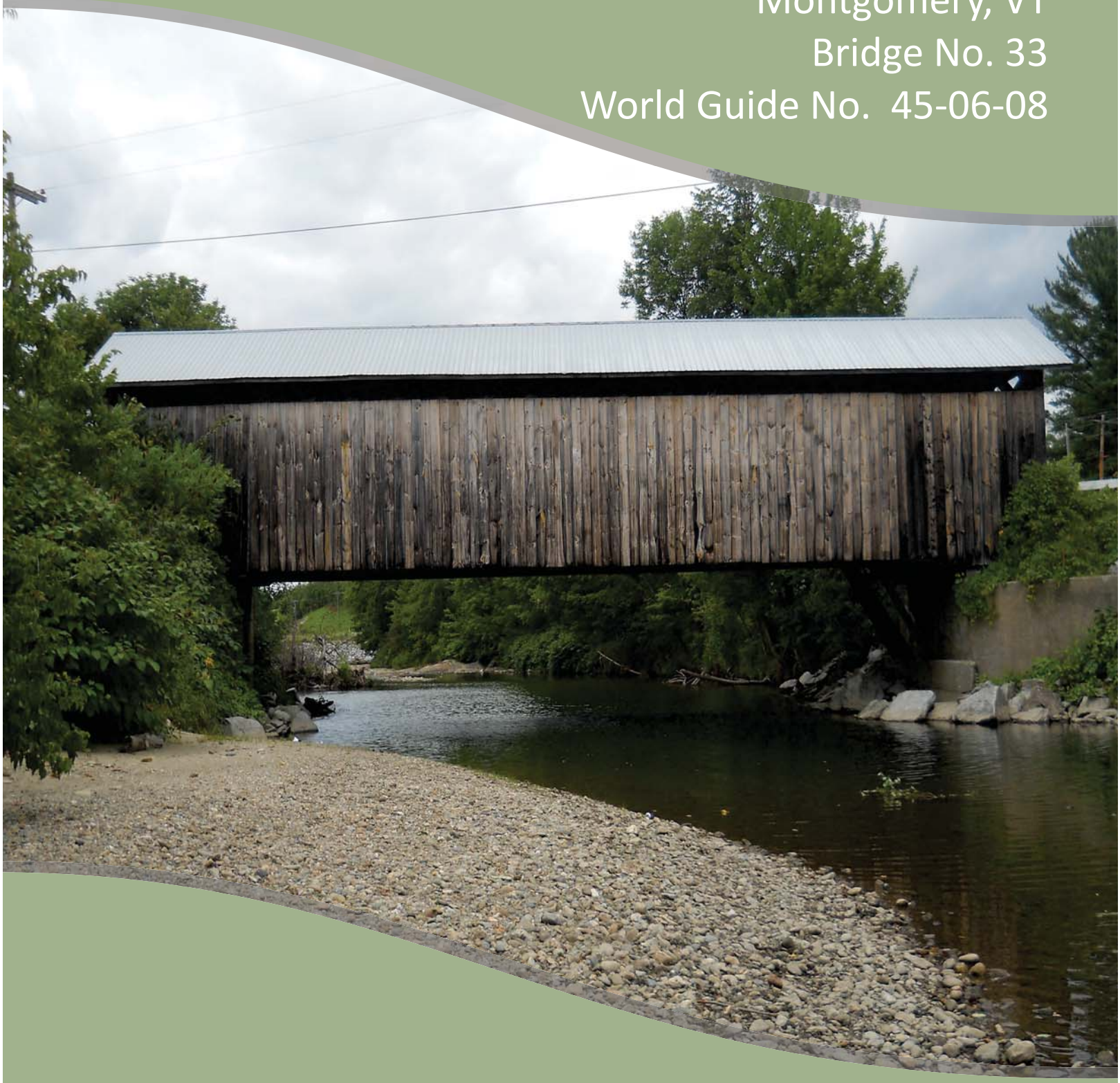
Scoping Study

Longley Covered Bridge
Montgomery, VT
Bridge No. 33
World Guide No. 45-06-08



Prepared for:
Town of Montgomery, VT
VTrans Project No. STP EH 12(16)
March 2013

Hoyle, Tanner & Associates, Inc.

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LOCATION MAP

Longley Covered Bridge over the Trout River - Montgomery, VT	Hoyle, Tanner & Associates, Inc.	**File Name:** Longley CB Eng Stdy.docx	
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I. PURPOSE AND NEED OF THE PROJECT

A. Purpose

The purpose of this project is to provide a safe crossing over the Trout River at the Longley Covered Bridge with increased live load capacity. The crossing provides access in a remote area of Franklin County to dairy farms and homes.

B. Need

The Longley Covered Bridge over the Trout River was built in 1863. The bridge utilizes Town Lattice Trusses and was closed in 2011 due to deteriorated condition of the trusses as well as several broken floor beams. The bridge was bypassed immediately downstream with a temporary prefabricated steel truss bridge. The closure of the Longley Covered Bridge creates the need for the project. The project needs include the following:

- The prefabricated steel truss bridge installed immediately downstream is a short-term solution and is not intended to provide a long-term crossing.
- The detour around the bridge is on a gravel road with several sections in poor condition. The route also includes a very steep section near the Town line with Enosburgh. These conditions make the road nearly impassable several times a year.
- The crossing reduces the travel distance for emergency vehicles from approximately 18 miles for fire trucks and 23 miles for rescue vehicles to approximately 5 miles.
- The bridge has been determined to have a live load capacity of 6 tons in a 'pristine' condition based on the floor beams and 8 tons based on the trusses.
- The Town's emergency vehicles range in weight from 6-10 tons for an ambulance to 12-17 tons for fire department vehicles.

II. PROJECT AREA AND EXISTING CONDITIONS

For those readers not familiar with engineering and/or covered bridge terminology, a glossary of terms has been included in Appendix E.

Upstream Bridge Elevation
Looking North

A. Background

The Longley Covered Bridge was built in 1863 by the Jewett Brothers and is located at the intersection of Longley Bridge Road (Town Highway No.4 – Class 3 Road) and VT Route 118. The bridge is an 84'-0" long single span Town Lattice Truss, which spans the Trout River near the northwestern boundary of the Town of Montgomery with the Town of Enosburgh. The bridge is the oldest of six covered bridges remaining in

the Town of Montgomery. Due to its historic and national significance the Longley Covered Bridge is currently listed on the National Register of Historic Places, a federal program that is administered by the National Park Service.

The bridge has undergone numerous changes and additions throughout its history with various degrees of documentation. Two lines of longitudinal distribution beams, suspended directly below the wheel lines, were installed circa 1960. In 1979 the two stone masonry abutments were faced with concrete and three steel braces were added at the base of the west abutment in an attempt to support the floor system and shorten the bridge span. Extensive repairs were completed in 1993 and the work consisted of the following major items:

- Replacement of several roof and upper bracing members.
- New roof.
- Replacement of several truss lattice and portions of top and bottom chords.
- New deck and running planks.
- Replacement of several floor beams.
- Installation of new sleeper beams and bearing blocks.
- New bridge approach railing.
- Paving of roadway approaches to the bridge.

Longitudinal Distribution Beams
Looking Towards East Abutment

Added Steel Braces
East Abutment

Record plans of the existing bridge and recent repairs are not available or known to exist.

Several serious structural deficiencies were observed during a routine bridge inspection by Vermont Agency of Transportation (VTrans) personnel in 2010. As a result of the bridge inspection findings, the bridge was posted shortly thereafter for no trucks and a gross weight of 3 tons. The bridge remained opened to all traffic until early fall of 2011 when its deteriorated condition prompted the Town to close the bridge to all traffic. Vehicular traffic was bypassed at a temporary prefabricated steel truss type bridge (Acrow Bridge), which was erected downstream of the existing covered bridge.

B. Field Observations

Hoyle, Tanner personnel visited the site on two occasions. The first site visit was on May 7, 2012. This was a limited site visit to observe existing conditions and prepare a scope of work and proposal for this Scoping Study. On August 6-7, 2012 a two person inspection team from Hoyle, Tanner visited the covered bridge to perform in-depth field measurements and gather field data for this Scoping Study. The floor beams, longitudinal distribution beams, underside surface of the bottom layer of deck, lower panel truss joints and truss members below the bridge deck were inspected visually from each bank under the bridge. The roof framing members, truss members above the bridge deck, upper panel truss joints, upper lateral and sway bracing members were inspected using extension and folding ladders. Field observations were used as a basis for this report and expanded as appropriate.

Bridge Orientation Conventions

The upper most truss top chord is referred as chord 1 while the lower most top chord is referred to as chord 2. The upper most truss bottom chord is referred to as chord 3 while the lower most bottom chord is referred to as chord 4. Each truss chord consists of four plies, which are denoted as plies “A”, “B”, “C” and “D”. Ply “A” is the most exterior ply while ply “D” is the most interior ply at any given chord member. Plies “B” and “C” are between plies “A” and “D” from the exterior to interior of the covered bridge. The node points are numbered from west to east with the western most node point designated as 1 at the intersection of end post members to chord 1. Each consecutive node number is numbered in ascending order at each intersection of lattice members to chord 1.

1. *Roof Framing*

Typical Break along Slope of Grain at Roof Rafter

The roof framing consists of a standing seam metal roof on ¾” thick variable width roof boards which bear on variable sized and spaced roof rafters. The rafter sizes vary from 2⅞” to 4” wide and from 3⅞” to 6½” deep. The spacing varies with a range of 1’-7½” to 2’-7” and an average spacing of approximately 2’-0” on center. The roof rafters are notched into the 8”x8” ridge beam and toe nailed at truss top chord members. Several original roof rafters have been replaced with new 4”x6” members or sistered with 1”x4” or 1¾”x4” rafters. The ridge beam is supported by 8”x8” vertical posts at each cross beam location.

The roof framing wood species are assumed to be Eastern Hemlock and they have been assigned a grade of No.1 for the structural analysis based on a visual examination of knots, checks, slope of grain of the wood and the growth rate characteristics of the wood.

The roof framing is generally in fair to good condition with many roof rafters having been previously replaced or supplemented at the bearings. Several roof rafters have minor knots, checks and splits that were observed during our site inspections.

Roof Framing - Looking East

2. *Upper Bracing*

The upper bracing consists of 8”x8” cross beams spaced at 12’ on center in the end bays and 8’ on center in the interior bays, 4”x5” diagonal “X” bracing between cross beams, 4”x4” ridge post braces, 8”x8” ridge beam support posts and 4”x4” knee braces.

The upper bracing wood species are assumed to be Eastern Hemlock and they have been assigned a grade of No.1 based on a visual examination of knots, checks, slope of grain of the wood and the growth rate characteristics of the wood.

Break at Ridge Post Brace between Nodes 9 and 10

Rot at Cross Beam between Nodes 17 and 18 and Ridge Beam Support Post

The upper bracing is generally in fair to good condition with only a few broken or rotted members. The upper bracing alignment is poor in many locations where lateral or vertical movement of the trusses have loosened or broken connections of the components to the trusses. Up to 8” of rack was observed, which most likely has occurred from overloading of the trusses. A gap of up to 1½” was observed between the bottom of the cross beams and mostly plies A and B of chord 1 at 11 locations.

3. *Trusses*

South Truss – Looking West

The Town Lattice Truss was patented in 1820 by Ithiel Town and included lattice members and two (four-piece) chords (a single upper and single lower chord). The original design was sufficient for light loads and smaller spans but was subject to out of plane bending. A second patent was granted in 1835 that included four (four-piece) chords and two layers (planes) of lattice. The 1835 patent truss type was used primarily for railroad bridges, and the use of four chords adopted for vehicular bridges. The Longley Covered Bridge has two each (four-piece) top and bottom chords.

The trusses are 84'-0" long and support a roof length of 88'-0". The clear span from face of east abutment to face of west abutment is approximately 68' long. Truss chord members consist of 4-3"x11" plies built-up double top and bottom chords. Truss lattice members consist of 3"x11" timber planks.

The truss members' wood species are assumed to be Eastern Hemlock. The grade assigned to each member was based on a visual examination of knots, checks, slope of grain of the wood and the growth rate characteristics of the wood.

Typical Split in Lattice Member

The trusses are in poor condition with some rot, broken truss members and trunnels, racking and sweep (bow) throughout the bridge length. The trusses were observed to be bowed upstream by approximately 8". This deficiency is believed to have been caused by excessive live loading, beyond that envisioned at the time of the original bridge construction.

Gaps of up to 1" wide were observed during our inspection between the butt joints of chord 3. Chord 4 butt joints could not be measured during our inspection due to limited access below the deck; however, they are believed to be greater than 1" wide. At the time of the original construction the butt joints would most likely not had any gaps and our findings indicate overstressing of trunnel connections and possible hidden breaks that could not be seen without disassembling truss members. Numerous trunnel holes in truss chord members were observed to be oversized. New larger diameter trunnels would need to be used at

oversized holes for all the rehabilitation alternatives. Several trunnels were found to be broken, most likely from excessive live loading.

Typical Oversized Trunnel Hole in Top Chord

Sweep (Bow) in North Truss Looking West

The ends of the lattice members (or tails) extend 2½" to 3½" beyond the top and bottom chords of the truss. Many of the tails have splits at the ends. The splits do not affect the capacity of the lattice members unless they extend along the member and through the trunnel connection at the chord.

4. *Floor Beams, Distribution Beams and Decking*

The floor framing consists of transverse 6"x12" floor beams at 2'-0" on center, two lines of 6"x10" longitudinal distribution beams suspended directly below the wheel lines and a 3" thick longitudinal deck. Directly over the timber deck there are two lines of 40½" wide and 2⅜" thick longitudinal running timber planks at the wheel lines. There is no lower lateral bracing on this covered bridge.

The floor framing wood species are assumed to be Eastern Hemlock and they have been assigned a grade of No.1 based on a visual examination of knots, checks, slope of grain of the wood and the growth rate characteristics of the wood.

The floor beams are in critical condition with many broken floor beams noted. The floor beams vary in length with every other floor beam butting against the lattice members and the remaining floor beams passing through the lattice and bearing on all four chords. There is 6" of bearing width for the shorter floor beams onto the bottom chord. Distribution beams have been added and hung below the floor beams in order to improve the distribution of live load to the floor beams. Many of the steel hanger hardware were observed to be in poor condition with heavy rusting and some section loss.

Longitudinal Deck – Looking West

Typical Broken Floor Beam

The longitudinal layer of the deck and the running timber planks are in fair to good condition with some minor deficiencies. The running timber planks are worn and several planks along the wheel lines exhibit some splitting. There is considerable sand and debris buildup on the decking.

C. Substructure

The bridge substructure consists of two dry-laid stone abutments encased in concrete. Both bridge abutments have various amounts of stone fill in front of them. It is not known if the abutments bear on ledge, however, it is noted that the existing channel bed consists of sandy soils. The substructure is generally in fair to good condition.

East Abutment – Looking East

The east abutment is in fair condition with some areas of moderate spalling and efflorescence staining, concrete deterioration on the downstream top corner, exposed aggregate at the flow line and minor to heavy concrete cracking. The top 2' of the northeast wingwall is in poor condition with deteriorated concrete. The southeast wingwall is in good condition.

West Abutment – Looking West

The west abutment is in fair to good condition with some areas of minor spalling and exposed aggregate and abrasion at the flow line. The northwest wingwall is in good condition and exhibits exposed

aggregate throughout the front face of the concrete. The southwest wingwall is in good condition and has an 8”x8” spalled area in the end of the wingwall.

D. Wood Species Identification

Several small wood samples were removed from the bridge for the purpose of species identification. The samples were taken from deteriorated members that will most likely be replaced during the course of potential bridge rehabilitation or from non-critical sections of the members. If required, during the design phase of this project the samples would be forwarded for identification to Doug Gardner, Ph.D., a professor of Wood Science and Technology, at the University of Maine at Orono.

Several wood samples of Hutchins Covered Bridge were previously identified to be Eastern Hemlock. Considering that Hutchins Covered Bridge was built by the Jewett Brothers and in the relatively the same timeframe as the Longley Covered Bridge, it is assumed that all wood is Eastern Hemlock for the purposes of this Scoping Study. This assumption is consistent with historical records that indicate native and local wood was used during the original construction of the bridge.

E. Hydraulics

Trout River – Looking Upstream
From the Bridge

The bridge crosses over the Trout River which flows primarily south to north at the bridge site. A Federal Emergency Management Agency (FEMA) Flood Insurance Study dated July 5, 2001 is available for the Trout River in the Franklin County. This FEMA Study provides water surface elevations at the project site for various flooding events. The FEMA Study indicates that under the current conditions, the base flood (100 year flood event) water level of the Trout River at the bridge location is at elevation 449.9 feet compared to the bridge low chord elevation of 451.0 feet. The base flood event is defined as a flood having a one percent (1%) chance of being met or exceeded in any given year (base flood designation Q_{100}). The west approach to the bridge is completely inundated during the base flood event. The provided freeboard for the current conditions for the base flood water level is 1.1 feet. The existing bridge opening has sufficient hydraulic capacity to pass the base flood flow with adequate freeboard. A summary of existing conditions hydraulic data for the 100 year flood event is tabulated below.

Existing Conditions Hydraulic Data:
(Base Flood - 100-Year Flood Event)

Drainage Area:	71.6 mi^2
Flood Elevation:	449.9 feet
Flood Flows:	Q = 18,000 cfs
Flood Velocity:	V = 6.1 feet per second (fps)
Floodway Section Area:	A = 3,213 square feet (sf)

The primary purpose of the hydraulics section is to determine if the rehabilitated covered bridge is at an elevation high enough to provide adequate free board during the 100 year flood event. It is recommended to not change the bridge low chord elevation for all the bridge alternatives considered in order to not change the flow characteristic at the project site and to maintain the 1.1 feet of freeboard.

