternative 3 Minimal Path Improvements w/ 42" Barrier	Alternative 4 3'-8'-3' Typical w/ 24" Vegetative Barrier and Intermittent 5' Recovery Areas	Alternative 5 3'-8'-3' Typical w/ No Barrier and Intermittent 5' Recovery Areas
Cost	**Total Estimated Cost***	**$0**	**$4,000,000**	**$450,000**	**$1,300,000**	**$1,200,000**
	Properties Affected	0	0	0	0	0
Engineering	**Typical Section**	**Varies**	**5'-8'-5'**	**2'-8'-2'**	**3'-8'-3'**	**3'-8'-3'**
	Barriers	None	Not required	Shrubbery, trees/Marble blocks/Wooden Fence	Vegetation	None
	Meets State and Federal Guidelines	**N/A**	**Yes**	**Yes**	**Yes**	**Requires design exception**
	Meets ADA Guidelines	N/A	Yes	Yes	Yes	Yes
	Alignment Change	No	No	No	No	No
	Drainage Change	No Change	2% sloped down from west to east bank	2% sloped down from west to east bank	2% sloped down from west to east bank	2% sloped down from west to east bank
	Hydraulic	N/A	N/A	N/A	N/A	N/A
	Utility	N/A	N/A	N/A	N/A	N/A
Impacts	Agricultural	No	No	No	No	No
	Air Quality	No	No	No	No	No
	Archaeological	**No**	**Possible**	**Unlikely**	**Unlikely**	**Unlikely**
	Historic Structures, Sites and Districts	**No**	**Yes, removal of old trees & fill**	**Possible, removal of old trees**	**Possible, removal of old trees**	**Possible, removal of old trees**
	Hazardous Materials	No	No	No	No	No
	Fish and Wildlife	**No**	**Possible**	**Possible**	**Possible**	**Possible**
	Rare, Threatened & Endangered Species	**No**	**Likely**	**Possible**	**Possible**	**Possible**
	Public Lands - Section 4(f)	No	No	No	No	No
	LWCF - Section 6(f)	No	No	No	No	No
	Noise	No	No	No	No	No
	Water Quality	No	Unlikely	Unlikely	Unlikely	Unlikely
	Wetlands	No	No	No	No	No
Local and Regional Issues	Conformance to Regional Transportation Plan	No	Yes	Yes	Yes	Yes
	Socio-Economic Impacts	No	Yes	Yes	Yes	Yes
	Satisfies Purpose and Needs Statement (Rankings: 1-Does not satisfy to 5-Best satisfies)					
	Maintains or Enhances Community Character	**3**	**2**	**3**	**4**	**5**
	Increases Safety	**1**	**5**	**4**	**5**	**4**
	Improves Access To Causeway and Links Regions	**1**	**5**	**5**	**5**	**5**
Permits	Act 250	No	No	No	No	No
	401 Water Quality	No	Yes	No	No	No
	404 COE Permit	**No**	**Yes, Individual Permit (>5000 ft2)**	**Unlikely, Category B (up to 5000 ft2)**	**Unlikely, Category B (up to 5000 ft2)**	**Unlikely, Category B (up to 5000 ft2)**
	Coast Guard	No	No	No	No	No
	Categorical Exclusion	**No**	**Yes, C.3**	**Yes, C.3**	**Yes, C.3**	**Yes, C.3**
	Stream Alteration	N/A	N/A	N/A	N/A	N/A
	Conditional Use Determination	No	No	No	No	No
	Stormwater Discharge	No	Yes	Unlikely	Unlikely	Unlikely
	Lakes and Ponds	**No**	**Yes**	**Unlikely**	**Unlikely**	**Unlikely**
	Threatened and Endangered Species	No	Yes	Unlikely	Unlikely	Unlikely
	SHPO	**No**	**Possible**	**Possible**	**Possible**	**Possible**

