-- HOMER STONE BROOK BERM REMOVAL --

FINAL REPORT

Date of Photo: Sept. 13, 2018

Location:	Homer Stone Brook, South Wallingford, Vermont
Client:	Rutland Natural Resources Conservation District
Town:	South Wallingford, Vermont
Consultant:	DuBois & King, Inc.
Date of Report:	January 31, 2019

EXECUTIVE SUMMARY

This Homer Stone Berm Removal Report details the existing conditions and the evaluation of design alternatives to mitigate flooding of the Homer Stone Brook between Homer Stone Road and the brook's railroad crossing. DuBois & King, Inc. (D&K) has observed site conditions of this brook reach, including approximately 1,000 feet upstream where high flows left the channel. In addition to the design alternatives, this report discusses a "Do-Nothing" approach as well as the consideration of property buyouts. Some of the existing conditions and events that have led to this report are listed below:

- Upstream flows leaving the brook channel, causing erosion and flood conditions for residences along Homer Stone Road and Audy Road
- Migration of large boulders along the brook channel
- Bank erosion or destabilization resulting in woody debris falling into the brook channel
- Historical straightening of the brook, abandoning the original brook channel
- Inadequate hydraulic capacity at the railroad, causing lateral or back flow of higher flows and creating erosion and failure along the railroad corridor
- Berming along the brook channel to contain higher flow events, which do not allow access of the flows to the floodplain

D&K has considered several alternatives to mitigate flooding or allow flood waters to enter the floodplain and return to the brook channel. After a public meeting on December 18, 2018, alternatives were selected for the final report. The full list of alternatives considered follows:

- Modify the hydraulic capacity of the railroad bridge crossing, which includes returning the hydraulic capacity to the 1979 FEMA study grades, vertically increasing the hydraulic capacity and increasing the hydraulic capacity both horizontally and vertically;
- Remove berms along the brook to allow higher flows to enter the floodplain adjacent to the brook;
- Construct flood chutes to convey flows that have left the channel so they return;
- Increase hydraulic capacity of the existing channel;
- Return some flows to the original brook channel and maintain the existing channel for higher flow events;
- Raise Homer Stone Road; and
- Over-excavate along the brook channel, increasing the hydraulic capacity of the brook, allowing higher flows to enter the floodplain and returning flows to the brook channel.

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SECTION 1

1.0 DESCRIPTION OF PROJECT

1.1 General

1.1.1 Introduction

The Rutland Natural Resources Conservation District (RNRCD) contracted DuBois & King, Inc. (D&K) to evaluate a portion of the Homer Stone Brook in South Wallingford, Vermont. This section of the brook has undergone various levels of effort to help mitigate flood damage, resulting in the installation of multiple berms that may or may not protect the intended areas. D&K used hydraulic and hydrologic modeling to compared the existing conditions to several alternatives along the brook, including the removal of one or more berms, returning this section of the brook to its historical alignment and hydraulic capacity, and constructing flood chutes.

1.1.2 Purpose of Work

In previous flooding events, a portion of the railroad experienced significant erosion causing an area of the railroad tracks to be unusable for rail transportation. Additionally, homes in close proximity to Homer Stone Brook have flooded during large storm events, such as Tropical Storm Irene. These home are at risk of flooding in the event of another large storm.

1.2 Description of Project

1.2.1 Location

The section of the brook considered for the evaluation was between Homer Stone Road and the Vermont Railroad bridge, immediately north of residences on Audy Lane.

Latitude: 43.407578°
Longitude: -72.989901°

From Rutland, travel south on Route 7 for approximately 14 miles. Turn right onto Hartboro Road. Then turn right onto Homer Stone Road. Approximately 0.5 miles south, Homer Stone Brook passed under Homer Stone Road.

See Figure 1 – Locus Plan

1.3 Existing Conditions

1.3.1 Existing Conditions Plan

The conditions of this section of Homer Stone brook are shown in Figure 2 and include an overview of the site and surrounding area.

SECTION 2

2.0 CONSIDERED ALTERNATIVES

2.1 Do Nothing

Under this alternative, no action will be taken to mitigate flooding or erosion on Homer Stone Brook. The Do Nothing alternative is specifically evaluated to determine baseline conditions and assess the risks associated with the hazard zones. The straightened and incised stream channel will remain as is and no effort to manage bank erosion or mitigate flooding will be undertaken. There will be no improvements to the existing infrastructure, i.e., the State-owned railroad bridge, the Town-owned bridge, or Homer Stone Road.

If no action is taken, flooding and erosion associated with Homer Stone Brook will continue unmitigated. Stream banks will continue to erode as the stream strives to reach equilibrium with its high sediment load and the presence of two undersized bridges and an over-straightened stream channel. Deposition of sediment at the railroad bridge will continue to reduce capacity under this structure, resulting in more frequent backwatering during floods and increasing the potential for unpredictable channel avulsion. There is high potential for the stream to change its course, which may eventually result in reactivation of abandoned side channels, including the previous stream channel and the flood chute created during Tropical Storm Irene in 2011. Though this dynamic natural adjustment is normal for a stream in an alluvial fan setting, the presence of adjacent houses and public infrastructure make this No Action alternative an unsustainable option.

See Figure 1 in Appendix B for the approximate inundation extents for this Alternative.

2.2 Hydraulic Capacity of Railroad Bridge

Several alternatives can be used to modify the railroad bridge crossing, including raising the bridge, excavating deeper than the FEMA FIS elevations, increasing the bridge span, and utilizing horizontal drilling to install a culvert or other feature to convey flows during larger rainfall events. The end result will be dependent on discussions with VRS and VTRANS, an evaluation of costs associated with each alternative, and other procedural issues, such as the length of time the railroad would be closed to traffic.

In conversations with VRS, Shane Filskov indicated that raising the railroad approximately 3 feet would require approximately 1,000 feet of runout. This runout could affect additional crossings such as Hartsboro Road. Additionally, raising the railroad would require an evaluation of the structural capability of the existing crossing.

The costs associated with exploring the railroad alternatives vary significantly and would be based on design conversations with VRS and VTRANS. The costs for each railroad option were not included in the opinion of probably construction costs. Work within the railroad right-of-way will require a flagger ($75/hr) and the design of a new railroad bridge is approximately 10% of the construction costs. We estimate the construction cost to be approximately $250,000.00.

For this alternative, we have considered modifying the hydraulic capacity of the railroad bridge by lowering the channel bottom at the railroad bridge to 627.0 feet and increasing the bridge span distance. The area beneath the railroad bridge will be over-excavated, the channel will be graded to the upstream and downstream reaches of the brook, and the bridge span will be increased. The grades (channel bottom and banks) along the channel will be designed to convey design flows, including the slope along the brook alignment and channel lining. The design of the railroad bridge will be dependent on conversations with VRS and VTRANS. The design options may include raising the bridge, increasing the bridge span, performing horizontal drilling to install a culvert, or a combination of options.

By lowering the channel bottom, the hydraulic capacity at the railroad bridge is increased. The H+H analysis calculates the 100-year flood elevation to be 637.6 feet, which does not overtop the railroad tracks. See the Rail Bridge Modification Section (Sheet 6 of 7) in Appendix A for more information.

If the channel bottom is lowered beyond the FEMA FIS elevations, the bridge support/foundation systems will need to be evaluated for structural and elemental (frost depth, scouring, etc.) capabilities.

See Figure 2 in Appendix B for the approximate inundation extents for this alternative.

Our opinion of probable cost for this alternative is $589,600.00, which includes construction costs, design costs, and permitting costs. See Appendix D for the breakdown of the opinion of probable cost for this alternative. This is the second most expensive alternative. In comparison to the existing condition inundation map (see Figure 1 in Appendix B), this alternative reduces flooding along the southern portion of the railroad (see Figure 2 in Appendix B). This alternative has a minimal effect at reducing flooding surrounding the residential structures on Audy Lane, as well as flooding along the northern portion of the railroad where damage has occurred previously.

This alternative requires local and state permitting. A local Flood Hazard Area Permit is to be completed and approved by the Zoning Administrator. Additionally, the state Vermont Stream Alteration General Permit will be required. Blank application forms for both permits are provided in Appendix E. Federal permitting for work to be completed within the floodplain is typically associated with structures. We anticipate the work associated with the Flood Hazard Area Permit application will satisfy any federal requirements.

2.3 Remove Berms, Reconnect Flows, and Widen Brook Channel

This alternative includes the removal of berms along the brook alignment, restoring the former brook channel, constructing a flood chute to reconnect flood waters to the brook, and widening the channel bottom along the brook channel where it is narrower than 15 feet. The removal of the berms along the brook alignment would allow higher flows to enter the floodplain area. In order to reduce the effects of the flood waters, higher flows will need to be slowed down, allowed to leave the brook channel, and returned to the brook with reduced velocities. The configuration proposed in this alternative conveys flows through the former brook channel during smaller rainfall events, allows flows during larger rainfall events to be conveyed in the current brook channel, and routes flows from extreme rainfall events back to the brook channel prior to the railroad bridge crossing. To widen the channel, the channel will be over-excavated and designed stone types will be placed to safely convey flows during each of the design rainfall events.

See Brook, Flood Chute, & Road Section (Sheet 7 of 7) in Appendix A for more information.

See Figure 3 in Appendix B for the approximate inundation extents for this alternative.

Our opinion of probable cost for this alternative is $442,100.00, which includes construction costs, design costs, and permitting costs. See Appendix D for the breakdown of the opinion of probable cost for this alternative. This is the second least expensive alternative. In comparison to the existing condition inundation map (see Figure 1 in Appendix B), this alternative reduces flooding surrounding the residential structures on Audy Lane (see Figure 3 in Appendix B). By reestablishing the former channel, the flood waters will be directed away from the residential structures. Additionally, the constructed flood chute will allow flood water to be directed back into the stream channel and reduce the flooding along the northern portion of the railroad.

See Alternative 2.2 (Section 2.2) for local and state permitting requirements. Prior to the development of this alternative past the 30% design level, the project should acquire written agreements with adjacent landowners for work to be completed on their property(s).

2.4 Raise Homer Stone Road

This alternative proposes to raise the road approximately 2 feet. The pavement on the road will be removed and the roadway would be over-excavated, where necessary. Granular subbase (fine and course graded) will be placed and the roadway will be paved.

See Brook, Flood Chute, & Road Section (Sheet 7 of 7) in Appendix A for more information.

Our opinion of probable cost for this alternative is $110,740.00, which includes construction costs, design costs, and permitting costs. See Appendix D for the breakdown of the opinion of probable cost for this alternative. This is the least expensive alternative. In comparison to the existing condition inundation map (see Figure 1 in Appendix B) and Alternative 2.3 inundation map (see Figure 3 in Appendix B), this alternative reduces flooding surrounding the residential structures on Audy Lane (see Figure 4 in Appendix B). The raised road restricts flood waters from crossing the road and directs the water back into the stream channel at the Homer Stone Road bridge.

See Figure 4 in Appendix B for the approximate inundation extents for this alternative. The work associated with this alternative should be considered routine maintenance, depending on the limit of disturbance and the change in impervious area, if any.