The potential for scour at this site is not included in our scope of work and is anticipated to be completed by VTrans during the design phase of the project. During our site inspections the channel was observed to be stable.

III. RIGHT OF WAY

Mr. Scott Perry, Montgomery Selectboard Chair, has indicated that the right-of-way within the project limits is three-rod (49 feet, 6 inches).

IV. UTILITY IMPACTS

The bridge and surrounding area were reviewed for the presence of above and below ground utilities. The only known utilities within the project limits are overhead utility lines which cross the Trout River upstream of the bridge. The closest utility pole to the bridge is located upstream the southwest corner of the bridge. These utilities are not expected to be impacted by any of the alternatives being studied.

V. NATURAL AND CULTURAL RESOURCES

A. Natural Resources

Natural resources often exist along bridge projects. Many of these resources such as wetlands, floodplains, and endangered species are protected by law. Impacts to natural resources are avoided when possible and minimized when the impacts are unavoidable. The following sections describe all natural resources within the vicinity of the proposed project and any impacts to them if any.

1. Wetlands

Based on a review of Agency of Natural Resources (ANR) Environmental Interest Locator online mapping there are no mapped wetlands sites within the project area.

2. Lakes/Ponds/Streams/Rivers

The project is located within and adjacent to Trout River. The Trout River, part of the Missisquoi River watershed, is 14 miles long and has a total drainage area of 86 square miles. The Trout River runs through a wide "U-shaped" valley between the two population centers of Montgomery Center and the Village of Montgomery. Agriculture is the main land use along this reach, with soil types ranging from silt loam to gravelly loamy sand. The Trout River is formed by the joining of two major tributaries in Montgomery Center, the South Branch and the Jay Brook. Land use along the South Branch is agriculture, while Jay Brook runs through a steep "V" shaped forested valley.

The proposed project is not expected to impact the Trout River.

3. Floodplains

Floodplains are mapped on Federal Emergency Management Agency (FEMA) Community Panel Number 500056 0001 C, dated July 5, 2001. Part of the bridge falls within the mapped 100 year floodplain. Minor impacts to the floodplain are expected due to installation of additional stone fill in front of both abutments, however, they are not expected to affect FEMA flood elevations.

4. Endangered Species

The Vermont Nongame and Natural Heritage Program (NNHP) does not report species that are known to occur in the vicinity of the project that are state threatened. There are no known federally listed species in the vicinity of the project. In-stream work is proposed to only be in front of both abutments and not in the bed of the river. No impacts to the known state threatened species are expected. However, further consultation with VT Fish and Wildlife Department would be required during the design phase of the proposed project.

5. Flora/Fauna

There are no mapped areas of native plants within the project area.

6. Stormwater

There are no mapped stormwater impaired watersheds or permits within the project area.

7. Hazardous Wastes

There are no mapped hazardous waste generators or hazardous waste sites within the project area.

8. Forest Land

There are no mapped forest lands within the project area.

B. Cultural Resources

Cultural resources such as archeology sites, public lands and historic structures are also protected by regulations. Close coordination with a number of state agencies who review projects for compliance with existing laws and regulations is required.

1. Historic

The Longley Covered Bridge was listed on the National Register of Historic Places on December 30, 1974 (National Register of Historic Places Inventory-Nomination Form 1974). The project was initially presented at the Historic Covered Bridge Committee (HCBC) meeting on October 25, 2012. The project was also discussed at a meeting on November 27, 2012. The committee reviewed the proposed project based on the Historic Covered Bridge Preservation Plan and Section 106 review process set forth by the National Historic Preservation Act of 1966, as amended, and the Advisory Council on Historic Preservation's Procedures for the Protection of Historic Properties (36 CFR 800) and did not have any objections to any of the alternatives presented in this Scoping Study.

2. Archaeological

Hartgen Archeological Associates, Inc. (HAA, Inc.) was retained to conduct an Archeological Resource Assessment (ARA) for the proposed rehabilitation of the Longley Covered Bridge. HAA, Inc. report indicates that the project area is considered to have low precontact archeological sensitivity based on alteration through cultural and natural processes. However, the terrace landforms north of the temporary bridge and south of Longley Covered Bridge appear to be undisturbed, and as such, have precontact archaeological potential. Disturbance to undisturbed portions of the terrace, including staging areas are not expected to occur as part of this project. No further archeological investigation is recommended for the proposed Longley Covered Bridge rehabilitation project. The full report is included in Appendix C.

3. Architectural

There are no mapped architectural resources within the project area.

4. Public Lands

Section 4(f) of the U.S. Department of Transportation Act and Section 6(f) of the Land Water Conservation Fund Act state that lands cannot be taken from a publicly owned park, recreation area, wildlife or waterfowl refuge, or historic site unless there is no feasible or prudent alternative to the use of land and the action includes all possible planning to minimize harm to the property resulting from such use.

No mapped 4(f) or 6(f) resources have been identified within the project area.

5. Agricultural Lands

The United States Department of Agriculture's Natural Resource Conservation Service identifies "prime farmland", "farmland of statewide importance", and "locally important farmland" on the published soil surveys. The following soil type is found within the project limits:

- Ondawa variant silt loam (prime (f)) (west and east approach)

This soil type is considered to be prime farmland that is not frequently flooded during the growing season. No impacts to the agricultural lands are expected as part of this project.

VI. STRUCTURAL ANALYSIS

A structural analysis and load rating was performed for all floor framing members. Superstructure roof framing members were also checked for the applied wind, snow and dead loads. The Service Load (Allowable Stress) Rating method was used for all members in accordance with the provisions of the American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Highway Bridges, 17th Edition, AASHTO Manual for Bridge Evaluation Second Edition with 2011 Interim Revisions and VAOT Structures Manual. The AASHTO H20 (20 tons) live load served as the basis for the load rating calculations. All structural members were rated for single lane loading configurations. Excel spreadsheets, MathCAD computer program and hand calculations were utilized to calculate the as-inspected section properties, roof boards, roof rafters, deck and floor beam capacities and load rating values.

For the floor system (floor beams and decking) the inventory rating[1] was determined by combining the maximum effects of live load with the dead load effects and compared to allowable inventory stress levels, while the operating rating[2] was determined by combining the maximum effects of live load with the dead load and compared to higher operating stress levels.

The Town Lattice Trusses were not load rated as part of this Scoping Study. Due to Hoyle, Tanner's experience with similar type of structures, such as Hutchins Covered Bridge, it is expected that Longley Covered Bridge can be rehabilitated for and AASHTO H6 (6 tons) live load if the deteriorated truss members are replaced. The live load capacity of the bridge is expected to be increased to a maximum AASHTO H8 (8 tons) live load with sistering of several lattice members near the abutment supports. Any increase in live load capacity beyond H8 is not considered to be feasible for Longley Covered Bridge alone.

The wood species used in the superstructure were assumed to be Eastern Hemlock as discussed above in Section II.D. The grade assigned to each member was based on a visual examination of knots, checks, slope of grain of the wood and the growth rate characteristics

[1] The inventory rating is defined as a vehicle live load that can safely pass over the bridge an infinite number of times without any detrimental effects to the bridge.
[2] Operating rating is defined as the maximum permissible vehicle live load to which the structure may be subjected. Allowing unlimited numbers of vehicles to use the bridge at the Operating level may shorten the life of the bridge.

of the wood. Allowable stress values for wood members were obtained from the 2005 National Design Specification for Wood Construction and Supplement. All superstructure members are wood unless noted otherwise. The substructure was not analyzed as part of the load rating, since it was not expected to control the load rating of the bridge.

Our initial recommendations for repair or replacement of each member are detailed in the following sections and were reviewed by the Historic Covered Bridge Committee (HCBC) and the structural and historical issues weighed. We have also identified in the recommendations the priority treatment number from the Historic Covered Bridge Preservation Plan to aid in review.

It should be noted that not all members to be replaced can be identified based on our inspection due to inaccessible areas (i.e. top face of rafters, etc.). The estimate of cost in this study includes an additional amount of conditional replacement where appropriate to determine an appropriate budget for the project.

A. Roof Framing

Analysis

The roof rafters and roof boards were analyzed for dead load, wind load (4.0 pounds per square foot (PSF) downward and 6.2 PSF uplift) and a ground snow load of 50 PSF (33.3 PSF roof applied) per the 2006 Vermont Fire and Building Safety Code snow load and the 2010 ASCE 7 Minimum Design Loads for Buildings and Other Structures. A grade of No.1 was assigned to all roof boards and rafters based on a visual examination of the wood. Our structural analyses showed that roof boards and rafters are adequate for the applied dead, wind and snow loads (21% utilized for the roof boards and 89% utilized for the roof rafters).

Recommendations

The existing standing-seam metal roof is in fair to good condition. During rehabilitation, the existing metal roof would be damaged even further by the removal of certain truss and roof members and we recommend that it be replaced with a new standing-seam metal roof. A replacement of nine roof rafters and 20% of the existing roof boards is included for this study based upon our field inspections. (Priority Treatment No.2 for the roof boards and the roof rafters). A total of three roof rafters are also recommended to be sistered with new 3”x4” roof rafters (Priority Treatment No.3). Approximately 21% of the existing ridge beam is recommended to be replaced based upon our field inspections (Priority Treatment No.2).

B. Upper Bracing

Analysis

The existing upper lateral bracing, which consists of “X” braces, cross beams, ridge post braces, ridge beam support posts and knee braces, was analyzed for wind loading in conformance with ASCE 7-10. A grade of No.1 was assigned to all “X” braces based on a visual examination of the wood. Our analysis showed that it is adequate to resist code required wind loads. A portion of the lateral wind load based on the tributary area is applied

to the existing upper later "X" bracing. It was found that the existing upper lateral bracing provides ample strength and it meets the code lateral wind loading.

Recommendations

We recommend installation of a new upper lateral bracing where missing on the last bay of the Town Lattice Truss (Priority Treatment No.3). In addition, there are five locations where "X" braces have been identified to be replaced in-kind (Priority Treatment No.2).

There are five locations where knee braces have been identified to be replaced in-kind (Priority Treatment No.2). There are six locations where cross beams have been identified to be replaced in-kind (Priority Treatment No.2). There are six locations where ridge post braces have been identified to be replaced in-kind (Priority Treatment No.2). There are two locations where ridge beam support posts have been identified to be replaced in-kind (Priority Treatment No.2).

C. Trusses

Analysis

The Town Lattice Trusses were not load rated as part of this Scoping Study. As described above it is expected that Longley Covered Bridge can be rehabilitated for an AASHTO H6 (6 tons) live load if the deteriorated truss members are replaced. See the third paragraph on Section VI Structural Analysis for further discussion on the truss members load rating.

Recommendations

The removal and replacement of the truss members due to condition is recommended for Alternatives Nos. 1, 2 and 3 (see Section VIII) (Priority Treatment Nos. 2 and 3). Sistering of several lattice members is recommended for Alternatives Nos. 2 and 3 (Priority Treatment No.3). Epoxy injection into the large splits of a few members and rotted areas is also recommended for Alternatives Nos. 1, 2 and 3 to lessen further splitting and deteriorating to these members (Priority Treatment No.1).

To prevent the spread of the splits in the tails we recommend that wood epoxy be applied to the splits and through bolts be added to prevent further splitting for Alternatives Nos. 1, 2 and 3 (Priority Treatment No.1). This repair was recently completed for the Hutchins Covered Bridge in Montgomery, VT.

D. Floor Beams, Distribution Beams and Decking

Analysis

The existing floor beams and decking were analyzed to determine their live load capacity (see Table 1). The load rating of all floor framing shown in Table 1 was controlled by the rear axle of the H6 (6 tons) truck. A grade of No.1 was assigned to all these members based on visual examination of the wood.

Table 1 – Existing Floor Framing Load Rating Summary

Member	Size and Spacing	Inventory Load Rating	Operating Load Rating
Deck	3” thickness, 12” clear span	H12.5	H16.6
Floor Beams	6” x 12”, 2’-0” on center	H6.6	H9.0

The existing deck was analyzed for this study for wind loading in conformance with ASCE 7-10. It was found that the existing deck acts as a diaphragm and has ample strength to meet the code lateral wind loading.

Recommendations

There are approximately 20 floor beams identified to be replaced due to condition with new Douglas Fir species, since local species of these sizes and required grade are most likely not readily available (Priority Treatment No.2). The remaining floor beams would also need to be replaced for Alternatives Nos. 2 and 3.

It is recommended to remove the existing longitudinal distribution beams since they offer no significant distribution of load due to the poor condition of the steel hanger hardware.

In addition, we recommend that a new wood curb be added to the bridge to help keep vehicles from impacting the trusses and arches. This curb has previously been used by VTrans on the Hutchins and Comstock Covered Bridges in Montgomery and many other covered bridges throughout the state.

E. Substructure

The existing abutments have not been analyzed for overturning and sliding per the VTrans structures manual since they appear stable.

Overall, the existing abutments appear sound and globally stable with no apparent sign of movement, settlement, or tipping. Some isolated cracks were found on various surfaces of the existing substructure elements. The scope of work does not include the stability analysis of the existing substructure.

Recommendations

The following recommendations are made for the bridge substructure:

- Install additional stone fill at both abutments in order to minimize local scour due to the scour susceptibility of the existing channel bed (Substructure Priority Treatment No.1).
- Conduct minor partial depth concrete repairs to all of the existing substructure elements (Substructure Priority Treatment No.1).
- Route and seal the concrete cracks greater than ⅛” in width (Substructure Priority Treatment No.1).

- Stain and seal all of exposed concrete surfaces with a water based sealant in order to provide long-term protection of the concrete (Substructure Priority Treatment No.1).
- Remove all vegetation and small trees at both abutments (Substructure Priority Treatment No.1).
- Construct new backwalls and wingwalls for Alternative Nos. 3 and 4.

VII. FIRE PROTECTION

As part of this Scoping Study, the bridge was assessed for improvements against the potential for arson. There are no known fire detection or protection systems at the covered bridge site and there is no evidence of past arson attempts. Three fire detection/protection systems are generally used for covered bridges, each of which was evaluated for this project.

A. Intumescent or fire retardant coatings (NOCHAR/POLASEAL)

These coatings are water-based, water repellent treatments that are specifically designed to protect exterior and interior wood surfaces. They penetrate the wood and then cure by reaction with air to lock into the pore structure of the wood. These coatings work by raising the flashpoint of the wood making it difficult to start a fire. The fire-retardant coatings contain a proven fire retardant *to reduce* flame spread in the event of a fire and a blend of special preservatives to fight against the causes of decay. The coatings are available in colored and clear versions that are applied to the wood by brush or spray. The coatings do not affect the strength of the wood. We also recommend the application of a fungicide to the bridge members to defend against fungal growth. Infestation by fungi causes the wood to rot, lowering the capacity of affected members.

The application of fire retardant coatings is recommended for all alternatives considered.

B. Fire Detection System (PROTECTOWIRE)

If a fire is started, it is advantageous to notify the local fire department as soon as possible. The "Protectowire" is a proprietary alert system that works by running a small wire through key locations in the bridge. The sensor cable is comprised of steel conductors individually insulated with a heat sensitive polymer. The insulated conductors are twisted together to impose a spring pressure between them and wrapped with a protective tape. If a rapid rise in temperature is detected or if a wire is cut, the system alerts the local mutual aid or fire department. This advanced warning can greatly reduce fire damage to a bridge and hopefully prevent the fire from making the bridge a total loss.

Protectowire Cabinet
(Slate Covered Bridge)

It should be noted that there is an annual maintenance cost associated with this system. The system requires power and a phone line (land or cell) to contact mutual aid. In addition, the control box contains batteries that have small electric strip heaters on them to prevent damage from freezing during cold weather. The control box is typically hidden at the end of the bridge in siding and can be well insulated to reduce electrical costs.

After consultation with representatives from the Town of Montgomery, a fire detection system is not recommended for the alternatives being considered.

C. Dry Deluge Sprinkler System

The purpose of a deluge sprinkler system is to prevent the spread of fire by wetting down the entire fire area. The sprinkler system typically used includes dry pipes with a fire department connection away from the ends of the bridge. During a fire, the fire department feeds the system which directs water to the source of the fire. The majority of the piping and heads are in the roof, however, coverage is also provided under the bridge at the abutments. These systems are typically used in longer or multi-span bridges where the fire department cannot effectively fight the fire near the center of the bridge.

Typical Sprinkler Head
(Slate Covered Bridge)

After consultation with representatives from the Town of Montgomery, a fire dry deluge sprinkler system is not recommended for the alternatives being considered.

VIII. ALTERNATIVES

The alternative that would avoid the use of the historic resource was considered during this phase of project development. This alternative includes the no-build alternative.

A. Null Alternative - “No-Build”

The “No-Build” alternative does not address the structural deficient condition of the covered bridge. Selection of this alternative would not prevent further deterioration, which could cause eventual collapse of the covered bridge into the Trout River.

As such, this alternative does not meet the stated project purpose and need. In addition, the impacts associated with the proposed action were not of a magnitude to warrant the selection of this alternative.