*The total estimated cost does not include preliminary engineering, ROW, or E&C

Figure 7-12: Evaluation Matrix for Path Width Alternatives

7.5 Other Considerations

The following additional amenities were suggested at the public meetings:

- Additional parking
- Benches
- Identification plaques for native plant species and historical places/landmarks
- Storm shelter
- Restrooms
- Snack bar
- Lighthouse replica near the "Cut"
- Art work
- Stairs to access beach on South Hero shore
- Ladder from bridge down to Lake Champlain

The proposed improvements described in Sections 7.1 - 7.4 would form the foundation for additional improvements to the Causeway. The need for any other enhancements, such as benches, storm shelters or additional parking may be best evaluated after the construction of the proposed improvements.

8.0 Recommendations

The following recommendations are based on state/federal guidelines, engineering judgement, permitting requirements, and public input. The recommendations provided herein best meet the purpose and need of the project while minimizing impacts to the environment. The total cost for the recommended improvements is estimated at $1.8 million.

8.1 Emergency/Maintenance Turnarounds

Construction of emergency turnarounds is recommended near each end of the "Cut." A layout similar to that shown in Figure 7-1 should be used to ensure safe turning movements for emergency and maintenance vehicles, and minimize impacts to Lake Champlain. Materials similar to existing materials should be used to minimize aesthetic impacts to those using the Causeway and to those viewing the Causeway from Lake Champlain.

8.2 Fishing Platforms

Fishing platforms, similar to the one shown in Figure 7-3, constructed on top of the existing abutments at the "Cut" are recommended.

8.3 Path Improvements

Inconsistent width defines the existing path. Washouts along the rock slopes are scattered throughout and need attention. A consistent width and more uniform crushed gravel surface is recommended. Alternative #4 is recommended for final design, and is summarized as follows:

- *Travelway* – A crushed gravel surface with dimensions of 8' width by 4" depth, adhering to VTrans guidelines, is recommended. The surface shall be firm, stable, slip resistant, and adhere to ADA firmness guidelines.

- *Shoulders* – A grassed area with a minimum 3' width on each side of the travelway is recommended to provide minimum recovery area widths along the entire length of the causeway.

- *Recovery Areas* – 5' recovery areas are recommended to provide pull-offs for slower traffic, therefore reducing the potential for user collisions. Recovery areas should be constructed where existing width is available and where the path can be widened without impacting Lake Champlain below ordinary high water (see Table 7-1).

- *Barriers* – The causeway slopes consist of waste marble rip-rap material, are steeper than 2:1 in some locations, and have a vertical drop greater than 4' in the summer months. The causeway also provides stunning views of the Lake Champlain landscape, is visually pleasing in itself for those on Lake Champlain, and is recognized as a historic property type. For these reasons, 24" vegetative barriers are recommended to provide protection from falls onto these steep, unforgiving slopes, without adversely affecting the scenic and historic values of the landscape. Small

shrubs and groundcovers are recommended as barriers in areas where slopes are greater than 2:1 and/or shoulder width is less than 5'. These vegetative barriers shall be established intermittently with spacing of no more than 6'. Examples of shrubs and groundcovers that will survive the harsh conditions of the lake environment include Prostrate Juniper (Juniperus Communis Depressa) and Dwarf Grey Willow (Salix Trista). Barriers are not recommended where 5' recovery areas can be obtained.

- *Signage* – Limited signage located prior to both the South Hero and Colchester entrances is recommended to educate and warn users of the inherent hazards that may be encountered on this unique recreation path. To avoid detracting from the visual appeal of the landscape, signage placed along the Causeway, if any, should have a similar look to that used on hiking trails throughout Vermont. Signs developed for this project should conform to specifications outlined in the Manual for Uniform Traffic Control Devices (MUTCD).

8.4 Other Considerations

The need for any other enhancements, such as benches, storm shelters or additional fishing docks may be best evaluated after the construction of the proposed improvements, and are not recommended at this time.