Prior to the development of this alternative past the 30% design level, the project should acquire written agreements with adjacent landowners for work to be completed on their property(s).

2.5 Remove Berms, Reconnect Flows, Widen Brook Channel, and Raise Road

This alternative includes the activities included in Alternatives 2.3 and 2.4.

See Brook, Flood Chute, & Road Section (Sheet 7 of 7) in Appendix A for more information.

See Figure 5 in Appendix B for the approximate inundation extents for this alternative.

See Alternative 2.2 (Section 2.2) for local permitting and state permitting requirements.

Our opinion of probable cost for this alternative is $521,300.00, which includes construction costs, design costs, and permitting costs. See Appendix D for the breakdown of the opinion of probable cost for this alternative. This alternative has the median probable cost. In comparison to the existing condition inundation map (see Figure 1 in Appendix B) and the other considered alternatives (see Figures 2-4 in Appendix B), this alternative significantly reduces the flooding surrounding the residential structures on Audy Lane (see Figure 5 in Appendix B). The flood water upstream of Homer Stone Road bridge will be restricted from flowing over the road to Audy Lane and will be directed back into the stream channel at Homer Stone Road bridge. The flood water downstream of the Homer Stone Road will be directed into the reestablished former channel and constructed flood chute.

Prior to the development of this alternative past the 30% design level, the project should acquire written agreements with adjacent landowners for work to be completed on their property(s).

2.6 Property Buyouts

Under this alternative, some or all of the residential structures in the floodplain of Homer Stone Brook would be acquired by the Town of Wallingford and the parcels converted into open space. According to the modeling performed for this report (see Appendix B – Figure 1), there are a total of seven residential structures in the floodplain of Homer Stone Brook. These structures have a total value, according to the 2018 Wallingford grand list, of $853,200. Given the model results, the risk to life and property from flooding is higher than what is conveyed by the existing mapped FEMA Special Flood Hazard Area (see Appendix C), which only includes two residential structures. These structures have a total value of $254,700 according to the 2018 Wallingford grand list.

Removing residential infrastructure from the hazard area could reduce or eliminate the risk to life and private property. Additionally, by reducing the need to actively manage the channel to protect homes, Homer Stone Brook could begin to naturally adjust in order to achieve equilibrium and reduce erosion. However, some channel management activities may still be necessary to protect Homer Stone Road, the rail bridge, and any structures that are not removed.

Since 1993, FEMA's hazard Mitigation Grant Program has funded the acquisition of over 37,000 flood-damaged properties. The program is voluntary and no homeowner is required to sell their property and move because their home is located in an area subject to repetitive flooding. Since 2011, over 135 buyouts have occurred in Vermont. Local governments usually oversee these floodplain buyouts and ultimately take ownership of the site. Once the properties are purchased and removed, the land must be dedicated to open space, recreational, or wetland management uses. A property eligible for a buyout would be purchased at the fair market value, determined by a certified appraiser and based on comparable homes. Any debt connected to the property must be paid off prior to the municipality receiving ownership. Debts on the property are paid off through the proceeds of the sale with the remainder of the proceeds being paid to the property owner.

FEMA may contribute up to 75 percent of the cost of a buyout project. FEMA funding may be obtained through the Hazard Mitigation Grant Program, which provides funds after presidential disasters are declared in an area, and through annual funds from the Pre-Disaster Mitigation and Flood Mitigation Assistance Programs. Additional federal funds may be obtained through the Community Development Block Grant administered by the U.S. Department of Housing and Urban Development. The state and/or local government typically contribute the remaining nonfederal share, although the homeowner may also be a source of funding. The funding sources for the remaining share may be valued in cash, in-kind services, or materials. The town must submit buyout applications on the homeowner's behalf and a FEMA decision can take between 6-18 months, although more thorough applications may move more quickly. For further information on the process, requirements, and deadlines, contact the Vermont Emergency Management (VEM) Hazard Mitigation Officer. As of the publication of this document, Lauren Oates (Lauren.oates@vermont .gov) is the VEM Hazard Mitigation Officer.

Our opinion of probable cost for this alternative is $938,520.00. Our opinion of probable cost is the total value, according to the 2018 Wallingford grand list, of the seven residential structures in the floodplain of Homer Stone Brook, as well as, a 10% contingency. See Appendix D for the breakdown of the opinion of probable cost. This alternative is the most expensive and does not mitigate flooding in the area.

FIGURES

NOTES:

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2. PROPERTY LINE INFORMATION WAS DOWNLOADED FROM THE VCGI WEBSITE ON SEPTEMBER 11, 2018. LOCATIONS SHOULD BE CONSIDERED APPROXIMATE. SOURCE YEAR 2000.

LEGEND

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60 0 30 60 120

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PRELIMINARY PLANS NOT FOR CONSTRUCTION

NO.	DATE	DESCRIPTION	BY	CK'D

CLIENT

RUTLAND NATURAL RESOURCES CONSERVATION DISTRICT

PROJECT

HOMER STONE BROOK BERM REMOVAL

SOUTH WALLINGFORD, VT

SHEET TITLE

LOCATION MAP

DRAWN BY	DATE
LNM	JAN 2019
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1

SHEET 1 OF 2

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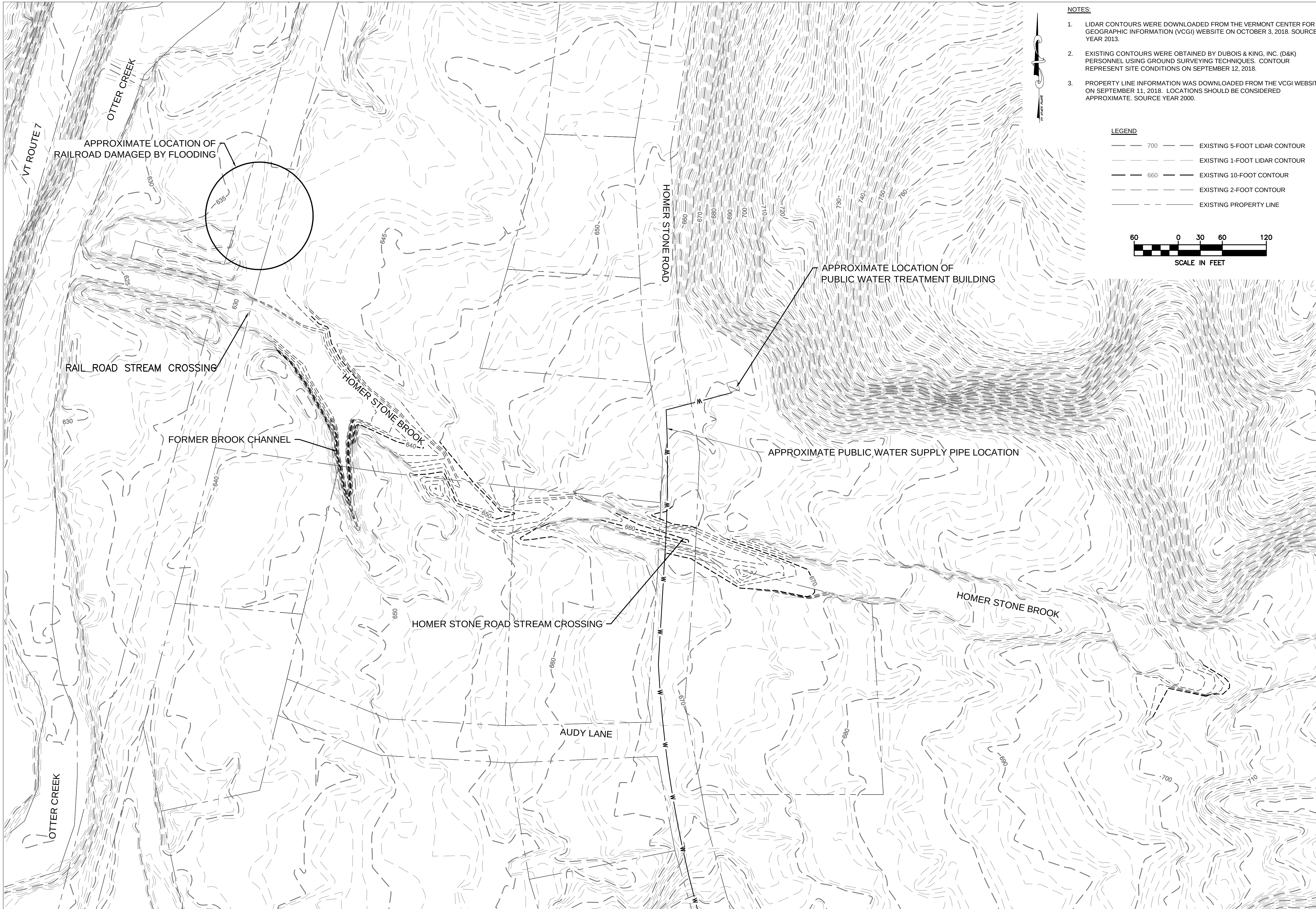

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- 700 EXISTING 5-FOOT LIDAR CONTOUR
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- 660 EXISTING 10-FOOT CONTOUR
- EXISTING 2-FOOT CONTOUR
- EXISTING PROPERTY LINE

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HOMER STONE BROOK BERM REMOVAL

SOUTH WALLINGFORD, VT

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2

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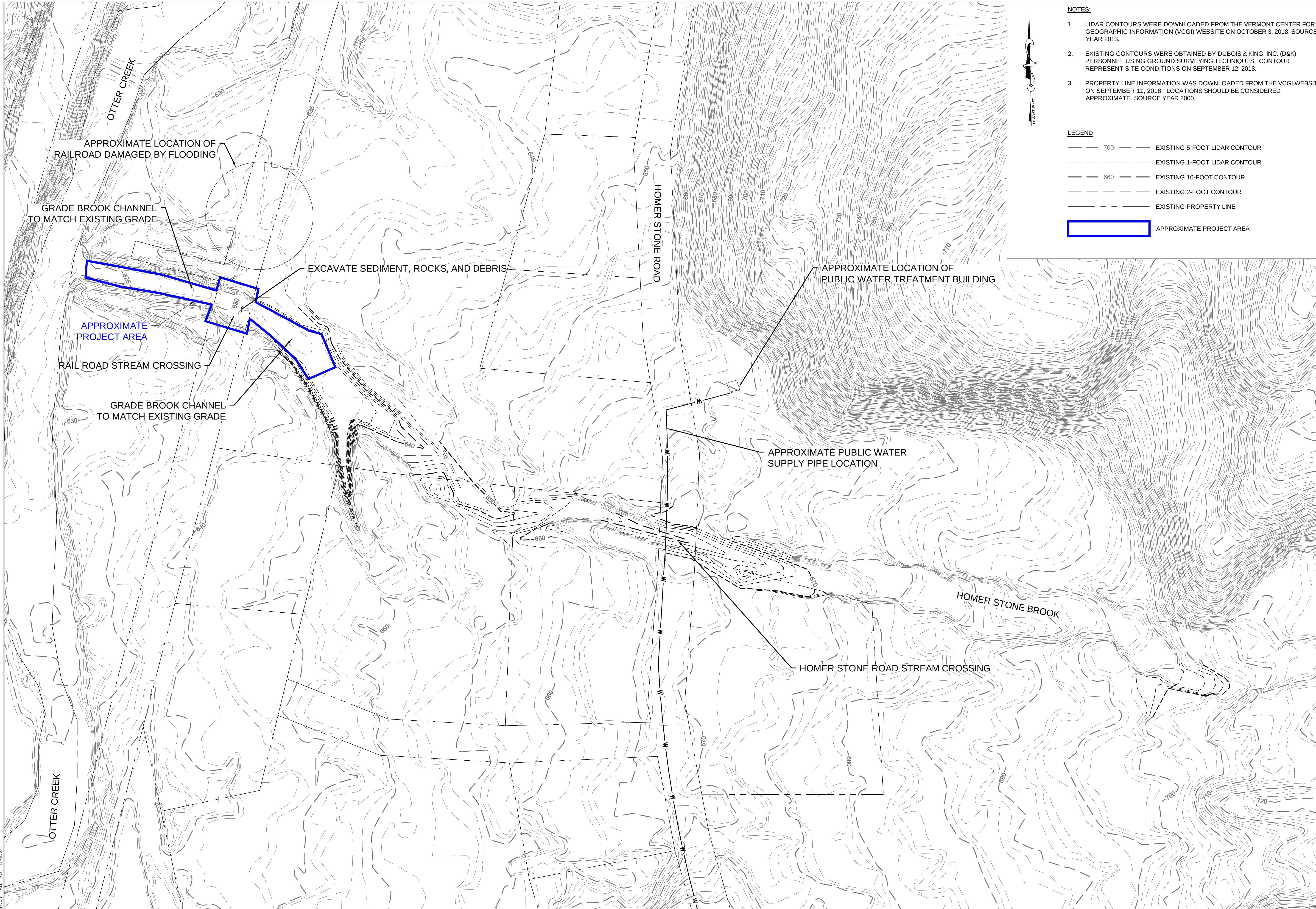
APPENDIX A:

30% Design Plans



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HOMER STONE BROOK BERM REMOVAL

SOUTH WALLINGFORD, VT

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PROPOSED WORK AREA PLAN (RAIL BRIDGE)

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MPH	124690
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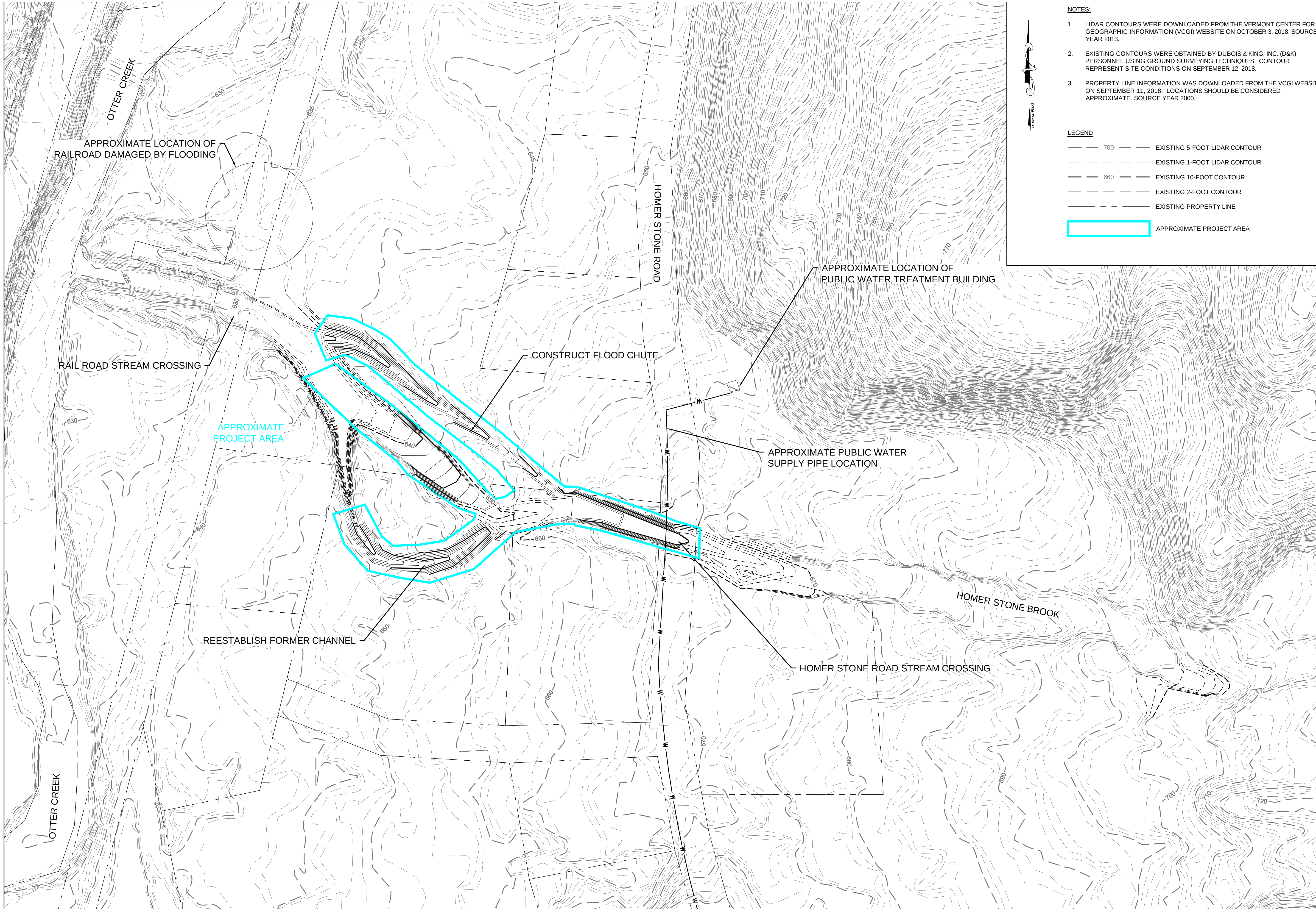

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RUTLAND NATURAL RESOURCES CONSERVATION DISTRICT

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HOMER STONE BROOK BERM REMOVAL

SOUTH WALLINGFORD, VT

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PROPOSED WORK AREA PLAN (BERMS, FLOOD CHUTES, & CHANNEL)

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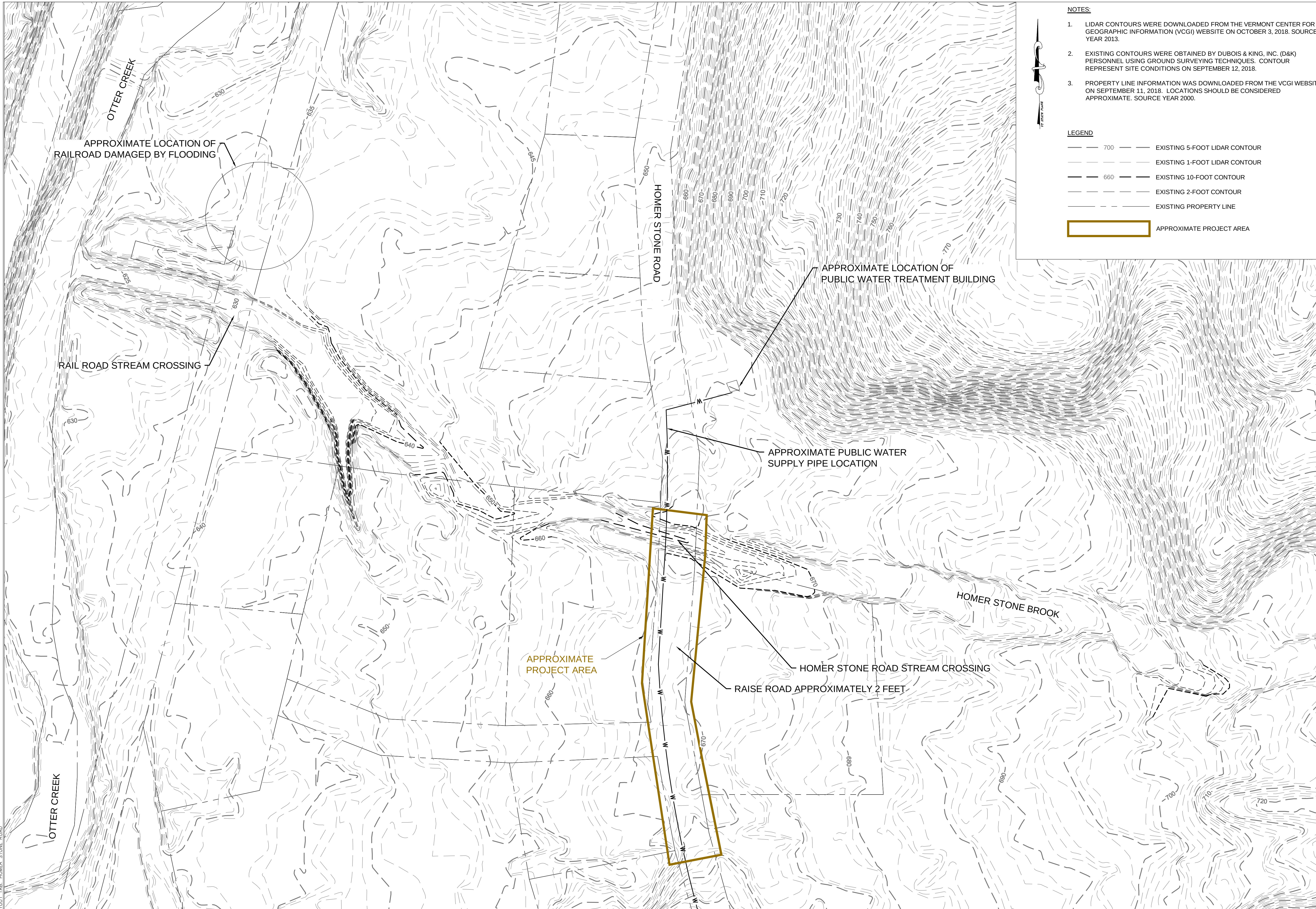

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HOMER STONE BROOK BERM REMOVAL

SOUTH WALLINGFORD, VT

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PROPOSED WORK AREA PLAN (HOMER STONE ROAD)