B. Alternative No.1 - Rehabilitate the Existing Bridge for H6 Loading

Due to the apparent safety and structural deficiencies of the Longley Covered Bridge over the Trout River, the main intent of this alternative is to rehabilitate this timber structure for an AASHTO H6 (6 tons) vehicular live load. The Longley Covered Bridge is listed on the National Register of Historic Places for its statewide historical significance and it will require extensive repairs and replacements of the deteriorated bridge members. This alternative preserves the bridge for future generations with the intended use of it for both pedestrian and vehicular traffic, however, it does not meet the project purpose and need. Key elements of this alternative include:

a. Remove the existing metal roof in its entirety and replace it with a new standing seam metal roof.
b. Remove and replace select, deteriorated or damaged bridge members such as roof boards, roof rafters, cross beams, upper lateral bracing, ridge beam, ridge post braces, knee braces, truss chord members, truss lattice members, floor beams and siding.
c. Repairing of several bridge members with wood epoxy.
d. Replacement of all existing trunnels.
e. Removal of exterior layer of siding, salvaging of interior layer of siding and installing it in the exterior layer and installation of new siding in the interior layer.
f. Removal and replacement of portal and end return siding.
g. Removal and replacement of timber decking and running timber planks in their entirety.
h. Installation of new wood curbing within the bridge.
i. Removal and replacement of the majority of the existing bedding timbers.
j. Removal of distribution beams.
k. Vertical and horizontal realignment of truss members.
l. Concrete repairs at existing substructure.
m. Route and seal the concrete cracks greater than ⅛” in width.
n. Stain and seal all of exposed concrete surfaces.
o. Application of a fire retardant, insecticide and fungicide coatings to all wood surfaces.
p. Reconstruction and repaving of each roadway approach for a total project length of approximately 180 feet.
q. Installation of new approach steel backed timber guardrail.

The species of wood selected for replacement members will be based on several factors including: current species used, exposure to the environment and structural capacity. Local species, most likely eastern spruce or hemlock, will be specified for lower stress members including the roof rafters, roof boards and upper lateral bracing, while eastern white pine will be specified for the siding. Douglas fir will be specified for the truss and floor framing replacement due to the high structural capacity of the wood required which cannot be met by local species. The preferred wood species for the bridge deck is white oak; however douglas fir is often used when cost is a consideration. Pressure treated wood will be used in the covered bridge for the new deck, curbs, floor beams and sleeper beams at the truss bearings.

The bridge members will be replaced with members of the same dimensions. The replacement members will be rough sawn so that their appearance matches the original members, however some members will be surfaced on one side. The surfacing is required for lattice and chord members to meet thickness requirements so that they fit within the existing truss.

The Town Lattice Trusses have been repaired in the past by sistering broken or deteriorated members. In general, the sister members added are not fully effective due to poor detailing in the connections. In some locations insufficient trunnels are added to transfer load into the sister. The existing sister members will be retained and trunnels added as required so that they function properly. In locations where a lattice member requires replacement and has not been previously sistered, the existing member will be replaced with a new member.

C. Alternative No.2 - Rehabilitate the Existing Bridge for H8 Loading

The main intent of this alternative is to rehabilitate this timber structure for an AASHTO H8 (8 tons) vehicular live load. Similar to Alternative No.1, this alternative preserves the bridge for future generations with the intended use of it for both pedestrian and vehicular traffic, however, it does not appreciably increase the load carrying capacity, and thus it does not meet the project purpose and need. In addition to the items listed above for Alternative No.1 this alternative includes the following additional items:

r. Remove and replace of all floor beams.
s. Installation of new sister lattice near the abutment supports

D. Alternative No.3 - Rehabilitate the Existing Bridge for H16 Loading

The main intent of this alternative is to rehabilitate this timber structure for an AASHTO H16 (16 tons) vehicular live load. Similar to Alternatives Nos. 1 and 2, this alternative preserves the bridge for future generations with the intended use of it for both pedestrian and vehicular traffic and it furthermore meets the project purpose and need. In addition to the items listed above for Alternatives Nos. 1 and 2 this alternative includes the following additional items:

t. Installation of four new 10¾”x39” glulam longitudinal stringers.
u. Raising of existing roadway approaches by approximately 2’.
v. Construction of new backwalls and wingwalls at each abutment.

The vehicular loading is to be equally shared between the trusses and new glulam stringers. The snow load and covered bridge dead load is to be carried by the trusses.

E. Alternative No.4 - Preservation of Design, New Bridge for H20 Loading

The main intent of this alternative is to preserve the original design of the Town Lattice Truss. This alternative consists of a new this timber structure for an AASHTO H20 (20 tons) vehicular live load, retains the roof framing and upper lateral bracing, preserves the original

design of the Longley Covered Bridge and meets the project purpose and need. Key elements of this alternative include:

a. Removal of the existing bridge structure with the exception of the roof framing and upper bracing members.
b. Remove the existing metal roof in its entirety and replace it with a new standing seam metal roof.
c. Remove and replace select, deteriorated or damaged bridge roof and upper bracing members such as roof boards, roof rafters, cross beams, upper lateral bracing, ridge beam, ridge post braces and knee braces.
d. Concrete repairs at existing substructure.
e. Construction of new backwalls and wingwalls at each abutment.
f. Route and seal the concrete cracks greater than ⅛" in width.
g. Stain and seal all of exposed concrete surfaces.
h. Application of a fire retardant, insecticide and fungicide coatings to all new wood surfaces.
i. Reconstruction and repaving of each roadway approach for a total project length of approximately 180 feet.
j. Installation of new approach steel backed timber guardrail.
k. Raising of existing roadway approaches by approximately 2'.

Existing members to be replaced will be replaced with wood as described above for Alternative No.1. Douglas fir will be specified for the new truss and floor framing members due to the high structural capacity of the wood required which cannot be met by local species. Pressure treated wood will be used as described above for Alternative No.1.

The new truss members will have for the most part the same dimensions of the existing Town Lattice Trusses. The new members will be rough sawn so that their appearance matches the original members, however some members will be surfaced on one side. The surfacing is required for lattice and chord members to meet thickness requirements so that they fit within the existing truss.

IX. PRELIMINARY PROJECT COST ESTIMATE

An estimate of cost was prepared for this project in "Estimator" software format and utilizing recent Hoyle, Tanner and VTrans covered bridge bid data. The estimate of cost for each alternative is shown below. Refer to Appendix A for a complete breakdown of cost for each alternative.

A. <u>Alternative No.1 - Rehabilitate the Existing Bridge for H6 Loading</u>

The total estimated construction cost of all recommended work items for this alternative in 2013 dollars is approximately $827,000 including 5% for contingences.

B. <u>Alternative No.2 - Rehabilitate the Existing Bridge for H8 Loading</u>

The total estimated construction cost of all recommended work items for this alternative in

2013 dollars is approximately $914,000 including 5% for contingences.

C. Alternative No.3 - Rehabilitate the Existing Bridge for H16 Loading

The total estimated construction cost of all recommended work items for this alternative in 2013 dollars is approximately $1,110,000 including 5% for contingences.

D. Alternative No.4 - Preservation of Design, New Bridge for H20 Loading

The total estimated construction cost of all recommended work items for this alternative in 2013 dollars is approximately $1,400,000 including 5% for contingences.

X. MAINTENANCE

Maintenance is critical to the long-term use of a timber covered bridge structure. This maintenance should include periodic inspection of the bridge roof and siding with repairs as needed as well as periodic removal of dirt and debris from inside the bridge. It is recommended that a detailed maintenance plan should be prepared for the selected alternative.

XI. PUBLIC INVOLVEMENT

Public involvement for this project included a Local Concerns Meeting and Alternatives Presentation Meeting, both of which were held in Montgomery and are summarized below. Presentations were also made to the VTrans Historic Covered Bridge Committee on October 25 and November 27, 2012. A copy of the minutes for each meeting are included in Appendix D.

A. Local Concerns Meeting

A Local Concerns Meeting was held on August 6, 2012 at the Montgomery Town Offices. Attendees included the Montgomery Selectboard, Montgomery Road Foreman, Hoyle, Tanner personnel and members of the public. Concerns included the following (see Appendix D for meeting minutes:

- Project funding.
- Hydraulics at the crossing. The west approach to the bridge has been washed out by flood waters on several occasions in recent years.
- The live load capacity of the Longley Covered Bridge. The bridge has been subjected to numerous heavy loads in recent years which led to its closure.

B. Alternatives Presentation Meeting

An Alternatives Presentation Meeting was held on December 13, 2012 at the Montgomery Public Safety Building. Attendees included members of the Montgomery Selectboard, Hoyle, Tanner personnel and the public. The following four Alternatives were presented at the meeting:

1. 6 ton capacity – existing bridge
2. 8 ton capacity – existing bridge
3. 16 ton capacity – existing bridge supplementation with glulam
4. 20 ton capacity – preservation of design (new Town Lattice Covered Bridge)

After careful discussion of the Alternatives, the members of the public supported Alternative 4.

C. Historic Covered Bridge Committee Meetings

The project was presented to the VTrans Historic Covered Bridge Committee on October 25, 2012 and November 27, 2012 (see Appendix D for meeting minutes). Attendees included representatives of VTrans, Town of Montgomery, the Preservation Trust of Vermont, Northwest Regional Planning Commission, Vermont Covered Bridge Society, Restoration and Traditional Builders Consultant and Hoyle, Tanner. Alternatives to repair the existing covered bridge, increase capacity by supplementation and preservation of design with a new timber covered bridge were presented and discussed.

XII. COMPATIBILITY WITH PLANNING EFFORTS

The Town of Montgomery is known as Vermont's Covered Bridge Capital. In 1940's there were thirteen covered bridges within the Town's limits, however today there are only six covered bridges remaining. Out of six remaining covered bridges one is in storage, one is closed to all traffic (Longley) and four have been rehabilitated in the last ten years. The covered bridges are vitally important cultural, economic, educational, aesthetic, and historic resources in the Town of Montgomery. The selected alternative in Section XIV is consistent and compatible with the 2010 Montgomery Town Plan as it protects the safety of the traveling public, promotes a safe transportation system, increases the load carrying capacity of the crossing for the emergency responses vehicles, promotes economic development and growth of nearby businesses and maintains the historic character of the covered bridge.

XIII. PROJECT TIMELINE

Upon approval of the project Scoping Study, this project will be managed by VTrans and completed with majority funding through the National Historic Covered Bridge Preservation Program. It is anticipated that design and permitting of the project will take approximately fourteen months from Notice to Proceed for design phase services.

XIV. SUMMARY/VIABILITY

The Longley Covered Bridge was built in 1863. Several serious structural deficiencies were observed during a routine bridge inspection by VTrans personnel in 2010. As a result of the bridge inspection findings, the bridge was posted shortly thereafter for no trucks and a gross weight of 3 tons. The bridge remained opened to all traffic until early fall of 2011 when its deteriorated condition prompted the Town to close the bridge to all traffic. Vehicular traffic was bypassed at a temporary prefabricated steel truss type bridge, which was erected downstream of the existing covered bridge.

The bridge has undergone numerous changes and additions throughout its history with various degrees of documentation. The floor beams are in critical condition with many broken floor beams noted. The trusses are in poor condition with some rot, broken truss members and trunnels, racking and sweep (bow) throughout the bridge length. The trusses were observed to be bowed upstream by approximately 8”. This deficiency is believed to have been caused by excessive live loading, beyond that envisioned at the time of the original bridge construction.

A detailed inspection and evaluation of the bridge was completed to determine if the bridge can meet the project purpose and need. The roof framing was determined to be adequate for code required snow loads with some member replacements and sistering of some members. The bridge was determined to be adequate for code required wind loads. The substructure was visually reviewed and appears to be adequate with minor repairs. Several alternatives were considered and studied as described above in Section VIII.

Of the four rehabilitation alternatives studied, only two were determined to meet the project purpose and need. The Town Selectboard and public at the December 13, 2012 meeting were in favor of Alternative No.4. A “No-Build” alternative was also considered; however it was determined that it does not meet the project purpose and need.

Alternative No.4 promotes a safe transportation system, increases the load carrying capacity of the crossing for the emergency responses vehicles, promotes economic development and growth of nearby businesses and maintains the historic character of the covered bridge.

The total estimated construction cost of all recommended work items for Alternative No.4, in 2013 dollars, including a 5% contingency is $1,400,000.

APPENDIX A

Estimate of Probable Construction Costs

Estimate

Estimated Cost:$787,619.05

Contingency: 5.00%

Estimated Total: $827,000.00

WORK INCLUDES THE REHABILITATION OF THE LONGLEY COVERED BRIDGE (BR. NO. 33 ON THE TH 4 SPANNING THE TROUT RIVER ALTERNATIVE NO. 1 - REHABILITATION FOR H6 LIVE LOAD

Base Date: 05/05/14

Spec Year: 11

Unit System: E

Work Type: COVERED BRIDGE REHABILITATION

Highway Type: LOCAL

Urban/Rural Type: RURAL

Season: CONSTRUCTION SEASON BIDS (4/15 - 10/15)

County: FRANKLIN

Midpoint of Latitude: 449072

Midpoint of Longitude: 0726555

District: NW

Federal/State Project Number: STP EH12(16)

Prepared by Hoyle, Tanner & Associates, Inc. on 03/05/13

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension

Group 1011: ROADWAY

0005	201.10 CLEARING AND GRUBBING, INCLUDING INDIVIDUAL TREES AND STUMPS	1.00	LS	$3,000.00	$3,000.00
0010	203.15 COMMON EXCAVATION	50.00	CY	$50.00	$2,500.00
0015	301.25 SUBBASE OF CRUSHED GRAVEL, COARSE GRADED	20.00	CY	$50.00	$1,000.00
0020	402.12 AGGREGATE SHOULDERS	30.00	TON	$50.00	$1,500.00
0025	404.65 EMULSIFIED ASPHALT	1.00	CWT	$1,000.00	$1,000.00
0030	613.11 STONE FILL, TYPE II	25.00	CY	$100.00	$2,500.00
0035	621.18 STEEL BACKED TIMBER GUARDRAIL	120.00	LF	$150.00	$18,000.00
0040	621.80 REMOVAL AND DISPOSAL OF GUARDRAIL	81.00	LF	$10.00	$810.00
0045	621.90 TEMPORARY TRAFFIC BARRIER	60.00	LF	$30.00	$1,800.00
0050	635.11 MOBILIZATION/DEMOBILIZATION	1.00	LS	$70,764.05	$70,764.05
0055	649.31 GEOTEXTILE UNDER STONE FILL	80.00	SY	$5.00	$400.00
0060	653.55 PROJECT DEMARCATION FENCE	400.00	LF	$2.00	$800.00
0065	675.20 TRAFFIC SIGNS, TYPE A	30.00	SF	$15.00	$450.00
0070	675.50 REMOVING SIGNS	2.00	EACH	$50.00	$100.00
0075	675.341 SQUARE TUBE SIGN POST AND ANCHOR	52.00	LF	$10.00	$520.00
0080	900.680 SPECIAL PROVISION *(BITUMINOUS CONCRETE PAVEMENT, SMALL QUANTITY)*	100.00	TON	$250.00	$25,000.00

Total for Group 1011:$130,144.05

Group 1051: EROSION CONTROL

0085	608.25 ALL PURPOSE EXCAVATOR RENTAL, TYPE I	5.00	HR	$130.00	$650.00
0090	649.515 GEOTEXTILE FOR SILT FENCE, WOVEN WIRE REINFORCED	140.00	SY	$10.00	$1,400.00
0095	649.61 GEOTEXTILE FOR FILTER CURTAIN	160.00	SY	$20.00	$3,200.00
0100	651.15 SEED	10.00	LB	$20.00	$200.00
0105	651.18 FERTILIZER	30.00	LB	$5.00	$150.00
0110	651.20 AGRICULTURAL LIMESTONE	1.00	TON	$800.00	$800.00
0115	651.25 HAY MULCH	1.00	TON	$1,000.00	$1,000.00
0120	651.35 TOPSOIL	50.00	CY	$50.00	$2,500.00
0125	652.10 EPSC PLAN	1.00	LS	$3,000.00	$3,000.00
0130	652.20	92.00	HR	$75.00	$6,900.00

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
	MONITORING EPSC PLAN				
0135	652.30 MAINTENANCE OF EPSC PLAN (N.A.B.I.)	1.00	LU	$3,000.00	$3,000.00
0140	653.20 TEMPORARY EROSION MATTING	160.00	SY	$5.00	$800.00
0145	653.25 TEMPORARY STONE CHECK DAM, TYPE I	10.00	CY	$70.00	$700.00

Total for Group 1051:$24,300.00

Group 1211: BRIDGE

0150	501.34 CONCRETE, HIGH PERFORMANCE CLASS B	1.00	CY	$1,500.00	$1,500.00
0155	506.75 STRUCTURAL STEEL	1.00	LS	$3,000.00	$3,000.00
0160	507.16 DRILLING AND GROUTING DOWELS	8.00	LF	$50.00	$400.00
0165	507.17 EPOXY COATED REINFORCING STEEL	100.00	LB	$5.00	$500.00
0170	522.20 STRUCTURAL LUMBER AND TIMBER, UNTREATED	6.50	MFBM	$13,500.00	$87,750.00
0175	522.25 STRUCTURAL LUMBER AND TIMBER, TREATED	8.50	MFBM	$10,500.00	$89,250.00
0180	522.30 NONSTRUCTURAL LUMBER, UNTREATED	3.50	MFBM	$8,000.00	$28,000.00
0185	524.21 JOINT SEALER, POLYURETHANE	90.00	LF	$20.00	$1,800.00
0190	580.14 REPAIR OF CONCRETE SUBSTRUCTURE SURFACE, CLASS II	10.00	SY	$1,200.00	$12,000.00
0195	660.10 TIMBER PAINTING, ENVIRONMENTAL PROTECTION	1.00	LS	$5,000.00	$5,000.00
0200	660.20 TIMBER PAINTING, FIRE RETARDANT	1.00	LS	$12,000.00	$12,000.00
0205	660.30 TIMBER PAINTING, INSECTICIDE/FUNGICIDE	1.00	LS	$7,000.00	$7,000.00
0210	661.10 METAL ROOFING	255.00	SY	$80.00	$20,400.00
0215	900.620 SPECIAL PROVISION *(WOOD EPOXY REPAIRS)*	50.00	EACH	$200.00	$10,000.00
0220	900.625 SPECIAL PROVISION *(CONCRETE STAINING AND SEALING)*	9.00	GAL	$175.00	$1,575.00

Total for Group 1211:$280,175.00

Group 1221: ALTERNATE A (IN-PLACE REHABILITATION)