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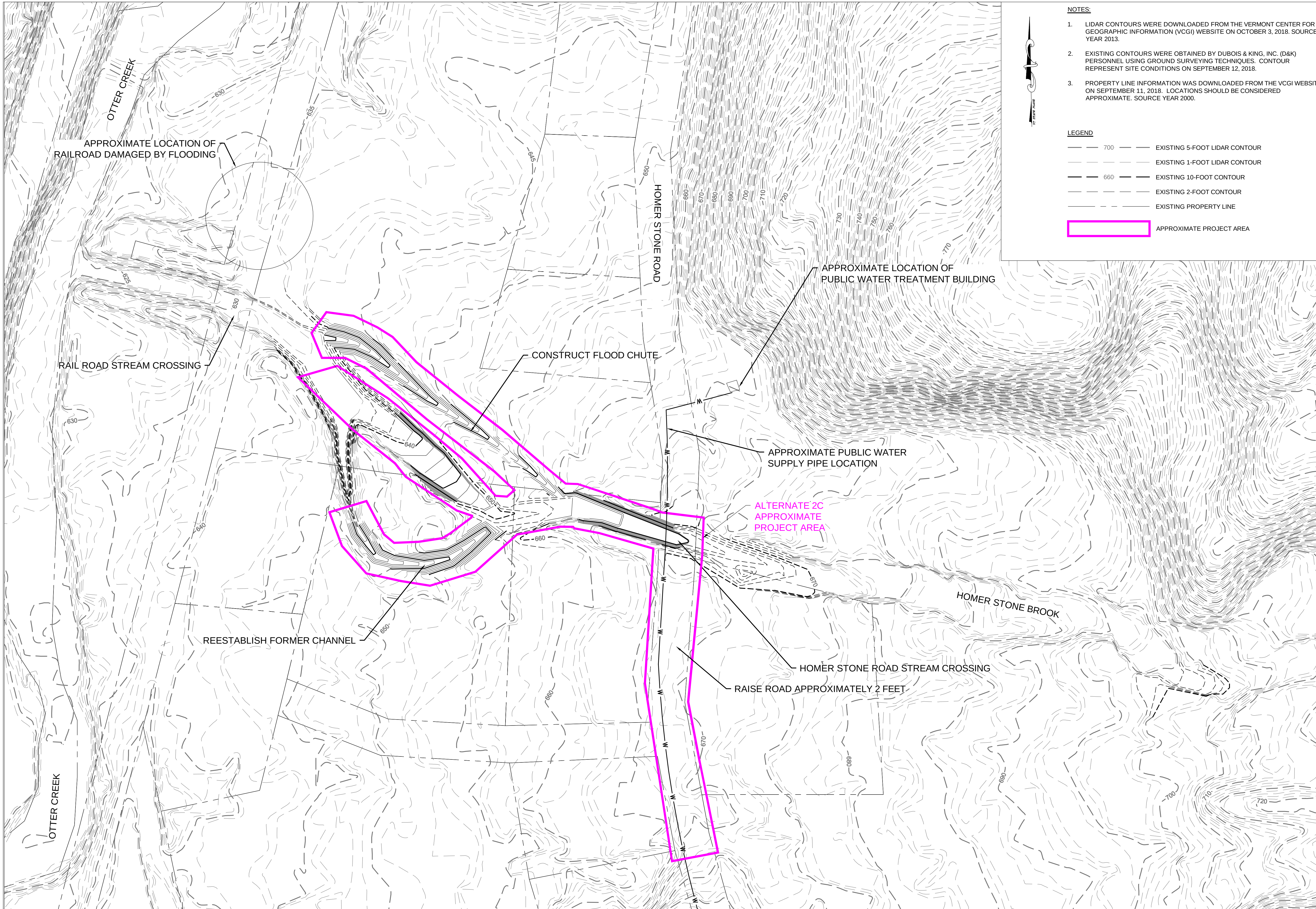

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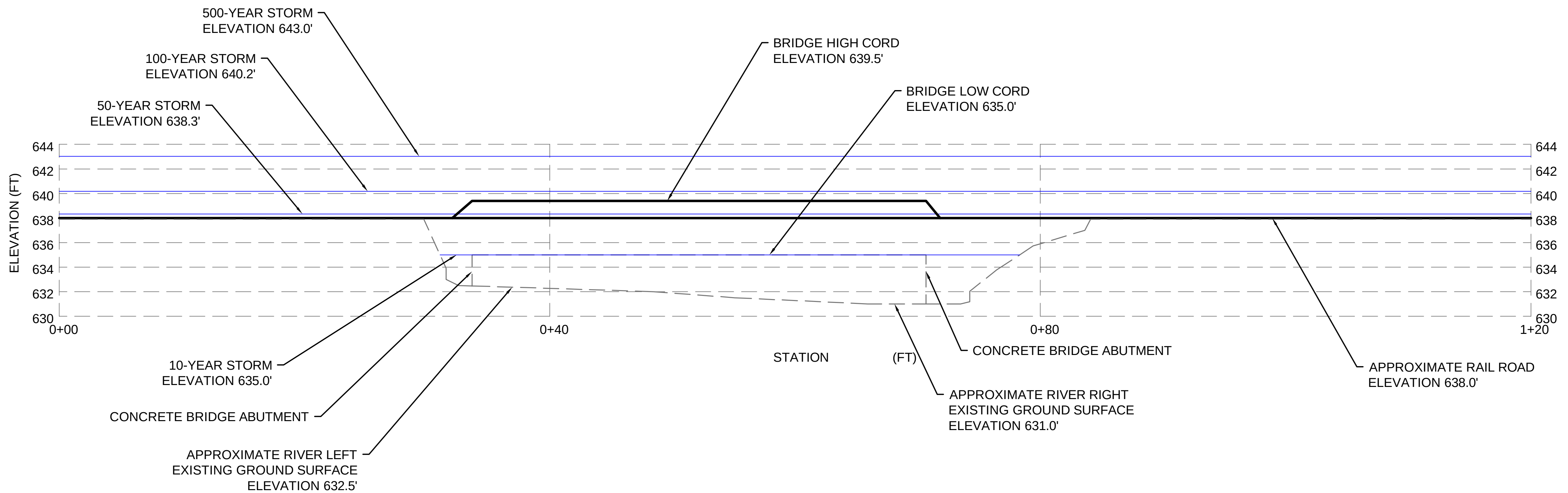

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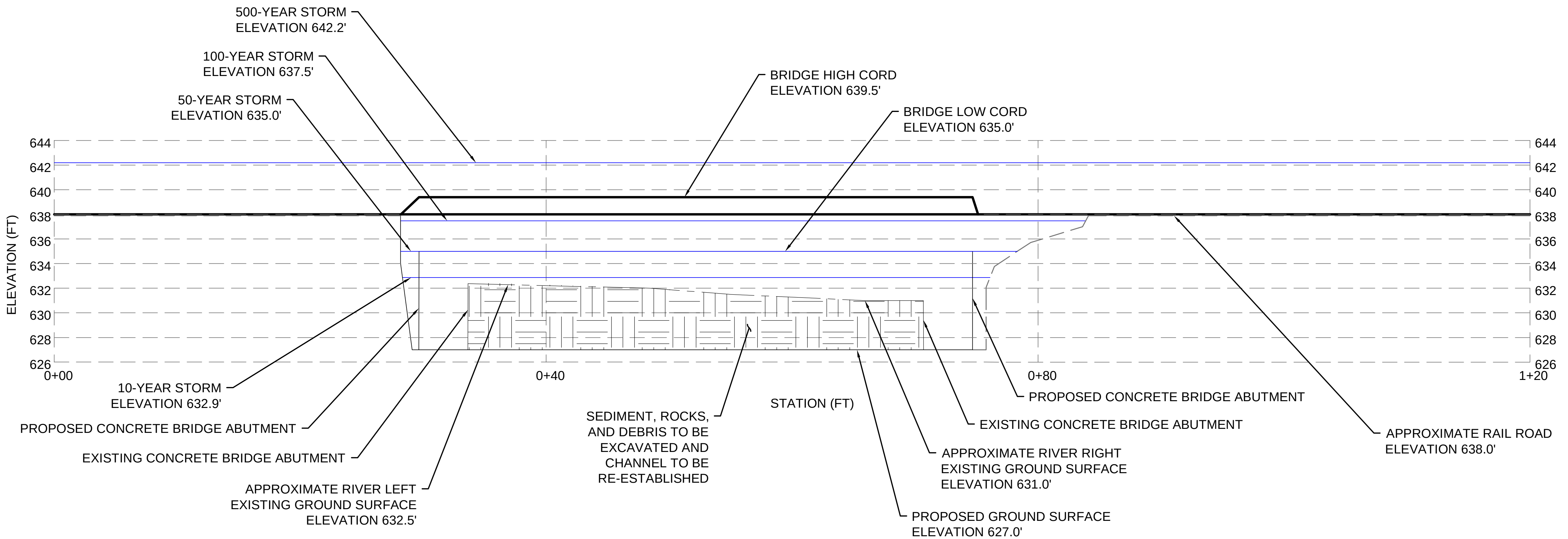
5



RAIL BRIDGE MODIFICATION SECTION

NOTES:

1. THIS ALTERNATIVE INCLUDES INCREASING THE BRIDGE SPAN AND LOWERING THE CHANNEL BOTTOM TO 627.0' (BELOW FEMA FIS ELEVATION). THE RAIL BRIDGE WILL NEED TO BE REDESIGNED FOR THE INCREASED SPAN DISTANCE.

2. ADJUSTING THE CHANNEL BOTTOM WILL REQUIRE THE UPSTREAM AND DOWNSTREAM CHANNEL BOTTOM TO BE ADJUSTED TO BLEND THE CHANNEL ALIGNMENT SLOPE.

DuBois & King Inc.
ENGINEERING · PLANNING · MANAGEMENT · DEVELOPMENT
28 NORTH MAIN ST.
RANDOLPH, VT 05060
TEL: (802) 728-3376
FAX: (802) 783-7101
www.dubois-king.com
RANDOLPH, VT
SO. BURLINGTON, VT
SPRINGFIELD, VT
LACONIA, NH