0225	502.10 SHORING SUPERSTRUCTURE	1.00	LS	$150,000.00	$150,000.00
0230	529.20 PARTIAL REMOVAL OF STRUCTURE	1.00	EACH	$75,000.00	$75,000.00
0235	900.645 SPECIAL PROVISION *(REHABILITATING COVERED BRIDGE SUPERSTRUCTURE)*	1.00	LS	$105,000.00	$105,000.00

Group Alternate Code: ZA1

Total for Group 1221:$330,000.00

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension

Group 1231: ALTERNATE B (RELOCATED REHABILITATION)

0240	529.20 PARTIAL REMOVAL OF STRUCTURE	1.00	EACH	$95,000.00	$95,000.00
0245	900.645 SPECIAL PROVISION *(HANDLING, TRANSPORT AND RE-ERECTION OF COVERED BRIDGE SUPERSTRUCTURE)*	1.00	LS	$150,000.00	$150,000.00
0250	900.645 SPECIAL PROVISION *(REHABILITATING COVERED BRIDGE SUPERSTRUCTURE)*	1.00	LS	$90,000.00	$90,000.00

Group Alternate Code: ZA2

Total for Group 1231:$335,000.00

Group 1999: FULL C.E. ITEMS

0255	631.10 FIELD OFFICE, ENGINEERS	1.00	LS	$20,000.00	$20,000.00
0260	631.26 FIELD OFFICE TELEPHONE (N.A.B.I.)	1.00	DL	$3,000.00	$3,000.00

Total for Group 1999:$23,000.00

Estimate

Estimated Cost:$870,476.19

Contingency: 5.00%

Estimated Total: $914,000.00

WORK INCLUDES THE REHABILITATION OF THE LONGLEY COVERED BRIDGE (BR. NO. 33) ON THE TH 4 SPANNING THE TROUT RIVER ALTERNATIVE NO. 2 - REHABILITATION FOR H8 LIVE LOAD

Base Date: 05/05/14

Spec Year: 11

Unit System: E

Work Type: COVERED BRIDGE REHABILITATION

Highway Type: LOCAL

Urban/Rural Type: RURAL

Season: CONSTRUCTION SEASON BIDS (4/15 - 10/15)

County: FRANKLIN

Midpoint of Latitude: 449072

Midpoint of Longitude: 0726555

District: NW

Federal/State Project Number: STP EH12(16)

Prepared by Hoyle, Tanner & Associates, Inc. on 03/05/13

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension

Group 1011: ROADWAY

0005	201.10 CLEARING AND GRUBBING, INCLUDING INDIVIDUAL TREES AND STUMPS	1.00	LS	$3,000.00	$3,000.00
0010	203.15 COMMON EXCAVATION	50.00	CY	$50.00	$2,500.00
0015	301.25 SUBBASE OF CRUSHED GRAVEL, COARSE GRADED	20.00	CY	$50.00	$1,000.00
0020	402.12 AGGREGATE SHOULDERS	30.00	TON	$50.00	$1,500.00
0025	404.65 EMULSIFIED ASPHALT	1.00	CWT	$1,000.00	$1,000.00
0030	613.11 STONE FILL, TYPE II	25.00	CY	$100.00	$2,500.00
0035	621.18 STEEL BACKED TIMBER GUARDRAIL	120.00	LF	$150.00	$18,000.00
0040	621.80 REMOVAL AND DISPOSAL OF GUARDRAIL	81.00	LF	$10.00	$810.00
0045	621.90 TEMPORARY TRAFFIC BARRIER	60.00	LF	$30.00	$1,800.00
0050	635.11 MOBILIZATION/DEMOBILIZATION	1.00	LS	$78,721.19	$78,721.19
0055	649.31 GEOTEXTILE UNDER STONE FILL	80.00	SY	$5.00	$400.00
0060	653.55 PROJECT DEMARCATION FENCE	400.00	LF	$2.00	$800.00
0065	675.20 TRAFFIC SIGNS, TYPE A	30.00	SF	$15.00	$450.00
0070	675.50 REMOVING SIGNS	2.00	EACH	$50.00	$100.00
0075	675.341 SQUARE TUBE SIGN POST AND ANCHOR	52.00	LF	$10.00	$520.00
0080	900.680 SPECIAL PROVISION *(BITUMINOUS CONCRETE PAVEMENT, SMALL QUANTITY)*	100.00	TON	$250.00	$25,000.00

Total for Group 1011:$138,101.19

Group 1051: EROSION CONTROL

0085	608.25 ALL PURPOSE EXCAVATOR RENTAL, TYPE I	5.00	HR	$130.00	$650.00
0090	649.515 GEOTEXTILE FOR SILT FENCE, WOVEN WIRE REINFORCED	140.00	SY	$10.00	$1,400.00
0095	649.61 GEOTEXTILE FOR FILTER CURTAIN	160.00	SY	$20.00	$3,200.00
0100	651.15 SEED	10.00	LB	$20.00	$200.00
0105	651.18 FERTILIZER	30.00	LB	$5.00	$150.00
0110	651.20 AGRICULTURAL LIMESTONE	1.00	TON	$800.00	$800.00
0115	651.25 HAY MULCH	1.00	TON	$1,000.00	$1,000.00
0120	651.35 TOPSOIL	50.00	CY	$50.00	$2,500.00
0125	652.10 EPSC PLAN	1.00	LS	$3,000.00	$3,000.00
0130	652.20	100.00	HR	$75.00	$7,500.00

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
	MONITORING EPSC PLAN				
0135	652.30 MAINTENANCE OF EPSC PLAN (N.A.B.I.)	1.00	LU	$3,000.00	$3,000.00
0140	653.20 TEMPORARY EROSION MATTING	160.00	SY	$5.00	$800.00
0145	653.25 TEMPORARY STONE CHECK DAM, TYPE I	10.00	CY	$70.00	$700.00

Total for Group 1051:$24,900.00

Group 1211: BRIDGE

0150	501.34 CONCRETE, HIGH PERFORMANCE CLASS B	1.00	CY	$1,500.00	$1,500.00
0155	506.75 STRUCTURAL STEEL	1.00	LS	$3,000.00	$3,000.00
0160	507.16 DRILLING AND GROUTING DOWELS	8.00	LF	$50.00	$400.00
0165	507.17 EPOXY COATED REINFORCING STEEL	100.00	LB	$5.00	$500.00
0170	522.20 STRUCTURAL LUMBER AND TIMBER, UNTREATED	6.80	MFBM	$13,500.00	$91,800.00
0175	522.25 STRUCTURAL LUMBER AND TIMBER, TREATED	14.00	MFBM	$10,500.00	$147,000.00
0180	522.30 NONSTRUCTURAL LUMBER, UNTREATED	3.50	MFBM	$8,000.00	$28,000.00
0185	524.21 JOINT SEALER, POLYURETHANE	90.00	LF	$20.00	$1,800.00
0190	580.14 REPAIR OF CONCRETE SUBSTRUCTURE SURFACE, CLASS II	10.00	SY	$1,200.00	$12,000.00
0195	660.10 TIMBER PAINTING, ENVIRONMENTAL PROTECTION	1.00	LS	$5,000.00	$5,000.00
0200	660.20 TIMBER PAINTING, FIRE RETARDANT	1.00	LS	$12,000.00	$12,000.00
0205	660.30 TIMBER PAINTING, INSECTICIDE/FUNGICIDE	1.00	LS	$7,000.00	$7,000.00
0210	661.10 METAL ROOFING	255.00	SY	$80.00	$20,400.00
0215	900.620 SPECIAL PROVISION *(WOOD EPOXY REPAIRS)*	50.00	EACH	$200.00	$10,000.00
0220	900.625 SPECIAL PROVISION *(CONCRETE STAINING AND SEALING)*	9.00	GAL	$175.00	$1,575.00

Total for Group 1211:$341,975.00

Group 1221: ALTERNATE A (IN-PLACE REHABILITATION)

0225	502.10 SHORING SUPERSTRUCTURE	1.00	LS	$150,000.00	$150,000.00
0230	529.20 PARTIAL REMOVAL OF STRUCTURE	1.00	EACH	$85,000.00	$85,000.00
0235	900.645 SPECIAL PROVISION *(REHABILITATING COVERED BRIDGE SUPERSTRUCTURE)*	1.00	LS	$105,000.00	$105,000.00

Group Alternate Code: ZA1

Total for Group 1221:$340,000.00

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension

Group 1231: ALTERNATE B (RELOCATED REHABILITATION)

0240	529.20 PARTIAL REMOVAL OF STRUCTURE	1.00	EACH	$105,000.00	$105,000.00
0245	900.645 SPECIAL PROVISION *(HANDLING, TRANSPORT AND RE-ERECTION OF COVERED BRIDGE SUPERSTRUCTURE)*	1.00	LS	$150,000.00	$150,000.00
0250	900.645 SPECIAL PROVISION *(REHABILITATING COVERED BRIDGE SUPERSTRUCTURE)*	1.00	LS	$90,000.00	$90,000.00

Group Alternate Code: ZA2

Total for Group 1231:$345,000.00

Group 1999: FULL C.E. ITEMS

0255	631.10 FIELD OFFICE, ENGINEERS	1.00	LS	$22,500.00	$22,500.00
0260	631.26 FIELD OFFICE TELEPHONE (N.A.B.I.)	1.00	DL	$3,000.00	$3,000.00

Total for Group 1999:$25,500.00

Estimate

Estimated Cost:$1,057,142.86

Contingency: 5.00%

Estimated Total: $1,110,000.00

WORK INCLUDES THE REHABILITATION OF THE LONGLEY COVERED BRIDGE (BR. NO. 33) ON THE TH 4 SPANNING THE TROUT RIVER ALTERNATIVE NO. 3 - REHABILITATION FOR H16 LIVE LOAD

Base Date: 05/05/14

Spec Year: 11

Unit System: E

Work Type: COVERED BRIDGE REHABILITATION

Highway Type: LOCAL

Urban/Rural Type: RURAL

Season: CONSTRUCTION SEASON BIDS (4/15 - 10/15)

County: FRANKLIN

Midpoint of Latitude: 449072

Midpoint of Longitude: 0726555

District: NW

Federal/State Project Number: STP EH12(16)

Prepared by Hoyle, Tanner & Associates, Inc. on 03/05/13

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension

Group 1011: ROADWAY

0005	201.10 CLEARING AND GRUBBING, INCLUDING INDIVIDUAL TREES AND STUMPS	1.00	LS	$4,000.00	$4,000.00
0010	203.15 COMMON EXCAVATION	50.00	CY	$50.00	$2,500.00
0015	301.15 SUBBASE OF GRAVEL	400.00	CY	$30.00	$12,000.00
0020	301.25 SUBBASE OF CRUSHED GRAVEL, COARSE GRADED	150.00	CY	$30.00	$4,500.00
0025	402.12 AGGREGATE SHOULDERS	30.00	TON	$50.00	$1,500.00
0030	404.65 EMULSIFIED ASPHALT	1.00	CWT	$1,000.00	$1,000.00
0035	613.11 STONE FILL, TYPE II	25.00	CY	$100.00	$2,500.00
0040	621.18 STEEL BACKED TIMBER GUARDRAIL	120.00	LF	$150.00	$18,000.00
0045	621.80 REMOVAL AND DISPOSAL OF GUARDRAIL	81.00	LF	$10.00	$810.00
0050	621.90 TEMPORARY TRAFFIC BARRIER	60.00	LF	$30.00	$1,800.00
0055	635.11 MOBILIZATION/DEMOBILIZATION	1.00	LS	$95,262.86	$95,262.86
0060	649.31 GEOTEXTILE UNDER STONE FILL	80.00	SY	$5.00	$400.00
0065	653.55 PROJECT DEMARCATION FENCE	600.00	LF	$2.00	$1,200.00
0070	675.20 TRAFFIC SIGNS, TYPE A	30.00	SF	$15.00	$450.00
0075	675.50 REMOVING SIGNS	2.00	EACH	$50.00	$100.00
0080	675.341 SQUARE TUBE SIGN POST AND ANCHOR	52.00	LF	$10.00	$520.00
0085	900.680 SPECIAL PROVISION *(BITUMINOUS CONCRETE PAVEMENT, SMALL QUANTITY)*	100.00	TON	$250.00	$25,000.00

Total for Group 1011:$171,542.86

Group 1051: EROSION CONTROL

0090	608.25 ALL PURPOSE EXCAVATOR RENTAL, TYPE I	5.00	HR	$130.00	$650.00
0095	649.515 GEOTEXTILE FOR SILT FENCE, WOVEN WIRE REINFORCED	140.00	SY	$10.00	$1,400.00
0100	649.61 GEOTEXTILE FOR FILTER CURTAIN	160.00	SY	$20.00	$3,200.00
0105	651.15 SEED	20.00	LB	$20.00	$400.00
0110	651.18 FERTILIZER	50.00	LB	$5.00	$250.00
0115	651.20 AGRICULTURAL LIMESTONE	1.00	TON	$800.00	$800.00
0120	651.25 HAY MULCH	1.00	TON	$1,000.00	$1,000.00
0125	651.35 TOPSOIL	75.00	CY	$50.00	$3,750.00
0130	652.10	1.00	LS	$3,000.00	$3,000.00

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
	EPSC PLAN				
0135	652.20 MONITORING EPSC PLAN	126.00	HR	$75.00	$9,450.00
0140	652.30 MAINTENANCE OF EPSC PLAN (N.A.B.I.)	1.00	LU	$3,000.00	$3,000.00
0145	653.20 TEMPORARY EROSION MATTING	670.00	SY	$5.00	$3,350.00
0150	653.25 TEMPORARY STONE CHECK DAM, TYPE I	10.00	CY	$70.00	$700.00

Total for Group 1051:$30,950.00

Group 1211: BRIDGE

0155	204.25 STRUCTURE EXCAVATION	30.00	CY	$40.00	$1,200.00
0160	204.30 GRANULAR BACKFILL FOR STRUCTURES	55.00	CY	$45.00	$2,475.00
0165	501.34 CONCRETE, HIGH PERFORMANCE CLASS B	31.00	CY	$1,000.00	$31,000.00
0170	506.75 STRUCTURAL STEEL	1.00	LS	$3,000.00	$3,000.00
0175	507.16 DRILLING AND GROUTING DOWELS	80.00	LF	$30.00	$2,400.00
0180	507.17 EPOXY COATED REINFORCING STEEL	4,000.00	LB	$5.00	$20,000.00
0185	522.20 STRUCTURAL LUMBER AND TIMBER, UNTREATED	6.80	MFBM	$13,500.00	$91,800.00
0190	522.25 STRUCTURAL LUMBER AND TIMBER, TREATED	14.00	MFBM	$10,500.00	$147,000.00
0195	522.30 NONSTRUCTURAL LUMBER, UNTREATED	3.50	MFBM	$8,000.00	$28,000.00
0200	522.40 STRUCTURAL GLUED LAMINATED TIMBER	1.00	LS	$90,000.00	$90,000.00
0205	524.21 JOINT SEALER, POLYURETHANE	90.00	LF	$20.00	$1,800.00
0210	580.14 REPAIR OF CONCRETE SUBSTRUCTURE SURFACE, CLASS II	10.00	SY	$1,200.00	$12,000.00
0215	660.10 TIMBER PAINTING, ENVIRONMENTAL PROTECTION	1.00	LS	$5,000.00	$5,000.00
0220	660.20 TIMBER PAINTING, FIRE RETARDANT	1.00	LS	$12,000.00	$12,000.00
0225	660.30 TIMBER PAINTING, INSECTICIDE/FUNGICIDE	1.00	LS	$7,000.00	$7,000.00
0230	661.10 METAL ROOFING	255.00	SY	$80.00	$20,400.00
0235	900.620 SPECIAL PROVISION *(WOOD EPOXY REPAIRS)*	50.00	EACH	$200.00	$10,000.00
0240	900.625 SPECIAL PROVISION *(CONCRETE STAINING AND SEALING)*	9.00	GAL	$175.00	$1,575.00

Total for Group 1211:$486,650.00

Group 1221: ALTERNATE A (IN-PLACE REHABILITATION)

0245	502.10 SHORING SUPERSTRUCTURE	1.00	LS	$150,000.00	$150,000.00
0250	529.20	1.00	EACH	$85,000.00	$85,000.00

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
	PARTIAL REMOVAL OF STRUCTURE				
0255	900.645 SPECIAL PROVISION *(REHABILITATING COVERED BRIDGE SUPERSTRUCTURE)*	1.00	LS	$105,000.00	$105,000.00

Group Alternate Code: ZA1

Total for Group 1221:$340,000.00

Group 1231: ALTERNATE B (RELOCATED REHABILITATION)

0260	529.20 PARTIAL REMOVAL OF STRUCTURE	1.00	EACH	$105,000.00	$105,000.00
0265	900.645 SPECIAL PROVISION *(REHABILITATING COVERED BRIDGE SUPERSTRUCTURE)*	1.00	LS	$90,000.00	$90,000.00
0270	900.645 SPECIAL PROVISION *(HANDLING, TRANSPORT AND RE-ERECTION OF COVERED BRIDGE SUPERSTRUCTURE)*	1.00	LS	$150,000.00	$150,000.00

Group Alternate Code: ZA2

Total for Group 1231:$345,000.00

Group 1999: FULL C.E. ITEMS

0275	631.10 FIELD OFFICE, ENGINEERS	1.00	LS	$25,000.00	$25,000.00
0280	631.26 FIELD OFFICE TELEPHONE (N.A.B.I.)	1.00	DL	$3,000.00	$3,000.00

Total for Group 1999:$28,000.00

Estimate

Estimated Cost:$1,333,333.33

Contingency: 5.00%

Estimated Total: $1,400,000.00

WORK INCLUDES THE REHABILITATION OF THE LONGLEY COVERED BRIDGE (BR. NO. 33) ON THE TH 4 SPANNING THE TROUT RIVER ALTERNATIVE NO. 4 - NEW COVERED BRIDGE FOR H20 LIVE LOAD

Base Date: 05/05/14

Spec Year: 11

Unit System: E

Work Type: COVERED BRIDGE REHABILITATION

Highway Type: LOCAL

Urban/Rural Type: RURAL

Season: CONSTRUCTION SEASON BIDS (4/15 - 10/15)

County: FRANKLIN

Midpoint of Latitude: 449072

Midpoint of Longitude: 0726555

District: NW

Federal/State Project Number: STP EH12(16)

Prepared by Hoyle, Tanner & Associates, Inc. on 03/05/13

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension

Group 1011: ROADWAY

0005	201.10 CLEARING AND GRUBBING, INCLUDING INDIVIDUAL TREES AND STUMPS	1.00	LS	$3,000.00	$3,000.00
0010	203.15 COMMON EXCAVATION	50.00	CY	$50.00	$2,500.00
0015	301.25 SUBBASE OF CRUSHED GRAVEL, COARSE GRADED	20.00	CY	$50.00	$1,000.00
0020	402.12 AGGREGATE SHOULDERS	30.00	TON	$50.00	$1,500.00
0025	404.65 EMULSIFIED ASPHALT	1.00	CWT	$1,000.00	$1,000.00
0030	613.11 STONE FILL, TYPE II	25.00	CY	$100.00	$2,500.00
0035	621.18 STEEL BACKED TIMBER GUARDRAIL	120.00	LF	$150.00	$18,000.00
0040	621.80 REMOVAL AND DISPOSAL OF GUARDRAIL	81.00	LF	$10.00	$810.00
0045	621.90 TEMPORARY TRAFFIC BARRIER	60.00	LF	$30.00	$1,800.00
0050	635.11 MOBILIZATION/DEMOBILIZATION	1.00	LS	$124,928.33	$124,928.33
0055	649.31 GEOTEXTILE UNDER STONE FILL	80.00	SY	$5.00	$400.00
0060	653.55 PROJECT DEMARCATION FENCE	400.00	LF	$2.00	$800.00
0065	675.20 TRAFFIC SIGNS, TYPE A	30.00	SF	$15.00	$450.00
0070	675.50 REMOVING SIGNS	2.00	EACH	$50.00	$100.00
0075	675.341 SQUARE TUBE SIGN POST AND ANCHOR	52.00	LF	$10.00	$520.00
0080	900.680 SPECIAL PROVISION *(BITUMINOUS CONCRETE PAVEMENT, SMALL QUANTITY)*	100.00	TON	$250.00	$25,000.00

Total for Group 1011:$184,308.33

Group 1051: EROSION CONTROL

0085	608.25 ALL PURPOSE EXCAVATOR RENTAL, TYPE I	5.00	HR	$130.00	$650.00
0090	649.515 GEOTEXTILE FOR SILT FENCE, WOVEN WIRE REINFORCED	140.00	SY	$10.00	$1,400.00
0095	649.61 GEOTEXTILE FOR FILTER CURTAIN	160.00	SY	$20.00	$3,200.00
0100	651.15 SEED	10.00	LB	$20.00	$200.00
0105	651.18 FERTILIZER	30.00	LB	$5.00	$150.00
0110	651.20 AGRICULTURAL LIMESTONE	1.00	TON	$800.00	$800.00
0115	651.25 HAY MULCH	1.00	TON	$1,000.00	$1,000.00
0120	651.35 TOPSOIL	50.00	CY	$50.00	$2,500.00
0125	652.10 EPSC PLAN	1.00	LS	$3,000.00	$3,000.00
0130	652.20	126.00	HR	$75.00	$9,450.00

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
	MONITORING EPSC PLAN				
0135	652.30 MAINTENANCE OF EPSC PLAN (N.A.B.I.)	1.00	LU	$3,000.00	$3,000.00
0140	653.20 TEMPORARY EROSION MATTING	160.00	SY	$5.00	$800.00
0145	653.25 TEMPORARY STONE CHECK DAM, TYPE I	10.00	CY	$70.00	$700.00

Total for Group 1051:$26,850.00

Group 1211: BRIDGE

0150	501.34 CONCRETE, HIGH PERFORMANCE CLASS B	1.00	CY	$1,500.00	$1,500.00
0155	506.75 STRUCTURAL STEEL	1.00	LS	$3,000.00	$3,000.00
0160	507.16 DRILLING AND GROUTING DOWELS	8.00	LF	$50.00	$400.00
0165	507.17 EPOXY COATED REINFORCING STEEL	100.00	LB	$5.00	$500.00
0170	524.21 JOINT SEALER, POLYURETHANE	90.00	LF	$20.00	$1,800.00
0175	529.10 REMOVAL OF BRIDGE PAVEMENT	1.00	SY	$200,000.00	$200,000.00
0180	580.14 REPAIR OF CONCRETE SUBSTRUCTURE SURFACE, CLASS II	10.00	SY	$1,200.00	$12,000.00
0185	660.10 TIMBER PAINTING, ENVIRONMENTAL PROTECTION	1.00	LS	$5,000.00	$5,000.00
0190	660.20 TIMBER PAINTING, FIRE RETARDANT	1.00	LS	$12,000.00	$12,000.00
0195	660.30 TIMBER PAINTING, INSECTICIDE/FUNGICIDE	1.00	LS	$7,000.00	$7,000.00
0200	661.10 METAL ROOFING	255.00	SY	$80.00	$20,400.00
0205	900.620 SPECIAL PROVISION *(WOOD EPOXY REPAIRS)*	20.00	EACH	$200.00	$4,000.00
0210	900.625 SPECIAL PROVISION *(CONCRETE STAINING AND SEALING)*	9.00	GAL	$175.00	$1,575.00
0215	900.645 SPECIAL PROVISION *(NEW COVERED BRIDGE SUPERSTRUCTURE WITH SALVAGED ROOF)*	1.00	LS	$825,000.00	$825,000.00

Total for Group 1211:$1,094,175.00

Group 1999: FULL C.E. ITEMS

0220	631.10 FIELD OFFICE, ENGINEERS	1.00	LS	$25,000.00	$25,000.00
0225	631.26 FIELD OFFICE TELEPHONE (N.A.B.I.)	1.00	DL	$3,000.00	$3,000.00

Total for Group 1999:$28,000.00

APPENDIX B

Plans of Proposed Improvements

GENERAL PLAN

SCALE: 1" = APPROX. 40'-0"

0 20 40

Hoyle, Tanner & Associates, Inc.

HTA PROJECT	MODEL
92070I	92070IPLAN

PROJECT NAME: MONTGOMERY

PROJECT NUMBER: STP EH 12(16)

FILE NAME: 92070IPLAN.dgn
PROJECT LEADER: K.RUSSELL
DESIGNED BY: J.BICJA
GENERAL PLAN

PLOT DATE: 3/5/2013
DRAWN BY: J.B.MCQUAID
CHECKED BY: S.T.JAMES
SHEET 1 OF 4

ENVIRONMENTAL RESOURCE	LEVEL	LINESTYLE NAME	CHECKED BY	DATE
WETLANDS	N/A	N/A	HOYLE, TANNER	3-4-2013
HISTORIC/HISTORIC DISTRICT	LAHD	HISTORIC DIST. —— HISTORIC DIST ——	HOYLE, TANNER	3-4-2013
ARCHAEOLOGICALLY SENSITIVE LAND	N/A	N/A	HOYLE, TANNER	3-4-2013
4F PROPERTY	N/A	N/A	HOYLE, TANNER	3-4-2013
6F PROPERTY	N/A	N/A	HOYLE, TANNER	3-4-2013
AGRICULTURAL LAND	LAAG	AGRICULT. LAND AG —— AG —	HOYLE, TANNER	3-4-2013
FISH & WILDLIFE HABITAT	N/A	N/A	HOYLE, TANNER	3-4-2013
FLOOD PLAINS	LAFP	FLD. PLAINS —— FLOOD PLAIN ——	HOYLE, TANNER	3-4-2013
ENDANGERED SPECIES	N/A	N/A	HOYLE, TANNER	3-4-2013
HAZARDOUS WASTE	N/A	N/A	HOYLE, TANNER	3-4-2013
STORMWATER	N/A	N/A	HOYLE, TANNER	3-4-2013
GREEN MOUNTAIN NATIONAL FOREST LAND	N/A	N/A	HOYLE, TANNER	3-4-2013

RESOURCE PLAN

SCALE: 1" = APPROX. 40'-0"

0 20 40

Hoyle, Tanner & Associates, Inc.

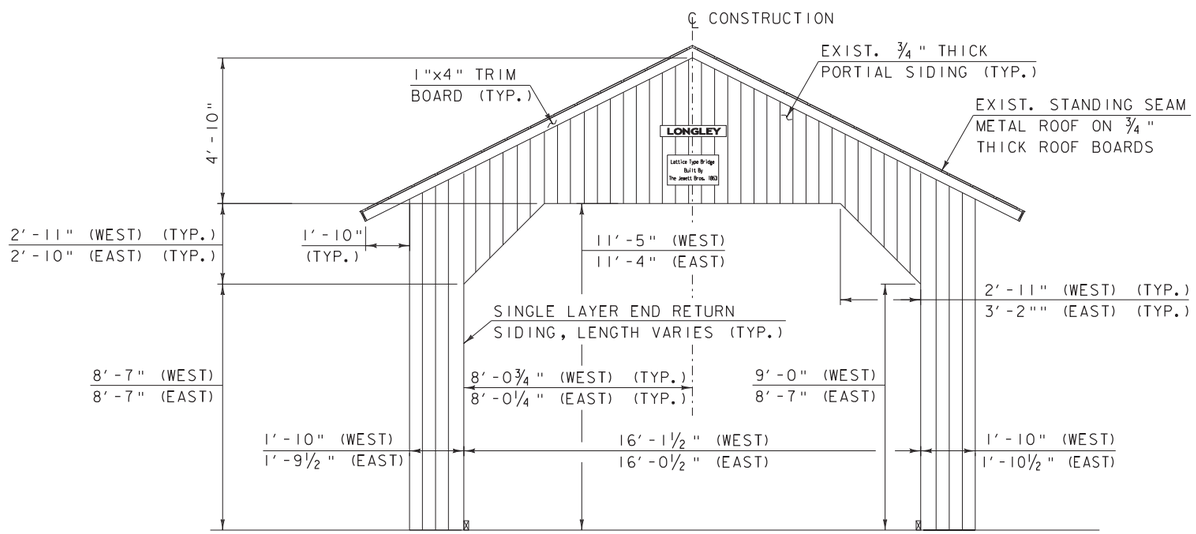
HTA PROJECT	MODEL
92070I	92070IPLAN

PROJECT NAME: MONTGOMERY

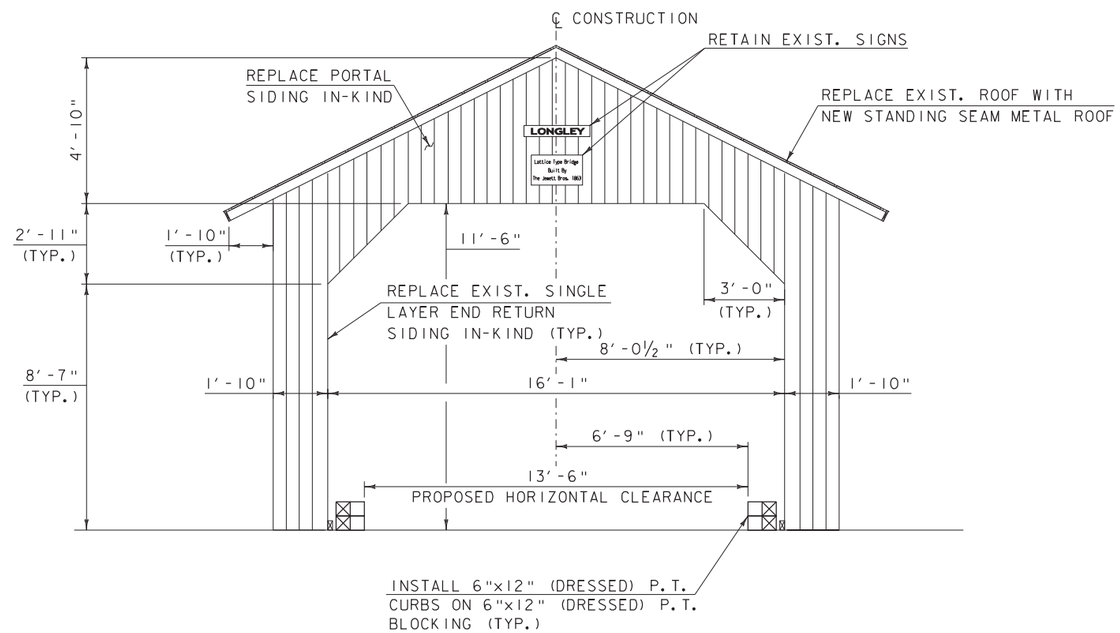
PROJECT NUMBER: STP EH 12(16)

FILE NAME: 92070IRES2.dgn
PROJECT LEADER: K.RUSSELL
DESIGNED BY: J.BICJA
RESOURCE LAYOUT SHEET

PLOT DATE: 3/5/2013
DRAWN BY: J.B.MCQUAID
CHECKED BY: S.T.JAMES
SHEET 2 OF 4



EXISTING PORTAL SECTION
(LOOKING EAST)
(WEST PORTAL SHOWN, EAST PORTAL SIMILAR)
SCALE: 3/16" = 1'-0"



PROPOSED PORTAL SECTION
(LOOKING EAST) - ALTERNATIVE NO. 4
(WEST PORTAL SHOWN, EAST PORTAL SIMILAR)
SCALE: 3/16" = 1'-0"

SCALE: 3/16" = 1'-0"
1 0 1 2 3 4

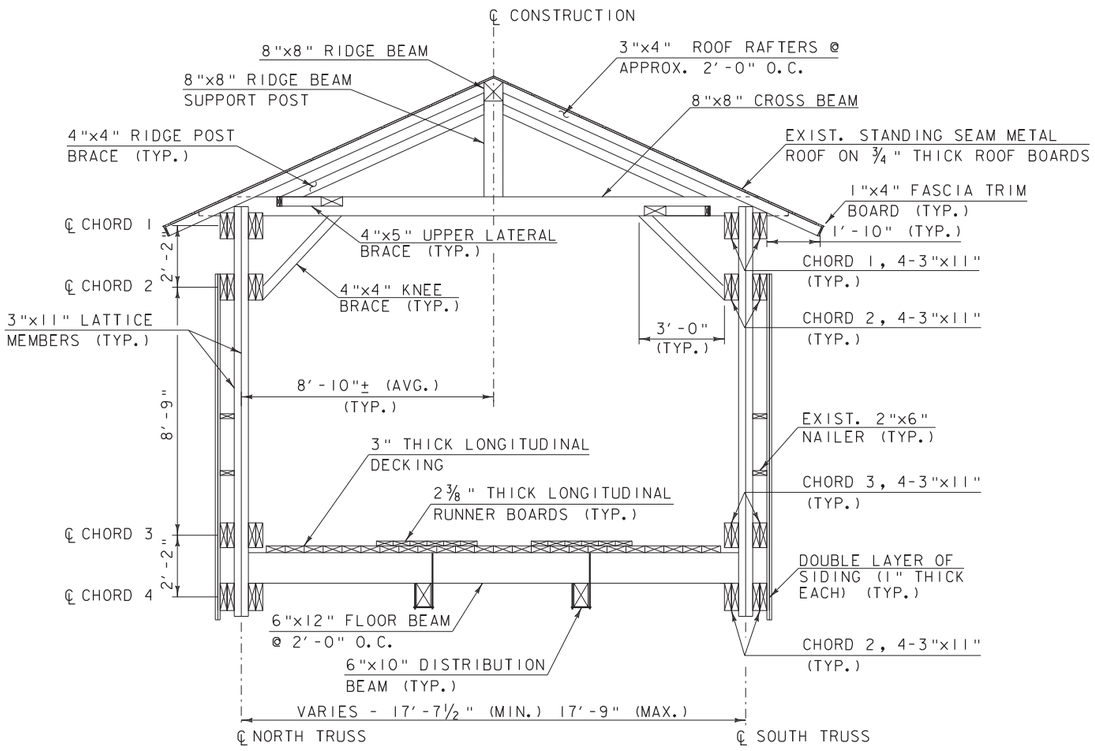
Hoyle, Tanner & Associates, Inc.