PROFESSIONAL SEAL

PRELIMINARY PLANS NOT FOR CONSTRUCTION

NO.	DATE	DESCRIPTION	BY	CK'D

CLIENT

RUTLAND NATURAL RESOURCES CONSERVATION DISTRICT

PROJECT

HOMER STONE BROOK BERM REMOVAL

SOUTH WALLINGFORD, VT

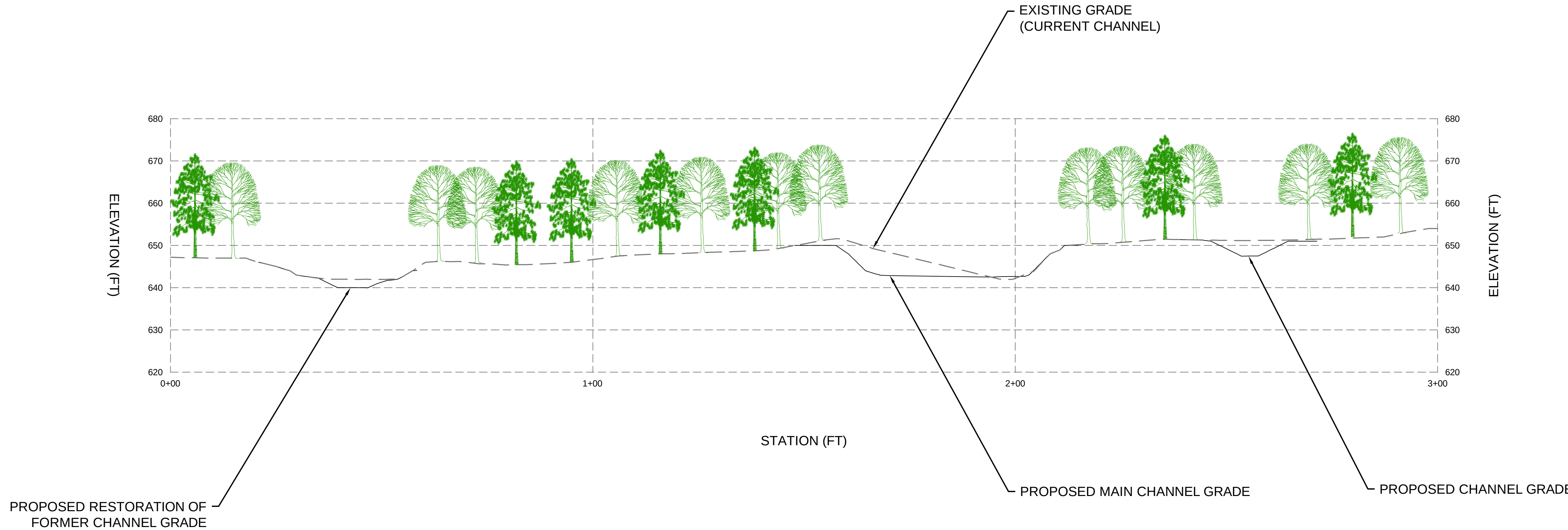
SHEET TITLE

RAIL BRIDGE MODIFICATION SECTION

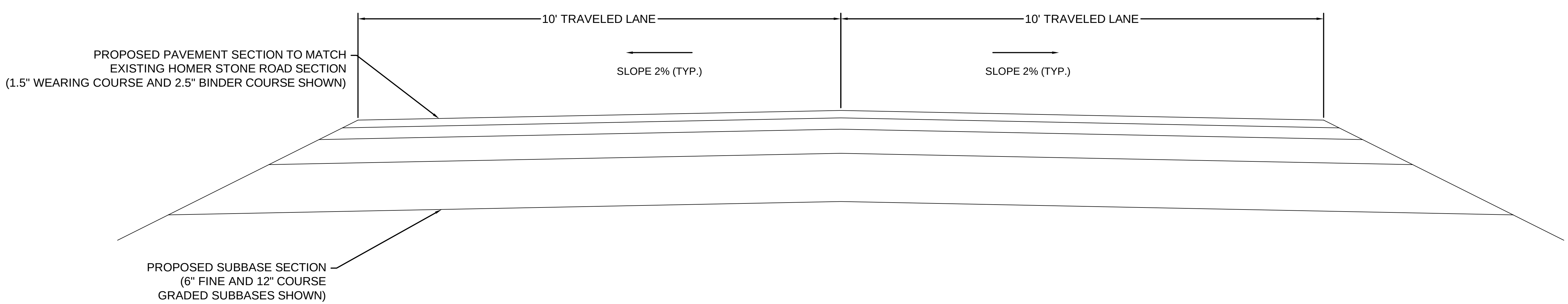
DRAWN BY	DATE
LNM	JAN 2019
CHECKED BY	D&K PROJECT #
MPH	124690
PROJ. ENG.	D&K ARCHIVE #
JBA	

SHEET NUMBER

6



ALTERNATIVE 2.3 SECTION



TYPICAL ROADWAY SECTION

NOTES:

1. ALTERNATIVE 2.3 INCLUDES RE-ESTABLISHING THE ORIGINAL STREAM CHANNEL, USING THE CURRENT CHANNEL AS OVERFLOW, CONSTRUCTING AN ADDITIONAL CHANNEL TO CONVEY LARGER STORM EVENTS BACK TO THE BROOK, AND WIDENING THE MAIN CHANNEL BOTTOM.
2. ALTERNATIVE 2.4 ONLY INCLUDES RAISING HOMER STONE ROAD APPROXIMATE 2'.
3. ALTERNATIVE 2.5 INCLUDES ACTIVITIES IN ALTERNATIVE 2.3 IN ADDITION TO RAISING HOMER STONE ROAD APPROXIMATELY 2'.

I:\1124690 RNRCD Homer Stone Brook\Drawings\CAD\Alternatives\20181129 - Main Channel Alternative.dwg 1/9/2019 9:11 AM LAYOUT TAB: ALT 2B & 2C SECTION

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LACONIA, NH

PROFESSIONAL SEAL

NOT FOR CONSTRUCTION PRELIMINARY PLANS

NO.	DATE	DESCRIPTION	BY	CK'D

CLIENT

RUTLAND NATURAL RESOURCES CONSERVATION DISTRICT

PROJECT

HOMER STONE BROOK BERM REMOVAL

SOUTH WALLINGFORD, VT

SHEET TITLE

BROOK, FLOOD CHUTE, & ROAD SECTION

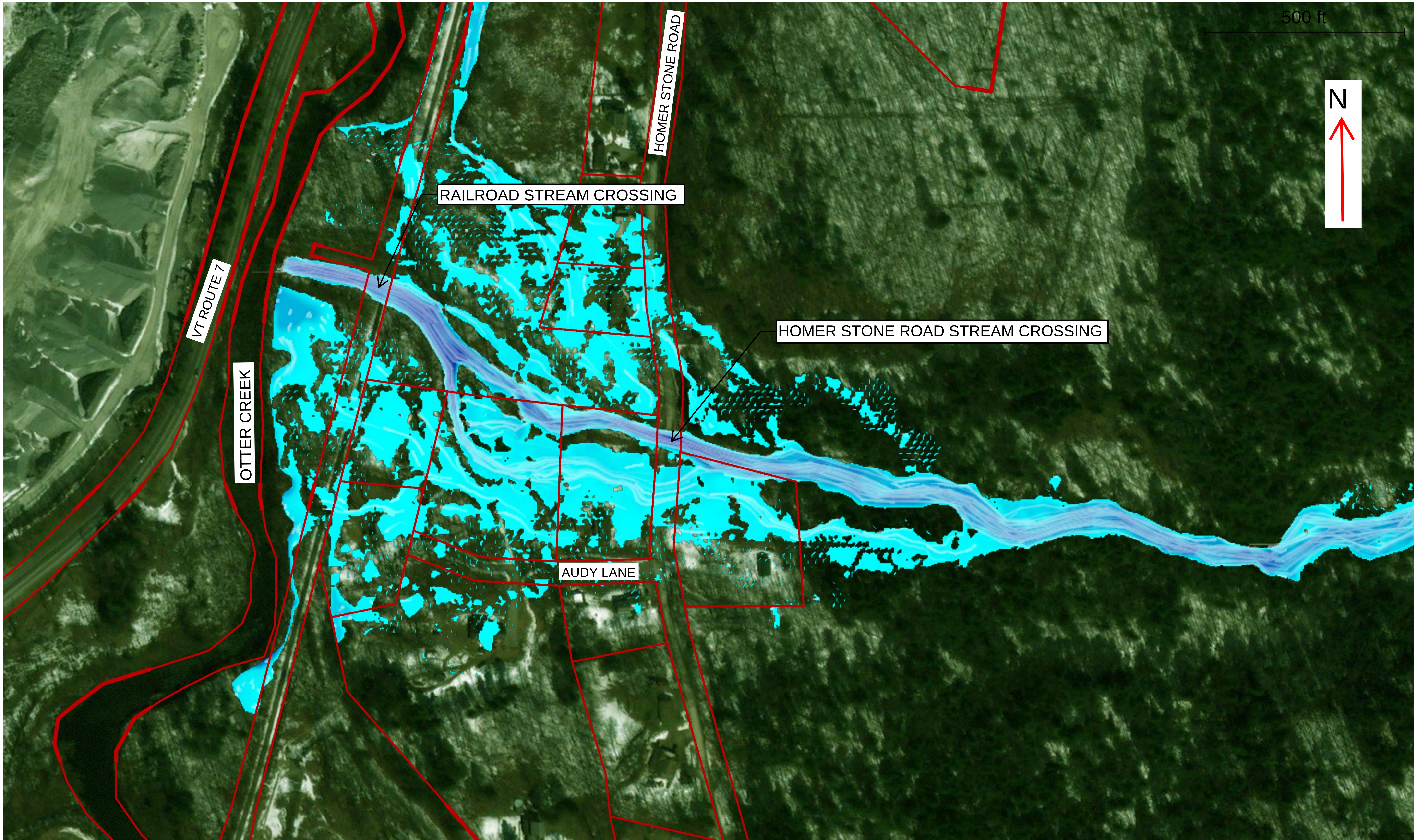
DRAWN BY	DATE
LNM	JAN 2019
CHECKED BY	D&K PROJECT #
MPH	124690
PROJ. ENG.	D&K ARCHIVE #
JBA	

SHEET NUMBER

7

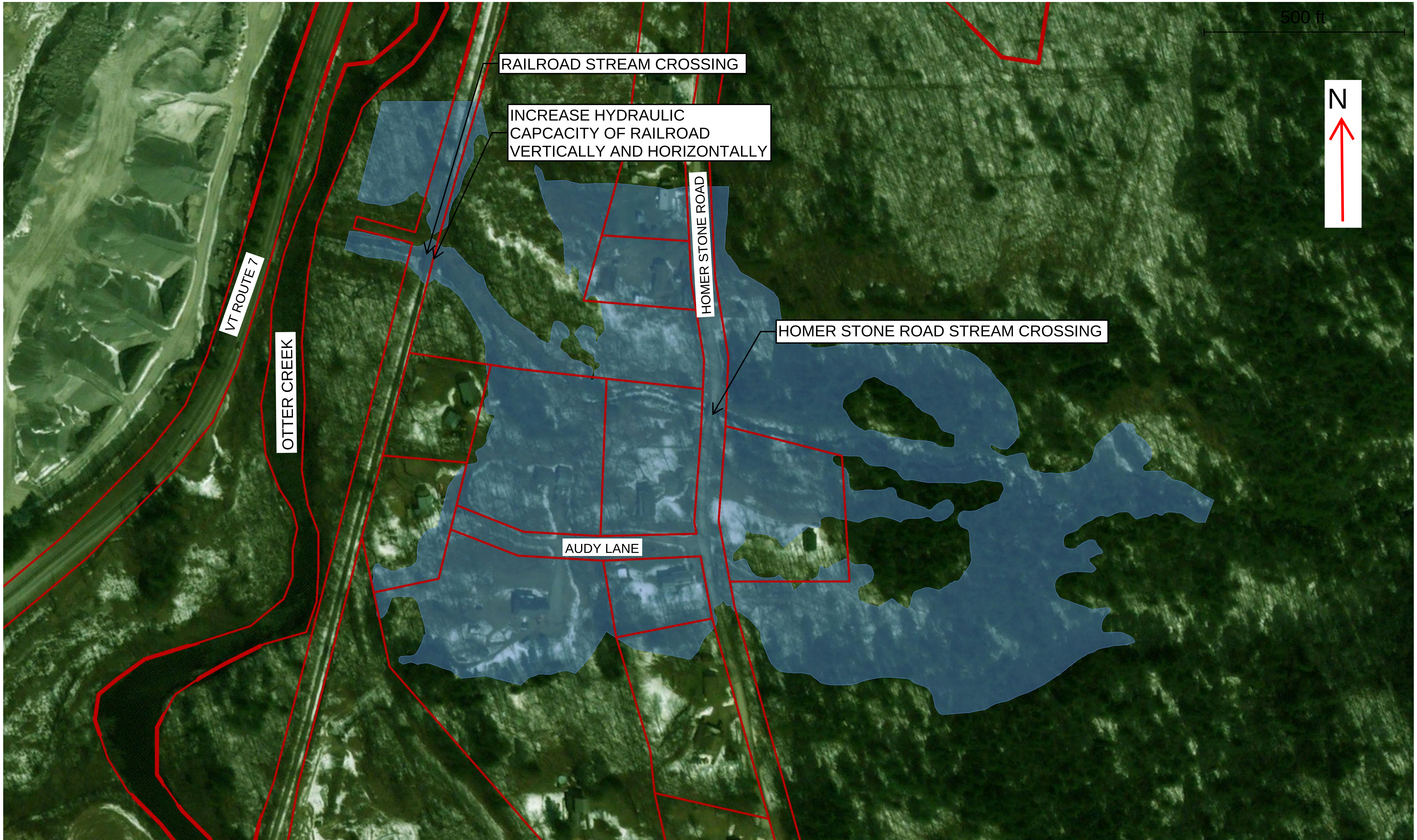
APPENDIX B:

H+H Model Analysis



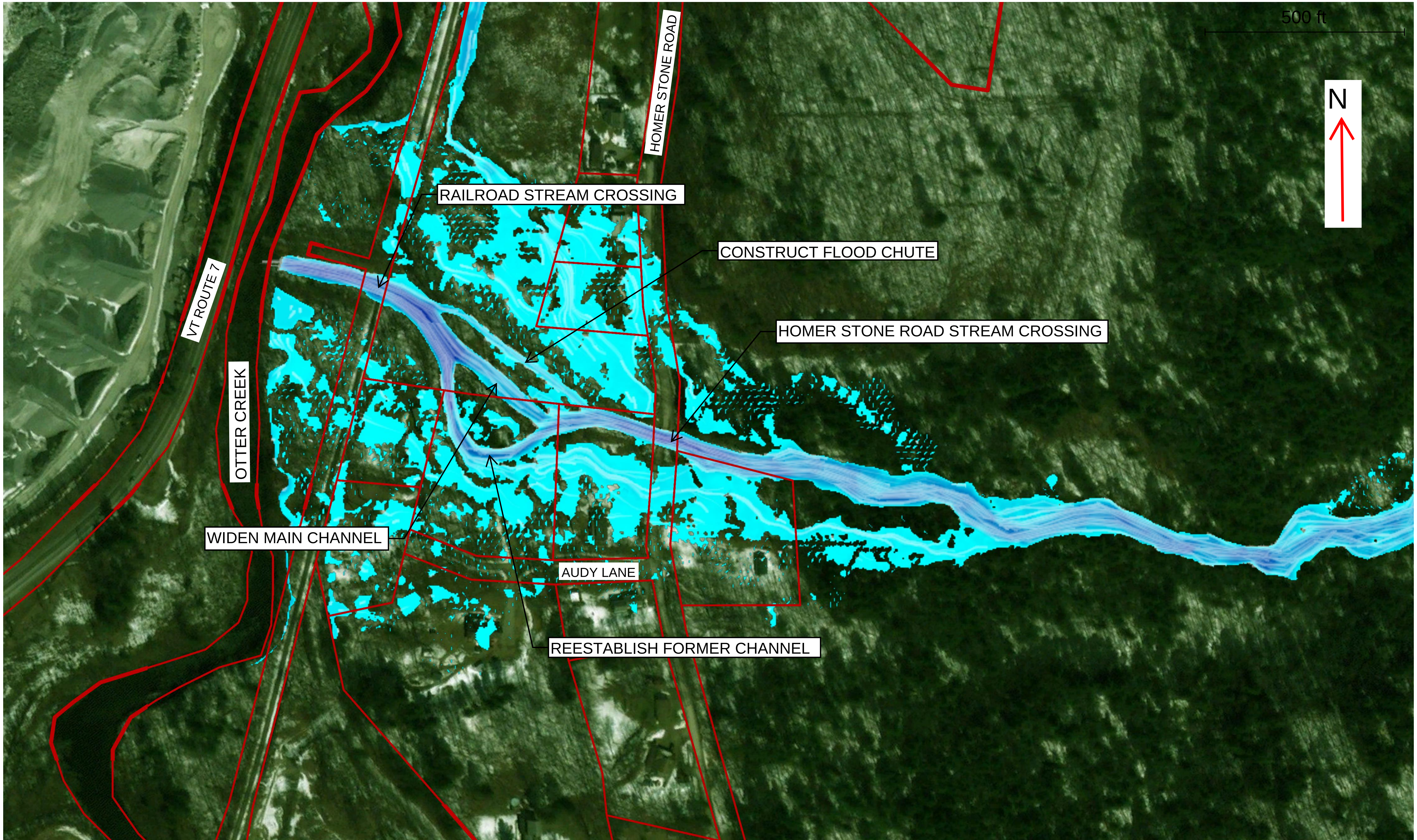
Note: Modeled using HECRAS 2D

FIGURE 1
EXISTING CONDTIONS
(DO NOTHING)
INUNDATION MAP



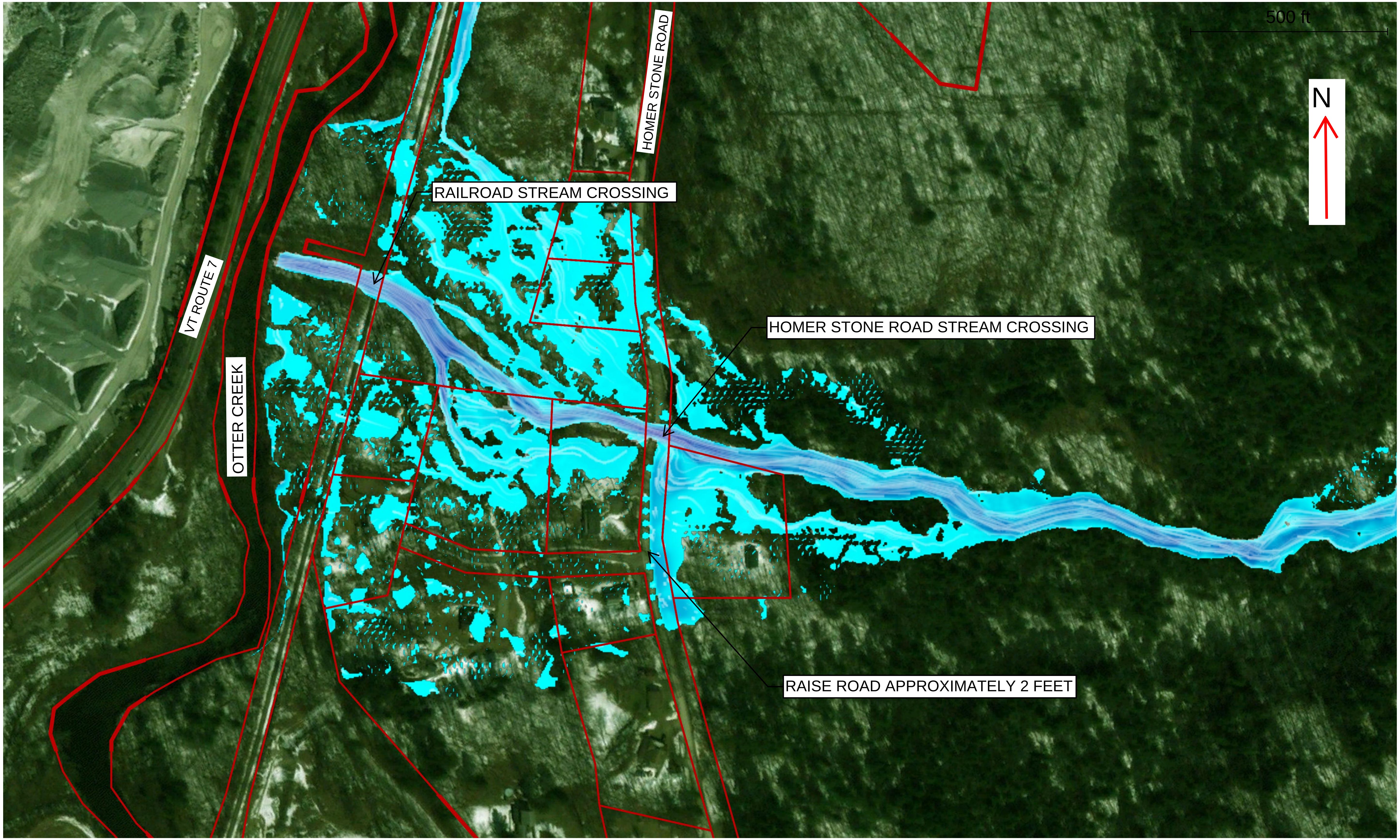
Note: Modeled using HECRAS 1D

FIGURE 2
HYDRAULIC CAPACITY OF RAILROAD BRIDGE
INUNDATION MAP



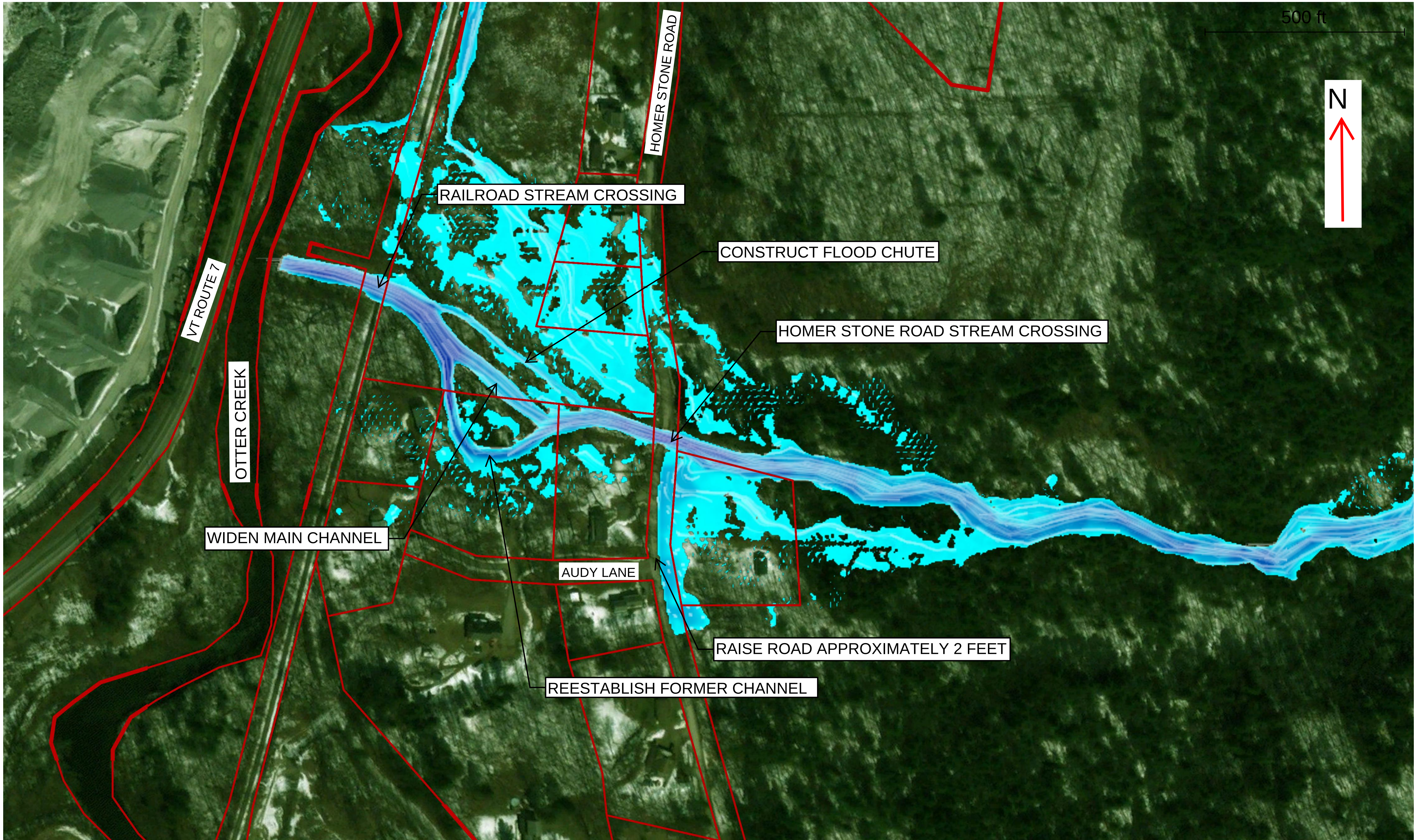
Note: Modeled using HECRAS 2D

FIGURE 3
REMOVE BERMS, RECONNECT FLOWS, & WIDEN BROOK CHANNEL
INUNDATION MAP



Note: Modeled using HECRAS 2D

FIGURE 4
RAISE HOMER STONE ROAD
INUNDATION MAP



Note: Modeled using HECRAS 2D

FIGURE 5
REMOVE BERMS, RECONNECT FLOWS, WIDEN BROOK CHANNEL, & RAISE ROAD
INUNDATION MAP

APPENDIX C:

FEMA Special Flood Hazard Area and Flood Profiles for Homer Stone Brook

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations tables in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations tables should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Vermont State Plane, FIPSZONE 4400. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3182
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from Vermont digital orthophotography, provided by the Vermont Mapping Program, Department of Taxes. These data were produced at a scale of 1:5000 from photography dated May 1994.