HTA PROJECT	MODEL
920701	920701SUP1

PROJECT NAME: MONTGOMERY
PROJECT NUMBER: STP EH 12(16)

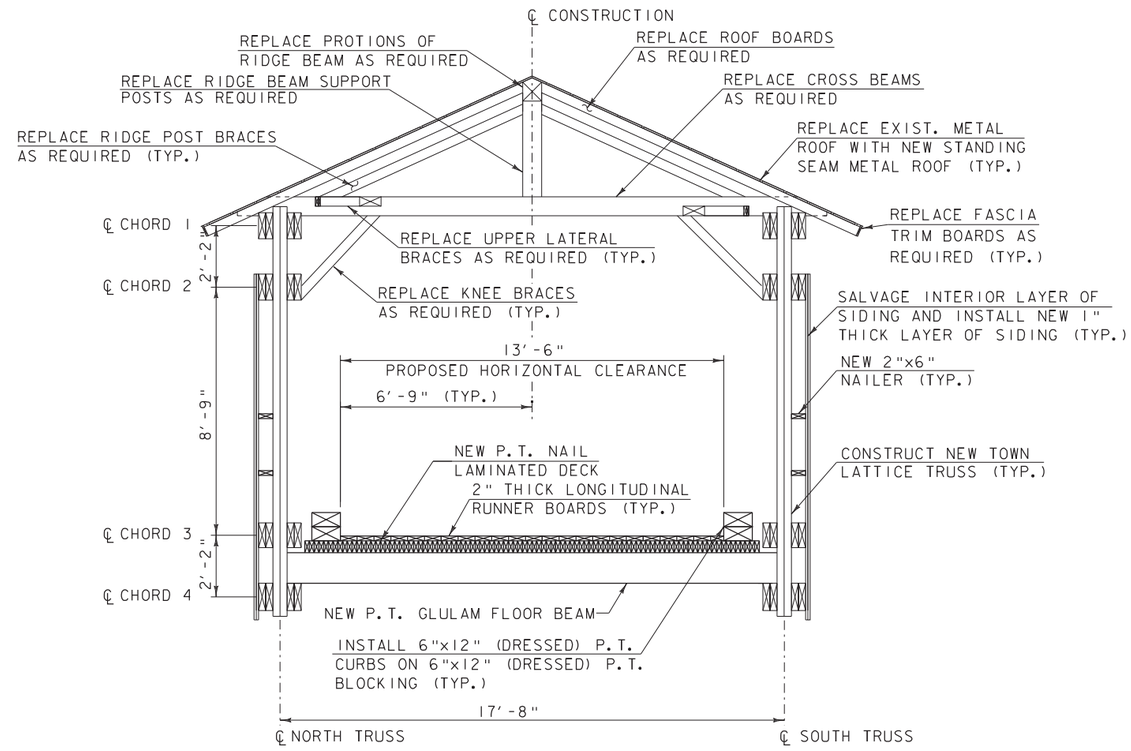
FILE NAME: 920701sup1.dgn
PROJECT LEADER: K.RUSSELL
DESIGNED BY: J.BICJA
PORTAL TYPICAL SECTIONS

PLOT DATE: 3/5/2013
DRAWN BY: J.B.MCQUAID
CHECKED BY: S.T.JAMES
SHEET 3 OF 4



EXISTING TYPICAL BRIDGE SECTION

SCALE: 3/16" = 1'-0"



PROPOSED TYPICAL BRIDGE SECTION
ALTERNATIVE NO. 4

SCALE: 3/16" = 1'-0"

NOTE:
DIMENSIONS OF TIMBER AND LUMBER MEMBERS SHOWN ON THE PLANS ARE THE ACTUAL SIZES UNLESS NOTES OTHERWISE.

SCALE: 3/16" = 1'-0"
1 0 1 2 3 4

Hoyle, Tanner & Associates, Inc.

HTA PROJECT	MODEL
920701	920701SUP2

PROJECT NAME: MONTGOMERY
PROJECT NUMBER: STP EH 12(16)

FILE NAME: 920701sup2.dgn
PROJECT LEADER: K.RUSSELL
DESIGNED BY: J.BICJA
BRIDGE TYPICAL SECTIONS

PLOT DATE: 3/5/2013
DRAWN BY: J.B.MCQUAID
CHECKED BY: S.T.JAMES
SHEET 4 OF 4

APPENDIX C

Hartgen Archaeological and Historical Resource Assessment

HARTGEN
archeological associates inc

ARCHEOLOGICAL AND HISTORICAL RESOURCE ASSESSMENT

Longley Covered Bridge Rehabilitation

Town of Montgomery
Franklin County, Vermont

HAA # 4539-11

Submitted to:

Sean T. James, P.E.
Hoyle, Tanner & Associates, Inc.
150 Dow Street
Manchester, New Hampshire 03101
p. 603.669.5555 Ext. 164
c. 603.785.0671
sjames@hoyletanner.com

Prepared by:

Hartgen Archeological Associates, Inc.
PO Box 81
Putney, Vermont 05346
p +1 802 387 6020
f +1 802 387 8524
email: emanning@hartgen.com

www.hartgen.com

An ACRA Member Firm
www.acra-crm.org

August 2012

ARCHEOLOGICAL RESOURCE ASSESSMENT

INTRODUCTION

Hartgen Archeological Associates, Inc. (HAA, Inc.) was retained by Hoyle, Tanner and Associates to conduct an Archeological Resource Assessment and Historic Resource Assessment for the proposed repairs to the Longley Covered Bridge located in the Town of Montgomery, Franklin County, Vermont (Map 1). Specific project plans have not yet been drafted. However, the proposed project will likely include the rehabilitation of the existing covered bridge and the removal of the recently installed temporary bridge located downstream (Photo 1). The project is being managed by the Town of Montgomery and will be funded through the federally funded Transportation Enhancement program.

The ARA objectives are to identify areas of archeological sensitivity based on environmental factors, known site information and historical information for the project Area of Potential Effects (APE). Reference to the general project vicinity is provided as appropriate to understanding its precontact and historical contexts. Background research was conducted at the Vermont Division for Historic Preservation (VDHP) in Montpelier where archeological site files, National Register (NR), State Register (SR) and town information files were reviewed, and the Vermont Historical Society in Barre where historical maps were accessed.

DOCUMENTARY RESEARCH

Environmental Background

Environmental characteristics of an area are significant for determining the sensitivity for archeological resources. Precontact and historic groups often favored level, well-drained locations near wetlands and waterways. Therefore, topography, proximity to wetlands, and soils are examined to determine if there are landforms in the project area that are more likely to contain archeological resources. In addition, bedrock formations or other lithic sources may contain resources that may have been quarried by precontact groups. Other locations can also be special purpose sacred and traditional use sites. Soil conditions can provide a clue to past climatic conditions, as well as changes in local hydrology.

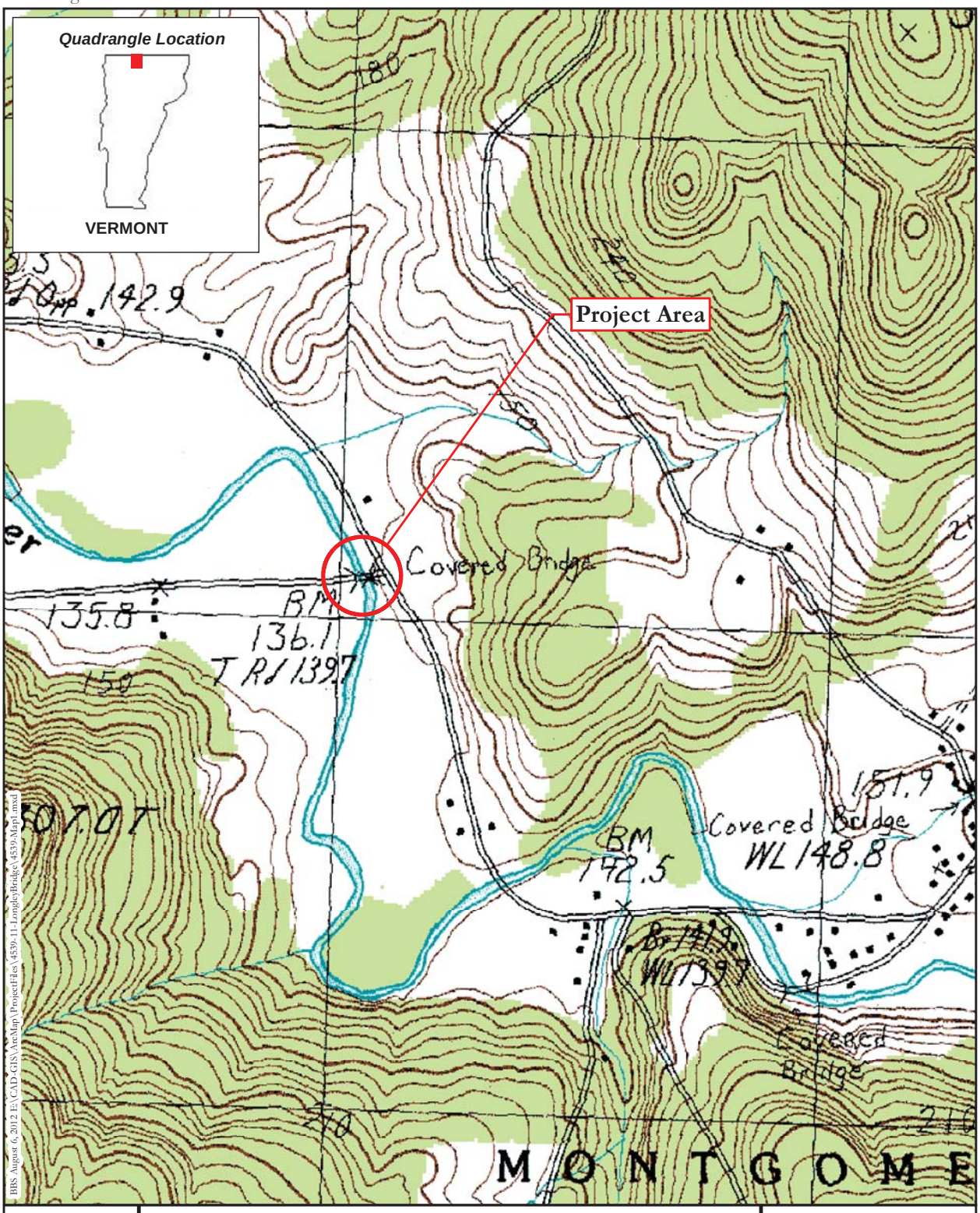
The Longley Covered Bridge, which spans the Trout River, is one of many covered bridges located in the scenic rural landscape located just north of the Town of Montgomery. Situated at an elevation of 136 feet above mean sea level (amsl), the bridge is located on Longley Bridge Road (TH 4) just off of VT RT 118. The Trout River Valley trends northwest to southeast, and is bordered to the east and west by hills rising to heights of 300 to 600 feet amsl. Little Jay Peak, which rises to a height of 970 feet amsl, is located approximately six miles east of the project area. Longley Bridge is located approximately 900 feet (274 m) south of an unnamed stream, and three miles (4.8 km) south of the confluence of the Trout River and Missisquoi River at East Berkshire.

The soils on either side of the bridge consist of Ondawa variant silt loam. These soils formed in coarse loamy alluvium over sandy and gravelly alluvium on flood plains. The soils are very deep to bedrock and well drained (USDA 2005).

DOCUMENTARY RESEARCH

Precontact Site File Research and Precontact Sensitivity

Examination of VDHP site files indicates that there are no reported precontact sites located within several miles of the project area. The paucity of recorded sites in the area is more likely a reflection of limited archaeological testing rather than the absence of precontact sites. The project area has precontact



N

0 1,000 2,000 Feet

0 200 400 600 Meters

Note: Contour interval is 20 feet.

Legend

Project Area

USGS 1986, Provisional Ed.
Richford, Vermont

HARTGEN archeological associates inc

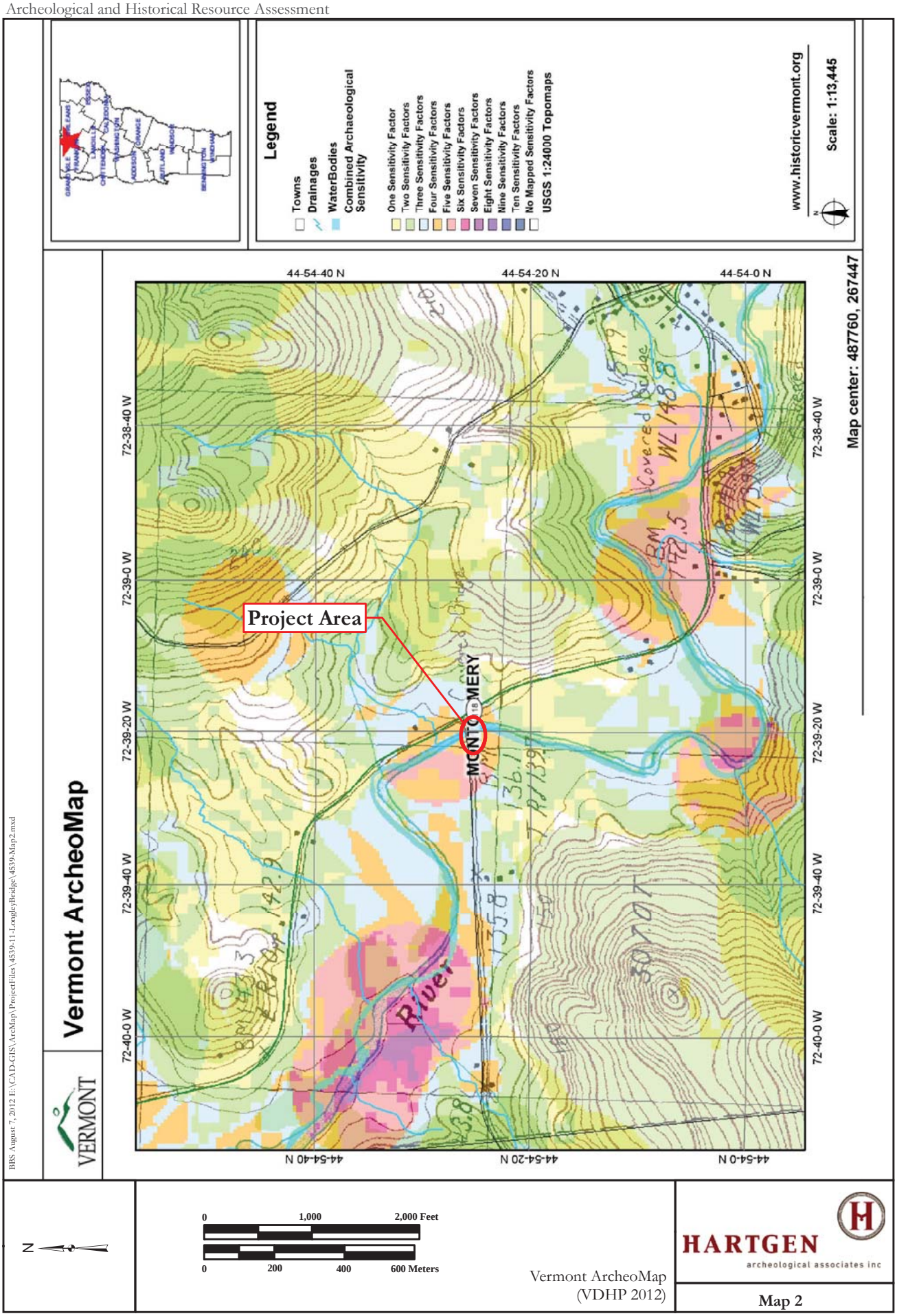
Map 1

Photo 1. Photo shows the Longley Covered Bridge and the temporary bridge located to its north. View is to the west.

archeological sensitivity based on its location on level terrain adjacent to a waterway, situated within a travel corridor – the Trout River Valley. The VDHP Environmental Predictive Model was completed for the general project area which produced an overall rating of 32, with a rating of 32 or above indicating precontact sensitivity (Appendix 1). Its sensitivity was based on the bridge's location on a river terrace, situated within a travel corridor. The predictive model also rating also subtracts (32) point for major disturbance. Thus, the previously disturbed areas directly adjacent to the bridge would have a low sensitivity rating of zero.

The Vermont Division for Historic Preservation Internet Mapping Site was accessed and used to formulate the archeological sensitivity of the proposed project area (VDHP 2009). The mapping site evaluates the precontact potential of all areas of Vermont, based on 11 environmental factors, such as the presence of specific terrain, soils, or proximity to streams or wetlands. If an area possesses just one of these environmental characteristics, it is considered by the Vermont Division for Historic Preservation (VDHP) / State Historic Preservation Officer (SHPO) to be archeologically sensitive. Based on the Vermont ArcheoMap Information System, the project area possessed five sensitivity factors, including the proximity to a permanent stream, proximity to a waterbody, proximity to wetlands, proximity to the confluence of a stream and waterbody, and the presence of level terrain (Map 2).

If undisturbed, the project area location would be considered to have precontact archaeological potential because of the environmental characteristics outlined above. However, the lands directly adjacent to the bridge have been compromised by bridge and road construction, significantly altering its archaeological sensitivity. Undisturbed river terrace landforms, located further south of Longley Bridge and north of the replacement bridge, are considered to have precontact archeological sensitivity.


Legend
Towns
Drainages
WaterBodies
Combined Archaeological Sensitivity
One Sensitivity Factor
Two Sensitivity Factors
Three Sensitivity Factors
Four Sensitivity Factors
Five Sensitivity Factors
Six Sensitivity Factors
Seven Sensitivity Factors
Eight Sensitivity Factors
Nine Sensitivity Factors
Ten Sensitivity Factors
No Mapped Sensitivity Factors
USGS 1:24000 Topomaps
www.historicvermont.org
Scale: 1:13,445
Map center: 487760, 267447
Vermont ArcheoMap
VERMONT
Project Area
MONTGOMERY
River
Covered Bridge
44-54-40 N
44-54-20 N
44-54-0 N
72-40-0 W
72-39-40 W
72-39-20 W
72-39-0 W
72-38-40 W
BBS August 7, 2012 E:\CAD-GIS\ArcMap\ProjectFiles\4539-11-LongleyBridge\4539-Map2.mxd
0
1,000
2,000 Feet
200
400
600 Meters
Vermont ArcheoMap
(VDHP 2012)
HARTGEN
archeological associates inc
Map 2

Historic Site File Research and Historic Sensitivity

Historic Sites

An examination of the VDHP archeological site files indicated that there is one historic archeological site located within one mile of the project APE. Historic cellar holes, designated Site VT-FR-280, were identified in the Village of Montgomery, approximately one mile (1.6 km) southeast of the APE.

Cemeteries

Study of *Burial Grounds of Vermont* indicates that there are no known cemeteries located within or adjacent to the project area (Hyde and Hyde 1991).

National Register

The 1863 Longley Covered Bridge is listed on the National Register (NR) of Historic Places. The Longley bridge measures 84.5 feet long, 19.5 feet wide, and has a 16 foot wide roadway. The bridge consists of a single span supported by two flanking timber Town lattice trusses (NR Nomination Form 1974:2). The bridge's history and significance is summarized thus in the NR form:

> The Longley Covered Bridge crosses the Trout River northwest of Montgomery Village. Five other covered wooden bridges remain in the Town of Montgomery, giving it the highest concentration of covered bridges by town in Vermont. Two brothers, Sheldon and Savannah Jewett of Montgomery, built all six of the bridges; they completed the Longley Bridge in 1863, the oldest among their bridges whose dates are known. The Jewetts used Town lattice trusses in all of their bridges, which also share common architectural design and similar dimensions (NR Nomination Form 1974:3).

The timber used in the construction of the Jewett brothers' bridges was prepared at their own mill, which had been located in the West Hill district of Montgomery near one of the extant covered bridges. (NR Nomination Form 1974)

State Register

There are two historic structures and/or farm complexes located in the project vicinity which are listed on the Vermont Historic Sites & Structures Survey (VHSSS). None of these properties listed on the VHSSS will be impacted by Longley Covered Bridge rehabilitation project.

The Potvin Residence (originally the H.H. Rawson residence) is a Vernacular style house built c. 1845, which is located on the east side of VT RT 118, situated approximately 475 feet (145 m) north of the bridge (VHSSS Survey Number 0610-6). The survey form notes that the Potvin residence is a rare architectural type to Montgomery – a connected farmhouse, which is more often found in Maine. The original owner of the property, H.H. Rawson, was born in Massachusetts, but had lived in New Hampshire and Maine before moving to Vermont (VHSSS 1983).

The Longley Bridge Farm (originally the Samuel Head residence) is a c. 1850 farm complex, located on the south side of TH 4 (Longley Bridge Road), situated approximately 1,000 feet (310 m) west of, and within sight of, the Longley Covered Bridge (VHSSS Survey Number 0610-8). The survey form notes that the farm complex, situated at the end of a broad valley bordering the Trout River, is a well preserved example of a 19th-century Montgomery farmstead with a wide range of building types, methods of construction and stylistic references (Photo 2). The farm complex includes a c. 1850 central hall residence with Italianate additions, a c.1850 woodshed, a c. 1860 heifer barn, a c. 1880 blacksmith shop, a c. 1900 horse and pig barn, and the foundation remains of a barn and silo.

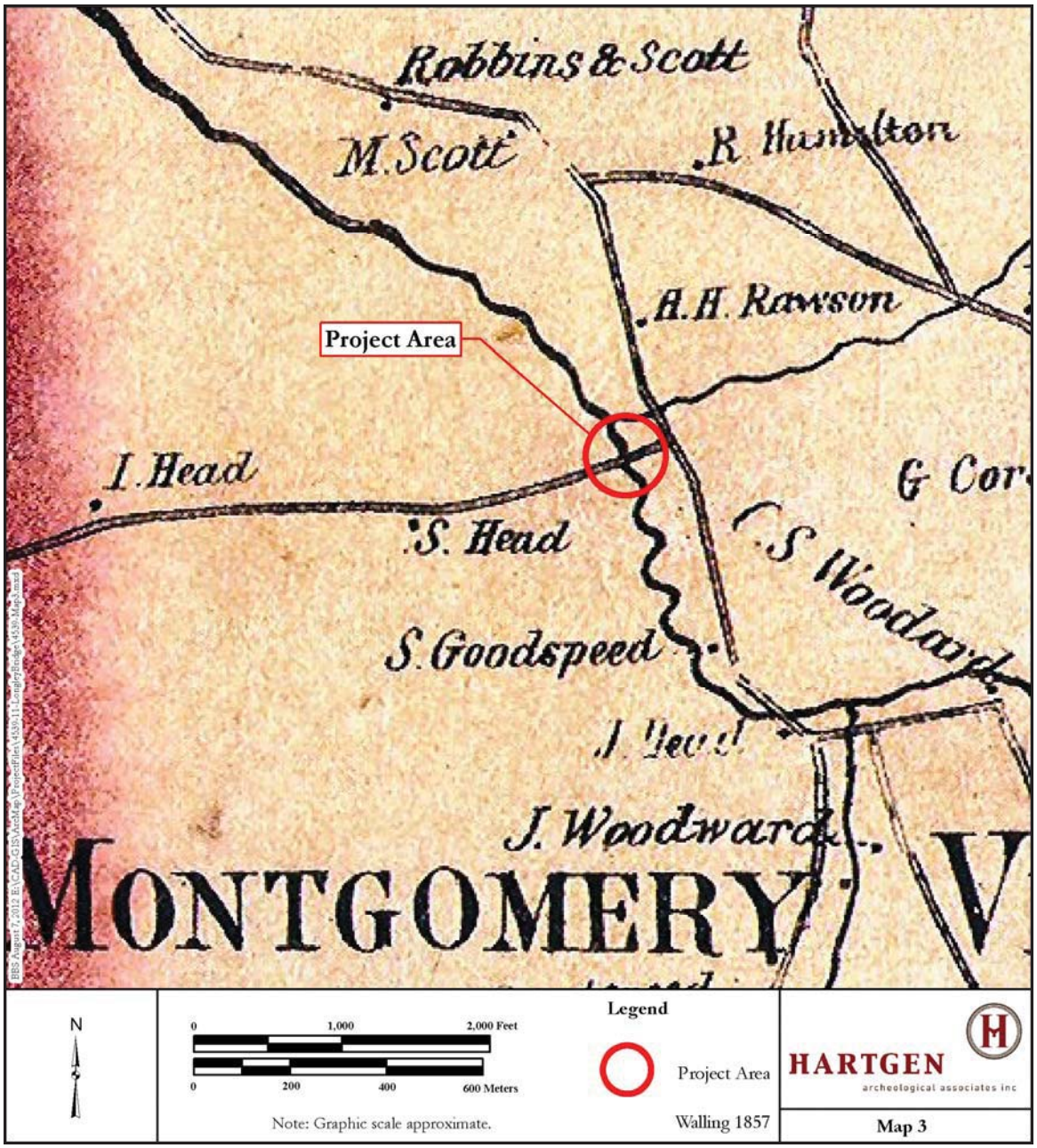
Photo 2. Photo shows the historic Samuel Head Farm complex located on Longley Bridge Road. Photo is taken from the bridge looking west.

Historic Maps and Archeological Sensitivity

A review of historic maps of the project area was conducted to attain an overview of the changing historical and environmental landscape within the project area. This review includes the study of historic structures that may be or may no longer be extant, alterations to road and rail systems, and changes in stream and river courses. Two 19th-century maps, the 1857 Walling map and the 1871 Beers map, depict the roadways and river and stream courses in the project area, as well as the names of the residents who lived there in those years (Maps 3 & 4).

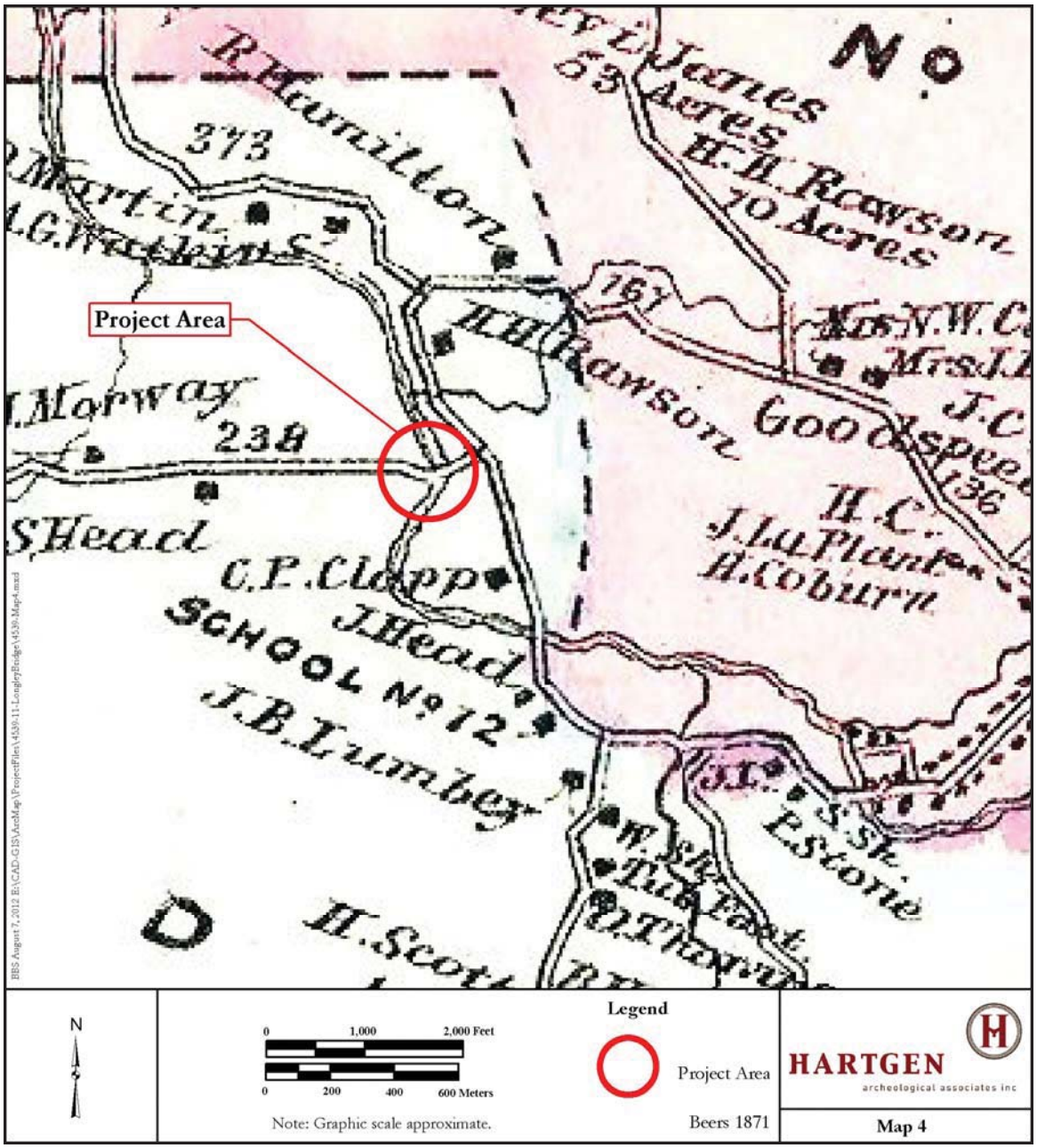
The 1857 map shows TH 4 with the S. Head farm complex, and a bridge crossing the Trout River. This bridge would have been the predecessor to the Longley Covered Bridge, which was reputedly built six years after this map was drafted. The H.H. Rawson residence is shown to the north of the bridge on the east side of VT118. The 1871 map depicts these same roads and domestic structures, and a bridge crossing – presumably the then eight-year old Longley Covered Bridge.

No other structures are depicted on historic maps in the vicinity of the covered bridge. The historical archeological sensitivity of the project area is considered to be low.



SITE RECONNAISSANCE AND RECOMMENDATIONS

A site visit was conducted by Hartgen archaeologist Elise Manning Sterling under sunny and warm conditions. Site reconnaissance suggests that the land located on the east and west approaches to the bridge have been subjected to ground disturbance from bridge and road construction.



The bridge was originally constructed with dry-laid stone block abutments, but these have been replaced or reinforced with concrete blocks which support the west and east sides of the bridge (Photos 3 and 4). From the level of the abutments, the banks of the river rise steeply upwards, leading to the terrace on which the TH4 and the bridge are situated. The bridge was constructed slightly higher than the adjacent terrace landforms, requiring fill to create the lead up ramps on the east and west side of the bridge (Photo 5). There is also evidence of erosion of the riverbank beneath the bridge from flooding. Based on alteration through both cultural and natural processes, the land directly adjacent to the bridge is considered to have low

Photo 3. Photo shows the abutment beneath the east side of the bridge. View is to the south.

Photo 4. Photo shows the abutment beneath the west side of the bridge. View is to the south.

Photo 5. Photo shows the western approach to the bridge. View is to the east.

precontact archeological sensitivity. Similarly, the terrace landform to the north of Longley Bridge has been impacted by the construction of the replacement bridge. However, the terrace landforms north of the replacement bridge, and south of Longley Bridge appear to be undisturbed, and as such, have precontact archaeological potential (Photos 6 and 7).

The area directly adjacent to Longley Bridge is considered to have low archeological sensitivity based on alteration through cultural and natural processes. Terrace landforms further distant from the immediate bridge area are considered to have precontact archaeological potential. If project plans will entail disturbance to undisturbed portions of the terrace, including possible staging areas, then further archaeological investigation is recommended. It is recommended that once the bridge rehabilitation plans have been drafted, that they be reviewed by an archaeologist to determine whether further archaeological investigation is needed.

Photo 6. The terrace landform located northeast of the replacement bridge. View is to the north.

Photo 7. The terrace landform located southwest of the Longley Covered Bridge. View is to the west.

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APPENDIX 1: VDHP Archaeological Resources Assessment Form

Vermont Division for Historic Preservation
Archeological Resources Assessment Form
Longley Covered Bridge Rehabilitation

DHP# _____
Organization & Recorder: **HAA. INC./ E. Manning**
Date: 8/1/2012

Envronmental Predictive Model				ArcheoMapTool GIS Model	Field Inspection Comments
Variable	Proximity	Value	Assigned Score	Variable	
A. Rivers and Streams (Existing or relict)					
1) Proximity to Rivers and Permanent Streams	0–90 m	12	**12**	Layer 1: Proximity to Rivers and Permanent Streams (0-180 m)	
	90-180 m	6			
2) Proximity to Intermittent Streams	0–90 m	12		-	
	90-180 m	6			
3) Proximity to Permanent River/Stream Confluences	0–90 m	8		Layer 6: Proximity to River/Stream Confluences (0-180 m)	
	90-180 m	4			
4) Proximity to Intermittent Stream Confluences	0–90 m	12		-	
	90-180 m	6			
5) Proximity to Waterfalls	0–90 m	8		Layer 7: Proximity to Waterfalls (0-180 m)	
	90-180 m	4			
6) Proximity to Heads of Drainages	0–90 m	8		Layer 5: Proximity to Heads of Permanent Drainages (0-300 m)	
	90-180 m	4			
7) Major Floodplain - Alluvial Terrace	0–90 m	8	**8**	Layer 10: Floodplain Soils Presence	
	90-180 m	4			
8) Knoll or Swamp Island		32		Layer 1: Proximity to Rivers and Permanent Streams (0-180 m)	
9) Stable Riverine Island		32		Layer 2: Proximity to Waterbodies (0-180 m)	
B. Lakes and Ponds					
10) Proximity to Pond or Lake	0–90 m	12		Layer 2: Proximity to Waterbodies (0-180 m)	
	90-180 m	6			
11) Proximity to Stream-Waterbody Confluences	0–90 m	12		Layer 4: Proximity to Stream-Waterbody Confluences (0-180 m)	
	90-180 m	6			
12) Lake Coves, Peninsulas, and Bayheads	0–90 m	12		Layer 2: Proximity to Waterbodies (0-180 m)	
	90-180 m	6			
C. Wetlands					
13) Proximity to Wetlands*	0–90 m	12		Layer 3: Proximity to Wetlands (0-180 m)	
	90-180 m	6			

Envronmental Predictive Model				ArcheoMapTool GIS Model	Field Inspection Comments
Variable	Proximity	Value	Assigned Score	Variable	
14) Knoll or Swamp Island		32		Layer 3: Proximity to Wetlands (0-180 m)	
D) Valley edge and Glacial Landforms					
15) High Elevated Landform (e.g. Knoll Top, Ridge Crest, Promontory)		12		See Landmarks (Info Layers) and Catchment layers (Water-related Layers)	
16) Valley Edge Features (e.g. Kame Outwash Terrace)		12		Layer 9 Glacial Outwash and Kame Terrace Soils	
17) Marine/Lake Delta Complexes		12		Layer 9 Glacial Outwash and Kame Terrace Soils Presence	
18) Champlain Sea or Glacial Lake Shore Line**		12		Layer 8: Paleo Lake Soils Proximity (0-180 m)	
E. Other Environmental Factors					
19) Caves and Rockshelters		32		-	
20) Natural Travel Corridors (e.g. Drainage Divides)		12	**12**	See Landmarks (Info Layers) and catchment layers (Water-related Layers)	
21) Existing or Relict Springs	0–90 m	8		-	
	90–180 m	4			
22) Potential or Apparent Prehistoric Quarry for Lithic Material Procurement	0–90 m	8		See Soils with "M" parent material (Under Construction)	
	90–180 m	4			
23) Special Environmental or Natural Area~	0–180 m	32		-	
F. Other High Sensitivity Layers					
24) High Likelihood of Burials		32		See VAI layer (Under Construction)	
25) High Recorded Archeological Site Density		32		See VAI layer (Under Construction)	
26) High likelihood of containing significant site based on recorded or archival data or oral tradition		32		See VAI layer (Under Construction)	

Envronmental Predictive Model				ArcheoMapTool GIS Model	Field Inspection Comments
Variable	Proximity	Value	Assigned Score	Variable	
G. Negative Factors					
27) Excessive (>15%) or Steep Erosional (>20%) Slopes		-32		See Slope Layer (Info Layers folder)	
28) Previously Disturbed Land***		-32		See Land Use ND Building Footprint Layers (Info Layers folder)	
Total Score:			**32**		

** remains incompletely mapped; digital layer includes paleo lakes and wetlands based on soils data
*** as evaluated by a qualified archeological professional or engineer based on coring, earlier as-built plans, or obvious surface evidence (such as a gravel pit)
~such as Milton acquifer, mountain top, etc. (historic or prehistoric sacred or traditional site locations, other prehistoric site types)
*Environmental predictive model limits wetlands to those > one acre in size; ArchSensMap

APPENDIX D

Meeting Minutes

Local Concerns Meeting
August 6, 2012

REGULAR MEETING OF THE SELECTBOARD & WATER COMMISSION TOWN OFFICE August 6, 2012 6:00 P.M. Unapproved

Scott called the meeting to order at 6:30

Selectboard Members present are Scott Perry, Carol McGregor, Wendy Howard, Susan Regan and Mark Brouillette.