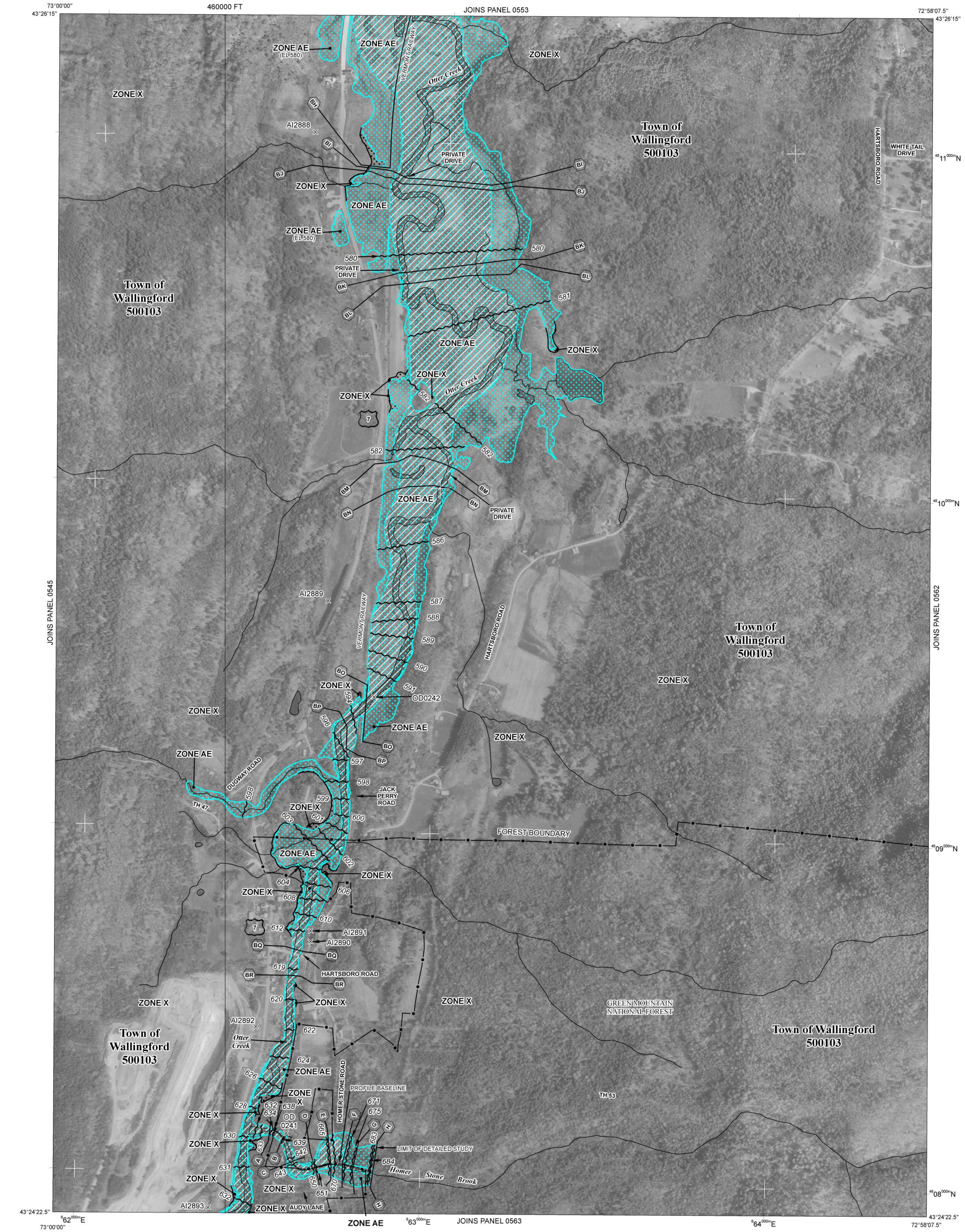
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://msc.fema.gov.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov.



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

513 — Base Flood Elevation line and value; elevation in feet*

(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

A — A Cross section line

23 - - - 23 Transect line

87°07'45", 32°22'30" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere

$^{24}76^{000m}$N 1000-meter Universal Transverse Mercator grid values, zone 18

600000 FT 5000-foot grid ticks: Vermont State Plane coordinate system (FIPSZONE 4400), Transverse Mercator projection

DX5510 × Bench mark (see explanation in Notes to Users section of this FIRM panel)

● M1.5 River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
August 28, 2008

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

N

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0561D

FIRM
FLOOD INSURANCE RATE MAP

RUTLAND COUNTY, VERMONT
(ALL JURISDICTIONS)

PANEL 561 OF 740
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
WALLINGFORD, TOWN OF	500103	0561	D

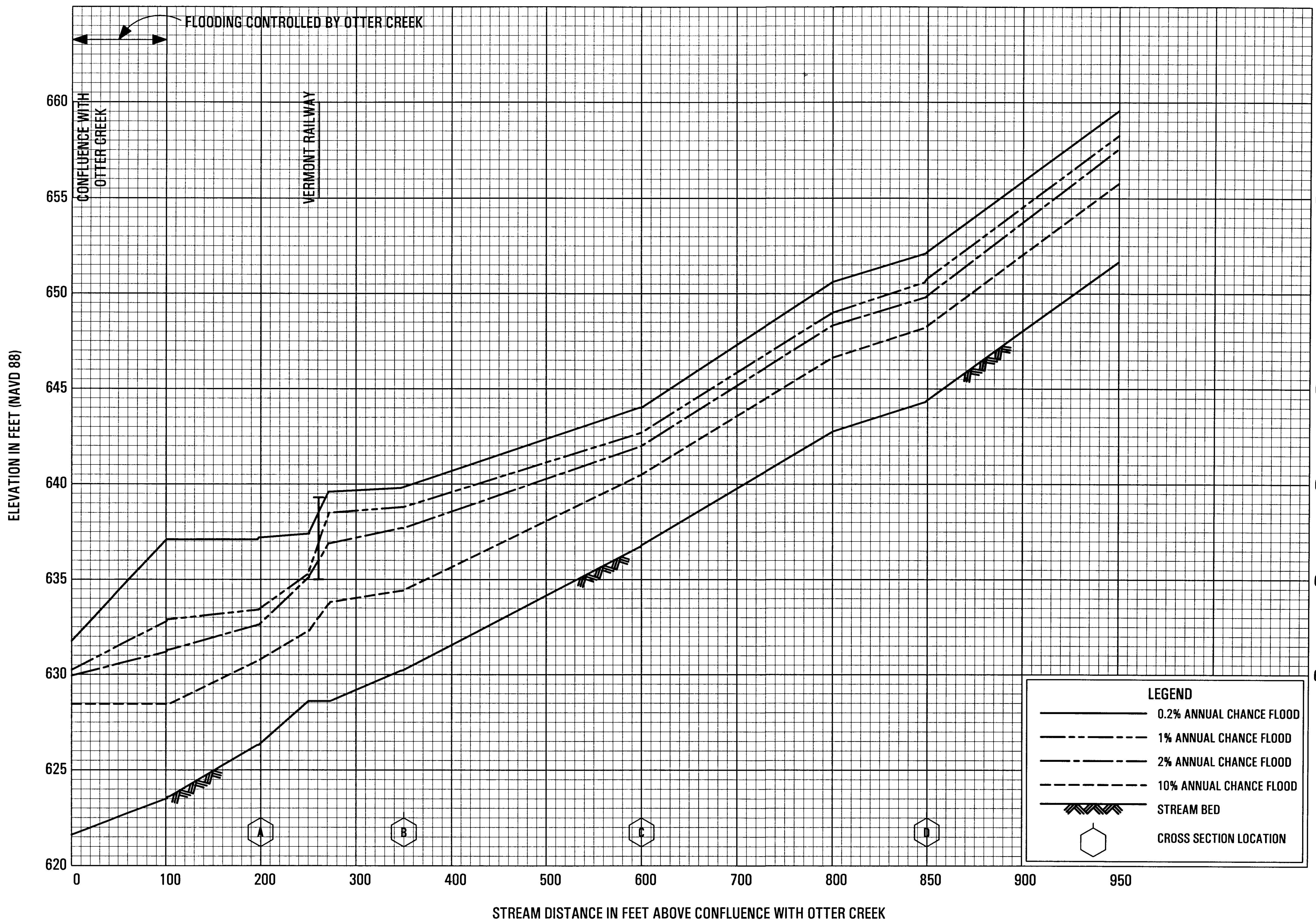
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