1. Visitors: Shane Reed, Road Foreman, Barry Kade, Shawn James from Hoyle Tanner, Joseph Bicja also from Hoyle Tanner (Engineering Firm re: Longley Bridge repair)

Mark made a motion to accept the minutes from July 16, 2012. Carol seconded the minutes. Motion carried 5-0

2. Roads and Bridges

a. Longley Bridge - Montgomery received monies from a Federal Grant in the amount of $850,000. Parties discussed the details of bridge repair. Possible options. Next step is to set a public meeting for information on alternatives and feedback. Meeting set at Grange Hall for September 24, 2012 @ 7:00 pm

b. Irene State Reimbursement: Email went out requesting monies from the State. The state has had an increase on the amount they will reimburse from 75% to 90%. We are waiting on $3,700 in final monies.

c. Discontinue portion of TH14. Wendy made a motion to initiate the procedure for the discontinuance of a portion of Town Highway 14. This portion is a Class 4 portion of the road and is .9 or 9/10 of a mile starting at the intersection of TH 13 and TH 14 heading North. Carol seconded the motion. Motion carried 5-0 September 17, 2012 at 5:30 is a site visit at this location as well as hearing.

d. Loader repair/replacement. Fixed-removed from agenda

e. Dump Truck. Gas is in the oil. Still having trouble getting proper responses re: getting the work done via the warrantee. Carried Ove

f. Training. Shane will be setting up a plan for training on the plow.

3. Visitors. (discussed the Longley Bridge as previously state)

4. Water Commission Issues. Wendy made a motion to authorize Disconnect notices to be mailed and to disconnect water according to water ordinance. Carol seconded. Motion carried 5-0 .

5. Animal Cruelty Ordinance. We reviewed and discussed. Wendy cleaned up the draft of the Dog Ordinance. Sue to call VLTC re: the Animal Cruelty and get more information.

6. Old Business

a. Painting and small repairs for Town. Jay Adams in process of installing ceiling tiles in Grange Hall basement. New ceiling tiles to also be installed in Library. Fallen tree to be taken away at Library. Exterior painting has begun on Town Hall building. Les Gove finished Library roof and Cupola beautifully. Carol has been beautifying the front of the Grange Hall.

b. NWSWD follow up. Off agenda

c. Discussion of Fairpoint/e911 issue. There was a teleconference about the notification system. A letter was written to Fairpoint by Scott. Susan made a motion to send letter. Mark seconded the motion . Motion carried 5-0

d. Animal cruelty ordinance-Discussed above

e. Tax Sale Research Carried Over

7. New Business

a. Liquor Licenses-none

b. Overweight Truck Permits-none

8. Open and Mail/Sign Orders

Mark made a motion to Adjourn @ 9:32. Susan seconded the motion. Motion carried 5-0.

Respectfully submitted,
Susan J. Regan

Alternatives Presentation Meeting
December 13, 2012

TOWN OF MONTGOMERY
SPECIAL MEETING OF THE
SELECBOARD & WATER COMMISSION

Public Safety Building Conference Room
Thursday, December 13, 2012
7:00 p.m.

A special meeting to inform the public and seek public input on the rehabilitation/repair of the Longley Covered Bridge

UNAPPROVED

Scott called the meeting to order at 7:05 p.m.

Selecboard members present: Scott Perry-Chair, Carol McGregor and Wendy Howard-Vice Chair

Visitors present: Sean James (Hoyle Tanner) and Shane Reed (Road Foreman)

Members of the Public present: Sharon Perry, Mickey Doheny, Pat Farmer and Carol Farmer

Scott and Sean shared with those present the presentation previously presented to the Historic Covered Bridge Preservation Committee concerning the rehabilitation/repair of the Longley Covered Bridge.

Four alternatives were presented and discussed, of which two (3 & 4) have been approved by the Historic Covered Bridge Preservation Committee.

1) 6 ton (12,000 #) weight capacity -
2) 8 ton (16,000 #) weight capacity -
3) 16 ton (32,000 #) weight capacity – Glulam Augmentation
4) 20 tons (40,000 #) weight capacity - Preservation of Design

Members of the public supported the Selectboard and Sean that alternative # 4 is the best option for increasing weight capacity and preserving the design of the bridge for the longest duration.

Wendy made a motion to adjourn. Carol seconded and the motion carried 3-0. The meeting adjourned at 8:30 p.m.

Respectfully Submitted
Wendy Howard

Vermont Historic Covered Bridge Committee Meeting
October 25, 2012

Vermont Historic Covered Bridge Committee Meeting
November 27, 2012

Historic Covered Bridge Committee Meeting
November 27, 2012

Montgomery: Longley Covered Bridge

Attendance: VTrans: J.B. McCarthy, Mike Hedges, Wayne Symonds, John Weaver, Doug Bonneau, Scott Newman, Kaitlin O'Shea, Kevin Russell (project manager), Pam Thurber, and Bob McCullough (Historic Bridge Program); **Hoyle-Tanner, Consulting Engineers**: Sean James; **Preservation Trust of Vermont**: Eric Gilbertson; **Town of Montgomery**: Scott Perry, Carol McGregor; **Northwest Regional Planning Commission**: Bethany Remmers; **Vermont Covered Bridge Society**: Joe Nelson; **Restoration and Traditional Builders Consultant**: Jan Lewandowski

Introductory Report. J.B. McCarthy began the meeting with an invitation to Scott Perry and Bethany Remmers to provide reports concerning the transportation routes dependent upon the bridge, length and locations of detours for emergency service, traffic volume, availability of alternative sites for a new bridge and access road, and town requirements.

The town's very thorough report made it clear that fire and emergency service vehicles would be forced to make substantial detours of 18 or 23 miles to reach the active farm currently served by the Longley Bridge, and that those detours would require use of roads that are not always in passable condition. The town also reported that property owners in the vicinity of the bridge are not interested in conveying land to the town to create a new access road and bridge. The town clearly wants to preserve the historic bridge but also wants to make it as functional as possible and to develop the project in a way that will offer future protection for the bridge.

Discussion. Discussion then narrowed to consideration of the two viable methods of achieving the load rating required to make the bridge functional for the town's objectives: (1) the introduction of glu-laminated girders as a secondary structural system, accompanied by disassembly of the existing lattice trusses, replacement of members that have deteriorated beyond the point of repair (estimated to be about 50% - subject to inspection during disassembly) and reassembly; or (2) demolition of the existing covered bridge and construction of a new Town lattice truss, with retention of the existing roof structure.

Alternative 1: Would achieve a rating of H16 (32,000 lbs) and would require replacement of all existing floor beams with glu-laminated floor beams and would also require raising the bridge on its abutments, with a corresponding raising of the approaches, to accommodate the depth of the glu-laminated girders placed beneath the bridge.

Committee members considered the possibility of inserting the glu-laminated girders through the bridge as a way to avoid changes to the bridge elevation, reduce potential danger from flooding, and reinforce the trusses, thus increasing the load capacity beyond

32,000 lbs. The girders would also add the benefit of protecting the trusses. However, that alternative was regarded as too visually intrusive.

Concerns about Alternative 1 centered on the probability that overloaded vehicles would continue to use bridge as they have in the past, with no realistic method for enforcing a posted limit. Given potential overloading, questions remain concerning whether the budget assigned to this project would be adequate for a forty-year period, and whether the town would again be forced to make repairs during that period.

Additional concerns focused on the design, geometry, and size of the truss members as inadequate for the span.

Alternative 2: Offers the benefit of increasing the load capacity to 40,000 lbs, while also preserving the roof structure.

The obvious disadvantage is that it requires destruction of the historic bridge and is inconsistent with three specific provisions of the Historic Covered Bridge Preservation Plan, including (1) the principle objective of preserving material integrity of the historic bridge to the maximum extent possible; (2) Priority Treatment No. 1, which specifies that the deterioration of a large number of bridge elements should never justify the replacement of any single member capable of being repaired; and (3) the requirement that the preservation treatments should be applied in order of priority to the maximum extent possible before considering treatments lower in priority. Here, Alternative 1 is Priority Treatment No. 4, is feasible, and restricts consideration of other treatments lower in priority.

Conclusion. Town officials will discuss the two alternatives with members of the town and will report to the committee at a later date

APPENDIX E

Glossary

GLOSSARY

The following definition of terms is provided to assist the reader in comprehending this report. Not all terms provided herein have necessarily been used in the context of the report.

AASHTO: American Association of State Highway & Transportation Officials

Abutment: The outermost end supports on a bridge, which carry the load from deck to ground.

Annual Average Daily Traffic (AADT): The total volume passing a point or segment of a highway facility in both directions for one year, divided by the number of days in the year.

Approach: The part of the bridge that carries traffic from the land to the main parts of the bridge.

Arch: A curved construction, usually of stone, brick or concrete, that spans an opening.

Arch Bridge: A bridge whose main support structure is an arch. Additionally, the bridge may be termed a *through* arch, which is simply one where the roadway appears to go through the arch.

Arch Barrel: The inner surface of an arch extending the full width of the structure.

Beam: A rigid, usually horizontal, member whose primary function is to carry a transverse load, i.e., a load that causes bending.

Bearing: A device at the ends of beams that is placed on top of a pier or abutment. The ends of the beam rest on the bearing.

Bedrock: The solid rock layer beneath sand or silt.

Bed Timbers: Timber components typically located between the top of an abutment or pier and the underside of the truss bottom chord. Intended to serve as sacrificial components they are easily replaced when deteriorated from rot, thus protecting truss components from similar deterioration.

Brace: A structural support or to strengthen and stiffen a structure to resist loads.

Camber: A positive, upward curve built into a beam that compensates for some of the vertical load and anticipated deflection.

Cantilever: A projecting beam or member supported only on one end.

Cast-in-Place: Concrete poured within formwork on site to create a structural element in its final position.

Chord: A member at the top or bottom of a truss between which the vertical posts and

diagonal braces are positioned.

Cofferdam: A watertight temporary structure used in bridge building to keep water away from an area that has been pumped dry. It is used to create a dry section of a lake or riverbed, allowing construction of bridge foundations unimpeded by water.

Compression: The stress resulting from a pushing force on a member, which tends to shorten it (the opposite of tension).

Compression Member: An engineering term that describes a timber or other truss member that is subjected to squeezing or pushing. Also see tension member.

Continuous Span Beam Bridge: A simple bridge made by linking one beam bridge to another; some of the longest bridges in the world are continuous span beam bridges.

Crown: On road surfaces, where the center is the highest point and the surface slopes downward in opposite directions, assisting in drainage. Also a point at the top of an arch.

Damping: The action of reducing the vibration of an object. This tends to return the vibrating object to its original position.

Dead Load: The weight of a structure itself, including the weight of fixtures or equipment permanently attached to it.

Deck: The roadway portion of a bridge, including shoulders. Most bridge decks are constructed as reinforced concrete slabs, but timber decks are still seen in rural areas and open-grid steel decks are used in some movable bridge designs.

Deflection: The displacement of a structural member or system under load.

Diaphragm: Bracing that spans between the main beams or girders of a bridge or viaduct and assists in the distribution of loads.

Diagonal: A sloping structural member of a truss or bracing system.

Embankment: Angled grading of the ground.

End Post: The outwardmost vertical or angled compression member of a truss.

Federal Highway Administration (FHWA): FHWA administers the Federal-Aid Highway Program to create and maintain the transportation system. The FHWA is a part of the United States Department of Transportation and is headquartered in Washington, D.C., with field offices located across the United States.

Floor Beam: Horizontal members that are placed transversely to the major beams, girders or trusses; used to support the deck.

Force: Any action that tends to maintain or alter the position of a structure.

Gross Vehicle Weight (GVW): Refers to the total curb weight of the vehicle and payload. Expresses the maximum continuous load for vehicles traversing a bridge.

Guardrail: Structural barrier which is meant to keep vehicular traffic from leaving the roadway in the event of an accident. Guardrail may be steel beam with wooden posts, concrete barriers or numerous other types.

Hanger: A tension member serving to suspend an attached member.

Knee Brace: Additional support connecting the deck with the main beam that keeps the beam from buckling outward. Commonly made from plates and angles.

Lag: Crosspieces used to connect the ribs in centering.

Lateral Bracing: Members used to stabilize a structure by introducing diagonal connections.

Lattice: An assembly of smaller pieces arranged in a grid like pattern; sometimes used a decorative element or to form a truss of primarily diagonal members

Live Load: The moving load on a structure, including the weight of people, cars, and equipment, but not including wind load.

Load: Weight distribution throughout a structure; loads caused by wind, earthquakes and gravity affect how weight is distributed throughout a structure.

Load Posted: Any bridge or structure restricted to carrying loads less than the legal load limit. Load posting a bridge is required by National Bridge Inspection Standards when a bridge is not capable of safely carrying a legal load.

Lower Chord: The bottom horizontal member of a truss.

Masonry: Construction of stone and mortar. Concrete masonry involves the use of concrete masonry units, commonly, but incorrectly, referred to as “Cinder Blocks”.

Member: Any individual angle, beam, plate or other single component, which is a part of the overall bridge structure.

Pier: The middle supporting structure between two or more spans.

Portal: The opening at the ends of a through truss with forms the entrance. Also the open entrance of a tunnel.

Post: One of the vertical compression members of a truss that is perpendicular to the bottom chord.

Railing: A fence-like construction built at the outermost edge of the roadway or the sidewalk portion of a bridge to protect pedestrians and vehicles.

Reaction: The resistance of a support against the pressure of a loaded member.

Redundancy: A structural condition where there are more elements of support than are necessary for stability.

Redundant Member: A member in a bridge that renders it a statically indeterminate structure; the structure would be stable without the redundant member whose primary purpose is to reduce the stresses carried by the determinate structure.

Reinforced Concrete: Concrete that has been hardened onto embedded metal, usually steel, in the form of rods, bars, or mesh. The tensile strength of steel and the compression strength of concrete render a member capable of sustaining heavy stresses of all kinds over considerable spans.

Reinforcing Steel: Steel rods, which are placed in concrete to give it additional strength.

Rust Scale: The brown flaky material seen on the surface of steel, which is caused by corrosion.

Scour: The erosion of submerged piers and abutments or the soil beneath them from fast-flowing water.

Section Loss: The amount of an original member which has been lost due to heavy rust scale or rot and has reduced its strength because of that loss.

Shear: The sliding of one layer of a material relative to another layer.

Silt: Sediment particles ranging from 0.00016 to 0.0024 inches in diameter.

Skew: When the superstructure is not perpendicular to the substructure, a skew angle is created. The skew angle is the acute angle between the alignment of the superstructure and the alignment of the substructure.

Spalling: Areas of concrete where the surface has been affected by salt or other factors and has begun to break away.

Span: The distance a bridge extends between two supports.

Splice Plate: A plate that joins two girders. Commonly riveted or bolted.

Stringers: Members that run in the same direction as the traffic and which are underneath the riding surface and provide support for the riding surface.

Strut: A compressive member.

Substructure: The substructure consists of all parts that support the superstructure. The main components are:

- Abutments or end-bents

- Piers or interior bents
- Footings
- Piling

Superstructure: The superstructure consists of the components that actually span the obstacle the bridge is intended to cross. It includes:
Bridge deck,

- Structural members
- Parapets, handrails, sidewalk, lighting and drainage features

Tension: The stress resulting from a pulling force on a member, which tends to extend it (the opposite of compression).

Tension Member: Any timber or rod of a truss that is subjected to pull or stretch.

Through Truss: A truss that carries its traffic through the interior of the structure with crossbracing between the parallel top and bottom chords. Compare to deck truss and pony truss.

Tie: A tension member of a truss.

Torsion: An action that twists a material.

Truss: Lengths of timber, iron, or steel framed together, usually in the form of triangles, to bridge a space economically without bending.

Ultimate Strength: The highest stress that a material can withstand before breaking.

Uniform Load: A constant load across a member.

Upper Chord: Top chord of a truss.

Vertical Curve: A sag or crest in the profile of a roadway.

Voids: Holes in a stone abutment caused when a stone falls out.

Waterway: The available width for the passage of water beneath a bridge.

Wearing Surface: The topmost layer of material applied upon a roadway to receive the traffic loads and to resist the resulting disintegrating action; also known as wearing course.

Web Members: The intermediate members of a truss, not including the end posts, usually vertical or inclined.

Weephole: A hole in a concrete retaining wall to provide drainage of the water in the retained soil.

Wheel Load: The load carried by and transmitted to the supporting structure by one wheel of a traffic vehicle, a movable bridge or other motive equipment or device.

Wingwalls: A retaining wall that is a part of an abutment and used to keep the fill from falling into the stream.

X-Bracing: A form of additional supports for the piling of a bridge. The timbers are placed in a "criss-cross" pattern joining the supporting piling.

Yield: Permanent deformation that a metal piece takes when it is stressed beyond the elastic limit.

Yield Stress: The stress at which noticeable, suddenly increased deformation occurs under slowly increasing load.

Hoyle, Tanner & Associates, Inc.

CORPORATE HEADQUARTERS

150 Dow Street
Manchester, NH 03101

REGIONAL OFFICES

Pease International Tradeport
100 International Drive, Suite 360
Portsmouth, NH 03801

18 Lyman Street, Suite Q
Westborough, MA 01581

125 College Street, 4th Floor
Burlington, VT 05401

Nisky Center
East Wing - Suite 740
St. Thomas, USVI 00802

2424 North Essex Avenue
Hernando, FL 34442

95 E. Mitchell Hammock Road, Suite 200
Oviedo, FL 32765