U.S. DEPARTMENT OF HOMELAND SECURITY

MAP NUMBER
50021C0561D

EFFECTIVE DATE
AUGUST 28, 2008

Federal Emergency Management Agency



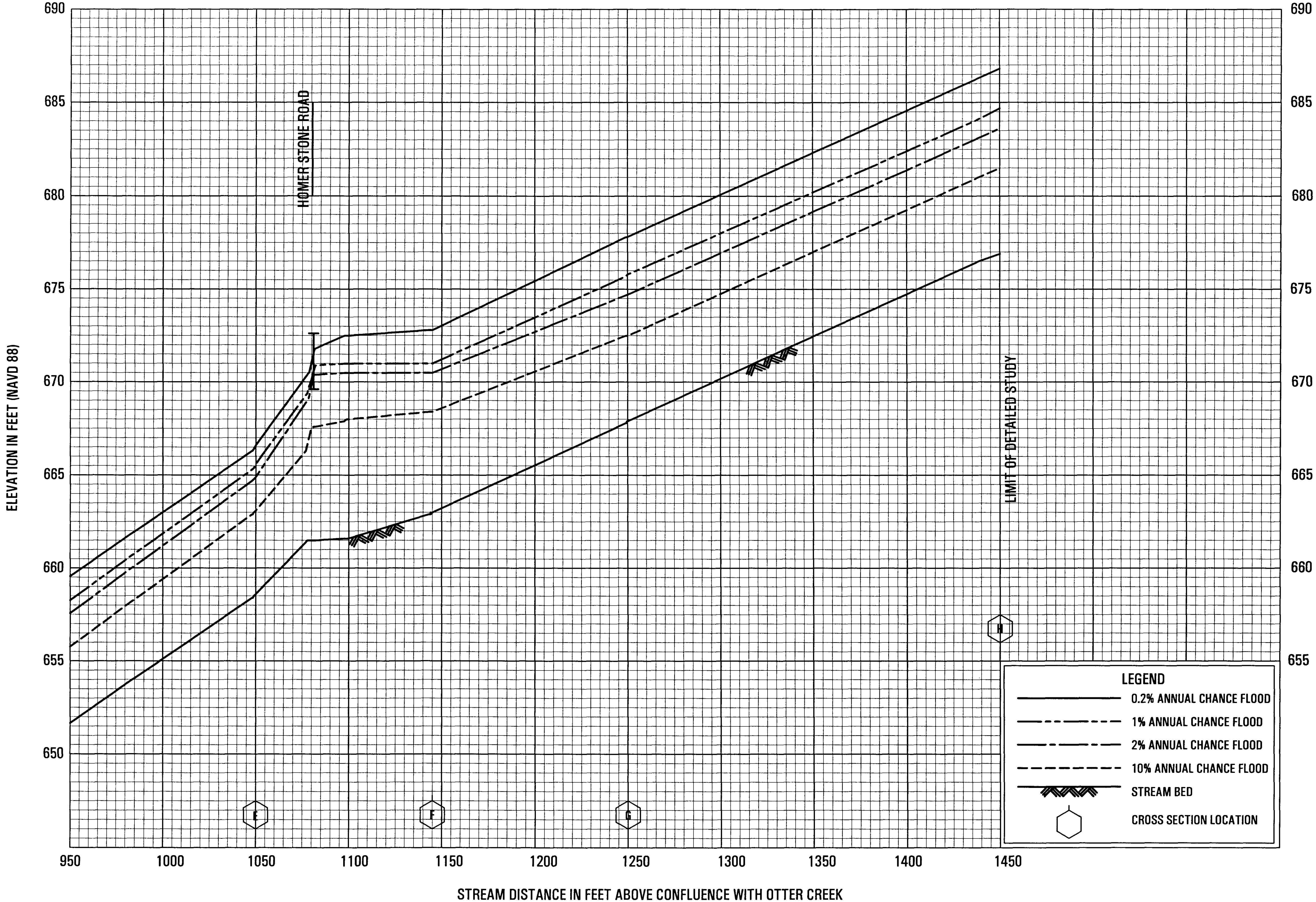
FLOOD PROFILES

HOMER STONE BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

RUTLAND COUNTY, VT

(ALL JURISDICTIONS)



FLOOD PROFILES

HOMER STONE BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

RUTLAND COUNTY, VT

(ALL JURISDICTIONS)

APPENDIX D:

Opinion of Probable Construction Costs

OPINION OF PROBABLE CONSTRUCTION COST		Date: 30-Jan-19
Project:	Homer Stone Brook Berm Removal	
Engineer:	DuBois & King, Inc.	
Subject:		Sheet: 1

Please note that DuBois & King, Inc has no control over the cost of labor, material, and equipment, or over competitive bidding or market conditions within the State of Vermont. Therefore we do not guarantee the accuracy of our project or construction cost estimates as compared to actual contractor bids or the actual cost to the Client. This is understood to be an opinion of a probable budget. If a more accurate budget is required, we recommend enlisting the services of a professional estimating agency.

Category		Unit Meas.	**Rail Bridge Modification (Alt 2.2)**			**Restore & Widen Channel (Alt 2.3)**			**Raise Homer Stone Road (Alt 2.4)**			**Restore, Widen, & Raise (Alt 2.5)**			**Property Buyouts (Alt 2.6)**		
Sub-Category	Item Description		No. Units	$/unit	Total	No. Units	$/unit	Total	No. Units	$/unit	Total	No. Units	$/unit	Total	No. Units	$/unit	Total
Project Work	Access Road	LS	1	$5,000.00	$5,000.00	1.25	$5,000.00	$6,250.00	0.00	$5,000.00	$0.00	1.25	$5,000.00	$6,250.00	0	$5,000.00	$0.00
	Control of Water/Sediment	LS	1	$10,000.00	$10,000.00	2.00	$10,000.00	$20,000.00	1.00	$10,000.00	$10,000.00	2.00	$10,000.00	$20,000.00	0	$10,000.00	$0.00
	Erosion Control and Restoration of Surfaces	LS	1	$10,000.00	$10,000.00	1.00	$10,000.00	$10,000.00	1.00	$10,000.00	$10,000.00	1.00	$10,000.00	$10,000.00	0	$10,000.00	$0.00
	Clearing and Grubbing	LS	0.5	$2,000.00	$1,000.00	1.0	$2,000.00	$2,000.00	0.0	$2,000.00	$0.00	1	$2,000.00	$2,000.00	0	$2,000.00	$0.00
	Common Excavation	CY	311	$22.00	$6,842.00	1517	$22.00	$33,374.00	0	$22.00	$0.00	1517	$22.00	$33,374.00	0	$22.00	$0.00
	Unclassified Channel Excavation	CY	667	$27.50	$18,333.33	738	$27.50	$20,295.00	0	$27.50	$0.00	738	$27.50	$20,295.00	0	$27.50	$0.00
	Grubbing Material	CY	111	$65.00	$7,215.00	1175	$65.00	$76,382.22	0	$65.00	$0.00	1175	$65.00	$76,382.22	0	$65.00	$0.00
	Bank Stabilization, Vegetation*	SY	400	$45.00	$18,000.00	400	$45.00	$18,000.00	0	$45.00	$0.00	400	$45.00	$18,000.00	0	$45.00	$0.00
	Bank Stabilization, Stone Fill - Type II	CY	111	$58.00	$6,444.44	811	$58.00	$47,038.00	0	$58.00	$0.00	811	$58.00	$47,038.00	0	$58.00	$0.00
	Bank Stabilization, Stone Fill - Type IV	CY	111	$65.00	$7,222.22	811	$65.00	$52,715.00	0	$65.00	$0.00	811	$65.00	$52,715.00	0	$65.00	$0.00
Roadway	Pavement Removal and Excavation	SY	0	$9.00	$0.00	0	$9.00	$0.00	1100	$9.00	$9,900.00	1100	$9.00	$9,900.00	0	$9.00	$0.00
	Road Granular Subbase, Fine Graded	CY	0	$30.00	$0.00	0	$30.00	$0.00	182	$30.00	$5,460.00	182	$30.00	$5,460.00	0	$30.00	$0.00
	Road Granular Subbase, Course Graded	CY	0	$25.00	$0.00	0	$25.00	$0.00	364	$25.00	$9,100.00	364	$25.00	$9,100.00	0	$25.00	$0.00
	Pavement, Machine Method	TON	0	$110.00	$0.00	0	$110.00	$0.00	220	$110.00	$24,200.00	220	$110.00	$24,200.00	0	$110.00	$0.00
	Pavement, Hand Method	TON	0	$125.00	$0.00	0	$125.00	$0.00	20	$125.00	$2,500.00	20	$125.00	$2,500.00	0	$125.00	$0.00
Railroad	See Narrative for Railroad Costs		1	$0.00	$0.00	0	$0.00	$0.00	0	$0.00	$0.00	0	$0.00	$0.00	0	$0.00	$0.00
	Flagger	HR	400	$75.00	$30,000.00	0	$75.00	$0.00	0	$75.00	$0.00	0	$75.00	$0.00	0	$75.00	$0.00
	New Bridge Construction	LS	1	$250,000.00	$250,000.00	0	$250,000.00	$0.00	0	$250,000.00	$0.00	0	$250,000.00	$0.00	0	$250,000.00	$0.00
Property Buyouts	See Narrative for Explanation of Costs		0	$0.00	$0.00	0	$0.00	$0.00	0	$0.00	$0.00	0	$0.00	$0.00	1	$853,200.00	$853,200.00
Project Costs	(total construction cost)				$370,057.00			$286,054.22			$71,160.00			$337,214.22			$853,200.00
Mobilization/Demobilization (assumed 10% construction costs)		LS	1	$37,005.70	$37,005.70	1	$28,605.42	$28,605.42	1	$7,116.00	$7,116.00	1	$33,721.42	$33,721.42	0	$85,320.00	$0.00
Contractor Markup (assumed 20% construction costs)		LS	1	$74,011.40	$74,011.40	1	$57,210.84	$57,210.84	1	$14,232.00	$14,232.00	1	$67,442.84	$67,442.84	0	$170,640.00	$0.00
Contingency (assumed 20% construction costs)		LS	1	$74,011.40	$74,011.40	1	$57,210.84	$57,210.84	1	$14,232.00	$14,232.00	1	$67,442.84	$67,442.84	0.5	$170,640.00	$85,320.00
Design Costs		LS	1	$25,000.00	$25,000.00	1	$3,500.00	$3,500.00	1	$4,000.00	$4,000.00	1	$6,000.00	$6,000.00	0	$0.00	$0.00
Permitting	Stream Alteration Permit	LS	1	$3,000.00	$3,000.00	1	$3,000.00	$3,000.00	0	$3,000.00	$0.00	1	$3,000.00	$3,000.00	0	$3,000.00	$0.00
	Wetland Permit**	LS	1	$3,500.00	$3,500.00	1	$3,500.00	$3,500.00	0	$3,500.00	$0.00	1	$3,500.00	$3,500.00	0	$3,500.00	$0.00
	Railroad Access Permit	LS	1	$3,000.00	$3,000.00	1	$3,000.00	$3,000.00	0	$3,000.00	$0.00	1	$3,000.00	$3,000.00	0	$3,000.00	$0.00
Total Project Costs					$589,585.50			$442,081.33			$110,740.00			$521,321.33			$938,520.00

Notes:

* Actual areas to be determined at time of bidding. Areas/Volumes shown are for comparison purposes only.

** Vermont ANR Atlas shows a potential wetland boundary between the railroad bridge and the Otter Creek.